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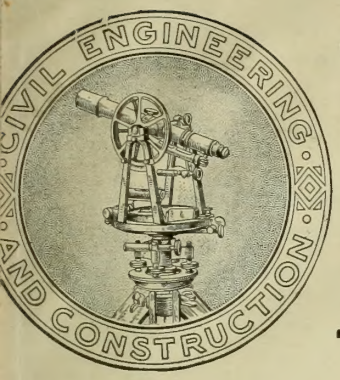
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July 1 to December 31, 1915

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INDEX TO VOLUME LXXIV

July 1 to December 31, 1915

Subdivided into General (including Authors,) Engineering Literature and Contract Prices

Explanatory Note

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Rapid Erection of Steel Coal Breaker

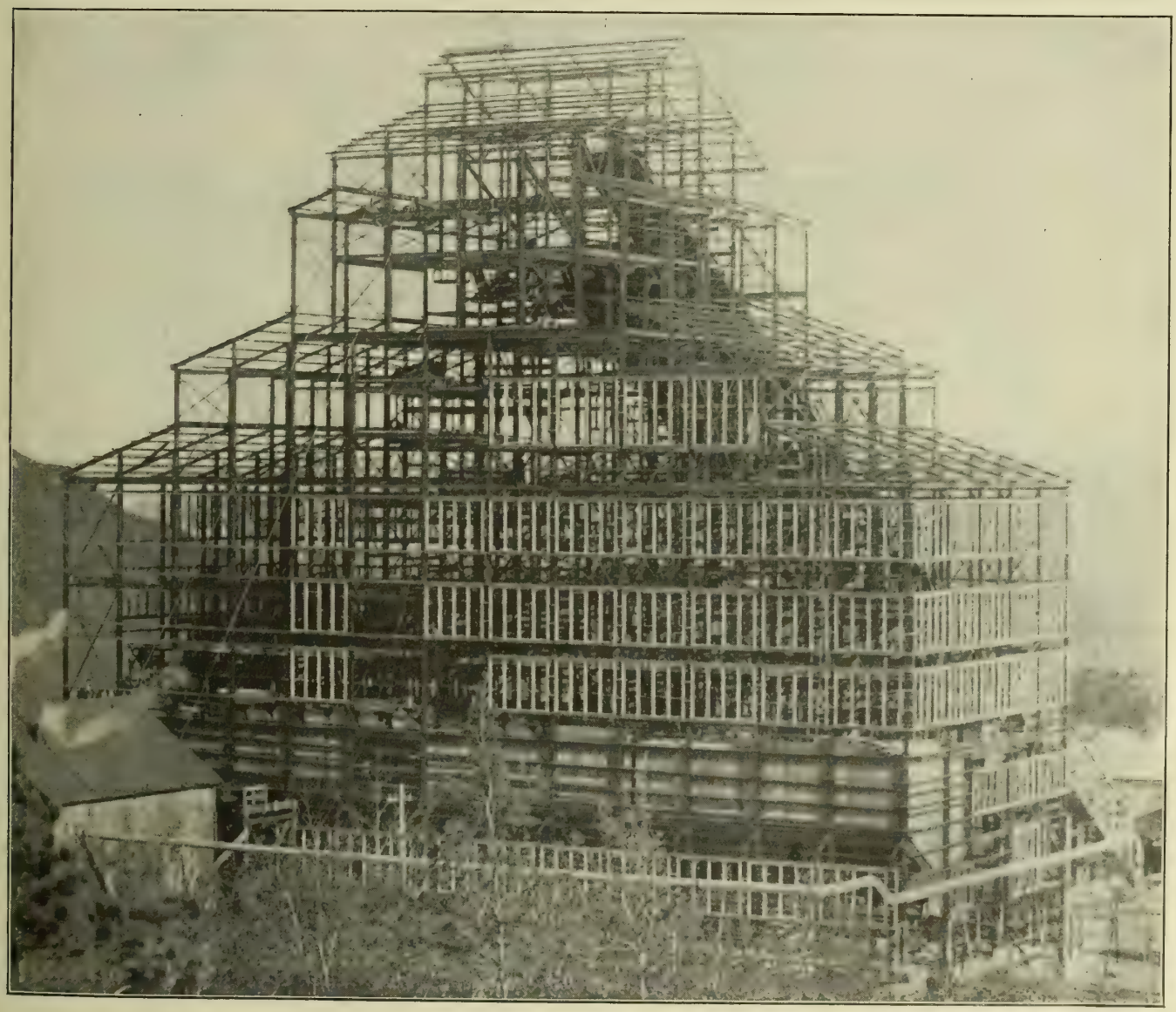
By C. Stuart Phillips*

Practically the last great industry to cling to the use of heavy timber framing for permanent construction has been the anthracite industry of Pennsylvania; but within the last three years the wooden coal breaker has started to go the way of the wooden ship and the wooden bridge.

One of the first companies to abandon the old type was the Lehigh Valley Coal Co., which three years ago rebuilt its Mineral Springs and Franklin breakers of structural steel. In the short time following there have been placed in operation two other steel breakers in the Wyoming Valley, two in the Schuylkill district, and at present three more are in process of erection in the former district and two in the Hazleton district.

The timber breaker is highly inflammable, framing, floors, siding, roof, pockets and bins being of wood, usually yellow pine. Three disastrous fires, one with loss of life, within the last year have emphasized its danger. The Ewen breaker of the Pennsylvania Coal Co. in the Wyom-

*G. B. Markle Co., Jeddo, Penn.



Structural-Steel Coal Breaker, Highland No. 5, Hazleton, Penn., 91 Days after Contract for Erection Was Signed

ing Valley, the Lattimer No. 4 breaker of the Pardee Coal Co., and the Highland No. 5 breaker of the G. B. Markle Co. in the Hazleton district each burned to the ground, being completely lost in two or three hours. In the last-mentioned case the fire was with difficulty kept from spreading down the slope to the mines, the whole plane having to be dynamited to prevent this occurrence.

All these breakers are being rebuilt of steel, and the Markle company is replacing several of its timber planes with steel, to prevent possible conflagrations in the wooden breakers spreading to the mines.

The erection of the new breaker at Highland No. 5 has been interesting because an enviable record for speed has been establishd for this type of construction. The old breaker burned on Jan. 15, 1915, and the contract for the new steel structure was signed on Feb. 9. The Guerber Engineering Co., of Bethlehem, Penn., did the design and detailing and furnished and erected the steel.

On account of the expense entailed in hauling the coal, until the new breaker is in operation, from this mine to a breaker 2 mi. distant, to be crushed, cleaned, and assorted, the coal company let the contract on the basis of a $75-per-day bonus or penalty from May 19, one hundred days after the signing of the contract.

Seven designers were sent to the G. B. Markle Co.'s offices at Jeddo the day after the agreement was concluded. These men worked 14 hr. a day, consulting the coal company's engineers as to panel lengths, machinery locations, loadings, etc. As fast as one section was designed and approved, prints were sent to the detailers at Bethlehem. On the approval of the first batch of details the shop started fabrication.

The design was finished by Feb. 26, and the following day the first shipment of steel was received on the site. The previous week the erecting gang had come on the ground and unloaded their tools and erected the derrick, so that no time was lost. The débris had been cleared away and the foundations got into shape by the coal company's forces. The working time was 10½ hr. a day, seven days a week; but much time was lost, 12 days in all, on account of bad weather.

The field organization consisted of an unloading gang, a derrick gang, a handline erecting gang, and four riveting gangs. The derrick used was a stiff-leg, 5-ton, 100-ft. boom steel derrick, set in the center of the building. The latter being 158 ft. long and 75 ft. wide, the corner columns were reached from the center set-up. When the erection had progressed to the 35-ft. height the derrick was jumped up to that floor and again to the 75-ft. height, from which elevation the rest of the steel was set, 148 ft. being the maximum height in the center of the building, stepping down to about 90 ft. at the two ends. At each move of the derrick three-quarters of the steel was set with the boom outside the stiff-legs; the boom jumped inside the legs to erect the remaining quadrant. Two panels near the center were left open, as the derrick frame was hoisted up bodily each time the rig was raised, using the boom as a ginpole. When the rest of the erection was completed the derrick frame was dismantled and lowered to the ground and these two panels erected with the boom as a ginpole.

The wind bracing, channel girts for the corrugated siding, etc., were erected by handline. The riveting was done by compressed air furnished by the coal company, Ingersoll-Rand pneumatic hammers being used. In the writer's experience the Boyer hammer has usually been the most satisfactory on all-around bridge and building work, but the Ingersoll-Rand proved the best on this work, being shorter than the Boyer and more easily manipulated in the close quarters, due to the wide flanges of the Bethlehem sections.

Altogether there are 736 tons in the structure, 25,000 rivets, 8300 bolts, and 900 tie-rods, small castings, etc.; 3000 pieces were erected by the derrick and 1700 by handline.

The first column was erected Feb. 28 and the first rivet driven Mar. 14. The job was completed and accepted on May 11 (the date the accompanying photograph was taken), 91 days after the signing of the contract and 8 days before the contract time expired.

The coal company's carpenters started work on Apr. 18 on the wooden bins, pockets, floors, walks, chutes, etc. and the machinists began installing the heavy machinery shortly afterward. The corrugated siding and roofing have also been started, and the breaker will probably be in complete operation by Aug. 1—6½ months after the destruction of the old timber breaker.

Perry Sneathen had charge of the design, Victor Pfeiffer of the erection, for the Guerber Engineering Co., and the writer was engineer in charge of erection for the G. B. Markle Co.

In comparing this type of steel breaker with the standard timber construction, the following comparisons can be made:

1. Cost.—The contract price for the steel was between $65 and $70 per ton, totaling $44,000.

The framing for a timber breaker of like dimensions would necessitate about 510 M of lumber and would cost $25,000. While the initial cost of the steel is greater, the smaller insurance rates will in time equalize the two.

2. Speed of Erection.—The steel structure was erected, complete, in 60 working days, practically the time required to raise a timber frame. The first delivery of steel, however, was made 18 days after signing the contract. Yellow-pine timbers 12x12 in. and 14x14 in., in sufficient quantity cannot be obtained from the South in less than 60 days after placing an order; thus six weeks' time was saved by using steel construction.

3. Fire-Resisting Qualities.—The steel-frame breaker is far less inflammable than the timber frame. It is, however, by no means fireproof unless the remainder of the structure is in keeping.

In the breaker in question there is so much wood in the flooring, walkways, pockets, bins, window frames, etc., that it is quite possible that a fire could break out and generate sufficient heat to soften and weaken the steel columns and cause the whole structure to collapse. If a real fireproof structure is desired, the floors, dump and jig pockets and loading bins should all be of reinforced concrete, the walkways of iron and metal sash should be used for windows. In this connection it may be stated that wooden pockets and bins have to be renewed every five years. Reinforced-concrete walls costing 60 to 75 per cent. more in initial outlay would probably last three times as long.

Plans for the Ventilation of the new subway lines in New York City are to be considered by a board of engineers made up of Alfred Craven, Chief Engineer of the Public Service Commission; the consulting engineers of the Interborough Co., William Barclay Parsons and S. L. F. Deyo, and the consulting engineers of the New York Municipal Ry. Co., Jacobs & Davies and L. B. Stillwell. The present plan is to ventilate the subway by means of open gratings in the sidewalks. This plan is opposed by the merchants along Broadway on the ground that the gratings are avoided by pedestrians and prevent people from stopping to look into store windows.

The Binder Course in Asphalt Pavements

By Robert Klotz*

Present-day practice in sheet-asphalt and asphaltic or bituminous pavement construction for city streets and discussions of defects in such pavements show evidence of a constantly increasing tendency to overlook the purpose and importance of what is known as the "binder course," even to the extent of entirely eliminating this course or any substitute for it.

The various schemes and devices brought forward from time to time for the purpose of eliminating the wave effect met with in pavements of this character lead to the conclusion that a gentle reminder of the nature of and reason for the binder course might be of value to those interested in the question of economical pavement maintenance.

The purpose of the binder course is, as its name implies, to bind the top layer or wearing surface of the pavement to the base, whether the latter be of concrete, granite block, macadam or other material. The mixture used for the wearing surface is designed to form, under compression, a reasonably hard, durable and impervious covering, and being therefore comparatively low in bitumen has little if any power of adhesion.

The binder course originally used consisted of graded gravel thoroughly coated with coal tar, or coal-tar pitch, and laid at a temperature sufficiently high to provide for good adhesion to the base and to the surface layer.

The coal tar or pitch was later replaced by asphalt or asphaltic cement, presumably because of the increased difficulty of obtaining tar economically, due to the development of the water-gas process for the manufacture of illuminating gas and the consequent reduction in the quantity of commercial coal tar produced, and because of the decreased cost of the asphalt and its availability as part of the stock of the mixing plant. While the adhesive power of the binder thus produced was apparently lower than that of the tar-binder, it was still sufficient to provide the binding action required to prevent the forming of waves in the surface.

Within the last three or four years the various asphalt companies have introduced, apparently with a view to economy, what is commonly referred to as a close-mixture binder, which consists of broken stone screenings, varying from about a 1-in. size downward, covered with hot liquid asphalt. Owing probably to the reduced first cost of the pavement thus obtained, the use of this type of binder has been permitted under certain specifications, and quite a considerable area of this pavement has been laid.

The writer's experience with this type of binder, particularly on repair work, has shown that the old-style, or stone, binder is far more preferable and the one to be relied on to prevent the formation of waves in the pavement surface.

Owing to the decreased viscosity of the asphalt necessary to provide for the proper mixing of close-mixture binder, the coating on the particles of stone is comparatively thin. This makes the mixture subject to cooling below the critical temperature, within the time required for delivery and laying. The weight of the roller is more evenly distributed over the surface of contact between the binder and the base, and the pressure on the individual particles of stone is insufficient to bring the hotter portion of the more or less hardened coating into intimate contact with the base.

With new pavement the unfavorable behavior of the "close mixture" is less evident than when an old pavement is repaired, due, no doubt, to the greater care and the more exacting supervision.

The action of an asphalt pavement where no binder course is used was brought very clearly to the writer's attention during 1912, when he was in charge of certain pavement repairs in the city of New York, all of the work being subject to the city's specifications and inspection.

During the early part of that year an order was issued to the effect that when repairs were required on asphalt pavements where the thickness of the original pavement, consisting of 1 in. of binder and a 2 in. top course, had been reduced to 1½ in. or less (that being the newly specified thickness of the top course), the binder course was to be omitted.

The writer managed to avoid almost entirely the forming of waves in the pavement, which he felt certain would be the result of literal adherence to this order, by having the base spattered or painted with a coating of hot liquid asphalt immediately before laying the top-course mixture, this asphalt acting as a very efficient "glue." Repairs made under the direct supervision of the city authorities on the same streets and subject to the same traffic, without the thin but effective layer of adhesive, showed waves within from two to three days after laying, and were destroyed by the action of traffic within two or three weeks.

While various theories have been advanced from time to time to account for the waves formed in asphalt pavements, some of them apparently based upon sound reasoning, practical experience seems to show that whatever may be the particular action of traffic which causes them, waves can be avoided by providing a proper bond between the pavement proper and the base, and that three-wheel rollers, etc., are unnecessary and inadvisable complications to attempt to insert into the science of constructing and maintaining bituminous pavements.

An example of the need of special care in the construction of the binder course is shown in some work carried out by the writer in New York City in 1910, the area involving about 250 sq.yd. of sheet-asphalt pavement located in and around two underground-conduit car tracks with a double branch-off and curves, both being crossed constantly in the same direction by exceedingly heavy traffic. Frequent repairs had been required at this point owing to the rolling effect of traffic, the asphalt being continually forced against the rails and ground off as it reached the level of the head.

The relaying of the entire area was required upon the reconstruction of the tracks, and the work was carried out during the night and the early morning to permit laying of the pavement without seriously hindering traffic. Under the circumstances, the supervision of the city authorities was not as definite and exacting as might have been the case had the work been done during regular hours; and as the sub-base was known to be of a sufficiently dry and porous nature to permit of the proper setting of the base, the asphalt was laid on the "green" concrete, which had been in place from 3 to 12 hr.

*111 West 49th St., New York City.

This pavement remained in place for over 2½ years under the same traffic conditions as previously, the only repair required being one small patch where the asphalt had been disturbed by a loose rail joint.

Sad to relate, this area was almost entirely removed in connection with subway construction at the end of the time mentioned. A more extended record of its behavior would probably have been of considerable value, although the writer feels that the performance up to the time of removal was sufficiently marked to warrant more consideration of a proper joining of the pavement and the base than seems to be the practice at present.

Constructing the Fitchburg Sewage-Works

By Frank A. Marston*

SYNOPSIS—Features of the work were the 2½-in. cement-plaster and metal-lath walls of the Imhoff tanks and sprinkling filters, and the drainage system of the sprinkling filters. The sprinkling nozzles are also described.

Operation of the sewage-treatment works for the city of Fitchburg, Mass., was officially started on Oct. 8, 1914, and put into full swing a week later. The design of these works, consisting of Imhoff settling tanks, sludge beds 10 ft. deep, sprinkling filters and secondary settling tanks, was described in Engineering News, June 5, 1913, page 1176. As a number of the details are unusual, it may be of interest to consider them in view of the knowledge gained during construction.

The thin partition walls in the Imhoff tanks were constructed of 1½- to 2-in. cement plaster on rib-metal reinforcing lath of the type known as rib-trus, manufactured by the Berger Manufacturing Co., Canton, Ohio. The sheets of steel were supported every 10 ft. by structural-steel frames, and temporary wooden supports were also provided to reduce the unsupported span to 5 ft. during construction. Even with these additional supports considerable difficulty was experienced in keeping the partitions in proper alignment. The cement mortar, composed of 1 part cement and 2 parts granite dust, was applied by means of the cement-gun. This method, although producing a dense, hard wall, increased the difficulty in screeding and troweling the surface to requisite smoothness. The upper edge was made square by shooting the mortar against a piece of lagging laid along the top of the steel sheets. The chief difficulty in manipulating the cement-gun was to secure a uniform thickness of wall and uniform width of slots at the bottom of the V-shaped troughs. The cement mortar, as shot from the nozzle, accumulated rapidly on the steel, both on the ribs and flat surfaces, so that it was difficult to obtain a wall having a plane surface. This latter effect was produced by screeding and troweling. It is a question whether hand-plastered work would have been as cheap or as durable; on the other hand, it would have been possible to obtain a better-finished surface. The lower edges could probably have been handled more easily if a light steel angle had been fastened to the edge of the steel sheets as a stiffener.

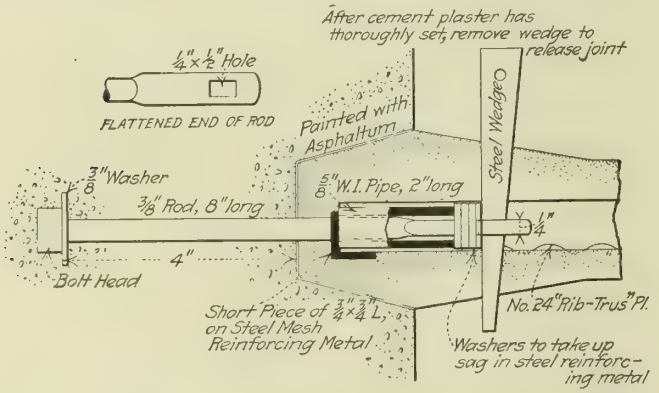


Fig. 1. Expansion Joint between Trough and Walls of Imhoff Tank

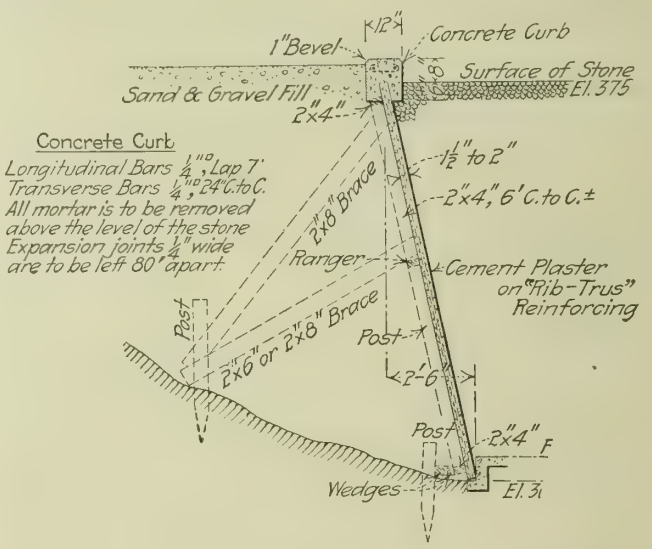


Fig. 2. Details of Retaining Wall for Sprinkling Filter



Fig. 3. Applying Cement Plaster to Wall of Sprinkling Filter

*Assistant Engineer with Metcalf & Eddy, Consulting Engineers, 14 Beacon St., Boston, Mass.

The special expansion joint and gas cutoff used between the thin partitions and the end walls of the Imhoff tanks, shown in section in Fig. 1, was very successful. This varies somewhat from the original design described in the article previously mentioned. This form of joint was designed to anchor the metal lath to the end walls during construction. A groove was built in the end walls along the line of the partition and in the center of this groove wrought-iron rods with flattened ends were embedded at intervals in the concrete. Short pieces of $\frac{3}{4}$x$\frac{3}{4}$-in. steel angles were fastened to the edges of the rib-trus plates opposite each rod, to serve as lugs for anchoring the sheet-metal reinforcement. Tension was applied to the sheets by driving a taper pin or wedge into the hole in the flattened end of the rod, which caused the washers and pipe spacers to be wedged over against the steel angle lug fastened to the sheets. After the cement mortar in the thin walls had set, the pins were pulled out, leaving the partition walls free to contract without cracking. In nearly every instance these joints have opened up and but few cracks occurred in the thin walls themselves. The thin walls are 90 ft. long, with permanent supports every 10 ft.

The same type of thin-wall construction was used for the outside walls in the sprinkling filters (see Figs. 2 and 3), and the results are very satisfactory. It was specified that the surface of the wall should be left rough and no trowel finish applied. This was done with the idea that sewage running down over the rough face of the wall would be purified to a greater extent than if the wall surface was smooth. The earth backfilling on one side and the broken-stone filtering material on the other were placed at about the same time, and were carried up evenly on each side to prevent excessive pressures on the thin wall. The wall serves to keep sand and gravel from being washed into the broken stone, and with the earth backing acts as a retaining wall for the stone. For the conditions at Fitchburg, where the filters were constructed largely in excavation, this form of wall proved to be more economical than any other form considered. A concrete curb 12 in. wide and 14 in. deep was cast on the exposed edge of the thin wall to add a finish and make it more durable. The total cost of the sprinkling-filter wall, exclusive of earth backing, was approximately $3 per lin.ft., which for a height of 10 to 11 ft. is very low. The earth backing came from the filter excavation and cost practically nothing in addition, as embankment, to what it would have cost with the remainder of the excavation, which had to be placed in spoil banks some distance away. The cement-gun proved very advantageous to the contractor in this work on account of the extent of the plane surface to be plastered.

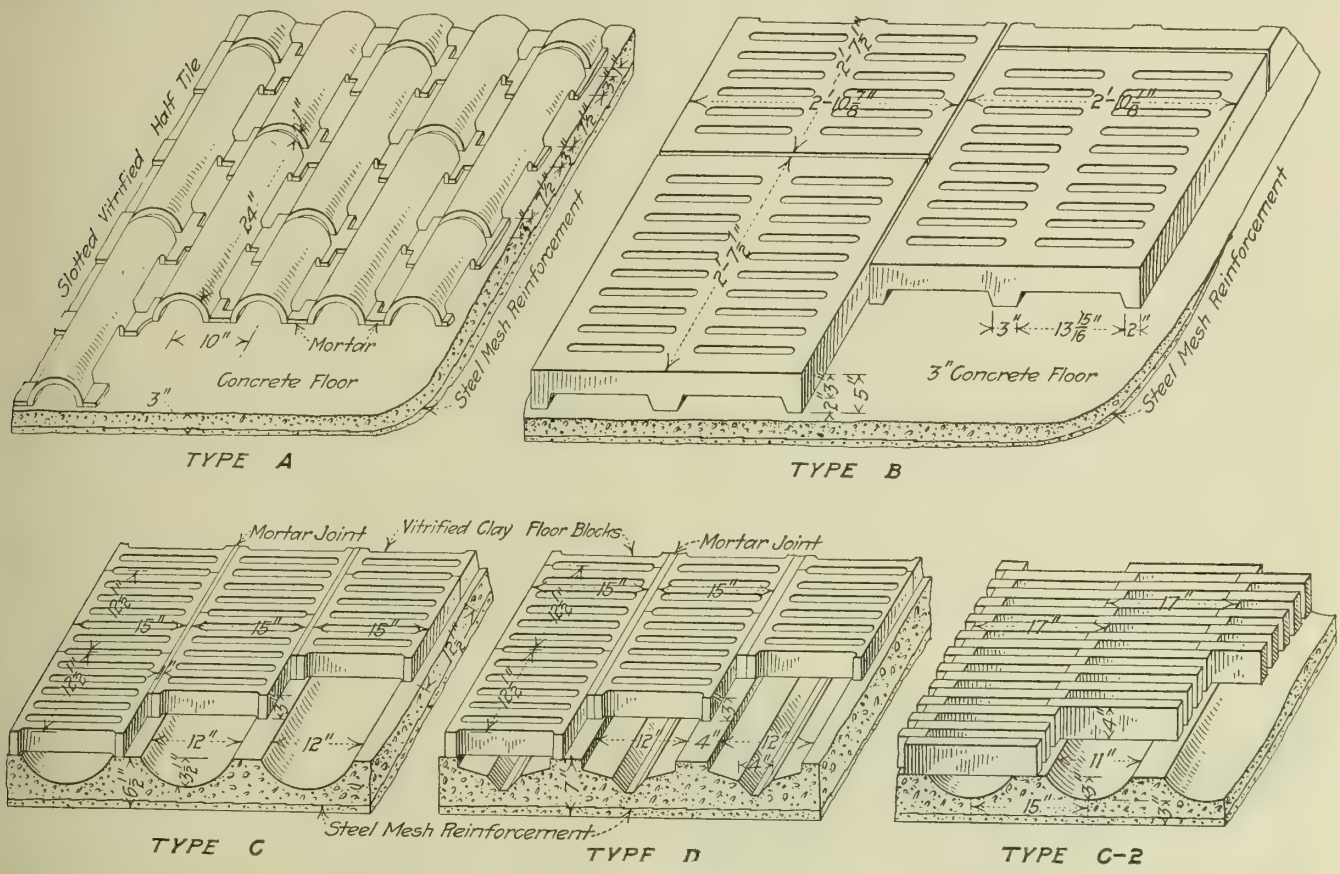


FIG. 4. TYPES OF SPRINKLING-FILTER FLOOR SYSTEM

(Bids were received on Types A to C. Type C was chosen, but, for reasons stated in the text, Type C-2 was used)

When bids were received for the construction of the sewage-treatment works four types of sprinkling-filter floor system were submitted to the contractors. These are illustrated in Fig. 4. The prices per square yard complete quoted by the R. H. Newell Co. and N. S. Brock, to whom the contract was awarded, were as follows: Type A, $2.90; Type B, $3.20; Type C, $2.60; Type D, $3.20.

Type C was selected as being the cheapest and at the same time one of the most desirable. Before constructing the floor the contractors encountered a serious difficulty on account of the failure of a clay-goods concern to furnish the vitrified clay blocks required at the original price quoted, and accordingly a new design was brought out, which was substituted for Type C. This design (Fig. 4),

Type C-2, is similar to one of the alternate designs made by Metcalf & Eddy for Gloversville, N. Y. The small cement blocks, 17 in. long by 1⅛ in. thick and about 3¾ in. high, were constructed of cement mortar composed of 1 part cement and 2 parts granite dust, mixed to the consistency of thick cream and poured by hand in gang molds and then stored in tanks under water for about 24 days. The blocks were set in place (Figs. 4 and 5) in a thin bed of mortar. With this type of floor system 43% of the floor surface is drainage area. The flat floor offers a good surface for construction purposes, and the flow is confined in good channels, which can be readily flushed and cleaned.

The filter excavation was largely in coarse sand and gravel containing many small cobbles 2 to 3 in. in diameter. A layer of these was placed on top of the small concrete floor-beams to act as a guard against "splinters" of stone dropping down between the beams or into the floor channels. The same difficulty, although to a much less extent, was experienced with the remainder of the stone, which was trap rock brought in on cars. Especially in damp weather, fine dust adhered to the stone in spite of careful screening.

The broken stone for the filters was intended to be of such size as to be retained on a 1-in. ring and pass through a 2-in. ring. Some difficulty was experienced in keeping the size of stone within these limits. Apparently a sieve having 1-in. holes and operated carefully will retain some pieces of stone as small as ½ in. in maximum dimension, and similarly a sieve having 2-in. holes will not pass all of the stone having a maximum dimension less than 2 in. It would appear desirable to use screens having holes slightly larger than the ring sizes specified. About half of the stone used was a local granite obtained from Rollstone Hill.

Four 4-ton gasoline auto trucks were used to haul the stone a distance of about three miles from the quarry to the work. Although the roads were fairly good, the stone was shaken up considerably, resulting in grinding

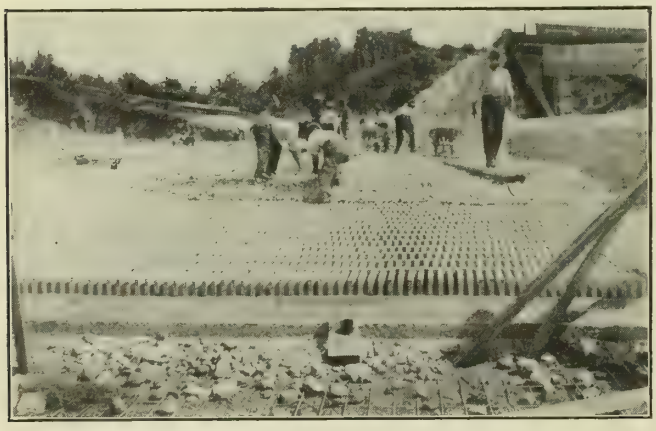


Fig. 5. Constructing Floor System and Placing Cobbles, Sprinkling-Filter Floor System

and breaking, and it was found necessary to screen the stone again at the filter site to remove fine material thus produced as well as that escaping from the main screening plant. It is believed that better results would have been obtained if the stone had been both screened and thoroughly washed.

The distribution mains in the sprinkling filters, comprising 17 lines of 16- and 12-in. cast-iron bell-and-spigot pipe jointed with lead joints, were laid just below the surface of the stone, in order that the nozzles might be screwed directly into tapped holes in the mains and thereby obviate the necessity of using riser pipes. A special drilling machine was used for drilling and tapping these holes. The machine was fastened to the pipe by a chain passing around the pipe. The spindle carrying the drill and tap was set plumb by means of a machinist's

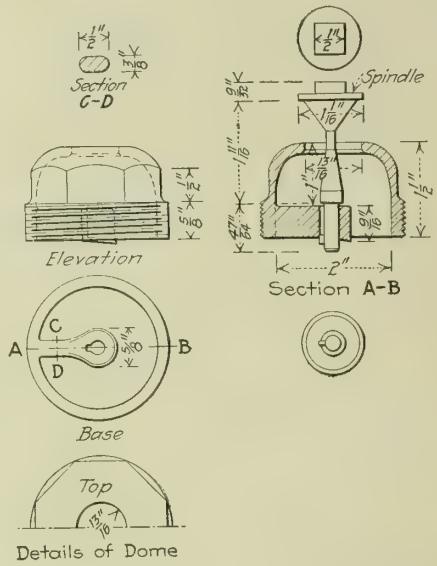


Fig. 6. Details of Sprinkling-Filter Nozzle

level held against the vertical guide on which the spindle moved, and metal shims were used to adjust the machine to the required position.

The sprinkling filter nozzles used are a modified form of the nozzle developed at the Worcester sewage-treatment works. The general details of this nozzle are shown in Fig. 6. The patent rights in the nozzle are controlled by Matthew Gault, Superintendent of Sewers, Worcester, Mass.

The sewage-treatment works have been constructed under the supervision of David A. Hartwell, Chief Engineer, and Harrison P. Eddy, Consulting Engineer. The contractors were the R. H. Newell Co. and N. S. Brock. The Resident Engineer was Ernest E. Lothrop, to whom the writer is indebted for suggestions and photographs.

Philadelphia Street Cleaning by Contract

Philadelphia is one of the few large American cities where practically all the street-cleaning work is done by contract. To get this done efficiently by short-term agreements has required much study and many experiments on the part of William H. Connell, Chief of the Bureau of Highways; and the results are incorporated in the specifications for the current year, which contain many points worth noting. Abstracts of some of the more interesting clauses and those of value to city officials facing the same problem follow.

The contractor is not allowed to sublet his contract. He assumes responsibility for the use of patented materials or processes. He is liable for all damage done by his employees' acts. He is bound to observe all the city and state public health laws. City officials cannot be interested in the contracts.

Use of City Water

Water from the city low-pressure fire hydrants which have been specially marked for street-cleaning work, and generally are not less than one to a block, are used without charge only on permit issued by the Bureau of Water, and only for the purpose of executing the work designated in the specifications, the contractor being liable for any damage done to the hydrants by his employees. Failure to use a standard key in operating the hydrants, the use of leaking hose or hydrant connections, wasting the water, using unmarked hydrants, or other abuse of the privilege may result in the revocation of the permit. The city may revoke the permit when circumstances call for restriction in the use of water.

Annual Inspection

The specifications require that an annual inspection in the form of a parade shall be held during the year at a time designated by the Chief of the Bureau of Highways. The contractor is required to have his entire equipment and employees present, and any equipment or men absent from the inspection, or equipment or men present who do not conform to the requirements of the specifications, are subject to the deductions enumerated in the specifications. On the day of the inspection the men and equipment are relieved of their duties only for the time absolutely necessary, and on the completion of the inspection must continue their work for the full remainder of the day.

Reports by Contractor

The contractor makes daily reports to the Chief of the Bureau on approved forms, which indicate the number of men, machines and vehicles employed, the number of loads of dirt removed, the net weights of each, the number of sewer inlets cleaned each day and such other information as may be requested. The contractor also furnishes, in writing, such information in reference to the conduct of the work under his contract as may be required from time to time by the Chief of the Bureau of Highways. If such information is not supplied within two weeks from date of request for the same, the city may retain such payment as may be due the contractor until he has supplied the information requested.

The contract may be annulled at any time for failure to commence work when specified or to prosecute work to the satisfaction of the city officials. Failure to comply with any part of the specifications is cause for the city, after giving 24-hr. notice to the contractor, to employ sufficient force to have the work properly done and to pay for the same out of the fund deposited by the contractor as security. Payments are made monthly.

Qualifications of Employees

All employees must be thoroughly able-bodied and capable, both physically and mentally, of performing their duties to the satisfaction of the Chief of the Bureau of Highways. Any employee showing evidence of physical or mental incapacity is to be discharged upon the demand of the Chief of the Bureau, and is not to be re-employed except with the written consent of the Chief of the Bureau. All employees must be able to speak English satisfactorily. None but citizens of the United States are employed.

Any employee who neglects his duties, or uses improper language, or is under the influence of liquor while on duty, or accepts or demands pay from citizens for service rendered, or falsifies any report he may be called upon to make, is, upon demand of the Chief of the Bureau of Highways, to be at once discharged.

Each inspector, superintendent or foreman is required to wear while on duty a dark-gray uniform. All other employees must be provided at all times with uniforms approved by the Bureau of Highways. Uniforms are to be kept clean and must not be worn longer than one week without washing. Each employee must also wear at all times a badge on his hat or cap having thereon "D. P. W." in large letters and "Bureau of Highways" in small letters, also the number of the street-cleaning district, preceded by "Dist.," and a serial number. Each employee must also be provided with a suit of oilskin and other necessary articles to protect him while working during inclement weather.

Equipment

All sprinklers, cleaning machines, carts, wagons and other vehicles used in the prosecution of the work under the specifications must be painted in colors designated by the Chief of the Bureau of Highways, and all repainting during the life of the contract must be done in the same colors. All equipment is to be painted at least twice during the year with standard paints, specifications for which are on file in the office of the Bureau of Highways, and must be painted more frequently if these two paintings do not preserve the permanency of the distinguishing colors. The equipment must at all times be maintained in a cleanly condition, and the contractor is required to install adequate cleaning facilities within his stable or yard. Cleaning equipment in streets is not permitted.

Each kind of equipment is defined and described in detail, including squeegees, flushers, machine brooms, sprinklers, hand machine brooms and hand brooms. The contractor is required to keep all his equipment in repair and adjustment, subject to city inspection.

Classification of Street Cleaning

The city is divided into eight districts, and the kind and amount of street cleaning to be done in each are defined. A table is included in the contract giving the areas in each district to be cleaned every day, every two days, every three days and once a week. The day working hours are 7 a.m. to 12 m. and 1 p.m. to 6 p.m., and the night hours, 7:30 p.m. to 6 a.m. The work includes cleaning sidewalks of all waste paper and other refuse and in winter snow removal from the streets.

Liquidated Damages

The amounts of liquidated damages for each kind of neglect, or failure to comply with the specifications, are parts of the contract. There are 38 of these sums specified for various infringements of the contract specifications, and these vary from $25 a day for neglect to make daily reports to 50c. a day for failure of employees to wear badges and the prescribed uniform in a cleanly condition. For instance, failure to provide machine brooms with dust guards entails a loss to the contractor of $1 a day for each machine so operated. For cleaning streets without sprinkling (unless so authorized) $1 per square or part of square so cleaned is charged against the contractor. For not properly loading street dirt into wagons or carts or spilling the dirt 50c. is charged for each offense. These are random illustrations.

Two Large Irrigation Projects in Russia

By Milan Nikolitch*, Assoc. M. Am. Soc. C. E.

SYNOPSIS—Immense areas of dry land are being brought under irrigation by the Russian Government. Of two projects to be described, that on the Golodnaya Steppe, in Turkestan, reclaims for the present some 125,000 acres, while the one on the Mugan Steppe, which borders the Caspian Sea, reclaims 465,000 acres. The Golodnaya Project, here described, is a relatively simple one, consisting of head-gates, 32.6 miles of main canals, 110 miles of distributary and main-drainage canals and 780 miles of laterals and secondary-drainage canals. The Mugan Steppe Project, which will be described in a later issue, is more complex, comprising four independent canal systems.

Within the limits of the Russian Empire, stretching from the 17th to the 191st meridian and from the 35th to the 78th parallel, there is a great variety of climates. Speaking broadly, the average yearly rainfall varies between 16 and 28 in., with the exception of the western provinces of European Russia, where the rainfall rises above, and Caucasia and Turkestan, where it drops below that figure.

The greater part of southwestern European Russia belongs to the zone where agriculture is partly dependent upon irrigation. Turkestan and the eastern part of Transcaucasia are representatives of arid lands in the true sense of the word and require complete irrigation for existence.

It is very probable that in old times a certain portion of now desert lands in Turkestan and Caucasia were irrigated, but there are no means of judging of their magnitude. The most prosperous provinces of Turkestan, like Samarkand, Tashkent and Fergana, have been irrigated from time immemorial and are still supplied with water by primitive native canals. The water-supply for irrigation in Turkestan is mostly derived from small mountain rivers at their emergence upon the plains. Although the small rivers are almost used up, the large ones are scarcely touched.

It is certain that there is more land in Turkestan than can be supplied with water. The six great rivers of Turkestan and Transcaucasia—Illi, Choo, Sir-Daria, Amu-Daria, Arrax and Kura—have a total annual runoff of about 93,000,000 acre-ft., which can all be used for irrigation. Altogether the water-supply of Turkestan is sufficient for many millions of acres.

With the exception of native works, the art of irrigation is quite new in Russia and almost entirely confined to government enterprises. It might be safely said that there is not a single private enterprise of importance. The first large irrigation project in Russia was the irrigation of the Imperial Domains on the Murgab River, described in Engineering News, of Apr. 4, 1912.

The two irrigation projects here described are, so to say, pioneer projects and do in no way represent the standard work of the Russian Reclamation Service. They were begun with small means, and could be seriously attended to only in the last two or three years. The systematic work of the Reclamation Service was begun only a few years ago, but it has already developed to great proportions, promising to give excellent results. At the head of the Reclamation Service are Prince V. Masalsky and S. P. Maximoff, M. Am. Soc. C. E.

What is known as the Golodnaya Steppe occupies the country inclosed between the Sir-Daria River, the Turkestan Mountain range and the Kizil Kum Desert. It is situated between the 40th and 41st parallels and has an average altitude of 927 ft. above sea level. The total area of this country is about 1,900,000 acres, but not all of it can be irrigated. With the completion of the northeastern Golodnaya Steppe irrigation project, about 218,700 acres will be reclaimed. Surveys and designs for the other portions of the steppe are under way, and in the near future a great portion of the former arid waste will be brought under irrigation. The situation of the Golodnaya Steppe between the rich provinces of Tashkent, Samarkand and Fergana, with which it is tied by railroad lines, together with rich soil and favorable climatic conditions, guarantees the success of the enterprise.

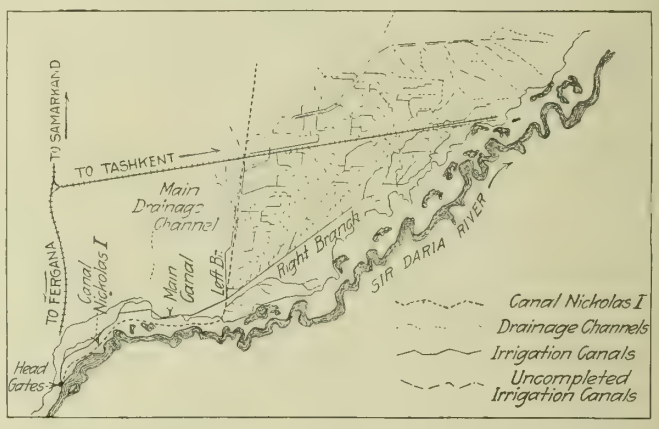


Fig. 1. Map of Golodnaya Steppe Irrigation Project, Russia

The climate of the Golodnaya Steppe is continental and is characterized by extremes. The summers are long and hot; the winters are sometimes very cold. The temperature reaches as high as 108° F. in the shade and as low as —20° F. The maximum mean monthly temperature for a period of seven years was 83° F., while the minimum was 19.2° F. Low temperatures last but a short time. The summer heat, on the contrary, extends over a long period of the year. An average for seven years shows that the number of days without frost in the Golodnaya Steppe is 209.

The precipitation is comparatively small, and the greatest portion of it occurs in the winter. The average rainfall for five years was 12.3 in., but for a longer period of observation it would probably be less. Of this

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amount only 0.55 in. fell during June, July, August and September.

The low rainfall, the great dryness of the air and the fact that the dry period of the year coincides with high temperatures make irrigation a necessity. For only a short time during the early spring the steppe is covered with luxuriant vegetation, but in May the sun and the lack of moisture turn it into a desert-like area, fully justifying its name, the Steppe of Hunger.

The water-supply for the Golodnaya Steppe is diverted from the Sir-Daria River, the only stream which can insure a supply to a large area. Sir-Daria rises in the mountains of the Central Tian-shan, where its two branches are known as Narin and Kara-Daria. Both are torrential in character in their upper courses. After leaving the mountains, each river runs through the province of Fergana, where a great portion of the Kara-Daria is used for irrigation by the native works. The Sir-Daria, made up by the junction of the Narin and the Kara-Daria, flows for some distance through Fergana, and after passing the mountain Mogol Tau, enters the great central Asiatic plain, through which it runs for about 810 miles to the Aral Sea. The total length of the river is about 1430 miles.

The Sir-Daria owes its waters to the melting of snow in the high mountains. Its high-water period occurs in summer, when mostly needed for irrigation.

The discharge of the river has been regularly observed since 1903. In the following table are given mean annual discharges of the Sir-Daria for a period of eight years, according to the reports of the Turkestan hydrometric service:

ANNUAL DISCHARGES OF SIR-DARIA RIVER FROM 1903 TO 1910

(Gaged at the head of the main canal)

Year	Discharge, Sec.-Ft.	Year	Discharge, Sec.-Ft.
1903	27,000	1907	22,400
1904	22,400	1908	33,500
1905	22,500	1909	22,400
1906	17,100	1910	23,000

The maximum discharge occurs in May and June and the minimum in January. During the period 1903-1910 a maximum of 109,000 sec.-ft. has been observed, while during the same time the minimum was 6860 sec.-ft.

History—The art of irrigation has been practiced in Turkestan from very early times. Large areas that are now abandoned and desert-like have been reclaimed in the past. Still, the Golodnaya Steppe does not seem to have been irrigated to a large extent, although, judging by existing legends, attempts to that end were not lacking. The fact that the river lies some 50 ft. below the floor of the Golodnaya Steppe made it difficult for native engineers to bring the water to the steppe, and all attempts resulted in a few small canals, their remains still being traced in the steppe. Only the lowland along the river and the area near the mouth of cañons of the small mountain rivers were irrigated to some extent.

With the Russian occupation of the country the idea of reclaiming the Golodnaya Steppe by the water of the Sir-Daria was renewed. During the last 40 years several attempts have been made, but owing to various unfortunate circumstances, most of them proved failures. Only the Canal Emperor Nicholas I was successfully completed. It irrigates an area of about 32,400 acres.

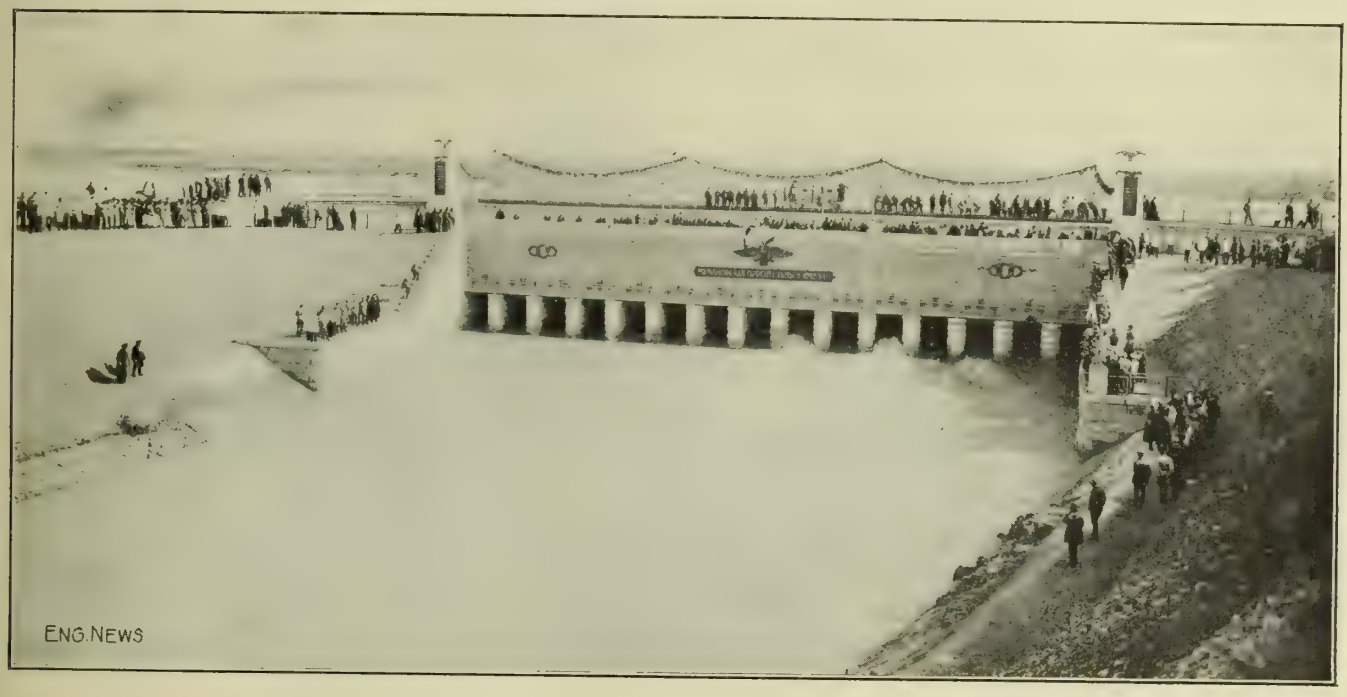


Fig. 2. View of Head-Gates of Golodnaya Irrigation Project

(The structure was officially opened on Oct. 5, 1913, in the presence of many state officials)

The first steps toward irrigating large areas of the Golodnaya Steppe by the government date back to 1895, when the first well-organized parties were sent there. The actual work of construction of the Northeastern Golodnaya Steppe project began in 1901, and was prosecuted slowly on account of lack of funds until 1911, when the first large appropriation was made and the work vigorously resumed. By the end of 1913 most of the work was completed. The area thus brought under cultivation is 121,500 acres, not counting 32,400 acres, dominated by the Canal Nicholas I, which is to be incorporated into this system.

General Features of the Project—Generally speaking, the project (see map, Fig. 1) comprises head-

gates, a main canal 23.6 miles long, distributaries and main drainage canals 110 miles long, laterals and secondary drainage channels about 870 miles long, regulators, outlets, bridges, etc.—altogether 540 structures.

During the construction about 17,500,000 cu.yd.of earth had to be moved, of which 46% was from the main canal. The total area covered by the canal is about 218,700 acres, but only some 125,000 acres is supposed to be actually irrigated at one time. The cost of the works is estimated to be $3,660,000, or a unit cost of $29.28 per acre of irrigated land.

Head-Works—No dam is provided, and in order to assure the full supply to the canal during the lowest water stand in the river, even when other irrigation projects along the upper course of the Sir-Daria are realized, the sill of the intake gates is placed at about the bottom elevation of the river. This has resulted in a maximum head against the gates of about 21.7 ft.

The head-gates (Fig. 2) are similar to those used on irrigation canals in India. They consist of 15 openings, 6.3x10.50 ft., separated by masonry piers 28.70 ft. high and 3.50 ft. thick. The piers rest upon a heavy concrete foundation 8.75 ft. thick, which is faced by granite blocks 1.05 to 1.75 ft. thick. The entrance to the canal is regulated by steel gates raised by a traveling winch from the working platform. A row of stop logs, placed in the front of the gates, is provided to prevent the débris, carried on the bottom of the river, from entering the canal, and to help in obtaining relatively clear water from the surface. To reduce the effect of the falling water upon the floor, provision is made for another row of stop logs in the rear part of the piers, by means of which a kind of water cushion is created. For a distance of 2450 ft. below the head-gates the bottom and the slopes of the canal are protected by rubble masonry, concrete and riprap. The cost of the structure was $288,000.

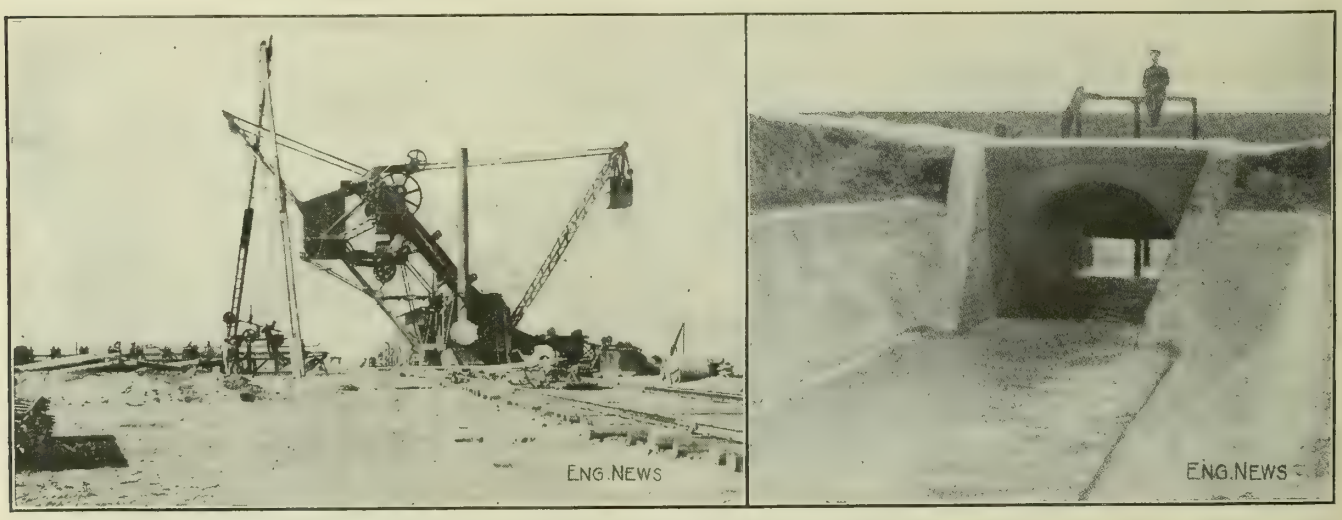
The Main Canal—The floor of the Golodnaya Steppe below the head-gates is about 56 ft. higher than the alluvial lowland along the river. The length of the main canal from the head-gates to the point where it emerges upon the steppe and is divided into two main distributaries is about 23 miles.

The first part of the canal is made in conglomerate and gravel, after which the canal runs through the lowland area, mostly in cut, also in combined cut-and-fill section. Toward the end the canal extends through several deep cuts, of which the deepest is about 53 ft.

The dimensions of the main canal have been designed according to the material in which the canal is located. The bottom width varies from 56.70 to 98 ft. The depth ranges from 5.25 to 9.45 ft. The adopted grade is rather higher than is commonly used for canals of this size, varying from 0.0001 to 0.0007. The discharging capacity of the canal is said to be not less than 1715 sec.-ft. Where the canal is made in cut it is given side slopes of $1\frac{1}{2}:1$ and in deep cuts above the water surface $\frac{1}{4}:1$. Embankments are made with side slopes of 2:1 and have a top width of 21 ft.

The total earthwork, in amount of 8,130,000 cu.yd., cost $1,215,000. About 266,000 cu.yd. of excavation in gravel and conglomerate at the head of the canal has been done with a steam shovel. For the remaining part hand labor has been used exclusively.

The Distributary System—At the 23d mile the main canal is divided into two branches, which are practically two main canals. The Right Branch was completed early last year (May 16, 1914), while the other branch is only partly completed with a view to future extensions. The topography of the country allowed of so locating the canals as to enable them to supply the water to laterals on either side.



Figs. 3 and 4. Views on Golodnaya Steppe Irrigation Project, Russia
(Fig. 3 (left)—The Lübeck excavator. Fig. 4 (right)—A regulator at the head of a distributing canal)

The Right Branch is designed to have a capacity of 600 sec.-ft.; the Left Branch, of 1294 sec.-ft. The Right Branch has a length of 29.3 miles, besides two main laterals, while the Left Branch is 33.3 miles long. The cross-section of both branches is so designed that the water is mostly above the surface of the surrounding country. Of 3,660,000 cu.yd. moved from the canal cross-section and borrow-pits, about 2,950,000 cu.yd. were used in embankments. The top width of the embankments is from 10.50 to 17.50 ft. and the side slopes are 2:1. The grades vary from 0.0001 to 0.0005.

The water surface in the canal being well above the ground surface, special care was exercised to obtain tight embankments by thorough wetting and tamping. A special feature of building embankments on several canal sections was to provide, by means of low embankments, basins of the required width and to dump earth into

them and allow it to settle under water, after which the water was drained off. The embankments obtained in this way are said to be more satisfactory than those made by common methods of wetting and tamping.

So far the lateral system is built to deliver water to units of 370 acres, but as the land is to be sold in units of 8 to 10 dessetins, or about 21.60 to 27 acres, it is very probable that the government is going to construct the lateral system to suit this subdivision, leaving only the farmers' ditches to private initiative.

The lateral outlets are of concrete or reinforced concrete, controlled by steel gates. With the completion of the system there will be about 292 miles of laterals and 510 outlets.

During the construction of the distributary system both hand and machine work were used. Three excavators of the type shown by the view, Fig. 3, were installed, and gave fairly good results.

Drainage System—The small slope of the country, the proximity of ground water, the presence of alkali and the possibility of increasing it with the use of irrigation, but especially the aim to improve the alkali soil by thorough drainage, have imposed the necessity of designing and building a complete drainage system at the same time as the irrigation system.

The main drainage channel is excavated in the valley between the Right and Left Branches. It is 35.8 miles long and has a discharge of 515 sec.-ft. With a small exception the entire irrigated area drains into it. The total length of drainage canals and ditches amounts to about 537 miles. The object of the drainage system is not only to take care of the surplus water in the soil, but also of one part of the surface water, which is going to be wasted through the main collector into the river.

Structures—With the exception of the head-gates, there are no structures of special interest. (See Fig. 2 for head-gates and Fig. 4 for a minor head-gate or regulator at the head of a small canal.) For building material, concrete and reinforced concrete were used for permanent bridges, regulators and outlets. Concrete and rubble masonry were used in substructures of steel bridges under railroad tracks; common and adobe brick for buildings, and wood for temporary bridges.

Future Extensions—By the project just completed, only the northeastern part of the Golodnaya Steppe is irrigated; but simultaneously with the construction other large areas of the steppe have been surveyed, and at the time of writing the designs are being prepared. In the near future there will be about 1,323,000 acres of irrigated land in this part of Turkestan. Of the total acreage it is estimated that 594,000 acres are in the northern part of Golodnaya Steppe; 648,000 acres in its southern part, and about 81,000 acres are situated on the right bank of the Sir-Daria, which is also called the Dalverzin Steppe.

For this great undertaking some change must be made in the adopted type of the head-works, which are not designed to meet the requirements of a large project. Very probably a dam will be built across the river at or above the present head-gates. By means of the dam, water can be taken direct to the floor of the Golodnaya Steppe. The drop thus created in the canal can be utilized for generating power, which again can be used for pumping.

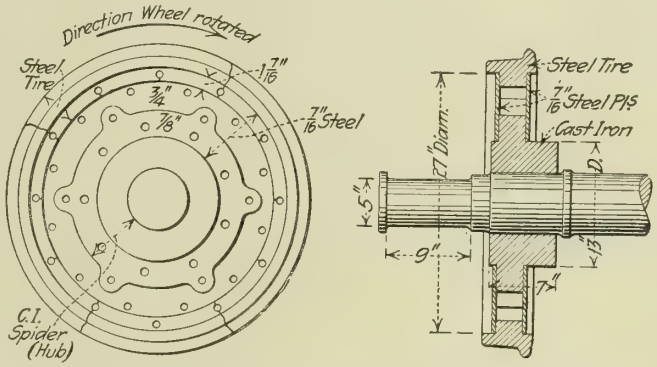
The construction of the project has been made under the chief engineer, F. Tolmacheff, and the assistant chief engineer, A. Kursish, to whom the author is indebted for many data. The contractor was S. N. Chaeff.

[*The Mugan Steppe Project will be described later.*]

Built-Up Car Wheels Declared Inadequate

Steel-railway-car wheels built up with a cast hub, rolled tire and thin cheek plates have been declared of insufficient strength for present requirements. This statement is made by H. W. Belknap, Chief of the Division of Safety, and J. E. Howard, Engineer-Physicist, Interstate Commerce Commission, as the result of investigations following the derailment of a passenger train, caused by a broken wheel, on the Chicago, Milwaukee & St. Paul Ry., at Oakwood, Wis., on Jan. 30, 1915.

After this accident the tire of the wheel causing the trouble was found broken in four pieces, three of which were recovered in 850 ft. back along the track. The remaining piece has not been found. The construction of



Elevation and Section of Built-Up Wheel Which Failed at Oakwood, Wis.

the broken wheel was as shown in the accompanying sketch. Besides the four radial fractures, which all passed through bolt holes, the tire web was cracked from each bolt hole to the inner circumference. The broken pieces of tire assumed a radius of curvature slightly less than when intact, indicating internal stresses. Lack of rigidity and of unity of action in the built-up wheel were shown by brightened plate metal around the outer bolt holes and by shoulders where the inner edge of the tire web bore. The mate to the broken wheel (on the same axle) was found to have incipient cracks at each bolt hole of the tire, though otherwise intact. The total travel of the broken wheel was 276,400 mi., corresponding to 170 million revolutions. The loads ranged from 9375 to 11,250 lb.

Twenty similar wheels which had been removed (for cause) from service were examined, and half were found defective, 56 incipient cracks being seen in the interior of the webs and 19 full fractures. All the tires examined showed internal stress, due to cold rolling in service. One tire through which a radial cut, 2 in. wide, was made sprung together $\frac{15}{16}$ in.

The presence of incipient fractures cannot be detected by hammer test or external inspection—only by partial dismantling of a wheel. The critical places in the construction are hidden by plates and bolts. While wheels of this type are reported as not being used as much as formerly, the investigators recommend inspection of the metal at bolt holes as a safety measure.

The Federal Railway-Valuation Work*

By George H. Burgess†

In the Federal valuation work now under way the Interstate Commerce Commission and the railways of this country are engaged upon an undertaking of great magnitude, and one for which there have been no well-established precedents in this or any other country.

The first state valuation of railways was made in Texas in 1894 for the regulation of security issues. This work was taken up in Michigan in 1900 and in Wisconsin in 1903 for taxation purposes, and in Minnesota in 1907 in connection with revision of rates. Valuations have also been made in Washington, New Jersey, South Dakota, Nebraska, Kansas, Oklahoma and California for various purposes.

The trend toward a Federal valuation of all railroad properties in the United States began with recommendations in the early reports of the Interstate Commerce Commission that such work be undertaken. In 1900 the Interstate Commerce Commission made an investigation of the value of all railroad properties as indicated by market prices of securities, and expanded this work in coöperation with the Census Office in 1904. President Roosevelt in March, 1906, wrote to the Interstate Commerce Commission stating that it seemed to him to be desirable to have a valuation made, and in December, 1906, and again in December, 1907, Senator La Follette introduced bills providing for such a valuation. The final bill which has resulted in this work being undertaken was approved by the President Mar. 1, 1913. There is nothing in the act which specifies the purpose for which this valuation is to be made. The results may be used for any of the following purposes: Taxation, rate-making, control of security issues and state ownership.

The provisions of the act require the ascertainment of the original cost to date, the cost of reproduction new, the amount of depreciation, and other values and elements of value. It also provides for investigation into the financial and corporate histories of the properties and a study of the amount and nature of public aid given in connection with the construction of railroads. The act provides that after the commission has made its investigation and has arrived at a determination of the value of any property, public notice of the same shall be given, and the carrier is allowed 30 days to either accept or appeal from the findings of the commission. It is this provision that makes it so necessary for the carriers to have their own organizations to follow closely the work of the commission's employees, so as to be prepared when the valuation is announced to either accept or reject it.

The Government organization for this work consists of a director of valuation assisted by an advisory board and an attorney, an engineering board, an accounting board, and a land board, as well as a number of men for special purposes; as, for instance, a cost-data bureau has recently been established to make a study as to unit prices to be applied to construction quantities. Charles A. Prouty, who was a member of the Interstate Commerce Commission at the time of the passage of the Valuation Act, is director of valuation. The country has been divided into five districts, each containing about 50,000 mi. of railroad. These districts are known as the Eastern, Southern, Central, Western, and Pacific. The engineering board consists of five members, each member having charge of one of the districts.

Each member of the engineering board is assisted by a district engineer, who is in charge of all the field organizations for his district.

All the members of the engineering board and the district engineers have had considerable experience in railroad work. Of these ten men, nine are members of the American Society of Civil Engineers. The organization for each district consists of a number of engineers having varied duties. There is an assistant district engineer, civil, structural, signal, mechanical, electrical, bridge, roadway and track, field, and office engineers, architects, inspectors of motive power and car equipment, and numerous engineers filling positions in the field parties.

Parties have been sent out on several railroads in each district to make the actual field surveys and field inventory. A field party generally consists of ten men divided into squads or groups, some of which do cross-sectioning, others chaining, and others miscellaneous field and computation work. All of the engineers employed in this work, with the exception of the members of the engineering board and the district engineers, have been selected through the Civil Service Commission at Washington. Many of the higher rated engineers have been selected by the Civil Service Commission, not by means of examination but through selection based on study of a man's record as submitted by himself and as given by references to whom he may have referred the commission in connection with his application. For the junior positions, regular written examinations have been submitted, and the result of such examination, together with a man's record as to education and experience and recommendations by his references, has established a basis for selection.

So far as the work has been undertaken by the Government in the field, it has been to make a very careful and minute survey of all physical property. This involves cross-sectioning of the entire road and careful compilation of quantities of cuts and fills and the classification of materials. All bridges and buildings are measured; all tracks and various units that go to make up the track, such as weight of rail, number of ties, frogs and switches, spikes, fastenings of all kinds, and depth and character of ballast, are noted, and proper allowance is made in compilation of quantities in connection with each item. No attempt has thus been made to establish uniform prices to apply to the units found by the field survey. This is probably a question that will require careful consideration and conference between the Government engineers and the carriers. The Government has, as before stated, established a bureau, the sole duty of which is to investigate unit costs, and this work is in the hands of men who are undoubtedly well suited to handle this question.

Survey parties were placed in the field by the Government in 1914, and work has been in progress on about 16 different lines. Field work has been practically completed on six railways, about 3800 mi. of line.

*From a paper presented before the Binghamton Engineering Society.

†Chairman of Valuation Committee, Delaware & Hudson Co., Albany, N. Y.

Cost of the Work

When it was first suggested that a valuation should be undertaken of all the railroads in the United States, Professor Adams, statistician of the Interstate Commerce Commission, stated his belief that the work could be done at about the same cost as the work that was completed in Michigan at about that time, about $5 per mile or $1,250,000 for the whole country, and that the cost to the railroads would probably be as much more. The costs of all state appraisals had been not to exceed $10 per mile, and in Texas as low as $2 per mile, indicating a very incomplete method of doing the work. In 1912 Interstate Commerce Commissioner Clements stated that the cost would probably approximate $3,000,000 and the length of time to do the work would be three years, although he afterward stated that the cost might run up to $5,000,000 and the time to five years. Interstate Commerce Commissioner Meyer at about the same time stated that the cost would probably be as high as $5,000,000 for the Government and that it would cost the railroads as much more and take four years to complete the work. Railroad officials who appeared before the Senate committee at hearings on the bill which was finally passed also greatly underestimated the cost, as they stated that the work would cost the railroad companies and the Government each about $3,000,000.

In August, 1913, after the passage of the act and when the plans were fairly well formulated as to the method of handling the work, the Interstate Commerce Commission estimated that the Government expenditure would be from $10,000,000 to $15,000,000 and that the work would take about seven years to complete. A year and a half after the passage of the act Director Prouty in his speech before the National Association of Railway Commissioners on Nov. 17, 1914, stated that the expense to the Government would be about $16,000,000 for obtaining cost of reproduction and for the accounting work and that it was likely the cost to the railroads would be from $25,000,000 to $35,000,000, which would mean a total cost of nearly $50,000,000—quite a different estimate from that made at the time of the passage of the act. As to the length of time that it will take to do this work, two years have elapsed since the passage of the act, and up to about the first of January field work has been completed on about 11,000 mi. Allowing a year to get the work under way, it is safe to state that 11,000 mi. has been completed in one year. Directer Prouty has stated that sufficient parties should be in the field by July 1, 1915, to complete 4000 mi. per month, or 48,000 per year, which would mean that from July 1, 1915, it will take practically five years to complete the work. This estimate is based on past results, generally on smaller roads, and it is probable that work cannot proceed so rapidly on the larger systems, so that it seems probable that this time limit may be exceeded.

Valuation Organization by the Railways

On the passage of the Valuation Act it became necessary for the railroad companies to establish an organization which would enable them to keep in touch with the progress of the work and provide the required coöperation with the Government. Practically all the railroad companies in the country joined in the formation of what is known as the President's Conference Committee. This committee consists of 18 railroad presidents under the general chairmanship of Samual Rea, president of the Pennsylvania Railroad. This conference committee is divided into three groups—Eastern, Western and Southern—with a chairman for each group.

At the group headquarters there is an engineer reporting to the chairman. There are a number of attorneys attached to the various groups, whose duty it is to consider the legal aspects of the problems confronting them in connection with the work. There have also been formed an engineering committee of 13, an equipment committee of 5, a land committee of 15, and a financial, history, and accounting committee of 13. These committees report to the Presidents' Conference Committee and take under consideration the various questions for which decision is desired by the carriers as to methods of procedure and uniformity of action; and at the same time these committees meet with the various Government boards of similar character to discuss questions which may arise.

Practically all the railroad companies have organized valuation committees, made up of officials of the company, generally composed of representatives of the engineering, motive-power, land, accounting, and legal departments, and in addition a special organization has been formed to carry on the actual preparation of necessary information. The Delaware & Hudson Co. established an organization about Nov. 1, 1913. In addition to the preparation of required maps and profiles, we have made a careful study of the construction history of the road to obtain dates as to the building of the various parts of the system.

One of the most important features of our present work is the study of our records for hidden or obscure items of cost. It is obvious that a field inspection of a property, even with careful measurements taken of all visible features of construction, will not be the true measure of quantities comprised in the property nor give us the true cost or value. For instance, fills have been made on soft ground requiring many yards of earth which cannot be measured, difficult and expensive foundations have been placed under structures which do not show up now, streams and highways have been changed, and innumerable difficulties have been encountered involving heavy expenditures which cannot be determined on the ground.

Our search of the records discloses many of these items in such a way as to be readily verified, also the recollection of older employees and residents along the line gives us information of importance. All these data are collected in such form as to be properly presented to the Government engineers, and will no doubt be accepted.

It is necessary for the carriers to have representatives with the Government parties, who are called pilots, who are supposed to be thoroughly familiar with the property. These pilots will be intrusted with the duty of seeing to it that all visible property of the railroad is measured or noted. Also they must call attention to the hidden and obscure quantities where known to exist, and generally assist the Government party in making an accurate survey of the entire property. The careful training of the pilots is essential, and the men who are now working up the preliminary information will later be used by the carriers as their pilots.

The Delaware & Hudson Co.'s lines are made up of 11 different active corporations, while the total number of

corporations that have been organized during the history of the company is 47.

The first railroad track built on the Delaware & Hudson was completed and put in operation in 1829 between Carbondale and Honesdale. This consisted of hemlock stringers with iron strap rail to reduce wear. The motive power was gravity and horses. The first locomotive engine that ever ran on rails in this country was the "Stourbridge Lion," which ran a trial trip over a part of this track on Aug. 8, 1829. While the success of this means of locomotion was assured by this experimental trip, the locomotive was not used in regular traffic, it being found that the track and trestles supporting it over streams were not of sufficient strength to carry it.

The first line which now makes up the Delaware & Hudson system on which steam power was used regularly is that between Saratoga and Schenectady, which was built in 1832 from Schenectady to Ballston and completed in 1833 to Saratoga. In 1835 the line from Troy to Ballston was built and in 1850 was completed through to Whitehall. The line along Lake Champlain to the Canada line was built in the '70's and completed in 1876. The line between Albany and Binghamton was completed in 1869, having been under construction for about ten years. About 87% of the Delaware & Hudson system was built prior to 1880, so that it becomes rather difficult to get satisfactory records of construction carried on more than 30 years ago.

It is of the utmost importance that all quantities should be carefully measured and every possible allowance made to the railroad companies for the full amount of tangible property.

New Chittenden Plant of the Pittsford Power Co.

By Thomas Fraher*

SYNOPSIS—The highest-head plant in the East develops 3700 hp. from water flowing between two reservoirs and previously unutilized. A notable feature is a 2¼-mile length of Oregon fir pipe. Some interesting notes on construction methods for a small plant are appended.

The recently completed hydro-electric development of the Pittsford Power Co. in Chittenden, Vt., 7 mi. north of Rutland, is of unusual interest, since it has the highest head in the East and a long wood-stave penstock built mostly of Oregon fir. A short run of pipe made from local spruce allows comparison of two materials and shows the advantages of the Western lumber.

The plant utilizes storage water from an existing reservoir, the flow from which to a lower reservoir formerly performed no useful work. This reservoir impounded about 800,000,000 cu.ft., which the additional runoff increased to about 1,000,000,000 cu.ft. of water available in an average year. The static head from the top of the flashboards to the weir in the tailrace is 481 ft. Two 1850-hp. units are installed at present, and provision has been made for a third similar unit.

Features of Design

Wood-Stave Pipe—Fig. 2 shows the alignment of the pipe line. Starting at the dam, it is of native spruce for a distance of about 1400 ft., and then of Oregon fir for 12,000 ft. farther, except at a point around a rocky knoll, where the curvature was too short for wood-stave pipe and it was found necessary to insert a steel bend. The gradient to the end of the wood-stave pipe is uniform at 0.3%, but from here the line drops abruptly to the power house through a steel penstock about 2800 ft. long. The spruce staves were made from lumber cut in the adjacent territory and air-dried for nine months. They were then milled to a finished thickness of 2⅝ in. and averaged from 12 to 14 ft. long. The Oregon-fir staves were made from live Douglas fir and were milled to a finished thickness of 2⅛ in., the average lengths running about 20 ft. Thirty-six fir staves made a pipe section of 60 in. inside diameter. The pipe details may be summarized as follows:

Inside and outside of staves milled to true pipe circumference; edges beveled radially; ends butted square and given ⅛ x ½-in. saw cut for steel tongues; bands of openhearth steel, ⅝-in. diameter, one with both ends headed and one with rolled threads on each end, bent to pipe circumference and dipped in asphaltum paint before shipping; "noneccentric" malleable-iron dipped shoes; band spacing varied from 3 to 6½ in.; maximum head, 85 ft.

Connection was made between the existing 48-in. outlet valve of the reservoir and the 60-in. wooden penstock through a steel increaser with an 18-in. branch, upon which was placed a 24-in. steel vent pipe 55 ft. high, protected by a double casing of wood staves and electrically heated by a car heater.

Aqueducts—Fig. 2 shows four stream crossings. These were made on steel I-beams supported by 2x8-ft. concrete piers and rubble-stone abutments. The spans are shown in detail in Fig. 4. The distance of the cradles above the top of the flange varied according to their position, so that when the pipe was full the deflection of the beams would bring the staves to a straight line. Both cradles and staves on the trestles were creosoted.

Steel Penstock—At the end of the wood-pipe line is a steel nipple, to which is bolted a butterfly valve, to which in turn is bolted a tapered section, reducing the size from 60 to 54 in. The steel penstock then makes a combined horizontal and vertical curve and runs to the power house through various gradients from 2 to 65%. The steel-pipe data may be thus summarized:

Length of 54-in. lock-bar pipe, 600 ft.; length of 54-in. riveted pipe, 1100 ft.; length of 52-in. riveted pipe, 1050 ft.; thickness varies from ⅝ to ⅜ in. All circumferential seams single riveted; longitudinal seams triple riveted with double butt straps.

The steel penstock is anchored at the angles and there is a heavy reinforced-concrete anchor at the power house.

Surge Tank—Just below the butterfly valve a 48-in. steel-pipe connection is taken off to a surge tank 14 ft. in diameter by 90 ft. high. The top of this is 19 ft. above the flashboards on the dam. After the tank was tested a frost casing, 18 ft. in diameter, made of old 2-in. plank

*219 West 140th St., New York City; formerly Superintendent of Construction for W. S. Barstow & Co., at Chittenden, Vt.

and covered with wire lath and cement plaster, was built around it. The tank is heated by a stove housed in a stone structure located at the foot of the 48-in. connection, from which point a smoke-pipe is run inside the casing and out through the roof at the top of the tank. The foundation for the tank is of concrete on solid rock, the six 2½-in. anchor bolts going into the rock.

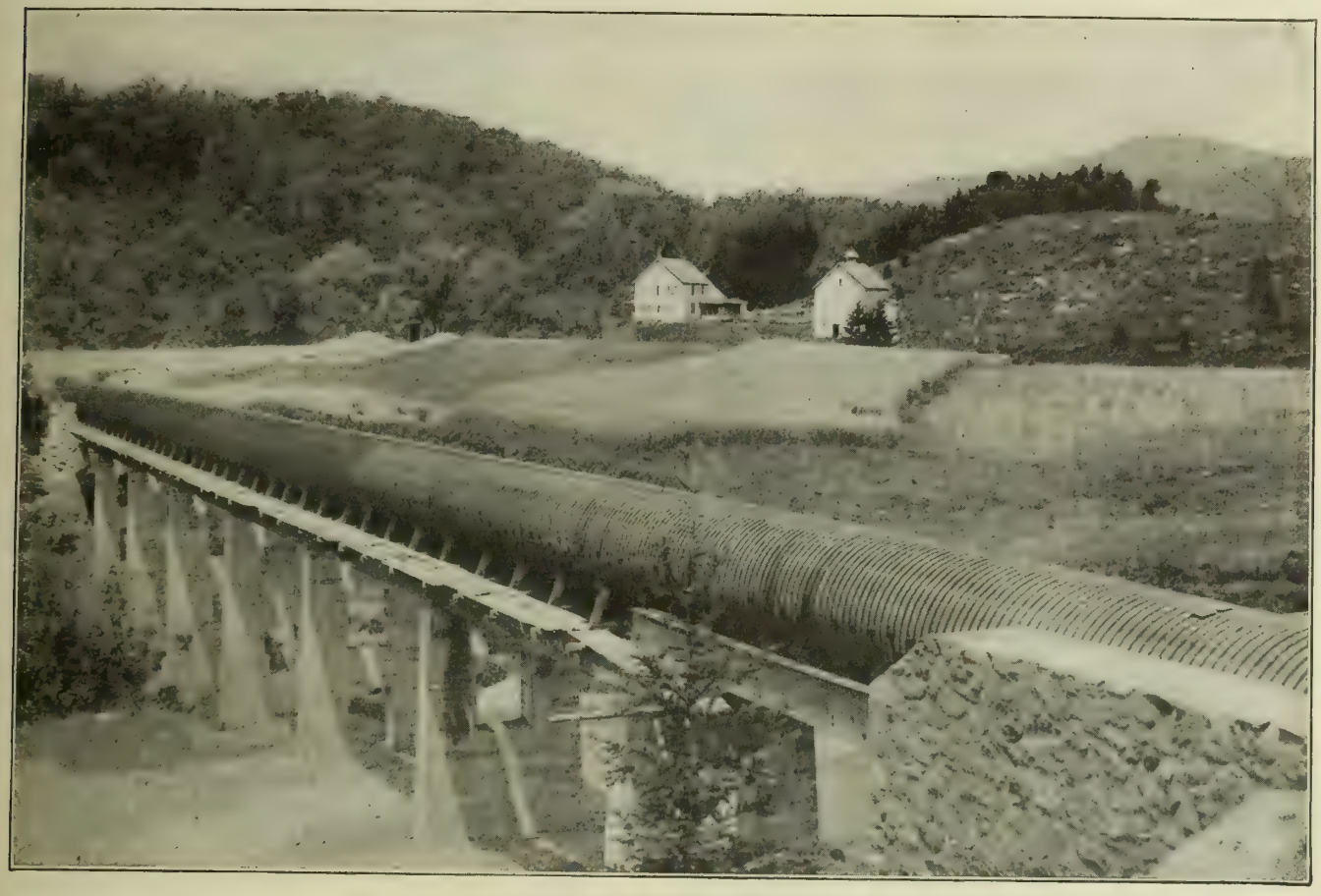


FIG. 1. WOOD-STAVE PIPE LINE AND VIADUCT, PITTSFORD, VT.

Power Station—The generating station (see accompanying elevation) is a single-story brick structure 38x71 ft. inside and 22 ft. high. Just outside is located a venturi meter, from which the penstock enters the building, coming up through 24-in. nozzles into the turbines, which are supported directly overhead on 12-in. H-beams. The turbines are of the Francis type, rated at 1850 hp. for 720 r.p.m. and 430 ft. effective head at full gate. At the driving end of the shaft is a 4½-ton flywheel. Relief valves operated by the governor are installed on each turbine to protect the line against undue rise in pressure resulting from any sudden large variation in the load.

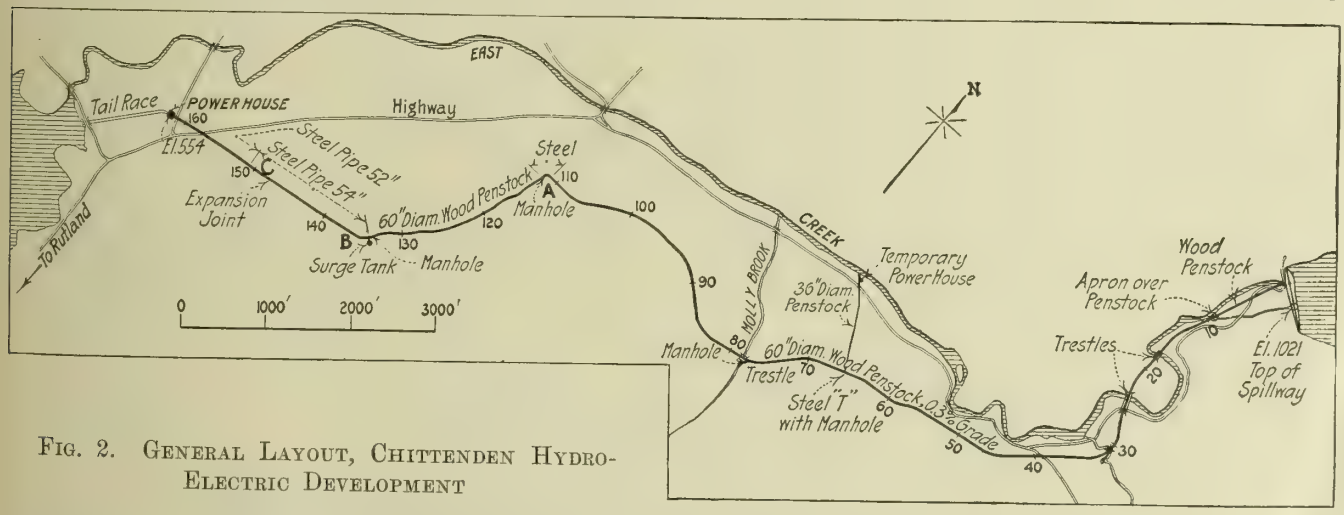


FIG. 2. GENERAL LAYOUT, CHITTENDEN HYDRO-ELECTRIC DEVELOPMENT

Each generator is a 2300-volt three-phase 60-cycle machine, rated at 1250 kv.-a., and has an overload capacity of 25% for two hours. Each has a direct-connected exciter. Each unit has a bank of transformers consisting of three single-phase 400-kv.-a. 2300-44,000-volt water-cooled units, taking water at reduced pressure from the penstocks. Cables under the floor lead through remote-control switches to a copper-tube bus. Each transformer bank is connected to the bus through disconnecting

switches and to a 44,000-volt outside bus through roof bushings and outside air-break switches, which are hand-operated from the station floor. The high-tension bus, air-break switches and lightning-arrester horn gaps are mounted on pipe framework on the roof.

Construction Notes

Excavation—Excavation was started about Jan. 1, 1914, but on account of a contract to deliver power beginning July 1 it was decided that it would be necessary to build a temporary station at a point half way down the line



Fig. 3. Covered Surge Tank

where 200-ft. head could be obtained, and then finish the permanent station as soon afterward as possible. An office, storehouse and bunkhouses were first built near the temporary station site. A party ran out line and grade, set slope stakes, etc., for the pipe lines. About 50 men were started on excavation, and it was found that the snow blanket had prevented deep freezing. Most of the work was done by pick and shovel, with the assistance of plows and scrapers where they could be used to advantage. It was necessary, however, to uncover only as much ground as could be brought up to grade by nightfall. Most of the excavating was through ground filled with large boulders, some of which were dragged out to fills; but the largest were broken and removed by exploding a charge of powder in a pocket underneath. All fills were left until warm weather, although the culvert drains were laid.

By March an office, cement-shed, storehouse and bunkhouses had been built near the permanent station site and 75 men were started on the excavation for the steel penstock. The forces were increased with better weather, and numbered 300 in June. On the lower thousand feet of the wooden penstock and for the steel line much solid rock was encountered. This was drilled first with two hand air drills supplied by a 6-hp. portable gas-engine vertical-compressor outfit; later three drills were used with an 8x8-in. compressor, which at the start was driven by a gasoline engine and later by a 50-hp. electric motor.

Distributing Material—About Apr. 1 the different materials began to arrive in Rutland. The site is from 500 to 1000 ft. higher than the city and from 7 to 10 mi. distant. Except for about 2 mi. near the city, the roads are very poor, chiefly of sand or sand and clay. About 2500 tons of freight was moved, mostly by means of horse-drawn vehicles, but two gasoline motor trucks gave good service also.

Most of the penstock line was through a very rough country more or less timbered, which required the building of roads and special arrangements for handling material. The greater part of the steel pipe was unloaded at two yards, from which it was distributed into place on flat cars hauled along a narrow-gage track by hand winches and a horse-driven capstan.

Laying of steel pipe commenced about the middle of July, the construction being started from the power-house end. To supply his reaming machine, riveting hammers, calking chisels, etc., the contractor used a 250-cu.ft. air compressor operated by a 50-hp. motor. The pipe was lowered into the trench by two portable derricks made of 4x6-in. timbers and spanning the trench.

Building the Wood-Stave Pipe—The wood-pipe material was unloaded and sorted at several distribution points along the line and carried alongside or into the trench by lightly loaded wagons. The wood-pipe company had an experienced foreman and assistant and about 25 common laborers from the surrounding territory. On curves the average progress was about 200 ft. per day of 10 hr. and on tangents about 300 ft., the best day's work being about 420 ft. where the staves averaged about 25 ft. long. Laying the 1400 ft. of spruce pipe (by the power company) was necessarily slower because of the short staves

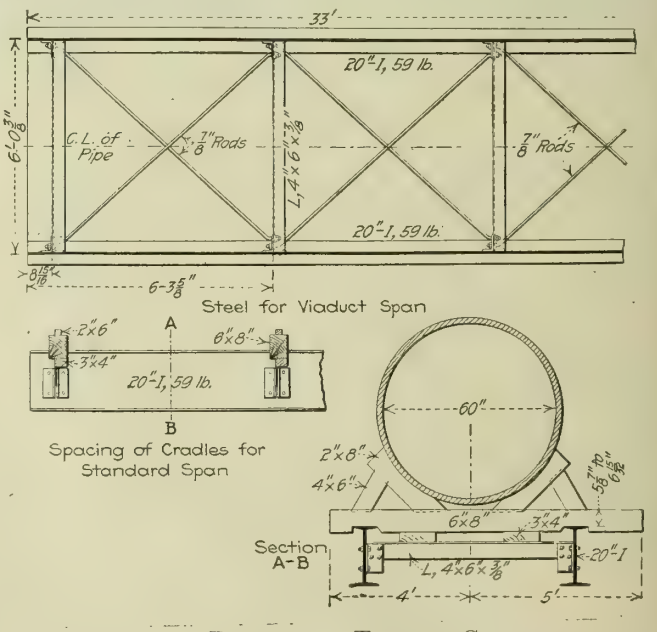


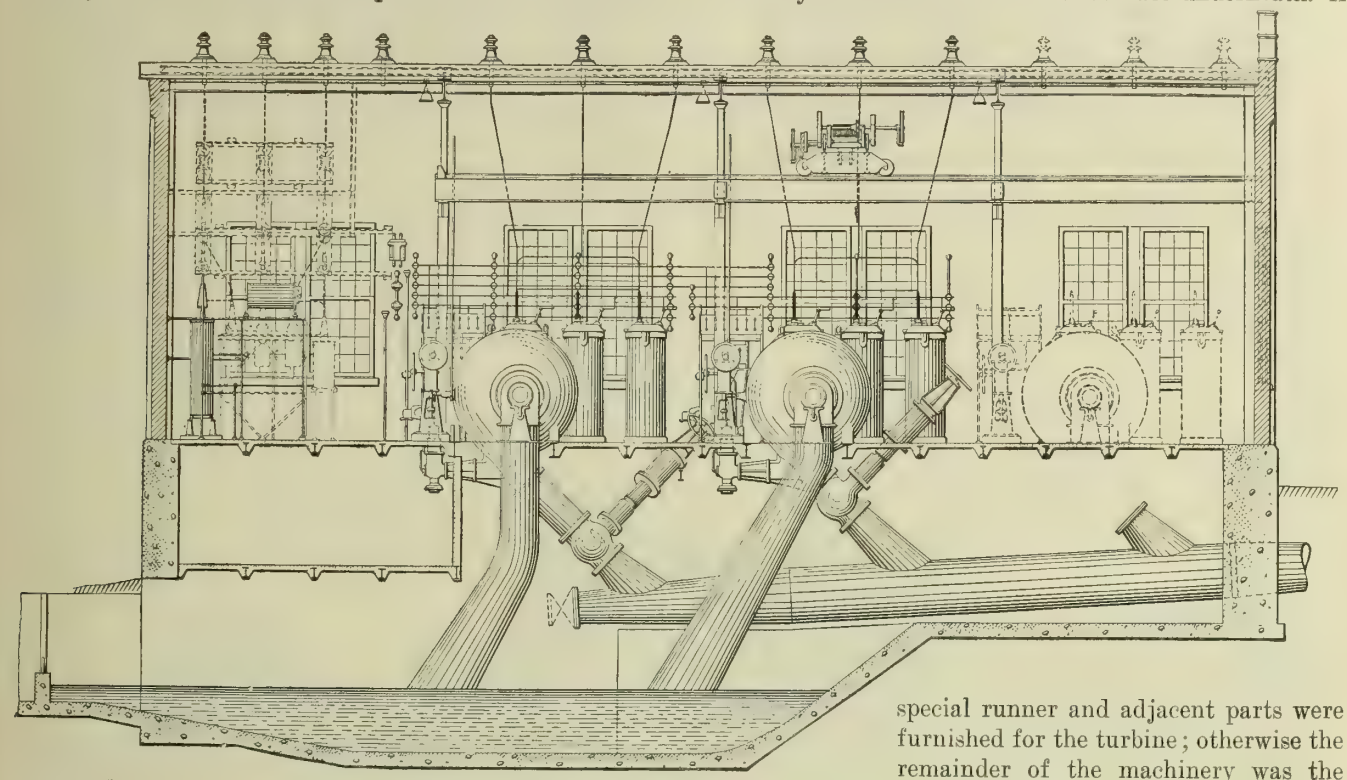
Fig. 4. Details of Trestle Cradle

and because the work had to be done in sheeted and braced trenches.

Temporary Station—On the wood-pipe line, at a distance of 6550 ft. from the dam, a steel T was inserted and from it a 3-ft. penstock, 1080 ft. long, was run to the temporary plant. The upper 580 ft. was made of spruce; the lower 500 ft. was made of ¼-in. steel plates with single-riveted lap joints. The staves were milled by the company and put together with one-piece bands. A

local firm made the steel pipe at the site. At the back of the T there was connected a 2-ft. steel pipe, 80 ft. high, performing the functions of a surge tank and vent. In the main (60-in.) wooden penstock, just below the end of the T, was put a steel bulkhead made of a boiler head, backed by an inside ring of staves held by bolts through the pipe and packed with oakum. As additional security a wooden bulkhead was placed about 1000 ft. farther down the line and the space between filled with water, with an overflow to prevent excessive pressure. This assisted in taking up shocks due to water hammer.

The temporary building, 18x40 ft. and 20 ft. high, was a frame structure covered with tar-paper and having a wooden roof, on which was mounted the high-tension switches and horn gaps. Concrete foundations were built for one hydro-electric unit and its tailrace underneath. A special runner and adjacent parts were furnished for the turbine; otherwise the remainder of the machinery was the same as that for the permanent plant. The maximum capacity obtained from the unit under the 200-ft. head was about 600 kw.



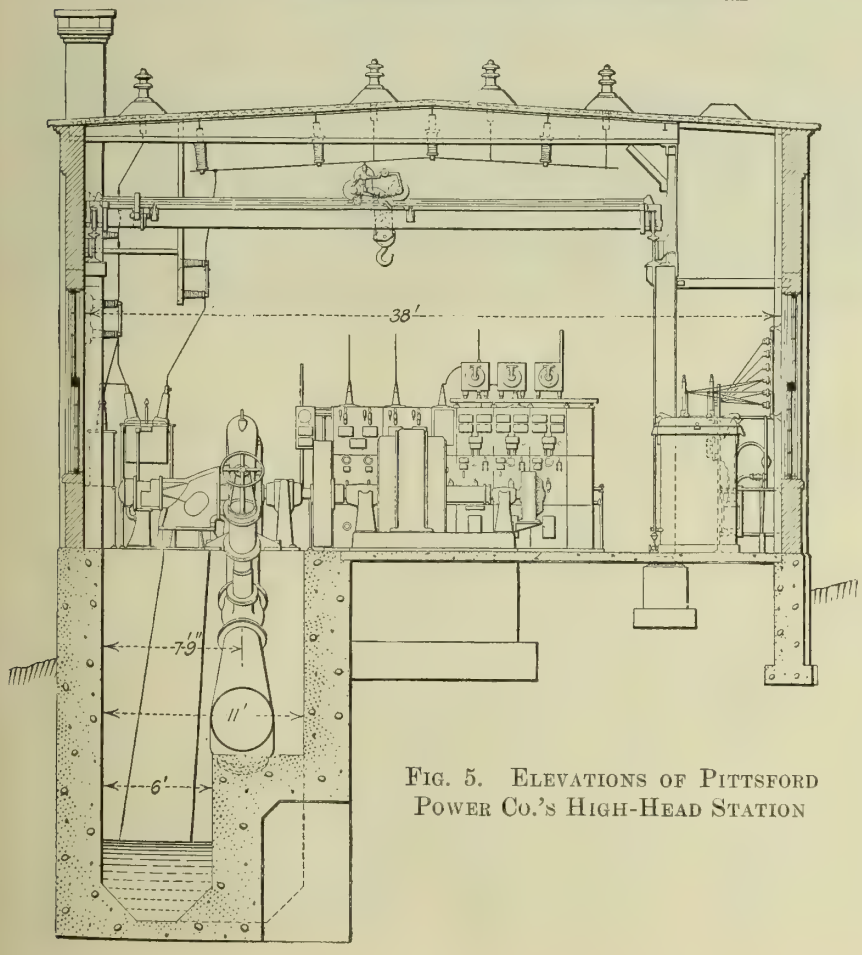


FIG. 5. ELEVATIONS OF PITTSFORD POWER CO.'S HIGH-HEAD STATION

The temporary plant was started on July 1 and kept in service until October, although the permanent plant was started in September. The apparatus from the temporary plant was then removed to the permanent plant. The temporary penstock was taken down and rebuilt at Molly Brook (Fig. 2), where a small collecting basin with a dam was built at an elevation of 80 ft. above the penstock to carry the water from that brook into the penstock instead of letting it flow unharnessed into the lower reservoir.

ORGANIZATION

This development of the Pittsford Power Co. was designed and constructed under the supervision of W. S. Barstow & Co., New York City. The wood-stave line was built by the Pacific Tank & Pipe Co.; the steel pipe by the East Jersey Pipe Corporation, the turbines by S. Morgan Smith Co., the governors by the Lombard Governor Co., and the electrical equipment by the General Electric Co.

The New Traymore Hotel at Atlantic City

SYNOPSIS—Details of design of one of the largest and most complicated reinforced-concrete buildings in this country. Eighteen stories high. Founded on wooden piles in sand beach of Atlantic Ocean. Structural details complicated by architectural layout. Notable for its rapid and efficient construction.

The Traymore, at Illinois Ave. and the Boardwalk, in Atlantic City, N. J., is one of the oldest hotels in that city of hotels. In 1909 a 12-story tower of reinforced concrete faced with building tile was built at the Boardwalk end of the lot to connect with the low frame structure which had long occupied the site. During the last year there has been under construction on the site of this old frame building an 18-story reinforced-concrete structure of exceptional size and architectural complications, which when joined to the slightly altered tower section forms one of the largest buildings of its type.



FIG. 1. THE WEST FACE OF THE TRAYMORE HOTEL JUST BEFORE COMPLETION

The hotel contains 700 bedrooms with baths, besides a great number of public rooms. Its construction is remarkable not only on account of the structural design but because of the speed with which it was erected. The old hotel was vacated July 1, 1914. The site was cleared ready for the builders Sept. 1, 1914. The new hotel was opened for service June 1, 1915.

REVISION OF OLD BUILDING

The Boardwalk tower, being of modern construction, was, with few changes, incorporated into the final structure. These changes comprise the erection of a three-story addition at the front, where before had been only porches and an entrance walk; the addition of several balconies and porches, the changing of the first three floors to meet the different levels of the same floors in the new building, and the architectural revision of the dome and upper works to fit in with the final architectural design of the building.

The old tower, of reinforced-concrete frame and tile face, was 55 ft., octagon in plan, and 12 stories high. The two lowest floors had to be removed to fit the levels of the adjoining new building, and cutting out these floors left the reinforced-concrete columns of the structure without permanent interior bracing for three stories. In order not to overstress these columns during construction through excessive unsupported height and wind stresses, lateral temporary shoring was used until two new floors and a gallery were installed. As these old floors came at different levels, the original column splices were midway between the floors, and in order to overcome the weakness thus left concrete collars (Fig. 4) were placed around the columns at the splices and reinforced with spiral and vertical steel. During the time the temporary shoring was in place the superstructure underwent strains from two very severe storms without apparent effect. The old concrete at this part was cut out with chisels and the rods cut through with gas torches.

The balconies which were added were supported on steel brackets stone-bolted into existing reinforced-concrete columns. These brackets were fireproofed with concrete and a concrete slab was put on top. The floor was then tested to twice the live-load without deflection, thus proving the value of stone bolts when properly executed (Fig. 4). Outside of the old building three stories of stores and porches were built of reinforced-concrete col-

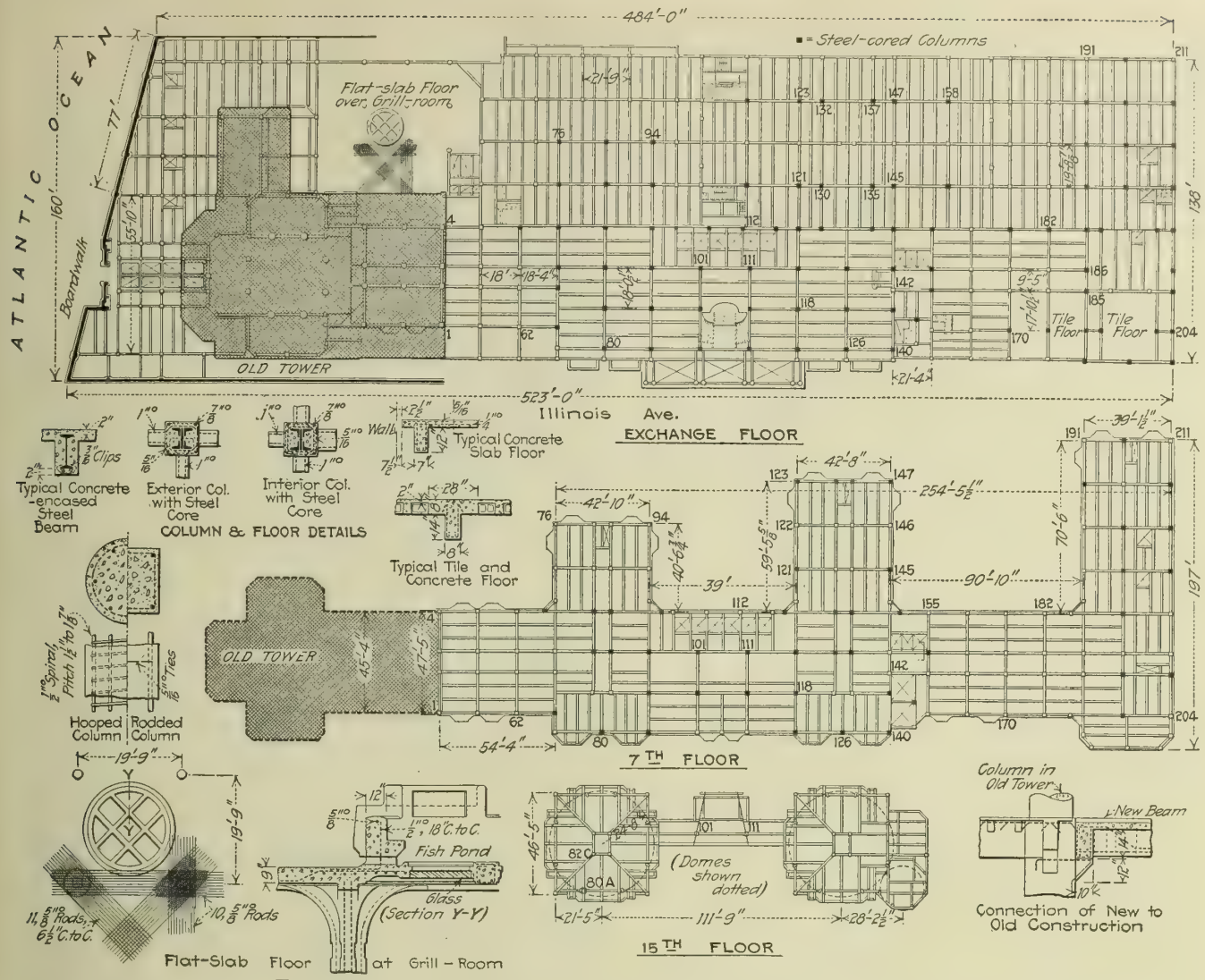


FIG. 2. FLOOR PLANS AND DETAILS OF THE TRAYMORE HOTEL

(The three plans show the main changes in floor plan; from them the continuous columns may be located by numbers. Old tower is shown hatched and in outline. Steel-cored concrete columns are denoted by solid section. Details are given of various column and floor sections)

umn and beam-and-slab construction. In this section no particular complication arose except in a few balconies and cantilever supports to porches and in the flat-slab roof to the grill-room, described hereinafter.

GENERAL DESIGN OF NEW SECTION

The addition, which with the revised tower forms the new Traymore Hotel, was built simultaneously with the alterations and additions to the old building. This addition is of reinforced concrete, rising at its highest part 18 stories (15 sleeping floors above 3 service floors), and is capped off with two large central domes with one smaller one, so that the total height from grade to top of dome is 230 ft. The facing walls are of 6-in. hollow tile faced with brick, and the old tower will be refaced with brick to blend in color and texture with the new surface. For the first three floors the building with the old section covers an area of 140x520 ft. Above the third floor the central section is somewhat smaller, and there are three wings, each extending farther than the other from the main building, thus permitting a maximum number of rooms to have an ocean view. From the eighth sleeping floor, or the 11th main floor of the building, the plan changes at each floor for architectural purposes, thus involving extreme complication in column location, and consequently in structural design. The plans in Fig. 2 show three floors where changes are most marked, and the relative area of the new to the old section is indicated.

FOUNDATIONS

The building site is entirely in beach sand, extending down as far as any investigations have gone. Grade is only 4 ft. above mean high water of the Atlantic Ocean, and the ocean at extreme high water flows up practically

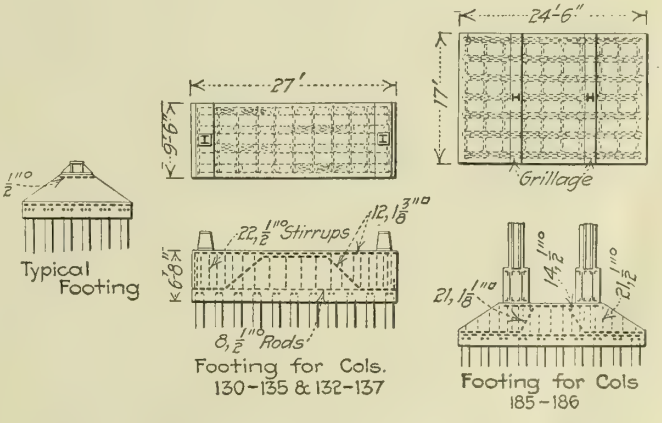


FIG. 3. SOME TYPICAL FOUNDATION DETAILS

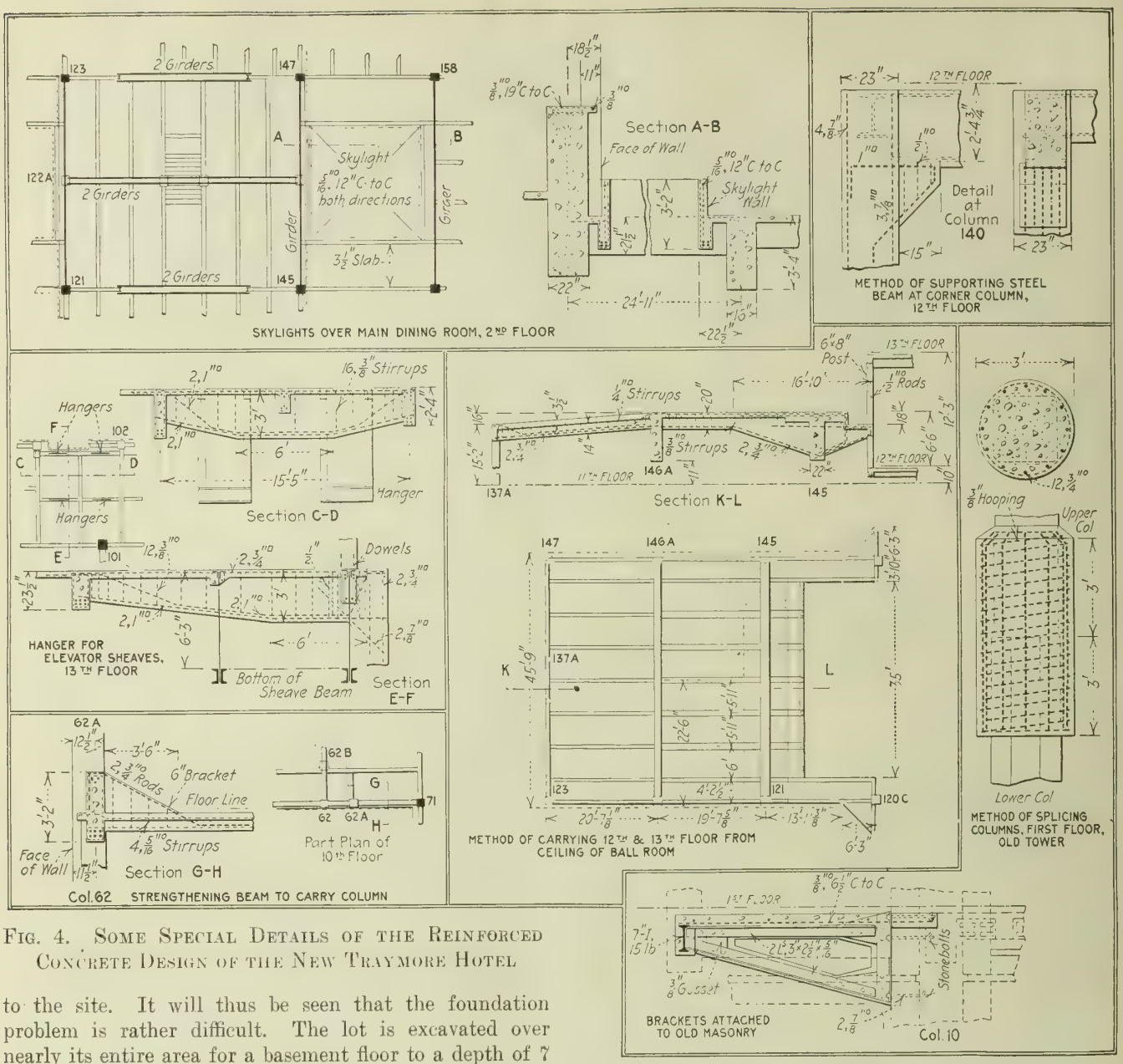


FIG. 4. SOME SPECIAL DETAILS OF THE REINFORCED CONCRETE DESIGN OF THE NEW TRAYMORE HOTEL

to the site. It will thus be seen that the foundation problem is rather difficult. The lot is excavated over nearly its entire area for a basement floor to a depth of 7 ft. Waterproofed reinforced-concrete retaining walls and floors were built for the various service pits required, which run from 8 to 11 ft. below the basement floor.

The foundations to the columns consist of reinforced-concrete mattress footings on wooden piles. These piles average 18 ft. long, are 12 in. at the butt and 6 in. at the tip. They were jetted into place, but afterward were tapped with a steam hammer to practical refusal. In order to test the behavior of the pile, one of each group was retapped several days after jetting the group, and it was found that they maintained their refusal position.

On account of the varying loads on the piles during erection, due to the peculiarities of the plan, it was anticipated that at times some piles would be fully loaded far in advance of adjacent piles. In order to overcome any tendency to unequal settlement a rather low unit load (15 tons) per pile was used. This load is considerably less than that used on the original tower, which was not subjected to this condition, being more uniform in plan. From tests on piles on an adjacent plot it was decided that a long pile, say 32 ft., did very little more work, if any, than a short one of 16 ft., and that a pile by itself developed greater unit resistance than one of a number in a cluster, the pile spacing being 2 ft. 6 in. c. to c. As shown in the details in Fig. 3, where exceptional loading required it, the pile footings were reinforced with steel girders.

As plunger elevators were installed and plunger wells were sunk after the main construction of the building, it was necessary to keep the jetting above the lowest point of the plunger well so as not to disturb the soil around the piles through which these plungers extend.

STRUCTURAL DESIGN

The structural design is complicated by the architectural details and the arrangement of floor space demanded for a large hotel. In general the floors of beam-and-slab reinforced concrete are carried on straight rodded reinforced-concrete columns, but in different places tile-and-concrete and girderless floors are used and columns are reinforced with either hoops or structural-steel cores. Bay windows, bracketed porches, curved dormers, domes, pilasters, etc., all added to the difficulty of detailing the concrete work.

Column Layout and Design

The offsetting from floor to floor complicated the column layout, and on this account the girder design. There are 179 columns starting from the foundation. All these continue up through the first three floors to the first sleeping floor. At this floor 15 columns stop and carry girders which support 20 additional columns starting

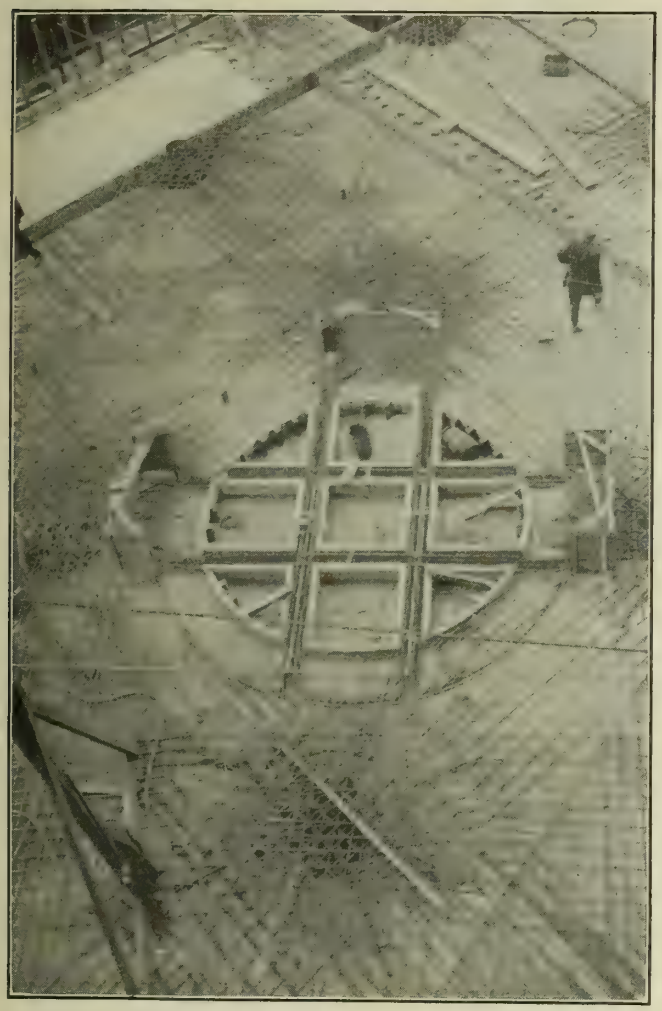


Fig. 5. Mushroom Flat-Slab Floor over Grill-Room under Construction

(See detail in Fig. 2 for design and location)

at that floor. At the second sleeping floor 12 columns stop and carry girders supporting 17 additional columns. At the ninth sleeping floor 6 columns stop and carry girders supporting 8 additional columns. At the 10th sleeping floor 13 columns stop and carry girders supporting 18 additional columns. At the 11th sleeping floor 10 columns stop and carry girders supporting 10 additional columns. At the 12th sleeping floor 13 columns stop and carry girders supporting 11 additional columns. At the 13th sleeping floor 25 columns stop and carry girders supporting 22 additional columns (see View *A* in Fig. 7).

Thus of the 179 columns starting at the foundation there are in addition 132 columns starting on girders at the various floors. Of the 41 columns that run up to the springing line of the dome only 9 continue to their own foundation. The 32 other columns are supported by girders at different floors.

In the upper part of the building, where most of these new columns start, the sections are of the straight-rodded type. Where the loads are heavy and space would not permit a concrete column, the steel-cored columns shown in detail in Fig. 2 are used. In these cases steel bracket angles are framed into the steel of the column to carry the reinforced-concrete beams, and rods are placed both ways around the columns to take negative bending moments. In some cases, as shown in Fig. 4, an outside girder had to be strengthened to take the load from a column starting at that floor.

Floors

A typical beam-and-slab floor is shown in Fig. 2. At the front of the building over the grill-room, where a flat ceiling was desired, it was considered that a flat-slab floor of the "mushroom" type answered the purpose best. The details are shown in Fig. 2 and a view during construction is given in Fig. 5. Here, too, a fish pond is carried on the floor with glass bottom visible from the grill-room below, which detail added to the difficulties of design. Over the mezzanine and first floors long-span tile and concrete joist slabs, as shown in Fig. 2, were detailed so as to provide ceilings comparatively free from beams in the public rooms of the lower floors.

Special Details

Mainly on account of the offsetting, a number of special structural details had to be used. These cannot be described fully, but a few of the more important ones will be noted. Most of these are shown in detail in Fig. 4. Their location in the main building may be traced from the column numbers which are shown in both Fig. 2 and Fig. 4.

From the second to the ninth floor the construction is fairly typical, except for the cantilevered bay windows, both of slab and of beam type, and the balconies on concrete brackets. On the second floor, in the central wing, large steel girders were used to support the columns coming down from the 13th floor, thereby enabling the American-plan dining room on the second floor to be free of central columns. Above the 11th floor the building begins to reduce in size, and consequently offset columns

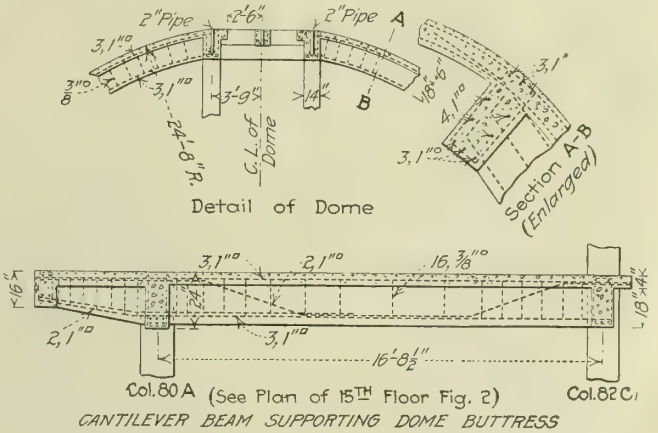


Fig. 6. Reinforced-Concrete Details of Dome

commence to occur. Here also is a pitched roof section (View C, Fig. 7).

Above the 13th floor special details had to be provided to support the groups of elevator sheave beams, which are suspended from the floor-beams by hangers.

The 14th and 15th floors are practically all cantilever members supporting the large ornamental brick buttresses

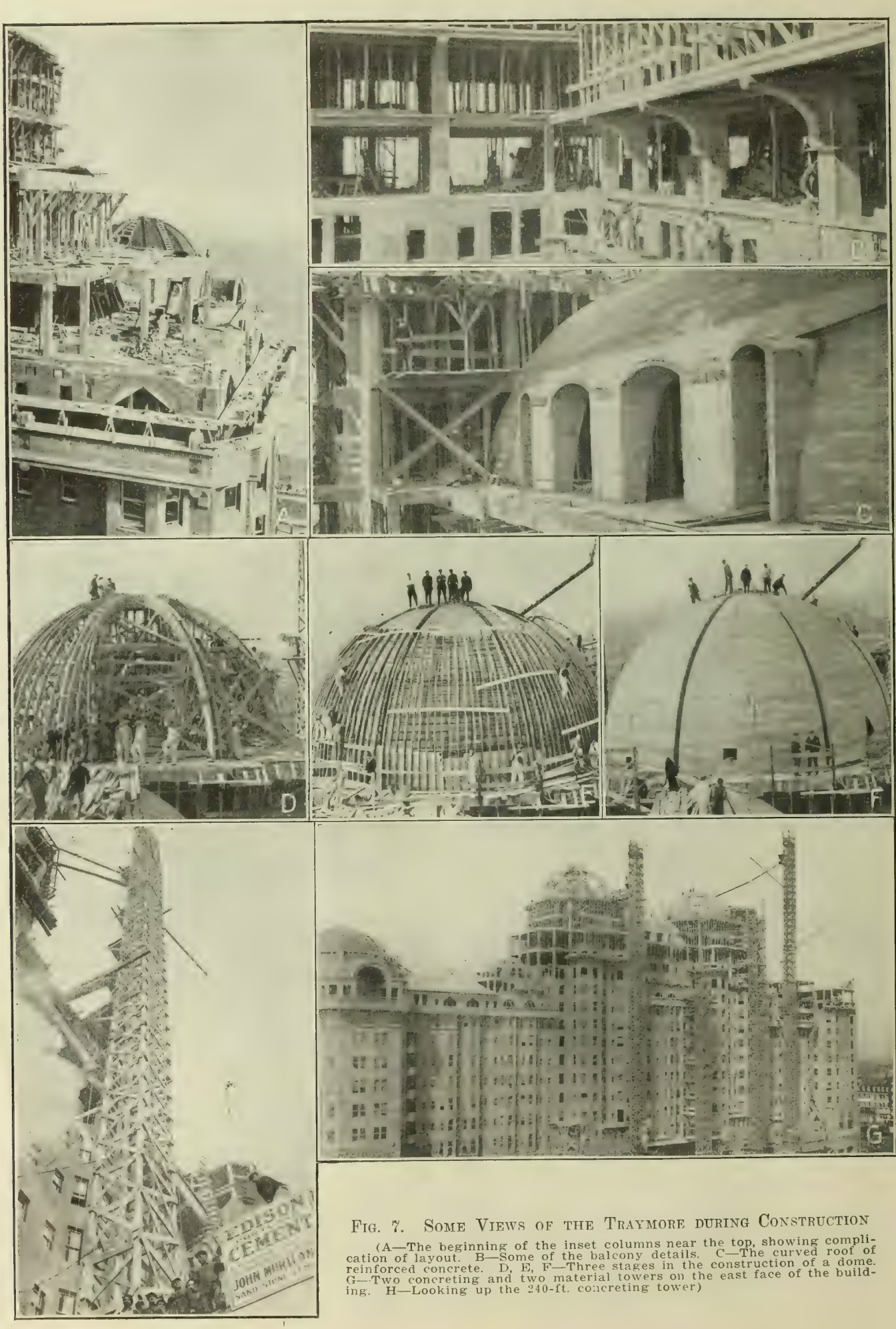


FIG. 7. SOME VIEWS OF THE TRAYMORE DURING CONSTRUCTION

(A—The beginning of the inset columns near the top, showing complication of layout. B—Some of the balcony details. C—The curved roof of reinforced concrete. D, E, F—Three stages in the construction of a dome. G—Two concreting and two material towers on the east face of the building. H—Looking up the 240-ft. concreting tower)

(Fig. 2). These buttresses run down 3½ stories, about 35 ft., and extend out a maximum distance of 13 ft. They are supported on cantilevers framing into a diagonal girder of the floor construction, which takes a negative moment from the kick-up (Fig. 6). The weight of each dome is 240 tons, and two-thirds of this is carried by concrete girders not directly meeting columns.

A special detail occurs above the 12th floor, where a reinforced-concrete girder, 44 ft. long, over the ballroom carries on secondary cantilever members the columns of the floor above and on hangers the floor below (see detail in Fig. 4).

Loads and Stresses

The live-loads used in the design were as follows:

	Lb. per Sq.Ft.
Roof	30
Sleeping floors	60
Laundry floor (plus special machinery loads)	150
Kitchen and exchange floor	100
Garden (plus dead-load of earth fill)	200

The live-load coming on girders was reduced 10 per cent. when carrying bays of not less than 100 sq.ft. and 2 per cent. additional for every additional 100 sq.ft. above 100 sq.ft. The live-load on columns except on roof, top floor and exchange floor were reduced 5 per cent. per floor until 50 per cent. of the live-load was reached, when such reduced load was used throughout the remaining floors.

The following stresses were used:

	Lb. per Sq.In.
Concrete in direct compression	500
Concrete in compression under bending	500
Concrete in shear	100
Concrete in bond to steel	75
Steel in tension	16,000
Steel in shear	10,000
Ratio modulus of elasticity of concrete to steel	1 to 12

In a few special cases the steel was stressed to 20,000 lb. tension where the load carried had quite a number of floors and a large area of live-load was included in the load. All uniformly loaded members were designed with a bending moment of $WL/8$, taking the length as face to face.

The tile-and-concrete joist floor slabs were designed as a series of T-beams 16 in. c. to c. In the design of beams and girders the horizontal shears were resisted by concrete and steel stirrups, the vertical shear generally by the concrete alone; but in several cases where the shears were excessive the main reinforcing steel was allowed to assume part of the shear, in which case the rods were embedded into the concrete, giving sufficient resistance in bond to resist their portion of the vertical shear.

The "mushroom" slab was designed in accordance with the general practice in use in the Philadelphia district; the diagonal bands with a moment of $WL/24$ at center of span and the straight bands with a moment of $WL/12$ at the center of span. All rods extend into the adjacent panel to the one-quarter point, which doubles the reinforcing steel over the support, at which place the rods were bent up to within 1 in. of top of slab. The thickness of the slab was determined from the shear brought about by the load, and the column caps were made one-quarter of the span in diameter. These caps were designed for bending produced by unequal loading. Where the pool occurred the latticed concrete beams were taken into the bands of the adjacent mushroom panel and the bending moment of these bands figured accordingly, having in addition to a uniform load the concentrations from the lattice beams.

The columns were figured as follows:

Plain reinforced-concrete columns—500 lb. per sq.in. over entire area, with 1½ per cent. of vertical steel and tied with ¼-in. round ties placed 12 in. on centers.

Hooped columns—1000 lb. per sq.in. on the concrete inside the hooping, with 1½-in. covering of concrete outside of hooping. The vertical steel rods and spiral hooping were designed from the Considère formula for hooped columns.

Steel-cored columns—Core was figured to take all the load, the concrete incasement being only considered as fireproofing, except that its rigidity permitted the diameter of the column to be taken as the size of the concrete casing when figuring the radius of gyration for reduction. This produced about 15,000 lb. per sq.in. as an allowable unit stress on the steel cores.

With steel cores, cast-steel bases were used, figured in the usual way and anchored to concrete footings. The footings were designed with mattress reinforcement, developing sufficient resistance to take reactions from the piles, and the reinforcing steel was placed each way over the tops of the piles. Where cast bases rest on concrete footings these footings were reinforced 2 in. below the top to permit figuring 500 lb. per sq.in. as a bearing resistance.

The domes are figured as true domes, placing sufficient horizontal reinforcing bonds completely around them with a 4-ft. lap at splice to resist the thrust from the weight of the portion of the dome above the ring being designed. Where openings were cut in the dome, secondary members were incorporated above and below the opening to take up the stress broken by opening. In this method the thrusts were resisted, while the ribs were used as arched beams on the interior of the shell.

Construction Details

The feature of the construction was the rapidity with which so involved a structure was completed and is worthy of a separate article to appear in an early issue. Meanwhile in views *G* and *H*, Fig. 7, the 256-ft. chuting towers may be noted.

Personnel

The architects for the new Traymore Hotel were Price & McLanihan. The structural features were designed by Otto H. Gentner, Jr., and F. Dickinson Shaw, Associate Consulting Engineers, and the contractor was Cramp & Co.—all of Philadelphia, Penn.

A Peculiar Accident occurred in the building of the Society for the Prevention of Cruelty to Animals in New York City on May 27. A large steel gas reservoir, used for asphyxiating dogs and cats, exploded while in use. The tank is a steel chamber 5 ft. high, 5 ft. wide and 10 ft. in length. The cats to be killed are placed inside of the tank and illuminating gas from the city mains is discharged into it. In the published reports of the accident the remarkable cause assigned for the explosion is that the sharp claws of the cats inside clawing the sides of the tank must have produced a spark and ignited the contents. It is extremely doubtful that a material no harder than a cat's claws rubbing on soft steel could ever produce a spark. It may be suggested, however, that cat's fur when properly agitated is one of the oldest and best-known sources of electric sparks. If the tank had been filled with illuminating gas alone, any sparks produced would of course have been harmless, since there would have been no oxygen with which the gas could unite. Probably, however, as the tank at the start of the process is filled with air as well as cats, a gradual mixture takes place between the air and the gas as the latter is discharged into the tank and thus an explosive or ignitable mixture may be formed. While the explosion of the tank was powerful enough to blow out some of the windows in the building, the mixture ignited was evidently not that which would produce complete combustion or the explosion would have been of much greater violence.

Field and Office

Stopping a Difficult Slide by the Use of Explosives

The Pennsylvania Co. on its C. & P. division recently built a spur track about a mile long from its main track to the plant of the Pittsburgh Crucible Steel Co. at Midland, Penn. In excavating for the new roadbed, which for a portion of the way lies along and below the Ohio River Passenger Ry., a double-track electric line, a bad slide developed about 1700 ft. long, extending back from the cut a maximum width of about 350 ft. to the face of a rock cliff. About 40,000 cu.yd. of material in excess of the preliminary estimate slid into the roadbed prism and was removed by a steam shovel.

As may be seen from the sketch showing an approximate typical section through the slide, the electric railway required considerable work to keep it to line and surface sufficient to allow traffic to pass on it. For a time it was necessary to abandon the track on the side toward the new cut, using the other track past the slide. The track being used was lined back up the hill from time to time and brought to surface with blast-furnace slag (see Fig. 2; the shovel in the sliding bank in the middle right of the picture gives a measure of height).

In a thorough study of soil conditions it was found that a sliding plane existed at the top of a bed of fireclay about 10 ft. below the surface of the sliding mass.

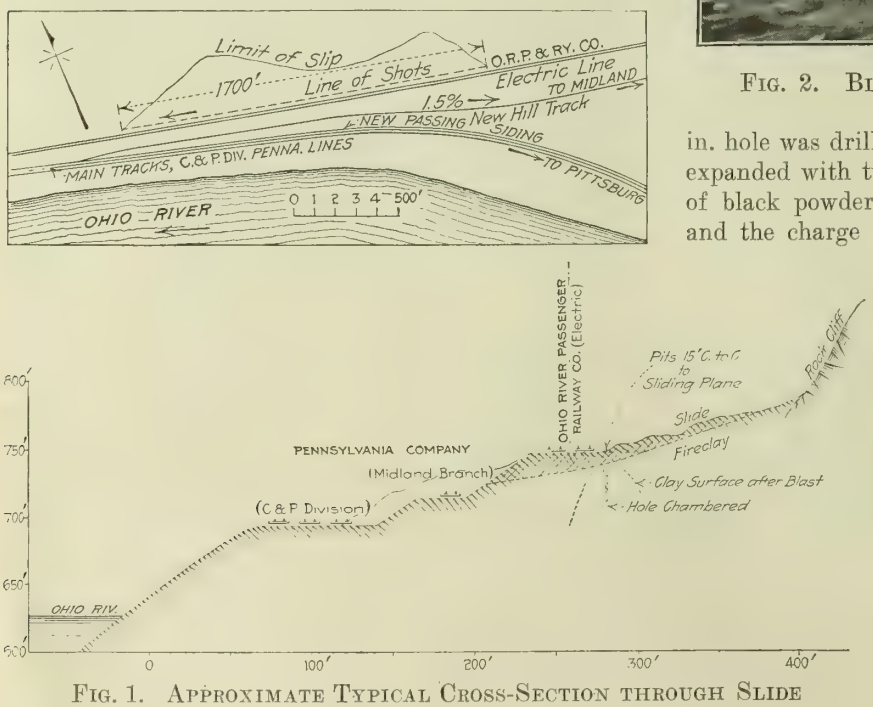


FIG. 1. APPROXIMATE TYPICAL CROSS-SECTION THROUGH SLIDE

The method adopted to stop the slide, which is described in what follows, proved a complete success. A similar plan was considered by the Big Four in the case of a slide near Cincinnati, described in ENGINEERING NEWS, May 16, 1907, p. 536, but was not carried out for fear the explosives themselves would start heavier slides. The material on the Big Four was wet yellow clay lying over a species of soapstone.

Holes large enough for a man to work in were dug on 15-ft. centers to the surface of the fireclay. Then a 2-in. hole was drilled 10 ft. into the clay and the lower end expanded with two sticks of 40% dynamite. Three kegs of black powder were then placed in the enlarged hole and the charge fired. The clay was lifted into mounds which connected into each other at about the surface of the clay.

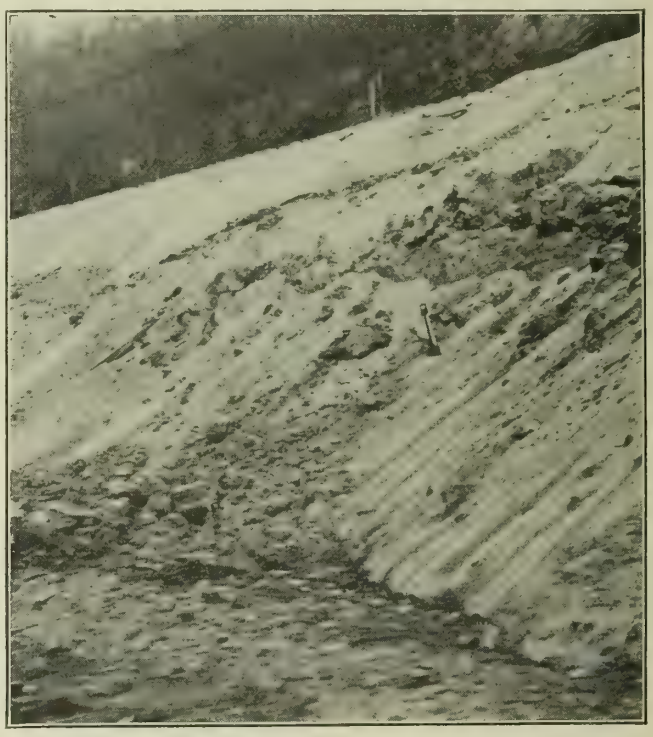


FIG. 2. BLAST-FURNACE SLAG RAILWAY FILL

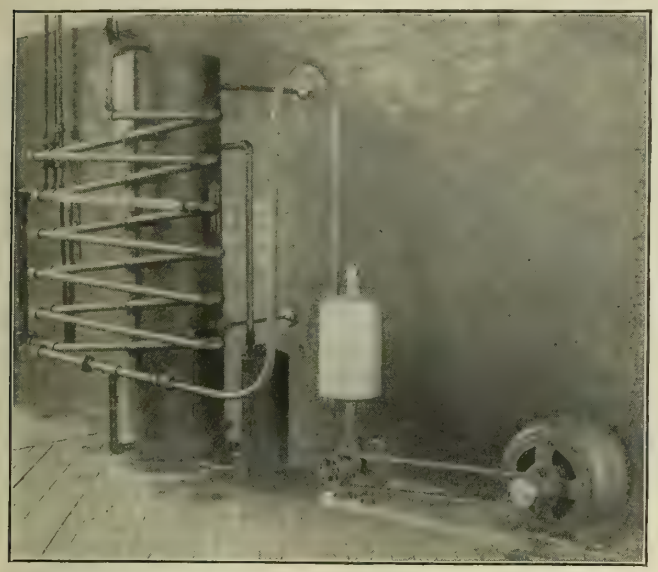
The plan to stop the slide was devised by E. F. McCrea, Division Engineer at Cleveland. Field work was done by the H. E. Culbertson Co. under the direction of Mr. McCrea and H. W. Brown, Assistant Division Engineer, with C. P. Spangler as Engineer in Charge.

The Big Four slides referred to above were stopped by a double row of piles 8 ft. apart each way, staggered, which were driven near the toe of the slope. In one instance it was necessary to make a screen of woven brushes with a filling of cinders to prevent the material flowing away between the piles. A similar condition of sliding ground in a railway cut, which was also stopped by driving piles, was described in an article in ENGINEERING NEWS, Sept. 13, 1906, on "Railway Construction through Sliding Ground in France."

Accelerated Pipe-Corrosion Test Machine

A machine has been developed by the National Tube Co., of Pittsburgh, for the rapid testing of iron and steel pipe, as to resistance to corrosion, more nearly under service conditions than has been possible before.

The scheme is to circulate a mixture of air and water through a series of pipes to be compared, thus giving the same conditions on each. With a constant circulation of hot water saturated with oxygen corrosion proceeds about twelve times as fast as on ordinary hot-water lines.



Pipe-Corrosion Test Apparatus of National Tube Co.

A set-up of the apparatus is shown in the accompanying view. There is an open hot-water tank, a gas-burning water heater with control thermostat, an air pump and injector foot, and a test coil made up of lengths of the various kinds of pipe to be tested. One length is made of glass for observation. The air, which is injected at the bottom of the coil, causes the water to flow up and spill over into the storage tank. The air supply is regulated so that the flow is kept down to about 1½ gal. per min., at which rate the corrosion products are not swept away.

Construction Plant at the Nepaug Dam

Work on the 128-ft. masonry arch dam of the Nepaug reservoir for the additional water-supply of the city of Hartford, Conn., is progressing rapidly, as the accompanying views show. Fig. 1 is the contractor's (Fred T. Ley Co., of Springfield, Mass.) construction plant; Fig. 2 is the concrete distributing tower, which is being carried up to a height of over 200 ft.; Fig. 3 is a general view of the dam site with cyclopean masonry of the foundation in place, and Fig. 4 shows how the contractor solved the transportation problem. A blacksmith and general repair shop is on the left of the railway (Fig. 4), below the sand and stone bins. An air-compressor plant is above the dam site to the right in Fig. 3.

When the contractor began work in the early spring the Nepaug valley below the dam site was about as wild and rugged as any western cañon. Fortunately, a branch line of the New York, New Haven & Hartford R.R. crosses the river about 4000 ft. below the dam site, and the contractor has admirably solved his transportation and supply problem by building a standard-gage railway to connect his construction plant with this branch line.

Broken trap rock for the concrete is purchased from the railway company and hauled from a quarry and stone-crushing plant about 25 mi. distant. Sand and gravel pits are near the contractor's railway, and boulders are plentiful. The broken stone is taken up the inclined trestle (Fig. 1) and dumped directly into elevated bins. Sand and gravel are dumped in the rear of the bins into a hopper, and after passing over a bar screen, the larger rocks and boulders go through a crusher. From below the hopper these materials are elevated by bucket conveyors to the tops of their respective bins.

The long low building on the left (Fig. 1) is the cement house. The bags of cement are opened and the cement is dumped into a hopper at the extreme right end of a passageway under the bins, where it is chuted into cable-cars, which in their passage under the bins receive the correct proportions of sand and stone through manually operated gates in the bins overhead. There are two parallel lines of cable-cars, each running up an incline at the right end of the bins and dumping automatically into two concrete mixers at the foot of the tower (see Fig. 1).

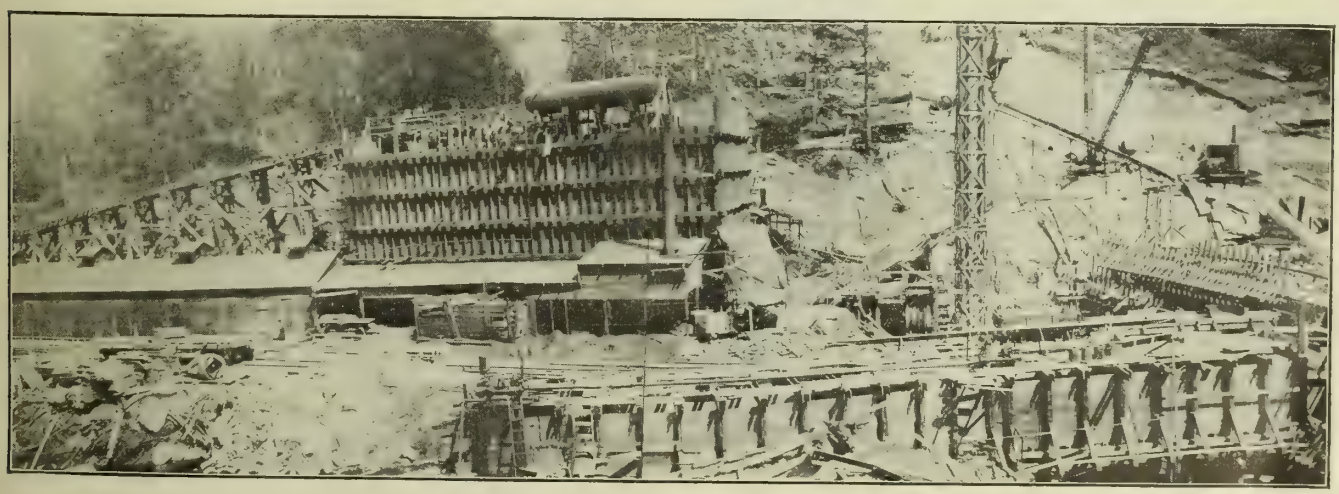
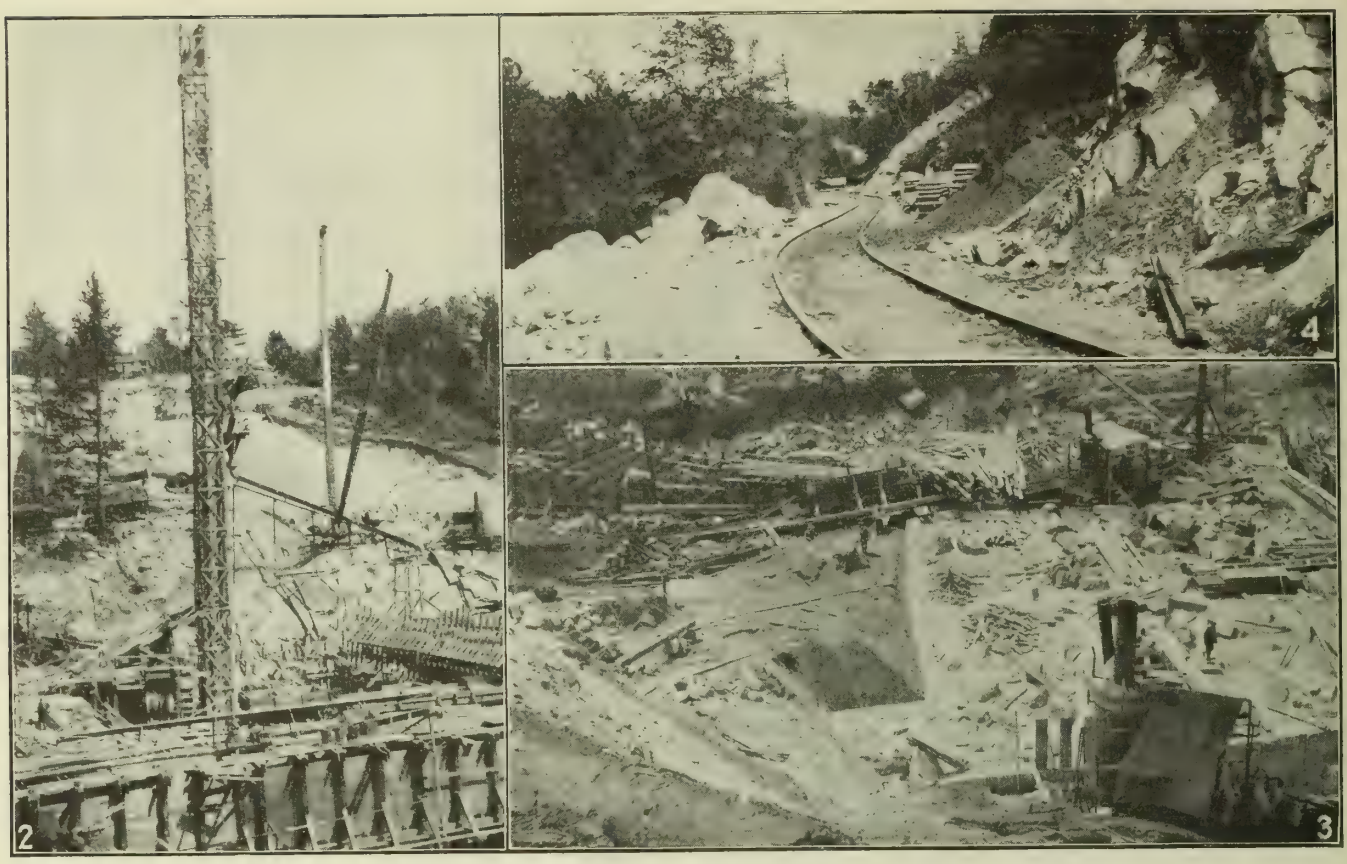


Fig. 1. Construction Plant at the Nepaug Dam; Hartford, Conn., Water-Supply



FIGS. 2 TO 4. BUILDING THE NEPAUG DAM OF THE HARTFORD, CONN., WATER-SUPPLY

(Fig. 2—Concreting tower over 200 ft. high. Fig. 3—Lower course of cyclopean masonry in place. Fig. 4—Contractor's standard-gage railway)



FIG. 5. DERRICK FOR HANDLING ENDS OF CONCRETING SPOUTS

From the tower the concrete is distributed by spouts, one from each mixer elevator, to any part of the dam. The method of handling the far end of the spouts is unusual. It was designed to have them supported on horses or A-frames and shifted about in that way, but this was so cumbersome that the superintendent, Robert Coombs, hit upon the derrick scheme shown in Fig. 5. This derrick is a single mast with two right-angle brackets, or booms, one for each end of the distributing spout. These derricks are planted in wood boxes extending to the hardened course of concrete below and each is supported by five guy wires. The concreting spout from the main tower connects with the elbow of the derrick's distributing spout, as Fig. 5 shows.

For handling the boulders or "plums" for the masonry the contractor has two large stiff-leg derricks reaching to any part of the structure. So to move the small concrete-distributing derricks from place to place one of these large derricks is used to pick up the whole outfit bodily, and the guys being loosened, the shift is made in about 15 to 30 min. with two men, whereas the original scheme, with spout supported on horses, required 8 men working twice as long.

The Nepaug dam is a part of a new large water-supply project now under construction for the city of Hartford under a board of water commissioners, for whom Caleb Mills Saville is Chief Engineer. The dam is to be approximately 600 ft. long on top, with a 200-ft. spillway section. The radius of the center line is 390 ft. It has contraction joints every 43 ft. and an interior inspection gallery. The new reservoir will have a watershed of 32.4 sq.mi.

New Hydrographic Signal of the U. S. Coast and Geodetic Survey

A hydrographic or triangulation signal 80 to 90 ft. high, which can be built for $1 per vertical foot, including all materials, transportation of party and outfit, pay and subsistence—a signal which gives a maximum of height and strength for a minimum of material and labor—has been designed by J. S. Bilby, signalman of the United States Coast and Geodetic Survey. Several signals of this type have been built since Jan. 1 on the Florida coast.

The elements of the signal are (1) the foundation, (2) the scaffold, (3) the superstructure, (4) the target and (5) the guys.

1. Foundation—Stakes are driven at the corners of an 11-ft. square (Figs. 1 and 2). The post-holes are 3x3 ft. by 3 ft. deep. In the bottom of each hole is a footplate 2x8 in. by 2½ ft., made of two pieces of 2x4 held together by pieces of 1x4 nailed across the ends. The scaffold legs are toe-nailed to the foot-plates. Fig. 3D shows a plan of the leg anchors. These are 2x4's about 2½ ft. long, placed in two sets of two pieces each on each leg. The first set of anchors is nailed to the leg near the bottom with 20d. nails, five nails to a piece. Earth is filled in to the top of the anchor pieces and scrap pieces of timber are nailed on top of them. The second set of leg anchors is then nailed in place just above and at right angles to the lower set, filled in and covered with scrap timber as before and the holes then filled and thoroughly tamped.

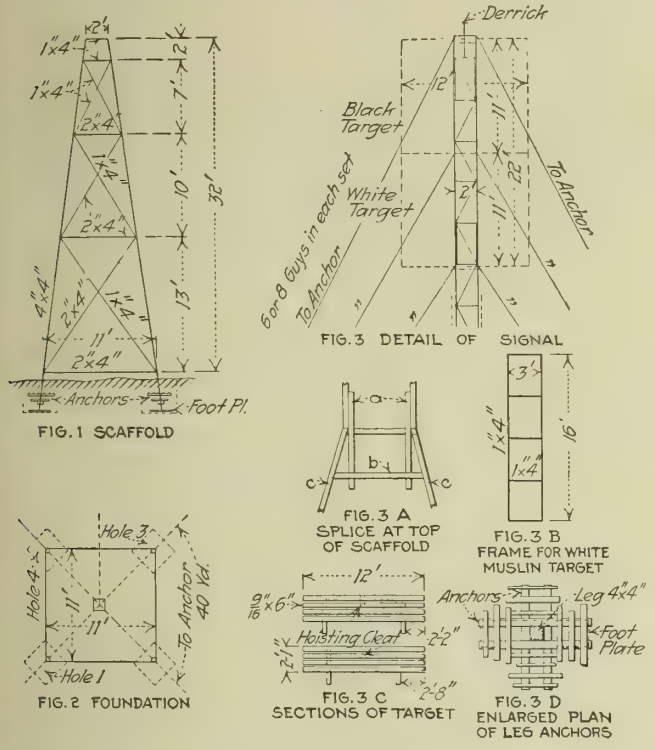


FIG. 1 SCAFFOLD. FIG. 3 DETAIL OF SIGNAL. FIG. 3 A SPLICE AT TOP OF SCAFFOLD. FIG. 3 B FRAME FOR WHITE MUSLIN TARGET. FIG. 2 FOUNDATION. FIG. 3 C SECTIONS OF TARGET. FIG. 3 D ENLARGED PLAN OF LEG ANCHORS

DETAILS OF A NEW HYDROGRAPHIC SIGNAL, UNITED STATES COAST AND GEODETIC SURVEY

2. Scaffold—Fig. 1 shows the working plan and dimensions of the scaffold; outside measurements are shown except where c. to c. dimensions are specified in spacing horizontal ties. Two sides of the scaffold are completely framed and assembled on the ground and raised to place with a tackle. The ties and braces are on the outside, so one scaffold sideframe has to be turned over before being raised to position. The horizontal ties and diagonal braces of the other two sides are nailed on after the four legs are set upright.

In framing the scaffold the first step is to make the legs, which are 4x4 in. by 36 ft. long, built up by nailing together 2x4's, breaking joints by at least 4 ft. The joints are strengthened by pieces of 1x4 in. by 3 ft. nailed over them. Marks are made on the legs for horizontal ties at 2, 9, 19 and 32 ft. from top of ground for the ties and braces. For the 2x4's 20d. nails are used and 8d. for the 1x4's. The opposite sides, Nos. 1 and 3 (see Fig. 2), are raised by a line and tackle of two single blocks, from posts about 60 ft. from the scaffold. The legs are not toe-nailed to the foot-plates and the anchors made until the scaffold is completely erected.

3. Superstructure—The superstructure is 2 ft. square with legs 2x4 and ties and braces 1x4, framed as shown in Fig. 3 of the completed signal. All ties are 2 ft. long and spaced 4 ft. on the legs. The braces are all cut from one pattern. Fig. 3A shows how the superstructure is joined to the top of the scaffold. The pieces marked *a* are 2x4's 4 ft. long; those marked *b* are 2x4's nailed across the scaffold legs *c*. The legs for the superstructure are sent aloft one piece at a time and set on top of *c* and nailed to *a*. The second section of legs is spliced on the first by nailing pieces of 2x4's 4 ft. long on the inside of the legs. The legs, ties and braces are all marked and cut from patterns before being sent aloft, the legs being raised singly and the braces in sets of four. One man aloft, inside, nails the pieces in place, while another on the ground cuts the pieces and sends them up by means of a hauling line.

4. Targets—The top target is 11x12 ft., painted black, and beneath it is one of the same size painted white. They are made of dressed boards $\frac{9}{16}$x6 in. by 12 ft. long in five sections (10 in all) of four boards each, nailed to pieces of 1x4 in. by 3 ft., with 1-in. spaces between the boards. Fig. 3C shows a detail. The targets are fastened to the legs by 8d. nails, five nails being used to each board in each leg. Below the target the superstructure is covered with white muslin.

5. Guys—The structure may be from 80 to 90 ft. high before it is necessary to attach any guys. The guy anchors are about 120 ft. distant from the base of the structure. Six anchors are used when a target shows in one direction and eight anchors for a signal with targets showing in four directions. The anchors are 8x2-ft. timber frames buried in 3 ft. of earth. The guys are No. 8 galvanized-iron wire attached to the superstructure, as shown in Fig. 3. The guys are set by tackle.

For hydrographic work the signal described can be seen from 10 to 12 mi. In no case should the size of the target be increased without additional guy wires. All lumber is dressed on four sides. Two men can build the signal in an average of two days when the material is on the ground.

The following tools are necessary: Two hand saws, one axe, one carpenter's level, one bevel, one try-square, two rules, one hatchet, two clawhammers, two paint brushes, one shovel, one spade, three 6-in. blocks, 320 ft. of ½-in. rope and 125 ft. of ⅝-in. rope.

The following materials are necessary for an 84-ft. signal: 40 pieces of timber $\frac{9}{16}$x6 in. by 12 ft. long; 60 pieces

2x4 by 16 ft. long; 75 pieces 1x4 by 16 ft. long; 40 pieces 1x4 by 12 ft. long—making in all 1333 ft. b.m.; 50 lb. 8d. nails; 25 lb. 20d. nails; ½ gal. white paint; ½ gal. black paint; 12 yd. of white muslin; ¼ lb. 8 oz. tacks; 2000 ft. No. 8 galvanized iron wire.

Clean-Up Work after Erecting Three 600-Ft. Radio Towers

After the erection of one of the 600-ft. self-supporting steel radio towers at Darien, C. Z., there was still considerable work to be performed in the way of cleaning up. First of all, two channels were laid horizontally across the top of the horizontal beams and bisecting the angle formed at each tower by the lines to the other two towers. Two sheaves were mounted between these channels, one directly over the center of the tower, the other just outside the edge of the deck at the top of the tower. These sheaves were to carry the cable used to hoist the antennæ. The cables of the antennæ are held permanently in place by pennants hooked into shackles at the outer end of the sheave supports. The hoist cable is carried down the inside of the tower to an electric-motor-driven hoist located on a platform framed into the steelwork about 40 ft. above ground.

A ladder is built on one of the legs of the tower from the foundation to the top. It is composed of ¼x5-in. side plates with two ⅝-in. diameter rungs riveted in each step. Ten landing platforms are provided, the lowest being at the 110-ft. level. While it involves considerable labor, it has been found to be quite safe for any person physically fit to climb to the top of the tower; dizziness is prevented by the climber continually confronting the broad back of the tower leg. Workmen on the tower habitually rode up and sometimes down by means of the hoisting cable as long as erection was in progress, but for final bolting and painting the ladder was used exclusively.

It was discovered that following rains a small quantity of water remained in the horizontal star-strut members due to the way they were placed. Holes were accordingly drilled in the outstanding legs of these angles.

The tower steel was painted with one coat of red lead before leaving the shop. This coat was made intact after erection, and when the bolting was completed, all bolt heads and nuts were painted with red lead in this retouching. As soon as this coat had dried a coat of dark-green lead-and-zinc paint, of very thick consistency, was applied and rubbed well into the joints and crevices. A final coat was also of dark olive green lead-and-zinc paint, but somewhat thinner in consistency and with a more glossy finish.

The antennæ were raised into position on Apr. 2, 1915, without accident. The greatest deflection of the top of the tower which could be noted with a transit was about 4 in. during the raising of the mat. This deflection was reduced to 2 in. when the hoisting stopped.

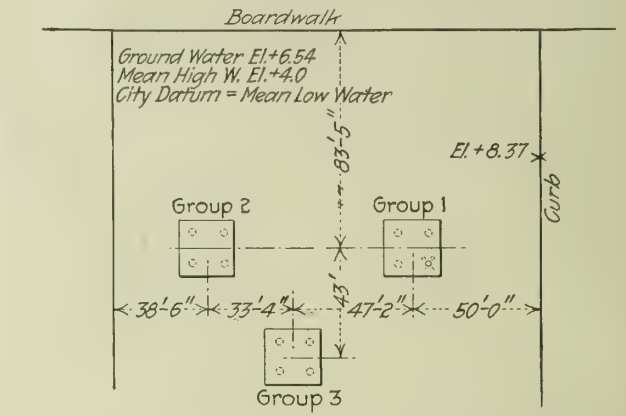
Painting Safety Lines on Pavements for the guidance of traffic is being tried in New York City. At the Fifth Ave. crossings at 34th and 42nd St. safety lanes have been painted on the pavement to indicate the proper place of crossing for pedestrians. The practice has proved successful in some other cities, notably in the downtown district of Detroit. At sharp curves on a new road opened for traffic down the steep slope of the Palisades from Englewood Cliff, N. J., on June 17, lines have been painted to indicate the safe zone for traffic in each direction.

Tests of Piles in Sand Beach, Atlantic City, N. J.

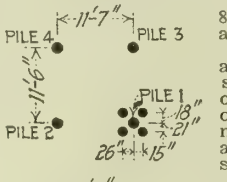
By Fred W. Abbott*

The ground formation at Atlantic City is a clean-sand bed, interlaid with clayey streaks and thin beds of clayey sand to a depth of 400 ft., where it overlays the great diatom clay bed of the Atlantic Coast plain. The lighter structures (the vast majority) are founded directly on the sand at, or near, the water line. When piles are used they are usually the commercial "Jersey" pile, about 15 ft. in length, waterjetted to place. Data as to the dependable value of such foundations are meager and the herein-described tests were performed to supply in a measure information desired in the design of a contemplated lofty building. They were made in a vacant lot immediately adjoining the boardwalk.

PILE TESTS. PLANS OF TEST GROUPS

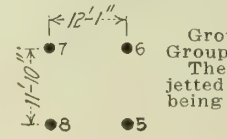


All piles were Jersey pine, driven with the bark on.



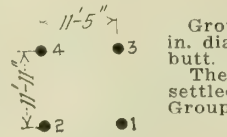
Group 1—4 piles, 32 ft. long, averaging 8 in. diam. at the point and 11½ in. diam. at the butt.

These piles were water-jetted to place and settled by drop hammer. The four supplementary piles around pile No. 1 were of the same size and penetration as the others and were driven in the same manner, but were cut off at the ground line and carried no load. They were driven subsequent to the driving of pile No. 1.



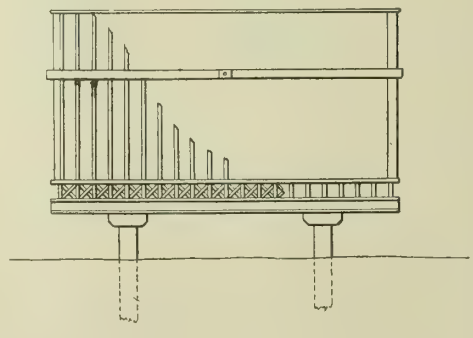
Group 2—4 piles, same size as those of Group 1.

These piles were entirely water driven, being jetted to place, subsequent hammer settlement being omitted.



Group 3—4 piles, 18 ft. long, averaging 6½ in. diam. at the point and 8⅝ in. diam. at the butt.

These piles were water-jetted to place and settled by drop hammer as were the piles of Group 1.



Elevation of Load Box—Inside dimensions of box, 20 x 20 x 10 ft. Settlements were read directly off the head of the pile. On the pile head and under the bolster was placed a steel plate on which rested a loose iron pipe passing free through a hole in the bolster and through an open box in the interior of the load box.

Fig. 1. Layout of Pile Groups Tested on Atlantic City Beach

*7438 Devon St., Mt. Airy, Philadelphia, Penn.

In laying out the tests it was planned to drive three groups of four piles each, two groups of 30-ft. piles, of varied treatment in driving, to be loaded with 100,000 lb. each, approximately twice the contemplated working load for such piles, and a third group of 15-ft. piles to be loaded to failure.

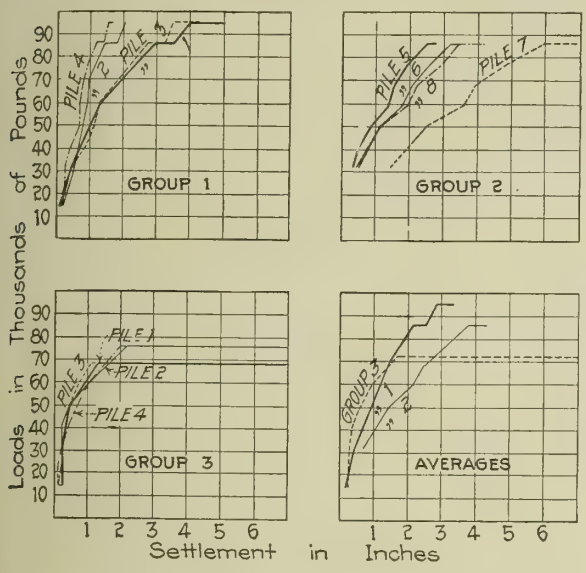
After the piles were driven and cut off to a level they were bolstered and capped with double steel-beam stringers and a box with inside dimensions of 20x20 ft. and 10 ft. deep was erected thereon. The test load was applied by filling the box with sand.

In all cases the surface was leveled off around the pile groups, for a space of about 30x30 ft., at the ground-water level. Instrument readings were taken directly off the pile heads, the box and load being arranged to make this possible, and settlements were noted on the application of each foot in depth of sand load.

Four supplementary piles were driven in close proximity to Pile 1. They were the same size and were driven (jetted and hammered) in the same manner as the other four, and were driven subsequent to the driving of Pile 1. They were cut off at the surface and carried no load, their purpose being to show what influence, if any, the waterjetting of piles in close proximity had on those previously driven. The driving of these piles raised the nearby pile ¼ in.

This group was loaded with a total of 95,000 lb. per pile, including the weight of the box.

The extreme settlement noted was from 1.75 to 5.00 in., the average being 3.28 in. At a load of 86,000 lb. per pile there was an average increase of settlement of 0.42 in. over night. At the extreme load there was an average increase of 0.28 in. over night. Three days later a further average increase of 0.22 in. was noted, at which point settlement practically ceased.



	Group					Group 2					Group 3				
Pile No.	1	2	3	4	Av'g.	5	6	7	8	Av'g.	1	2	3	4	Av'g.
Penetration in feet	30.2	30.2	30.2	30.7		29.3	27.7	29.4	29.1		15.1	15.2	15.7	15.7	
Area of surface, sq.ft.	72.5	75.5	81.0	83.0							30.3	30.1	32.7	30.5	
Area of point, sq.ft.	0.33	0.37	0.42	0.40							0.23	0.21	0.287	0.23	
Load, lb.															
14,000											(a)0.19	0.19	0.13	0.13	0.16
14,000	0.13	0.19	0.13	0.06	0.13						0.25	0.25	0.13	0.13	0.19
23,000	0.31	0.38	0.25	0.25	0.30						0.25	0.25	0.13	0.25	0.22
32,000	0.44	0.44	0.50	0.25	0.41	0.31	0.50	1.44	0.44	0.67	0.25	0.25	0.25	0.25	0.25
41,000	0.69	0.63	0.88	0.44	0.66	0.50	0.81	2.00	0.81	1.03	0.38	0.25	0.25	0.44	0.33
50,000	1.00	0.75	1.13	0.69	0.89	0.88	1.13	2.5	1.13	1.41	0.50	0.50	0.50	0.63	0.53
59,000	1.31	0.88	1.38	0.69	1.06	1.38	1.80	3.59	1.94	2.09	0.88	0.94	0.75	1.00	0.89
68,000	1.88	0.94	1.81	0.81	1.36	1.56	2.06	3.94	2.25	2.45	1.31	1.69	1.13	1.56	1.42
68,000											Failure		Failure		
76,000												Failure		Failure	
77,000	2.38	1.19	2.25	0.94	1.69	1.94	2.56	4.81	2.94	3.06					
86,000	2.94	1.44	2.75	1.19	2.08	2.5	3.19	6.0	3.44	3.78					
86,000	(b)3.5	1.81	3.25	1.44	2.5	2 75	3.44	6.88	4.13	4.30					
86,000						(c)2.75	3.44	6.88	4.13	4.30					
95,000	4.0	2.06	3.5	1.56	2.78										
95,000	4.56	2.13	4.0	1.56	3.06										
95,000	(d)5.0	2.13	4.25	1.75	3.28										

Settlement in Inches

(a) 4-day interval between 14,000-lb. load. (b) 1-day interval. (c) 7-day interval. (d) 3-day interval.

DATA ON TESTS OF PILES IN SAND BEACH, ATLANTIC CITY, N. J.; GIVING SETTLEMENT OF PILES GRAPHICALLY AND NUMERICALLY

GROUP NO. 1

Group No. 1 consisted of four 32-ft. piles, waterjetted to place and firmly settled under the blows of a hammer. It was expected that the hammer blows would compact the sand in juxtaposition to the pile, putting it at once in a condition of active resistance, and reduce the settlement under working load to within allowable limits. The hammer used (1200 lb.) was too light for this size and weight of pile and the desired result was not entirely achieved. It is believed that a heavier hammer with less fall would have given better results. These piles were driven to a penetration of 30 ft. The jet used gave 30-lb. gage pressure at the surface.

At a depth of 28 ft. a thin membrane, 1 to 2 in. in thickness, of tough blue clay was encountered, below which the jet was not effective; and the last 2 ft. of penetration was effected only with the assistance of the hammer. The hammer records show that Piles 1, 2 and 4 received an average of 19 blows, with a fall of from 4 to 15 ft., the last five blows, with a 10-ft. fall, gaining only 1 in. The number of hammer blows seems to have had no influence on subsequent settlement of the pile, Pile 1 (18 blows) and Pile 3 (127 blows) settling practically the same amount.

GROUP NO. 2

Group No. 2 included four piles of the same dimensions as those of Group 1. They were driven with the waterjet alone, subsequent hammering being omitted, the object being to determine by comparison with Group 1 the value of the final hammering. As before mentioned, the waterjet was found to be ineffective below the clay sheet at the depth of 28 ft., and these piles were therefore jetted to this depth only, their points resting approximately on the membrane of clay.

This group was loaded with a total of 86,000 lb. per pile.

The extreme settlement noted was from 2.75 to 6.88 in., the average being 4.30 in. At the final load there was an increase in average settlement of 0.52 in. during the first week after loading. Readings one week later showed no further movement.

GROUP NO. 3

Group No. 3 comprised four 18-ft. piles, waterjetted to place and hammered. They were jetted to a penetration of 15 ft. and received an average of 13 blows each of a 1200-lb. hammer with a 10-ft. fall. The hammer blows

settled the piles an average of 7 in. to practical refusal, the last three blows gaining nothing.

The settlement of these piles was quite uniform and was less in amount than that of the other groups up to the point of failure. Failure occurred under an average load of 72,000 lb. per pile. The failure was most positive. At the time the layer of sand then being placed in the load box extended over Piles 2 and 4 and about half way across the box toward Piles 1 and 3, there being, as near as can be estimated, 76,000 lb. each on Pile 2 and on Pile 4 and 68,000 lb. each on Pile 1 and on Pile 3. Pile 2 seemed to start first, followed instantly by Piles 4, 1 and 3, all piles being immediately in motion. The greater part of the settlement occurred in a few seconds, but the movement continued for about 10 min., and until the structure of the load box rested upon the surface.

Settlements are tabulated and graphically compared in Fig. 2.

NOTES

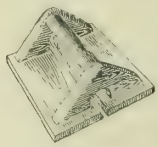
Scaffold for Painting Railway-Crossing Signs—A light movable platform, or scaffold, devised by a foreman of the Nickel Plate R.R. has considerably reduced the cost of repainting railway-crossing signs. The platform is 8 ft. long and is held in place at any height by a simple wedge. The frame is of 2x6's surfaced on four sides and the floor is 1x6 boards and is about 24 in. wide. The 2x6 cantilever arms are fastened together a trifle over 8 in. apart. These arms are held to the post by a piece of 2x6 protected by a steel plate in front of the signpost and a ½-in. bolt behind the post. Between the bolt and the post an oak wedge is driven. To prevent wear on the sides of the cantilever arms they are protected at the post by thin steel plates. A stepladder is required to mount the platform. A smaller platform of similar design is used to paint "no-trespass" and like signs. The whole outfit may be knocked down and carried from place to place on a railway velocipede. To erect the platform it is held with its outstanding legs about the post, the bolt inserted, the platform raised to any desired height and the wedge driven.



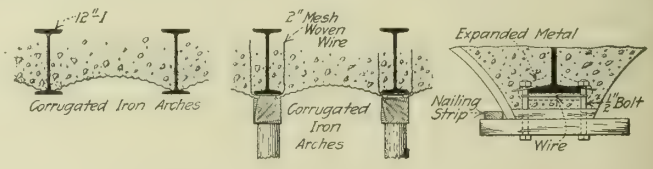
Crossing Signs Scaffold

Recovering Tools Lost in Well-Drilling—The first step in recovering a tool lost while drilling a well is to learn the shape of its upper end and the position in which it lies in the well. This knowledge may be obtained by lowering over the tool a sheet-iron vessel containing soap or other soft material for making an impression. Another scheme of location is to reflect a light from a mirror into the well. A third is by means of a photographic device, consisting of a stereoscopic photographic apparatus, which is lowered to a point near the lost tool, light for the negative being furnished by an electric current carried by wires arranged in the camera. If the drill is lost in the well, but is not jammed tight, it may be possible to lower a spudding spear and prod the top of the drill loose from the wall. The drill may then be grasped and removed by a slip socket suspended by a light string. If the tool has fallen only a short distance it may be removed by a horn socket, which when jammed over the fallen tool obtains a friction grip. Sometimes a powerful electromagnet is used for fishing, but the rigging of this apparatus is expensive and its use is difficult. In the case of a cable break, the rope can often be withdrawn by catching it with a rope spear, a rod armed with upward-pointing barbs. In dealing with defective casing it is sometimes necessary to remove it in short sections. This is accomplished by means of a casing cutter having expanding knives. When only slightly bent the casing may be straightened by the use of a pipe swedge dropped into it repeatedly. If these methods, which are described by Frederick G. Clapp in a report to Dr. Eugene Haanel, Canadian Department of Mines, prove ineffective in removing the broken or lost parts, the driller usually shifts his outfit a few inches to one side and redrills and enlarges the hole.

Split Float for Finishing Joints in Concrete Pavements—The accompanying illustration shows a special float by the use of which it is possible to obtain an exceptionally good joint in concrete pavements. This type of finishing float was used successfully during the fall of 1914 on 25,000 sq.yd. of Ohio State Highway Department work on a pavement between Ashtabula and Jefferson. The filler used was asphaltic felt, ¼ in. thick, as specified in the new specifications of the American Concrete Institute. The felt was cut sufficiently wide to extend not only through the entire thickness of the concrete but well above the finished surface. By the use of the split floats the concrete was carefully finished to the same elevation on both sides and close against the joint filler. When the concrete had hardened the surplus filler was cut away with an adz to about ½ in. above the pavement, the remainder being left to be ironed down by traffic.



Three Ways of Concreting the Arches between I-beams to form the floor of a highway bridge are shown herewith. Fig. 1 is the old way, now generally abandoned, of arching a piece of corrugated iron across the space between the I-beam flanges and filling in concrete behind these arches. This practice is objectionable for several reasons: It leaves the bottoms of the I-beams exposed, the corrugated-iron forms are lost, and remain with the under side exposed. To get around these difficulties, Willis Whited, Bridge Engineer of the Pennsylvania State Highway Department, uses the method of construction shown in Fig. 2. Under each I-beam is a stringer or centering, and the corrugated-iron arch forms



Three Ways of Concreting Arches between I-Beams of Bridge Floor

are laid on these centers; a loop of 2-in. mesh woven wire is made under and around each I-beam and the concrete placed. When the centers are removed the corrugated-iron forms are recovered. Fig. 3 is another means of accomplishing the same result, as practiced by the Connecticut State Highway Department under Charles J. Bennett, Commissioner. Here the I-beams themselves are made to support the centering. As often as necessary ½-in. bolts are placed to carry a board hung 1½ in. below the bottoms of the I-beams. The bolts are tied together with a loop of wire and are held in place as shown by 2½-in. round washers, overlapping the I-beam flanges; the nut ends of the bolts are up. Expanded-metal reinforcement is placed around the I-beam flanges. When the concrete has sufficiently set the bolts are screwed out of the nuts, the centers recovered, and only the nuts are lost. The bolt holes are plugged with concrete. No falsework is required.

Clearing Slides from Railway Cuts—During the recent heavy rainstorms around Kansas City, Mo., the Kansas City, Clay County & St. Joseph Ry. (an electric high-speed interurban line) suffered seriously from slides in the cuts. On the St. Joseph division train service was discontinued for three days. The company had an electrically operated American ditching machine which was put in service, and it is stated that without this the clearing of the line would have taken nearly two weeks. On the Excelsior Springs division there was a slide in a cut where the mud was 4 ft. deep. A nose plow placed on one of the snow-plow cars was used successfully in plowing out the mud and slush. In this way the track was cleared quickly and was kept clear.

Editorials

The Quality of Steel Rails and the Heat Treatment of Steel

The indictment of the quality of heavy section steel rails which was drawn by Gustav Lindenthal in his recent New York Railway Club paper, which was printed in ENGINEERING NEWS, May 27, is seconded by a correspondent in this issue in even more emphatic terms. While our correspondent prefers to sign his letter only with the nom de plume "Civil Engineer," we can say for the information of our readers that the letter is written by one of the best-known railway engineers in the United States and that the statements made may be accepted as authoritative. It is of especial interest to note the correspondent's declaration that the influence of steel-rail manufacturers with the railway companies, through financial connections, has been such that the efforts of engineers to secure improved quality in steel rails have been unavailing.

It is of course true that the charge made by Mr. Lindenthal and by our correspondent that the poor quality of rails is due to their being rolled at too high a temperature is far from being new. Twenty-five years ago it was a common saying among engineers, disgusted with the poor service of some of the heavy section rails just then coming into use, that the trouble was the rails were rolled so hot that the metal was practically squirted through the rolls.

Of course few railway engineers are expert metallurgists, and they would not attempt to specify by what detailed operations in the rolling mills the proper quality could be obtained in steel rails. Enough is known, however, as to the benefit accruing to steel from thorough working during the process of manufacture and from proper heat treatment to make it certain that very great improvement in rails should be possible.

Heat treatment of steel and its benefits have been well known to metallurgists for many years; but in most industries the demand for cheapness has been more controlling than the demand for quality, and the process has not been in extensive use commercially until within a very few years.

The remarkable possibilities of heat treatment in raising the strength and elastic limit of steel are only now beginning to be thoroughly appreciated. The automobile industry has been a great educator in this department of engineering work. In automobile design strict limits are fixed as to size and cross-section and weight of parts, and the manufacturers have been obliged to resort to heat treatment to obtain the desired strength.

Perhaps the best-known use of heat treatment in the field of railway materials is the Coffin process for treating steel axles, long in use by the Cambria Steel Company. This process consists in heating the axle to a temperature of about 850 deg. C., keeping it at this temperature for about 15 min. or so, and then quenching it in oil. After cooling, the axle is again heated to about 600 deg. C. and again cooled. The process is roughly comparable to the well-known process of hardening and tempering tool steel. By this means axles are produced having a tensile strength of 80,000 lb. per sq.in., with an elastic limit of 55,000 lb. Much higher figures are possible, of course, if, instead of treating ordinary carbon steel, alloy steels are used. Similarly, high figures should be obtainable by the application of proper heat treatment to the high-carbon steel used in rails.

We are by no means suggesting that this particular process would necessarily be applicable to steel rails. It is reasonable to believe, however, in view of the excellent quality secured in rails of light sections made 25 to 40 years ago, that with all the advancement in metallurgical knowledge since that time it should be entirely practicable at the present day to turn out rails at least as good.

Opening Another East River Tunnel

The formal opening to traffic on June 22 of the tunnel from 42nd St., New York City, under the East River to Long Island City marks the completion of an enterprise which had its origin 28 years ago. In an address at the opening of the tunnel Theodore P. Shonts, president of the Interborough Rapid Transit Co., briefly reviewed the history of the scheme.

In 1887 Walter S. Gurney and others incorporated a company to build the tunnel and later secured the backing of the late William Steinway, who was a large real-estate owner in Long Island City and interested in its horse-car lines. At that time no tunnel had been driven under either the North or East River, and the only means of transit across the East River, save by ferryboat, was the original New York and Brooklyn Bridge.

The company expended a large sum of money in securing franchises, rights-of-way, etc., and in 1892 let the contract for building the tunnel. The panic of 1893, together with a disastrous dynamite explosion, caused the bankruptcy of the contractor doing the work and brought operations to a standstill. The Steinway tunnel enterprise, as it came to be known, lay dormant for over ten years, very much as did the still earlier tunnel, then partly built, under the Hudson.

After the completion of the New York City rapid-transit system, however, August Belmont, president of the Interborough Rapid Transit Co., operating the rapid-transit lines, became interested in the important traffic possibilities in connection with this tunnel. The property was purchased by the Interborough company and its completion was undertaken. The company's franchise required that the tunnel should be completed and opened for traffic by Jan. 1, 1907; otherwise the franchise would be forfeited. The contract for the work was let to the Degnon Contracting Co. in July, 1905, with the proviso that it was to receive a large bonus if the work was com-

pleted within the time fixed by the franchise. According to Mr. Shonts, rapid progress was being made on the tunnel, and it would have been completed on time, but the city authorities arbitrarily cancelled the company's permits for the handling of explosives and for the deposit of excavated material. An appeal to the courts obliged the city to restore these privileges; but the delay thus occasioned prevented the finishing of the tunnel within the fixed-time limit, and the company was left with the completed tunnel on its hands but with no franchise for its operation.

In order to terminate the confusion as to the relative right of the investors in the tunnel company and the city, the Interborough company agreed with the city authorities, as part of the dual-system contracts for the construction and operation of the new rapid-transit system, to sell to the city the completed tunnel, representing a total investment of about $10,000,000, for the sum of $3,000,000. The line will be operated as an integral part of the new rapid-transit system.

The importance of this tunnel is likely to be far greater in the future development of the Greater City than was dreamed of by its original promoters 28 years ago. At that time business on Manhattan Island was largely concentrated at the lower end. The spread of business northward has been so rapid that at the present time 42nd St. may fairly be considered the center of gravity of Manhattan's traffic lines. The new tunnel brings a large area on Long Island, still unoccupied and available for residence and industries, within 10 to 20 minutes' ride of the Grand Central Station.

The Inventor of the Openhearth Process

The death in France on May 23 of Pierre-Emile Martin, the inventor of the openhearth process of steel manufacture, calls attention anew to the common experience that the originators of great inventions often fail to derive any benefit from them. Martin was born in 1824. His first patent on the openhearth process was taken out in July, 1865, and covered the melting of pig iron with scrap steel and iron oxide. To obtain sufficient heat for the process the regenerative gas furnace invented by Sir William Siemens was employed, and in England and the United States the openhearth process has always been called the Siemens-Martin process. On the Continent, however, it is called the Martin process. The new invention was taken up by two of the leading French steel companies, but the validity of Martin's patents was soon attacked on the ground that the invention was antedated by an experiment made by Réaumur in 1722, who produced steel in the laboratory by melting a mixture of pig iron with scrap iron and iron oxide. As Martin lacked the means to defend his patents, he was obliged after two or three years to give up his struggle for commercial success and retire to private life, and for many years he remained practically unknown to the engineering world.

In the early years of steel manufacture the Martin process was entirely eclipsed by the Bessemer process. In 1879 the invention by Thomas and Gilchrist of basic linings to furnaces made it possible to use phosphoric iron in openhearth furnaces, and gave a great impetus, in Europe particularly, to the use of the openhearth. Since that time the improved quality of the openhearth metal as compared with the bessemer has caused a steady growth of the former and a gradual reduction in the use of the bessemer system, and at the present time the output of openhearth steel in the world largely exceeds that of bessemer steel. A few years ago French engineers took steps to recognize the contribution made by Martin so many years ago to the art of steel manufacture. The French Government made him an officer of the Legion of Honor, and in 1910 the bankers of Europe gave a banquet in his honor in Paris.

Franchises and Fair Value for Ratemaking

Control over utility rates in New Jersey was recently regained by the State Board of Public Utility Commissioners when the highest state court, as noted in ENGINEERING NEWS, June 17, reversed a former decision and refused to allow a value for franchises above their cost and burden. The court as a whole filed no opinion, but Justice White gave his reasons for concurring, and the following passage from his statement is well worth repeating here:

> I suppose it must be conceded that the franchise to charge as a "reasonable rate," sufficient to yield a net profit of 8 per cent. on the value of the company's property as allowed and established respectively by the findings of the Utilities Commission in this case, is a very valuable property right. Certainly I think it is. That this valuable privilege is the company's is beyond question. That it is property is undoubted. That the law protects it against confiscation and subjects it to taxation follows as a matter of course. But that this valuable property right to charge "reasonable rates" should by virtue of its own existence have the effect of converting itself into a still more valuable property right to charge "unreasonable rates" is, of course, preposterous. Presumably the incorporators went into this public-utility business because they expected that their charter privilege to charge "reasonable rates" for the gas they were to manufacture, distribute and sell would be a valuable one, but that fact and the fact that it has become so cannot have the effect of altering the terms of the contract made with the state. . . .
>
> That the company's contract with the state to charge "reasonable rates" cannot be thus evaded is, of course, quite obvious. The plain fact is that the commercial value of the company's property right in its franchise can have no effect in fixing the rate it can charge, because by the terms of its contract with the state the stream of its franchise value arises from the spring of its right to charge "reasonable rates," and in the very nature of things no stream can rise higher than its source.

Here is a clear disposition of a claim which frequently has been made in various parts of the country. In effect it is said that franchises are property, but not "property used and useful in furnishing service," which public-utility laws now commonly specify as the basis of rates.

One Way to Advertise an Engineering School

A correspondent sends us a leaflet with the interesting heading "Why I Am An Engineer." According to the title page of this leaflet, it is issued by the University of Pittsburgh, School of Engineering.

We quote verbatim the first two answers to the question, "Why I Am An Engineer," printed in this leaflet:

> 1. Because the members of the engineering profession are well paid.
>
> The average salary of engineers 20 years after graduating from an engineering school is $10,000 per year.
>
> 2. Because the demand for good engineers is increasing faster than the supply.

The attendance at the School of Engineering at the University of Pittsburgh has more than doubled in two years, and still each graduate has from two to four positions offered him.

It is unnecessary to say to our readers that the average salary of an engineer twenty years after he graduates from an engineering school is not $10,000 per year, nor anything like it. It is possible, furthermore, to state what is the average income or salary from professional work, not of every graduate from an engineering school, but of such of those graduates as achieve enough prominence in their profession to become members of the American Society of Civil Engineers. The diagram which we published on p. 34 of ENGINEERING NEWS of Jan. 7, 1915, made up from the experience of some 4800 members of the American Society, showed that the average annual earnings of an engineer member of that society of twenty years' experience are $4892. Lest some defender of the university may raise the point that these were not all university graduates, else they would have earned more, we note further that another diagram in the same issue showed that, comparing the members of the society who were graduates with those who were non-graduates, the non-graduates of equal years of experience were receiving the larger salaries.

As most readers will recall, it has been fully shown in these columns during the last two years that these figures represent a much higher rate of earning power than the average engineer or the average engineering graduate obtains at the present time. So much in order to place the actual facts obtained by statistical investigation in contrast with the advertisement of the University of Pittsburgh.

The facts are so well known to engineers of experience that it is almost unnecessary to say that the advertisement of the University of Pittsburgh is false and misleading. The demand for good engineers is not increasing faster than the supply. On the contrary, there never has been a time during the past quarter century when so large a surplus of engineers of experience and ability found themselves without occupation because there was not enough engineering work to go around.

Perhaps it may be said in defense of the University of Pittsburgh that this is advertising, and that the purpose of advertising is to get business, and that it is often necessary to sacrifice adherence to the truth for the sake of getting "punch" into the advertisement.

If any such excuse is offered for the advertisement above quoted, it may be well to state the ethics which govern ordinary commercial advertising, which is carried on as a sordid business matter, and is not supposed to be governed by the high and altruistic principles which control the conduct of a great institution of learning.

The ethics of commercial advertising, then, is that false or misleading advertisements are not to be published. ENGINEERING NEWS, in common with other high-class journals, refuses to publish advertising which contains statements that it may know to be false or misleading. It is not meant by this, of course, that it is possible for the publisher to check up and verify the statements made by every individual advertiser concerning his goods. Any statement, however, which is contrary to well-known facts, and the tendency of which is to mislead or defraud, must be eliminated from the advertisement before publication.

This is the ethics of advertising manufactured articles, which are sold to men supposedly competent to judge for themselves and who make any necessary allowances for the enthusiasm of the advertiser and the tendency of every man to praise his own goods.

Certainly a code of ethics at least as high ought to prevail in advertising addressed to the general public. It is of course well known that advertising of this sort was long conducted on a very low standard, or none at all. Reputable newspapers used to publish huge advertisements of stock in get-rich-quick schemes, and objectionable patent medicines. In recent years a great improvement has been effected. The United States Post Office Department has stopped the circulation of such advertisements through the mails and has punished those guilty of carrying on such enterprises. This in connection with advancing standards in journalism has produced a great reform.

The harm done by advertising fraudulent enterprises, inducing the investment of hard-earned savings by those who can ill afford to lose them, has often been depicted. But is the harm any less serious when a youth is persuaded to invest years of time and to spend money, which may be borrowed, or on which his parents may be relying for support in their old age, under the illusion that merely by taking a course of study in a certain institution he will have various firms competing with one another for the privilege of securing his services and can reasonably expect to be earning a large salary in comparatively few years? Manifestly, if the statements made in the advertisement of the University of Pittsburgh were true, attendance at that institution and at every other first-class engineering school might well be doubled and quadrupled.

Possibly some one may offer the excuse for the above-quoted advertisement that securing an engineering education is so advantageous that any sort of exaggeration is justified if it will persuade boys to come to the schools. Let us pass over for the moment the ethics of doing evil that good may come and admit, just for the sake of argument, that it is an advantage for young men with the right qualifications to have the benefit of a course in engineering. It still remains true that the circulation of such advertising is bound to turn toward the engineering school a lot of students who are wholly unqualified to do good work as engineers. Indeed, there are many in the profession who believe that part of the overcrowding of the engineering profession and the number of misfits in its ranks can be tracel to the zeal of the engineering schools to increase the number of their students by any means possible.

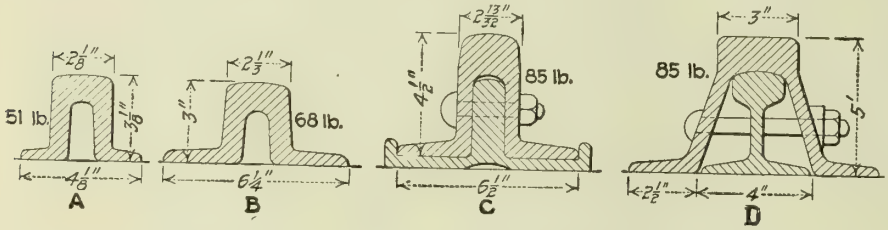
The more one reads the above-quoted advertisement, the more one is puzzled to understand how the authorities of a university of high standing could countenance its circulation. About the only reasonable and charitable explanation that we can suggest is that the work of preparing publicity matter regarding the institution must have been delegated to someone with a smattering of knowledge concerning things in general and none at all concerning engineering, and that his productions must have been sent out without supervision by someone higher in authority.

To avoid the possibility of misunderstanding by any one of our readers it may be well to add that ENGINEERING NEWS has not the slightest doubt as to the enormous value of the service which the engineering schools have rendered to the engineering profession.

Letters to the Editor

History of the U-Rail Section

Sir—Your editorial on "A New Heavy Rail Section," in ENGINEERING NEWS of May 27, mentions Brunel, the famous English engineer, as the inventor of the U-rail or bridge rail for railway track. It is quite true that he did invent this rail in England, in 1835. But he had been anticipated in this country by Strickland in 1834, who is given credit for this in Tratman's "Railway Track and Track Work." Bridge rails were used in this country on the Susquehanna & Wilmington Ry. in 1835, the Western Ry. of Massachusetts in 1840, and the Baltimore & Ohio in 1842. Those of the first line were 2½ in. high and 4 in. wide. Those of the Baltimore & Ohio were 51-lb. rails, 3⅛ in. high, 2⅛ in. wide in the head and 4⅛ in. over the base. The tendency in Strickland's designs was to increase the height in order to get a stiff rail for track laid with cross-ties. Bridge rails were used also in France and Germany in the early days of railways, but were of the broad and shallow Brunel type.



EXAMPLES OF U-RAIL OR BRIDGE-RAIL SECTIONS

A—The Strickland rail of the Baltimore & Ohio R.R., 1842 (invented 1834). B—The Brunel rail of the Great Western Ry., England (invented 1835). C—The Wrenshall rail proposed for the Northern Pacific R.R., in 1885. D—The Strobel rail, proposed in 1889

The only cases in which the bridge rail has come down to modern times are in Great Britain. The Great Western Ry. of England used the Brunel 3-in. 68-lb. rail on its broad-gage (7-ft.) and mixed-gage tracks until 1892, when the broad gage was finally abandoned. No splice bolts were used, the rail ends resting on base plates and being double spiked with screw spikes. The tracks on the Forth Bridge are laid with 145-lb. bridge rails (ENGINEERING NEWS, Sept. 9, 1909). The Central London Ry., one of the first underground "tube" lines, has 100-lb. 3½-in. bridge rails, 7 in. wide, in order to keep the height of track at a minimum (ENGINEERING NEWS, Aug. 2, 1906). In all these cases the rails were laid on longitudinal timber supports, and the height (or stiffness) of the rail was a secondary consideration.

American bridge rails have been designed for use on cross-ties, and with special regard to stiffness. In a paper on "The Improvement of Railway Track," by E. E. R. Tratman, in the *Transactions* of the American Society of Civil Engineers (March, 1890), reference is made to an 85-lb. bridge rail proposed for the Northern Pacific Ry. in 1885 by C. C. Wrenshall. This was to be 4½ in. high, 2 13/32 in. wide in the head and 6½ in. over the base, with webs ½ in. thick. The joints were to be spliced with T-shaped splice plates bolted through the webs, the edges of the plate being turned up to engage the sides of the rail base.

In the paper by Don J. Whittemore on "Cylindrical Wheels and Flat-Topped Rails," which attracted so much attention some years ago (*Transactions*, Am. Soc. C. E., 1889), the bridge rail received favorable comment, as follows: "If a change is necessary, why not have our form of rail a type of that noblest of all creatures, a level-headed man with two legs and feet to correspond? Why not come back to the design of the American, Strickland, of 1834, redesigned by Brunel in 1835 and still in use on the Great Western Railway of England?"

In the lengthy discussion of this paper George B. Hazlehurst suggested a bridge rail in which the head projected beyond the webs, in order to get a bearing for ordinary angle splice bars. An 85-lb. bridge rail section was proposed also by Charles L. Strobel; this had the webs flaring outward below the head. The splices were to be made with light T-rails or special rolled sections, and with or without the use of bolts. This rail is a combination of the bridge rail and Barlow's "saddle" rail of 1849 (England). The Barlow rail had curved flaring sides or webs and was originally intended to be packed with ballast and used without other support, but in a few cases it was spiked to cross-ties.

The accompanying drawing shows the Strickland, Brunel, Wrenshall and Strobel bridge rails.

"RAIL AND TRACK."

Chicago, June 9, 1915.

Poor Quality of Heavy Steel Rails

Sir—In ENGINEERING NEWS, May 27, 1915, you published some very interesting comments on Gustav Lindenthal's paper on "The Qualities of a Good Steel Rail," as presented at a meeting of the New York Railway Club on May 21.

It is encouraging to know that interest in this important subject is still manifested and that such an eminent authority as Mr. Lindenthal has advanced views which must compel engineers to give thought to the grave problem. In connection with this matter, the writer, over three years ago, in a discussion with the president of a prominent railroad, was asked to outline his views, in consequence of the many breakages of heavy steel rail. The inclosed article, which was then intended for private use only, was the result, and close observation since the time it was written has only accentuated the writer's opinion. It will be noted that on the very vital point of rail manufacture the writer, while perhaps going farther

than Mr. Lindenthal, sets forth substantially the same ideas.

CIVIL ENGINEER.

New York, June 3, 1915.

[The inclosure referred to follows.—EDITOR.]

The article "Making Steel Rails Better," published in the "Times" of Jan. 20, deals with a subject of grave importance to us all, and one which, apparently, has not been given the discussion and attention which it deserves. This letter is not intended in any manner as an argument against trusts, which the writer firmly believes in under proper regulation, but rather as advancing some ideas which are worthy of discussion, and which for some obvious reasons he believes have not heretofore been presented, publicly at least.

The writer advances the general proposition that provision for safety to the traveling public, as far as human intelligence can foresee, is the duty of every official to whom is confided the maintenance and operation of railways; also, that under present conditions, with the modern rail as now laid on even our best roads, wrecks, with loss of life and its consequent horrors, are ever present, not as a possibility, but as a probability.

Now, upon whom does the responsibility for this rest—the railroads or the rail manufacturers? The writer believes it to rest upon both, but largely upon the latter.

It may be safely assumed that perfect drainage of roadbeds, plenty of well-tamped ballast, sound ties and an ample amount of track labor under intelligent supervision are necessary to maintain what in railroad parlance is called "good track." This brings us up to the duty the rail and its adjuncts have to perform.

It is true, as stated by the authority which your article quotes (and high officials of the Steel Corporation have previously said the same) that weights of engines and speeds of trains have increased to a marked degree in the past few years, and therefore greater burdens have been imposed on track and rails. But it is not true in the broad sense that should characterize an honest discussion of this very important subject, that the quality of the rails has kept pace with the increased duty; quite the reverse. Apparently, about all the effort made for the improvement of rails to enable them to carry their increased burden has been to make them heavier. This increased section, as a matter of fact, makes the rails relatively weaker; but—mark this carefully—it provides a much increased tonnage, for which the railroads must pay, for a given mileage, without an adequate compensation in the way of increased safety.

Now, what is meant by this? Briefly, everything is sacrificed to haste—to get all the possible tonnage through the rolling mills in the shortest possible time; and the results are apparent in broken rails, loss of life and property, and a general uncertainty which pervades every railroad-operating office as to what is the trouble and how it can be averted.

Any one visiting a modern steel-rail mill will see the ingots, each of a size and weight sufficient to roll about 100 ft. of rail, come out of the gas furnaces heated almost to the melting point. They are picked up and sent with almost incredible speed through the rolls—back and forth; biff-bang—and in a comparatively few passes assume the form of a modern T rail. After snipping off the jagged ends, the piece is sawed into three 33-ft. rails, which go to the cooling beds to be straightened, and (God save the mark!) inspected, ready for shipment and delivery.

There is something in all this overheating and rapid rolling which our chemist friends are not alive to, or are wisely oblivious to, which is injuriously affecting the quality and strength of the rail. The writer believes that sufficient time is not given to allow the molecules to adjust and reassemble themselves as the laws of nature and chemistry demand, and that the excessive heat to which the steel is subjected tends to destroy its strength.

Under the processes of former years, to roll a steel rail required very much longer time than at present. It was not heated to such an excessive temperature—almost burned up, as now—and it was reheated several times, during or between its passage through the rolls. Thus, sufficient time was allowed apparently for the molecules of the steel to adjust themselves to their new conditions and to insure that only natural, normal strains would result. This theory may be sneered at as purely academic and theoretical, but let us take some practical examples:

A few years ago the writer was in charge of the maintenance and operation of a very busy piece of track, with severe grades and curves and carrying heavy tonnage. Modern and powerful engines were used, carrying heavy wheel loads and at fast speeds. This track was laid with rails weighing 75 lb. per yd. rolled in 1892. In 1900 some of this rail became curve-worn to the extent that it became unsafe. A lot of new 80-lb. rail, rolled in 1900, was purchased and laid in place of the old rail of 1892. In many places the new rail was laid for one rail of the track and the old rail was left on the opposite side. What was the result? In less than two years a very large proportion of the new rail had failed from breakages and wear of head and was taken out, while the old lighter rail was left, still carrying its load safely.

Many samples of both rails were taken and broken under the steam hammer so as to show the actual appearance of each, as regarded texture, etc. In every case the old rail showed a fine grain, perfectly homogeneous structure, indicating perfect crystallization and, presumably, maximum strength. In case of the new heavier rail, the showing was entirely different. The crystallization was uneven, unhomogeneous, some of it in fine crystals and some extraordinarily large, the whole cross-section looking in size and general appearance more like the back of a bull frog than a piece of steel. In the testing machine the new heavier rail showed 20 per cent. less strength than the old and lighter rail.

The writer also compared samples of this modern heavy rail and rail of 60 lb. rolled in 1886, both at the Krupp Works at Essen with some rails rolled in this country at the same time. It is hardly a stretch of the truth to say that the old 60-lb. rail was equal in strength and duty to the modern 80 lb.

The writer has discussed this matter with various railroad officials, and universally has found a disposition to admit that the quality and strength of rails are being sacrificed to speed in manufacture. Also, he has found, sad to say, a disposition to "let sleeping dogs lie," as the connection between the manufacturers of rails and the financial control of railroads was altogether too intimate.

As a matter of fact, it would be good business for any railroad company to pay $40 per ton for rails, heated to lower temperature, rolled slowly and reheated during rolling, than to pay, as now $28 per ton for the imperfect product now being forced upon the companies. Furthermore, at the average price of pig, coke, etc., for the past ten years, rails rolled properly can be made at the present price and give a fine profit to the mills. There is no service that the railroads are called upon to perform that a 90-lb. rail, made as it should be, laid on a well-kept roadbed, will not perform with comparative safety. The purchase of rails of heavier weight is a concession to ignorance and the arbitrary demands of the manufacturers of steel rails.

Steel Ties for Street Railway Track

Sir—We have read the editorial appearing in ENGINEERING NEWS of June 10 relative to selling stock in patent railway-ties companies, and we endorse it in so far as it applies to steam-railway ties.

The editorial, however, does not do justice to the steel tie in paved-street track for electric railways. Our twin steel ties were first used in 1908, and are now widely used by electric railways all over the country, as shown by the inclosed list. This tie is not only superior to wooden ties in paved-street track, but it is cheaper in first cost.

Our company is not a stock-selling proposition. We manufacture steel ties and steel crossing foundations exclusively and are doing a rapidly increasing business in these products.

INTERNATIONAL STEEL TIE CO.,
William P. Day,
Vice-President and General Manager.

Cleveland, Ohio, June 19, 1915.

[The editorial referred to related solely to ties used on steam railways, and we specifically disclaimed reference to any concern carrying on a legitimate business. The information forwarded with the above printed letter shows that the steel tie made by the company is in use on over 30 street railways and is claimed to effect a large saving in cost and maintenance over wooden ties for track in paved streets.—EDITOR.]

American Society for Testing Materials

SYNOPSIS—The annual meeting last week showed active committee work in preparing specifications for materials; 37 new or revised specifications, 11 test methods, and 3 sets of definitions were adopted. Continued interest and growth but anaemic finances resulted in increase of dues. Steps taken toward getting out new cement specifications led to bitter contention. The society declared against making specifications for engineering methods or structures.

By electing Prof. Mansfield Merriman as its new president, the American Society for Testing Materials has in one respect turned time back 17 years, to the society's date of origin. He was the first president of the organization before it seceded from the International Association for Testing Materials of Construction. Even in those days it represented a new thought—the creation of uniform or standard specifications for commonly used materials. The vitality of this idea is largely responsible for the great growth of the society and its present high rank among technical organizations.

In other respects than the choice of its president the society at its annual meeting held June 22-26, at Atlantic City, N. J., showed no turning back. Its well-fixed reputation for holding very active and stimulating meetings was maintained or even increased. There was not only the depressing influence of the European war to be figured with, but the competition of at least two other large meetings of engineers—the American Society of Mechanical Engineers (at Buffalo) and the Society for the Promotion of Engineering Education (at Ames, Iowa)—which were simultaneous with the Atlantic City meeting. Yet the attendance (489 men and 112 women) was practically equal to last year's. And, what is more to the point, the proceedings of this meeting showed a higher efficiency in the society's work than any prior one.

The last statement applies to the work of the technical committees. Nearly all of them brought in new or revised specifications, the product of research and conferences during the year. Without making comparisons as to number or variety of specifications with other years, it can be said that marked progress in securing harmony and bringing divergent views together in the committees was evident.

Two notable exceptions to the general condition of harmony formed prominent features of the meeting: (1) The cement committee, which by an unusual chain of events was confronted with concrete proposals for revolutionizing the standard cement specification, indulged in a lively fight, ended for the present by a parliamentary truce, not peace. (2) The committee on Tests for Lubricants has squabbled over the question of viscosity tests for two years and is still far from agreement; this produced a solid hour's wrangle in the meeting, until finally the society decided that the matter should be returned to the committee for another year. But these two contests, besides being highly interesting, showed efficient work on the part of the society if not of the committees concerned, since in both cases the society rejected the chance of getting an earlier result at the cost of losing the agreement of a small but strong minority. The society's past history proves that specifications for materials or for test methods can be made to suit all parties, if only the parties are locked up long enough in a committee room and left together till they recognize that their purposes are identical.

President Gibbs Criticizes Rail Specification

It may be that too much of this harmony prevailed in drawing up and revising the railway-rail specifications of the society during the past eight years. These specifications, declared Pres. A. W. Gibbs in his presidential address, contain glaring faults. Thus, as to ladle analysis:

> It is difficult to see how a specification could be made more absurd. . . . Neither the American Society for Testing Materials nor the American Railway Engineering Association specification really protects the buyer as to chemistry.

Again, as to acceptance of rails by retest if the first drop-test fails:

> We hold that this is a pernicious practice, in that the consumer has positive proof that some of the accepted material does not meet the requirements.

And, after further criticizing the clause which permits unsound rails to be accepted as "special," presumably for use in unimportant locations, he said:

> Summed up, the rail specification of our society does not put a proper premium on the selection of the better part of the ingot for one of the most exacting services for which steel is used. Where our specification differs from that of the American Railway Engineering Association it is not so good.

He followed this up by calling for constructive work in committee to "prescribe specifications and tests which, if enforced, will prevent improper material from getting into service."

It is fair to say that he also expressed the opinion that heavier rail-sections are a first requisite. And he likewise mentioned the steady increase in weights of locomotives and cars:

> In this country the answer [to the rising costs] has been operation by larger units. Tersely stated, it means heavier loads and more of them. This is a path which, once entered upon, admits of no turning back. It leads directly to the Rail Problem.

Probably no important railway man heretofore has stated so clearly the view that there will be no stopping point in the increase of train loads and axle loads.

Before referring further to the committee work and its results, we note some features of the meeting bearing vitally on the society's future.

Specifying Engineering Methods and Pipe Threads

As it is only a short step, in many cases, from prescribing materials to dictating methods of construction, so the danger always existed that the society might overstep the proper bounds of its activities by taking up engineering design or practice. Not till last year, however, did an actual case of any importance come up—the Drain Tile committee insisted on joining to its specifications for drain tile and test methods a treatise on how to lay drain tile. The strange thing is that, without deliberation

or debate, the 1914 meeting accepted this treatise and voted to adopt it as a standard.

One or two further cases came up at the present meeting. A prescription for laying sewer pipe was formulated, and the meeting accepted it among its Tentative Standards. Again, the gypsum committee asked authority to specify concerning the laying up of gypsum-block walls and the like. And again, the society set a committee to work preparing a revision of existing standards for pipe threads—surely not a material!

However, in the near future means are to be considered for keeping out of foreign fields, except perhaps as to pipe threads. Even last year the governing authorities felt that to specify methods of laying pipe was risky business, and they therefore secured authority from the meeting to consider broadly the problem of establishing limiting principles. The result was the announcement, at this year's meeting, of the rule that the society's committees should not attempt to specify engineering methods of design or construction. How this rule can be carried into practice is a problem yet to be solved.

For the present the specifications for laying drain tile and for laying pipe sewers remain among the society's standards (the latter only as a Tentative Standard), and the gypsum and pipe-thread committees are continuing their work unmodified. But the meeting gave some active discussion to the subject, which clearly showed a healthy sentiment in favor of sticking to materials *per se*.

Good Growth but Close Finances

The records presented by the secretary show a steady growth in spite of the war conditions. In fact, the number of new members admitted in the first half of 1915 exceeded prior figures, amounting to 201. The total membership is now 1842, a net increase of 155 for the year, as compared with an average annual increase of 105 in five years.

Considering the growing membership and the increasing volume of publications (1881 pages during the past year, as compared with less than 1000 five years ago), it might be expected that trouble would develop from the low membership dues ($10). The secretary reported, in fact, that each member cost $10.79 during the year, so that a deficit is being accumulated.

Membership Dues Increased

The Executive Committee studied both sides of the question—cutting expenses and raising the income—and finally recommended that curtailment was inadvisable but that the income ought to be increased. Various means to this end were proposed by the committee. Its last and most radical proposal was a flat 50% increase in the annual dues of juniors ($5 to $7.50) and members ($10 to $15), as well as in the fee for membership-in-perpetuity of firms and corporations ($200 to $300). When this was laid before the meeting by Vice-Pres. A. A. Stevenson, discussion was not needed or requested, but the meeting voted solid and strong in favor of the increase—subject to ratification by letter-ballot.

New Officers Elected

The selections for officers by the nominating committee were ratified by the society's vote. They are: President, Mansfield Merriman, New York, N. Y.; Vice-President, Gen. W. H. Bixby, Washington, D. C.; members of Executive Committee, J. H. Gibboney (Roanoke, Va.), Prof. W. K. Hatt (Lafayette, Ind.), J. A. Mathews (Syracuse, N. Y.) and Prof. Edward Orton, Jr. (Columbus, Ohio).

The work done by the society's committees in preparing and revising specifications is hardly more important than their research and study work. Some of this appears in papers contributed by individual members of committees, while the rest is largely embalmed in appendixes to the committee reports. We will mention some of the most interesting items of committee research after noting the specifications adopted.

The independent papers presented at the meeting will be reviewed in brief abstract in coming issues, in so far as they bring forward new facts or arguments necessary to the engineer in his work.

New and Revised Specifications

The following list gives the subjects of the new and revised specifications, test methods, and codes of definitions which the meeting passed upon. The last-named are a new thing in the society's work, originating in the fact that many terms used in specifications did not have a single and unquestioned meaning as generally employed. Three sets of definitions were adopted this year, and more are in preparation.

Reference is made in the list to dates of the original specifications revised, and to joint action with committees of other societies.

SPECIFICATIONS

Brackets indicate those accepted as "Tentative" only

For iron and steel chain.*

For malleable-iron castings (revised from 1904 standard).

[For foundry coke.]†

[For bare concentric-lay copper cable; hard, medium-hard or soft.]‡

[For high-strength bronze trolley wire, round and grooved; 40% and 65% conductivity.]

For hard-drawn copper wire.§
For medium hard-drawn copper wire.
For soft or annealed copper wire.
} Revised from 1913 standards to omit reference to cable or strand, and by changing "surface imperfections" to "imperfections."

[For the alloy: Copper 88%, tin 10%, zinc 2%.]

For quenched high-carbon-steel splice bars.

For quenched carbon-steel track bolts.

For quenched alloy-steel track bolts.

For lap-welded and seamless boiler tubes for stationary service.||

For welded steel and wrought-iron pipe.||

For structural steel for bridges (revised from 1914 standard by providing for unannealed specimen tests of eyebar material.)

For automobile carbon and alloy steels (revised from 1914 standard).

[For carbon-steel bars for vehicle and automobile springs.]

[For silico-manganese-steel bars for automobile and railway springs.]

[For chrome-vanadium-steel bars for automobile and railway springs.]

[For helical and elliptical springs for railways.]

[For alloy-steel forgings.]

[For quenched-and-tempered alloy-steel axles, shafts and other forgings for locomotives and cars.]

For cold-drawn steel openhearth automatic screw stock (printed as tentative in 1914).

For paving brick.**

*With partial coöperation of a committee of the American Railway Association. The specifications differ slightly from those of the Master Car Builders' Association.

†Includes methods of sampling, and will include methods of analyzing coke, the latter to be formulated jointly with committees of the American Foundrymen's Association and the American Chemical Society.

‡Prepared jointly with the Standards Committee of the American Institute of Electrical Engineers.

§This was under joint consideration with the Power Committee of the American Electric Railway Engineering Association, but agreement could not be reached.

||Cover iron as well as steel tube and pipe. The specifications were drafted jointly with the wrought-iron committee.

**Includes methods of test.

[For the laying of sewer pipe.]
For quicklime. } Printed as tentative in 1914; the present form contains many changes and is essentially new.
For hydrated lime. }
For purity of raw linseed oil from North American seed (revised from 1913 standard).
For purity of raw Chinese wood oil.
For purity of boiled linseed oil from North American seed.
For turpentine.*
For classification of structural timber (revised from 1907 standard).
For yellow-pine bridge and trestle timbers (revised from 1910 standard).
[For Southern yellow-pine piles and poles to be creosoted.]
[For Southern yellow-pine timber to be creosoted.]
For cotton rubber-lined fire hose for private department use.
[For insulated wire, 30% rubber insulation.]

METHODS FOR TEST OR SAMPLING

Brackets indicate those accepted as "Tentative" only.

[For sampling and analysis of pig and cast iron.]
[For the sampling of coal.]
[For the laboratory sampling and analysis of coal.]†
For chemical analysis of alloy steels.
For testing.‡
[For routine analysis of white pigments.]
[For distillation test of paint thinners other than turpentine.]
[For determination of moisture in bleached shellac.]
[For sampling and analysis of creosote oil.]
For test for cotton rubber-lined hose.
[For the testing of automobile tire fabrics.]

DEFINITIONS

Of terms relating to sewer pipe.
Of terms used in paint specifications.
Of terms applicable to materials relating to roads and pavements.

Copper Wire

During the past year disagreement of Committee B-1 with the Power committee of the American Electric Railway Engineering Association developed on the subject of including the twist test. The latter insisted on including such a test, and no agreement could be reached. Cooperation therefore terminated, and Committee B-1 reported no revision of its specifications for hard-drawn copper wire. It fortified its case by an inquiry among electric railways, which showed that many are using the specifications.

Government Bronze (88-10-2)

In considering the new specifications for 88-10-2 bronze some opposition developed. The specifications of the committee (Chairman Wm. Campbell, New York) set the range of composition at copper 86-89%, tin 8-11%, zinc 1-3%. G. H. Clamer of Philadelphia demanded a higher copper content (88-90%) with reduction of the tin range. No support was given to this, but it led to the acceptance of the specification as "Tentative" instead of "Standard," so that argument on the matter can continue.

Steel

The smooth way in which the recommendations of the Steel committee (Chairman C. D. Young, Altoona, Penn.) went through was a notable feature of the meeting. Apart from a slight argument on spring steel the dozen or more new specifications brought in by the committee were accepted by the meeting in routine style. It is true, of course, that steel rails, always a sore theme, were not involved. A dispute at last year's meeting over axle specifications, voicing the opposition of representatives of the American Electric Railway Engineering Association, has been cleared away by the withdrawal of these representatives from joint action.

The moment the specifications were disposed of, however, the rail subject bobbed up, and there was an argument, as noted farther on.

Methods of Physical Testing

The long labors of the committee on Standard Methods of Testing (Chairman G. Lanza, Philadelphia, Penn.) were rewarded at last year's meeting by a rejection of the revised specifications brought in. Practically the same thing happened this year, inasmuch as vital parts of the specifications were accepted only as "Tentative." The chief trouble arose over the committee specifying three-point attachment of extensometers, and stopping the machine to take readings, in getting the modulus of elasticity. Men from both mill and college testing laboratories joined in opposing these practices, which showed that the committee in trying to prescribe for both commercial and research testing in a single specification failed to satisfy either party. Other opposition related to definitions proposed by the committee for elastic limit, proportional limit, and yield-point, and methods for determining them.

T. D. Lynch (Westinghouse E. & M. Co.), Prof. H. F. Moore (University of Illinois) and others declared that two-point extensometers and continuous running of the machine give reliable results. Prof. G. Lanza insisted that only a three-point instrument with three separate readings (not mechanically averaged) would reveal a curved condition of the specimen. Mont Schuyler (St. Louis municipal laboratory) claimed that lateral motion of the head of the testing machine might neutralize attempts at centering a specimen, to the extent of requiring three-point instruments to show whether the pull is central. Prof. H. F. Moore objected to specifying three-point measurement for research tests because the investigator would use any method suited to his purpose; in certain recent tests at the University of Illinois extensometers have been used on 46 gage-lines, the results showing among other things that transverse planes do not remain planes during the test.

It is expected that further work of the committee will be directed toward working out specifications for a definite field of use.

Lime Inspection

The Lime committee's specifications for quicklime and hydrated lime were opposed by W. C. Hanna (Calif. Port. Cem. Co., Colton, Calif.) on the ground that the inspector has no business in the whole lime plant but should be limited to the shipping room; special methods of the plant might become known to competitors through the inspector. The meeting did not take the same view.

Viscosity Measurements for Lubricants

The burning question whether the Engler viscosimeter is better than the Saybolt and whether either of them merits the distinction of being made the standard of the society has kept the lubricants committee stirred up for two years. Last year the society declined to settle the matter and referred the dispute back to the committee; this year it did the same. The majority

*Covers both gum spirits and wood turpentine.

†Prepared by a joint committee of the American Chemical Society and the American Society for Testing Materials.

‡Two sections were accepted as merely tentative. They deal with three-point extensometers and with definitions of elastic limit.

of the committee preferred the Saybolt instrument last year, but the opposition of the Bureau of Standards carried the day. Since then the Bureau made careful studies of viscosimeters and dropped its opposition, besides drawing up factor tables for converting the readings of one instrument into those of the other. But other members of the committee continued their opposition, and brought minority reports before the meeting. The meeting devoted a great amount of time to hearing the dispute, which went so far as to question the propriety of specifying a type of instrument by name. The verdict on the dispute was that the committee should adjust its differences during another year's consideration.

"Dense" and "Sound" Pine

Classifying southern-pine timber into long-leaf, short-leaf, etc., proved to be unworkable for commercial grading and buying, as the material from the different pines intergrades more or less. The Forest Service during the past year studied the relation between rings per inch, percentage of summer wood, strength, etc. From the results of this study a grading classification of distinct novelty has been developed. In the form as drafted by the committee and accepted by the meeting for letter-ballot, there are two classes, either of which may include long-leaf, short-leaf, loblolly, Cuban, and pond pine:

Dense Southern yellow pine shall show on either end an average of at least 6 annual rings per inch and at least one-third summer wood, or else the greater number of the rings shall show at least one-third summer wood, all as measured over the third, fourth, and fifth inches on a radial line from the pith. Wide-ringed material excluded by this rule will be acceptable, provided that the amount of summer wood as above measured shall be at least one-half.

The contrast in color between summer wood and spring wood shall be sharp and the summer wood shall be dark in color, except in pieces having considerably above the minimum requirement for summer wood.

Sound Southern yellow pine shall include pieces of Southern pine without any ring or summer wood requirement.

Two elaborate papers, "Discussion of the Proposed Forest Service Rules for Grading the Strength of Southern Pine Structural Timbers," by H. S. Betts, and "Southern Yellow-Pine Timber and Density Grading Rules," by O. T. Swan, supported these recommendations.

Committee Research

Of the extensive research work done by the various committees, only a few notes can be given. Specially comprehensive investigations have been or are being made by the committees on Steel, Cement, Concrete Aggregates, and Paint. A few individual items are reviewed here.

Studies of Rail Shrinkage

Pyrometer studies of rails in rolling mills made by the Bureau of Standards during the past year showed that the shrinkage clause in rail specifications does not and can not insure that the final rolling will be done cool enough to give good metal structure.

Criticism of the society's specification was so distasteful to the rail subcommittee that it undertook a defense of the shrinkage clause. The subcommittee presented a very elaborate study, published as an appendix to the Steel committee report. It proves even more than might have been anticipated, namely that the finishing temperature has no relation to the service value of the rail. Partly for this reason the subcommittee concludes that it seems hardly justifiable to go to any great expense in determining finishing temperatures any more accurately than is possible with the shrinkage clause, which on account of its easy application is by far the most convenient means of checking the finishing temperature.

G. K. Burgess, of the Bureau of Standards, after presenting a destructive detailed review of the report, pointed out that the subcommittee itself declares the finishing temperature to show no service relations, hence finds the shrinkage clause meaningless, but insists on retaining it in the specification. Further, the specified shrinkage allowances permit 100-lb. rails to be finished at a temperature 60° C. higher than 75-lb. rails; is this a manufacturing convenience or a necessary limitation for efficiency in service? In reply E. F. Kenney (Johnstown, Penn.) defended the shrinkage clause as a heritage, and opposed with the following argument Burgess' proposal to use pyrometric control: Between making more difficult a feature of doubtful value (control of finishing temperature) and throwing it out entirely, a middle course is possible, namely retaining the doubtful feature in its simplest form.

However, the Steel committee voted, Chairman Young announced, to consider seriously the matter of accepting Mr. Burgess' coöperation.

Final Report on the Havre de Grace Bridge Paint Test

Though the large-scale comparative test of bridge paints on the Havre de Grace bridge of the Pennsylvania R.R. was ended more than a year ago, no general report on the test was then rendered, and the Paint committee had to be instructed specifically by the society to make such report. An excellent report was therefore brought in this year. It describes the various paints as to composition, and in a sane and useful way states their performance. The painters' log-sheets are also reproduced, to supply information on conditions which affected the application of the paint.

The net result of the test—so the report impresses the reader—is to show that most of the 19 paints had a surprisingly long life, that paints of nearly all varieties can give good and long-time protection, and that the virtue of a red-lead addition is unmistakable.

Another important exposure test was also finally reported—the Atlantic City steel-and-iron plate test of paints made to show whether a classification by the Thompson water test into so-called "inhibitors" and "stimulators" has any meaning. The subcommittee which reported could find no meaning, but evaded any direct statement with the recommendation that further tests be undertaken.

The cyclopedic work of the Paint committee on analysis and normalization of paint-oils continues with undiminished energy. Most of the oil and paint laboratories in the country are participating in this work. As the list of specifications indicates, the work has already been brought to a fair conclusion as to turpentine, several kinds of linseed oil, and raw Chinese wood oil.

Cement and Concrete

Committee activities in the concrete field were restricted this year to the consideration of the constituent materials of concrete and did not consider the finished concrete. Committees have evidently come to the belated conclusion that the trouble with concrete, where it is in trouble, is not owing so much to a lack of appreciation of

the qualities of the finished product as to an ignorance of its ingredients, an ignorance more than surprising in view of the amount of concrete and the long experience in its use.

Committee C-1 on Standard Specifications for Cement, George F. Swain, chairman, reported on four of its subsidiary activities—the Joint Conference on Uniform Tests and Standard Specifications for Cement, the autoclave test, the standard screen scale and the Chapman consistency test. The report was accepted as read with no discussion.

Cement Specification

In March, 1912, Committee C-1 adopted the following resolution:

> In order to secure uniformity in specifications for cement, it is recommended that the Board of Direction of the American Society of Civil Engineers, the Committee on Standard Specifications for Cement of the American Society for Testing Materials, and the Government Departmental Committee on Specifications for Cement be each requested to appoint a committee of three to confer for the purpose of reconciling differences.

In pursuance of this resolution on Oct. 24, 1912, the Joint Conference on Uniform Methods of Test and Standard Specifications for Cement was organized with nine* members. The conference has conducted investigations and inquiries of various kinds, and reached an agreement on Apr. 28, 1915, in all matters except the method for the determination of time of setting. The report of the conference, a document of over a hundred pages, was mailed to the members of Committee C-1 on June 5, 1915. At a meeting on June 23, 1915, Committee C-1 adopted the following motion:

> It is moved that the report of the Joint Conference be received and referred to suitable subcommittees of Committee C-1 to investigate and report in not later than one year; said subcommittees to be appointed by the Advisory Committee and approved by Committee C-1.
>
> It is further moved that the Executive Committee of the American Society for Testing Materials be asked to confer with the Board of Direction of the American Society of Civil Engineers and to suggest that they withhold from general publication the Joint Conference report until this committee (C-1) has had a sufficient opportunity (not longer than one year) to consider the report.

It will be remembered that the Joint Conference was called into being primarily to reconcile the differences in the standard cement specification of the American Society for Testing Materials (adopted in 1904 and revised slightly in 1908 and 1909) and the specification used in the purchase of all cement by the Federal Government (signed by the President in 1912). The American Society of Civil Engineers was a party to the conference because that society is the author of the standard method of testing cement always considered as a part of the Am. Soc. T. M. specification. The difference between the two standard specifications is mainly in wording, arrangement and in the test for time of set. In the minds of some members of Committee C-1 the sole function of the Joint Conference was to reconcile *these* differences. Apparently the members of the conference have a different view, for the work of two years and eight months has ranged over the whole field of cement and its testing and the recent report (available only to members of the committee) is a résumé of the results of such an investigation together with a suggested standard specification differing—rather radically in some details—from either of the two originally under consideration. The peculiar resolutions adopted first by the committee and later accepted by the meeting are the result of a feeling on the part of a bare majority of the committee that the report and the proposed specifications should not be made public until the manufacturers of cement have had time to study the report and to submit criticisms of both report and specification. It is of course a matter of debate in just what degree the wishes and opinions of Committee C-1 can be imposed on the American Society of Civil Engineers or on the engineers representing the Federal Government in the conference.

*Alfred Noble, one of the American Society of Civil Engineers' members, died Apr. 19, 1914, and his place was not filled.

Autoclave Test

The subcommittee on the autoclave recommended that "the autoclave test for soundness should not for the present be adopted for the reason that the investigations which have been made of this method do not show that it is in any way superior to the present test for soundness." The subcommittee on a standard screen scale reported that in accordance with a decision of the Executive Committee of the society no further action should be taken on this question. The subcommittee to investigate the Chapman consistency test reported that "the apparatus when operated in accordance with the method recommended by the inventor does not give sufficiently concordant results on 1:3 cement-sand mortars or on neat cement paste to warrant recommending its use as a reliable test for consistency."

Concrete Aggregates

The Committee C-9 on Standard Tests for Concrete and Concrete Aggregates (Sanford E. Thompson, chairman) has outlined a most elaborate series of tests which is now under way, the tests themselves for the most part being made in various commercial and college laboratories. Work is being carried on in coöperation with the Committee on Specifications and Methods of Tests for Concrete Materials, of the American Concrete Institute.

Subcommittees have been appointed, each to direct the investigations into one particular branch of the general subject. There is no better method of conveying the extent of the program than by abstracting the work of each subcommittee as given in the main committee report:

> Laboratory Tests for Concrete and Laws of Mechanical Mixtures.—This subcommittee has outlined certain tests on concrete and mortars with the view of establishing the best practice in making and testing concrete specimens in the laboratory and to determine the effect of variations in the gradation of sizes of the aggregates on the strength and properties of the concrete. These tests cover a wide range and necessitate the making and testing of a large number of specimens. It is felt that only by making such tests exhaustive can information be obtained which will permit the drawing of definite conclusions. It is hoped that these tests will furnish information upon which can be based definite recommendations as to the practices which should be followed in testing concrete in the laboratory; and it is also hoped that definite conclusions can be reached as to the effects of certain variations in the gradation of the sizes of the aggregate materials. The following series of tests have been outlined as a part of the necessary investigations:
>
> 1. Comparison of metal and wood forms for standard laboratory tests of concrete. 2. Variations in strength and properties of concrete throughout the batch. 3. Effect of different methods of tamping and compacting. 4. Effect of condition of storage of specimens for standard compression test of concrete. 5. Method of capping test specimens preparatory to testing. 6. Effect of gradation of sand. 7. Effect of varying ratio of fine to coarse aggregates. 8. Effect of varying sizes of fine to coarse aggregates. 9. Strength of mortar as affected by the form of the test specimens.

Sampling and Testing Field Concrete.—In laying out the work for this subcommittee it was found that on a number of the larger concrete jobs field tests are being made, but there seems to be no uniformity of practice in making, storing and testing the specimens. It was deemed wise, therefore, that this subcommittee select tentatively a method which seems to have the most merit and recommend that wherever possible such tests be made. The following tests have been outlined:

1. Comparison of four methods of storage during first two days after molding. 2. Comparison of methods of storage subsequent to first two days. 3. Study of the cold-weather effect on field specimens. 4. Comparison of prisms made in the field and in the laboratory with prisms cut from work. 5. It is considered within the realm of possibility that a portable core drill can be made to use in cutting test specimens from concrete already in place in the form of 6x12- or 8x16-in. cylinders.

Relative Values of Various Strength Tests.—In the field to be covered by this subcommittee there are certain fundamental problems which it is felt should be investigated as soon as possible. These may be stated as follows:

1. To establish the relative reliability of mortar strength tests for determining the suitability of sand for use in concrete. 2. A determination of the most desirable size and shape of mortar test specimens and the relation of tension to compression. 3. A determination of the most desirable size and shape of concrete test specimens.

Impurities Affecting Fine Aggregates.—The work of this subcommittee is as follows:

1. In securing samples of fine aggregates which have shown abnormal results when used for concrete. 2. To make tests on the samples secured with the view of determining the cause of the peculiar action noted. 3. To find, if possible, an economical corrective for such peculiarities.

In order to secure samples for this investigation, letters were addressed to a large number of persons throughout the United States and Canada, who it was thought might be able to assist in supplying samples of sand which would be of economic importance if the impurities could be removed. Considerable information has been collected concerning sands of this kind. Several samples have been received and are now being subjected to preliminary tests. The tensile and compressive strengths of mortars made from each of these sands will be compared with mortar from standard Ottawa sands, using various brands of portland cement. Chemical analyses will be conducted on the foreign material in the sands, and an effort made to discover some method of treatment which will remove the defects. In searching for a corrective, the commercial aspect of the problem will be kept constantly in mind so that the method of correcting used for each sand will be practical and the most economical one available.

Methods of Tests for Voids, Weights, Density, Specific Gravity and Consistency.—In the standardization of certain of these tests the committee is coöperating with other committees of the society in order to arrive at specifications which will apply to all classes of work. The first series of tests laid out has been with reference to methods of determining weights and voids.

The variables to be standardized are (a) size of measure, (b) method of filling, (c) condition of sand.

Methods of Tests of Coarse Aggregates—The work of this subcommittee is the investigation of methods of tests to determine the suitability of coarse aggregates for concrete to be used under varying conditions.

Available Aggregates for Concrete.—The work of this subcommittee is the compilation of localities throughout the United States where concrete aggregates are available. The coöperation of geologists of the United States Government in the various states will be solicited and also the assistance of engineers. The efforts of the committee will first be devoted to states in which there are few deposits of available aggregates.

Tests of Building Brick

The Brick committee began a series of coöperative brick tests a year or two ago. More than a dozen university testing laboratories joined in the testing, and many brick manufacturers furnished brick for the tests. Compressive strength, modulus of rupture in bending test, and absorption, are determined. The bricks reported on up to the present range in compressive strength from 1564 to 14,982 lb. per sq.in., in modulus of rupture from 187 to 3354 lb. per sq.in., and in absorption from 0.57 per cent. to 27.50 per cent.

New Committees

Extension of the society's work continues steadily. Four new technical committees started work during the past year—on hollow building-tile, on gypsum and gypsum products, on textile materials, and on revision of pipe threads. Their formation was in each case the outcome of an active demand. The hollow tile and gypsum committees have a particularly strong representation of manufacturers.

Already the new committee on textile materials has done productive work. A specification for automobile tire fabrics which it prepared was accepted by the meeting. The gypsum committee has laid out for itself an ambitious program, five subcommittees being organized to deal respectively with gypsum, gypsum plaster, plaster board and block, testing methods, and nomenclature.

Co-operation of Engineers in Publicity Work

Plans for systematic work in educating the public to a better appreciation of engineering and the engineer were discussed at a conference held at Buffalo on June 23 which was attended by a dozen or more prominent engineers. In sending out invitations to the conference a number of matters were suggested on which the coöperation of engineers is desirable, such as a general employment bureau for engineers, passage of legislation in which engineers are specially interested, and coöperation between different societies of engineers. The conference, however, decided to lay principal emphasis on publicity work. The written opinions received from those unable to attend the conference as well as the opinions expressed by those present were generally in favor of this feature. It was felt to be unwise at this time to form an independent organization to carry on such work, and it was deemed best to work instead through existing engineering societies. It is probable that a committee of engineers prominent in different organizations will be organized to formulate definite plans for carrying forward the work. Dr. Frederick H. Newell, Professor of Civil Engineering in the University of Illinois, has been the leading spirit in the movement, in coöperation with C. E. Drayer, of Cleveland, Ohio, who has done such notable work in connection with the publicity committee of the Cleveland Engineering Society.

Flood Protection at Olean, N. Y.—The floods of March, 1913, which wrought so much damage in the Central States also exacted severe toll from Olean, N. Y. Following the disaster a flood-abatement committee was appointed by the Chamber of Commerce of Olean. Its first step was to apply to the Federal government for information regarding flood-protection work that had been done elsewhere in the United States. The committee report which followed was adopted by the mayor and common council, and a bill was introduced in the State legislature in January, 1914, asking for an appropriation of $150,000 on condition that the city bond itself for a like amount. The bill was vetoed by Governor Glynn; but was again passed by the legislature in 1915, and on May 24 was signed by Governor Whitman. The local bond issue was carried on June 18 by a vote of 6 to 1. The proposed flood-protection structures along the Allegheny River, Olean Creek, and their tributaries within the city limits will be erected under the direction of the superintendent of public works. The bill provides for a local commission of five men to look after the city's interests in this matter. The rights-of-way have been secured and the preliminary plans completed; the intention is to start construction without unnecessary delay.

News of the Engineering World

Report on Chicago Railway Terminal Improvements

The Chicago Railway Terminal Commission, organized in May, 1914, has issued its preliminary report, which was submitted to the City Council Committee on Railway Terminals in March. John F. Wallace is chairman of the commission. The general recommendations may be summarized as follows:

1. The railway terminals in the district bounded by Lake Michigan, Chicago Ave., Desplaines St. and 16th St. should be readjusted and simplified by combination and coöperation. Many railway officials favor this suggestion.

2. The through passenger service of all the railways now using terminals east of the south branch of the Chicago River should be combined in one (or two) union stations, with the exception of such roads as can be taken into the new union station on Canal St., west of the river.

3. The suburban service should be given the advantage of existing opportunities for through routing of traffic.

4. The river should be straightened between Polk and Dodge St., eliminating the present bend and enabling three streets to be extended as continuous north-and-south thoroughfares. This is provided for in some of the ordinances for terminal improvements and is approved by some of the other roads affected.

5. No carload freight should be handled within the congested district, except that intended for consumption and use within the district. It should be handled by cooperative methods and facilities outside of the district, as in the case of clearing yard of the Chicago & Western Indiana R.R. (ENGINEERING NEWS, June 17, 1915).

6. Outbound less-than-carload freight should not, as a general rule, be sorted or loaded to destination at the freight stations in the congested district, but should be loaded into trap cars and taken to outlying transfer stations or yards. Such yards should be operated jointly by the railways.

7. Union freight stations should be established within the congested district, taking the place of separate stations for individual roads. In this way freight for any or all roads may be delivered at one station or freight house and the necessary sorting and transfer made at outlying points.

Buffalo Meeting of the American Society of Mechanical Engineers

The summer meeting of this society was held at Buffalo June 22-25 with over 400 members and guests in attendance. The meeting was especially noteworthy for its excursions to points of interest in connection with manufacturing industries and the scenic wonders of Niagara Falls, the entire day Wednesday being spent there and a session being held in the auditorium of the Shredded Wheat Co.'s factory.

A notable feature of the meeting was a conference of the secretaries of the local sections of the society in different cities. The principal questions discussed were the amount of financial support the national society should extend to the local section, the relation between the local section and the local engineering society in the same city and the use or disposition to be made of papers read before the local section. After an extended discussion, there appeared to be general agreement that the amount of aid extended by the national society to local sections must vary with the circumstances of the different sections. It was further the opinion that the manner in which the money should be expended should be left to the discretion of the officers of the local section, but an accounting should be rendered to the parent society.

Regarding the relations between the local section and the local engineering society, the prevailing opinion was that the local section should if necessary merge itself in the local society, which should be open to engineers in all branches of the profession. A good example of this is the situation at Buffalo, where the strong and prosperous Buffalo Engineering Society has been developed out of what was originally started as a local section of the American Society of Mechanical Engineers.

The number and attractiveness of the excursions offered and the specialized character of most of the papers presented at the meeting combined to limit the amount of discussion. Among the papers of interest presented was one describing the use of heat treatment for improving the quality of the metal in an axle shaft for a motor truck. The shaft was a 2¼-in. diameter chrome-nickel-steel bar with an ultimate strength of 105,000 lb. per sq.in. and an elastic limit of 90,000 lb. per sq.in. Some improvements were made in its design to avoid concentration of stresses, and by subjecting the shaft to heat treatment the elastic limit of the material was raised to 175,000 lb. per sq.in. The cost of this heat treatment is between 2 and 2½c. per lb. and the strength of the material is nearly doubled.

The concluding paragraph of the paper was as follows:

> Alloy steels properly heat-treated are indispensable for motor-truck work, as their capacity to resist fatigue is very great. The writer looks forward to their extended use in other fields of mechanical engineering. As a permanent repair, the heat-treated piece of steel is in many cases worth its weight in gold.

A paper by F. W. Dean, of Boston, Mass., on the use of corrugated furnaces for vertical fire-tube boilers reported excellent results from the use of such furnaces. The elimination of stay-bolts is a very important advantage. In a paper on the influence of disk friction on turbine pump design, the author, F. zur Nedden, concludes that while smoothness of both disk and casing is necessary for high efficiency, the smoothness attained by ordinary machining is as good as high polish. The most important

consideration is to keep the surface of both disk and casing as small as possible. High pressures are more economically produced by high speeds or a larger number of stages than by increasing the diameter of the impellers.

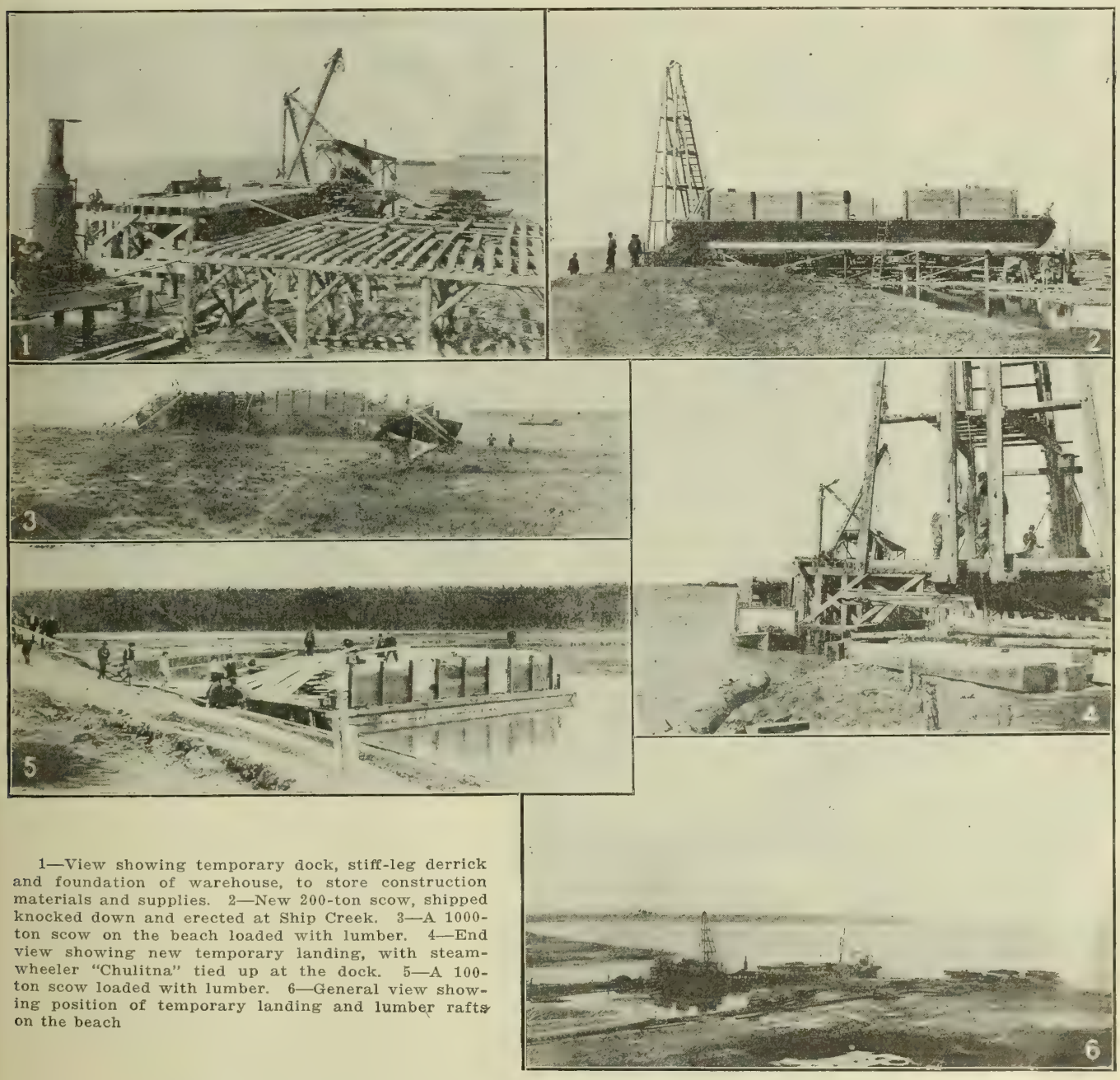
A general meeting of the society is to be held at San Francisco in September just preceding the National Engineering Congress.

Progress on the Alaskan Railways

Construction work on the government railways in Alaska began at Ship Creek, Cook's Inlet, on Apr. 26, when Lieut. Frederick Mears, member of the Alaskan Engineering Commission, and a number of engineers and laborers arrived. The illustrations and what follows are from Lieut. Mears' preliminary report to Secretary Lane of the Department of the Interior.

A complete piledriver outfit and an experienced crew began work as soon as the equipment could be landed and set in place. The dock completed on the right bank of Ship Creek, near the mouth, is equipped with a 15-ton stiff-leg derrick operated by a hoisting engine. This derrick takes the loads out of the scows in nets or large packages and places them on the dock or on a flat car. A gridiron with pile foundation was constructed to furnish level bases for the scows to rest upon when lying at the dock at low tide, and this enables lighters to be unloaded at all stages of the tide. Demurrage charges would amount to $150 to $200 a day. A 1000-ton barge has also been purchased for use as a floating dock.

Contracts had been made with about 400 stationmen, and about 100 men were employed on force account by June 1. No difficulty has been experienced in securing all the stationmen required. A force of between 1500 and 2000 men will soon be at work. By using water transportation it will be possible to start work at several points.



1—View showing temporary dock, stiff-leg derrick and foundation of warehouse, to store construction materials and supplies. 2—New 200-ton scow, shipped knocked down and erected at Ship Creek. 3—A 1000-ton scow on the beach loaded with lumber. 4—End view showing new temporary landing, with steam-wheeler "Chulitna" tied up at the dock. 5—A 100-ton scow loaded with lumber. 6—General view showing position of temporary landing and lumber rafts on the beach

PROGRESS ON THE GOVERNMENT RAILWAYS IN ALASKA; SHIP CREEK TERMINAL

Construction camps have already been established at Eagle River and Peters Creek, 10 and 22 miles respectively from the terminus.

Engineering Conventions Scheduled for San Francisco

Engineers who intend visiting the Panama-Pacific International Exposition in September will be interested in the following list of engineering-society meetings to be held in San Francisco. From Aug. 19 to Oct. 20, two hundred fifty-seven congresses, conferences and conventions are scheduled. From these we have selected a list of 29 meetings which are of the most direct interest and importance to engineers.

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. 19-21. Secy., E. H. Harman, Room 101, Union Station, St. Louis, Mo.

INSTITUTE OF RADIO ENGINEERS.
Sept. 13-18. Secy., David Sarnoff, 71 Broadway, New York.

PAN-AMERICAN ROAD CONGRESS.
Sept. 13-18. Secy., E. L. Powers, Road Builders Association, 150 Nassau St., New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 16-18. Secy., Charles Warren Hunt, 220 West 57th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Sept. 16-18. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 16-18. Secy., Bradley Stoughton, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 16-18. Secy., F. L. Hutchinson, 29 West 39th St., New York City.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Sept. 16-18. Secy., J. J. Blackmore, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Sept. 16-18. Secy., J. W. Richards, Lehigh University, South Bethlehem, Penn.

INTERNATIONAL IRRIGATION CONGRESS.
Sept. 20. Secy., Arthur Hooker, Sacramento, Calif.; until Aug. 1, New Stockton, Calif.

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Sept. 20. Secy., F. F. Sharpless, 52 Broadway, New York City.

PACIFIC COAST ASSOCIATION OF PORT AUTHORITIES.
Sept. 20 and 21. Secy., Leo V. Merle, Ferry Bldg., San Francisco, Calif.

AMERICAN MINING CONGRESS.
Sept. 20-22. Secy., J. F. Callbreath, Washington, D. C.

INTERNATIONAL ENGINEERING CONGRESS.
Sept. 20-25. W. A. Cattell, Secy., Comm. of Management, Foxcroft Bldg., San Francisco.

INTERNATIONAL ASSOCIATION OF BRIDGE AND STRUCTURAL IRON WORKERS.
Sept. 20-30. Secy., Harry Jones, American Central Life Bldg., Indianapolis, Ind.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Sept. 21 and 22. Secy., F. M. White, Madison, Wis.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Sept. 23 and 24. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 23 and 24. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN ASSOCIATION OF REFRIGERATION.
Sept. 23 and 24. Secy., J. F. Nickerson, 431 South Dearborn St., Chicago, Ill.

ILLINOIS GAS ASSOCIATION.
Sept. 27. Adjourned meeting. Secy., H. H. Clark, 72 West Adams St., Chicago, Ill.

SAFETY CONFERENCE.
Sept. 27 to 30.

INTERNATIONAL GAS CONGRESS.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

NATIONAL DRAINAGE CONGRESS.
September, 1915.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

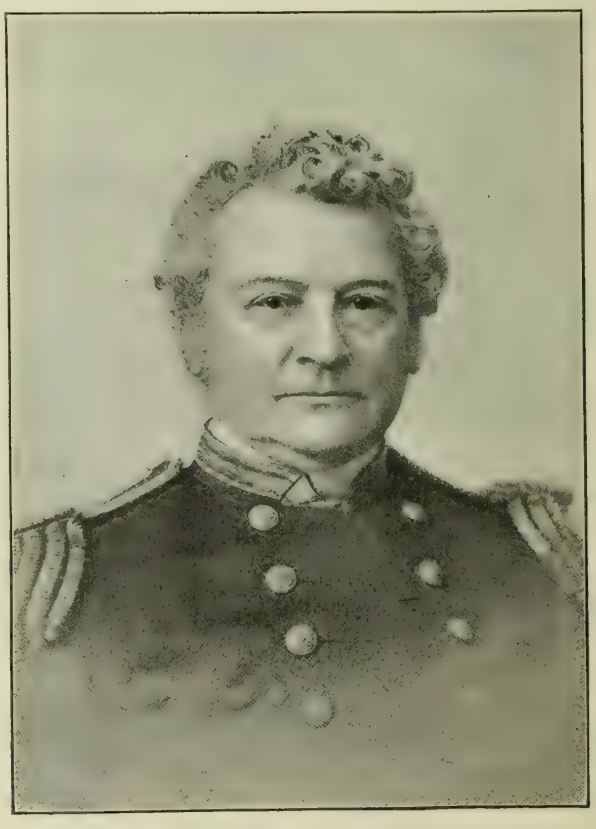
NATIONAL ASSOCIATION OF RAILWAY COMMISSIONERS.
Oct. 12-16. Secy., William H. Connolly, care Interstate Commerce Commission, Washington, D. C.

AMERICAN FORESTRY ASSOCIATION.
Oct. 20. Secy., P. S. Risdale, 1410 H St., N. W., Washington, D. C.

Benjamin F. Isherwood

At his home in New York City, on June 19, at the age of 93 years, occurred the death of Benjamin Franklin Isherwood, one of the most distinguished members of the engineering profession in a generation long since passed into history. He was a man whose actual experience dated so far back in engineering annals that it seems incredible so many and so great changes could have occurred within the span of one man's life. He was Engineer-in-Chief of the United States Navy during the whole of the Civil War.

Benjamin F. Isherwood was born in New York City, Oct. 6, 1822. His father was a physician, and his great-grandfather, Captain Du Clos, was a distinguished French engineer and a member of Lafayette's staff during the



Benjamin F. Isherwood

American Revolution who had settled in this country following the war and married into the famous Stevens family of New Jersey. Isherwood was educated at Albany Academy and then entered railway work as an assistant to William C. Young, Civil Engineer of the Utica & Schenectady R.R. (now part of the New York Central Lines). William Lake, afterward a distinguished British engineer, was then Resident Engineer and Isherwood's immediate superior and instructor.

From railway work he went to New York City, where he was employed on the staff of John B. Jervis, Chief Engineer of the Croton Aqueduct, then under construction, and later to the engineering department of the Erie R.R. under Charles B. Stuart, Division Engineer of the rail-

way and subsequently Engineer-in-Chief of the U. S. Navy. After this railway experience Isherwood was employed by the U. S. Treasury Department on lighthouse construction. In this connection he was sent to France to superintend the making of lighthouse lenses after his own designs.

Upon the organization of the Engineer Corps of the United States Navy, Isherwood was among the first to be appointed a member, and at the outbreak of the Mexican War (1846) he began his sea service on the "Princeton," the first screw steam vessel of the navy, built by Ericsson as an experiment. His steam engineering studies therefore began with the navy's earliest experience with steam as a motive power. As Chief Engineer of the "Spitfire" he subsequently took part in every naval action of the war.

From this time began his systematic study and solution of an infinite number of problems then facing the steam engineer and naval architect. He inaugurated a system of experiments, planned researches and conducted investigations in many fields. In 1859 were published the results of some of his work in two volumes of "Engineering Precedents," which was the first attempt of any importance to study the duty of steam engines in connection with their indicated horsepower, their losses by friction, the losses in transmission and the net energy expended in propulsion of the ship. About the same time he wrote the chapter on American railroad bridges for Weale's monumental British work on bridge engineering.

Isherwood's fame as a steam engineer was greatly increased by his experiments on the "U. S. S. Michigan," which were published in two volumes, one in 1863 and the other in 1865. This work was undertaken by the direction of the Navy Department in 1860, and its results created a tremendous impression among engineers the world over, for some of his conclusions were revolutionary in respect to principles which until that time had been firmly held to. Here was first pointed out the practical limit to the use of expansion in a single engine cylinder, beyond which further expansion of the working charge produces a net loss rather than a gain. His deductions were eventually admitted to be unquestionable, and Isherwood attained a very high rank among engineers throughout the world. His work made possible the development of the multiple-expansion engine.*

In spite of his arduous duties in building up a navy of 600 vessels during the Civil War, he continued his scientific and engineering researches, and his eight-year term as Engineer-in-Chief (1861-1869) closed with a most extraordinary record of accomplishments, both for the United States Navy and the engineering profession.

For many years afterward he lived in retirement in New York; but his habits of mind and his inclinations led him to continue his studies and investigations and to make some valuable translations from French engineering literature. In 1894 he was elected an honorary member of the American Society of Mechanical Engineers.

Little Damage by Kansas Floods

During the recent floods (ENGINEERING NEWS, June 24, p. 1243) the Missouri and Kansas Rivers reached higher stages than in the destructive floods of 1904 and 1909, but the damage done was practically nominal. The protection of the levees and revetment of the two rivers has proved effective, the streams flowing under control between the new and prescribed banks.

The levees of the Kaw at and above Kansas City were erected under the direction of the Kaw Valley Drainage Board, by means of assessments over the district, at a cost of $2,000,000. In most cases the railroads have raised their bridges to conform with the elevation of the tops of the levees, which were designed to hold a flood almost equal to that of 1903. The few railroads that had not raised their tracks and had cut approaches to bridges through the levees, were compelled to fill the cuts with sandbags as the waters rose this year, and the flood was kept out of the lowlands.

During the spring there was a contest between the Drainage Board and the Kansas City Southern R.R. on the rebuilding of the latter's bridge over the Kaw River at Kansas City. The present structure is of three spans, and the west abutment is about 40 ft. from the levee, the track between being carried on piling. The flood of this year indicated danger from the piling and the low level of the structure, and when the high rise of the middle of June approached, the Drainage Board received instructions and authority from Governor Capper of Kansas to blow up the approaches if necessary to prevent the bridge from damming waters and causing an overflow. Three railroads



BRIDGE OF THE KANSAS CITY SOUTHERN R.R. OVER THE KAW RIVER

using the Chicago-Great Western R.R. bridge near the mouth of the Kaw were ordered by the Drainage Board to remove sandbags and rock placed against the pile approaches to hold them firm against rising water, but the railways secured an injunction restraining the Board from tearing out the approaches or damaging the bridge.

On June 19, when it seemed certain that the Kaw would rise to a dangerous height, officials of the Kansas City Southern R.R. ordered the piling approaches removed from the west end of the bridge. The water rose until it lapped the girders, as shown in the illustration, even with the current flowing through the channel left where the piling was removed.

The Worst Railway Accident on Record

The collision which occurred on the Caledonian Ry. at Gretna, England, on May 22 was the most serious railway disaster that has ever happened in Great Britain or,

*For interesting account of some of the experiments on the "Michigan," see "Engineering News," Dec. 27, 1906, p. 682.

as far as we recall, in any other country since the railway era began. The total number killed was about 162, with 200 injured. Only two railway accidents have ever occurred in the British Isles which at all compare with this in the number of lives lost. One of these was the famous Tay bridge disaster in 1879, when a bridge across the Firth of Tay, near Dundee, Scotland, was blown down in a terrible storm while a train was crossing and every one of the 60 persons on board perished. Ten years later at Armagh, Ireland, a long excursion train had to be split in two in order to ascend a steep grade. The first half of the train was left at the top, while the locomotive went back for the rest of the train. To keep the cars on top of the grade from running back down the hill the wheels were spragged with wooden blocks (for at that day railway cars on remote lines in the British Isle, were not always provided with brake gears). By some means these blocks became displaced and the cars ran back down the grade, colliding with the ascending portion of the train and killing 80 persons.

The Gretna disaster, therefore, caused more than double the loss of life of the worst previous railway disaster in British railway history. The principal facts concerning the Grertna collision, as now reported in London *Engineering* and *The Engineer,* are as follows: The accident occurred at a block signal station known as Quintin's Hill, where there are two sidings (which at the time of the accident were filled with freight trains) and two main tracks for north- and south-bound trains. A northbound local train arrived at 6:30 a.m., and the signalman on duty, in order to clear the main track for a northbound express, switched the local train onto the southbound main track to wait until the northbound express had passed. Two minutes later the day signalman arrived, and, forgetting that the local train was standing on the southbound track, he gave a "line-clear" signal to the next signal box, allowing a southbound troop train to come into the block. A curve prevented the engineer of the troop train from seeing the standing local train until he was close upon it. The collision blocked both tracks, and very shortly afterward the northbound express ran into the wreck at high speed. Fire followed the collision and nearly a score of cars were burned. From the account of the collision there was apparently no track circuit control of the block instruments, so that the sole reliance for safety was on the signalman's records and accuracy.

Investigation showed that while the day signalman should have relieved the night man at 6 a.m., they actually made the change at 6:30. In order to prevent this irregularity from being discovered by the inspectors, records of trains after 6 a.m. were made on a piece of paper and not on the train register and were copied in the train register by the man who later came on duty.

A Broken Dike at Fairfield, Neb., caused by a flood in the Little Blue River on June 18, resulted in the washing away and damaging of a number of summer cottages.

A 36-in. Sewer Settled for 75 ft. of its length and broke, in Council Bluffs, Ia., recently. The ground in the vicinity is cracked and caved to a width of 20 ft. The accident was caused by heavy rains loosening the sand on which the pipe lay. Press dispatches state that the settlement began two weeks previous to the break. To repair this sewer sheet-piling was driven all around the break, and the earth surrounding the pipe was excavated to a width of 6 ft. The sewer is 14 ft. below the street surface and lies in 2 ft. of quicksand. Two lengths of pipe were laid in 1½ days. About 25 lengths were required to make the repair.

A Severe Earthquake shook the Imperial Valley in California on the night of June 22. Nine lives were lost, eight of them in the town of Mexicali across the border in Mexico. Damage estimated at half a million dollars was done to buildings in various towns. The irrigation system from the Colorado River, on which the Imperial Valley is entirely dependent for its water-supply, was not injured by the earthquake. A telegram from C. R. Rockwood, engineer of the Imperial Irrigation District, to "Engineering News" states that there was no interruption of water service anywhere on the canal system. One wooden structure was damaged by a landslide, but can be repaired at a cost of $1000. The protection levees along the Colorado which guard the Imperial Valley from overflow were uninjured.

A Railway Passenger Station in Oakland, Calif., to cost $1,000,000, is to be built by the Southern Pacific Co. The Oakland City Council has passed an ordinance authorizing the proposed construction and requiring work to begin within six months. A 12-story office building will be erected in connection with the station.

A Change in the Tread Contour of Car Wheels has been proposed, reducing the taper of the tread from the present standard of 1 in 20 to 1 in 38. It is claimed that the present standard taper is responsible for increased rail renewals and is severe upon the wheel. This proposition was noted in the report of the Committee on Car Wheels presented at the recent annual convention of the Master Car Builders' Association. It is the opinion of the committee that such a change will be detrimental to the wheel, but the committee will give it consideration if it can be shown that it will be of such benefit to the rail as to offset any bad effect upon the wheel. The matter is to be investigated jointly by this Association and the American Railway Engineering Association.

Fair Treatment of Subcontractors by general contractors was discussed editorially in our issue of May 27 (p. 1041), in connection with the action taken by the Master Builders' Association of Boston. Action has just been taken by the Bridge Builders & Structural Society of New York in opposition to general contractors who, after using a bid which they have received on steel fabrication in their own bid for an entire work and receiving the award of the contract, seek to obtain still lower prices from competing concerns. To meet this condition the Bridge Builders & Structural Society will seek to have engineers and architects receive separate bids for steelwork, apart from the general contract, wherever the amount involved is 250 tons or more.

The Bill for Licensing Structural Engineers in Illinois, backed by the Western Society of Engineers, has made two definite steps, having been amended to meet some objections of the architects and having been passed (as amended) by the House of Representatives. The amendments were made under an agreement between the engineers and the architects, and their effect is to limit the work of engineers to buildings which are commonly recognized as engineering structures, such as manufacturing plants, power houses, etc. In consequence, the Illinois Society of Architects and the Illinois Chapter of the American Institute of Architects have withdrawn their opposition, although it is understood that the State Board of Examiners of Architects continues its opposition. The bill is now in the Senate, where some minor amendments (agreed to by the architects) will be offered.

Two Passenger Trains on the Western Maryland Ry. came together in a head collision on High Bridge, a mile and a half west of Thurmont, Md., at 5:45 p.m., June 24. Six persons were killed and many others injured. An investigation to fix responsibility was begun on June 25 by the Interstate Commerce Commission. The direct cause of the collision, which was between the accommodation train bound from Hagerstown to Baltimore and the Blue Mountain express from Baltimore to Hagerstown, seems to have been an error committed by the Hagerstown dispatcher. High Bridge is about 35 mi. from Hagerstown, and is about 90 ft. above a road at the bottom of a ravine on the eastern slope of the Blue Ridge Mountains. The wreckage on the bridge was cleared away before 7 p.m., June 25. One of the cars hung over the edge of the bridge. To recover this car a temporary trestle was built from the bridge under the car so that the falsework supported the load until locomotive cranes lifted the car back to the track. The bridge was not badly damaged. Owing to a sharp curve just at the bridge the enginemen of the two locomotives were unable to see each other until they were both on the bridge. The brakes were applied, but with little result, as the trains were too close to each other. In addition to the investigation made by the Interstate Commerce Commission inspectors, the railway began an investigation on the morning of June 28.

A Department of Engineering and Public Works for New York State was discussed on June 25 before a joint committee of the Constitutional Convention. Representatives were present from the Committee of Engineers representing national and local engineering societies which favor the control of the proposed department by a commission appointed by the Governor, with terms of office such that a new member of the commission might be appointed by each successive governor. Arguments in favor of this system were presented editorially in "Engineering News" of June 17, p. 1186. Arguments before the committee were made by Messrs. Nelson P. Lewis and Ernest P. Goodrich. Prof. Olin R. Landreth, of Schenectady, a member of the Constitutional Convention, has introduced a bill by which the proposed department would be under control of the state engineer, with certain matters of general policy determined by the Canal Board, which is made up of various state officers ex officio. This plan of organization was advocated by Robert E. Horton, of Albany. Professor Landreth's bill has been indorsed in its essential details by the Albany Society of Civil Engineers and by the Society of Engineers of Eastern New York. Mr. Horton said that the existing system of a state engineer who is a constitutional officer backed by a deliberative body such as the Canal Board has much good in it and should not be discarded unless the system to be adopted in its place can be proved to be better. Other speakers were Albert E. Cluett, of Troy, former State Engineer H. A. Van Alstyne, Edwin A. Fisher and George A. Ricker, late Deputy Highway Commissioner. All the speakers favored consolidation of the engineering work of the state into one department and only disagreed as to whether that department should be under one man or controlled by a commission.

PERSONALS

Mr. S. Ennes, General Superintendent of the Western Maryland Ry., has been appointed General Manager of the road, his old position being abolished. His headquarters will be at Hagerstown, Md.

Mr. E. I. Cantine, M. Am. Soc. C. E., Chief Deputy to State Engineer John H. Lewis, Assoc. M. Am. Soc. C. E., has been placed in charge of all highway work in the State of Oregon initiated since May. 22

Mr. F. M. Fuller, Jun. Am. Soc. M. E., Consulting Engineer, Duluth, Minn., has been appointed General Manager of the Park Point Traction Co., of that city, to succeed J. B. Crane, M. Am. Soc. M. E., removed to New York.

Mr. T. J. Cosgrove, formerly of Cosgrove Bros., Stone Contractors, and recently a member of the New York City Building Code Revision Commission, has resumed business as a cut stone contractor after several years rest owing to ill health.

Mr. John H. Boschen, President of the Commonwealth Savings Bank, has been appointed Assistant Commissioner of Public Works of Manhattan, to fill the vacancy caused by the appointment of Mr. Ralph Folks as Commissioner of Public Works. Mr. Boschen will receive a salary of $6000 a year.

Mr. E. A. Kingsley, Assoc. M. Am. Soc. C. E., of Temple, Tex., has been selected as Paving Engineer of San Antonio, Tex., under the commission form of government. For the past year Mr. Kingsley has been Supervising Engineer in charge of the roads being constructed in the Temple good roads district of Bell County.

Mr. M. P. Paret, M. Am. Soc. C. E., formerly Assistant District Engineer of the Pacific District of the Interstate Commerce Commission, has been appointed District Engineer. Mr. Charles H. Byers has been appointed Assistant District Engineer. The district headquarters are in the Wells Fargo Building, San Francisco, Calif.

Mr. C. W. Reinhardt, technical illustrator, 120 Liberty St., New York City, formerly chief draftsman of "Engineering News," has joined the firm of Winters & Cahill, technical illustrators, Times Building, New York City. Hereafter the firm will be known as Reinhardt, Winters & Cahill, Inc., with offices at the latter address.

Mr. B. G. Slining, formerly Vice-President of the Southwestern Engineering Co., of San Antonio, Tex., has severed his connections with that firm. Mr. Slining expects to spend several months in Chicago, returning in the late summer to San Antonio, where he will take up the investigation of several hydraulic developments.

Mr. E. B. De Vilbiss, Assoc. Am. Inst. E. E., Electrical Engineer, at Fort Wayne, Ind., of the Pennsylvania Lines West, has been appointed Assistant Engineer of Motive Power, with headquarters at Toledo, Ohio. Mr. W. A. Stockbridge, Assoc. Am. Inst. E. E., Inspector of Motive Power, at Fort Wayne, will succeed Mr. De Vilbiss as Electrical Engineer.

Messrs. F. F. Prentiss, Vice-President of the Cleveland Twist Drill Co.; William G. Mather, President of the Cleveland-Cliffs Iron Co.; Morris A. Black, President of the H. Black Co.; O. P. Van Sweringen, Agent for the Shaker Heights Land Co. and Director of the Cleveland & Youngstown R.R. Co., and H. M. Farnsworth, President of the County Park Board, have been appointed members of the newly organized City Plan Commission of Cleveland, Ohio.

Messrs. C. Rupert and J. H. Callahan, Brick Contractors, have gone into partnership under the firm name of Rupert & Callahan, with offices at 1306 South 2nd St., St. Joseph, Mo. Mr. Callahan was previously connected with the St. Joseph Construction Co., of St. Joseph and Hutchinson, Kan., and also with the Stamey-Callahan Construction Co., of Hutchinson.

Maj. Wildurr Willing, Corps of Engineers, U. S. A., has been detailed, in addition to his other duties, as inspector and for consultation or to superintend the construction or repair of any aid to navigation authorized by Congress in the Fifteenth Lighthouse District. Maj. Willing will relieve Col. Curtis McD. Townsend, Corps of Engineers, M. Am. Soc. C. E.

The Pennsylvania Co. announces the following changes and appointments: Mr. E. T. Whiter, General Superintendent of the Northwest System, has been promoted to the newly created position of Assistant General Manager of the entire system. Mr. W. C. Downing, Superintendent of the Central System, at Toledo, has been appointed General Superintendent of the Northwest System. Mr. Isaac W. Geer, Superintendent of the Cleveland & Pittsburgh Division, at Cleveland, has been promoted to General Superintendent of the Central System, with offices at Toledo, Ohio.

OBITUARY

Richard Gilpin, Consulting Engineer, Philadelphia, Penn., died, June 21, at Cape May, N. J., where he was spending the summer with his mother. Death was due to pneumonia, aggravated by an attack of heart disease. He was a member of the Engineers' Club of Philadelphia.

Loomis Eaton Chapin, M. Am. Soc. C. E., Consulting Hydraulic and Sanitary Engineer of Pittsburgh and of Canton, Ohio, died recently, at 57 years of age, at his home in Canton, where he had lived for 20 years, serving until 12 years ago as City Engineer. He was a graduate of the University of Michigan. His widow and a son and two daughters survive him.

William MacKenzie Hughes, M. Am. Soc. C. E., Consulting Bridge Engineer, died June 25, at his home in Chicago. He was born at Utica, N. Y., in 1848, and started his business life as a machinist's apprentice. Beginning in 1870, he took a special course at Cornell University, graduating in 1874. He made a specialty of steel bridge and structural work, and was City Bridge Engineer of Cincinnati from 1874 to 1881, of Cleveland from 1883 to 1888, and of Chicago about 1894. After leaving Cincinnati he was in charge of bridge work on the New York, Chicago & St. Louis Ry. During 1889 and 1890 he was Engineer and Assistant General Manager of the Keystone Bridge Co., and from 1891 to 1893 was Engineer of Construction for the Columbian Exhibition at Chicago and of the Metropolitan Elevated Ry. at Chicago. In 1895 he took up private practice, and was engineer for the design and construction of numerous works, including drawbridges over the Chicago River and the Chicago Drainage Canal, part of the Chicago South Side Elevated Ry. extensions, etc. His widow and a daughter survive him.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
Aug. 16-18 and 25-28. Annual meeting in Los Angeles, Calif., Aug. 16-18; in San Francisco, Aug. 25-28. Secy., J. C. Olsen, Cooper Union, New York City.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Aug. 24-27. Annual convention in Cincinnati. Secy., Clarence R. George, Houston, Tex.

Colorado Electric Light, Power and Railway Association—The 13th annual convention will be held this year in Glen-

wood Springs, Colo., Sept. 23-25. Thomas F. Kennedy, 900 Fifteenth St., Denver, is secretary.

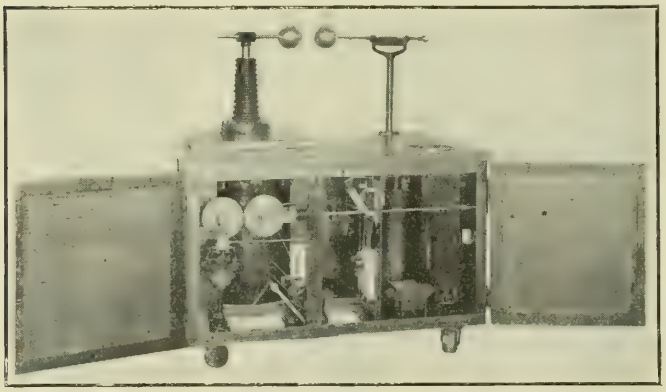
Engineers Club of Baltimore—At the annual meeting held June 3 the following officers were elected: President, Oscar F. Lackey; vice-president, W. Watters Pagon; chairman of house committee, John N. Mackall; members of the board of directors, William Walter Crosby, R. Keith Compton and Ezra B. Whitman. The secretary continues to be William D. Janney. The opening meeting of the club for the ensuing season will be held on the first Thursday in September. The secretary's address is 4 West Eager St., Baltimore, Md.

Appliances and Materials

High-Voltage Insulation Tester

The commercial form of high-voltage, high-frequency oscillator, shown in the accompanying view, has been developed by the General Electric Co., Schenectady, N. Y., to furnish current for testing porcelain insulators and bushings. The outfit requires from about 1.5 kv.-a. at 25 cycles to 2.5 kv.-a. at 60 cycles, and may be used on 110 or 220 volts. It will deliver current up to 165,000 volts and 30,000 cycles. Other sets for 100,000, 250,000 and 500,000 volts are being designed.

The essential elements of the high-frequency oscillator are (1) a step-up transformer (from 110 or 220 to 13,000 volts); (2) a condenser placed across the high-voltage terminals of this transformer, (3) an adjustable control gap, (4) an oscillation transformer with non-ferrous core and consisting of a few turns on the primary and many turns on the secondary, (5) a properly proportioned sphere gap, and (6) a suitable reactance to protect the step-up transformer against short circuit during sparking at the control gap.



HIGH-TENSION TESTING OSCILLATOR

The voltage is controlled by gradually opening the control gap, one electrode being grounded and connected to a rod extending through the side of the case, which permits manipulation while the spark is playing. The high potential of discharge across the sphere gap is read directly in volts from a graduated scale. The fuses and disconnecting switches are mounted inside the frame, the main switch being connected by a rod to a handle just above the control-gap handle.

When a spark passes across the control gap the condenser is short-circuitel and a damped oscillating current surges back and forth through the low-tension winding of the oscillation transformer. Forced oscillations are set up in the high-tension circuit for application to the insulators under test.

The high-frequency oscillator test of insulators is intended to approximate more nearly the conditions under which insulators fail in service. Experience has shown that the high-frequency, high-potential test is not harmful to good porcelain, provided the insulators are properly proportioned and constructed and the electric strain is not carried unreasonably close to maximum limits. Insulators that fail under proper tests would fail under similar stresses in service. In the laboratory good insulators have withstood high-frequency tests by the hour, while imperfect ones have been quickly picked out.

* * *

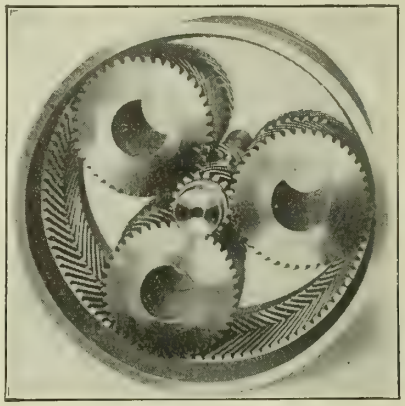
Locomotive Pyrometer

A pyrometer for superheater locomotives is being introduced by the Locomotive Superheater Co., New York. Its purpose is to indicate to the engineman the temperature of the superheated steam. The instrument is of the electrical type, consisting of thermo-couples, having the cold end located in the saturated steam in the steam space of the boiler and the hot end located in the steam chest, directly in the flow of the superheated steam. The former is subject only to slight variations in temperature, owing to variation of pressure, while the latter is subject to a range from that of saturated steam to about 650°. The instrument has a range of 250° to 750°. The difference in electromotive force generated by the two ends is read in degrees of temperature on the dial in the cab. When running, with throttle open, the indicator should register 600° to 650°; if this is not attained it is evidence either that the engine is not being properly handled or that it has not been put in running condition by the roundhouse force.

* * *

Speed-Reducing Gear

A novel mechanical gear for reducing steam-turbine or electric-motor speeds has been devised by the Turbo-Gear Co., Industrial Bldg., Baltimore, Md. It is also used for stepping up speeds where this is desired. The scheme is shown by the accompanying view of the nested gears.



SPEED-REDUCTION GEARS

There is a large internal double helical gear, of openhearth steel, fixed to the casing. Concentric with this is a double helical pinion, of chrome-vanadium steel, on the high-speed shaft. Three parallel intermediate gears of manganese-bronze are on hardened forged-steel shafts carried by the slow-speed shaft which extends out from the casing opposite to the high-speed shaft and concentric with it. The housing is a gray-iron casting, split horizontally and ribbed to give rigidity. An eccentric on the slow-speed shaft drives an oil pump which supplies the high-speed bearings, the discharge flow passing over the gears, which do not run in an oil bath. A ball bearing on each end plate supports the slow-speed member; the high-speed shaft is carried by a babbited bearing on one plate and a bronze socket bushing in the slow-speed gear frame. Only one type is now furnished. This is 30 in. high and occupies an overall space 38x28 in.; speed ratios of from 8.5 : 1 to 16 : 1 are secured for high-speed shaft speeds of 500 to 6000 r.p.m. The weight is 1200 lb. An efficiency of 95 per cent. is guaranteed, but 98 and 99 per cent. are reported to have been reached on test.

* * *

Traveling Cranes with Platform Hoists

The novel design of the traveling crane shown in the accompanying view has been developed by the Cleveland Crane & Engineering Co., Wickliffe, Ohio, for the assembling shops of the Ford Motor Co. at Cleveland, Cincinnati, Pittsburgh, Atlanta and Long Island City. They will be used in unloading freight received in bulk on the ground level and



CRANE FOR FORD SHOPS

conveying it to staggered platforms projecting from the floors above into the crane runway. The main hoists have a capacity of 50 tons; four ropes wind up on drums 8 ft. apart, the maximum lift being about 86 ft. The main hoist is driven by a 40-hp. induction motor (a new design just brought out by the Westinghouse Electric & Manufacturing Co.). The bridge and trolley motors are of 11 and 5 hp. respectively.

Engineering News

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Electric Hoist of the Hamilton Inclined Railway*

New hoist equipment, with a variety of novel features, has been installed by the Hamilton Mountain Park Co., Ltd., at Hamilton, Ont., making the Hamilton Inclined Railway probably the "largest passenger incline in the world." The difference in elevation between the general level of the city and the plateau back of the bluffs is 325 ft. As the roads leading up the bluffs are necessarily steep, the inclined railway handles a very large and miscellaneous traffic—transporting passengers, freight, automobiles, trolley cars, teams etc. The railway was formerly operated by a steam hoist, but this became inadequate to the requirements of increased speed and safety.

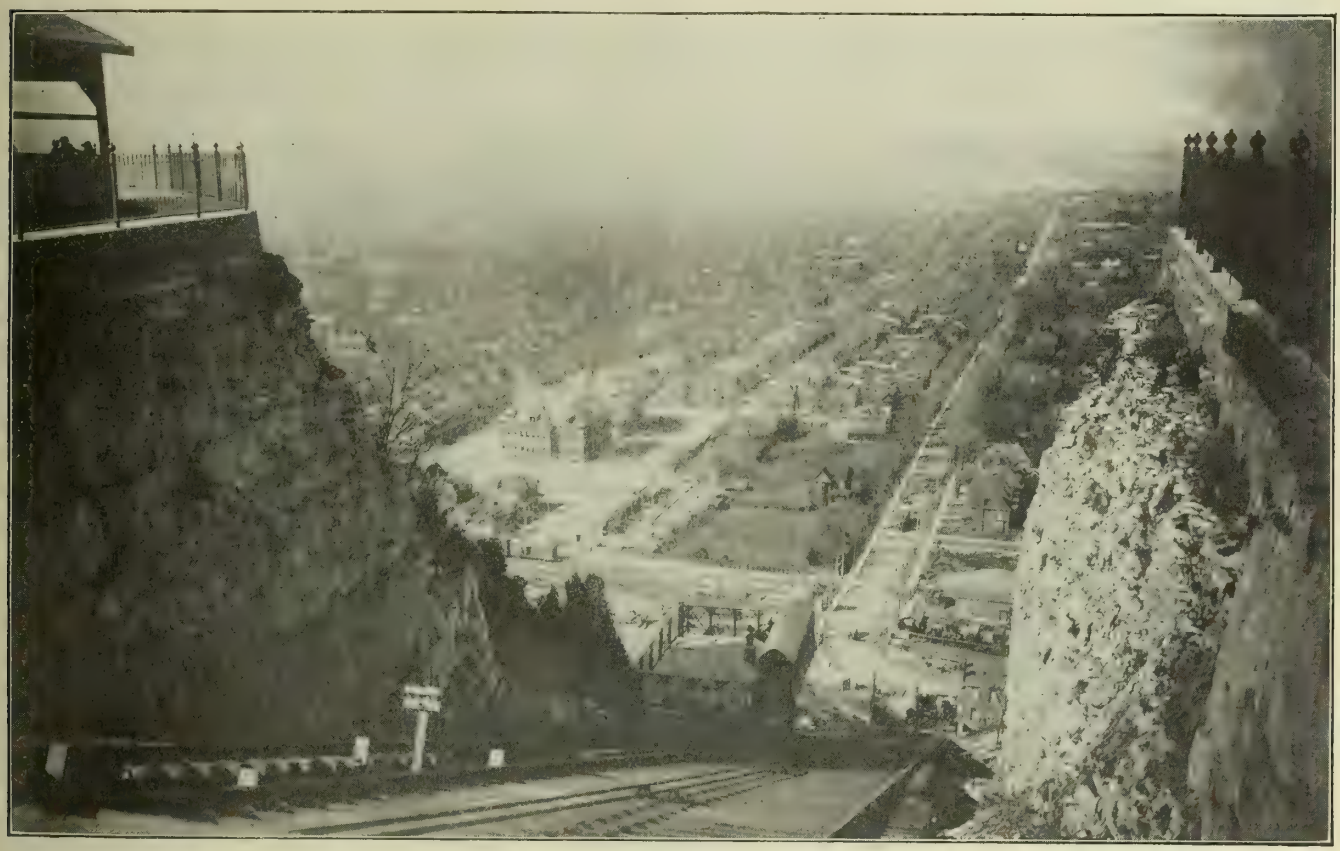


FIG. 1. HAMILTON MOUNTAIN PARK INCLINED RAILWAY AT HAMILTON, ONTARIO

THE INCLINED RAILWAY

Two large platform cars are carried in balance on an inclined double track 800 ft. long, having a grade of 40.3 per cent. The track gage is 12 ft. 1½ in.; each car weighs 30,000 lb.; the average car load is 20,000 lb., the maximum being 30,000 lb.

Two 1⅝-in. ropes, weighing 4.15 lb. per ft., run from each car to a special double fixed-drum double-geared electric incline hoist. One rope is for haulage; the other is a safety cable. The average rope speed during a run is 585 ft. per min. The time of a single trip is 1½ min., and there is a 3-min. rest period between trips.

NEW HOIST

The hoist is located in a house 106 ft. from the knuckle between the incline and the level of the summit. The main rope from the right-hand car is wound over the top of the right-hand hoist drum. The main rope from the left-hand car is wound underneath the left-hand hoist drum. The safety rope from the right-hand car is led over 7-ft. deflecting sheaves to the top of the left-hand drum, while that from the left-hand car is similarly led to the bottom of the right-hand drum.

There are four head sheaves and four deflecting sheaves. The former are arranged vertically so as to carry the

*From information furnished by the Lidgerwood Manufacturing Co., New York City, and the General Electric Co., Schenectady, N. Y.

hoist and safety ropes in a direct line from the cars; the deflecting sheaves are placed horizontally at such an angle that the rope will be led in a direct line either to the top or bottom of the hoist drums, as the case may be. Floating guide sheaves are placed in the rope tunnels between the head sheaves and the hoist drums.

The 12-in. drum shaft is a two-piece steel forging, 52 ft. long and weighing 13,300 lb. The 7-in. intermediate shaft is a single forging 20 ft. long. Two two-section cast-iron barrel drums, 96 in. in diameter and 70 in. on the face, coil 800 ft. of rope. Each drum barrel weighs 16,700 lb. The drums are bolted at one end to a post-brake ring and at the other to a gear.

The cast-steel drum gears are double eight-arm wheels with 122 involute teeth of 12-in. face and 122-in. pitch diameter. The intermediate cast-steel gears have 113 herringbone teeth of 8-in. face and 56½-in. pitch diameter; the intermediate forged pinions have 22 herringbone teeth of 8-in. face and 11-in. pitch diameter.

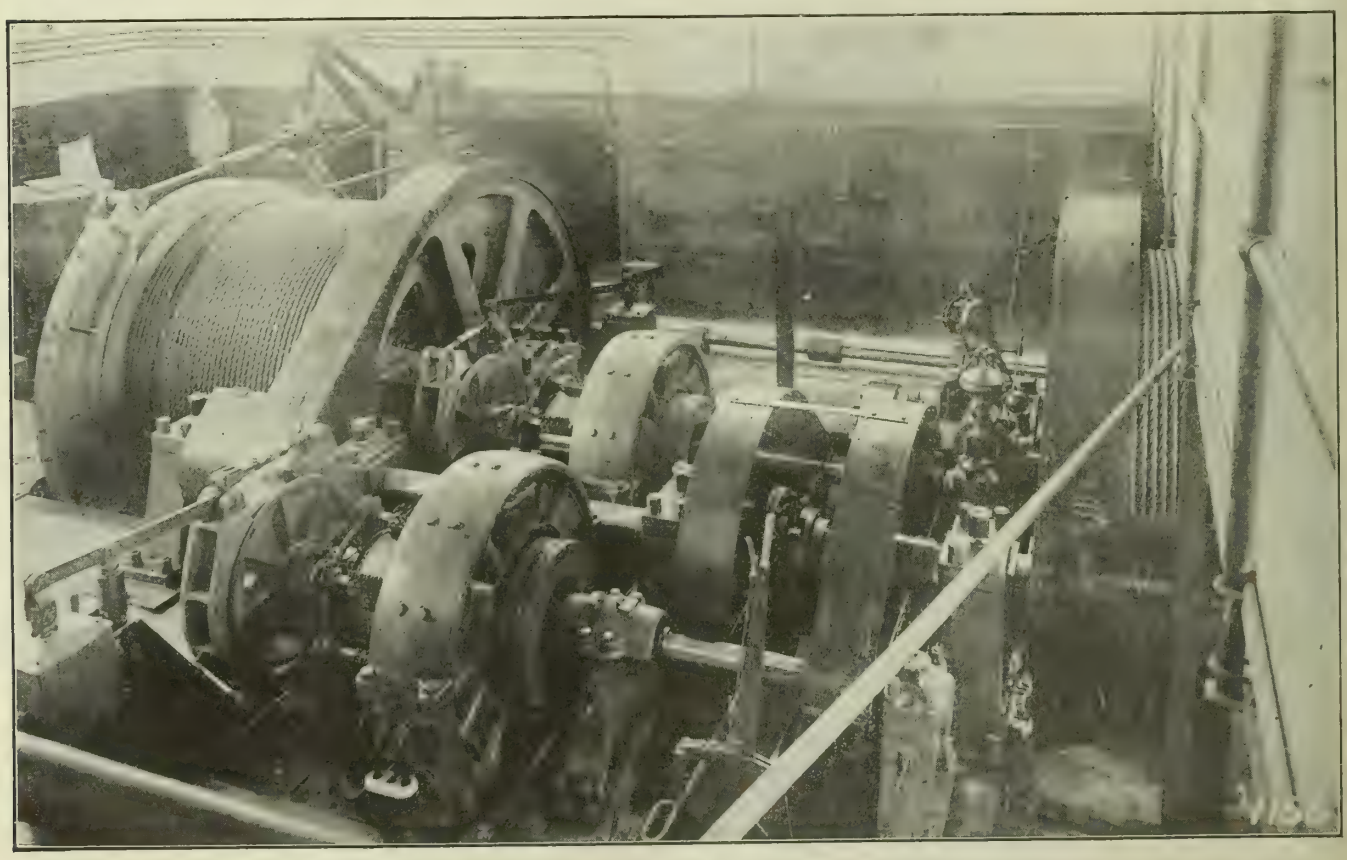


FIG. 2. ELECTRIC HOIST OF THE HAMILTON INCLINED RAILWAY

Showing all of one drum and part of the second, both motors, both solenoid brakes, geared connections, clutches, flyball governor, etc.

DRIVE

A 180-hp. 500-volt 475-585-r.p.m. direct-current motor (designed for the voltage variation of storage-battery service) drives the hoist through two gear reductions with a total ratio of 29.8 to 1. A magnetic-contactor panel gives remote control. To insure continuous service a reserve 180-hp. motor and solenoid are provided and can be substituted in a few minutes.

Power is supplied in the form of three-phase 25-cycle 2200-volt alternating current. For changing this into direct current, a motor-generator set has been installed of sufficient capacity to supply the average demand of the hoist, plus some surplus for charging a storage-battery floating on the line. The generator has a reversed series field throwing load fluctuations on the battery. A small percentage of the load fluctuations falling on the machine will lower its voltage to such an extent that the battery must discharge and furnish the balance of the momentary demand. The regulation is therefore inherent in the design of the machine and is entirely automatic.

OPERATION AND SAFETY APPLIANCES

The operator's cabin is fitted with one electric control and two hand-brake levers. The levers will not be used ordinarily, as the hoist is equipped with solenoid brakes operating on the motor shaft. The hand-brakes therefore need only be used for locking the cars at the top and bottom positions or in an emergency.

In starting a run, the operator releases the drum post brakes by the hand-levers, puts his foot on the small foot-pedal located at the bottom of the master controller and moves the handle of the controller either to the right or the left, as the case may be. The cars start and automatically accelerate to the normal rope speed. At a predetermined point on the incline, the controller handle automatically is turned to such a position that the speed is cut down to one-tenth normal and finally is turned to the off position, setting the solenoid brakes and bringing the cars to rest.

Should the operator become disabled during a run, he will of necessity remove his foot from the foot-pedal, thereby cutting off the current and bringing the cars to rest. In order to move the cars, the operator's foot must be on this pedal.

Should the controller fail to stop the cars, an over-winding device is attached which will shut off the current

and set the solenoid brakes. In case the cars should stop short of their landing positions, owing to the action of the automatic overwinding mechanism, there are two or three points on the controller available so that the operator can bring the cars to their proper positions. Should the speed of the cars exceed the normal by a predetermined amount, an overspeed device (flyball governor) will trip a 570-lb. weight which will set the drum post brakes. The emergency weight can also be tripped manually from the cabin.

The hoist was made by the Lidgerwood Manufacturing Co., of New York City, the electrical machinery and control apparatus by the General Electric Co., of Schenectady, and the storage battery by the Electric Storage Battery Co., of Philadelphia.

The Roman Aqueduct near Tarragona, Spain

By John R. Rippey*

Among the imposing monuments of the Roman period in Spain is the aqueduct of Tarragona. This conduit brought water from the River Gaya, about twenty-two miles, by means of canals and tunnels and by conduits supported on arches and piers.

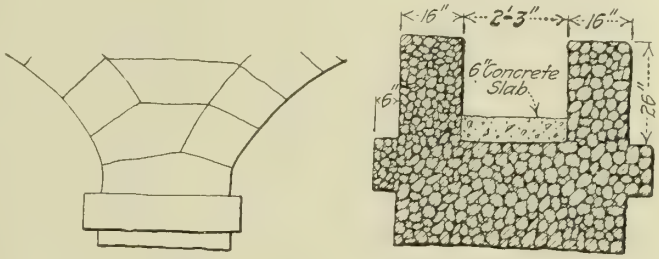
Although built about 200 B.C., the remains of the masonry aqueduct are in a fine state of preservation today. Figs. 1 and 2 show a portion of the structure extending across a valley about four miles north of Tarragona, and Figs. 3 and 4 show the aqueduct near the city. The valley crossing, shown in Figs. 1 and 2, is composed of two tiers of stone arches. The tower tier of eleven arches is 240 ft. long and 45 ft. high. The upper tier is 712 ft. long and 78 ft. high, thus making a total height of 123 ft. The span of the arches is 22 ft. 6 in. and the piers are 12 ft. square at the base.

*Assistant Superintendent of Construction, University of Nebraska, Lincoln, Neb.

There is apparently no mortar between the 18 voussoirs which make up the arches, arranged as shown in Fig. 5.

From all appearances, this aqueduct was part of an inverted siphon. Very little remains of the waterway. Fig. 6 is a sketch showing the largest portion that remains intact. At several points slabs of concrete were found, which probably formed the top of the siphon. These are about 6 in. thick, and the coarse aggregate is composed of broken brick—the only sign of brick in the structure.

After crossing over the hill shown in Fig. 1, the water was carried on for about three miles and then turned to the

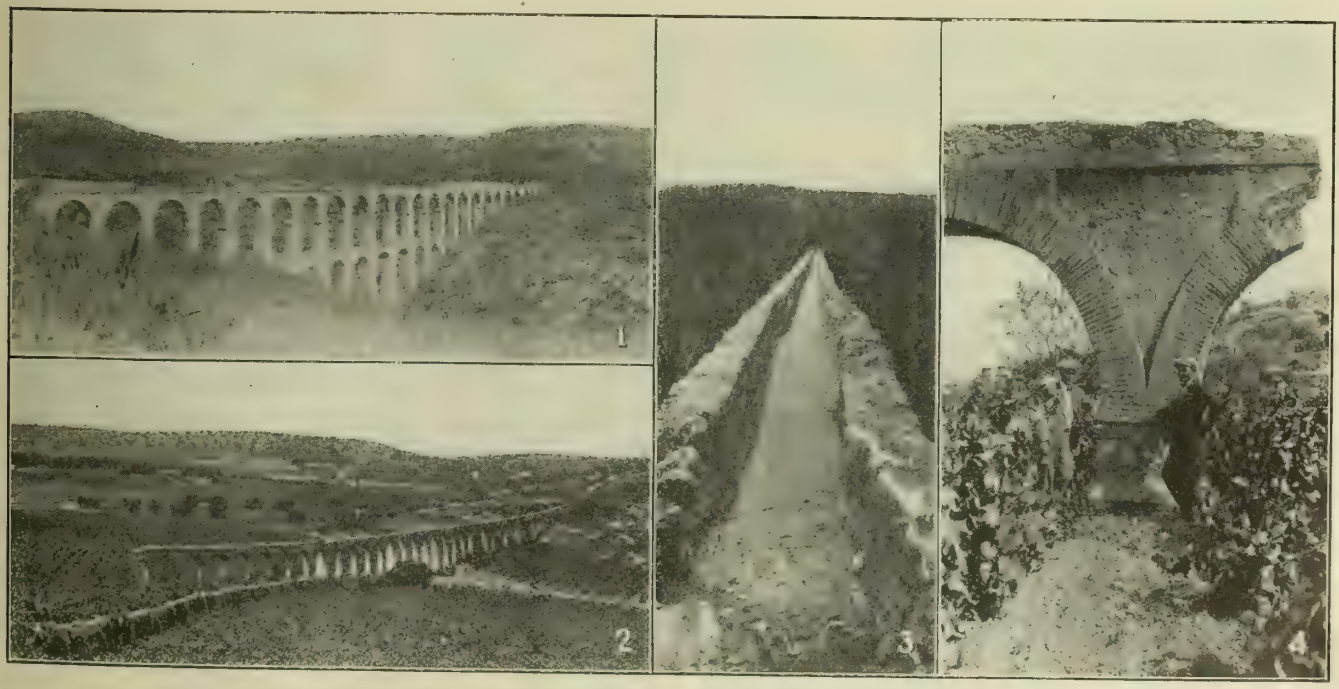


Figs. 5 and 6. Details of Part of Aqueduct Shown in Figs. 1 and 2

Fig. 5—Arrangement of facing stone of arches. Fig. 6—Details of waterway

right and brought into the city, as shown in Figs. 3 and 4. This portion of the aqueduct is built entirely of brick and concrete. Originally, this structure had a total length of about 1200 ft. At present there are only 27 arches standing, each having a span of about 12 ft. and a rise of about 7 ft. The brick used in this work are 12 in. long, 6 in. wide and 1¼ in. thick. The mortar at present is extremely hard.

The Spanish government, realizing the historic value of these aqueducts, has taken steps to preserve them. Before these steps were taken, the people tore down a number of the arches and used the brick for the construction of a number of the neighboring buildings.



Figs. 1 to 4. Views of Two Portions of Tarragona Aqueduct, Spain

Fig. 1—About four miles from the city. Fig. 2—Entering the city. Fig. 3—Waterway of portion shown in Fig. 1. Fig. 4—Detail of brickwork and concrete

Eliminating the Tower Grove Grade Crossing at St. Louis

SYNOPSIS—This complicated crossing involved two intersecting streets (with car tracks), two groups of steam railways, and spur tracks to several industries. The railways were lowered and the streets raised, crossing the tracks by an X-shaped viaduct of reinforced concrete, the two legs of this being of different design. The work was done by the two railways and was carried on without interrupting street traffic. One railway did all its work with its own forces, while the other let contracts for a part of the work.

The elimination of the grade crossings at Tower Grove is the most extensive of the works of this kind at St. Louis, Mo. It involved special problems and difficulties due to the location and the traffic conditions, as may be seen from the plan, Fig. 1.

Tower Grove Ave. and Vandeventer Ave. are two wide intersecting thoroughfares with car tracks and heavy street traffic. At their intersection they are crossed by the numerous tracks of the Missouri Pacific Ry. and the St. Louis & San Francisco Ry. The former has a suburban branch (to Oak Hill) which crosses the latter at grade, and both lines have spurs serving several industries. Each has a station at the crossing. There are about 56 passenger and freight trains on the St. Louis & San Francisco and 70 on the Missouri Pacific passing over the crossing every 24 hours, while the street cars number 519 in the same time.

Some years ago the city passed a grade-separation ordinance under which the railways would have had to lower their tracks about 25 ft., leaving the street level unaltered and throwing the entire expense upon the railways. The industries objected to this, as it would have made it impracticable to serve them by spurs to the ground level, and two of these industries obtained an injunction to prevent the railways from carrying out the work. It was finally decided by the State Supreme Court that, while the city had power to order grade separation, it had no power to compel the work to be done in the most expensive manner and in such a way as to interfere with the facilities enjoyed by the industries.

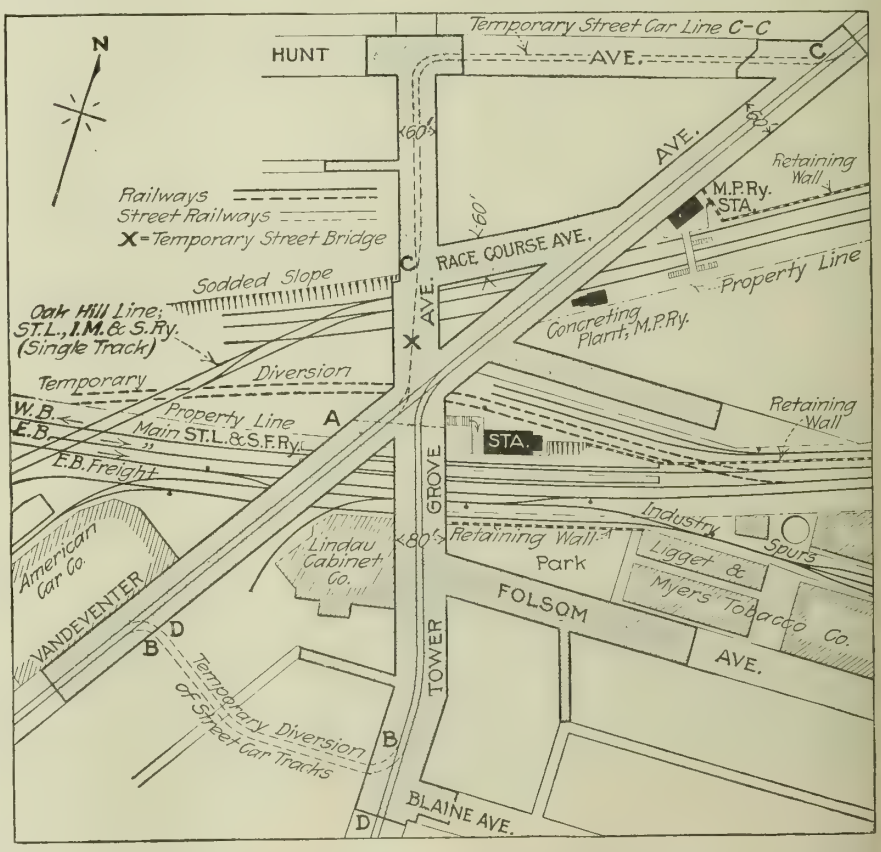


FIG. 1. PLAN OF TRACKS AND VIADUCTS AT THE TOWER GROVE CROSSING, ST. LOUIS, MO.

The layout of the Missouri Pacific Ry. tracks is tentative only. At present it has only the two tracks adjacent to the station, and a single track on the Oak Hill line. Additional tracks will be laid later

The railways had shown that a cheaper method would be to carry the streets beneath the tracks. After the above defeat the city prepared a compromise ordinance, under which the railway tracks were to be lowered 12 ft. and the streets elevated 13 ft., and providing that the city would assume the consequential damages to abutting property. This ordinance was accepted by the railways in 1913. Work was commenced early in 1914.

The general plans and the designs for the viaduct were prepared by the railways jointly and approved by the city authorities. The work is under the direction of F. G. Jonah, Chief Engineer of the St. Louis & San Francisco Ry.; C. E. Smith, Assistant Chief Engineer of the Missouri Pacific Ry., and C. E. Talbert, Street Commissioner. The engineers in direct charge are Perry Topping, Assistant Engineer of the St. Louis & San Francisco Ry.; E. S. Wonson, Bridge Engineer of the Missouri Pacific Ry., and L. R. Bowen, Bridge Engineer of the city's Street Department.

The railways pay all construction cost, amounting to about $600,000. This includes industry connections, no part of these being paid for by the industries. The city pays all consequential damages, as before noted, and pays also for the paving. At the north end the elevation for the viaduct approaches made it necessary to raise several buildings to the new grade. As this compelled closing some stores, etc., during the change, the city undertook to pay a portion of the rent in such cases. The street-railway company pays for its temporary track work and the shifting of the tracks, also the cost of track and overhead work across the viaduct. Each of the railway companies assumed the construction of that part of the viaduct over its own tracks, and the dividing line is shown at *A* in Fig. 1.

The ground is nearly level. The track depression extends for a distance of about 4500 ft. and reaches a maximum depth of about 16 ft. below the original level. The viaducts have a maximum elevation of about 12 ft. above the original level, or 9 ft. to the under side of the floor-beams, giving a clear headway of 22 ft. between rail level and the viaduct. It will be seen by the profile of the St. Louis & San Francisco Ry., Fig. 2, that the original crossing was a summit in the grades, so that the main line is improved by the lowering of the tracks, the grade through the depression being 0.75%. On the other hand, it introduces difficulties in the industry-track connections, for which grades of 1.85 and 3% are required to reach the surface.

The St. Louis & San Francisco Ry. did its grading, including steam-shovel work, with its own forces. The concrete work, including this railway's portion of the viaduct, was let to the Jarrett-Richardson Paving Co., of Springfield, Mo., while the additions and improvements to the passenger station were let to James Stewart & Co., of St. Louis.

During the excavation for the new grade, the two main tracks of the St. Louis & San Francisco Ry. were diverted to pass around the station (at the original level) as shown by the dotted lines in Fig. 1, thus facilitating both the traffic and the construction work. Fig. 3 shows this cut in progress, looking west from the crossing, with the temporary tracks at the right. The Missouri Pacific Ry. branch line is shown shifted beyond its original location and carried by a temporary trestle. With the lowering of the main lines this branch was replaced on its original location, but at the new grade.

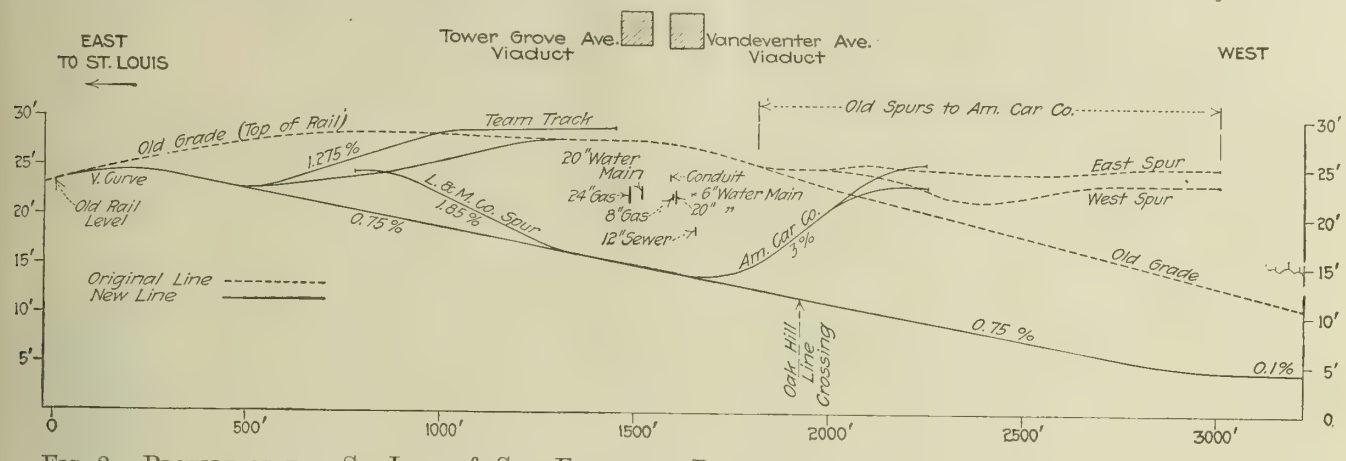


FIG. 2. PROFILE OF THE ST. LOUIS & SAN FRANCISCO RY. AT THE TOWER-GROVE CROSSING, ST. LOUIS, MO.



FIG. 3. LOWERING TRACKS AT THE TOWER GROVE CROSSING, ST. LOUIS, MO.

The view is looking west from the Vandeventer Ave. viaduct. The cut is for the St. Louis & San Francisco Ry., traffic being diverted to the two temporary tracks at the right. Beyond the temporary tracks is the main line of the Missouri Pacific Ry., while the line crossing the cut is the Oak Hill branch of the St. Louis, Iron Mountain & Southern Ry.

Fig. 4 shows the work in progress for the St. Louis & San Francisco Ry. at the south end of the Vandeventer Ave. viaduct. The foundations of the viaduct were built in trenches before the general excavation was made. The remaining high-level track at the right is an industry connection (now lowered). Beyond the viaduct may be seen the temporary bridge carrying Tower Grove Ave. across the cut, at the original ground level. At the deepest part, the cut has retaining walls, and on the east side an incline will lead up to a double-track paved team yard at the present ground level, as shown in Fig. 1. The Tower Grove station also will remain at the present level, with stairways to the train platforms and to the viaduct.

On the Missouri Pacific Ry. the restricted space prevented diversion of the tracks, and running tracks had to be kept open while a preliminary cut was made for the first two tracks at the new grade. These were adjacent to the station and had a double-track junction with the single-track Oak Hill branch. The limited traffic on this branch did not warrant the cost of a diversion to secure an overhead crossing of the St. Louis & San Francisco Ry., but an interlocking switch and signal plant will be installed for the protection of traffic over the grade crossing.

South of this double-track cut, trenches were made for the foundations of the viaduct. The bents were built on these and the deck then built, leaving for the future the excavation of the ground to widen the cut for additional tracks. The Tower Grove station (M. P. Ry.) was raised to the level of the viaduct approach and placed against the sidewalk line, as shown in Fig. 1. Later, a bridge will extend from the station across the tracks, with stairs to the train platforms. The excavation of the cut was interfered with by sewers and water and gas mains, and the change of grade of the tracks was complicated by the necessity of maintaining a connection with the Oak Hill branch. The Missouri Pacific Ry. did all its portion of the work (including the viaduct) with its own forces.

In the concreting, the Missouri Pacific Ry. employed a stationary mixer plant with tall elevator tower and inclined chutes to the forms. Smaller intermediate towers supported the long runs of chutes. The plant was placed first near one end of the viaduct and later on the ground in the angle between Vandeventer Ave. and Park Ave. (Fig. 1). The contractor for the concreting on the St. Louis & San Francisco Ry. used a small portable mixer which was shifted as the work progressed. In building the retaining walls and viaduct bents, this outfit stood on the ground and had attached to it a truck with a telescopic elevator tower. For concreting the deck, the portable mixer was placed on the upper level and discharged the concrete directly into wheelbarrows for delivery to the forms.



FIG. 4. BUILDING THE VIADUCT OVER TRACK DEPRESSION AT TOWER GROVE, ST. LOUIS, MO.

This is the five-span section of the Vandeventer Ave. viaduct over the St. L. & S. F. Ry. The foundations and bents were built in trenches, and the main excavation was done later, traffic being diverted to a temporary track

TYPE OF VIADUCT DESIGN

The viaducts are of reinforced concrete, with bents supporting a slab and beam deck. Together they form an X-shaped structure, with a solid fill at the intersection (between the two railways). The approaches and lateral connections are solid fills with concrete retaining walls. Each of the four sections of the viaduct has five spans, alternately long and short, with ¾-in. expansion joints over two of the bents (Fig. 5). At these joints the ends of the slabs have zinc plates which rest upon other zinc bearing plates on the cap girder of the bent. Concrete trolley poles are used.

The bents have square columns and footings spaced 12 ft. c. to c., with a guard wall extending between the

columns to a height of about 5 ft. above the rails, to protect the structure in the event of a train being derailed beneath it. The columns are capped with a heavy girder, on the faces of which are formed skewbacks for the floor-beams. In the Tower Grove Ave. viaduct, which is at right angles to the tracks, the floor-beams are

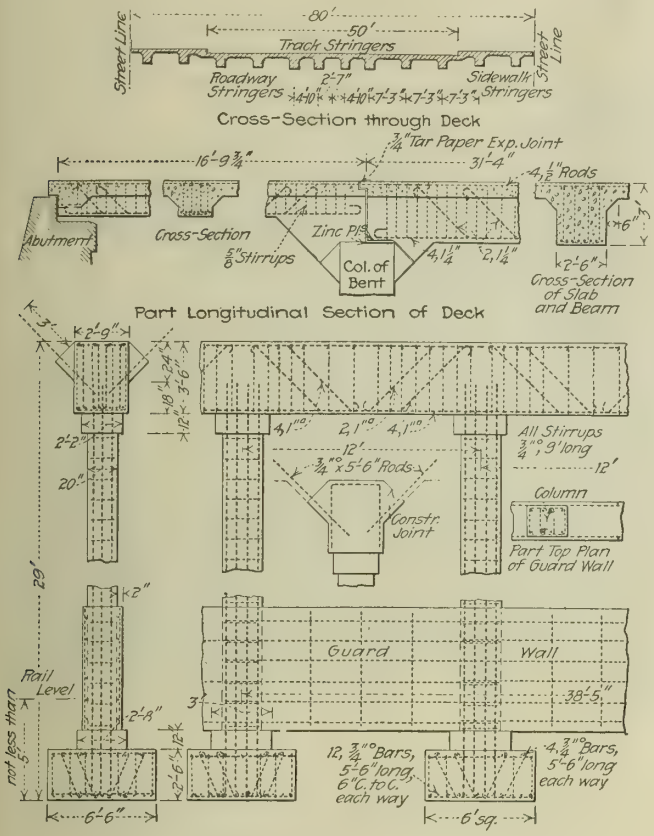


FIG. 5. THE TOWER GROVE AVE. VIADUCT

parallel to the line of the viaduct and are spaced to give two beams beneath each street-car track, as shown in Fig. 5.

On the Vandeventer Ave. viaduct, however, which makes a skew crossing with the tracks, the floor-beams are diagonal to the deck, as shown in Fig. 6. In this case, the ends of the beams and deck slabs are carried by deep facia girders, which are not required in the Tower Grove Ave. viaduct. It will be seen that for the longer skew spans (46 to 55 ft. long on the skew) steel facia girders are used, but these are incased in concrete so as to harmonize with the remainder of the structure.

HANDLING STREET TRAFFIC ACROSS THE WORK

One of the difficulties in construction was the necessity of keeping the streets open for pedestrians, street cars and vehicles. It was proposed at first to stop the cars at either side of the crossing, and let passengers walk across, placing temporary footbridges over the track-depression cuts. This would have been dangerous on account of the track crossings and would have caused much confusion owing to the different lines of cars that run on these two streets.

The car tracks were maintained therefore, and the temporary bridges over the cuts (which were built by the steam-railway companies) were made large and strong enough to carry the street cars. The bridges had to be shifted three times as the work progressed, so that very sharp curves had to be fitted for the track connections. Extra watchmen and policemen were provided to control traffic movements over the crossing, as long as the steam cars, street cars and other vehicles were operated on the same level. During the construction of the south end of the Vandeventer Ave. viaduct, street cars were diverted to the Tower Grove Ave. surface line by a temporary connection through property owned by the street-railway company. This is shown at *BB*, Fig. 1.

Later on, with the north end of Tower Grove Ave. viaduct built and the south end of Vandeventer Ave. also built, a timber bridge was built somewhat higher than the viaduct level, so that all street cars and vehicles could be carried above the work. This eliminated the grade crossing entirely, but introduced steep grades for the temporary approaches. The street cars were then run on a temporary track laid on the paving along Hunt Ave. and the viaduct approach (*CC*, Fig. 1) to a single track over this temporary bridge, and then diverted again through the connection noted above, but with the curves reversed (*DD*, Fig. 1).

For controlling traffic over the single-track temporary bridge, a pole at each end of this track carried a box containing two groups of incandescent electric lamps. Half the lamps were red and the others white. These were controlled by a man in a cabin at the center of the

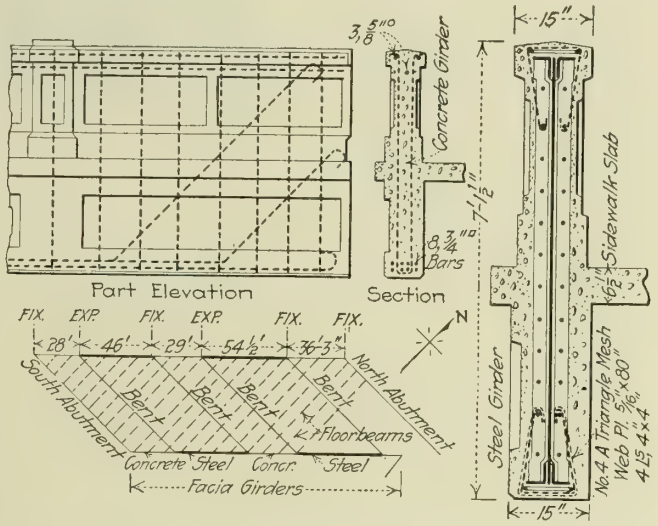


FIG. 6. THE VANDEVENTER AVE. VIADUCT (WITH FACIA GIRDERS SUPPORTING DIAGONAL FLOOR-BEAMS)

bridge, the movement of a handle causing the red lamps to be lighted at one end and the white lamps at the opposite end of the bridge.

United States-Canada Boundary Survey—Since 1908 surveyors have been at work marking the boundaries between the United States and Canada. The land surveys are nearing completion and the water lines of international lakes and rivers have been established. Charts of the international boundary, where the surveyors of the two countries have laid it down on maps of the water frontier, were on June 11 presented to Premier Borden by J. W. Stewart, head of the Canadian Hydrographic Survey. The Canadian Prime Minister, in receiving the charts of the boundary line from St. Regis Island in the St. Lawrence through Lakes Ontario, Erie, Huron and Superior to the head of the Lake of the Woods, referred to the happy relations existing between Canada and the United States as follows:

The fact that two great nations whose interests are concerned have chosen this method of bringing to a happy conclusion every possible difference is not only an example but a happy augury of future good relations. I trust that the work of delimiting the land boundary will be equally successful, and when this is done there will be set at rest every possible cause for dispute or controversy over the boundaries between the two countries.

A Novel Type of Motor Omnibus

The accompanying view shows an interesting design of motor omnibus which has just been completed by the McKeen Motor Car Co., of Omaha, Neb., for the Interurban Motor Transportation Co. operating between Minneapolis and St. Paul. The various details of the car body have been designed along lines similar to those used in the McKeen motor cars for railway service. The new vehicle is called the McKeen highway coach.

The chassis of the vehicle is the same as that used on a 3½-ton gasoline motor truck, and the propelling machinery is substantially identical. The wheel base is 18 ft. and the length of the frame back of the driver's seat is 22 ft. The passenger compartment is 18 ft. 2 in. long inside and 7 ft. 6 in. wide.

The round windows, with aluminum frames, are similar in design to those used on the McKeen motor cars. The advantages claimed for the round window are that it can be made absolutely air-tight, so that dust is entirely excluded, and the frame is so made that the rattling and disagreeable noise often experienced with square windows on street cars and motor omnibuses is eliminated. The frame of the round window is hinged at the top, and in hot weather the window can be swung inward and fastened to the ceiling.



A New Type of Motor Omnibus

A novelty in the seating of the car is the use of revolving chairs. These are mounted on telescoping iron standards, the weight of the chair being supported by a spiral spring 2 ft. long, which gives an elastic adjustment to secure easy riding. The passenger compartment contains 27 of these revolving chairs.

From the point of view of operating economy the most important feature in design is that the car is arranged to permit operation without a conductor, thus cutting in half the "platform-expense" item in operating costs. Passengers enter at the front through folding doors past a prepayment-fare collection box under the driver's supervision. The opening of entering and exit doors is controlled by the driver. The car draws up alongside the curb to take passengers on or let them off; the height of the step from the curb is only about 7 in.

The coach is lit by electricity from the storage battery used for starting the engine and is heated by hot-water circulation from the engine jackets. The price of the coach at Omaha is $6500. The McKeen company plans to build a vehicle with a similar body and seating capacity for operation on railway track at a price of about $8000.

Improvements on the Chicago Great Western Ry. made during the last four or five years represent an average of $11,000 per mile for the entire system. This is as great an outlay per mile as was expended 30 years ago in the original construction of the railways built in the prairie states.

Three Residential Sewage-Treatment Plants Near Cleveland

By R. F. MacDowell*

Even with the smallest class of sewage-treatment plants, namely, those for residences and estates, there is often required much originality of design, so that plants of the same size, if properly designed to suit the local conditions, often differ considerably in their general features, especially with regard to the secondary treatment employed. This fact is brought out forcibly by a comparison of three small plants constructed near Cleveland during the past year. These plants were designed in the office of R. Winthrop Pratt and were constructed under his general supervision for three private estates, the owners of which, for convenience, will be called A, B and C.

A—Two-Story Sedimentation Tank and Glass-Covered Rapid Sand Filters

The estate and summer residence of Mr. A fronts on Lake Erie, and for many years the sewage has been discharged into the lake directly in front of his grounds. During 1914 Mr. A spent a large sum of money to improve his private bathing beach, which is also in front of his grounds, and he accordingly desired to provide other means of disposal of the sewage and kitchen wastes from his residence. It was therefore decided to construct a sewage-treatment plant on the grounds, having an outlet into a small stream which separates an adjoining estate. The plant was constructed at an inconspicuous location in the chicken yard in the rear of the garage. As the ground at this point was at too high an elevation to permit the construction of a gravity system, the sewage was raised to the plant by means of an ejector located in a manhole placed on the line of the existing sewer leading to the lake. The motor-driven compressor and air-receiving tank to operate the ejector were placed in the garage, which is 300 ft. from the ejector manhole.

*Assistant Engineer with R. Winthrop Pratt, Consulting Engineer, Cleveland, Ohio.

The sewage-treatment plant, which provides for the sewage of 30 people at the rate of 50 gal. per day, consists of a two-story sedimentation tank and two rapid sand filters, the latter being covered with glass. The filters were constructed adjacent to the tank, making a very compact layout which lies entirely within an area of 20x20 ft. As both tank and filters are built entirely in excavation, with covering, the plant is inconspicuous. The velocity of the sewage as it leaves the force main from the ejector is broken by discharging into a manhole 30 ft. from the sedimentation tank. The latter tank is 4½x8 ft. in plan and 8 ft. deep and has 2-in. wood flow-compartment walls and a 3-in. flat wood cover. A wrought-iron basket screen, which is placed inside the tank just below the inlet, may be removed by lifting a hinged door in the cover. As the plant will be used for only a short time each year, frequent removal of the sludge will be unnecessary, and hence no sludge-removal pipe was provided in the tank.

The filters, each about 6x11 ft. in plan, with concrete walls and floors, contain 4 ft. of filtering material, consisting, from bottom to top, of coarse slag, fine slag, pea-size silica gravel and lake sand. Only 3 in. of sand was used on the surface, and the sewage is thus filtered at a rapid rate. The sand was used merely for the purpose of distributing the tank effluent uniformly over the surface of the filtering material.

The degree of purification produced by the plant was not expected to be very high, but in view of the large dilution afforded the effluent by the stream it was considered adequate to eliminate all possibility of a "sight" nuisance being created. Furthermore, because of the coarseness of a large proportion of the filtering material, the intermittent discharge onto the filters by means of a dosing tank and siphon was considered unnecessary, and the latter were eliminated. After operating the plant for some time, however, it was found that even with only 3 in. of sand on the surface the filter clogged readily and became ponded, due principally, however, to a large quantity of grease from kitchen wastes. To remedy this, additional baffles were placed in the sedimentation tank and a glass covering was put over the filters. The purpose of the glass was to produce heat which would aid in drying the surface of the beds and thus make the scum and grease deposits more readily removable. The glass covering consists of an inclined, low, hip roof framework, holding hinged sashes in sections, the glass for which was lapped to shed water, as in greenhouse construction. Ventilators were placed in the top.

It is planned to use the plant during the bathing season only, while during the remainder of the summer the sewage will be discharged into the lake by means of a by-pass at the ejector manhole, the outlet being submerged in 5 ft. of water 100 ft. from the shore.

The total cost of the plant, including ejector equipment, was about $2000.

B—Screens, Two-Story Sedimentation Tank, Dosing Tank and Intermittent Sand Filters

The estate of Mr. B, for whom the second plant was built, is located on a ridge about 2 mi. from the lake. A very small stream, which practically dries up in the summer time, affords no dilution for the effluent from the plant. The grounds are of sufficient area and have suitable topography to suggest the construction of a subsoil irrigation, or absorption, system for the secondary treatment, but as the soil is a heavy clay and the sewage flow is comparatively large, it was considered more practicable to provide intermittent sand filters, especially since a location for open filters could be obtained which was well removed from dwelling houses.

The plant was designed to treat a maximum daily sewage flow of 4500 gal., based on 75 gal. per capita per day for 60 persons. The plant will be used throughout the year. The design provided for a screen chamber, a two-story sedimentation tank, a dosing tank, and two intermittent sand filters. The tanks are built together as one unit, and the filters are located 200 ft. away.

The sedimentation tank, which is built of reinforced concrete, with wood-plank covering and flow-compartment walls, is 6x10 ft. in plan and 10 ft. deep to the flow line. By means of a 6-in. cast-iron pipe leading to the bottom of the tank the sludge may be removed by gravity onto the surrounding corn field, where it may be plowed into the loamy top soil. A 1-in. water main leading to the bottom of the tank is also provided to assist in loosening the sludge. The dosing tank, which is 12x12 ft. in plan, is also covered with wood. A single 4-in. Miller siphon discharges the sewage onto the filters. The latter, which are 50x40 ft. in plan, or 0.046 acre in area, are constructed partly in excavation, with concrete walls. The filtering material, which has an average depth of 3 ft., consists of 6 in. of 1- to 1½-in. slag, on the bottom, and 2.5 ft. of river sand. The siphons discharge into a gate chamber at one end of the dividing wall between the filters. The flow onto either filter is controlled by hand-operated, metal slide gates. The sewage is distributed by means of wooden troughs, extending diagonally across each filter, each trough having hinged openings at intervals for distributing the sewage uniformly over the surface.

To keep out sticks, leaves, etc., during high water, the main underdrain from the filters is provided with a flap valve. The cost of this plant, exclusive of sewers, was about $1200.

C—Septic Tank, Dosing Tank and Sub-Surface Irrigation

The third plant, built for the country home of Mr. C, provides for only 10 to 12 persons, and is much simpler in design than the two other plants. There is no watercourse nearby, and as the soil is a good sandy loam, a subsoil irrigation, or absorption system, was designed for the secondary treatment. The plant was built on a steep hillside, and consists of a septic tank, a dosing tank and 600 ft. of 4-in. vitrified pipe, laid with open joints, in two lines, each at different depths from the surface, but at the same elevation, along parallel contours of the hill, 8 ft. apart. A single 3-in. Miller siphon gives intermittent discharge into the absorption system, and by means of a small concrete gate chamber one-half of the system may be cut out at any time. The vitrified absorption pipe is surrounded in the trench with 4 in. of screened river gravel and each joint is covered with tarred felt to keep out fine material. The tanks are oval-shaped in plan and are built of brick, plastered both outside and inside, and have concrete bottoms. The cost of the plant, exclusive of sewers, was about $350.

All three plants have operated successfully and have produced effluents of satisfactory character.

Hydrostatic Catenary Flume on a Concrete Aqueduct

By H. B. Muckleston*

SYNOPSIS—The Brooks Aqueduct, a concrete flume shaped to the hydrostatic catenary, a curve of zero moment and zero shear under hydrostatic load, supported on and a part of a reinforced-concrete trestle 2 mi. long. A part of the Canadian Pacific Railway's Alberta irrigation scheme. Carries on hydraulic gradient a maximum flow of 900 cu.ft. per sec. Has reinforced-concrete siphon under railway tracks.

The Brooks Aqueduct plays a very important part in the system which has been built to serve the Eastern

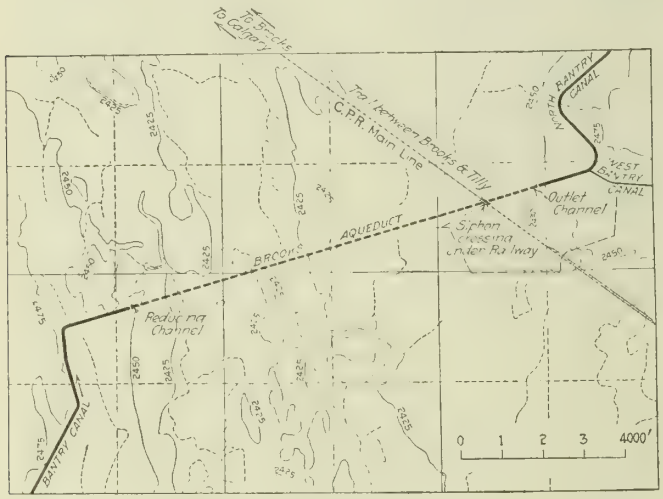


Fig. 1. Location of Brooks Aqueduct in Southern Alberta Irrigation System of Canadian Pacific Ry.

section of the Canadian Pacific Railway Company's irrigation block in southern Alberta. The system is supplied with water from an intake in the Bow River near the town of Bassano.† The main diverting canal cuts through the watershed between the rivers and reaches bench elevation after a course of about five miles. From this point it runs in a southeasterly direction, and after supplying many branches spills its surplus waters into Lake Newell. This lake is a storage reservoir with a useful capacity of 187,300 acre-feet. It occupies a depression to the west of a low range of hills and is designed to be filled during the nonirrigating season. From the reservoir the aqueduct is supplied by a short canal.

*Assistant Chief Engineer, Department of Natural Resources, Canadian Pacific Ry., Calgary, Alta.

†The headworks were described in "Engineering News," Aug. 27, 1914, p. 425, and Sept. 3, 1914, p. 484. See map of system given there.

A marked feature in the major topography of the project is the existence of several deep valleys, which cut clear across from one river to the other. One of these is utilized by the main canal; another is crossed by the East Branch at Antelope Creek, and a third is situated just east of the reservoir and is crossed by the Brooks Aqueduct. The aqueduct is required to carry water for the irrigation of 125,000 acres of land, and its discharge capacity is required to be 900 cu.ft. per sec.

Controlling Factors of Design

The reservoir is a very important factor, not only in the design of the canal system as a whole, but in the design of the aqueduct. By the Canadian law the duty of water is fixed at 1 cu.ft. per sec., delivered at the farm boundary, for each 150 acres of irrigable land flowing continuously for 153 days, or, in round figures, about two acre-feet per acre during the season. To this must be added about 25% for losses in transit through seepage and evaporation, thus requiring the diversion of about 2.5 acre-feet for each acre of irrigable land. The legal season is from May 1 to Oct. 1, and during the remainder of the year, under usual conditions, the system would be empty. However, if facilities can be provided in the lower portion of the system for storing up the otherwise useless winter flow of the river for use during the following summer, the discharge capacity of the upper part of the system can be correspondingly reduced. Such storage, therefore, has a definite and easily ascertainable value, which fixes the maximum allowable cost of developing it. It is evident, too, that any works which tend to reduce this reservoir capacity must have a value in some other direction in excess of that of the lost storage, or they would not be economical.

Now, the elevations of high water in the reservoir and of the discharge end of the aqueduct were fixed by

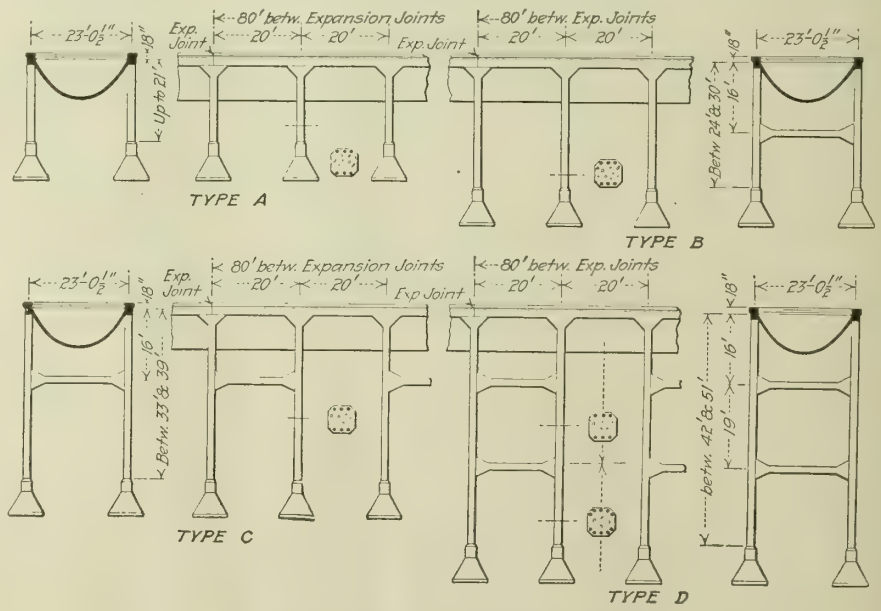


Fig. 2. General Design of the Brooks Aqueduct Showing Variation in Type of Structure

other considerations and could not be altered. That is to say, the total available fall between high water in the reservoir and the outlet end of the aqueduct was a fixed quantity, of which a certain portion would be required for the slope of the outlet canal and aqueduct and the remainder available as storage. Consequently, the depth and quantity of available storage in the reservoir depended directly on the slope given to the aqueduct. This latter might be chosen at any value between somewhat wide limits, and the cost of the structure would vary inversely as some function of the value chosen.

The cost of the head lost in the aqueduct may be figured in two ways: First, it represents a certain direct expenditure in the cost of the aqueduct, varying inversely with the slope given to it; second, it represents a certain indirect expenditure, equal to the value of the lost storage, varying in some degree directly with the slope; and there will be some value where the sum of these two is a minimum. In order to determine this point, it was necessary to know, first, the value of the lost storage per acre-foot; second, the probable cost of the aqueduct over a considerable range in slope.

The value of the lost storage is very nearly a constant quantity, and is equal to the cost of the canal system supplying this reservoir divided by its average annual discharge in acre-feet. The probable cost of the aqueduct involves questions of type of structure and material to be used, and can only be solved by a process of cut and try on a number of examples.

For a preliminary estimate it was assumed, first, that a pressure pipe or inverted siphon would be the cheapest type; second, that the cost would be a direct straight-line function of the cross-section area. Approximate designs were worked up for steel, concrete, and wood-stave pipes and estimates made, allowing for maintenance charges in each case. From these estimates the probable extreme values of the lost storage were deduced.

While in many cases, especially where the depth of the valley is great, a siphon is cheaper than a structure on the hydraulic grade with free surface, it is not always so; and even when it is cheaper, siphons as the solution of such problems are open to many objections from which flumes are free. In the first place, canals do not always run full, whereas the siphon must always do so. This condition has two very disagreeable effects. The low velocity in the siphon causes the hydraulic grade to flatten out, resulting in a drop at the upper end, which, in a large canal at any rate, requires control works; otherwise the effect of the fall will be felt for a long distance above. Another effect is the accumulation in periods of little demand for water of sediment in the bottom of the pipe, which is caused by the low velocity at small discharges. The only cure for these effects is to divide the full discharge among several pipes and provide means of cutting out one or more pipes as the discharge decreases. This remedy costs money and, if the available head is limited, is not always feasible. Another objection is the necessity in a northern climate of blowing off every fall.

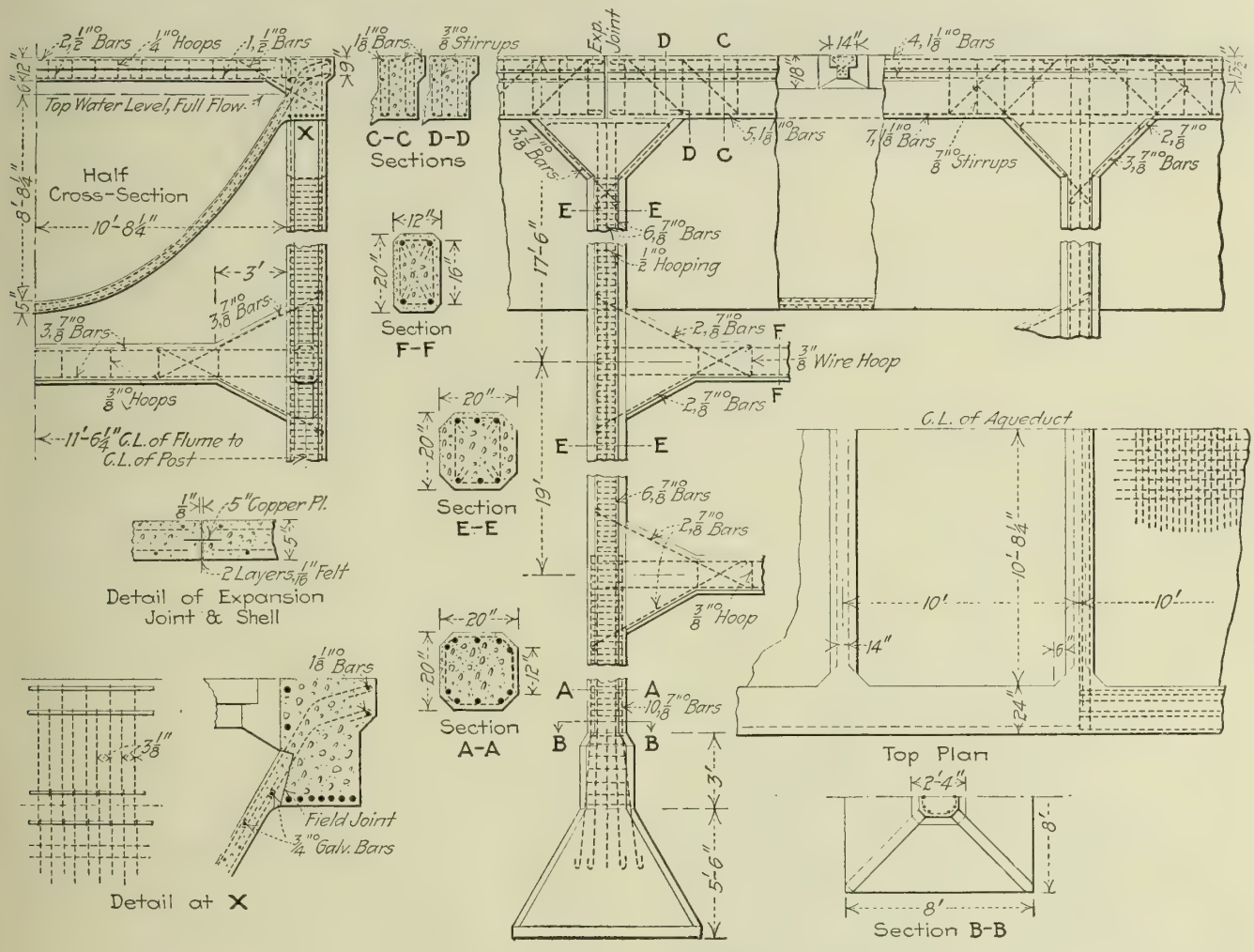


Fig. 3. Typical Details of Brooks Aqueduct

In a large pipe under high head, especially if very long, this must be done very slowly; otherwise serious pressure oscillations are liable to be set up, giving rise to stresses which are difficult, if not impossible, to estimate with any accuracy.

For these reasons and some others it was decided to investigate the possibilities of a grade structure. Accordingly, a tentative design was worked out and its probable cost compared with that of a pressure pipe, using the same hydraulic slope in each case. The cost of the grade structure proved to be somewhat less than that of a single pipe and very much less than that of a double one. Consequently, subsequent investigations were confined to the grade structure. Four values of lost head were then assumed, two on either side of the probable final value, and four approximate designs were made, from which a cost curve was plotted. From this curve and from a similar curve for value of lost storage the final value of the lost head was determined.



FIG. 4. VIEW OF ONE END OF BROOKS AQUEDUCT IN SOUTHERN ALBERTA

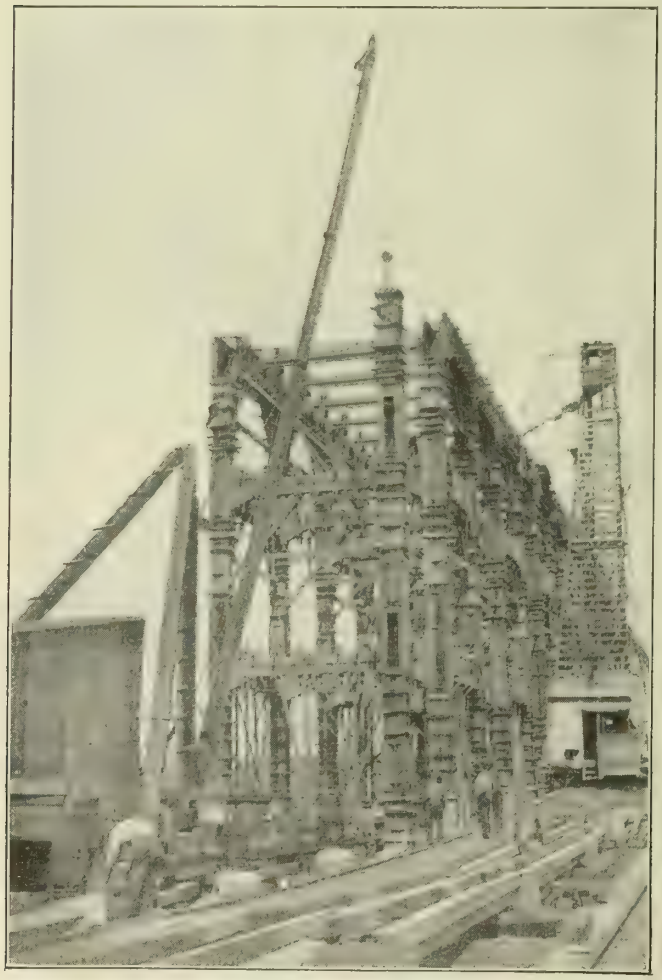


FIG. 5. ERECTING THE BROOKS AQUEDUCT

DESIGN OF AQUEDUCT

The final design (Fig. 2) consists of a curved shell of reinforced concrete, 10,480 ft. long, suspended between horizontal girders, the whole being supported by a reinforced-concrete trestle made up of two lines of columns spaced 20 ft. c. to c. and varying in bracing according to the height, which increases from 24 to 60 ft. The novelty in the design is in the curve adopted for the suspended shell. The suspended type in itself is not new, being familiar in steel construction. In such cases, however, the curve used is almost invariably circular, probably from reasons connected with manufacture. In the case under discussion the curve chosen is the hydrostatic chord, or elastic curve, sometimes called the hydrostatic catenary. It is the curve which the shell would assume were it made of some perfectly flexible and inextensible material. It is also one of the forms assumed by a straight spring when the ends are acted on by two equal opposite forces in the same line. The radius of curvature at any point varies inversely as the distance from the water surface. Consequently the shell tension is uniform throughout, and there is neither moment nor shear at any point.

It is evident that the initial angle may be anything between very wide limits, and hence it must be chosen to satisfy external considerations. In this case hydraulic considerations pointed to an angle somewhere about 60°; and as this angle also happens to be suitable from the structural point of view, it was chosen as the value to be used. The best value for hydraulic properties only may be most easily determined by a little experimenting with a piece of clock-spring and a planimeter.

Computation of Curve—In order to calculate coördinates to the curve for the purpose of plotting and to determine the area and wetted perimeter, recourse is had to the fact that the curve is the equilibrium polygon for the liquid load filling it to the bowstring. A rigid analysis by calculus leads to a differential equation which the writer was unable to integrate. However, the equilibrium polygon furnishes an approximate solution, which gives results close enough for practical purposes.

Since the load is normal to the curve and the tension uniform, it follows that the load line in the force diagram must be the arc of a circle, the radii of which represent the tension in the chord. With the initial angle given and the required area known it is a simple matter to draw the force diagram.*

*See a method of computing the hydrostatic catenary, by H. M. Gibb, the detailer of the Brooks Aqueduct, in "Engineering News," Apr. 8, 1915, p. 668.

The curve used for the Brooks Aqueduct is figured out in the table at the bottom of the page, in which (*a*) is the force diagram and (*b*) is the beginning of the catenary as drawn from that diagram.

Stress Computations—The thickness of the shell is determined by two requirements—(1) when the channel is running less than full there exist both moment and shear, and the shell must be designed stiff enough to resist these without cracking; (2) when running full, the concrete shell must not crack in tension. To meet these requirements, a sufficient area of steel was provided to take all the tension at 10,650 lb. per sq.in. The elastic ratio was assumed at 15, and a sufficient thickness of concrete was then added so that, assuming the concrete and steel to share the tension, the stress in the concrete should not exceed 70 lb. per sq.in. The steel was then distributed in two layers, as far apart as the thickness so found would allow, and the shell investigated for deflection, moment and shear under partial loads. The stresses thus calculated were well within the specified limits and the deflections very moderate.

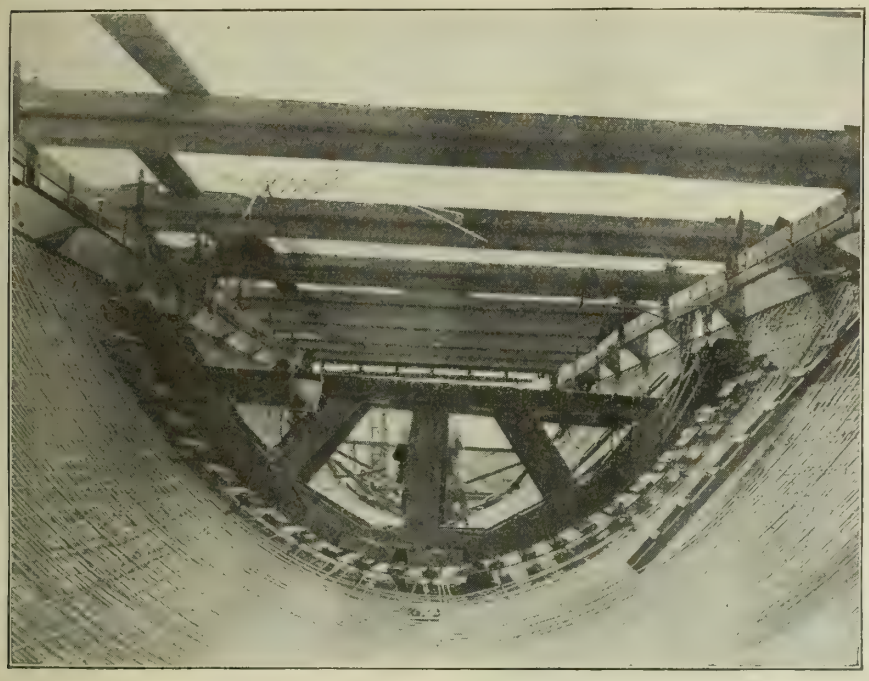


FIG. 6. CONCRETING THE FLUME

Calculations of the Discharge—The discharge calculations were made by an exponential formula instead of by the usual Kutter formula. The latter formula, while very widely used, holds its place in hydraulics largely because of the very extensive collection of tables and diagrams which have accumulated around it. The exponential formulas require no such aid, are as easily handled and are believed more closely to fit observed results than the older and much more complicated Kutter formula. The particular formula used is attributed to Prof. T. Claxton Fidler, of St. Andrews University, Dundee, and is as follows:

$$Log\ S = X\ (M + log\ V - \tfrac{2}{3}\ log\ R) - 6.00$$

S, *V* and *R* have the usual significance, *X* is a friction factor depending on surface and *M* a friction factor depending on shape. For any given relations between area and hydraulic radius the formula is readily transposed to give friction head direct for any required conditions. It is thus simpler than Kutter's formula for channels of fixed shape, such as pipes, flumes and the like.

CALCULATION OF HYDROSTATIC CHORD FOR BROOKS AQUEDUCT

Draw AB equal, by a convenient scale, to the desired area of cross section, and draw AC and BC making the angles with the horizontal at A and B equal to the required initial angle (in this case 60°). Draw the arc ADB. Divide the arc into any convenient number 2r (in this case 20) of equal parts, the more the better, and compute the length of one part by the scale. Call this L; it represents the equal areas into which the catenary section is divided. That is, in the diagram (b), $hx = L$, where h is the head on any one of the sections and x is the chord of the curve being sought. The table herewith is then worked out, giving the ordinates of the curve from point to point. This table merely gives in tabular form the steps in the derivation of the formula in Col. IX, which is a geometric solution of the chord length, from which the ordinates and abscissæ (Cols. XII and XIV) are readily deduced. The geometric solution of L (see b in table) is as follows, solving in this case for x_1 and x_2:

$$h_1 x_1 = L$$

$$h_1 = \frac{x_1}{2} \sin \theta_1$$

$$\therefore L = \frac{x_1^2}{2} \sin \theta_1$$

$$2L = x_1^2 \sin \theta_1$$

Further:

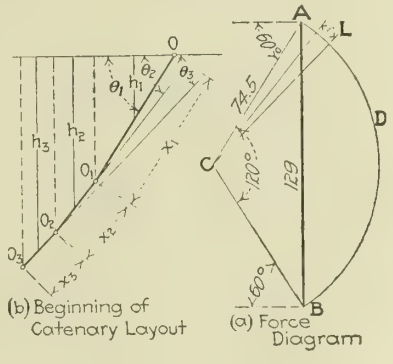
$$h_2 x_2 = L$$

but from diagram (b)

$$h_2 = \left(\frac{x_2}{2} + \frac{x_1 \sin \theta_2}{\sin \theta_1}\right) \sin \theta_2$$

$$2L = x_2^2 \sin \theta_2 + 2\ x_1 x_2 \sin \theta_1$$

which is the formula in Col. IX.



Twice the sum of Col. X gives the perimeter, nearly. As a check on the work, add the ordinates in pairs and multiply by the figures in Col. XIII; the sum of the results (Col. XV) should be slightly less than the required area. To insure accurate results, it is advisable to work to several places of decimals.

$\alpha = 6°0'$, r = 10, L = 7.825. A = 129.

I	II	III	IV	V	VI	VII	VIII	IX	X		XI	XII	XIII	XIV	XV
n	$(r-n+\frac{1}{2})\ \alpha$	Sin. II	$(r-n+1\frac{1}{2})\alpha$	Sin. IV	$2\ x_{n-1}$	V×VI	Prog. Sum. VII	III x^2_n + VIII x_n = 2 L	x_n	Point	X×III	Ordinate	X×Cos II	Abscissa	A
1	57°	0.839	63°	0.891	0	0	0	$0.839x^2$	4.32	0	....	0	..	0	.....
2	51°	0.777	57°	0.839	8.64	7.24	7.24	$0.777x^2 + 7.24x$	1.89	1	3.62	3.62	2.36	2.36	8.55
3	45°	0.707	51°	0.777	3.79	2.93	10.17	$0.707x^2 + 10.17x$	1.40	2	1.47	5.09	1.19	3.55	10.36
4	39°	0.629	45°	0.707	2.80	1.98	12.15	$0.629x^2 + 12.15x$	1.22	3	0.99	6.08	0.99	4.54	11.05
5	33°	0.545	39°	0.629	2.43	1.53	13.68	$0.545x^2 + 13.68x$	1.10	4	0.77	6.85	0.95	5.49	12.30
6	27°	0.454	33°	0.545	2.20	1.20	14.88	$0.454x^2 + 14.88x$	1.00	5	0.60	7.45	0.92	6.41	13.15
7	21°	0.358	27°	0.454	2.00	0.91	15.79	$0.358x^2 + 15.79x$	0.95	6	0.45	7.90	0.89	7.30	13.67
8	15°	0.259	21°	0.358	1.90	0.68	16.47	$0.259x^2 + 16.47x$	0.90	7	0.34	8.24	0.88	8.18	14.20
9	9°	0.156	15°	0.259	1.80	0.47	16.94	$0.156x^2 + 16.94x$	0.85	8	0.28	8.52	0.87	9.05	14.58
10	3°	0.052	9°	0.156	1.70	0.27	17.21	$0.052x^2 + 17.21x$	0.80	9	0.13	8.65	0.84	9.89	14.42
									14.43	10	0.04	8.69	0.80	10.69	13.86
								P = 28.86							
								Hydr. rad. = 4.48							126 14

Siphon—The site of the aqueduct is crossed by the main line of the Canadian Pacific Ry. This track is at such an elevation that sufficient headroom for an overcrossing could not be obtained and a siphon under the track was necessary. In order to save excavation, and more especially for reasons of drainage, the siphon was designed with a reduced section and an increased velocity on the principle of the Venturi tube. The general layout of the siphon is given in Fig. 8.

Trestle Design—In designing the trestle carrying the flume a good deal of preliminary work was done in order to arrive at the most economical type. The final design is shown in Figs. 3 and 4. In order to keep down form costs it was desired to have as little variety in spans as possible, even if quantities were somewhat increased thereby.

The trestle is divided into four typical constructions, depending on the height of the columns. When the height of the columns changes, the change is invariably by a step of 3 ft. or a multiple of three. Provision is made for variation in length of shell due to change of temperature by expansion joints at every fourth bent and at each portal and at each end of the siphon.

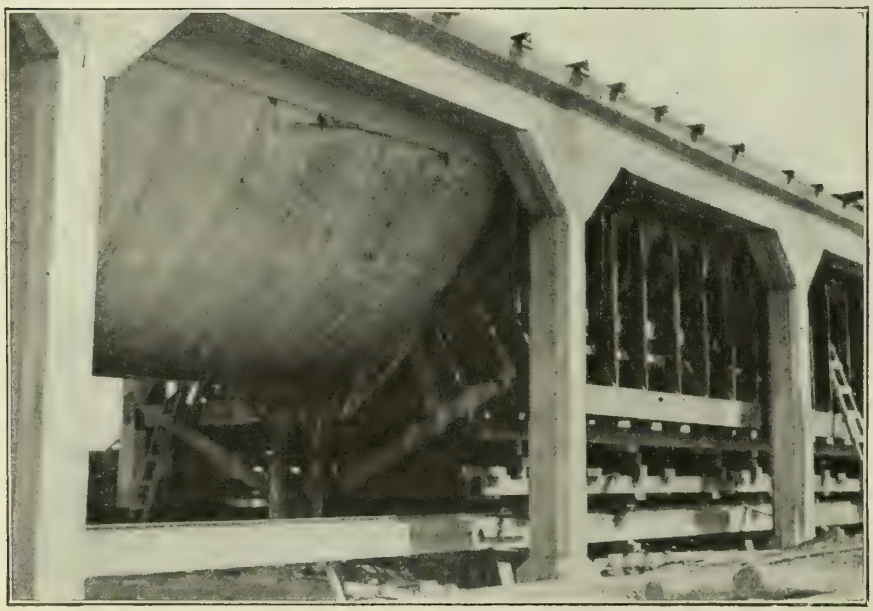


Fig. 7. Near View of Outside of Flume

Stresses—The structure was designed for the following unit stresses:

	Lb. per Sq.In.
Concrete-bearing stress	400
Direct compression—massive work	400
Compression in flexure, reinforced	750
Short columns, not over 18 in. diameters. Not hooped	400
Hooped columns	600
Shear in flexure	60
Bond plain bars	60
Bond deformed bars	120
Steel tension	16,000

The structure was designed to resist wind pressure of 30 lb. per sq.ft. in any direction on all exposed surfaces. The range of atmospheric temperature was assumed from —45° to +85°, and full allowance was made in the design for all stresses caused thereby.

Foundations—The foundations for the aqueduct are carried to a depth of at least 7 ft. below the original surface, so as to be sure of getting below any possibility of heaving by frost. At this depth the material as exposed in foundation pits is a stiff sandy clay, which might almost be classed as a weak sandstone. In its natural state or when freshly exposed it is quite firm, but it disintegrates rapidly on exposure to the atmosphere. Test loads were applied to surfaces varying from 36 to 324 sq.in. in area and the sinking under various loadings observed. Under 18 tons per sq.ft., on 36 sq.in., the settlement was about 0.20 ft. when dry and 0.31 ft. when wet. As the service load under maximum wind pressure is only about two tons per foot, the foundations were considered satisfactory.

Construction

Railway sidings were built near the crossing, storehouses for cement and other material erected and a concrete-lined reservoir for water was constructed. A double-track, standard-gage railway, with frequent crossovers, was built along the line of the work on the south side, and a pipe leading from the reservoir to an elevated tank at the west end of the structure laid down, with taps at frequent intervals. Column, girder and brace forms were erected by stiff-leg derricks traveling on skids and working backward as the forms were put up. Outside shell forms were mounted on a carriage which traveled on rails carried by the upper cross-struts, the forms being raised into place or lowered by screwjacks. A locomotive crane was used for various purposes and a Shay engine for switching cars and pulling the outside shell forms ahead.

The pedestals were poured by a portable mixing plant with a dwarf hoist and spout, from four to six pedestals being cast from one setting. As soon as the concrete had set, the forms were stripped and the pits backfilled. For the construction of everything except the pedestals, the concrete hoisting and mixing plant was mounted on flat cars, which traveled on the track nearest the structure. The gravel for concrete was all shipped in by rail in steel side-dump cars. A small reserve storage was kept, but most of the requirements were filled direct from the cars. A special chute with gate was constructed which could be fitted to the cars and which allowed them to discharge directly into the hopper of the mixer, the cars standing on the second track alongside the mixer car.

All reinforcing steel, except that for the shell, was shipped cut to length. All bending and the assembling of the column reinforcement were done in a central yard. The shell steel, which consisted of No. 0000 galvanized-steel wire, was shipped in coils and, after being passed through a straightening machine, was cut to length by a power shear. Steel for braces, girders and the shell was assembled in place and wired.

The first step after the pedestals had been stripped and backfilled was to erect the column forms, which were securely guyed and cross-braced. Forms for the braces, if any, and the girders were next set up and the reinforcement placed in them and wired. The girder cross-struts were precast in yards and hoisted and placed by the locomotive crane. The columns and braces were poured in a single lift, followed by the girders after an interval

to allow for setting and shrinkage. After the concrete had set sufficiently, the column, brace and girder forms were stripped and the track for the outside shell forms put in place (Fig. 7). The outside forms for the shell were then pulled ahead and jacked up to correct elevation, followed by the placing of the shell reinforcement, which was held in position by concrete spacing blocks grooved to hold the wires. Inside forms for the shell were handled from Π-tracks suspended from the cross-struts (Fig. 6), and were placed as soon as the steel had been put in.

The pouring of the shell was done in alternate 80-ft. sections. A good deal of difficulty had been anticipated in making a good job of casting this thin member, and the inside forms first provided had removable panels or doors so that the lower part could be poured from near the bottom. It was found, however, that if a sufficiently fine aggregate were used and the mixture kept very wet, little or no difficulty was experienced, and the doors were abandoned as unnecessary. The secret of success was found to lie in pouring batches alternately from each side, and in rapid work, thus insuring a constant backward and forward movement of the fluid concrete crossways of the shell until it was full. This method made certain that the reinforcement was well surrounded and that no voids were left unfilled. This was only possible because the running foot quantities were small and a whole section could be cast in a short time before the concrete first poured could take its initial set.

It was found in building the experimental section that the shrinkage in setting lifted the concrete off the outside forms. This had been expected, and the inside forms had been stripped as soon as the concrete was sufficiently hard to stand alone on the steep side slopes. The same thing was anticipated in building the aqueduct, and to prevent possible cracking from this cause, the inside forms were stripped within a few hours after pouring.

The construction of inlet, outlet and siphon, apart from rather complicated formwork, presented little that was in any way unusual. As they could be used but once, the forms were built up on the spot and wrecked when the concrete had set.

During construction of the aqueduct temporary bulkheads were built at several points and the shell filled with water for testing. The object was principally to test the efficiency of expansion joints, and no attempt was made to measure deflections. They must have been very small, however, as the leakage under the bulkheads was almost negligible.

Personnel

The general design of the structure and the method of calculating the curve were worked up by the author. The detailed design is the work of H. M. Gibb. A. S. Dawson was the Chief Engineer for the railway company. The contractors were Grant Smith Co. & McDonnell, Ltd., of Vancouver, R. V. Engstrom being their Superintendent of construction.

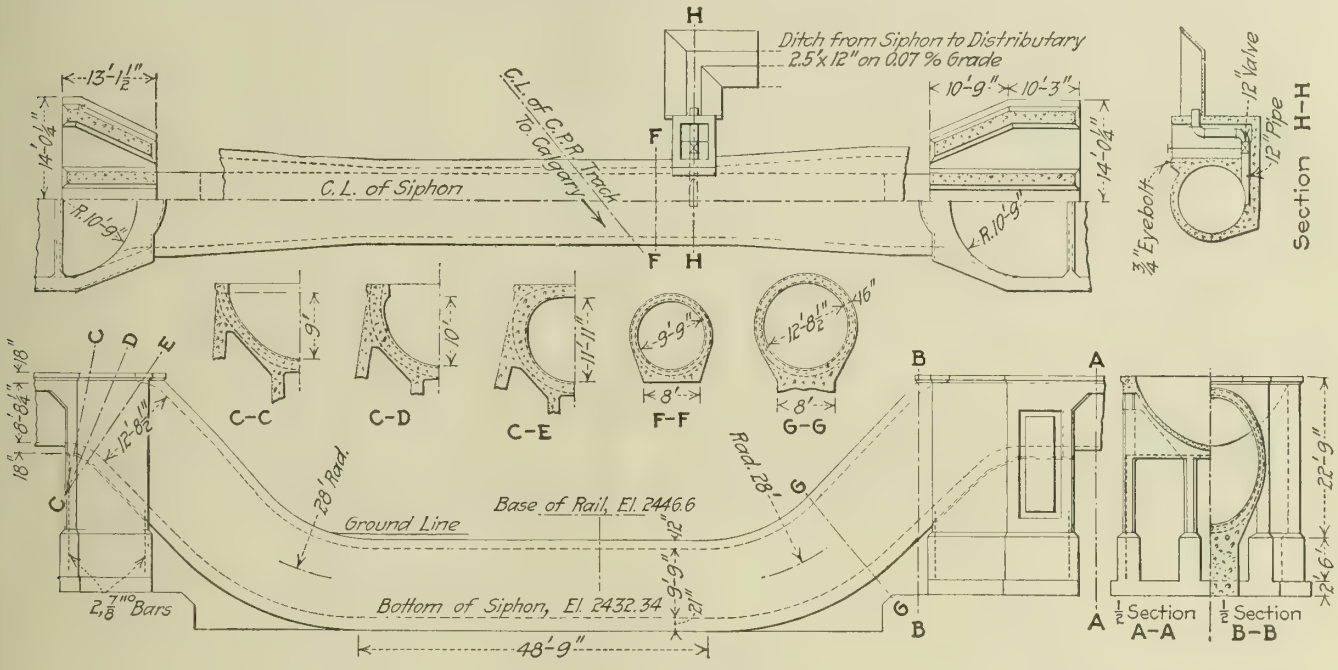


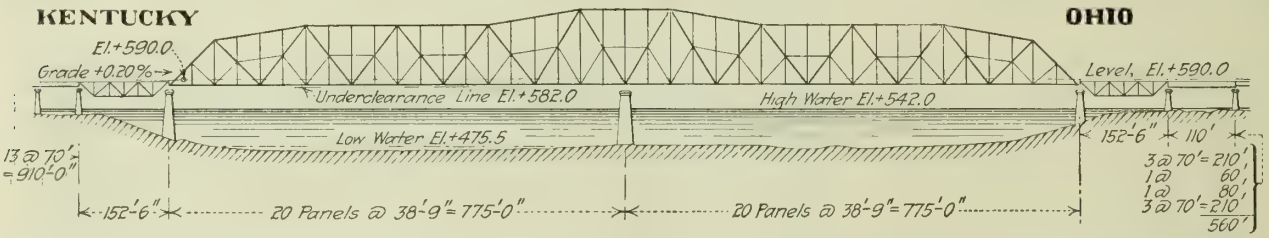
Fig. 8. Details of Siphon Carrying Brooks Aqueduct under Railway

Street-Railway Cars in Christiania—The excellent electric street-car service and the luxurious-looking street cars in Christiania, Norway, are mentioned by Commercial-Attache Henry D. Baker, of Petrograd, in a recent report to the United States Department of Commerce. The Christiania street cars are painted bright red, green, blue, etc., according to the lines on which they are operated. They are conspicuous for their large windows and clean curtains. The device so familiar to street-car patrons in the United States, namely, the strap, is absent, but on the backs of the seats (which face forward) there are small niches which afford passengers standing in the aisle convenient grips for the hand. On the platform are small metal receptacles into which passengers can throw used-up tickets, remains of cigars, etc., instead of dropping them onto the floor. Mr. Baker mentions an interesting advertising device he observed on these cars: Across the ceiling of the car, midway between the two ends, is a double-faced clock bearing the advertisement of a certain locally made shoe. A clock is always an object of interest and attention, so in this case the advertisement must perforce be read. On the outside of the cars are a number of hooks to which passengers can attach their skis. The fare within city limits is the equivalent of three cents; to outlying districts about eight cents. The conductor is paid $27.04 per month net after deducting payments for uniforms, sick funds and widows' pensions. The population of Christiania is about 250,000, but within a range of 10 mi. there are 750,000 people.

Long-Span Continuous-Truss Bridge over the Ohio

SYNOPSIS—Requirement of two 750-ft. openings led to adoption of two-span continuous truss; first large bridge of continuous type in America; piers on rock, eliminating the question of settlement; triangular web system with all joints riveted; enormous gussets required; floor-beams of U-shape, sides extending up the posts to the bottom of the swaybracing, which reduces the bending-moment in the floor-beam nearly one-half; traction truss in every panel; no expansion joints in floor

Striking departure from conventional practice in bridge design is found in the Chesapeake & Ohio Northern Ry.* bridge which is now under construction over the Ohio River at Sciotoville, Ohio. The consulting engineer, Gustav Lindenthal, of New York, who worked out the design of the bridge and viaduct approaches and is directing the construction, decided upon a two-span continuous-truss bridge as best suited to the conditions. The bridge has two equal spans of the extraordinary length of 775 ft. each, continuous over the center pier. Since the continuous truss is practically unknown in American bridge practice except for its use in swing bridges, the radical character of the Sciotoville design is evident.



New Double-Track Bridge Over Ohio River for Chesapeake & Ohio Northern Ry. at Sciotoville, Ohio

Continuous Spans

The river is about 1500 ft. wide at the bridge site, and makes a sharp curve with the channel near the inner, or Kentucky, side. At high water, however, the river traffic shifts over to the Ohio side. These circumstances made it desirable to have two large openings, fixed by the War Department at 750 ft. This called for two spans of about 775 ft. between centers of piers. A comparison among various designs consisting of successive simple spans, cantilever trusses and continuous trusses showed a decisive economy for the adopted design, in addition to which it has the advantage of symmetrical appearance.

Foundation conditions for the river spans are excellent. Rock was found in the middle of the river at an elevation of about 10 ft. below low-water level, and it extends nearly horizontally across the river. Since the concrete piers will rest on solid rock, settlements are not to be expected, so that one of the common objections to the continuous type of bridge is not present in this case.

*The Chesapeake & Ohio Northern is a new branch line of the Chesapeake & Ohio Ry., to connect the main line of the latter on the Kentucky side of the Ohio River with the Hocking Valley R.R. at Columbus, Ohio. It crosses the Ohio at Sciotoville, about 120 mi. above Cincinnati. The new line is projected for heavy freight traffic, principally coal trains, for which reason the grade has been limited to 0.2%, compensated on curves.

The principal dimensions of the river spans are as follows:

Total length c. to c. end piers	1550	ft.
Span length c. to c. of piers	775	ft.
Clear height above low water	106½	ft.
Clear height above high water	40	ft.
Height of trusses at center pier	129	ft. 2 in.
Height of trusses at ends	77	ft. 6 in.
Width between centers of trusses	38	ft. 9 in.
Panel length	38	ft. 9 in.

The two large channel-spans are being built double-track. The approach viaducts, on the other hand—consisting largely of plate-girder spans 67½ to 110 ft. long—are being built for the present with steelwork for one track, while the masonry is built to accommodate a future second track.

Triangular Web System, Riveted Joints

A Warren web system was applied to the adopted truss outline, with main-panel length 155 ft., subdivided by verticals and by a substrut system.

Most chord and web members being subject to both tension and compression, on account of the continuous design and the web system employed, it was decided to make them stiff throughout. It appeared also that no saving could be effected by the use of eye-bars for the few members taking tension only.

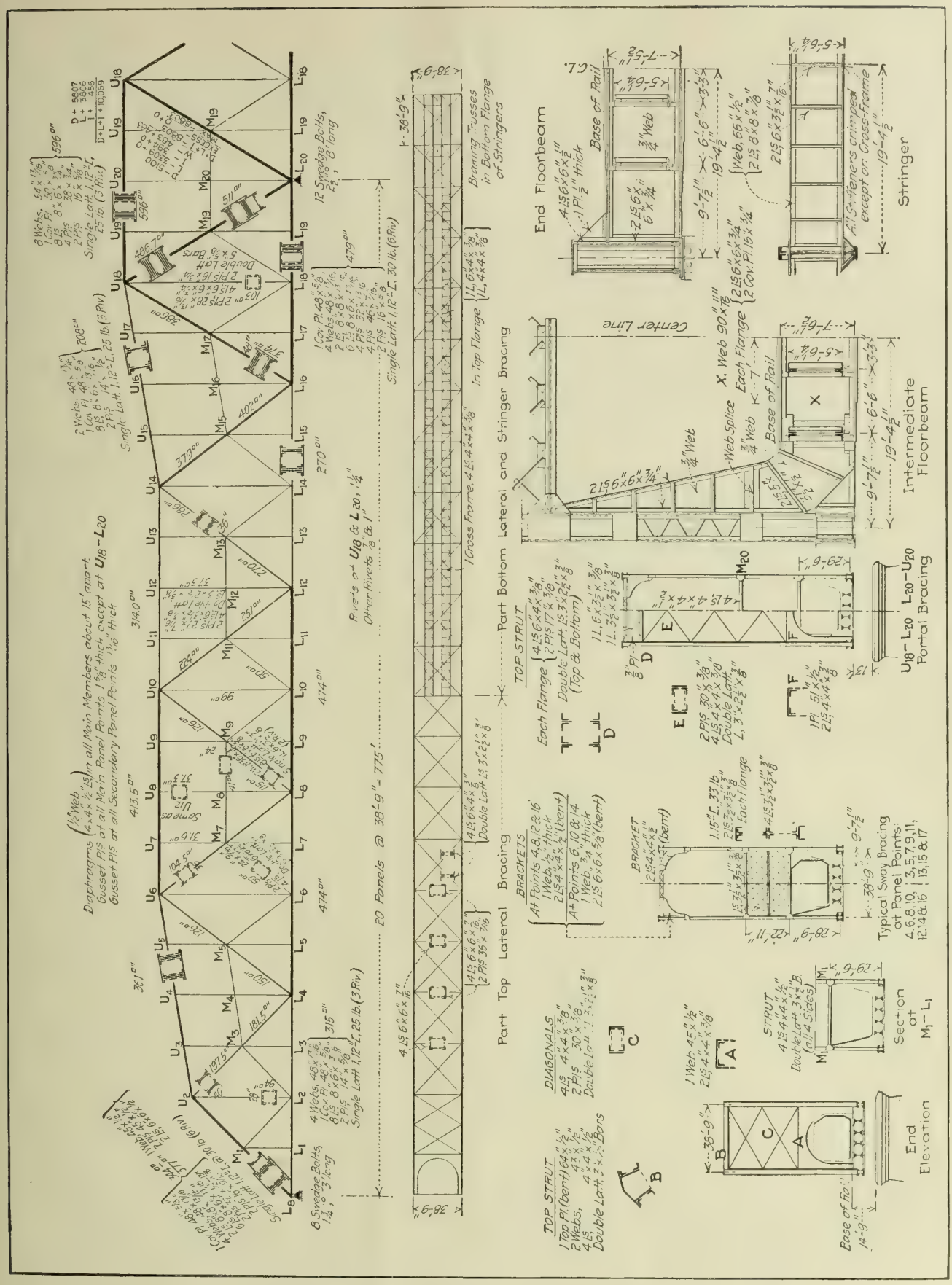
Pin connections being considered undesirable for members subject to reversal of stress, it was decided to use riveted connections throughout and thereby secure greatest possible rigidity. These spans will be the longest and heaviest of the fully riveted type built in America.

The riveted connections involve tremendous gusset-plates, larger, in fact, than those of the Hell Gate arch and of the same thickness—1⅝ in. The facilities of mills and bridge shops will be taxed to the utmost in providing these gussets.

Even so, it was not possible to provide gusset connections of the ordinary type at panel-points U18 and L20 (that is, at both ends of the main-pier diagonal). The stresses in the members that connect at these points are so great that it was found impracticable to make the connection to the gussets with rivets in double shear without exceeding the obtainable size of plates. Therefore, each web-plate of the top chord and diagonal members, as well as the gussets at U18 and L20, was made of four $\frac{13}{16}$-in. plates so arranged that the rivets can transmit the stress in shearing in four planes. The aggregate thickness of each gusset at these two points is 3¼ in.

Sizes and weights of individual parts in the bridge are given by the following tabulation:

Heaviest chord member, 4x4½x77½ ft.; cross-section, 596 sq.in.; weight, 228,000 lb.



STRESS SHEET AND DETAILS OF CHESAPEAKE & OHIO NORTHERN RY. AT SCIOTOVILLE, OHIO

EXCESS LOAD PROVISIONS IN SCIOTOVILLE BRIDGE

Wind load, top chord, 800 lb. per lin.ft. bridge.
Wind load, bottom chord, 700 lb. per lin.ft. bridge.
Wind load, train, 500 lb. per lin.ft. bridge.
Lateral force, 10% of live-load of one track.
Braking, 670 lb. per lin.ft. truss.
Excess = (W. + Br.) — 20% (D + L + I + Lat.)

Field connections of stringers to floor-beams not riveted up until span is completely erected and self-supporting. Field connection of diagonal M19 — L20 to bottom-chord gusset not reamed to full size or riveted up until span is self-supporting.

Heaviest web member, 4x4½x75 ft.; section, 511 sq.in.; weight, 166,000 lb.

Largest gusset-plates, 135x1⅝ in. by 14 ft. 9 in., and 140x1⅛ in. by 18 ft. 2 in.

Heaviest casting, 45,000 lb.

Largest rivets, 1¼-in. diameter by 7⅝-in. grip.

Each center bearing carries a dead-load of nearly 5000 tons and a live-load of 3000 tons.

All joints of members, whether in tension or compression, are fully spliced.

Floor-Beam Construction

The floor is no less remarkable than the trusses. The floor-beams are U-shaped frames, with sides extending up the posts to the bottom of the sway-bracing. This new form was used because of the shallow depth available; ordinary floor-beams would not have been as rigid and would have weighed considerably more. The computed center moments of the U-shaped floor-beam and of the end floor-beam—which is of ordinary construction—are 6,300,000 and 8,197,000 ft.-lb. respectively, and their flange areas are 42.63 and 55.17 sq.in.; but the end floor-beam carries only half a panel-load, and its moment and flange area must therefore be increased in ratio of the end shears (including impact) to compare the two types fairly. Making this correction, the plain floor-beam has a moment of 11,700,000 and a flange area of 78.8, against 6,300,000 and 42.6 for the U-shaped floor-beam. This reduction of bending moment is, of course, due to the fact that the upper ends of the U are held apart by the swaybrace strut.

The deflection as well as the moment of the floor-beam is greatly reduced, and the bridge as a whole is stiffened transversely.

Transverse stiffening and bracing effect is further secured by the type of sway-frames and portals employed. Solid plate-girder portals, forming an inverted U which extends down to floor level, are provided in the planes of the inclined posts at end and middle piers. For intermediate sway bracing, in place of the diagonal sway bracing ordinarily employed, deep lattice-girders and curved knee-brackets are used.

Traction Truss in Every Panel

In each panel in the plane of the bottom lateral bracing a truss is provided to transmit the longitudinal "traction" due to braking of trains directly to the trusses without bending the floor-beams. The arrangement is shown by sketch in the drawing.

No expansion joints are provided in the floor system. However, to prevent setting up chord tension in the stringers, the stringer connections are not riveted up until the spans are swung.

Design Loading

The design and details were worked out with a view to obtaining a strong, rigid structure that would meet the demands of the heaviest immediate and future traffic. The live-load is E60 on each track. The dead-load (weight of steel 13,500 tons) amounts to 18,800 lb. per lin.ft. of bridge. A lateral force equal to 10% of single-track live-load is counted. The braking force amounts to 670 lb. per lin.ft. per truss. Wind was figured as 800 lb. per lin.ft. of bridge on the top chord, 700 lb. on the bottom chord, and 500 lb. on the train. An excess stress was taken into account in all members subjected to various kinds of stress, of an amount equal to the excess of wind and braking force over 20% of the sum of dead- and live-loads plus impact and lateral force. The impact allowance is as per Gustav Lindenthal's formula (Engineering News, Aug. 1, 1912). Secondary stresses and erection stresses received special investigation in relation to and because of the rigid gusset-plate connections.

Medium Steel

For this bridge a somewhat harder material is specified than ordinary commercial bridge steel. The specification calls for steel of ultimate strength 62,000 to 70,000 lb. per sq.in., which exceeds by 5000 or 6000 lb. the standard bridge steel of today. At the same time a bend test fully as severe as that required of bridge steel is demanded—180° cold bend flat.

Alloy steels at present prices showed no economy over carbon structural steel.

Erection

The bridge will be erected partly on falsework, partly by cantilevering out from the middle pier over the channel. An opening of 350 ft. has to be maintained in the channel for river traffic.

The bridge is being built by the C. & O. N. Ry. (G. W. Stevens, President; M. J. Caples, Vice-President). The design and detail plans of the bridge and approaches were worked out by Gustav Lindenthal, Consulting Engineer, New York, who is also in charge of the execution of the work. The foundations and masonry are being built by the Dravo Contracting Co., Pittsburgh. The contract for fabrication and erection of the steel superstructure has been let to the McClintic-Marshall Co., Pittsburgh, Penn.

Construction work on the foundations was started in November, 1914. It is expected that the bridge will be completed and ready for traffic by November, 1916.

Increasing Ontario Hydro-Electric Power—The total revenue from the Niagara hydro-electric system for the six months ending Apr. 30 was $710,324, according to returns just received by the Ontario Hydro-electric Commission from 84 municipalities, railways and large users of power in the Niagara district. Of this sum $353,508 was expended for power, $155,120 for interest charges, $49,696 for maintenance, $30,815 for operating expense and $1156 for engineering and auditing. Of the balance, $69,808 was devoted to the sinking fund and $50,221 to the depreciation reserve. At the end of April the total consumption of power under commission control was approximately 88,000 hp., of which Niagara contributed 75,281 hp., the Ottawa, Port Arthur, Big Chute and Wasdels Falls developing the rest. At the present rate of increase the remainder of the 100,000 hp. contracted for with the Ontario Power Co. will be required before the end of the year. Having in view the early exhaustion of the supply now under contract, the commission is preparing plans for submission to the Ontario government for the development of new power. It is understood that these plans will provide for an ultimate total development of 250,000 hp. and that the bulk of this will probably be derived from developments upon the Welland Canal and a proposed public development on the Niagara River. New schemes, however, are under consideration. Contracts for the construction of the distributing stations and connecting line of the Eugenia Falls development were recently let. Adam Beck, chairman of the Ontario Hydro-electric Commission, states that the territory covered by the operation of the system is being rapidly extended. During the last two months the commission has concluded contracts with 17 additional municipalities for supplying electricity, and 14 others have made application for it and will submit by-laws to their citizens for authorization to make contracts. The system is now operating 2200 mi. of transmission lines, outside of the local distribution systems of the municipalities, and an additional 200 mi. is under construction.

Useful New Facts About Materials

The following short articles have all been abstracted from papers, with discussions, presented to the annual meeting of the American Society for Testing Materials, held June 22 to 26, 1915.

New Testing Devices

Every year some new testing device or machine is brought forward. Three of the more important described at the meeting are a bin-pressure scale, a peculiar arrangement to study cylinder lubrication, and a Charpy impact machine. On p. 66 a well-designed wire extensometer is described.

Apparatus for Determining Pressures on Walls

A comparatively simple testing apparatus has been devised by J. Hammond Smith, of the University of Pittsburgh, by the use of which laboratory determinations may be made of the pressures on walls or in bins of any kind of filling. The device consists essentially of a vertical bin with one face hinged around its lower end and so connected to a series of multiplying levers and scales that the side pressure of the fill may be easily calculated in direction, location and magnitude. The arrangement is quite ingenious, but the limitations of size and conditions of fill would seem to detract from its practical value.

Lubrication-Testing Machine

A machine was described by A. E. Flowers, of Ohio State University, for testing engine-cylinder friction and the effect of different lubrication under varying conditions of piston-ring pressure, steam-pressure and temperature. In a long steam cylinder there were two pistons connected by a rod and having steam admitted to the space between them. A long driving rod, with ball-bearing end connections, led to a special electric motor with which close speed adjustment and accurate load determination could be made. The outfit included also a high-pressure superheating flash boiler.

It was found that to maintain constant friction required a liberal supply of lubricant, most of which was carried out directly with the exhaust. Reducing the supply of lubricant brought about an increase of friction within 5 min. Increasing the supply brought a reduction within 15 min.; but with low steam pressures or when starting with dry piston surfaces, it often took 2 hr. to reach a consistent low value. Continued increase of lubricant did not reduce friction below a certain minimum. The coefficients obtained were all large, 3 to 4 per cent. or more, and very much larger than the values found in well-lubricated bearings. The coefficients obtained and the amount of lubricant necessary were greatly modified by the presence of steam and by the difference of steam pressure on the two sides of the piston.

Impact Steel-Testing Machine

The Charpy machine, for chopping through small specimens of steel and measuring the energy absorbed at the break, was described by J. J. Thomas in the paper entitled "Charpy Impact Test on Heat-Treated Steels." A pendulum hammer with knife, capable of delivering a blow of 217 ft.-lb. energy, showed the work left in it after striking by recording the angle of upswing past the broken specimen. Experiments showed no effect of flaring the test-bar notch out to an angle of 30 deg. The tests cited appeared to distinguish degrees of brittleness, but four or more tests were advised to avoid discrepancies of single specimens.

Fusibility of Coal Ash

Excessive clinker troubles with some coals are bringing a growing demand for including in specifications for the purchase of coal a limit to the fusing or softening temperature of the ash. Tests to determine softening temperatures were reported by A. C. Fieldner, A. E. Hall, and A. L. Feild, of the U. S. Bureau of Mines, in the paper entitled "Fusibility of Coal Ash." Comparative studies were made of 18 types of coal ash in six different furnaces under various oxidizing and reducing atmospheres.

The ash was made up into three different sizes of pyramids, similar to Seger test cones. A slender type, $\frac{3}{16}$-in. base by 1 in. height, was the most satisfactory in giving shorter and more definite softening intervals and less trouble from evolution of gases. The most satisfactory indication was obtained by mounting the cone with one side vertical. Further inclination was undesirable and led to premature falling. When the ash had been ground to an impalpable powder the cones tended to soften at slightly lower temperature than when made with ash merely passing a 100-mesh screen. The slower rates of heating gave lower softening points; a rate of above 10 deg. C. per minute led to inaccuracy. Below 2 deg. C. per minute made the runs too tedious. It was recommended that a rate of 5 deg. C. per minute be maintained up to initial deformation and that then this be reduced to 2 deg. C. per minute.

The atmosphere in which the ash was heated proved to be the most important factor in varying the softening temperature. The highest softening points were obtained either in air or carbon monoxide; the lowest temperatures were obtained in a mixture of hydrogen and water vapor, ranging from 30 to 70 per cent. water vapor. Analysis of the cones which had been melted in an atmosphere of 50:50 per cent. hydrogen and water vapor showed that the iron oxide in the ash was combined principally in the ferrous state similar to the condition actually found in fuel-bed clinkers.

It was recommended that such tests should be carried out in an atmosphere of 30 to 70 per cent. water vapor in hydrogen, under conditions easily reproducible in different laboratories.

Deterioration of Bitumens

Samples of three gas-house tars, two coke-oven tars, two water-gas tars, one blast-furnace tar, one pine tar, one stearine pitch, two refined asphalts, one fluxed grahamite, one fluxed gilsonite, one straight-run California asphalt, one straight-run Mexican asphalt, one blown fluxed Texas asphalt and one straight-run fluxed Texas asphalt were exposed to the effects of overheating, "gas drips," illuminating gas and sunlight and air to study their deterioration. The results were presented by S. R. Church and J. M. Weiss in the paper entitled "Some Experiments on Technical Bitumens."

In studying the effect of overheating, 50 grams of pitch, or 45 grams of asphalt, were heated for 2 hr. in an open iron crucible, at 400 deg. F. for the pitches and 450 deg. F. for the asphalts. The pitches, excluding the blast-furnace tar and pine-tar pitch, showed an average loss of 6.2 per cent., compared with 3.8 per cent. for the asphalt. The increase in melting point of the pitches averaged 24 deg. The increase for the asphalt was 20 deg. The results indicated that moderate overheating had no serious effect.

"Gas drips" is a condensate from illuminating gas found more or less in all gas mains. It often leaks into the ground and destroys bituminous materials used in waterproofing foundations, etc. In studying its action on these pitches thin films (0.012-0.019 in. thick) of the bitumens were placed over perforated papers on special glass tubes. The tubes were immersed in a beaker of the drips so as to give a pressure head of 1 in. of liquid on the bitumen film. The time in minutes required for penetration was noted. The asphalts required from 1 to 4 min.; water-gas tar, 3 to 5 min.; the coke-oven and coal-gas tars, from 99 to 135 min.

In studying the action of illuminating gas, bitumen samples were maintained at 60 deg. F. in an atmosphere of gas for six days. There was an almost inappreciable gain in weight of the tar, while the asphalts took on from 2 to 4 per cent. There was an appreciable softening of some asphalts and of the water-gas tar pitches.

In making the air and sunlight exposures, the samples were exposed on petri dishes in a dustproof box with a glass top. Air circulation was provided by side vents filled with cotton and protected by a dashboard. They remained in this box on a roof for one year. The changes in the bitumens were not very marked, either in chemical or physical properties. The tar pitches showed an average increase in melting point of 3 deg. F. and the asphalts an increase of 16 deg. F. The pitches showed a decrease in penetration at normal temperature of 21 deg. and the asphalts a decrease of 23 deg. None of the bitumens showed any measurable increase in matter insoluble in benzol, but two gas-house tar pitches and one asphalt increased from 2 to 6 per cent. in matter insoluble in carbon tetrachloride.

New Test for Galvanizing

The paper entitled "Determination of Spelter Coating on Sheets and Wire," by J. A. Aupperle, proposed a new test for quantity of galvanizing to replace the Preece copper-sulphate and the Walker lead-acetate tests, the former being inaccurate and the latter requiring too much time.

The method hinges on using a small amount of antimony chloride in a hydrochloric-acid dip. The chloride appears to hasten the solution of the coating and, after the iron is exposed, plates a thin film on the base metal to retard attack. The small amount of antimony that plates out on the surface of the iron can easily be removed by scrubbing under running water.

For determining the weight of sheets several samples 2¼ in. square are cut from various parts. About five of these are weighed together and immersed singly for one minute in 100 c.c. of hydrochloric acid (sp.gr. 1.2) to which has been added 5 c.c. of an antimony chloride solution (20 grams in 1000 c.c. of hydrochloric acid). The dip can be used for the five samples, but 5 c.c. of the antimony liquid should be added for each sample on account of the metal deposited. Samples are washed and scrubbed under running water, dried with a towel and laid in a warm place for a few seconds. The samples are weighed together and the number of grams lost is divided by the number of pieces used. Each gram corresponds to 1 oz. of coating per sq.ft. of sheet (1 oz. per 2 sq.ft. of galvanizing).

In testing wire the length of sample should be chosen so that the number of grams of coating represent the number of ounces per square foot. (This varies from 12.1 cm. length for No. 0 gage to 49.5 cm. for No. 14 gage.) Only one-half the amount of antimony chloride is added to the acid on account of wire exposing one-half the area of plate. The coating on galvanized sheets, while expressed in ounces per square foot, considers metal on both sides of each square foot, in reality representing 2 sq.ft.

Surface Decarburization of Heat-Treated Steel

It is known that loss of carbon at the surface of heat-treated steel frequently exists and defeats the object of the treatment. J. G. Ayers, Jr., in the paper "Micrographic Determination of Surface Decarburization in Heat-Treated Steels," described a physical method of quantitatively studying decarburization. The steel under study was first heated to 1000 deg. in an atmosphere of nitrogen, so as to make the carbon-bearing portions visible without reduction of surface carbon content. The specimens were polished, etched and photomicrographed. From the prints the proportion of sorbitic pearlite present was estimated and the per cent. carbon deduced from that. The method was illustrated by study of one case where the mill process was a greater factor in surface decarburization than the heat treatment.

Molten Zinc for Etching Iron and Steel

A paper entitled "Molten Zinc as a Reagent for the Macroscopic Etching of Iron and Steel," by J. L. Jones, described a method for making visible, on a large scale, porosity, lack of homogeneity, cracks, blisters, seams, overlaps and other defects usually covered in rolling and forging. The scheme employed the action of molten zinc in dissolving highly carbonized steel.

Some typical tests were described. Bars of various materials were suspended in a galvanizing pot; on taking them out the dross was broken off with a hammer while hot and the coating of metallic zinc was removed by immersion in dilute sulphuric acid. Some specimens of high-speed tool steel had their surface deeply pitted and grooved, due to imperfect alloying of ferro-tungsten, etc. Several carbon-steel samples were eaten away remarkably; they showed also a curious shelly structure and apparently concentric layers of steel, as though the metal had not been sufficiently plastic to fill out the grooves in the mill rolls. A few sections of bessemer-steel rails which seemed perfectly solid before etching showed the web part of each sample to be spongy. A defective axle which failed in service showed a pipe. A rejected piece of die

steel showed a blistered portion deeply etched. A broken high-speed tool was not attacked on the hardened end, but the other was eroded.

Defective Battery Zincs

In the paper entitled "Battery Zincs; Some Causes of Defective Service," Robert Job and F. S. White described the physical examination of some poor battery zincs bought for the signal system of the Lehigh Valley R.R. Comparative chemical analyses of satisfactory and unsatisfactory shipments did not explain the trouble. Transverse sections were taken from several samples, polished and etched lightly with ammonium sulphide acidified with hydrochloric acid. The satisfactory zincs were fine-grained and of uniform structure; the unsatisfactory ones were coarse-grained and had a band of white metal around the outside. The inference was that they had been poured at too high temperature and that this had volatilized the mercury usually added to the metal.

Cracking of Copper Alloys

Further investigations of the service behavior of manganese bronze, naval brass, muntz metal and gunmetal was reported in the paper "Fatigue of Copper Alloys," by Ernst Jonson, New York Board of Water Supply. Tension-test specimens were stressed before and during corrosion.

The results of the investigations were generalized as follows: (1) Prolonged excessive stress does not injure the metal when it is protected from corrosion while under stress; (2) corrosion does not generally injure the metal when not accompanied by excessive stress; (3) corrosion accompanied by prolonged stress of less than 20,000 lb. per sq.in. does not generally injure the metal; (4) corrosion with ammonia accompanied by a prolonged stress of 20,000 lb. per sq.in. or more causes cracking similar to season cracking.

Ammonia appeared to be a representative corrosive agent, although it attacked these alloys more quickly than the average. Therefore, the ammonia reaction was regarded as an accelerated test, which in a few hours produces results that would ordinarily require days or months to develop. It was recommended that copper alloys in general should never be stressed beyond 20,000 lb. per sq.in. and that the process of manufacturing copper-alloy rods should be planned so that no appreciable initial tensile stress is left in the metal.

The Microstructure of Concrete

From a study through the microscope of the polished surfaces of opaque specimens of concrete Nathan C. Johnson has developed certain facts about the structure of concrete from which deductions as to the deterioration may be made. The facts and the deductions taken serially are: (1) The individual pieces of aggregates, both fine and coarse, in concrete are not in that close proximity one to the other that the void-filling theory (that is, that the aggregates are so proportioned in regard to voids that they all join together in an approximately complete solid) would predict. In consequence, too great a part of concrete is made up of the cement matrix, the weakest element in the mixture. (2) Large quantities of occluded air, in relatively small bubbles widely dispersed, reduce the actual concrete volume in a mass of concrete, with consequent reduction in possible strength. (3) Aggregations of solid particles commonly observed under the microscope and obviously not sand nor individual particles of cement appear to be unhydrated cement, thrown into groups because the surface tension in the water at the time of mixing prevents the dispersion of water to all the cement particles; in consequence the little groups of unhydrated cement are surrounded by shells of hydrated cement which the water did reach. These unhydrated portions are zones of danger because of possible future crystallization and expansion if water ever does reach them. Such crystallized zones are observable under the microscope. Experiments to discover some means of reducing surface tension as a remedy are incomplete and unsatisfactory, though Mr. Johnson considers such a remedy within the range of possibility.

In the discussion H. L. Spackman disagreed with Mr. Johnson in regard to the last-mentioned observation. He does not consider that the groups of unhydrated cement were segregated by the behavior of the water under surface tension but are merely the larger particles of cement. Groups of the same appearance can be observed in any normal clinker. This, if true, would destroy the value of any method of reducing surface tension. Mr. Spackman contended that the void tests for aggregate should be made on a wetted material from which water had been drawn by a vacuum pump, as an approximation of the conditions in concrete-making. He also doubted Mr. Johnson's zones of crystallization, saying that in all probability they were mere shrinkage cracks. P. H. Bates agreed with Mr. Spackman, and further pointed out that an extremely wet concrete, mixed much longer than is common, might avoid some of the troubles discovered by Mr. Johnson. Cement in a concrete mixture will continue to take up water of hydration for a very long time.

An Extensometer Rig for Wire Tests

In the laboratory of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penn., tension tests of 240-in. lengths of wire are made with extensometer readings to 0.0001 in. T. D. Lynch described the extensometer arrangement in a paper on "Elastic Limit." The wire is suspended vertically in a 2-in. iron pipe, the lower end of which branches into two parallel pieces of pipe to which a cross-bar is clamped. An insulated micrometer screw mounted in this cross-bar can make electrical contact with a steel ball fixed in the bottom of a scale-pan hung to the wire and serving to apply load to the wire by laying weights in the pan. The micrometer screw has a large dial which reads direct to 0.0001 in. Before test, the wire is annealed and straightened by hanging a weight to it and heating the wire electrically until permanently straight. During the test the temperature of pipe and wire is maintained approximately constant by passing a gentle current of air down through the pipe.

With this rig a tension test on copper wire can be made to give an excellent straight line up to the limit of proportionality.

[*Further abstracts of a similar nature will appear in an early issue.*]

Deep Bridge Piers Sunk Without Air

SYNOPSIS—Difficulties encountered in placing concrete foundations for a bascule bridge of D., L. & W. R.R. at Buffalo, N. Y. Six piers sunk 70 ft. through five varying soil strata; open-cylinder method attempted in all cases, but resort to air necessary in two.

In connection with extensive river improvements which are being carried on by the city at Buffalo, N. Y., the Delaware, Lackawanna & Western R.R. is required to reconstruct its bridge over the Buffalo River and to provide a bascule lift span. At this point an extensive piece of track-elevation work is in progress whereby the grade crossing with the Buffalo Creek R.R., the Pennsylvania R.R. (Chautauqua Division), and the Nickel Plate R.R., is being eliminated. The tracks of the Lackawanna are raised 22 ft. at the river and 26 ft. at the crossing of the railroads named. The reconstruction of the bridge has nothing to do with the track elevation aside from the fact that it is located within the limits of the grade-crossing elimination work.

The City of Buffalo is deepening the Buffalo River and, at the site of the bridge, slightly altering its course. This improvement was started in 1911, and the new bridge had to be completed this summer so as to be ready when the river improvement reached it. The width of the improved channel will be 190 ft. at the bottom, with 256 ft. between dock lines.

The depth of channel below mean low water will be 23 ft. Mean low water is elevation —3 with respect to city datum, and the normal difference at present between mean low water and mean high water is about 9 ft. This difference will be less after the enlarged channel is completed.

The new bridge is located substantially on the site of the old one, the west abutment of the new structure will be located at the center pier of the old one, and the removal of this pier was included in the foundation contract. Originally, the track centers were 13 ft. In order to permit the construction work, both at the bridge and throughout the elevation zone, to be carried out without interruption and still maintain certain important track connections, it was found desirable to spread the main tracks to 83-ft. centers, each track being moved out the same distance from the center line. The old bridge, consisting of four single-track through-girder spans 116 ft. 6 in. c. to c. (two for each track), was shifted accordingly and carried on pile bridgeseats. These girders were originally designed and fabricated so that they can be used either as through or deck girders. They will be used eventually as deck spans in the completed structure. Track centers on the completed work will be 15 ft.

The New Bridge

The new double-track bridge will consist from east to west of a deck span 42 ft. long c. to c.; a tower span 36 ft. long; a Strauss trunnion bascule lift span 125 ft. c. to c., giving a clear channel of 110 ft.; one deck span 116 ft. 6 in. long, composed of the girders from the old bridge, as noted; a deck span 44 ft. long c. to c.; a deck span 116 ft. 6 in. long. The last-named span is temporary and is required in order to maintain the present channel until the river improvement is completed, after which it will be removed and the embankment extended across the old channel.

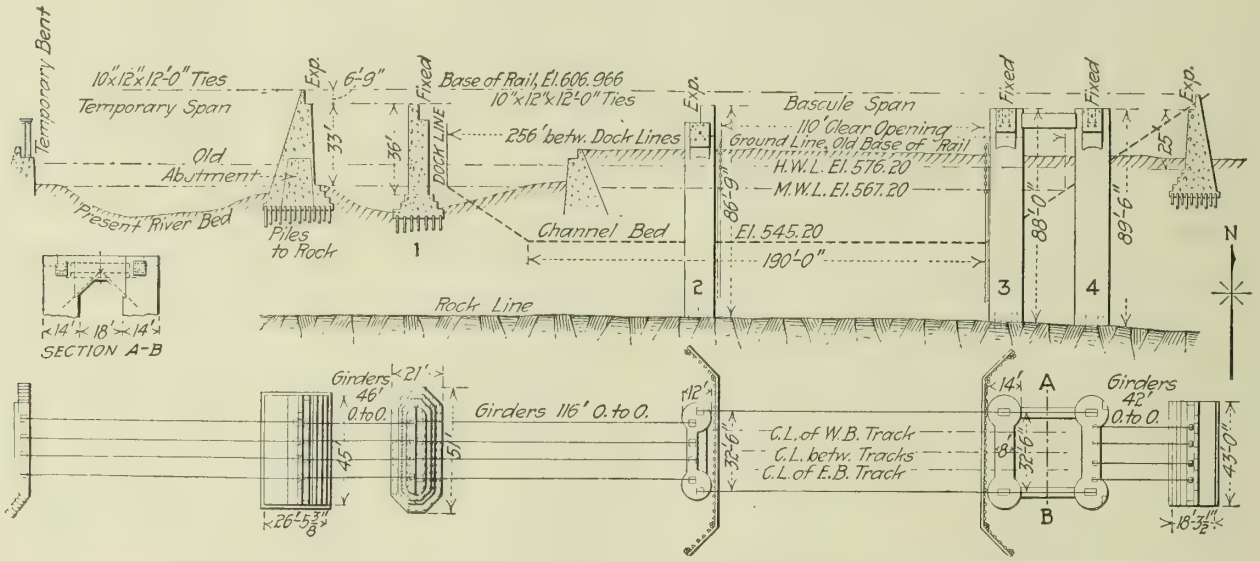


Fig. 1. Masonry Plan of New Bascule Bridge of D., L. & W. at Buffalo

Soil Conditions

Borings were made on both sides of the river as near as possible to location of piers and abutments. Rock was found to be about 70 ft. below the ground (track) level with five soil strata intervening (Fig. 2). First came 5 to 6 ft. of fill (railroad embankment); then about 13 ft. of alluvial material containing some butternut logs; third, a sand-and-gravel stratum of approximately the same depth. The lower part of this stratum was very compact. The fourth stratum was a reddish clay about 25 ft. deep completely impervious to water, but fully as plastic as soft putty. Last came a stratum of variable material: Very fine and tightly packed sand; sandy clay; hard red clay; very plastic red clay; and immediately overlying the rock from one to two feet was a hardpan of finely pul-

verized limestone which, under great pressure, had taken on the character of hard shale. In this last stratum were found boulders of sizes varying from one-man stone to 5 cu.yd. Some mention of these boulders will be made later.

Abutments and Pier 1

Because of the character of the material to be encountered, as determined by test borings and data secured from the piledriving for temporary structures, it was decided to carry all piers except Pier 1 to rock at a depth of 70 ft. The abutments, being of the buried type, are carried on piles driven to rock (53 ft. below cutoff at elevation —3) and loaded to a maximum of 18 tons each. The driving for the east abutment was done without incident. At the west abutment some difficulty was experienced because of boulders encountered, and eight or nine additional piles were driven on this account. When the work is completed both abutments will be buried as shown in Fig. 1.

Work first started on the east abutment and the sheetpiling for the coffer-dam was in place June 14, 1914; excavation was commenced six days later. This abutment was completed Aug. 23. An orange-peel bucket on a 20-ton locomotive crane was used to take out all the excavation except at Pier 1 and the west abutment, which are located in the present river channel. The spoil was loaded on 20-yd. side-dump cars running on a temporary track, and was hauled out and used in the fill for the track elevation a short distance from the bridge.

The coffer-dam and foundation piles for the west abutment and Pier 1 were put down by a floating driver. This portion of the work was commenced July 6, 1914. The scow supporting the driver was built on the job by company forces, of material from an old Howe truss. It was originally constructed and used to drive the piles supporting the old bridge in its temporary location. The foundation piles were driven, using a follower, before the coffer-dam was constructed. The coffer-dam of Wakefield sheeting was driven 2 ft. below the gravel stratum as shown by the test-borings. With tight sheeting, therefore, the foundation pit should have been free of water.

On account of the very compact character of the lower portion of this stratum some difficulty was experienced

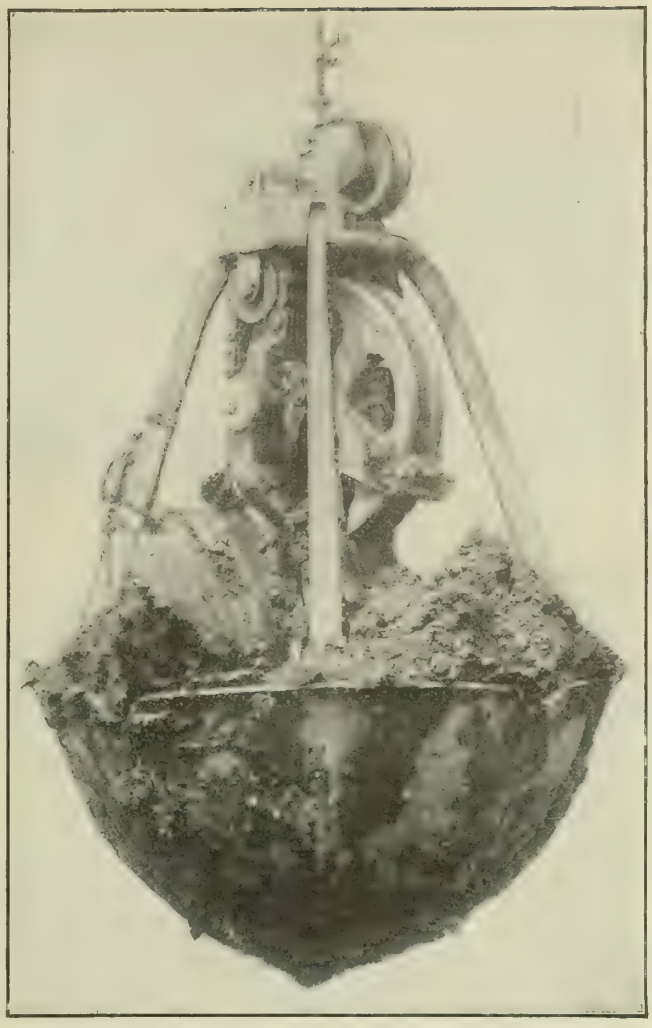


Fig. 3. Bucket Used for Dredging Cylinders
Especially heavy (about 5000 lb.) "Multi-Power" orange-peel bucket built by the Hayward Co., New York

in putting down the sheeting, and considerable leakage occurred. All these leaks were closed with plank-and-canvas patches and by damming off with clay taken from the cylinder excavations. The most serious leak occurred on the north side of the coffer-dam for Pier 1, where a buried log was encountered. The sheeting was forced so far out of line that this leak could not be controlled, and a second line of sheeting (Lackawanna steel sheetpiling) was driven around it. After all the large leaks had been closed off, water still appeared in such quantities that a 6-in. centrifugal pump was required to keep each of these two coffer-dams dry. In placing concrete the water was prevented from washing over the concrete by means of sluiceways.

A 15-ton derrick equipped with a 60-ft. boom was set on piling between the west abutment and Pier 1, and was used to remove the old stone pier, handle the excavation, place concrete, and to pull the sheetpiling of the coffer-dams. This derrick was handled by means of a hoisting engine set up on the east bank of the river.

There are four piers and on the drawing they are numbered from west to east. Pier 1 is solid and rests on

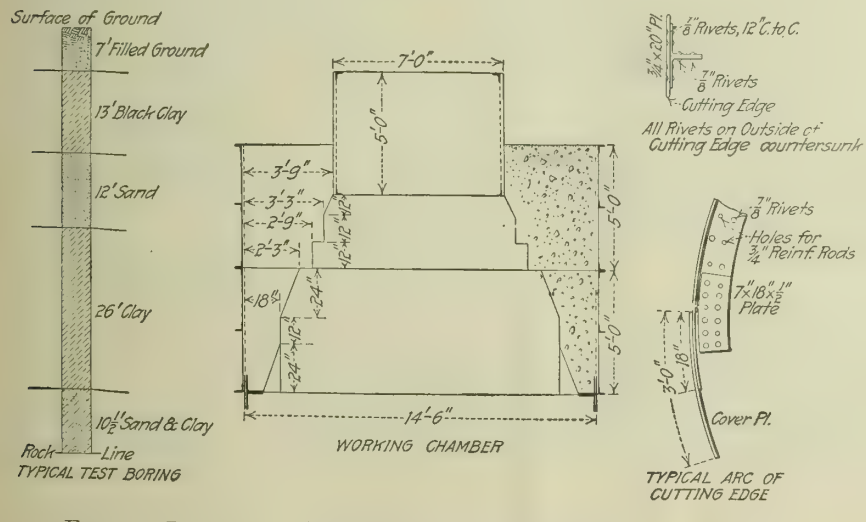


Fig. 2. Design of Cutting Edges and Working Chamber of Dredging Cylinders

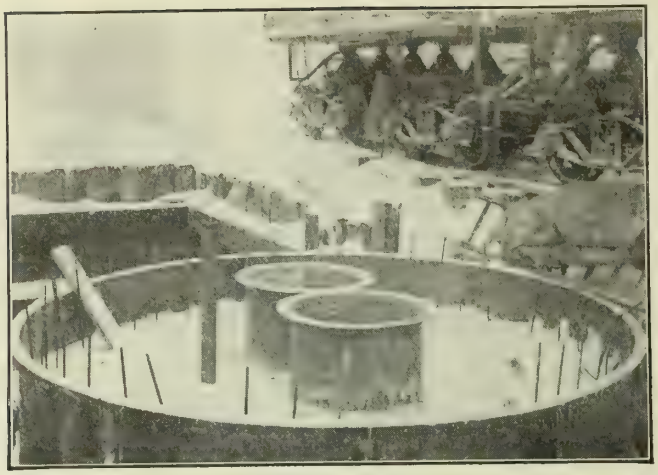


FIG. 4. A CYLINDER ON ROCK WITH AIR LOCK REMOVED
Compressed air was used on two of the piers



FIG. 5. REMOVING SPOIL FROM CYLINDER OF PIER 4 NORTH
North cylinder piers 3 and 4; method of excavating; 20-yd. dump car at extreme left

piles. Each of the others consists of two concrete cylinders (designated as north and south) tied together at the top with reinforced-concrete struts. The cylinders of Pier 2 are 12 ft. in diameter, and the cylinders of Piers 3 and 4 are each 14 ft. in diameter. They extend to rock 92 ft. below base of rail, 87 ft. below bridgeseat of the movable span, and 70 ft. below ground (present-track) level. Only the west abutment and Pier 1 stand in water; the other piers and the east abutment will not be wet until the channel is changed. Work on Piers 2 to 4 commenced in numerical order, Pier 2 being started shortly after the work was under way on the east abutment.

The open-cylinder method was used on all these piers. Cylinders 3 North and 4 South had to be finished by using compressed air as noted below. The shaft in all cylinders was 7 ft. in diameter; the arrangement of cutting edge and working chamber is shown in Fig. 2.

In starting to sink the piers the earth was excavated to a depth of about five feet, and the sides of this excavation were carefully cribbed with heavy timbers. The

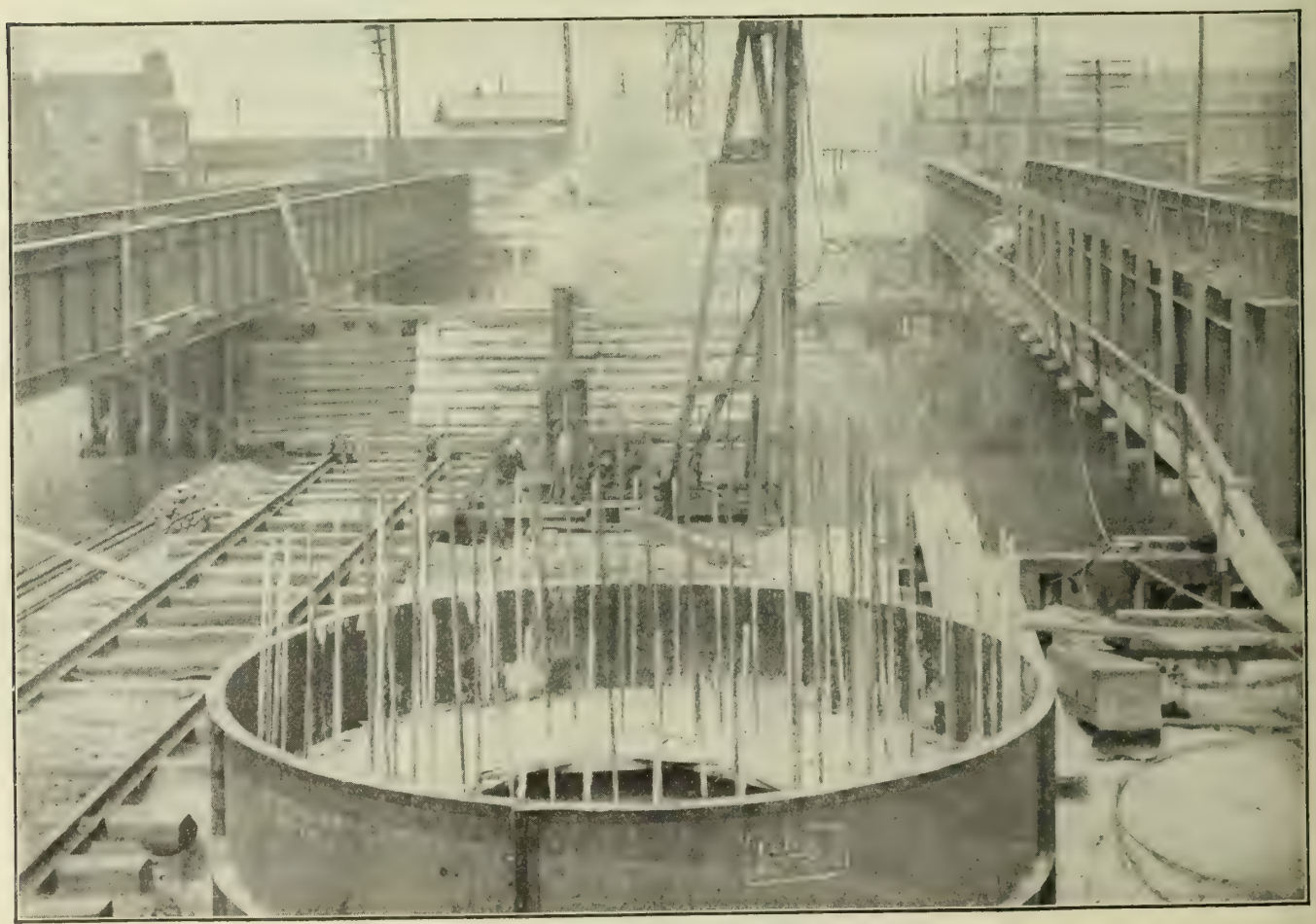


FIG. 6. GENERAL VIEW OF WEST END OF WORK
Cylinder of pier 2 north in foreground; center pier of old bridge not yet removed; manner in which tracks were spread and carried across Buffalo River

purpose of this cribbing was to brace the cylinders and assist in guiding them down in a vertical position, and without lateral shifting. On the bottom of this excavation the cutting edges were placed and carefully centered and blocked level. The interior forms (wood) of the working chamber were shaped as shown in Figs. 2 and 7 in order that the sinking of the cylinders could be kept under control. An outer row of ¾-in. round, smooth, vertical reinforcing rods were placed with the lower ends through the outer holes in the flange of the cutting edge (Fig. 2). This reinforcing was continued up to the bridge seat. Horizontal reinforcing rings of ¾-in. rods spaced about 12 in. apart were also provided. An inner row of vertical reinforcing rods bent over to conform to the slope of the inner face of the cutting chamber was also provided. These rods were fitted in the inner line of holes and were carried up only 16 ft.

After the cutting edges had been placed, the wood form for inner face of cutting chamber constructed and reinforcing placed, the exterior steel forms were set up and

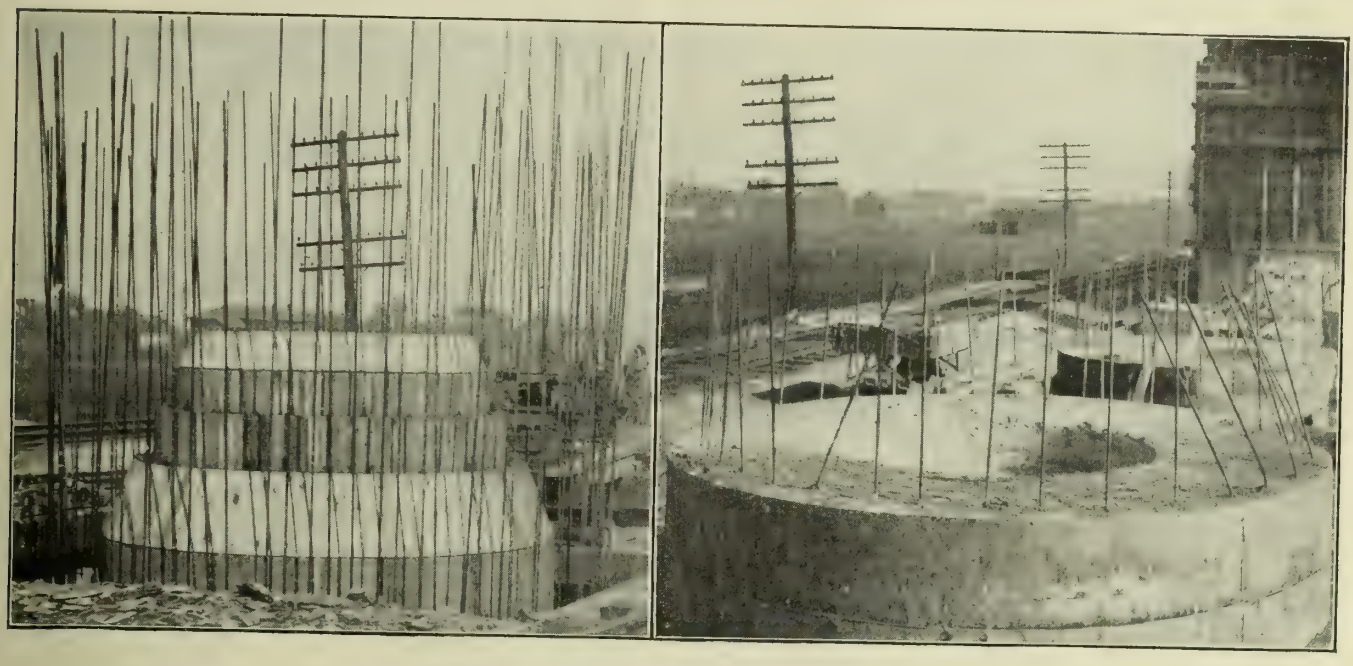


FIG. 7. TWO VIEWS OF PIER WORK

Left—Form for cutting chamber of a cylinder, showing vertical reinforcing rods for first section. Right—Piers 3 and 4 north; east abutment partially completed; westbound main track and construction tracks beyond piers

the whole again carefully leveled. A section of cylinder 10 ft. high was poured. As the cylinder was quite top-heavy at first the 10-ft. section was sunk by hand, better control being thus maintained. The earth was removed by the orange-peel bucket mentioned. After water was encountered all excavation was done by the locomotive crane. The cylinders were all constructed and sunk in 10-ft. sections.

Neither cylinder for Pier 2 encountered any obstructions and went down without difficulty until about two feet off rock. Sufficient material could not then be excavated to obtain settlement and this had to be secured by loading them. Their cutting edges were laid July 6, 1914. On Aug. 29 each was two feet off rock. They remained some days without appreciable settlement; then they were loaded with stone removed from the old center pier. The north cylinder remained loaded until Sept. 20, 1914, when it was one foot off rock. It was then carefully cleaned out and filled with concrete. The south cylinder settled the same amount by Oct. 18, when it was also cleaned out and filled.

The north cylinder of Pier 4 was started Aug. 1, and was filled Nov. 2. This cylinder was sunk without incident, save that at one dredging considerable difficulty was experienced in getting it to start. When it finally did start to settle, it sank until the top of the cylinder was below the bottom of the excavation.

The north cylinder of Pier 3 was started at the same time as the north cylinder of Pier 4. At a depth of about 20 ft. (about 5 ft. in the gravel stratum) a large butternut log was encountered, which interfered with the operation of the orange-peel; but some excavation was taken out and finally the cutting edge cut through the log, which was then taken out in pieces. About 8 ft. above rock a very large boulder was struck. The cylinder was pumped out, but because of the plastic character of the soil, the rock could not be uncovered sufficiently to do any effective job of breaking it up. Well drills were used outside the cylinder, and the boulder was broken up with a heavy charge of dynamite. After this was accomplished and the fragments removed, the soil rose about 25 ft. in the cylinder and could not be pushed back. Eventually, it was found necessary to apply air. Before the air lock was applied the cylinder was filled with water and the earth excavated to the level of the cutting edge. The air was then applied and the water bailed out. Dredging then proceeded successfully and the pier reached rock on Dec. 26.

The south cylinders of Piers 3 and 4 were started about the same time, Aug. 8, 1914, and went down to a point about 12 ft. above rock without any special incident. At this point Clyinder 4 South stopped and did not settle further. Cylinder 3 South eventually continued down to a point 5 ft. above rock and stopped. Continued excavation had no effect on it, and it eventually developed that a seam of exceedingly plastic material had been encountered. After about 150 cu.yd. had been removed excavation was discontinued. This was on Nov. 3, and about

noon a slight subsidence of the ground in the vicinity of the cylinder was noticeable. By night this amounted to 5 in. No further subsidence occurred until Nov. 6, when a further settlement of 18 in. took place. After this the subsidence was gradual, reaching a maximum of 9 ft. by Nov. 8. The main tracks were affected and considerable work was required to keep them in serviceable condition. The most serious effect, however, was that the movement of the earth toward the point of greatest settlement caused the tipping of the south cylinder of Pier 4. The cylinder apparently pivoted on the very compact layer of the gravel stratum and the top moved to the northwest so it was out of position 13⅝ in. to the west and 9⅛ in. to the north. The bottom moved in the opposite direction an amount nearly double that of the top. This was the correct proportion if it pivoted on the gravel stratum.

While waiting for the air equipment, Cylinder 3 South settled to a point 18 in. from the rock. By careful handling, it was found possible to complete the excavation and dam off the flowing material and clean out and fill with concrete. This work was completed Nov. 28, 1914.

Immediately after this cylinder was filled heavy timber braces were placed between Cylinder 4 South and Cylinder 3 South and 4 North. In addition to the braces 35-ton jacks were also used, and the whole system of bracing continued until the cylinder straightened up. When ready to apply the air the cylinder was filled with water and the soil removed to the bottom of the cutting edge as in Pier 3 North. As the cylinder showed some disposition not to settle, it was loaded with 90 tons of pig iron. The loading was eccentric in order to assist the process of straightening. After the air was applied the cylinder sank without difficulty and as it settled it straightened up, and is now plumb. The cylinder was filled Jan. 25, 1915.

Twenty pounds' air pressure was used. The air lock used was furnished by the Union Iron Works, Hoboken, N. J., in 14 days, from a special design furnished by the contractor. The cutting edges and steel forms were furnished by the Lackawanna Bridge Co. The work was done under the supervision of G. J. Ray, Chief Engineer of the Delaware, Lackawanna & Western R.R., A. E. Deal, Bridge Engineer, and George E. Boyd, Division Engineer, by Walter H. Gahagan, contracting engineer, Brooklyn, N. Y. (Boyd C. Myers, Superintendent on the job.)

Superelevation of Curves on Highways, Illinois Practice

By H. E. Bilger*

The advent of the motor vehicle upon our rural public highways, with the consequent stimulus that has been given to the adoption of types of highway improvement best suited to withstand this new character of traffic, presents to the engineer many details of design and construction that heretofore have not required much consideration.

One of the details that are demanding more and more attention each year is the matter of the proper crown, cross-slope or superelevation of the pavement on curves. As in most other matters of engineering design or construction, there can be no one best solution of the problem, inasmuch as the governing conditions on different pieces of work may bear relatively different weights.

Generally speaking, I would say that the treatment to be administered should vary with the type of the pavement and with the relative amounts of motor and horse-drawn traffic, and should depend upon such minor considerations as the radius of the curve and the climatic conditions.

This matter is receiving especially careful consideration in Illinois, inasmuch as for practically all state-aid road construction vitrified brick and portland-cement concrete alone have been adopted up to this time. The employment of these costly types of pavement requires for the full development of their merits that all matters relating to the horizontal and the vertical alignment of the pavement be cared for just as accurately as though the work was on a city street.

In Illinois the popular widths of brick and concrete pavements are 10 and 18 ft., though the 15-ft. width is destined soon to surpass these in point of mileage. For other types of construction the prevailing widths are 10, 12 and 15 ft.; but the 12-ft. width is losing in popularity. On tangents the brick and the concrete pavements are designed with a 1-in. crown for the 10-ft. widths and with a 2-in. crown for the 18-ft. widths.

From past experience it would seem that, all matters considered, the most satisfactory treatment of these types on curves is to carry the profile of the center line and of the inner edge of the pavement around the curve without a break, but to elevate the outer longitudinal half of the slab 2 in. for the 10-ft. pavements and 4 in. for the 18-ft. ones. On the inner as well as the outer longitudinal half of the slab the convexity of the surface should be avoided, to the end that the entire portion of the slab that comes upon the curve may be a surface having a straight-line top on any cross-section.

Gravel and macadam road surface should be similarly treated on curves—that is, by elevating the outer longitudinal half of the metaled way by an amount equal to twice the crown on tangents for the particular type in question.

Where the central angle of the curve is more than about 30 deg., the width of the pavement around the curve should be increased by some 30 or 40 per cent., and the pavement's position should be such as to bring its inner edge to within some 4 ft. of the fence corner, necessitating the inner ditch being converted into an underground drain.

When such pressure is brought to bear by the tax-paying public as to require the engineer to construct a brick or concrete pavement to one side of the center line of the traveled way, the upper surface of the pavement should be flat and, of course, should drain to the nearest side ditch.

Occasionally theoretical arguments are advanced for crowning, or rather convexing, the upper surface of the pavement that drains to one side only. The argument usually put forth is that if the completed surface is not convex it will present the unsightly appearance of being concave. This is merely a matter of construction. If the design of the template is such as to assure against deflection, I have not yet heard advanced a worthy argument for a brick or concrete "off-center" pavement with a convex surface.

*Road Engineer, Illinois State Highway Department, Springfield, Ill.

In anticipation of a deflection of the template it would, of course, be only the part of wisdom to use a template curved convexly by at least the amount of the expected deflection; but the use of a template of questionable rigidity is clearly not in accord with the other construction requirements of good brick and concrete pavements.

San Francisco Convention of the National Electric Light Association*

San Francisco has been the natural rendezvous this year of many and varied organizations, so that it is a significant fact when a particular society can make itself conspicuous in the busy life of the Exposition City. Thus far no other visitors probably have been so singularly honored as were the members of the National Electric Light Association, which held its thirty-eighth annual convention here June 7 to 11. An imposing and beautifully illuminated colonnade was specially built for them in the downtown section; at the Exposition grounds a night was appointed in their honor for exceptionally spectacular fireworks and illumination effects.

The night wonders of the Exposition are essentially electrical, and every deference was shown to the men of the industry which made them possible; on the other hand, the Exposition was particularly pleasing to the convention because of the acknowledged triumph of its illumination as a beauty feature, and on every hand warm praise was given to the designer, W. D'A. Ryan, of Schenectady, N. Y.

Association Work

The Committee on Organization (George Williams, of New York City, chairman) reported a total of 13,448 members—an increase of 431. The treasurer (W. F. Wells, of Brooklyn, N. Y.) reported an annual income of $136,327, expenses of $122,811, assets of $43,667, and liabilities of $9420. Expenses and income of the convention were $29,000 and $27,000 respectively.

The chairman of the Committee on Education, John F. Gilchrist, of Chicago, gave a brief outline of the committee's activities. It was intended to have leading men give lectures before student bodies, and likewise to have some of the prominent university men do the same before the association. It was purposed also to establish courses for ambitious college graduates desiring to enter the electrical industry, and especially to provide vacation work for students. There were reported 262 students spoken for, most of the work being in the commercial departments, where the students become directly profitable to the companies employing them. Complete records of the fitness and capacity of each student will be filed with the committee.

"Electrical Prosperity Week," to be held by the Society for Electrical Development Nov. 29 to Dec. 4, was explained to the association. This will be the closing week of the Exposition, and every effort will be made to make the week a memorable one. It is aimed to illuminate and decorate every city and town in the country.

The annual report of the Committee on Progress (T. C. Martin, of New York City, sole member) stated that within the last 30 years the net earnings of public utilities had been 8.5 per cent., compared with 4.3 per cent. for railroads and 7.8 per cent. for industrial concerns. Risk of receivership had been 0.37 per cent. for public utilities, compared with 1.84 per cent. for railroads and 2.1 per cent. for industrial concerns. The increase of net earnings of gas and electric companies between 1907 and 1911 was 60 per cent., compared with 5 per cent. for steam railways.

The report discussed the status of municipal ownership, stating that while the total number of electric municipal stations in this country were 29.9 per cent. of the total, they earned only 7.7 per cent. of the gross income of the industry, which was $302,116,000. The municipal plants had 18.2 per cent. of the estimated total number of arc lamps.

Public Policy

The report of the Public Policy Committee (W. W. Freeman, of Cincinnati, chairman) commented in some detail on certain commission decisions, which seemed to show greater liberality toward utility corporations in the rate of return, protection from competition, etc. It was stated that there had been no final determination of law, by any high court in any state, fixing rates for electric service—all the decisions being in cases of gas, water and transportation concerns. Protection from competition was discussed and arguments were presented for regulated monopolies.

In a paper entitled "Municipal Regulation of Public Utilities" J. H. Roemer, chief counsel of H. M. Byllesby & Co. and former chairman of the Wisconsin Railroad Commission, gave a lengthy justification for state control of utilities being preferred to local regulation. He charged municipal electric plants with poor service in general, with being slow to respond to new discoveries and holding to crude methods, with discrimination in rates as flagrant as in private corporations, and with poor bookkeeping and office systems.

"Public-Utility Regulation in California" was the title of a forceful address by Max Thelen, president of the California Railroad Commission. One of the difficulties he described was in regulating rates where one company supplied as many as 175 cities and towns with various classes of service. He also reviewed the policy of the state in the matter of extensions which would have to be made in all fields which the companies claimed, before any protection against competion could be given. The commission aims to safeguard utility securities so that an investor anywhere in the country may be reasonably safe. This has helped to promote the sale of local securities within the state. Several millions of dollars in stock of the Pacific Gas & Electric Co. have been so disposed of at a cost of 65c. per share, compared with the 50 per cent. discount which at times had been demanded by brokers for selling securities.

New Officers

The following officers were elected for the ensuing year: President, E. W. Lloyd, Chicago; vice-presidents, H. A. Wagner, Baltimore; W. F. Wells, Brooklyn; R. H. Ballard, Los Angeles, and R. S. Orr, Pittsburgh; treasurer, W. H. Atkins, Boston; secretary, T. Commerford Martin, New York.

*Reported by E. Owen McCann, Humboldt Bank Building, San Francisco.

Field and Office

Loading Test of Lagged Piles in Soft Silt

By C. W. Staniford*

In Engineering News, July 23, 1914, in a view similar to Fig. 1, there were shown two sets of foundation piles loaded with concrete blocks as a test for an actual loading in the soft silt of the North River at New York City. The pier being built at this site (West 46th St.) presents two opposite conditions of foundation, in that

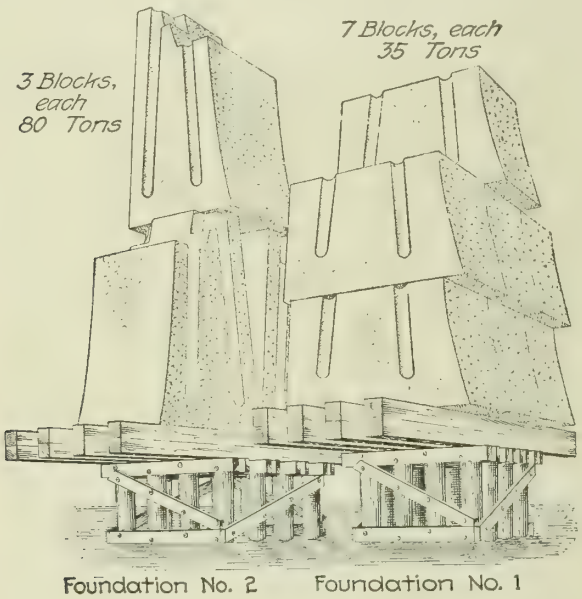


Fig. 1. 230-Ton Pile Tests in North River

the inner end is being closed by a sheetpile coffer-dam inside of which the solid rock is to be blasted to a depth of 44 ft. below mean low water; while extending from the coffer-dam outshore the solid rock gradually dips so that at the pierhead line, 1000 ft. from the bulkhead line, the rock is 150 ft. below mean low water. The overlying material is a soft silt furnishing no bearing capacity for an ordinary pile of the longest length.

Experience in founding the columns for double-deck steel sheds with their heavy loads indicated that the standard lagged piles, arranged in groups and capped with the form of grillage generally used, would perform the required service with safety. However, in order to produce these foundations at a minimum cost and to reduce the expense of lagging, it was the desire for this pier to create a foundation with as few lagged piles as possible and to arrange them in the most economical manner to produce the best carrying result. Therefore the first foundation, called "Foundation No. 1," was designed and placed so that every other pile was provided with four pieces of lagging, consisting of 5x6-in. sticks, 30 ft. long, bolted to the pile as shown in Fig. 2.

On account of the large settlement in this foundation, another group of piles, each pile of the group being provided with lagging and the spacing being increased so as to spread the load over a larger area, was designed and subjected to test. This is labeled on the drawing, "Foundation No. 2."

Each foundation was subjected as soon as built to the maximum theoretical load of about 230 tons, the loading being made with concrete blocks to be used elsewhere in the harbor. This second foundation also showed large settlement in the first 60 days, but thereafter the settlement became less than that shown for Foundation No. 1, until at the completion of the test, when both appeared to have come to rest, there was a difference in settlement of about 3 in. The total settlement for Foundation No. 1 was about 11¼ in. and for Foundation No. 2 about 8¼ in. The log of the settlement is given in Fig. 3.

Inasmuch as the load which these foundations have to carry will be gradually applied during the construction of the pier and the erection of the steelwork for the shed, and also as the maximum theoretical load may never be realized except possibly for short intervals of time, it was expected that these fully-lagged piles would become so thoroughly set and incorporated in the supporting bottom that little, if any, settlement would occur if the

*Chief Engineer, Department of Docks and Ferries, New York City.

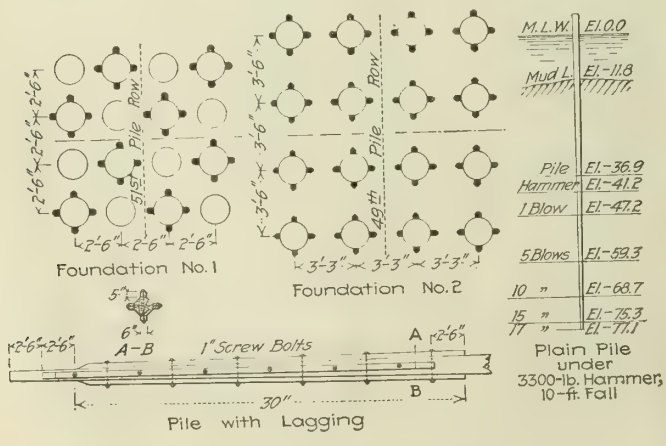


Fig. 2. Layouts of Pile Tests and Details of Piles

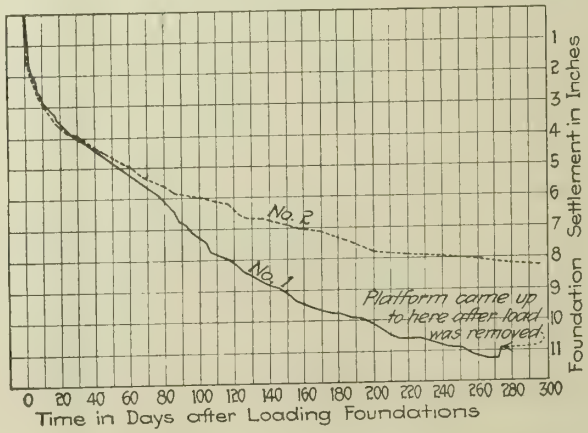


Fig. 3. Log of Pile Tests

foundations were designed as shown on the diagram for Foundation No. 2. Accordingly, all column foundations for this pier requiring long piles in soft bottom were thus designed; that is, using fully-lagged piles with the larger spacing between piles.

Before having the benefit of these actual long-time tests to a quiescent state of settlement, the department constructed the nine Chelsea Piers in similar material, and at the present time, after about seven years of use with the heaviest loadings, the settlement is not discernible with the eye; there has been, however, an actual settlement of about 3 in. detected by instrumental observation. As the result of this recent test and the use of grillages as outlined in Foundation No. 2, it is expected that the settlement in the 46th St. Pier will be less, and in any event that it will be symmetrical.

The 46th St. Pier is being constructed by Holbrook, Cabot & Rollins, Inc., for the Department of Docks and Ferries of New York City, under the direction of R. A. C. Smith, Commissioner, R. C. Harrison, First Deputy Commissioner, and C. W. Staniford, Chief Engineer. A. J. Bryson is in charge for the contractors.

Three Points in Chimney Design

From a standard specification for perforated radial-brick chimneys prepared for its clients by the M. W. Kellogg Co., 140 Cedar St., New York City, the following three items of instruction and explanation are selected as being of especial interest:

Lining for Brick Chimneys.—The height of the lining for chimneys is found in the following manner: For ordinary conditions, where the temperature does not exceed 800 deg. F., the lining should be approximately one-fifth the height of the chimney; above 800 deg. and below 1200 deg., one-half

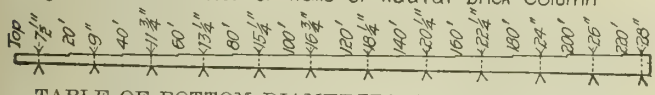


TABLE OF BOTTOM DIAMETERS OF RADIAL-BRICK CHIMNEYS

Height of Chimney in ft.	Internal Diameter at Top 3′	3′6″	4′	4′6″	5′	5′6″	6′	6′6″	7′	7′6″	8′	8′6″	9′	9′6″	10′
	Diameters in Feet at Bottom of Column														
75	7.42	7.69	7.96	8.46	8.96	9.46	9.96								
80	7.80	8.04	8.27	8.70	9.13	9.58	10.02								
85	8.18	8.38	8.58	8.95	9.31	9.70	10.08								
90	8.57	8.73	8.88	9.18	9.48	9.81	10.13								
95	8.95	9.07	9.19	9.43	9.66	9.93	10.19								
100	9.33	9.42	9.50	9.67	9.83	10.04	10.25	10.75	11.25	11.75	12.25				
105	9.70	9.78	9.85	10.03	10 21	10.38	10.55	11.03	11.50	11.95	12.40				
110	10.06	10.13	10.20	10.40	10 60	10.73	10.85	11.30	11.75	12.15	12.55				
115	10.43	10.49	10.55	10.77	10 98	11.07	11.15	11.58	12.00	12.35	12.70				
120	10.79	10.85	10.90	11.14	11.37	11.41	11.45	11.85	12.25	12.55	12.85				
125	11.16	11.21	11.25	11.50	11.75	11.75	11.75	12.13	12.50	12.75	13.00	13.50	14.00	14.50	15.00
130			11.65	11.88	12.10	12.12	12.13	12.47	12.80	13.09	13.37	13.80	14.22	14.69	15.15
135			12.05	12.25	12.45	12.48	12.51	12.81	13.10	13 42	13.73	14.08	14.43	14.87	15.30
140			12.45	12.63	12.80	12.85	12.90	13.15	13.40	13 75	14.10	14.38	14.65	15 05	15 45
145			12.85	13.00	13.15	13 22	13.2	13.49	13.70	14.08	14.46	14.66	14.86	15.23	15.60
150			13.25	13.38	13.50	13.58	13.66	13.83	14.00	14.42	14.83	14.96	15.08	15.42	15 75
155			13.58	13.73	13.87	13 97	14.06	14.18	14.30	14.68	15.06	15.19	15.31	15.61	15 91
160			13.92	14.08	14.23	14.35	14.46	14.53	14.60	14.95	15.30	15.43	15.55	15.81	16.07
165			14.25	14.43	14.60	14.73	14.86	14.88	14.90	15.22	15.53	15.66	15.78	16.00	16.22
170			14.59	14.78	14.96	15.11	15.26	15.23	15.20	15.49	15.77	15.90	16.02	16.20	16.38
175			14.92	15.13	15.33	15.50	15.66	15.58	15.50	15.75	16.00	16.13	16.25	16.40	16.54
180									15.80	16.05	16.30	16.40	16.50	16.65	16.80
185									16.10	16.35	16.60	16.68	16.75	16.91	17.06
190									16.40	16.65	16.90	16.95	17.00	17.16	17.31
195									16.70	16.95	17.20	17.23	17.25	17.41	17.57
200									17.00	17.25	17.50	17.50	17.50	17.67	17.83
205													17.80	17.98	18 16
210													18.10	18.30	18 50
215													18.40	18 62	18 83
220													18.70	18 94	19 17
225													19.00	19.25	19.50

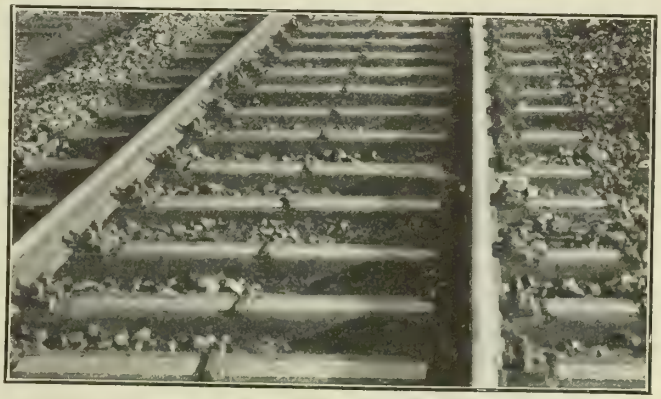
the total height; above 1200 deg. and below 2000 deg., full height.

Protection against Lightning.—For lightning protection two points are the minimum for any chimney of diameter up to 5 ft. Above this, one point should be added for every 2 ft. in diameter or fraction thereof. The points of the conductor should be of copper ¾ in. in diameter by 8 ft. long. with a 1½-in. platinum-covered tip. They should be anchored at the top of the column and extend from the bottom of the corbeling upward. The lower ends of the points are connected by a copper cable which encircles the chimney. From this loop a 1½-in. 7-strand No. 10 Stubs' gage copper cable is carried down the side of the chimney and connected to a copper ground plate of the three-winged type. On the way up, the cable is anchored every 7 ft. with brass anchors, which support the weight of the cable. The ground plate is buried by the foundation contractor at the time the foundation is built.

Wall thicknesses of chimneys are obtained from the accompanying diagram. The table shown below is offered for use in quickly determining the maximum outside diameter of the chimney at the base, for various heights and inside diameters.

Reinforced-Concrete Ties after Service

After several years' service in main-line track on the Pennsylvania R.R. the Riegler type of steel-incased reinforced-concrete tie has been reported on by the Tie



RIEGLER CONCRETE AND STEEL TIES ON PENNSYLVANIA TRACK

Committee of the American Electric Railway Association thus:

All the ties are still in good condition and giving satisfactory service, with no apparent depreciation (after 6½ yr.).

The action of these ties under traffic shows that there is considerably less deflection of the track than the adjacent wood-tie track. No separate records of cost of maintenance have been kept. The opinion of the surpervisor is that much less work is required for both line and surface than with wood ties. An average traffic of about 70 trains per day passes over this track (60 passenger and 10 freight).

It will be remembered that the tie (described in ENGINEERING NEWS, Feb. 17, 1910) has a concrete body, with a curved steel plate on each side, the plate being connected at the top and bottom by transverse riveted straps. The rails rest on flat steel tie-plates and are secured by through bolts and clips, the bolt-heads lying in pockets in the bottom of the tie. Two bent steel rods are embedded in the concrete.

The depth is 7 in. and the width 9⅜ in. on the flat, or 12 in. over the curved sides. The width and form of section are claimed to give such a large bearing that the 15 ties used under one rail length are as efficient as the 18 wood ties per rail used elsewhere in the track; while the curved sides are believed to prevent any tendency of the ties to slew in the ballast. Owing to the stiffness of the tie, further bearing can be given by increasing its length.

The weight is about 800 to 850 lb.; but the inventor says this causes little inconvenience in handling when proper tools are used, while it adds to the stability of the track. The cost of the ties is not given. The annual cost for ties per mile of track, with a uniform supporting area of 80 sq.ft. per rail length, is given as follows in a statement prepared by the inventor: Concrete ties (16 per rail), $875 per mile per year; untreated oak ties or inferior treated ties (20 per rail), $1196 and $1286 respectively. The life of the concrete tie is estimated at 20 or 15 years for roads of medium and heavy traffic, as against 9 or 6 years for wood ties under the same conditions.

Corrosion of "Pure Irons" and Steels Used by U. S. Reclamation Service

Materials used in the construction of semicircular metal flumes are of much importance to the United States Reclamation Service. Their life is determined principally by the rapidity of corrosion. Galvanizing will prevent corrosion for a certain time, but a base metal of superior resistance would be of distinct value. No conclusive evidence has been received which justifies the claim that any one of the special products on the market has any positive superiority over ordinary commercial grades of iron and steel under conditions of use that obtain on our projects.

CHEMICAL ANALYSES OF TEST SHEETS: U. S. R. S.

	"Pure Irons"		Steels	
	No. 1	No. 2	No. 3	No. 4
Silica	0.0716	0.0294	0.0235	0.0317
Sulphur	0.0424	0.0400	0.0490	0.0414
Manganese	0.4330	0.1730	0.8070	0.8640
Phosphorus	0.0296	0.0222	0.1314	0.0352
Carbon (total)	0.1100	0.0826	0.0901	0.1500
Copper	0.1020	0.0505	0.0307	0.2022

LOSSES (PER CENT. OF WEIGHT) ON EXPOSURE; UNITED STATES RECLAMATION SERVICE TEST SHEETS

	Galvanized	Ungalvanized
No. 1 (pure iron)	1.23	4.53
No. 2 (pure iron)	1.41	3.07
No. 3 (steel)	1.32	2.76
No. 4 (steel)	1.44	2.79

RELATIVE LOSS (LOWEST TO HIGHEST); UNITED STATES RECLAMATION SERVICE TEST SHEETS

Project	Galvanized	Ungalvanized
Belle Fourche	No. (1 and 4), 3, 2	No. 3, 4, 2, 1
Carlsbad	No. 2, 1, 3, 4	No. 2, 4, 3, 1
Sun River	No. (2 and 4), 1, 3	No. 4, 3, 2, 1
Uncompahgre	No. (1, 2 and 3), 4	No. 4, 3, 2, 1
Average	No. 1, 3, 2, 4	No. 3, 4, 2, 1

J. Y. Jewett, cement expert, has tabulated the results of observations on 12x24x$\frac{1}{16}$-in. test specimens exposed on four different projects where the destructive action of alkali has been pronounced. All specimens on any one project were exposed the same length of time, but the tests varied from 10 to 13 months on the different projects. The figures are given in the appended tables.—I. C. HARRIS, Engineer in Charge of Inspection of Materials, in the *Reclamation Record*, May, 1915.

A Home-Made Clamshell Excavator of 1877

BY LEONARD GOODDAY*

As bridge engineer of the South Australian Government many years ago I had charge of the erection of a half-mile iron bridge over the Murray River and swamps, at Edwards Crossing, 56 mi. from Adelaide. It was in the bush, and we did not have many uptodate facilities.

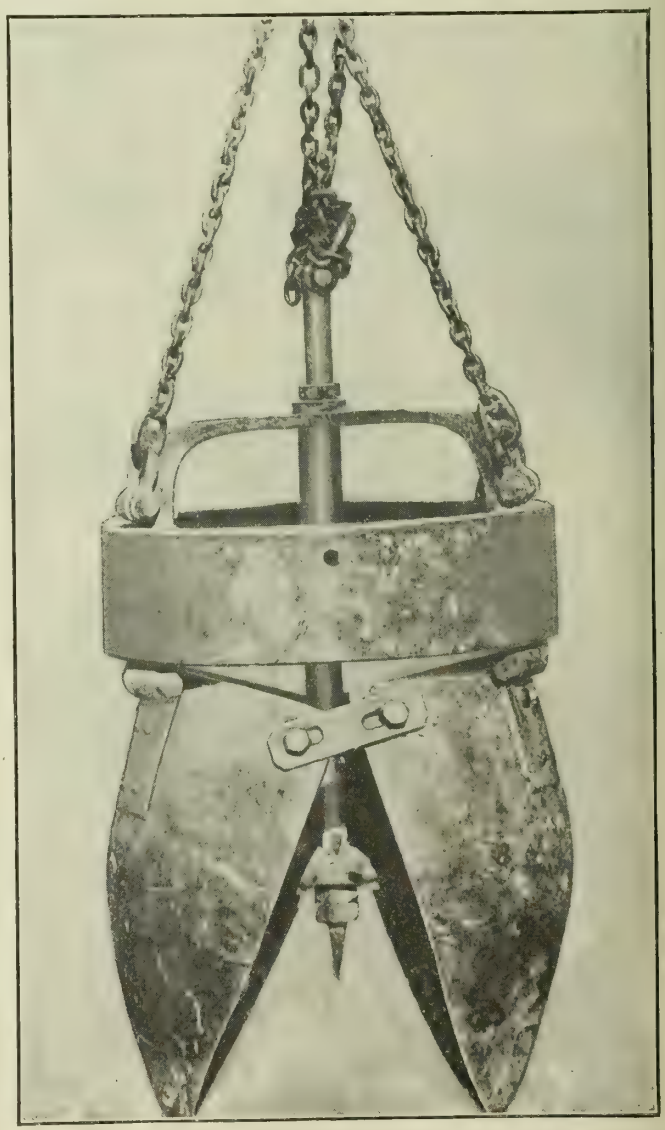


FIG. 1. HOME-MADE EXCAVATOR BUCKET DESIGNED AND BUILT BY LEONARD GOODDAY IN 1877

To those who may some day be similarly situated the following should be interesting.

The main bridge was composed of five 120-ft. spans across the river, for which piers were built comprising

*62 Craig, Ottawa, Ont.

two 7-ft. diameter cylinders each. The rest of the bridge was of 60-ft. spans on piers made of two 3½-ft. cylinders each.

For sinking the smaller cylinders some type of special excavator had to be designed. The kind of grab bucket usually made in those days was hexagonal in plan, which gave it somewhat greater spread, but less capacity than was desired. It was therefore decided to build a bucket circular in plan, with only two leaves, so as to have fewer working parts.

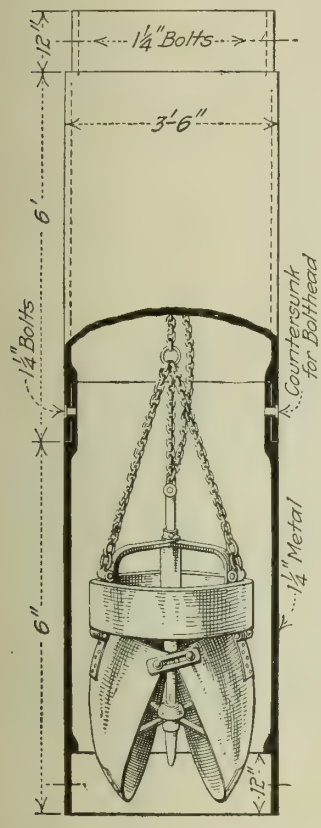


FIG. 2. SKETCH OF EXCAVATOR BUCKET SHOWING CLEARANCE IN FOUNDATION CYLINDER

The cylinders were 3½ ft. in external diameter and 1¼ in. thick, with inside sleeve joints, leaving only 3 ft. 1 in. clear at the joints. The external diameter of the bucket was about 2 ft. 9 in. Fig. 1 is from a photograph of the bucket and Fig. 2 is a sketch showing its clearance in the cylinder.

To obtain proper curves for the leaves several bar-iron templates were made of horizontal and vertical cross-sections, and with these as guides a die was cut in the rock of a nearby quarry. Using the die, ⅜-in. iron plates heated red hot were beaten to shape by hammering.

The links for closing the leaves were ⅜x2-in. bar iron, two to each leaf. The center rod was 2½ in. in diameter, working in a sleeve as shown, with lugs at the lower end for connection with the links. The links were fastened to the leaves by two angle- or bracket-lugs to each link. The upper end of the center rod had a collar stop and a shackle for the chain lift.

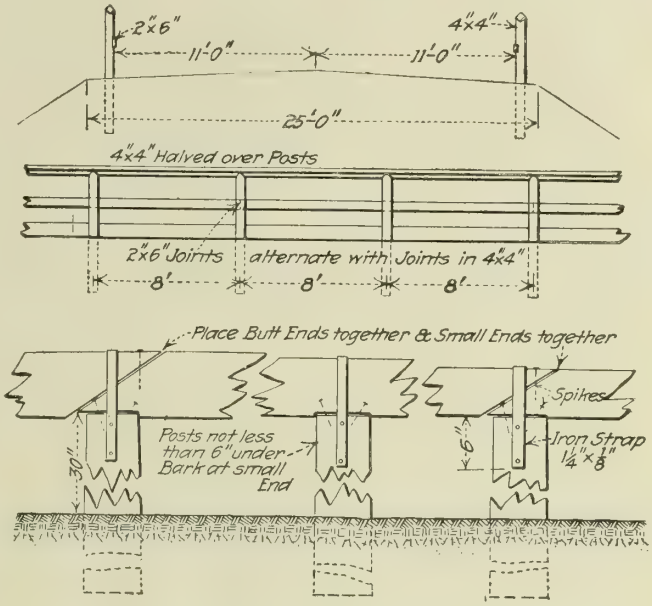
The frame of the bucket was a heavy iron ring, to which the leaves were hinged. Three arms on the top of the ring held the guide sleeve; they were also the points at which chains were attached, forming a three-chain sling by which the bucket was lowered. For additional strength the leaves were shod with forgings as shown.

The amount of material raised at each lift was about 0.44 cu.yd., as against 0.27 cu.yd. if a bucket of hexagonal shape had been used. There were 33 pairs of cylinders sunk at varying depths from 15 to 90 ft. The total material excavated was about 1490 cu.yd., requiring 3387 lifts, as against 5731 which would have been required with a hexagonal bucket, which meant a saving in labor of 40.9 per cent.

Comparative Costs of Guard Rail and Wide Fills on Highways

The general statement is made in a well-known highway engineering handbook that a 1 on 4 slope on the sides of a road fill is cheaper than 1 on 1½ slope with guard-rail protection, until a fill of 7 ft. is reached.

There are, however, a number of elements entering this problem which must be allowed for before a definite



STANDARD GUARD RAILS OF THE MASSACHUSETTS HIGHWAY COMMISSION

decision can be reached. To take account of these varying conditions and yet avoid computation, J. A. Johnston, Division Engineer of the Massachusetts Highway Commission at Springfield, Mass., has prepared the accompanying table and curve.

The table and curve together give the approximate cost of the extra fill (from borrow) required by a 4 on 1 slope, compared with the cost of both standard and

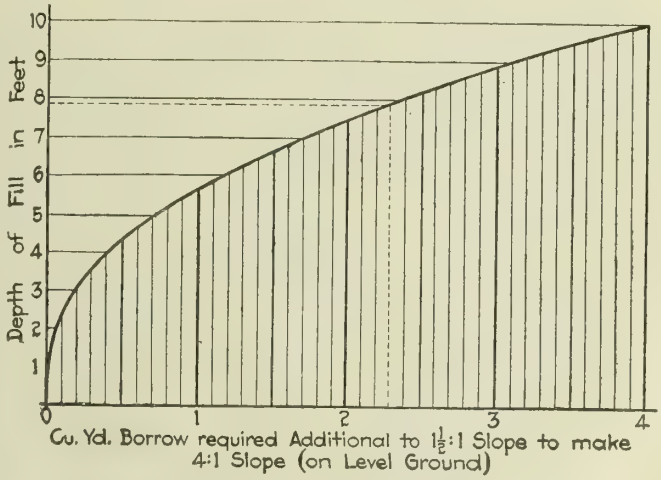


TABLE OF COMPARATIVE COSTS OF GUARD RAIL AND FILL

Cost of Borrow per Cu.Yd.			$0.40	$0.45	$0.50	$0.55	$0.60	$0.65	$0.70	$0.75	$0.80	$0.90	$1.00	$1.10	$1.20	$1.30	$1.40	$1.50
			Cu.Yd.															
Cost of Guard-rail per Lin.Ft.	Rustic	$0.15	1.6	1.4	1.3	1.2	1.1	1.0	0.9	0.9	0.8	0.7	0.7	0.6	0.5	0.5	0.5	0.4
		.20	2.0	1.8	1.6	1.5	1.4	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.6
		.25	2.5	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.3	1.1	1.0	0.9	0.8	0.8	0.7	0.7
	Standard	.30	2.9	2.6	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.8
		.35	3.4	3.0	2.7	2.5	2.2	2.1	1.9	1.8	1.7	1.5	1.4	1.2	1.1	1.0	1.0	0.9
		.40	3.7	3.3	3.0	2.7	2.5	2.3	2.1	2.0	1.9	1.6	1.5	1.3	1.2	1.1	1.1	1.0

*Cu.Yd. of Borrow which can be paid for by the sinking fund necessary to construct, maintain, and reconstruct guard rail (at indicated unit prices).

rustic guard rails (see accompanying illustrations), which are required with a 1½ on 1 slope fill. For example:

Cost of borrow = 50c. per cu.yd.
Cost of guard rail = 30c. per lin.ft.

In the table the number of cubic yards of borrow at 50c., which is equivalent in value to one linear foot of guard rail at 30c., is found to be 2.3. The depth of fill (shoulder to toe) which can be made by 2.3 cu.yd. borrow per lin.ft. is found from the curve as indicated by the dotted line. Depth = 7.8 ft.

Construction Work on Traymore Hotel, Atlantic City

The construction of the new reinforced-concrete Traymore Hotel at Atlantic City, N. J., the design of which was described in ENGINEERING NEWS, July 1, 1915, is noteworthy for the combination of very rapid work and a most complicated design. The old building was vacated on July 1, 1914, and the site cleared by Sept. 1, when construction on the new hotel, a structure covering 110x 520 ft. on its lower floor plan and rising to 18 stories, was started. Although much finishing work yet remains to be done, the hotel was opened June 1, 1915, and in the last week in June was sufficiently near completion to house practically all of the 500 who attended the meeting of the American Society for Testing Materials, in addition to the regular guests.

The site is peculiarly disadvantageous for the delivery of materials. It is at the ocean end of a narrow street and immediately on the Boardwalk, which cannot be used for haulage. It was necessary to bring in all material by trucks which had to turn in the dead-end made by the Boardwalk and return along the same street.

The whole concreting was controlled from two plants of similar design located, as shown in Fig. 1, along the street-side of the building. The details of one of the plants is shown also in Fig. 1. It was located so that wagons could drive up on inclined platforms from the street and dump, through screening gratings, into the boot of bucket conveyors which would raise the sand on one side and the stone on the other to bins above. From these bins gate-controlled hoppers permitted the dropping of the aggregate to the mixer below, whence the mixed concrete was dumped into the elevator and carried to the chute to be spouted to its required location. All of the moving parts were driven by an electric motor.

The elevating towers were of very substantial design, approximately 6x8 ft. in plan and 256 ft. high, so that concrete could be spouted to the top of the dome, which is about 230 ft. above the street. The towers were of timber and the height was added to as the building rose, wire guy lines being used to insure stability. For a part of the time each tower was provided with two chuting equipments, as shown in the view in Fig. 2, so that work could be carried on simultaneously at different elevations. The towers also were equipped with 30-ft. booms for handling lumber.

The floors were so large that the spouts could not control the whole area, particularly as the building rose and the spouting angle was reduced; so the concrete was spouted to well located hoppers on each floor and delivered by concrete carts. A small quantity was deposited directly from the spouts.

Most of the concreting was done in winter and as a precaution against freezing, the material bins were heated by steam coils. The water was also heated, and immediately after the centering was completed for the different floors, and before concrete was placed, the floors were entirely inclosed with tarpaulins. Salamanders were placed under the centering and the temperature was kept constantly at 50 deg., until the concrete was about seven days old. Immediately after the concrete was placed it was covered with salt hay.

The concrete was made from a washed bank sand and graded pebbles of maximum ¾-in. diameter, both of exceptionally good quality. Some of the test cubes taken from the concrete when being deposited showed as high as 2800 lb. per sq.in. in compression in seven days and the average of such tests was about 2000 lb. per sq.in.

The foundations, of short timber piles grouped under concrete caps, were very difficult to build on account of the water-bearing nature of the ground, which is beach sand with the water surface only a foot or so below the street level. It was necessary to sheetpile around each footing, or group of footings, and to keep pumps going continuously until the concrete was all deposited. Some of the excavation for these footings was made with a sand pump.

During the first part of the construction both day and night shifts were worked in building the centering, and during that period there were from 100 to 140 carpenters in the day shift and from 60 to 70 laborers helping them. The night gang consisted of from 30 to 40 carpenters and about 20 laborers.

When the job was a little over half done, the local labor unions refused to allow the carpenters to work on night

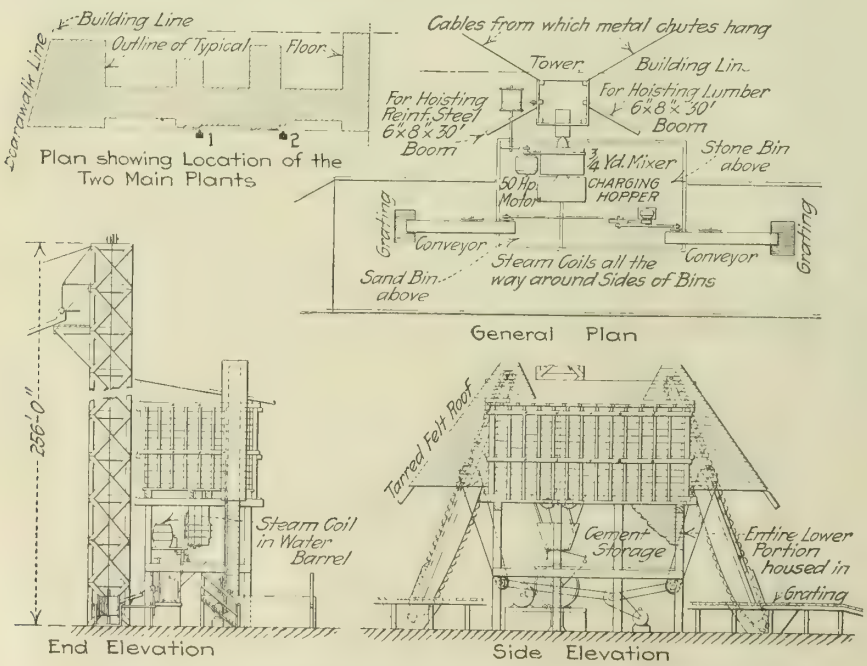


FIG. 1. DETAILS OF CONCRETING PLANT ON NEW TRAYMORE HOTEL ATLANTIC CITY

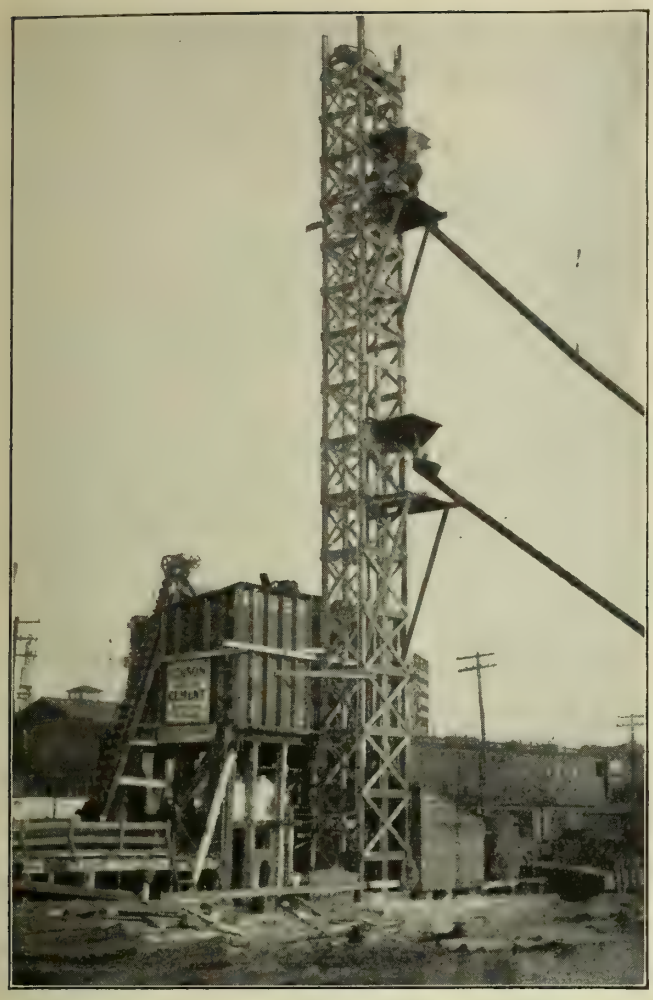


FIG. 2. CONCRETING PLANT AND CHUTING TOWER AT A LOW HEIGHT; TWO CHUTES FROM TOWER

shift. It was possible to increase the regular day shift of carpenters by about 20 men, so that after the night gang was discontinued the day gang consisted of from 150 to 160 carpenters. The concrete was placed either day or night, as fast as the forms were ready to receive it.

With this force and the equipment noted some very speedy work was done. The dates of the completion of the various parts of the concrete work are as follows:

	1914	
Footings	Dec. 27	
Exchange floor	Dec. 30	
	1915	
Mezzanine floor	Jan. 2	Area—140x520 ft.
First floor	Jan. 7	
Second floor	Jan. 12	
Third floor	Jan. 20	
Fourth floor	Jan. 25	
Fifth floor	Jan. 29	
Sixth floor	Feb. 10	
Seventh floor	Feb. 14	Area—about 50x450 ft. with three wings.
Eighth floor	Feb. 20	
Ninth floor	Feb. 28	
Tenth floor	Mar. 5	
Eleventh floor	Mar. 13	
Twelfth floor	Mar. 20	
Thirteenth floor	Mar. 28	
Fourteenth floor	Apr. 2	Area—about 40x150 ft.
Fifteenth floor	Apr. 10	
North Dome	Apr. 22	
South Dome	Apr. 24	

The contract for the building was held by Cramp & Co., of Philadelphia, Penn., and all of the work was done by them under the general direction of F. V. Warren of the company. The architects for the hotel were Price & McLanihan, and the engineers, Otto H. Gentner, Jr., and F. Dickinson Shaw, associate engineers, all of Philadelphia.

A Simply Constructed Tar-Macadam Road

In these days of elaborate roadmaking apparatus, complicated specifications, etc., it is occasionally refreshing to see how crudely a successful road can be built. The whole apparatus used in the construction of the Connecticut state-aid road, shown in the accompanying views, were a tar kettle, a 3-ton steam roller, wheelbarrows, rakes, shovels, pails, etc. The mixing was done by hand. With this simple apparatus and a force of a dozen or fifteen men a 3-in. tar-macadam pavement was placed on an old macadam surface for 70c. per sq.yd.—and more than that, the new pavement is guaranteed for five years by a cash deposit.

The contractor for this road is C. L. Farnsworth, Ayer, Mass., who has spent 35 years building tar sidewalks and tar pavements. His pavements are very



A SIMPLY CONSTRUCTED TAR-MACADAM ROAD NEAR HARTFORD, CONN.

similar in construction and looks to the old-fashioned city tar sidewalk, but he has built many miles of them on city and town streets and state roads, and has successfully guaranteed them with cash. Mr. Farnsworth builds these pavements under the trade name of "Ma-Drite." They are not patented; indeed, the contractor frankly informs us that they are nothing else than the "old tar-concrete crosswalks laid throughout New England for 50 or 60 years."

The formula for their construction is as follows:

On the subgrade place 3 in. of No. 1 stone covered with "Ma-Drite" binder, 17 gal. to 1 cu.yd. of stone, rolled until compacted firmly. On this place No. 2 stone (covered with "Ma-Drite" binder, 19 to 20 gal. to 1 cu.yd. of stone) of sufficient thickness to bring the grade 1 in. below the finished grade. These are to be rolled and compacted firmly. On this is to be placed 1¼ in. of pea stone and dust (crusher run) or pea stone and sand, properly proportioned so that the finished surface shall not be slippery. This surface shall be mixed and spread while warm, using 38 to 45 gal. of "Ma-Drite" binder to the cubic yard, rolled and finished in the usual manner.

We find it necessary to vary the quantity of binder owing to the difference in the quality of sand, etc. I always use all the aggregate will hold without the binder coming to the surface and causing a slippery road. I also wish to say that the success of this class of work depends a great deal on the knowledge and skill of the workmen as to the quality of the aggregates and binding material.

The cost of the road illustrated is analyzed by Mr. Farnsworth as follows: Cost of material—stone, $1.63 per ton delivered; sand, $1.15 per cu.yd.; teams, $5 per day; labor, $2.50 per day, with the usual incidentals, such as wood, oils, tools, overhead charges, etc.

This road is a few miles north of Hartford, Conn., and is built under the general supervision of the Connecticut State Highway Commissioner, Charles J. Bennett.

NOTES

A Historic Old Bridge is that shown in the accompanying views. It crosses the Connecticut River at Springfield, Mass., and at the time it was built it was one of the main gateways from New England to the then far west. The original bridge was built in 1804-05. It was financed by a lottery and operated as a toll bridge. The bridge was 1234 ft. long, 30 ft. wide and 40 ft. above low water. There were six spans of 187 ft. each, composed of a framework of timbers, reinforced with wood arches. The roadway, according to an ancient description, followed pretty much the contours of the arches. The superstructure of this bridge was pulled down soon after the freshets of 1814 and rebuilt. This bridge was opened to the public in 1816. In 1817 President Monroe passed over the bridge on his famous tour of the country. It was partly carried away by a freshet in 1818, but was restored in 1820, and has lived and been useful ever since. Tolls were collected until 1872, when the bridge was purchased by the public authorities and made free. The footpath shown in the view was added in 1872 by strengthening the outside truss with a lattice of planks. The bridge proper is made of three Burr trusses, so called. Practically nothing was done to it until 1913, when it became so wobbly that two or three of the spans were strengthened by the addition of some new timber arches paralleling the old and some tension rods. Other places on the interior present curious patches and splices. The old framework was put together with wood pins. It is contrary to law to cross the bridge at a faster pace than a walk. The maximum load is 4 tons, and not more than one heavy load is allowed in any span at the same time. There is a special policeman constantly on duty to enforce these rules. A bill now before the Massachusetts legislature provides for a commission to plan and finance a new bridge.



CONNECTICUT RIVER BRIDGE AT SPRINGFIELD, MASS.; IN SERVICE SINCE 1816

The Uselessness of General Cost Data—An examination of tables giving the costs of all state highway work in Connecticut during the last two years shows an enormous variation in unit price per square yard of road surface for the same types of road built under the same specifications. The reasons for these discrepancies are many; but principally the variation arises from the location of the road with reference to the source of supply of material used in its surface construction. For instance, many of the roads are located at a long distance from a railroad station or from a supply of native stone or gravel to be used in construction. In addition, the variation is, to some extent, due to the fact that different contractors in need of work bid extremely low prices for road surface in certain cases. Variations in the cost of labor have also been noticeable, and occasionally the material excavated has been used in the surface of the road, thereby reducing the cost.—From the recent biennial Report of the Connecticut State Highway Commissioner, Charles J. Bennett.

The Deepest Boring in the World, according to the United States Geological Survey, is in Upper Silesia, in the German Empire. It is a diamond-drill hole in a coal field and is 7350 ft. deep. A well in the United States which may go deeper is 4 mi. northwest of McDonald, Penn., and about 15 mi. west of Pittsburgh. This well is being sunk to the Medina sandstone, and is now down 7164 ft. Gas and oil were struck in the upper part of the well, and between the depths of 6830 and 7100 ft. rock (bearing rock salt) and salt water were encountered. The temperature in this well at the depth of 6775 ft. was recently determined with accuracy to be 145.8 deg. F. At Derrick City, McKean County, Penn., there is a well 5820 ft. deep, which is probably the second deepest well in the United States. There is another on Slaughter Creek, W. Va., which is 5595 ft. deep. In sinking the last-named well a sandstone was encountered at 5030 to 5050 ft., and from this depth to the bottom, a distance of 545 ft., the well is in limestone.

Steel Roof-Trusses Have Been Destroyed by corrosion in a number of paper mills in northern New York. These frames were erected in the period 1896-1905. In one mill it was recently found that large chunks could be knocked loose from almost any truss member with light blows from a hammer. Yet the steel had retained its shape and from a short distance did not appear to be in bad condition—except that it showed some tuberculation and surface scaling. Examination revealed that every member of one truss was so completely corroded as to make it a puzzling matter to explain how the roof could remain in position.

Editorials

Allowance for Transverse Strength in Columns

In discussing the remarkable failure of the Panama Canal crane "Ajax" in the issue of May 13, ENGINEERING NEWS suggested, as one of the lessons of that accident, the propriety of increasing the specification requirement for transverse strength in column latticing to 4% of the column load in place of the 2½% now commonly specified.

Elsewhere in this issue are printed letters from T. D. Monniche, engineer of docks of the Panama R.R.; F. H. Cooke, Civil Engineer U. S. N., author of the description of the "Ajax" wreck published in ENGINEERING NEWS of May 13, and H. F. Welty, bridge engineer of the New York Central R.R. All these engineers dissent from the suggestion as to the increase in specification requirements for transverse strength in column latticing. Mr. Monniche's argument is especially notable because of his intimate knowledge of all the details of the crane's construction. Both Mr. Monniche and Mr. Cooke express the opinion that the failure of the compression member which caused the wreck of the "Ajax" was the result more largely of secondary stresses in the member caused by the connections than of weakness in the latticing. These opinions are, of course, entitled to great weight.

It is well to bear in mind, however, that in no framed structure are the stresses imparted to the members in an absolutely axial direction. In any actual structure there always exist more or less of secondary stresses caused by deformation and by unavoidable inaccuracies in design and in construction. The factor of safety used in proportioning the members is in part designed to make provision for just these variations of stressing, and it was our idea that the secondary effects in this particular crane were no greater than may be expected to occur at any time in any ordinary structural framework.

The so-called shear provision in specifications for columns is meant to cover allowances for torsion, local irregularity, inaccuracies in the application of load, results of distortion, etc. Just how much each of these several elements amounts to in a particular case, we do not try to compute. To do so, indeed, would be impracticable. The best that can be done is to choose empirically a limit which will be safe in practice. Such a limit may indeed provide a large excess of strength in most instances, but it must cover all the cases which practice presents.

The great importance to the engineering profession of the failure of a large member under load is that it furnishes an example which can be calculated to see how our empirical limits correspond to the limit which an actual member passes when it fails.

It may be said that there are two necessary foundations on which to work in reaching a safe load for columns. The first is the ultimate strength which a column exhibits when loaded with greatest care to secure an accurate loading. We can obtain these figures by the use of a testing machine. In the second place we can determine the load at which an actual member fails under the conditions of service, with all the irregularities of load application, secondary stresses, etc., which always occur in practice and use this as a guide for the designer. It is from this point of view that the failure of the compression member in the "Ajax" framework becomes of such importance.

The letter of Mr. Welty raises the question as to what is a reasonable impact allowance for large cranes if 100% is a proper allowance for railway bridges. Mr. Welty states that 50% is used for cranes in the New York Central practice. Possibly on small hoists, which get all sorts of rough and careless handling, such an impact allowance may be justified; but on such a huge crane as that at Panama when heavy loads are being lifted it would be difficult to find an engineering structure to which the load is applied more gradually and carefully.

Unprofitable Street-Car Traffic

In a valuable paper on the rapid-transit problem in cities, by Prof. George F. Swain, published in the April *Proceedings* of the Engineers Society of Western Pennsylvania, considerable emphasis is laid on the unprofitable nature of long-distance traffic on street railways in cities where the universal five-cent fare prevails. Professor Swain states that in making a study of the transportation question in Boston a few years ago it appeared that the limit of a street-railway ride yielding a profit to the company was about 4½ mi. In other words, the cost of carrying a passenger on the Boston street-railway system was in the neighborhood of one cent per mile. Professor Swain notes that this result was only approximate and that similar investigations in other cities under different conditions might show a widely different result and continues:

> The results obtained in Boston indicate very clearly that it is easy to go too far in supplying facilities for long rides for a single fare. There is no question in the mind of the writer that in most cities of this country long-distance riders, and in fact a large proportion of the passengers, are being carried for less than cost.

Professor Swain's discussion is along the lines usually followed in dealing with this question; but it seems worth while to raise the question whether this common method of dealing with it does not, after all, involve a fallacy. Is it the distance that makes the carrying of passengers to and from remote suburbs unprofitable? It is true that in the operation of the ordinary surface street railway the short-distance riders who get on the car and off again after having ridden only a few blocks are far more profitable patrons for the company, provided the cars are kept filled, than those who ride half an hour or longer. On the other hand, it is easy to imagine conditions under which passengers could be carried distances of from 5 to 10 mi. at a very small fraction of the one cent per mile which Professor Swain's figures indicate.

The largest item of cost to the railway company in carrying passengers is the wages of motormen and conductors, and these men are paid by the hour and not by the mile. If an express service were operated between a city and an outlying suburb, for example, so that a run of, say, 5 to 8 mi. could be made in 10 or 15 min., the rolling stock and operatives would be used much more effectively in the transport of passengers, and the cost per passenger mile would be correspondingly reduced. A further reduction in the cost would be made if the traffic between the two points was reasonably continuous through the greater part of the day instead of concentrated in the rush hours in the morning and evening.

It would promote clear thinking and accurate statement in dealing with the economics of city-passenger transportation if it were emphasized that the cost to the company of carrying passengers long distances to remote suburbs is due not so much to the distance which they travel as to the fact that they take this journey only in the morning and evening hours. If the cars running from the remote suburbs to the center of the city could be as well filled all day long as they are during the morning and evening rush hours, even these long-distance riders would yield the company a large margin of profit.

It will be admitted by everyone conversant with the street-railway business that what the companies need to do most is to develop short-distance traffic and traffic during the off hours of the day. The first could be brought about by the adoption of the zone system of fares, already in practically universal use in Europe and pretty certain sooner or later to gain favor here. Both these ends might be attained, however, through the sale of passes bearing the photograph of the purchaser and permitting him to ride when and where he pleased on the street-railway system during the time the pass remained valid—a month, a quarter of a year or a year—without further payment of fare.

The holder of such a pass would use it for short-distance riding, when he would walk if payment of fare were required, and he would also use it for travel at hours other than the morning and evening rush hours. Another great advantage of such passes would be the reduction of the delays necessary for the payment of fare when passengers enter the common pay-as-you-enter car. A car earns no revenue while it is standing still, and anything which facilitates rapid movement of passengers in entering or leaving the car is worth an enormous amount to the railway company and is still more valuable to the traveling public in reduction of time necessary for the journey. The general use of such passes would make it possible to eliminate the cumbersome transfer system.

Doubtless the proposal to sell street-railway transportation on such a plan may seem a wildly radical proposal; but there is good precedent for it. Such a system has been in use for years on the Swiss Government railways with most excellent results. It is giving satisfaction to the public and profits to the railways.

It is in line with the most modern ideas with reference to street-traffic problems. A street-railway company expends its money chiefly to provide facilities for handling the traffic. Once these facilities are provided, it is for the benefit of all parties concerned that they shall be used to the fullest extent and produce a maximum of profit combined with a maximum of service.

The Steel-Rail Puzzle

No better indication could be given of the importance of the question, How can good steel rails be secured? than the fact that A. W. Gibbs, Chief Mechanical Engineer of the Pennsylvania R.R., made this the subject of his presidential address at the recent annual convention of the American Society for Testing Materials. That some of the steel rails now rolled are satisfactory is evident from Mr. Gibbs' statement that "if all the rail rolled was as good as the best there would be very little room for complaint." The puzzle is how to frame a specification which will insure that the railway shall receive rails of this satisfactory quality and will exclude rails that are likely to break in service.

In the recent New York Railway Club paper of Gustav Lindenthal[1] and in the letter from a prominent railway engineer printed on p. 35 of the last issue, chief stress was laid on finishing the rails at a lower temperature in order to insure better working of the metal. It has indeed been a general belief among railway engineers for a very long time that rolling the metal too hot is the chief cause of poor rails. At the recent Testing Materials convention, however, one of the subcommittees of the Steel Rails Committee submitted a report on the finishing temperatures of rails. This committee reported tests made by M. H. Wickhorst, the Illinois Steel Co., the Pennsylvania Steel Co. and the Cambria Steel Co. on rails rolled at different temperatures, some of the rails being rolled as cold as was possible without reaching the critical temperature. In all these tests, those conducting them were unable to find any considerable difference between the physical qualities of the rails rolled at low temperatures and of those rolled at high temperatures. The Pennsylvania Steel Co. tested these rails with a machine devised to wear the rail by a revolving car wheel, but no material difference was discernible between the wear of rails rolled at high temperature and of those rolled at low temperature.

The logical result of this committee's investigations would be the abandonment of the shrinkage clause in rail specifications, as was stated in the convention report in the last issue. But engineers naturally hesitate to take the responsibility of introducing any such radical innovation in specifications lest they be charged with omitting some precaution that might conduce to greater safety.

Disappointing though it may be to realize that a radical improvement in the quality of rails cannot be expected by so simple a change as rolling at a lower temperature, it is on the other hand important from the economic view that such a change, which would doubtless result in a material increase in the cost of rails, is not likely to be necessary. As Mr. Gibbs pointed out in his address, the railways have been forced to the use of heavier rolling stock and consequent increase in rail stresses by the steady increase in operating expenses and steady reduction in freight rates. "If the railways had to revert to the old methods, using the type of equipment standard twenty years ago, it is improbable that they could exist under modern conditions and burdens. The sheriff would have them."

Similarly, Mr. Gibbs pointed out, the modern steel mill like the railroad can exist only by being operated on a large scale. Modern steel-rail production is a continuous

[1] "Engineering News," May 27.

process from the time the raw ore and coal are dumped into the blast furnace until the finished steel rail is discharged onto the cooling beds. Any change in method to finish the rails at a lower temperature which would involve an upsetting of this continuous process might result in such an increase in cost as would make the product uncommercial.

Mr. Gibbs was careful not to overstate the situation with reference to rails. The actual percentage of rail breakages is trifling compared with the number in service, and the very great majority of those which break are discovered by vigilant track inspection before any harm ensues. It is because every rail breakage in main line track presents the possibility of a serious accident involving large loss of life that it is worth while to use every endeavor to reduce such breakages. Mr. Gibbs frankly admits, also, that the very heavy wheel loads and high train speeds, with imperfect conditions of track maintenance, are responsible for much of the rail breakage. There is not likely to be a material reduction, however, in either loads or speeds, and the means available for maintaining track are too crude to expect perfection or anything approaching it.

Probably the most important move toward a better quality of steel in rails is the very general change to openhearth instead of bessemer steel. The railways have been willing to pay an increased price for openhearth rails in order to secure a safer metal. The willingness of railways to spend money in order to obtain greater safety is illustrated by Mr. Gibbs' statement that on one railway system the actual expense of every kind caused by rail breakage in a year was less than one-fifth the amount of the increased cost of rails because of the introduction of a proposed new specification designed to secure better quality rails.

As to the possible methods by which the quality of the metal in rails may be improved, Mr. Gibbs names three which are now being tried to the extent that rails produced by them are in service in the track. These are the electric furnace, the sink head process for casting ingots and the Lackawanna Steel Co.'s deseaming process.[2] Heat treatment of rails is also being tried and Mr. Gibbs thinks it is promising. His personal opinion is that the time has arrived for a considerable increase in the weight of rail sections and that this rather than improvement in quality of the metal is the most promising means for reducing rail breakages at the present time. He would have no halt made, however, in the search for a means to produce rails of more reliable quality, and particularly in the study of methods which will enable the engineer to be more certain as to the quality of the rails that he purchases.

At present neither the standard rail specification of the American Society of Testing Materials nor that of the American Railway Engineering Association really protects the buyer as to the chemistry of the rail which he purchases. It has been demonstrated that the chemical analysis of the finished rail often varies very widely from the analysis of the specimen taken from the ladle before pouring the ingot. It may yet be necessary in rail specifications to do as has been done in some of the specifications framed by Dr. Dudley for the Pennsylvania R.R.—make the method of chemical determination a part of the specification.

[2] "Engineering News," Dec. 17, 1914, p. 1228.

Unemployment Among English Engineers

It is doubtless little realized in this country how serious is the situation that confronts the civil-engineering profession of Great Britain. In an editorial entitled "Employment After the War," London *Engineering* reveals the extent to which the abandonment of ordinary construction work has made idle many hundreds of engineers. In Great Britain at present everything is subordinated to the one task of vigorous prosecution of the war, especially to securing an ample supply of guns and munitions for the British troops and their allies. This means the suspension of nearly all civil-engineering work, mainly because funds for it are lacking. All the money which can be secured from investors is devoted to the prosecution of the war. Cities are required by the Local Government Board to make only such extensions and improvements to their water-supply, sewerage and drainage systems as are absolutely essential, and such work is limited to what can be paid for by taxation.

British cities must not compete with the government in the market for capital. A similar condition exists with respect to county work; the railways are all in the hands of the government and private firms are not undertaking extensions of plant or buildings. Even if capital were available to undertake engineering works, the labor is lacking to carry them on.

Under these conditions the civil engineers of Great Britain, unless they happen to be connected with some of the establishments which are producing ammunition or necessary supplies for the war, find their occupation gone. They cannot mend their situation, either, by emigrating to the colonies, for the tying up of capital by the war has put a stop to constructive enterprise there as well, and the same thing is true of such regions as South America and China, which have been accustomed to draw from Europe the capital required for their engineering works.

Engineering points out, however, that as soon as the war is over a great demand will arise for the immediate construction of work long deferred. For one thing, such work will be necessary in order to provide employment for the hundreds of thousands of soldiers returning to civil occupations. Our contemporary urges, therefore, that the engineers now idle should be set at work making surveys, plans and specifications for works to be undertaken when the war shall end, so that when the emergency comes, the plans for such work will not have to be made in a rush, with insufficient investigation.

An amendment recently introduced in the New York Constitutional Convention reads as follows:

> The legislature shall not pass any bill nor shall a state board, commission or officer adopt any rule or regulation affecting manufacturing industries or business which is unreasonable.

If only it were possible by constitutional amendment to so restrict our legislators and public officials that they should subject no one, high or low, to unreasonable laws or restrictions! If the New York Constitutional Convention could work that miracle for the benefit of the people of the state it would confer such a boon upon them that it could afford to forget all the other measures before it. But who would decide where reason ended and unreason began?

Letters to the Editor

Stresses in the Panama Canal Cranes

Sir—I have just read, on p. 947 of ENGINEERING NEWS, May 13, 1915, your comments on the article written by Civil Engineer F. H. Cooke, U. S. N., on the failure of the Panama Canal crane "Ajax." I note your statement: "The crane is a type of engineering structure in which it is possible to compute the stresses with greater accuracy and certainty than in almost any other structure which the engineer builds," and also the conclusion, "The safe course is to make latticing strong enough for 4 per cent. of the column load."

In view of the great influence such a conclusion, appearing in one of the foremost American technical journals, will have on the work of the structural engineer, I desire to present my views on the matter, particularly as the plans for the strengthening of members 27, 28 and 29 were prepared under my immediate direction, and the strengthening of the crane "Hercules" was executed in accordance therewith while Mr. Cooke was absent on leave.

Referring to your statement regarding the exact computation of the stresses in all the members of the crane, your attention is called to the fact that no spherical pins have been provided at the intersection of members 28 and 29, whereas such pins have been used at the heel of the jib. The reason for using spherical pins at the latter place is that it is a practical impossibility so to align these pins as to avoid excessive bending and torsional stresses in the adjacent members, as well as increased friction in the journals while revolving the jib.

The crunching sound mentioned by Mr. Cooke in connection with the "Ajax," and which was also heard by the writer during the tests of the "Hercules" after it had been strengthened, clearly demonstrates that the heel pins on both cranes are out of alignment. The perfect alignment of the pins at the intersection of members 28 and 29 is even more difficult to obtain than the alignment of the heel pins. It is therefore fair to assume that the pins at the intersection of members 28 and 29 are not in proper alignment. If this be the case, and assuming members 28 and 29 to be perfectly rigid against torsion and bending, the pin at the intersection of these members will describe a warped surface of a definite geometric shape when the jib revolves, whereby the angular inclination of the pin relative to the longitudinal and transverse axes of the connecting link will continually change, causing torsional and bending stresses in the connecting link. As, however, none of these members are perfectly rigid, they will all distort due to torsion and bending, and the consequent inclination of the axis of the pin will change from its geometric position under the previous assumption to one dependent upon the combined influence of the strength of each member to resist torsion and bending, the angular deflection of the pin caused by each member being in inverse proportion to its strength. The analysis of this problem involves complicated calculations, which will not give results with the accuracy and certainty stated in your comment.

A general idea of the magnitude of the various stresses produced in the members by the improper alignment of the pin may be obtained from the following discussion:

Members 28 and 29 are fastened together nearly at right angles to each other by two gusset plates. Any bending or torsion in member 29 produces torsion or bending respectively in member 28, and vice versa. As these members are adapted to resist bending stresses better than torsional ones, any change in the inclination of the pin with reference to any plane is resisted principally by the strength of these members in bending. On the other hand, the connecting link is so constructed that it is not well adapted to resist either torsion or bending; therefore the inclination of the pin is principally dependent upon the bending strength of members 28 and 29. This will result in a condition of loading approximately the same as that previously described, in which members 28 and 29 were assumed perfectly rigid and all distortion due to torsion and bending was taken up by the connecting link. In analyzing the strength of the connecting link it can readily be seen that this member may, without serious weakening, be subjected to torsion, but it cannot be subjected to great bending, since this member consists only of two large plates fastened together by small batten plates spaced about four feet apart. Since this member cannot resist great bending, the combined bending and tension in this member will result in the unequal distribution of tension between the two sides of the link, which by increased angular inclination of the pin may result in the total load being carried by one side of the link, thereby subjecting member 29 to nearly its full load applied at one side, thus producing excessive bending stresses, resulting in probable failure.

Referring to the detail construction of member 29, at the heel of the jib, it will be seen that the unsupported length of gusset plate was originally about 6 ft., no diaphragms having been provided at this point for member 29, the only connection between the two plates being three small batten plates in No. 28, each 9 in. long. At the other end of member 29 the unsupported length of gusset plate was also about 6 ft. It is evident that, when a column of this character is subjected to eccentric loading, buckling will take place in the gusset plates if no provision is made for transferring the shear produced by the bending. It is therefore believed that, as far as member 29 alone is concerned, failure was due to the omission of diaphragms between the gusset plates at each end, and that the lacing bars and batten plates were sheared off after the buckling of the gusset plates took place. Inspection of the lacing bars and batten plates throughout the structure will show that they are weaker than is usual in American practice; and although the strength of the lacing bars for member 29 is comparatively less than for any other member of the structure, it should be noted that this member was

furnished with plate separators connecting the webs of each side of the member, which tend to increase the strength of this member for centric loads.

The lower chord of the jib, which is about 120 ft. long, is furnished for its total length with only two small batten plates, one at each end, whereas American practice would call for one batten plate at each end of each panel, or, in other words, for a total of 14. This member showed no weakness; on the contrary, as can be seen from the photographs, it withstood wonderfully the shocks to which it was subjected when the jib collapsed. In view hereof it is not believed that the present American practice regarding lacing bars and batten plates for compression members is unsafe, nor is it believed that the failure of member 29 was caused by insufficient strength of lacing bars or batten plates.

The principal strengthening of member 29 was the provision of diaphragms at each end to prevent buckling of the weakest part—the gusset plates. As the detail of the heel and of the strut would not permit the placing of the diaphragms as desired, a yoke of plates and angles was added on the outside of the strut as further precaution against buckling. Heavier lacing bars, with stronger rivet connections, were also supplied, but solely for the purpose of taking care of the increased bending stresses that might be produced in the strut by the eccentric loading which, as pointed out in the foregoing discussion, is likely to occur on account of improper alignment of the pins.

The upper end of strut 29 is braced against lateral motion by a portal at member 28, a sway-frame at member 23, and lateral bracing at member 25. As member 28 consisted of two built-up channel sections connected by double lacing of one-rivet connections, the upper part of member 29 was braced against lateral motion by the value of one rivet only. In order to increase this value, the double lacing bars were replaced by a solid web. As far as member 27 is concerned, the inclination of the lacing bars was found to exceed that of common American practice, and since it was found impracticable to change this inclination, batten plates were substituted.

Regarding the general construction of the jib, it should be noted that the top lateral system has intentionally been omitted in order to allow the two vertical trusses so to adjust themselves in their own planes that both trusses will at all times carry equal loads. This method of construction would work admirably in case a sway-frame could be placed at member 29. As the details of construction are such that a sway-frame cannot be placed at member 29, and as it is essential to the construction of the jib to have it stayed at the intersection of members 28 and 29, this was accomplished by the portal, sway-frame, and bottom lateral system previously mentioned. By this method of construction, however, the great advantage of omitting the top lateral system is offset by the fact that any adjustment of the vertical trusses to equalize the loads they are to carry causes lateral deflections at the intersection of members 28 and 29, which in turn introduce bending in member 29, the calculation of which is equally as complicated and uncertain as that due to improper alignment of the pins.

In conclusion, I wish to state that, in my opinion, the primary cause of the failure of the jib was the excessive bending stresses produced in member 29 by either an improper alignment of the pins or by the lateral deflection produced by the portal, or by both. The secondary cause was the omission of diaphragms at each end of member 29. In the event that these had been provided, that the pins were properly aligned, and that the portal caused no deflection, I see no reason why failure should occur in either the lacing bars or batten plates.

The plans for stiffening the various members as described in this letter show what was done in the effort to make the jib already erected on the "Hercules" as strong as possible without dismantling and re-erecting. I wish, however, to state that before the "Hercules" was tested I gave no assurance that the method of reinforcing would be successful, as it was not as good as could have been employed if the jib were rebuilt entirely.

As the writer has not yet had the opportunity to make the required calculations, it has not yet been definitely established whether the successful tests of the "Hercules" were due solely to the stronger members, to the more perfect alignment of the pins, or to both.

T. B. MONNICHE,
Engineer of Docks, Panama R.R.

Cristobal, C. Z., May 25, 1915.

[Comment on the foregoing letter is made in our editorial pages.—EDITOR.]

Sir—I note that in the editorial comment on my account of the failure of the floating crane "Ajax" the conclusion is reached that latticing of compression members should be capable of resisting a transverse shear equal to 4 per cent. of the calculated column load instead of the 2 or 2½ per cent. at present considered sufficient. I think that the statements made in the article hardly justify such a conclusion.

It is true that the principal or primary stresses in structures like the crane "Ajax" are susceptible of more satisfactory computation than corresponding stresses for railway bridges, for the reason that it is not necessary to make more or less arbitrary assumptions for impact and vibration, but it is very possible that secondary stresses not susceptible of such satisfactory computation may exist, and may have an important bearing on the resultant strength.

In the next to the last paragraph of your editorial you draw attention to the unusual character of the strut, particularly as regards the detail at its upper end. These conditions were brought out in the description of the general construction of the jib contained in the article. I was absent from the Isthmus at the time of the failure and did not return until about two months thereafter. T. B. Monniche, Engineer of Docks, made an investigation of the conditions developed by the failure, and I understand that he is of the opinion that the primary cause of the failure was the absence of correct alignment of the pin at the intersection of members 28 and 29. If this pin was out of line, it might well produce secondary stresses of considerable magnitude, though difficult to compute satisfactorily, and the effect of this misalignment would be felt in compression member 29. This member was not well designed to resist forces producing shear between its individually weak halves; although it would in all probability have withstood with ease an axial compressive force of the magnitude of the theoretical compression existing in it at the time of the failure.

Therefore, I am of the opinion that a conclusion that the latticing of all columns should be strong enough to resist a transverse shear equal to 4 per cent. of the column load does not logically follow from the "Ajax's" failure, for there are too many elements of doubt to justify such a conclusion.

F. H. Cooke,
Designing Engineer.

Balboa Heights, May 29, 1915.

Sir—Referring to the description of the failure of the Panama Canal crane "Ajax" and your editorial comments on this failure:

The formula for transverse shear to be taken by lacing bars, which appears in the New York Central Lines Specifications, is based on the cross-sectional area of the member, assuming that the member has been designed to meet the specification requirement as to the loads and unit stresses. This formula would give, in the case of the "Ajax" crane, a transverse shear of about 2½ per cent. of the calculated axial stress.

In the writer's opinion your conclusion that this requirement should be increased to 4 per cent. is not warranted by the failure under discussion.

The calculated unit stress in the heel strut under conditions which produced failure—that is, a dead-load plus a live-load of 580,000 lb.—is practically equal to the stress permitted by the Canal commission's specifications; but apparently no allowance has been made for so-called "impact," and it seems entirely probable that the heel strut was subjected to a stress considerably in excess of the calculated stress. There was a considerable inertia to be overcome in moving the load of 135 tons when the luffing pull was applied. Thus for an instant after the luffing motors were started the stress in the heel strut was probably considerably in excess of the stress due to dead- and live-loads alone.

Besides being increased by the inertia of the load, the calculated stress might have been also increased by an unequal distribution of the load to the two trusses.

The failure of a column at a unit stress of 12,000 lb., even with poor details, seems unreasonable; but assuming that this stress was increased 50 per cent., and considering the poor details and the fact that the member was unbraced, the result was not extraordinary.

In the writer's office an impact allowance of 50 per cent. is added to the lifted load when calculating stresses in crane girders. Assuming that lacing bars should have been designed for a shear equal to 4 per cent. of the stress due to dead-load plus live-load, we would get a shear transverse to the axis of column of 580,000 × 0.04 = 23,200 lb. Assuming again that an impact allowance of 50 per cent. should have been added to the lifted load, the designing stress in the strut would have been 147,800 lb. + 432,300 lb. + 216,150 lb. = 796,250 lb.

The shear of 23,200 lb. (4 per cent. of the dead-load and live-load stresses combined) is practically 2.9 per cent. of the stress, which includes 50 per cent. impact, and agrees closely with the New York Central Lines' specification requirements, considering the fact that these specifications are for railroad bridges and provide for a maximum impact of 100 per cent.

The stress in the lacing bars is determined by multiplying this shear by the secant of the angle which the bars make with a line normal to the axis of the column. In this case the bars were inclined at an angle of practically 45 deg., although first-class practice would require that they be placed at an angle not greater than 30 deg., with effective stay-plates at the ends of the member. The rivet shear at any lacing-bar connection would be equal to the sum of the longitudinal components of the stresses in the two bars meeting at that connection.

An analysis of the rivet stress in the lacing-bar connections of the member under discussion, assuming an increase in stress for lifted load of 50 per cent. and a transverse shear equal to 2½ per cent. of the axial stress—which in this case would conform with the requirements of the New York Central Lines' specifications—shows the following result:

Transverse shear on two planes = 0.025 × 796,250 = 19,900 lb.

$$\text{Shear on one } \tfrac{3}{4}\text{-in. rivet} = \frac{19{,}900 \times 2}{2} = 19{,}900 \text{ lb.}$$

$$\text{Shear per square inch} = \frac{19{,}900}{0.44} = 45{,}200 \text{ lb.}$$

At an allowable unit stress in shear of 13,500 lb. per sq.in., one ¾-in. rivet would have a value of 5940 lb., so that the lacing-bar stress of 14,000 lb. would have called for a three-rivet connection.

While the foregoing, in the writer's opinion, justifies the use of the formula for lacing bars contained in the New York Central Lines' specifications, it is not meant to justify the use of lacing bars in such a case as that under discussion. In this connection your attention is called to the following paragraphs in that specification.

Par. 66. . . . Compression members shall have their segments connected by solid webs, if practicable.

Par. 67. The open sides of compression members without central webs transverse to the plane of the segments shall be stayed by stay-plates and lacing bars. The open sides of the compression members with such central webs shall be stayed by stay-plates. The stay-plates at the ends of members shall be placed as near the end of the member as practicable, and shall have a length not less than one and one-fourth times the width of the member between the nearest rivet lines connecting them to the flanges.

H. T. Wenty,
Engineer of Structures, Exterior Zone,
The N. Y. C. R.R. Co. East.

Grand Central Terminal,
New York, June 4, 1915.

Competitions as an Aid to Engineering Instruction

Sir—Recently instructors in two of the leading technical schools of this country have commented on a marked difference between the students of the departments of civil and architectural engineering as regards their attitude toward their studies, capacity for work, enthusiasm and *esprit de corps.* The writer, also, from experience as a student and a teacher in both architectural and civil engineering, believes that this distinction exists and is not due to dissimilarity of character and qualifications of the students in the respective courses but to essential differences in the administrative and pedagogical methods of the two departments.

The courses in architectural engineering are so taught that the student first learns the fundamental principles and then their application to the solution of a number of practical problems. Each student solves the same problem—but independently, in an original manner and with-

in a limited period of time. In many of the more advanced courses the students' work is graded and ranked in order of merit by a group of judges composed of members of the instructional staff and often one or more distinguished practitioners. The results for each problem are publicly exhibited and at a stated time are reviewed and criticized by the instructor in charge. This method of competitive and coöperative endeavor on the part of the students arouses in them a healthy spirit of emulation and enthusiasm. The solution of each problem becomes an interesting game in which all participate with that earnestness and industry which are essential elements for success in their school training as well as in later life.

It is true that the courses in civil engineering also require the solution by the students of a large number of practical problems; but the writer does not know of a single school where these problems are solved on a competitive basis. The usual abstract and noncompetitive methods of field, laboratory and drafting-room work lead to individual, isolated and an unenthusiastic effort. The most earnest and enthusiastic teaching cannot inspire the student with the same interest in his work as does the knowledge that he and his work are constantly up for judgment before the whole school. Awaken a student's pride and you will arouse him to high endeavor, while the mere acquisition of "passing grades" will hardly more than maintain his flagging interest.

It is believed that the competitive method of instruction could be successfully applied to many courses in still other branches of engineering. In order to become effective, this method would have to be adopted as a department policy and all the members of the instructional staff and student body would have to coöperate. It would be desirable in some of the more advanced courses to secure the coöperation of agencies outside of the school, such as engineering companies, technical societies and public organizations, in the formulation of problems, criticism of the results and the possible award of tokens of merit.

A. B. McDaniel,
Assistant Professor of Civil Engineering,
University of Illinois.

June 9, 1915.

Making the Most of the Working Season on Public Works

Sir—Much municipal work suffers from the lack of system in preliminary details. For example, there is the custom of beginning in the spring to arrange for paving, dragging the necessary legislation along for weeks, letting the contract in midsummer or later, and beginning actual construction so late in the season that bad and perhaps freezing weather in the fall overtakes the contractor. This almost always results in added expense to the contractor and injury to the concrete and to the cement-grout filler, if a brick pavement is being put down. Much has been said and written about greater efficiency in construction methods employed on public works, nor has too much emphasis been placed on this phase of the subject; but there is just as urgent need for system and efficiency in preliminary proceedings.

The present illogical system, or lack of system, is chargeable partly to what seems to be the natural tendency of public officials to dilatory action and partly to the laws which govern political units. So far as public officials are concerned, aroused public sentiment could be made to act as a spur; but sometimes laws enacted by state legislatures are so firmly rooted in custom that it is difficult to get them changed.

In most states all municipal and county officials are inducted into office in the early part of the year. Time is consumed in organizing the government, familiarizing the personnel with their duties, and in formulating plans and devising means for putting them into effect. Ordinarily the budget of receipts and appropriations for the year is made out in the spring. Usually a city administration which is to go out in the spring does not assume the responsibility of authorizing expenditures for work to be done under the succeeding administration.

Some change ought to be effected in these matters, either by legislative enactment or through an iconoclastic assault by public opinion upon the idol of procrastination so long worshipped by public officials, so that all preparatory work shall be got out of the way during the winter months and construction work begun as early in the spring as the weather permits.

F. A. Churchill.

Conneaut, Ohio, June 22, 1915.

Selling Water by Meter

Sir—The editorial comment on my letter in your issue of June 3 concerning water meters should in fairness permit a reply.

The policy of charging for public use, and for facilities provided though not used, will undoubtedly reduce the cost to actual consumers; but these matters are obviously not related to the economic question involved in metering small consumers under conditions similar to those existing at Portland, Ore.

As to selling water at flat rate based on estimated legitimate consumption, which you apparently condemn as unfair and absurd under all circumstances, cases can be cited in which actual experience has shown that the general use of meters resulted in increased cost or decreased profits. Two such are personally known to me, one a hydro-electric plant and the other a privately owned water company which pumped all water against a 240-ft. head. In both cases the books showed that the use of meters on small consumers resulted in financial loss.

In Portland the fact in regard to distributing mains is that in small sections, through poor planning and the purchase of inadequate private mains, the present legitimate consumption unduly lowers the pressure at summits, and therefore it is impossible that meters will remedy this trouble except by objectionably curtailing the legitimate use.

The high peak of the consumption curve due to general lawn sprinking for a few hours in the early evening is the direct cause of the insufficient pressure in limited districts, and this can be overcome for the present mains only by regulations distributing the hours of sprinkling.

In any case, it appears axiomatic that only if the value of the water saved, or the value of the extended term of useful service of existing mains, equals or exceeds the total costs of metering is the metering of all consumers justified as a business proposition.

George Rae.

34 Jefferson Ave., Brooklyn, N. Y., June 12, 1915.

News of the Engineering World

Convention of American Institute of Electrical Engineers

The thirty-second annual convention of the American Institute of Electrical Engineers was held at Deer Park, Md., June 29 to July 2. There was the usual varied program of papers and entertainment. The attendance (200) was good in spite of possible interference with the special September convention in connection with the International Engineering Congress at San Francisco.

While parts of the technical program were of greatest interest to various electrical specialists, yet a considerable number of papers were of general engineering interest and are briefly reviewed here.

Power Transmission

A series of short papers, by J. A. Walls, of the Pennsylvania Water & Power Co., W. E. Mitchell, of the Alabama Power Co., P. M. Downing, of the Pacific Gas & Electric Co., F. C. Connery, of the Toronto Power Co., and J. B. Leeper, of the American Bridge Co., described tower footings that were unsatisfactory and others that amply provided against uplift, compression and horizontal movement. Methods of tower erection were briefly noted.

A paper by A. Bang, "Four Years' Operating Experience on a High-Tension Line," gave information about the Holtwood-Baltimore 70,000-volt system of the Pennsylvania Water & Power Co. and described the failure of about 3 per cent. of the porcelain insulators—due possibly to unburned spots or cracks caused by thermal and other service stresses. Special devices were described which had reduced the number and severity of disturbances caused by lightning; these involved (1) shunting the short-circuit arc momentarily with a fuse across the line in trouble and (2) momentarily reducing the generator field excitation.

Electric Railroads

A series of papers were presented showing the construction and maintenance methods and costs of contact systems on various heavy electric roads (all of which have been described at various times in Engineering News).

E. J. Amberg described the catenary lines of the New Haven, New York, Westchester & Boston and Boston & Maine (Hoosac Tunnel) lines, quoting the construction costs as running from $5000 (tangent single catenary) to $12,500 (4-deg. compound catenary) per mile. F. Zogbaum described the organization of maintenance on the New York, Westchester & Boston, and gave various data on failures and maintenance costs, the total average monthly cost for the last half of 1914 being $17.61 per track mile of contact system and $2.69 per mile of feeders. The total of this electrical maintenance for December, 1914, was 1.42c. per car-mile.

J. B. Cox described the 1500-volt catenary trolley system and locomotive collectors (roller pantographs) of the Butte, Anaconda & Pacific Ry., and gave the line-construction cost as $5514 per mile. The troubles overcome in operation were pictured, particularly those with the collectors. The maintenance cost for nine months to April, 1915, was at the rate of $95 per track mile per year.

J. V. B. Duer outlined the protected third-rail construction of the West Jersey & Seashore R.R. (Pennsylvania Lines) which had cost $4235 per mile for the third-rail system and $679 for the track bonding. The principal trouble described was that due to sleet. The detention figures were given—497 min. per year due to the third-rail system. The maintenance cost was $82 per mile per year (average of seven years) for the third rail and $26 for the track bonding. The much higher figures of the discarded trolley wire were given for comparison.

Experience with the unprotected 600-volt conductor rail of the Chicago Elevated Ry. was presented by C. H. Jones, showing a first cost of $3284 per mile and a maintenance burden of $80 per mile per year.

The design and materials for the 1550-volt overhead lines of the Portland Division of the Southern Pacific Co. were given in considerable detail by Paul Lebenbaum, with tabulated costs of material and labor. Briefly summarized these showed a first cost of $2550 per mile of track. The maintenance burden was $78 per mile per year.

C. J. Hixson, of the General Electric Co., presented curves showing the variation of factors affecting the design of proper contact systems, especially catenary trolleys.

Street Lighting

At a joint session with the Illuminating Engineering Society, P. S. Millar, of New York City, presented a lengthy paper, "Effective Illumination of Streets," and accompanied it with demonstrations by small lamps on a miniature street. He classified various streets and described the varied aims in illuminating them. Particular attention was given to vehicle driving. It was emphasized that objects were discerned usually more by contrast perceptions than by actual illumination. The important rôle of silhouetting against specular reflection on polished pavements was dwelt on. Glare was to be reduced by more lamps and lighter surroundings rather than by any shading which prevented specular reflection. The necessity was shown of arranging road lamps so that their glare did not obscure important stretches behind them.

Use of Motors

A discussion of the engineering factors which have to be studied in adapting electric power to various industries was opened by D. B. Rushmore, of Schenectady, for the Industrial Power Committee, with a general analysis of manufacturing industries, processes, equipment, labor and cost factors. This was followed by brief reviews by several members of the power requirements and service difficulties of elevators, rubber works, printing shops, brick, cement,

pulp and sugar mills, and of excavating and dredging operations in the field.

Electric Cooking

Definite data on the operation of several typical commercial electric ovens were offered by P. W. Gumaer, of St. Louis, in the paper "Economic Operation of Electric Ovens." The objects of cooking were reviewed as aimed (1) to increase digestibility of food, (2) to make it more palatable, or (3) to sterilize it. The most economical temperatures and lengths of time for oven cooking of various foods were found by a long series of trials. This necessitated finding the energy lost in preheating an oven, in maintaining it at constant temperature, and in opening the doors. The most economical temperature for well-done beef roasts was 120 deg. C.; for rarer conditions 100 deg. There was a great saving by searing the roast on top of the stove instead of preheating the oven to 250 deg. for this purpose.

Biscuits were best baked in temperatures of 200 to 240 deg. C. The energy required was the same for any temperature within this range. Bread was best baked at from 180 to 240 deg., and the most economical temperatures were between 200 and 315 deg. For baking sponge cake the highest satisfactory temperature, 190 deg. C., was the most economical. It was considered feasible to reduce cooking to a more exact science.

In the discussion, the large and increasing number of electric ranges in use were made evident. By careful heat insulation and reduced losses the operating cost was being brought down close to gas. In Spokane, where gas was $1.15 per thousand cubic feet and electricity 10c. per kw.-hr. (base rate), there were about a hundred ranges. In St. Louis it was found that cooking current at 5c. per kw.-hr. equaled gas at $1.

Rates

One of the papers attracting the most interest was entitled "Class Rates for Light and Power Systems or Territories," by F. G. Baum, of San Francisco. Customers were divided into eight classes—(1) residence lighting, (2) commercial lighting and small power, (3) street lighting, (4) day power, (5) day and night power, (6) railway power, (7) irrigation, and (8) reclamation. The author had found close similarity in the load characteristics of such classes over large districts; therefore he proposed considering together all the customers of a system, irrespective of small local differences, and fixing the rates according to the averages for the classes, following the accepted scheme of making each class support its own investment and operating charges—in proportion to peak-loads demands and total energy drawn. The proposition was applied in detail for a hypothetical California case.

Miscellaneous Papers

The following papers completed the program:

1. "President's Address," by P. M. Lincoln, of Pittsburgh; a review of 15 years' progress and an argument that startling advances in efficiency of generators, motors, water wheels, engines and turbines were no longer possible.
2. "The Electric Strength of Air," by Prof. J. B. Whitehead, of Johns Hopkins University; a summary of theory for the behavior of air under electric stress.
3. "Form Factor and Its Significance," by Prof. F. Bedell, R. Bown and H. A. Pidgeon, of Cornell University; showing the futility of defining alternating-current wave shapes by "form factor"—ratio of root-mean-square to average value.
4. "Distortion Factors," by Prof. F. Bedell, R. Bown and C. L. Swisher, of Cornell University; numerical measures for the departure of an irregular wave from a pure sine wave.
5. "An Analytical and Graphical Solution for Nonsinusoidal Alternating Currents," by F. M. Mizushi, of Cornell University; modification of the usual expressions for alternating currents to make them hold true for nonsine waves.
6. "Classification of Alternating-Current Motors," by V. A. Fynn; "Classification of Electromagnetic Machinery," by F. Creedy.
7. "Phase Angle of Current Transformers," by C. L. Dawes, and "Calibration of Current Transformers by Mutual Inductances," by C. L. Fortescue; new laboratory and shop-testing equipment.
8. "The Induction Watt Hour Meter," by Prof. V. L. Hollister; an argument that induction meters did not behave as induction motors.
9. "Measurement of Dielectric Losses with the Cathode Ray Tube," by J. P. Minton, of Pittsfield; new apparatus for measuring the energy absorbed by insulation under various pressures.

Progress in Philadelphia's Rapid-Transit Plans

On July 1 Philadelphia City Councils enacted the necessary municipal legislation to authorize the placing under contract and the commencement of construction of the first section of the Broad St. subway and of a stretch of about 5 mi. of the Frankford elevated railway. The appropriation for the subway work is $3,000,000 and the appropriation for the elevated work is also $3,000,000.

The plans have yet to be passed upon by the Public Service Commission of the State of Pennsylvania, but in anticipation of its approval of them bids are now being invited to be opened Aug. 16 next, and prescribing that construction work shall be commenced Sept. 13 next.

The section of subway upon which the first work is to be done comprises the City Hall station section, which will be located diagonally under the west and south sides of City Hall and under the two lines of the present Market St. subway. The work will include underpinning City Hall and the Market St. subway structure.

The first contract on the Frankford elevated line which is expected to be awarded Aug. 16 will consist of the column foundations in Front St. from Callowhill St. to Kensington Ave., in Kensington Ave. to Frankford Ave., and in Frankford Ave. to Unity St., a distance of about 26,000 ft. Bids for the steel superstructure of the same stretch will be invited one month later. The reason for commencing the elevated work at Callowhill St. is that no operating agreement has yet been made, and therefore it is not yet known whether the line south of Callowhill St. will have to be connected to the Market St. system at Front and Arch St. for operation by the Philadelphia Rapid Transit Co., or whether it will have to be connected to a Chestnut St. subway for operation by some other company.

Completion of a Long Tunnel in France

The Mont d'Or tunnel through the Jura Mountains was opened to traffic on May 15, completing the new direct line for the Paris, Lyons & Mediterranean Ry. to the Simplon Tunnel route to Italy direct. The tunnel is 3¾ mi. in length and has a descending grade toward the Swiss end. It is laid with 96-lb. T-rails on creosoted oak ties. The trains will be handled by steam locomotives; but as the ventilation is said to be very effective, this is not objectionable. The tunnel was driven by Meyer compressed-air drills, four drills

being mounted on a heavy cross-bar wedged against the sides of the heading. This outfit was carried on a small four-wheel truck. The compressors were operated electrically by current from a Swiss hydro-electric plant. Compressed-air locomotives handled the construction cars.

The Swiss and French headings were started Nov. 14, 1910, and July 21, 1911, respectively. The work was in hard limestone, and in December, 1912, water was encountered, which increased from 660 to 1000 gal. per sec., drying up surface springs and a small river. A concrete bulkhead 20 ft. thick was built, the water being carried through pipes during its construction. The gate valves in these pipes were closed in January, 1913. The surface springs then flowed again. The damage done by the rush of water was repaired and a central drain built with a capacity of 220 gal. per sec. The pipes were then opened to drain off the water behind the bulkhead, and this was removed in February, 1913.

Other springs were encountered in April, 1913, when water burst in again and reached a flow of 2200 gal. per sec. The heading was again closed by a bulkhead and a side drift run parallel with it (and 65 ft. distant) to drain off the water. This drift encountered a great cave, which was utilized as a drainage well, into which the water was diverted. The heading was then reopened and the tunnel work proceeded. Wet spots in the stone lining of the roof were finally closed by forcing in grout under pressure.

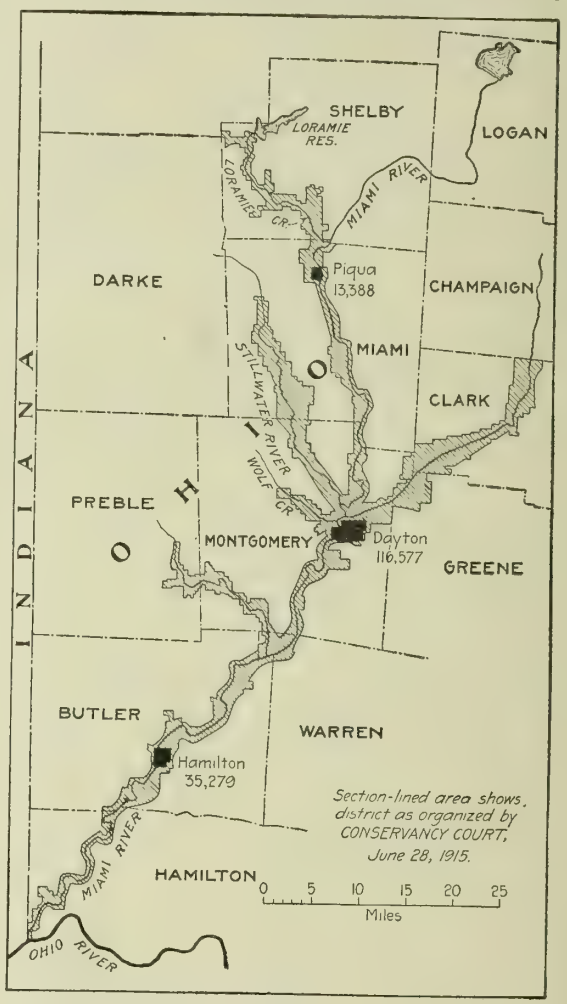
The new line between Frasne and Vallorbe is 15 mi. long and is double track, with maximum grades of 1.5 per cent. and a summit elevation of 2938 ft. It is thus much more favorable for fast and heavy traffic than the old circuitous single-track line by way of Pontarlier, which is 26 mi. long, with grades of 2.5 per cent. and a summit elevation of 3319 ft., and on which traffic in winter is subject to interruption by heavy snow.

Progress on the Miami Valley Flood-Prevention Work

On June 24 the Miami conservancy court convened at Dayton, Ohio, to consider a petition to organize a flood-protection district to be known as the Miami Conservancy District. The judges of Hamilton, Butler, Warren, Preble and Montgomery Counties voted to establish the district, and those of Miami, Greene, Shelby and Clark Counties dissented from the majority. The directors appointed by the conservancy court are Elward A. Deeds, of Dayton, Henry M. Allen, of Troy, and Gordon S. Rentschler, of Hamilton.

The court voted to exclude Logan County, owing to the fact that the detailed surveys and studies of various reservoir sites made by the Morgan Engineering Co. for the Flood-Prevention Committee have developed that the reservoir originally contemplated in Logan County is less efficient than at first supposed and that this reservoir can be compensated for at other sites at a substantial saving in cost. The accompanying map shows the district as planned.

The engineering work already completed under the supervision of Arthur E. Morgan, of the Morgan Engineering Co., includes a topographical survey of 240 sq.mi., property surveys of every piece of property in the proposed reservoirs, local, city and town surveys, relocation surveys for all steam and electric railways affected by the proposed reservoirs, the making of some 12,000 ft. of test borings on dam sites and many geological and hydrological studies and investigations. The preparation of construction plans is now in progress, about 20 engineers, draftsmen and computers being employed on this work. Sufficient progress has been made to determine the general character of the flood protection and prevention works, but there remain many details to be completed before actual construction work can proceed.



THE MIAMI CONSERVANCY DISTRICT

Bonds cannot be sold nor construction work started until the appraisal roll has been approved by the court. The total amount of money collected for the preliminary work to June 10 was nearly $478,000 and the total expenditures $301,000, leaving $176,000 to carry on this part of the work, which has included many local improvements.

Mr. Morgan has been made chief engineer of the work and will hereafter devote his entire time to it, instead of half time, as heretofore.

Failure of 17-Year-Old Concrete Roof Slab

One panel of the roof of a wing to the Gratiot School building in St. Louis, Mo., collapsed during a severe wind and rain storm on June 11, fortunately at a time when the building was unoccupied. The details of the collapse assume a certain importance because it has been errone-

ously reported as the failure of a long-established concrete building.

The wing in question was built in 1898. It comprises two stories and basement, with reinforced-concrete floor and roof slabs. There are brick bearing walls 24 ft. c. to c. which are spanned by I-beam joist 16 ft. c. to c. Into these I-beams frame 3x15-in. concrete beams spaced 18 in. c. to c. and each reinforced only with one 1-in. square deformed bar which extends simply into the concrete fireproofing around the I-beams and about 2 in. beyond the inside face of the end brick wall. The roof is a 2-in. unreinforced-concrete slab resting, without connection of any sort, on the concrete beams, and carrying a cinder concrete fill varying from 9 in. in thickness at the high point of the roof to zero at the drains.

One end panel, 16x24 ft. in plan, of this roof collapsed onto the second floor. The slab there was seriously damaged, but held under the impact of the 28-ton mass. The other panels of the floor and roof are intact, but damaged.

An examination of the roof after the failure showed that at the opposite end panel nearly all the concrete ribs had shear cracks at their supports, and in most cases were separated from the slab. Most of the ribs were badly deflected and had many diagonal tension cracks. The brick wall at the standing end panel was about ¾ in. out of plumb. It is assumed that the expansion of the cinder concrete fill pushed out the end walls and thus weakened the roof slab so that it was easily thrown down by the storm. At the same time it should be recognized that the whole construction is inherently weak and merited its long-delayed failure.

Growth of American Merchant Marine—The tonnage increase of the American Merchant Marine up to May 1, 1915, amounted to 1019 vessels of 680,155 gross tons, according to a recent report of the Bureau of Navigation. This is a greater increase than has been recorded for any previous year. In 1907 there were added to the American registry 596,708 gross tons; previous to that the record had been held by the year 1855, when an increase of 586,102 gross tons was recorded.

The Hudson Bay Railway, from Le Pas (on the Canadian Northern Ry.) to Port Nelson, 420 mi., has the construction work well advanced. Work was started last spring with the grading at 290 mi. from Le Pas and tracklaying at 214 mi. The cantilever bridge over the Nelson River will be commenced and further work will be done on the terminals and harbor at Port Nelson. W. A. Bowder is Chief Engineer. The work is under the direction of the Department of Railways and Canals.

The Pan-American Scientific Congress is to be held in Washington, Dec. 27, 1915, to Jan. 8, 1916. The arrangements are in the hands of the Department of State. Hon. John Barrett, director-general of the Pan-American Union, is to act as secretary-general of the congress. The sessions will be held in the building of the Pan-American Union, which also will be the headquarters of the congress. Among the subjects which will be dealt with by the congress are meteorology and seismology, conservation, irrigation, engineering, mining and metallurgy, applied chemistry and transportation.

Freight Terminal Improvements at Chicago, proposed by the Atchison, Topeka & Santa Fé Ry., include a produce terminal at Wentworth Ave. and 16th St. Nothing definite has been decided, but the railway company has requested the city authorities to close some streets in a district where all the property is owned or controlled by the company, with the idea that if this is done the district can be utilized for terminal purposes. This would be for the railway company's own use. A project for a union terminal, warehouse and market for fruit and produce was noted in "Engineering News" of April 29.

Continuing Alaskan Railway Surveys—Thomas Riggs, Jr., member of the Alaskan Engineering Commission, left Seattle with his party May 6 and arrived at White Horse, Yukon Territory, May 11. As river navigation from White Horse is not open until June, he had the party transported overland, a distance of 135 mi., sending out the first wagon the day after he arrived. He reached Nenana on May 25, just 19 days after leaving Seattle, which was record time for that period of the year. There a camp had already been erected. On May 26 one of the party started up the Nenana River, and two days later the full party was in the field surveying.

The National Forest Reservation Commission has approved the purchase of lands in the White Mountains and the Southern Appalachians amounting to a total of 1,275,000 acres, the latest purchase of about 98,000 acres having been authorized on June 23. The prices paid for these latest purchases were $1.90 per acre for a block of 36,000 acres in North Carolina and $7.21 per acre for about 23,000 acres in New Hampshire. There were also acquired more than 13,000 acres at $2.70 per acre in the Natural Bridge area in Virginia. Practically all the land is mountainous and useful only for forest growth. Most of it has been cut over, but several large tracts have considerable timber on them.

Another Large Blast—A blast at the quarries of the Riverside Portland Cement Co. in California was described in "Engineering News," May 27, as the largest blast on record. The quantity of explosive used was 58 tons, nearly all 5% Hercules R. R. P.; and it was estimated that between 350,000 and 400,000 tons of rock was loosened. The "Engineering and Mining Journal" of May 29 describes a blast at the British Columbia Copper Co.'s Mother Lode mine, Greenwood, B. C., in 1913, in which 25 tons of 40% dynamite was used, and it was estimated that fully 400,000 tons of rock and ore were broken up. This, like the one at Riverside, was a strictly underground blast. There were 4830 holes loaded from interior shafts or tunnels.

The Panama Canal in its first eleven months of operation earned from tolls a little more than enough to pay the cost of its operation and maintenance. For the ten months ending Apr. 30, the tolls earned amounted to $3,338,000 and the expenses of operation and maintenance were $3,377,000, leaving a deficit of about $40,000. In May, however, the tolls earned amounted to $547,000, giving a sufficient margin above the expenses to wipe out the deficit and show a slight profit for the canal. It should be noted that in the cost of operation and maintenance is included the sum of $1,369,000 expended on dredging in the Gaillard cut. If this expense were charged to construction, the total cost of operating and maintaining the canal would be a little over $2,000,000 for its first year.

Hollow-Tile Walls are the subject of a specification recently adopted by the Hollow Building Tile Manufacturers' Association of America as a suggestion for municipal building codes. An absorption of 10 per cent. maximum and a minimum crushing strength of 3000 lb. per sq.in. net area are called for. The permissible loading is fixed at 200 lb. per sq.in. bearing members (continuous shell and web area.) The specification allows tile to be used in place of brick in all walls, including foundation walls, in the same gross thickness. For buildings outside the fire limits a minimum wall thickness of 6 in. (for one-story buildings) is specified. Copies of the specification may be secured from Charles T. Harris, secretary of the association, Engineers' Building, Cleveland, Ohio.

Reasons for Station Contracts in building the government railways in Alaska are given by William C. Edes, chairman of the Alaskan Engineering Commission, in a newspaper dispatch to the Boston "Transcript" from Seward, June 28. Mr. Edes is quoted as follows:

> We have been criticized for employing what is referred to as foreign labor and for cutting the so-called Alaska wage scale. The men gathered here to secure station work are above the average. Many come here from the railroads just completed in Canada, and we are fortunate to get such experienced help. The commission is handicapped by the Federal 8-hr. day law, because the season is only seven or eight months long and the men would prefer working longer hours for more pay. The wages paid are 37½c. an hour, which, after deducting $1 a day for board, leaves $2. With 24 hr. of daylight the men could work 10 hr. with ease. With this in mind, the commission is letting out contracts to groups of men and contractors so that they may work as long as they wish.

A Shortage of Potash Salts in the United States in 1914 was caused by the curtailment of imports consequent to the European War. Voluminous discussions as to the remedy for this condition have appeared, especially with regard to the fertilizer industry. A bulletin by W. C. Phelan, just published by the United States Geological Survey, discusses the situation and describes the work done in this country last year toward finding a domestic supply of potash salts. Potash salts imported for consumption in the United States in 1913 amounted to 612,514,916 lb., valued at $10,805,720. In 1913 nearly 1,000,000 lb. of potash fertilizer was used. On account of the field cost, investigations by the Survey have been limited to the drilling of a single deep well in the Black Rock Desert in Nevada, to general reconnaissance, and to tracing and checking reported discoveries or possibilities. The drilling uncovered no bed of potash or other salts.

Work on the Second Simplon Tunnel Continues in spite of the entrance of Italy into the war. The south end of the tunnel is on Italian territory, the north on Swiss territory; but at present work on the north end is discontinued, while progress at the south end was not interrupted when Italy declared war, except that the number of workmen was reduced by the call to colors, which required the recruiting of a new force. The May advance of each of the various elements of the work (crown heading, full section excavation, sidewall construction, arch construction) in the south end was about 875 ft.; heading work was prosecuted from a number of upraises. The total length of completed tunnel at the end of May was 15,232 ft. in the south end and 15,987 ft. in the north end, or a total of 31,219 ft., representing 48 per cent. of the final length of the second Simplon tunnel (65,026 ft.).—"Schweizerische Bauzeitung," June 12.

A Pavement Guarantee was sustained in a suit brought by the City of St. Paul against the Barber Asphalt Paving Co. to recover about $70,000. The company took 12 paving contracts in St. Paul some years ago, agreeing to make all necessary repairs on the pavement for a period of ten years. In October, 1912, the company refused to make repairs, claiming the damage to the pavement was due to leakage from gas mains, injury by street-railway tracks, excessive sprinkling of the streets, dirt in the gutters, insufficient crowning on some streets and the nature of the subsoil. The city therefore made the repairs and brought suit against the company for the amount expended. The U. S. District Court gave judgment in favor of the city, and that judgment has now been affirmed by the Circuit Court of Appeals, which holds that the company was bound to have had knowledge of the conditions likely to cause injury to the pavements when it entered into the contract.

Lock No. 4 at the Soo Canal has the excavation completed by the MacArthur Brothers Co., of Chicago, and work will soon be commenced by the contractors for the masonry, the Oscar Daniels Co., of Chicago. The lock is parallel with and a duplicate of Lock No. 3, which was described fully in "Engineering News," Mar. 5 and Apr. 23, 1914. It will be 1350x80 ft., with from 24½ to 25 ft. of water on the sills. The filling culverts will extend under the floor for the full length of the lock and the emptying culverts will extend from its lower end to discharge beyond the lower gates. These culverts will have butterfly valves operated by hydraulic cylinders. The steel lock gates will be operated by electric winding engines. All the work of construction and operation is under the direction of Louis C. Sabin, General Superintendent of the St. Mary's Falls Canal. Lieut.-Col. Mason M. Patrick, Corps of Engineers, U. S. A., is in charge of the district which includes the Soo canals and locks.

A Patent Decision on electric car-lighting systems, recently delivered by the United States Circuit Court of Appeals for the Second District, in the case of the Safety Car Heating & Lighting Co. versus the United States Light & Heating Co., sustains the decision of the lower court upholding the first eight claims of patent No. 747,686 to J. L. Creveling, dated Dec. 22, 1903, and owned by the Safety company. The patent covers an electrical regulating system by which the current delivered by the generator, which is driven from the car axle at rates varying with the speed of the train, is maintained at substantially constant voltage. The court's decision reviews the methods of regulation adopted by various other inventors and awards priority to Creveling. A decision in favor of the Safety company was also entered on June 1 by Judge Hazel in the United States District Court of Western New York in a suit against the Goulds Coupler Co. for infringement of patent No. 1,070,080, to H. G. Thompson, dated Aug. 12, 1913. The judge held that claims 4, 9, 10, 11, 12 and 13 of the Thompson patent were infringed by the Simplex system, made by the Goulds Coupler Co.

An Automatic Train-Stop and Cab Signal system was given a practical trial on the Cincinnati Southern Ry. a few weeks ago. The track installation has been made on 18 miles of the southbound track between Erlanger and Crittenden, Ky., this being a double-track line equipped with automatic three-position block signals. At each block a track contact and a 6-ft. bar outside of and a little above the track rail are located 600 ft. in advance of the fixed signal. The tender carries shoes which engage the contact device, and circuit-breakers which are engaged by the bar. The engine is equipped with a three-light signal and a speed recorder driven from one of the truck axles. When the block signal is at "proceed," the cab device shows a white light while the train is running through the block. If the signal is at the "proceed under control" position, a green light is shown, while a "stop" signal causes a red light to be shown in the cab. If a train passes a "stop" signal, the circuit closes an air valve and the brakes are applied. When it has come to a full stop, the needle of the speed recorder closes a circuit, and the train can proceed no faster than 10 m.p.h. to the next signal. The circuit breaker is to insure that no cab signal is carried through from one block to the next, but is actuated definitely at each block. A special feature of the system is its speed-control arrangement. If the train exceeds 25 m.p.h. while in a block governed by a caution signal, the brakes will be applied, but will be released automatically when the speed has been reduced within this limit. By the same means the maximum speed of the train can be kept within any desired limit. This control is secured by contacts made with the indicating needle of the speed recorder. The system is controlled by the Julian-Beggs Signal Co., of Terre Haute, Ind.

PERSONALS

Mr. B. H. Klyce, Assoc. M. Am. Soc. C. E., was recently appointed City Engineer of Miami, Fla.

Mr. William B. Winslow, a lawyer of New York City, has been appointed Receiver for the Florida Railway Co.

Mr. A. K. Nicolaysen, Assistant City Engineer in Charge of Bridge Construction of San Antonio, Tex., has resigned from the city's service.

Mr. W. H. Keller has been appointed Master Mechanic of the Baltimore & Ohio Southwestern R.R., with headquarters at Cincinnati, Ohio.

Mr. Arthur S. Piers has been appointed Manager of the Real Estate Department of the Canadian Pacific Ry., with headquarters at Montreal.

Mr. E. M. Turner, for the past 12 years Assistant City Engineer of Shreveport, La., has been elected City Engineer, to succeed Mr. George R. Wilson, resigned.

Mr. Frank E. Davidson, M. Am. Soc. C. E., of Patterson & Davidson, Engineers and Architects, Chicago, Ill., has been elected President of the Illinois Society of Architects.

Lieut.-Col. Jay J. Morrow, Corps of Engineers, U. S. A., has been relieved from duty at Portland, Ore., to take effect Aug. 1, 1915. He is to go to the Panama Canal Zone for duty under the Governor.

Mr. H. M. Montgomery, Chairman of the Chicago Section of the American Society of Mechanical Engineers, has been elected Vice-President and Director of the Powdered Coal Engineering & Equipment Co., of Chicago.

Mr. R. L. Squier, Deputy County Engineer of Champaign County, Ohio, recently passed the bar examination at Columbus, Ohio, and will be admitted to practice. Mr. Squier is a graduate civil engineer and will continue his practice as such.

Mr. Guy Nevil, who has been connected with the City Engineering Department of San Antonio, Tex., has resigned and expects to sail for Spain in the near future, where he will be connected with one of the Pearson Engineering Co.'s projects.

Messrs. H. C. Trexler, Malcolm Gross, City Solicitor; David Williams, Editor of the "Labor Herald;" E. J. Lumley, President of the Chamber of Commerce; F. W. Weil and S. A. Weishampel have been appointed members of the City Planning Commission of Allentown, Penn.

Mr. Hurlbut S. Jacoby, formerly Chief Engineer of the Standard Steel Construction Co., of Welland, Ont., now Instructor in Civil Engineering at Pennsylvania State College, will spend the summer as Associate Engineer with the Samuel Austin & Son Co., of Cleveland, Ohio.

Mr. E. F. Booth, Assistant City Engineer of Youngstown, Ohio, has resigned and will enter into partnership with R. C. Shook, local contractor, who has been awarded the contract to grade and build the bridge foundations for the Fredericksburg road at the Milton Reservoir site.

Mr. H. E. Bilger, M. Am. Soc. C. E., Road Engineer, Illinois State Highway Department, Springfield, Ill., was granted the degree of Master of Science, pro merito, by Bucknell University, on June 16. Mr. Bilger is a graduate of both Bucknell University and the University of Missouri.

Mr. Thomas J. McMaster, who for the last 30 years has acted in the capacity of Sales Engineer for a number of concerns in the West, has been made District Manager of the Diamond Power Specialty Co., of Detroit, Mich. His headquarters will be at 809 Ashland Block, Chicago, Ill.

Mr. Frank R. Farnham, previously with the Make-It-Pay Department of the Hill Publishing Co. and later in charge of the Copy Service Department of the McGraw Publishing Co.,

has joined the Staff of Walter B. Snow, Publicity Engineer and Advertising Agent, 136 Federal St., Boston, Mass.

Mr. M. L. Scannell, Manager of Water-Works of Tiffin, Ohio, has resigned, after 37 years of service as an officer and director of the company. He will be succeeded by Mr. C. H. Witter, who has been for some time employed as Superintendent of Construction and Operation by the company.

Mr. L. R. Jorgensen, M. Am. Soc. C. E., who for many years has been associated with the engineering firm of F. G. Baum & Co., San Francisco, Calif., has severed his connections with that company and will engage in a general electric and hydraulic engineering practice at 1404 Chronicle Bldg., San Francisco. Mr. L. Jorgensen is the inventor and patentee of the constant-angle multiple-radius dam. He will make a specialty of the design of arch dams.

Prof. Charles M. Spofford, M. Am. Soc. C. E., of the firm of Fay, Spofford & Thorndike, Consulting Engineers, Boston, Mass., and Head of the Department of Civil and Sanitary Engineering of the Massachusetts Institute of Technology, has been appointed by Governor Walsh, of Massachusetts, one of the commissioners to investigate the subject of terminal facilities and the improvement of facilities for the transportation of freight in the Metropolitan District.

The following changes have been announced by the Wabash R.R.; Mr. S. E. Cotter, General Superintendent, at St. Louis, has been appointed General Manager, and will continue to have headquarters at St. Louis; Mr. J. W. Jones, Superintendent of Terminals, at St. Louis, has been appointed Superintendent of the Western division and will have headquarters at Moberly, and Mr. C. E. Ocheltree, Assistant Superintendent, at Forrest, Ill., will succeed Mr. Jones.

Lieut.-Col. C. W. P. Ramsay, Assoc. M. Can. Soc. C. E., formerly Engineer of Construction of the Eastern lines of the Canadian Pacific Ry., is now in command of the Canadian Overseas Railway Construction Corps of the Allies' armies in France. He entered the service of the Canadian Pacific in 1898. In 1912 he was appointed Engineer of Construction for Eastern lines, and has been closely identified with the construction of all the company's new lines since that time, notably the building of the lake shore line from Montreal to Toronto.

Mr. J. F. Trumbull, Chief Clerk to the Chief Engineer of the New York, New Haven & Hartford R.R., has been appointed Chief Engineer of the Public Utilities Commission of Connecticut at a salary of $3000 a year. Mr. Trumbull is a graduate of Sheffield Scientific School, Yale University, and since graduation has been engaged in steam and electric railway engineering work, having been employed by the New York, New Haven & Hartford R.R., the International R.R. of Mexico and the Connecticut Co. Mr. Trumbull passed the civil-service examination for the position of Chief Engineer with a rating of 97.5 per cent.

Mr. Edward F. Vincent, M. Am. Soc. C. E., Assistant Chief Engineer of the Colorado & Southern Ry., has been appointed Chief Engineer, with headquarters at Denver. Mr. Vincent was born at Maquoketa, Iowa, in 1863. He is a graduate of the State University of Iowa. In 1886 he entered the service of the Union Pacific Ry. as draftsman and field assistant. The following year he was engineer on construction of the State Capitol Building at Denver, returning the next year to the Union Pacific. Later he was connected with the U. S. Geographical Survey, in charge of a party on reservoir sites near Leadville, Colo., and was for a time Principal Assistant Engineer of the Board of Public Works of Denver. He entered the service of the Colorado & Southern R.R. in 1906.

The Pennsylvania Company announces the following changes made in its operating department: Mr. S. B. Robertson, Superintendent of the Erie & Ashtabula division, at Newcastle, Penn., has been transferred to Cleveland as Superintendent of the Cleveland and Pittsburgh division, succeeding Mr. I. W. Geer, who has been promoted to General Superintendent of the Central System, with headquarters at Toledo. Mr. W. M. Wardop, Superintendent of the Fort Wayne division, will succeed Mr. Robertson, and Mr. Otto Schroll, Superintendent of the Toledo division, will succeed Mr. Wardop. Mr. Paul Jones, Superintendent of the Zanesville division, will succeed Mr. Schroll, and F. J. Stimson is promoted to Superintendent of the Zanesville division, succeeding Mr. Jones.

Mr. E. F. Saxton has been appointed Assistant Director of the Department of Wharves, Docks and Ferries of Philadelphia, Penn. For the last three years Mr. Saxton has been Acting Supervising Engineer of the Permit Bureau of the Philadelphia Bureau of Highways, and since the death of M. M. Coppuck has been Secretary of the Board of Highway Supervisors. He is a graduate of Lehigh University and of the New York University Law School. Mr. Saxton was connected with the Engineering Department of the New York Central & Hudson River R.R. during the construction of the Park Ave. improvements, and has had a varied experience in bridge and railway construction. Subsequently he was connected with the Chicago & Northwestern Ry. and the Mexican Central R.R.

OBITUARY

Aaron Ward, a well-known contractor of Camden, N. J., died on June 28 at the Cooper Hospital in that city in his 81st year. Mr. Ward was born in Camden and most of his life was engaged in the contracting business.

ENGINEERING SOCIETIES

COMING MEETINGS

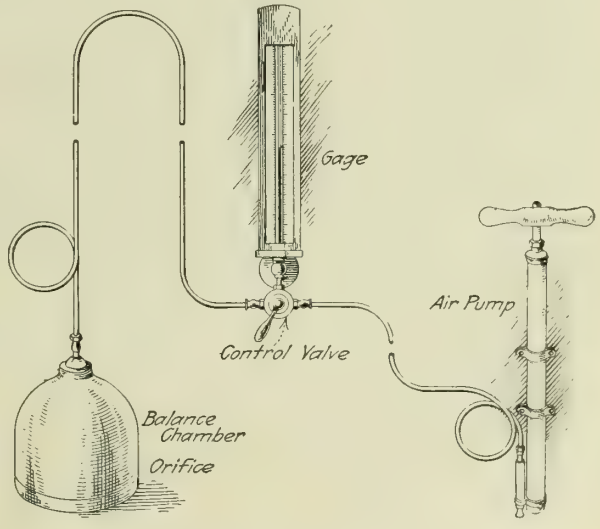
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
Aug. 16-18 and 25-28. Annual meeting in Los Angeles, Calif., Aug. 16-18; in San Francisco, Aug. 25-28. Secy., J. C. Olsen, Cooper Union, New York City.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Aug. 24-27. Annual convention in Cincinnati. Secy., Clarence R. George, Houston, Tex.

Appliances and Materials

"Pneumercator" Depth Gage

A device, called the "Pneumercator," for measuring the depth and volume of tanks, etc., and accurately registering the measurement at any convenient place has been invented by H. S. Parks, of Philadelphia, and is being introduced by the Pneumercator Co., 118 Liberty St., New York City. The various parts of the system, as shown in the sketch herewith, include a balance chamber, a mercury gage, a three-way control valve and an air pump—all properly connected by small flexible piping. The balance chamber is placed inside the tank, with its orifice at some point which it is desired to represent by the zero on the gage scale. With the chamber connected to the gage the rising liquid traps and compresses the air in the chamber and pipe line, but the gage does not register accurately, the error being proportional to the height of liquid above the orifice. To set the gage accurately the valve is changed to connect the chamber with the pump, which is given a few strokes to expel any liquid above the orifice. The air pressure remaining after the pump is disconnected and the pipe dead-ended (by turning the control



TANK-LEVEL GAGE

valve), balances the liquid column outside the chamber. Now by connecting the chamber to the gage the correct height is shown, and thereafter the device registers properly—there being only an inappreciable compression and displacement of the air. The chamber and piping are blown out once in a while to guard against slow leaks.

The gage may be located above or below the body of liquid measured. Where the tank is under greater than atmos-

pheric pressure the upper part of it is connected to the top of the mercury tube.

A trial installation has been placed in the fuel-oil tanks of the United States battleship "New York, and is reported to give oil consumption with an accuracy not before possible. By placing fore and aft balance chambers in casings connected to the sea, the draft and trim of a vessel can be registered. Several such installations on commercial boats have been reported.

* * *

Backfilling and Pipe-Handling Machine

A portable gasoline hoist for operating a derrick and scraper and intended specially for trench work is now built by the Waterloo Cement Machinery Corporation, of Waterloo, Iowa. The bedplate carying the hoist and engine is pivoted to a wagon bed so that it can swing horizontally. The machine weighs about 2600 lb. and is equipped with a 4½-hp. engine.

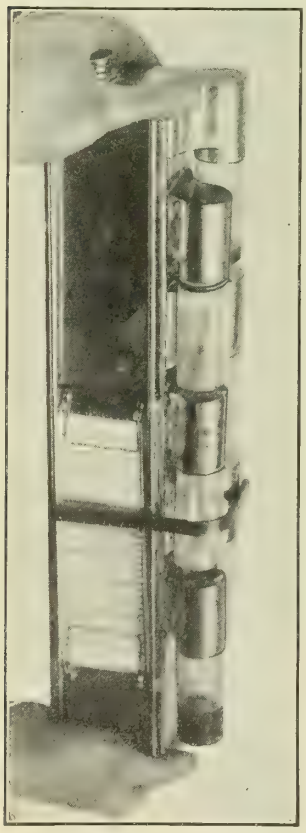
For backfilling, the machine travels along the clear side of the trench, and its cable is attached to a scraper handled by a man on the opposite side. The machine hauls the scraper across the spoil bank, dragging a load into the trench, and the man pulls it back for another haul. The swinging of the machine enables it to backfill a considerable length of trench at each move. One contractor reports having backfilled 309 cu.yd. in 8 hr., at 2c. per yd., with the machine, while another has used it (with two men) in place of a gang of 20 shovelers.

To move the machine, the hoist is locked in line across the wagon bed and a cable is led through a sheave anchored ahead and given a turn around the hoist's niggerhead. The main cable can be used also in unloading pipe from cars and lowering it into the trench, and for miscellaneous service on construction work.

* * *

Field Sand-Testing Device

The device shown in the accompanying view is designed for making granulometric analyses of sand and is intended mainly to be used in rapid field investigations of concrete sands. It consists of a metal box containing a ladder of graduated screens soldered into the case on planes which slope down to openings into the glass tubes shown in the view. Sand mixed with a little water is poured in the top of the case and, by agitating, is passed down through the successive screens, the selections being passed out into the glass tubes. In this way the amounts of the various gradations of sizes appear each in its proper glass tube. Measurement is then made by marking off an a card which fits in a frame that slides on rods up one side of the case the exact amount in each grade, adding graphically each amount to the one previously measured. The exact percentages of the various amounts may then be read from the interpolating lines permanently ruled on the card.



JOHNSON-CHAPMAN SAND TESTER

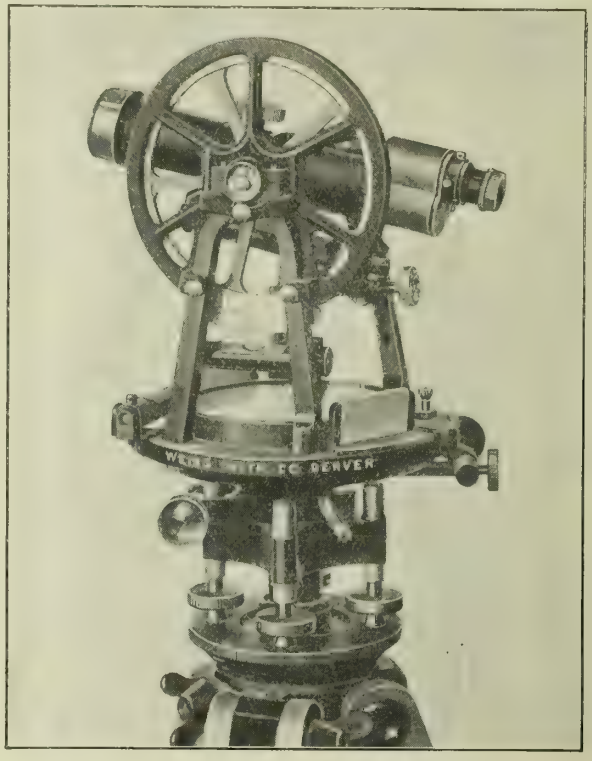
The device was invented by Nathan C. Johnson and Cloyd M. Chapman and is being marketed by the Concrete Appliances Co., Inc., Singer Building, New York City.

* * *

Transit with Poro Prism Telescope

The accompanying illustration shows a new type of engineers's and surveyor's transit recently patented and put on the market by the Weiss Instrument Co., of Denver, Colo. With the Poro prism type of telescope shown, the image is erected in the direct path from the objective to the eye-piece, permitting the use of an astronomical eye-piece, which gives greater light and field than an erecting eye-piece. Other advantages claimed are that the telescope is much shorter for the same magnifying power, which indirectly means lower standards and greater rigidity and stability. The Poro prism telescope also makes it possible to use different eye-pieces, which are made in 15-, 20- and 25-diameter sizes. The maker guarantees this type of telescope to maintain its line of collimation under all conditions.

The telescope is 8 in. long for a magnifying power of 20 diameters, against 12 in. for the regulation transit telescope. The field is 1° 45′ with an aperture of 1⅛ in. The standards are 4¾ in. high from plate to center of telescope bearings.



TRANSIT WITH PORO PRISM TELESCOPE

The instrument described and illustrated weighs 10 lb. The light mountain transit of the same type has a telescope only 6½ in. long, a magnifying power of 17 diameters, a field of 2° 15′, an aperture of $1\frac{1}{16}$ in., and weighs 9 lb.

* * *

Non-Slip Ladder Shoe

An anti-slipping shoe for ladders has been put on the market by the American Mason Safety Tread Co., 50 Church St., New York City. The shoe consists of a cast plate, with triangular lugs coming up on either side of the ladder leg. The bottom is faced with carborundum grit, and it is claimed that the shoe will safely grip on the smoothest concrete or steel floor. A bolt passes through the lugs and leg so that the shoe is pivoted on the end of the string-piece; this permits the face of the shoe to lie flat against the floor regardless of the angularity of the ladder.

* * *

Portable Rivet Forge

A portable rivet forge has been designed by the Mahr Manufacturing Co., Minneapolis, Minn., for general use in shops and on construction work. The forge uses oil fuel, and an 18-gal. tank forms part of a welded truck frame. This is on three wheels, the front one being in a pivoted fork carrying the pull handle. Steel-angle legs support a firebrick-lined steel furnace with combustion and heating spaces. A chain bail on the furnace hood allows lifting the machine by a crane. Compressed air at from 10 to 125 lb. pressure is required.

* * *

Pressed Asbestos Products

Material for a wide variety of industrial and commercial fittings' and composed largely of asbestos and binder, is being marketed by the Pressed Asbestos Products Co., 451 W. 19th St., New York City. The material, called "Papco," is furnished in densities varying from that of soft wood to that of stone; it is an electrical insulator and can be produced to withstand temperatures up to 2600 deg. F. It has been employed for handles on hot utensils, for bowling balls, table tops, switchboard panels, rheostat bases, and sanitary seats. For many such services it is claimed to serve as well as porcelain, but not to be cold to the touch.

Engineering News

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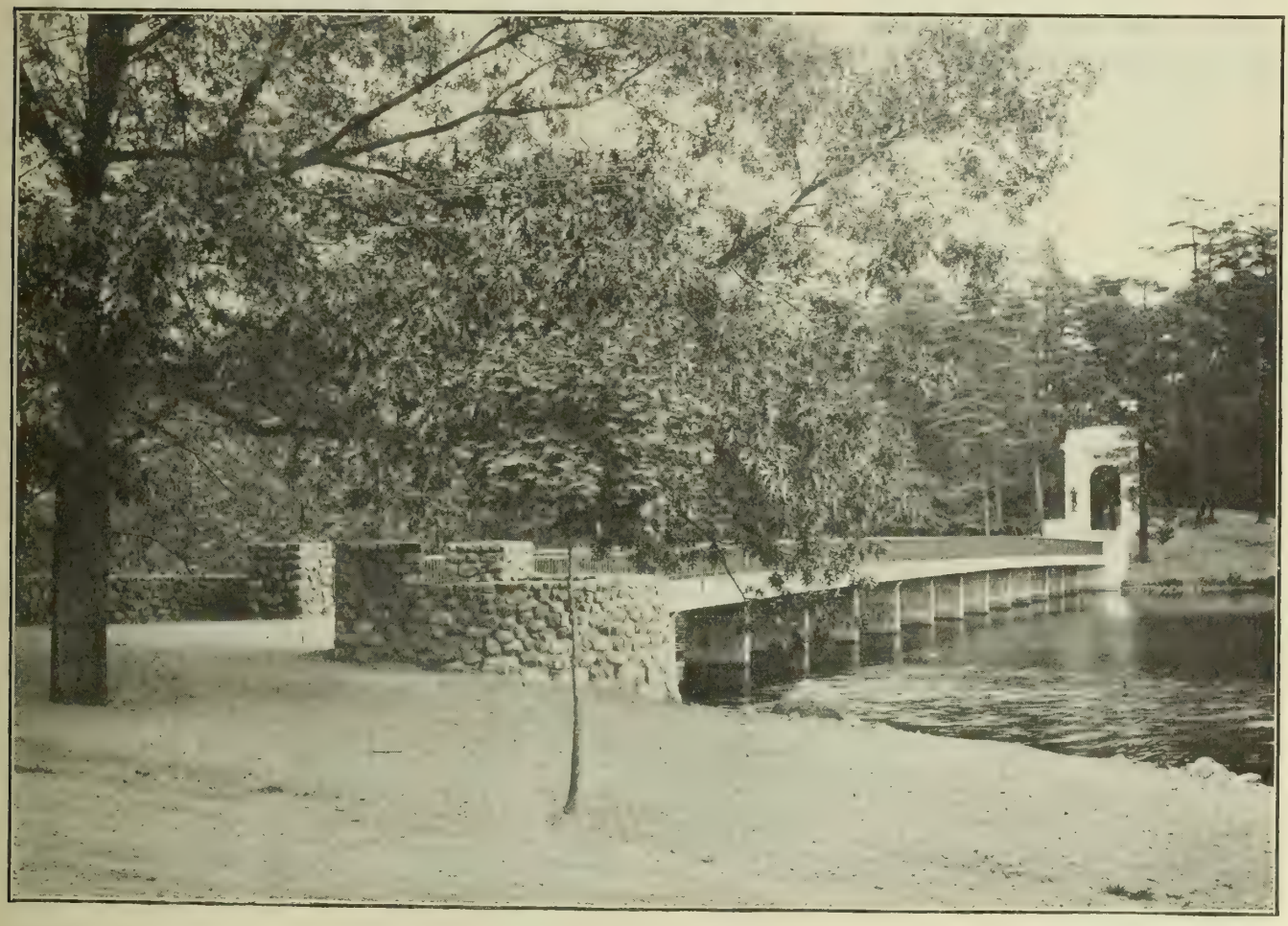
A Light Ornamental Bridge

The very handsome and yet simple park bridge shown in the view on this page is the Memorial Bridge crossing Island Grove Pond between the main part of the town of Abington, Mass., and the Island Grove Park Reservation. It forms part of a memorial to the Abington men who were members of the United States Army and Navy during the Civil War.

The design is most simple. It comprises 15 similar spans, each 20 ft. long, made up of three reinforced-concrete girders resting on rectangular piers and carrying a flat reinforced-concrete floor 14 ft. wide, which is used only for a footpath. The piers extend through silt into hard, coarse gravel; they are 7 ft. wide and are cantilevered out at the top to carry the outside girders.

At every third pier, or 60 ft. apart, an expansion joint was formed by placing a heavy sheet of zinc upon the top of the pier at the level of the bottom of the beams. The beams and slab meeting on these piers were separated by several layers of roofing paper. Over all the other piers the slab and beam steel was lapped. In the winter following the completion of the bridge the expansion joints opened up from ¼ to ½ in., due to contraction.

Special provision was made for securing the handrail posts by casting into the concrete pipe sleeves, which projected about 10 in. above the surface; over these the rail posts were set and securely fastened. The top surface of the bridge was granolithic paving finished with a wooden float, and was pitched at the rate of ¼ in. per ft. from the center to both sides. The whole bridge was cambered 15 in. to afford clearance for small boats at the highest waters.



MEMORIAL BRIDGE AT ABINGTON, MASS.

J. W. Beal, of Boston, was the architect for the memorial project, including this bridge, and the contract was executed by Wilson & Tomlinson, of Boston, who also acted as engineers for the reinforced-concrete design.

Design of Shore-Protection Works

By Ralph Bennett*

SYNOPSIS—This article contains a brief statement of the governing principles of wave action on coasts, a comparison of coast-protection structures actually built and an outline of logical procedure in designing such structures, illustrated with a design which, in the author's opinion, meets all the requirements of coast-protection works.

The energy stored in sea waves comes almost entirely from a single source, the wind. As the water shoals, the free formation of the lower tiers of the rapidly moving wave is interfered with by the bottom and the wave gradually decreases its velocity of translation. As the water continues to shoal, the disturbance becomes more acute and the energy of the single deep wave is distributed among several smaller ones. As these approach the actual shore line, they are still further distorted by intersection or coalition with secondary or tidal waves or reflected waves from shallow bottoms or rocky headlands.

The tides are a gigantic heaving of the surface of the ocean, which should move around the earth in a regular 12-hr. sequence. The irregularities of the masses of land are, however, so great as to completely obscure the theoretical form of the tidal movement and to render it quite irregular in time and form. As the tide approaches the land and feels the retarding effect of the shallow water, it tends to become a series of overlapping waves instead of a single imperceptible rise and fall.

These tidal wavelets intermingle with, and interact on, the various wind-formed waves and their derivatives, and the whole irregular mass, still obeying the general laws which form its simple elements, advances into more shallow water until the depth becomes so slight that the lower particles of water are again tripped by the bottom.

The wave motion, which up to this time has been without horizontal advance of the water in which the action is taking place, now tends to become an advancing motion of a mass of water. The energy first stored in the wave by the wind and the tide becomes visible as the velocity of a mass of water. As the water in contact with the bed of the ocean is still held back by bottom friction, the crest overruns it and falls on the beach. The height, the length and the velocity of the waves in shallow water are all regulated and controlled, not by the energy stored in the deep-sea waves, but by the effect which the depth has on them, so that the waves into which the energy of the deep-sea rollers enters are in all dimensions a function of the cube of the depth of the water in which they occur. Thus the strength of the sea defense required on any given coast is as much or more a function of the depth of the shore waters during storms as it is of the exposure of that coast to the wind and waves of the open sea. Therefore, the first step in protecting a coast must be the formation of a beach. If this is properly done it will render it certain that no waves of a violence greater than can be readily handled will ever impinge unbroken on the defenses.

A beach, being itself composed of loose material, cannot be made absolutely stable. But its upper and side limits are readily defined, and if this definition is made by proper structures the changes of the beach will be so restricted that the alterations made by even the most severe storm will be well within the fixed safety limits.

If the shore consists of a nearly horizontal body of sand, the sudden release of the energy of the wave produces only a local effect which is readily absorbed in local agitation without altering the beach to any perceptible extent. If its slope is not correct for the height of the tide and the seas, the material loosened by the wave will be delivered at a higher or a lower level than it was picked up and the beach will waste away or build up until stability is attained or the conditions change.

The rapidity of beach action is very much affected by the direction of the wind, the nature of the beach material and the violence of the shore currents. An onshore wind blows the crests of the waves ahead of their normal positions and so causes breakers with steep high fronts. These are very violent and tear up and carry off much material. An offshore wind blows the crests back into the body of the waves, flattens the slopes and causes the final failures to occur in shallow water and with but little damage.

When waves approach a shore from deeper water, they are at first traveling along the axis of their primal cause, which is usually the wind. As shoal water is reached, the waves tend to square themselves up with the slope of the bottom over which they are traveling, but this slewing around of their fronts also tends to cause the formation of a longshore current. When the wind blows on the surface of a body of water, it tends to form, not only waves, but also a surface current. As this current approaches the shore, it is deflected and parallels the beach. The tide becomes a powerful current as it approaches the shallow waters. In almost its entire progress along the shore it assumes the form of a stream which hugs the beach.

If the waves and currents of the sea were at all times at right angles with the beach, the sand and gravel of the shore would be moved forward and back over the same track. Under such a condition the upper beach would finally be of coarse gravel and sand, the intermediate slopes of finer material and the depths beyond the influence of the waves would be faced with sand so fine as to be almost mud. As shown in the preceding paragraphs, however, there are numerous factors deflecting the ocean currents away from the right-angle approach, and this deflection, however slight, causes a longitudinal movement of the material loosened by the waves. This is littoral drift. Practically the only method of successfully building foreshores is by utilizing its existence.

The maintenance of existing coast lines in their present positions is dependent on the continuance of the forces which placed them and on the supply of materials from which they are replenished. If a beach or cliff which is wearing is protected so as to cause it to cease from supplying littoral material to the stretches of coast to the leeward of it, the beaches on that coast will grad-

*Engineer, Washington Building, Los Angeles, Calif.

ually waste away; and the same result will follow the stoppage of the drift at any point, as by the construction of a projecting pier or wall. If the supply of material is ample, drifting will be only temporarily stopped and the general action will continue after the obstacle has been overwhelmed.

To a very considerable extent beaches can be formed, built up or protected by the proper application of the principles outlined. But the action of the wind and of the ocean vary from day to day. Any attempt to operate continuously in a cycle of forces which exists for but a small fraction of the entire season will result in failure.

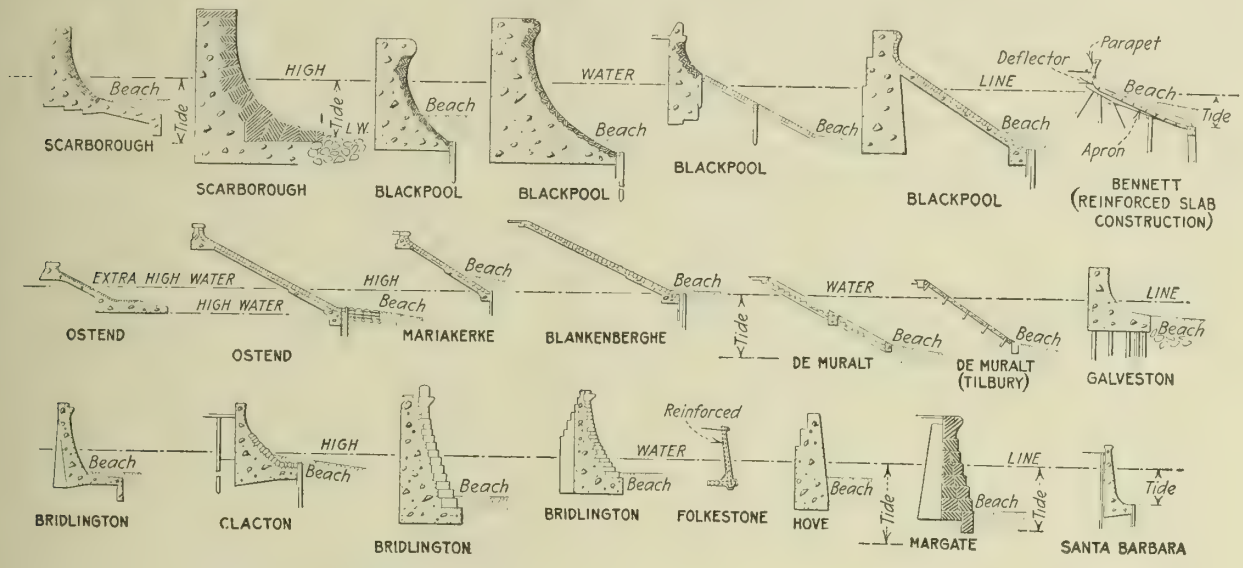


FIG. 1. SECTION OF TYPICAL EUROPEAN AND AMERICAN SEA WALLS
Drawn to same scale

Location	Material	Beach Protection	Apron	Deflector	Parapet	Remarks
Blackpool	Masonry		Sloping	Curved	Projects	Three similar types
Bridlington	Masonry	Groins	6 ft.	Curved	Projects	Several similar types
Blankenberghe		None	A long flat slope of stone on concrete	Slope 1 on 2.3		
Clacton	Masonry	Groins	Yes	Slanting	Projects	
Dyn-church	Masonry	Groins	Sloping	Curved	None	
Felixstowe	Wood on concrete	None	None	9 ft.	None	
Folkestone	Reinforced concrete	None	None	Slant 6 on 1	None	Vertical slab rock faced
Hastings	Masonry	Groins	None	8 on 1	Projects	
Hornsea	Concrete	Groins	None	5 on 1	Sets back 10 ft.	
Hove	Masonry	None	None	8 on 1 stepped	None	
Herne	Wood	None	None	9-ft. wall	None	
Leven	Masonry	None	None	2 on 1	Vertical	
Mariakerke	Masonry	None	Slope	Curved	Overhang	
Margate	Masonry	Groins	Sheet piling	8 on 1	Retreating	
Morecambe	Concrete	None	None	Slight curve	Vertical	
Ostend	Masonry	None	Sloping	Curved	Overhang	
Scarborough	Concrete	None	Sloping	Curved	Vertical	
Scheveningen	Concrete	None	Sloping	Curved 1 on 4	Vertical	
Tilbury	Concrete		Sloping	Sloping	None	Stepped concrete
Trusthorpe	Wood	None	Sloping	Sloping	None	

Beach protection and building works must be based on that action which will throughout the season balance the slow accumulation of favorable weather against the rapid depletion during periods of abnormal action.

Typical Sea Walls

In Fig. 1 are shown a number of the important coast defenses in Europe, a few American walls and a design proposed by the writer. For simplicity in comparison these have all been referred to the high-water line and reduced to the same scale. The material and slope of the beach, taken with the range of the tide and the nature of the backfill, cause a wide variation in the dimensions of the walls, but they show on the whole a rather definite tendency to the use of a general outline which conforms to the theoretical requirements.

Details of a Shore Protection

A sea wall is a retaining wall so built that it will successfully hold a distributed backfill on one side and an intermittent water load on the other. It must be firmly founded and so built as to possess the greatest possible homogeneity. The front face of the wall must be arranged to destroy as much of the energy of the wave as possible before it reaches the upper portion of the wall. No live water must be allowed to fall back of the wall.

A curved reinforced-concrete deck slab of variable thickness on a series of reinforced beams carried on piling can be made to answer every requirement of the problem in a more elegant manner and at a less cost than can a structure of any other material. In Fig. 2 are given the details of such a wall designed by the writer, which, it is believed, best satisfied the requirements of a coast defense, as outlined below.

A complete coast defense will have, inside of a fringe of long groins, three distinct wall portions combined in one interlaced and homogeneous structure. There must be the groins, an apron, a deflecting wall, and an upper wall, or parapet. The purpose and details of each of these parts is explained in the following paragraphs:

Groins

The term groin is used to designate any ridge, wall or fence run into the sea in a direction more or less perpendicular to the coast line for the purpose of controlling littoral drift. At one time massive masonry walls were used for the purpose. Some portions of the Netherlands coast are still protected by flat masonry ridges running well into the deep water. So far as its action is concerned, the material of the structure is of little importance, and most modern work is of wooden construction.

When the history and working forces of a stretch of coast have been properly studied, it is possible to make studies of the comparative effect of various spacings, heights and lengths. In general, the preferred system will start above high water or at the face of the sea wall and extend to below low water. The groins will at first be of nominal height, but the posts will be arranged for carrying the work up as sand accumulates. The most stable beaches are usually formed by low walls, which catch without difficulty sufficient sand to completely cover themselves and allow all excess material to flow past. Thus they maintain the leeward beaches without erosion and cause the least possible change from the natural beach slope and outline.

The entire intention of a groin system is to confine all the littoral material that is needed for any given section of the shore within rather narrow but certain limits lengthwise of the beach. Seas can enter the pockets between the groins only at the lower end and must travel

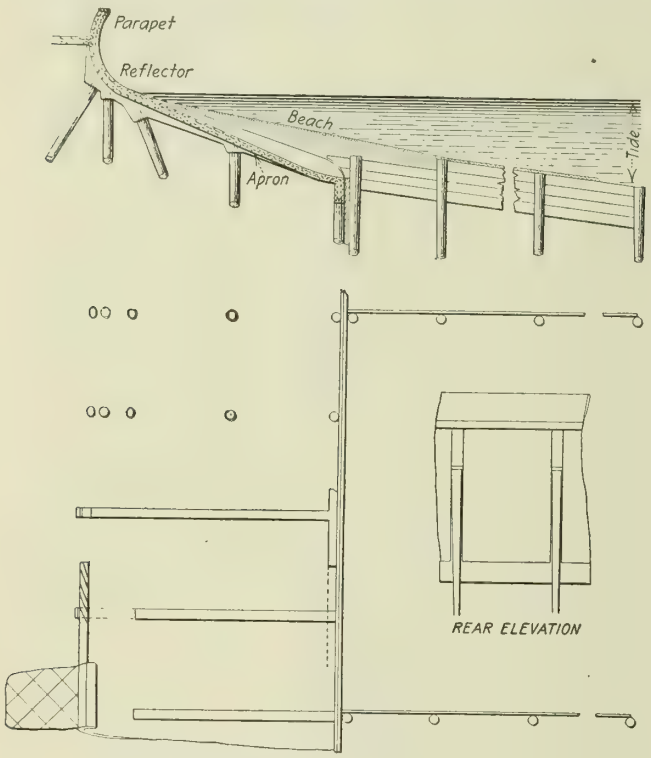


FIG. 2. PROPOSED SHORE PROTECTION

more or less parallel to the walls in running up the beach. Material moving under the influence of the ocean in this zone can travel only up and down the slope of the shore. If just sufficient in quantity it will wear down under water in times of severe seas and store on the upper beach in quiet seasons.

In reality this ideal condition can never be attained. Much of the material carried down in storms passes beyond the control of the groins and is carried away by the longshore currents. Some of the sand left on the upper beach dries out and blows away unless held by a wall.

There is a slight action, even between the walls, of the littoral currents, and so a depletion of beach occurs next to the leeward side of every groin and an accumulation on its windward face. As soon as this accumulation becomes higher than the wall, the littoral drift is reëstablished and there is a flow of material into one end of the series of groins and a corresponding outflow at the other end. If the source of the material is still active, the normal flow will now be secured.

That spacing of groins which will be suitable for the proper underwater beach conditions may not be close enough to hold the upper beach sands to as true a plane lengthwise of the coast as is desired. Short intermediate or inshore groins can then be introduced to advantage.

On ordinary coasts the main groins will extend from the sea wall or the high tide straight out to beyond low tide. They will be spaced their own length apart, will have the same slope as the beach naturally has and will not project more than a few feet above the sand when erected.

Shape of Sea Wall

The upward range of the seas, the drift of the upper beach sand and the cliffs or embankments of the shore must all be fixed at some definite point by a stable structure. The maximum pressure of the wave action is applied to the area on which the crest of the wave, the breaker, falls. If the sea wall is hard, smooth and impervious, no internal shocks occur. If it is properly shaped, no secondary shocks due to projecting faces or pockets are possible. The time of application is very brief, for the wave has a transitory motion of many feet per second. So the surface of the sea wall is subjected to a series of rapidly moving zones of pressure from the waves and to a more or less intermittent water pressure corresponding to the depth of water behind them, while there is applied to the back the constant even pressure of an earth backfill.

The stability of a wall designed to be loaded with a static load on one side and an intermittent load on the other is largely dependent on the proper determination of the static load both as to amount and direction. Such a wall, as a beach protection structure, will probably be backed by sand both on the sea and the land sides. Sand, when wet and agitated, will flow freely, so if there occur any break in such a wall its backfill is likely to be lost and if it discharge water too close to its front serious erosion may take place at its toe.

Foundations

One of the most difficult problems in the construction of sea walls of any type is the securing of proper foundations if the structure is to be built, as is usually the case, on the sands of the beach.

A structure resting directly on sand is only stable if the sand is confined. The sand of the beach is anything but confined before the wall is built, and the placing of a structure in the edge of the sea is almost certain to cause currents that will to some extent scour along its face. Even with proper groins there will be places and times during the restabilizing of beach conditions, or even after, when the sea may tend to cut against the wall. Ground water will start channels and rapidly enlarge them. Sometimes the burrows of animals are enlarged into extensive trenches by water from storms.

The only safe foundation for a sand-founded sea wall is piling. By driving part of a group vertically and part as batter piles an absolutely stable base can be had that will be independent of the superficial wear of the surface sands. This piling may be either wood or concrete. In most cases it will be in wet ground and wood will have a satisfactory life. It is essential that there be a

firm joint between the piles and the concrete and that the piling have a length sufficient to make them safe against dead-load, erosion, uplift, shock and reversal of loading.

Apron

The lowest portion of the sea wall, the apron, must join the sands of the beach and extend their general slope up to the base of the deflector. It must pass the incoming waves on toward the shore without serious disturbance and must receive the back-wash from the deflector and parapet and deliver it to the deeper water beyond without local damage.

Its slope and length should be sufficient to carry the concrete down to low-tide line or to a depth below the permanent beach line sufficient to obviate any chance of scour. The projection of secondary groins on the apron is advantageous, as it tends to limit the sidewise flow and so to prevent depletion of the upper beach.

The thickness and reinforcement of the apron will vary from a minimum at the lower lip to a maximum as the apron approaches the deflecting portion of the wall. At the lower edge the sand blanket will almost always be in position and the slab will need to carry only a well-distributed wave shock. Under this section the underlying sand will almost certainly be in complete contact with the concrete and will serve to support it. Reinforcement will be needed only as a precaution against extraordinary conditions and shrinkage cracking.

Deflector

As the apron extends upward, it gradually merges into the deflector. This section of the wall should consist of a thick, heavy slab, so arranged that all local shocks are distributed to the unloaded portions of the wall. It lies between wind and water. On it much of the energy of the waves is expanded in impact, and it is battered by loose or floating material. It should commence low enough to properly resist such shocks as may occur at low tide and yet be so arranged that it is properly shaped to receive the violent shock of the deep waves which reach it at high tide.

To successfully resist impact it must have a hard yet resilient face and must be, so nearly as may be, non-absorbent, for an absorbent face, alternately wet and dry, will soon begin to flake. The presence of large open joints is extremely undesirable, for through them water under pressure is driven into the interior of the wall and it is subjected to internal as well as external shock. It must be so formed as to be stable even after the loss of backfill behind or beneath it. As it lies high, wave blows will fall, during storms, on its unprotected face. It must be of ample strength and rigidity to handle their maximum concentrated load without failure.

The shape of the curve of the deflector should be determined by the height and shape of the maximum waves that will beat against it. The lower edge must join the slope of the apron with an easy sweep along which the back wash from the wall will flow without tending to cause shock or scour. When the most severe seas are attacking the wall at high tide, the curve at the point of tripping should be such that the water will either fall on a cushion formed of water from the front edge of the wave, or will slide up the face of the wall with little or no local shock. As the conditions here vary a great deal, the ordinary result against a well-proportioned wall is a mixture of the two actions. The cushioning on disturbed water is probably the most advantageous method of receiving wave shock, but it is also the most difficult of accomplishment against a steep-faced wall. As the wall is at this point curving rapidly to join the parapet above, many of the waves must impinge on the steeper portions.

Parapet

After the direction of the water movement has been changed from the horizontal to an inclined upward sweep by the deflector, the final direction of its course is taken care of by the parapet. In general, there will be a gradual outward curve, so that when the water has passed beyond the wall and has reached its maximum height it will fall back into the sea and will not, even during an onshore gale, fall heavily on the landward side of the wall. If the discharge is properly made, the spent water can be thrown so far toward the sea that it will fall on the water surface and dissipate its energy in breaking up the incoming surf.

As this curve must sometimes be separated from the deflector by a stretch of flat or nearly flat wall, it must start to overhang at a very gentle rate, but it can curve at an increasing rate as it gains in height. But a short abrupt curve will not control a wave of any considerable thickness. If the surface is smooth, the curves gradual and the entire structure of ample height, the parapet will be but little buffeted by the seas. It can be built with a rapidly decreasing thickness as it rises from the deflector.

Motor-Bus Lines to Pike's Peak—A new motor-bus line is scheduled to run between Colorado Springs and the summit of Pike's Peak. The buses will be operated in competition with the old cog railroad, a new highway having been built from Cascade to the Peak. For this service, which will be inaugurated on July 15, the White Co. of Cleveland, Ohio, is building twelve 12-passenger motor buses and three 7-passenger touring cars. The new highway is 17 mi. long, 20 ft. wide, with no grades exceeding 10 per cent. At the summit the elevation of the road is 14,109 ft., making it the most lofty highway in North America. Only one other road on the Western Hemisphere exceeds this altitude, and that road, which crosses the Andes Mountains in Bolivia at an elevation of 17,000 ft., is also the route of a White bus line. The Pike's Peak highway is constructed with many wide turnouts and view stations. The road will be open to all kinds of motor vehicles and automobile supply stations will be located at convenient points. A round trip can be made easily in five hours, and the schedules of the buses will include trips at sunset, sunrise and moonlight.

Four Years' Record of the operation of the 33 electric locomotives in service on the New York terminal division of the Pennsylvania R.R. shows 3,974,746 locomotive miles, 45 engine failures, 271 minutes total train detention, 88,328 locomotive miles per detention, 14,667 locomotive miles per minute detention, 463,558 train movements, and 1300 train movements per engine failure. This type of locomotive was described in "Engineering News," Nov. 11, 1909. Briefly the design shows two half-units, each having a four-wheel bogie truck and two pairs of rod-connected drivers, coupled with a knuckle joint at the driving-wheel end. Each locomotive in service passes over an inspection pit every 24 hr., when a running inspection of machinery is given and slight repairs are made where necessary. The average time required for this inspection is approximately 10 min. After 3000 mi. of run the locomotives are taken into the shop for a general inspection, when all electrical apparatus is thoroughly looked over, tested, cleaned and, when necessary, adjustments and renewals are made to all electrical and mechanical parts. The "shopping" of these locomotives for general repairs is governed by tire wear. A number of locomotives have run from 90,000 to 112,000 mi. before it was necessary to turn the tires or make any general repairs.

Two Large Irrigation Projects in Russia--II

By Milan Nikolitch*

SYNOPSIS—The Mugan Steppe Irrigation Project comprises 465,000 acres bordering the Caspian Sea. The water-supply is from the Arrax River, which presents river-control problems similar to the Colorado River in its relation to the Imperial Valley, southern California. The Mugan Project comprises four independent canal systems. The Golodnaya Project was described in Engineering News of July 1, 1915.

The southeastern portion of Caucasia, composed chiefly of the lower parts of the Kura and Arrax Valleys, approximates in its character the central Asiatic plains. High mountains of Caucasia and the Armenian Highlands fringe the valleys on the north, west and south. The eastern border is formed by the Caspian Sea, into which discharge two main rivers of the region, Kura and Arrax. Both rivers drain an area of about 70,750 sq. mi., consisting chiefly of mountains and having heavy precipitation. The lower part of the valleys has the character of the dry steppe, the rainfall being not suffficient to support the plant life promoted by high summer temperatures.

Where the irrigation did not require great engineering skill, the valleys have been irrigated by the natives; but the greatest part on both sides of the Kura and Arrax is still untouched, awaiting larger expenditures of brains and money than the natives can make.

The Mugan Steppe is only a portion of the total area needing irrigation. It occupies the most eastern part of the Kura and Arrax valleys, forming nearly a square between these rivers, the Persian boundary and the Caspian Sea.

In a not very remote period, according to some authorities, the area of the Mugan Steppe was covered with the waters of the Caspian Sea, which gradually receded, as they are receding now. In fact, the greatest part of the Mugan Steppe is situated below the level of the Black Sea, which in former days was connected with the Caspian Sea, but which now lies about 85 ft. above it.

The rivers Kura and Arrax, which emptied into the sea in this place, contributed by their silt deposits to the formation of the continent. The Arrax River has played in the formation of the Mugan Steppe the same part as did the Colorado River in the Imperial Valley in southern California, and the same problems of irrigation and river control that present themselves in the Imperial Valley may be found here too.

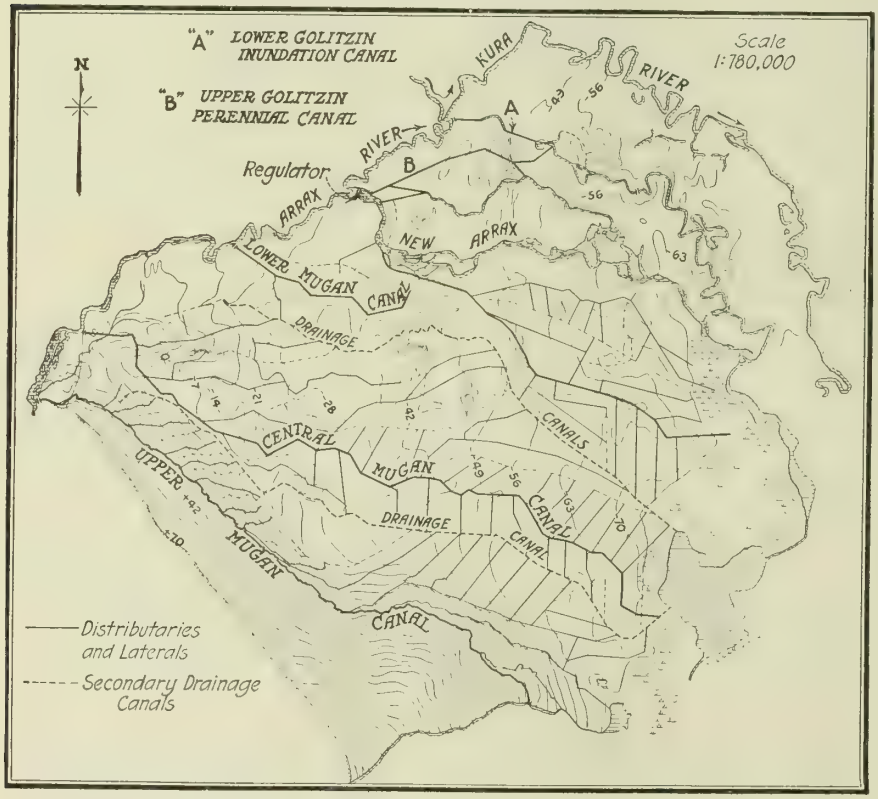


FIG. 1. MAP OF MUGAN STEPPE IRRIGATION PROJECT, RUSSIA

The Lower Mugan Canal was extended to take the place of the unnamed canal shown as heading in the New Arrax River. No canal is taken out of the stream just named

Each river carries a large amount of suspended matter, which is deposited either at the mouth of the Kura or is spread over smaller or larger areas of the steppe during the high-water period. This is especially true of the Arrax, which annually floods its banks. Owing to low banks and the fine material of which they are composed, this river has several times in the recent history of the Mugan changed its course and flooded enormous areas of the steppe, creating a chain of lakes and always leaving new layers of silt when the water receded. The last break which had a bearing upon the irrigation works in this region occurred in 1896. This time the break remained until 1908, when it was closed by a modern structure and the river turned into its old channel.

The water-supply for the irrigation of the Mugan Steppe is obtained from the Arrax River. This river rises in the mountains of Turkish Armenia, not far from the origin of the Euphrates River, which has a western and southwestern course toward the Persian Gulf, while the Arrax follows an eastern direction to the Caspian Sea. The upper portion of the drainage area, which measures about 35,000 sq.mi., is composed chiefly of high mountains, among which Mount Ararat reaches 17,000 ft. The total length of the river is about 600 miles, of which about 240 miles form the boundary between Persia and Russia. The lower portion of the drain-

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age area is occupied by semi-desert plains generally called the Milsk and the Mugan Steppes. The Milsk Steppe is situated northeast of Arrax. The Mugan Steppe occupies the southeastern part. At present the Arrax River empties into the Kura River. In the past it often changed its course and on many older maps its mouth is shown independently of that of the Kura. The discharge of the Arrax has not been sufficiently observed to give a good idea of its flow for a long period. It is only known that the maximum discharge is about 35,000 sec.-ft. and that the minimum flow has been as low as 858 sec.-ft. In the following table are given the maximum, minimum and mean discharges for three years, all in second-feet:

Year	Maximum	Minimum	Mean
1903	15,100	3040	6650
1904	18,250	3020	6900
1912	35,000	2990	....

Regarding the high-water period, Arrax differs somewhat from other large Turkestan rivers, where the high-water period covers almost the whole irrigation season. Here the high water begins in March after heavy spring rains and melting of snow, reaches its maximum in May, and ends in June. July and August are the months of the minimum discharge. It follows that the low-water period coincides with the period of least rainfall. The river brings a large quantity of silt from the higher parts of its watershed. With the diminishing slopes in the Mugan, a part of the silt is deposited in the steppe, while the other is taken down to Kura and used for building up the delta at the mouth of that river. The experiments made by different authorities who have been engaged in the investigation work in the Mugan show that the river carries in the spring about 1.12% of silt by weight, and in winter about 0.3% by weight. The silt of Arrax is recognized as very beneficial to the soil and can be used as fertilizer. But at the same time the river carries a comparatively large amount of dissolved salts, which are deposited with the silt. This is especially true during the low-water period. The amount of dissolved salts in the Arrax water during the spring time is about 21.74 parts per 100,000.

History—Certain portions of the Mugan Steppe have been irrigated in past centuries, as is witnessed by many remains of old canals; but generally with the passing of the masters of the Mugan the irrigation works were destroyed and abandoned. However, owing to the low banks of the Arrax River and the comparatively easy way of diverting the water from it, the narrow area of about 3½ miles on both sides of the river has been irrigated to the present day, and settled by prosperous Tartars.

During the last fifteen years the northern part of the Mugan (about 81,000 acres) has been irrigated and settled by Russians. The irrigation works have been of rather primitive character, and the canals could only utilize the flood waters. In 1908, the first perennial canals were constructed by means of which the water-supply of the Northern Mugan is assured the year round. To the 81,000 acres were added during the last few years some 384,000 acres, all of which are situated south of the New Arrax.

The total irrigated area of the Mugan amounts to 465,000 acres. It is situated (Fig. 1) between the rivers Arrax and Kura, the upper Mugan Canal and the swamps bordering the Caspian Sea. The ground surface slopes away from the river, the slope in the immediate vicinity of it being about 0.0003. The area is divided by the New Arrax River into two unequal parts. All recent and more important works are included in the area south of the New Arrax.

Irrigation Systems—The total irrigated area is divided into four independent systems supplied from independent main canals. The oldest of these is the North Mugan system, situated between the New Arrax and Kura Rivers. As has been stated, it was completed some years ago and is already settled. The other three systems, the Upper, the Central and the Lower Mugan, have been under construction for the last three years and are nearing completion.



FIGS. 2 AND 3. SPUR CONSTRUCTION TO PROTECT CANAL INTAKES, MUGAN STEPPE IRRIGATION PROJECT
Left—General view of spur. Right—Lowering 3½-ft. concrete block in building spur

Head-Works—The adoption of four independent systems for irrigating the 465,000 acres has resulted in five independent intakes, all of which are of the same type, The uppermost intake (see map, Fig. 1) is located a few hundred feet below the Persian boundary and about 5½ miles above the intake to the central canal. The third or lower intake is located about 15 miles below the central intake. For irrigating the Northern Mugan two intakes were made, one just above the junction of the Arrax and Kura, and the other at the point of diversion of the New Arrax from the Arrax.

Generally speaking, the head-works consist of an intake channel terminating in head-gates at the head of the main canals. No works whatever are provided for regulating the water surface in the river in front of the head-gates. The intake channel is not less than 2100 ft. in length and is given ample dimensions with the view of partial silting up, which inevitably must take place above the head-gates.

The head-gates are all of the same type. They consist of concrete or masonry abutments and a concrete or masonry floor 3½ ft. thick across the whole width of the

canal. Upon the foundation floor are placed structural steel bents, which support the working platform and lifting apparatus, and between which slide the gates. The bents are placed 5.6 ft. apart and securely anchored to the foundation. The gates are 7 ft. high. They are made either of wood or corrugated sheet iron, and are raised by means of lifting screws or rack and pinion.

The bottom and slopes of the canal below the head-gates are faced with concrete 1.4 ft. thick for a distance of about 90 ft. The intake sill is placed about 4 ft. below the lowest water stand in the river.

Canals—With the exception of the Northern Mugan, the canal net is very simple. There are three main canals, taking out from the Arrax and running nearly parallel to each other. Owing to almost complete absence of watercourses in the Mugan, no difficult construction work is met along the canal line. The total length of main canals in the Southern Mugan is about 133 miles, and that of distributaries and laterals about 1470 miles. As a rule the main canals have not large distributaries. Very often small laterals take out directly from main canals.

The canals are designed to suit the discharge of the river, which is variable throughout the summer. In the spring, when the discharge is great, the discharging capacity of all three canals is about 5192 sec.-ft. It seems to be proved by practice that one good irrigation in the spring is sufficient for growing a good crop in the Mugan. Therefore, during the dry summer months, when the river carries its minimum, the discharge of the canals will be reduced to a minimum sufficient only to satisfy the most vital needs of the population. The mean discharge of the canals is computed to be about 3600 sec.-ft.

Drainage System—Practically all land along the lower Arrax is subject to overflow, and at the present time is protected by levees. All this area needs thorough drainage, as is also true of the rest of the irrigated Mugan, where on account of small slope and lack of drainage the alkali problem might become very serious. Therefore a complete drainage system is designed and built at the same time as the irrigation system (see map, Fig. 1). The main drainage canals are located in the valley between the main canals, and take care not only of the drainage but also of the surplus water from the irrigation canals. They discharge into lakes and swamps bordering the Caspian Sea.

The river control is one of the chief engineering problems in the Mugan. As already mentioned, the Mugan Steppe represents the delta of the Kura and Arrax Rivers, within which the Arrax meanders with a slope of about 9½ in. per mi. Like the Colorado River below Yuma, the Arrax has several distributaries, through which it has sent the surplus water independently from the main channel to the Caspian Sea, creating always a line of lakes and swamps. In many instances it has entirely changed its course. Such a break occurred in 1896, when the greatest part of the flow went through the so-called New Arrax, leaving the lower 13 miles of the old river bed almost dry. An enormous area was overflowed, and the lakes created at that time are still in existence.

The break was closed in 1908 by a structure known as the Regulator Nicholas II. This structure has been successful in regulating the flow of the Arrax, and has fully justified its cost. The purpose of the structure was not only to close the break and turn the water into the old channel, but also to relieve the lower channel during the flood period and prevent possible damage along the river. The structure is similar in its design to the common type of head-gates already described. The masonry piers divide the structure into five bays 35 ft. wide, which are again subdivided by structural-steel bents into four openings, closed by steel gates in much the same manner as the head-gates. The structure is designed to discharge about 12,700 sec.-ft.

The banks of the Arrax consist of alluvial silt, and in many points are overflowed during high stages. The area subject to overflow is protected by an earth embankment. The destructive action of the river in this kind of soil is great, and the bank protection is given serious consideration. On this account the head-gates have been placed 2100 ft. away from the river, and in addition to it the bank above and below the intake is protected by spurs, with the purpose of diverting the current from the bank. The spurs, one of which is shown in Fig. 2, are made of concrete or masonry in cubes 3½ ft. wide, which are lowered into position from boats (Fig. 3). On account of soft bottom, the spurs sink into it considerably. Generally speaking, the construction of spurs is expensive and their ultimate value is not yet known.

In the near future will begin the construction of the Milsk Steppe irrigation project, by which 405,000 acres of land lying on the left bank of Arrax will be reclaimed. This means that altogether 870,000 acres will receive their supply from the Arrax River. It is hardly possible to supply this area, without the additional storage of water, from a river with a total annual runoff of about 5,165,000 acre-ft. The storage reservoirs and the supply of main canals are the chief problems of the future on the Arrax River.

The chief engineer, and the man who has been connected since the beginning with the irrigation works in the Mugan Steppe, is N. Petroff.

Annual Street-Cleaning Exhibition—Encouraged by the success which attended the exhibition of Nov. 23-28, 1914, and by the generally expressed desire for its repetition, the New York City Department of Street Cleaning announces that it will hold its second annual exhibition of street-cleaning apparatus and appliances in the First Regiment Field Artillery Armory, 68th St. and Broadway, New York City, during the week beginning Monday, Oct. 11, 1915. The exhibition of 1914 was more or less experimental. However, its results made manifest beyond all doubt the newly awakened and constantly increasing interest of the people in the vital question of public cleanliness. It also made clear the desire of public officials to improve their methods, as well as the alertness of the inventors and manufacturers who are striving to meet the demand for improved mechanical equipment. At the time of this year's exhibition it is expected the Model District, for which a special fund was provided by the Board of Estimate and Apportionment, and which is to be equipped with modern apparatus, will be well under way. The Model District should prove an attraction to manufacturers and inventors, as well as to visting officials. The street-cleaning apparatus eligible for entry in the forthcoming exhibition includes all sorts of brooms, brushes, sweeping machines, flushing machines and other equipment or applicances used in cleaning streets and removing snow; carts, wagons, motor trucks or other vehicles used for collecting garbage, ashes, rubbish and street sweepings; conveyances for transporting refuse, by water or by rail; methods for the disposal of garbage, ashes, rubbish and street sweepings, including garbage-reduction works, garbage crematories, incinerators, destructors, etc. Exhibitors will not be required to pay entrance fees. Legitimate street-cleaning apparatus and appurtenances will be given free space in the exhibition hall. Other costs of placing their exhibits and all risks must, however, be borne by the exhibitors, except that storage will be provided, without charge, for pieces of apparatus which arrive in the city of New York prior to the evening of Oct. 9.

Rebuilding the Muskingum Bridge Near Coshocton

SYNOPSIS—A three-span bridge weighing 3500 tons had to be slid into place laterally as a unit; the work had to be done between trains. Thoroughly planned moving arrangements enabled the moving to be completed in 10 min. 17 sec. from train to train.

During the last season two remarkable bridge-moving enterprises were carried out, involving in both cases the handling of very heavy riveted truss spans. In one case, the renewal of the Muskingum River bridge, a set of three double-track riveted truss spans was moved as a unit, yet in spite of this a record of quick and successful moving was achieved. In the other case, the Brunot's Island portion of the Ohio Connecting Ry. bridge over the Ohio River, eleven successive spans were moved, one by one, under railway traffic that was probably as heavy as that over any other large bridge in the country, and throughout the entire season's work this fact had to be dealt with. A further interesting fact is that both enterprises took place on the same railway and were carried out by the same contractors. They will be described in this and succeeding articles.

Conditions at the Muskingum River Crossing

At Tyndall, near Coshocton, Ohio, the "Pan Handle," or the Southwest System of the Pennsylvania Lines, crosses the Muskingum River by a double-track through riveted truss bridge about 735 ft. long. In the great flood of March, 1913, two piers were undermined and two spans carried away, one of the remaining spans being dropped at one end. The railroad was cut in two and remained so for nearly three weeks. Temporary repair was made by jacking up the dropped end of the second span on a crib and substituting for the two missing spans a temporary trestle, later replaced by a series of 70-ft. plate-girder spans carried on pile piers. Almost immediately permanent rebuilding was taken in hand.

Choice of Reconstruction Method

The character of the new foundations and the erection problem were largely the determining elements of the replacement. The bridge had to be built on the old alignment, but the replacement of the steelwork *under traffic* was believed to be practically out of the question, on account of the many interferences offered by the temporary structure, the very heavy and important train

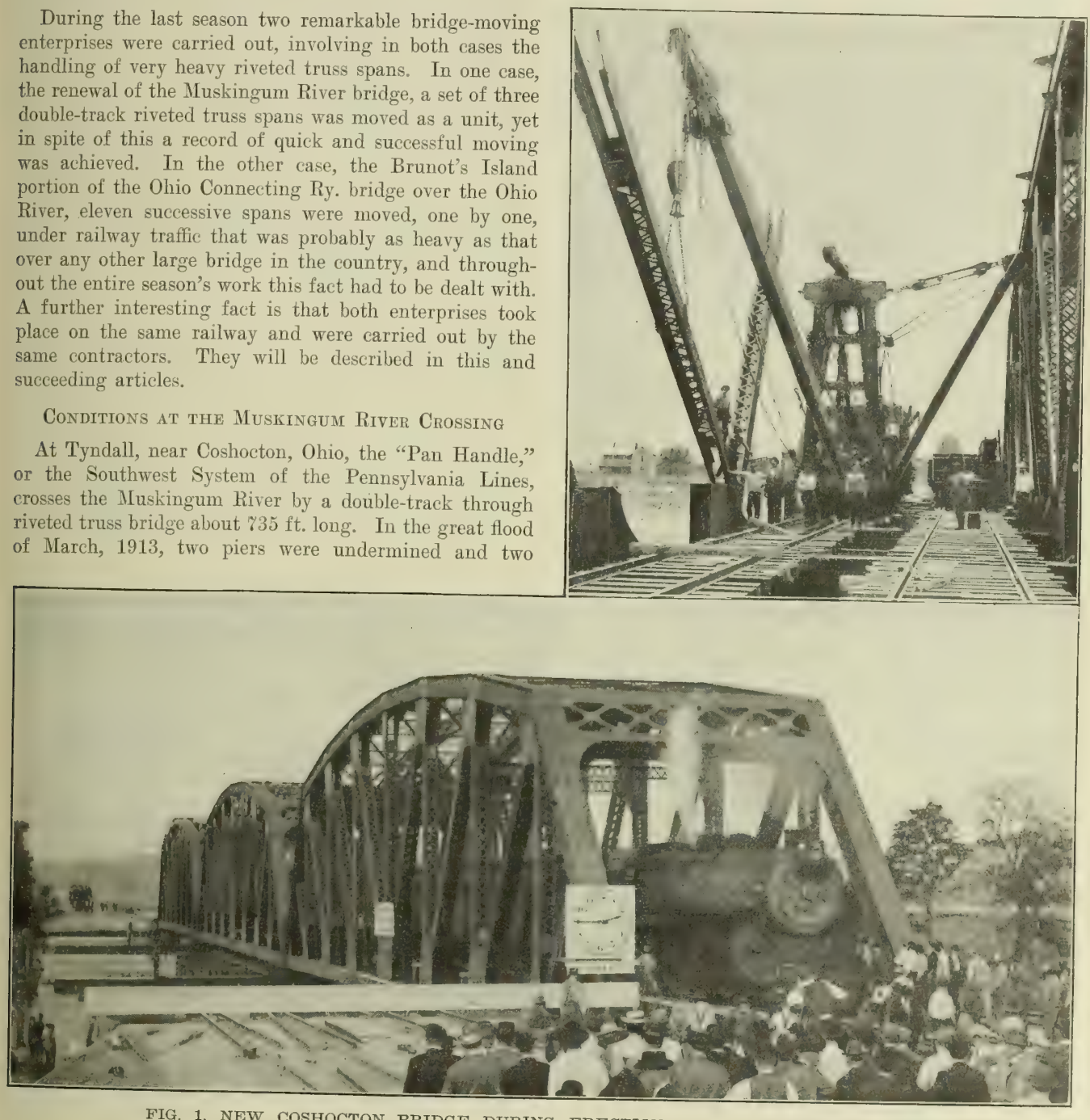


FIG. 1. NEW COSHOCTON BRIDGE DURING ERECTION AND AT START OF MOVING

movement over the bridge, the large amount of miscellaneous débris in the river at the site, and the treacherous nature of the stream itself. At the same time, the railway officials did not wish to operate over a temporary run-around trestle, as the traffic was too important and too fast and heavy to make this method prudent. It was therefore decided to build the new bridge on temporary supports alongside of the existing structure, and later on roll the new bridge over into its permanent position.

The problem was affected by two unusual factors—the necessity for building new piers and the consequent advantage of choosing new pier locations, and the fact that one half of the old bridge consisted of miscellaneous short spans put in to replace the two spans which had been washed out, while the other half consisted of the original spans, one of which was supported on cribbing and

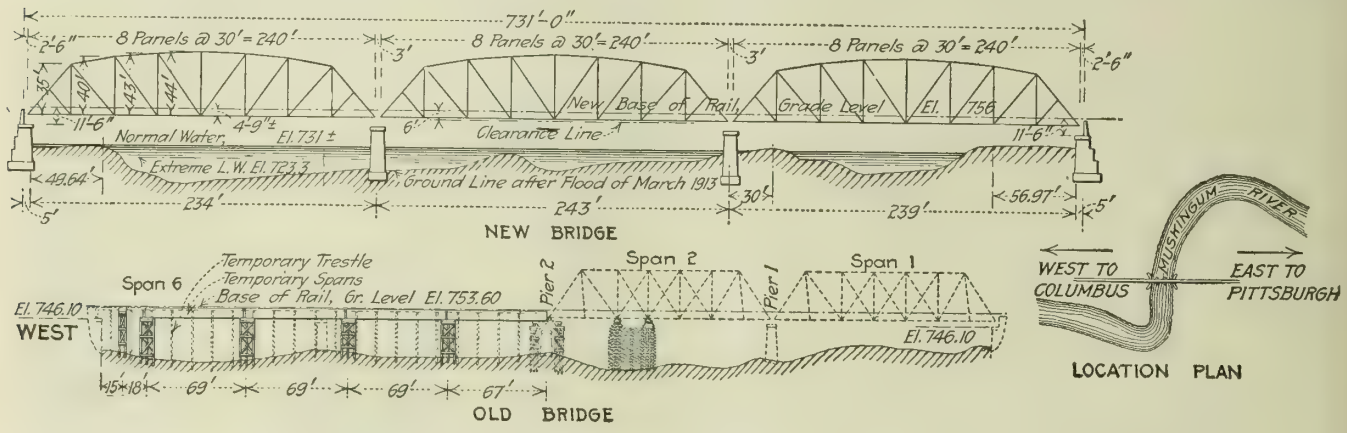


FIG. 2. NEW AND OLD BRIDGES ACROSS THE MUSKINGUM RIVER NEAR COSHOCTON, OHIO

The old bridge as shown involves three elements: Two truss spans, not torn out by the 1913 flood, single-track pile trestle built in place of two washed-out spans as first repair, and plate-girder bridge on timber piers as second repair. The plate-girder bridge only is shown by full lines.

protection. The 1913 flood underscoured one pier about 20 ft. below the bottom and destroyed it, while it tipped over the next one. Deep pneumatic-caisson foundations, resting in fine gravel, were therefore chosen for the new bridge. By a revision of the span lengths, substituting

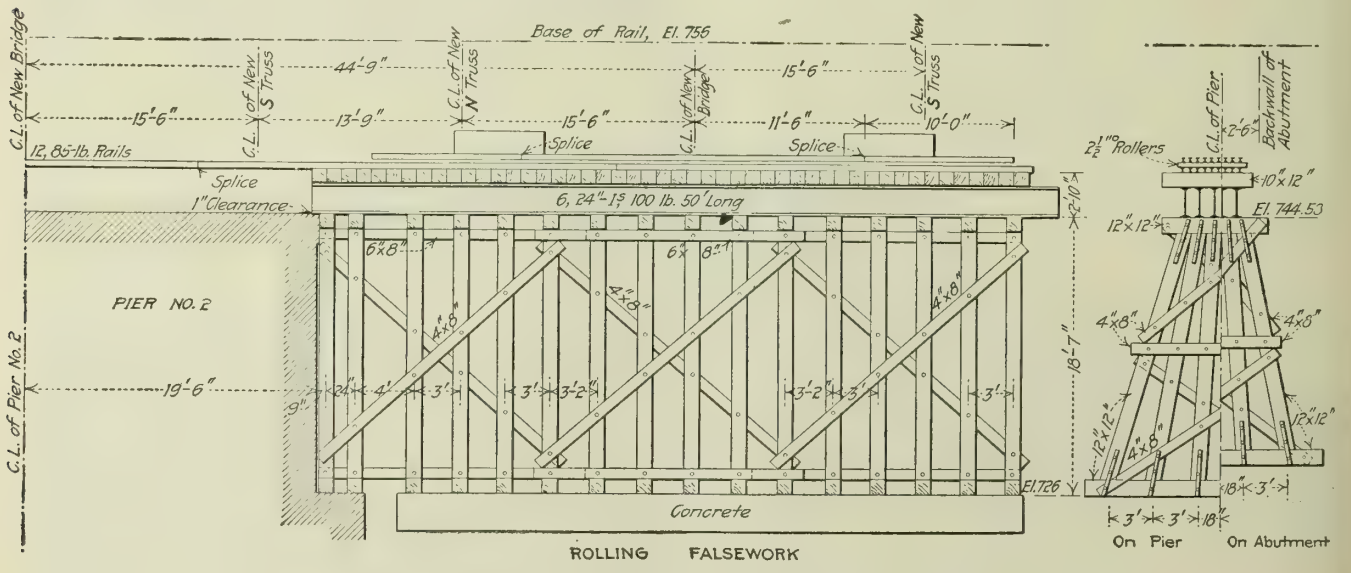


FIG. 3. ERECTION FALSEWORK AND ROLLING FALSEWORK, COSHOCTON BRIDGE

falsework that had been thrown in in a hurry in order to get the line opened as soon as possible after the flood.

Under these conditions replacement by rolling the separate spans into place in successive operations was impracticable; instead, it was necessary to roll the three spans of the new bridge, as a whole, in one operation.

Under this method it was preferable to tear out the old bridge before moving the new one, on account of the many interferences that would have been encountered, and on account of the character of the old and temporary structure, supporting cribs, débris, etc. To make this possible, traffic had to be carried over the new bridge in its temporary location while tearing out the old bridge, and the traffic over the line demanded that the break in the tracks while moving the bridge should be reduced to the shortest possible length of time. How this was accomplished in detail is described in the following.

The old piers, which were built a number of years ago, when the Pan Handle Line was originally constructed, were founded practically at the river bottom, with riprap

three 240-ft. spans for the four 155-ft. spans in the old bridge, the location of the new piers and abutments came clear of the old, so that they could be built complete without disturbing the old bridge to any considerable extent. The new piers and abutments were square, while the old ones were on a 15° skew.

After the new abutments and river piers were built, temporary piers for the erection of the new bridge were built in line with them, on the downstream side, where

they would be sheltered from drift and scour in case of flood. Because these temporary supports were to carry the regular traffic over the new bridge for probably two months while the old structure was being removed, and because of the very heavy loads carried (in the case of the two intermediate piers over 4,500,000 lb. per pier), more robust construction than ordinary pile bents was necessary. Both of the temporary abutments and one of the piers happened to come on ground that was dry at low water, and in these cases the temporary foundations were prepared by placing concrete mats about 5 ft. thick just below the ground surface. The remaining pier, however, came directly in the channel, in 20 ft. or more of water, and required some other form of construction. A novel type of pier was used, at the suggestion of S. P. Mitchell, consisting of a pile group filled around with sand retained by a timber box, and the whole capped with concrete, all as described in *Engineering News* of May 6, 1915, p. 890.

On the foundations thus prepared framed timber bents were placed, carrying 24-in. I-beams, which in turn supported the rolling ways and the dead- and live-loads of the bridge. These are shown in Fig. 3 as "Rolling Falsework."

Erection Trestle

For the erection of the new bridge, bents consisting of 12 piles each, capped and braced, were driven at each panel-point, that is, about 30 ft. apart. Fig. 3 shows their construction. To drive these bents a special cantilever piledriver was built, which could reach forward from the bent last driven, and in one setting drive six piles of the half-bent (described in *Engineering News* of Jan. 7, 1915, p. 28). The trestle, in fact, was built as two parallel trestles (one for each truss) connected by splices between their caps and sash timbers. The driver first drove and completed the 6-pile bents for one of the half-trestles for the full length of a span, setting the caps, bracing and stringers as it proceeded, and then returned and drove the other half-trestle.

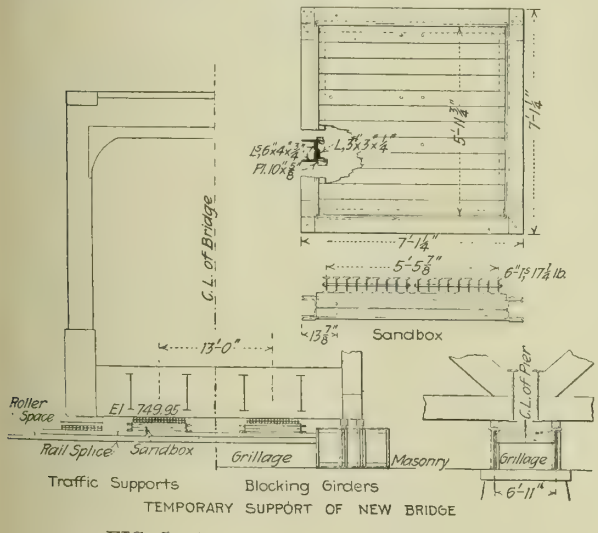


FIG. 5. GRILLAGES AND SANDBOXES

This erection trestle was in service only up to the time of swinging the new steel spans. Upon completing the steelwork the whole load of the spans was transferred to the "rolling falsework," and the intermediate erection bents were then removed. On account of the extremely heavy dead- and live-loads to be carried by the temporary abutments and piers, it was necessary to distribute these loads over the entire length of the temporary abutments and piers, instead of concentrating them under the truss bearing-points. This was accomplished by utilizing the end floor-beams of the spans (which were strong enough for the purpose) by the following method:

Sandboxes capable of carrying the entire dead-load were placed between the end floor-beams and the rolling ways,

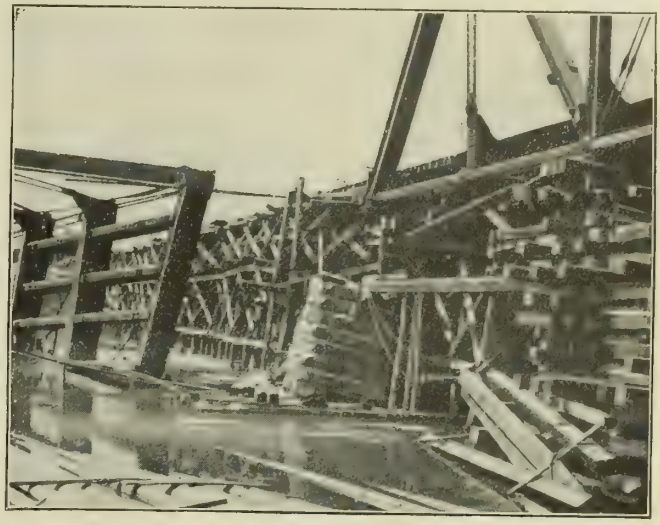


FIG. 4. CONDITIONS AT OLD COSHOCTON BRIDGE
Showing difficulties which complicated the erection

while the live-loads were carried by temporary grillages, consisting of two layers of I-beams with a layer of timber between, which were inserted between the rolling ways and the truss bearing-points.

In order to make sure that the dead-loads would be carried entirely by the sandboxes, the temporary blocking under the ends of the truss was removed before the blocking over the intermediate bents was taken out, and *the spans were swung on the sandboxes for supports.* The temporary grillages were then placed under the truss

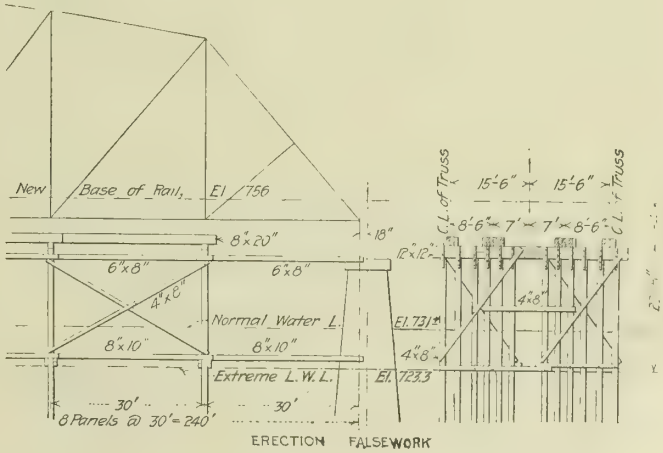


FIG. 6. VIEWS OF ERECTION FALSEWORK

bearing-points, and the layer of timber in these grillages driven in to a tight fit.

The primary purpose of the sandboxes was to hold the entire dead-load of the bridge a little above its permanent elevation, so as to permit the removal of the temporary

grillages and rolling ways and the placing of the shoes after the bridge had been moved to its final position and for lowering the spans to a bearing on these shoes, thus avoiding all jacking for the purpose of removing rolling ways, etc., and placing shoes, which, under the conditions, could have been done only with much difficulty and at considerable cost.

The grillages, rolling ways and sandboxes forming the supports for the new bridge in its movement from temporary to permanent position are shown by drawings in Fig. 5. The sandboxes are of unusual proportions, but otherwise follow the previous practice of the contracting company's engineer.

Traffic was turned over the new bridge as soon as its floor was completed and track laid, and the dismantling of the old structure was then proceeded with and preparations made for moving the new bridge over to its permanent position.

Moving the Bridge

The power for moving the bridge was obtained from the hoisting engines of two derrick-cars placed end to end in the middle of the center span. Four sets of 7-part wire-rope tackle were arranged to pull the spans along the rolling ways laid on the temporary and permanent piers, the four leadlines from these tackles being carried to separate drums on the hoisting engine (see Fig. 7). A vertical telltale, or indicator, set up directly in front of the position of the foreman in charge of the operation, was so arranged that four pointers traveled up the indicator as the corresponding bridge shoes moved along their tracks, thus making it easy to keep the four moving points exactly abreast of one another.

The moving was done on Sept. 22, 1914, and the railway officials, a large number of whom were present, had arranged, in order to make the progress of the moving more striking, a large clock dial at one end of the bridge, with a pointer on a horizontal scale alongside, so that the time and the progress of the moving could be readily seen. Within 10 min. 17 sec. after an express train passed off the west end of the bridge in its temporary position (see Fig. 1), a special train passed onto the east end of the bridge in its permanent position. During this interval the tracks were disconnected, the bridge (having a total length of about 735 ft. and weighing, including the derrick-cars, 3500 tons) was moved laterally a distance of 45 ft. and the tracks were then reconnected ready for regular traffic.

The remaining operations consisted of removing the rolling ways, etc., and the placing of the spans on their permanent shoes.

The splices in the rolling ways were so arranged that by splitting out the layer of timber in the temporary grillages these grillages, as well as the rolling ways under the truss bearing-points, could be removed without interfering with the rolling ways and sandboxes carrying the spans, thus making it possible to set the shoes under the truss bearing-points and lower the spans to their permanent position by means of the sandboxes.

The bridge shoes are carried by plate-girder grillages running the full length of the concrete piers and abutments and are attached to these grillages by large bolts. In order to avoid having to shift the spans longitudinally to make the holes in the shoes match those in the grillages, great care was taken to set the spans in their proper relation to the grillages longitudinally of the bridge and also to set the rolling ways exactly perpendicular to the center line, the result being that, after the bridge was moved laterally 45 ft., the holes matched so that the bolts could be put in with the greatest ease, thus showing that the bridge could not have shifted longitudinally during its movement more than about 1/8 in.

The entire work was carried out under the general direction of J. C. Bland, Engineer of Bridges, Pennsylvania Lines West of Pittsburgh, and the erection scheme and methods were devised by S. P. Mitchell, president of the Seaboard Construction Co., of Philadelphia, the contractor for the erection of the superstructure.

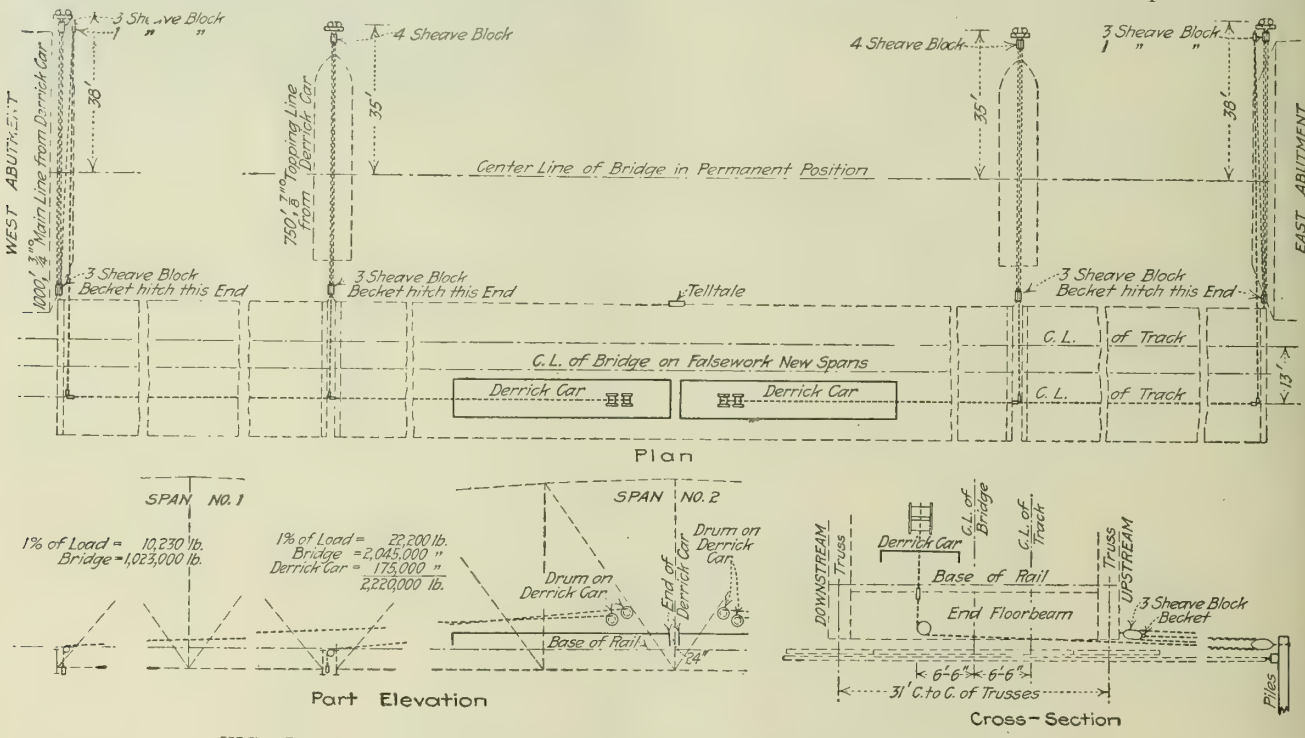


FIG. 7. ARRANGEMENT OF RIGGING FOR MOVING COSHOCTON BRIDGE

A New Form of Government Contract

By Richard D. Micou*

The specifications recently issued by the supervising architect of the Treasury Department for the construction of a new building for the Interior Department, Washington, D. C., mark the latest development in the endeavor of the supervising architect's office to devise a contract that shall make such provision for partial payments during the progress of the work as will be fair to the contractor, the subcontractor and the Government.

In this aim they have been much handicapped by the provisions of the Heard law, 28 Stat., 278, c. 280, which provides that persons entering into formal contracts with the United States for the construction of public buildings shall be required to furnish bond with the additional obligation that such contractors shall promptly make payments to all persons supplying them labor or materials in the prosecution of the work provided for in the contract, such persons being given the right to sue both the contractor and his sureties in the name of the United States.

This act has been interpreted by the United States Supreme Court in Hill vs. American Surety Company, 200 U. S., 197, to apply to any person who furnished labor or material in any particular, even as it has been said, to a man who cut down a tree from which planks were sawed that eventually went into a building. As a matter of fact, however, suits have rarely been filed by any one more remote from the contractor than the subcontractor of a subcontractor, and even such cases are extremely rare.

Up to about a year ago the specifications simply provided for the payment to the contractor each month of an amount covering 90% of the work completed during the month, as certified by the Government inspector; and such is the form of contract now in use for small contracts†. This was not in any way segregated, but was paid him in bulk and it was possible for a contractor to play one subcontractor against another from month to month, making it difficult for subcontractors to get their money. These payments to the contractor without any method of providing for partial payments to subcontractors and material-men as the work progresses frequently resulted in the surety being made liable for the contractor's obligations. In other cases the contractor would never quite finish the building, taking his own profit out of the 90% already paid him and leaving the retained 10% to cover unpaid claims for materials, etc., thus forcing the surety company not only to assume his obligations, but actually to finish the work in order to secure release on their bond.

During the past year, however, the supervising architect's office has been experimenting with the payment provisions of the contract, and the specifications for the present building represent perhaps the most nearly perfect form possible under the law.

The new requirements are in brief as follows: After the award of the contract, the contractor must furnish to the supervising architect a schedule of the cost of the main branches of the work, the sum total of which shall equal the amount of the contract. Upon the completion of this schedule the contractor must furnish a detailed supplementary schedule of the work and materials involved in each main branch, arranged as far as possible according to the various subcontracts and itemizing in detail the quantities of materials and labor involved, with the unit price for each (including overhead and miscellaneous expenses and profit).

A copy of these schedules is to be furnished to the government superintendent of construction; and on the fifteenth day of each month he certifies to the supervising architect an estimate showing the scheduled value of the work executed and satisfactorily in place and of the materials on the site but not in place. Upon such certification, the contractor is paid for 90% of the work executed and for 60% of the materials delivered and not placed. This last provision is an innovation and enables the contractor to receive pay for such materials as stone and structural steel to the extent of 60% several months before he would have received it under the old form of contract.

These payments are exactly subdivided and apportioned so that it is possible to tell at any given time what has been paid to the contractor for any part of the work or for any of the materials delivered. After having completed this estimate for a partial payment, the superintendent of construction prepares and posts on the bulletin board in his office a statement of the same for the information of subcontractors and material-men, showing in percentage the ratio of the total payments to date on account of each subcontract.

Before any subsequent payment can be made the contractor is compelled to submit to the superintendent of construction an affidavit setting forth that he has made payment to the subcontractors and material-men in the proportion shown to be due them by the previous statement; or, if he has failed to make such payment, to state how much has been withheld and for what reasons. His subsequent payments depend on this statement. The contractor may further be required to make a sworn statement before he is fully paid on the work to the effect that all subcontractors and material-men have been paid in full.

A further innovation of considerable benefit to the contractor is the provision that after gross payments aggregating one-half of the contract price have been made, the supervising architect may remit to the contractor one-half of the percentage retained on the first quarter of the work; after gross payments aggregating three-quarters, one-half of the percentage retained on the second quarter; and after the work is completed, awaiting final inspection, one-half of the percentage retained on the third quarter.

At the time of the final payment, therefore, the retained percentage would amount to 5% on the first three-quarters and 10% on the last quarter instead of 10% on the whole as formerly.

The provisions outlined above do not relieve the contractor or the surety of their obligations but they do prevent the indefinite postponement of partial payments to subcontractors and the accumulation of claims at the end of a contract.

*Attorney-at-Law, Maryland Building, Washington, D. C.

†Payment of 90% of the value of the work executed and satisfactorily in place, as ascertained by the supervising architect, acting through the superintendent, will be made monthly and payment of the 10% retained will be made after the final acceptance by the duly constituted representative of the Treasury Department, of all materials and workmanship embraced in the contract, but payment will not be made until every part of the work to the point for which payment is claimed is satisfactorily supplied and executed in every particular and all defects therein remedied to the satisfaction of the supervising architect.

Track Depression at Mattoon; Illinois Central R. R.

SYNOPSIS—Details of a grade-crossing elimination, involving cuts and special reinforced-concrete bridge crossings.

The elimination of grade crossings at Mattoon, Ill., has been complicated by the fact that two railways intersected near the center of the city. With a train standing at the station or a long freight train passing over one line and trains held on the other line, the street traffic was blocked to a serious extent. The plan adopted was to lower the Illiniois Central R.R. (as having the heavier traffic) and to leave the Cleveland, Cincinnati, Chicago & St. Louis Ry. unaltered. At the intersection a two-story union station will be built, with station facilities on the first floor and railway offices above, stairs leading to the platforms of the depressed tracks.

The grade is lowered through the city for about 7000 ft., and continues for some distance beyond, to the freight yards. This eliminates a former summit with 0.6% grades and gives a slight sag, with descending grades of 0.3% from the south and 0.05% from the north. This effects a material improvement in the operation of the division. The maximum depth of cut is about 28 ft. The C., C., C. & St. L. Ry. will be raised about 2 ft. at its bridge over the cut, and five street bridges will be built. An inclined transfer track north of the station will provide for interchange between the two lines.

The Illinois Central R.R. has a 200-ft. right-of-way, and the cut is taken out to a bottom width of 100 ft., with nominal slopes of 1 on 1. This provides for five main tracks, with three through tracks and platforms at the station, and leaves room for a future additional track. At the south end of the station will be two stub tracks for the lines east to Evansville and west to Peoria. Originally, the Peoria & Evansville division had crossed the main line at grade, but this crossing has been replaced by double Y connections on each side, so that trains will not run through between Peoria and Evansville. For this division a new freighthouse and team yard have been built, as shown.

It was expected that the clay in which the cut is made would slip after the steam-shovel work and stand finally at about 1 on 1, so that retaining walls would not be neces-

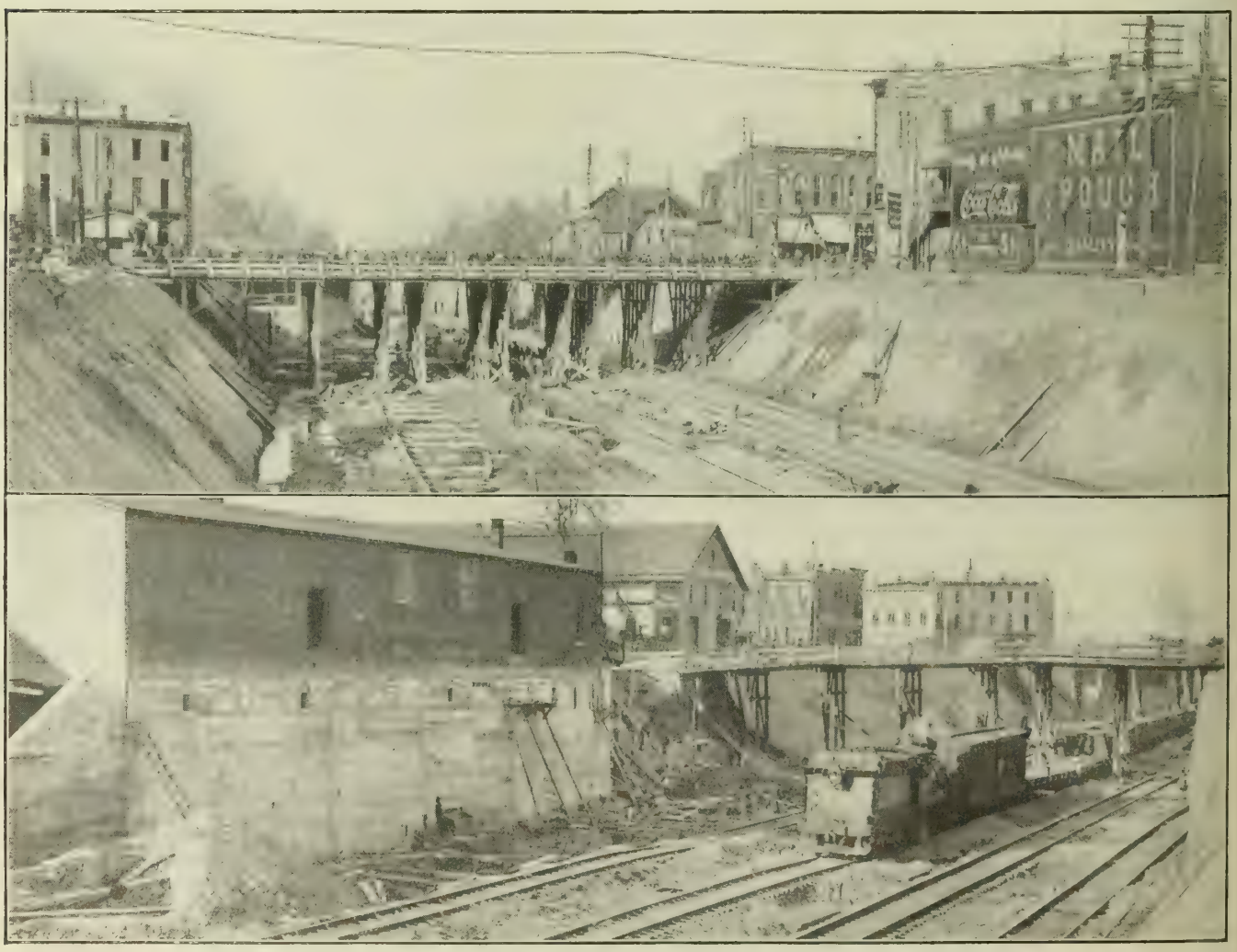


FIG. 1. TRACK DEPRESSION AT MATTOON, ILL.; ILLINOIS CENTRAL R.R.

The upper view shows the work at Broadway, with the temporary bridge. The new station will be at the left. The three-story building at the left is the old union station and hotel, a part of which has been pulled down to make room for the slope of the cut. The lower view shows a broom-corn warehouse, with concrete underpinning. Beyond it is the temporary bridge at Charleston St.

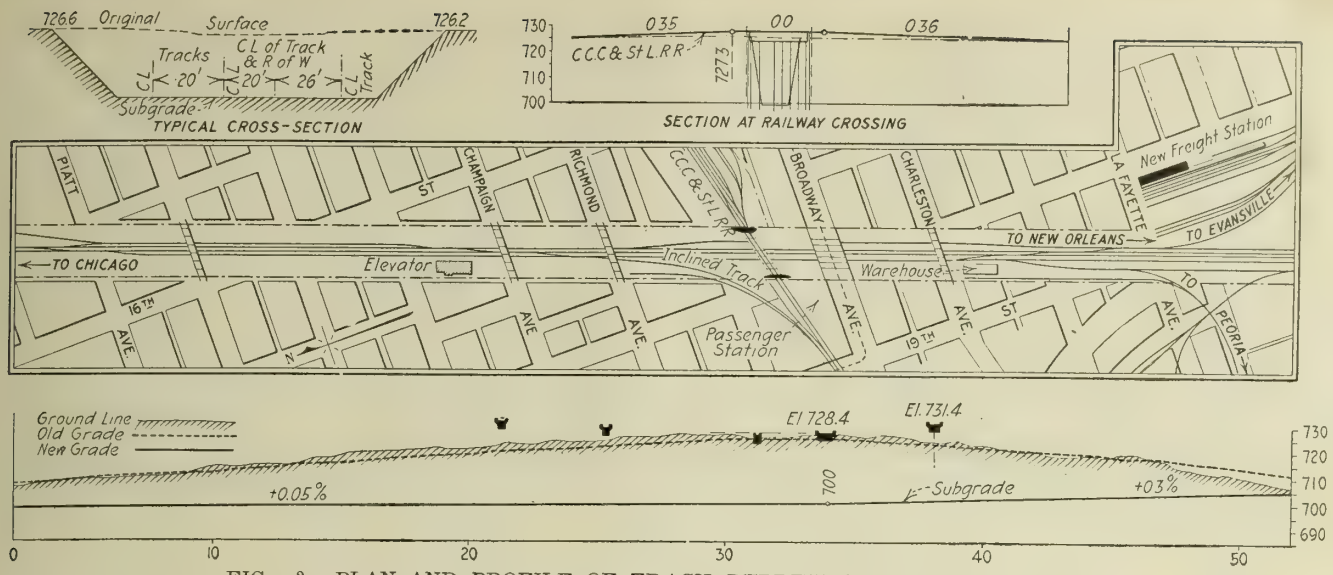


FIG. 2. PLAN AND PROFILE OF TRACK DEPRESSION AT MATTOON, ILL.

sary. But the material continues to slide and cave, and it is probable that retaining walls will have to be built in the deeper section, where the slips may affect private property. To keep the right-of-way clear, a toe wall of piles backed with heavy planks has been built, but this does not check the slipping.

There are several industries adjacent to the right-of-way line. In some cases the buildings occupied by these have been supported on timber trestling, allowing the slope to extend beneath them; in others a heavy retaining wall has been built. For this latter work piles were first driven and I-beam needle-beams placed with the inner ends resting on solid ground and the outer ends on the piles. A trench was then made to the required depth, and the retaining wall was built before making the cut for the track depression.

The typical design of the street bridges is shown in Fig. 3. There are five spans of 30-ft. clear width measured on the square, providing for four main tracks and for inclines to the industry connections. Most of them are 30 ft. wide between parapets, with 20-ft. roadways. But the bridge at Broadway, the principal street, will be 100 ft. wide, with 25-ft. sidewalks. The bridges are of reinforced concrete, with slab and beam deck supported on bents and abutments. No piling is required, the footings being carried down in the clay to about 5 ft. below subgrade. In the bents the columns are connected at the bottom by a guard wall 3½ ft. high above rail level, as a protection against derailed wheels. The beams of the floor slab rest on brackets upon the faces of the bents and abutments, and the sidewalks are cantilever slabs carried by brackets on the ends of the bents.

Gas and water mains are carried through the bents, being supported by U-hangers embedded in the deck slab. The sewerage system being separated by the deep cut an intercepting sewer had to be built along the east side of the right-of-way.

In concreting, the bents are poured to the level of the tops of the column shafts, and the concrete for the cap girder, extending to the top of the bent, is poured sepa-

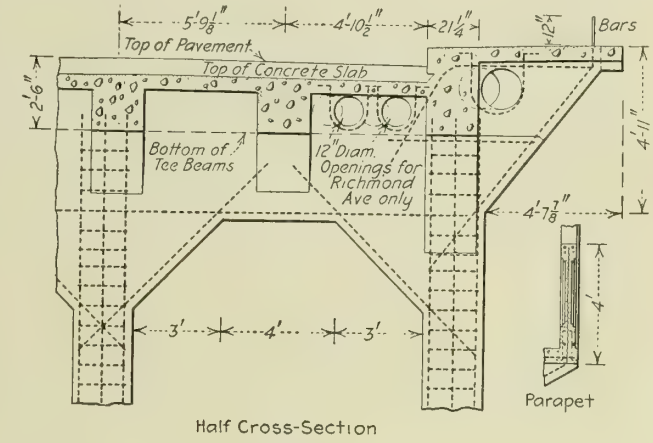


FIG. 4. DETAILS OF BRIDGE OVER TRACK

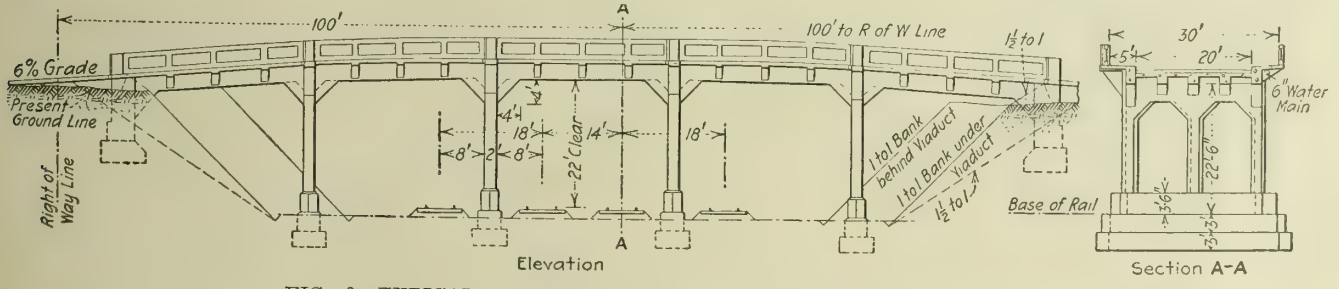


FIG. 3. TYPICAL DESIGN OF REINFORCED-CONCRETE BRIDGES

rately. The floor slab, with its longitudinal and transverse beams, is poured next, the parapets being poured last as a separate operation. The forms are of wood. The concrete in the footings is 1:3:6, and that in the upper work 1:2:4, using both gravel and broken stone. A concreting plant is installed adjacent to the bridge, with an elevator tower for spouting the concrete into place.

The C., C., C. & St. L. Ry. will be carried by a double-track through-girder bridge, the steel being incased in concrete to harmonize in appearance with the adjacent street bridges. This railway and the several streets are carried across the cut by timber bridges during the progress of the work.

In making the excavation a cut wide enough for two tracks was made first, while trains were operated on surface tracks at one side of the right-of-way. When running tracks were laid in the cut, the surface tracks were abandoned and the cut then widened to full section. In both cases two 75-ton steam-shovels were used, working from opposite ends of the work. The material was handled in 12-yd. side-dump cars and was all used for widening the roadbed and freight yards south to the city.

The cost of the work will be about $600,000. All of this will be paid by the Illinois Central R.R. and the C., C., C. & St. L. Ry. The grading was let to J. D. Lynch, of Monmouth, Ill., and the concreting was done by the Bates & Rogers Construction Co., of Chicago. The work was begun in April, 1914. The four-track cut was completed in December, 1914, and the bridges are rapidly nearing completion. The work is under the direction of A. S. Baldwin, Chief Engineer of the Illinois Central R.R., and F. L. Thompson, Assistant Chief Engineer.

Framing of the Dome of the Palace of Horticulture

By A. W. Earl* and Thos. F. Chace*

SYNOPSIS—Details of intricate steel work of a special dome. Method of erection also given.

The dome of the Palace of Horticulture at the Panama-Pacific Exposition, already referred to in *Engineering News* of Oct. 15, 1914, p. 759, is quite fully shown as to framing by the group of drawings in Fig. 1 of the present article, and is briefly described in the following.

Dome Framing

The dome framing is similar to that first used by the noted German engineer, Schwedler, being of the rib type. The dome has 24 latticed ribs, 36 in. in depth, which frame into a ring at the top and are connected by 11 horizontal latticed rings. These horizontal rings are 18 in. deep, except a 36-in. ring at the springing line of the dome, which absorbs all residual dome thrust. The ribs, however, continue 25 ft. below the springing line as vertical members framing the cylindrical base of the dome, down to a level 65 ft. above ground, where they foot upon a system of girders forming the top of the supporting tower.

Between the main ribs, 4-in. I-beam jackrafters frame into the horizontal rings. These carry wooden purlins to which skylight bars are attached, all of the dome surface except the basket being glass. All bays of the dome frame are braced by crossed adjustable rod diagonals, ranging in size from $\frac{9}{16}$ in. square at the top to 1⅜ in. square at the bottom.

In all the latticed members of the dome framing, angle lacing bars were used instead of flat bars. These give greater shear resistance and can transmit compression, for which flat bars are poorly adapted.

The spider or ring at the apex of the dome is a circular girder 6 ft. in diameter and 36 in. deep; it has $\frac{5}{16}$-in. web-plate and four flange angles 4x4x$\frac{5}{16}$ in. Two diametral diaphragms at right angles to each other stiffen the ring. These have 3x3x$\frac{5}{16}$-in. flange angles, and $\frac{5}{16}$-in. web-plates.

Supporting Tower

The system of tower framing supporting the dome itself is also shown in the drawings, Fig. 1. It comprises eight piers capped by girders and trusses. Each pier is composed of four columns placed at the corners of a trapezoid. The trapezoid has two sides normal to a radius of the dome passing through its center, the shorter side being 4½ ft. long; the diverging sides, which inclose an angle of 45 deg., are 15 ft. 10 in. in length. The outer and inner sides of the piers are braced from bottom to top, but the diverging sides have portal-framed openings for a height of 14 ft. 7 in. from the bottom, to provide a passageway.

Between the tops of the interior columns of adjacent piers are plate-girders 6 ft. 4½ in. in depth, 57 ft. 5⅞ in. long. These, together with trusses which frame from girder to girder across the interior face of the piers, support the 24 ribs of the dome.

Between the exterior columns of adjacent piers, steel trusses (also 6 ft. 4½ in. deep) support a portion of the flat roof and the staff ornaments forming the decoration of the wall surrounding the lower part of the dome. These trusses, as well as the plate-girders on the inner face of the tower, are kneebraced to the columns of the piers. The trusses and plate-girders are braced together in both upper- and lower-chord planes. This not only serves the purpose of bracing the compression chords of the girders and trusses, but constitutes a stiff ring around the entire base of the dome which effectually distributes the horizontal wind load to all of the eight piers.

Each of the inner columns is a 20-in. 59-lb. I-beam; the two adjacent columns are laced together front and back with 5x3x$\frac{5}{16}$-in. angles. The lacing is doubled above the knee-braces, to provide for portal action. These col-

*Assistant Structural Engineers, Panama-Pacific International Exposition.

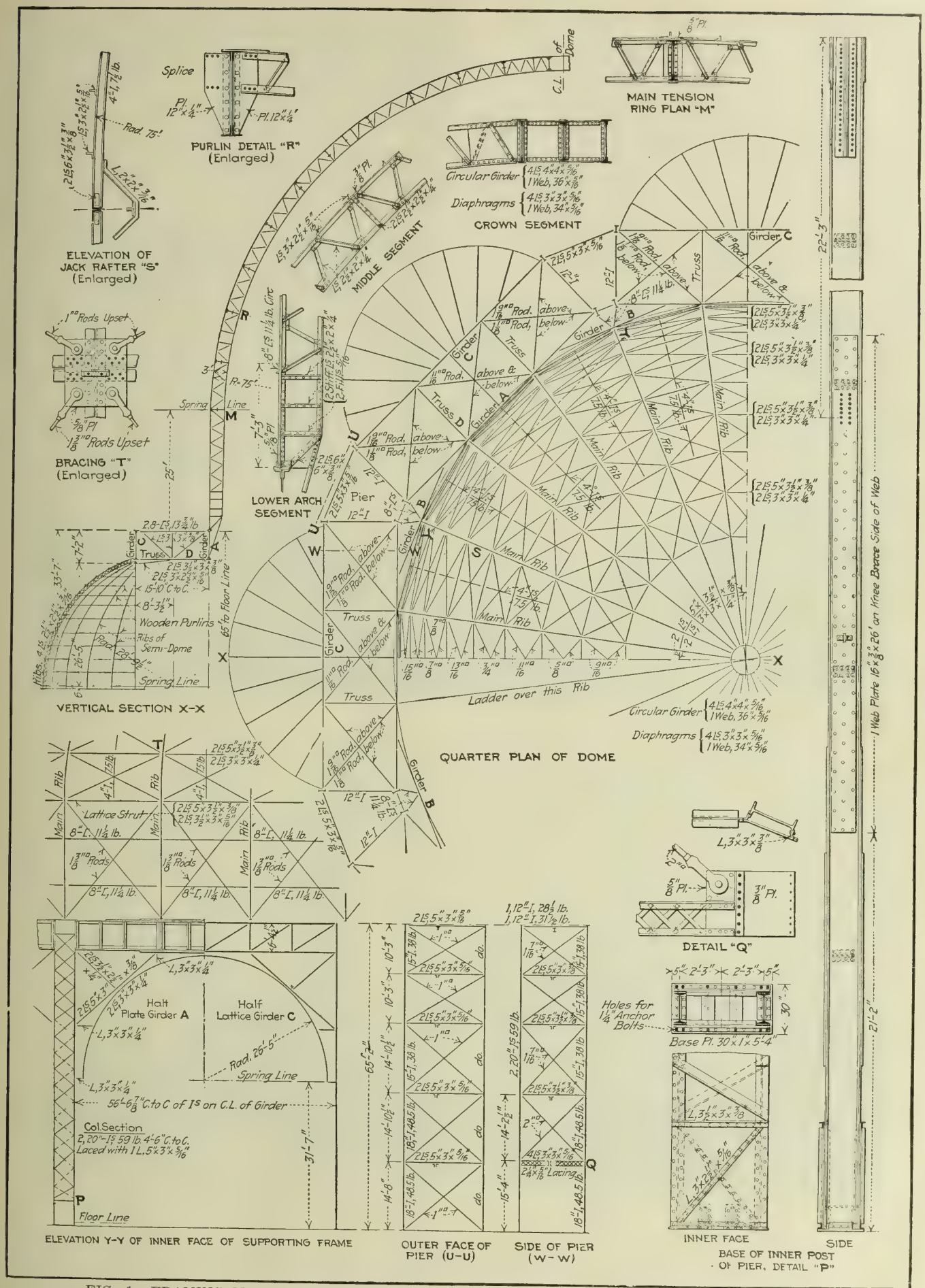


FIG. 1. FRAMING OF DOME AND SUPPORTING TOWER, PALACE OF HORTICULTURE, PANAMA-PACIFIC EXPOSITION, SAN FRANCISCO

umns are reinforced by flange-plates and by web side-plates in the respective regions of maximum bending, as indicated in the drawing of these columns in Fig. 1. The outer columns of the pier are each one I-beam, 15-in. 38-lb. in the upper section, and 18-in. 48½-lb. in the lower section.

Particulars as to makeup of trusses and bracing are given in the drawing.

The weight of steel for that portion of the structure above the tower plate-girders is 200 tons. This amounts to 8½ lb. per superficial sq.ft. of roof surface, or 0.304 lb. per cu.ft. of volume of the portion considered. The total weight of steel in dome and substructure is 503 tons, giving an average weight of 0.358 lb. per cu.ft. volume inclosed by the frame. The corresponding quantities for the dome of the Horticultural Building at the Chicago Exposition, as computed from the data in the article in *Engineering News,* March 12, 1892, p. 240, were: Steel per sq.ft. roof, 10.7 lb.; steel per cu.ft. inclosed space, 0.312 lb.

Erection

The steel of the supporting frame of the dome rests upon a timber grillage supported by piles. The timber caps are well drift-bolted to the piles. This is counted on as producing some fixing effect upon the column, which was utilized in the analysis of stresses.

The supporting frame up to the base of the dome ribs was erected complete before any of the ribs were placed. For raising the ribs, a battered tower was constructed in

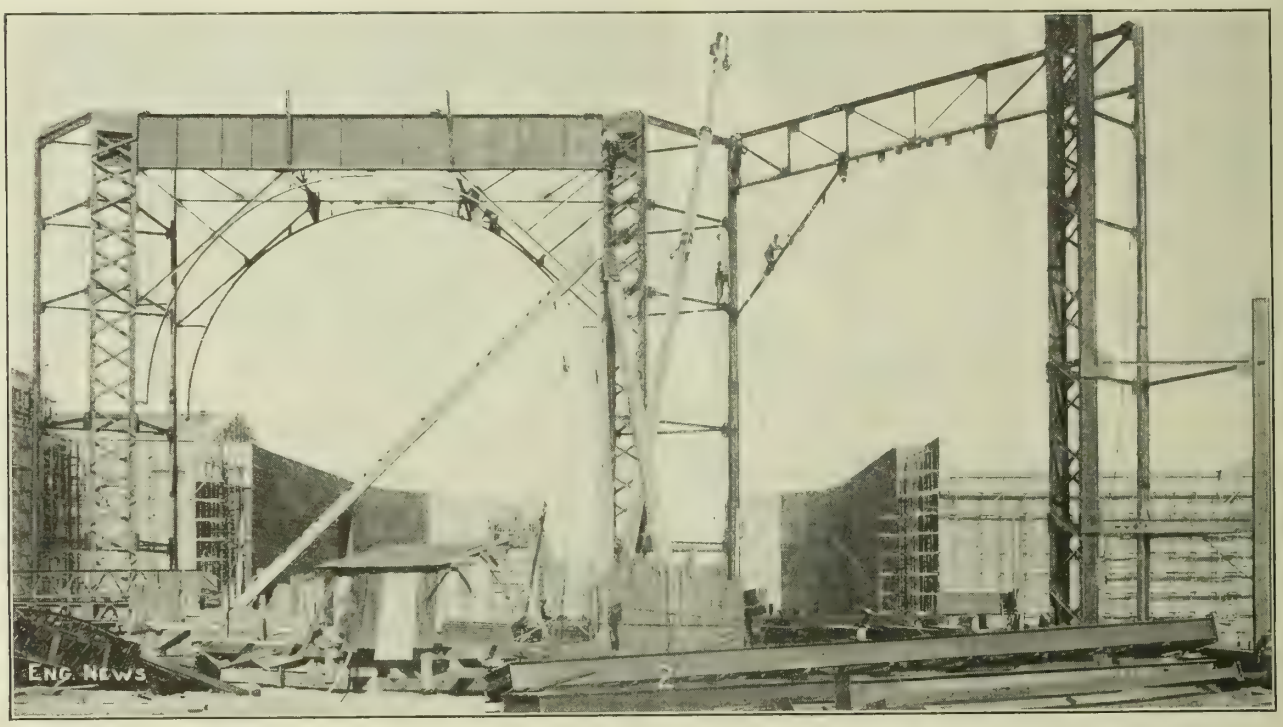


FIG. 2. ONE SIDE OF SUPPORTING TOWER OF DOME COMPLETED, AND ANOTHER SIDE BEING ERECTED

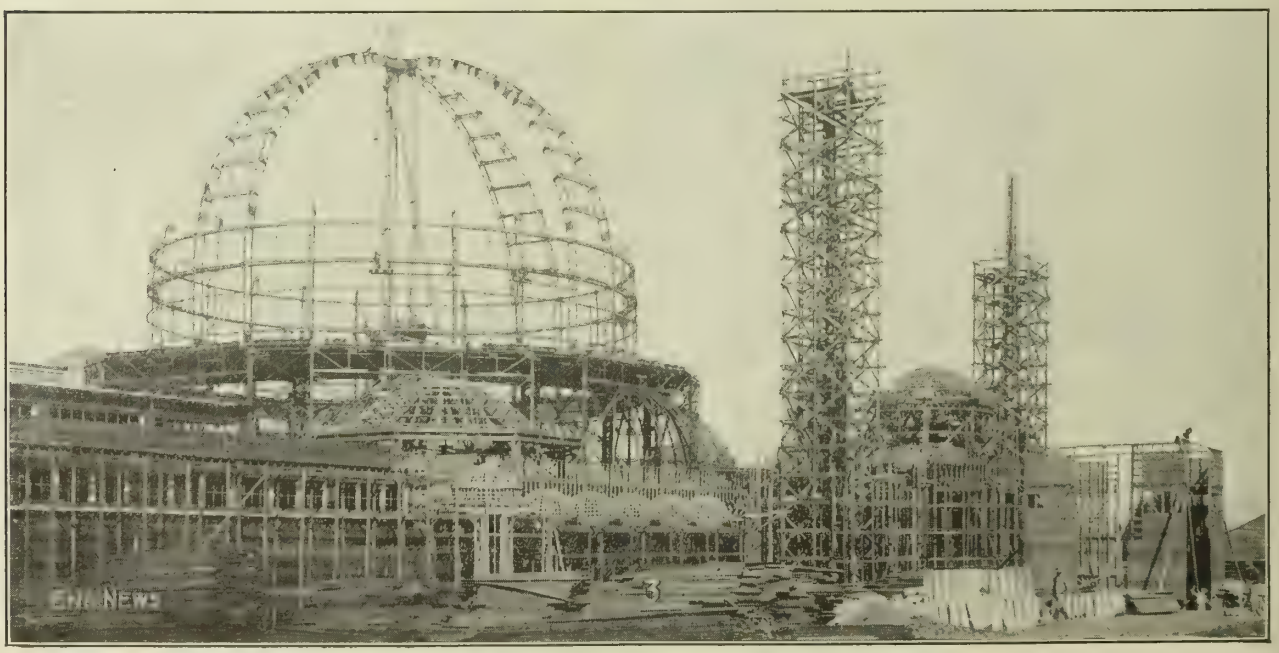


FIG. 3. PLACING UPPER RIB SECTIONS OF DOME; LOWER PART OF DOME ALREADY ERECTED

the center of the dome area, in height slightly greater than the top of the dome substructure. Upon this tower were placed one guyed mast and two guy derricks. The mast supported the top ring of the dome by means of rod hangers with turnbuckles; adjustment of the top ring to position was made by means of these turnbuckles and similar turnbuckles in the mast guys.

The portion of the ribs between the girders and the first splice, including the rings and diagonal rods, was erected first. Meanwhile the remaining ribs were assembled in pairs on the ground, a pair of ribs with the connecting rings and diagonal rods being riveted together, and swung into place by the guy derricks, completing the erection of the steel. The weight of a pair of rib sections, completely assembled, was approximately 8 tons.

All steel connections of the dome frame itself were riveted; the supporting frame, however, has bolted steel connections, ordinary bolts being used.

The plans for this building were prepared by the Division of Works of the Exposition Company. H. D. H. Connick is Director of Works, and A. H. Markwart is Assistant Director of Works. The dome and substructure were designed by the writers under the immediate supervision of H. D. Dewell, Chief Structural Engineer. After the design was completed, the stresses in the dome were checked by R. G. Doerfling, Civil Engineer.

Bakewell & Brown, of San Francisco, were the architects of the building. Dyer Bros., of San Francisco, were the contractors for the fabrication and erection of the steel.

A Proposed Rating System for Track Scales

By A. M. Van Auken*

There is no well-defined manner of determining the capacity of either a track scale or a wagon scale. Most scale companies calculate the scale for a distributed load and call that its capacity, although some have in certain instances just doubled this. Many railway engineers who have studied the scale question are of the opinion that the capacity of the scale should be twice the load which can be imposed upon one section, while a few think it should be 2½ times this.

To illustrate the wide divergence thus created between the scale designer, the scale salesman and the railroad engineer, a well-known four-section scale of the cross-lever or Fairbanks type may be cited. It was designed for a distributed load of 330,000 lb. and called by its designer a 150-ton scale. The salesmen for the company call it a 300-ton scale, while those engineers who consider twice the weight on one pair of levers as the capacity would call it a 110-ton scale and those who would allow 2½ times the weight on one pair of levers to be the capacity would call it a 137½-ton scale.

There are three parts to a track scale—scale-pit and foundation, weighing machine, or scale proper, and weigh-bridge and its tracks. The deck over the pit is part of that structure. At certain points the weighing machine rests on the foundation, while at points above it supports the weigh-bridge. The scale is called a four-section scale when there are eight such points and a five-section when there are ten, there being a set of two cross-levers at each point. Each cross-lever transmits the load to a longitudinal lever, and other levers transmit it to the weigh-beam. The capacity of the scale is not affected by the scale-pit or weigh-bridge, though each of these must be adequate to the service it must perform. The accuracy of the scale depends upon the sufficiency of the levers in strength and rigidity and upon the sufficiency in length and perfection of bearing of the pivot—or, as it is commonly called, the knife-edge. As the levers are made of cast-iron, of steel castings and of rolled steel sections, there is a wide range in their rigidity and ultimate strength. Another feature of the capacity is the weigh-beam, which must be graduated to a point where it will weigh the maximum load to come upon the scale.

It is proposed to suggest a better method of designating scales than the present one of capacity.

A suggestion has been made by W. Samaus, of the Bessemer & Lake Erie R.R., for describing a scale—namely, to use three sets of figures. Scales are installed in several ways: (1) With weigh-bridge and scale-rail the full length of the pit; (2) with ends of the pit bridged over so that the end of the scale-rail comes just over the center of the end levers and pivot; (3) with ends bridged so that the end of scale-rail comes at some point between the first and second pair of levers and pivot. Each will call for a different length of scale-irons and pit for the same scale-rail. Mr. Samaus suggests calling a scale by figures which will represent (a) length between centers of end sections of scale, (b) number of sections of scale, (c) length of scale rail. Thus, a scale 52 ft. between end sections, with four sections, and 50-ft. scale-rail, would be denominated a 52-4-50 scale. This seems a most excellent suggestion.

Another compound expression which would give a good description of the scale might be used. Let the first figure give in thousands of pounds the load for which the main lever is designed, the second the length in inches of the bearing of the main knife-edge or pivot, and the third the capacity of the weigh-beam in thousands of pounds. Thus the well-known "B. & O." scale would be described with reference to capacity as 55-10-200 and the New York Central Lines West proposed scale as 75-15-300; in each case the correct capacity of the scale would be indicated. As to how the capacity of the lever should be rated, it might be well to define that it should be able, in a testing machine, to sustain the load named without showing a deflection in excess of one two-thousandth part its length, and to sustain double that load without permanent set, leaving choice of metal to the builder.

This plan is offered as a step forward and in the hope that it or some better method will be adopted which shall correct the prevailing confusion. Even in cases where scales are designed for a stated load under present conditions it is possible for a "150-ton" scale to have its levers designed for a static load anywhere from 50,000 to 75,000 lb. and its main pivot to be anywhere from 5 in. to 15 in. in length. Some scale men contend for a load of 10,000 lb. per lin.in. of pivot, while others would not allow over half that amount.

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The First Honorary Doctor's Degree in Engineering to be awarded in this country, so far as we can determine, was that given by New York University in June, 1866, to Erastus W. Smith, who became Doctor of Physical Science, "in recognition of his abilities as an engineer."

Engineering Literature

A New Railroad Field Book

Reviewed by M. P. Paret*

RAILROAD FIELD MANUAL FOR CIVIL ENGINEERS—By William G. Raymond, M. Am. Soc. C. E., Professor of Civil Engineering and Dean of the College of Applied Science in the State University of Iowa. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Leather, 5x7 in.; pp. vii + 398; 31 text figures and 83 tables. $3, net.

The author has in his preface largely confined his remarks to his suggested general adoption of the decimal division of degrees and of five-place tables. While the actual use of either is not new, yet a practical effort to make their use universal as good, or the best practice, is new, and the author is to be commended for his courage in coming to the front in a way tending to a practical realization of his hope for a general adoption of such features.

The engineering profession is not so hidebound by precedent as is that of the law, but, like the "man from Missouri," it likes to be "shown." Its conservatism requires practical demonstration of applicability before it will adopt anything new as good practice.

This is an age of overtalked, overwritten, but underapplied, efficiency. The general (it should be the universal) adoption and use of the author's tables will be a deserved example of applied efficiency.

The feature of having the applicable tables assembled with the immediate subject matter is practical and commendable; however, a thumb index would materially assist to locate them quickly.

It seems to be a more or less firmly established principle that a review of a book must be largely a criticism. It would be unjust to Professor Raymond to utilize more space in criticism than in commendation, without first stating that the commendable features are largely in excess and at the same time apparent.

The treatise is a "Railroad Field Manual," and when considered by the man behind the gun—the field man—it is found to lack certain features which, if not essential, may safely be termed desirable, as tending from a practical point of view to completeness.

There are noticeably two features, or, more properly, classes, of railroad field work which might have been profitably mentioned but which are not—railroad surveys and railroad valuation. Railroad surveys—reconnaissance, preliminary and location—are the very foundation of railroad work, and upon the outcome of these is very largely dependent the final success of the railroad. The omission of a chapter on railroad surveys materially reduces the value of the treatise as a field book. Railroad work does not begin with the running of curves, the use of the spiral or the application of "location theories and tables" and "estimating and construction tables."

In a chapter on railroad surveys there might be presented a brief practical method of determining a P. I., short cuts to setting angles on vernier for successive deflections, thumb rules and short practical methods generally.

Lavis' treatise on "Railroad Location Surveys," issued in 1906, while possibly not fully modern, is about the best compendium of good practice in that line, and a condensation of its subject matter would seem a very desirable, if indeed not an essential, feature of a railroad field manual.

Not so essential, but to be up to date, a brief chapter on railroad valuation would not have been out of place. Life is too short to cull something practical out of the great mass of what has been *written* on the subject of railroad valuation, but from what has been *done* by corporations and state commissions it would be feasible to compile a useful abstract of field practice.

In connection with the use of Table I, p. 12, and following the introduction, a table converting minutes into decimals of a degree would be serviceable. The table of tangential corrections on p. 33 might well have been extended to angles over 20 deg. to cover certain classes of interurban and street-railway and yard and canal work.

The chapter on "The Spiral" seems unnecessarily voluminous, both as to text and tables, although it might have been well also to give an illustrative example of spiraling a simple curve. The form of spiral used is a good one, but the tables are not carried out far enough for use in mountain country calling for sharp curvature and short tangents. To illustrate: If there was a 10-deg. curve and the tangent length between curves were limited to 40 ft., the amount available for that curve spiral (Table XXIII, for shortest spirals) would give 49.92 ft. for "L," necessitating a rather complicated use of the tables.

Chapter V should have embraced an article on overhaul. While the tendency may be toward pay-both-way contracts, yet there are many railroad companies which almost universally use haul-clause contracts, and there are many sections of country where to get desirable competitive bids and economic grading its use is necessary.

Table LXI, p. 290, is ostensibly for the conversion of linear feet of 100-ft. wide right-of-way into acres. In point of fact it is a table to convert acres into linear feet of 100-ft. wide right-of-way. If it were what the text terms it, the first columns should contain "linear feet of R. O. W.," and the second "acres;" then, with the first column reading by tens, the table would have covered the ground in less space and in a more practical manner for field application.

The chapter on "Turnouts and Crossovers" deals only with straight track. It might well have contained something on turnouts from the inside or outside of curves.

I take this opportunity to express to my assistants, H. J. Saunders, G. T. Morris and R. T. Guppy, my appreciation of valuable comments on this book from the viewpoint of modern field practice.

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Electric Railway Handbook

ELECTRIC RAILWAY HANDBOOK: A Reference Book of Practice Data, Formulas and Tables for the Use of Operators, Engineers and Students—By Albert S. Richey, Fellow, Am. Inst. E. E., Consulting Engineer, Professor of Electric Railway Engineering, Worcester Polytechnic Institute; Assisted by William C. Greenough. New York and London: McGraw-Hill Book Co., Inc. Flexible leather; 4x7 in.; pp. xi + 832; illustrated. $4, net.

Most engineer-authors would have felt that the subdivision of engineering work on an electric railway was so distinct that there would always be track and structure engineers, electrical and mechanical men, etc., and that a general handbook of electric-railway engineering would not be demanded. But Professor Richey enjoys a large acquaintance among street-railway engineers and has a good chance to find the need for such a book, as well as what should go into it. The book certainly brings together in very convenient form a variety of data which have been widely scattered before.

Location and the cost of the various operations of original construction appear first. Standard city-track construction on a number of important systems is pictured and the use of various standard and special rails is discussed. Theory and practice in track work are briefly outlined, including diagrams of some notable car-barn track layouts. Considerable attention is paid to general car-house and shop layouts.

Following this is a section on train movements—building up schedules and finding train resistance, acceleration, run curves, current requirements, etc. A section on motors gives typical characteristics, selection for a given service, methods of maintenance and repair, and lubrication practice. Another section describes the available systems of motor control and gives a few notes on inspection and maintenance. Many data on practice throughout the country are given in the sections on trolley wheels and other collectors, and on trucks, axles, bearings and wheels.

One section takes up braking, going into such ultimate details as variations of friction coefficients, weight transfer, relations between air pressure, piston areas, and lever lengths, shoe positions, rigging standards, slack adjusters etc. Various air-brake systems are described at length. Other types of brakes (besides hand brakes), such as magnetic, reversed-motor, regenerative, etc., are briefly noted. The growing importance of regenerative braking, as manifested by recent important heavy installations, would have excused a more detailed presentation of that topic than is found under train movements or brakes.

Rolling stock is given one section, diagrams for a large number of urban surface and rapid-transit and interurban cars being shown. The advantages and limitations of surface-car trains are presented. Practice in cleaning, heating, ventilation and lighting of cars is reviewed. The most important features of the leading types of electric locomotives are presented in a form making comparisons easy.

Under transmission and distribution are grouped important details of trolley-wire supports, data for steel, concrete and wood poles, specifications for overhead crossings of light and power lines, features of approved wires and cables, etc. Third rails and conduits are not neglected. The importance today of the return circuits warrants the attention here shown to details of track bonding, electrolysis of neighboring buried structures, insulated negative feeders, etc. Some will feel that this section could have been strengthened by giving the electrolysis-mitigation results secured in various cities with the coöperation of the Bureau of Standards.

The final pages of the book give brief summaries of commercial processes for preserving wood and descriptions of various signal and telephone lines, highway-crossing warnings, etc.

Automatic Telephones

AUTOMATIC TELEPHONY: A Comprehensive Treatise on Automatic and Semi-Automatic Systems—By Arthur Bessey Smith, M. Am. Inst. E. E.; Formerly Professor of Telephone Engineering, Purdue University, and Wilson Lee Campbell, Fellow Am. Inst. E. E. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xii + 407; 271 illustrations. $4, net.

Engineers generally feel that ordinary telephony is a complicated art and science not to be seriously invaded except by specialists; and automatic systems are commonly regarded as still farther beyond ordinary comprehension. The several good treatises on manual systems have done much to open up that branch to any intelligent student, and this book will do the same for the other division. The automatic equipment and operation is, of course, extremely complex, but it can be mastered if studied step by step with a lucid text like this.

The authors have succeeded, as well as could be expected in 400-odd pages, in describing typical apparatus and circuits of the more important makers, including the Western Electric Co. (the manufacturing department of the American Bell system). Their more general discussions, however, on territorial development, traffic, central-station design, long-distance lines, etc., have followed the practice of a single company—the Automatic Electric Co., probably the best known of the "independent" makers of automatic-telephone equipment.

The volume opens up with a discussion of "trunking"—economic arrangement of leads from subscribers to the central office. After this it plunges into the details of calling and switching systems, which make up the book, except for the general discussions noted before.

Line-Wire Sags and Stresses

GRAPHICAL DETERMINATION OF SAGS AND STRESSES FOR OVERHEAD LINE CONSTRUCTION—By Guido Semenza, Local Honorary Secretary of Am. Inst. E. E., for Italy; Consulting Engineer and Technical Adviser of Societa Edison of Milan, and Marco Semenza, Electrical Engineer, Milan. Translated from the Italian by C. O. Mailloux, Past-President, Am. Inst. E. E., Consulting Electrical Engineer. New York and London: McGraw-Hill Book Co., Inc. Cloth; 9x12 in.; pp. x + 24; 13 charts. $3, net.

Essentially this volume is a collection of diagrams from which anyone, knowing the diameter of copper distribution- and transmission-line conductors, the minimum allowable stress, the length of span, minimum temperature, wind velocity, and thickness of probable ice coating, can find the sag which should be given at the temperature prevailing when the wire is strung. Besides the working charts themselves, there are sections showing their derivation and giving practical examples of their use.

The authors are distinguished Italian engineers and pioneers in foreign power-transmission work, so that their methods must command respect here. The translator is a well-known consulting engineer, a past president of the American Institute, whose reputation should increase the attention secured by this volume. H. W.

Buck, a prominent electrical engineer, has made some additions to a section on allowances for weather and wind conditions so that the results may be better applied to American circumstances.

Valuation of Utilities

Reviewed by Leonard Metcalf*

PUBLIC UTILITIES: THEIR FAIR PRESENT VALUE AND RETURN—By Hammond V. Hayes, Consulting Engineer; author of "Public Utilities: Their Cost New and Depreciation." New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. viii + 207. $2, net.

The author's second volume on the valuation of public-utility properties is limited to the field of rate-making. Unlike the first volume[1]—which outlined clearly the more important measures of value, original cost, reproduction cost, market price of the securities, etc., and left to the courts, as a legal question, the interpretation of the results obtained—this book, while nominally adhering to this view, seeks to determine the method which shall be pursued and lays great emphasis on, if it does not practically tie to, original actual cost of the property as the proper measure of the rating base. To the lawyer, engineer and layman, well read in the subject of valuation, the book will be most interesting and suggestive as indicating clearly the apparent trend of thought of the public-service commissions and of many legislators in these matters; but in the hands of those unfamiliar with court rulings, the book may prove dangerous, in that the author has fallen into the error of not making sufficiently clear the fundamental difference between the trend of recent public-service commission rulings and the consistent past position of the courts upon this subject—the former striving for cost, the latter adhering always to value as the proper rating base.

The author's acceptance of investment cost as the fair rating base is indicated by his statement:

> Starting new and operating successfully, the actual capital cost—in the production of the plant, organization and service—is the fair basis upon which the fair rate of return can be earned . . . when the loss in the value of the investment in perishable property arising from depreciation has been restored by the reserves for renewals.

In other words, the investment cost in labor, materials and service, made in good faith in the production of the plant, property and organization required in the production of the service sold to the public, with only such deduction for depreciation as the rates in the past may have provided and methods of accounting used may justify, and without allowance to the corporation of the appreciation in value of its property, so long as this property is dedicated to the use of the public or used in its service. While it is true that the apparent trend of thought on the part of certain of the public-service commissions lends color to this viewpoint, it is not sanctioned by the United States Courts which have consistently adhered to *value* and not cost, as the proper base, though they have recognized in cost one of the criteria of value.

Public-service companies could operate successfully under two quite different methods—first, the right to earn upon the fair value of their property a return commensurate with the risks of the business; second, the right to earn upon the investment cost of the property a guaranteed return commensurate with the nature of this guarantee. The United States Supreme Court has followed the first basis in a long line of decisions. Some of the public-utility commissions lean toward the second, and this is the basis advocated by the author. It is in the failure to make this divergence of views more clear that the danger lies of misinterpretation of the author's statements and views.

The author naturally assumes that the action of the commissions will be fair and untrammeled by political or other influences and calls attention to the danger of making these commissions the financial balance wheel. He says:

> The power of commissions to fix a fair rate of return—assuming the fair capital value established—will inevitably change entirely the methods of financial management which have prevailed in the past. It virtually transfers from the officers of the company to the commissions the financial policy of the company.

It may well be asked whether under present American political conditions the freedom of action of public-utility commissions to raise and lower rates stated by Mr. Hayes to be necessary to fair relations between the corporations and the public exists or can exist. Certainly many intelligent and fair-minded observers who have been studying these conditions believe that at present there is evidence of a generally declining character of service, likely to be followed by greater expenditures by the corporations in the near future, unless the commissions hereafter deal more liberally with them, either in finding value or in the rate of return allowed upon the property values or rating bases determined as heretofore or at present.

In Chapter I the author outlines "the present controversy;" in Chapter II he discusses the ascertainment of fair present value of old and new, regulated and unregulated, successful and unsuccessful public service properties, and competitive and non-competitive conditions; and in Chapter III is treated fair rate of return, including not only the going rate or cost of money but also the necessary profit element to induce private interest in such enterprises. Replacement cost under present conditions is intelligently discussed in Chapter VI, the propriety of including therein proper allowance for administrative, engineering, overhead and contingent costs, interest during construction, preliminary and promotion costs, and development expense or going-concern value being clearly and convincingly set forth. The segregation or classification of some of these items is, perhaps, unfortunate as being at variance with general current practice, but the final results obtained by the author are in accord with present methods. Actual original cost determination of existing property is then discussed, though most engineers would disagree with the author's conclusion that it can usually be determined as readily and accurately as reproduction cost.

The discussion upon going-concern value is one of the best that has yet appeared. Among other methods the author outlines one for determining the reproduction cost of this element of value based upon the reasonable, instead of the actual, rate of return. In this connection it is perhaps interesting to note that quite independently of Mr. Hayes' work and prior to the appearance of his book a similar treatment of this subject was submitted in evidence by the reviewer in the Denver Union Water Co. rating case.

Depreciation is ably treated in the last chapter. The author treats the problem as an accounting one, dis-

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[1]Review in these pages by Mr. Metcalf, Feb. 12, 1914.—Editor.

criminating between the relative desirability in application of different methods as applied to long- and to short-lived properties, and pertinently pointing out that "justice demands . . . that the method employed at the time of appraisal should be the same as that which had been employed by the corporation in the past in creating the reserves for renewals."

The author's adoption of the straight-line method as easiest of application and, on the whole, most reasonable, may well apply to future conditions and in the case of old plants to those the greater part of the property of which is short-lived; but it would do serious injury to old water-works and like properties having long-lived structures, and would, in the majority of such cases necessarily require an increase in rates to meet the greater annual depreciation reserves which would be presently involved by it, as compared with reserves determined by the sinking fund or equal annual payment methods.

The book is a thoughtful one, and will prove suggestive to those interested in public-service corporation management or control. The publisher's work is excellent. The index is good.

Steam Valves and Valve Gears

Reviewed by John J. Flather*

VALVES AND VALVE GEARS: Vol. I, Steam Engines and Steam Turbines—By Franklin DeRonde Furman, M. Am. Soc. M. E., Professor of Mechanism and Machine Design at Stevens Institute of Technology. Second edition, reset and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. x + 253; 300 illustrations. $2.50, net.

This work is a further development of the book noted in these columns by the present reviewer Mar. 14, 1912, which was an outgrowth of a series of notes originally prepared in mimeograph form for the use of students in the author's classes. The book referred chiefly to steam engines and briefly to steam turbines. In the edition under review the matter relating to present-day reciprocating steam engines has been considerably increased and the steam turbine is treated much more completely. A separate volume, now in preparation, on the several types of the internal-combustion engine is to be added.

In this edition, as in its predecessors, the subject is treated entirely from the kinematic standpoint with a view to the actual layout of valve gears and the control of the operating agent.

A feature of the present edition is a collection of the various types of practical prime-mover valves into a few (seven) fundamental forms and a grouping of six fundamental types of mechanism from which all valve-gear constructions may be formed. These constitute a handy and reliable reference group for students and others interested in the various phases of the subject.

Other commendable features are the arrangement of the material, the same as in the older edition, and the presentation of problems to conform with the methods in vogue in the best drafting-rooms where the design of valves and valve gears is being carried on in connection with actual construction.

The first section of the book is devoted to a discussion of the simple steam engine. The elements of valves and valve gears are defined and the Zeuner diagram is deduced. Exercises in the use of the Zeuner diagram follow, and practical methods are given for proportioning the plain D- and the Allen valves, equalizing cut-offs and other phases of the cycle, and for determining the width of ports under varying conditions. The limitations of these valves are also pointed out.

Various valve diagrams are presented in Section II, in which illustrative applications are noted of the Bilgram diagram, the valve ellipse, the Reuleaux diagram, the sinusoidal, and others. This is followed by a discussion of fundamental valve forms (Section III) and valve-gear mechanisms (Section IV). Section V is devoted to a presentation of practical types of valves for reciprocating steam engines, interspersed with various drafting-room problems, which include double-ported valves, Meyer, Corliss and other forms, for which the methods of design are given fully.

In Section VI eccentrics and shaft governors are treated both descriptively and kinematically, with especial reference to the relation of the Zeuner diagram, under varying conditions of service.

This is followed by a discussion of steam-engine valve gears of various types and the design of link motions as applied to locomotives and other engines. This section also deals with floating or self-centering valve gears, steering-gear engines and the uniflow steam engine, including the Ames-Stumpf and Skinner universal una-flow.

The final section (Section VIII) is devoted to steam-turbine valve gears, in which the various methods of control are discussed at length.

The new material which has been added on the subject of the reciprocating steam engine in the present edition includes the "semi-plug" and high-pressure piston valves of the American Balance Valve Co., the Rice & Sargent-Corliss engine, including the Rites and Sargent governors, and directions for setting valves and valve gear, Nordberg valves and valve gears, J. T. Marshall valve gear, Sulzer steam-engine valve gear, Williamson steering gear, and several types of the uniflow steam engine. The Curtis "steam-actuated" and "mechanical" gears, the Westinghouse "direct" and "steam-operated" gears and the De Laval gear have been added to the section on steam-turbine control.

As in his previous presentation of this subject, Professor Furman has been successful in his treatment, which is especially well adapted to the work of instruction. The numerous problems and exercises which accompany the text and the logical methods of procedure suggested for each case are excellent features, which must appeal equally to the teacher of machine design and to the student of engineering.

OXY-ACETYLENE WELDING AND CUTTING, Including the Operation and Care of Acetylene Generating Plants and the Oxygen Process for Removal of Carbon—By Calvin F. Swingle, author of "The Twentieth Century Handbook for Steam Engineers and Electricians," etc., etc. Chicago: Frederick J. Drake & Co. Cloth; 4x7 in.; pp. 190; 76 illustrations. $1. Leather, $1.50.

The publishers have added one more practical handbook to their already long list. In doing so they have continued the high degree of utility generally maintained in previous volumes. There is of course a predominance of description of apparatus and its manipulation, but the theory is given in sufficient outline to make the book more than a rule-of-thumb guide.

A short review of welding processes, the action of welding flames, and the properties and preparation of oxygen

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and acetylene occupies 45 per cent. of the text; the remainder discusses torches (or blowpipes), miscellaneous welding equipment, metal-cutting, and burning carbon deposits out of gasoline-engine cylinders.

Public Health and the Law

LEGAL PRINCIPLES OF PUBLIC HEALTH ADMINISTRATION—By Henry Bixby Hemenway, M. D., Fellow, American Academy of Medicine; Fellow American Medical Association; Member American Public Health Association; Member American Association of Railway Surgeons; Member American Statistical Association. Introduction by John Henry Wigmore, Dean, Northwestern University Law School; Illinois Commissioner on Uniform State Laws. Chicago: T. H. Flood & Co. Cloth; 6x9 in.; pp. xxxvi + 859. $7.50, net.

Dr. Hemenway has produced a unique book in that he has combined in one volume a review of the fundamental legal and many of the basic hygienic and sanitary principles of public-health administration. His viewpoint is that of a physician who years ago was a health officer in a small city and has since followed the progress in health-protective work and made a careful study of its many legal aspects.

The book first reviews in considerable detail the whole field of Federal, state and health administration as affected by constitutions, statutes, local ordinances, court decisions and public policy. These take up the larger part of the volume. The remainder of the book is devoted to special applications, under such topics as quarantine, water-supply, sewage disposal, and medical inspection of schools.

In view of several flattering tributes paid by the author to the engineering profession, including a statement that it might be better to choose a health officer from sanitary engineers than from physicians, it may seem ungracious on our part to point out that in discussing sewage treatment he says that the Imhoff tank "takes the crude sewage and pours out water much clearer than that found in many streams, and practically devoid of bacteria." This is clearly a misconception of the object and the effect of the Imhoff tank, but it may not do much harm in this book.

For the every-day use of the health officer a smaller work, containing less about government in general and more regarding the legal difficulties encountered in public-health work, might be more serviceable, but for those who wish a one-volume survey of the field of constitutional and statutory law, from the health rather than the legal standpoint, the volume promises to be valuable.

ELEMENTARY MECHANICS FOR THE PRACTICAL ENGINEER—By John Paul Kottcamp, Head of the Mechanical Laboratory, Pratt Institute. [Engineers' Study Course from "Power."] New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. vii + 181; 85 text illustrations. $1.50, net.

Mechanics does not lend itself easily to home study. An elementary knowledge of the subject, however, can be obtained by anyone who will study Mr. Kottcamp's book, which comprises thirty lessons prepared by him for publication in *Power*. The author knows how to teach mechanics and has presented his lessons in the clear and concise manner which characterizes his classroom lectures.

STANDARDIZED SQUARE FOOTINGS OF REINFORCED CONCRETE—By Lewis A. Hicks, Structural Engineer, Rialto Building, San Francisco. Stiff paper; 6x9 in.; pp. 62; 14 illustrations; accompanied by chart 16x18 in.

A most elaborate and complete diagram for the design of reinforced-concrete footings has been issued by Lewis A. Hicks, of San Francisco, in the form of a small pamphlet of instructions accompanying a linen sheet carrying the diagram. The methods of solution are founded on the well-known tests on concrete footings conducted by Prof. A. N. Talbot, of the University of Illinois. The pamphlet is entitled "Standardized Square Footings of Reinforced Concrete" and is issued by the author, whose address is the Rialto Building, San Francisco, Calif. Its price is not noted.

Construction Materials

MATERIALS OF CONSTRUCTION; Their Manufacture, Properties and Uses—By Adelbert P. Mills, Assoc. M. Am. Soc. C. E.; Assistant Professor of Materials, College of Civil Engineering, Cornell University. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xxi + 682; 346 illustrations. $4.50, net.

The standard textbooks on the materials of construction have been so long standard that in many ways they are far out of date, not only because processes of manufacture, and consequently properties of the material, have changed, but because new, or at least additional, facts about certain materials are continually being discovered. A new book which takes account of these changes in as satisfactory a manner as does Professor Mills' text is welcome. While it makes no pretense to the completeness of the earlier treaties by Johnson and Thurston, it amply satisfies the ordinary wants of both student and practitioner, although frankly directed more to the former than to the latter.

The subject matter as outlined in the chapter heads covers gypsum plaster, quicklime, hydrated lime, hydraulic lime and grappier cements; cements, concrete, building stones, clay products; pig iron, cast iron, steel, alloy steels, non-ferrous metals and timber. The method of treatment is to preface the consideration of each material by a discussion of its ordinary application in engineering construction and a study of its manufacture or natural occurrence. The main treatment is then devoted to a discussion of its physical properties in relation to its use.

PRACTICAL APPLIED MATHEMATICS—By Joseph W. L. Hale, Assoc. M. Am. Inst. E. E.; Associate Professor of Engineering, the Pennsylvania State College; Detailed as Supervisor Apprentice Schools, Pennsylvania Lines East of Pittsburgh and Erie. New York and London: McGraw-Hill Book Co., Inc. Cloth; 4x7 in.; pp. xi + 206; 184 text illustrations. $1, net.

"It is often necessary in the work of the shop to find the sum of two or more numbers or quantities. . . . This process is called addition." This is the way Mr. Hale's book begins, and the simplicity of the beginning is maintained to the end. The book will interest only the veriest beginners in arithmetic; but these are sufficient in number to warrant its publication. After the simplest processes have been explained by text and example, fractions, ratio and proportion, use of rules and formulas, simple equations, cube root and a brief chapter on the metric system are taken up successively.

UNIVERSAL SAFETY STANDARDS: A Reference Book of Rules, Drawings, Tables, Formulæ, Data and Suggestions for Use of Architects, Engineers, Superintendents, Foremen, Inspectors, Mechanics and Students—By Carl M. Hansen, M. Am. Soc. M. E., Consulting Safety Engineer. Compiled under the Direction of and Approved by the Workmen's Compensation Service Bureau, New York. Second edition, revised and enlarged. New York, Philadelphia and London: Universal Safety Standards Publishing Co. Flexible leather; 5x8 in.; pp. 312; illustrated. $3, net.

Safety attachments and guards for machinery in shop and foundry and various devices for decreasing the hazard of dangerous operations are explained and amply illus-

trated in two colors in Mr. Hansen's book recently revised. All the appliances and methods have been approved by the Workmen's Compensation Service Bureau, which is supported by the various casualty companies. Those interested in the safety campaign in shop and foundry will find much of value in this collection of safety methods.

NEW PUBLICATIONS

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor, the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

AMERICAN RAILWAY ENGINEERING ASSOCIATION: Proceedings of Annual Convention Held at Chicago, Ill., Mar. 16-18, 1915; also individual papers as issued in bulletins.—Chicago (900 So. Michigan Ave.): E. H. Fritch, Secretary. Cloth; 6x9 in.; pp. 1558.

ANNUAL REPORTS OF WAR DEPARTMENT, 1914 (in three volumes): Vol. II, Report of the Chief of Engineers, U. S. Army (Without Appendices). Washington, D. C. Paper; 6x9 in.; pp. 1565.

BOARD OF HARBOR AND LAND COMMISSIONERS OF MASSACHUSETTS: Annual Report for 1914. Boston (State House); Frederick N. Wales, Clerk of Board. Cloth; 6x9 in.; 124; illustrated.

BOARD OF SUPERVISING ENGINEERS OF CHICAGO TRACTION: Annual Report covering fiscal year ended Jan. 31, 1913. Cloth; 6x9 in.; pp. 534; illustrated.

This belated report is useful mainly as a record, as many important events in Chicago's traction development have occurred in the past two and a half years.

CHICAGO RAILWAY TERMINAL COMMISSION: Preliminary Report Submitted to the City Council Committee on Railway Terminals. Paper; 6x9 in.; pp. 144; illustrated.

CONSERVATION OF WATER BY STORAGE—By George Fillmore Swain, Gordon McKay, Professor of Civil Engineering in Harvard University; Past President, American Society of Civil Engineers. [Addresses delivered in the Chester S. Lyman Lecture Series, 1914, before the Senior Class of the Sheffield Scientific School, Yale University.] New Haven, Conn.: Yale University Press. London, England: Humphrey Milford. Cloth; 7x10 in.; pp. xvii + 384; 91 illustrations. $3, net.

THE DESIGN OF DRILL JIGS: A Practical Manual—By Andrew N. Haddow. [The "Mechanical World" Series.] Manchester and London: Emmott & Co., Ltd. Cloth; 6x9 in.; pp. xi + 96; 142 text illustrations. 2s. 6d., net.

THE DRAINAGE OF JEFFERSON COUNTY, TEXAS—By H. A. Kipp, A. G. Hall and S. W. Frescoln, Drainage Engineers. Bulletin No. 193. Washington, D. C.: U. S. Department of Agriculture. Paper; 6x9 in.; pp. 40; illustrated.

THE ESSENTIALS OF DESCRIPTIVE GEOMETRY—By F. G. Higbee, M. E., Professor and Head of Department of Descriptive Geometry and Drawing, State University of Iowa. New York and London: John Wiley & Sons. Cloth; 6x9 in.; pp. vi + 204. $1.80, net.

THE FUNDAMENTAL ELEMENTS ENTERING INTO THE MAKEUP OF THE MODERN CITY AND A PLEA FOR A SMALLER CITY—By S. M. Swaab, care Keystone State Construction Co., Pennsylvania Building, Philadelphia, Penn. [Reprinted from Proceedings of the Engineers' Club of Philadelphia.] Paper; 6x9 in.; pp. 53; illustrated.

GRINDING MACHINERY—By James J. Guest. New York: Longmans, Green & Co. London: Edward Arnold. Cloth; 6x9 in.; pp. xi + 444; 200 illustrations. $4.20, net.

A HISTORY OF TRAVEL IN AMERICA: Showing the Development of Travel and Transportation from the Crude Methods of the Canoe and the Dog-Sled to the Highly Organized Railway Systems of the Present, Together with a Narrative of the Human Experiences and Changing Social Conditions That Accompanied This Economic Conquest of the Continent—By Seymour Dunbar. (In four volumes.) Indianapolis, Ind.: The Bobbs-Merrill Co. Cloth; 6x9 in.; pp. 1529; 400 illustrations and numerous colored plates. $10, net.

"HÜTTE": DES INGENIEURS TASCHENBUCH—Herausgegeben vom Akademischen Verein Hütte, E. V. 22nd edition. (In Three Volumes.) Berlin: Wilhelm Ernst & Sohn. 5x8 in.; pp. 1084, 1077 and 1109; 4700 illustrations. Linen, 18 Marks; leather, 21 Marks.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS: Proceedings of Meeting Held at Springfield, Ill., Jan. 27-29, 1915. Chicago (Monadnock Block): E. E. R. Tratman, Secretary. Paper; 6x9 in.; pp. 148; 18 illustrations. 50c.

INDUSTRIAL ACCIDENT STATISTICS: Bulletin No. 157—Washington, D. C.: Bureau of Labor Statistics. Paper; 6x9 in.; pp. 210.

LIMESTONE ROAD MATERIALS OF WISCONSIN—By W. O. Hotchkiss and Edward Steidtmann. Bulletin No. 34. Madison, Wis.: Wisconsin Geological and Natural History. Survey. Cloth; 7x10 in.; pp. 136; illustrated.

LOCATION OF FORD ENGINE TROUBLES MADE EASY—A Chart Arranged by Victor W. Page, author of "The Ford Model T Car." New York: The Norman W. Henley Publishing Co. Paper; 25x28 in. 25c.

MANUAL OF SURVEYING FOR FIELD AND OFFICE—By Raymond E. Davis, C. E., Instructor in Civil Engineering, University of Illinois. New York and London: McGraw-Hill Book Co., Inc. Leather; 4x7 in.; pp. xv + 395; 54 text illustrations. $2.50, net.

MUNICIPAL REVENUES, EXPENDITURES AND PUBLIC PROPERTIES, 1913—Washington, D. C.: Bureau of the Census. Paper; 9x12 in.; pp. 378.

RAILROAD COMMISSIONERS OF THE STATE OF MAINE: Annual Report for 1914, with Statistical Tables Compiled from the Annual Returns of the Railroad Companies Operating Railroads in the State for the Year Ending June 30, 1914, including Petitions, Decisions and Rules of the Board—Augusta, Me.: Geo. F. Giddings, Clerk of Board. Cloth; 6x9 in.; pp. 502.

REPORT OF THE BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913—By R. G. Swan, Assoc. M. Can. Soc. C. E. Water Resources Paper No. 8. Ottawa, Ont.: Water Power Branch, Department of the Interior of Canada. Paper; 7x10 in.; pp. 367; illustrated.

REPORT OF THE EFFICIENCY AND ECONOMY COMMITTEE Created Under the Authority of the 48th General Assembly of the State of Illinois, with Accompanying Reports on Revenue and Finance Administration by John A. Fairlie; The Accounts of the State of Illinois by George E. Frazer; Accounting Administration for Correctional Institutions by Spurgeon Bell; Charitable and Correctional Institutions by James W. Garner; Educational Administration by John M. Mathews; Labor and Mining Agencies by W. F. Dodd; Agricultural Agencies by James W. Garner; Public Health Administration by John M. Mathews; Supervision of Corporations by Maurice H. Robinson; Public Works, Parks and Buildings by C. O. Gardner; Military Administration by Quincy Wright; Civil Service Laws by A. C. Hanford; Secretary of State and Law Officers; Efficiency and Economy Commissions in Other States by A. C. Hanford; Fire Insurance Rates by Maurice H. Robinson; Comparative State of Appropriations by Thomas P. Waters. Cloth; 6x9 in.; pp. 1051.

SANITATION IN PANAMA—By William Crawford Gorgas, Chief Sanitary Officer, Panama Canal; Surgeon General, U. S. A.; Major General, U. S. A. New York and London: D. Appleton & Co. Cloth; 5x8 in.; pp. 298; illustrated. $2, net.

SEVENTH ANNUAL REPORT OF THE PUBLIC SERVICE COMMISSION OF THE SECOND DISTRICT of the State of New York: Vol. III, Abstracts of Reports of Corporations; Electrical, Gas, Telegraph, Telephone, Steam—Albany, N. Y. Cloth; 9x12 in.; pp. 348.

SHRAPNEL AND OTHER WAR MATERIAL: A Reprint of Important Articles Presented in the "American Machinist" From January to June, 1915. New York and London: McGraw-Hill Book Co., Inc. Cloth; 9x12 in.; pp. 92; illustrated. $1.50, net.

STANDARD CLASSIFICATION OF ACCOUNTS FOR THE USE OF THE CITY AND COUNTY OF DENVER, COLORADO, With Explanatory Statements and Ready Reference Index—By Thomas R. Lill, for the Colorado Taxpayers Protective League. East Orange, N. J.: The Author. Paper; 6x9 in.; pp. 55.

STATISTICS OF RAILWAYS IN THE UNITED STATES for the Year Ended June 30, 1913: 26th Annual Report—Washington, D. C.: Interstate Commerce Commission. Cloth; 9x12 in.; pp. 751.

A STUDY OF BOILER LOSSES—By A. P. Kratz, Assistant in Mechanical Engineering. Bulletin No. 78. Urbana, Ill.: Engineering Experiment Station, University of Illinois. Paper; 6x9 in.; pp. 72; illustrated. 35c.

A TESTING SERVICE: Description of the Equipment, Organization and Work of the Electrical Testing Laboratories, Inc., 80th St. and East End Ave., New York City. Paper; 9x6 in.; illustrated.

A loose-leaf pamphlet describing the great varieties of work carried on by one of the best known commercial laboratories in the country. Facilities are described as provided for standardizing instruments, for testing quality of magnetic, insulating and conducting materials, for shop, laboratory and field tests of machinery, for checking performance of supplies of incandescent lamps, for studying the characteristics of illuminants and illumination, and for a great variety of mechanical and chemical work.

THIRD REPORT OF THE QUEBEC STREAMS COMMISSION, November, 1914—Quebec, P. Q.: O. Lefebvre, Secretary. Paper; 7x10 in.; pp. 101; illustrated, and accompanied by 37 folding plates.

WATER-SUPPLY PAPERS, UNITED STATES GEOLOGICAL SURVEY—Washington, D. C. Paper; 6x9 in.; illustrated.

No. 342: Surface Water Supply of the Yukon-Tanana Region, Alaska—By C. E. Ellsworth and R. W. Davenport. Pp. 343.

No. 357: Surface Water Supply of the United States, 1913; Part VII, Lower Mississippi River Basin—By N. C. Grover, Chief Hydraulic Engineer; Robert Follansbee and Glenn A. Gray, District Engineers. Pp. 86.

No. 358: Water Resources of the Rio Grande Basin, 1888-1913—By Robert Follansbee and H. J. Dean, including Surface Water Supply of the United States, 1913; Part VIII, Western Gulf of Mexico Basins, by Robert Follansbee, W. W. Follett and Glenn A. Gray. Pp. 725.

Field and Office

A Temporary Support for an Elevated-Railway Bent*

By Harry L. Dlyn†

The necessity of moving a 20-in. water main which crossed the site of a column pier on the White Plains elevated extension to the old subway line of New York

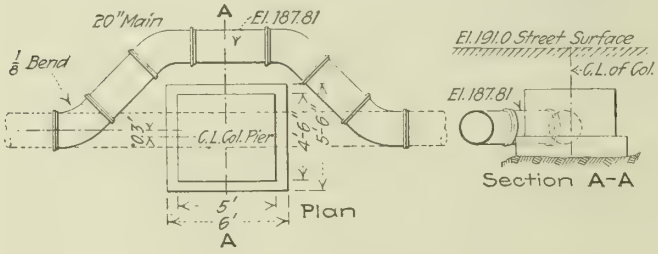


FIG. 1. OLD LOCATION OF WATER MAIN WITH RESPECT TO PROPOSED COLUMN FOOTING

City afforded the use of a simple and interesting device to avoid delay in erecting the steelwork. The particular pier was known as No. 179E. Fig. 1 shows the general location of the water main and the necessary changes in its location to facilitate the construction of the concrete pier.

Technical delays held up the moving of the water main, so that the pier could not be built as scheduled. When the steel erection had advanced to bent 179E, something had to be done. The following method was adopted:

Cribwork of 12x12s was laid over the site of the proposed pier to an elevation of 189.18 ft., this being 0.3 ft. higher than the elevation of the finished pier on the west side. Upon this crib the new column was set and held in position by guys fastened to adjacent trees. An A-frame was placed between the tracks of the Union St. Ry., as shown in the view. As soon as the frame was in place the cross-girder was set up over it and securely bolted to the kneebraces and columns. The stringers, cross-frames and diagonal struts were then erected. An additional wood strut was placed diagonally under the east end of the cross-girder, its base being about 10 ft. from the base of the column, as shown in the view.

After the construction of the steel had advanced over the next bent, two upright supports, each consisting of 12x12-in. timbers bolted together, were placed under the easterly longitudinal girders about 10 ft. on either side of column 179E. The aforementioned cribwork was then removed from under the column, which was then suspended with its base 0.3 ft. higher than the pier. The column showed a settlement of 0.04 ft. the following day and an additional settlement of 0.08 ft. after a lapse of three days, leaving then a clearance of 0.18 ft. between the baseplate and the elevation of the top of the concrete pier. A tilt in the structure of 1½ in. toward the west was discovered, and this was due, undoubtedly, to the greater elevation of the base-plate of the east column. As the top of column 179E had deflected 1½ in. to the west, it was necessary to throw the bottom of that column out of plumb 1½ in. to the east.

When the concrete pier had been built, after the removal of the water main, the anchor bolts were set in place and fastened by wires to the easterly edges of the anchor-



FIG. 2. TEMPORARY SET-UP AT BENT 179E PRIOR TO COMPLETION OF EAST COLUMN FOOTING

*For comprehensive information concerning the "Design of the Steel Elevated Railways, New York Rapid-Transit System," see "Engineering News," May 20, 1915, pp. 971-977.

†794 Elsmere Place, Bronx, New York City.

bolt holes of the column base, in order to give maximum play when the column was dropped in place.

The wooden supports were removed seven days after the pier was built, the two uprights being knocked out easily by means of a heavy sledge hammer. With some greater difficulty the inside support also was removed. It was at first intended to have the wedges on the top of the A-frame removed first; but this was found impossible on account of the rivets of the bottom flange of the cross-girder forming grooves in the wood and holding the wedges tightly to the frame. The difficulty was obviated by removing all the bolts connecting the members of the A-frame. An 8-in. length was then cut off the bottom of the center upright of the frame, after which the end posts were easily removed by sledge hammers. Column 179E was then in its place and at its true elevation.

Upon plumbing the column a tilt was still found in the structure, toward the west, amounting to 0.06 ft. This was rectified by placing a 70-ton jack against a 12x12-in. inclined timber resting against the west column. A small load threw the structure into the correct position. The jack was left against the strut until all the riveting had been finished on that bent.

The work was done by the Lucius Engineering Co., subcontractor for the Oscar Daniels Co., under the supervision of the Engineering Department of the Public Service Commission of the First District, New York, for which George Paaswell is engineer in charge of construction. The writer was in close contact with the supervision of this work.

Erecting a Lever Lift Bridge

A Strauss lever lift bridge spanning the Louisville & Portland Canal at 18th St., Louisville, Ky., was completed June 23, 1915. It has a clear span of 210 ft., with approach spans of 85 ft. and 75 ft.; the lift is 40 ft., giving a clearance when raised of 90 ft. above normal stage. It is the second bridge of this type in the United States, the first being much smaller. The full lift requires 1½ min.

The new bridge replaces a swingbridge of 187-ft. span, the change being made necessary by the widening of the canal. The south half of the new bridge comes over the north arm of the swing-span. As the latter had to be left free so as not to interfere with navigation, it was necessary to build the new bridge about 17 ft. above the old one and to erect the south half by cantilevering.

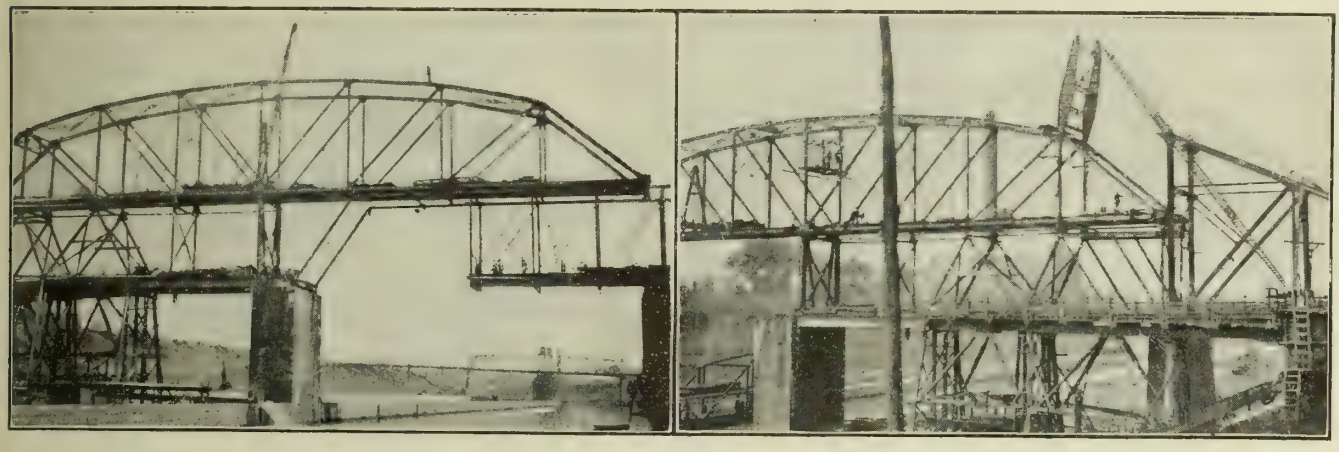
A new abutment, of concrete, 24x10 ft. by 52 ft. high, was built on the new north bank of the canal. A temporary trestle was built across the new portion of the canal as an approach to the swing-span. The new north approach span was then erected, its alignment being to one side of the old bridge. In starting erection on the main span, falsework was built up from the temporary approach trestle. When the old north abutment was reached (about midlength of the new span) a bent composed of six 12x12 timbers was built as an outboard support, and from this point the span was cantilevered.

Steel in the approach and part of the main span was placed with a stiff-leg derrick with an 85-ft. boom. A mule traveler with a 50-ft. boom then took up the work, being operated by the same engine.

One big day's run was made, when nearly all the steel in the cantilevered portion was placed and bolted, and on the same day from this part of the new bridge the members of one side of the swingbridge were removed, the rivets having been burned off previously. As fast as they were removed the traveler carried the members to the other side of the swingbridge and placed them on wagons.

When the south bank was reached another bent was built over the old pivot-pier and the south end of the new span supported on it. The remainder of the old bridge was then removed.

The lift-span is carried at each end by levers of truss construction, resting at its middle on trunnion bearings. Counterweight hangers, 25 ft. long, on the outer ends of the levers carry counterweights each consisting of two reinforced-concrete blocks totaling 60 tons in weight. (The span weighs 120 tons.) The tender's house, suspended between the top chords in the middle of the bridge, is of stucco on expanded metal. The lift is operated by two 5-hp. motors located on the outside of the bottom chord. The motors are provided with an automatic stop to halt the bridge when it is within 6 ft. of the full opening, while a spring switch is furnished which must be held closed to allow a greater lift. Hand-operated turning levers for use in emergency are located at each end of the main span. A feature of the operating devices is that five signal lights show the height of the bridge to the tender. Electrically controlled safety gates are placed at each end of the bridge, interlocked so that



ERECTING A LEVER LIFT BRIDGE AT LOUISVILLE

Left—South half cantilevered and north arm of swingbridge being dismantled. Right—Erection of north lifting link; bridge 17 ft. above final level

the operator cannot throw in the switch to lift the bridge until he has closed the gates.

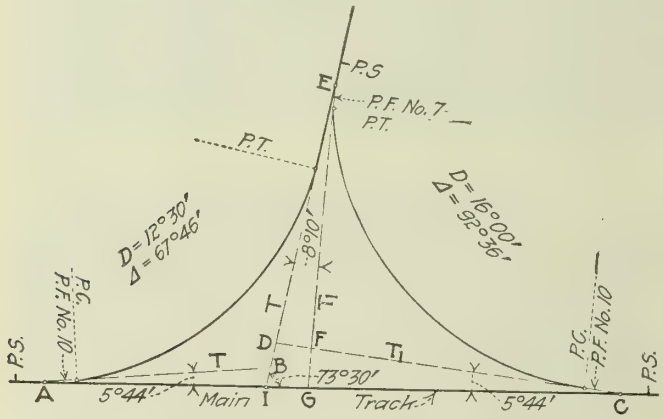
The bridge was erected in 60 working days, the erection being marked by the fact that there was not an accident of any kind. The contractor was the Middle States Construction Co., of Columbus, Ohio. L. E. Breithaupt was in charge of the construction. L. E. Louckes was engineer for the Government. The cost of the superstructure was $50,000.

Location of Frogs for an Unsymmetrical Y-Track

By G. W. White*

The writer recently had the following problem to solve: A spur-track tangent intersected the main-line tangent at I at an angle of 73° 30′. It was desired to put in a Y-connection, using a No. 10 frog and a 12° 30′ curve for one leg and No. 10 and No. 7 frogs with a 16° curve for the other leg of the Y. Frog tangents 10 ft. long were to be used.

To find the location of the frogs, draw the lines AB, CD, EG, these being the tangents through the frogs, produced, parallel with the turnout wings of the frogs



LOCATING FROGS IN AN UNSYMMETRICAL Y-TRACK CONNECTION

and on the center of the spur tracks. The distance from the theoretical frog points to the points A, C, and E, where these lines intersect the main-track center lines, is ng, n being the frog number and g the gage of track. This is true of all frogs located on tangent. For standard gage this is 47.08 ft. for a No. 10 frog and 32.96 ft. for a No. 7 frog. Calculate the tangent distances T and T_1 for the two curves. These are 308.43 ft. for the 12° 30′ curve and 375.95 ft. for the 16° curve.

Then

$$AB = 47.08 + 10.00 + 308.43 = 365.51$$

$$AI = \frac{\sin 67° 46'}{\sin 73° 30'} \times 365.51 = 352.87$$

$$IB = \frac{\sin 5° 44'}{\sin 73° 30'} \times 365.51 = 38.18$$

It is not necessary to have the distance IB, but it gives a good field check on the calculations.

To run in the connection, locate the P.T., B, and A, and mark actual point of frog 47.08 + 0.42 = 47.50 ft. from A toward I. Also mark point of switch at standard lead distance back of frog point. From A turn the frog angle (5° 44′) and set the P.C. of the curve 57.08 ft. toward B, which may serve as a foresight in running in the curve.

For the other leg of the Y

$$CF = 47.08 + 10.00 + 375.95 = 433.03$$

$$FG = \frac{\sin 5° 44'}{\sin 81° 40'} \times 433.03 = 43.72$$

Then

$$EG = 32.96 + 10.00 + 375.95 + 43.72 = 462.63$$

$$EI = \frac{\sin 98° 20'}{\sin 73° 30'} \times 462.63 = 477.40$$

$$IG = \frac{\sin 8° 10'}{\sin 73° 30'} \times 462.63 = 68.50$$

$$CG = \frac{\sin 92° 36'}{\sin 81° 40'} \times 433.03 = 437.20$$

Then

$$CI = 437.20 + 68.50 = 505.70$$

The frog points and curve points may then be located, and the connection run in as for the other leg of the Y.

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More About Traverse Tables and Survey Computations

By E. E. Thum*

I have found that Guerdon's traverse tables are extensively used by engineers in the Rocky Mountain region. Such tables reduce the work of computing latitudes and departures to a minimum where the courses are expressed in whole minutes. In passing, it might be mentioned that the engineer uses latitudes and departures perhaps less to compute areas than to calculate coördinates for mapping, or to determine a closing course to arrive at a certain point.

In close work the transitman will double each angle, the angle used being taken as half his final reading. Should this be an odd minute, the courses will naturally read to half minutes; therefore, in such work or in adjusted traverses it is quite common to deal with half or quarter minutes, in which case the traverse table is of small use.

The experienced office man finds that he can use a five-place table of natural functions reading to minutes, such as is found in any fieldbook, interpolating halves and quarters mentally (as the maximum tabular difference will be 0.00030), and by "contracted multiplication" get his latitudes and departures as easily and rapidly as in any other way. An example will show the method:

S 44° 10½′ E 623.85 ft.

By mental interpolation the following natural functions are written directly from the table:

$cos = 0.71721$ $sin = 0.69685$

By ordinary multiplication we would have (partial products are shown at the side):

cos = .71721	
dist. = 623.85	
35.8605	= 5 × 7.1721
573.768	= 8 × 71.721
2151.63	= 3 × 717.21
14344.2	= 2 × 7172.1
430326.	= 6 × 71721.
447431.4585	

*Assistant Professor of Metallurgy, University of Cincinnati, formerly Engineer in Charge of Construction, Anaconda Copper Mining Co., Great Falls, Mont.

The figures to the right of the periods are useless in the final result and "contracted multiplication" eliminates them, thus:

cos	= .71721
dist.	= 623.85
	35 = 5 × 7
	576 = 8 × 72
	2151 = 3 × 717
	14344 = 2 × 7172
	430326 = .6 × 71721
	447432
lat.	= 447.43

The corresponding departure in a similar manner is 434.73.

For courses below 25° or above 65° it will be handier to use the versine instead of the cosine of the angle; a table of versines need not be consulted, however, as they can be written directly from the table of cosines. Remember that the versine is equal to one minus the cosine, and subtract each digit of the latter from nine except the last, which subtract from ten. For instance the line:

S 24° 19¼′ W 397.25 ft.

cos	= .91124	dist.	= 397.25
dist.	= 397.25	sin	= .41185
vers	= .08876		
	24		20
	280		320
	3176		397
	31776		3972
			158900
correction	= 35256		163609
dist.	= 397.25	dep.	= 163.61
correction	= 35.26		
lat.	= 361.99		

Notice that it is usually preferable to use the function for the multiplier.

For courses below 8° or above 82° the correction can be figured on a slide-rule:

N 8° E 512.45 ft.

cos	= .99027	dist.	= 512.45
vers	= .00973	sin	.13917
dist.	= 512.45		35
correction	= 4.99		51
			4608
lat	= 507.46		15372
			51245
			71311
		dep.	= 71.31

Casting Concrete-Slab Bridges for the Pennsylvania R.R.

By LeRoy M. Schrufer*

An interesting as well as economical method of casting and handling reinforced-concrete slabs for use in the construction of flat-slab concrete bridges of spans up to 30 ft. in the clear is being used by the Pennsylvania R.R. Co., with a centrally located assemblng plant at Pomeroy, Penn.

The site chosen for the concreting plant is located along an old spur of track, with direct connections to the main line and other important branches, and extends for several hundred yards between high hills covered with shade trees and foliage which protect the workmen to some extent from the hot rays of the sun and direct winds. It is so located as to be of easy access for the delivery of materials that go to make up the finished slab, such as the heavy steel reinforcing frames, cement, sand, crushed stone, lumber, machinery, etc. Furthermore, the site is established at such a centrally located vantage point on the division that the finished concrete slabs weighing up to approximately 75 tons can be readily transported over a comparatively short distance in opposite directions to reach the different points on the division and unloaded direct at the bridge site, and in most cases direct from the car to the bridge seat, and then slid into proper position without delay to traffic.

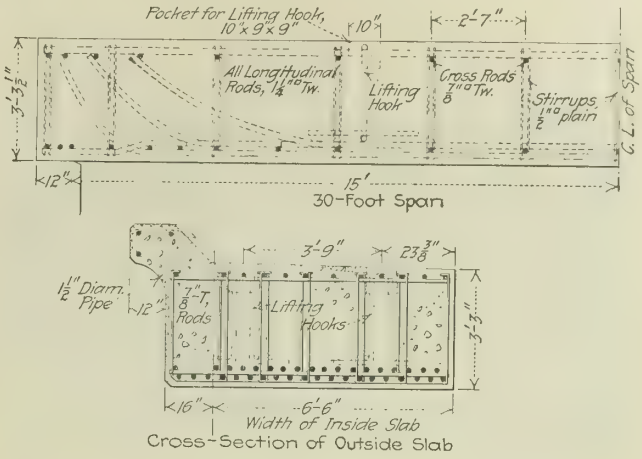


FIG. 1. DETAILS OF FLAT-SLAB BRIDGE

Method of Constructing Slab Forms

The old method of constructing a form composed of wooden bottom and sides for each slab was thought to be too expensive and a concrete platform or pavement, 210 ft. long by 20 ft. wide, to accommodate a large number of slabs at one time, was built. An extra-heavy floor or pavement was desired in order to provide for the heavy loads of a number of slabs at one time; it was therefore laid with 18 in. of cinder, which was flooded, rolled and thoroughly tamped, and a layer of 12 in. of concrete of a lean mix of 1 part cement, 3 parts sand and 6 parts broken stone was placed, with a top coat 1 in. ihick of 1 part cement and 2 parts sand troweled to a hard steely surface and finished level. A curbing of concrete 6 in. above the pavement extended along both sides and at the ends, forming a sort of large pan and acting as a brace for the struts supporting the sides surrounding the slab forms. A wide expansion joint was made down the center of the length of the slab, with cross-joints every 15 ft. The longitudinal central joint was laid of sufficient dimensions to be used for a gutter to carry off the excess water.



FIG. 2. GENERAL VIEW OF CASTING YARD FOR FLAT-SLAB BRIDGES, PENNSYLVANIA R.R.

*Engineering Department, Pennsylvania R.R., Philadelphia, Penn.

The work of laying the pavement was started in the early part of this year, and the entire surface was exposed to the elements and allowed to season for several weeks before the work of pouring the concrete slabs was started.

The prime object for the construction of this platform or pavement was to form a substantial and durable sur-

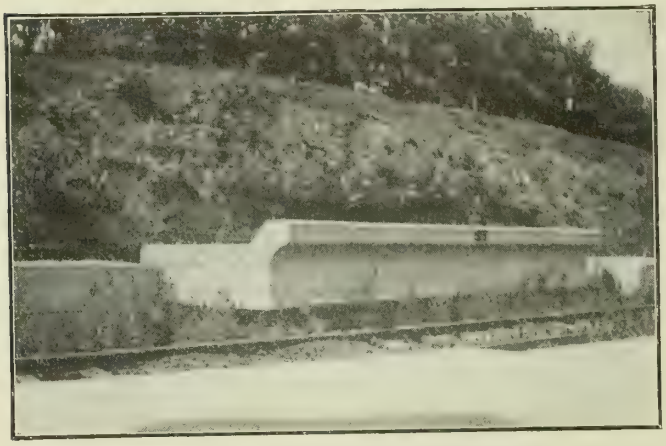


FIG. 3. ONE OF THE CAST UNITS

face upon which to pour the concrete mix direct, so that the same surface could be used over and over again for a large number of slabs, thus eliminating the extra cost of labor and new lumber in building and resetting new wooden base forms. Wooden forms were built in sections for the sides and ends of slabs, but the old method of a wooden floor form was entirely omitted and the concrete was poured directly on the cement pavement form.

Steel Reinforcement for Slabs

The steel reinforcement for slabs (using square twisted bars, one complete turn or twist in 12 diameters) after being fabricated and assembled at a fabricating mill, was unloaded from the cars and placed directly on the concrete pavement, using concrete wedge-shaped blocks to support the lower steel rods and to retain the slab frame at the proper distance from the surface of the pavement in order

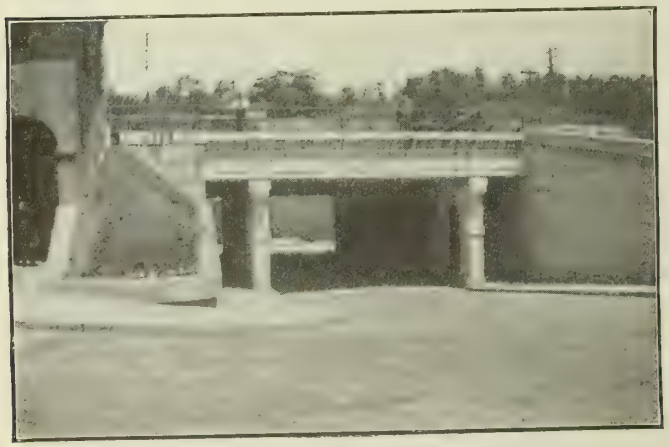


FIG. 4. VIEW OF A COMPLETED UNIT-SLAB BRIDGE

to have sufficient concrete between the lower reinforcement and the soffit of the finished slab (Fig. 1). After the whole slab frame had been lined into exact position and the surrounding wooden forms were placed, the concrete mix of 1 part cement, 2 parts sand and 4 parts ¾-in. stone was poured directly into the form and spaded and worked around the reinforcement.

Before pouring the first slabs on the cement pavement, and as a precaution to aid in preventing possible adhesion between the top surface of the pavement and the slab soffit, a liquid coating of lime paste was applied to the pavement with a whitewash brush. After the surface had received the first few batches of slabs and had been worked over, the above-mentioned precaution was omitted and the concrete poured directly on the pavement, with excellent results.

The steel reinforcement for the slabs was fabricated and assembled by outside contractors at their own plants and shipped direct and unloaded at the site of the assembling plant as previously described. After the concrete is poured to form the slabs and is allowed to set and sufficiently to season (Fig. 3), the slabs are then lifted from the assembling pavement by powerful wrecking cranes, with the lifting chains attached to heavy lifting hooks embedded and concreted in the slab. There are four such hooks to each large slab (two hooks at each end), so designed and placed that each hook takes its calculated proportion of the load or weight of the finished slab. The slabs are then loaded on flat cars and transported to the various bridge sites and finally placed into position with little trouble and practically no delay to traffic. Two such slabs placed lengthwise on the bridge seats generally carry one track and are designed to carry the heaviest types as well as the fastest trains under maximum traffic conditions (Fig. 4).

About 150 bridge slabs have already been cast upon the platform, with most satisfactory results.

Locomotive Cranes at Stone-Crushing Plants—The Knickerbocker Portland Cement Co., Hudson, N. Y., employs a 2-yd., 65-ft. radius electric crane running on a circular track to increase the storage capacity for crushed stone. The plan of



CIRCULAR STORAGE SYSTEM FOR CRUSHED STONE

the company is to work as near full capacity as possible during the summer months so that the quarries may be closed in winter. The present storage capacity is from 50,000 to 100,000 tons. The stone is delivered from the crusher at the quarry to an underground conveyor, which feeds into an elevator located in the middle of the storage area. The elevator discharges the stone at a convenient point, so that it may be rehandled by the 2-yd. grab bucket to the storage area. The idea of using a locomotive crane to increase storage capacity is by no means new. It has been employed for years in storing coal, but its entry into the crushed-stone field is interesting. Patent rights for the circular storage system held by the Link-Belt Co., Chicago, Ill., are claimed to cover the use of a locomotive crane on circular tracks for storing crushed stone.

Building a Sewer Tunnel of Special Concrete Blocks Reinforced*

The city of Edmonton, Alberta, Canada, has recently completed about 11 mi. of trunk sewers in tunnel varying in size from 4 to 10½ ft. in diameter. These were

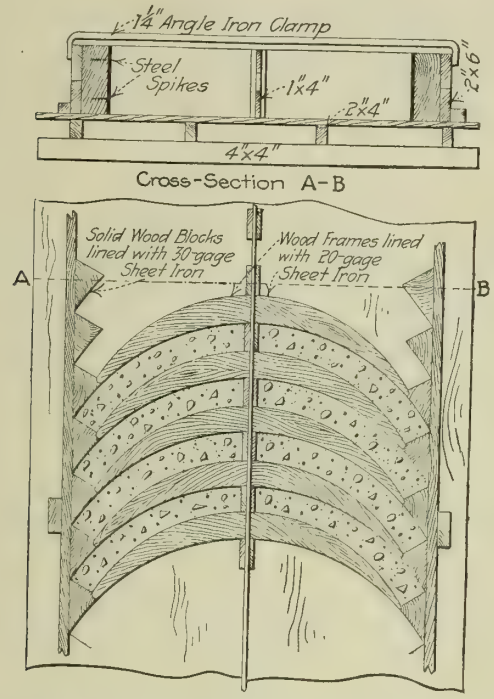


FIG. 1. FORMS FOR CONCRETE BLOCKS OF 5-FT. SEWER TUNNEL, EDMONTON, ALBERTA, CANADA

all built of special 12x4-in. concrete blocks in the form of rings 1 ft. wide, reinforced by steel bars in longitudinal grooves between the blocks and by circular bands or ribs on the outside of the blocks, which are backed by 4 in. or more of plain 1:3:6 concrete. The accompanying table shows the details of the various sizes of sewers.

The tunnels were driven chiefly through a stiff gray clay with occasional pockets of sand. Excavation was carried on from shafts sunk at intervals varying from 200 to 1150 ft. Small charges of dynamite (½ to 1 stick) were used to loosen the clay, and mattocks were used instead of picks. The work was done by electric light. Sand pockets were generally short and caused no special difficulties except in one instance, where the tunnel alignment was changed to avoid a particularly bad place, but before any great expense was incurred.

The block forms were in the shape of gang molds, as shown in Fig. 1. The forms were lined with sheet metal. The blocks were cast on their sides. The concrete (1:2:3) was mixed wet and well spaded into the forms and allowed to set for 24 hr. A considerable number of blocks were rejected because of damage in handling before the blocks had sufficiently seasoned. The arch blocks required special forms which left grooves on both faces of the blocks for placing the reinforcing crown rods shown in Fig. 2.

Blocks and Block Laying

After a length of excavation was completed the subdrain was laid (see Fig. 2) and concrete was placed along the bottom to the grade of the bottoms of the blocks. The lower half of the hooping or reinforcing bands for a ring of blocks was then placed and the invert blocks laid. The remaining blocks to the springing line were added and the backing concrete placed until the lower half of the ring was complete. These blocks were staggered as shown in Fig. 3.

To place the upper half of the ring of blocks, a wooden form or centering extending a short distance back into the finished sewer was used. The reinforcing crown rod, previously bent to the proper radius, was placed in position against the face of the previous ring and the block laying completed around the arch. The crown blocks, of course, could not be staggered. Care was taken to fill the joints between the blocks thoroughly, so that the reinforcing bar and jointing irons (see Fig. 3) would be surrounded by and bedded in the mortar.

When the last block had been placed in the crown of the arch, the upper half of the hooping band was put on, the halves being connected by (patented) coupling shoes (Fig. 4) and tightened by wrenches. The backing concrete was then placed and the laying of the next ring of blocks proceeded.

The junction of the block rings between two shafts was accomplished by measuring the gap as it grew narrow and so adjusting the widths of the joints between the rings of blocks as to make the last ring just fit. If

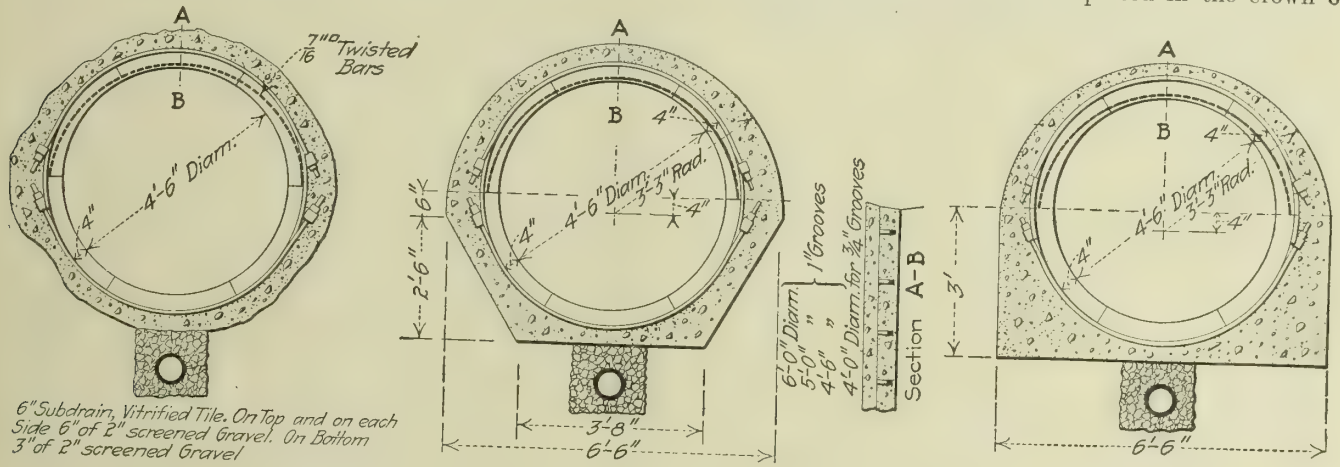


FIG. 2. CROSS-SECTION OF 4½-FT. SEWER TUNNELS MADE OF SPECIAL CONCRETE BLOCKS

*From a paper by A. J. Latornell, City Engineer of Edmonton, Alberta, Canada, read before the Canadian Society of Civil Engineers, Apr. 8, 1915, supplemented by additional information from the author.

this resulted in too great width of joints, the blocks were cut to fit, but generally this was not necessary. The gap in the upper part of the ring was closed with mass concrete, forms being used to hold the concrete in place. The

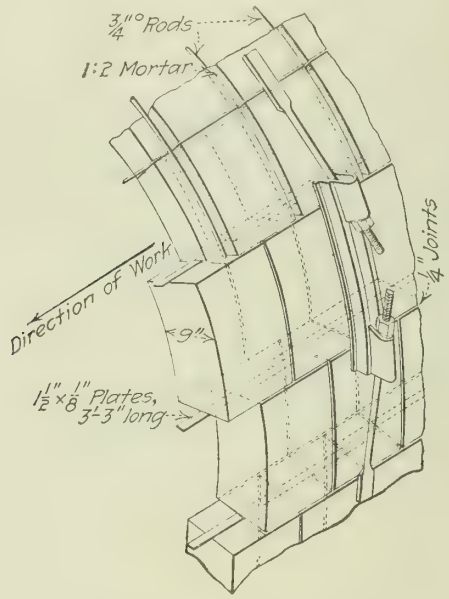


FIG. 3. ISOMETRIC VIEW OF CROSS-SECTION OF 10½-FT. SEWER TUNNEL

last small portion of the crown was lifted or shoved into place. After the concrete had set and the work smoothed off, the junction between the two sections was barely noticeable.

The work was carried on in two 10-hr. shifts, the same men doing both the excavating and the block-laying.

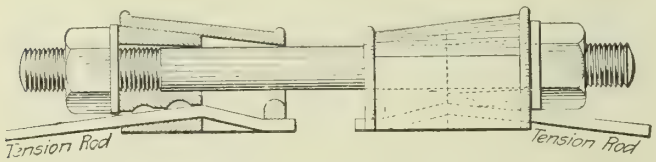


FIG. 4. LUGS PATENTED FOR FASTENING TENSION BANDS

In the 4½- and 5-ft. sewers two men worked in the heading, one man as car pusher and two or three men at the top of the shaft, exclusive of the hoistman and foreman. On 6-, 6½- and 8-ft. sewers three men worked in the heading and two men were car pushers. The progress per week was 30 to 36 ft. of completed sewers in each heading.

The contract prices varied fairly regularly, from $24.25 per lin.ft. for a 4-ft. sewer to $55.15 for 9½-ft. sewers. The cost for the 10½-ft. outflow sewers was less ($50.36), because much of it was in open cut. The cost per linear foot of building the 9½-ft. sewer was distributed as follows: Excavation, timbering and spoil disposal, $17.35; making and laying concrete blocks and for joints, $16.40; concrete backing, $8.40; reinforcement and subdrains, $13—a total of $55.15, as noted. The cost of the 4½-ft. sewer was $6.90, $5.40, $3.60, $7.03 and $22.93 respectively.

The city engineer of Edmonton is A. C. Latornell, and the consulting engineer in charge of the design was Alexander Potter, New York City.

STATISTICS OF CONCRETE-BLOCK SEWERS, EDMONTON, ALTA.

Diam. Ft.	Diam. In.	Concrete: Thickness In. Blocks	Concrete: No. of Segment Blocks	Concrete: Cu.Yd. per Lin.Ft. Backing	Steel Dimensions: Crown Reinforcement	Steel Dimensions: Circumferential Bands		Steel Dimensions: Longitudinal Straps In.
4	0	4	6	0.17	0.19	⅜	To resist	6	1 x⅛
4	6	4	6	0.19	0.21	7/16	hydrostatic	6	1 x⅛
5	0	5	6	0.25	0.24	7/16	pressure	6	1 x⅛
6	0	5	10	0.31	0.28	½	at unit	10	1½x⅛
6	6	6	12	0.40	0.33	9/16	stress not	12	1½x⅛
8	0	7	18	0.56	0.37	5/8	exceeding	18	1½x⅛
9	6	9	24	0.90	0.54	11/16	elastic	24	1½x⅛
10	6	9	24	0.97	0.74	¾	limit.	24	1½x⅛

NOTES

Planning Formwork Ahead—Some years ago, when we simply sent the foreman a set of blueprints of the building and said, "Go ahead and build it," leaving him to work out his own form designs, column forms used to cost, for direct labor, as much as 18c. per sq.ft., and floor forms 12c. Now we spend much time in the office making plans, sometimes as many as 45 sheets of form details for a simple building. These designs may cost 0.2c. per sq.ft. of formwork. But now if the cost for labor for floor forms runs over 4c. per sq.ft. we want to know what is the matter; if it runs over 7c. for a column we usually make a row. We have come to the conclusion that a dollar spent intelligently in the drafting-room usually saves ten on the work, and sometimes more.—Leonard C. Wason, President Aberthaw Construction Co., Boston.

Dry Mortar Bed for Brick Pavements—Sand and cement (or dry mortar) cushions are used extensively for wood-block, asphalt-block and recently experimentally for granite-block pavements. Dalton Moomaw, Road Engineer of Cuyahoga County, Ohio, is now experimenting with a dry mortar bed for brick pavements. The sand and cement are mixed dry in the proportions 1:3 and spread to a depth that when struck and rolled a 1-in. cushion is formed. A hand roller weighing 250 lb. is used. The preparation of the sand-cement cushion proceeds ahead of the placing of the brick only so far as the pavement can be completed before stopping work for the day. The bricks are rolled only enough to obtain an even surface, and when the rolling and culling is completed the pavement is sprinkled from a spraying nozzle until sufficient water is applied to insure wetting the cushion to its entire depth. Grouting the joints follows the wetting of the cushion and is completed as far as the bricks are laid. If weather conditions do not permit grouting on the day the bricks are placed, the pavement is covered and protected against rain and wash.

Ballasted Street-Railway Tracks in Dallas, Tex., have been in service under a traffic of 1500 cars each day since December, 1912, and have shown absolutely no defects either in track or in the street paving (which is of creosoted wood block), according to B. R. Brown, Superintendent Maintenance-of-Way, Dallas Consolidated Electric Street Ry., in a paper presented at the 11th annual convention of the Southwestern Electric and Gas Association, held in Galveston, May 19-22. This statement is especially interesting in view of the experience in Baltimore related in "Engineering News," May 6, p. 884, and the short article entitled "Practice in Paving Street-Railway Tracks," on p. 888 of the same issue. In Baltimore the stone-and-gravel ballast did not prove to be satisfactory under very heavy traffic, cracks in the asphalt appearing adjacent to, and parallel with, the tracks. Mr. Brown states further that within the last year or so this type of construction has gained much favor in the larger Northern cities, but that in the South the solid-concrete base has been adhered to. However, he says, if the subsoil is mucky, soft earth, or quicksand formation, or if the district is poorly drained, a concrete base should be used.

Automatic Track-Inspection Cars are to be used on the Chicago Great Western Ry., which recently purchased four machines from Willis C. Squire & Co., of Chicago. They are of the type invented by T. Ellis, roadmaster of the Northern Pacific Ry., and described in "Engineering News," June 4, 1908. The apparatus is carried on a light three-wheel frame, which is hauled by a motor inspection car. Two pens trace diagrams on a continuous roll of paper. One of these diagrams indicates the surface condition, with superelevation on curves and vertical irregularities such as low joints, etc. The other diagram indicates variations in the gage of the track.

Editorials

More Steel in Bridges

Present low steel prices emphasize and reinforce a movement that has been going on steadily for some years past. Structural design in times gone by had as its ideal the production of structures of minimum quantity of steel. Excellence of general design, soundness of details and resistance to the various attacks of time were neglected elements in comparison with the matter of satisfying certain computed stresses by the fewest pounds of steel. We are in a period of reaction from this school of design. The movement is toward heavier, more substantial design.

Sound designing is not a mere problem of arithmetic, in engineering any more than in architecture. There are many factors vital to the finished structure which do not appear in the force polygon. To take them into proper account calls for a well-ripened judgment; their requirements will often conflict, and the solution must be a compromise.

Let an instance of this be taken in the old and yet obscure conflict between flexibility and rigidity of structure. In past times this was responsible for the existence of two different groups of designers—one aiming to cushion impact and damp out vibration by building resilient structures, the other holding to the view that the most rigid and solid support, a rocklike absence of all yielding quality, is the ideal structural condition. The opposition between these views still exists in part, but we have progressed a little, and know that both views are partly right. What we seek therefore to produce today is an aggregate that contains both rigid and yielding elements, providing flexibility where primary impact is received or where other secondary effects of unmanageable character occur—as expansion or distortion—and, on the other hand, providing a highly rigid construction in the main frame.

This instance well exemplifies how the noncalculable elements of design must be handled on the basis of experience which develops from thorough intimate study of structure, service and material. All the workings of this judgment from experience, however, lie beyond the field of mere sectional-area computations, and may lead to conclusions which seem to violate the requirements of close economy of metal.

Let the inquirer into this subject note the contrast between modern and old-time ideas of good design as expressed in pounds of metal, where a bridge, say, 25 years of age is renewed. He will see, frequently, that the weight of the new structure is four times that of the old one, though designed for not more than twice its load capacity. The excess represents partly insurance, partly a commutation of maintenance expense.

Useful data will be added to this phase of the subject when a railway man takes the trouble to cast up and publish the record of maintenance and repair expense on an old-time bridge which was finally condemned and renewed. Such a record will be certain to form a convincing argument in favor of "ample" design and against the practice of seeking the lightest possible solution of the stress-sheet.

Safeguarding South American Investments

The recent Pan-American Financial Congress at Washington has served to call public attention to the possibilities of a large development of business between the United States and its neighboring countries on the south. It has been repeatedly stated that if manufacturers in the United States are to sell to these countries the goods they formerly purchased from Europe, then capital must be found in the United States for the development of railways and mines and public works in these countries.

While the war continues and for a long period after its close, the European countries that have hitherto been the great reservoir of capital for the development of the other continents are likely to need all their available savings to provide for their own necessities. Those who seek capital for use in other countries on the American continents, therefore, are likely to come to the United States; and the promoters of trade with South America appear to think that it will be easy to dispose of such securities to American bankers and investors.

Before that result is realized, however, investors in the United States may well ask to be shown that the shares or bonds offered are really "securities." The stability of government and of finance in some of the South American countries seems well assured; but in some others revolution and repudiation are too recent affairs to encourage foreigners to risk their money there.

Any responsible American banker who is asked to sell such securities here may well ask, first, What is the attitude of the government in the country where these securities are issued; and second, and not less important, What attitude does the United States government hold toward such investments by Americans abroad?

There is plenty of money in the United States available for investment in any part of the American continents, provided there is reasonable assurance that the government of the country where the investment is made will give a square deal to the man who risks his money, and secondly, that the United States Government will give reasonable support to the legitimate claims of Americans who have loaned money abroad.

It has become the fashion to speak slurringly of "dollar diplomacy" for the reason that a great deal of the financing in connection with concessions and contracts in South and Central American countries has been carried on with more or less corruption. There is admittedly reason in the opposition to the use of the United States Government to collect the claims of American adventurers who may have, through bribery or other illegitimate means, obtained concessions or contracts, which are annulled when some revolution occurs. On the other hand,

where American money has been honestly invested in a foreign enterprise and the government of that country fails to maintain law and order so as to protect it from destruction; or where a government leaves its creditors in the lurch merely because it finds it inconvenient to pay what it has agreed to pay—under these conditions, the American citizen who has loaned his money would seem to deserve some support from his government.

It must be frankly stated that the recent experience of American investors in Mexico—to go no farther southward—has been eminently discouraging to the increase of American investments in Spanish-American countries.

Back of this condemnation of "dollar diplomacy" there appears to be the idea that it is on the whole a rather praiseworthy thing to let the foreign bondholder whistle for his money, and that in notifying the American capitalist who makes an investment abroad that he does it at his own risk, our government is working in the general interest of democracy and popular government, and is condemning the oligarchic plan on which admittedly too many of the Spanish-American governments have been run.

Will this idea stand analysis? Let us see. It is generally agreed that throughout South and Central America the greatest need is an influx of capital to develop the natural resources and give employment to the people who are idle and property-stricken in the midst of vast natural wealth.

If the position of the South American governments and our own government is such that those investing such capital can be assured of reasonable protection to their interests and reasonably fair treatment, they will be willing to loan the money at a much lower rate of interest than will be the case if it is understood beforehand that the risk of repudiation is very considerable. The present Administration appears to be sincerely desirous of increasing the trade relations between the United States and the other American countries, but there is no way in which it can so effectively increase these trade relations and stimulate the investment of American capital in these countries as by giving the assurance that American investors there will be assured of reasonable protection from their own government.

Coast Erosion and Protection

The protection of foreshores against the continual encroachments of ocean or lake is a branch of engineering which has never received its proper attention in the United States, in spite of the fact that this country has a longer water frontage than any other nation. In recent years, however, the increased use, mainly for summer-resort purposes, of the sandy stretches along both oceans and the Great Lakes has brought forward in a most emphatic manner the rapidity with which the littoral currents can wear down an occupied beach and expose expensive structures to the destructive force of the waves. In consequence, on both coasts a great number of engineers, in private practice and in public service, are engaged in the study of what to most of them is a new subject—the protection of these valuable shores against erosion.

It is in recognition of this new interest that *Engineering News* has been presenting to its readers a considerable number of articles on the causes of and protection against coast erosion. A notable addition to these articles is the contribution by R. Bennett on another page of this issue. This will be followed in early issues by a short series of articles by Gerald O. Case, the well-known British expert on this subject, who has devoted the larger part of the last six months to a study of the problem of shore protection on our Atlantic coast.

Recognition at Last

Engineering News has so often deplored the lack of public appreciation of the work of the engineer that it cannot in justice to the often-criticized public refrain from publishing the following brief abstract from the Houston, Tex., *Chronicle and Herald:*

> This city is entering upon a great epoch. For the moment its destiny is in the hands of engineers—more particularly its own engineer. And right here let it be remarked how important the engineer is becoming, and how little recognition his services have received. He is the man who does things, who carries the railroad into waste places, who tunnels the hills, who brings clean water to our doors, who protects public health with sewers and sanitation plants, who digs canals and deepens rivers, who creates and distributes electric power. He is the man with whose work we come in contact on every avenue of life, and upon whose skill and cunning rest in large measure the growth and prosperity of this country.
>
> If somebody writes a trashy book or paints a smutty picture, we rave, call it art, and vote to put a new statue in the Hall of Fame, but the engineer we still consider as rather commonplace, rather tiresome and prosaic.

The occasion of the editorial of which these paragraphs are an abstract is a recent report of the City Engineer, E. E. Sands, on the plans for developing the new ship canal and the harbor which all good citizens of Houston hope will make that city a seaport rivaling Galveston.

Market Quotation for Investment Capital

It has been agreed generally by economists and financiers that the war in Europe with its enormous demands on capital would cause a large increase in the ruling rate of interest. This hardly has been realized as yet in the financial markets of the United States, since the stringency and panic which prevailed during the first two or three months of the war disappeared. On June 29 the City of New York received bids for a bond issue of $71,000,000, bearing 4½% interest. The average price bid for the total issue was 101.272. These bids may be taken to represent the consensus of opinion of the principal bankers and financiers of the United States as to the market for capital in the immediate future. This rate of premium is equivalent to an interest yield of 4.44%. Of course, this represents a radical increase in the interest rate over the 3 to 3½% which prevailed on high-class bond issues in the 90's. On the other hand, it is only a trifling increase, if any, over the ruling rates for capital which have prevailed for two or three years past. It is indeed one of the surprises of the world-war that notwithstanding the enormous demands upon capital in Europe and the cutting off of the sources of capital in so many directions through stagnating business and men out of employment, there is still a vast supply of capital available for investment in the United States so that the New York bond issue was subscribed three times over.

It is to be hoped in the interest of a revival of engineering enterprise, which is so intimately dependent upon the

market for investment capital, that the rate fixed by the New York City bond sale fairly represents what may be expected to prevail for at least two or three years to come. It is a favorable feature for the United States that the public here evidently prefers investment in home securities to purchases of the bonds issued by the warring nations of Europe.

Irrigation Stock and Water Rights Not Related

In one of the most interesting of recent public-service commission decisions, the Kansas board has decided that there can be no relation between the stock of an irrigation-ditch company and the water rights of lands served. The case[1] was that of J. B. Hammon vs. Fort Aubrey Irrigation Co. and involved a number of complaints on complicated legal and administrative matters, out of which this one question stood preëminent.

The Kansas statutes provide that a purchaser of water may continue to purchase, and the board holds that this establishes a water right on the land benefited whether or not the owner holds any stock in the company supplying the water.

The principle involved has a parallel in the idea, generally held to by public-service commissions all over the country, that stock ownership in a public-utility company does not entitle any one to preferential service or rates. All customers stand on a par as customers; the benefits of stock ownership come solely in dividends and such rewards. This has been best expounded probably in the large number of telephone cases decided in the last two years by the Illinois and Wisconsin commissions.

[1]Reported in full in "Public Utility Reports," 1915 C.

Letters to the Editor

Engineering Students Should Practice Public Speaking

Sir—The writer has read with a great deal of interest several articles in your publication relative to the position of the engineer. As I see it, one of the greatest faults of the engineer is that he relies too much on his technical training, and confines himself to an entirely too small a field, taking little interest in the affairs of the day outside of his own chosen profession and not mixing with clubs and organizations as other business men do.

Surely there is no business or profession which is more certainly founded upon sound business principles than is engineering. "Engineering is the theory of economy" expressed in a few words. No engineering business can ever be truly successful until it takes on a sound business system. We have often heard that an engineer is "a man who can do for one dollar what any fool can do for two." How can this be true unless, in addition to technical engineering knowledge, a man employs business methods in his calculations and transactions?

Most engineers are inclined to lack confidence in themselves when it comes to mingling with men of affairs, or else their outward demeanor does not show that this is not the case. We cannot expect to always talk "shop," and in our intercourse with men it is exceedingly important to our success that we be able to converse on other subjects. It is the big, broad man who accomplishes things in this day and age, and we must enlarge our field and become conversant with the events of the day.

We have read a great deal of late in the engineering publications on the subject of public speaking by engineers. Right here is one of the greatest failings of the men in our profession. The engineer should train himself to speak in simple, well-selected, plain words, and be able to show his hearers the advantage to the community at large of engineering works. Surely there is no other profession which should be more interesting to the public than engineering, but the great trouble has been that we have not been trained to present our side of the case.

The engineer should be versed in legal procedure, labor conditions, social problems and all general questions of city, state and country. In order to be successful, he must be able to express himself in good, clear, sound English, and not simply sit back with the air that "I am an engineer and I can make no mistakes," or "you must take my word for it, for you would not understand even if I tried to explain, because you have no technical education."

I have found that the knowledge of legal procedure relative to public improvements which are constructed from funds derived from bond issues or special assessments is one of the most valuable assets.

The writer believes that technical schools could not make a better move as an improvement in their courses than to include one on public speaking. If every student of engineering were required every so often to deliver a lecture on his subjects he would soon lose his "stage fright," and this training would be of incalculable value in life later.

W. L. Benham.

Oklahoma City, Okla., June 5, 1915.

Suggested Military Training for Engineers

Sir—The action of the American Society of Civil Engineers of May 19 regarding a reserve corps of engineers and the editorial on the same subject in *Engineering News*, June 3, 1915, interest me deeply. While there is no doubt that the United States would have the help of most engineers in an emergency I must approve your idea of systematic training.

This training in many, or most, cases would be more to keep the men in practice than in the nature of original instruction, since a very large proportion of all engineers

have had from two to four years' military training in college. In my senior year at college the four cadet captains, the adjutant, the quartermaster and, I believe, a majority of the other cadet officers were engineers. If this can be taken as a criterion—and many state and other universities and colleges prescribe or permit military training—there must be a very large number of engineers in America who are or with very little instruction would become thoroughly capable not only of conducting engineering operations in time of war but of training men in military science as well. In all the talk about military unpreparedness in the last year I have heard no single reference to the quite considerable army of military college men being graduated each year whose service can always be counted on in time of need.

The subject is so broad and of such general interest that I should like to make a suggestion relative to military preparedness, and supplementary to your suggestion of a year's training for engineers. The suggestion comes not alone out of my personal feelings in the matter but from long study and a continual questioning and investigation of the sentiments of boys and young men wherever I have met them. The suggestion embraces, first, a term of enlistment of one year with no reserve, but with extra pay allowance and other advantages for reënlistment. Then the military training during this short term should be more like that given in good military schools but should be for more hours each day so that the recruit would get the same training in his one year of service as he would in two or three at college. Besides his military training, there should be regular courses (say an hour a day at least) in history and geography—history as it is shown us in the biographies of great men and stories of special determining events in the world's and our national life, and geography more like that taught by the National Geographic Society.

There should be schools for mechanical or trade instructions so that every soldier could be taught the rudiments at least of manual training and the operation and care of the more common machines. Fullest provision should be made for play—baseball, football, swimming, bowling and all other games requiring strength or skill. The harder the average American works the harder he wants to play.

Each year some great military campaign should be conducted in which a typical military engineering work would be done in fact or in outline, but preferably in fact, for men like best to work to some definite purpose and will work better if they feel their work is to endure. The officers of this great army (for I have no doubt a great army would soon be created, and I would place the maximum limit high) would be the engineers whom you suggest training. Some of the engineer officers as well as some of the enlisted men would find the life and work to their liking, and sufficient officers for the higher ranks and men for the more important noncommissioned posts would be found. No reserve corps of either would be necessary if the training and instruction were kept on the high plane of idealism where they belong.

For second and succeeding term men the courses of instruction should be advanced so that a young man could spend three or even four years in the army and feel that his time had been profitably spent. In a word, make army life such that any young man could be proud to be a soldier and so that he leaves the service better in every way than he entered it—a better employee, a better associate, a better man.

G. H. Bayles.

Atlanta, Ga., June 21, 1915.

Classification of Technical Literature

Sir—The Joint Committee on Classification of Technical Literature is extremely desirous of obtaining the assistance of your readers in making a collection of classifications of applied science that have been developed independently in the offices of manufacturing plants or engineering firms, especially those that exist in manuscript form and have been used for filing or indexing data.

The committee would especially like to have copies of any extensions of present systems to cover any special industry or branch of engineering not now fully covered by the published classifications.

W. P. Cutter,
Secretary of Committee.

29 West 39th St. New York City, June 21, 1915.

Topographic Surveys for Logging Operations

Sir—I read with interest the article in *Engineering News,* June 10, entitled "Topographic Surveys for Logging Operations," by Earl A. Marshall, of Portland, Ore.

It seems to be Mr. Marshall's opinion that the "Northwest" consists of Washington and Oregon, and his article would leave the impression that the methods of making topographic surveys over the entire Northwest are as described in his article. I call your attention to the fact that the "aneroid method" has been discarded for several years over a large portion of the country generally assumed to be the Northwest.

When District No. 1 of the United States Forest Service first began to make surveys for timber sales, land exchanges, etc., it was found necessary to devise some method of making intensive surveys of rough country that would be both economical and accurate; the aneroid barometer method for determining levels was given a trial, but on account of the aneroid's well-known eccentricities, was soon discarded. Since that time the Abney level method has come into general use, and the results of surveys made by this method have been marvelous.

Mr. Marshall states that the cost of making the aneroid surveys runs 20 to 35c. per acre; by the Abney method the cost is from 8 to 10c. He says, "In leveling over these lines an error of several feet in a mile is of no consequence, as the elevations are to be used only to set aneroid barometers from."

Well, for heaven's sake, what is the use of spending 20 to 35c. per acre if errors of several feet to the mile are of no consequence? With the Abney method, if a man does not check within 4 ft. to the mile, he does the work over. Further, he says, "the draftsman adjusts the closing error, usually marks the adjusted elevations on the map, interpolates for the contours."

This remark alone would justify us in using the Abney in preference to the aneroid, for in the former method there are absolutely no adjustments to make, no juggling of contours and consequent loss of topographic detail.

The Abney method is not an experiment, but has passed through several successful seasons, and is proving its superiority every year; the writer had the privilege of assisting in the design of the special Abney level used for this purpose, and participating in the first trials made with the instrument under the direction of R. V. Reynolds, of the office of Entry Surveys, Washington, D. C. This method has been the method of topographic mapping taught in the Montana University Forest School for some time, and our boys are in demand with the Forest Service and lumber companies for this sort of work.

James H. Bonner,
Professor of Forest Engineering,
University of Montana.

Missoula, Mont., June 17, 1915.

[Professor Bonner has promised to contribute an article describing the Abney level method in detail.—Editor.]

Elimination of Garbage-Reduction Odors

Sir—In your issue of June 24, 1915, p. 1246, I note that a report has been made by I. S. Osborne and others on the elimination of odors in the garbage-reduction works at Barren Island, New York City.

We have had the best of success at Schenectady by exhausting the steam from our digesters into a separate tank which has no connection with any other part of the plant. In this tank there is running water in a compartment about 3 ft. deep, into which the steam is condensed and then discharged into our sewers. With our plant operating at full capacity, we have not been troubled with odors since the installation of this system, at a distance of more than 100 to 250 ft. from the plant. The leakage which causes these odors is now known and will be overcome in the near future.

The other fault we had was the odor arising from the drier, which being improperly constructed did not allow us to pass the air and vapor from the drier over our fires. I removed the pipes that were supposed to eliminate the vapor passing through the scrubber. Behind these pipes I erected two eliminators, which catch all the water forced against them by a blower. The air is dry after passing through the eliminators and is then passed through the fires, where all remaining odors are destroyed.

W. W. Chadsey,
Deputy Commissioner of Public Works.

Schenectady, N. Y., July 1, 1915.

Long Embedment of Piles in Concrete Piers

Sir—I have read with interest the editorial entitled "Long Foundation Piles" in the issue of June 24, in reference particularly to the Columbia River Bridge and remarking upon the pier design.

The type of pier discussed, involving piles extending considerable distances into the concrete bases, was used both for the Hawthorne Ave. bridge over the Willamette River at Portland, Ore. (*Engineering News,* Mar. 9, 1911), and for the City Waterway bridge at Tacoma, Wash. (*Engineering News,* May 15, 1913), both designed by my firm and involving piers of large dimensions. About two years ago in the office of William Hood, Chief Engineer of the Southern Pacific Co., the writer prepared estimates for the Coos Bay bridge referred to and for certain other bridges, and proposed to Mr. Hood the use of this type of pier, basing the recommendation largely upon the experiences with the large piers of the Hawthorne Ave. bridge.

In one pier of the Hawthorne Ave. bridge, in which the total base height was 50 ft., the piles extended into the base about 44 ft. The base is 23 ft. wide by 47 ft. long and contains 105 piles spaced about 3 ft. centers. The concrete placed under water was deposited through a tremie consisting of a 10-in. wrought-iron pipe equipped at the top with a hopper of about 2 cu.yd. capacity. This tremie pipe was 70 ft. long and was supported by a special derrick, held vertically between the piles, so that it could be raised and lowered at will. After the first charge of concrete was placed, the lower end of the tremie was continually immersed in soft concrete and the full length of the pipe was kept continually filled with concrete. The hopper was filled with successive batches and the tremie lifted slightly after each filling until the pressure was sufficient to force the concrete out at the lower end of the pipe, and as the hopper was nearly emptied the tremie would be lowered and the flow of concrete stopped.

The concrete was mixed very wet, with as much water as the mixers could hold, and about 1000 cu.yd. was deposited without stopping. After pumping out the crib, the surface of the concrete was found to be very hard and dense. The tremie was placed only at the center of the pier and the concrete distributed itself so thoroughly that the elevation of its surface at the extreme corner was only about 2 ft. lower than at the tremie. During the depositing of concrete in this manner, the water contained in the crib was not discolored by laitance.

With such equipment, therefore, the depositing of the concrete in the bases is not exceedingly difficult, but goes forward very readily. The concrete placed above water can be deposited without any particular inconvenience, as it is usual to deposit concrete under water up to within about 2 ft. of the cutoff of the piles. The piers of the bridge over the Fraser River, at New Westminster, are somewhat similar in character, but it is believed that those of the Hawthorne Ave. Bridge, Portland, Ore., are the first notably large piers constructed in this manner on the West Coast.

In connection with the long timbers, the writer was interested in an order placed for the gins for a piledriver 90 ft. high built for the Hawthorne Ave. piers. The gins were single 6x12-in. sticks, and a casual request from the contractor to a sawmill not far above the bridge site for "a couple of 6x12-in. sticks cut from the longest log lying around convenient" brought to the bridge site within an hour two pieces 6x12 in., 110 ft. long, so that 20 ft. was cut off from each to make the gins. For the timber approaches of the same bridge joists 16x20 in. 20 ft. long were required, and the mill sought permission to deliver them 40 ft. long instead, because of the annoyance it caused in the yard to saw them in two. The longer sticks were accepted without prejudice.

E. E. Howard.

Kansas City, Mo., June 28, 1915.

U. S. Reclamation Projects produced crops valued at $16,475,000 in 1914, according to an estimate published in the "Reclamation Record" for July. The estimate is based on careful returns obtained from all the projects.

Activated-Sludge Experiments at Milwaukee, Wis.

By T. Chalkley Hatton*

SYNOPSIS—Tests of this new proposed method of sewage treatment on a more extensive scale than has heretofore been reported are described and the results summarized. Glass tubes, two small glass-window tanks, a large fill-and-draw tank and a continuous-flow tank of the same size are included in the studies which are being made at the Milwaukee sewage-testing station. Methods of air diffusion, volume and time of air application and careful cost records are features of the experiments.

For the purpose of comprehensively replying to the very many inquiries received from engineers throughout the country interested in the new process of treating sewage by means of "activated sludge," the writer ventures to report the results obtained thus far in carrying out the process at the Milwaukee sewage-testing station, which is being operated under his direction.

In submitting the information contained herein the writer desires to state most emphatically that he has drawn no final conclusions as to the ultimate applicability of this process for the disposal of the sewage of Milwaukee, as there are many features yet to be studied before such conclusions would be warranted. But the results obtained have given sufficient promise to be helpful to those carrying out similar investigations and to other engineers engaged in sewage-disposal studies.

The purpose of investigating the activated-sludge process was to determine the following points, and the experiments so far undertaken lead to that end:

1. SEWAGE EFFLUENT

(a) Reduction of suspended matters during various detention periods.
(b) Reduction of organic nitrogen during various periods of aëration.
(c) Clarification of liquor per hour aërated.
(d) Removal of bacteria per hour aërated.
(e) Volume of air and pressures necessary to effect the different degrees of purification.
(f) Economic depth of liquor in tank.
(g) Economic method of applying air.
(h) Cost of producing effluent at different degrees of purification.
(i) Effect of temperature on the process.

2. SLUDGE

(a) Proportion of sludge to liquor required to effect different degrees of purification.
(b) Character of activated sludge.
(c) Time and air required to produce activated sludge.
(d) Volume of sludge produced per 1,000,000 gal. of liquor treated.
(e) Best method of maintaining necessary proportion of activated sludge in aërating tanks.
(f) Moisture content of wet sludge produced from aërating tank.
(g) Length of time tank sludge will keep without serious putrefaction.
(h) Value of sludge as a fertilizer.
(i) Dewatering of sludge.
(j) Final disposition of sludge.
(k) Cost of disposing of sludge.
(l) Effect of temperature on sludge.

3. CHARACTER OF TANKS

(a) Fill-and-draw process.
(b) Continuous-flow process.
(c) Combination of both processes.

*Chief Engineer Sewerage Commission, Milwaukee, Wis.

Apparatus Used

On Mar. 6, 1915, a laboratory test was begun particularly to try out the best method of applying air prior to building a working tank. The apparatus for making this test consisted of two glass tubes 5 ft. long and $1\frac{5}{16}$ in. internal diameter, set vertically. In the bottom of one tube a "filtros" plate was inserted.

Filtros is composed of quartz sand and some cementing agent combined under high temperature. It may be made of any required porosity by varying the fineness or coarseness of the sand. It is manufactured by the General Filtration Co., of Rochester, N. Y., and was furnished to Milwaukee in plates 12 in. square by $1\frac{1}{2}$ in. thick.

In the bottom of the filtros plate a small glass tube was inserted through which the air is delivered to the bottom of the plate. This diffuses the air as it comes in contact with the sewage with which the larger tube is filled.

The second glass tube was plugged at the bottom and a small inner glass tube was inserted, with its open end terminating near the top of the plug. The air is discharged through this orifice into the sewage near the bottom, rising up through the larger tube in the form of bubbles, and thus keeping the entire body of the liquor agitated.

These tubes have been in fairly constant operation up to date. Some representative results obtained therefrom are noted at the beginning of Table 1. No attempt was made to measure the air used to obtain these results.

On May 8, 1915, two inspection tanks were placed in operation. These tanks, made of wood, were 10 ft. high, 5 ft. wide, and 1 ft. between sides, the bottom sloping to a 12-in. square in the center. On each side glass plates were inserted at various depths to permit observations to be made of the interior.

In the bottom of one tank a filtros plate was inserted, 12 in. square by $1\frac{1}{2}$ in. thick, and a $\frac{1}{2}$-in. air pipe was attached to the cast-iron frame in which the plate was set.

In the other tank a $\frac{1}{2}$-in. pipe was placed in the center, terminating in an open end within 3 in. of the bottom of the tank.

Meters, U mercury tubes and valves were attached to each air feed to determine and regulate the air pressure and volume.

These inspection tanks were installed for the purpose of investigating the process under high and low temperatures, the economic method of applying air, the volume and air pressure required, the sludge characteristics and the period of sedimentation; also, the most economic depth of liquor to be maintained.

The results are shown in Table 1, under "Glass-Window Tanks." The workmen about the plant have dubbed

them the Annette Kellerman tanks because they resemble somewhat the tanks used by the famous swimmer.

On Mar. 26, 1915, the Fowler tank was placed in operation. This tank is so named because it was designed by Dr. Gilbert J. Fowler, of Manchester, England, who is advising with the writer in investigating this process. This tank is made of wood, 32 ft. long, 10½ ft. wide and 10 ft. clear depth.

Fig. 1 shows how the Fowler tank was constructed. the bottom of each frame. Since this has been done there has been less trouble with entrained air.

Rebuilding the bottom of this tank put it out of commission from Apr. 14 until May 6, 1915, from which date it has been in continuous operation.

The air delivered to the tank is measured through a Venturi meter and recorded by a manometer furnished by the Builders Iron Foundry. The air for the plant is furnished by a Connersville positive blower of the

TABLE 1. RESULTS OF ACTIVATED-SLUDGE EXPERIMENTS IN GLASS TUBES AND SMALL TANKS AT MILWAUKEE, WIS.

(Parts per Million)

Date 1915	Temperature, Deg. F. Air	Temperature, Deg. F. Sewage	Aeration, Hr.	Raw Sewage: Suspended Matter	Raw Sewage: Nitrogen As Free Ammonia	Raw Sewage: Nitrogen As Nitrite	Raw Sewage: Nitrogen As Nitrate	Filtros Diffusion: Nitrogen As Free Ammonia	Filtros Diffusion: Nitrogen As Nitrite	Filtros Diffusion: Nitrogen As Nitrate	Air-Jet Diffusion: Nitrogen As Free Ammonia	Air-Jet Diffusion: Nitrogen As Nitrite	Air-Jet Diffusion: Nitrogen As Nitrate	Number of Bacteria per c.c.: Sewage 20°C.	Sewage 37°C.	Filtros 20°C.	Filtros 37°C.	Air Jet 20°C.	Air Jet 37°C.
Glass Tubes in Laboratory (1000 C.c. Samples)																			
Mar. 31...	70	48	0	268	16.0	0.08	0.56	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
			2	Total	....	....	....	7.0	3.75	2.40	7.5	1.94	1.80	.....	.....	.....	.....	.....	.....
			4	Solids	....	....	....	0.6	1.50	6.40	4.0	1.10	3.60	.....	.....	.....	.....	.....	.....
			6	....	....	....	....	Trace	0.40	8.80	1.6	1.00	4.80	.....	.....	.....	.....	.....	.....
			8	1247	....	....	....	Trace	0.10	9.12	Trace	0.95	4.80	.....	.....	.....	.....	.....	.....
Apr. 1	..	..	24	....	....	....	....	Trace	0.17	10.40	Trace	0.76	11.20	.....	.....	.....	.....	.....	.....
Small Glass-Window Tanks (Kellermans) Outdoors*																			
May 20...	54	51	0	257	12.6	0.24	0.40	....	....	....	....	....	....	763,000	44,000	.....	.....	.....	.....
			2	Total	....	....	....	8.6	3.7	3.8	12.6	6.0	3.8	.....	.....	142,000	.....	108,000	.....
			4	Solids	....	....	....	7.1	3.7	14.0	11.1	3.0	7.0	.....	.....	31,500	13,600	52,000	13,500
			24	....	....	....	....	1.0	0.9	32.0	2.0	8.0	18.0	.....	.....	6,700	1,800	10,700	5,300
Volume of sludge, per cent								27	....	....	27	....		Volume of water, gal.		124	.....	124	
May 22...	54	55	0	255	9.6	0.45	2.00	....	....	....	....	....	....	430,000	50,000	.....	.....	.....	.....
			2	Total	....	....	....	5.0	1.8	12.8	6.6	1.7	10.4	.....	.....	59,000	5,000	52,000	5,000
			4	Solids	....	....	....	2.5	1.5	14.4	4.0	1.5	14.4	.....	.....	80,000	4,000	68,000	1,000
			6	1127	....	....	....	1.0	1.4	16.8	3.0	1.4	19.2	.....	.....	41,000	1,000	11,000	1,000
Volume of sludge, per cent								28	....	....	28	....		Volume of water, gal.		124	.....	124	
May 27...	46	52	0	290	9.1	0.42	1.60	....	....	....	....	....	....	1,350,000	120,000	.....	.....	.....	.....
			2	Total	....	....	....	4.0	0.9	3.8	6.6	2.2	4.0	.....	.....	.....	.....	.....	.....
			4	Solids	....	....	....	2.4	0.9	12.0	5.0	1.3	8.0	.....	.....	.....	.....	.....	.....
			6	....	....	....	....	Trace	0.8	13.6	3.4	0.9	9.0	.....	.....	34,200	3,700	32,000	5,400
Volume of sludge, per cent								30	....	....	30	....		Volume of water, gal.		124	.....	124	
June 11...	59	59	0	272	11.6	0.33	1.00	....	....	....	....	....	....	1,070,000	80,000	.....	.....	.....	.....
			1	Total	....	....	....	7.1	0.08	4.0	8.1	0.20	2.2	.....	.....	74,000	6,000	135,000	12,000
			2	Solids	....	....	....	6.6	0.05	4.2	8.1	0.07	2.4	.....	.....	61,000	5,000	67,000	8,000
			3	1148	....	....	....	6.1	0.16	6.4	8.1	0.10	4.4	.....	.....	96,000	9,000	33,000	1,000
			4	....	....	....	....	4.5	0.15	8.0	6.6	0.20	5.2	.....	.....	42,000	2,000	26,000	1,000
Volume of sludge, per cent								18	....	....	20			Volume of water, gal.		124	.....	124	

* The air was applied to these tanks at an average rate of ¼ cu.ft. per sq.ft. of surface area per min., or at a rate of 605,000 cu.ft. per 1,000,000 gal. per hr. of aeration. The air was applied at following pressures in lb. per sq.in.; filtros, 3.6; air jet, 3.2

TABLE 2. ACTIVATED-SLUDGE RESULTS IN FOWLER TANKS AT MILWAUKEE, WIS.*

(Parts per Million)

Date 1915	Temperature, Deg. F., Air	Temperature, Deg. F., Sewage	Aeration, Hr.	Raw Sewage: Suspended Matter	Raw Sewage: Nitrogen As Free Ammonia	Raw Sewage: Nitrogen As Nitrite	Raw Sewage: Nitrogen As Nitrate	Fowler Supernatant Liquor: Nitrogen As Free Ammonia	Fowler Supernatant Liquor: Nitrogen As Nitrite	Fowler Supernatant Liquor: Nitrogen As Nitrate	Fowler Supernatant Liquor: Suspended Matter	Fowler Supernatant Liquor: Putrescibility	Fowler Supernatant Liquor: Turbidity	Number of Bacteria per c.c.: Raw Sewage 20°C.	Raw Sewage 37°C.	Fowler 20°C.	Fowler 37°C.	Volume of Sludge in Tank, %
June 2...	59	58	0	129	12.0	0.60	1.50	....	....	....	....	....	....	2,000,000	230,000	.....	.....	..
			1	Total	.....	....	....	13.2	1.50	0.30	0	48	Slight	.....	.....	31,000	2,000	9
			2	Solids	....	....	....	15.6	1.30	0.30	0	120	v. s.	.....	.....	19,000	1,000	..
			3	1125	....	....	....	14.4	1.10	0.30	0	120	v. s.	.....	.....	2,000	1,000	..
			4	....	....	....	....	4.0	....	0.30	0	120	v. s.	.....	.....	.....	.....	..
June 8	56	59	0	135	14.6	0.43	0.60	....	....	....	....	....	....	1,230,000	240,000	.....	.....	..
			1	Total	....	....	....	16.7	0.90	0.40	0	48	Slight	.....	.....	137,000	12,000	..
			2	Solids	....	....	....	17.2	0.90	0 67	0	120	v. s.	.....	.....	51,000	5,000	..
			3	957	....	....	....	18.7	0.90	0.72	0	120	v. s.	.....	.....	46,000	1,000	12
			4	....	....	....	....	16 2	1.00	0.64	0	120	v. s.	.....	.....	31,000	1,000	..
June 10...	48	58	0	170	16.0	0.42	0.60	....	....	....	....	....	....	2,180,000	150,000	.....	.....	..
			1	Total	....	....	....	16.0	0.70	0.50	0	40	Slight	.....	.....	135,000	11,000	..
			2	Solids	....	....	....	15.0	0.68	0.50	0	120	v. s.	.....	.....	110,000	8,000	13
			3	954	....	....	....	17.5	0.70	0.50	0	120	v. s.	.....	.....	170,000	12,000	..
			4	....	....	....	....	18.5	0.70	0.36	0	120	v. s.	.....	.....	73,000	5,000	..
June 12	57	59	0	223	8.1	0.85	0.60	9.6	0.38	0.70	0	48	Slight	1,000,000	110,000	.....	.....	..
			1	Total	....	....	....	10.1	0.43	0.80	0	120	v. s.	.....	.....	780,000	6,000	12½
			2	Solids	....	....	....	10.1	0.43	0.80	0	120	v. s.	.....	.....	760,000	5,000	..
			3	1026	....	....	....	10.1	0.43	0.70	0	120	v. s.	.....	.....	110,000	1,000	..
			4	....	....	....	....	10.1	0.43	0.70	0	120	v. s.	.....	.....	34,000	1,000	..

Analyses of Sludge from the Fowler Tank

Date 1915	Specific Gravity	Per Cent. of: Moisture	Solids	Mineral Matter	Organic Matter	Fats	Phosphoric Acid: Total	Phosphoric Acid: Soluble	Parts per Million: Oxygen Consumed	Parts per Million: Total Nitrogen
June 2	1.014	97.7	2.28	0.66	1.62	0.12	1.63	0.33	5,760	1,920
June 9	1.008	97.8	2.16	0.70	1.46	0.13	1.71	0.00	4,000	1,600

* The volume of sewage treated in the Fowler tank is about 15,850 gal. per filling, or 63,400 gal. per day. Air was applied at the rate of ¼ cu.ft. per sq.ft. per min. for 4 hr., or at a rate of 284,000 cu.ft. of air per 1,000,000 gal. per hr., at a pressure of about 4¾ lb. per sq.in.

Filtros plates were used as air diffusers. These were built into a concrete channel; but this method was found unsatisfactory because the cinders under the concrete contained the air after the pressure was shut off and, during the sedimentation period, when it is necessary to maintain the liquor as quiet as possible, this entrained air persisted in rising to the surface and keeping the liquid considerably disturbed. To overcome this the plates were placed in cast-iron frames, as shown in detail in Fig. 1, and a ½-in. air pipe was tapped into Boston type, operating to 5 lb. pressure and actuated by a d.-c. motor.

Operation of the Experimental Units

The laboratory test tubes have been operated under varied conditions for the purpose of observing the characteristics of the process, and many interesting results have been obtained which have guided the operations in the other tanks. The record at the top of Table 1 represents the nitrogen cycle obtained with activated

sludge, although 20 to 30 parts of nitrogen as nitrates have been frequently obtained with 24-hr. aëration.

When the two Kellerman tanks were placed in operation on May 8, 25 per cent. of their capacity was filled with sludge which had been artificially aërated for several days, although the nitrogen cycle was not complete. For several days thereafter fresh sewage was added, then aërated for 12 to 24 hr., allowed to settle, and the clarified liquor run off. This process was repeated until the drawn-off liquor was limpid in appearance and the organic nitrogen had been reduced to nitrates; what remained was the true "activated sludge." After this the tanks were operated on 4- and 6-hr. cycles—that is, their contents were aërated for 4 and 6 hr., settled for ½ hr. and then the supernatant liquor was drawn off and the tank refilled in another 1½ hr.

The Fowler tank has been operated since May 6 on a 6-hr. cycle—that is, 4 hr. aëration, ½ hr. settling and 1½ hr. drawing and filling. A small volume of aërated sludge was placed in the tank when starting, but through a break in the connection of the draw-off pipe most of this was lost. However, since May 6 we have been trying to build up the volume of sludge so as to obtain 25 per cent. of sludge to 75 per cent. of liquor, but after 46 days we accumulated only 13 per cent., during which time we treated 2,760,000 gal. of sewage. Measuring the volume of sludge after ½ hr. of settlement, we accumulated approximately 5 cu.yd. per 1,000,000 gal., giving 98 per cent. moisture when drawn.

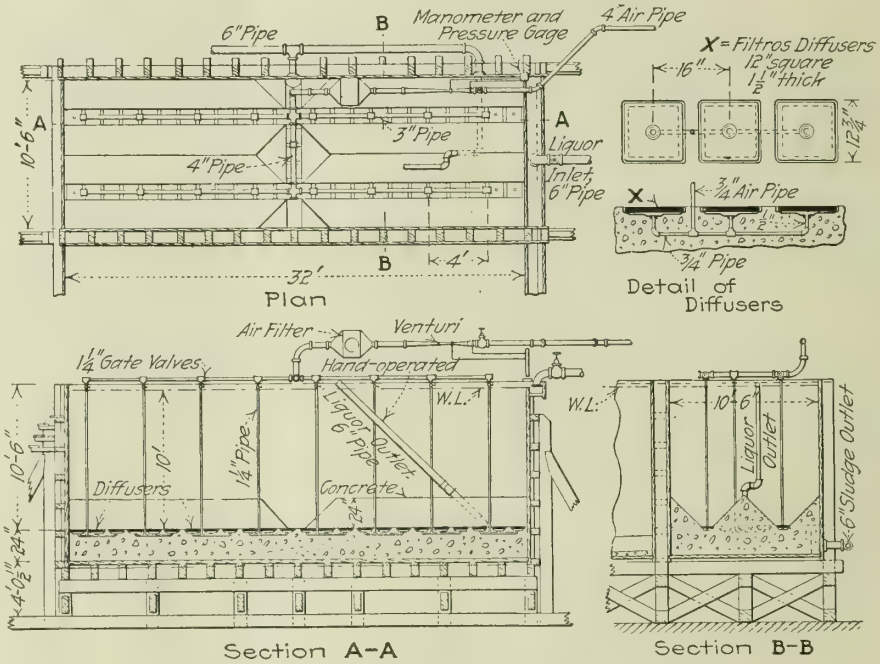


FIG. 1. ACTIVATED SLUDGE TANK AT MILWAUKEE—FILL-AND-DRAW PLAN

Remarks on the Results Obtained

Attention is called to the difference in volume of air used per 1,000,000 gal. of sewage treated in the small glass-window tanks, as shown by Table 1, and in the Fowler tank, as shown by Table 2. The cause of the excess in the former is that only 124 gal. of raw sewage was being added during each run, whereas 255 gal. should have been added to correspond with the same proportion being treated in the Fowler tank. Whether this increased air is the agent by which the effluent from the glass-window tanks is brought up to a higher standard than the effluent from the Fowler tank is uncertain; but the writer is of the opinion that it had very little effect, and that the higher standard is due to the presence of a sufficient volume of good activated sludge, which is not yet present in the Fowler tank.

In studying the results shown in the accompanying tables it must be borne in mind that the process is quite different from the aërating processes which have been investigated from time to time for a generation, in which air was used as an oxidizer and to separate the colloids by agitation or "scrubbing," leaving the colloids to pass off with the aërated liquor and again combine as soon as agitation was over. In the activated-sludge process these colloids combine with the sludge intimately mingled with and at the same time separated from the liquor, and which contains a mass of nitrifying organisms absorbing the organic nitrogen in the sewage.

This is well brought out by two facts. Table 3 shows 1,580,000 bacteria per c.c. in the raw liquor. After 4½ hr. aëration these had been reduced in the effluent to 8000, or 99 per cent., whereas the sludge, after 30 min. settlement, contained 14,490,000 bacteria per c.c. The small glass-window tanks which had been operating with from 25 to 30 per cent. of activated sludge have largely reduced the organic nitrogen to mineral nitrogen, whereas the Fowler tank, which has been operating with from 6 to 13 per cent. of sludge, not completely activated, has shown very little, if any, reduction of the organic nitrogen. That is, the sludge plays a most important part in the process, and to do its best it must be thoroughly activated. Whether it is necessary to have a volume of sludge equal to 25 per cent. of the volume of liquor is a point yet to be determined, but from the results shown by Tables 2 and 3 this does not seem to be necessary in order to get sterilized, stable liquor with 4-hr. aëration. This question will be better answered when results from the continuous-flow tank have been obtained, but it is

TABLE 3. BACTERIA IN MILWAUKEE ACTIVATED-SLUDGE TANK DURING DIFFERENT PERIODS OF AERATION*

	Time Sample Was Taken	Total Bacteria per c.c. at 20°	Total Bacteria per c.c. at 37°	Total Red Colonies per c.c.	Percentage of Removal of Total Bacteria at 20°	Percentage of Removal of Body Bacteria at 37°
Coarse screened raw sewage.....	11:30 a.m.	1,580,000	160,000	100,000	.	.
End of ½ hr. aeration..	12:00 m.	240,000	25,000	11,000	85	34.5
End of 1½ hr. aeration.....	1:00 p.m.	200,000	16,000	7,000	87	90
End of 2½ hr. aeration.....	2:00 p.m.	120,000	3,000	1,000	92	98
End of 3½ hr. aeration.....	3:00 p.m.	42,000	2,000	2,000	97	99
End of 4½ hr. aeration.....	4:00 p.m.	8,000	1,000	.....	99	99.4
Sludge after settlement....	4:00 p.m.	14,490,000	1,380,000	370,000	..	....

* This record was made May 28, 1915, when the tank contained only 9 per cent. of activated sludge, on coarse-screened sewage of the strongest character obtained during the 24 hr.

one which must be solved, as it figures greatly in the capacity of tanks necessary.

Sufficient information has not yet been gathered to indicate what effect low temperature will have on the process. The Milwaukee sewage effluents from the sprinkling filters at the testing station reached a temperature of 42 deg. F. during the past winter. The small glass-window tanks were started on July 6, 1915, on a series of tests to denote temperature effects, by keeping the temperature of the liquor in the tanks from 40 to 50 deg. F.

Few investigations have been made of the sludge because we have been unable so far to build up enough

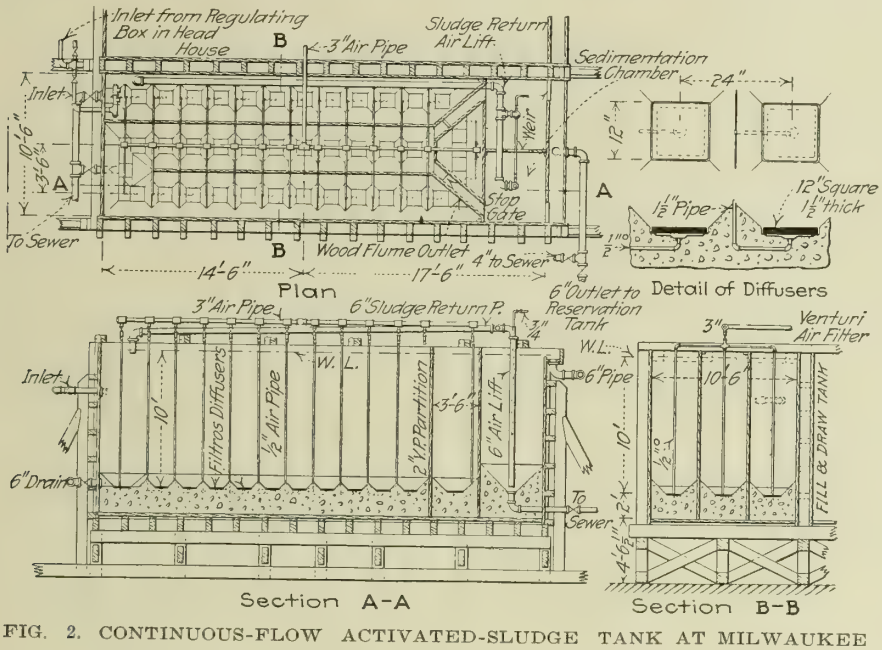


FIG. 2. CONTINUOUS-FLOW ACTIVATED-SLUDGE TANK AT MILWAUKEE

without robbing the tanks. The laboratory tests show a sludge which differs materially from either Emscher-tank or septic-tank sludge. It is not gaseous, like the former, nor does it retain its moisture, like the latter. It is granular in appearance, settles to the bottom, the clarified liquor coming to the surface quickly. That is, in four hours a sludge containing 98 per cent. moisture is reduced to from 75 to 80 per cent. of its volume, containing about 75 per cent. of moisture. The liquid separates from the sludge so quickly and effectually that there need be but little difficulty in drawing it off from a sludge tank and dewatering from the surface as well as from the bottom. The sludge gives off no odor when fresh; after being retained in open bottles for several days it turns from a medium brown to black and putrifies. There is no odor about the tanks while the sewage is being treated.

It is the intention to investigate thoroughly the treatment of the sludge as sufficient quantity accumulates.

From the beginning of the test it has appeared so simple to get a nearly sterile liquor after four hours' aëration, and the whole process has seemed so much more promising in general results than any other of the many processes being tried out at the testing station, that all connected with directing the tests have been fearful lest some overwhelming obstacle would arise which would make the process impracticable.

Several inquiries have suggested that the cost of air would prove to be prohibitive, as has been the case in investigations of other processes. To the end that the writer would not be deceived in this very important item, special attention has been given by all connected with the work to arriving at the cost of air. The best apparatus obtainable for measuring the volume and pressure of air used in each tank have been installed, and these are tested out every week. Every half hour of the 24 hr. readings are taken. The liquor treated is all measured volumetrically. An engineer is in charge of the work both night and day under the direction of William R. Copeland, Chief Chemist, and the orders from headquarters are to record the truth.

So far the cost of air for treating the sewage in the Fowler tank is $1 per 1,000,000 gal. per hr. aërated. This cost is based on electric current at 1c. per kw.-hr., a blower efficiency of 73 per cent. and a motor efficiency of 90 per cent. The sewage commission has been tendered a proposition from the local electric company to supply current in the quantity required for pumping and blowing for 0.77c. per kw.-hr. A blower of 30,000 to 40,000 cu.ft. per min., direct-connected to a steam turbine, will produce power at less cost than the electric unit. So far the cost bugaboo has not materialized. It may appear with winter temperatures.

If this process can be satisfactorily carried out on the basis of continuous flow, both winter and summer, it will far excel every other sewage treatment to date where a stable, sterilized effluent is required. It is especially adaptable to being increased from year to year as population grows by simply adding to tank and blower capacity, and it largely circumvents the fool-killer.

For the purpose of testing the continuous-flow principal a tank of 22,500 gal. capacity has been installed and was put in operation on June 21, and we hope by September next to be able to report some interesting results from it (see Fig. 2). It has been improvised from a chemical precipitation tank which has been thrown out of commission, and is of the same capacity as the Fowler tank.

As stated in the beginning, this article is submitted for the purpose of answering the many inquiries received from interested engineers, and incidentally for giving those parties working along similar lines the information obtained to date at the Milwaukee plant. The writer so far claims nothing except that there is no doubt that the Milwaukee sewage can be treated by this process, during at least eight months in the year, so as to produce a stable effluent at less cost than any of the other processes so far tested in the experiment station under his directions—and these processes have included fine screening, Emscher tanks, chemical precipitation, sprinkling filters, liquid-chlorine disinfection and electrolytic disinfection.

A Large-Capacity Coal Car for the Erie R.R., exhibited at the Atlantic City convention of the Master Car Builders' Association, is a hopper-bottom car with high sides and has a capacity of 140,000 lb. The dead-weight is 60,700 lb., and it is carried on four-wheel trucks, giving a wheel loading of over 25,000 lb. per wheel. The car body is 40 ft. 6 in. long, 9 ft. 3 in. wide and 11 ft. high. It holds 2646 cu.ft.

Useful New Facts About Materials

The following short articles have all been abstracted from papers, with discussions, presented to the annual meeting of the American Society for Testing Materials, held June 22 to 26, 1915, at Atlantic City, N. J.

A Laboratory Method of Proportioning Concrete

For comparable test-pieces of concrete the ordinary volumetric proportioning of the aggregate does not give entirely accurate results on account of the variation in voids. To provide a more uniform method, J. A. Kitts proposes a weight-volumetric system of proportioning in which the specific gravity and voids in each aggregate are considered and such a proportion determined that all the aggregates will have approximately the same strengths.

Internal Stresses from Hardening

H. V. Wille (Baldwin Locomotive Works, Philadelphia) measured the internal stresses produced in steel cylinders about 9½ in. in diameter by quenching in water and in various oils. The method of study was to cut out rings, measuring their diameter before and after cutting loose. Stresses from 24,000 to 45,000 lb. per sq.in. were found. Only a thin outer skin was in tension and all the remaining cross-section in circular compression. Occasionally internal flaws resulting from the quenching were found. The temperature from which the steel was quenched did not seem to have any particular influence on the result of the hardening.

How quickly and how thoroughly a piece of steel heats up in its interior, when in a heating furnace, was studied by M. E. Leeds (Leeds & Northrup Co., Philadelphia) on field specimens ranging from 2 in. round to 12 in. round. Pyrometers laid against the surface of the specimen remained well ahead of the interior temperature throughout the early stages of the heating, but by the time the exterior of the specimen reached furnace temperature the interior had also reached furnace temperature. Moreover, the exterior temperature when plotted by a self-recording pyrometer correctly showed the time at which the entire specimens reached a transformation point, by an inflection in its curve, in spite of the fact that the indicated temperature of this inflection was higher than the transformation temperature.

With the help of his observations, pyrometric control of the heat treatment of steel is made considerably more precise and therefore serviceable.

Steel Hardness Proportional to Strength

Some 4000 tests of various kinds of carbon and alloy steel subjected to various heat treatments, comprising the determination of tensile strength and of Brinell and scleroscope hardness number, were reported on by R. R. Abbott (Peerless Motor Car Co., Cleveland). It was found that all carbon steels show a straight-line relation between hardness and tensile strength throughout the whole range investigated—from 40,000 to 250,000 lb. per sq.in. tensile strength. The same thing is true of the other classes of steel—nickel steel, chrome-vanadium steel, etc. In each instance, however, the values plotted form a belt rather than a thin line on the diagram, and the width of this belt is sufficient to represent about 20% variation in tensile strength for any given hardness. This extent of variation will probably seriously interfere with making direct practical use of the straight-line relation, as, for instance, by substituting hardness tests for tensile tests of steel in the control of mill and shop operations.

"Fatigue" of Steel

In the important question of fatigue or endurance of steel, H. F. Moore (University of Illinois, Urbana, Ill.) and F. B. Seely, in a paper entitled "The Failure of Materials Under Repeated Stress," attempt to extend the results of observations at fairly high stress (that is, not far below the yield-point) to stresses considerably lower. Adopting an exponential formula for the relation between stress and number of repetitions required to produce failure, they adopt the hypothesis (based on a slender structure of facts available at present) that fatigue phenomena do not have a lower limit of stress, and that an exponential relation holds for low stresses. On the other hand, an exponential formula fitted to those test results which have been obtained at high stresses gives unduly low values of stress for greater number of repetitions; in this range, therefore, the authors propose an arbitrary factor by which the stress calculated from the exponential formula is to be increased. This factor increases with the number of repetitions whose fatigue stress is to be determined. The authors give graphical charts and tables for dealing with the equations they propose.

Concrete-Filled Pipe Columns

Columns made up of pipes varying from a 4-in. light-weight boiler tube to a 6⅝-in. standard-weight steampipe and filled with a 1:2:3 concrete jolted down into place have been tested by F. W. Swain and A. F. Holmes. The tests show that the filled columns were perfectly elastic under loads below the elastic limit. Inasmuch as indicator blocks of the same concrete showed a permanent set after loading, it is apparent that in the filled column the steel tube prevents the permanent set from taking place in the concrete. In other words, the composite column is elastic under working loads and can be so figured. Formulas are given for the kind and quality of columns tested, with constants which permit of alteration to fit other concrete mixtures.

Finer Grinding and Higher SO_3 in Portland Cement

For some time there has been a demand in certain quarters for a finer grinding of portland cement as a means of improving its quality, and in other quarters a claim that the SO_3, added to retard setting could be increased without serious danger. P. H. Bates (United States

Bureau of Standards) reported a series of tests of interest along this line. Ten commercial cements were tested over a period of six months in tension and compression and for expansion—(1) in their original state, (2) when reground so that about 12 per cent. more passed a 200-mesh sieve, (3) with the SO_3 content increased to 2½ per cent. and (4) when reground and with the added SO_3 besides. In the main the author points out the unsatisfactory results obtained, indicating that fine grinding and added SO_3 have not the importance generally ascribed to them. Judicious selection of certain of the test results could prove almost any contention on either side of the controversy. The following abstract is a part of the author's general conclusions:

So far as time of set is concerned, no disadvantageous results have been produced. The fine grinding produces a quicker set; the additional SO_3 produces a quicker initial but slower final set. Few of the changes, however, are such as to place the treated cement beyond specification limits.

Either fine grinding, the addition of SO_3, or fine grinding plus addition of SO_3, generally improves the strength of neat specimens. The neat specimens, however, do not give very consistent results, and not much value should be placed upon them. The indications are that at later periods the results for all neat specimens, including those made from the coarse cements, will be very close together.

The strength of the standard sand mortars in tension shows the advantage of all of the three treatments of the original cements. In the compression test specimens the addition of SO_3 to the coarse cement has caused a falling off of the rate of gain of strength, which might be assumed to be caused by steadily increasing disruptive action.

At the end of 28 days the grand average strength of all the concrete specimens, made from the cements as received, was 2417 lb. per sq.in.; of the specimens made of the cement with the additional plaster, 2635 lb. per sq.in.; of the specimens made from the finer-ground cement, 3103 lb. per sq.in.; and of the specimens made from the finer-ground cement further plastered was 3028 lb. per sq.in. The strength of the concrete of these specimens at the end of 90 days was 3263, 3175, 3828 and 3760 lb. per sq.in. respectively. From these figures it appears that at the end of 28 days, by the above-mentioned treatment, the original amounts have been improved about 10, 28 and 25 per cent. respectively; and at the end of 90 days about 0.0, 17 and 15 per cent. respectively. It would appear, therefore, from these grand averages that at later periods the original cements may give as good strength values in concrete as the treated cements. It might even be assumed that the further SO_3 in the coarse cements was not desirable from the standpoint of strength. It is, however, very evident that finer grinding is very advantageous for early strength, and that the addition of more SO_3 to such finer-ground cements to more properly control their set is not disadvantageous at this period.

The results of expansion measurements on neat specimens stored in water show large increases in length for the specimens made from the cements containing more SO_3. In the sand specimens this is not so apparent. At present these specimens do not furnish much aid in studying the problem under investigation. It may be, however, that these neat specimens are foretelling the ultimate results which will be noticed in the strength specimens.

The results are not conclusive as to the effect of the composition upon finer grinding or further SO_3. Neither can any satisfactory conclusion be drawn from the constitution of the cements.

News of the Engineering World

Important Action on New York Building Code

In the section-by-section revision of the building code of New York City three vital sections were adopted by the Board of Aldermen July 6. They relate to masonry, fireproof construction, and reinforced concrete. In walls, hollow blocks of tile or of concrete are admitted on equal terms with brick, as to wall thicknesses; in skeleton-construction buildings they may be used for all heights, but in other types they are limited to buildings not over 40 ft. high. For exterior surfaces they must be extra-hard burned or else veneered, or else coated with ¾-in. cement stucco. A further important innovation is a section permitting the use of 12-in. curtain walls for the entire height of skeleton structures.

In residence buildings, a minimum thickness of 8 in. is fixed for outside as well as interior walls.

The fireproofing requirements call for a 2-in. thickness of covering except at edges of column brackets or lugs, which may extend to 1 in. from the surface of the fireproofing.

All types of fireproofing are admitted. No pipes or wires may be embedded in the protective material. Conservative methods of design are prescribed for floor arches and the like, with a unit-stress of 500 lb. per sq.in. for stone-concrete and tile, and 300 for cinder concrete. Tile or gypsum block partitions 3 in. thick and 2 in. solid cement or gypsum plaster on metal fabric or studs are allowed.

In reinforced concrete, beam stress is limited to 650 lb. per sq.in. and direct compression to 500; but over supports of continuous beams the stress may be 15 per cent. higher. In columns, vertical steel is counted at 7500 lb. and concrete at 500; the hooping percentage times 2¼ times its unit-stress is the amount allowed as added capacity per square inch of the concrete. The reinforced-concrete ordinance for the first time establishes by law an up-to-date concrete regulation in New York City.

The Structural Engineers' License Law in Illinois

The bill requiring the licensing of structural engineers in Illinois was signed by Governor Dunne on July 5. Normally it would have been signed in June and have gone into effect on July 1, but owing to the protracted session of the legislature this bill (with many others) was not signed until after July 1. It is now a question whether the act becomes effective at once or does not take effect until July 1, 1916.

The act provides for a State Board of Examiners composed of five members, one to be a professor in the Civil Engineering Department of the University of Illinois and the others structural engineers of recognized standing and of not less than ten years' practical experience. Two members are to hold office until Jan. 31, 1917, and three until Jan. 31, 1919. Applicants for license pay a fee of $20, a further fee of $30 if the license is granted, and an annual fee of $10. Structural engineers who are in prac-

tice at the date when the act becomes effective are entitled to a license without examination. The board may grant a license without examination (but requiring the full fee of $50) to structural engineers licensed under the laws of other states. After six months from the date the act takes effect, it will be unlawful to practice without a license.

No corporation may be licensed to practice, but it may prepare plans and specifications for structures (as covered by the act) to be built under its supervision, provided the chief executive officer or managing agent of such corporation in Illinois is a structural engineer licensed under this act. It is lawful for licensed structural engineers to enter into partnership with architects.

At least two examinations must be held each year. The board must adopt rules and regulations for the examinations. Upon the election of each of its officers and upon the adoption, repeal or modification of its rules of government or rules for examinations, the board must publish the name and address of each officer and a copy of the rules (or amendments, etc.) at least twice in one engineering journal of general circulation in the State of Illinois and in one daily newspaper published in the state.

Two of the principal clauses of the bill, defining structures and structural engineers, are as follows:

Structures within the meaning of the act shall be construed to mean all structures other than buildings, having as essential features foundations, columns, girders, trusses, arches and beams, with or without other parts, and in which safe design and construction require that loads and stresses must be computed and the size and strength of parts must be determined by mathematical calculations based upon scientific principles and engineering data.

And any persons who shall be engaged as principals in the designing and supervision of the construction of structures or the structural part of structures designed solely for the generation of electricity, or for the hoisting, cleaning, sizing or storing of coal, cement, sand, grain, gravel or similar materials, elevators, manufacturing plants, docks, bridges, blast furnaces, rolling mills, gas producers and reservoirs, water-works, sanitary works as applied to the purification of water or plants for waste and sewage disposal, or roundhouses for locomotives, railroad shops, pumping or power stations for drainage districts, or power houses, shall be considered as structural engineers within the meaning of this act, and shall be entitled to the benefits of these provisions, even though such structures may come under the definition of "buildings" as defined in an act to provide for the licensing of architects and regulating the practice of architecture, in force July 1, 1897.

Cincinnati Buildings Suffer from Wind Storm

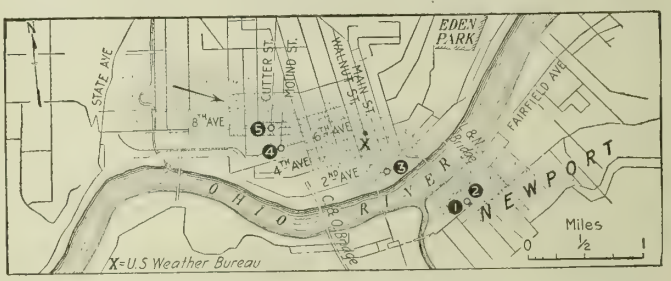
A violent wind, rain and thunder storm swept over southern Ohio and northern Kentucky during the night of July 7, which in the vicinity of Cincinnati resulted in a loss of 37 lives and property damage to the extent of several million dollars. This was the most devastating storm in local history.

A wind velocity of 50 mi. per hr. was recorded on two previous occasions—in 1901 and in 1902. The storm of July 7 establishes a highest wind velocity for the Cincinnati Weather Bureau of 50 mi. per hr. for 5 min., with an extreme velocity of 62 mi. for a period of 1 min. In all probability the wind was more violent in certain sections of the city than the anemometers at the Government Building recorded. The observatory in Clifton, which is about 4 mi. north of the Government Building, showed a velocity of 44 mi. per hr., with an extreme velocity of 50 mi. for 1 min.

According to Acting Weather Forecaster Schlomer, the storm occurred in connection with an eastward movement of a low-pressure area from northwestern Iowa at 7 a.m. on July 7, 1915, reaching northeastern Ohio at 7 a.m. on the next day. At 7 p.m. the area of low pressure was central over Illinois, with Cincinnati in the southeastern quadrant of this area, so that severe storms were probable. The sky during the day was overcast with alto-stratus and strato-cumulus clouds moving from the southwest. At 7:30 p.m. a formation of mammato-cumulus clouds was observed in the zenith. This type of cloud appeared just before the St. Louis tornado in May, 1896.

The wind during the day was from the southeast, with an average velocity of 7 mi. per hr. After 7:30 p.m. the velocity gradually increased, and at 9 p.m. it was blowing at the rate of 20 mi. per hr. from the southeast. This direction continued until 9:29 p.m., when the wind veered to the northwest with a greatly increased velocity. After 9:35 p.m. the wind gradually decreased in velocity, blowing from the northwest until 10.20 p.m., at which time it backed to the south, continuing light until midnight.

A rainstorm began at 8:40 p.m. and ended at midnight, with a total rainfall of 1.01 in. The downpour occurred



PATH OF STORM THROUGH CINCINNATI AND SUBURBS

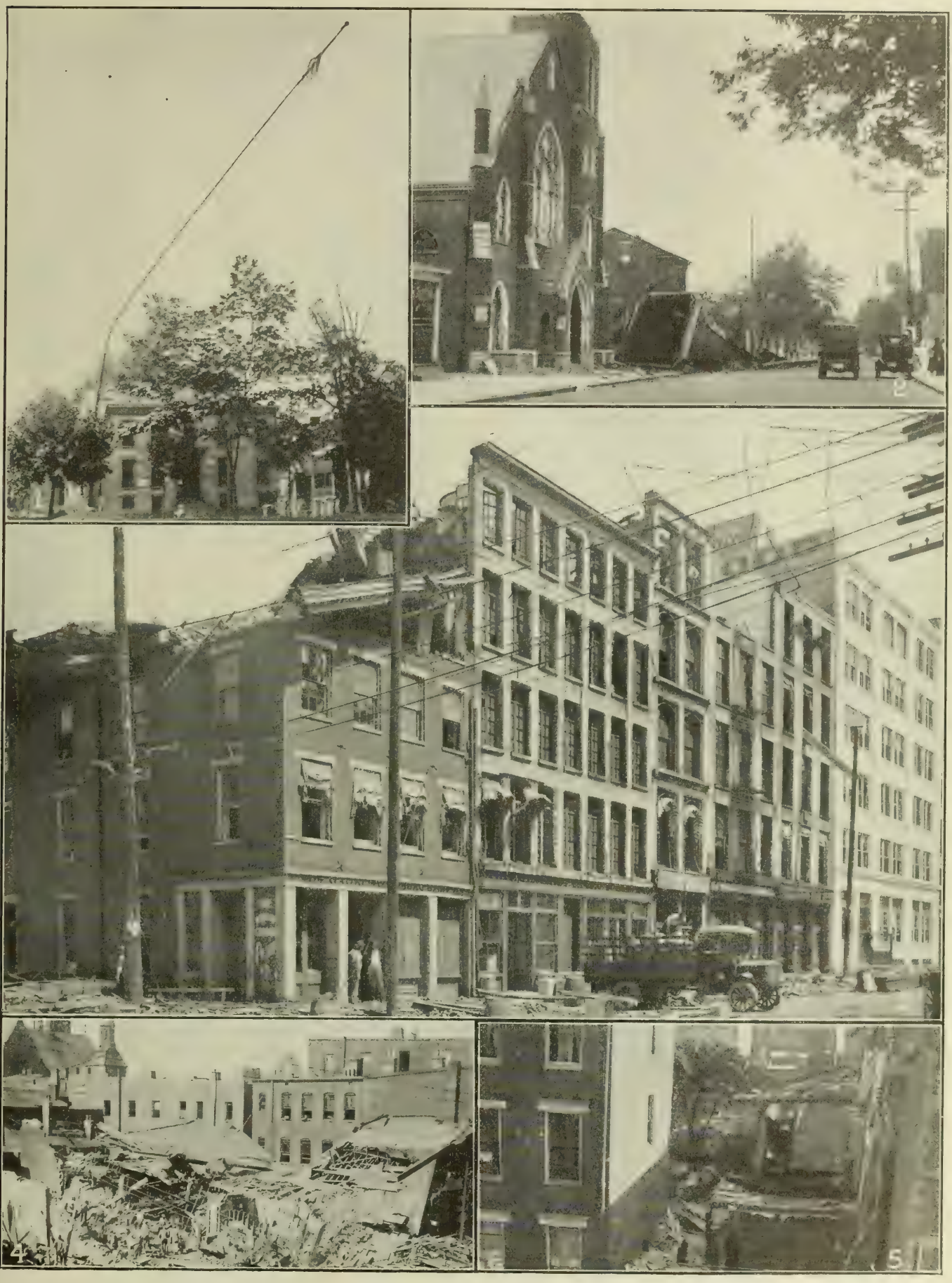
Shaded area represents general path of storm. Figures indicate location of views on opposite page

between 9:23 and 9:32 p.m., during which time 0.66 in. of rain was recorded. During the 5 min. ended at 9:32 p.m., 0.53 in. of rain fell, which is very close to the local record for a 5-min. period.

The lightning is known to have struck twice in Cincinnati and once across the river in Kentucky. The electrical display was one of the most brilliant ever observed.

In spite of the popular belief that the storm was a tornado, it is described by the Weather Bureau as a violent wind squall accompanied by excessive rainfall and lightning. All local indications show a straight blow from the northwest. The funnel-shaped cloud with a violent vortex and roaring noise, destroying everything in its path, was not observed. The largest property damage and the greatest loss of life, however, are in localities on a straight line extending from Eighth and Cutter St., through Sixth and Mound, Second and Main, terminating at the Central Bridge over the Ohio, where the steamer "Dick Fulton" sank.

An examination of the damaged buildings leaves the impression that the destruction and loss of life were due to the old and insecure condition of the structures rather than to the severity of the wind. At Eighth and Cutter St., for example (Fig. 5), a three-story residence was crushed by the fall of an adjoining roof, which resulted in five deaths. Immediately opposite is a 6-story reinforced-concrete building that suffered no injury beyond the breakage of a dozen window panes. At Sixth and Mound



FIGS. 1 TO 5. STORM DAMAGE AT CINCINNATI, OHIO, AND NEWPORT, KY.

Fig. 1—Iron flagpole at courthouse in Newport, 10 in. in diameter at base. Fig. 2—Church steeple thrown to ground in Newport. Fig. 3—Second and Main St., Cincinnati, showing destruction in old buildings, and new reinforced-concrete building, in background, intact. Fig. 4—Five or six small buildings destroyed at Sixth and Mount St., Cincinnati. Fig. 5—Three-story residence at Eighth and Cutter St., Cincinnati, crushed by fall of adjoining roof

St. (Fig. 4) five or six old buildings were demolished, with a loss of 14 lives. Some of these buildings are known to have outlived their period of safe usefulness.

The next scene of severe destruction was at Second and Main St., which is about 1 mi. southeast of Sixth and Mound St. Between these points are solid blocks of buildings varying in height from one or two stories to thirty. While there was considerable damage in this area, it was confined almost entirely to the old buildings. The injury to the newer buildings consisted in broken chimneys, firewalls and windows.

The block of buildings on the east side of Main St. between Second and Front St. was badly damaged, with the exception of the Lippincott Building, which is a six-story reinforced-concrete structure (Fig. 3). The old sandstone front, brick and wood-joist buildings, razed for the construction of the Lippincott Building, were very dilapidated, and it is fair to presume that the buildings on either side, which appear to have been built at the same time, over fifty years ago, are not much better. There was no loss of life here, fortunately, because the employees had left several hours before the storm.

Near the Central Bridge over the Ohio River the steamer "Dick Fulton" struck a bridge pier and sank, with a known loss of one life. The 30-story Union Central Building at Fourth and Vine St. and the 12-story Textile Building at Fourth and Elm St., the tallest structures in the path of the storm, suffered very little injury.

After crossing the river the storm did considerable damage—roughly estimated at not less than $500,000—in Covington, Newport, Bellevue, Dayton and the Highlands, most of which was confined to unroofing old buildings, blowing down chimneys and walls, breaking trees, telephone and traction poles. Only one life was lost. The flagpole in Fig. 1 and the church steeple in Fig. 2 show interesting effects of the storm in Newport.—C. M. Stegner, Cincinnati, Ohio.

Kansas Flood-Prevention Conference

A conference on flood prevention in Kansas was held at Topeka last week. About 200 persons were present, including railroad presidents, engineers, mayors and prominent landowners. The conference was called by Arthur Capper, Governor of Kansas, who was elected president of the permanent organization subsequently effected. The vice-president-elect is T. J. Strickler, Engineer of the Utilities Commission of Kansas, and the secretary is J. C. Mohler, Secretary of Agriculture. An engineering investigating committee will be appointed. The need for study of the Kansas flood problem is shown by the fact that the flood losses in that state this year are estimated at $15,000,000.

A Hoisting Chain Broke while steel was being unloaded from a flat-car at the Harrison, N. J., plant of the Crucible Steel Co. of America, on July 1.

A Train Fell on Another Train near Ranier, Wash., on July 3, killing three persons and injuring 16 others. A Chicago, Milwaukee & St. Paul passenger train, bound from Seattle to Graysharbor, went through a weakened trestle and fell upon a Northern Pacific freight train 40 ft. below. A trestle bent had been torn out by a crane arm carried on a car of the freight train. The crane arm had worked loose and caught a diagonal cross-stringer of the trestle. Unsuccessful attempts were made to flag the passenger train.

Derailment of an Electric Car on the International Ry. on Queenston Heights, Canada, on July 7 killed 14 persons and injured many others. The car, which was an open one, was overloaded with excursionists and appears to have exceeded a safe limit of speed in passing over a reverse curve on a down grade. When it left the rails it struck the low branches of a large maple tree, which demolished the superstructure of the car. A preliminary coroner's inquest has been held and a further hearing will be had on July 19. E. G. Connette, president of the International Ry., states that a representative of the Railroad Commission of Toronto examined the track and car on July 9 and is reported to have found no fault with either. As near as Mr. Connette is able to learn, the motorman lost control of the car on account of the slippery rails resulting from weather conditions. The car just previous to the wreck had stopped at the foot of a heavy grade in order that a switch might be thrown, showing that the brakes were working. The sandbox was full of sand. The car should have been in first-class condition, having come out of the shops on July 6.

An Alaskan Timber Reservation, 200 miles long and 5 to 10 miles wide, has been created by proclamation of President Wilson to reserve for government use timber that may be needed in the construction of the government railroad in Alaska.

St. Louis Municipal Bridge—The east approach to the bridge has at last been put under contract. The fabrication of the steelwork for the approach was awarded July 9, 1915, to the American Bridge Co. for $1,035,000. The work includes about 24,000 tons of steel. The length of the viaduct is over 3 mi.

A Heavy Rainfall in Boston, Mass., on July 1 broke all records for rate of rainfall for two-hour and five-hour periods. Between 4 and 6 a.m., 2.29 in. of rain fell; between 3 and 7 a.m., 3.37 in. A total rainfall of about 4½ in. for the day exceeded the normal for the whole month of July by about an inch and greatly reduces the deficiency of 6.74 in. since Jan. 1.

The Spring Valley Water Co., of San Francisco, has offered to extend its mains into various suburban districts provided the city withdraws its contest against the rates now charged. At present the rates charged to consumers by the water company are 15% in excess of the rate allowed by the Board of Supervisors. The company also asks an increase of $2.50 per year on the hydrant rental. It is likely that the city authorities will accept the company's proposal.

A Motor Speedway with a brick-paved track, to cost approximately $2,000,000, has been begun near Philadelphia by the Philadelphia Motor Speedway Association. Excavation work has been started on a tract of ground between Old York Road and the Philadelphia & Reading Ry. tracks north of Willow Grove, about 16 mi. from Philadelphia. The track is to be a 2-mi. circuit of brick pavement on a concrete foundation. There are to be reinforced-concrete grandstands seating 100,000 persons and parking space for 30,000 motor cars.

Bronx Valley Sewer Litigation—The United States Circuit Court of Appeals has reversed the action of the lower court and ordered a trial of the suit brought by the American Pipe and Construction Co., of Pennsylvania, to recover $891,952 from the County of Westchester, New York, for alleged extra expenses, due to mistakes in the engineers' plans, incurred by the Mack Paving & Construction Co., contractor on the Bronx Valley sewer. The lower court dismissed the suit on the ground that the whole county was not obligated to bear the expense of the sewer, which benefits only a part of the county. The higher court ruled that the Bronx Valley Sewer Commission is agent for the entire county and the county is responsible for debts incurred by the commission.

The New Union Station at St. Paul, Minn., may be delayed by the refusal of the Chief of Engineers, Gen. Dan C. Kingman, U. S. A., to approve the plans submitted by the city for changing the channel of the Mississippi River in connection with the station. The City Council, in its haste to have work started on the new station, and urged on by the city's business interests, submitted skeleton plans showing only the new harbor lines and lacking in engineering detail. These have been returned and the Chief of Engineers has asked for detailed plans showing the necessary protection of the new river banks and proposed harbor and dockage plans for the accommodation of river traffic and ownership of levees. Early last spring the Union Depot Co. called for bids for changing the channel and held them awaiting the approval of General Kingman. These bids have now been returned to the contractors with the statement that the delay in approval of the new harbor line may make it impossible to start work this season

PERSONALS

Mr. J. L. White has been appointed Assistant to the General Superintendent of Transportation of the Atlantic Coast Line R.R.

Mr. James G. White, M. Am. Soc. C. E., President of the J. G. White Engineering Corporation, a member of the Board of Directors, has been elected Third Vice-President of the Merchants' Association of Greater New York.

Mr. Ambrose M. White, an Assistant Engineer of the Baltimore (Md.) Paving Commission, has resigned to take a position on the staff of W. D. Uhler, M. Am. Soc. C. E., Chief Engineer of the Pennsylvania State Highway Commission.

Mr. Waldo H. Marshall, M. Am. Soc. M. E., President of the American Locomotive Co., has been elected First Vice-President of the Merchants' Association of Greater New York, to fill the vacancy caused by the death of Mr. Albert Plaut.

Mr. B. F. Cresson, M. Am. Soc. C. E., has been appointed Chief Engineer of the Board of Commerce and Navigation of the State of New Jersey. This board combines the New Jersey Harbor Commission, the Riparian Commission, the Department of Inland Waterways and the Inspectors of Power Vessels.

Mr. R. H. Gould, who is associated with James H. Fuertes, M. Am. Soc. C. E., of New York City, has been appointed Resident Engineer of the new $300,000 sewage-disposal plant at Dallas, Tex. Mr. Gould was formerly with Karl Imhoff at Essen, Germany.

Mr. Irving C. Brower, Assoc. M. Am. Soc. C. E., Division Engineer of the Chicago & Alton R.R. at Bloomington, Ill., has been appointed Commissioner of Public Works of Evanston, Ill. He will succeed Mr. John H. Moore, who has resigned after holding that office for over 20 years.

Messrs. J. C. Workman and A. W. Cross have been appointed to newly created positions of Assistants to Managers of the American Shipbuilding Co. Mr. Workman will have charge of all engine departments, and Mr. Cross will be in charge of the hull departments of the company.

Mr. C. F. Crane, General Superintendent of the Eastern Pennsylvania Ry. Co., controlling traction lines over the greater part of lower Schuylkill and Carbon Counties, Pennsylvania, has resigned and will hold a similar position in Wilkes-Barre. Mr. George R. Williams, Superintendent of the Lansford division, will succeed Mr. Crane, and Mr. T. J. Collins, of Palo Alto, has been made Assistant Superintendent.

Mr. M. N. Baker, Editor of "Engineering News," has resigned from the Board of Health of Montclair, N. J., after serving for 21 years, during eleven of which he was President of the board. On July 1 Mr. Baker became a member and Vice-President of the new State Department of Health of New Jersey.

Mr. Nathan C. Johnson has opened an office in the Singer Building, New Work City, as a specialist in the production of high-grade concrete and in the causes and prevention of defective concrete construction. He has associated with him, as a specialist in reinforced-concrete design and construction, Mr. Walter S. Edge. Mr. Johnson has been engaged for some years in the study of the microstructure of concrete and the relation of that study to the methods of producing good concrete. Mr. Edge has had long experience with a number of contracting and engineering firms engaged in concrete work.

Mr. Albert Russel Erskine, First Vice-President and Treasurer of the Studebaker Corporation, has been elected President. Previous to his association with the Studebaker Corporation, Mr. Erskine was treasurer and member of the executive committee of the Yale & Towne Manufacturing Co. and later vice-president of the Underwood Typewriter Co., which position he resigned in 1911 to go to the Studebaker Corporation. Mr. F. S. Fish, who relinquishes the presidency, becomes chairman of the board, the executive and finance committees. Mr. C. C. Hanch, formerly of the Nordyke & Marmon Co., of Indianapolis, becomes treasurer.

Mr. Frank E. Winsor, M. Am. Soc. C. E., Department Engineer at White Plains of the New York City Board of Water Supply, has been selected as Chief Engineer of the Providence, R. I., Water-Supply Board, in charge of the development of the new municipal water-supply at Scituate. After graduation from Brown University, Mr. Winsor was appointed Engineer of the Massachusetts Metropolitan Sewerage System, having charge of the system embracing Boston and surrounding cities. Later he was Resident Engineer of the Natick, Mass., Sewerage System. In 1903 he became connected with the additional water-supply projects of New York City. Since 1910 Mr. Winsor has been Division and Department Engineer on the Catskill water-supply, in charge of construction in the southern aqueduct department.

Mr. G. R. G. Conway, M. Can. Soc. C. E., has resigned as Chief Engineer of the British Columbia Electric Ry. Co., Ltd., Mr. Conway has been appointed Consulting Engineer to the company, and in addition intends to take up private practice in Toronto. Previous to his association with the British Columbia railway, Mr. Conway was Consulting Engineer in connection with the construction of the Coquitlam dam for the Vancouver Power Co., and prior to his work in British Columbia he represented Mackenzie, Mann & Co. as Chief Engineer for the Monterey Railway, Light & Power Co. and the Monterey Water Works & Drainage Co., of Monterey, Mex. Mr. Conway was educated at the Hartley University College, Southampton, England. On leaving college he became assistant to the late Mr. James Mansergh, a former president of the Institution of Civil Engineers, and later Resident Engineer of the City of Aberdeen. Mr. Conway expects to open his Toronto office at the end of July.

OBITUARY

Louis C. Gaby, Civil Engineer of the Madison Coal Corporation, of Madison, Ill., died at his home in Edwardsville, Ill., on July 3, at 29 years of age.

John Grey Hoben, a civil engineer employed by the New York State Public Service Commission, died in Long Island City, N. Y., on July 6, at 31 years of age.

Samuel H. Lockett, formerly Chief of the Engineering Department of the Continental and Fidelity-Phenix Insurance Co.'s, died at his home in East Orange, N. J., on July 4.

George G. Kennedy, for 20 years Superintendent of the Harrisburg, Penn., Water Department prior to the inauguration of the commission form of government, died in that city on July 3 after a long illness. He was 51 years of age.

Robert Childs Scott, Secretary-Treasurer of the Morris Machine Works, of Baldwinsville, N. Y., died suddenly on July 3, in his 67th year. Mr. Scott was born at Oswego, N. Y., and received his education in the Oswego schools and Hobart College, at Geneva, N. Y. He entered the office of the Morris Machine Works in 1885, and on the incorporation of the company in 1892 became its Secretary and Treasurer.

Ernst Schild, who was in executive charge of the military construction works of the German War Department for a quarter of a century, died at his home in Charlottenburg on May 21 from a stroke of paralysis. He was in his 62nd year. Major Schild's works covered a wide field, from the building of military hospitals and sanitation to the water-supplies and drainage of large military communities and the designing of entire military towns for the assemblage of troops. He was a member of the Advisory Committee of the German Ministry of War.

Joseph A. Holmes, M. Am. Inst. M. E., Director of the United States Bureau of Mines since its creation in 1910, died July 13 in Denver, Colo., from tuberculosis. He was born at Laurens, S. C., Nov. 23, 1859. He was graduated from Cornell University in 1881 with the degree of B. S., and was subsequently awarded doctors' degrees by the Universities of Pittsburgh and North Carolina. He was Professor of Geology and Natural History at the University of North Carolina from 1881 to 1891 and State Geologist of North Carolina until 1904. From 1904 to 1907 Doctor Holmes was in charge of the United States Geological Survey laboratories for testing fuels and structural materials at St. Louis, Mo. He was then made Chief of the Technological Branch of the Survey in charge of the investigation of mine accidents, the work which was placed under the new Bureau of Mines in 1910.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
Aug. 16-18 and 25-28. Annual meeting in Los Angeles, Calif., Aug. 16-18; in San Francisco, Aug. 25-28. Secy., J. C. Olsen, Cooper Union, New York City.

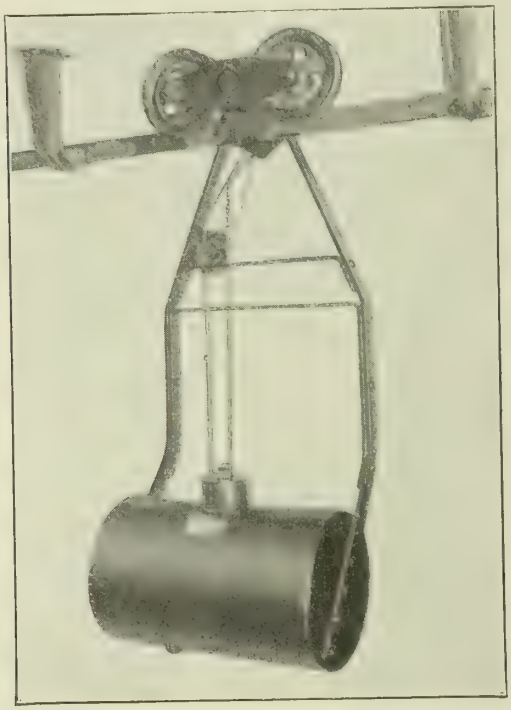
INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Aug. 24-27. Annual convention in Cincinnati. Secy., Clarence R. George, Houston, Tex.

San Francisco Conventions—The technical societies meeting in San Francisco from Aug. 19 to Oct. 20 were published in "Engineering News" July 1, 1915, p. 44. The list will be published again in an early issue.

Appliances and Materials

Cable-Oiling Car

To protect the track cables of aërial wire-rope tramways from corrosion, and to reduce the wear and friction, it is necessary to keep them thoroughly lubricated. Oiling from buckets by hand is practically out of the question, especially on long tramways. The accompanying view shows an auto-



CABLE-LUBRICATING CAR

matic track-cable oiler furnished by the Broderick & Bascom Rope Co., of St. Louis, Mo., for the maintenance of its aërial tramways.

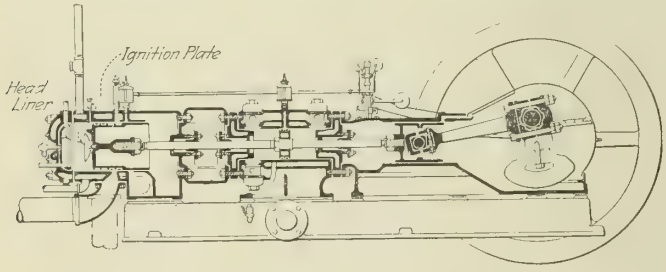
The device consists of an oil tank attached to a hanger and carriage in the same way as the regular bucket, and having a small geared centrifugal pump driven from one of the trolley sheaves. The oiler grips the hauling cable and is sent over the line in the same way as a bucket. As it travels along the oil is pumped up and sprayed on the track cables.

For the lubrication of the hauling line, this cable is passed, at the end of the line, through a box which has a grooved sheave, with its top above the surface of an oil bath. The cable takes up oil from this sheave and then passes between a pair of stiff wire brushes, by which the excess oil is removed and dropped back into the bath.

* * *

Oil-Engine Air Compressor

Because of the demand for an engine-driven air compressor taking cheap fuel, the Chicago Pneumatic Tool Co. has recently developed a design employing a two-cycle low-compression fuel-oil engine operating on anything between gaso-



OIL-ENGINE COMPRESSOR UNIT

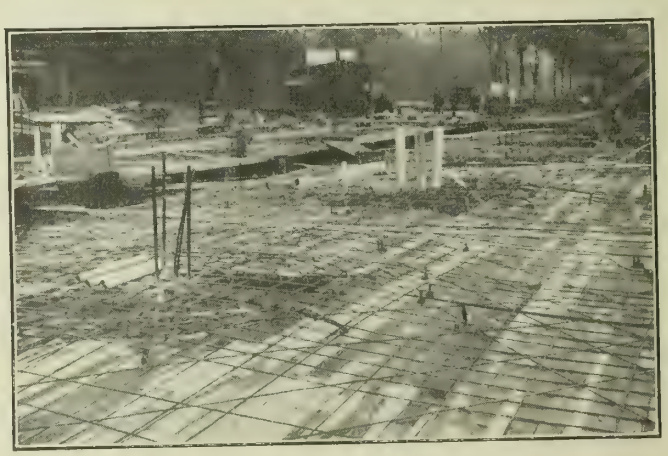
line and crude oil inclusive. The engine cylinders are valveless and carry integral water jackets over combustion spaces. Heads are single castings with jackets. The piston carries four spring rings and a charge deflector. Relatively high compression is given in the crank-end case. Only air is compressed in the power cylinder, the fuel being injected, at the end of the compression stroke, against a thin hot-plate on the piston. In starting, a torch-heated tube ignites the charge. The fuel pump stroke is controlled by a flyball governor; a needle valve, injecting water in with the fuel, is also governor-controlled.

The air cylinder and heads are water jacketed; the air piston carries two spring rings. Discharge valves on the bottom permit the escape of excess lubricating oil. Flat-disk, high-speed inlet and discharge valves are set radially in the cylinder. The air cylinder is unloaded on light loads by automatically holding the inlet valves open. The frame is fully inclosed, with access given by side and crank-case covers. The main bearings are integral with the frame and are babbitted. The shaft has a center counterbalanced crank of forged steel. The connecting rod is forged and has a solid wrist-pin end with bronze boxes; the crank end is babbitted. The cylinders carry sight-feed lubricators.

* * *

New Flat-Slab Floor

A new and improved type of girderless floor or flat-slab construction, known as the "spiral mushroom," is now being built by the C. A. P. Turner Co., of Minneapolis, Minn. The reinforcement consists of (1) a flat spiral over the column head, (2) slab rods running parallel to the columns and crossing over the column heads, and (3) diagonal bands running from midspan to midspan, thus not touching the column head reinforcement. According to the inventor, C. A. P. Turner, the new system "obviates the disadvantage of the cob-piling of the reinforcement in the old type and permits a more compact



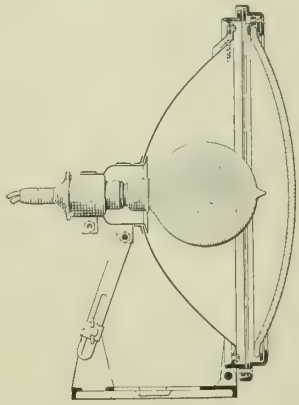
SPIRAL MUSHROOM FLAT-SLAB FLOOR

arrangement of the reinforcement resisting negative bending. The flat spiral, by circumferential stresses, resists radial deformation with considerably greater efficiency than radial reinforcement, and the slab steel is by this arrangement placed in much thinner layers, with greatly increased efficiency. The diagonal belts perform the function of ring ties, and by reference to the flat-plate theory it will be seen that they traverse the zone in which horizontal shear in vertical planes is the greatest."

* * *

Projection Lamp for Exteriors

To meet the demand for equipment adapted for flood-lighting of architectural exteriors, the General Electric Co., of Schenectady, has designed the projection lamp shown in the accompanying sketch. A polished aluminum parabolic reflector is mounted in an iron frame and closed in front with a plate of heat-resisting glass set in a waterproof packing. The reflector support is pivoted to a base plate, so that the axis of the beam can be shifted through various angles; a slotted link holds the reflector and base locked. The illuminant most commonly used is a 500-watt 1000-cp. gas-filled tungsten unit with concentrated filament. By moving the lamp in or out of the reflector the spread of the projected beam may be varied from 6 to 18 deg. The lamps are placed from 25 to 500 ft. from the surface to be lighted—on a roof, side wall or pole.



SECTION THROUGH PROJECTING LAMP

Engineering News

VOLUME 74 JULY 22, 1915 NUMBER 4

Stepped Concrete River Wall at Harrisburg, Penn.

By Joel D. Justin*

The City of Harrisburg, Penn., has just completed the construction of a stepped reinforced-concrete retaining wall along the Susquehanna River about 2½ miles long. The prime purpose of this wall was for the protection from ice and flood of an intercepting sewer along the river front that was completed in 1913.

The river front of Harrisburg constitutes the best residence section of the city, and throughout most of its length there is a narrow strip of parking on top of the river bank, which varies in height from 15 to 20 ft. above low water. With the completion of the dam across the Susquehanna River at the lower end of the city, it is expected that motor boating and canoeing will become very popular. Accordingly, it was decided to construct the wall in such a manner as to make it an integral part of the park system.

The position of the wall was so chosen that at minimum low water there will always be water at the bottom step of the wall. The grade follows very closely the gradient of the river at summer stages. The alignment consists of a series of long tangents and gradual curves throughout the river front of the city. With two exceptions the curves are all 1° and 2° curves, making the effect very pleasing to the eye.

At several points along the line of the wall it was necessary to provide landing places for the accommodation of parties engaged in the dredging of sand and coal from the river. At such points a cantilever reinforced-concrete retaining wall 8 to 10 ft. in height was used.

Throughout the entire length of the wall, removable electric-light posts are provided for, spaced 104 ft. c. to c. In the fall, when floods may be expected overtopping the wall, these posts can be disconnected and removed.

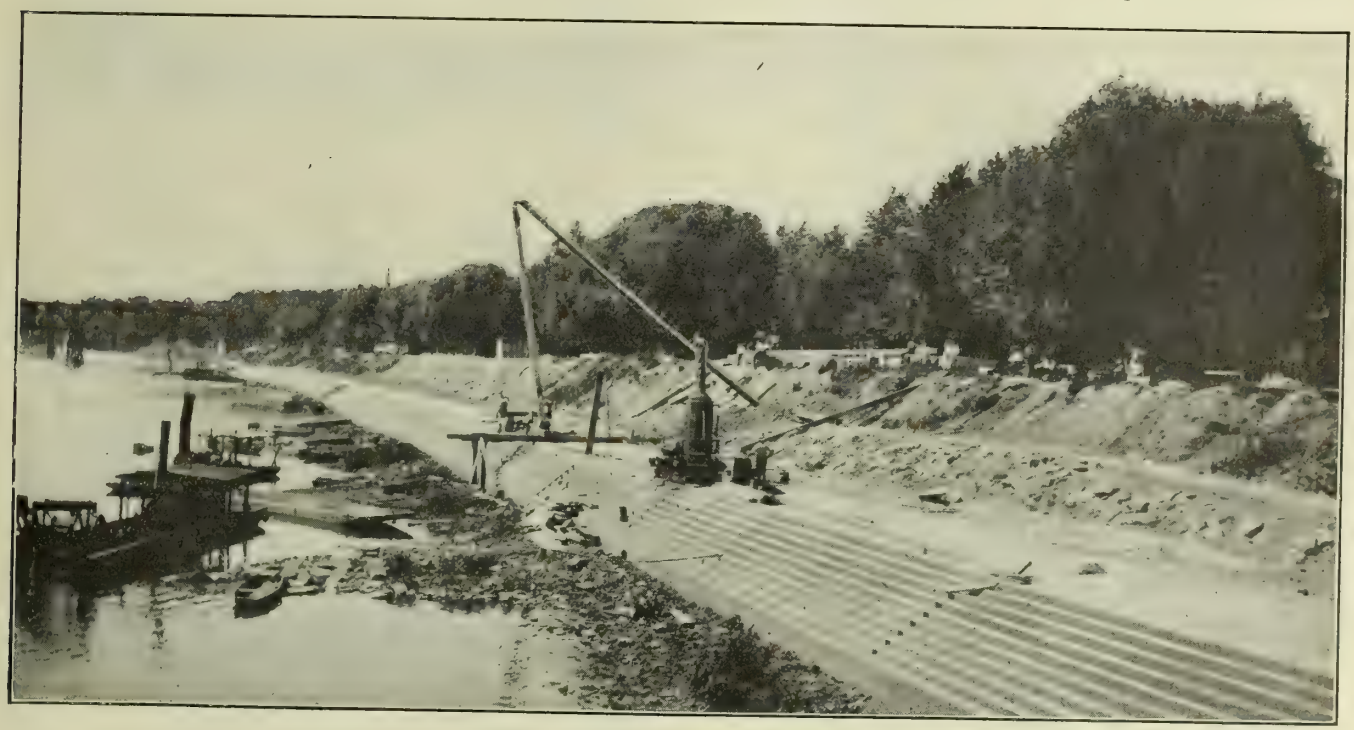


FIG. 1. THE PARTLY COMPLETED RIVER WALL ON THE SUSQUEHANNA AT HARRISBURG

Concrete buttresses spaced 8 ft. c. to c. and 12 in. thick were built to rock throughout the length of the work. These buttresses carry the reinforced-concrete steps and are fastened to them by ⅝-in. square quill bars set in the stringers and projecting into the steps. The latter have a 7-in. rise and 10-in. tread and vary in number from 9 to 14. Below the bottom step is the footwall, which in all cases runs down to rock and is fastened to the buttresses by ⅝-in. square quill bars. Back of the steps a 14-ft. granolithic sidewalk was constructed. The total height of the wall thus varies from 7 to 10 ft.

*Principal Engineer, Board of Public Works, Harrisburg, Penn.

The concrete buttresses were cast first, then the fill was made to approximate line and grade and the reinforced-concrete steps were cast in 8-ft. sections, the entire flight being poured in one operation. These steps were built in alternate sections. At one end of the section they were fastened to the buttresses by the 5/8-in. square bars, as described, while the other end was free to move horizontally, being merely beveled under the next section. Thus each 8-ft. section was a unit held rigidly in place at one end to the buttress, but free to move horizontally at the other end, although held in place by the bevel mentioned. The expansion joints thus located 8 ft. apart were greased with petrolatum to prevent adhesion of the concrete when the alternate section was poured. The use of this material also gave a slight but appreciable space between the sections. Each step was reinforced with two 5/8-in. square bars at the back and two 3/8-in. square bars at the front, against ice pressure from the river and earth pressure from the retained fill.

All concrete was mixed in the proportion of 1 part of cement, 2½ of sand and 4½ of crushed stone. The sand used was Juniata River sand and was excellent in quality, except that the grading of the particles from fine to coarse was poor, 80% passing the 30-mesh sieve and only 4% the 50-mesh sieve. The deficiencies in this sand were largely compensated for by the finer particles of the run of crusher stone. The crushed stone used was limestone from local quarries, maximum size 1 in.

The concrete in the buttresses, footwall and special retaining walls was mixed wet and thoroughly spaded. That for the steps and sidewalk was mixed so dry that considerable heavy ramming was necessary to make moisture come to the top. The steps and sidewalk had a wearing surface composed of 1 part cement and 1½ parts sand.

In the construction of the buttresses wooden forms were used. During the first season these were built up and torn down for each individual buttress. Inasmuch as there are some 1500 of these buttresses all of the same design and varying only in the number of steps provided for and in depth, this proved to be a very expensive method. About 500 buttresses were erected in this manner. The following season the panel system of forms was adopted and the forms were moved from buttress to buttress as the work progressed.

Sand, stone and cement were delivered along the line of the work by wagon. A ½-cu.yd. mixer, with cantilever arm and traveling concrete bucket, was used in concreting the stringers.

In the construction of the steps wooden "horses," or templates, set to line and grade and clamped on the top of the buttresses, were used. The forms to secure the beveled expansion joints were attached to these horses. To the risers of these horses were attached the riser boards of 2-in. plank lagging 7 in. wide, stiffened with 2x2x¼-in. steel angles. These risers were held in place by adjustable bolts fastened to the horses. The only bottom forms used for the steps were some strips of 1-in. plank used to retain the earth at the rear of the steps while the concrete was being placed. These were removed after part of the concrete had been placed. For the rest, the concrete was deposited on the earth embankment. The mortar surfacing for the risers was placed while the concreting was in progress by plastering the riser boards with mortar, care being taken to keep the mortar surfacing ahead of the concrete. The concrete and mortar surfacing, both of which were placed rather dry, were tamped together with small tampers. The concrete for the steps was mixed in a one-bag batch mixer, but it was found necessary to mix all mortar top coat by hand.

While fair alignment of the step forms and risers was attained, it was secured at the cost of a great deal of trouble and it is believed that money could have been saved by the use of steel horses and riser forms, which could have been more readily kept in line.

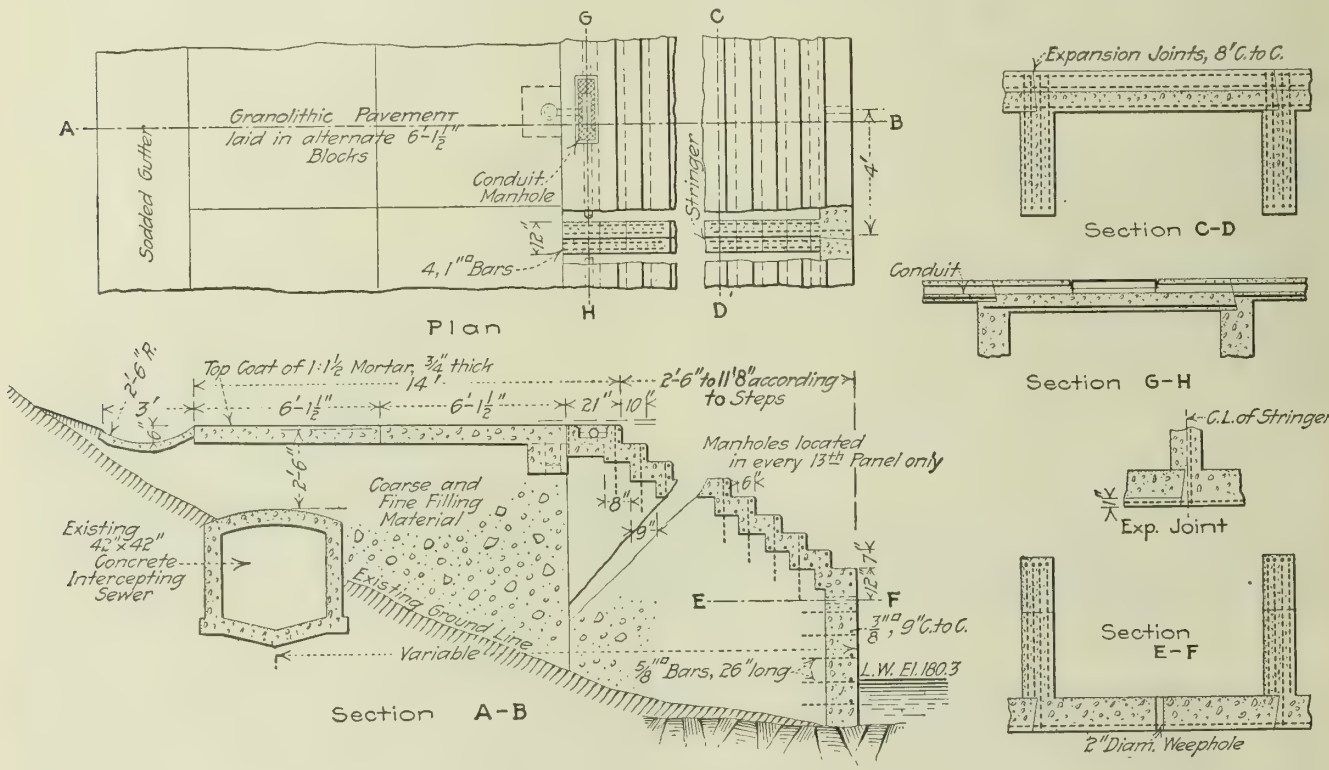


FIG. 2. DETAILS OF STEPPED RIVER WALL AT HARRISBURG, PENN.

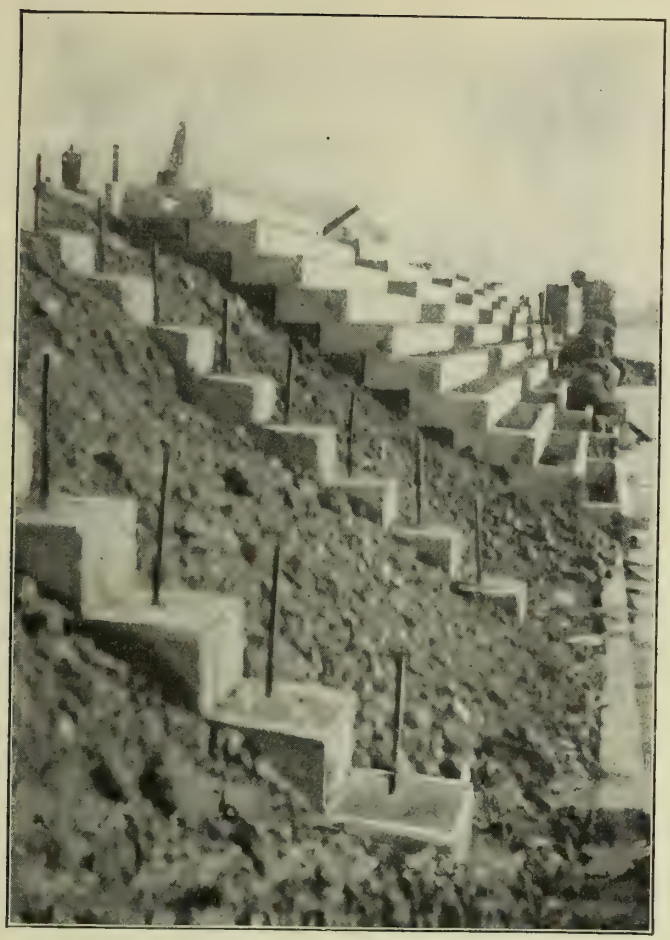


FIG. 3. LOOKING ALONG WALL DURING CONSTRUCTION

In the construction of the embankment all earth outside, and for a depth of 2 ft. below the top, of the footwall was required to be excavated. The remainder of the filling material came from borrow-pits along the line of the work and elsewhere at points specified by the engineer. No payment was made for embankment, but material was measured and paid for in excavation. The contractor was required to give 1500 ft. free haul, and allowance was made for any overhaul required at the price specified in the contract per 1000 ft. overhaul per cubic yard. A 20-ton shovel and bottom dump wagons were used for making the fill.

The construction of the sidewalks was carried on in 6-ft. alternate blocks, with a wearing surface of mortar ½ to ¾ in. thick, with expansion joints located 36 ft. apart. The method of placing this wearing surface on the steps and sidewalk is worthy of attention, as it is the only method, aside from the cement-gun, that absolutely assures the permanent adherence of the mortar wearing surface to the concrete base. The latter, whether sidewalk or steps, was placed so dry as to require considerable heavy ramming to bring moisture to the surface. The mortar top coat is mixed so dry that when a ball of it is formed in the hand it must be squeezed quite a bit in order to make water come to the surface. This top coat is then spread over the concrete base within a half-hour of the time of placing the latter, and is rammed and screeded into place. The surface is then finished at once with wooden floats and metal trowels. When the top coat is placed by this method with proper attention to details, it will never come off.

The writer has removed slabs placed in this manner and found that there was no dividing line between the top coat and concrete. In fact it was found impossible to separate the top coat from the base, the fracture occurring elsewhere in every case.

The contractor's plant consisted of a 20-ton shovel, one two-bag batch mixer, self-propelling and operated by steam, and one one-bag batch mixer operated by gasoline. At different times there were two additional mixers on the work, and of course there were the usual wheelbarrows, small tools, etc. Teams and wagons were hired by the day.

The quantities involved and the contract prices were as follows:

12,000 cu.yd. 1 : 2½ : 4½ concrete, at	$7.29
330 tons of reinforcing steel, at	50.00
12,000 lin.ft. of fiber conduit, at	.06½
12,000 lb. cast iron, at	.08
12,000 cu.yd. of excavation, at	.60
45,000 cu.yd. of excavation, at	.70
43,000 cu.yd. 1000-ft. overhaul, at	.08

The total cost of the work will be about $160,000.

The price of concrete is considered very low for this class of work, but the price on excavation was ample. Inasmuch as the contractor secured much of his material from excavations where he was also paid for doing the excavating by other parties, it is believed that he did not make out so badly on the contract as a whole after all.

The work was done by the Stucker Brothers Construction Co. of Harrisburg, under the direction and plans



FIG. 4. ALTERNATE STEP FORMS IN PLACE ON HARRISBURG RIVER WALL

of the Board of Public Works, and W. H. Lynch, Superintendent of Streets and Public Improvements. James H. Fuertes, of New York Ctiy, is Consulting Engineer of the Board. The writer is the Principal Engineer and Henry M. Gross was Assistant Engineer in immediate charge of construction.

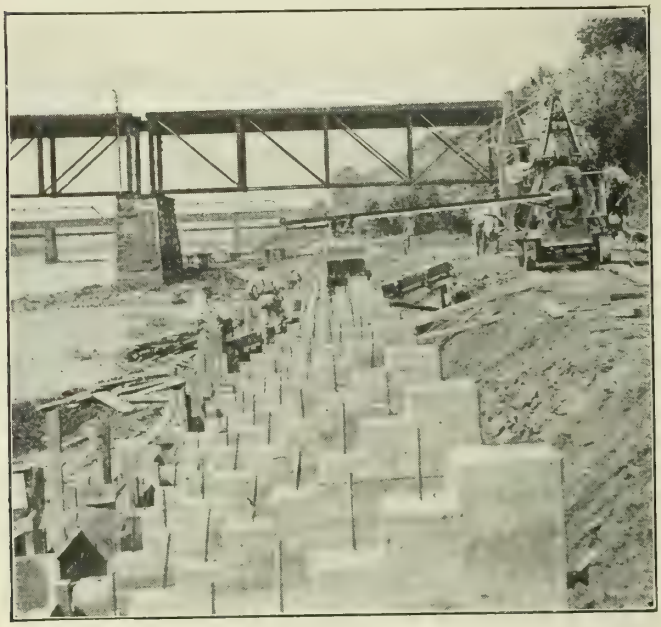


FIG. 5. CONCRETING WALL FROM TRAVELING MIXER

Determination of Rainfall Rates, Pawtucket, R. I.

By George A. Carpenter*

The writer has been interested for several years in a study of rainfall rates or precipitation, figures now regarded by engineers engaged in the design of storm-water sewers as of much greater importance than formerly. There are few rain gages on the market, however, from which such figures can be obtained with any degree of accuracy.

A number of years ago there came into the writer's possession an automatic recording rain gage made by the Draper Manufacturing Co. of New York. The rainfall was recorded on a chart measuring about 5x12 in. and intended to cover a period of seven days. This gave an hour interval of less than ⅛ in. and a space of 1 in. for each 0.1 in. of rainfall. The scale showing the amount of precipitation was sufficiently large to give even a greater degree of accuracy than was necessary, but the time scale was altogether too small for the computation of rates, although it answered perfectly the purposes for which the gage was made, namely, the recording of the beginning and ending of storms and the total amount of precipitation.

This rain gage, inclosed in its case, is illustrated in Fig. 1. In the lower right-hand corner of the view may be seen the train of wheels and striking arm which were added later, and the action of which will be explained.

The chart upon which the record is drawn is held by clips upon a plaque suspended from a moving carriage. The carriage is actuated by clockwork contained in the circular case shown at the top. The tilting bucket *A* catches the rain conducted to it through the tube *B* from the receiving funnel on the roof. The bucket is held in a rectangular frame running upon vertical guides and suspended from helicoidal springs. Attached to this frame and following it in its downward movement is the pen arm *C*, which terminates in the pen shown marking along the top line of the chart.

With a precipitation equivalent to ½ in. of rainfall, the bucket moves downward, carrying the pen to the lower limit of the chart; automatically dumps its contents and returns to the top of the chart, where it is again in position for a downward movement upon continuation of the rainfall. During this time the chart is moving at a uniform rate from right to left in front of the pen.

By increasing the diameter of a pulley the plaque holding the chart was made to travel faster and at a rate whereby the pen would move across the face of the chart in 24 hr. instead of in seven days. A new chart was drawn to conform to this increase of the time interval. On this chart the time scale is about ½ in. to an hour.

Even with this expansion of the time scale it was soon found that the rates of precipitation, which were of importance and of which an accurate record was desired, made lines so near the vertical that their inclination was difficult of interpretation. For example, rates of precipitation of 1 in. per hr., lasting for 5 min., made lines less than 1 in. in length and which departed from the vertical at the lower end only 0.04 in. And rates of 4 in. per hr., lasting for a similar period of 5 min., made lines 3⅓ in. long, departing at the lower end from the vertical by only the same amount, namely, 0.04 in. It is obvious that no accurate interpretation of intermediate rates can be made from lines so nearly parallel, and there are, in addition, mechanical inaccuracies of the instrument which preclude any such fine adjustment of its working parts.

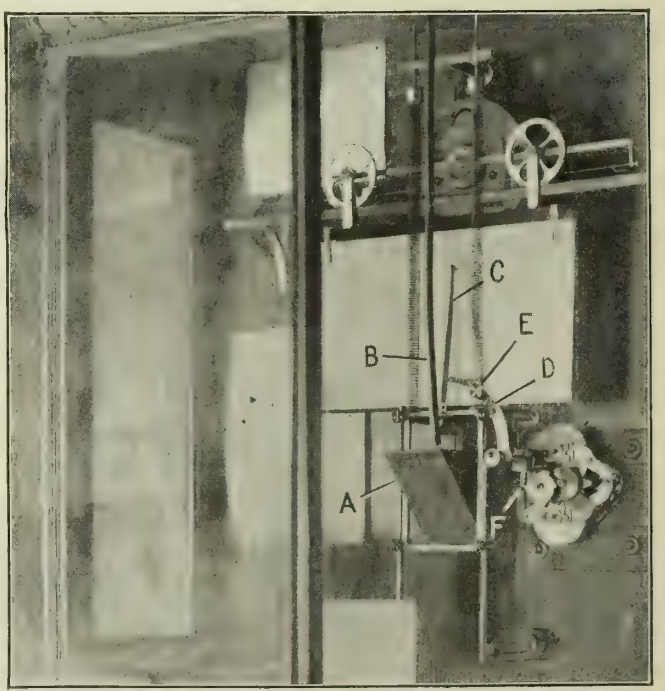


FIG. 1. MODIFICATION OF REGISTERING DEVICE OF DRAPER RAIN GAGE

The writer studied this instrument a long time before he hit upon the expedient finally adopted to overcome the

*City Engineer, Pawtucket, R. I.

difficulty and to produce an accurate record of rates. It was discovered that a slight blow upon the pen arm *C* of the instrument produced a perfectly legible tick, or dash, upon the record, and after that the solution was comparatively simple.

Working under suggestions from the writer, Schneider Brothers, of Jersey City, N. J., made a striking arm actuated by clockwork, which was installed in the case of the Draper gage, as shown in Fig. 1. At the left end of the striking arm *D*, but concealed by it in the illustration, is the hammer. The holes in this arm provide a variable location for a balance weight *E*, which regulates the blow, and the pawl *F*, bearing upon a ratchet wheel, raises this striking arm and hammer as the wheel revolves. At the upper limit of its movement the pawl drops off the tooth of the ratchet and the hammer in falling gives a slight blow upon the pen arm *C* of the rain gage.

The ratchet wheel revolves once in 12 min. and has six teeth, thus producing a blow of the hammer once in two minutes. The time between hammer strokes can be regulated by substituting a wheel having the proper number of teeth to produce the desired interval. A wheel with 12 teeth, giving a blow once each minute, was first tried, but the marks on the record were found to be nearer together than was necessary and therefore the time interval was increased to 2 min. by substituting a wheel with half the number of teeth.

Fig. 2 is a reproduction of a chart made by this instrument. An inspection of the chart will show how easily and accurately the rates of precipitation of the storm recorded may be determined.* Where the marks produced by the action of the hammer are so close together as to be uncertain in number, or indistinguishable, the rates of precipitation are less than 0.1 in. per hr. and are of no value for the record desired. All rates of any importance may be determined easily from these charts.

*Unfortunately, the dots on the original were so small that they do not show in the reproduction.—Editor.

In the original of Fig. 2 it could be readily seen that the maximum precipitation occurred between 5:30 and 6:15 p.m. As the space between any two horizontal lines on the chart represents 0.01 in. of rainfall, counting the number of such spaces between any two consecutive marks made by the hammer and multiplying this number by 30 will give the rate of precipitation, in hundredths of an inch per hour, for a period of 2 min. Counting the number of spaces between any three consecutive marks and multiplying by 15 will give the rate in hundredths of an inch per hour, which lasted for 4 min., and, similarly, the number of horizontal spaces between any of the marks produced by the hammer multiplied by 60 and divided by the number of minutes indicated by the hammer markings over the space under consideration will give the corresponding rate of precipitation in hundredths of an inch per hour for the period covered.

From the foregoing statements it is evident that an accurate interpretation of rates per hour can be readily determined for any length of time desired, and that such interpretation does not depend on any scaling of lines upon the chart, but can be read directly from the same.

FIG. 2. PAWTUCKET RAINFALL CHART, SHOWING RAINFALL RATES

The ruled face of the original chart is 5x12⅝ in., and is much more easily read than is this reproduction

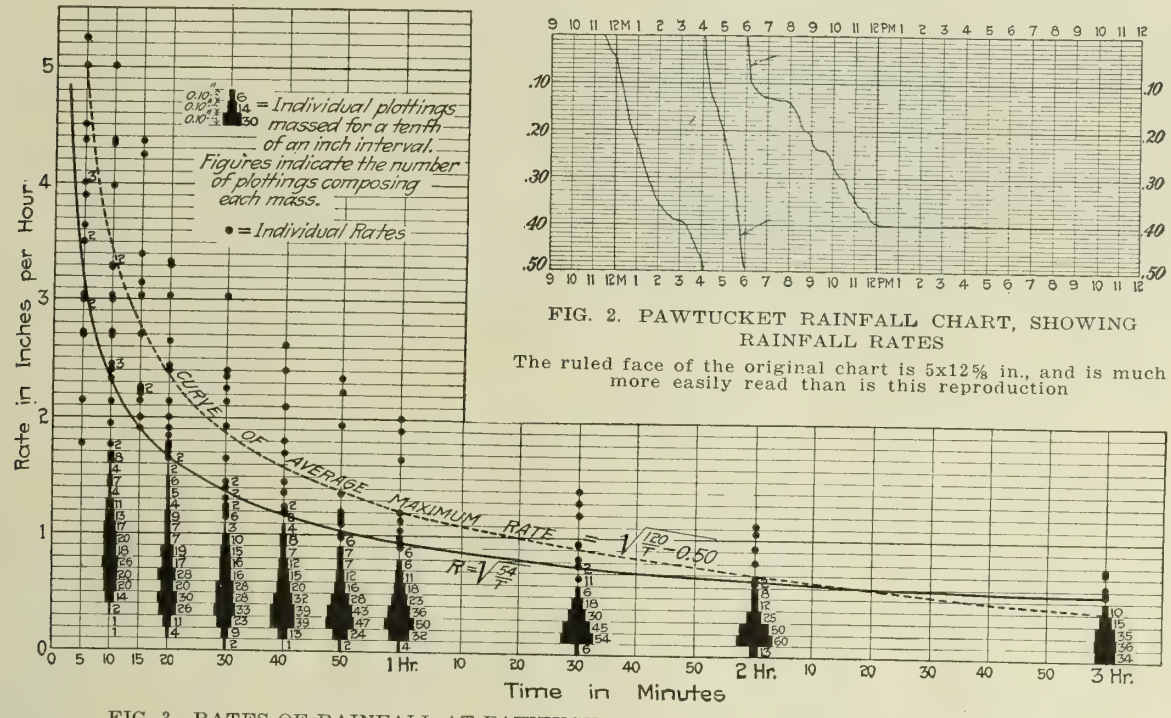


FIG. 3. RATES OF RAINFALL AT PAWTUCKET, R. I., JANUARY, 1902, TO JANUARY, 1912

A practical application of the data thus obtained is illustrated in the rainfall curve shown in Fig. 3. After determining rates of precipitation for intervals of 5, 10, 15, 20, etc., minutes for a period of years, these data are plotted as shown by the black dots of Fig. 3. Where these dots become so numerous as to be indistinguishable as to number, the expedient has been adopted of representing them by the *volume* of the area made solid black and by indicating the number of the dots by a figure placed opposite each black space.

The rates plotted in Fig. 3 cover all the storms of the ten-year period from January, 1902, to January, 1912, which had rates of precipitation of 0.75 in. per hr. or more. The arbitrary "curve of average maximum rate" was obtained by averaging the maximum rates of each year.

Automatic Block Signals on an Interurban Railway

The Oakland, Antioch & Eastern Ry. is an interurban electric line between Oakland and Sacramento, Calif., 85 miles long. The nine miles between the Oakland station and San Francisco is covered by running over the San Francisco & Oakland Terminal Ry. to that company's pier, where passengers are transferred to the ferry

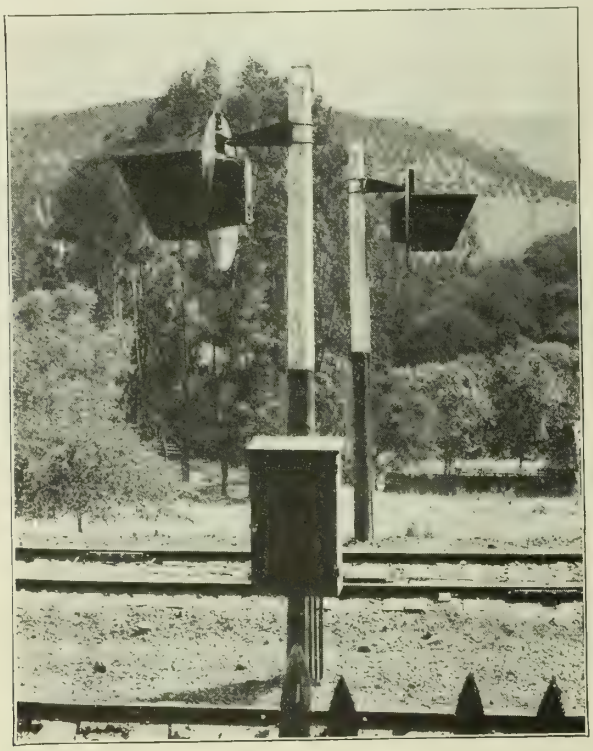


FIG. 1. ELECTRIC-LIGHT ALTERNATING-CURRENT AUTOMATIC BLOCK SIGNALS ON THE OAKLAND, ANTIOCH & EASTERN RY.

steamers. The road has a single track. Passing sidings, the majority of which are single-ended, are one to six miles apart. Substations 16 to 22 miles apart receive 60-cycle current from the hydro-electric plant of the Great Western Power Co.; one receives it at 22,000 volts, the others at 11,000. The substations deliver 1200-volt direct current for propulsion and 2200-volt, 60-cycle alternating current for the signal system.

As the line passes through much country in which traffic will be comparatively light for some years to come, it was desirable to keep the initial investment down to a minimum. In the signal system economy in construction has been combined with safety in operation.

Block-Signal System

The block-signal system consists of center-fed track circuits extending between pairs of home signals located at sidings, each home signal having its distant signal serving as a repeater. Track circuits were not allowed to exceed 7000 ft. in length. When the distance between sidings is greater than this, it is divided into two or more track circuits, all alike as to apparatus and arrangement. When the distance between sidings is greater than that desired between the home signals, intermediate pairs of home signals (with their respective distant signals) are installed, the apparatus being the same as at sidings except for the absence of the switch indicator. There are 42 blocks (averaging two miles in length) and 72 track sections for the 85 miles of line.

The signals are of the electric-light type, shown in Fig. 1, no semaphores being used. This has the advantage of eliminating all moving parts, and is therefore less liable to interruptions of service caused by the signal's getting out of order. It is very much cheaper, consisting of only two lamps in a hood designed to make them distinctly visible by day as well as by night (*Engineering News*, Dec. 24, 1914). The home signals are in pairs, as shown in Fig. 1, with a single distant signal in each direction. The box on the nearer pole contains the control apparatus, which consists of two line relays on an upper shelf and two galvanometer-type track relays below.

Each home signal gives red and green indications. The distant signal is located 1000 to 2000 ft. from the home signal and gives yellow and green indications. The yellow light shows at the same time as the red light of the home signal, giving the motorman ample time to get his train under control so as not to overrun the home signal if the latter still shows red when he reaches it. Fig. 2 shows a single-end siding, with the two home signals placed at the fouling point.

Opposing trains may approach each other to a common point at a pair of home signals, but each will have been forewarned by the distant signal. Thus opposing trains do not run blindly up to a pair of home signals indicating "stop" without previous warning of their position. A simple form of switch indicator is used, shown at the left in Fig. 2. This has only a green light. When the light does not show, the switchman must not open the switch to allow a train to leave the siding. The signal equipment was furnished by the Union Switch & Signal Co., of Pittsburgh, Penn., and includes 83 home and 84 distant signals.

Details of Circuits

Fig. 3 shows the circuits for a typical block consisting of one track circuit. When the block length is such as to require two track circuits, the additional connections shown by the smaller diagram (at the right) are intro-



FIG. 2. SIGNALS AT PASSING SIDING
Home signals at the fouling point and indicator to the left of the switchstand

duced in the middle of the block. It should be noted that the impedance bond permits the direct current for propulsion to flow without interruption past the insulating rail joints, but is practically a barrier against the flow of alternating current between two track circuits or between the two rails of one track circuit. In tracing

the signal circuits on the diagram the rails and track circuits should be considered as insulated from each other at insulating joints.

All track circuits are center-fed, having a galvanometer relay at each end. It will be seen by Fig. 3 that the control circuit of a block is carried through the track relay at the adjacent end of the next track circuit east of the block. This is done to secure a preliminary indication and obviate the possibility of two trains entering the block at opposite ends and meeting in the middle.

When a westbound train enters the track circuit just east of the block under consideration, the track relay at the west end of that track circuit is not operated at once, but when the train has advanced through about one-fourth of the track circuit the resistance of the rails between the train and the track transformer has fallen so low as to short-circuit the track relay, and the signals at the west end of the block are set to danger. If an opposing train has already entered this block, the two trains will be protected by the distant signals, as noted.

By this arrangement the necessary amount of alternating-current track-circuit equipment is reduced to a minimum. Line relays control the indications of the home and distant signals and of the switch indicators. Switch-circuit controllers are applied to the siding and other switches to give the necessary protection when a train is entering or leaving a siding or when a switch is left open for any other reason or through carelessness.

Two No. 6 bare copper wires extend the length of the signal system, carrying the 2200-volt alternating current. There are three No. 10 weatherproof copper line wires for the signal-control circuits and two additional similar wires extending from the home to the distant signals. The wires are all carried on the upper crossarm (Fig. 2), the five line wires on the left-hand side of the pole and the two 2200-volt mains on the right. A line transformer is also shown on the pole, connected to the 2200-volt mains and supported beneath them.

In the initial installation it was desired to avoid the expense of standard switch indicators and control wires. An effective substitute arrangement was provided by installing at the east end of double-end sidings and at the switches of single-end sidings electric-light indicators controlled by the adjacent signal-control apparatus. The indicator is shown at the left in Fig. 2.

The pair of home signals is located between the ends of double-end sidings. At a single-end siding with switch pointing to the west the home signals are west of the switch; where the switch points to the east they are at the fouling points (as in Fig. 2). With the indicator circuit as shown in Fig. 3 and with the location of signals as described, preliminary protection is given the indicator from each direction without the use of line wires and without sacrifice of safety.

At a double-end siding, cars must leave by the east end only, and the switchman must note that the indicator shows green as he opens the switch. On leaving the siding, an eastbound train proceeds without observing the home signal at that location, the signal indication having been duplicated in the switch indicator. A westbound train observes the indication of the home signal and thereby secures preliminary protection. These conditions apply also for movement out of a single-end siding with its switch pointing east.

When leaving a single-end siding with switch pointing west, the switch indicator is observed in the same manner and the proper home signal is observed before proceeding either west or east. For proceeding out of a siding of this class when the indicator shows green, preliminary protection between this movement and an approaching eastbound train is given by the time interval between the opening of the switch and the moment when the train reaches the westbound home signal, having covered the distance between the fouling point and the signal. This operation, being necessarily slow, occupies a period of time during which a train moving at high speed on the main track covers a comparatively long distance. Thus, as long as the signals and switch indicators are observed there can be no collision.

One point of objection is the time lost by an eastbound train waiting on a siding for a passing westbound train to travel the length of a block in order that the switch indicator may show green. This is not serious under the present conditions of light traffic. When increased traffic demands the elimination of this delay, a switch-indicator wire can be run the length of the block and two indicators (one for each direction) placed at each switch.

The reason for not leaving a double-end siding at the west end is that such a move could not be protected by a switch indicator without running an additional wire, because no preliminary protection would here be available, as at the east end.

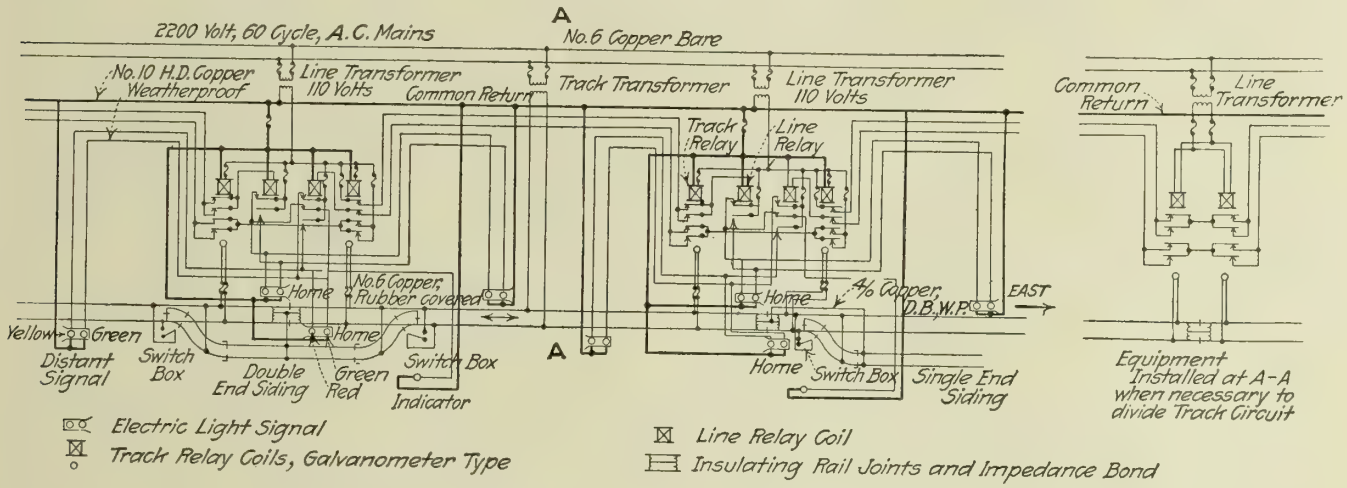


FIG. 3. DIAGRAM OF CIRCUITS FOR THE BLOCK-SIGNAL SYSTEM OF THE OAKLAND, ANTIOCH & EASTERN RY.

The April Floods in Texas*

By B. Bunnemeyer†

The floods that occurred in Texas during the last ten days of April, 1915, and the greater part of May, while far from approaching the severity of the record-breaking floods of December, 1913, are memorable from the fact that they caused a loss of 40 lives and an indeterminable, but immense, damage to crops. The latter had to be replanted not only in the flooded area but also in sections where the soil had been washed by heavy rains. Incomplete returns give an estimated damage of $2,354,125 (exclusive of losses sustained by railroad, telegraph and telephone companies), classified as follows:

	Watersheds				
	Colorado	Brazos	Trinity	Guadalupe	Total
County bridges, roads, buildings, etc.	$650,750	$159,900	$15,400	$500	$915,425
Crops	5,250	1,324,000	6,000	6,500	1,341,750
Live stock	..	68,825	..	..	68,825
Suspension of business	..	102,500	10,000	4,500	117,000
Total	$656,000	$1,655,225	$31,400	$11,500	$2,423,000

The deaths occurred in the creeks, which were rapidly converted into raging torrents by the heavy rains and caught the people unawares. Of the 40 deaths, perhaps 8 could have been prevented by the exercise of a little caution.

Considerably over one-half of the total damage reported was due to loss of crops in the field; over one-third consisted of damage to buildings, bridges and roads, mostly in the city of Austin; and the remainder (less than one-twelfth) represents losses by suspension of business and drowning of live stock. Railroads suffered considerably from washouts and interruption of traffic.

From Apr. 14 to 20, 1915, a series of local showers occurred over the Guadalupe, Colorado, Brazos and Trinity watersheds, which became sufficiently cumulative to justify the issuance of warnings on Apr. 20 for the Guadalupe and lower Colorado. Most of this water soaked into the ground and no dangerous rises occurred. On Apr. 21 the precipitation was too light to affect the streams, but on the 22nd unusually heavy showers set in, which were reported on the morning of Apr. 23 and resulted in an immediate issuance of flood warnings for the Guadalupe, middle and lower Colorado, middle and lower Brazos and upper Trinity.

Colorado River Flood

The Colorado River began to assume a serious stage all along its course during the night of Apr. 22 and 23. A heavy rain set in at Austin about 7:45 p.m., and by midnight as much as 8 in. of water had fallen. The rain converted Waller and Shoal Creeks into raging torrents, and the flood damage and loss of life at Austin were almost entirely due to the overflows of these creeks. Shoal Creek empties into the Colorado below the Austin Dam and about one-half mile above Congress Ave. wagon bridge, on which the river-gage is located. Waller Creek flows into the Colorado at a point about one-half mile below that bridge. The river gage therefore showed only the flood waters coming in from Shoal Creek. The channels of these creeks are naturally narrow, and on Waller Creek houses had been built to the edge of the banks. The width of either stream at the time of the crest did not exceed ¼ mi., and possibly 6 sq.mi. of territory was submerged. The depth of the water in the middle of the channels was probably as much as 30 or 40 ft.

A second flood occurred at Austin on the afternoon of Apr. 25, with gage reading 17.5 ft. at 3 p.m. and 17.8 ft. at 7 a.m. next morning. These two floods had a fall of 8 ft. between their crests at Lagrange; but at Columbus the fall was not pronounced. At the latter station the crest passed at 4 p.m., Apr. 28, with gage reading 36.3 ft. This is 7.8 ft. lower than that recorded during the flood of December, 1913. The width of the flooded area below Columbus was from ½ to 2 mi.

Brazos River Flood

The flood in the valley of the Brazos River was much more severe than that of the Colorado, so far as property damage is concerned. But there were only five deaths by drowning. At Valley Junction, however, the flood was severe, due to an immense volume of water coming in from the Little River. On the morning of Apr. 23 unusually heavy rains were reported from the Little River watershed, with 8.29 in. at Taylor and 7.30 in. at Cameron. The river observer at Valley Junction reported a stage of 26 ft. at 7 a.m. on Apr. 23, and on the following morning he reported the gage under water and inaccessible. Later he found that the height of the water on Apr. 24 corresponded to a gage reading of 50 ft. This is 5 ft. less than the crest of the record flood of December, 1913. The crest of the flood was at Washington at 7 p.m. Apr. 27, with a stage of 52.9 ft. The stream remained stationary for 12 hr. and then began to fall slowly. It reached Hempstead on Apr. 29, with a stage of 46.5 ft.; and Rosenberg at 11 p.m. May 1, with a stage of 46.4 ft. No records were obtained from either Washington or Rosenberg in December, 1913, but at Hempstead the stream was 6.3 ft. higher in December, 1913, than in the present flood. The width of the stream ranged from about 1½ to 5 mi. at and below Valley Junction, and a few of the smaller towns were partly under water. Lowlands were deserted before the water came and stock and property moved out as far as possible.

In some places sandbanks 3 to 5 ft. high washed up, and in other places big holes and gullies were left. The crest of the flood reached the Gulf on May 6.

Trinity River Flood

The flood in the valley of the Trinity River was comparatively mild, and the resulting losses were small when compared with those sustained in the Brazos and Colorado overflows. The stream was strongly fluctuating above Dallas from Apr. 22 to 27; but at Dallas there was a continuous rise after the flood stage was reached on Apr. 23. The crest occurred at 7:30 p.m. Apr. 29 with the stage at 36.7 ft.

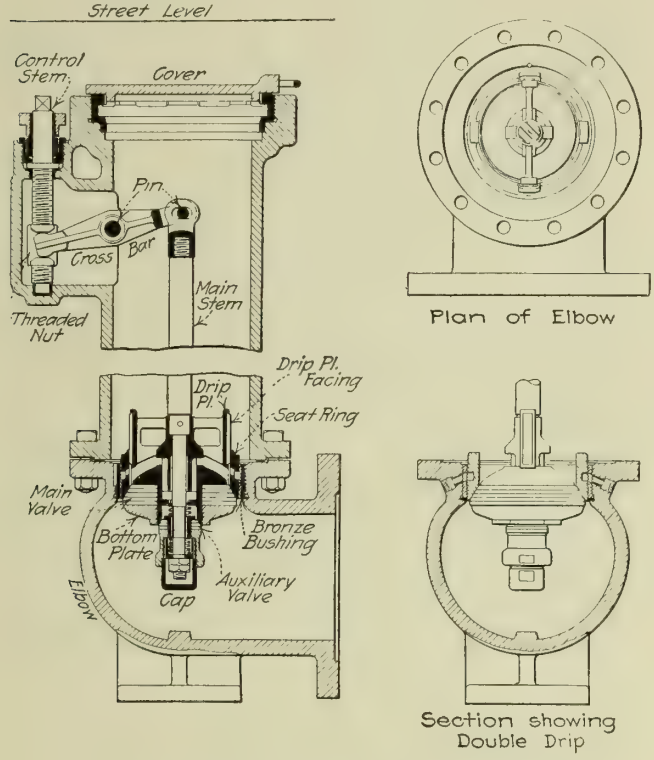
The Guadalupe flood was of comparatively short duration at Gonzales. On Apr. 21 the river got bankful at that place and then fell rapidly, but rose again on Apr. 24, and by 5:30 a.m. Apr. 25 attained a stage of 30 ft., which was the highest reported. The flood had subsided by May 5.

*The record-breaking floods in Texas in December, 1913, which caused the loss of 177 lives and property valued at $8,000,000, were described in detail by Mr. Bunnemeyer in "Engineering News," May 21, 1914, pp. 1116-1121.

†Section Director, Weather Bureau, Houston, Tex.

Cincinnati High-Pressure Fire Hydrants

The Cincinnati high-pressure fire service is being equipped with the interesting design of hydrant shown in the accompanying sketch, as made by the Kennedy Valve Manufacturing Co., Elmira, N. Y. The hydrants are designed for a working pressure of 300 lb. per sq.in. and are tested to 600 lb. The design is unusual in having the top slotted to take a head on which are the hose outlets, this feature not being found elsewhere except in the Baltimore high-pressure hydrants. These heads are carried on the hose wagons and engage by one-sixteenth turn. The hydrants are set in vaults, their tops being about 4 in. below street level. Where possible they are located between the car tracks, for accessibility and freedom from snow.



CINCINNATI HIGH-PRESSURE FIRE HYDRANT
Without hose head

Hydrant Design

The hydrant consists primarily of three parts—the elbow or inlet for introducing the water, the gate and its operating mechanism for controlling the flow of water, and the standpipe or outlet for delivering the water.

The elbow is a flanged female part made of "semi-steel." Into this elbow a bronze bushing is screwed and pinned. This in turn receives the bronze seat-ring, which can be unscrewed with a wrench and removed through the standpipe. The seat-ring has a tapered seat for the valve leather and is slotted out for the drip-plate; it is also drilled and grooved so as to carry away the waste water.

The gate is made up of the main valve, which is of leather, the bronze top plate and the cast-iron bottom plate. A hole through the center of the top plate terminates at its lower end in a tapered seat for the auxiliary valve.

The standpipe is 9 in. inside diameter, has a ¾-in. wall and is made of "semisteel." Its upper end terminates in a bronze bushing which is slotted to take the hydrant-head previously mentioned.

Operation of Hydrant

When the hydrant is to be used, after its installation, the street-cover is removed from over the vault and the hydrant-cover lifted off. Then the hydrant-head is slipped into the bushing and turned to lock it in place. The joint is sealed by a rubber gasket which fits into a groove on the lower end of the head. This gasket being slightly larger in diameter than the bore of the bushing is thus partly compressed; the water pressure does the rest.

A wrench is applied to the square head on the top of the control-stem; this being turned, the main stem is moved through the threaded nut, the crossbar and the pins. The main stem carries with it the drip plate, which is faced with leather. The first movement of the stem carries the leathers over the drip holes in the seat-ring and prevents the waste of any water as it flows through the hydrant. Movement of the stem is continued until the end of the stem strikes the bottom of the cap, whereupon its further movement opens the auxiliary valve, allowing water to enter and fill the hydrant through the hole in the top plate until the hydrant and the head are full and the pressure is equalized. Still further movement of the stem opens the main valve, allowing the free passage of water. The hydrant-head is furnished with five independent hose valves which control the further delivery of water.

Springs are necessary to keep the main and auxiliary valves against their respective seats while the hydrant is being closed, thus preventing "water-hammer." These springs also serve another purpose by preventing the drip-plate facings from uncovering the drip holes until the valves are closed and pressure shut off from the hydrant.

All bearing or wearing surfaces are of bronze or heavily bushed with bronze. The iron surfaces are thickly coated with rust-resisting paint. The specifications required the following strengths of material:

	Tensile Strength, Lb.	Yield Point, Lb.	Elongation in 2 In., %	Deflection 2x1x24-In. Bar, In.
"Semisteel"	30,000			0.40
Manganese bronze	70,000	35,000	20	
Bronze	30,000			
Mild steel	60,000 to 68,000	At least ½ of tensile strength	25	

High-Pressure System

The Cincinnati high-pressure fire system was designed and is being constructed by J. A. Hiller, general superintendent of the Cincinnati Water-Works.

The congested-area district to be protected is surrounded by a 20-in. ring main with two 16-in. cross mains. From these, 12-in. lines run across the district. There are four valves at each cross and three at each T, so that any block or blocks can be cut off without interfering with any of the others. These valves are in vaults with manhole covers marked to distinguish them from hydrant-vault covers. The pipes are of double-grooved hub-and-spigot cast-iron pipe, tested to 600 lb. Special parts are of "semisteel." Completed mains are tested to 400 lb. before covering.

The high-pressure pumping station, at Eighth St. and Eggleston Ave., takes filtered water at 55 lb. pressure from three city mains, a 36-in., a 40-in. and a 48-in. The station has a capacity of 75 million gallons per day.

Reinforced-Concrete Cap of Perry Memorial Column

By Howard C. Baird*

The principal feature of the Perry Memorial† at Put-in-Bay, Ohio, is a hollow shaft 300 ft. high, in the form of a Doric column, built of granite backed with concrete. It is 45 ft. in diameter at the base, 35 ft. 6 in. diameter at the echinus, and has a uniform inside diameter of 27 ft. 6 in. The abacus, or cap, which is 47 ft. 6 in. square and 7 ft. 6 in. deep, surmounts the shaft. On this cap is an

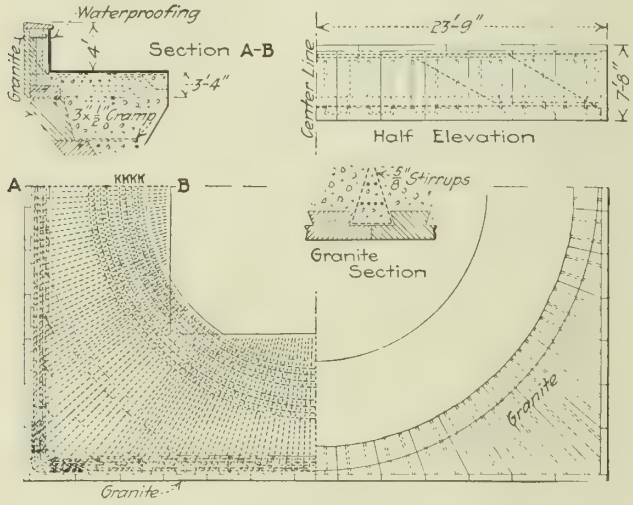


FIG. 1. REINFORCEMENT OF COLUMN CAP, PERRY MEMORIAL COLUMN, PUT-IN-BAY, OHIO

attic 17 ft. high, with a domed roof, which carries a bronze lantern 18 ft. high and weighing 11 tons.

The well, 27 ft. 6 in. in diameter, contains a reinforced-concrete frame carrying the elevator and a staircase of reinforced concrete. This construction is supported by a double set of reinforced-concrete girders 23 ft. above the base, the lower surfaces so shaped as to fit into the concrete and limestone dome over the crypt.

The structural design of the abacus, or cap, owing to architectural requirements, is somewhat unusual, and its erection was necessarily difficult, calling for a carefully devised erection outfit and very accurate placing of material under extremely disadvantageous conditions.

It was required by the architects that the granite facing forming the ceiling and sides of the cap be so secured to the construction that there would be no chance of discoloration from metal fastenings; and it was further required that the cap be adapted for use as a lookout, the floor being made of such depth as would allow the sides to form a parapet high enough to provide for the security of observers.

The method of attaching the 12-in. thick granite facing to the concrete of the soffit and the sides of the cap, as adopted, consisted in cutting the stones to 6 in. thick at the joints, so that the middle portions formed dovetail projections, the spaces between them having a similar shape to receive the concrete. The facing, when carefully placed in position on the falsework, made the forms for the concrete floor and parapet walls, and the concrete when placed filled up the recesses, thus firmly locking the granite slabs and the concrete together. Although the tension value of the dovetail sections of concrete is ample to support the granite, light steel reinforcement bent to shape was placed vertically in the recesses to provide security against any possible cracking.

The design of the carrying construction of this cap calls for a floor 3 ft. 6 in. thick, which, in addition to carrying its own weight and a live-load of 100 lb. per sq.ft., carries the parapet girders forming the side of the cap. The method of computing the stresses was as follows:

The floor of the cap was divided into 52 radial sections of constant depth and variable breadth, and each of these sections was considered as a cantilever supported at a point on a circle 41 ft. in diameter. The relative deflections for a load of unity at the extreme end of each of these cantilevers, varying in length from 3 to 12 ft., was then found, and the weight of the 7-ft. 6-in. parapet girder was so apportioned as to cause an equal deflection at the ends of all cantilevers, the girders being regarded as rigid owing to their comparatively great depth.

The bending moments and shears were then found in all these members, based on the above-cited distribution of load, and the reinforcement was computed accordingly. The horizontal forces from the maximum bending moments of the cantilevers were assumed to be taken up at the shaft by two rings—a tension ring 31 ft. in diameter, consisting of four 1⅛-in. rods, marked *K* in Fig. 1, and a compression ring formed of the concrete in the shaft. These rings, to be in direct tension or compression, would not be circular, owing to the variation of the horizontal forces; but the great excess of concrete provides for the flexural stresses in circular rings, the stresses in both the steel and concrete being kept within prescribed limits.

The load of the cap carried by the cantilever floor sections to the shaft causes a cantilever action on the two

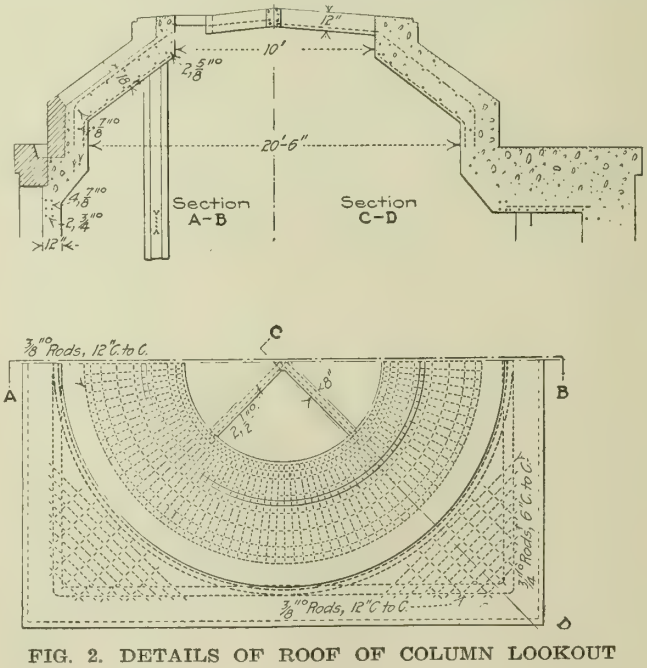


FIG. 2. DETAILS OF ROOF OF COLUMN LOOKOUT

courses of the echinus, the tension stresses being resisted in each case by 3x½-in. cramps carried back into the concrete and embracing a tension ring consisting of four ¾-in. rods, the concrete of the shaft forming the necessary compression ring as above.

In addition to the dead-loads, a live-load of 100 lb. per sq.ft. was assumed on the floor of the cap and 60 lb. per

*Boller, Hodge & Baird, Consulting Engineers, 149 Broadway, New York City.

†Described in "Engineering News," July 23, 1914, p. 172.

sq.ft. on the entire stairway for designing the columns and lower girders, in addition to the elevator loads.

During erection the cap was carried on temporary timber supports suspended from timber frames erected on the top of the shaft, and so arranged that no rods or other temporary members penetrated the concrete and granite construction, thus obviating any patching or filling up of holes in the facing of the finished column.

The architects for the Perry Memorial are Freedlander & Seymour; the consulting engineers, Boller, Hodge & Baird. The contractors for the column were J. C. Robinson & Son, who devised the erection outfit.

Cleaning a Water-Supply Main at Merced, Calif.

The successful cleaning of a long water main of moderately large diameter, without serious interruption to the service, was recently completed in Merced, Calif.

In 1888 the Yosemite Lake Reservoir was finished and the distributing pipe installed from the reservoir to a pump house at the easterly side of the city of Merced, a distance of 24,570 ft. From the pump house the line was extended across the city, a distance of 7080 ft., making a total length of 6 mi. of cast-iron bell-and-spigot pipe, all 16 in. in diameter, laid in almost a straight line for its entire length. The pipe line has numerous outlets from which water can be drawn for irrigation purposes, and in the extension across town there are the usual number of laterals required for domestic water distribution.

During the 27 years the line has been in continuous operation it has become very much incrusted, and consequently its capacity has been materially reduced. Due to this incrustation, in order to maintain an adequate supply and pressures at times of peak consumption and fires, it has been necessary for some time past to augment the supply by pumping from deep wells at the pumping station mentioned. This station is equipped with three centrifugal pumps, each with its independent drive, and each pump can draw water from either of two deep wells at the station, or from the main from the reservoir, or from both wells and main, and deliver it to the city system.

An arrangement of connections, valves and weir-box permits measurement of the water from the reservoir to the pump station, or the amount being drawn from the wells. At the time of the last investigation before the pipe was cleaned the discharge from the reservoir to the weir at the pumping station was 1220 gal. per min. under a static head of 76 ft. This is less than 60 per cent. of the discharge given in the Weston tables for flow under the given head through the same length of clean cast-iron pipe.

A contract was entered into between the owners of the water-supply and the National Water Main Cleaning Co., whereby the latter guaranteed to increase the capacity to 95 per cent. of the standard tabulated in the Weston tables for clean pipe of the same length and dimensions. A static head of 81 ft. was selected as being a fair mean of the high and low water in the reservoir. For this head and a length of 24,500 ft. of 16-in. main the discharge tabulated for clean pipe is 2285 gal. per min. Ninety-five per cent. of this would be 2170 gal. per min. The contract provided for a penalty in case the quantity delivered after the pipes were cleaned fell short of 2170 gal. per min. and a corresponding bonus if this amount were exceeded. As the discharge through the incrusted pipe was only 1220 gal. per min., an increased capacity of almost 80 per cent. was thereby guaranteed.

The device used for cleaning the pipe is shown in the accompanying photograph. In its operation and propulsion the turbine motor principle is applied, the water pressure behind the machine forcing it forward through the pipe and at the same time rotating the vanes and scrapers that remove the incrustation. For pipe 10 in. or more in diameter the machines are all self-propelling. Through pipe of smaller diameter they must be pulled with wire cables.



PIPE CLEANER AND DEPOSIT REMOVED

As noted in the foregoing, the pipe line at Merced was practically straight, having in its entire length no sharp bends or elbows. This condition is favorable for the use of the method described, since it diminishes the number of cuts that must be made in the pipe. In a straight pipe this number will be determined by the amount of incrustation in the pipe. The photograph shows the amount of deposit removed from the 7080 ft. of 16-in. pipe between the pump station and the end of the town main. This distance was traversed without removing the machine from the pipe line. The material removed from the pipe in this distance made a pile 10 ft. in diameter and 4½ ft. high.

Both before and after the pipe was cleaned the discharge was measured by directing the flow through a well-constructed concrete weir-box, provided with a thin steel plate crest 36 in. long. After cleaning the pipe, the depth of water over the weir was 7.75 in. By Smith's modification of Francis' formula, the quantity then flowing was $3.29\left(L-\frac{H}{10}\right)H^{\frac{3}{2}}$, or 2249 gal. per min. By the same method the flow before cleaning the pipe was 1220 gal. per min. The amount guaranteed was 2170 gal. per min.; so a bonus was earned by the contractors. The total cost for cleaning the pipe amounted to 15c. per lin.ft.

Orla Casad is superintendent of the water service for the town of Merced. B. B. Hodgmann, Chief Engineer of the National Water Main Cleaning Co., performed the contract and E. P. Jones was the consulting hydraulic and mechanical engineer.

Tests of Frictional Resistance of Concrete on Shale

By E. L. Lasier*

SYNOPSIS—A determination of the value of coefficient of frictional resistance to sliding of concrete blocks on shale, shale on shale and concrete cast on shale. Made on shale foundation of dam under construction.

Two years ago, during the early stage of construction of the so-called State Line Dam of the Hydro-Electric Co. of West Virginia, a series of experiments was conducted to determine the coefficient of frictional resistance against sliding. The dam is being constructed on Cheat River in West Virginia near Cheat Haven, Penn. It is of mass concrete. The foundation is a hard, dark bluish shale without pronounced laminations. In the belief that a report on the tests conducted will be of value to engineers, and with the approval of F. W. Scheidenhelm, Consulting Engineer and Chief Engineer of the Hydro-Electric Co. of West Virginia, the writer presents herewith the results of the experimental study.

It was desired to determine the value of the coefficient of frictional resistance to sliding offered by concrete upon shale and shale upon shale without bond resistance; also by concrete upon shale with bonding resistance included. Further, it was sought to ascertain the comparative value of the coefficient (more commonly known as the "coefficient of friction") when the surfaces of contact are dry and when they are thoroughly wet.

In the determination of the coefficients of friction without any bonding resistance, for both concrete on shale and shale on shale, and with the surfaces of contact both

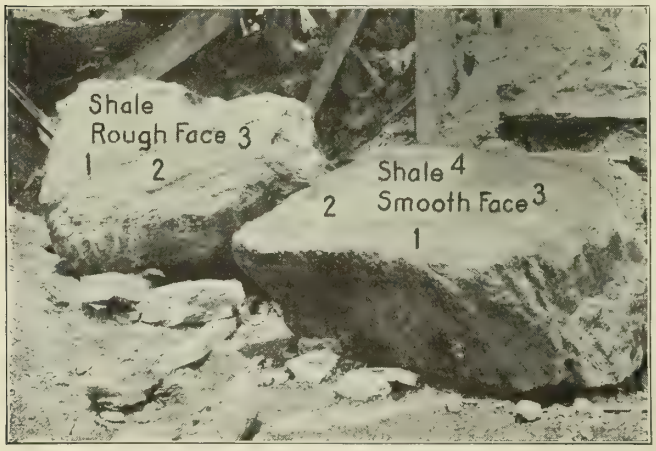


FIG. 1. TWO LARGE BLOCKS OF SHALE ON WHICH SPECIMENS WERE PLACED

dry and wet, the materials shown in the photographs (Figs. 1 and 2) and the device shown in Fig. 2 were used.

Two large blocks of shale (Fig. 1), each having a face approximately 3x4 ft., were selected. One of these blocks had a rough face; the other a smooth one, although the photograph gives the exaggerated impression that the latter is smooth to the extent of being polished. Upon the face of the rough block three reference localities were selected, numbered 1, 2 and 3, of varying degrees of roughness; upon the smooth block four reference localities were selected, numbered 1, 2, 3 and 4, of varying degrees of smoothness. Upon these relatively large surfaces of shale, concrete and shale specimens were successively placed and the large shale blocks jacked up until the specimens placed upon them commenced to slide.

The concrete and shale specimens used, together with the condition of the faces used in contact, are shown in



FIG. 2. SHALE AND CONCRETE SPECIMENS AND SLOPE MEASURE

the photograph (Fig. 2). The concrete specimen was a 6-in. cube, five months old, made of Cheat River crushed gravel and sand. The shale specimen had an area of contact of approximately 8x8 in. and was 4 in. thick.

The device used for measuring the slope of the face of the stationary shale block at the instant sliding commenced is likewise shown in Fig. 2. It consisted of two wooden pieces at right angles to each other. The piece with the level on it was used as the horizontal leg, free to move up and down in the same vertical plane. The vertical leg was graduated in inches. The effective length of the horizontal leg was exactly 10 in. Thus the components of the tangent of the angle formed with the horizontal by the face of the stationary block at the time the

TABLE 1. COEFFICIENTS OF FRICTION

Concrete Specimen on Stationary Shale Blocks

Smooth Stationary Block of Shale			Rough Stationary Block of Shale		
Reference Location	Dry	Wet	Reference Location	Dry	Wet
1 very smooth	0.61	0.63	1 fairly rough	0.75	0.73
1 very smooth	0.65	0.62	1 fairly rough	0.79	0.68
2 smooth	0.73	0.69	2 rough	0.78	0.73
2 smooth	0.72	0.69	2 rough	0.88	0.75
3 fairly smooth	0.72	0.67	3 very rough	0.88	0.81
3 fairly smooth	0.74	0.66	3 very rough	0.94	0.78
4 slightly rough	0.73	0.70			
4 slightly rough	0.73	0.69			
Average	0.704	0.669		0.837	0.747

Shale Specimen on Stationary Shale Blocks

1 very smooth	0.57	0.55	1 fairly rough	0.70	0.68
1 very smooth	0.54	0.54	1 fairly rough	0.76	0.71
2 smooth	0.58	0.53	2 rough	0.77	0.73
2 smooth	0.61	0.54	2 rough	0.84	0.75
3 fairly smooth	0.61	0.54	3 very rough	0.85	0.78
3 fairly smooth	0.62	0.54	3 very rough	0.90	0.83
4 slightly rough	0.64	0.58			
4 slightly rough	0.69	0.59			
Average	0.608	0.551		0.803	0.747

*Formerly engineer in charge of tests, Hydro-Electric Co. of West Virginia; present address, Engineering Department, Bureau of Standards, Washington, D. C.

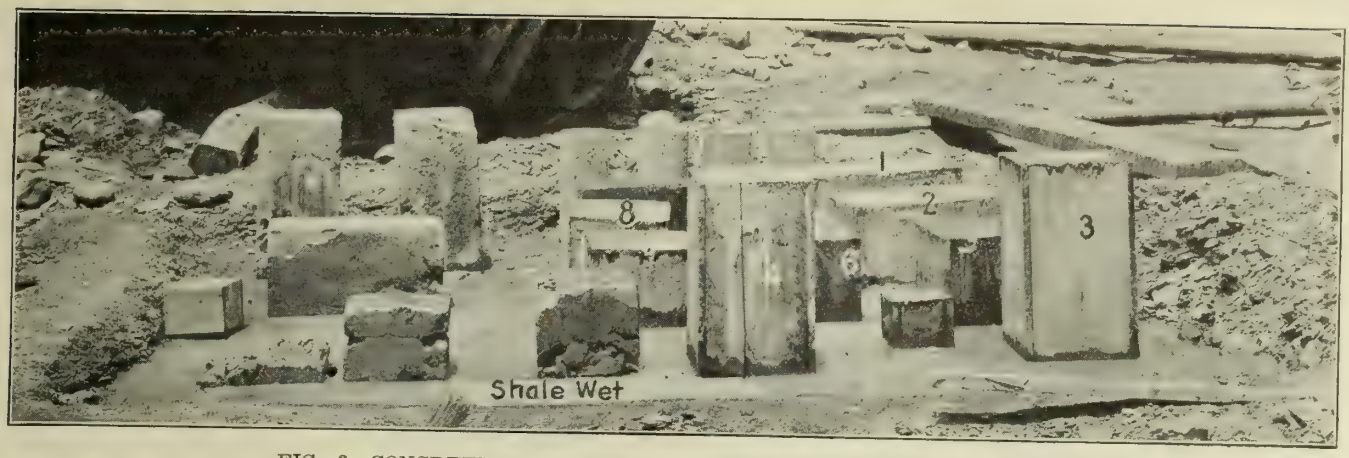


FIG. 3. CONCRETE SPECIMENS POURED ON EXPOSED BED SHALE
Only those numbered in view were tested

specimen commenced to slide were quickly read. Consequently the corresponding coefficient of friction—the tangent of the angle in question—was easily determined.

Table 1 shows the values found for the coefficient of friction for concrete on shale and shale on shale, with the surfaces of contact dry and also with them thoroughly wet. Two values were obtained, and are stated for each reference location, under each condition, showing the variation in the values of the coefficients found.

In the determination of the resistance to sliding of concrete on shale, including the bonding resistance of the concrete on the shale, the test specimens shown in the photographs (Figs. 3 and 4) were used.

An area of about 9x12 ft. of exposed bed shale rock within a coffer-dam was selected. By means of pick and shovel the loose shale was removed until a solid shale surface was presented. This surface was made approximately as rough as that used as the foundation of the dam. Upon this prepared section eight concrete specimens (numbered 1 to 8 in Fig. 3) were poured. Specimens Nos. 1 to 6 were rectangular prisms, 1x1x2 ft.; specimens Nos. 7 and 8 were 1-ft. cubes. The concrete used for making the specimens was taken from that being poured at that time into a portion of the dam. It was composed of Alpha portland cement, Cheat River gravel and a mixture of Cheat River crushed sand and Monongahela River sand, in 1 : 3 : 6 proportions.

Water was permitted to stand upon the shale surface so as to keep it thoroughly wet (see Fig. 3). The concrete specimens were allowed to age 8 days. Then the water upon the shale surface was drained off preparatory to making the tests. In Fig. 3 other concrete specimens than those marked 1 to 8 are to be observed. These additional unmarked blocks were prepared for the tests, but were damaged by water completely covering them before the concrete had set sufficiently, rendering them unfit for testing.

The device used in order to cause the specimens to slide on the shale bed is shown in Fig. 4. The method employed

TABLE 2. RESISTANCE TO SLIDING

Specimen Number and Shape	Weight (W) Lb.	Dynamometer Reading, Lb.	Leverage Ratio	Fric. and Bond. Resist. (R) Lb.	Ratio or Coeff. of Resist. $\left(\frac{R}{W}\right)$	Remarks
1	301.75	165	9:1	1485	4.93	75 per cent. shale failed (a)
2	307.25	155	18:1	2790	9.09	20 per cent. shale failed (a)
3	292.50	115	8:1	920	3.14	40 per cent. shale failed (a)
4	291.75	175	6:1	1050	3.61	80 per cent. shale failed (a)
5	300. (assumed)	100	16:1	1600	5.33	See note (b)
6	300. (assumed)	50	18:1	900	3.00	See note (c)
7	153.00	135	8:1	1080	7.06	5 per cent. shale failed (a)
8	155.25	100	8:1	800	5.15	10 per cent. shale failed (a)
Average					5.163	

(a) "75 per cent. shale failed" means that concrete block parted from shale over only 25 per cent. of the total area of contact. Over the remaining area 75 per cent. failure occurred within the shale rock.

(b) Concrete sheared entire length of specimen 3 in. from plane of contact. When the 3-in. layer adhering to the shale was dug up with a pick, shale adhered to the bottom of the concrete.

(c) Concrete sheared entire length of the concrete specimen 1 in. from plane of contact. Otherwise the same remarks as in (b) apply.



FIG. 4. CONDITION AFTER FAILURE OF SURFACES OF CONTACT

in using this device is indicated in the sketch shown in Fig. 5. The plate A was brought to bear against the proper face of the specimen below the center of gravity of the latter so as to cause the resultant of the force exerted and of the weight of the specimen to fall well within the base of the specimen, thus tending to eliminate lifting or overturning of the specimen. The force was exerted at a measurable length along the arm C from the fulcrum B, and read by means of a spring balance with a capacity of 200 lb. The legs D were used as braces. The force being then gradually increased, that pressure against the side of the specimen which just caused sliding was then determined from the reading of the spring dynamometer and the leverage ratio.

The condition after failure of the surfaces of contact of the concrete specimens, excepting Nos. 5 and 6, is seen in Fig. 4. This shows how in every case some of the bedrock shale adhered to the concrete specimen.

The values found for the resistance to sliding, including both frictional and bond resistance, of concrete on shale are shown in Table 2. The several values of the resistance are expressed also as "coefficients"—ratios of the resistances to the weights of the corresponding concrete blocks.

Evidently the frictional and bonding resistance of one shale layer on another was less in certain areas than was the resistance of the concrete on the shale in the overlying area. Attention is called to the large variation of the coefficient for specimens Nos. 1 and 2. There was, however, 55 per cent. more of the total area of the face of contact covered with shale in the case of No. 1 than in the case of No. 2.

Regarding the tests on specimens Nos. 5 and 6, the query naturally suggests itself: Would the concrete have sheared in the manner reported in the notes under Table 2 if it had been, say, 28 days instead of 8 days old? Furthermore, there is the possibility, in spite of the care exercised, that the arm *c* (see Fig. 5) of the lever was not vertical when the force was exerted to make the specimen slide. A very slight inclination of the arm *c* with a vertical line through the fulcrum *b* would, it is readily seen from Fig. 5, cause the direction of the force exerted upon the specimen at the plate *a* to be other than horizontal. If this inclination of *c* be toward the right (looking at the figure) of the vertical through *b*, the line of action of the force at *a* upon the specimen would be slightly up, instead of horizontal. Hence a lifting as well as a sliding force might have been exerted upon specimens Nos. 5 and 6.

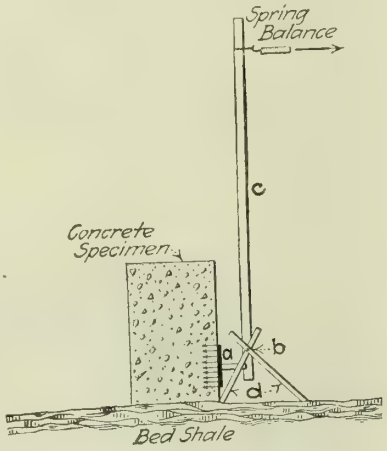


FIG. 5. DEVICE USED TO APPLY PRESSURE ON BLOCKS

Conclusions

1. The resistance to sliding of shale on shale is less than that of concrete on shale.

2. The resistance offered when surfaces of concrete and shale are in contact is approximately 10 per cent. greater than when both surfaces are of shale.

3. With wet surfaces of contact the frictional resistance is materially less than that offered by dry surfaces of contact.

4. The resistance when the surfaces in contact (both concrete on shale and also shale on shale) are wet is reduced to from 89 to 95 per cent. of the resistance when the corresponding surfaces are dry.

5. Findings as regards frictional resistance to sliding in the case of the shale rock investigated may be summarized as follows:

	Surfaces Dry		Surfaces Wet	
	Coef. of Friction	Aver.	Coef. of Friction	Aver.
Concrete on smooth shale.	0.61 to 0.74	0.704	0.62 to 0.70	0.669
Concrete on rough shale..	0.75 to 0.94	0.837	0.68 to 0.81	0.747
Shale on smooth shale....	0.54 to 0.69	0.608	0.53 to 0.59	0.551
Shale on rough shale.....	0.70 to 0.90	0.803	0.68 to 0.83	0.747

6. Frictional and bond resistance to sliding of concrete on the shale in question has a "coefficient" (or ratio of the horizontal force to weight) varying from 3 to 9.09. This variation is relatively so great that the limiting values, as determined experimentally, should be considered rather than the average value of 5.163.

Foundation Piles Cut Off Above Water Line

The buildings on the new municipal pier at Chicago have concrete column footings on pile clusters. These piles are cut off at heights of from 1 ft. 9 in. to 5 ft. 3 in. above the water line, as provided in the plans of the Harbor and Subway Commission, of which E. C. Shankland is chairman and chief engineer.

This construction was objected to by the building commissioner, Mr. Ericsson, who pointed out that the building ordinance requires all piles in foundations to be cut off 1 ft. below datum (water level). The present commissioner of public works, Mr. Moorhouse, appointed three engineers to investigate the matter—Col. W. V. Judson, U. S. A.; R. W. Patterson, and C. W. Cartlidge, Bridge Engineer of the C., B. & Q. R.R. The main part of their report is given below.

When it is considered that this ordinance for pile cutoff must provide for safe construction of buildings all over the city and subject to widely varying soil conditions the wisdom of this provision is evident. But it is not clear that it is necessary, from an engineering standpoint, to conform to this provision if conditions of soil, exposure, etc., in a specific case are such that piles cut off above the prescribed plane will not be subject to decay. Of course it is the general rule in such cases that timber will decay unless always dry or always wet, although protection (or lack of protection) from air currents is an important factor.

The plans for the municipal pier provide that the piles be cut off at heights varying from 9 in. below datum under the headhouse to from 1 ft. 9 in. to 5 ft. 3 in. above datum under the sheds proper, the bottom of the concrete footings being in all cases 9 in. below the cutoff. In all probability the piles will be continually moist and surrounded by moist clay or sand, and will be protected from circulation of air by the inclosing dock walls and the reinforced-concrete floor. The nearness of the water, the permeability of the walls retaining the pier, the sealing of the earth fill by a concrete floor, and the circumstance that the fill is largely hydraulic, and thus may not be expected to settle away from the pile tops, are conditions favorable to their life.

It is true that conformance with the building ordinance would have provided insurance against the remote probability of the decay of the tops of these piles; but on the other hand the cost would have been materially increased, and the increase would have been excessive as insurance. In the committee's opinion, while some decay of the tops of these piles is possible, it is a remote contingency. If it should occur, the damage would be slight and not such as to endanger either the structure or the lives of its occupants, and it would be easily and cheaply repaired.

The committee further states that the harbor commissioners have abundant precedent for their adoption of this feature, and have been more conservative in this respect than the designers of the piers at Portland, Ore., and Boston, where the piles were cut off 19 ft. and 9 ft. respectively.

Transmission-Line Towers: Foundations and Erection

A series of papers and discussions at the recent convention of the American Institute of Electrical Engineers brought to light the practice of several power companies in providing adequate supports for transmission-line steel towers and in erecting these structures. The leading points are summarized below.

Pennsylvania Water & Power Company

J. A. Walls, Chief Engineer of the Pennsylvania Water & Power Co., reported that, on the line from Holtwood (or McCall Ferry) to Lancaster, bell-bottomed concrete foundations had been used, and also on the anchor towers

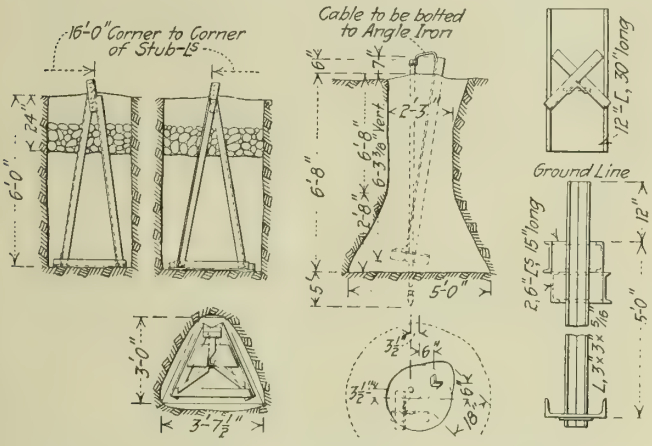


FIG. 1. OLD TOWER FOUNDATIONS; PENNSYLVANIA WATER & POWER CO.

of the Holtwood-Baltimore line. Buried steel tripod stubs were used for the intermediate towers of the latter line. Lifting tests were made on steel single-leg and tripod stubs (the former with top and bottom fins) and the bell-bottomed concrete supports. The single-leg stub pulled out at about 23,000 lb., the tripod type at 32,000 lb. and the concrete was untouched at 70,000 lb., the capacity of the testing outfit. These supports are shown in Fig. 1.

Concrete Footings

For the second Holtwood-Baltimore line (a short and important trunk of very heavy construction) it was decided to use concrete stubs, and four types were investigated—(1) bell-bottomed without forms, (2) bell-bottomed with steel forms, (3) bell-bottomed with wood forms, and (4) truncated pyramids with wood forms. They were more or less satisfactory, in the order named, and the first type (Fig. 2) was selected.

Post holes 3 to 4 ft. deep and 16 in. in diameter were dug and the bell scooped out with a spoon. If the soil for any hole was too hard for this, a half-stick of 40% dynamite was first shot in a small hole punched down about 2 ft. In rock two or three shots generally opened an entire hole. Ordinarily, one man dug two or three holes per day. One man was put on each hole and a foreman had charge of three or four gangs. Holes were laid out by rods and cord from reference stakes, only about 5 min. being required for a base. Attempts were made to shoot out the holes in ordinary soil with a full stick of 60% dynamite and two half sticks of 40%, but this was not generally successful.

Materials, Labor and Cost

The concrete mix varied from 1:2:4 to 1:3:5. Sand and ¾-in. stone were shipped in carload lots to various stations along the line and distributed by four-mule teams—1.5 yd. of stone and 3.4 yd. of sand being dumped at each tower site. These amounts were increased 50% at each fifth tower. Cement was stored in farmers' barns—100 to 200 bags to a place. Mixing and pouring for one tower required about ¾ hr., while moving and setting up required about an hour. A 2.5-cu.ft. hand mixer on two wheels was used. It weighed 1000 lb. with platform. A portable runway elevated the mixer enough to let a wheelbarrow go under the chute. Water was hauled in a two-horse steel tank, which was filled with a 4-in. boat pump from creeks. It would have been better to use a lighter wagon with a small suction pump and 15 ft. of hose.

The smallest number of men needed in concreting was nine—under one foreman. Two or three more men were often used to advantage, especially in moving. One to three teams were employed, depending on the length of haul for water and cement. Water in the anchor holes was pumped out. A short length of 6-in. sheet-iron pipe for depositing concrete would have been better where holes filled fast.

The tower bed plates were not on hand at first and dummy plates were tried, but did not give a good seating for the plates. Some piers were left 8 in. below grade and finished with the plates later. After the bed plates were on hand the concrete was poured to within 1 in.

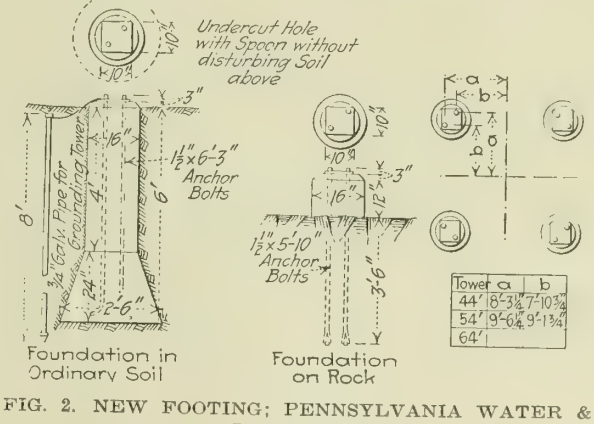


FIG. 2. NEW FOOTING; PENNSYLVANIA WATER & POWER CO.

of the top of the anchor bolts and the plates hammered down on the soft concrete to the grade given by the instrumentman.

The actual cost per tower averaged:

Hauling	$13.20
Grading	2.27
Digging	4.92
Materials and concreting	28.50
Total	$48.89

The steel was assembled on the ground in a horizontal position and towers were erected by a rigging gang of 11

men, a foreman and a four-mule team. The tower legs were pivoted on the foundation and the head lifted by a tackle going from below the cross-arms over a 42-ft. shear leg to five dead-end pins ahead. Back and side guy tackles were also used. For raising the shear leg the back guy was as long as the main tackle. The main lead line was hauled in very slowly until the weight of the shear leg, which was lashed by a long cable to the tower, was sufficient to pull the tower over. One pair of foundation shoes were fitted and guided over the bolts and then the tower was rocked ahead for the other pair.

Alabama Power Co.

W. E. Mitchell, Operating Manager of the Alabama Power Co., described the development of some all-steel footings which were necessary on account of the absence of local concrete materials and the existence of bad hauls of from 4 to 10 mi. from railway stations.

The test loads on towers were (1) a horizontal pull in the direction of the line at any insulator, (2) a vertical load of 1200 lb. on the end of all crossarms, and (3) a

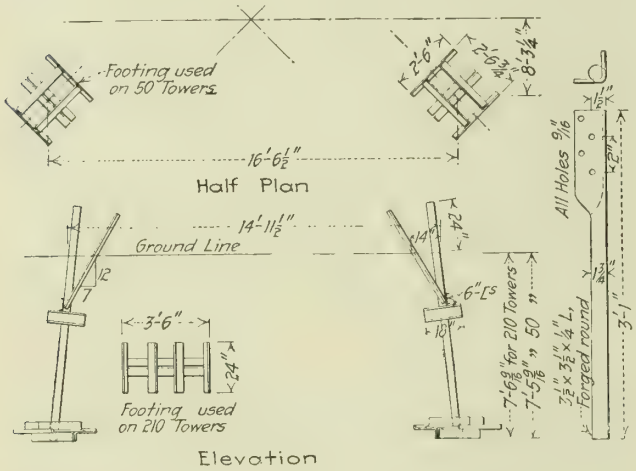


FIG. 3. STEEL FOOTING; ALABAMA POWER CO.

transverse pull of 5000 lb. on the middle crossarm, combined with 7000 lb. longitudinal pull on the top arm along the center line of the tower. In determining the size and depth of footing it was assumed that tension in a leg stub was withstood by a truncated cone of earth (100 lb. per cu.ft.) sloping outwardly from the footing base at 30 deg. to the vertical. A fair bearing pressure was assumed to carry thrust. A 6¼-sq.ft. base buried 7½ ft. gave a safety factor of 2. A grillage 2½ ft. square was at first used, but was later changed to 2x3½ ft., as the men in excavating for the first type had to dig a hole at least 2½x4 ft. The second grillage weighed more; but the saving in field work more than offset the extra cost.

Horizontal Thrust

It had been seen in the field that the legs tended to move due to the component of stress in the lowest diagonal, even though the earth was well tamped. Therefore it was decided to make the leg and the lowest diagonal junction 2½ ft. below ground and to put on here at right angles two 18-in. lengths of 6-in. channels (Fig. 3).

A tower with these footings was tested to destruction. Bolts in the upper part sheared, but the legs did not move.

In many cases the leg foundations were on stable rock. Then a 2¼-in. hole was drilled and a 3-ft. length of steel angle, the same size as the tower leg and forged round for 2 ft. of its length, was grouted in and bolted to the leg.

Location and Excavation

Towers were located by a field engineer from office spottings on a profile; reference hubs were set and depth of excavation marked. For the holes 40% dynamite was used and practically all holes were shot. A portable air compressor and hand drills, where they could be brought up, saved 25% over hand drilling in rock.

All four stubs were set and leveled at once, using a template. Backfill was carefully tamped. Towers were assembled flat, the insulators were hung and the structure was raised with a ginpole. The total cost of footings averaged $28 per tower; assembling the 4800-lb. towers cost $10, and erection, $5.

Pacific Gas & Electric Co.

P. M. Downing, Engineer of Operation and Maintenance of the Pacific Gas & Electric Co., reported that metal footings without concrete were not recommended. Permissible stress borne by dry, well-tamped earth was not always obtained when the soil was water-soaked. Towers have failed on a number of lines constructed with metal footings, and it has been necessary to reinforce them with concrete.

Recommended Footings

For 75- to 80-ft. double-circuit towers spaced 800 ft., each footing should contain at least 1¼ cu.yd. of concrete and be of the form shown in Fig. 4. Assuming concrete to weigh 140 lb. per cu.ft. and earth 110 lb., and the earth-cleavage angle to be 30 deg., these footings give a safety factor of about 2.

The cost, when the route is about equally divided between mountain and valley sections, averages as follows, for labor at $3 per day, concrete hand mixed at each tower, and a 6-mi. haul of material:

Labor	$40
Material	16
Hauling	34
Total	$90

Where the line is not too steep, erection is most economical by assembling on the ground and up-ending with a ginpole. A very satisfactory way has been to set a 35-ft. ginpole just outside the footings and hold it with three

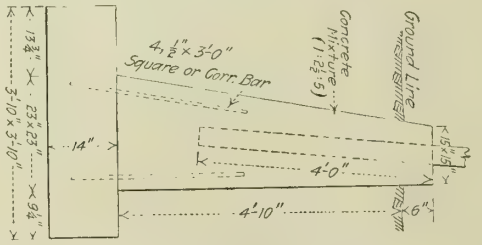


FIG. 4. REINFORCED-CONCRETE FOOTING; PACIFIC GAS & ELECTRIC CO.

guys running to iron-pin anchors. A flexible steel cable goes from the tower, at the lower crossarm, over an open sheave at the top of the pole and to a set of triple blocks anchored about 400 ft. from the tower base. A back guy is necessary to hold the tower as it comes into a vertical position; side guys are unnecessary except in windy weather. If the ground around the footings is not well packed, hold-back anchors are advisable for the lower

tower legs to prevent damaging the footings. A 3-ton motor truck is the best motive power for raising the towers and for transporting equipment. Nine men with a truck will raise and fasten down an average of nine towers in a 9-hr. day.

Toronto Power Co.

Notes on the old and new 60,000-volt lines from Niagara Falls to Toronto were contributed by F. C. Connery, Superintendent of Transmission Lines of the Toronto Power Co. About 100 sets of the type shown in Fig. 5 were dug up after seven years' service. In no case was the galvanizing deteriorated, and the impregnated wood blocks were in a fair state of preservation. These were used with standard 40-ft. two-circuit towers. With some 53-ft. double-circuit towers the wood blocks were omitted. Six such towers were erected in black muck, which gave no resistance with borings to 40 ft. Plank sheathing was driven around each leg location, the muck dug out and a floating foundation of impregnated 2-in. plank put down at 6 ft. below the surface. The stubs were set in concrete about 1 yd. to a footing. There has been no settlement or change of alignment in a year.

Stubs were bolted to a steel template lined up on center line stakes and leveled with a carpenter's level. One man backfilled, while two tamped, water being used when available to settle the earth.

Narrow-Base Towers

A type of very narrow-base latticed towers or poles was employed on a 6x6x6-ft. 1:3:5 concrete base with twelve 1¼-in. anchor bolts. The foundations for some of these

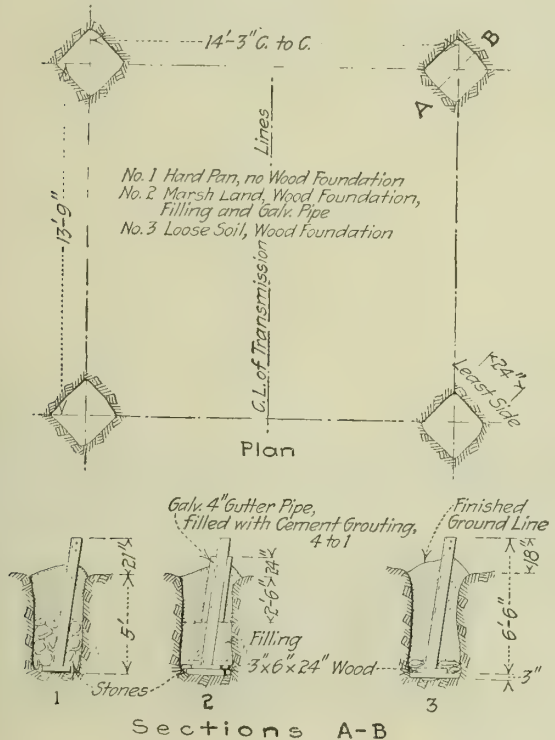


FIG. 5. FOUNDATIONS FOR 40-FT. TOWERS; TORONTO POWER CO.

poles varied beyond a minimum depth of 6 ft.; then they were erected on 12 in. of concrete and the excavation filled with concrete around the pole.

New tower footings are now being designed as follows: (1) Modified screw guy anchor for light structures, (2) a screw guy anchor with a large footplate on a shallow concrete slab, (3) a screw pile with top plate for the tower foot plate, and (4) threaded wood pile. It has been found unnecessary to drive a pile to refusal to get a good tower footing, there being sufficient skin friction in the upper layers of soil.

American Bridge Co.

J. B. Leeper, Manager of the Tower Department of the American Bridge Co., held that the ability of a tower to resist its loads depended largely on properly designed anchors, in designing which both vertical and horizontal

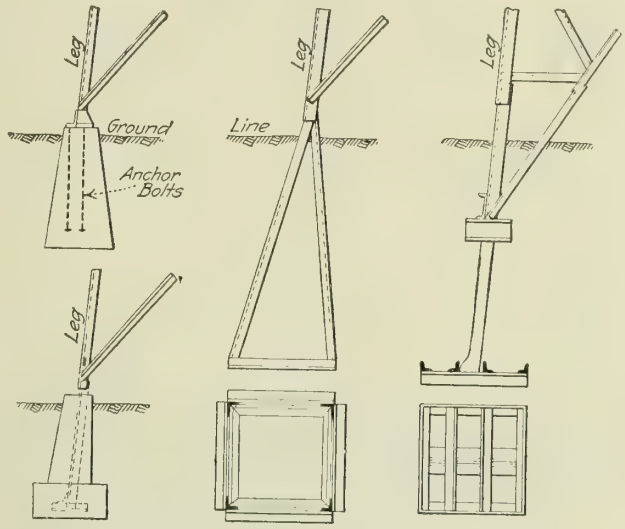


FIG. 6. TOWER FOOTINGS; AMERICAN BRIDGE CO.

forces had to be kept in mind. It has been found that if the uplift is properly cared for there will be ample provision for compression. Tests of the company show that the common assumption of the stub being held down by an inverted frustrum of earth, etc., gives no allowable overload with freshly tamped earth.

Horizontal Thrust

The failure of many towers has been due to insufficient provisions for horizontal force. Most of these failures have been with single-leg angle stubs which have little resistance to the horizontal component of bottom diagonal stress. There are several effective designs, such as (1) a concrete footing with anchor bolts, (2) a single-leg angle stub embedded in a concrete footing, (3) four battered angles extending from the tower leg to a base frame of angles, and (4) a single stub angle going down to a steel grillage and with the bottom diagonal attached 2 ft. below ground where channels resist side thrust.

Concrete anchors are stable and permanent but generally too expensive. Steel anchors, if properly designed, may be made practically as permanent as concrete and much less expensive. The fourth type in Fig. 6 has several advantages: (1) The leg splice can be kept far enough above ground to prevent serious corrosion, (2) by splicing the stub about 3 ft. below ground the ground-level parts can be renewed at small expense, (3) setting, backfilling and tamping is easy, (4) the amount of steel is small and the shopwork is inexpensive.

Boulder Parapet for Roadways in Palisades Interstate Park

The Palisades Interstate Park Commission is constructing a 15-mile roadway from the Bear Mountain playground, an excursion resort which the commission has developed on the Hudson River 5 mi. below West Point, westward through the great Harriman Park forest tract in Orange and Rockland Counties, New York, to Southfield on the Erie R.R. The commission is also proceeding with the construction of the long-planned Henry Hudson Driveway, which is to be built under the Palisades along the west shore of the Hudson River, opposite New York City.

In planning the construction of these roadways, built through rough mountainous country, and chiefly for automobile traffic, it was desired to safeguard those using the roadways from the danger of going over high embankments in case of skidding wheels, breakage of steering gear, or other accident.

The ordinary wooden guard rail commonly used along highways furnished some safeguard in the days of horse-drawn traffic, but is wholly inadequate to prevent machines of the weight and speed of modern automobiles from going



FIG. 1. BEAR MOUNTAIN INN OF THE PALISADES INTERSTATE PARK COMMISSION, IN THE HUDSON HIGHLANDS

In the foreground is the first loop in the road under construction from Bear Mountain to Tuxedo, showing the lines of boulder parapet

down the bank. A limited use has been made of concrete guard rails; but while they have the advantage of permanence as compared with wooden posts and rails, they have little more strength against impact.

It was therefore determined to use on the Interstate Park roads a parapet made either of boulders obtained from the fields along the route or blocks of stone secured from the numerous rock excavations. The original plans for this parapet were made under the direction of C. W. Leavitt, when Chief Engineer of the commission, and the actual construction has been carried out under the direction of the present Chief Engineer, W. A. Welch.

The accompanying views, taken in the vicinity of Bear Mountain along the roadway referred to, will give a clear idea of the appearance of the completed parapet. Most of the blocks of stone used are very large and heavy, weighing from one to two tons. They are placed on the shoulder of the road and roughly lined up on the roadway side. No expense is incurred in dressing the stones to regular form. To carry these stones from the ledge out of which they are blasted and place them in position on the shoulder of the road, a very effective traveling derrick has been built, and is shown in one of the accompanying photographs. The machine is a substantial four-wheel wagon carrying a low tripod from which a tackle block is sus-



FIG. 2. A MOUNTAIN LAKE ON THE BEAR MOUNTAIN-TUXEDO ROAD

Note the large size of the stones in the parapet

pended. A rope runs through this tackle block and is connected to a geared windlass over the rear axle of the wagon. This wagon is backed over a stone to be lifted, chains are put around the stone, it is hoisted free of the ground and hauled to the place where it is wanted. By this rig, stones are placed so close to the final position that very little work with bars is required to line them up on the shoulder of the road.

This boulder parapet is so heavy and substantial that it furnishes an absolute safeguard against machines going over the bank. Of course if a careless driver or some mishap causes a car to run against the parapet, the car is apt to suffer, but the boulders will stand the impact, and there is little chance that the machine will turn over.

With the abundant stone available along the line of the road, this boulder parapet which costs only 50 to 60c. per linear foot, has proved cheaper to build than even a wooden guard rail. When it is once placed no expense



FIG. 3. LOOKING UP THE HUDSON FROM THE ROAD TO BEAR MOUNTAIN INN

for maintenance is required. If through frost action or other causes some of the stones should in the course of years settle out of line, it is a simple matter for men with bars to go along the road and bring them back to position.



FIG. 4. VIEW OF ROAD AROUND THE SHOULDER OF BEAR MOUNTAIN

The construction may possibly be criticized from the artistic point of view, because of the jagged and rough appearance of the row of boulders. This can be remedied, however, by planting vines and creepers on the shoulders all along the roadway, and in a short time the rough stones will have become covered with a mass of verdure,



FIG. 5. DERRICK WAGON USED IN PLACING BOULDER PARAPET ON BEAR MOUNTAIN ROAD

and the stones will eventually become weathered to the color of other country rock along the way.

In the construction of the Henry Hudson drive along the Palisades, nearly all of which road is in sidehill cutting along a steep slope, the lower side of the road is to be protected by a continuous row of huge blocks of trap rock, roughly rectangular in outline. In this case the rock along every foot of the roadway is available for building the parapets on the lower side. To place this rock, another type of wheel derrick is used, shown in Fig. 6.

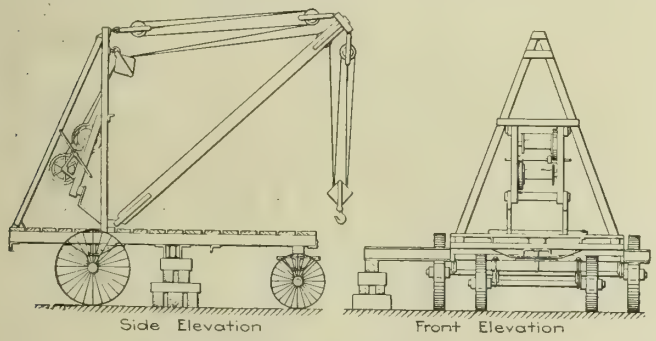


FIG. 6. PORTABLE DERRICK FOR PLACING BOULDER PARAPET ON HENRY HUDSON DRIVE
(Built by John T. Horton, New York)

Brick and Stone Pavements Without Sand Cushions

There is an increasing tendency toward eliminating the sand-cushion course in all kinds of block pavement. It has long been demonstrated that a mortar bed is preferable for asphalt blocks, and a mortar-bedded wood block is the common European method and has many advocates in this country. Experiments with mortar beds for stone-block pavements at Schenectady and New York City and with brick pavements in Cuyahoga County, Ohio, have recently been noted in *Engineering News*.

Now comes the news that the cushion coat has been entirely eliminated in the construction of a brick pavement at Paris, Ill. The bricks were laid on the green concrete base and gently rolled with a 600-lb. hand roller. This work was done under the supervision of W. T. Blackburn, Consulting Engineer of the Dun Wire-Cut-Lug Brick Co., and W. W. Marr, State Highway Engineer of Illinois.

Official notice has also just been received that the Borough of Manhattan, New York City, has abandoned the use of a sand cushion for granite-block pavements. Under the present specifications a mortar bed of 1 part cement and 3 parts sand, mixed dry, is used. The mortar hardens in a few weeks, even under traffic. An asphaltic filler is used for the joints.

The great advantage claimed for the mortar bed over the sand cushion is that water leaking through the joints of the blocks does not cause depressions in the surface, which was the case with the sand cushion, and the cost of maintenance is considerably reduced. Eugene W. Stern is Chief Engineer of the Bureau of Highways of the Borough of Manhattan.

From the foregoing the conclusion might be drawn that cushion course of block pavements has survived for no particular reason. But research on this subject shows that when modern squared stone-block pavements were introduced in Paris, in the seventies, they were first laid directly on the concrete foundation. M. Alphand, Director of Public Works of Paris, reported to the Municipal Council of that city that the result was "an enormous hubbub in the street and a continual shaking of the houses," and furthermore the pavement between the concrete and the carriage wheels was as if between a hammer and an anvil, and the stone wore out, although of very good quality. He accordingly sought to obtain the necessary elasticity by putting a layer of sand between the concrete and the stone blocks.

Losses of Merchant Shipping during the past ten months of war, according to statistics published by the "Journal of Commerce," aggregate 511 vessels, with a total tonnage of 915,457. This is approximately 2% of the total merchant shipping of the world. At the outbreak of the war the merchant vessels under the British flag had an aggregate gross tonnage of 20,431,000 tons. The total losses of British vessels by war have been 609,934 tons. Germany's merchant fleet at the outbreak of the war aggregated 5,082,000 tons, and she has lost 34 vessels, with a total tonnage of 102,000. Norway has lost 30 vessels, of 47,000 tons aggregate, and France 24 vessels, of 42,000 tons. A more serious reduction in the world's merchant marine than even the losses of the war is the practical stoppage of merchant shipbuilding by the European nations involved in war. In 1913 the shipyards of Great Britain, France, Germany and Austria launched merchant vessels with an aggregate tonnage of 2,635,000. During the past ten months the shipyards of these nations have built very few merchant vessels, their energies being absorbed by naval work. Difficulties in obtaining capital, labor and materials also hinder ship-owners from ordering new ships.

Activated Sludge in America: An Editorial Survey

By M. N. Baker*

SYNOPSIS—Notes on a new process of sewage-treatment gathered by the writer on visits to the several experimental plants. Sewage is aërated in a tank in the presence of an accumulation of aërated sludge. There is reason to hope that a high degree of clarification and perhaps bacterial reduction, when necessary, with a stable effluent and a quick-drying sludge, high in fertilizing value, can be produced by this process alone.

To see for himself and for such of the readers of this journal as cannot see for themselves just what is being done in the way of activated-sludge experiments in various parts of North America, the writer recently visited all the known experimental plants of the kind this side of the Atlantic, except the one at faraway Regina and the aërated contact bed at Houston. His notes, revised and supplemented by correspondence almost to the date of publication, constitute a general survey of this new, interesting and promising method of sewage treatment.

The experiments at Washington, Baltimore (thus far), Chicago and Regina are on a small scale. Those at Urbana have small but numerous and well-controlled units. The Milwaukee units, a half dozen in number, range from glass tubes to tanks of over 20,000-gal. holding capacity and more than 60,000-gal. daily capacity, one of these large tanks being operated on the fill-and-draw and one on the continuous-flow plan. The Brooklyn tank has a holding capacity of 16,000 gal. The Brockton and Cleveland tanks are of fair size. The Lawrence tanks are relatively small. Some of the tanks at Lawrence and each one at Brockton and at Houston might very properly be described as aërated contact beds.

The activated-sludge process, thus far on the small-laboratory or at best the large testing-station scale, will soon be tried on a more regular everyday basis. First in the field will be Baltimore, with two of its new Imhoff tanks modified to operate on the activated plan. Milwaukee was to receive bids for a 2,000,000-gal.-a-day plant on July 22. A preliminary plan for a unit of a plant to treat the sewage of 160,000 people at Houston, Tex., is published herewith. Activated-sludge plans have been prepared for several British cities and are merely awaiting funds before they are put in execution.

The Activated-Sludge Process

What is the process which in a brief period has been taken up by British and American investigators and cities, the State of Illinois and the United States Public Health Service? It is a new form or variety of forced aëration of sewage in the presence of a considerable volume (tentatively 25 per cent.) of accumulated sludge, which has itself been aërated and is enlivened with oxygen and bacteria. The oxygen is supplied by forced aëration, by a blower or an air compressor. In the cruder experiments with tanks the air is distributed by means of perforated pipes, giving uneven distribution, pronounced boiling at the surface and doubtless much waste of air. For satisfactory distribution some form of porous plate, extending over a considerable area of the tank bottom, seems essential. The medium used in the installations showing most careful design and giving the most promising results are 12x12x1½-in. filtros plates. These, we are informed, are being supplied for experimental purposes at special prices by the manufacturers, the General Filtration Co., Cutler Building, Rochester, N. Y.

Just what the activated-sludge process will accomplish within economic limits remains to be settled. The strongest claims for it are that with a relatively small tank area the process will produce a stable, well-clarified effluent with a considerable degree of nitrification; a quick-drying unobjectionable sludge of high fertilizing value; and, if the aëration process be continued for a not prohibitive length of time, that the effluent will show a 99-per cent. bacterial reduction.

For many localities the activated-sludge process bids fair to be a self-contained flexible process, easily adapted to changes due to season, flood or drought, and a variety of other conditions liable to frequent change, and easily supplemented, if need be, by more or less rapid filtration, or by chlorine disinfection.

Many questions about the new process await settlement. The first and most important one—assuming that the process will give the purification results desired and promised—is: What will the process cost? Others relate to size and shape of tank, depth of sewage, method of air distribution, and whether the tanks should be operated on the fill-and-draw or continuous-flow plan. A critical question in some localities will be the effect of blowing in air at and below zero temperatures.

In view of the high promise of the new process and the many points regarding it still to be settled, it is desirable that all who are in a position to do so join in the investigations now being made. It goes without saying that careful records of all significant data should be kept, particularly relative volumes of air and sewage and all the elements of cost, and that an effort should be made to so keep the records that they may be readily compared with others, or at least be reduced to a comparable basis.

Laboratory Tests and Proposed Full-Size Activated Imhoff Tanks at Baltimore

Up to the time of my visit on June 4 only small-scale laboratory experiments had been conducted at Baltimore, but these were of a varied character, and it was expected that by July 15 two of the nearly completed Imhoff tanks would have been adapted to the continuous-flow activated-sludge process, and put into use.

The Baltimore experiments, as a result of a coöperative agreement between that city and the United States Public Health Service, are being conducted under the joint direction of Calvin W. Hendrick, Chief Engineer of the Baltimore Sewerage Commission, and Leslie C. Frank, Sanitary Engineer, United States Public Health Service.

*Editor, "Engineering News."

Mr. Frank was formerly at Baltimore in charge of the design of the new Imhoff plant. Gustav J. Requardt is now Acting Division Engineer in charge of the Baltimore Sewage-Treatment Works.

Mr. Frank has adopted the name "aëro tank" for the type of continuous-flow activated-sludge tank which he has designed, and into which two of the new large Imhoff units are being converted.[1] In operating these aëro tanks hydro-electric power from the fall of the treated sewage can be used to supply the necessary compressed air.

The new sanitary sewerage system and sewage-treatment works for Baltimore were placed in operation in 1911. The sewage is stale when it reaches the works, where it is treated by means of plain preliminary settling tanks, fine screens, sprinkling filters, and plain final or post-filter tanks. The sludge from both the preliminary tanks and the post-filter tanks goes to separate digestion tanks and thence to sludge-drying beds.

The laboratory experiments were begun in the early part of March, 1915. The purpose of these laboratory experiments was threefold: (1) To determine whether the English activated-sludge results on the fill-and-draw plan could be duplicated with Baltimore raw sewage; (2) to determine the best manner of initial operation of the large aëro tanks; (3) to determine whether the presence or absence of light bore any relation to the activated-sludge process. Determination (2) was considered important because it was Mr. Frank's belief that activated sludge might possibly be generated much more quickly in the large aëro tanks by the introduction of post-filter tank sludge than by the use of raw sewage alone or raw sewage and preliminary-tank sludge. He considered determination (3) advisable because, so far as known, all English experiments had been conducted in extremely shallow tanks or containers and it was possible that the effect of light due to this shallowness permitted forms of organic life to thrive which were an important element in the activated-sludge process, and which it might prove impossible to grow in the relatively deep aëro tanks at Baltimore because of insufficient light.

In carrying out the laboratory experiments air in unmeasured quantities was aspirated through five 2.5-liter bottles containing the following:

1. Stale raw sewage and post-filter tank sludge.
2. Stale raw sewage.
3. Sprinkling-filter effluent and post-filter tank sludge. (Light has been excluded from this bottle since about May 1.)
4. Fresh sewage (after a flow of one hour or less in an uptown sewer) and post-filter tank sludge.
5. Stale raw sewage and raw sewage sludge.

In a sixth experiment a propeller system of agitation and air comminution was being studied.

Experiments (1) to (5) were being run on the fill-and-draw plan. In the first several weeks of the experiments only enough of the supernatant liquor for analysis was drawn off. Then gradually more and more of the supernatant liquor was removed until finally all the liquor down to the sludge was removed four times per day.

Under date of July 11 Mr. Frank kindly summarized the results of his experiments as follows:

Roughly, the experiments thus far have demonstrated that the activated-sludge process is possible with Baltimore sewage; that it is possible to generate activated sludge much more quickly with mixtures containing post-filter tank sludge than with raw sewage alone or with raw sewage sludge; that the absence of light does not seem to have an appreciable inhibiting effect. No difference could be observed in the rapidity with which activated sludge was generated in experiments (1), (3) and (4), all of which contained post-filter tank sludge. Post-filter tank sludge will therefore be used in starting the 40-ft. diameter modified Imhoff tanks.

At lower rates of dosing than the four complete replacements per day referred to above, nitrates in the effluent were high. Four replacements per day produced relatively low nitrates. At this latter loading the oxygen demand of the effluent, however, is still very low, and the effluent compares very favorably in stability with sprinkling-filter effluent. The nitrogen in the activated sludge is high. The foregoing results compare favorably with the English results.

Several of the experiments have now been discontinued, since, as previously indicated, the results from them practically duplicated one another.

Hygienic Laboratory, Washington, D. C.

From visiting the experimental work at Baltimore one naturally goes to Washington and rides out on a Pennsylvania Ave. car to the Hygienic Laboratory of the United States Public Health Service. There, under the eye of Prof. Earle B. Phelps, Leslie C. Frank is in charge of sewage investigations. As officially named, these investigations include at present sanitary privies for homes without water-carriage; sewage treatment for small communities and residences; the control and treatment of traffic sewage; activated-sludge and aëro-tank sewage treatment.

As part of the last-named investigation, and to supplement the joint experiments at Baltimore, Mr. Frank has been conducting a laboratory experiment since Feb. 17, 1915, on very fresh domestic sewage from two or three buildings. This sewage is three or four times as strong as that at Baltimore. The experiment was begun by filling a bottle with 80% raw sewage and 20% scum from the sludge chamber of the "small-community" Imhoff tank near the laboratory. This scum was in an entirely anaërobic condition and comparatively fresh. The container used for the experiment is a 4-liter bottle filled with 3.8 liters of liquid and sludge and provided with an inverted conical bottom. Unmeasured air is introduced into the bottle by aspiration.

In conducting the test only enough aërated sewage (500 c.c.) for analysis was removed daily at first. On Mar. 29 nitrification began, and shortly afterward the removal of aërated sewage was increased from 500 c.c. daily to 1000 and then to 2000 c.c. Finally, 2000 c.c. were removed twice each day; but as the results were poor a change was made to a removal of 1000 c.c. twice daily. The removal is again being increased gradually until the maximum posible loading of the device is determined.

The odor from the aërated sewage at both Baltimore and Washington is described by Mr. Frank as like that from forest mold. In appearance the effluent is very clear, often possessing a slightly yellowish or golden tinge.

On July 2 Mr. Frank reported that other experiments were being conducted to determine the relative effects of adding iron or manganese to the activated sludge, from the standpoint of what may be termed "bacteriological"—catalytic—action.

Milwaukee Sewage-Testing Station

Anyone who is investigating activated sludge should visit Milwaukee. The experiments there are varied, some of the tanks are large and the facilities for securing exact data are excellent. The tests are being conducted under

[1] On May 11, 1915, patent No. 1,139,024 (dedicated to the public) was granted to Mr. Frank for an invention relating "to the purification of sewage or other wastes by two known processes of sedimentation and oxidation combined in a new manner," carried on "continuously and simultaneously without interference one with the other." Copies of the patent may be obtained for 5c. each from the Commissioner of Patents, Washington, D. C.

the direction of T. Chalkley Hatton, Chief Engineer of the Milwaukee Sewerage Commission, with William R. Copeland as Chief Chemist and with Gilbert J. Fowler, of Manchester, England, as adviser.

Since the Milwaukee tests were described by Mr. Hatton in *Engineering News* of July 15, 1915, comparatively little need be said about them here. Two small glass tubes have been in nearly constant operation since March, 1915. A tank (Fig. 1) 10½x?? ft. in plan and 10 ft. deep was put in use on Mar. 26, 1915. On May 8, 1915, two inspection tanks, each 1x5 ft. in plan and 10 ft. deep, were started. All these tanks are operated on the fill-and-draw plan, but on June 21, 1915, a second large tank, working on the continuous-flow plan, was put into service.

The air for the tanks is supplied by a blower. Filtros plates are used for air distribution, except that in one of

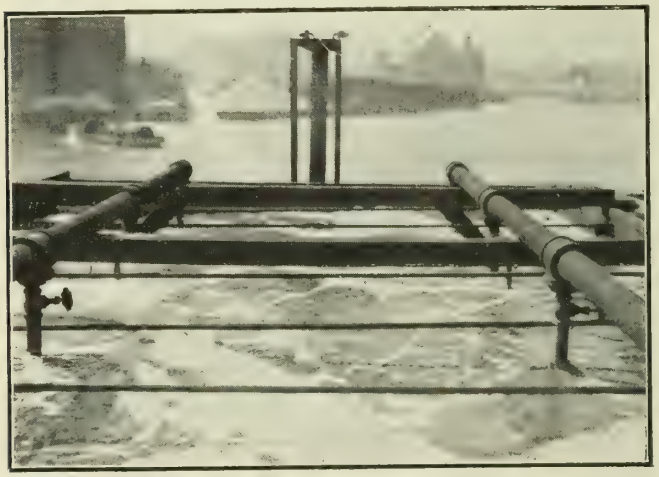


FIG. 1. ACTIVATED-SLUDGE TANK AT MILWAUKEE
Shows main air-supply pipes and top surface of sewage

the small tanks the air is admitted through a single pipe outlet. Ice bags will be suspended in the small inspection tanks to lower the temperature of the sewage.

The writer visited the Milwaukee sewage-testing station on June 10, 1915. He noted the quick-settling, granular, brown suspended matter and but slightly odorous character of both the sludge and the aërated sewage. He was informed that no attention has yet been paid to the fertilizing value of the sludge.

Bids for constructing a 2,000,000-gal. continuous-flow activated-sludge plant at Milwaukee were to be received on July 22, 1915. The contract form provides that the work shall be completed by Nov. 15. The object of this provision is to make it possible to get the plant primed before winter sets in, in order that the tanks may be operated in winter to determine the effects, if any, of low temperatures upon the process.

Stockyards Tests, Sanitary District of Chicago

Early in May, 1915, experiments at the Chicago Stockyards were begun by the Sanitary District of Chicago under the direction of Langdon W. Pearse, Division Engineer, and Arthur Lederer, Chemist. The stockyards sewage is seven or eight times the strength of ordinary domestic sewage. It is being treated in two galvanized-iron tanks, each 2 ft. in diameter and 10 ft. deep, operated on the fill-and-draw plan. One tank receives air at the rate of 0.1 and the other at 0.2 cu.ft. per sq.ft. of tank surface per min. The indications at the time of my visit on June 12 were that at least 0.2 cu.ft. of air would be required. The air is metered at a pressure equivalent to 8 ft. of water. It is supplied by a blower.

Sketch plans have been made for converting the Dortmund tank at the Stockyards Testing Station into an Imhoff aëration tank (continuous flow). It is also under advisement to convert some of the experimental tanks at the old Sanitary Testing Station at 39th St. into activated-sludge tanks. One sludge-digestion tank may be converted into a continuous, horizontal-flow aëration tank. An old roughing filter may be remodeled on a fill-and-draw plan. Up to July 6 it was not sure that the necessary funds could be secured for these additional experiments.

Illinois State Water Survey, Urbana

Like Milwaukee, Urbana is a place which should be visited by anyone who wishes to get knowledge and enthusiasm about activated sludge. Here the new process is being studied in minute detail from numerous scientific viewpoints, including the agricultural.

The experiments at Urbana were begun on Nov. 2, 1914, in 3-gal. glass bottles. On Jan. 4, 1915, a 9x9-in. wood tank, with glass windows front and back, was put in use. A filtros plate was placed 4 in. from the bottom of the tank. The working sewage depth was 3 ft. 7 in.

On May 5, 1915, two concrete tanks went into service. Each tank is square in plan, with an area of 10 sq.ft. and a depth of 8 ft. The sewage depth is about 5 ft., and the utilized holding capacity is 400 gal. per tank. In the bottom of each tank there are 9 sq.ft. of filtros plates for air distribution. On July 6 two more concrete tanks, of the same dimensions as those just described, were put in use. One of these has a filtros plate or air-diffusing area of 3 sq.ft. and the other of only 1 sq.ft.

The air for all the experiments has been supplied from the University of Illinois compressor plant, reduced from about 80 to 8 lb. All the air used is metered.

The earlier experiments at Urbana were described in *Engineering News* of Apr. 1, 1915 (p. 647). At the time of my visit on June 12, 1915, about 1 cu.ft. of air per gal. of sewage treated was being used, and the first two concrete tanks were being operated four cycles a day.

The sewage used in the experiments is a quite fresh average domestic sewage. For the bottle and 9-in. tank experiments the sewage was brought in 5-gal. carboys from the nearby Champaign trunk sewer; but the concrete tanks are supplied by pumping from the same sewer. All the experiments have been conducted indoors.

Drying beds for the sludge from the four concrete tanks were put in operation about June 20, 1915. Tests are to be made of a sludge-drying device which acts on the principle of a Robacher wheel. Filtros plates form the compartments of this wheel. Through these plates a vacuum may be applied to exhaust moisture from the sludge, and then pressure may be used to discharge the sludge.

Following the advice of Dr. Gilbert J. Fowler, of Manchester, England, the aim is to secure and retain in the tanks from 25 to 33% of activated sludge.

Notable features of the Urbana experiments are the studies being made of the biological condition and of the fertilizing value of the sludge. This value is shown both by analyses and by controlled plant cultures.

The experiments are being conducted under the direction of Prof. Edward Bartow, Director of the Illinois

State Water Survey, by F. W. Mohlman, W. D. Hatfield and Robins Russell. A. N. Talbot, professor of municipal engineering at the University of Illinois, was adviser in designing and constructing the new concrete tanks.

Cleveland Sewage-Testing Station

On May 5, 1915, an outdoor tank, 5x10 ft. in plan and 5 ft. deep, on the activated-sludge plan, was placed in service at Cleveland, and at the date of my visit (June 15, 1915) an indoor tank 17½ in. square in plan by about 5 ft. of sewage depth was being made ready. These were both fill-and-draw tanks, of wood, with flat bottoms.

The activated-sludge experiments at Cleveland are being conducted at the old sewage-testing station on the lake front.[2] The large tank was formerly a roughing filter. To convert it into an activated-sludge tank the old filter gravel was thrown out and the manifold system used for air distribution. This system consists of a central pipe 8 in. in diameter, with 2-in. branches, 6 in. c. to c. The branches were perforated with holes about $\frac{3}{16}$ in. in diameter, spaced 6 in. c. to c. Air was being supplied at the rate of 3 cu.ft. per min. for the whole tank, or 0.05 cu.ft. per min. per sq.ft. of tank bottom.

If necessary, at any time, compressed air may be stored in a tank. All the air used is metered and likewise the electric current which drives the motor. Reducing valves maintain a constant flow of air to the sewage which is being aërated.

The air distribution in the outdoor tank has been uneven. The unevenness or somewhat violent boiling shifts from side to side, suggesting that some of the perforations in the air pipe may, at times, be stopped up. To offset this condition it has been found advisable to shut off the air for a short period and then release the same. This method of procedure, on account of the additional pressure, creates a violent bubbling and stirring action.

At first, difficulties with the compressor interfered with a continual operation of the plant. However, on May 18 the large tank was placed in operation on the fill-and-draw plan, and has been working ever since. The tank was aërated for a week without drawing off any of the supernatant liquid. This aëration period was then reduced to three days for two weeks and since then it has been increased to one week.

The sewage used for the tests is distinctly stale. The question has arisen whether this would materially affect the process being tested. The suspended matter in the treated sewage settles rapidly, as at other places. From a putrescibility standpoint, the treated sewage stood up for 3½ days. Up to June 15 no nitrification had been secured.

The indoor tank is being used to study air distribution and to secure cost data. A satisfactory air distribution was not secured until a filtros block was used for the purpose. First a 2-in. layer of sand held in a box between fine screens was tried. The sand streaked and gave no uniformity. On substituting a perforated tin plate the air appeared at the surface in large bubbles and unevenly.

After securing some activated sludge in the two tanks described, the intention is to fit up another wooden tank, about 6 ft. in diameter and in height, and operate it on the continuous-flow plan. This tank will be located on the lake edge and filled directly from the settling-tank chamber without pumping.

Robert Hoffman is City Engineer of Cleveland. The tests just outlined are under the direction of R. Winthrop Pratt, Consulting Engineer on Cleveland Sewage Disposal, and in immediate charge of George B. Gascoigne, Assistant Engineer.

Plain and Activated-Sludge Aëration at the Brooklyn Sewage-Testing Station

A large outdoor sewage-aëration tank of unique design, originally installed to conduct experiments similar to those carried on at the same site by Black and Phelps in 1910-11, was changed to the activated-sludge plan about the middle of March, 1915. Bottle experiments have also been conducted here.

The tank is of wood, 12 ft. in diameter, 25⅔ ft. high, with a sewage depth of about 22 ft. and a holding capacity of 16,000 gal. Compressed air is admitted at the bottom through a grid of pipe perforated with $\frac{1}{16}$-in. holes, 6 in. c. to c. To get additional diffusion of the air this grid is placed midway in a 15-in. bed of gravel. In addition, on its upward way the air passes through nine equal-spaced horizontal disk deflectors, composed of inclined slats of wood. These deflectors are also designed to prevent streaming of the sewage in its downward passage through the tank. Originally the aërated sewage was taken out at a point 1 ft. above the top of the gravel bed; but since the activated-sludge experiments were started it has been drawn out at a point about one-third up, so as to remove 10,000 gal. of the clearer liquor and leave 6000 gal. of sludge and sewage.

The tanks are aërated 22½ hr. out of the twenty-four. The schedule is as follows: Air off from 8 to 10:30 a.m., with sewage being drawn from 9 to 10:30 a.m.; refilling, with air on, from 10:30 a.m. to 12 m. Air is applied at the rate of 1.17 volumes of air to 1 volume of sewage (full-tank basis) treated.

The writer observed the tank on June 21, 1915. Notwithstanding the means of air distribution already described, there was a decided boiling on a third or more of the area of the tank. Samples of the top liquor become well clarified after a brief period of sedimentation.

A small aërated contact bed has also been tested at Brooklyn.

E. J. Fort is Chief Engineer and George T. Hammond is Engineer of Design of the Bureau of Sewers, Borough of Brooklyn.

Cascade Aërator and Continuous Multiple-Contact Bed at Brockton, Mass.

Instead of using an air compressor to force air through sewage under a considerable head, R. S. Weston, Sanitary Engineer, Boston, Mass., decided to try the more efficient centrifugal pump to lift and relift the sewage itself under a very low head to a cascade aërator over which it would flow in a thin air-exposed sheet to and through a tank nearly filled with cobblestones.[3] The effluent from the "Brockton tank," as Mr. Weston has named it, goes to an Imhoff tank, and the effluent from this goes to a sprinkling filter.

Twenty years ago Brockton built sanitary sewers, a receiving reservoir, a pumping station, a 3-mile force

[2] See "Engineering News," Feb. 13, 1913. For the present, the new tests will be carried on with the tank and apparatus at hand, so certain details which might affect the results are lacking. Tests formerly conducted at this station with sludge from Imhoff tanks make it particularly desirable to run similar tests with activated sludge.

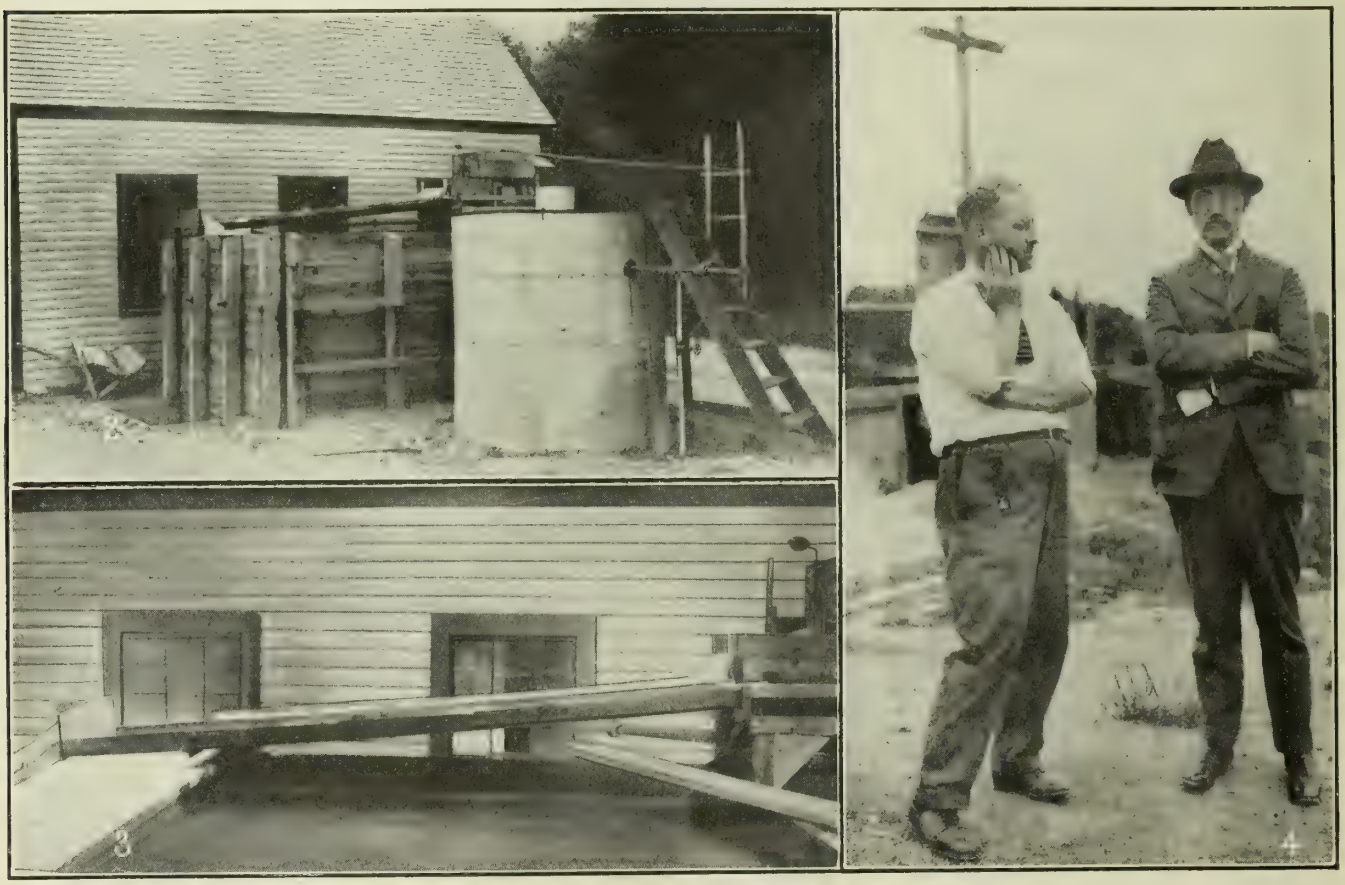
[3] Similar to the Clark tank at Lawrence (described further on), but with the slate replaced by cobbles.

main and intermittent sand filters. Since then more sand filters have been built, and a Weand rotary screen and sprinkling filters have been put in; but the sand filters are still overtaxed and the sprinkling filters do not operate satisfactorily.

The sewage is strong, contains wastes from the leather and shoe industries, and is very stale when it reaches the disposal works, some of it 15 mi. from the point of origin. At the pumping station the sewage is only 13 to 15 per cent. saturated with dissolved oxygen, which disappears when the sewage is delivered through the force main at the sewage works. The deficiency in oxygen is a great disadvantage, especially in winter. The Brockton Sewerage Commission recently employed Mr. Weston to report

The tank is of wood, 10 ft. square and 10 ft. in maximum depth, and has a holding capacity or detention period of five hours, the same as the Clark tank at Lawrence. On a false bottom there is a bed of 6-in. cobblestones, 6 ft. in depth, above which the sewage stands to a depth of 12 in. There is a shallow chamber with a sloping bottom which gives a depth of 0.5 to 2 ft.

A stream of sewage is continuously discharged over the aërator and into the tank. A centrifugal pump takes sewage from the bottom of the tank for reaëration and discharges it back into the orifice tank and then to and over the aërator. At the same time a portion of the treated sewage is flowing by gravity from the base of the "Brockton tank" into the bottom of the Imhoff tank. At



FIGS. 2 TO 4. VIEWS AT THE EXPERIMENTAL PLANT, BROCKTON, MASS.

Fig. 2—"Brockton tank," with orifice and weir boxes and cascade aërator in middle distance; Imhoff tank in foreground. Fig. 3—Weir box and cascade aërator. Fig. 4—Superintendent Hornaday and the Editor being snapshotted by Mr. Weston

on improvements to the works. In his experiments he is working in coöperation with Benjamin R. Chapman, City Engineer, and Frank E. Kennedy, Superintendent of Sewage Beds.

At the experimental plant (Fig. 2) sewage "supposed to be fine-screened" is delivered into an orifice box about 2x3 ft. in plan and 1 ft. deep. From this it flows through a calibrated orifice to a small weir box and over a weir about 18 in. long on to the cascade aërator. This aërator (Fig. 3) was made of corrugated sheet iron, with the corrugations at right angles to the sewage flow. It is about 2 ft. wide, has a slope of 1 ft. vertical to 10 ft. horizontal and has a total length of about 20 ft., secured by placing it along two sides of the tank which receives the aërated sewage. The sewage flows down the aërator in a thin sheet and is well broken up by the corrugations.

the time of my visit (June 25, 1915) the sewage was being passed over the aërator and through the tank twenty times.

The Imhoff tank (foreground of Fig. 2) is of galvanized sheet iron, 5 ft. in diameter and 6 ft. high, with 4½ ft. of sewage depth. The settling period is 2 hr.

Two sludge beds of sand, each 5 ft. square, receive the Imhoff-tank sludge.

The sprinkling filter is built of broken stone with rubble wall It is 12 ft. in diameter and 6.5 ft. deep. It is a replica of one sprinkler unit of the nearby municipal filter.

On one of the preliminary runs fine-screened sewage was aërated continuously for 15 days. A nitrification of 2.5 parts (nitrates) per 1,000,000 was secured. This subsequently decreased, but was not altogether lost. At

the time of my visit the plant had been operated since June 6, 1915, on the continuous plan already described. To that date the oxygen consumed (required oxygen) had been greatly reduced, the nitrites largely increased and there had probably been a slight nitrification. The sprinkling filter effluent showed nitrification.[4]

There was a finely divided gray scum, less than 0.5 in. thick, on the "Brockton tank," but no scum on the Imhoff tank. Samples of top liquor from the "Brockton tank" showed to the eye considerable finely divided suspended matter, but unlike the suspended matter in activated-tank top liquors. There was little odor to the samples from either tank. A cobblestone lifted from the first tank was well covered with a blackish sludge. It was said that fly larvæ appear in the "Brockton tank"; also tubifex, one of the scavenging worms.

Under date of July 12, 1915, Mr. Weston sent the writer the following supplementary facts and comments:

> The Brockton experiments are being made to determine the relative value of aëration and contact with the accumulations of sludge on a contact surface, as suggested by Clark and others, and as compared with the activated-sludge method as suggested by Fowler and others—i.e., aëration with fixed and with moving sludge respectively. The method of aëration by pumping over a cascade is being tried. A trial of aëration with compressed air, using filtros plate for distribution, is being considered. After the completion of the experiments with the cobbles they will be removed and the tank used as a continuous activated-sludge tank.
>
> The height of 40 ft. for pumping the sewage will, of course, make the air blower the cheaper machine. We are starting, however, with the extreme amount of aëration which is possible with the devices as constructed, and hope that this can be gradually reduced.

Aërated Slate and Activated-Sludge Tanks at the Lawrence Experiment Station

Like so many other innovations in sewage treatment, the activated-sludge process was suggested by experiments carried on at Lawrence under the direction of H. W. Clark, Chemist of the Massachusetts State Board of Health. It was here in 1912 that Gilbert J. Fowler, of Manchester, England, renewed his interest in sewage aëration to such an extent as to lead him to undertake experiments of his own on his return to England. The results of these experiments by Fowler, and also by others in England, came back over the Atlantic in such form as to cause the starting up of activated-sludge experiments in the United States and Canada in and since the latter part of 1914.

Just what Dr. Fowler saw at Lawrence and Mr. Clark's view of its relation to the early stages of the activated-sludge process may best be stated in Mr. Clark's own words:

> He [Dr. Fowler] visited the station in August, 1912. At that time we had been carrying on bottle experiments upon aëration for four months, as explained in the reports on the Lawrence work [Massachusetts State Board of Health] for 1912 and 1913. In these gallon-bottle experiments, in which aëration was kept up continuously, we produced stable sewage and high nitrification. The bottles were emptied daily and filled with fresh sewage, allowing only what we designated as "growths" on the sides and bottoms of the bottles to remain. By means of these "growths" and aëration, we day after day produced stable and highly nitrified bottle effluents. This was the work shown to Dr. Fowler in August, 1912. On returning to England he began exactly similar experiments [except that he retained sludge in the bottle], but instead of calling the algal life and other life in the bottle "growths," as we designated it, he gave it the more taking name of "activated sludge."

[4] A letter from Mr. Weston states that the nitrification was 1.1 parts per million on July 6 and 2.2 parts on July 9.

Meanwhile at Lawrence attention was directed to sewage aëration in tanks containing slate—called for convenience aërated slate tanks. The slate were thin. At first they were placed vertically, but for the last two years they have been in a horizontal position. During the present year activated-sludge experiments have also been carried on at Lawrence.

Visiting Lawrence on June 28, 1915, I first noted three slate tanks. These are small rectangular tanks of galvanized iron, with a sewage depth of about 3 ft. Two have a capacity of 200 gal. each and one of 168 gal. If the slate in the tanks were packed solidly it would occupy respectively 10, 3.5 and 1.75 per cent. of the space. The sewage is aërated for 5 hr., at the rate of 50,000 cu.ft. of air per hr. per 1,000,000 gal. of sewage. After aëration the sewage is drawn off down to the sludge, the tank is refilled, and aëration is resumed. Through the night, aëration is discontinued, as the mechanical plant at the Lawrence station is operated only 12 hr. a day.

Air is supplied to the bottom of the tanks by a blower. One tank has two air inlets; each of the others has one inlet and an air deflector.

The aërated slate tanks give a stable effluent 90 per cent. of the time, and always produce a stable sludge. The original sewage, it may be added, from combined sewers, is fairly strong.

Activated-sludge tanks have been in operation at Lawrence since February, 1915—in addition to the bottle experiments with aëration and "growths" already mentioned, begun in April, 1912, and continued to date. Two small tanks are in use. One is of galvanized iron, 26 in. in diameter and 48 in. high, and is filled nearly to the top. The other tank is of wood—a small barrel. Metered air is admitted to the bottom of each tank through a single inlet, at the rate of about 250,000 cu.ft. per hr. per 1,000,000 gal. of sewage, or five times the rate for the aërated slate tanks.

Mr. Clark states that the same general results are being obtained with the activated-sludge tanks at Lawrence as elsewhere, but that he is more interested in the aërated slate tanks, which give better results at less operating cost for air. The Lawrence activated-sludge tanks give a quick-settling stable liquor, without nitrates, and a stable sludge.

Both kinds of tanks at Lawrence are indoors. The sewage treated in them probably never goes below 48 deg. F. Equally good results appear to have been obtained with the lower as with the higher temperatures, but it is not known how low the temperatures could go and still give good results.

It is interesting to note that the effluent from the aërated slate tanks has been successfully treated by a sprinkling filter at the rate of 9,000,000 gal. a day, applied during a period of 22 hr.

Experiments at Regina

While at Chicago the writer heard that activated-sludge experiments had been conducted at Regina, Sask., under the direction of R. O. Wynne-Roberts. Regina was too far afield to warrant a visit, but the *Canadian Engineer* of July 1, 1915, contains a description of the Regina plant written by Mr. Roberts. The following statements are from that source.

Two indoor galvanized-iron tanks, 4 ft. 7½ in. in diameter, with a 2-in. central outlet pipe in their bottom

and a long, narrow glass window in their side, were provided. The sewage depth was about 5½ ft., giving about 700 U. S. gal. of sewage per tank.

The tanks were filled with raw sewage. Aëration was started in No. 1 on May 18 and in No. 2 on May 20, 1915. After two days' aëration a "pailful of concentrated sewage from houses" not yet connected with the sewers was poured into each tank. Subsequently the process was "repeated about seven times." What happened still later is not stated.

Air was supplied to Tank 1 by means of an improvised air compressor and receiver through pipe in the bottom of the tank. Perforations 6 in. c. to c., covered with canvas, served as air diffusers. The size and arrangement of the air pipes and the size of the perforations are not given.

The air supply for Tank No. 2 was secured by an improvised and apparently unsatisfactory injector, which discharged a mixture of sewage and air at the top of the tank with such force that it was driven nearly to the bottom of the tank, where it was spread out to the side of the tank by striking an inverted cone.

The air delivered to each tank was measured by a ⅜-in. orifice plate inserted in the air pipe, with a connection from either side of the plate to a water gage. The aim was to supply air at the rate of 0.25 cu.ft. per min. per sq.ft. of tank area.

Mr. Roberts' connection with the experiments closed on May 31, when they were taken in charge by F. A. McArthur, City Engineer of Regina. Andrews and Cruckshanks were employed to make analyses, but at the time Mr. Roberts wrote, full results were not available.

Settling and Aërated Contact-Bed Experiments at Houston, Tex.

Present indications are that Houston, Tex., will be the first city to treat all its sewage by the activated-sludge process. However that may be, it seems worth while to relate briefly how E. E. Sands, City Engineer of Houston, experimented for four months with sedimentation and the treatment of the settled sewage in an aërated contact bed and by electrolysis, and then, after visiting a number of places where experiments with activated sludge are being carried on, decided that this new process was just the one to meet conditions at Houston and began to design works to treat the sewage of 160,000 people, including residents of some suburbs.

per cent. of voids, giving a sewage-holding capacity of 270 gal. A small air compressor, driven by a ¼-hp. induction motor, supplied air at the bottom of the tank through three ½-in. pipes, each perforated with five $\frac{1}{16}$-in. holes. A gas meter and a mercury U-tube showed the amount and pressure of the air supply. At first the air had a tendency to go up through two or three orifices. A relief valve was put on and the compressor speeded up, after which a better distribution was secured. An air pressure of 81 in. of water was required to force the air through 42 in. of sewage. This is thought to have been due to partial stoppage of the pipe perforations by the stone. The aërated tank or contact bed was operated on the fill-and-draw plan.

Average stability results under the conditions stated are shown by the accompanying table.

SEWAGE AËRATION RESULTS AT HOUSTON

Settled, Hr.	Aërated, Min.	Cu.Ft. of Air per Gal.	Relative Stability
2	20	0.6	41
2	30	0.9	46
2	40	1.2	70
2	50	1.5	78
2	60	1.8	88
2	90	2.7	99

Aëration for more than 90 min. showed but little further improvement. It was not unusual, Mr. Sands states, for the aërated effluent to stand up 40 to 45 days or more. An oxygen-consumed test showed 351 parts per 1,000,000 in the raw sewage and 10 parts in the aërated sewage.

The electrolytic tank or flume, similar to the one at Oklahoma City, was 22 in. wide, about 14 in. deep, and

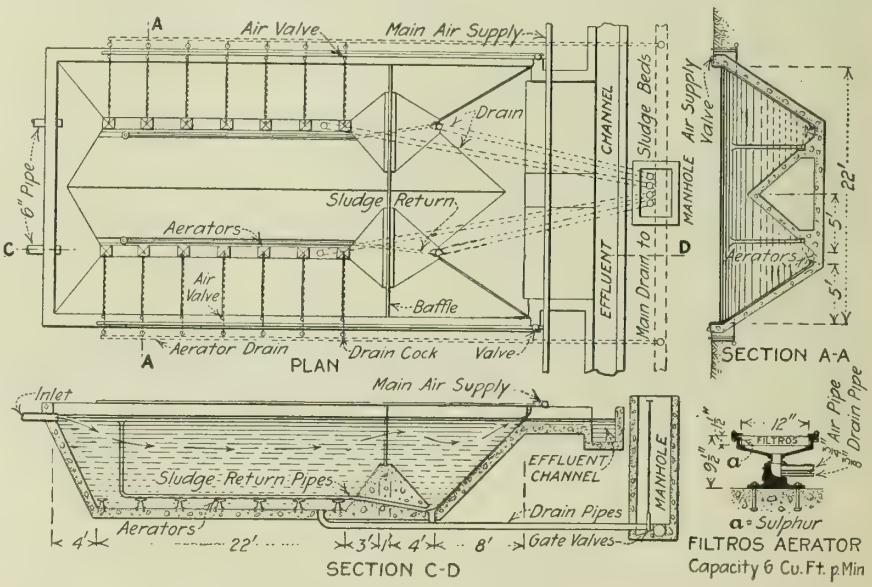


FIG. 5. TENTATIVE DESIGN FOR ACTIVATED-SLUDGE TANK, HOUSTON

The holding capacity of the aërating tank is 2850 cu.ft.; of the upper part of the settling tanks, 761 cu.ft.; of the lower part of the settling tanks, 156 cu.ft. The aërating period is 75 min. The inflow of raw sewage is at the rate of about 226 gal. per min. and the return flow of sludge at the rate of about 57 gal. per min. The settling period in the upper part of the settling tank is 20 min. The required volume of air (compressed) is 84 cu.ft. per min., not including that for the sludge-return pipe

Houston has a strong sanitary sewage, which is more or less septic when it reaches the pumping station. In the experimental plant this sewage first went to a settling tank 6 ft. wide, 20 ft. long and 5 ft. deep, from which sludge was removed to prevent septic action. The tank was operated on the fill-and-draw plan. The settled sewage was measured by a weir.

The aërated contact bed was a tank 5 ft. square and 3.55 deep, filled practically to the top with 1½ to 2-in. broken limestone and settled sewage. The stone had 42

30 ft. long. It was filled with vertical plates about 1 in. apart supplied with electric current at 4 volts and 150 amp. (sometimes 5.8 and 315 respectively). Sewage settled for various periods was passed through the electrolytic flume at the rate of 27,000 gal. a day, but no "consistent results" were obtained. Crude sewage with 351 parts per 1,000,000 of oxygen consumed, which after being settled 2 hr. and aërated in the contact bed for 2½ hr. showed only 10 parts per 1,000,000 of oxygen consumed, showed 78 parts after the same sedimentation

period, followed by electrolytic treatment at 4 volts and 150 amperes. The same electrolytic effluent, after being aërated for 6 min. in an open barrel, showed 63 parts of oxygen consumed.

The conclusions drawn by Mr. Sands from his experiments were that the electrolytic process was too uncertain to warrant further consideration and that the aërated contact bed supplied with settled sewage indicated that "a first-class effluent may be obtained by a plant occupying a relatively small area, and without creating any nuisance, but that the cost of operating such a plant would be comparatively high."

Proposed Activated-Sludge Plant at Houston

After making a trip to Milwaukee and other sewage-experiment and sewage-disposal plants Mr. Sands decided late in May, 1915, that the activated-sludge process would solve the sewage problem of Houston.

The Houston effluent will be discharged into a navigable stream which is not used for water-supply purposes, so only nuisance prevention need be considered. Ordinary sewage-treatment works would require pumping of the sewage several miles under a considerable head, which would be avoided with the activated-sludge process.

On June 30 Mr. Sands sent *Engineering News* his preliminary design (Fig. 5) for a unit of an activated-sludge plant for Houston. He states that the design is liable to change before he begins construction, and that meanwhile criticism would be welcome.

Coarse screens and grit chambers will be installed at the pumping station. The disposal plant consists simply of electrically operated blowers, activated-sludge tanks and perhaps sludge-drying beds.

Mr. Sands considers as settled that to meet Houston conditions aëration for from 60 to 75 min. followed by settlement for from 15 to 20 min. will be sufficient. He also believes that "a return rate of from 20 to 25% in the sludge pipe will keep a sufficient amount of activated sludge in the aërating tank to produce first-class results." He is in doubt as to the best means of controlling the sewage flow in the tank and of returning activated sludge to the tank, and is not satisfied that filtros blocks will be the best medium for air diffusion. He is making experiments to clear up some of these doubts.

What is "Vitrified" Brick or Pipe?

The original meaning of "vitrified" is "made glassy," and in this sense few, if any, ceramic products are vitrified.[1] On account of the differing characteristics of different clays, the best degree of burning is variable, and the resulting appearance also varies. Often a product of more "glassy" appearance than another is less serviceable. There is no uniform meaning applied to the word "vitrified" as commonly used. An analysis of the several effects of burning clay wares leads Prof. Edward Orton, Jr., of Columbus, Ohio, in a paper presented to the recent annual meeting of the American Society for Testing Materials, to conclude that the most useful measure of burning may be determined from the absorption, interpreted as an index of resulting compactness. He proposes the following definition:

> Where the word "vitrified" is used in a contract or agreement in describing the properties of a clay product, and is not further defined in the contract, it shall mean that the product shall have attained in the firing process such a degree of compactness that its mean absorption does not exceed 3 per cent. of its own initial weight of pure water, when subjected to complete immersion in cold water for 48 hr. or boiling water for 3 hr. Not less than three tests shall be made in determining the mean absorption, and no single test may exceed the mean by more than 0.5 per cent. Neither the possession of the visual properties or appearance of a glass nor any definite degree of physical strength, hardness, color or specific gravity shall be implied as an attribute of vitrification.

The proviso that this definition applies only where the contract gives no definition is important. If vitrified paving brick of 5 per cent. absorption gives good service (Mont Schuyler, St. Louis, Mo.), the specification should set limits including this value[2] and the definition is not intended to apply.

Overhead Line Construction

In a paper presented before the recent meeting of the National Electric Light Association at San Francisco, J. C. Martin described the difficulties of electric development in the Pacific Northwest where the requirements of the association's specifications had been embodied in acts and orders. He contended that the construction advocated was well adapted only to Eastern conditions. In the West, distribution at pressures up to 15,000 volts or more is necessary because of sparse population. The construction required for that voltage under the specifications was prohibitive in cost.

A dispute arose in comparing oil switches with air-break switches, but no important conclusion resulted. It was agreed that oil switches give less trouble generally, but that in cases where air-break switches satisfy they are just as good. One member stated that there is now an instrument for locating inductive interferences, and that it had been successfully used. If the inductive interference of the two lines can be localized, it is believed that the trouble can be remedied and that the power companies can be saved the present annoyance and expense of shifting their poles at the bidding of the telephone companies.

Unnecessary Underground Piping in the streets of the Borough of Manhattan, New York City, was described in a report recently made by Charles N. Green, engineer of subsurface structures for the Public Service Commission, to Chief Engineer Craven. In the construction of the subway, which makes necessary the removal of underground piping, the commission is obliged, after the subway itself is constructed, to relay all pipes that have been displaced, including duplicate and unused pipes, as well as those now required for service. It is estimated that the cost of relaying these unnecessary mains is from $2000 to $15,000 on each subway contract section. Mr. Green estimates that there are approximately 1450 mi. of gas mains in the Borough of Manhattan on about 500 mi. of street, and about 800 mi. of water mains, not including the 100 mi. of high-pressure mains. There is no reason why the mileage of gas mains should be greater than the mileage of water mains, except that a considerable part of the mains was originally laid by separate and competing companies. Mr. Green estimates, therefore, that there are at least 500 miles of unnecessary gas mains occupying space beneath the street surface which is badly needed for other underground conduits. The city derives little revenue from these underground pipes in its streets, as most of them were laid many years ago under perpetual franchises.

[1] The new standard definitions of terms relating to sewer pipe of the American Society for Testing Materials define "vitrification" as "fusion into a hard glassy material under high heat."

[2] The new standard specification for paving brick of the American Society for Testing Materials does not specify absorption, but judges the brick exclusively by appearance and by rattler test.

Field and Office

Flume Without Side Braces

In the construction of the City Trunk Line, by means of which the municipality of Los Angeles receives its apportionment of the Los Angeles Aqueduct, flume work is employed in the crossing of a shallow creek bed. The flume erected differs from the standard form of flume construction in that no outside struts or braces were employed.

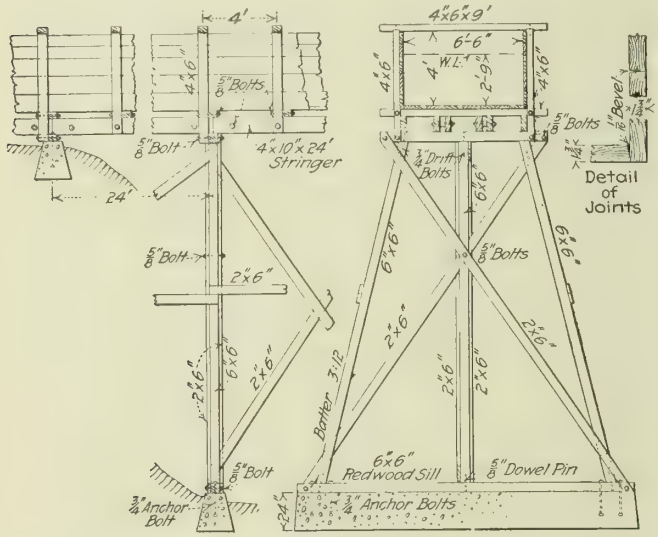


FIG. 1. DETAILS OF FERNANDO FLUME, LOS ANGELES WATER-WORKS

The flume has a total length of 676 ft. and is designed to carry a flow of 20,000 miner's inches (approximately 258,000,000 gal. per 24 hr.) at the high velocity of 22 ft. per sec. The grade is 2.58 per cent. The allowance for n in Kutter's formula was 0.011. The structure is built

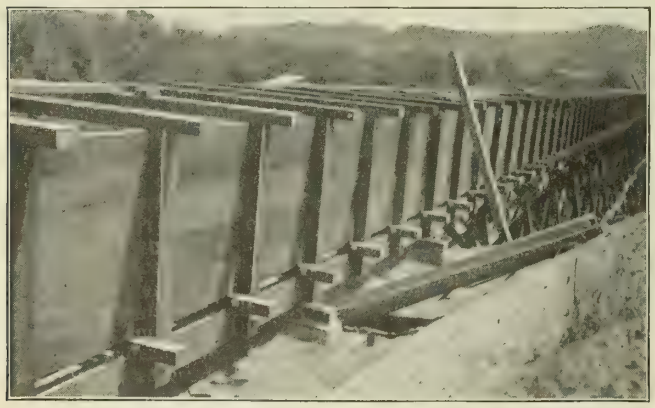


FIG. 2. VIEW OF FERNANDO FLUME, LOS ANGELES WATER-WORKS

on a tangent and carries the full flow of the aqueduct 18 ft. above the creek bottom.

The flume proper is built of 2-in. redwood plank, sized on one side, calked with oakum, with inside dimensions of 6½ ft. in width and 4 ft. in depth, with an allowance of 15 in. for freeboard.

Since the usual side struts were considered likely to loosen and weaken the structure, the side walls are held firm by bolting the outside posts to both the cap of the bent and the cross-tie under the flooring and by employing a 4x6-in. cross-tie doweled in at the top (see Figs. 1 and 2).

The bents are of selected Oregon pine, set 12 ft. apart, on concrete foundations, except over the stream bed, where there is a truss with the end bents placed 48 ft. apart to permit the passage of drift in winter freshets. The cost complete amounted to $7.50 per lin.ft.—From Burt A. Heinly, 645 South Olive St., Los Angeles, Calif.

New Rope-Testing Machine

A continuous rope-testing machine recently placed on the market consists of a series of four revolving grooved wheels, which grasp the rope in such a way that for about 8 ft. of its length it is subjected to a known tension. Two forward sheaves and a coiling frame are driven by a motor, while the rear pair are restrained by a friction brake. The tension can be regulated by a lever, which

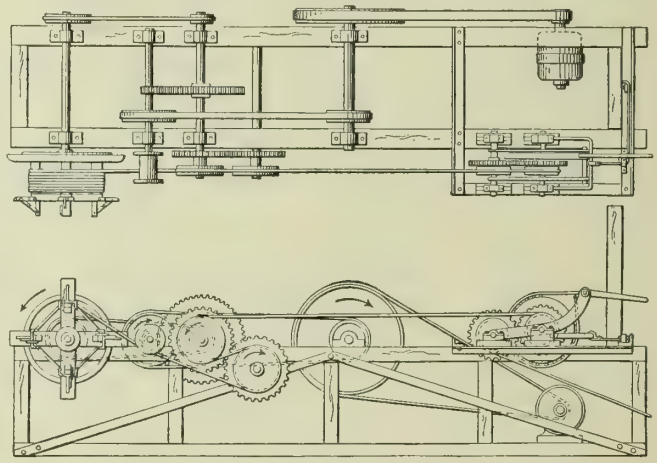


FIG. 1. PLAN AND ELEVATION OF NEW ROPE-TESTING MACHINE

acts on the friction brake. The rear sheaves and brake are mounted upon a sliding carriage, which is connected with a weighing device for measuring the tension in the rope. Special provision is made for testing the extreme ends of a rope. An end is looped over a hook, after the body of the rope has been tested, and a momentary pull is exerted upon the end. The accompanying plan and elevation illustrate the design of this machine. For the photograph of the machine in operation we are indebted to the New York Edison Co.

It was invented by A. N. Faulkner, secretary of the Chesebro-Whitman Co., 64th St. and First Ave., New York City. This company proposes to lease these machines as soon as it is in a position to produce them in sufficient quantity. Mr. Faulkner states that he intends to build another machine for testing steel cables. The

present machine is adapted especially for testing rope used for rigging work. He also proposes to build a machine on the same principle as the present one for testing chains,

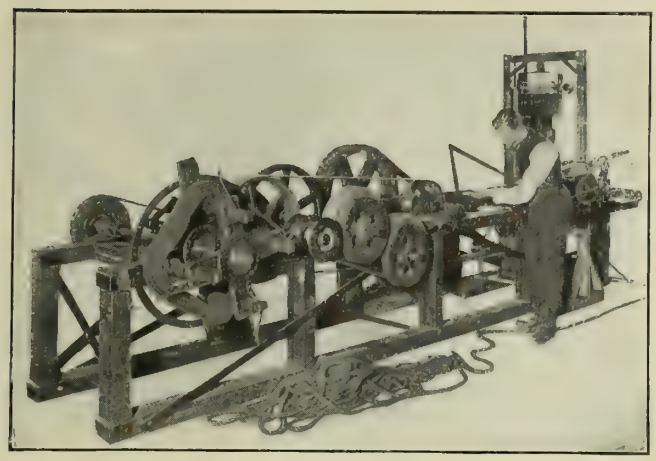


FIG. 2. ROPE-TESTING MACHINE

and has applied for a patent on the chain-testing machine. About 400 ft. of manila rope can be tested by the present machine in 10 min.

Erecting New Trusses on a Canal Bridge and Dam

By W. R. Browne*

Part of the work necessary for the strengthening of the New York State Barge Canal bridge[1] at Dam 5 near Rotterdam Junction consisted of erecting a new truss on the downstream side of each of the three spans, centered 2 ft. outside of the present downstream truss. This work was made difficult by the limited working space available (Fig. 1), due to the necessity of keeping the track clear for the passage of the steam hoist used in operating the wickets and gates of the movable dam. The track itself proved a help, in that it provided for the use of flat cars for running the iron out to its position, and a niggerhead on the hoist was used for a runner or with the falls on a ginpole, as each in turn was required.

The lower-chord members of the new truss were placed with a set of falls attached to the upper chord, while a light latticed steel ginpole served to place the remaining members of the trusses. The members were swung up to the bridge at the west approach, landed on flat cars, and run out to their respective positions as required.

Since the steel was unloaded at the shore end of span 1, it was planned to erect first the truss in span 3 and back away from the work, clearing up the bridge as the work progressed. Here, however, a change was made, since it was found impossible to complete the reinforcing on the upstream truss of span 3 in time to allow the start of the new truss on that span without laying off part of the gang. The direct causes for this condition were, first, the nature of the reinforcing on the upstream truss was such that only a few men could be used; and, second, the state would not permit the increase of dead-load caused by the erection of the new truss until the upstream truss reinforcement was completely driven up.

*Fort Trumbull Beach, Milford, Conn.

[1]For description of the movable dam and bridge used on the Barge Canal, see "Engineering News," May 27, 1915, p. 1034.

For these reasons the trusses in spans 2 and 1 were erected, in the order named, and jacked onto the shoes to clear the track before the last truss was started. This program caused less inconvenience than was thought probable, but incurred a slightly greater expense, in that the same ground had to be covered twice.

As previously mentioned, when completed and in position, the new trusses were to be centered 2 ft. outside the old trusses; but it was necessary to erect them outside of the final position to permit connecting and riveting. In order that the trusses might retain camber during erection, a set of camber blocks was made from rounds of the proper diameters. Since $\frac{7}{16}$-in. bearing plates for the new trusses were riveted to the floor-beams, and the blocking must necessarily clear the final position of the truss, the rounds used at the different panel-points were $\frac{7}{16}$ in. greater in diameter than the difference in camber required.

The trusses having been completed in their temporary positions on the blocking, the top chord was pulled into line by means of four sets of double falls. The bottom chord was then jacked into position by means of six Norton jacks—one at each shoe and one at each L_2 and L_5 panel. Blocking placed against the inside rail of the track gave a firm bearing to the jacks. No difficulty was encountered in lining the truss in this manner, it being merely necessary to jack the truss over until the



FIG. 1. LOOKING ALONG DAM NO. 5, SHOWING AT LEFT THE REINFORCING TRUSS

floor-beam hangers came into position. When the 216-ft. 6 in. truss left the blocking, it dropped approximately ¼ in. at the L_5-L_5 panel. The drop in the 156-ft. 6 in. span was still less noticeable. It was observed that at several panel points the lower chord was high after the

truss was completed, having no bearing on the camber blocks. It is assumed that this fault may be traced directly to the fact that although the various sections were fitted together at the shop prior to shipment, the trusses were not assembled entire and reamed to camber.

Arrangement of Screwjacks and Supports

The new trusses having been lined, they will be brought to their final position by means of screwjacks constructed and arranged after the manner described below. In order

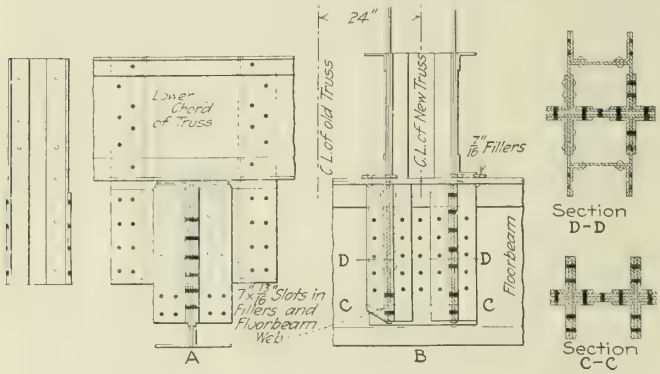


FIG. 2. CONNECTION BETWEEN POST AND FLOOR-BEAM

to understand fully the use of these jacks it is necessary to describe briefly the type of floor-beam hanger connecting the floor-beams to the trusses.

Fig. 2 shows the floor-beam prepared to take the truss; *A* shows the diaphragm attached to the truss, while *B* shows the new truss in position on the floor-beam. It will be noticed that the diaphragms below the truss are not punched to take the holes in the floor-beam hanger. These holes are drilled in the field after the truss has been swung to its final position.

The arrangement and construction of the jacks are shown in Fig. 3. As is shown in the sketch, two jacks were employed at every panel-point, one on each side of

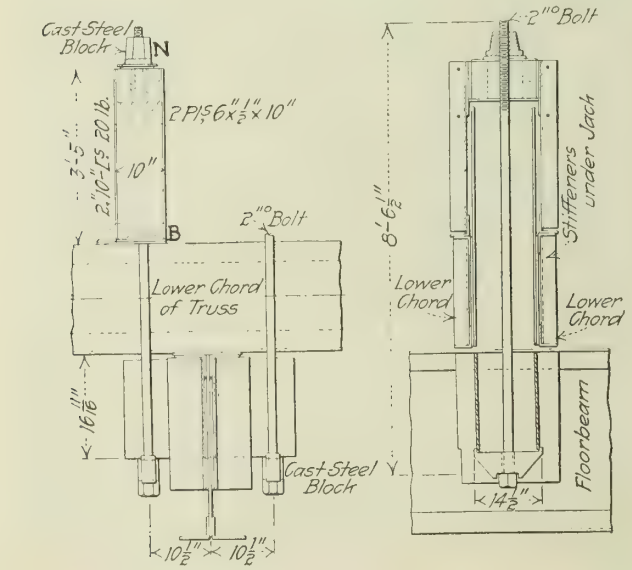


FIG. 3. DEVICE FOR JACKING UP FLOOR-BEAM

the floor-beam. The cast-steel blocks at the bottom of the jacks engaged the floor-beam hangers after the manner indicated, and, as may be observed, the bearing on the top of the lower chord at *B* brought the truss and floor-beam together when the cast steel nut *N* was turned down.

The two main uprights in the jack are 10-in. 20-lb. channels, back to back, with 6x4x½-in. lug angles, 1 ft. 2 in. long at the foot of each. These lugs are provided with three slotted holes each to permit bolting to the chord angles which have open holes for this purpose. The holes are slotted to allow a slight adjustment of the jack after it has been raised to a working position, and at the same time insure good holes for the bolts, while avoiding rivet heads in the floor-beams. The top of each channel is stiffened with one 6x½x10-in. plate, which also forms a shelf for the connecting lugs on two 8-in. 16¼-lb. channels, which separate the vertical channel posts. A finished cast-steel plate resting on the flanges of these 8-in. channels provides an accurate bearing for the cast-steel nut. The 2-in. bolt is threaded for 2 ft. 2 in. at the top with standard thread, which is more than sufficient to care for any variation in the sizes of chord sections over which these jacks will be operated on other structures.

At the time of writing, the jacks are in position on the 216-ft. 6 in. span, but it will be impossible to swing the truss until such time as the gates of the dam are lifted, since the bridge under the existing conditions is fully loaded, and the specifications dictate that this work shall be done under more favorable conditions.

The Whitehead & Kales Iron Works of Detroit, Mich., has the contract for the reinforcing work at Dam 5 and for six other dams of a similar type along the barge canal. The work is under the supervision of E. L. Andrews, field superintendent, and W. A. McKeough, foreman.

Motor Trucks for Heavy Structural Steel

By William Collins, Jr.*

It is common in New York City to see teams of from 4 to 20 horses hauling trucks loaded with huge steel girders and columns for building and elevated-railway construction. The use of motor trucks for this service is rare, but has been tried with success by George H. Pride, a subcontractor on the new Jerome Ave. elevated structure, an extension of the Lexington Ave. subway.

The greatest amount of steel to be hauled and stored in any one place was on River Ave., a narrow and unpaved section of the route. In wet weather this street was almost impassable to any vehicle, and the comparative ease with which the heavily loaded motor trucks traversed it was a revelation. The heaviest girders were 80 ft. long, weighing 32 tons, and several were as long as 107 ft., weighing 23 tons; the average was 50 ft. long and weighed 7 tons. The average length of haul was 2 mi., a large part of which was through unpaved streets.

The steel was delivered on lighters by the American Bridge Co. at a city dock, 155th St. and Harlem River. No steel was stored on the dock, the trucks being loaded by the lighter's derrick. The trucks are of 6½ tons' capacity, 38 hp., and have special flat bodies. The trailers, which are of special design, are substantially built, yet conform in a pleasing manner to the lines of the tractors. They have withstood a remarkable amount of abuse and rough handling. The reach poles which connect the truck

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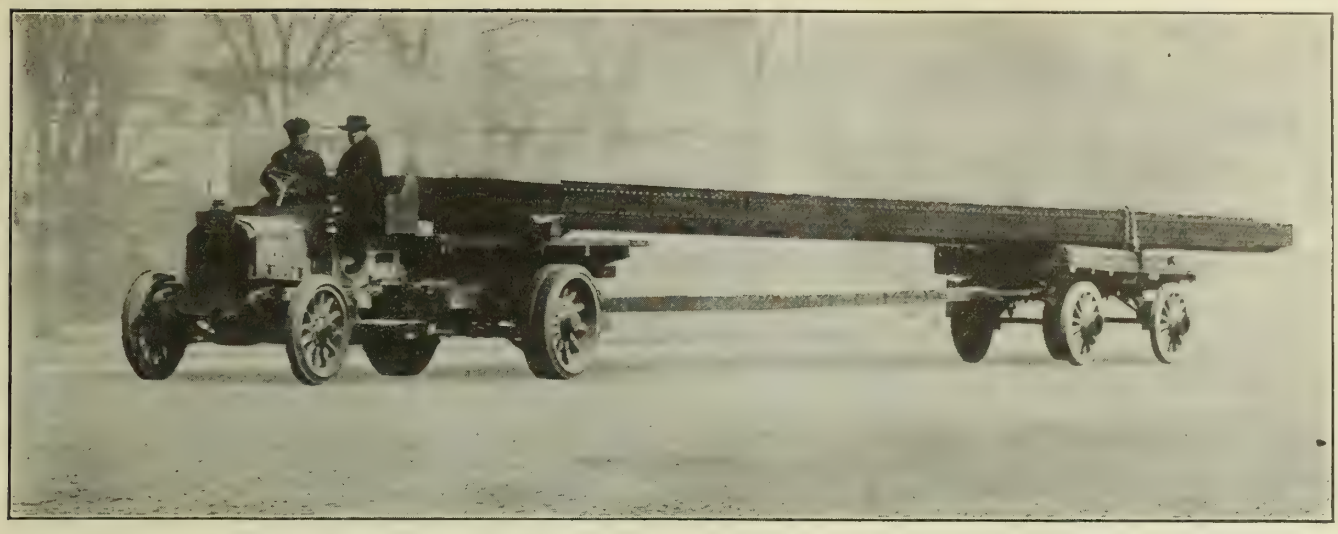


FIG. 1. MOTOR TRUCKS AND TRAILERS HAULING HEAVY GIRDERS FOR ELEVATED-RAILWAY CONSTRUCTION

and trailer can be detached quickly, so that they may be replaced by longer ones or shorter ones to fit the length of steel to be handled. They are pin-connected to the rear of the truck.

The girders were hauled as shown in the accompanying views, the front end resting on a 10x10-in. block which was free to slide on the truck. The rear end, resting on a rail fastened to the trailer, was lashed in place by a chain, the slack in which was taken up by a 12-in. turnbuckle with hooks on both ends, which held the girder firmly in position. The girders, when they reached their destination, were skidded from the truck on to rope mats, after which the mats were withdrawn and the girders placed in an upright position in storage piles on 4x4-in. blocks. The columns were hauled on two-wheeled underslung trailers.

Great care was required to bring the 107-ft. longitudinal girders through the narrow, traffic-crowded streets which they had to traverse to reach River Ave. These girders were placed on two trailers as shown in Fig. 2, and two trucks were used to bring them up some heavy grades. In spite of the fact that a sharp turn had to be made to get into River Ave., it was accomplished with comparatively little interruption to traffic on 161st St., where there is a crosstown trolley line with a headway during rush hours of less than two minutes. These long girders and the 32-ton girders were delivered at a time which allowed the contractor doing the steel erection to unload them with the erection derrick-car, which transferred them directly to the structure.

Motor-truck transportation was also used successfully and profitably on the White Plains Ave. extension of the Lenox Ave. subway and on the Brooklyn rapid-transit extension of the Fulton St. elevated line in Brooklyn, both of which are parts of the new dual rapid-transit system being built at the present time in New York City. On these particular jobs, however, the haul was long, the steel was delivered in large units, and there was no time lost in loading and unloading. These are the essential contributing factors to the contractor's success.

Bids made by teamsters for these jobs were from 25 to 35 per cent. greater than the price received by Mr.

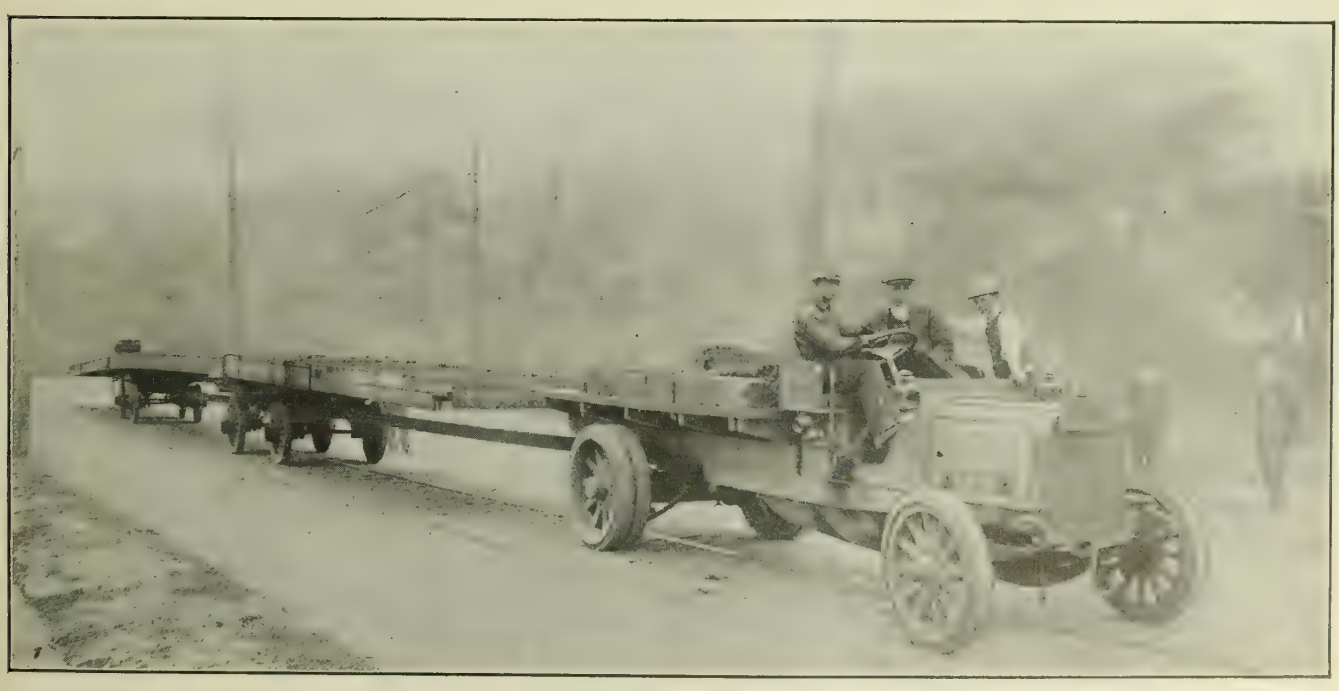


FIG. 2. DOUBLE TRAILERS FOR HAULING LONG ELEVATED-RAILWAY GIRDERS, NEW YORK CITY

Pride. The general contractors for the Jerome Ave. and White Plains Ave. sections admitted having contemplated the hauling of the steel themselves, using teams for the large pieces and motor trucks for the smaller ones, but found it was cheaper to sublet the hauling. The subcontractor started hauling in the late winter and continued through the early spring in spite of the deep mud and heavy ruts in River Ave. These conditions alone would make it almost impossible for a teamster to realize a profit.

In building construction, however, where the steel units are small, the haul short and the dense traffic of the business streets cuts down the speed of vehicles, and where unloading is done by the erection derrick on the building, the trucks being made to wait until the derrick is idle, it would be impossible for motor trucks to compete. The reason is obvious. A motor truck which costs $20 a day to operate could not deliver sufficient tonnage under the prevailing rate of $1 per ton-mile for this class of teaming to pay its cost of operation.

The accompanying table gives the comparative costs per ton of motor truck and team hauling for the two adjoining contracts on Jerome Ave., where the conditions are almost identical.

COMPARATIVE OPERATING COSTS OF TEAMS AND MOTOR TRUCKS

Type	Average Length of Haul	No. of Trips	Tons per Trip	Cost* per Day	Cost per Ton
Motors, 6½-ton, 38-hp..	2 mi.	6	10	$20	$0.33
Teams 4-horse	2 mi.	4	5	10	.50

*Cost includes drivers, insurance, maintenance, etc.

It must be remembered that when it is necessary to haul a larger load than those referred to, such as long stringers and heavy cross-girders which average 12 tons, the teamsters find it necessary to double or triple the number of horses, using from 8 to 10 horses for the average cross-girder; and in case of a 30-ton girder, from 15 to 20 horses are required. This of course inflates the cost per ton beyond any comparison. The motor trucks, on the other hand, never required extra assistance for girders under 20 tons, one truck doing the work of 20 horses. This kept the motor trucks' cost per ton almost uniform.

To Mr. Pride belongs the credit of having demonstrated that heavy pieces of structural steel could be hauled cheaper, faster and with less interference to traffic by motor truck and trailer than by the time-honored methods. The employment of the motor truck and trailer in all fields of hauling is daily augmenting, but this marks a great step.

Wagon Loaders for Broken Stone

On road and other construction where bulk material such as stone, sand, gravel or coal has to be hauled from a railway siding to the work, special means are desirable for handling the material between the railway cars and the wagons or motor trucks. If the material is shoveled directly, the shovelers have to wait until vehicles are ready, they cannot see if they are delivering it properly, and the vehicles stand idle while being loaded. This involves much loss of time. With horse or mule haulage a certain amount of rest is required for the animals (though not as much time as it takes to load the wagon); but with tractor haulage, motor trucks or industrial-railway haulage this idle time is a dead loss.

Two methods of handling material in such cases are noted below—one where the material is delivered in railway dump cars or bottom-discharge cars and the other where it is delivered in gondola cars and must be unloaded by hand.

The first device, shown in Fig. 2, consists of an inclined bucket elevator and a storage bin, the elevator being driven by a small gasoline engine. The apparatus is readily portable by rail or road. It is erected at the siding, and a pit is excavated for the lower end of the bucket incline. This pit is lined with wood. An inclined chute is cut from the pit to the track, and in this is fitted a steel trough. A gate controls the flow of material to the bucket, which is of ¾-yd. capacity. At the top of the incline the material is dumped into the bin, which may be of from 15 to 50 tons' capacity, and from this it is discharged into the wagons, trucks or dump cars through gates and spouts. The elevator can handle from 250 to 500 tons of material daily, and it is stated that the transfer from car to wagon will cost not more than 2c. per yard. The apparatus is built by the Galion Iron Works & Manufacturing Co., of Galion, Ohio.

The second method of handling, where hand shoveling is necessary, is to place beside the car steel bins or hoppers, which are loaded by the men in the car and dumped when a wagon or truck is placed beside them. Thus the shovelers can work more steadily, they spill and waste less material, and the wagons are loaded very quickly. The device shown in Fig. 1 has a steel hopper carried by a frame which is hung directly on the side of the car.



FIG. 1. PORTABLE WAGON LOADER ATTACHED TO RAILWAY CARS

The hopper is so balanced that when loaded it will dump automatically when the latch is released. The hoppers and frames are easily handled. This device is built by the Bonney Supply Co., of Rochester, N. Y.

A somewhat similar loader built by the Lee Loader Co., of Chicago, has the hopper mounted on light steel frames placed beside the car, instead of being attached to it, as in the former case. Thus the loader is quite independent of the car. The hopper is not pivoted, but

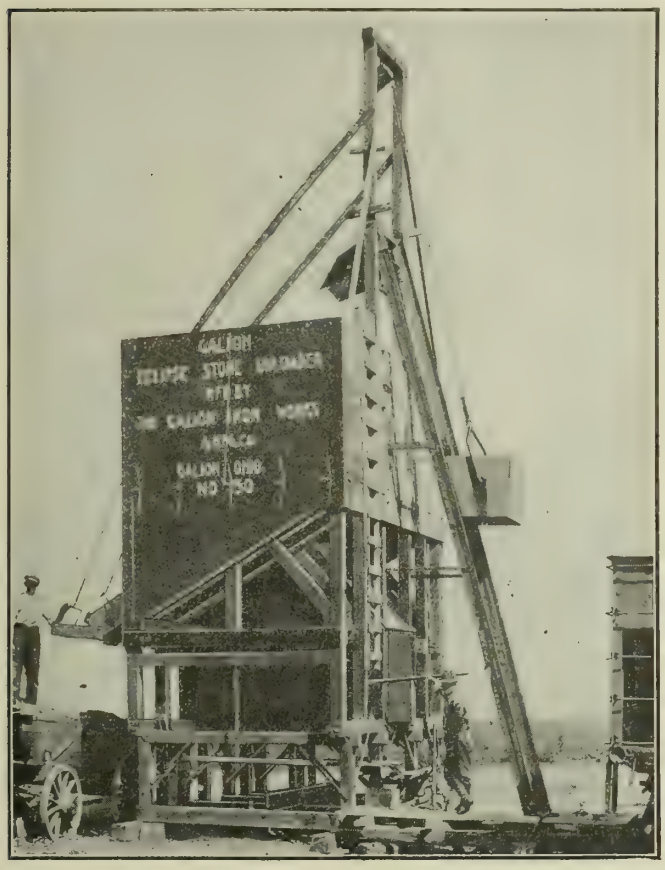


FIG. 2. PORTABLE LOADER AND BIN FOR TRANSFERRING MATERIAL FROM RAILWAY CARS TO WAGONS

has a round bottom upon which it rolls across the frame in dumping. It thus discharges its load clear of the supports, and rolls back to the side of the car. It is stated that in some cases these loaders have enabled the team or wagon equipment to be reduced considerably owing to the great reduction in lost time due to loading. The hoppers are made in sizes of from ¾-yd. to 5-yd. capacity, the larger ones being for loading motor trucks. These loaders can be carried from place to place in a wagon or truck.

Washing Paint Charged to Infected Oil

Deterioration of linseed-oil paints may often be due to fungus introduced with unclarified oil. Studies of paint which showed "washing" led Henry A. Gardner, of Washington, D. C., to conclude that microörganisms are probably responsible; that these originate in the oil and feed on it; and that the original sedimentary impurities or "foots" in the linseed oil are the seat of the trouble. The observations, together with other studies of fungus growth on paint, are reported in the June issue of the *Journal* of the Franklin Institute under the title "Some Curious Painting Phenomena."

Washing is found most commonly on concave surfaces, as the flutes of porch columns, presumably because moisture is held here longer. It is generally indicated by the appearance of a white deposit at the base of the column and by the paint assuming a soaplike condition. It occurs rather rarely, but in at least one instance it seems to have been almost epidemic in a community.

Study of the paint materials used in several instances of washing showed that the linseed oil contained considerable moisture and a large percentage of mucilaginous or albuminous matter commonly called "foots," indicating poorly clarified oil. The "foots" were found to grow a peculiar pink-colored mold on agar. It was indentified as a species of *Fusarium*. This mold was found capable of injuring the oil, setting free fatty acids and glycerine. The action of these substances in conjunction with the moisture of the air keeps the paint soft and allows of the washing down of saponified portions of the paint film.

Both lead and combined lead-zinc paints are affected by washing.

Mr. Gardner's belief is that the infection is removed from the defective oil by proper clarification.

Canvas Air Duct in Tunneling

The innovation introduced by Thos. Connor & Sons in their tunneling work on the Mill Creek sewer in St. Louis—canvas tubing for air conduit—claims attention for application to all future tunneling as well as other construction work where low-pressure air has to be piped. The contractors report not only a gain in first cost, but—what is more important—a saving of delay and trouble in handling the air pipe at the heading just before and after shooting.

The job was started with galvanized-iron ducts in the shaft and the headings. On account of the time lost after shooting in reëxtending the air pipe to the heading, the contractor took up with the Bemis Bros. Bag Co. the question of supplying some form of flexible conduit. Experiments led to producing a duct or tube of heavy rubberized fabric, in sizes up to 24-in. diameter, which was practically air-tight and water-tight, and was much cheaper than galvanized-iron pipe. Made up in 100-ft. lengths, and joined by a special coupling—an inside metal sleeve grooved at both ends, with clamping rings fastened over the ends—it can be rolled up or reëxtended very rapidly.

At the shaft the contractor has a 15x24-in. Jeffrey blower, delivering 10,000 cu.ft. per min. under 2-in. water head. A 24-in. tube of the rubberized fabric—called "Flexoid"—carries the air down the shaft, and from here a 16-in. Flexoid tube leads it to the headings, about 1600 ft. each way from the shaft.

D. H. Blanks, engineer for Thos. Connor & Sons, estimates that just before shooting, the blower having been shut down, one man can roll up the duct for 200 ft. or more in one or two minutes, and that it can be replaced in even less time after shooting. This is a great saving in labor over the corresponding handling of metal duct.

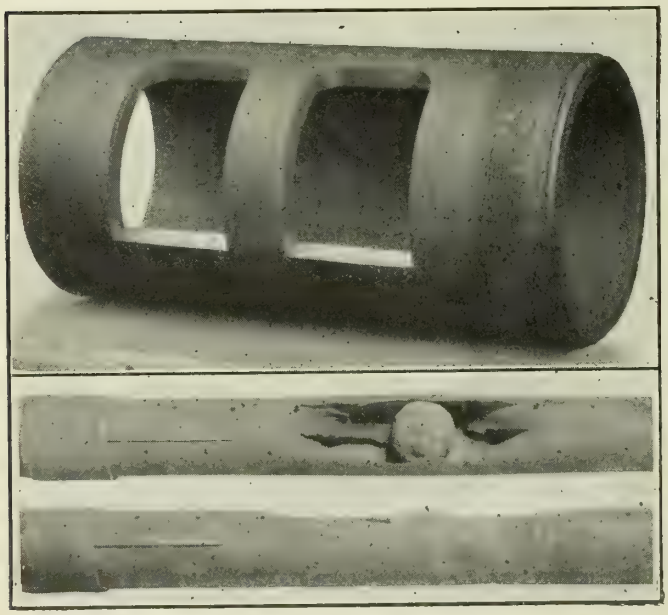
The Flexoid duct has been in use for 5 mo., and a portion of it has been replaced. Mr. Blanks considers that its life would be much greater in a perfectly dry tunnel,

the loss to date having been largely due to weakening from damp rot. As matters stand, however, he figures that by the time the excavation is finished, about 8 mo. in all, the whole installation will have been replaced once. This still represents a great saving in first cost, as the Flexoid costs only about 20 per cent. as much as sheet-metal piping.

The makers of the canvas duct believe it can also be used as temporary water conduit in many instances. Its chief field, however, is ventilating air service. Because it is so simple to handle and does not obstruct other work, it may lead to putting in ventilation in shaft or deep trench work, now done without ventilation.

NOTES

Well-Casing Freaks—The accompanying views show some mistreated pieces of well-casing secured by the National Tube Co., makers of the casings. One specimen shows three telescoped sections. These were the bottom lengths of a 1640-ft. string of 8¼-in. tube which dropped 200 ft. to a



TWO WELL-CASING FREAKS

limestone bottom. Two lengths were completely telescoped and a part of the third; no other injury was evident. The second view shows a casing with an embedded stone which worked in while the tube was being sunk and without causing the pipe to collapse.

Old Granite Block Not a Satisfactory Foundation for Asphalt—About 15 yr. ago the plan of rebuilding the pavements of many of the streets of New York City with a sheet-asphalt surface, using as a foundation the old paving stones, was inaugurated. This has proved a costly blunder for the city, for the unevenness of the foundation has made it very expensive to keep the top surface in good condition. The wear and tear caused by modern traffic is so great that the foundation is just as important as the top surface, and experience has proved that it should be brought to a smooth surface and exactly parallel with the top of the wearing course, in order to accomplish the best results. If there are any depressions in the foundation, in time the traffic will roll out the asphalt so as to follow these indentations. It is both difficult and expensive to keep the surface of the streets in a satisfactory condition if the foundation is uneven, and it therefore becomes necessary after a number of years to remove the top, or wearing, surface, and bring the foundation to a proper surface by filling in the depressions with concrete. In parts of New York such as lower Manhattan or along the main lines of travel and where building operations are active this should be done about every 10 or 12 yr. In other parts, where the conditions do not change so quickly, the foundations may remain in good condition 15, 20 or even more years. There are streets in New York which have not been repaved in over 20 yr., and there is a sheet-asphalt pavement in use in the Murray Hill district on lower Park Ave. laid in 1889, and still serviceable.—From the recent Annual Report of the President of Manhattan Borough, New York City.

Baltimore Sewer-Cleaning Scow—The lower end of the large outfall sewer of Baltimore, Md., is cleaned by means of a scow to which is attached an adjustable dam. The sewer is 12½ ft. wide and the scow nearly as wide. It is built of 3-in. plank on a framework of 6x8-in. stuff. The dam is hinged to the rear of the scow and in cross-section is of the same shape as the lower part of the sewer, but 1 ft. less in diameter. When the sewer is to be cleaned the scow is pulled upstream from the disposal works in the following manner: A man in a small scow or boat paddles up to the first manhole with a rope that has been attached to the large scow and fastens the rope to one of the iron steps. The men in the large scow pull it up to the manhole and secure it there. The process is repeated from manhole to manhole. While the scow is being towed upstream the dam folds over the end of the scow and floats. When ready to start cleaning the dam is placed in a vertical position and braced with guy ropes that can be quickly loosened in case of emergency. The flow of water beneath the boat and dam scours the deposit from the sewer bottom. The small scow follows the large one closely on its way downstream and helps the three men in the large scow keep the latter to rights. The scow is pulled upstream about two miles from the disposal works, or as far as the backwater caused by the tanks extends. Above this point there is no trouble from deposits and such sediment as is found is hard and gritty, about 4 in. deep, and would not be loosened by the scow and dam. Calvin W. Hendrick is Chief Engineer of the Baltimore Sewerage Commission and G. J. Requardt is Acting Division Engineer at the sewage disposal works.

Crowning of Levee Tops seems to be a necessary provision when the river side of the levee is paved, according to recent experience with the levees near Kansas City during floods. Where the levee top was level and slightly below the top edge of the paving or revetment, heavy rains cut under the top edge of the paving and washed out large holes in the levee both on top and down the under side of the paving. Probably if the levee had been crowned above the paving slab such action would not have taken place. It has been shown by cost data kept on this work that it is cheaper to crown the levee and keep it crowned by constant maintenance than it is to fill up the holes discovered in occasional inspections.

An Unusual Drainage Problem—A very unusual situation was encountered by engineers constructing a concrete-lined irrigation canal through a section of land in Riverside County, California. This canal was for all-the-year-round use and carried about the same amount of water at all times. During its construction it was found that at various places it was crossed by storm-water drains, which during and immediately



CONCRETE AQUEDUCTS FOR CARRYING STORM WATER OVER IRRIGATION CANAL

after heavy rains carried large quantities of water. To prevent this storm water from entering the main canal and possibly causing damage, it was decided to carry the wash waters over the canal by the use of small concrete aqueducts or troughs. At various points these aqueducts were constructed and found perfectly satisfactory. During the rains of the past winter neither the aqueducts nor the canal was damaged.—Albert Marple, Tropico, Calif.

Editorials

What Are the "Mechanic Arts"?

The engineering profession in the United States owes a great debt to the Morrill land-grant law, enacted in 1862, which gave a munificent endowment in public land to at least one college in each state, "where the leading object shall be without excluding other scientific and classical studies and including military tactics to teach such branches of learning as are related to agriculture and the mechanic arts."

There has been much discussion as to the true definition of the term "mechanic arts" as used in the Morrill law. A committee of the Association of Land Grant Colleges, of which Prof. A. Marston, of Ames, Iowa, is chairman, has recently rendered a report upon this matter. This committee holds that instruction in the "mechanic arts" properly includes professional engineering education, trade-school and short-course instruction, and experimental investigations. The term "mechanic arts" is not derived from the use of the word mechanic to designate artisans, but refers to the science of mechanics. A correct and concise definition of "mechanic arts," therefore, is the arts which are characterized by the use of the science of mechanics.

The committee puts on record in its report that Senator Morrill, of Vermont, the author of the Morrill act, stated in a letter written nearly 30 years after the law was enacted that the use of the Federal endowment for the development of engineering education was in accordance with his original purpose.

Developing Naval Inventions by a Government Bureau

By inviting Thomas A. Edison to head a board for examining inventions which may be made useful to the navy, Secretary Daniels has called general public attention to one weak spot in our naval organization. Good as our navy undoubtedly is in many respects, it is after all only a copy of the best that can be found in foreign practice. With a few notable exceptions, the United States Navy contains nothing of importance that has been originated in this country.

There are those who defend this policy and urge that it is good business to "let the other fellow spend his money on experiments and then copy what he does." Private concerns which pursue this policy, however, seldom hold a leading position in their industry; and were it generally known by the public that our navy was merely an imitation of foreign naval practice there would be loud protest.

Our naval officers are not to blame that our navy follows, instead of leading. The reason why the United States waits for naval inventions—even those of American origin—to be developed abroad before taking them up here is found in the method by which Congress appropriates funds for Government work. The naval appropriation bill provides specific sums for building such and such vessels and performing such and such work; but nothing, or at best a trifling sum, is provided for the development of inventions useful to the navy.

The theory has been of course that inventors and manufacturers will develop their devices to the point of practical success and then offer them to the department. Rarely does this happen, and then it is usually in connection with devices which are worth development for other than naval uses. In the great majority of cases, however, those who offer new inventions to the Government will not undertake the expense and risk involved in adapting their devices to the especial needs of the navy. They have, in fact, little inducement to do so. The Government policy with regard to new devices, even of established merit, is to purchase them at ordinary manufacturer's profit. The sanguine inventor or manufacturer who spends his own money to develop a device for naval use is only too likely to receive no return for his outlay other than the gratification of his patriotic impulses. If, then, the Government will not furnish the means for improving its great fighting machines, there is little reason to expect that such improvement will be undertaken.

Secretary Daniels has now injected himself into this situation with the proposition that the Government ought to do something to promote the development of inventions useful to the navy. If he had merely embodied this recommendation in a message to Congress, it probably would have been wholly ignored. As it is, by the spectacular advertising scheme of securing Mr. Edison to head the proposed board he has brought it to public attention and something tangible may grow out of it.

Of course Mr. Edison and Mr. Ford and the other prominent and successful inventors and manufacturers who have been named in the newspapers will not do the actual work of the proposed board. Very likely in the ultimate organization they may not be even members, but men who know the navy and its needs and how to carry on the detail work of sifting and developing inventions would probably take their place.

It is of interest to note that a similar movement has assumed form in Great Britain, where a Naval Inventions Board has just been created by the government, made up of such noted men as Sir William Crookes, Sir Oliver Lodge, Sir Charles Parsons, Dr. Percy F. Frankland, G. G. Stoney, George F. Beilby and others.

In both Great Britain and the United States one of the great lessons of this world war is the importance to a nation of fostering the development of new inventions and new industries, instead of relying upon importations from other countries where such advances in industry do receive encouragement.

The idea is still prevalent that the United States leads other nations in mechanical progress. Fourth-of-July orators brag of Yankee ingenuity, and numerous amateur statesmen are confident that should our nation ever be so unfortunate as to find itself again involved in warfare, our inventors would promptly devise apparatus certain to insure the enemy's defeat.

Those who are familiar with mechanical progress in Europe, however, have no such illusions. In certain fields the manufacturers of the United States have indeed remained in the lead; but in most industries it is unfortunately true that America has lagged behind other industrial nations in the development of new processes and new machinery during the past twenty-five years. Rapid changes have certainly occurred in every field of American industry; but a careful inquiry will show that a large proportion of the new devices have been developed abroad and their merits have been established there before they were introduced in this country.

There is no lack, it is true, of American ingenuity. By this we refer not to the country cross-roads inventor of the type who flourished three-quarters of a century ago but to the skilled and educated engineer and mechanic who knows the problems to be solved and the methods necessary for their solution. Unfortunately inventors of this class very often find their efforts fruitless, not because of lack of merit in their work but because manufacturers in the United States, in many fields, at least, will not take up any radically new invention until they are absolutely obliged to do so by competitive conditions.

The events of the past year have revealed to the world the extent to which Germany has made use of the inventive ability of her people. The other industrial nations have never before realized the degree to which they have become absolutely dependent on German production in many important fields, simply because German manufacturers, with the backing of the German Government, have had the energy and enterprise to undertake the development of new inventions to an extent unknown in any other nation. Certainly this lesson ought not to be lost upon the American people.

Secretary Daniels' scheme for a Bureau of Naval Inventions will at least serve the important purpose of directing general public attention toward this great need of our Navy Department. Congress does not hesitate to spend $16,000,000 to add another dreadnought to the navy. Why then should it hesitate to appropriate $1,000,000 or $2,000,000 or $5,000,000 for the Navy Department to spend in developing new inventions which promise to be of direct usefulness to the navy? Many of these inventions would be of value also in the merchant marine service, where also American prestige is sadly lacking.

Division of Earnings between Capital and Labor

The question how earnings are divided between capital and labor is one of wide popular interest. Many people believe that capital gets the lion's share. Back of most movements for strikes and other attempts to force up the rate of wages is the prevalent idea that the employer makes such profits that he could if he desired pay all who work for him some such extravagant rate of wages as that so widely advertised with reference to the Ford motor plant.

Nor are such views held by ignorant laboring men alone. It has been publicly claimed that of the annual product of industry, only one-fifth goes to labor, and capital takes the other four-fifths. No less a man than the Vice-President of the United States, in a commencement day address a year ago, declared that whereas in 1850 capital took three-fourths of the products of industry, at the present time it took four-fifths and left the laborer only one-fifth.

A committee of the National Civic Federation has just rendered a notably useful service by making a thorough investigation to determine the truth regarding this matter. The committee has taken official statistics collected by the Census Bureau, the Interstate Commerce Commission and some of the large corporations, until it has actual figures covering industries employing more than 10,000,000 people.

From these statistics the committee finds that of the net earnings of industry in general about two-thirds is paid out in wages and salaries and one-third goes to pay interest, dividends and depreciation. Thus, instead of the laborer receiving only one-fourth as much as the capitalist, he receives twice as much. In fact, labor receives more than twice as much as capital, for depreciation has to be deducted from earnings before interest or dividends can be paid.

The fallacious idea that labor receives only one-fourth as much as capital appears to have grown out of a misunderstanding of the 1900 census statistics of manufactures. These statistics gave the value of manufactured product per employee per annum in the manufacturing industries of the United States as $2420 and the average wages per employee as $437. The cost of materials used in manufacturing, however, were $1395, per employee, and this as well as other expenses of carrying on the business must be deducted before any payments can be made to capital.

Taking the figures of the 1910 census, it appears that the average earnings per employee in the manufacturing industries of the United States, after paying for the materials used and for taxes, advertising, insurance and all other expenses, were $889. Of this amount $590 was paid out in wages and salaries and $299 was left for capital. Before paying the interest or dividends, however, the expense of depreciation or of repairs to prevent depreciation had to be met. Allowing 5 per cent. as a fair depreciation rate, there was left $175 as the net earnings of capital per employee; or labor got about $10 for every $3 received by capital.

An interesting check on these figures may be obtained by taking the statistics for wage payments and capital payments on the steam railways of the United States, collected by the Interstate Commerce Commission. In 1914 the total amount paid out in wages to steam railway employees in the United States was $1,245,000,000. In the same year about $804,000,000 was paid out in interest and dividends on steam railway bonds and stocks, so that for every $3.50 paid to labor, capital received about $2. This larger relative return to capital in the case of the railway industry than in manufacturing is explained by the fact that the amount of capital invested in railways per employee is very much larger in railway transportation than in manufacturing industries. The capital invested in railways per employee is about $10,000; the capital invested per employee in manufacturing industry is about $2500.

It is possible roughly to check these figures in another way. The United States Census Bureau has just issued a report on wealth, debt and taxation which contains an estimate of the total wealth of the United States. This total is, in round figures, $188,000,000,000. It also shows the total amount collected by the states, counties, cities,

etc., by taxes on property amounting in 1913 to $1,350,000,000. Adding to this the taxes on property which are collected by the Federal Government, we have, in round figures, about $1,500,000,000 as the taxes paid annually by the property owners of the United States out of their income.

If we assume that the average annual income on all wealth is 4 per cent. (which is probably a high estimate), the total annual income on all the wealth of the United States is about $7,500,000,000, and deducting the taxes, the net income is $6,000,000,000.

To obtain, now, the earnings of labor of all classes, suppose we assume that one-fifth of the population of 100,000,000, or 20,000,000 persons, are engaged in industry of some sort or other and that their average earnings are $600 per year. (This compares closely with the $590 per employee in manufacturing industries determined by the Civic Federation committee.) Then the average earnings of these 20,000,000 workers averaging $600 apiece would be $12,000,000,000, or twice as much as the annual income from all the wealth of the United States. This checks closely with the results obtained by the Civic Federation committee.

In considering the vast wealth of this country it is well to remember that a very large proportion of it is owned by people of moderate means. The farms of the United States with their equipment alone are valued at about $41,000,000,000. The billions of dollars represented by savings-bank and life-insurance investments is a form of wealth which consists of the accumulated savings of millions of people.

Again, as much as 8 per cent. of all the real-estate wealth of the United States, or over $12,000,000,000, is owned by the public, in the form of school buildings, hospitals, parks, churches, asylums, and public buildings of all classes. Of that part of the earnings of industry which is paid for the use of capital, therefore, only a small part goes to increase the accumulations of the wealthy.

Another very important fact developed by the Civic Federation committee is that in the division of earnings between capital and labor, labor's share is increasing at the expense of capital's. In 60 years the average annual wages per employee in the manufacturing industries of the United States has increased from $247 to $518, and during the same time the average rate of interest has been reduced by more than one-fourth.

It is sometimes claimed that the tendency of labor-saving machinery is to increase the amount of capital required and reduce the wages of employees; but the official statistics prove that any tendency of this sort has been more than offset by other forces, which have increased wages and lowered the return on capital.

Be Sure to Prepay Full Postage on Foreign Business Letters

The warning has been often published that postage should be fully prepaid on letters mailed to foreign countries, and that if this is not done the receiver of the letter is obliged to pay not merely the amount by which the postage is deficient but double this amount. Notwithstanding such warnings, cases of underpaid postage on American letters to foreign countries continually occur. A correspondent of *Engineering News* in Calcutta, India, writes as follows:

> An an American who has been doing business in India for many years, I know the irritation that is caused when business firms here receive letters with deficient postage. The amount of the payment is small, but the irritation resulting is great. American firms are the greatest offenders in this respect, and it has to my knowledge been the cause of the loss of a great deal of business. It is the rule and not the exception that business firms will remember this matter, which to an American may seem so trifling, to the detriment of further business relations.

At this particular time, when many American business firms are making a special effort to increase the amount of their foreign trade, it seems well worth while again to call attention to this matter and also to suggest that on bulky foreign letters, in order to be on the safe side, it is best to attach an additional stamp to what the scales may indicate as necessary. In the damp atmosphere of the ocean voyage the paper of the letter absorbs moisture and increases in weight; and a bulky letter or document which may have passed the scales when it was mailed in the United States may be overweight when it finally reaches its destination.

Putting Municipal and Private Utilities on a Par

New evidence of the spreading tendency to subject all municipally owned utilities, like electricity and gas works, street railways, etc., to the same standards of operation and finance that are applied to public-service companies under private ownership is seen in a recent decision of the California Railroad Commission. The City and County of San Francisco applied for permission to carry the tracks of the Municipal Ry. on Potrero Ave. at grade across two main tracks and a siding of the Southern Pacific Co. It further asked that the expense of maintaining the main-line crossing be ordered divided between the municipality and the railroad and that the spur crossing be maintained by the railroad. Special privilege was claimed by virtue of being a municipal corporation.

Investigation showed that the railroad had a franchise from the city permitting it to cross Potrero Ave. with its two main tracks, but that the siding existed only on sufferance. Permission was granted the city to make the crossing, but the entire expense of construction and maintenance was imposed on the Municipal Ry., under the usual rule of imposing the burden of a grade crossing on the junior company. Municipal privilege was specifically denied, and certain similar cases in Los Angeles were cited as precedent.

Worse Than the Edison Fire!

Without naming any names, it is a pretty fair bet that the hearts of certain folks must have been glad within them when they read in a recent issue of a Portland, Ore., newspaper the following glaring headline:

CONCRETE BUILDINGS
BURNED TO ASHES

How great must have been their disappointment when a farther reading showed that the item described the destruction of the frame buildings comprising about half of the business section of the town of Concrete, Wash., which apparently was christened without regard to the type of buildings it contains.

Letters to the Editor

What Is "Pure Iron"?

Sir—On p. 78 of *Engineering News* of July 8, 1915, you have an extract from the *Reclamation Record* of May showing the results of exposure tests upon two grades of "pure iron" and two of "common steel." Feeling that the information therein given may mislead certain people, I deem it my duty to write calling your attention to the definition of pure iron adopted by Committee A-5 of the American Society for Testing Materials, perhaps the most authoritative body in this connection.[1] At a meeting held in Atlantic City, June 23, 1915, the following chemical composition was adopted for the class of metal known as "pure iron":

Carbon	under 0.02%	Phosphorus	under 0.01%
Manganese	under 0.03%	Copper	under 0.03%
Sulphur	under 0.03%		

A comparison of this analysis with the one given in your magazine shows that "pure iron" Nos. 1 and 2 could not come under the specification for "pure iron" adopted by Committee A-5. I feel that you should make note of this difference.

Mont Schuyler,
Engineer in Charge,
Municipal Testing Laboratory.

St. Louis, Mo., July 14, 1915.

Some Questions About the Austin, Tex., Dam

Sir—In connection with the very interesting article by Frank S. Taylor in *Engineering News,* June 3, 1915, on the rebuilding of the dam at Austin, Tex., several matters seem to call for comment.

It is stated that rerolled twisted steel was used and that stresses of 16,500 lb. per sq.in. were allowed. As rerolled steel for reinforcement purposes is generally regarded as entirely unreliable, it would be interesting to know if each shipment of steel for the Austin Dam was tested and what the results were, particularly with regard to uniformity of product.

According to Fig. 4, the roof of the sluiceways is reinforced horizontally near the bottom only. As, under certain conditions, these conduits would be subjected to considerable internal pressure, there would be tension in the roof near the top, where there is apparently no steel to resist it.

It is assumed in the article that grouting of the foundation and cutoff can be relied upon to secure a reconstructed foundation. The writer believes that grouting should merely be considered as a measure "to make assurance doubly sure."

Even where the work of grouting is as carefully done as it evidently was at Austin, there is no certainty that the grout actually does what is expected of it. When grout rises out of a hole adjacent to one into which the grout is being forced it is generally taken as "proving that the underground seams between these two holes are thoroughly filled with grout." It is conceivable, however, that this is not always the case. Assume that between these holes there are two seams, one a large seam, offering but little resistance to the flow of the grout through it, and the other a narrow seam, in spots tightly filled with sand. Under such conditions the grout may clog before it has gone very far in the narrow seam. All the grout flows through the other seam and rises in the adjacent hole, the narrow seam remaining practically open between the two holes. Again, mud seams which at the time are tight may later wash out.

It is more than probable that these conditions occur frequently in actual practice, and the writer ventures the opinion that if holes were drilled near the upstream toe and at intermediate points, and pipes cemented in them, observations taken after the dam is in service would show a considerable head in these pipes. In the article no mention is made of the depth of the grout holes or of the cutoff wall.

It is stated that "it was decided to build a hollow dam of reinforced concrete of such form that there could be no uplifting force from any leakage of water under it." The omission of a reinforced-concrete floor in the hollow dam does not secure this much-to-be-desired condition, as the uplifting force may act on the rock stratum itself. This would certainly be the case to a greater or less extent unless the rock is so broken up that the water flows freely from it. But in the latter case the velocity head of the water issuing from the broken up rock might conceivably be sufficient to move loose rock and thus endanger the footings of the buttress walls.

It is stated that for the foundations of the buttress walls, the rock wherever it was considered satisfactory was found to be firm for a depth of 4 ft. If we assume a net head of 65 ft. developing full hydrostatic pressure on the under side of this firm layer of rock 4 ft. thick, we have, in effect, a slab or beam of rock of 20 ft. span and 4 ft. thickness against the under side of which is exerted an upward hydrostatic pressure of 28 lb. per sq.in. This would mean a tension in the upper fibers of this layer acting as a beam of over 500 lb. per sq.in., which of course is more than the rock would stand.

Accordingly, it is clear that the engineers responsible for this structure must have been very firm in their conviction that the condition outlined in the foregoing was impossible of even partial realization. Extreme caution might, perhaps, have dictated the inclusion of a concrete floor under the dam, reinforced against a portion of this upward pressure and copiously provided with weep-holes, together with holes bored in the underlying strata concentric with the weep-holes, thus relieving the upward pressure and reducing it to the minimum.

The writer does not believe that any dam was ever built "of such form that there could be no uplifting force." Although there are of course cases in which the

[1] The subject of Committee A-5 is "Corrosion of Iron and Steel." "Engineering News" considers the fact worth note that this committee has nothing to do with specifying iron and steel or defining their qualities.—Editor.

designer might be justified in failing to take it into consideration. In the Austin Dam there is no base, which is probably the author's justification for the statement previously alluded to; but the underlying rock acts as the base, and against this rock upward pressure will be exerted—to what extent only those familiar with the details of the work and its foundation are competent to say.

JOEL D. JUSTIN.

Harrisburg, Penn., June 10, 1915.

[This letter was submitted to Mr. Taylor, the author of the article on the Austin Dam and the resident engineer on that recently completed structure. He has replied as follows.—Editor.]

Sir—With regard to the twisted steel, I should have written "square rolled twisted steel" instead of "rerolled," which latter was an error. We did use "ingot" steel square twisted bars, all tested by competent engineers before being used, according to the requirement of our standard specifications.

The construction of the foundation by the grouting process, as described, was mentioned only generally. Every part of the cutoff wall foundation was made impermeable to a depth of about 12 ft. below the bottom of the trenches for that wall, and test holes were always drilled between the grouted holes for the purpose of proving to ourselves that the space between the two holes grouted had been made impermeable. If the indications were such as to still leave a permeable condition, the process was continued until an impermeable foundation was achieved for the cutoff wall.

Mr. Justin computes that a slab of rock 20 ft. long, having a thickness of 4 ft. or more, as indicated by our tests, would have a tension in the upper fibers of over 500 lb. per sq.in. This calculation is based upon the assumption that the beam of rock would be just 4 ft. and that it would be a simple beam and 20 ft. long. The wall foundations had spread footings that averaged 4 ft. This reduced the span to 16 ft., and if the conditions of beam existed, we would have a continuous instead of a simple beam. The actual conditions encountered, however, indicated rock considerably more than 4 ft. in thickness, punctured with seams and test holes, so that no part of the foundation could be conceived to have an upward thrust equal to more than the resistance of that force which would be required to move accumulated mud from the cracks, provided that water permeated under the grouted portion of the cutoff wall to create such pressure.

The report of the grouting of the foundation of the Austin dam is, in itself, a considerable volume, more than 300 holes having been drilled, the log of each hole as it was drilled carefully observed, and the treatment of each hole separately described and recorded.

It would be impossible to cover technically all the details of construction in the scope of an article like that written for *Engineering News*, one of the unintentional omissions from that article being a paragraph describing the conditions under which cement was used in our aggregate. The cement was furnished by the Texas Portland Cement Co., tested separately at the mill for composition and soundness, handled under specific regulations in proper warehouse, and mixed under the constant supervision of assistant engineers.

FRANK S. TAYLOR.

Austin, Tex., June 26, 1915..

Mexican Railway History

Sir—On Dec. 2, 1857, Senor Don Antonio Escandon, a Mexican capitalist, in consultation with Gen. Manuel Robles, who represented the Mexican Government at Washington, engaged the services of Andrew Talcott, a former captain in the Corps of Engineers, U. S. A., to make surveys for a railroad from Vera Cruz to the city of Mexico.

Immediately after his appointment Captain Talcott organized a corps of engineers in the city of New York, which sailed from New Orleans Jan. 1, 1858, and landed in Vera Cruz Jan. 4 following. The members of this corps were:

Capt. Andrew Talcott, Chief Engineer; Andrew B. Gray, Quartermaster and Commissary; J. S. Stoddart, Assistant Engineer; Richard Page, Assistant Engineer; L. Van Wyck, Assistant Engineer.

First Brigade—M. E. Lyons, Chief Engineer; E. M. Richards, R. F. Stack, T. W. Sargeant, W. W. Dechert, A. C. Hall, E. McLonegan, J. Radnich, James J. Arnold, George E. Clymer.

Second Brigade—R. B. Gorsuch, Chief Engineer; D. S. Crosby, W. R. Eastman, A. Van Burcke, James Emmet, T. A. Emmet, H. G. Webber, L. B. Ward, O. W. Bownton, Alfred Delano, D. M. Gorsuch.

Exploring Party—Sidney Coolidge, Chief; T. M. R. Talcott, Charles Miller, C. A. Wolf, George R. Talcott.

Of the above T. M. R. Talcott, of Richmond, Va., and W. R. Eastman, of Albany, N. Y., I know to be still living.

Maj. Sidney Coolidge, 16th Regiment, U. S. A., was killed at Chickamauga during the Civil War.

I am very much interested to obtain information relative this survey and would like to hear from any who can give information.

EMILE LOW.

745 Lafayette Ave., Buffalo, N. Y., July 13, 1915.

Authorities Against Rivet-Tension

Sir—In response to Ernest McCullough's call for views of your readers on the use of rivets in direct tension (issue of June 10, 1915, p. 1139), permit me to call his attention to an article in the *Zeitschrift des Vereins Deutscher Ingenieure*, Nov. 23, 1912 (Vol. 56, No. 47, p. 1890), on "The Effects of Stresses Produced in Materials by Riveting."

This article describes a set of experiments which show that the tensile stresses in ordinary rivets parallel to the shank, after they have cooled subsequent to being driven by a hydraulic riveting machine, are 2200 kg. per sq.cm., or about 31,000 lb. per sq.in. A bolt heated to a dark cherry red, with the nut tightened just to bear on the metal, without initial pressure, was stressed to about 42,000 lb. per sq.in. on cooling.

The lower stress in the rivets is explained principally by the fact that the process of riveting heats the surrounding material and allows it to shrink together with the rivet on cooling. The large nut on the bolt is also more rigid than a rivet head, and bears on a larger area of metal, thus producing a smaller linear compression in the plates and a correspondingly greater elongation of the bolt shank, with the resulting higher stresses.

A simple computation of the amount of shrinkage on cooling from the riveting temperature, as well as experience with broken rivets, shows that most rivets must be stressed beyond the elastic limit, and often up to the

point of failure, especially on the outside of the shank, right under the head.

The foregoing seems sufficient to condemn the use of rivets in direct tension. In fact, the *shearing* strength of the undriven rivet, which is a function of the direct axial tension, is also seriously impaired. Cold bolts, in holes drilled to a driving fit, with no eccentric bearing, with nuts not too firmly tightened, or a detail in which rivets are used in shear only, should be employed.

In long riveted connections, connecting beams to girders, bolts near the end where there is considerable negative moment would probably do away with the frequent rivet failures. The question even arises whether in very heavy riveted work, where the holes are drilled in the field, where riveting is so expensive, and where the long rivet shanks give so much trouble, snugly fitting bolts would not give greater strength at lesser cost.

JACOB M. FRIEDLAND.

Borough Hall, Bronx, New York, June 12, 1915.

Sir—I think structural engineers of experience will generally sustain the contention that rivets should not be used in direct tension. Rivets, of course, have some direct tensile strength, and no rivet is well set unless it is under an initial stress of that character. The indeterminateness of this initial stress, however, and the difficulty of securing a uniform upset of rivets render uncertain the residual rivet value in direct tension that could be safely relied upon. Rivets are occasionally used in direct tension, but good practice is entirely against it, and if employed at all in that manner their use should be restricted to unimportant connections where failure could result in no serious damage.

All of the authorities of record with which I am familiar discountenance the use of rivets in direct tension, either by definite specification forbidding it or by inference, this latter being indicated by absolute omission of any allowed unit-stress for rivets other than in bearing and in shear. Many of these authorities might be quoted, but the following few will suffice and are characteristic:

Bouscaren's "General Specifications" of 1890, paragraph 85, "No tensile stress shall be allowed on rivets."

Merriman & Jacoby, "Bridge Design," Part III (third edition, 1898), "Specifications for a Pin Truss Bridge," paragraph 39, page 138, "Rivets must not be used in direct tension."

Atchison, Topeka & Santa Fé Ry., specifications of November, 1902, paragraph 89, "The details of riveted work must be so designed that there shall be no tensile stress on rivets."

General specifications for steel highway and electric railway bridge superstructure of the State of New York, 1905, paragraph 88, "Rivets and bolts shall not be used in direct tension."

Ketchum's "Design of Highway Bridges" (first edition, 1909), "General Specifications for Steel Highway Bridges," paragraph 39-a, "Rivets and bolts shall not be used in direct tension."

Cooper's "General Specifications for Steel Highway and Electric Street-Railway Bridges and Viaducts," 1909, "Rivets and bolts must not be used in direct tension."

A slight variation from the foregoing and partially providing for the use of rivets in direct tension is found in the following:

Waddell's "De Pontibus," page 25, points out that the requirement is less important for steel rivets than for iron rivets, but yet advocates adherence to the old rule "except for very unimportant members where there is a great excess in the number of rivets above the theoretical requirements."

"General Specifications for Steel Superstructures of Bridges and Viaducts," Department of Railways and Canals of Canada, 1908, paragraph 226, "Rivets will not be used in direct tension, but in any case where rivets, in direct tension, may be permitted, they shall be estimated at two-thirds of the unit stress."

JOSEPH JACOBS.

Seattle, Wash., June 19, 1915.

Sir—Referring to Ernest McCullough's communication in your issue of June 10, I beg leave to quote from my book, "Steel Designing," 1913, as follows:

P. 179. Tension on Rivet Heads.—Specifications usually require that tension on rivet heads must be avoided. As a general proposition this is a good requirement, but there are cases where it is very difficult to avoid tension on rivet heads without making expensive or clumsy details. One expedient resorted to is to use bolts, because a bolt is stronger to resist tension than a rivet. The author prefers rivets in tension, in general, to bolts, for the reason that too often common erection bolts are made use of, and it requires very close inspection to get them tight; and the rivet seals the hole better against the admission of water.

P. 180. Design of Detail to Take Tension on Rivet Heads.—A detail to take tension on rivet heads must be correctly and carefully proportioned. It should be symmetrical. A single angle on one side of a member is not a proper detail. There should be at least four rivets, and these should not be over about 2 in. from the back of angles. In many details where there is tension on the rivet heads the designer does not consider the thickness of the connecting angles. The angles may bend as per Fig. 13.

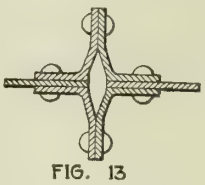


FIG. 13

The thickness of connecting angles must be such as to avoid this. The angle is under bending stress at the heel and at the rivet line, hence the lever arm for bending is half of the gage. For a tensile value on a rivet no more than one-half of the single shear value of the rivet should be used. If 6000 lb. be used as a unit in shear and 10,000 lb. in bending, we find, for ⅝-in. rivets, 1½-in. gage, 2¼-in. spacing, the thickness of angle required is $\frac{7}{16}$ in.; for ¾-in. rivets, 1¾-in. gage, 2½-in. spacing, the thickness of angle required is ½ in.; for ⅞-in. rivets, 2-in. gage, 2¾-in. spacing, the thickness of angle required is ⅝ in. The angles should not be any less in thickness than the figures given, and if the gage is more than that given above, the thickness of angle should be increased. Greater spacing of rivets would not be justification for diminished thickness of angles, because the distribution of load along the rivet line is not as good with wide spacing as with close spacing. If the connection angle has two rows of rivets, only the row next to the heel can be counted upon to take tension. It is manifestly impossible to transmit any tension into the second row in a more or less flexible angle until the first row fails. The second row, however, can take any shear in the connection. When there is shear in the connection, the rivets required for the same should be in addition to those required for tension.

Tests have shown that tension on rivets due to cooling is sometimes very high, approaching at times the elastic limit of the steel. This would seem to indicate that any more tension might cause failure; but a little analysis will show that pulling on the head of a rivet already in stress due to shrinkage does not increase the stress on the rivet, but relieves the pressure on the plates, unless the added tension exceeds that already on the rivet.

Under "General Specifications for Structural Steel Work," in the same book, p. 454, occurs the following:

Tension on rivet heads will be allowed only when the connection is symmetrical and contains at least four rivets. The bending at the heel of connection angle must be considered as well as the bending on the part to which the detail is attached. When ⅞-in. rivets are used, the connection angle should be ⅝-in. metal and the gage of rivets 2 in. With ¾-in. rivets use ½-in. angles and 1¾-in. gage, and with ⅝-in. rivets use $\frac{7}{16}$-in. angles and 1½-in. gage. Additional rivets must be provided to take any shear coming upon the same connection.

Mr. McCullough invites discussion of this subject. The foregoing is my contribution. Tension on rivet heads always has been and always will be used in designs. It behooves engineers, instead of winking at these details, to take cognizance of the facts and regulate the matter by proper and rational rules. In *Engineering News,* Apr. 11, 1907, I pointed out, among other bad details, a case

of a large viaduct near Pittsburgh where the sidewalk bracket is depending solely on tension on four rivet heads, and this in a lop-sided detail. Furthermore, if these rivets should pull apart the truss would be split and wrecked. The viaduct still stands; but this is no excuse for such details to exist. It does show, however, that rivet heads will stand a very considerable pull.

As to rivet heads that pop off, this could be avoided with proper field inspection on the job. When rivets are taken out of the forge spitting fire and driven in this condition, they are very apt to do just this.

The case of the rail at the switch-joint cited by Mr. McCullough is no doubt one where a rivet or bolt would be bent back and forth each time the load passed. This is a good way to break anything. A wire that would require half a ton in tension to break it can readily be broken off by the hand with an ordinary pair of pliers by bending back and forth. Some years ago the Brooklyn Bridge suspenders carrying a number of the floor-beams gave way. The failure was due to the bending back and forth of these bolts by expansion and contraction of the stiffening truss. The broken suspenders were close to the expansion joint of the stiiffening trusses. In such cases as these special provision must be made; but in the ordinary case of structural details tension on rivet heads, properly safeguarded and in proper details, is quite reliable.

EDWARD GODFREY.

Monongahela Bank Building,
Pittsburgh, Penn., June 15, 1915.

Sir—In the June 10 issue of *Engineering News* Ernest McCollough raises the oft-discussed question whether or not rivets should be subjected to direct tension. Specifications generally forbid the use of rivets in tension, and to my mind this is eminently proper.

Changing the shape of the metal in forming a head—an effect often obtained with insufficient heating and improper driving—must result in greatly weakening the rivet at the junction of the shank and the head. The shank shrinks in cooling, putting a considerable stress at this point, and rivet heads coming off "of their own accord" is not an uncommon occurrence. Rivets which may already be stressed from this cause to nearly the point of failure should not have an additional load applied.

I once directed a number of comparatively "green" hands in the partial reconstruction of a steel-frame building. A pneumatic hand-riveter was being used. The man at the riveter would hammer away long after the head had formed—to "make a good job of it," was his expression. I stopped the work for a few moments while I delivered an impromptu lecture on rivets and riveting. At its conclusion, to illustrate my remarks, I picked up a 4-lb. hammer and struck at a rivet-head in a manner perhaps more forceful than elegant. The rivet-head sailed off into space in a way that would have delighted a golfer, and I barely saved myself from falling off the scaffold.

In the light of the present knowledge of the art, I would not subject a rivet to a tensile stress except in very unimportant details.

C. O. SANDSTROM.

Kansas City, Mo., June 17, 1915.

[With most writers and prevailing practice against tension on rivets, the fact must be faced that many instances exist where rivets are exposed to severe tensile stresses, with entire success. Even in railway-bridge floors, where the impact is high, rivets in tension have been used, and no special trouble developed so far as *Engineering News* has been able to learn. Therefore it would be important to cite specific experience to show that rivets in tension are dangerous, or undesirable, or otherwise objectionable.—Editor.]

NOTES AND QUERIES

Steelwork for the Three Radio Towers at Darien, C. Z., the design and erection of which were described in "Engineering News" of June 24, p. 1228, was furnished and erected by the Penn Bridge Co., of Beaver Falls, Penn., instead of by the Pennsylvania Steel Co., as stated in the article.

A Correspondent Desires Information of a specific case where contracts for work have been let on a sliding-scale percentage basis, under which the percentage to be paid by the contractor was varied according to the proportion borne by the final cost to the original estimate for the work. That is to say, the contractor might receive a certain percentage if the final cost were less than the original estimate, and a decreased percentage if the cost were greater.

The Tentative Design for an Activated-Sludge tank at Houston, Tex., shown in Fig. 5 on p. 170 of this issue, has been revised in minor particulars since the original design was made. A telegram from the City Engineer, received after the page containing the drawing had gone to press, gives these revisions as follows:

Have changed plans. Filtros plate lowered until it is level with concrete at bottom of tank, thus eliminating space for accumulation of sludge in bottom of aërating tank. Have put return flow pipe out away from the shelf shown on drawing and eliminated shelf, thus making the sides of aërating tank smooth. Return-flow pipe will be supported by smooth flat bars with axis vertical extending from side to side of aërating tank. Have tested out return flow as designed and it works satisfactorily.

ENGINEERING SCHOOLS

NEW YORK UNIVERSITY—The School of Applied Science is now offering a four-year course in industrial engineering, intended to turn out men who can engage immediately in the business side of engineering work. The requirements for admission will be the same as for other courses in the school. The course aims to superimpose on the fundamentals of engineering, courses in accounting, economics, industrial history, statistics and cost finding, business organization, factory organization and shop management.

WASHINGTON UNIVERSITY—In 1914, as an experiment, the electrical engineering department offered two courses—one of lectures and one of laboratory work. These were intended primarily for St. Louis men connected with the electrical business and to whom a more detailed knowledge of certain phases of electricity would be valuable. These courses proved very popular and within three days after the opening, further registrations had to be refused. For the year 1915-16 it is proposed to offer night courses of a similar nature in a number of other branches. These are general courses in English, economics, political science, history, mathematics, mechanics and physics. There are technical courses in civil, mechanical and electrical engineering, architecture, mathematics, applied mechanics, and physics. Saturday and late afternoon courses, particularly for teachers, are being offered in all departments.

News of the Engineering World

Progress on the Jackson St. Bascule Bridge, Chicago

The erection of the superstructure of the Jackson St. bridge over the Chicago River has been delayed two months by the Chicago strike of steel workers. The condition of the work on July 2 on the west leaf of the bridge is shown in the accompanying view. This is a trunnion bascule bridge with a span of 202 ft. 3¼-in. c. to c. of trunnions, and will have 1310 tons of steel (exclusive of 105 tons for the machinery). About 500 tons are now erected, 350 tons of which are on the west side, as the completion of the foundation on the east side was delayed considerably.

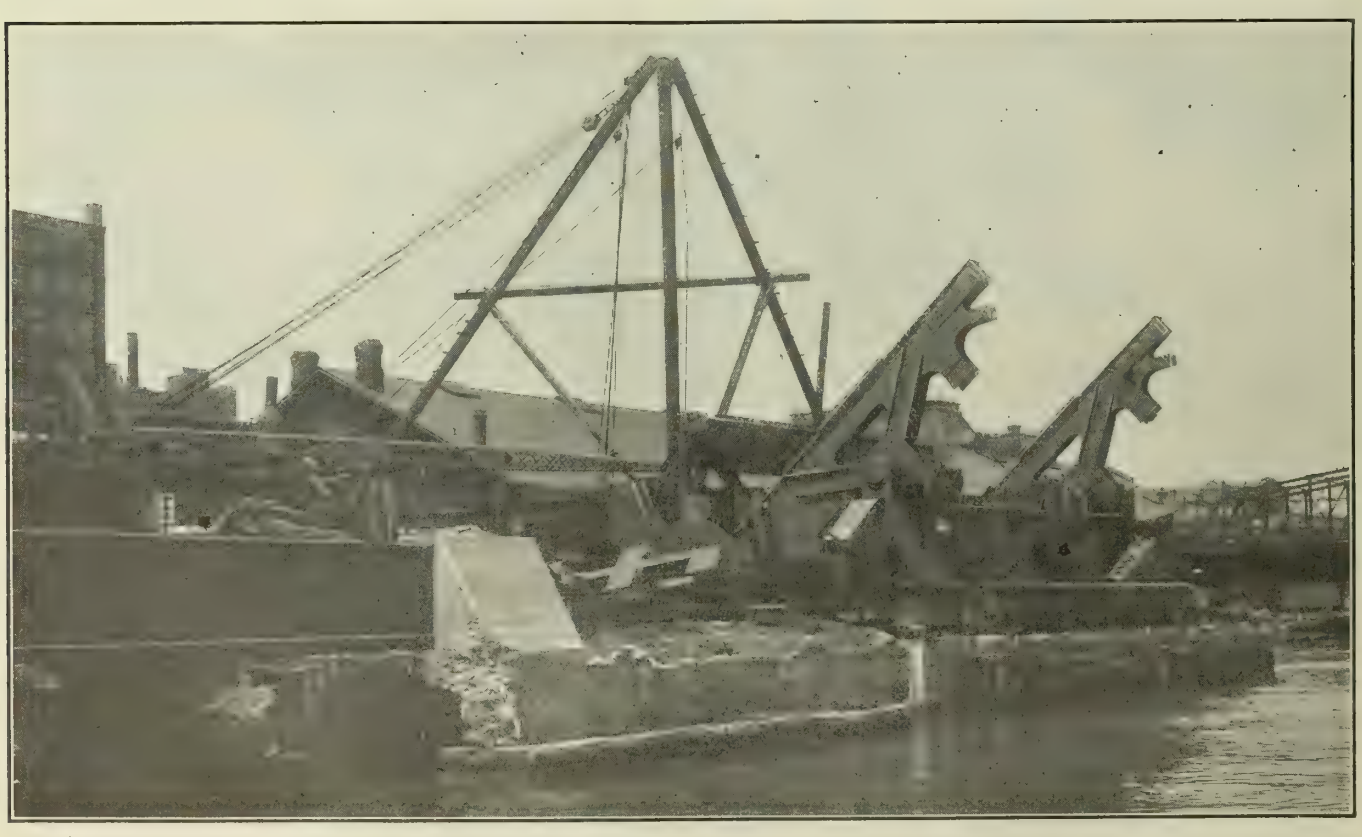
Erection was begun March 12. The strike occurred April 30, stopping all steel bridge and building work in the city until July 7, when a settlement was made and the strike ended.

The view shows the heels of the trusses erected and the trunnions in place. The erection is done by means of a stiff-leg derrick having a 50-ft. mast and a 70-ft. box-lattice boom, with a hoisting capacity of 40 tons. The heaviest loads handled are the 48-ton cross-girders. When the work has advanced farther, a boom 135 ft. long will be used, reducing the hoisting capacity to 20 tons.

The bridge is being built by the Sanitary District of Chicago, under George M. Wisner, Chief Engineer, the plans being approved also by John Ericson, City Engineer. The Strauss Bascule Bridge Co. acts as consulting engineer for both superstructure and substructure. The substructure was described in *Engineering News,* March 18, 1915, and was built by the Great Lakes Dredge & Dock Co. The steelwork is manufactured by the Mt. Vernon Steel Co., of Mt. Vernon, Ohio, and the erection is being done by the Strobel Steel & Construction Co., of Chicago.

First Shield Starts in East River Tunnels

On July 15 at Front St. and Old Slip, New York City, the first of the eight shields of the four new East River tunnels for subway lines started forward, and the first segments of cast-iron lining were erected. The southerly pair of tunnels will carry the Broadway-Church St. line (to be operated by the New York Municipal Ry. Corporation) across the river to a connection with the Fourth Ave. subway; these tunnels are located at South Ferry. The other pair, three blocks north, at Old Slip, will form the river crossing of the



ERECTION OF THE WEST LEAF OF THE JACKSON ST. BASCULE BRIDGE AT CHICAGO (DELAYED BY STEEL-WORKERS' STRIKE FROM APR. 30 TO JULY 7)

At the left is a truss span and deck span of the old approach (over the railway tracks). The girder at the left supports the outer side of a team driveway to the freight house, and spans the opening into the bypass which gives additional waterway for the flow of water in the river. At the right is the Adams St. swingbridge

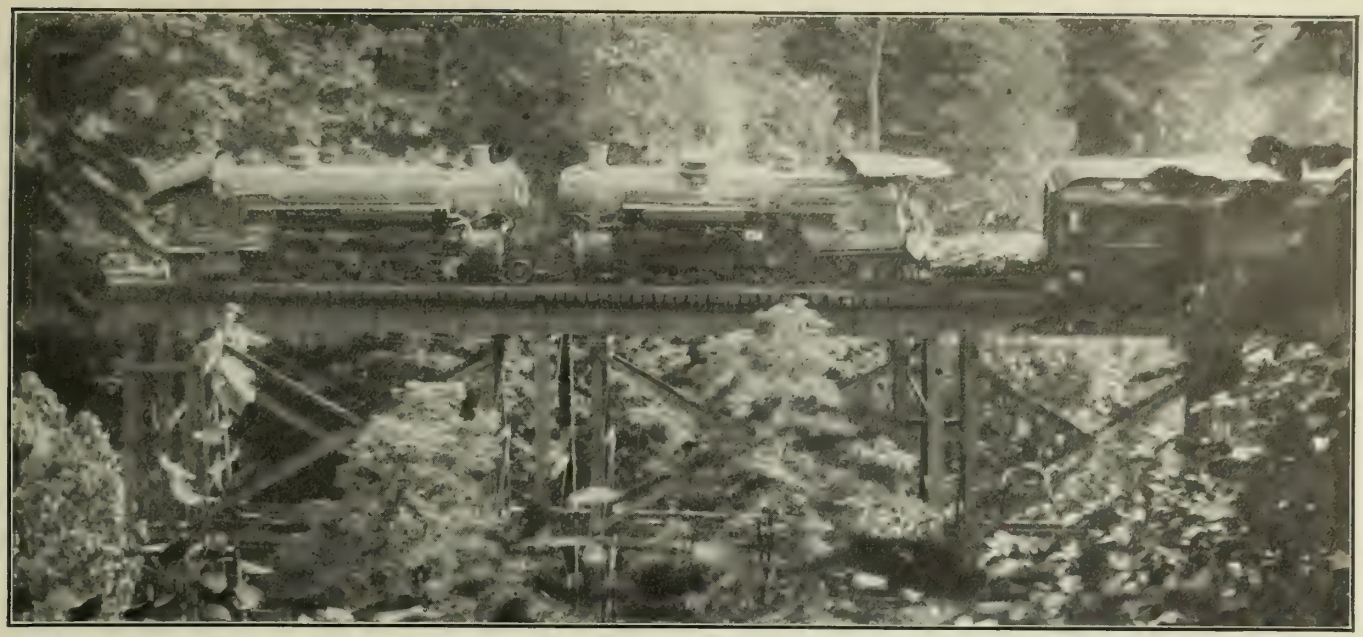


FIG. 1. LOCOMOTIVES TOGETHER ON HIGH BRIDGE

Seventh Ave.-Park Pl.-William St. subway of the Interborough Rapid Transit Co. The Flinn-O'Rourke Co. has the contract for all four. Five caissons have been sunk as land shafts, from which the shields start. In each case a single caisson serves for both tunnels of a pair, except at Old Slip, where the tunnels pass on either side of the Old Slip police station and therefore required separate caissons. The work is managed by George H. Flinn and John F. O'Rourke, of the contracting company.

Investigation of Western Maryland Ry. Wreck; Will Install Block Signals

A searching investigation into the cause of the fatal head collision on the Western Maryland Ry., which occurred on June 24 on High Bridge, near Thurmont, Md., has established that the wreck was caused by an error committed by the Hagerstown dispatcher. This corroborates the opinion voiced in *Engineering News* of July 1. The collision was between the Blue Ridge express and the Baltimore local. Six persons were killed. Property damage is placed at $17,123.



FIG. 2. SHOWING COMPARATIVE HEIGHT OF BRIDGE

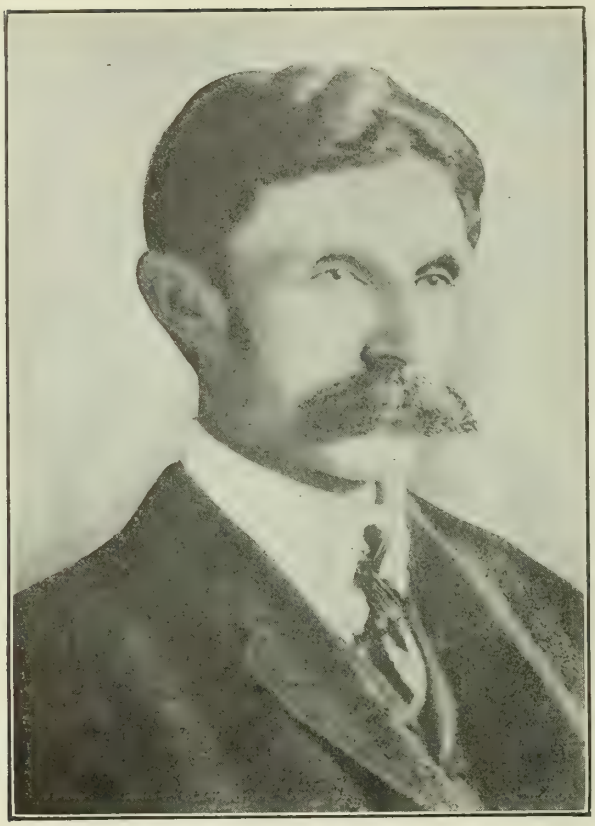
The investigation was in charge of Staunton Ennes, General Manager of the railway. Associated with him were representatives of the Interstate Commerce Commission, members of the Public Utilities Commission of Maryland, and the district attorneys of Frederick and Washington Counties. The Hagerstown dispatcher freely admitted his failure to annul a certain order and accepted full responsibility for the accident. The chief dispatcher in his testimony stated that he believed the mistake was caused by a momentary lapse and not by ignorance on the part of his dispatcher, who claimed to have been overworked.

As a result of the wreck the Western Maryland Ry. Co. will install the block-signal system on 50 mi. of track between Cumberland and Baltimore. It is stated to be the purpose of the company ultimately to equip the entire line with the block-signal system.

San Diego's City Department of Operation

San Diego, Calif., since last May, when the new charter went into effect, has been managed in the main by engineers. The new mayor, Edwin M. Capps, is a member of the American Society of Civil Engineers, and was formerly supervising engineer of city harbor improvements; the manager of operation is F. M. Lockwood, former engineer of the city sewer department, and the assistant manager of operation is John L. Bacon, a member of the American Society of Mechanical Engineers.

The form of city government is similar to the city-manager plan, but, unlike the city manager, the jurisdiction of the head of the city operating department is confined to the following bureaus: Water, sewer, street, harbor, engineering, and public buildings, by the original



JOSEPH AUSTIN HOLMES

charter provision; and the departments of pueblo lands and forestry, building inspection, boiler inspection and electrical inspection by subsequent charter amendment. The operating department has no jurisdiction over the bureaus of public health, purchasing, auditor, treasurer, attorney, city clerk, plumbing inspection, parks, playgrounds or the civil-service commission.

The department of operation, as now organized, pays particular attention to giving full publicity to all the work under its jurisdiction. There is one clerk whose sole duty it is personally to meet any citizen desiring information about the city's business and courteously to give that information as promptly and exactly as possible. A detailed public statement of the financial condition of the city bureaus is made monthly, which gives the various allowances and the percentages expended to date. The appropriations of the operating department for the current year total nearly $600,000.

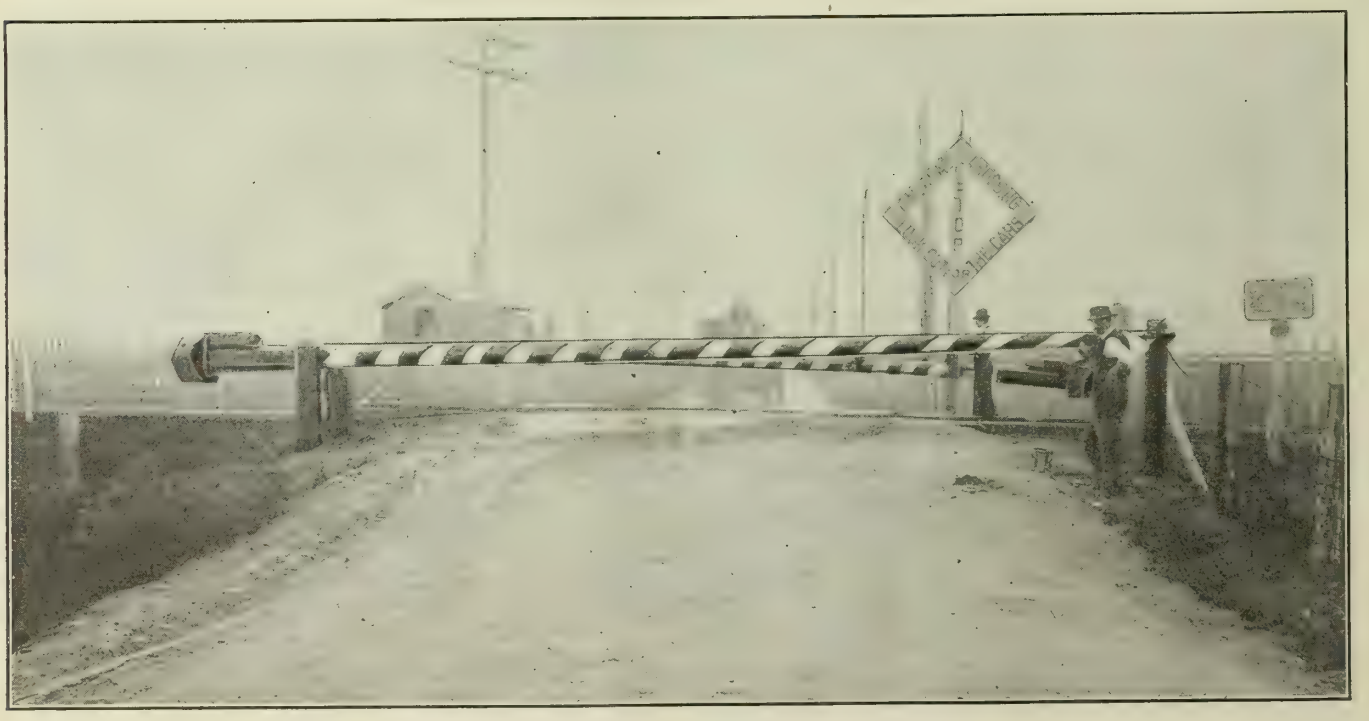
Crossing-Gates which Stop as Well as Warn

Heavy crossing-gates were recently installed by the Long Island R.R. Co. at Long Beach Road near Jekyl Island on the Long Beach division. The purpose of this new type of gate illustrated herewith is effectually to stop adventurous automobilists from trying to beat the train to a crossing.

The gates are constructed of two 40-ft. spruce poles each about 12 in. in diameter on the butt end and 8 in. at the point. They are counterweighted with 1000 lb. of iron and when down are 3 ft. 6 in. above the crown of the highway. They are lowered by means of a ¾-in. rope fastened to the tip of the pole and are kept in place by means of a chain and hook. The gates are about 35 ft. long between posts, with an overhang of 4 ft. The black and white stripes shown are about 12 in. wide.

Joseph Austin Holmes

News of the death of Dr. Joseph A. Holmes was received just as last week's issue was going to press, and space permitted only a brief announcement in the column of obituaries. Dr. Holmes' health failed over a year ago, and he removed with his family to Colorado, hoping to benefit by the change of climate. His system was weakened, however, by overwork, and after his removal to



HEAVY-POLE GATES ON THE LONG ISLAND R.R.

Colorado he continued his oversight of the affairs of his bureau with the aid of a secretary, instead of giving up all business and trying to regain his health.

The news of his untimely death brings sorrow to a wide circle of friends in all parts of the country.

For nearly a dozen years, ever since he was appointed by President Roosevelt to take charge of the fuel-testing work of the United States Geological Survey at the St. Louis Exposition in 1904, Dr. Holmes' enthusiastic devotion to his work has been an inspiring example to all his associates and to many others in the engineering profession who had the privilege of his acquaintance. Probably the greatest achievement of his life was the development of mine-rescue work by the Government, and the scientific investigation of mine accidents with a view to removal of their causes.

It is a notable illustration of Dr. Holmes' zeal and ability that when the Bureau of Mines was created by Congress in 1910, President Taft selected Dr. Holmes to take charge of it, notwithstanding the fact that Dr. Holmes was closely identified with the group of prominent officials in the Department of the Interior against whom the then Secretary of the Interior, R. A. Ballinger, had been in active opposition.

Dr. Holmes was a member of the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Society for Testing Materials, the Cosmos Club of Washington, the Engineers Club of New York City, and a number of other professional and scientific organizations. He is survived by a widow and four children.

Explosion in a Grain Bin of an elevator of the New York Central Lines at West New York, N. J. (opposite 42d St., New York City) partly wrecked the upper portion of the structure and flying fragments slightly injured six persons on nearby barges. It appears that No. 7 of the fourteen 14,000-bu. steel bins was empty when the explosion occurred in it. The supporting steelwork prevented rupture of the bin walls, so that the force of the explosion was exerted upward. The damage was confined to the cupola and main roof, on which the débris fell; the frame and machinery were uninjured. While the cause has not yet been definitely ascertained, it is reported that possibly dust in the bin became ignited by a spark.

A 450-Ton Canal Between the Vistula and the Oder was completed far enough to open traffic in April. The line is 293 km. long. It extends up the Warthe and the Netze rivers, has its summit level for 27 km. in an old canal of originally smaller capacity, and descends the Brahe to the Vistula. The total lift on the east side is 157½ ft. and on the west side 92 ft. The canal can be navigated by vessels of 4-ft. 8-in. draft.

The Los Angeles Municipal Cement Plant has been leased by the city to Los Angeles County. The county is to pay the city an annual rental of $27,500 for a period of three years and at the end of the first year the city may offer the plant in open sale, at which the county agrees to bid $500,000. The city is to have the privilege of buying cement for its own needs in any quantity at $1.35 per barrel and is to receive a royalty if 5¾c. per bbl. on all cement manufactured and an annual depreciation allowance of $11,000, which will be returned to the county in the event of a sale of the plant.

Floods in the Great Miami Valley—Two small floods have occurred in the Great Miami Valley, Ohio, since July 7. The first was caused by a heavy general precipitation over the basin on the afternoon and evening of July 7. The rainfall in the basin varied from 1.30 in. at Hamilton to 3.60 in. at Greenville, with 2.17 in. at Dayton (3½-hr. fall). The flood reached its crest of 11.3 ft. at Dayton about 1 a.m. July 9. The crest of the March, 1913, flood at Dayton was 29.0 ft. The maximum discharge at Dayton at the crest of the flood of July 9, 1915, was about 32,000 sec.ft., from a drainage area of about 2500 sq.mi. The channel at Dayton can carry about 90,000 sec.ft. The discharge in the great 1913 flood was about 250,000 sec.ft. at Dayton. The 1915 flood caused no damage at any of the cities or towns in the valley. Several temporary trestle bridges over the Miami River below Dayton, replacing structures washed out by the 1913 flood, were considerably damaged. The second flood occurred on July 16 at Dayton, where a stage of 7.5 ft. was reached at 8:30 a.m. Little or no damage was caused by this second flood in any part of the valley. The rainfall in the Miami Basin was much lighter than in the preceding flood. In northern and central Ohio, however, this second storm was very severe, and at several points the disastrous flood of March, 1913, was exceeded. At Kenton, on the Scioto River, 5.45 in. of rain fell in 12 hr. on the night of July 15-16. A large portion of the city was overflowed. Foraker, a village near Kenton, also suffered considerable damage. At Lima, where three lives were lost, more than 200 homes submerged and a large area flooded, it is believed that the damage will amount to about $500,000. An estimate places the total losses from this flood in Ohio at over $2,000,000. Ten per cent. of the corn crop of Ohio was destroyed and the wheat crops will be damaged to about the same extent.

The Proposed Navassa Island, W. I., Light Station to be constructed by the Lighthouse Service of the United States Department of Commerce will be located on the southern side of the island, on its highest point, which is about 250 ft. above sea level. The tower will be cylindrical, of reinforced concrete, supporting a cylindrical helical-bar lantern with a focal plane about 152 ft. above its base and 402 ft. above the sea level. The illuminating apparatus will consist of two four-sided, fourth-order lenses mounted side by side, parallel, and carried on a mercury float. The lenses will be provided with 35-mm. mantle lamps. The characteristic will be a double white flash every 30 sec. The range, due to the height of the light, will be about 27 nautical miles. The plans have been completed and bids are to be invited shortly.

A Naval Advisory Committee on Inventions, to comprise the best inventive genius in the United States, has been proposed by Josephus Daniels, Secretary of the Navy. Thomas A. Edison has accepted the chairmanship of this committee. As other members such men as Alexander Graham Bell, Henry Ford, Orville Wright, Lewis Nixon, John Hays Hammond, Jr., Hudson Maxim and C. P. Steinmetz have been suggested. The leading engineering and scientific societies of this country have been asked by Mr. Daniels to select two members each to serve on the committee. The societies thus invited are the American Society of Civil Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers, American Chemical Society, American Mathematical Society, American Aëronautical Society and the Inventor's Guild.

The State of Illinois May Purchase Cement for Highways, according to a recent decision of the State Supreme Court. A year ago a taxpayer filed a bill in the Circuit Court of De Kalb County praying the annulment of a certain contract made by and between the State Highway Commissioners and the Marquette Cement Manufacturing Co. on the ground that the commissioners did not have the power to buy cement, which was subsequently furnished to contractors for the construction of state-aid roads. The court ruled:

> We are of the view that the statutes appropriating funds to the commission for the building of state-aid roads, together with the statute giving the commission power to let all contracts for the construction of such roads, or in a certain event to construct the same through its own agencies, and to perform all other duties prescribed in the act or reasonably inferable therefrom, confer upon the commission full and express power to purchase such road building materials, tools, implements and machinery as may from time to time be needed for the purposes aforesaid, and in their discretion to estimate and anticipate the needs and prepare therefor, as the bill here under consideration shows was done, and to the same extent as if the methods of its procedure in the premises were as definitely prescribed as the same are prescribed in relation to letting contracts for highway construction.

A Deep Tunnel Relief Sewer was put under construction by the city of New York last week. The sewer will extend down Madison Ave. from 43rd St. to 41st St. and thence through a rock tunnel from 40 to 45 ft. below the surface, and eastward under 41st St. to the East River, draining the area in the vicinity of the Grand Central Station. A portion of the sewer from the west side of Park Ave., under the existing subway, on to a point slightly beyond Third Ave. will be constructed by the Rapid Transit Subway Construction Co. as part of its contract for the connection between the old subway and the new Lexington Ave. line. The remainder of the work will be done by contractors for the city under the supervision of the Manhattan Bureau of Sewers. Work was started at the site of the proposed shaft at the southeast corner of Lexington Ave. and 41st St. The first shovelful of dirt was turned by Robert Ridgway, Engineer of Subway Construction, Public Service Commission for the First District, after the earth had been loosened by a pick wielded by R. A. Shaler, Tunnel Engineer for the Rapid Transit Subway Construction Co. The cost of the entire work is estimated at $240,000.

PERSONALS

Mr. F. N. Hibbits has resigned as Superintendent of Motive Power of the Lehigh Valley R.R. Co., to accept another position.

Mr. W. Spencer Robertson has been appointed Secretary of the American Locomotive Co., to succeed Mr. C. B. Denny, resigned.

Mr. Carl H. Watson has been selected as Designing and Supervising Engineer of the Port Washington, L. I., Sewer District, lately organized by the Town Board of North Hempstead, L. I.

Mr. George M. Rice has been appointed Chief Engineer of the Puget Sound & Willapa Harbor Ry. Co., to succeed Mr. C. H. Byers, recently resigned. His headquarters will be at Raymond, Wash.

Mr. William T. Dunn, formerly tool-steel expert of the Carpenter Steel Co. in Boston and New England, has been appointed District Sales Agent in New England and Eastern Canada of the International High Speed Steel Co.

Mr. Edward J. Kelly, Assistant Chief Engineer of the Sanitary District of Chicago, has been appointed by Governor Dunne a member of the Illinois Waterway Commission, which is to undertake an 8-ft. waterway from the Chicago drainage canal at Joliet to the Illinois River at La Salle, Ill.

Mr. Joachim G. Giaver, for the last 17 years Chief Engineer of Structural Design and Foundations for D. H. Burnham & Co., has opened offices as consulting engineer, at 751 Railway Exchange Building, Chicago, and will specialize in structural design, foundations and building engineering in general.

Mr. Geo. B. Massey, Jun. Am. Soc. M. E., formerly Manager of Foreign Sales of the Bucyrus Co., at Milwaukee, has opened consulting engineering offices with the firm name of Geo. B. Massey Co., in the People's Gas Building, Chicago. The company will specialize in excavating machinery and methods.

Mr. E. G. Buckland, formerly vice-president and general counsel of the New York, New Haven & Hartford R.R., has been elected President of the Central New England R.R., to fill the vacancy, as required by the law of Massachusetts, caused by the resignation of Mr. Howard Elliott, President of the N. Y., N. H. & H. R.R.

Mr. Henry D. Dewell, Assoc. M. Am. Soc. C. E., formerly with the firm of Galloway & Markwart, San Francisco, Calif., and for the last three years Chief Structural Engineer of the Panama-Pacific International Exposition, has opened offices in the Holbrook Building, 58 Sutter St., San Francisco, for the general practice of civil engineering.

Mr. C. F. Rouze, for the past year Manager of the Kansas City office of the Knox Motors Co., has been appointed Sales Manager of the Knox Motors Associates, of Springfield, Mass., an association recently organized to act as sole distributor of the products of the Knox Motors Co. Mr. Rouze succeeds Mr. H. F. Blanchard, who recently resigned as Sales Manager of the company.

Mr. Charles M. Schwab, M. Am. Soc. M. E., President of the Bethlehem Steel Co., has advised the Pennsylvania State Highway Commission that he will bear a large part of the cost of improving the highways in the vicinity of Loretto, Penn., his birthplace. He has offered to pay 50 per cent. of the cost of construction of two sections of road from Cresson to Ebensburg by way of Loretto, and to build for the latter borough a highway through its center.

Mr. Farley Gannett, Assoc. M. Am. Soc. C. E., Chief Engineer of the Water Supply Commission of Pennsylvania, has resigned to engage in private practice in the City of Harrisburg. Mr. Gannett will specialize in practice before the state departments and commissions. In addition he has established a chemical and bacteriological laboratory to handle analyses of water, sewage and trade wastes. Mr. Gannett has held the position of Chief Engineer for 10 years. He is President of the Engineers' Society of Pennsylvania.

The following promotions and changes have been announced by the Southern Railway: Mr. J. H. Stanfiel, Superintendent of the Southern Railway and the Northern Alabama Ry., at Birmingham, Ala., has been promoted to General Superintendent of the Southern district of the Southern Railway, to succeed C. L. Harris, resigned. Mr. H. H. Vance, Superintendent of Terminals at Birmingham will succeed Mr. Stanfiel. Mr. G. E. Buckley, Engineer of Maintenance-of-Way, at St. Louis, of the Western district, has been appointed Engineer of Maintenance-of-Way of the Northern district, with headquarters at Richmond, Va. Mr. Buckley succeeds Mr. W. T. Dobyns, resigned. Mr. H. E. Tyrrell, Supervising Engineer at Washington, D. C., will succeed Mr. Buckley.

OBITUARY

Charles C. Rose, M. Am. Soc. C. E., Superintendent of the Delaware & Hudson Coal Co., died at his home in Scranton, Penn., on July 17, aged 69 years.

Harold B. Anderson, M. Am. Soc. M. E., Chief Engineer of the Winton Motor Carriage Co., Cleveland, Ohio, was killed in that city on July 13 by a street-car while trying to pass it in an automobile. The accident occurred at the west end of the Superior viaduct. He was 35 years old.

Frank R. Williamson, M. Am. Soc. C. E., Assistant Engineer of the Sanitary District of Chicago, died July 11. He had been in the bridge department of the District for the last six years, engaged principally in the design of bascule bridges. Previously he was Chief Draftsman of the Scherzer Rolling Lift Bridge Co.

E. C. Bower, for 30 years Superintendent of the Waynesburg & Washington R.R., died at his home in Waynesburg, Penn., 66 years of age. He retired from active service on July 1, 1914. Mr. Bower was assistant engineer, under his father, Charles W. Bower, engineer on the flagship "Bridgeport" on the Tennessee River during the Civil War.

Emil Rathenau, probably the best known in America of any of the German engineers, died recently at the age of 76 years. He was Director-General of the Allgemeine Elektrizitäts-Gesellschaft, and was practically founder of the electrical industries of Germany. He was born Dec. 11, 1838, and received his education at the technical high schools of Hanover and Zurich. His first employment was with the locomotive works of A. Borsig in Berlin. Later he was employed in England with John Penn & Son, of Greenwich, and with Easton, Amos & Sons, of London. About 1870 he founded the first telephone exchange in Berlin. He introduced the Edison carbon-filament electric lamp on the Continent and was largely instrumental in establishing the great German electrical works for the manufacture of electric lamps and electrical machinery.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
Aug. 16-18 and 25-28. Annual meeting in Los Angeles, Calif., Aug. 16-18; in San Francisco, Aug. 25-28. Secy., J. C. Olsen, Cooper Union, New York City.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Aug. 24-27. Annual convention in Cincinnati. Secy., Clarence R. George, Houston, Tex.

NEW ENGLAND WATER WORKS ASSOCIATION.
Sept. 7-9. Convention in New York City. Secy., Willard Kent, Narragansett Pier, R. I.

TRAVELING ENGINEERS' ASSOCIATION.
Sept. 7-10. Annual meeting in Chicago. Secy., W. O. Thompson, N. Y. C. R.R., East Buffalo, N. Y.

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

San Francisco Meetings

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. 19-21. Secy., E. H. Harman, Room 101, Union Station, St. Louis, Mo.

INSTITUTE OF RADIO ENGINEERS.
Sept. 13-18. Secy., David Sarnoff, 71 Broadway, New York.

PAN-AMERICAN ROAD CONGRESS.
Sept. 13-18. Secy., E. L. Powers, Road Builders Association, 150 Nassau St., New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 16-18. Secy., Charles Warren Hunt, 220 West 57th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Sept. 16-18. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 16-18. Secy., Bradley Stoughton, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 16-18. Secy., F. L. Hutchinson, 29 West 39th St., New York City.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Sept. 16-18. Secy., J. J. Blackmore, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Sept. 16-18. Secy., J. W. Richards, Lehigh University, South Bethlehem, Penn.

INTERNATIONAL IRRIGATION CONGRESS.
Sept. 20. Secy., Arthur Hooker, Sacramento, Calif.; until Aug. 1, New Stockton, Calif.

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Sept. 20. Secy., F. F. Sharpless, 52 Broadway, New York City.

PACIFIC COAST ASSOCIATION OF PORT AUTHORITIES.
Sept. 20 and 21. Secy., Leo V. Merle, Ferry Bldg., San Francisco, Calif.

AMERICAN MINING CONGRESS.
Sept. 20-22. Secy., J. F. Callbreath, Washington, D. C.

INTERNATIONAL ENGINEERING CONGRESS.
Sept. 20-25. W. A. Cattell, Secy., Comm. of Management, Foxcroft Bldg., San Francisco.

INTERNATIONAL ASSOCIATION OF BRIDGE AND STRUCTURAL IRON WORKERS.
Sept. 20-30. Secy., Harry Jones, American Central Life Bldg., Indianapolis, Ind.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Sept. 21 and 22. Secy., F. M. White, Madison, Wis.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Sept. 23 and 24. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 23 and 24. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN ASSOCIATION OF REFRIGERATION.
Sept. 23 and 24. Secy., J. F. Nickerson, 431 South Dearborn St., Chicago, Ill.

ILLINOIS GAS ASSOCIATION.
Sept. 27. Adjourned meeting. Secy., H. H. Clark, 72 West Adams St., Chicago, Ill.

SAFETY CONFERENCE.
Sept. 27 to 30.

INTERNATIONAL GAS CONGRESS.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

NATIONAL DRAINAGE CONGRESS.
September, 1915.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

Hollow Building Tile Manufacturers' Association of America—The semi-annual meeting of this association was held in Indianapolis, Ind., at the Hotel Severin, on Tuesday, July 13.

The Northwestern Road Congress will convene in Cedar Rapids, Iowa, Oct. 4-7. The states of Iowa, Illinois, Wisconsin, Indiana, North Dakota, South Dakota, Missouri, Michigan and Minnesota comprise the territory of the congress. The secretary is James P. Keenan, 71 Sentinel Building, Milwaukee, Wis.

Pan-American Scientific Congress—The Second Pan-American Scientific Congress will convene in Washington on Dec. 27, 1915, and conclude its sessions on Jan. 8, 1916. The first congress of this name was held in Santiago, Chile, in 1908. The assistant secretary of the congress is Dr. Glen Levin Swiggett.

American Institute of Chemical Engineers—At the seventh semiannual meeting to be held in Los Angeles (Aug. 16-18), and in San Francisco (Aug. 25-28), the following papers should be of special interest to engineers: "The Improvement of High Boiling Petroleum Oils and the Manufacture of Gasoline as a Byproduct Therefrom by the Action of Aluminum Chloride," "The Purification of Sewage by Aëration in the Presence of Activated Sludge," and "Electrical Precipitation Method."

Texas Good-Roads Association—A joint meeting of the Texas Good-Roads Association and the County Judges and Commissioners Association will be held at the Agricultural and Mechanical College of Texas, Aug. 5-7. Prof. R. L. Morrison, the secretary of the road association, states that practically every road-material company and road-machinery company doing business in the state has arranged for an exhibit at the convention, and that the indications are that it will be the largest and most important road convention ever held in Texas.

American Association of Engineers—This society announces its organization, with headquarters at 29 South La Salle St., Chicago, with W. D. Wilcox, gas engineer, president, and Arthur Kneisel, patent attorney, secretary. According to the constitution, the object of the association is to raise the standard of ethics of the engineering profession and promote its economic and social welfare. The association is to maintain a "service clearing house" for the benefit of its members, furnish patent and legal advice on matters of general interest, and supervise legislation affecting the profession. Applicants for membership must have had at least five years' practical experience in engineering work, or be graduates from recognized technical schools, with at least two years' practical experienec after graduation. The dues are $10 per annum.

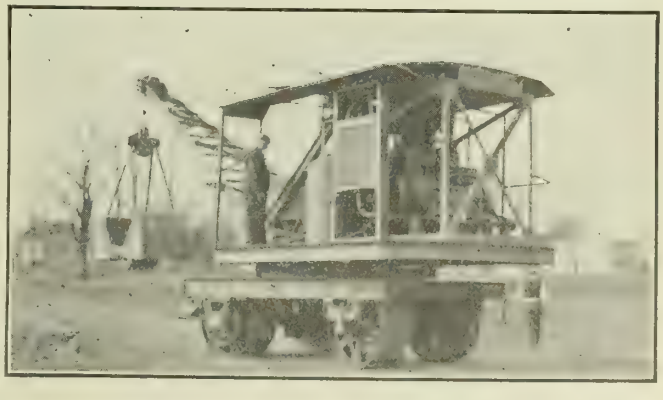
North Carolina Good-Roads Convention—The annual convention of the North Carolina Good-Roads Association occurred in Asheville, N. C., July 14-16, 1915. Sessions were held in the assembly room of the Langren Hotel. More than 200 delegates from all sections of the state were registered. A goodly number of county and township commissioners were present, as well as numerous county, highway and municipal engineers. Two features of interest were noted in the proceedings—the advocacy of state and federal aid for road construction and the emphasis placed on maintenance. Representative Gallatin Roberts, who was instrumental in the enactment of the law creating the North Carolina Highway Commission, spoke in favor of state aid for road building. He said that the state convicts, now used in railroad construction, should be used exclusively for highway work. Congressman J. J. Britt of North Carolina spoke strongly in favor of the Bourne bill, providing for federal aid in road construction. D. H. Winslow, Highway Engineer, United States Office of Public Roads, described methods employed in maintenance work on the Washington-Atlanta National Highway. W. S. Fallis, Highway Engineer of North Carolina, read a paper on the maintenance and repair of macadam roads. Other speakers discussed drainage, grading and maintenance of earth roads. The use of convicts in road construction was also discussed. The last day of the meeting was devoted to an auto trip over the new scenic road through Hickory Nut Gap.—S. H. Lea, City Engineer, Charlotte, N. C.

Appliances and Materials

Tractor-Type Revolving Crane

The revolving crane tractor shown in the accompanying view has been introduced recently by the Davenport Locomotive Works, of Davenport, Iowa, for use on construction work and at railway and material yards. Its main purpose is for handling such bulk material as sand, gravel, stone and coal; unloading it from railway cars at yards or construction switch tracks and loading it (from cars or stock piles) on wagons and motor trucks. It may be equipped also for direct hoisting (as in steel and lumber yards) or for operating a dragline bucket.

The main frame is mounted on 48-in. wheels 24 in. wide, and a differential gear on the rear axle enables the machine to make a turn as short as 25-ft. radius. Caterpillar tracks can be used on machines that are to work on very soft



TRACTOR-TYPE REVOLVING CRANE

ground. The frame carries a cast-steel ring having a track for the rollers of the revolving upper frame and an internal gear or circular rack for the pinion of this upper frame. The legs of the A-frames extend beneath the revolving frame and carry four rollers, which bear against the under side of a flange on the base ring, so that the load on the boom is transmitted directly to the truck and is not carried by the rotating frame or center pin.

The crane may be driven, as shown, by a 45-hp. four-cylinder gasoline engine, by an electric motor or by a two-cylinder vertical steam engine. It is operated by one man, who con-

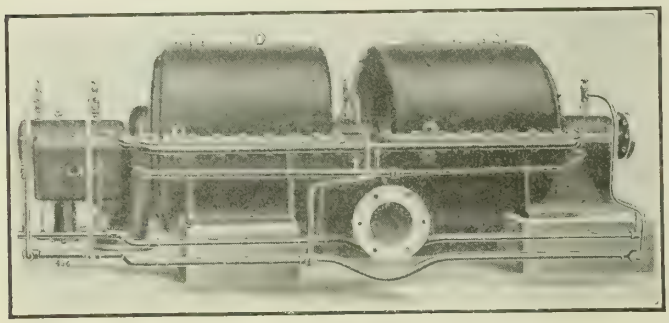
trols all movements from his platform. The wheelbase is 8 ft. 4 in., with a track width of 8 ft. 6 in. The boom is made 20 to 30 ft. long, with a reach equal to its length and a minimum working radius of 12 ft. The maximum hoisting capacity is 5 tons. The hoisting speed is 150 ft. per min, with a single line, and the swinging can be done at a rate of 3 r.p.m. The traveling speeds are 1¼ and 2½ mi. per hr. The weight of the machine is about 17 tons.

* * *

Rotary Air Compressors

A line of high-speed blowers and air compressors, furnishing air at pressure heads of from 4 in. of water up to 120 lb. per sq.in., has been designed by the De Laval Steam Turbine Co., of Trenton, N. J. One of the multi-stage compressor units is shown in the accompanying illustration. The difficulties overcome in getting out this line of apparatus were due largely to suiting materials and practices to very high-speed service. Employment of peripheral velocities of from 450 to 600 ft. per sec. makes pressures of 3 or 4 lb. per sq.in available from single-stage machines.

In the single-stage double-suction blowers, one-piece cast-iron housings carry inlet rings cast integral with a bearing



DE LAVAL CENTRIFUGAL COMPRESSOR

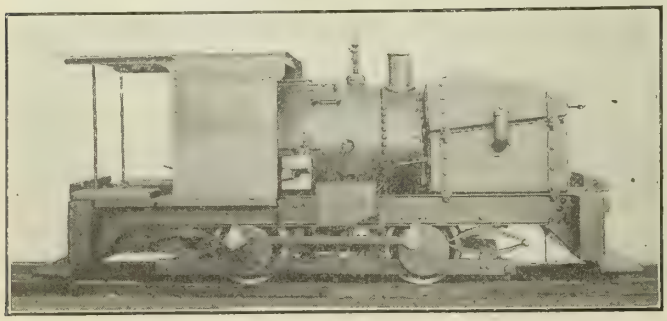
bracket. The housings serve as diffusers and volute passages. The impeller is built up on a chrome-nickel-steel disk thickened at the center to form a hub and to turn the air entering axially. One side of each vane is riveted to this disk and the other to a tapered side plate of the same material. Leakage from the discharge past the impeller is prevented by a labyrinth packing ring. The head-delivery relations can be designed for various services.

The multi-stage compressor casing is split horizontally. The impellers are carried by a large stiff shaft. There are packing rings between the diaphragm and shaft at each stage, a labyrinth packing at the suction end and (for gases other than air) carbon rings at each end of the casing. The stage diaphragms are made separate from the casing and are also split horizontally. When the compressors are water cooled the diaphragms are made hollow. The thrust of all stages is balanced by a cylinder and disk at the discharge end, having one side exposed to suction and the other to discharge pressure. The larger or lower-speed machines are built with two casings and two shafts.

* * *

Small Geared Steam Locomotive

A novel type of steam locomotive has recently been designed by the H. K. Porter Co., of Pittsburgh, for use by contractors and industrial railways in competition with gasoline and electric machines. The ordinary direct-connected locomotive when used at low speed, as in switching service and on industrial and contractors' railways, is inefficient because of the very low piston speed. By gearing the engine to the driving wheels, however, this is overcome and it is possible to develop large power with a comparatively small engine.



SMALL PORTER GEARED LOCOMOTIVE

The engine on this locomotive is accurately balanced, and by the use of roller bearings, oil-bath lubrication and careful finish of working parts it can run at very high speed, with reliability and without setting up vibration or nosing of the locomotive. The boiler is also of special design and is adopted to the use of any liquid fuel. This gives an exhaust free from smoke and sparks. The boiler has a straight shell, long enough to include both the fire-box and the smoke-box, and the copper tubes used are only ½ in. in diameter and about 16 in. long. On a 5-ton locomotive the complete boiler, with fire-box and smoke-box, is only 34 in. in diameter by 37 in. long. The locomotive is built in sizes from 2 to 12 tons for any desired gage of track.

* * *

Close-Quarter Air Drill

The air-driven drill shown in the accompanying view has recently been designed by the Ingersoll-Rand Co., of New York City, for shops and foundries, for field work on structural steel, or for any drilling, reaming and tapping in restricted locations. It has been given the trade name of "Little David Close-Quarter Drill."

The distance from end of casting to center of spindle is only $1\frac{5}{16}$ in. It has a three-cylinder air motor running in oil.



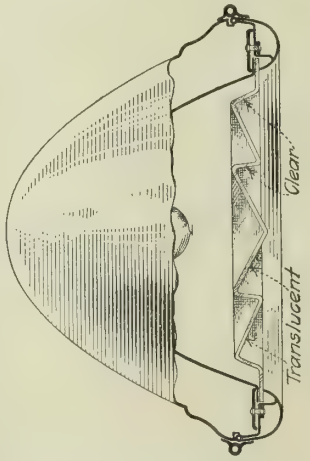
PORTABLE PNEUMATIC DRILLING MACHINE

Rotary valves are geared to a three-way crank-shaft turned by ratcheted levers connecting the pistons to the drill spindle. Some one of the three ratchets is always engaged. Loosening a few cap screws gives access to the working parts. The drill is rated for drilling up to 3 in. and for reaming and tapping up to 2 in. It runs at 150 r.p.m.

* * *

Anti-Glare Headlight Lens

A so-called "safety lens" has been developed by the Lancaster Lens Co., Lancaster, Ohio, to prevent headlight glare. The design for automobile lamps is shown herewith. The "lens" is a plate with circular corrugations and alternate clear and translucent surfaces. It is claimed that only the light thrown out in front is modified, as the reflected beams pass through the clear sections and are distributed as usual.



ANTI-GLARE HEADLIGHT GLASS

* * *

Camp Beds

A simple and efficient bunk for camp, cars, etc., is being put out by the Acme Supply Co., 28 East Jackson Boulevard, Chicago, under the name "Gosso Bed." It consists of a steel-tube frame with a canvas sheet stretched over it and suspended by four chains and springs from ceiling hooks. A spring and chain with tightening lever runs down from each corner to the floor.

* * *

Safety Stop for Crane Hooks

An automatic stop for electric crane hooks has been devised by the Electric Controller & Manufacturing Co., of Cleveland. It consists of a number of contactors mounted in a box and operated by a shaft carrying a sheave over which passes a cable carrying a heavy weight on each end. As the hook reaches the highest point of safe travel a shoulder on the hook engages and raises the lower weight. The contactors are thereby operated so as to open the motor and close the braking circuit. Lowering the hook restores the stop to its former position.

Engineering News

VOLUME 74 JULY 29, 1915 NUMBER 5

Chicago Municipal Pier

An important public work now being carried on by the city of Chicago in connection with its outer-harbor project is the construction of a municipal pier for freight and passenger steamship service, with accommodations for a recreation space and a public hall.

The pier is north of the mouth of the Chicago River, in line with Grand Ave. and Illinois St. It is 3000 ft. long and 292 ft. wide. At the shore end is a headhouse, forming the entrance and having offices on the upper floors. The city or land front of this is shown in Fig. 1. From the rear of this extend two parallel double-deck buildings, 2335 ft. long, for freight and passenger service. These are at the sides and are separated by a central 80-ft. driveway. The remaining 665 ft. is for recreation purposes, with an open upper deck, which forms a shelter for the space below. Near the end of the pier is a municipal hall for public meetings, concerts, etc. The general design is shown by the plan and cross-section (Fig. 2).



FIG. 1. HEADHOUSE OF THE CHICAGO MUNICIPAL PIER

From the shore or beach to the concrete bulkhead wall on the United States harbor line there is a fill 500 ft. long. This stretches south to the river and will be extended 400 ft. north of the pier to form a park and improve the approach facilities. Two double-track railway lines will be laid along the sides of the driveway adjacent to the sheds. These tracks will connect with the harbor branch of the Chicago & Northwestern Ry. at the street level; but locomotives will be allowed to work them only at night.

A double-track incline will connect the street railways on Grand Ave. and Illinois St. with tracks on the upper deck of the pier. There will be a single track along the inner (or driveway) side of each shed, extending along the recreation deck to a passenger terminal loop and station in the terminal building. One or more intermediate loops across the driveway will make it unnecessary to run all cars the full length of the pier. A concrete walk 8½ ft. wide will be laid between the shed and the track.

The situation is exposed, but protection for vessels in rough weather (and especially in the northeast gales) is provided by the existing outer breakwater of the United States Government. This is about 2500 ft. north of the pier and extends in a northwest direction toward the shore. It is intended to close the present open space by a breakwater extending northeast from the shore to the end of the present breakwater, leaving an opening between them for vessels to pass in and out. An extension of the present breakwater is also to run south from its outer end, with an opening in line with the mouth of the river. These protective works will be undertaken by the United States Government (War Department) as part of the Chicago harbor improvements.

The general construction of the pier is shown in the cross-section (Fig. 2). On each side are three rows of timber piles to carry a massive concrete dock wall, while an outer line of timber sheetpiling retains the fill of mud and sand pumped in by suction dredges. Part of the top fill behind the concrete walls was placed by a dipper dredge. The pier is in water 20 to 27 ft. deep. On the inside of the sheetpiling is a rock fill, which was deposited before the sand, so that the latter would fill all

interstices and make a solid fill. The sheetpiling is reinforced on the outside by loose rock filled against it along the bed of the lake, but not extending high enough to interfere with vessels. This construction was described in *Engineering News,* Sept. 18, 1913.

For the buildings there are pile clusters under the footings of the columns. The freight and passenger sheds have six piles under each outer footing (near the edge of the dock), four for each intermediate footing, and three for each inner footing (along the side of the driveway).

The piles for the concrete walls were cut off below the water line in the usual way, but these for the buildings were cut off about 5 ft. above that line, or at about the level of the top of the filling. Owing to the rough water some trouble was experienced in holding in line the rows of piles which are to carry the dock wall. Each row of piles is tied to the next row behind, and in the outer portion there are tie-rods extending across the entire width of the pier.

The dock walls were built in alternate sections 30 ft. long (105 cu.yd.) with interlocked joints. Forms were

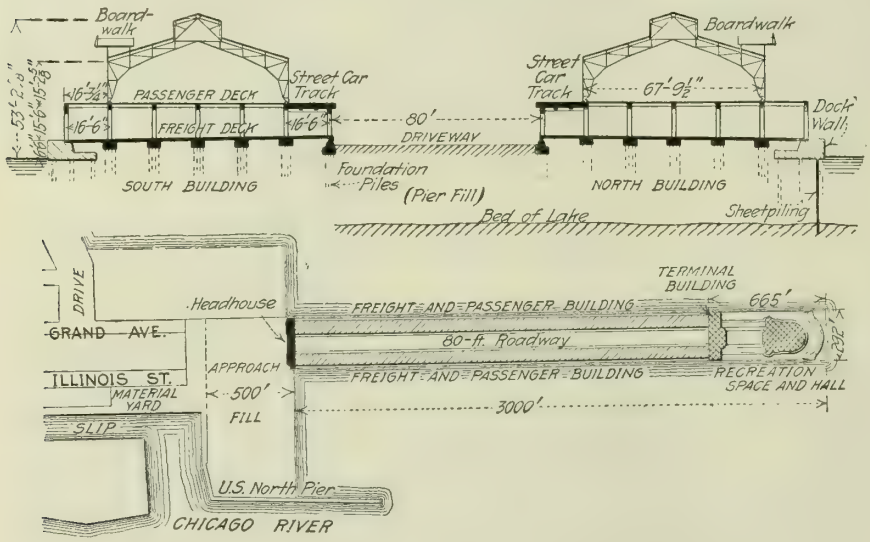


FIG. 2. PLAN AND TYPICAL CROSS-SECTION OF MUNICIPAL PIER

set in place upon the piles after the rock filling had been placed, and a sheet of canvas was laid over the surface of the rock and sand fill to prevent leakage of grout from the concrete. All the concrete for these walls was placed by the floating concreting plant illustrated in *Engineering News,* Mar. 18, 1915.

Sand was delivered in open dump scows and broken stone in deck scows. A revolving locomotive crane on the concreting plant delivered the materials to bins over the mixer. The lower part of the concrete was deposited under water by a drop-bottom bucket handled by the crane, but the upper part was delivered in place by spouts or chutes from the elevator tower on the scow.

Freight and Passenger Sheds

The sheds are double-deck structures 100 ft. wide, 6 ft. from the sides of the pier and separated by an open 80-ft. driveway paved with stone and having four railway tracks. The lower deck will be for freight. The upper or passenger deck will be covered for a width of 70 ft. On its water side will be a 16-ft. walk, from which gangplanks will connect with the steamers. On the driveway side will be a 16-ft. open deck with an 8-ft. walk and a single street-car track. To give access to the outer or recreation part of the pier without interference with steamer passengers, a 14-ft. boardwalk is built along the waterfront side of the shed roof. The details of construction are shown in Fig. 3.

The steel framing is in 20-ft. panels longitudinally, while the lower deck has interior columns spaced 16 ft. 6 in. c. to c. The columns are of I-section, built up of four angles and a web plate. These carry the framing of the upper deck, which for the shed floor and outer platform or walk consists of 24-in. I-beam longitudinal girders with 15-in. I-beam joists. The latter are framed between the columns and the girders and are spaced 3 ft. 9 in. c. to c. The framing for the walk and track on the inner side consists of transverse 20-in. I-beam girders between the columns and three lines of I-beam stringers (two under the track). Along the edge of this framing is a 20-in. fascia girder.

The shed roof over the upper deck is supported by three-hinged arch trusses 20 ft. apart. These are of 67-ft. 4-in. span c. to c. of the 4-in. shoe pins, and have a height of 22 ft. 6 in. to the center of the 3-in. crown pin. The shoes are not connected by tie-rods, but the horizontal reaction of the truss (48,000 lb.) is provided for in the joist connections. At the apex is a wide monitor roof, while the chords on the water side carry the framing for the boardwalk. Purlins of I-beams and channels are laid along the chords, and at two panel joints in each side there are kneebraces from the truss verticals to the purlins. Between the inclined portions of the trusses are two lines of longitudinal bracing on each side, and along the vertical backs of the trusses is a double line of heavy channels above the door openings.

The lower floor will be a 10-in. reinforced-concrete slab, with longitudinal girders between the pedestals or footings of the columns. Inside the building it will be paved with 3-in. creosoted wood blocks on a ½-in. sand cushion. The upper deck will be a 5-in. slab resting on the steel frame and having a 1-in. finish. The roof will be a 4-in. slab covered with a pitch-and-gravel composition. Each side of the monitor will be fitted with pivoted sash operated from the floor. The sides on both decks are composed almost entirely of glazed sliding doors and fixed sash, with a small amount of concrete paneling. The lower columns and upper-deck framing will be cased in concrete. The boardwalk will be laid with transverse 3x6-in. planks ⅜ in. apart.

Approach Trestle for Car Tracks

The incline approach connecting the street-car lines with the tracks on the upper deck will begin as a solid fill and continue as a double-track steel trestle having girder spans of 30 ft. on two-column bents. This trestle construction is shown in Fig. 4.

The columns carry 21-in. transverse girders, between which are framed two 24-in. outside girders and a central 30-in. girder. At the middle of the span a 16-in. girder is framed between the longitudinal girders, and between

the main and intermediate transverse girders are framed four lines of 15-in. I-beam stringers, upon which are laid the track ties. Each track has outside guard timbers, and the space between the rails and tracks is covered with longitudinal planking. Each column is composed of a 12-in. I-beam (web parallel to the track) and two 12-in. channels (flanges inward), with bottom plates across the flanges. This structure is designed to carry a load of 80,000 lb. on two car trucks 20 ft. c. to c. The maximum height is about 17 ft., and the incline is on a grade of 2½ per cent.

In front of the headhouse will be a deck or loading platform, where passengers can enter or leave the cars. This has a 6-in. slab floor on 15-in. I-beam framing. Here and on the deck carrying the tracks through the building the track ties are carried by pairs of 9-in. H-beams, as shown. On this deck also is a stub track about 100 ft. long, on which outbound cars can be placed ready for passengers. Beyond this the tracks diverge to the two single tracks along the inner sides of the passenger sheds.

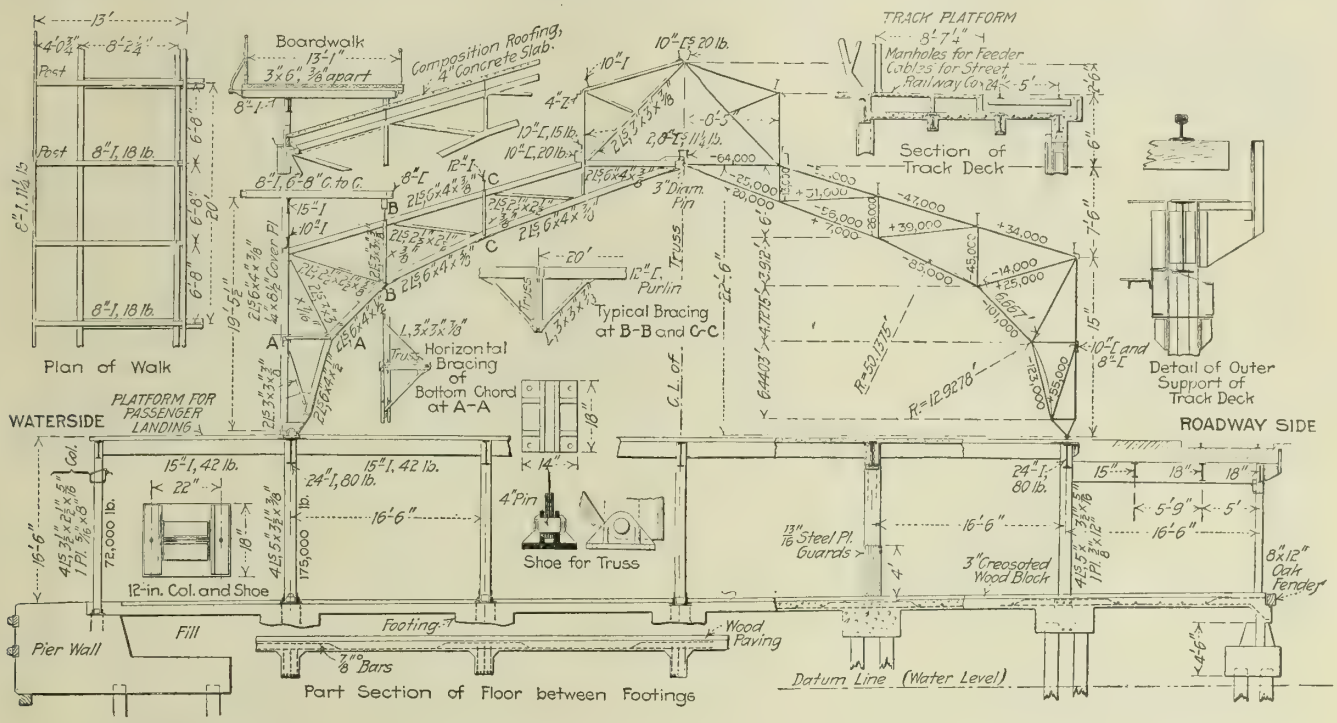


FIG. 3. CROSS-SECTION AND DETAILS; PIER SHED WITH BOARDWALK AND STREET-CAR DECK

Headhouse and Terminal Building

The headhouse (Fig. 1) at the shore end of the pier is of steel-frame construction, incased in concrete and having an exterior finish of brick and concrete which forms the architectural treatment. It is 283x36 ft., three stories high, and has at each end an octagonal tower 100 ft. high, with a 60,000-gal. tank for gravity supply of the sprinkler service. The second floor has toilet and rest rooms and the entrance to the upper (passenger) deck of the steamer sheds. The third floor is utilized for offices. The steel framing presents no unusual features.

At the middle of the building is the entrance to the driveway, with three openings or gateways 26 ft. 8 in. wide. On each side of this is a passenger entrance. A novel and notable feature of the arrangement is the use of winding inclines or ramps instead of stairways to give access to the second floor or passenger deck of the steamer sheds. Experience at some large railway terminals has shown that crowds can be handled more expeditiously and safely on ramps than on stairways. These ramps have a grade of 12 per cent., and are about 12 ft. wide. The concrete floor-slab is 5 in. thick, and crushed granite is used in the 1½-in. top portion to give a wear-resisting surface. The arrangement is shown in Fig. 5.

Access to the third floor (which is not for public use) and to the boardwalk is by stairways. At the second-floor level the double-track street-car line passes through the building, being carried above one of the driveway entrances, as indicated in Fig. 1.

The terminal building is a second transverse structure at the ends of the freight and passenger sheds. It is 283x51 ft., and will contain a restaurant, emergency hospital and public comfort stations. It is of the same general design and construction as the headhouse, but is only two stories high, with triangular roof trusses.

Beyond this will be a recreation space 220 ft. long and 292 ft. wide, covered at the middle by an upper deck or shelter 80 ft. wide, extending between the terminal and recreation buildings. The upper deck will be open. The columns for the shelter deck are of I-section (four 4x4-in. angles on a 10-in. web plate), and are spaced 20 ft. longitudinally and 16 ft. transversely. They carry six lines of 18-in. I-beam girders, with 12-in. I-beam joints spaced 6 ft. 8 in. c. to c. On this will be a 4½-in. concrete slab, with stair-well openings.

Recreation Building

The Recreation Building is at the extreme end of the pier, and its main feature is a great public hall, 140x150 ft., for concerts and entertainments. The floor is about 3 ft. above the main level of the pier for a width of 200 ft.

This hall has three-hinged arch ribs of 136-ft. 8-in. span and 74-ft. 4-in. rise. For the semicircular end of the building there will be radial semi-arch trusses, with their heads attached to a ring girder. In order to provide

against heavy pressure upon this girder, the trusses have cantilever projections on the outer side. These carry the weight of the superstructure and thus balance the half arch. The structural design of this large arched hall is shown in Fig. 6.

The roof will be of 8-in. tile carried by rafters of 6-in. channels on plate-girder purlins, the tops of which extend above the top chords of the arch trusses. Outside of this is a 3-in. layer of cinder concrete, covered with copper. The inner face of the tile will be plastered and finished in a decorative treatment. The towers (157 ft. high) and the exterior walls will be faced brick and terra cotta and given an architectural finish.

The structures, being in an exposed position, are designed for a wind load of 30 lb. per sq.ft.; roofs are designed to sustain a snow load of 25 lb. The floor loads are 250 lb. per sq.ft. for the freight sheds, 200 lb. for the passenger deck, and 100 lb. for the promenades, street-car deck and inclines, and the recreation hall.

The structural steel was not painted or oiled at the shops. After erection it was given one coat of red-lead and raw linseed oil (25 lb. per gal.) and then two similar white-lead coats. The finishing color will be olive green.

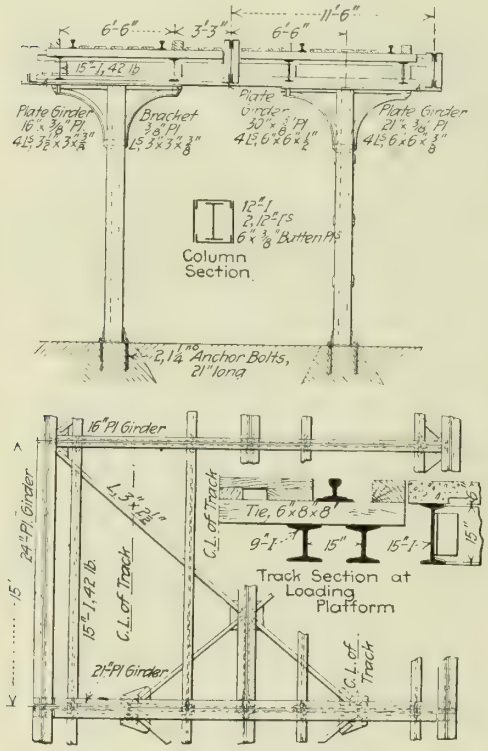


FIG. 4. STEEL VIADUCT FOR STREET-CAR INCLINE

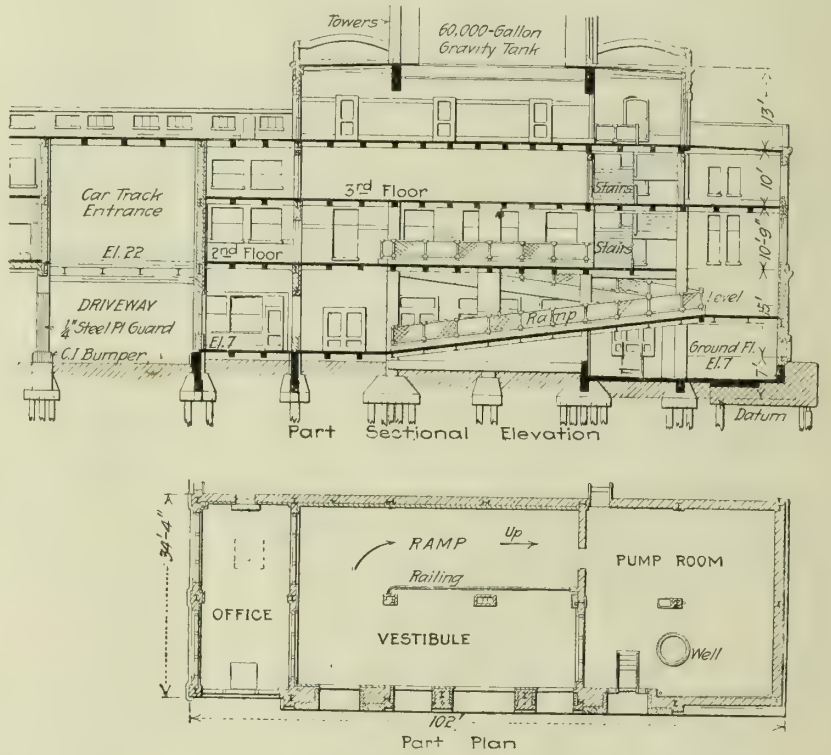


FIG. 5. ELEVATION AND PLAN OF HEADHOUSE

Engineers and Contractors

The pier, with its superstructure and buildings, was designed and built under the direction of the Harbor and Subway Commission, of which E. C. Shankland is Chairman and Chief Engineer, and William Artingstall, Harbor Engineer.

The principal contractors are as follows: Great Lakes Dredge & Dock Co.—foundation piling, $119,900; substructure, $859,869; filling, $200,000; E. L. Scheidenhelm—freight and passenger sheds, $1,091,800; Chaney Archibald Co.—headhouse, $121,757; automatic sprinkler fire-protection equipment, $99,405; John Griffith & Son Co.—terminal building, $129,436; Paschen Brothers—recreation building, $415,000; Ketler-Elliott Erection Co.—steel trestle and incline for street-car connection, $20,700. The total present contracts amount to $3,279,254. The land cost about $300,000, and the total cost of the pier complete, with approaches and superstructure and the water-supply, sewerage, plumbing, and electric-light equipment, will be about $4,000,000.

Criticisms on the Pier Design and Construction

During the execution of the work some criticisms were made, which led to investigations resulting in the approval of the design and construction.

In the first place, complaint was made that the pier was unsafe, due to the bulging of the piling and concrete walls forming the sides. The maximum movement was about 18 in. At the request of the contractors a board of five engineers[1] examined the work. They reported that this minor deformation of the alignment affected the appearance only.

The next complaint was against the interior piles (for footings of buildings) being cut off above the water line. The Commissioner of Public Works appointed a board of three engineers to investigate this.[2]

The report points out that while the general provision is wise, under certain specific conditions (as in this case) it may be ignored with safety. In the fill of the pier the piles will be surrounded by moist clay or sand and protected against air circulation by the pier walls and the concrete floor. The conditions are favorable for piles cut off above water line; and to conform to the building ordinance in order to provide against the remote proba-

[1] W. H. Finley, Chief Engineer, C. & N. W. Ry.; F. M. Graham, Division Engineer, Pennsylvania Lines; and Isham Randolph, H. B. Herr and G. L. Clausen, consulting engineers.

[2] Col. W. V. Judson, U. S. Engineer Corps; R. W. Patterson; and C. H. Cartlidge, Bridge Engineer, Chicago, Burlington & Quincy R. R.

bility of decay of the top of the piles would have caused an increase in cost not warranted by the conditions.

Another criticism from the Building Department was that (under the ordinances) the tensile stress in the reinforcing steel of the concrete should not exceed 11,000 lb. (instead of 16,000 lb. as specified), and that certain of the first-floor girders were of insufficient strength, while the floor might be loaded to 400 lb. per sq.ft. and the foundation pile overloaded. To this it was replied that the steel is specified to comply with the specifications of the American Society for Testing Materials, and that a usually fireproofed or the floors partitioned. The lower (freight) floor is equipped with sprinklers. The buildings have been approved by the insurance interests and the city's fire-prevention bureau.

As to loads on the piles, it is pointed out that the heaviest loads are on those carrying the headhouse, which have been under full load for some time and have shown no settlement. The freight-deck floor was designed for 250-lb. live-load; and to settle the question of its strength a loading test was made by R. W. Hunt & Co., to determine the deflection and settlement in the floors, girders and

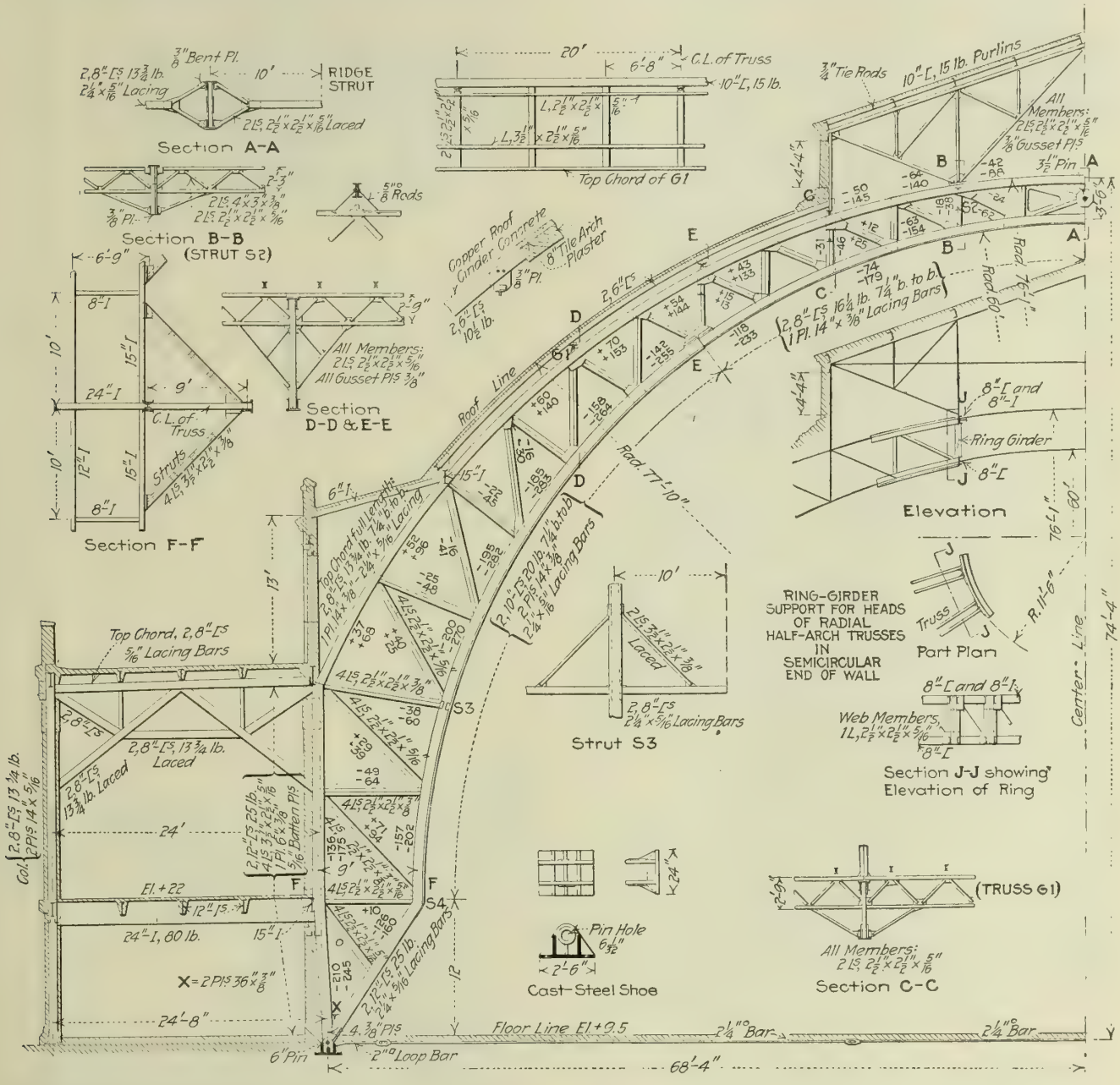


FIG. 6. THREE-HINGED ARCH TRUSSES OF THE RECREATION HALL ON THE MUNICIPAL PIER AT CHICAGO

stress lower than 16,000 lb. is not required in the numerous reinforced-concrete buildings that have been tested and approved by the department.

It was also claimed that in the upper deck (or passenger shed) the exposed steel of the trusses should be fireproofed or the deck divided by firewalls. This deck has a steel frame, concrete floor and roof. It is simply a concourse, and is in the same class with a trainshed, armory or coliseum, in none of which are the steel trusses

foundations under a live-load of 750 lb., or three times the designed live-load.

These tests showed a maximum floor deflection of 0.114 and 0.125 in. at two of the ten points of observation (and in most cases it was much less than this), while the allowable deflection is 0.247 in. The deflection in the girder tested was 0.092 in., while the allowable deflection is 0.30 in. With a load of 185.6 tons on one foundation, or 46.4 tons per pile, the settlement after 64 hr. was only 0.17 in.

New Features in Surveying Instruments

The modern engineer's transit is the product of a slow evolution, the elements of which are to be found in the old-time English theodolite and the transit compass invented by William Young, of Philadelphia, in 1831.

For many years most of the improvements were in the direction of more accurate graduation, additional devices, such as the vertical circle, gradienter screw, leveling vial,

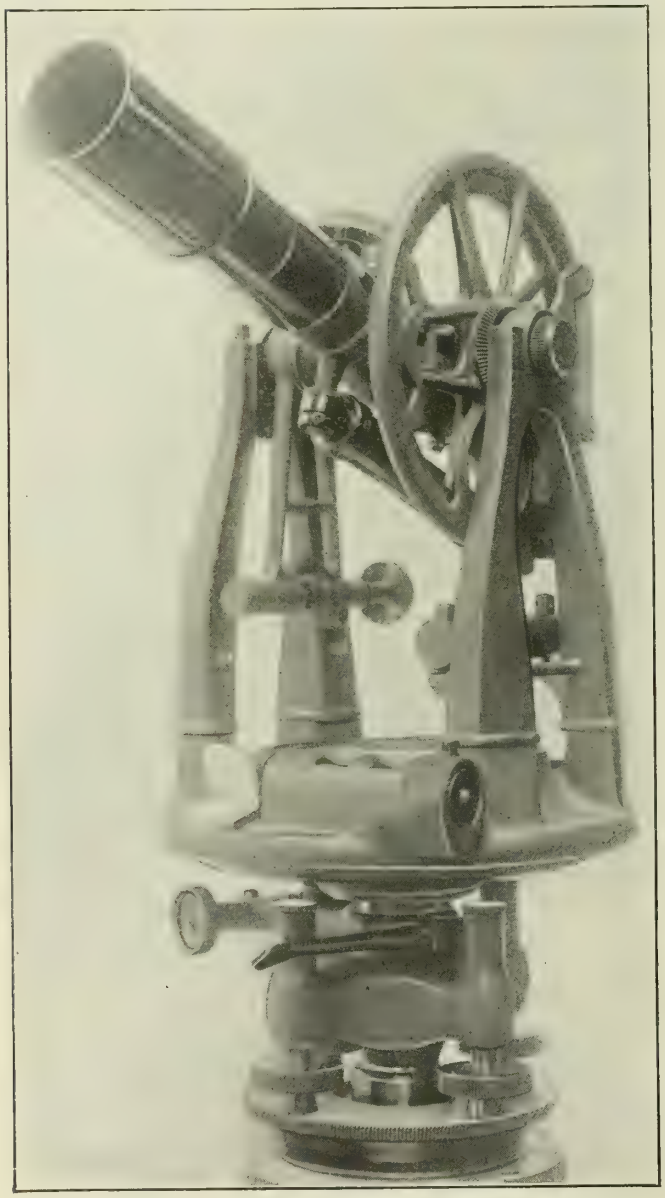


FIG. 1. NEW "MONITOR" TYPE TRANSIT OF EXCEPTIONALLY RUGGED CONSTRUCTION

shifting head, etc.—in short, toward increasing the efficiency and accuracy of the instrument. Recently, however, much of the development has been toward strengthening the structural parts to withstand rough usage, for a good surveying instrument is truly as delicate as a watch, and even with the best care is almost certain to undergo rough handling in preliminary and construction work.

This tendency toward increasing sturdiness is shown in the accompanying illustrations and notes describing a new line of instruments designed and built by C. L. Berger & Sons, Boston, Mass., and known by the trade name of "Monitor." A transit of this type is shown in Fig. 1. In this are embodied several new features, the most striking of which are the exceptionally rugged, strong and rigid standards. The standards are screwed

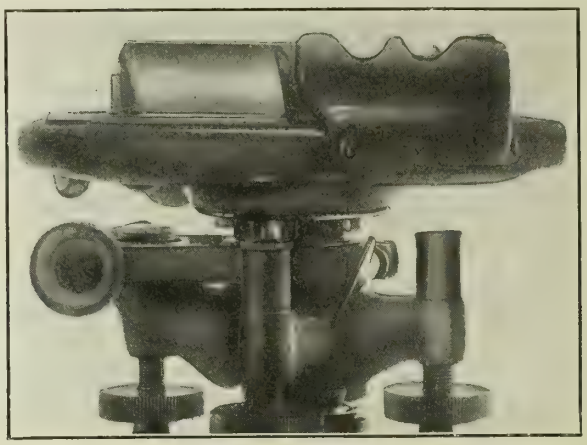


FIG. 2. BUBBLE GUARD FOR TRANSIT

into the plate casting at the ribs, which are seen about an inch above the plate.

The plate casting is reinforced beneath with two stout ribs which serve as continuations of the standards and give additional lateral stability. The plate casting has a pitched roof so as to shed water, and includes a plate-bubble protection as shown. A similar bubble guard, which may be screwed on any transit plate, is shown in Fig. 2. The bubble guard has the additional advantage of preventing inaccuracies resulting from sudden changes of temperature in the bubble, if the sun shines directly upon its mountings. Indeed, a sensitive bubble is appreciably affected if its mountings, on a cold day, come in contact with the fingers, or if the face of the observer is held too close.

The telescope axis has large (½-in.) bearings, with special provision to minimize wear and to make easy necessary adjustments. The screw caps on the ends of the axis are designed to prevent the least side play of

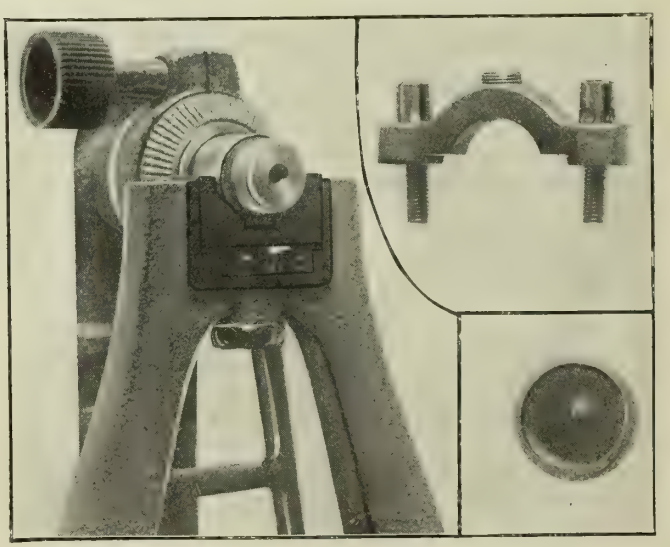


FIG. 3. AXIS DETAIL OF "MONITOR" TRANSIT

the axis and to give additional rigidity to the standards and telescope mounting. Fig. 3 shows a detail of this together with the improved adjustable Y-block, which can be moved in its grooves by opposing capstan-

headed screws. A more than ordinarily stiff aluminum casting is also used to protect the vertical circle.

The leveling head is strongly built of a ribbed casting, with the leveling screws protected throughout their

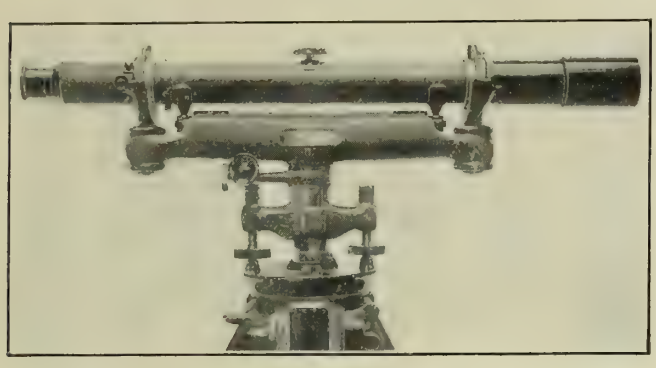


FIG. 4. "MONITOR" TYPE Y-LEVEL, SHOWING BUBBLE PROTECTION

length. The tangent screw and clamp are similarly protected. As will be noted, in the structure of the whole instrument every part, so far as possible, has been given a rounded form, and corners and square edges have been avoided.

A similar method of construction has been followed in the "Monitor"-type levels. Fig. 4 shows a new Y-level, which is noticeably low set and strongly built. The Y-bar is so constructed as to protect the bubble and still allow some lateral movement in making adjustments.

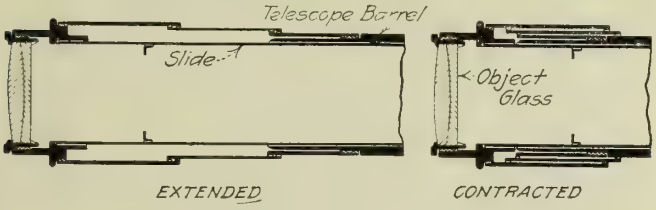


FIG. 5. COLLAPSIBLE-SLEEVE DUST GUARD

To prevent wear on the collars, as well as to secure compactness, the telescope can be revolved on the Y's only between 20° and 30°, but the line of collimation of the telescope may be verified at any time by lifting the telescope out of the Y's and rotating it to 180° in that manner. To more completely protect the bubble from the sun or rain, a piece of thin transparent celluloid may be stuck into the Y-bar casting, forming a complete box to inclose the bubble.

Another new feature is the collapsible dust guard shown in Fig. 5, which protects the object end of the telescope. This works on exactly the same principle as a collapsible drinking cup. Fig. 6 shows the construction

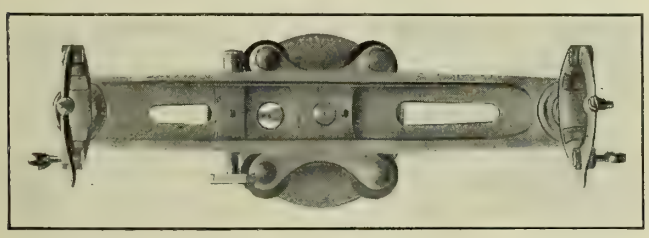


FIG. 6. HOLLOW Y-BAR OF NEW TYPE OF LEVEL

of the hollow Y-bar of the instrument shown in Fig. 4. This type of level was developed largely to meet the specifications of the U. S. Government for a level which would keep its accuracy in spite of rough handling. The mirror shown in Fig. 7 is made detachable and may be fitted to any of the new levels.

The type of dumpy level shown in Figs. 7 and 8 is also strongly built. In this instrument the telescope barrel

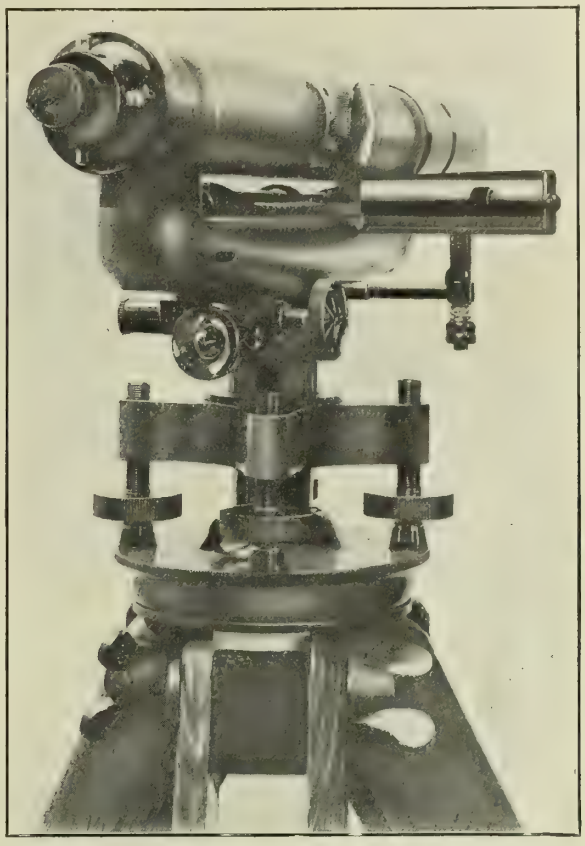


FIG. 7. END VIEW OF Y-LEVEL, SHOWING DETACHABLE MIRROR

and both uprights are cast in one piece. The barrel is bored and not made of drawn tubing. The ribbed cross-bar and instrument center are also cast in one piece. As will be seen from the illustration, the cross-bar is exceptionally long.

Another type of low set Y-level is shown in Fig. 9, and the tubular Y-bar of this level is shown in Fig. 10. This hollow Y-bar incloses the slow-motion screw and clamp, adding both to compactness and neatness; and it is claimed that the free circulation of air through

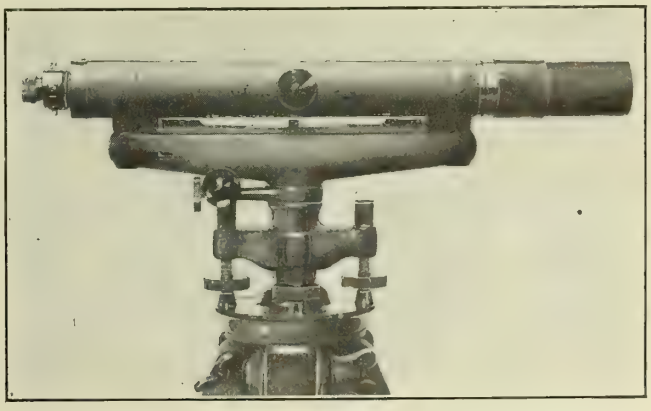


FIG. 8. "MONITOR" TYPE DUMPY LEVEL

and around the bar causes less movement due to temperature changes than with the older style solid bar.

In addition to the structural features described, the new type of transit has graduated circles in which fig-

ures reading to the left are red and those to the right black, and the figures in each row are inclined in the direction in which the circle is read—features which have hitherto been special to order.

Another innovation is the combination device attached to the compass for lifting the needle and setting off the

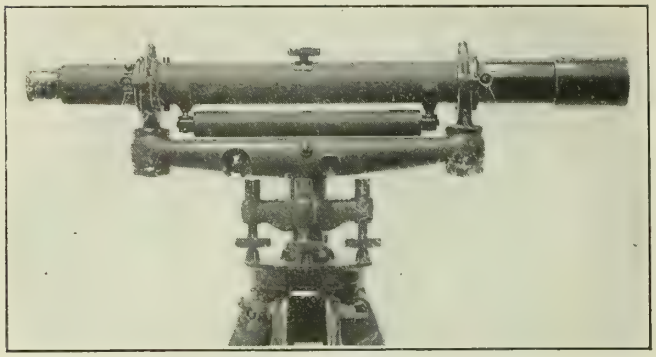


FIG. 9. TUBULAR-BAR Y-LEVEL WITH CONCEALED CLAMP AND TANGENT SCREW

magnetic declination (Fig. 11). This consists of the usual thumbscrew for the needle-lifting lever and a pinion which moves on a collar or nut inclosing the thumbscrew. The pinion is moved by a pin and capstan and meshes with the teeth in a ring on the compass circle so that any declination east or west may be readily turned off.

A valuable addition to transit and level equipments which is now available is a short-focus lens attachment.

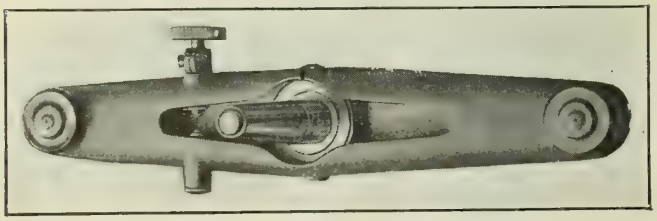


FIG. 10. BOTTOM VIEW OF TUBULAR BAR

Most transit telescopes will not focus on a point nearer than 5 or 6 ft. away from the instrument, which often is very annoying, especially in mine and building work. To permit focusing for short distances there are two attachments of a simple lens, each in a small aluminum tube, which fits the objective tube. Attachment No. 1 will permit focusing on objects 6 ft. away when the objective tube is drawn farthest in. This allows focusing for distances from 6 to 4 ft. For distances less than 4 ft. attachment No. 2 is applied in the same manner.

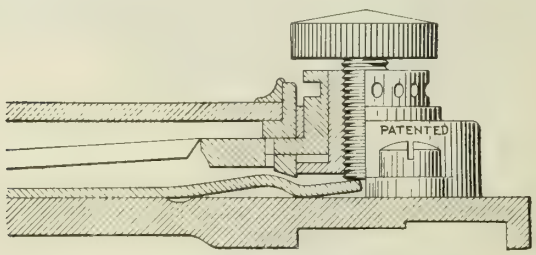


FIG. 11. NEEDLE-LIFTING DEVICE

By combining the two attachments focal distances from 2½ to 2 ft. may be obtained.

The instruments described are coated with a new leather finish of a dark-green color. This finish is claimed to be impervious to dampness or dryness and to be superior to the cloth finish formerly used.

Log-Handling Equipment at Arrowrock Dam

By Charles H. Paul*

It is estimated that there is about 3,000,000,000 ft. of timber above Arrowrock Dam, on the Boise River, much of which will be cut and driven down the river to lumber mills below within the next 20 or 30 years. Hence it is necessary to provide means of taking the logs out of the reservoir, over the dam, and down to the river below. Because of the great height of the dam (260 ft. above river level) and the fluctuations of water level in the reservoir due to varying irrigation demands, the studies of the problem resulted in a design somewhat unusual, although all the apparatus used is approved by standard practice.

The general requirements to be met by this equipment are as follows:

1. The maximum capacity must be sufficient to handle about 60,000,000 ft. of logs during a period of about 60 days, when the water surface in the reservoir is not more than 45 ft. below the top of the dam.

2. It must operate at a high efficiency at any stage of water level within the limits mentioned.

3. It must be capable of handling any size of log up to 6 ft. in diameter and 32 ft. in length, with a possibility of handling a log longer than 32 ft. as a special case.

4. It must be of substantial construction, as it will be exposed to the weather at all seasons of the year.

The average log to be handled will be less than 24 in. in diameter and not more than 16 or 20 ft. long, although larger and longer logs will come down occasionally; so that means must be provided for taking care of them.

The location of the log conveyor with reference to the dam and other features is shown in Fig. 2. The general details are given in Fig. 1.

Logs will be taken out of the reservoir by means of a cable lift, the details of which are shown in Fig. 1. This method of raising logs from the pond is being used in preference to the more common bull chain at many of the new sawmills on the Pacific Coast, and in this particular case, considering the great fluctuations of water level and other operating conditions, its advantages are apparent.

The log deck will be kept supplied with logs by this cable lift at a rate of speed calculated to fulfill the requirements. From the deck the logs will be fed by a deck stop and loader on to power-driven spiked rolls. The loader will feed the logs to the rolls one at a time, at intervals which are under the positive control of the operator. The rolls will carry the logs across the dam at a rate of speed corresponding to that of the lowering chain. A log longer than 32 ft. may be lifted direct to the rolls by means of a snub line; and as very few of these long sticks will need to be handled, they may be handled as special cases without inconvenience.

The power rolls or "live rolls" will take the logs to the bull chain, the spurs or teeth on which are spaced at 8-ft. centers, and are set to hold against sliding. This bull chain will take the logs down the 62½-per cent. slope at a speed of 85 ft. per min. and will discharge them into the gravity chute at the lower end, through which they travel to the river.

*Construction Engineer, United States Reclamation Service, Arrowrock, Idaho.

The chute carrying the bull chain and the gravity chute are both to be built of reinforced concrete. The chain chute is to be protected by replaceable 2½-in. half-round steel bars; the gravity chute has its wearing surface protected by embedded 60-lb. rails.

The "Proposed Power House," shown in Fig. 1, is not to be built at this time, but its location is shown in these drawings as a matter of convenience.

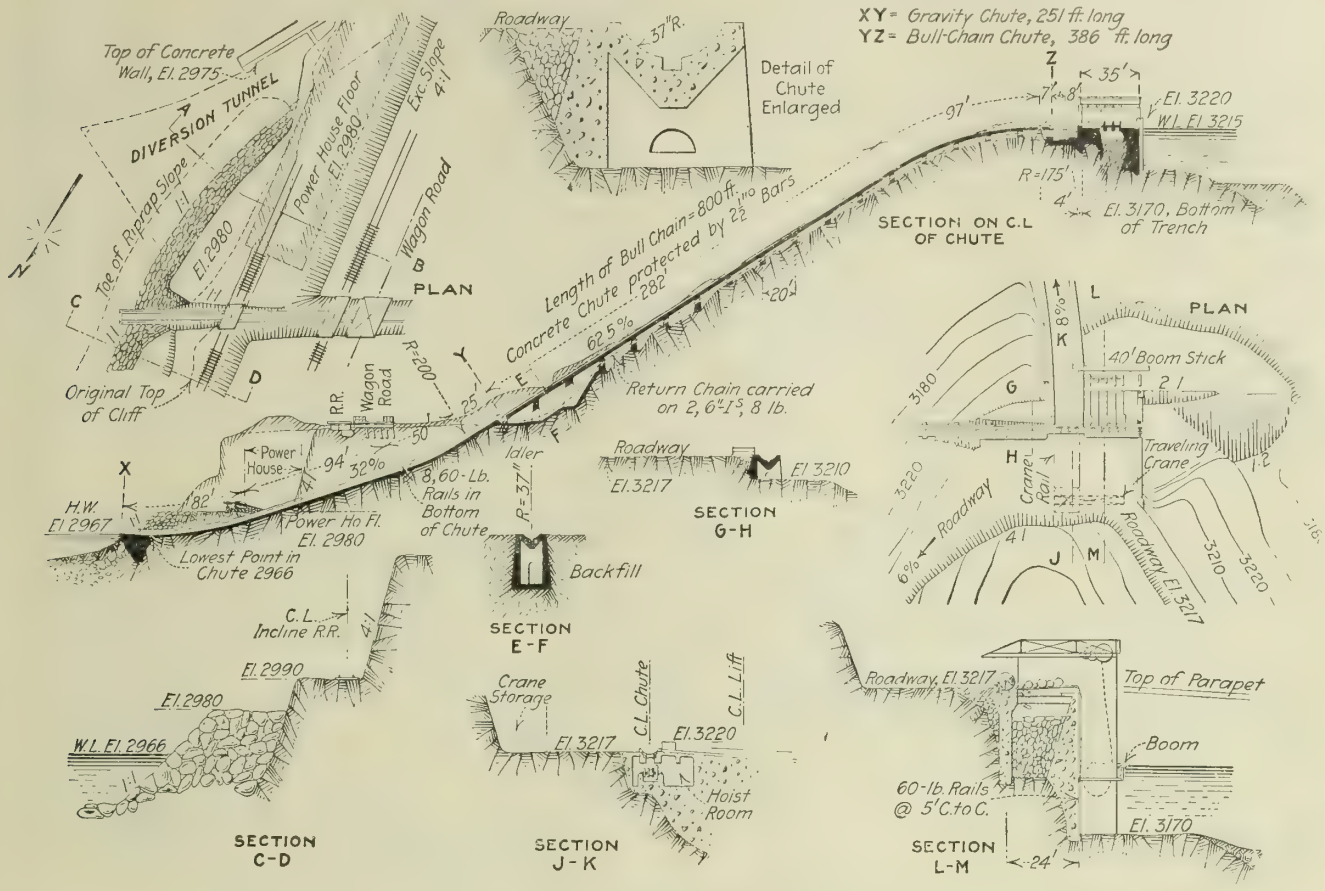


FIG. 1. DETAILS OF LOG-HANDLING EQUIPMENT AT ARROWROCK DAM

This log conveyor will be one of the final construction features in connection with the Arrowrock Dam which is being built on the Boise River about 20 mi. above the city of Boise, Idaho, to provide storage for use on the Boise project of the United States Reclamation Service. Other features of the work have been described in *Engineering News* of June 6, 1912, Jan. 16, Mar. 20, and July 17, 1913; July 11, 1914 and Feb. 25, 1915. Water is now being stored in the reservoir and will be used for irrigation this season. The work is located in the Central Division, of which F. E. Weymouth is Supervising Engineer. The writer is Construction Engineer, in direct charge of the work at Arrowrock. James Munn is Superintendent of Construction. The log-handling equipment was designed by Walker R. Young, Assistant Engineer.

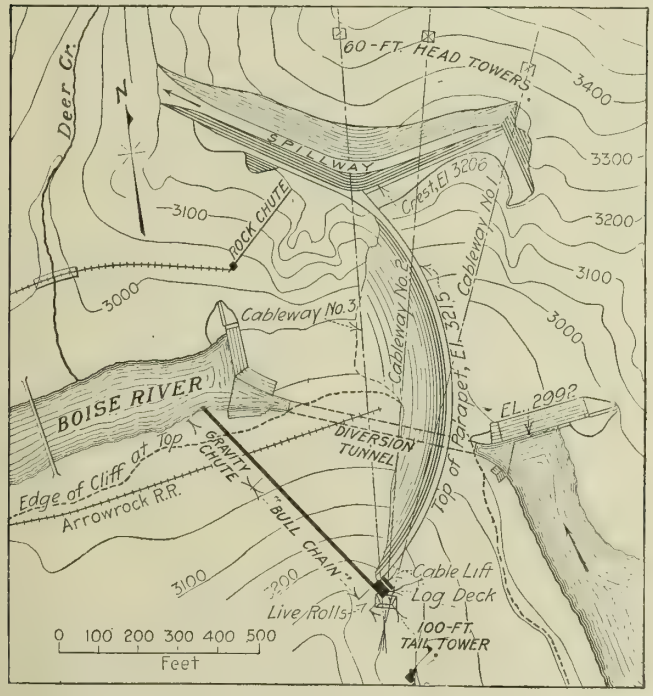


FIG. 2. LOCATION OF LOG HANDLERS AT ARROWROCK DAM, BOISE, IDAHO

The Use of Drainage Water from Irrigation Tracts for further irrigation is suggested by R. A. Hart, of the United States Reclamation Service, in a recent paper presented before the Utah Society of Engineers. In one locality a drainage system which was installed at a cost of $5000 developed a flow of 1 cu.ft. per sec., a sufficient amount to irrigate 120 acres in that locality. As water rights in that section are worth $50 per acre, the water developed by this drainage system has a value of $6000. Small drainage systems often develop large quantities of water. In one case a drain only 1000 ft. in length, put in at a cost of $200, developed a maximum discharge of 1¼ cu.ft. per sec. during the irrigation season. On a 30-acre tract near Ogden, Utah, which is fully underdrained, the drainage water is led to a sump, from which it is pumped by a centrifugal pump, an electrical motor-driven unit, to a reservoir at the highest point of the tract. In this way the entire tract of 30 acres is irrigated with its own drainage water, having no outside source of supply. It will be understood, of course, that in this case the water stored in the underground strata merely acts as a reservoir to store up the surplus rainfall.

Hydraulic Redevelopment at Turners Falls, Mass.

By Howard M. Turner*

To follow the steps in the interesting redevelopment at Turners Falls it is necessary to know the history of the local power company. In 1792 the company was chartered as the "Proprietors of the Upper Locks and Canals of the Connecticut River." A dam was built at about the site of the present one, and a canal for navigation, traces of which still show, was dug from the dam to Montague City, 2½ mi. down the river. In 1866, after the railroads had rendered navigation on the Connecticut River unnecessary, the Turners Falls Co. acquired the property. A new timber-crib dam, still in place, was built, and a canal 50 ft. wide and 10 ft. deep was dug for power purposes. Water was leased to mills constructed between it and the river, the power being generated under heads varying from 33 to 39 ft.

In 1904, with the development of electric-power transmission, the canal was extended; a hydro-electric power station was built with provision for 7000 hp. of equipment and utilizing a fall of 39 ft. The canal at the headgate end was widened to about 130 ft. for a distance of about 800 ft. downstream, and eight new headgates were put in on the shore side of the old ones.

New Power Works

Below Turners Falls the river drops about 20 ft. in the 2½ mi. to Montague City. The company owned this additional power, and plans were made in 1910 to develop it for the growing business. The scheme finally adopted consists of widening and deepening the present canal, extending it to Montague City and building a new power station there to develop the whole power.

From the headgates and through the town of Turners Falls, where the canal is in rock, the section is 127 ft. wide and 18 ft. deep, with almost vertical sides for a length of 3900 ft. About 500 ft. of this is new canal; over this section is a skew railroad bridge and under it a sewer crossing consisting of an inverted double siphon with a dip of about 16 ft. Gates at each end enable either tube to be cut off and cleaned out.

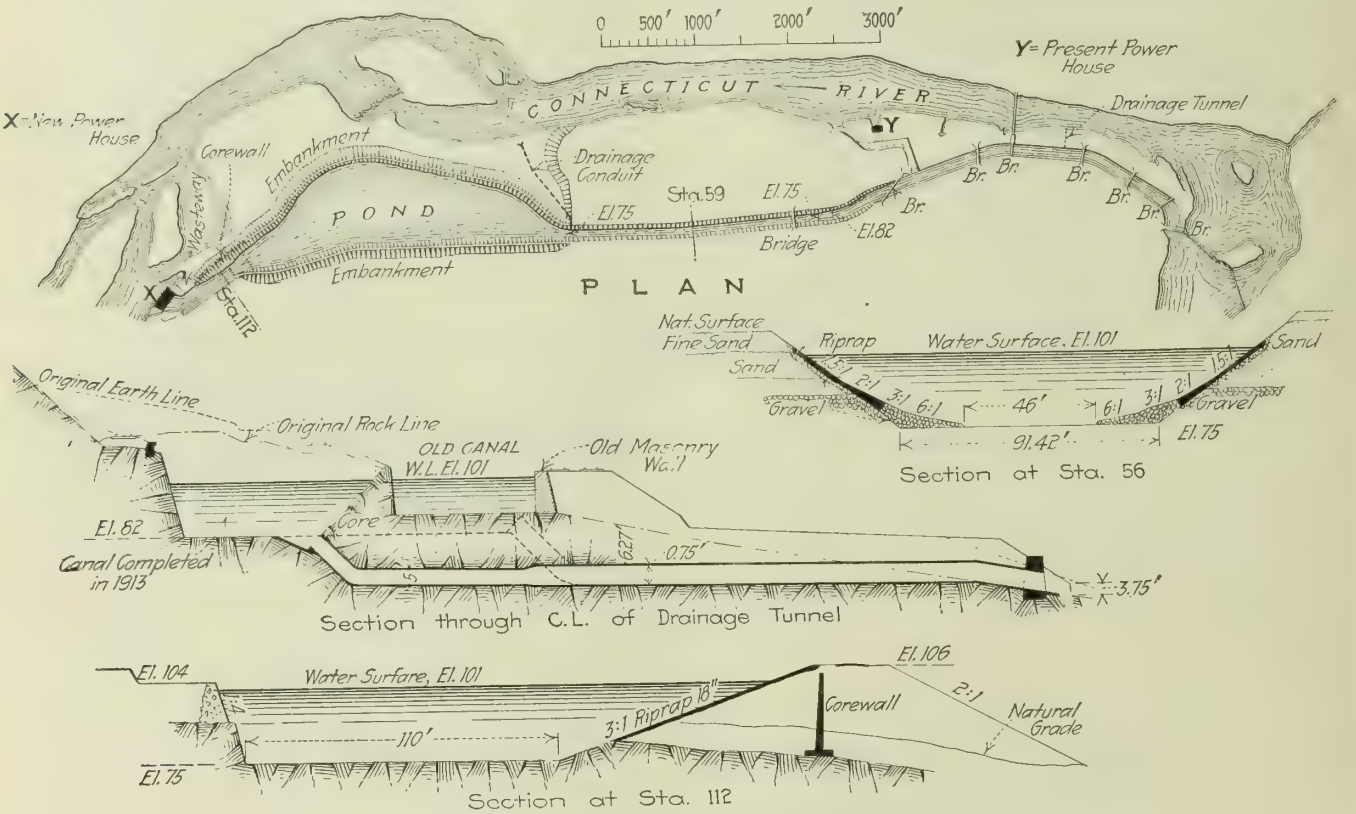


FIG. 1. GENERAL LAYOUT AND CANAL SECTIONS; TURNERS FALLS REDEVELOPMENT

The canal broadens out, beyond the town, in an earth cut to a section 25 ft. deep and 86 ft. wide on the bottom, with sides sloped 1½ on 1, and lined. This section extends for a distance of 3300 ft. At this point, where the natural surface drops off to a general level of about 10 ft. below water line, the canal widens out into a forebay pond of an average width of 600 ft. and a length of 3000 ft., with earth embankments on either side, narrowing up again to a canal section 150 ft. wide and 25 ft. deep for a distance of about 1000 ft. to the power house.

At the entrance to the pond, before the grade rises, there is a 5-ft. conduit to the river, serving as a drain during construction and as a permanent means of emptying this deep section of the canal for maintenance.

The bottom of the pond is slightly irregular, and to get the required effective cross-sectional area it was nec-

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essary to dig a channel 300 ft. wide to a depth of 10 ft. below water line, through a rise of ground in the middle. The pond has an area of about 60 acres, giving storage enough to take care of sudden increases of load at the power house without seriously drawing down the head before the canal headgates can be adjusted to the increased draft through the canal.

The embankments of the pond, which are carried 4 ft. above the maximum pond level, vary in height from 9 to 21 ft. Except for a small length at the lower end, they are built without core wall, from the material excavated from the main canal. Specifications call for a portion of the embankment on the inside below the assumed hydraulic grade line to be of fine sand or sandy clay, spread in 6-in. layers, watered and rolled once, the unrolled portion to consist of sand or sand and gravel. The canal banks are riprapped with 18 in. of stone on the inside. At the lower end, where the pond narrows up to the lower canal, there is a natural bank on one side and an embankment with a concrete core wall to rock on the river side. The core wall is set on a footing 10 ft. wide on the rock, in order to give a large area of contact.

Upstream from the end of the core wall, where the embankment is still near the river and the subsoil above the rock, which is about 20 ft. below the surface, is coarse sand, a cutoff of loam fill 15 ft. wide was put in for a distance of 300 ft. to prevent seepage.

Just upstream from the power house on the river side of the canal is the wasteway with a concrete spillway and ten wooden gates, 12 ft. wide by 10 ft. high, between piers. These gates are operated by hoists on a concrete floor across the piers, each hoist being geared to a shaft which is driven by a motor controlled from the power-house switchboard. The wasteway will pass full canal flow and will be used as a spillway in case of a sudden dropping of load, to remove the ice from the canal and to aid in emptying the waterway. From the end of the wasteway the river wall of the canal makes a curve, joining the end of the head wall of the power house, which is set with its long axis nearly parallel with the river. This wall, containing the racks and headgates, is at an angle of 20 with the center line of the canal. The racks are built of special rack bar spaced 3½ in. clear and with the bars turned slightly upstream. Behind the racks are piers separating the intake into penstock chambers; these in turn are divided into three parts by intermediate piers.

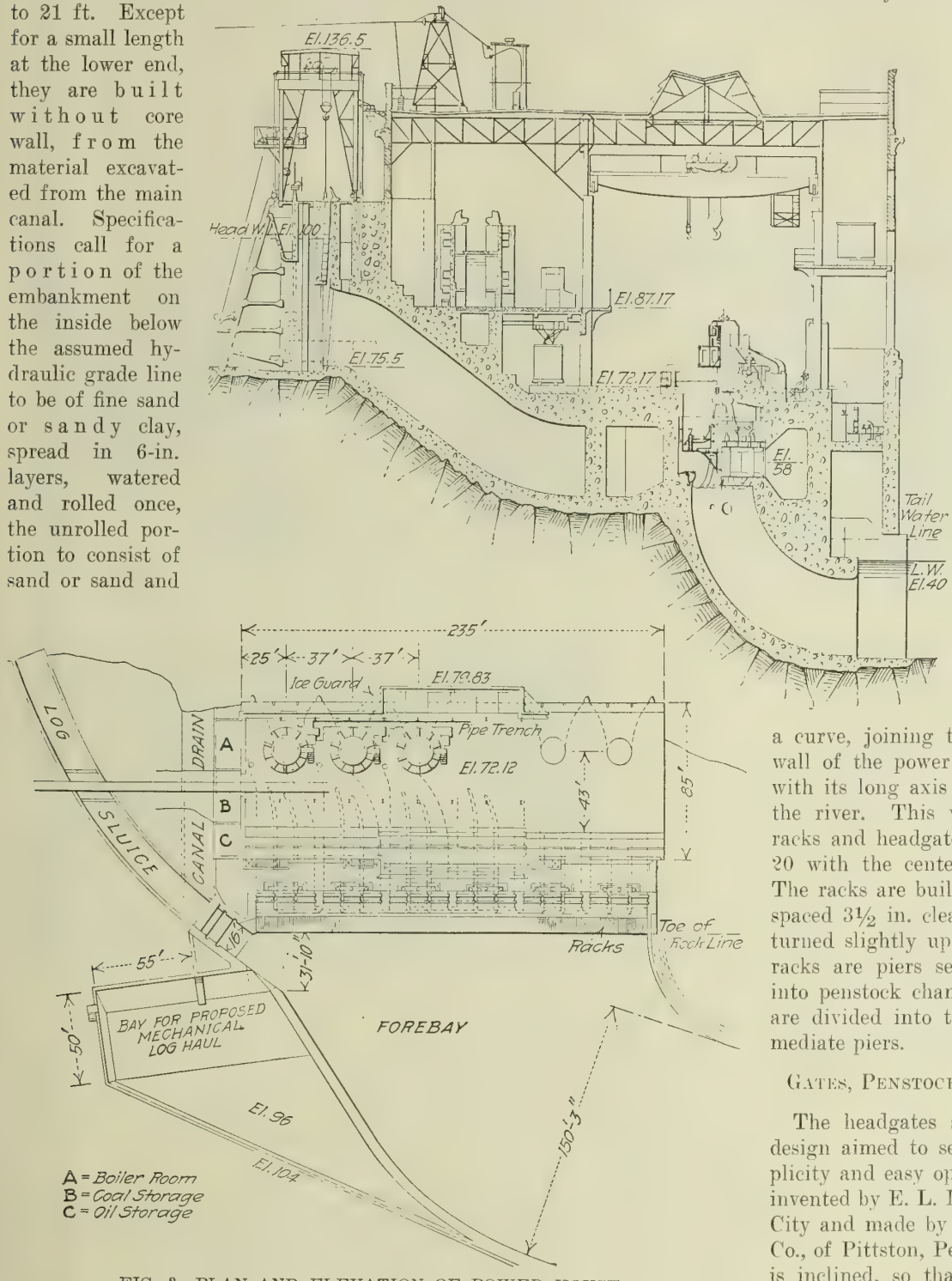


FIG. 2. PLAN AND ELEVATION OF POWER HOUSE

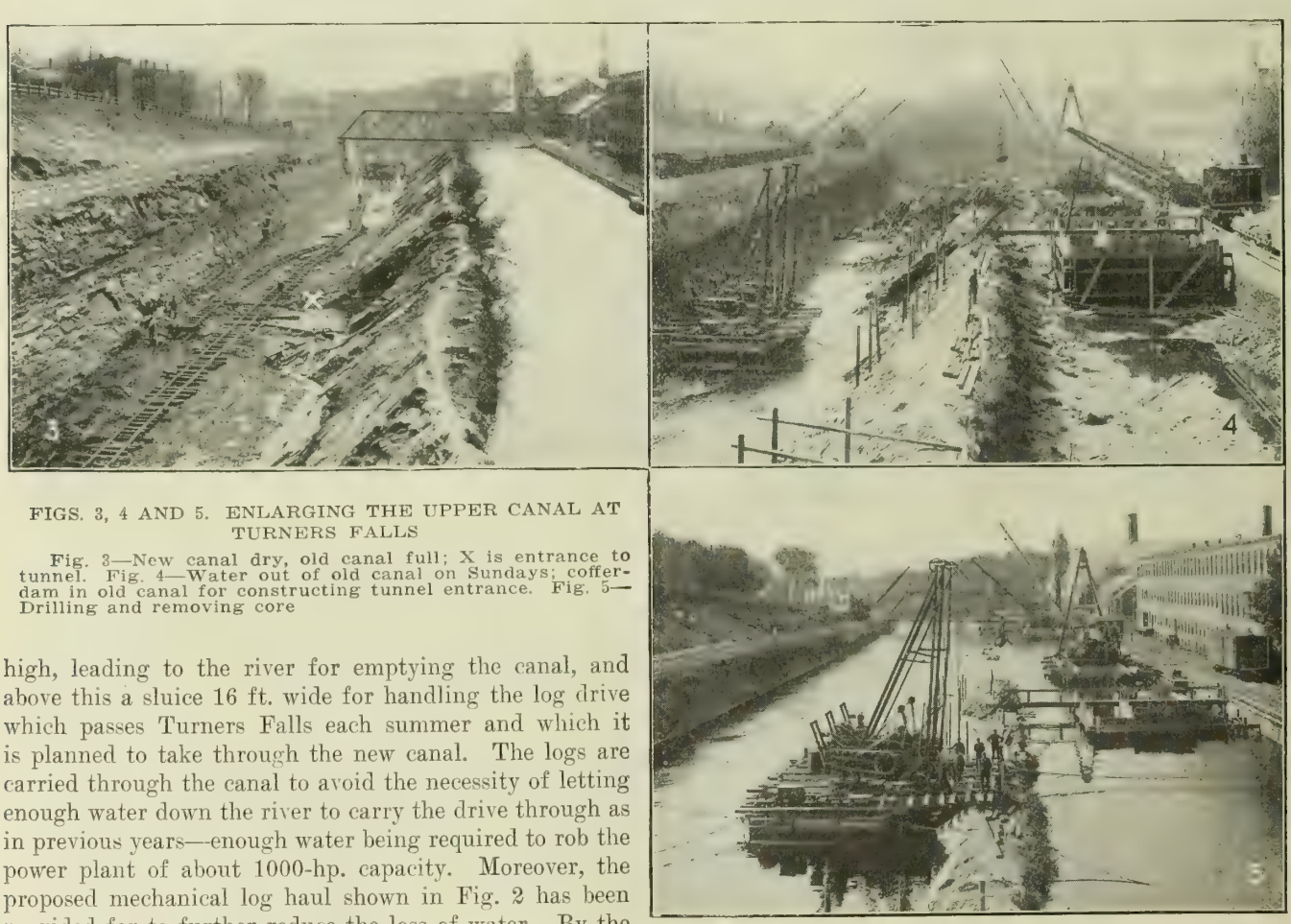
Gates, Penstocks and Log Sluice

The headgates show an interesting design aimed to secure tightness, simplicity and easy operation. They were invented by E. L. Broome of New York City and made by the Exeter Machine Co., of Pittston, Penn. The deck plate is inclined, so that the forces on the gate (weight plus the vertical component of the water pressure) keep the supporting cables always in tension and no rigid stems are required. The gates run on a continuous chain of rollers between tracks on the gates and guides. An electric gantry crane running on the head wall will raise these gates; and also

a mechanical rack-raking device will be carried by it.

The penstocks, of reinforced concrete, curve down from the headgates to the scroll cases of the wheels, which are set 18 ft. above low water and discharge out into the river. The penstocks, scroll cases and draft tubes all have a facing on the inside, 1 ft. thick, of 1:2:4 broken-stone concrete, poured at the same time as the surrounding concrete, which is a mixture equivalent to 1:3:5, with gravel dredged from the tailrace in the river as aggregate. Large stones are embedded in the gravel concrete when possible.

The power-house design is shown in Fig. 2. The superstructure is of brick and steel, with concrete floors, and a concrete roof supported on trusses. At the downstream end is a submerged gate, 16 ft. wide by 8 ft.



FIGS. 3, 4 AND 5. ENLARGING THE UPPER CANAL AT TURNERS FALLS

Fig. 3—New canal dry, old canal full; X is entrance to tunnel. Fig. 4—Water out of old canal on Sundays; coffer-dam in old canal for constructing tunnel entrance. Fig. 5—Drilling and removing core

high, leading to the river for emptying the canal, and above this a sluice 16 ft. wide for handling the log drive which passes Turners Falls each summer and which it is planned to take through the new canal. The logs are carried through the canal to avoid the necessity of letting enough water down the river to carry the drive through as in previous years—enough water being required to rob the power plant of about 1000-hp. capacity. Moreover, the proposed mechanical log haul shown in Fig. 2 has been provided for to further reduce the loss of water. By the expenditure of some 50 hp. in electric current the logs can be taken out of the canal and slid into the river with only enough water to "grease the ways."

Generating Station

The normal head to be made available for the wheels is to be 55 ft. with full load on all units. The final development will provide six 6000-kw. units, the present installation being three. Foundations were put down for all six and the power-house superstructure was completed for four.

The wheels are of a vertical-shaft single-runner type, 91½ ft. in diameter and rated at 9700 hp. with full gate under 54 ft. head and a speed of 97.3 r.p.m. The governors, designed with the turbines, use water pressure from a central pumping outfit with motor-driven centrifugals and sump tanks in a pit in the center of the station over the tailrace. In the governor-pump pit are the sump tanks and pump for the central gravity oiling system; the main tank and filter are on a gallery above, from which the oil flows to the guide and step bearings of each unit. Each generator is a 7500-kv.-a. three-phase 60-cycle 6600-volt revolving-field alternator. Upon the generator frame rests the bridge which supports the Kingsbury thrust bearing; above this is the exciter.

The transformers are on the main floor above the penstocks and will comprise four 66,000-volt banks for the out-going long-distance lines and two 13,200-volt banks for local transmission. The switchboard is located above the 13,200-volt transformers in a room that is 15 ft. above the main generator room, and has the 6600- and 13,200-volt bus galleries immediately behind it and the high-tension rooms on either side above the 66,000-volt transformers.

This development has been made gradually, each forward step being taken as the financial position of the company warranted and the growth of business required.

Construction of Canals

In 1912 the first work along the plans mentioned was started by enlarging and deepening the upper end of the canal. A new canal, 18 ft. deep, about 60 ft. wide and 2100 ft. long, was started parallel to the old one, leaving between the two a "core" of rock. The necessary relocations of railroads and highways were made, and the old bridges were replaced by bridges spanning the two canals. By coffer-dams at each end of the cut, the work was done in the dry and the original canal kept in operation during the construction. To drain

the cut during construction and also to serve as a permanent drain for the deeper part of the canal until such time as the "core" was removed, a tunnel was dug from the new canal under the old one to the river.

Owing to the small size of the upper canal section, smoothness of the sides and bottom was important. The specification called for the rock excavation on the bottom and finished side of the new canal to be carried at all points to the given line, but at no point more than 6 in. back of the line. While in some places this was not possible, on account of the nature of the rock, the result obtained was very good on the whole. This trimming was done with small drills and by hand after the main excavation had been done. Work was finished here in July, 1913.

Construction of Dams

An examination of the old timber-crib dam, built in 1866 and divided in the middle by an island, showed shutdown of the electric power, a small waterwheel was put in the abutment, with its gates opened from the headgate house.

The old timber-crib dam, with high and substantial flashboards erected on it, served as a coffer-dam on the upstream side of the river construction. But leakage through this old crib and the backwater from the river below required some further coffer-damming, particularly at a deep point in the river just below the sluice gates. The work on the new headgates required coffer-dams on each side—one in the river and one in the canal—as the canal was kept in operation continuously during the progress of the work.

In order to pass the water to the new sluice gates under the dam, it was necessary to remove a portion of the old timber dam and dredge out a considerable amount of filling that had been put on this upstream side. This was done by derricks on the new concrete dam, and a scow with a derrick, operating orangepeel buckets; divers were

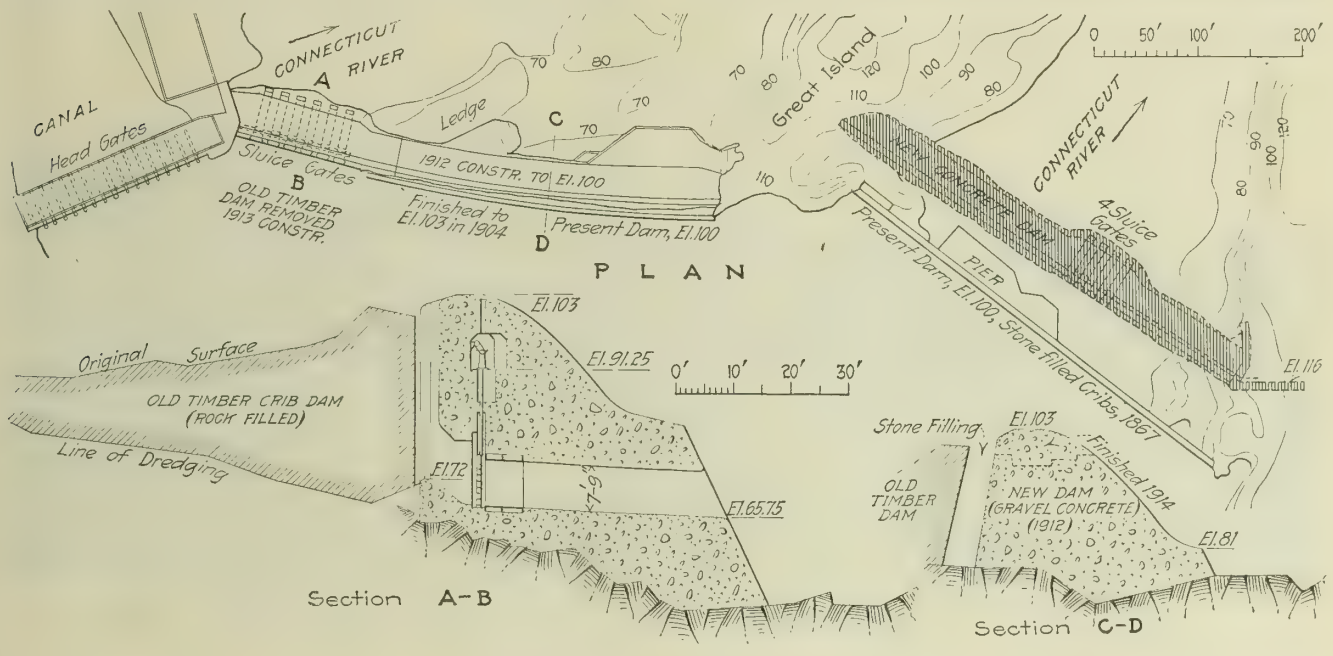


FIG. 6. PLANS AND SECTIONS OF DAMS AT TURNERS FALLS

that the Turners Falls side needed repair. It was decided to reinforce part of this by a concrete dam built just downstream from it, which could be part of the permanent structure from the island to the shore. Accordingly, in the summer of 1912, 350 ft. of concrete dam was built, the space between it and the old timber dam being filled with stone. This concrete dam was not carried up to the final height, as the rights to do this were not at that time secured. Keys were left in the top of the concrete dam, which was planked over back to the old dam.

In 1913 the remainder of the dam on the Turners Falls side of the island was built. This section, 150 ft. long, has six submerged gates 8 ft. wide by 7 ft. 9 in. high, operated from a tunnel in the dam. With this section of dam was built a new abutment on the Turners Falls side, and new canal headgates. The latter were put in at the location of the original headgates and extended from the abutment to the river end of the headgates built in 1904. They are nine in number, 8½ ft. wide by 12 ft. high, motor-operated by geared hoists inside a headgate building. To serve as a relay in case of any employed wherever necessary to chain out old logs. The upper part of the dam was loosened by small charges of dynamite.

Power-House Construction

In the spring of 1914 work was started on the extension of the canal, the construction of the new power station at Montague City, and the removal of the rock "core" in the present canal.

In the river about 20 ft. from the power house and running parallel to it, from the upstream end nearly to the downstream end, is a natural ridge of rock that is out of the water at low stages of the river. During low water in the summer of 1913, sills were pinned to this rock wall and concreted. On these sills a part of the contractor's coffer-dam of rock-filled timber cribs was placed. The space between the ridge of rock and the shore downstream from the power house was dammed with a double row of steel sheeting driven to clay beneath the level of the bottom of the tailrace.

The contract for the power-house substructure and the canal excavation immediately behind the power house was

let to Fred. T. Ley & Co., Inc., of Springfield, and work was started early last spring. This is nearly completed.

The wooden forms for the draft tubes were built complete on the bank, then sawed into four parts for handling and reassembled in place. The forms of the penstocks and scroll cases were built up in place. Concrete was mixed in two mixers, one for the 1:2:4 used in lining the waterways and one for the 1:3:5 mass concrete. The former mixture used sand and crushed trap brought in on cars and was deposited by a tower and chutes; the latter used river gravel and was dumped in through short chutes from cars on a track. The mixtures were kept separate by sheet-iron baffles, which were drawn up as the concrete was placed against them.

Forebay Work

The contracts for the canal dug in 1912 and for both sections of the dam and the headgates were let to the Bates & Rogers Construction Co., of Chicago and Spokane. This work is now entirely completed. The contract for the extension of the canal was let to Holbrook Cabot & Rollins Corporation, of New York and Boston, and work was begun early in the spring of 1914. The excavation of the canal above and below the pond is being done with steam shovels and standard-gage locomotives, with 12-yd. cars. The fine material, most of which is in the cut above the pond, is being used for the rolled embankment and the coarser material, for the unrolled portion of the embankment. The remainder of the material is dumped partly along the river bank near the power house and partly to fill some lower land outside the canal and embankments.

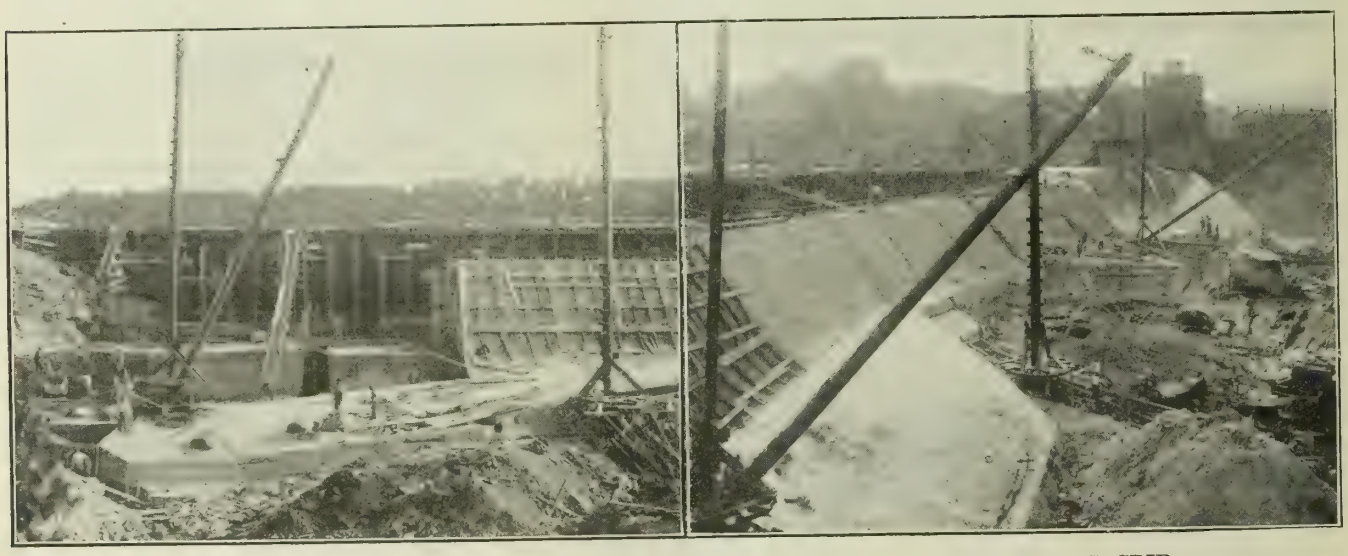
To cut off the water from the end of the present canal, a line of steel sheeting was driven to rock, extending the full width of the canal, behind which the material was excavated in the dry. The walls at this point were put in, in sheeted trenches. After these walls were complete, the main-canal excavation at this point was done, and a temporary wooden bulkhead with gates in it, to allow for filling the canal, was constructed from wall to wall; this will be left in until the canal has been tested out.

The construction of the drainage conduit, which was completed last November, enables the contractor to handle the water encountered in the cut without pumping. The original ground-water level in this cut was about 15 ft. above the grade of the bottom of the canal, but it is being lowered as the excavation progresses

The pond embankments are being constructed as follows: Two tracks are laid the length of the embankments at such a location that the material for the rolled embankment and the ordinary embankment may be separated. The trains from the steam shovel are dumped on the embankment, spread to the specified thickness by a Jordan spreader, watered with a tank car behind the spreader and rolled with a four-horse grooved roller. After the embankment is up to the level of the tracks, the latter are raised and a new layer or layers deposited, the contractor not being required to roll the embankment under the track. After the embankment is complete, the riprap is hauled out on it, dumped from the track and laid in place.

Engineers

The engineering work in connection with the detail plans and construction is being done by the Turners Falls company's engineers, with the writer as Hydraulic Engineer in charge, and H. A. Moody in charge of the power-house work. F. L. Hunt is the Chief Engineer of the system. A. T. Safford, of Lowell, is the general consulting engineer, and F. P. Stearns of Boston has been consulted in regard to embankments and cutoffs. The turbines and governors were designed and built by the I. P. Morris Co., of Philadelphia; the electrical equipment was furnished by the General Electric Co., of Schenectady.



FIGS. 7 AND 8. BUILDING CONCRETE DAM BEHIND OLD ROCK-FILLED TIMBER CRIB

A Long Fishing Pier extending from a point 1000 ft. into the ocean across the beach at Lonelyville, on Fire Island, and 500 ft. into Great South Bay is being built for the Fire Island (L. I.) Fish Co. The construction of the pier was undertaken to afford easy transportation of fish from the ocean pounds and to serve as an attraction to the many amateur fishermen who visit this vicinity from neighboring towns. At the ocean end the pier is 90 ft. wide. The land section is 14 ft. wide. It is stated that about 800 piles will be required of lengths varying from 45 to 75 ft. In the ocean portion the piles are set 10 ft. apart. In the 10-ft. intervals there will be stretched a series of nets which will lead up to a large trap at the end of the pier. The pier is of the same type as the one at Belmar, N. J. The pier on the bay side connects with a canal 1000 ft. long, which is being dug in the shallow water so as to accommodate deep-draft boats for carrying fish to the mainland. It is estimated that the project will cost between $60,000 and $75,000. It is expected to have the pier in operation by August.

New Type of Pick-Up Street Sweeper

One of the machines which attracted considerable attention at the exhibition of the street-cleaning apparatus in New York City last November (see *Engineering News,* Dec. 3, 1914) was the Merritt pick-up sweeper, shown in the accompanying illustration. This sweeper was invented by a New York City traffic policeman and was first tried in New York City in the summer of 1912. The machine was used by contract and the work paid for at the rate of 48c. per 1000 sq.yd. of street surface cleaned.

From July 25 to 31, 1912, inclusive the machine cleaned 288,914 sq.yd. of pavement, at rates ranging from 16,490 to 61,779 sq.yd. per working day. In August it cleaned 916,968 sq.yd. of pavement in 21 working days, or at an average rate of 43,600 sq.yd. per day. The amount of sweepings was 860 cans. The records show that in September 772,570 sq.yd. were cleaned in 23 working days, an average of 33,600 sq.yd. per day. The amount of sweepings, as in general throughout the record, averaged from 40 to 60 cans per day, or a can per 1000 sq.yd. In October the area cleaned was 914,617 sq.yd., or about 33,000 sq.yd. per day.

During 1913 two of these machines were used from June to November. The contract price for their work was 41c. per 1000 sq.yd. of street cleaned. The records of the two machines were much the same as that already given for the earlier machine in 1912. The best month's record was in October, 1913, when the two machines cleaned 3,109,394 sq.yd. in 31 working days, an average of 100,000 sq.yd. per day (50,000 sq.yd. to each machine). But this appears to have been a very extraordinary performance.

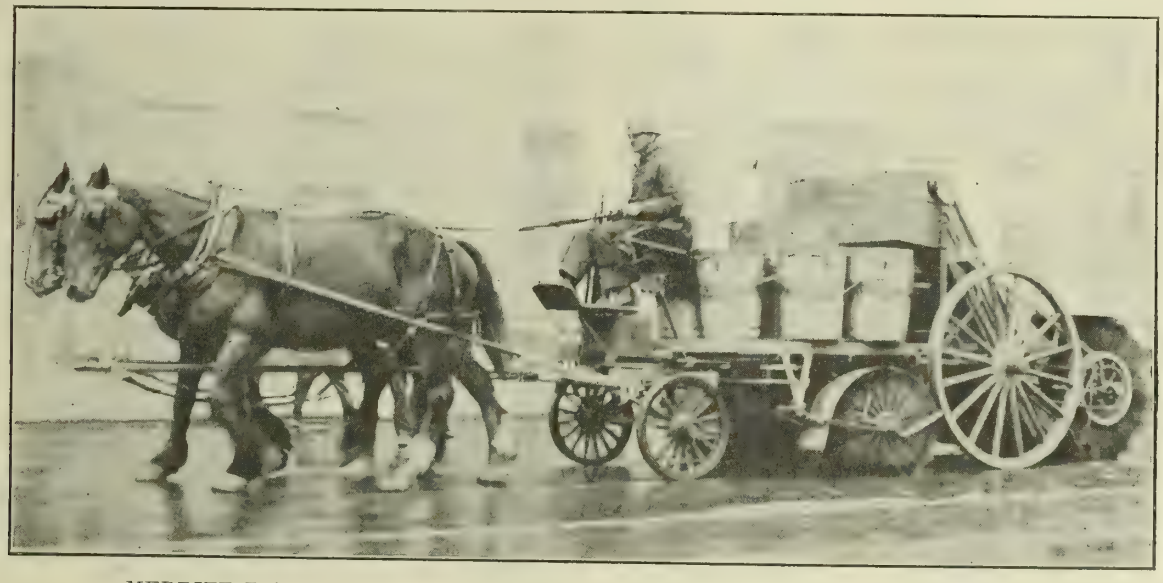
The work of both years included pavements of granite block, wood block and asphalt, but the pavements were chiefly asphalt, as nearly as can be judged by a cursory examination of the Street Cleaning Department's official records, from which all the foregoing information is taken. No contract was made for the use of these machines in 1914, although the street-cleaning officials have no fault to find with their efficiency. It was demonstrated at the exhibition of street-cleaning machinery, previously referred to, that these machines could be used very effectively to pick up refuse swept into windrows by handbroom men.

Description of Sweeping Machine

The Merritt street-sweeping machine has brooms on either side, revolving on axes at an angle to each other, and a rear broom to pick up the windrow made by the side brooms. The rear broom sweeps the material over a shoe or dustpan to a conveyor, which discharges through two chutes into cans on a revolving platform. The brooms and conveyor are driven through gears, which are in turn driven by chains from the rear wheels.

Both front and rear wheels run on roller bearings. The main frame of the wagon is of channel-bar steel and all castings are of cast steel. All the revolving parts are equipped with roller bearings. The side brooms are 28 in. in diameter and the rear broom is 38 in. A two-horse machine sweeps a 7-ft. strip and a three-horse machine a 10-ft. strip.

The shoe drags lightly on the pavement. It is made of spring steel, in flexible sections, allowing it to conform to depressions in the pavement. The conveyor is made in hinged sections of galvanized sheet-iron on sprocket chains, and is inclosed in a sheet-iron casing, which also forms the double chute for depositing the sweepings.



MERRITT PICK-UP STREET-CLEANING MACHINE ON NEW YORK CITY STREET

The can carrier is a revolving steel rack, made to hold eight cans. The rack is mounted on a specially constructed roller bearing. Two cans are filled at a time, and when filled are quickly shifted by the driver by means of a lever beside his seat and new cans spotted under the chutes. The cans are of the standard type.

The newest sweeping machine is provided with a 110-gal. galvanized-iron water tank arranged to sprinkle lightly the entire width of the sweeper. Variation in the flow is obtained by two perforated brass pipes, one giving a light flow, the other a slightly heavier flow. One or both pipes are used, according to the street.

The second machine embodying some of these improvements was built in 1912 and used on New York City streets, with the record given in this article. Since the New York City work was done the conveyor has been improved and the sprinkling device added. Two of these machines are in use in Yonkers, N. Y.

Designing a Steel Dome

By A. W. Earl and Thomas F. Chace*

Before designing the steel-frame dome of the Horticultural Palace at the Panama-Pacific International Exposition—described in *Engineering News* of Oct. 15, 1914, and July 15, 1915—a careful search was made of existing literature on framed-dome design. Discussions of the subject are conspicuous in American professional papers by their absence, and this is especially true with respect to methods of providing for wind and similar stresses produced by other than uniform vertical loads.

The size of this dome, coupled with a desire to keep the framework light and airy in conformity with the character of the building, made a careful study of the problem well worth while.

An outline diagram of the dome framing, with dimensions, is given in Fig. 1.

Available Methods of Design

There are two methods commonly employed in the design of framed domes. The first, and perhaps the most

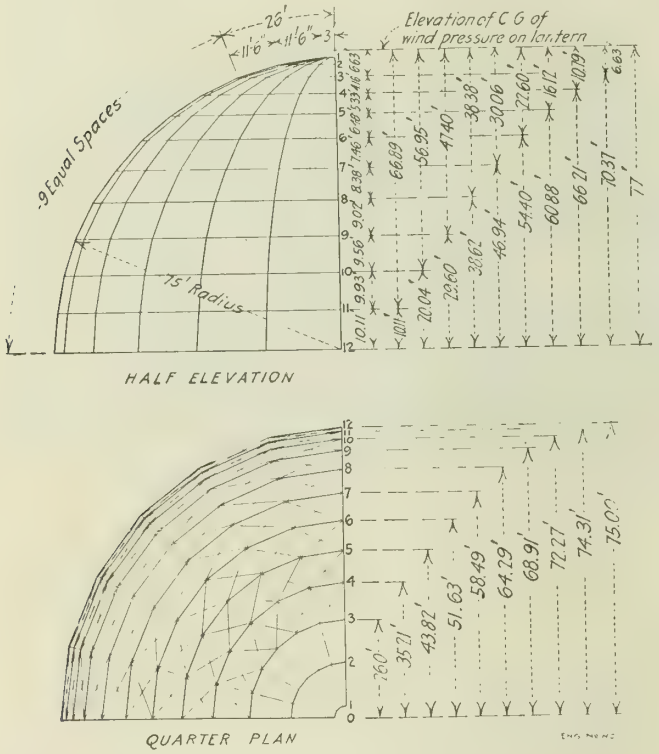


FIG. 1. DIMENSION DIAGRAM OF DOME, PALACE OF HORTICULTURE

common, consists of treating any two diametrically opposite ribs as forming a three-hinged arch, the hinges at the crown being replaced by a circular girder. In this method wind stresses are taken care of by considering the wind as a live-load on one side of the dome, applied only in the plane of the two ribs forming the arch. Diagonal rods are usually provided in the panels of alternate bays to give general stiffness to the structure.

The second method regards the ribs as members of a true dome wherein all primary stresses are resisted by compression in the ribs and compression or tension in the horizontal rings. Wind and all other than uniform vertical loads are taken care of by placing diagonals in every panel.

By applying this second method to structures of this type more material is saved than might at first be supposed. In the present instance the dome was completely designed by both methods, the second method resulting in a saving of one-third the steel called for by the first design in the portion of the structure above the plate-girder supports; that is, in the actual dome itself. An idea of the relative proportions of the respective frames may be gained from the statement that with the same number of ribs in both cases the ribs in the first design were 72 in. deep with chords of two 6x6x½-in. angles with 14x⅜-in. cover-plates, while the ribs as actually built are 36 in. deep with chords not exceeding two angles 4x4x$\frac{5}{16}$ in. with no cover-plates.

The writers lay no claims to originality in the following mathematical discussion, but rather have applied formulas and methods already developed in the design of similar structures. In the course of the discussion reference is made to books and papers on the subject by catchwords, while a complete list of the principal sources of information is given at the end of the article.

Rib and Ring Stresses

The rib and ring stresses were determined by the method outlined by E. Schmitt (Trans. Am. Soc. C. E.); no explanation is needed further than the load-and-stress summary and dead- and live-load diagrams shown in Fig. 2.

The ribs and rings of the dome of the Horticulture Building at the World's Columbian Exposition in Chicago were taken as a basis for a preliminary estimate of weight, and from this a tentative design was made. The dead-load of the roof covering was estimated by direct computation. Using the sections obtained from the stress sheet, a final estimate of weight was made, the stresses recomputed on the basis of the revised weights, and the members modified as necessary.

Diagonal Stresses

The problem presented in finding the diagonal stresses was slightly more intricate. Three methods were used, all based upon different assumptions. The first was as outlined in Hütte, the second somewhat similar to that given by Hazlehurst for stresses in a steel water tower, and the third like that used for the computation of stresses in a gas-holder guide-frame in an article in *Engineering News*.

First Method—The Hütte method is based (with a 50% correction) on simple resolution of forces at the several joints of a rib under the condition that one-half of the dome (on one side of the rib) carries full live-load, while the other half carries no live-load, which is assumed to be the worst condition of loading.

Let Q_1, Q_2, Q_3, etc., represent total dead- plus live-load per panel, beginning at the top; P_1, P_2, P_3, etc., dead-load per panel; A_1, A_2, A_3, etc., the angle between rib and horizontal plane; B_1, B_2, B_3, etc., the angle be-

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tween rib and diagonal measured in the roof plane; N_1, N_2, N_3, etc., the diagonal stress; then:

$$N_1 = \frac{Q_1 - P_1}{2 \sin A_1 \cos B_1}$$

$$N_2 = \frac{Q_1 + Q_2 - (P_1 + P_2)}{2 \sin A_2 \cos B_2}$$

$$N_3 = \frac{Q_1 + Q_2 + Q_3 - (P_1 + P_2 + P_3)}{2 \sin A_3 \cos B_3}$$

and so forth.

These formulas, with the exception of the figure 2 in the denominator, follow directly from the resolution of forces under the conditions stated. However, results obtained by Müller-Breslau and others from exact analyses gave stresses about one-half as large as those resulting from direct resolution of forces, and for this reason the 2 in the denominator is introduced.

The angles A and B are given in Fig. 3. They were used in the above formulas together with the loads noted in Fig. 2, which are the same as in Fig. 1. As there are no diagonals above ring III, Fig. 2, the diagonal between rings III and IV was called N_1, and the loads were summed down to this panel to get Q_1 and P_1.

It might be noted that the exact analysis of a dome by methods of least work, while presenting an interesting and instructive academic problem, is by far too laborious and complicated for commercial office use. On the other hand, the method above described is seen to be largely empirical; its application requires experience and judgment in the selection of live-load. In the present instance a

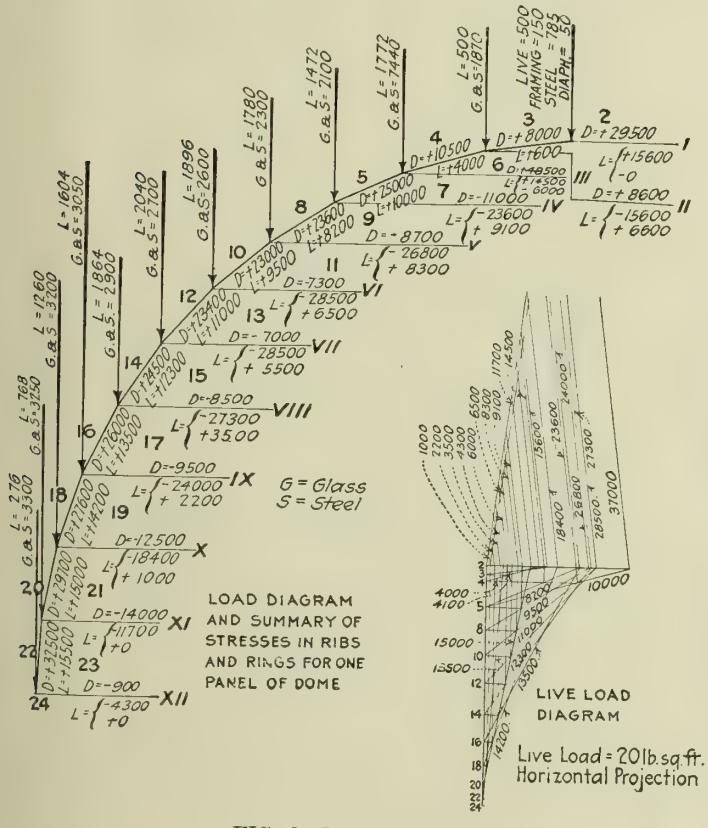


FIG. 2. LOADS AND RIB-STRESS DIAGRAMS

live-load of 20 lb. per sq.ft. of horizontal projection was taken.

Second Method—On account of the empirical nature of the Hütte formula and the fact that it has regard to unilateral loading only but not to wind, it was thought advisable to check the results by a method based on wind pressure, which would be the most likely cause of stress

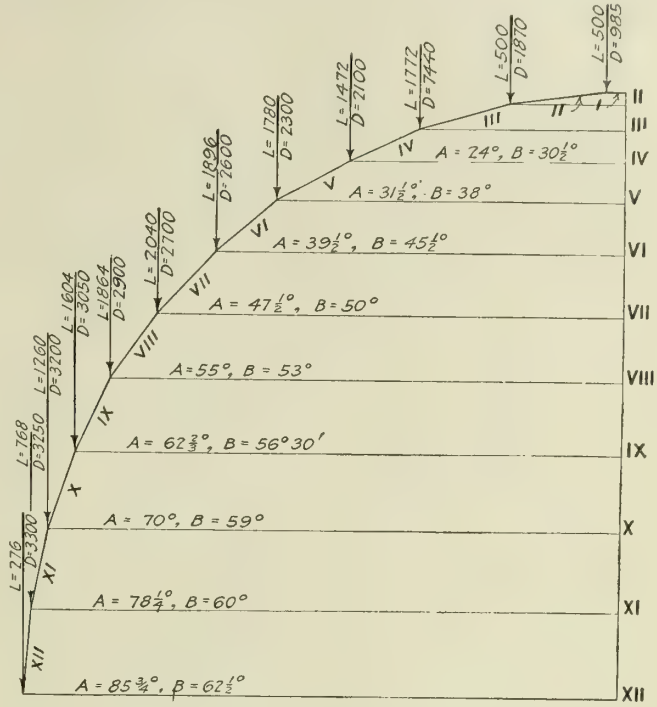


FIG. 3. ANGLES AND LOADS USED WITH HÜTTE METHOD

in the diagonals of a glass-covered dome of this character. To this end the method for the solution of the stresses in a water tower to be found in Hazlehurst's treatise on the subject was adapted to the present case.

The method may be briefly illustrated by reference to Fig. 4, which represents a trussed pyramid with inclined posts, acted upon by wind. Let P = the total wind shear from all zones above; p = the total wind shear per rib, that is, P divided by the total number of ribs, or in this case $\frac{1}{6}$ P. This means that the shear is assumed to be equally divided among the ribs. In addition to the forces p acting at each rib there will be a horizontal component of the rib stress. This component is most easily found by first computing the uplift at every point, assuming all ribs on the windward side of the neutral axis to be in tension while those on the leeward side are in compression, and further assuming that the magnitude of the tension or compression varies directly as the distance from the neutral axis. Knowing this vertical component and the angle of inclination of the ribs of the horizontal, the horizontal component of the rib stress may be computed. The resultant of the horizontal component of the rib stress and the force p at every rib is then found,

and finally this resultant is projected upon the two ring members. When this is done it will be seen that there is still an unbalanced condition at the point to which the diagonal furnishes the balancing component.

Third Method—A final method of computing the diagonal stresses was adapted from the method given in *Engineering News* for analysis of diagonal stresses in a gasholder guide frame. It may be seen from a study of the article that the bays most nearly parallel to the direction of the wind take the greatest diagonal stress, which in amount is equal to twice the average of all the bays. Thus, referring again to Fig. 4, the horizontal component of the maximum diagonal stress in any zone is

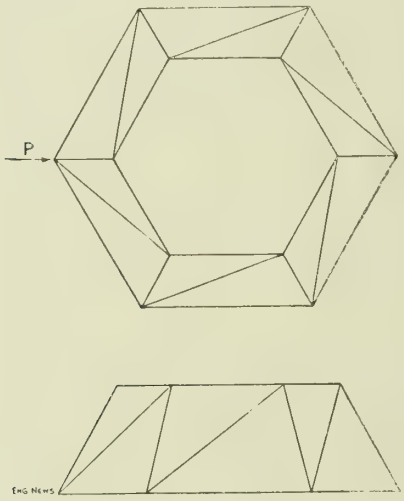


FIG. 4. DIAGRAM OF TRUSSED PYRAMID

equal to the total wind shear of all the zones above divided by one-half the number of panels. Having determined this horizontal component of the stress it is a matter of simple resolution of forces to obtain the total stress in the diagonal rod.

This method was followed in the analysis of the present dome, using graphical diagrams which are not of sufficient importance to reproduce.

Comparison of Results—The following table gives the summary of results obtained by the several methods:

Diagonal	Hütte Method	Hazlehurst Method	Eng. News Method
N_1	2,530	1,000	600
N_2	3,960	1,700	800
N_3	5,630	2,700	1,500
N_4	7,300	4,000	2,700
N_5	9,100	6,700	4,000
N_6	11,050	7,100	6,100
N_7	12,850	10,000	8,000
N_8	14,000	13,000	11,300
N_9	15,700	14,500	14,000
N_{10}*		36,000	36,000

*Diagonal in cylindrical part below spring line of dome.

Each diagonal was proportioned for the maximum of the three stresses given in this table. It will be noted that the three methods check fairly closely where the ribs of the dome approach the vertical, though they depart widely from each other where the ribs become more nearly horizontal.

It has been pointed out above that the Hütte method for finding the stresses in the diagonals is largely empirical. The same criticism may be made of the other two methods, since in each of these the assumption is made that the wind shear is distributed equally among the ribs, an assumption whose truth depends largely upon the stiffness of the horizontal rings. The close agreement shown by the preceding table may not always be realized.

It is therefore obvious that in the design of a structure of this nature a satisfactory design depends to a great extent on the judgment and experience of the designer, and while the methods here outlined are applicable to the general case of domes, no conclusion based upon this study of one dome should be applied to any other dome without careful consideration of the particular case.

Type of Rib and Ring Construction Used

After the stresses were computed careful consideration was given various types of rib and ring. The trussed type was decided upon because of its stiffness and its ability to resist secondary stresses due to bending. This latter consideration is important because the members are curved while the direct stresses between panel-points act in a straight line. The drawings of the dome given in a prior article, *Engineering News*, July 15, 1915, p. 112, show the type and makeup of sections chosen for the ribs and rings.

Where there is a heavy lantern on the dome, as in the present case, there should be a stiff ring at the top to insure a uniform distribution of this load.

Design of Supporting Tower

For the design of the dome the wind pressure was assumed at 20 lb. per sq.ft. of vertical projection, which amounts to slightly more than 30 lb. per sq.ft. on a plane normal to the wind with 40% reduction for a cylindrical surface. In designing the substructure or supporting tower, however, it was considered improbable that a wind pressure of 20 lb. would exist over the entire area of dome surface at the same instant. It was thought consistent to reduce the wind another 40%; if the first reduction took account of the circular horizontal section the sec-

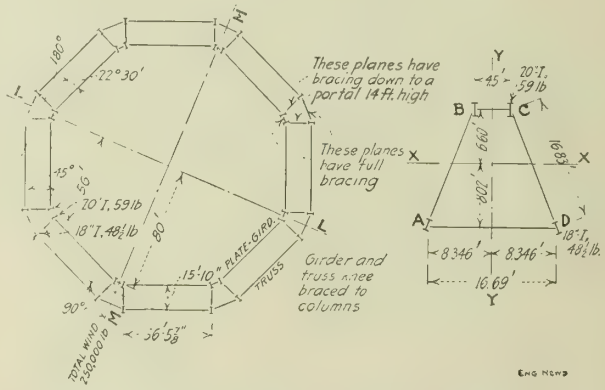


FIG. 5. PLAN DIAGRAM OF DOME-SUPPORTING TOWER AND PLAN OF ONE PIER

ond reduction takes account of the circular vertical section. The resulting pressure of 10.8 lb. per sq.ft. of projected area was used in designing the substructure. At the same time, the substructure itself and the lantern were loaded with 20 lb. per sq.ft. of projected area because the ornamentation formed pockets for the wind. The total wind load (including 120,000 lb. below the base of the dome structure) is 312,500 lb. An increase of 25% was allowed for wind stresses over those allowed for dead-load stresses, and therefore the equivalent horizontal dead-load was $312{,}500 \times 0.80 = 250{,}000$ lb. Fig. 5 is a plan diagram of the tower.

Two assumptions were made as to the distribution of the horizontal wind load among the eight piers—(1)

that the piers were loaded in proportion to their respective rigidities and (2) that they received equal loads. The most unfavorable conditions given by the two assumptions were used in the design. In calculating the stresses in the two nonparallel sides of a pier it was considered that each pier acted independently of the others, as a cantilever; but in calculating the stresses in the knee-braces of the truss and girder system and the stresses in the two parallel sides of the piers it was considered that each pier acted as part of a rigid structure with its neutral axis passing through the center of the tower.

First Assumption—The assumption that the piers take wind load in proportion to their respective rigidities may be stated as follows: The horizontal load at the top of each pier will be to the total horizontal load as the moment of inertia of each pier about an axis through its center of gravity normal to the direction of the wind is to the sum of these moments of inertia.

It was found by trial that for the outer columns 18-in. 48½-lb. I-beams would answer and for the inner columns 20-in. 59-lb. I-beams. With these sections and the geometrical shape of the pier known, the direction

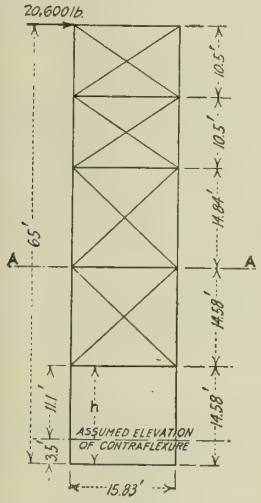


Fig. 6

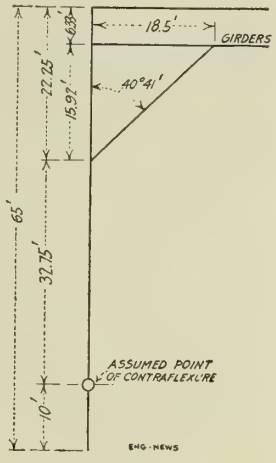


Fig. 7

of the wind was taken parallel to the long diameter of the tower octagon (this direction giving maximum stresses) and for each of the eight piers the moment of inertia about an axis at right angles to this direction of wind was computed.[1]

The wind load was distributed to the piers in accordance with the resulting values of moment of inertia. Then the wind load of each pier was resolved in the direction of the two principal axes of the pier; the pier was then to be designed to be strong enough in each of these two directions to resist the maximum wind component acting in that direction.

The maximum component in the direction of the longer axis of the pier was found at windward and leeward piers, being the full wind load coming on these piers, 38,000 lb. each. In the transverse direction (around axis *Y-Y*, pier plan in Fig. 5), the maximum component was the full wind load on the pier, 90° from this position, 24,400 lb.

Second Assumption—On the basis of equal wind loads for all the piers the force per pier was computed as 31,300 lb. equally on the pier whose long axis is in line with the wind and the pier at 90° from this point.

Combining the two assumptions, the maximum loads in the two directions of the pier are: 38,000 lb. in the direction of the long axis (from first assumption); 31,300 in the direction of the shorter axis (from second assumption).

Stresses in the Pier Columns

Portal Stresses—In the portals in the two nonparallel sides of the pier (*AB* and *CD* in Fig. 5), it was assumed that the columns would take horizontal shear in proportion to their respective rigidities. In the final design the inner columns were reinforced by 8x1-in. flange plates and the outer columns by 8x⅜-in. flange plates in the region of the upper part of the portal. Taking the respective moments of inertia of the full section of I-beam and flange plates the wind shear was divided between the two columns in the ratio of 2525 (Col. B) to 1304 (Col. A), the respective total moments of inertia about an axis normal to the slant side of the pier.

In the portal it was considered that the columns would be partially fixed at the base; the plane of contraflexure was assumed at 3.5 ft. from the bottom, which is approximately one-quarter the height of the portal (14.58 ft.) On this assumption the wind shear of 13,600 lb. on the inner column (Col. B) produces a bending moment at the top of the portal of 1,810,000 in.-lb., or a fiber stress (considering the angle between plane of portal and plane of I-beam web) of 8400 lb. per sq.in. The dead-load on one inside column amounts to 110,000 lb., or 3300 lb. per sq.in.; the compressive wind load due to overturning of the pier is 80,000 lb., reduced by the dome-rib uplift of 9300 lb., producing a net fiber-stress of 2100 lb. per sq.in. Thus the total extreme-fiber stress in the column at the top of the portal is 13,800 lb. per sq.in. Since this maximum stress occurs at the point where the column is supported laterally by the lower strut of the portal it is well inside safe limits.

For the outer column (Col. A), the wind shear of 7000 lb. produces a bending moment at the top of the portal of 930,000 in.-lb., or an extreme-fiber stress of 6700 lb. per sq.in. The dead-load of 21,500 lb. and the overturning compression of 80,000 produce unit compressions of 1060 and 3950 lb. per sq.in. respectively. Thus the total fiber stress in the outer column at the top of the portal is 11,710 lb., which, occurring at a supported point, is well on the side of safety.

Stresses in Parallel Faces of Piers—For the wind action in the inner and outer faces of the pier (*BC* and *AD*, Fig. 5), the following arbitrary assumptions were made: First, that the total load of 31,300 lb. wind shear is taken 75% by the bracing between the inside columns and 25% by the bracing between the outside columns; second, that there would be sufficient fixing effect at the base of the pier to cause contraflexure 10 ft. from the bottom of the pier when the tower is considered as a rigid whole tending to overturn about an axis through the centers of the bases of two opposite piers.

The total overturning moment on the tower was 26,525,000 ft.-lb. The vertical reactions on the piers caused by this overturning were considered as acting on the large interior columns only. Considering the reaction to vary with the distance of the column from the neutral axis of the tower, the maximum overturning load was found to be 84,000 lb. for the two columns of windward or leeward pier. However, this compression due to overturn-

[1]The moments of inertia about the two principal axes of the pier being first computed, the moments about any other axis making an angle a with one of the principal axes, say the Y-axis, was found by the formula $I = I_y \cos^2 a + I_x \sin^2 a$.

ing was not a governing stress in the design, as it was exceeded by the bending stress in the columns of the pier on the neutral axis of the tower, where the maximum wind shear occurs. On the two inner columns the shear is 75% of 31,300 lb., or 23,500 lb. Choosing for the section of the bent *BC* two 20-in. 59-lb. I-beams spaced 4½ ft. on centers, with one 16x⅜-in. plate on the outside of each web, and with point of contraflexure 10 ft. above the bottom, the maximum bending stress at the foot of the kneebrace was found to be 8300 lb. This combined with a dead-load stress of 4700 lb. per sq.in., but without compression stress from overturning of the tower (since this particular pier is at the neutral axis of the tower) gave a total extreme-fiber stress at the foot of the kneebrace of 13,000 lb. per sq.in. This is somewhat less than the stress of 13,800 lb. for extreme wind conditions in the inner columns due to portal action in the longitudinal face of the pier (that is, when the wind is at right angles to the direction just considered).

The latticing between the 20-in. I-beams was designed for a shear of 23,500 lb. below the kneebrace and (see Fig. 7) $\frac{23{,}500 \times 32.75}{15.92} = 48{,}000$ lb. above the kneebrace. Similarly, in the outer face of the pier the bracing between the 18-in. I-beam columns was designed for a shear of 25% of 31,500 lb., or 7850 lb. below the kneebrace and 16,000 lb. above the kneebrace. In both cases the kneebrace was designed for a stress whose horizontal component is the sum of the shears above and below.

Personnel and References

The plans for the dome were prepared by the Division of Works of the Exposition Company. H. D. H. Connick is Director of Works and A. H. Markwart Assistant Director of Works. The dome and substructure were designed by the writers under the immediate supervision of H. D. Dewell, Chief Structural Engineer of the Division of Works. After the design was complete, the stresses in the dome were checked by Richard G. Doerfling, Civil Engineer.

Bakewell & Brown, of San Francisco, were the architects of the building. Dyer Bros., of San Francisco, were the contractors for the fabrication and erection of the steel.

The methods discussed are outlined fully in the following original publications, which were consulted:

E. Schmitt, Dome Design. Trans. Am. Soc. C. E. Vol. 52, 1904.
Hazlehurst, Towers and Tanks for Waterworks. Wiley, 1910.
Engineering News, Design of a Gas Holder. Vol. 66, p. 644.
Engineering News, Dome of the Horticulture Building, Columbian Exposition. Vol. 27, Mar. 12, 1892.
Johnson, Bryan and Turneaure, The Theory and Practice of Modern Framed Structures, Part 1. Wiley, New Edition.
Greene, Structural Mechanics, 1897.
Eddy, Researches in Graphical Statics. Van Nostrand, 1878.
Hütte, Des Ingenieurs Taschenbuch, Abteilung II. Berlin, 1899.
Müller-Breslau, Die Neueren Methoden der Festigkeitslehre.

Discussion on Prime Movers

The general features of the San Francisco convention of the National Electric Light Association and some of the discussions have been noted in previous issues. The following paragraphs summarize the discussion on prime movers:

The report of the Committee on Prime Movers (I. E. Moultrop, Boston, chairman) took up in succession steam, water and gas power. Comment was made on widespread cracking of boiler plates in districts where carbonate of soda was found in the boiler-feed water. The water-power section consisted largely of a series of questions and answers on the advantages of open and closed hydraulic-governor systems. These showed great diversity of opinion.

The discussion of the report was voluminous. Part of it turned on the benefit of improving boiler-room practice by a greater use of measuring instruments. In discussing hydraulic power the salt-solution test for flow was the important topic. An objection was raised to the method on account of the extremely accurate analysis of the solution necessary; but it was argued in rebuttal that, without any undue refinement in the analysis, a 0.94-per cent. check had been obtained between a rectangular-weir and a salt-solution test of a discharge of 36,000 gal. per min. The costs differed very little. Another member claimed to have secured a check of 0.5 per cent. by measuring the electrical conductivity of the solution, using an instrument calibrated to read to salt concentration directly. A still more ingenious scheme consisted in sending the water through a pipe at one section of which was an electrode connected with a measuring instrument to give a continuous record.

In the paper entitled "Analysis of Waterwheel Governor Effort," by E. D. Searing, of Portland, Ore., some interesting work done by the Portland Railway, Light & Power Co. in studying the operation of governors was described. After eliminating some unsuccessful methods of attack, steam-engine indicators were connected to each end of the governor cylinder of the waterwheel unit under observation and continuous records of varying pressure from each side of the governor piston were obtained throughout cycles of operation. By an analysis of the governor effort, friction and unbalance were separated.

New Heavy Electric Railroad Opened in Michigan

A 2400-volt direct-current high-speed heavy interurban line has recently been put into operation by the Michigan Ry., connecting the cities of Grand Rapids, Kalamazoo and Battle Creek. This line was a project of the late W. A. Foote, of the Commonwealth Power, Railway & Light Co., and was made feasible by what was felt to be insufficient local railway development. A new 50-mi. single-track line has just been completed from Kalamazoo to Grand Rapids. A line from Allegan to Battle Creek, crossing the other at Monteith Junction, was purchased some time ago from the Michigan Central R.R.

Interurban Service

Three types of service are being given—local, express and "flyer." Local trains make the Kalamazoo-Grand Rapids run in 1 hr. 45 min., and the Grand Rapids-Battle Creek run in 2 hr. 25 min. Single cars from Kalamazoo and Battle Creek join at Monteith Junction and run as a train to Grand Rapids.

The express run from Grand Rapids to Kalamazoo requires 1 hr. 25 min., and that to Battle Creek 2 hr. 10 min. "Flyers" run only between Grand Rapids and Kalamazoo and take 1 hr. 10 min. The company previously had an electric line between Kalamazoo and Battle Creek and local systems in the terminal cities. All the cars in the new service are of steel and the "flyers"

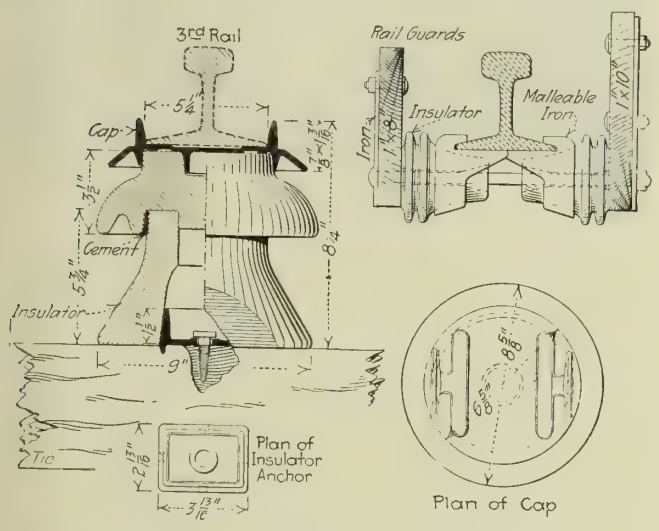
have special luxurious equipment. Bulk freight, package-freight, and express service are maintained, steel motor and trailer cars being used for the last two classes.

At Grand Rapids and Kalamazoo property was acquired for passenger and freight station and yard tracks. At the larger towns along the new road brick and concrete stations were put up; at the smaller places neat wooden buildings were erected, and for the important cross-road stops wooden shelters with concrete platforms.

Roadbed and Track

The new line (single track) was built through rolling country and required a few fairly heavy cuts (up to 85,000 cu.yd.) and fills (up to 60,000 cu.yd.). Except for the Kalamazoo city-street tracks and on the Grand Rapids private right-of-way, the maximum curvature is 3 deg. and the maximum grade 1 per cent. In cuts the roadbed is 24 ft. wide; on fills it is 18 ft. The right-of-way is generally 100 ft. wide and is fenced and equipped with cattle guards. All bridges are of concrete or steel.

The tracks are of 80-lb. rail laid on 6x8-in. by 8-ft. cedar ties, 20 to a 33-ft. rail; each sixth tie is extended



THIRD-RAIL CONSTRUCTION, MICHIGAN RY.

4 ft. to carry the third-rail supports where that equipment is used. Passing sidings are about 1000 ft. long and of main-line construction. Grade crossings over other railways have interlocked home and distant signals on both roads. Telephone jack boxes are installed at passing tracks and a telephone dispatching line is provided into which a conductor may connect.

Electric System

This road has the first 2400-volt over-running third-rail line in this country. Catenary overhead construction is resorted to where the road leaves its fenced-in right-of-way for open stretches in populated districts.

The third rail is a standard 80-lb. A. S. C. E. section rolled of special low-carbon steel (limit of carbon, 0.14; of manganese, 0.40; of sulphur, 0.08, and of phosphorous, 0.11). Slotted malleable-iron fish plates are used, allowing expansion, the joints being 1½ to 2 times as wide open as in the running rails. Copper ribbon bonds bridge the joints. The rail is carried by a malleable-casting cap sitting on a two-section 5000-volt porcelain insulator as shown. The insulator fits over a square malleable anchor held down to the tie by a lag screw. On sidings a 52-lb. rail is used, but the clearances are maintained by special insulator caps. The rail is guarded by two wood side boards supported from the rail by bolts, malleable castings and porcelain bushings. The inner board is made as high as possible without interfering with the collector shoes. The outer board is high enough so that any straight tools dropped fall across the boards and fail to touch the rail. At the highway crossings and in changing from third rail to catenary line, the break in running conductor is bridged by jumper cables.

On account of the self-induction in the steel third rails, lightning-arrester aluminum cells are connected from the line to the ground. The voltage rises on the rail as current is broken, and when it reaches a definite undesirable limit the cells pass current and relieve the stress. When the surge voltage drops, the electrolytic film in the arrester prevents further flow.

Overhead Lines

Where the catenary is used over single-track stretches, a single hard-drawn copper cable (500,000 circ.mil.) is strung with 4-ft. sags between arms on latticed steel poles 165 ft. apart. The poles will carry 1600 lb. vertical load 10 ft. out from the pole and 2000 lb. top pull at right angles to the line. Rigid hangers spaced 15 ft. apart along the messenger support a No. 0000 trolley wire parallel to the track.

On parallel sidings wooden poles are erected and cross-catenaries run to the steel poles and support the minor lines. On the few two-track lengths light steel anchor bridges, designed for a 1200-lb. vertical load, a 12,000-lb. longtitudinal four-point pull, and a 4000-lb. transverse pull, are put 300 ft. apart to carry the messenger cables. On curves the hangers are allowed to take inclined positions, much as in the New Haven type of construction. On sharp curves pulloffs are also used.

A 500,000-circ.mil. copper feeder is carried along with the overhead lines to give the same capacity as the third-rail line. On the sections over single track the feeder is carried by a short arm inside the poles; on double-track sections it is suspended alongside the messenger cable with the same sag.

The right-of-way and highway crossings are posted, to warn trespassers of the danger of high voltage, with blue-and-white enameled signs. The usual engineman's warning signs are also of enameled metal, and on galvanized angle posts for the most part. Special large illuminated signs mark the changes from third rail to overhead, or vice versa.

At present current is fed to the railway line at Grand Rapids and Kalamazoo. A transmission line is being constructed which will allow feeding at Battle Creek. At the present substations the 2400-volt direct current is secured from two rotary converters in series. At Battle Creek a motor-generator set will be used.

The construction of the Grand Rapids-Kalamazoo line and the electrification of the Allegan-Battle Creek line was in the hands of the Michigan Engineering Co. (a concern affiliated with the Michigan Ry.), under the direction of G. L. Erwin, president, and G. A. Wagner, superintendent. The late W. A. Foote had an active part in the design, up to his death a few months ago.

The important electrical equipment was furnished by the General Electric Co. and the third-rail supports by the Ohio Brass Co.

Brooklyn Sewage-Aeration and Activated-Sludge Experiments

By E. J. Fort*

SYNOPSIS—Since the Brooklyn Sewage-Experiment Station was put in operation on Jan. 1, 1914, careful studies have been made of sewage aëration by (1) compressed air passed upward from a pipe grid and shallow gravel bed through sewage passing downward in a deep tank containing nine horizontal disk deflectors; (2) an aërated contact bed or tank; (3) the activated-sludge process, carried on in the same tank as (1), after slight changes in piping. The experiments are described and the results summarized.

The Brooklyn Sewage-Experiment Station had as one of the principal objects of its design a series of experiments on the treatment of sewage and sludge by forced aëration with compressed air. Black and Phelps, experimenting with the sewage at the same location in 1910-11, had found it possible to reduce the oxygen demand of the sewage one-half or two-thirds under various conditions, by

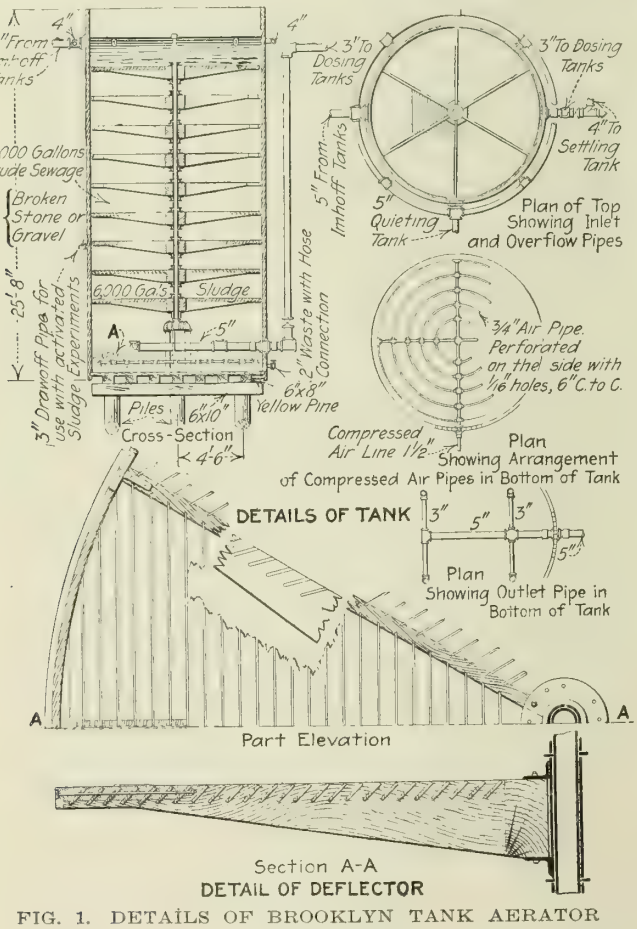


FIG. 1. DETAILS OF BROOKLYN TANK AERATOR

Used first for plain sewage aëration and then for aëration with activated sludge

applying about two volumes of air per volume of sewage in a retention period of three hours; although the apparatus used was crude and the conditions rather unfavorable for producing the best results. The appropriation to meet the expense of the experiment was very small. While highly gratifying, the results observed were considered by these investigators as demanding a more complete experimental study, which they strongly recommended; and the design and installation of the experimental plant in 1913 gave the opportunity for providing for this purpose equipment and apparatus of special design, with units on a working scale.

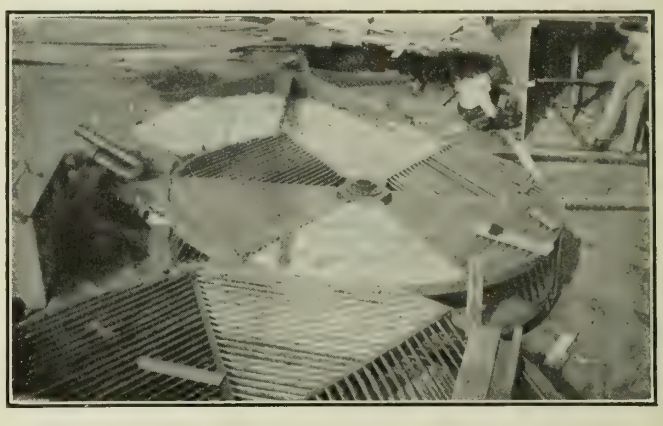


FIG. 2. DEFLECTOR DISKS OF BROOKLYN TANK AERATOR

The plant was completed and put in service Jan. 1, 1914, since which time sewage-aëration experiments have been carried on continuously, except in extremely cold weather. During the experiments, until the beginning of the present year, the principle of activated sludge was not appreciated, although the phenomena were at times noted. Indeed, it is not improbable that the results observed by Black and Phelps were due in some measure to the presence of activated sludge on the grids and deflectors and in the tanks used in their experiments.

The Brooklyn Tank Aerator

The apparatus used in conducting activated-sludge experiments consists of a tank provided for sewage-aëration experiments and listed in the station equipment as the "tank aërator." Fig. 1 shows its size and design. It has an effective capacity of 16,000 gal., sewage being introduced at the top and withdrawn from the bottom; although by a slight change in piping this method of operation can be reversed. The sewage is supplied by gravity from the crude-sewage supply or quieting tank that serves the entire experimental work of the station.[1] It is pumped from the sewer by a reciprocating pump and in passing is retained less than five minutes in the supply tank. Compressed air is furnished by a duplex air compressor of ample size, installed as part of the experimental plant.

The tank aërator had been in continuous use during 1914, except in extremely cold weather, on sewage-aëration experiments, giving some very interesting results, but

*Chief Engineer, Bureau of Sewers, Borough of Brooklyn, New York City. In the preparation of this paper the author wishes to acknowledge the collaboration of George T. Hammond, Engineer of Design, and William T. Carpenter, Chemist of the Sewage-Experiment Station.

[1]The Brooklyn Sewage-Experiment Station was described at length in "Engineering News" of Oct. 22, 1914.

using much more air for the work performed than would be economical in competition with the sprinkling filter for the same degree of purification. In order to adapt it to the purpose of conducting activated-sludge experiments it was only necessary to provide an additional outlet pipe about one-third of the distance up from the bottom of the tank.

The tank is 12 ft. in diameter and 25 ft. 8 in. in height. A grid for supplying compressed air is placed on the bottom of the tank, and 7½ in. of broken stone which passes a 2-in. ring and is retained by a 1-in. ring is provided to support it. The same depth of the same broken stone is placed over it, so that the air supplied to the contents of the tank passes upward at first through the voids in the broken stone. The outlet of the tank, as originally installed for sewage-aëration experiments, is about 1 ft. above the surface of the broken stone, so that in all such experiments about one-twentieth to one-twelfth of the contents of the tank was retained at each emptying. A still lower outlet is provided for draining the lowest level of the tank. The new outlet for the activated-sludge experiments is so placed that 6000 gal. is retained in the tank at each drawing.

The compressed-air supply grid consists of two 1½-in. pipes placed at right angles, forming a cross connected in the center. The arms of the cross are connected with quarter-circles of ¾-in. pipe forming concentric rings, of which there are five. Each ring is perforated at 6-in. intervals with $\frac{1}{16}$-in. holes. The air enters through the 1½-in. pipes and is distributed thereby to the rings and is discharged into the broken stone surrounding the grid. This is intended to prevent any upward streaming effect.

The deflector disk (Figs. 1 and 2) form one of the features of this tank. These disks are nine in number and

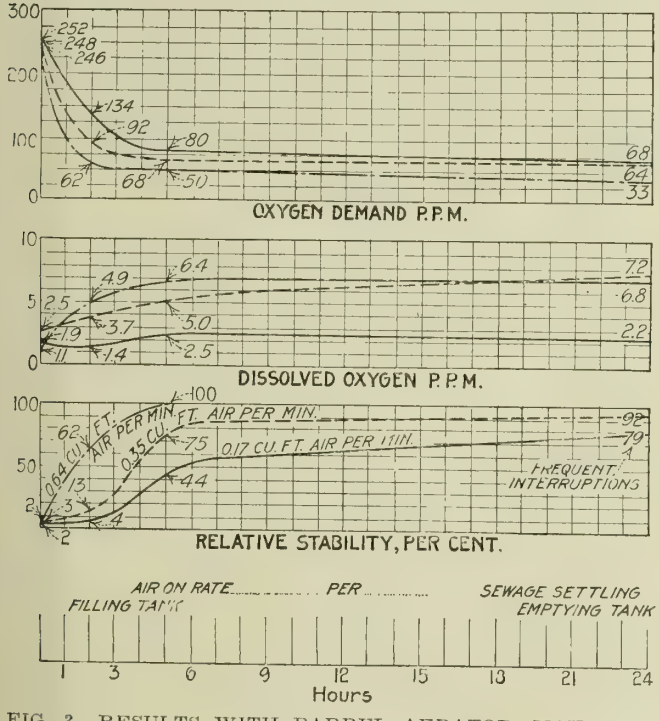


FIG. 3. RESULTS WITH BARREL AERATOR, MAY 6 TO JULY 6, 1915

divide the tank into a number of story-like compartments. They are designed to deflect the downward flow of sewage, so as to prevent streaming downward, and to equalize and give a sinuous motion to the upward flow of air, thus securing a more even distribution of each. The slats are set in grooves in the arms at an angle of 45° with th horizontal. The slats in each alternate disk are set alternately sloping away from and toward the center.

The first experiments with plain aëration of sewage in the aërating tank were not very encouraging, an air supply



FIG. 4. PROGRESSIVE SEWAGE CLARIFICATION, BROOKLYN BARREL AERATOR

After 0, 2, 5, and 22 hr. aëration. The black band was at the rear of the bottles

of 0.75 volume per volume of sewage with 2 hr. retention being insufficient to produce any marked improvement on crude sewage.

Barrel Aërator or Aërated Contact Bed

A visit to the Lawrence Experiment Station in April, 1914, led to the construction of a small unit consisting of an oil barrel filled with stone, with means of introducing air at the bottom, on the theory that the more area available for bacterial residence the better would be the results accomplished. The effective capacity of the barrel was 20 gal. Experiments with this small unit extending from May 6 to July 6, 1914, are summarized in Table 1 and are shown graphically in Fig. 3.

TABLE 1. RESULTS WITH SMALL AERATED CONTACT BED OR BARREL AERATOR

	Hours Aeration			
	0	2	5	24
Air at 0.17 cu.ft. per min:				
Dissolved oxygen	1.9	1.4	2.5	2.2
Relative stability[1]	2	4	44	79
Dissolved oxygen demand	252	134	80	68
Air at 0.35 cu.ft. per min.:				
Dissolved oxygen	2.5	3.7	5.0	7.2
Relative stability	3	13	75	92
Dissolved oxygen demand	248	92	68	64
Air at 0.64 cu.ft. per min.:				
Dissolved oxygen	1.1	4.9	6.4	6.8
Relative stability	2	62	100	100
Dissolved oxygen demand	246	62	50	33

[1] Interruptions in application of air.

The improvement in the character of the sewage with this treatment is extremely marked (Fig. 3), the 24-hr. samples being almost of drinking-water clarity.

Results with Plain Tank Aërator

Operation of the larger aërator tank was continued while this experiment was in progress, at first on the continuous-flow plan with a largely increased period of retention and a greater volume of air, without effecting any marked improvement in the result obtained. The continuous-flow plan was then suspended for a time, and on May 19, 1914, the tank was filled and air was passed through it for long periods, some of the phenomena observed being those of activated sludge, though the desirability of saving the latter was not recognized. This condition having been established in the tank on June 14, 1914, the continuous-flow plan of operation was again employed with more promising results. It is worthy

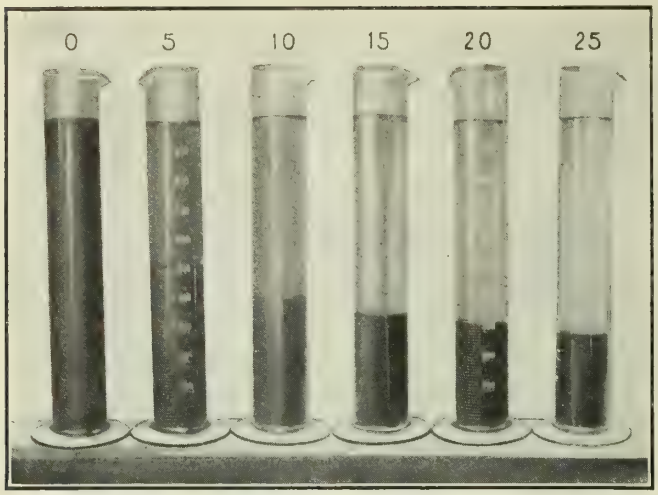


FIG. 5. RAPID SETTLING OF THE EFFLUENT FROM ACTIVATED-SLUDGE TANKS
After 0, 5, 10, 15, 20 and 25 min. settlement in beakers.

of remark, as already mentioned, that about one-twentieth of the contents of the tank, if filled to the water line, is below the discharge orifice; thus at least this proportion of the contents is retained at each drawing. This retained portion would no doubt consist to some extent of activated sludge even when operating on the continuous-flow plan; possibly some of the improvement was due to this fact. The tank was operated with 3.25 volumes of air per volume of sewage with 5 hr. of retention. The quality of the effluent was, however, not satisfactory.

The retention period was increased July 10, 1914, to 24 hr., with the same air flow per minute, bringing up the air to 18 volumes per volume of sewage, with marked effect; the effluent after passing a settling tank with about three hours retention showed a quality comparable with sprinkling-filter effluent. This experiment was carried on until Oct. 1, 1914. In September the effluent was 84% stable. On Oct. 1, 1914, the amount of air was reduced one-half, or to nine volumes per volume of sewage treated, the continuous-flow plan being continued and the retention period maintained at 24 hr. Under these conditions the relative stability of the settled effluent fell to 59 per cent.

Table 2 shows the average of the results of operating the tank aërator from July 10 to Oct. 1, 1914, on the continuous-flow plan.

Until the beginning of 1915 the principle of activated sludge was not appreciated, though, as mentioned in the



FIG. 6. TOP OF BROOKLYN TANK AERATOR DURING ACTIVATED-SLUDGE EXPERIMENTS
Air is escaping from surface with even distribution and lack of evident boiling

TABLE 2. TANK AERATOR RESULTS, JULY 10 TO OCT. 1, 1914

	Crude Sewage	Tank Aerator	Settling Tank No. 1
Settling matter, c.c. per liter	2.3	5.4	0.2
Suspended solids, p.p.m.:			
Total	164	103	40
Volatile	130	79	30
Oxygen Consumed			
Total	58	39	26
Dissolved	37	27	22
Dissolved oxygen	1.4	3.1	1.1
Dissolved-oxygen demand	191	55	31
Relative stability, per cent.:			
Undiluted	2	43	84
Diluted 1-10 with distilled water	35	94	100

Period of retention in tank aerator, 24 hr.
Amount of crude sewage treated in 24 hr., 16,000 gal.
Air applied, 2.3 cu.ft. per gal.
Settlement period of effluent in settling tank No. 1, 3 hr. 12 min.

foregoing, the phenomena were at times observed. In the spring of the present year, however, with the publication of results in which the retention of the aërated sludge played an important rôle, the aërating tank was remodeled by introducing a draw-off pipe in the side of the tank, as previously mentioned, so that after allowing the sludge to settle the supernatant liquor could be drawn off,

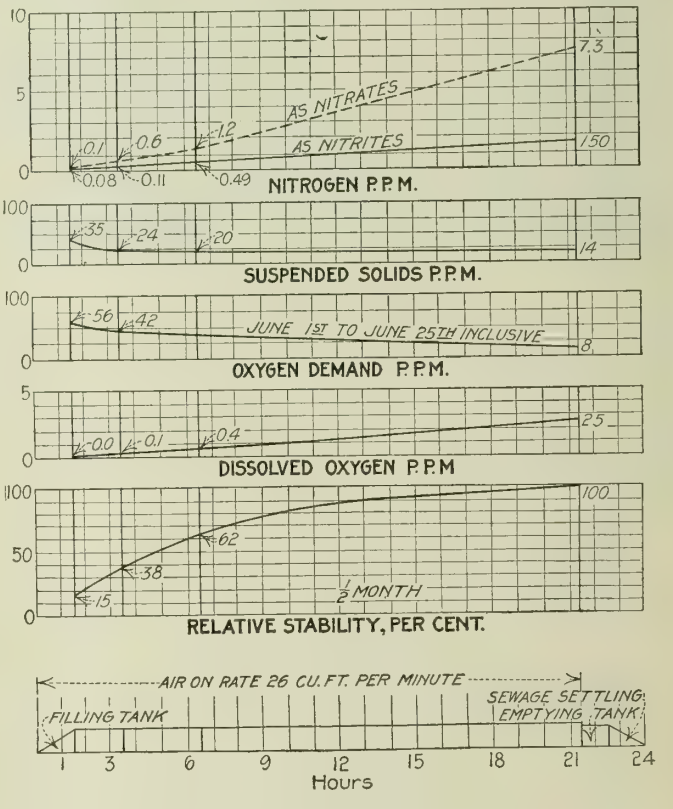


FIG. 7. BROOKLYN ACTIVATED-SLUDGE RESULTS FOR JUNE, 1915

Volume of air per volume of crude sewage, 117, with tank filled; or 26 cu.ft. of air per min. for 10,000 gal. of sewage treated and 6000 gal. of sludge left in tank.

leaving the sludge up to 6000 gal. in the bottom. The amount of sewage treated per charge was thus 10,000 gal. Bottle experiments were also tried which confirmed the experiments of other investigators.

Operations on the large tank were begun in the middle of March, 1915, but the slow process of accumulating sludge and bringing the liquid to stability took practically until June 1. By May the results with 24-hr. aëration showed up excellently.

On June 1 operation was commenced on the following schedule: At 8 a.m. air was shut off and sewage was allowed to settle for one hour. At 9 a.m. drawing off of supernatant was commenced, discharging 10,000 gal. At 10:30 a.m. drawing completed, and air again turned

on. The tank was then refilled with crude sewage. At 12 noon refilling was completed. The sampling was done as follows:

When the tank was filled, a sample of liquid and sludge was collected in an Imhoff cone and the sludge allowed to settle, the dissolved oxygen being determined in the supernatant liquor. Another sample, taken at the same time, was filtered through paper for use in determining relative stability and oxygen demand. A portion of the supernatant was preserved with chloroform for determination of suspended solids, nitrites and nitrates in a weekly composite. Sampling was repeated after 2, 5 and 20 hr., the latter just before emptying the tank.

Fig. 5 illustrates how rapidly the suspended matter goes down when sewage aërated with activated sludge is allowed to settle. Fig. 6 shows the surface of the Brooklyn aërator tank when operated on the activated-sludge plan.

The experiments up to June 1, 1915, confirmed the results of other investigators, with the exception that nitrification appeared not to have proceeded as far as reported previously.

The results for the month of June, 1915, are shown by the diagram in Fig. 7, and by Table 3.

TABLE 3. RESULTS WITH ACTIVATED SLUDGE, JUNE, 1915

	—Hours Aeration After Refilling Tank—			
	0	2	5	20
Dissolved oxygen, p.p.m.	0	0.1	0.4	2.5
Relative stability,* per cent	15	38	62	100
Oxygen demand (biologic) † p.p.m.	56	42		8
Suspended solids, p.p.m.	35	24	20	14
Nitrogen as nitrites, p.p.m.	0.08	0.11	0.49	1.5
Nitrogen as nitrates, p.p.m.	0.1	0.6	1.2	7.3

* June 1 to 15, inclusive. † June 1 to 25, inclusive.

The sewage used to fill the tank had the following average composition: Dissolved oxygen (p.p.m.), 1.0; relative stability, 3%; oxygen demand (biologic), p.p.m., 200; nitrogen as nitrites and nitrates, trace.

Commission Revises Water Rates in Leavenworth

An apparently anomalous situation was recently created in Leavenworth, Kan., when the Public Utilities Commission raised the rates for much of the service of the Leavenworth City & Fort Leavenworth Water Co. in response to a complaint of the city that the "rates charged a majority of the inhabitants of the city, and individuals residing outside, are excessive, oppressive, unreasonable and greatly in excess of the fair and reasonable value of the service rendered."

Old Service and Rates

The anomaly disappears when it is understood that the company supplied large quantities of water (1,627,000 gal. per day) to the Federal military reservation, penitentiary and soldiers' home at from 6 to 10c. per 1000 gal., whereas only 20 to 25 per cent. of the city population was served with about 1,450,000 gal. per day (not including some 2,050,000 gal. of free water for schools, public buildings, parks, flush tanks, gutter washing, etc.) at rates of from 50c. to 20c. per 1000 gal.

There was also an apparently haphazard flat-rate schedule covering some forty manufacturing and domestic items. The customers whose supply was metered were required, prior to this proceeding, to purchase a high-priced meter ($15, $17.50 and $21 for 5/8-in. size) on which the company realized from $5 to $7 profit.

Investigation showed that the water furnished the Federal government had to be pumped twice and was specially filtered. Removal of 97% of the bacteria and a minimum count of 100 per c.c. were guaranteed. An investment of $16,250 had been made to carry government sewage below the water-works intake.

The total pumpage was shown to be 1,875,000,000 gal. in 1913, of which 40 per cent. was alleged to be free water furnished to the city.

The total operating expenses and interest was $92,720, making the cost of water sold over 8c. per 1000 gal. About $50,000 more revenue was claimed necessary to put the property on a paying basis; this would make the cost over 12c. per 1000 gal.

Physical and Intangible Values

The present physical value was placed at $497,108, as determined by the Commission's engineer, T. J. Strickler. The company's engineers, Burns & McDonnell, of Kansas City, appraised the property at $834,374. For "going value" $37,283 (7½ per cent.) was allowed, making the rate-basis value $534,391. In making this last allowance the Commission raises this interesting query:

> Here we have a water plant in operation for nearly a third of a century, enjoying a monopoly in its territory, unburdened with the expenses incident to ordinary competition, serving now only one-fifth to one-fourth of the water users of the city of Leavenworth, with prices to domestic consumers, at all times, so high as to be almost prohibitive, and with an average net profit of only slightly over $3000 per year upon a claimed valuation of over $800,000, or an ascertained valuation of about half a million. What, in such a case, should be added to the ascertained present physical value for intangible or going value?

The Commission answers its own query by reviewing the practice of other bodies and concludes that in this case it should be the cost of building up the business where patrons cannot obtain service elsewhere and where they have been willing to lay private lines along the streets.

Rate of Return

A reasonable return was found to be 6 per cent. It is remarked that if the water business of the city had been properly developed, a higher rate might have been allowed, and that if the Commission's orders are carried out in good faith the business will still develop and automatically increase the return.

The new domestic rates start with a minimum charge of 50c. per month and run approximately straight from 28c. per 1000 gal. for the first 10,000 gal. to 6c. for all in excess of 20,480,000 gal.

The flat rates were unchanged on account of the possible hardship which might come to the smallest customers. The city's free services were ordered metered and charged at regular rates—except for water from hydrants used in flushing gutters, which was held covered by hydrant rental. The latter figure ($40 per hydrant per year) was left untouched with the note that if the 150 additional hydrants that were needed were installed, then this rate on 300 would prove compensatory.

The old requirement of guaranteed income of $25 per block as a pre-requisite for an extension of mains was changed to 10% of the cost of the extension (besides hydrant rental). The idea of a guaranteed return on a proportion of plant and other investments was rejected.

It was held reasonable that the customers should purchase their meters from the company, provided there was "proper regard for the patron's interests."

Field and Office

Model Record of Distribution of Construction Plant

It is important for contractors doing work at numerous and widely scattered points, and having a large amount of equipment distributed at these points, that they should have some system of keeping track of the location and movements of such equipment. A comprehensive and picturesque system which has been adopted by the Great Lakes Dredge & Dock Co., of Chicago, consists of the use of models placed in glass-covered display cases and arranged to show the character, location and condition of the equipment. This is operated in conjunction with the plant inventory, which takes care of everything, from small tools to large pieces of equipment. The system originated with William A. Lydon, president of the company, and *Engineering News* is indebted to the company for the information.

In the main office at Chicago there are four mahogany display cases, 7x4 ft., placed on tables and covered with ¼-in. plate-glass tops, which are made in sections to allow for ready removal. One of the cases is shown in Fig. 1. The inside of the case is painted black, and the bottom is divided into sections by ½-in. strips of white cardboard. Each section represents one port or harbor, as shown, and its size depends on the amount of equipment at that port and the corresponding number of models required to be placed in the section. The system is for movable plant only and does not cover such stationary units as machine shops, concrete-pile plants, coal docks, quarries, etc., the location of which is permanent.

The models are grouped upon sheets of cardboard of three colors: Those placed on a white card indicate plant that is working; those on a green card indicate plant that is idle, and those on a salmon card indicate plant under repair. On the green and salmon cards are placed small stands or easels, each bearing a card lettered "Idle" or "Equipment undergoing repair." Each piece of equipment under repair has an "A.F.E." card—that is, showing "authority for expenditure."

A red card, or "danger signal," about 3x3 in., is used to represent "Work awarded but not yet started." As soon as work is started the red card is replaced by a white card. Each particular contract in each port is represented by a 2x3-in. white card, placed on an easel and bearing the contract number and a typewritten description of the work. A typical example of one section of a case, showing the record of one port, is given in Fig. 2.

The models are of wood (mostly cherry) on a scale of 20 ft. to the inch. Those representing steel equipment are painted gray, while those representing wood are of natural color, varnished. Each model shows the main characteristics of the machine it represents. Thus the drill boat under "Boston," in Fig. 1, is varnished and has the drill frames painted gray, indicating that it is a timber hull with five steel drill frames. Models of dipper dredges have a projecting boom (appropriately colored), as shown under "Milwaukee," while those of hydraulic dredges (see "Albany," in Fig. 1) have a cutter frame and A-frame. The models of pile-drivers show at a glance whether they are of the floating or land type, etc. The two pedestals in the center line of the case are simply supports for the glass tops.

On each model information is given as to the name or number, capacity and condition of the machine represented. Thus, a dipper dredge will show the size of clay and rock dippers, the maximum dredging depth and the condition. Dump scows are divided into the proper number of pockets or hoppers, and show the cubic capacity, number or name of scow, and its condition.

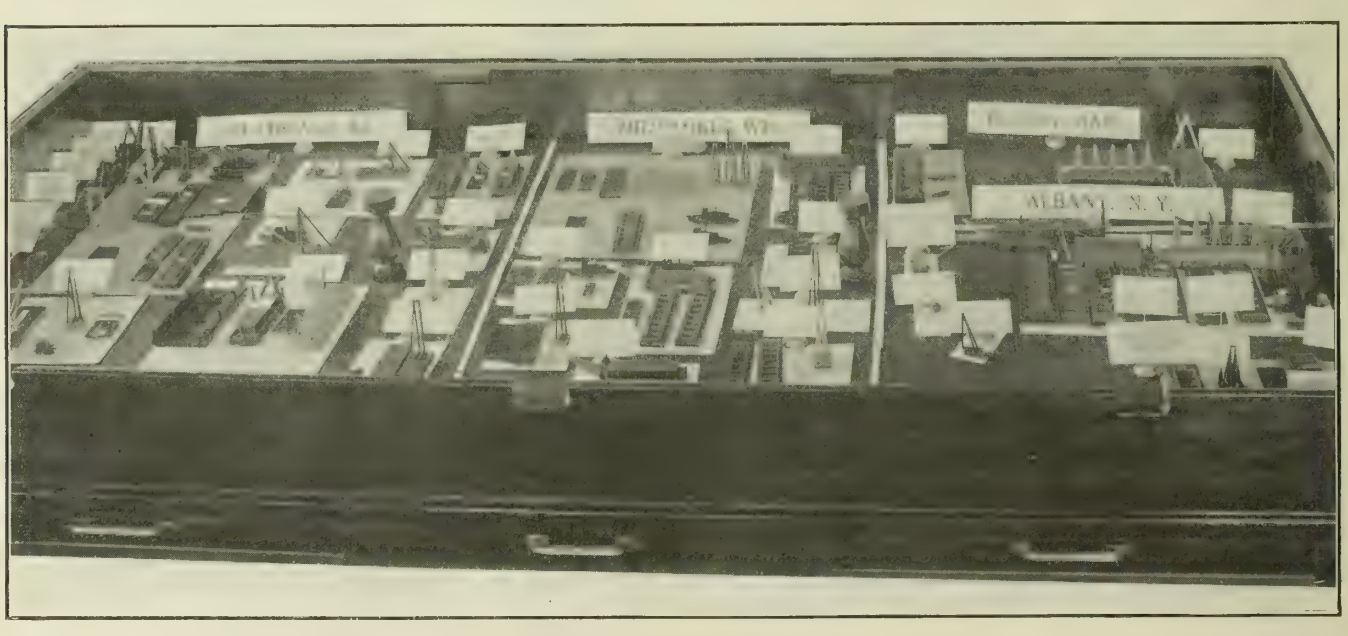


FIG. 1. CASE OF MODELS FOR RECORD OF CONSTRUCTION PLANT; GREAT LAKES DREDGE & DOCK CO., CHICAGO

The ports and harbors represented in this model system include a large number of those on the Great Lakes, the Atlantic Coast and the Hudson River. The models represent about 600 pieces of movable plant. The cases are "posted up" every morning by inventory clerks, the models being shifted according to the daily reports of various local superintendents.

Each of the company's ten branch offices in other cities has a similar system, consisting of one case containing models of the plant in that particular district. The models are shifted in accordance with the previously mentioned scheme. Removal of the plant or equipment from one division to another—that is, transfer of supervision of work from one branch office to another—is taken care of by shipping the model of the particular piece or pieces from one office to the other, so that at all times each branch office has a model of each piece of the plant or equipment at work in its district or under its supervision. The general scheme of subdividing under jobs, equipment idle, under repair, etc., is carried out as outlined in the foregoing for the main office at Chicago.

A specially interesting feature of this model scheme is its use in figuring equipment for prospective work. The models being scaled 20 ft. to 1 in., plans are made to the same scale, and plant or equipment is placed on this chart or map so as to indicate proper clearance in channels, bridge draws, etc. Also, dredging units can be built up of models for any proposed job, using the requisite number and capacities of scows to suit local conditions, depth of water, length of tow, etc. This scheme has worked out to great advantage and visualizes the proposed work to the outside men or superintendents better than drawings or written information could possibly do.

That there is an educational side to the system is illustrated by the rapid manner in which it enables new employees, such as superintendents, engineers and others, to become familiar with the equipment and with the situation on the different contracts. A view of the character and number of the different pieces of plant and of the available equipment is obtained by glancing over the layout of the models and creates more of an impression on the mind than any written description. Further, it gives to stockholders and prospective customers an excellent idea of the extensive amount of equipment and the wide extent of the company's field of operations.

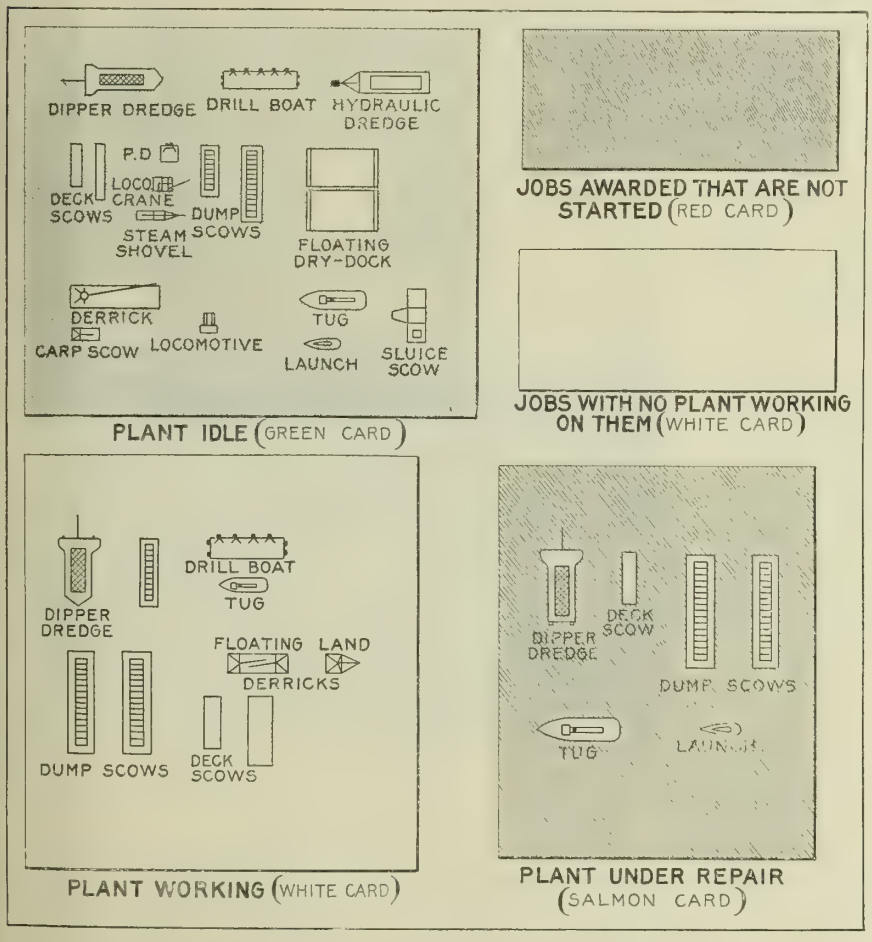


FIG. 2. TYPICAL PLAN OF CONTRACTOR'S MODEL RECORD OF CONSTRUCTION PLANT

Equipment represented by models on the white card is in service. That shown on the green card is idle. That shown on the salmon card is under repair.

Method of Adjusting Sewage Sprinklers

By A. T. Nabstedt*

When placing a new sprinkling filter bed in operation the question of distribution naturally assumes a rôle of vital importance. The following experience, which the writer recently had with a municipal plant of several acres, may be of interest to others. At any rate, this method of approaching the problem is offered for the purpose of soliciting criticism, so that, if possible, varied experiences may be brought together and a more perfect method of correction be applied.

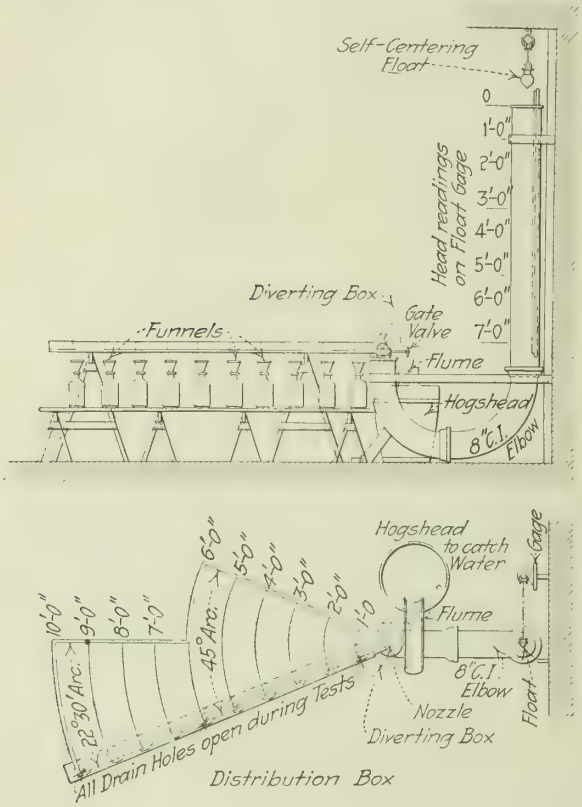
It was quite apparent from the beginning of the operation of the plant in question, that the distribution over the allotted areas would be quite unsatisfactory. Yet a great amount of care was used in the design of the plant, and the best available data on the sprinkling capacities of the various nozzles were at hand.

No mention will be made here of the methods used to build up gradually the available head and of the corrections applied to the various losses of head, but the description will be limited to the application to the spraying device of the best head available and the method used for improving the distribution under the conditions thus presented.

Under what were believed to be the best available conditions as regards the operating elevations of the siphon and the conservation of the hydrostatic head to the nozzle, a windshield was carefully erected around typical nozzles in actual service and a series of distribution tests was made. In these tests the same radial distribution box was used, which will later be described in connection with the interior testing apparatus, and the mean of a series of five successive tests was accepted.

*Associated with A. L. Webster, Consulting Sanitary Engineer, 80 Maiden Lane, New York City.

Having thus quite carefully found the discharge and the distribution of the spraying device under the above-mentioned conditions, it was the purpose to duplicate the same on a testing apparatus, so that the conditions of the field could be applied to one nozzle and the changes in design, capacity, etc., of the one nozzle be applied back again to the field of 1500 or 2000 nozzles.



APPARATUS FOR TESTING SEWAGE-SPRAYING NOZZLES

It was thought that all conceivable changes could thus be applied to a small unit as representing the entire field, and when the best changes had been accomplished these could be applied to the field at large. The advantage of this indirect experimental procedure over applying the same changes to a large number of nozzles on a field is obvious, whereas the changing of one nozzle among a thousand by testing directly on the filter beds would, no doubt, be open to criticism.

To duplicate the exact conditions of the field on the interior testing apparatus, the actual head on the spraying device was very slowly decreased from the theoretical head supplied by the siphon, and at the same time the capacity of the standpipe was decreased by placing timbers of various sections in it. Finally, a distribution was produced which was comparable with that shown by the tests on the field. It was under these conditions that the changes were applied to the capacity and design of the spraying device.

The accompanying plan and elevation of the testing apparatus make a description of its operation scarcely necessary, and it will, therefore, be but very briefly reviewed.

With the float-gage set at the desired head, the 2-in. gate valve was opened and the rate of discharge of the nozzle was determined by the rate at which the indicator rose foot by foot on the gage board. When the elevation or head was reached which represented the low-water level or venting point of the siphon, the gate valve was closed. The personal factor in opening and closing the valve was partly overcome by carefully considering the time taken for the operation and by imitating the initial and final sprays of the filter beds, as far as that was possible. A quick-opening valve might not quite give this same effect.

The spray, as it fell over the tin-lined distribution box, drained into the respective receptacles very quickly, while the box, which is designated on the accompanying sketch as being set over the nozzle, served the purpose of limiting the spray to an area slightly greater than that of the distribution box and deflecting the remainder of the discharge backward into the hogshead. In this way approximately 90% of the water was saved for the next test.

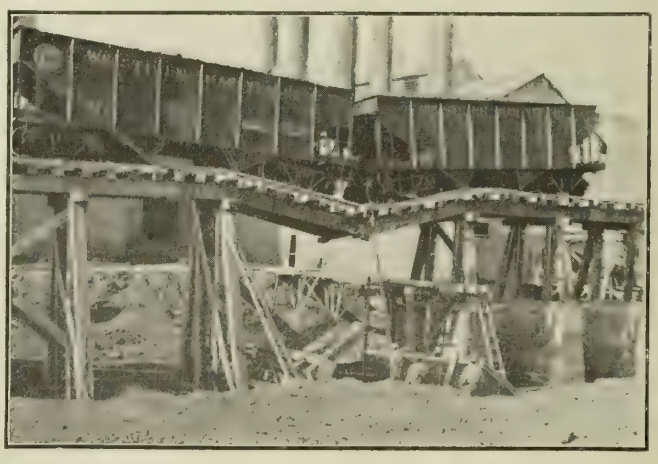
Where a large number of tests are to be carried on such facilities as have been described are appreciated.

The results of these tests not only gave an exact knowledge of what the capacity of each of the various designs was under each foot of head applied, but also its spraying ability with these same heads. Incidentally the results pointed out the exact loss of head in the filter system.

Underpinning a Trestle

Underpinning work on a coal trestle and a little accident which happened during this work are shown by the photograph herewith. The trestle is about seven years old. In spite of the fact that the sills rest on masonary footings, the lower portions of the bents were rotting away where coal had been stored for long periods. In planning repairs it was decided to use concrete piers in place of wooden bents, with a view to protection from coal fires. However, the poor business outlook last summer led to cutting down the cost of the work to a minimum, and for this reason the piers were built up only far enough to displace all bad timber, the remainder of the height to be built at some later period.

The work had to be done without interruption to service. It was carried out as follows: Timbers were



A TRESTLE ACCIDENT; HOPPER-BOTTOM CARS PREVENT COLLAPSE

bolted to the bents above, where they were to be sawed off, and jacks were put under these timbers. The bad portion of the bents was then removed and the concrete was placed and allowed to set several days before removing the temporary support. Old iron rods, pieces of pipe, etc., were placed vertically in the top surface of

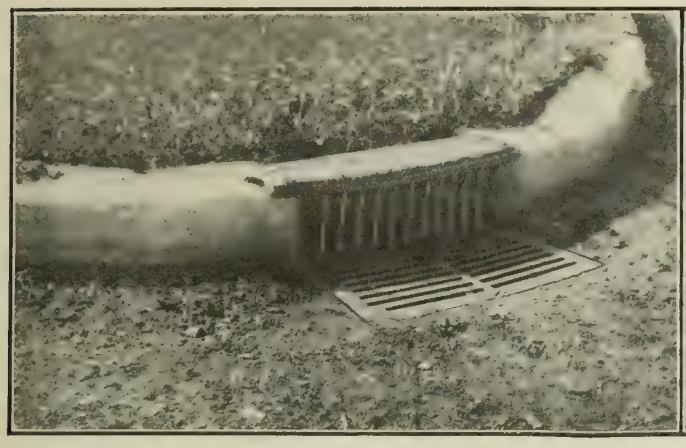


FIG. 1. INLET AT CURB CORNER ON UPHILL SIDE

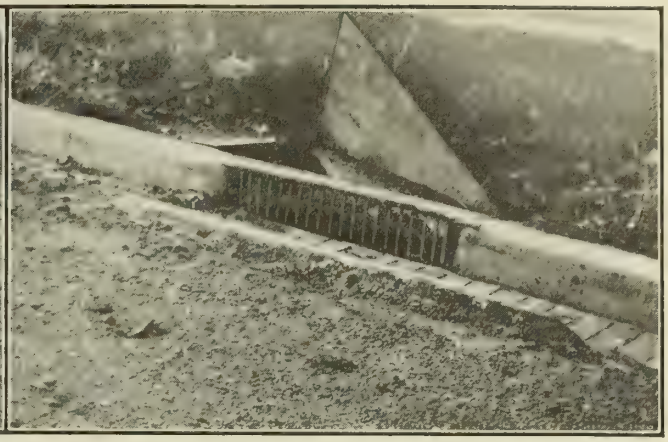


FIG. 2. OUTLET IN CURB BELOW STREET INTERSECTION

the concrete to give a good bond when the piers are extended up to the stringers later.

The accident shown in the photograph occurred in a peculiar way. A bent had been jacked up and sawed off, when a string of loaded coal cars was pushed over the trestle. The ground supporting the jacks sank slightly under the load, and jacks as well as bent fell to the ground, leaving the stringers hanging in the air, held only by the rails, which did not break. The hopper bottoms of the two coal cars over the break came down to a bearing on the rails, and this saved the day.—A. C. Hewitt, Hagerstown, Md.

Taking Care of Drainage at Street Intersections

By Clair V. Mann*

An arrangement of inlets and conduits for surface drainage at street intersections, somewhat different from that at Inglewood, Calif., described in *Engineering News*, Mar. 5, 1914, is giving satisfaction in Boulder, Colo. This drainage system has been constructed in Grant Place, which has a grade of from 7 to 9 per cent. The grades of cross-streets vary from ½ to 3 per cent.

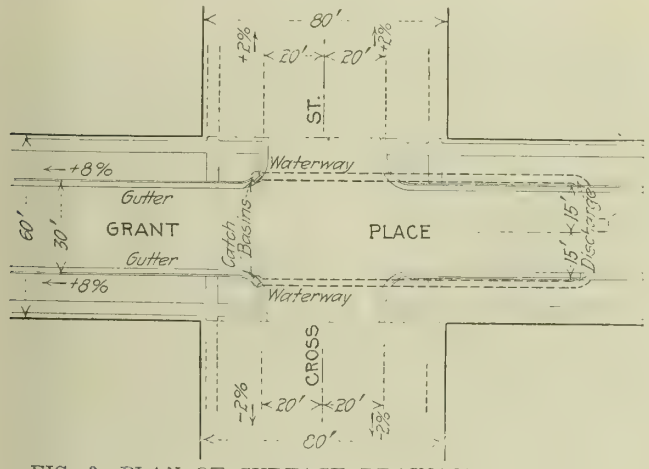


FIG. 3. PLAN OF SURFACE DRAINAGE CONDUITS, BOULDER, COLO.

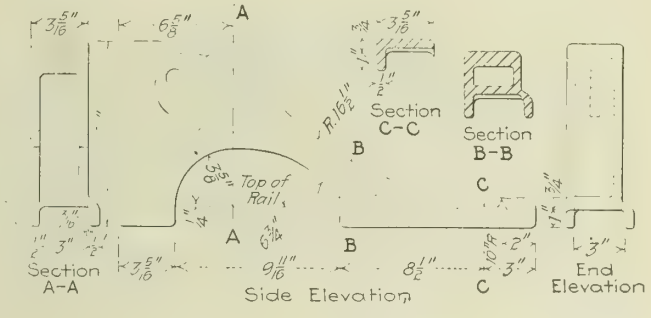
Inlets (Fig. 1) and shallow catchbasins were provided at the curb corners on the uphill side of the cross-streets. Leading from these catchbasins, under the cross-streets and the sidewalk parking area beyond, there are concrete conduits with covers made in removable sections. The grades for these conduits are sufficient to prevent deposit of silt, and such that they meet the grades of the gutters on the downhill side of the cross-street within 50 or 60 ft. beyond the lower line of that street. At this junction point the conduit is brought through the curbing to join the gutter, as shown in Fig. 2. A thin cast-iron cover, for the lower end of the conduit in the parking area, is shown raised up to permit cleaning the outlet. Fig. 3 is a plan of the layout.

*Civil Engineer, Boulder, Colo.

Portable Stop for a Car-Ferry Incline

The Chicago, Burlington & Quincy R.R. is operating a car ferry on the Ohio River for its new line between Metropolis, Ill., and Paducah, Ky. At each end the shore track is connected to the boat by an incline with a cradle that is adjusted to meet varying river level.

To hold the cradle in position on the incline, and also to hold the train on the cradle while its track is being adjusted to the level of that on the boat, portable rail stops are used. The stop, shown in the accompanying drawing, is of cast steel 23¾ in. long and 9⅝ in. high, weighing about 50 lb. It has a grooved base to hold it



PORTABLE STOP FOR CAR-FERRY INCLINE; CHICAGO, BURLINGTON & QUINCY R.R.

in place on the rail, and its bearing surface is corrugated in order to get a good grip on the rail head. The toe is feather-edged to engage the wheel, which rolls up on the stop against a surface having a radius of 16½ in., or about that of the wheel tread.

The U. S. Reclamation Service up to Dec. 31, 1914, has built dams and canals requiring a total of earth and rock excavation amounting to over 122,000,000 cu.yd. The total length of canals and ditches constructed by the Reclamation Service is more than 9000 mi.

Collapse of Unstiffened Timber Howe Bridge

An 80-ft. wooden bridge owned by Reclamation District No. 108 and spanning a reclamation canal near Knight's Landing, Yolo County, California, failed May 15, 1915, as noted in *Engineering News,* June 3, p. 109. The bridge was built only last fall. It is said to have been designed to support a load of 30 tons. At the time of the failure it was supporting a small tractor of the caterpillar type, followed by a flat wagon with a small load and also by a cook car. The total load was 11 tons.

The bridge was part of a floodgate separating a drainage canal from the Sacramento River. The trusses were low (pony), and were of the Howe type with total span of 80 ft. Both upper and lower chords were laminated and were in each instance built up of four 2x10-in. pieces. The main diagonals were 8x8 timbers. The floor-beams came at the hanger-rods, so that the trusses were practically unstayed in the top chord.

At the time of the failure the tractor had passed two-thirds of the way across the bridge. Both upper and lower chords failed completely. Eyewitnesses were unable to say whether the upper or lower chord failed first. The two trusses failed almost simultaneously.



FIGS. 1 AND 2. A SHORT-LIVED WOODEN BRIDGE
Left—Bridge practically completed, Dec. 26, 1914. Right—Just after failure, May 15, 1915

Precise-Level Benchmarks, New York City

There has recently been completed a net of precise levels covering the whole of Greater New York. The methods employed on the work were comprehensively described by Frederick W. Koop, Assistant Engineer, Board of Estimate and Apportionment, in *Engineering News,* Sept. 4, 1913. The drawings on p. 223 show the types of benchmarks used, which with the following notes are from Mr. Koop's recent report on the work.

Marks on large permanent structures are considered the most lasting and easy to locate. Such a benchmark is a large T or a + of uniform width with V-shaped indentations at least ¼ in. deep, or a bolt or brass tablet set in the masonry. The difficulty of taking readings on such benchmarks is offset by their permanence and freedom from interference. Readings on such marks are made easier by the use of a hand level, as shown in Fig. 2.

Ground monuments with covers were found to be often inaccessible in winter due to the difficulty of removing the cover; so a plain granite monument with a heavy base of concrete, set with its head about ½ in. above the surface, was found more satisfactory. However, benchmarks

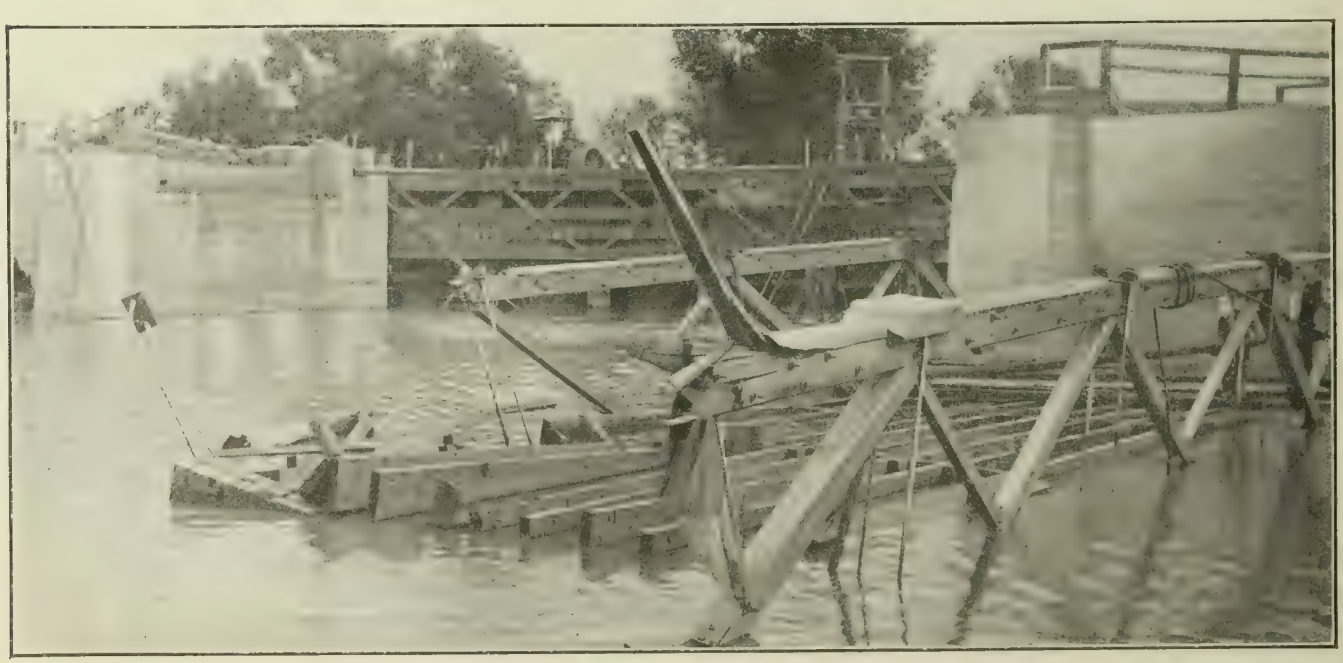


FIG. 3. BROKEN TRUSSES OF KNIGHT'S LANDING BRIDGE AFTER BEING HAULED TO CANAL BANK
Break in near truss is one-half panel from hip; break in far truss is at midspan

projecting any appreciable amount are undesirable on precise-level lines.

With the benchmarks located on buildings, etc., care was taken to place them on the foundations or base courses of massive structures whenever possible, and benches were not established on copings except when provision could be made for tying them into more permanent points in the vicinity. Benchmarks on bridges were either placed as low as possible or were located on the bridge seat. In consequence of the action of successive frosts on the joints of masonry, it was deemed wise, whenever it was necessary to place benches in the immediate vicinity of the waterfront, to select for their location the inshore portions of the structure or wall at points as remote as possible from the water.

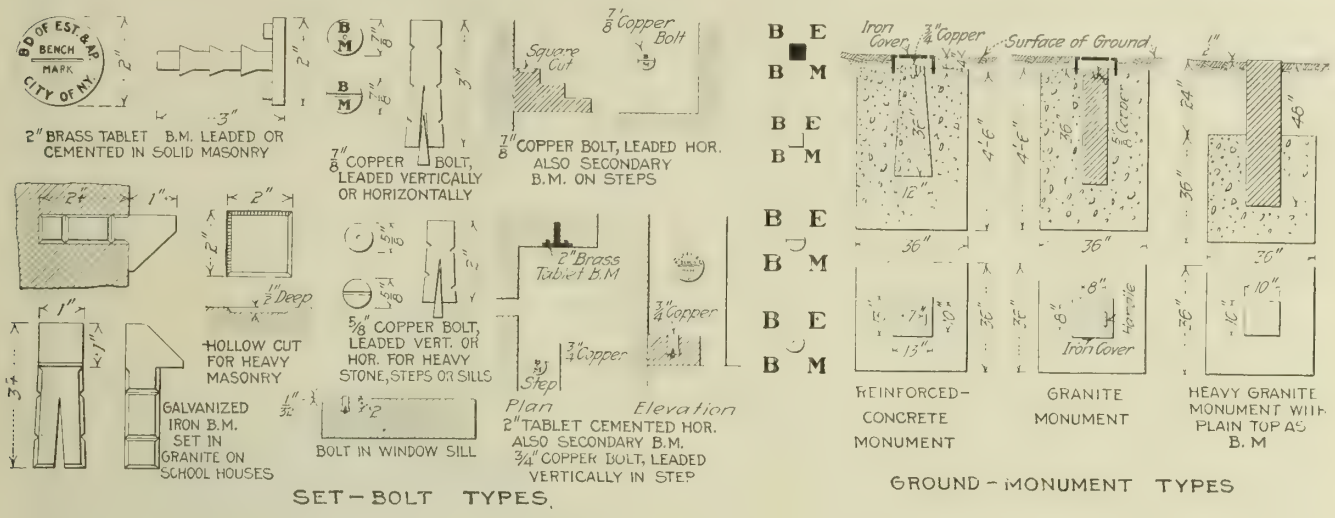


FIG. 1. STANDARD BENCHMARKS OF THE BOARD OF ESTIMATE AND APPORTIONMENT, NEW YORK CITY

Constructing a 70-Mi. Water Conduit in Alaska

The construction of a conduit comprising 21 mi. of flume, 37 mi. of open ditch, and 12 mi. of pipe was the subject of a paper recently presented by H. H. Hall before the San Francisco Association of Members of the American Society of Civil Engineers.

The conduit leads from the Ogelvie range of mountains southwesterly to the Klondike mines near Dawson City, Alaska. Its purpose is to convey 125 sec.-ft. of water, or about 80,000,000 gal. per day. The conduit was constructed under separate organizations during three seasons of about 120 days each (1907-1909). Ditch construction was used wherever possible—7 ft. wide on bottom, 1½:1 slope, and 3½ ft. deep, with a gradient of 4 to 7 ft. per mi., the greater portion being 6 ft.

The right-of-way was first cleared of trees and the moss scraped off, as fast as it thawed, with teams and slip scrapers. The latter work presented the most troublesome problem from a construction standpoint owing to the uneven thawing of the muck and the consequent miring of the horses. Thirty miles of ditch was dug with six 30-ton steam shovels, the remainder with horse scrapers. As the shovels required a working space at least 16 ft. wide, no side-sloping was done with them. Small patches of frost were removed with 40 per cent. dynamite, but the larger patches were passed over, and after thawing were taken out with scrapers.

The record performance for one shift was 410 ft. of ditch, or about 1200 cu.yd., with an average performance of 14.7 ft., or 51 cu.yd. per working hour. The season was from Jan. 15 to Oct. 15, with work usually slow the first and last weeks. The finishing gang followed the shovels—truing the grade, sloping the banks, clearing the berms, building a path along the top of the soil bank for watchmen, and constructing turnouts and overflows alternately every half mile. Common labor was paid $4 per day and board.

Mr. Hall stated that under operation the ditch had proved satisfactory, leaks being caused usually by ice seams.

Flume construction was adopted where the side slopes exceeded 15 deg. or where the muck was over 2 ft. thick.

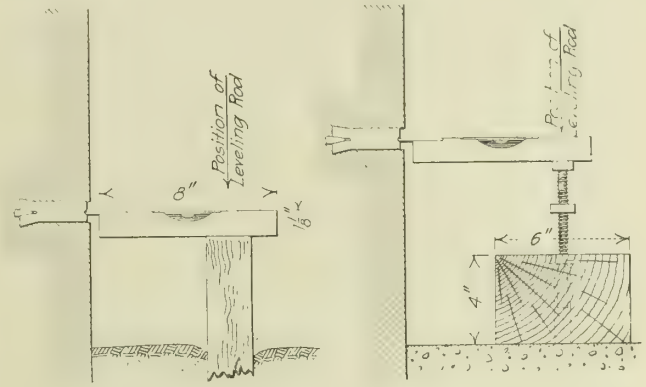


FIG. 2. HAND LEVEL FOR TAKING READINGS ON WALL-PLUG BENCHMARKS

The flume construction was of the board-and-batten type, 6x4 ft. in cross-section, and built of native lumber, made up in 16-ft. sections and set on trestle bents of hewn timber placed 8 ft. on centers. Most of the bents were carried on mudsills, laid below the black muck (about 4 ft. deep), great care being taken not to disturb the moss blanket unnecessarily, and to replace it as quickly as possible over the backfillings in order to preserve the ground in a frozen condition.

It was attempted to found some of the bents on piles driven into earth that had previously been thawed out by means of 16-ft. miner's steam points. In this manner the moss was broken only to admit the pile. Where the

depth of muck would require very deep mudsill pits, the experiment was tried of placing gravel ballast directly on top of the moss and laying the flume stringers on cross-ties.

According to Mr. Hall, several years' operation of this flume has shown that the pile foundation is the best. Mudsill bents show continual settlement, caused by water flowing down the posts (either from the flume or from natural drainage) and thawing out the substrata.

Pipe lines were employed for pressure sections. For pressures not exceeding 200 ft. redwood stave pipe was used; for over 200 ft. or less than 1000 ft., standard-riveted; for over 1000 ft., lap-welded steel pipe. One section was constructed of spiral riveted pipe with patent bolted couplings.

In operation it has been found that the wood pipe has given considerable trouble, owing to the fact that between Oct. 1 and June 1 lines are drained and closed up. The sand and gravel carried by the ditch water have worn the bottom staves badly. All intakes are now provided with sand boxes. Accumulations of ice at the discharge ends have caused considerable trouble by increasing the pressure on sections of the pipe. On high-pressure lines the sediment cuts the steel rapidly, and in one instance a 3/4-in. rivet was cut away in two weeks.

NOTES

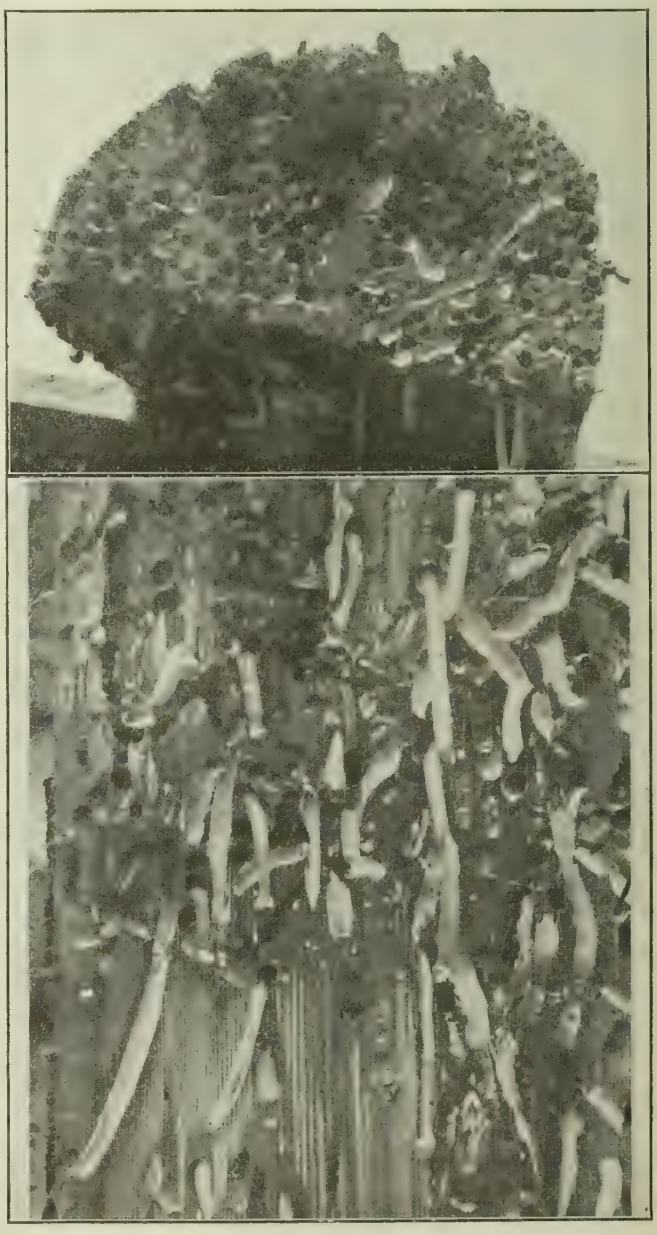
The Slope Angle of Paneling of a concrete-incased steel plate-girder in Chicago has proved troublesome during winter months because snow collecting on the lower ledge melted and dripped down on pedestrians below. The inset here was evidently too deep and the slope too flat, but the designer of the bridge does not know just how much to change both details to make sure that the snow will not lodge in quantity sufficient to cause a nuisance when melting. The angle of friction of snow on concrete evidently enters into the problem, and this angle is probably variable, depending on temperature. At least the incident is of interest to designers of similar structures.



Quick Methods of Excavating—During the recent high water in Kansas, when the Kaw River rose to a gage of 24.6 ft. above standard low water, the drainage board, realizing the immediate necessity for removing all possible obstructions from the river channel, ordered work to be begun at the Union Pacific bridge with the object of removing about 10,000 to 15,000 cu.yd. of earth near the east span. This was accomplished by a gang of eight men drilling and shooting the dirt, using just enough 40 per cent. dynamite to allow it to be broken up thoroughly and loosened. As soon as the shots at one end had been set off, a fire hose, with 1⅛-in. nozzle and about 80-lb. nozzle pressure, which was imparted to it by the use of a single fire engine at the end of about 1000 ft. of hose, was utilized to wash this loosened earth into the swift current of the Kaw. The current of the river at this time was flowing at the rate of approximately 8 to 10 ft. per sec., and the stream from this hose very quickly cut off large pieces of excavation and caused them to be washed downstream. The city of Kansas City, Kan., donated the services of the fire apparatus and firemen to operate it, while the Kaw Valley Drainage Board paid for the shooting. It has not been possible to get a unit cost from this work, but it is needless to say that it was done at a very much lower cost than it could have been done by any other means. Removing spoil banks and earth lying between the levees by means of hydraulic jets during periods of high water has proved to be a very efficient and economical process. The entire amount of the above-described job was removed in about two days time.

A Warning to Chainmen—In an entertaining paper on "Reminiscences" in the 1914 "Proceedings" of the Association of Ontario Land Surveyors, A. L. Russell gives an anecdote which impressed him very early in his career with the responsibility of a chainman: He writes: "I recollect a test made by the late Major Webb, who, as the chain was passing under his instrument one day, closely noted the exact distance to the plumb line. Then saying he wanted to be quite sure of the exact distance from the last tally, he asked the chainmen to repeat the measurement; and when they were out of sight he moved the transit ahead a few links. The head chainman had also noted where the plumb-bob had been on the chain, and gradually pulling the rear chainman ahead to a similar reading, sang out 'Pull tight!' and 'All right!' The major remarked that such work was 'too good for anything' and asked them to sign the payroll and clear out."

The Activities of Teredo Navalis in the waters of Union Bay, Vancouver Island, B. C., are well shown by the accompanying two views of a Douglas fir pile recently taken from a wharf there after 19 months' service under water. The upper view shows the head and the lower the exposed center of a split pile, which is characteristic of a number that were replaced.



A FIR PILE AFTER 19 MONTHS' EXPOSURE TO TEREDOS

In the lower view several of the sea worms may be noted with their bulb heads protruding from the little holes they have bored. One of these borers measured 16 in. in length. The views were sent by D. O. Lewis, District Engineer, of Mackenzie, Mann & Co., Ltd., Vancouver, B. C. They were taken by C. E. Sherwood, timber inspector of the company.

Editorials

Mechanical Log Driving

The design of mechanical means for driving logs past hydro-electric and water-storage works is one of the important incidental problems of many such hydraulic developments. A considerable number of mechanical logways are to be found in this country, but comparatively little has been published about them. Therefore, two articles in this issue are of uncommon interest. Details of the provisions for getting logs around the Arrowrock Dam are described in one case; in the other are noted the economic advantages of mechanical over hydraulic handling of the Connecticut River log drives at Turners Falls.

Ordinary sluicing past the dam was out of the question at Arrowrock because of the great height of the structure and the varying reservoir levels. Resort to a mechanical plant was the only possibility. The rugged ground made necessary a novel use of a descending conveyor—the restraining "bull chain" described in the article. This is undoubtedly one of the most rugged conveyors to be found anywhere today.

At Turners Falls to have continued the time-honored practice of shooting the logs through the rapids would have cost the power company the revenue from 1000 hp. of its plant capacity. By carrying the logs through the smooth waters of its power canal, and sluicing them past the power house, the first economy comes—both to the power company and to the lumber concerns. The latter benefit through a great saving in labor, for driving through rapids and loosening the inevitable jams require a considerable force of men. By using a simple snatch-line or a double chain lift only an insignificant amount of water is needed—just enough to wet the sluice—and further economy results.

Shale as a Dam Foundation

The tests to determine the frictional resistance of shale to sliding, described in last week's issue of *Engineering News,* are worth the careful study of every engineer interested in dam construction. A word of caution, however, seems advisable with regard to interpreting these experiments as a guide to practical design.

If their results could be taken at face value, the engineer might conclude that shale was a very safe and satisfactory foundation on which to base a gravity dam. The least coefficient of friction for the sliding of either shale on shale or concrete on shale was well above 0.50. If such a coefficient of friction could be relied upon, the engineer could found his dams on shale rock with entire confidence; but the actual failure of a number of dams founded on shale, notably the great calamity at Austin, Penn., points to the unreliability of the frictional resistance in shale dam foundations.

It is not difficult to explain this unreliability. For example, there are occasionally found in shale rock very thin layers of other materials, such as clay, which may act as a lubricant between adjacent layers and facilitate slipping, if slipping is possible. Again, if there is percolation between horizontal strata of a shale rock the water passing through may gradually erode and dissolve the material until a slight settlement occurs, and this may furnish an initial motion which will reduce the friction coefficient.

The lesson which we believe most engineers engaged in dam construction have drawn from the numerous failures that have occurred during the past dozen years is that as little reliance as possible should be placed upon the coefficient of friction in the foundation of dams. The bottom of the dam should be keyed to the bedrock by deep foundation trenches filled with good concrete. By this means and by stepping or sloping the foundation surfaces at right angles to the line of pressure it is generally possible so to design a structure that variations in the coefficient of friction of the bedrock surface, even though these variations may cover wide limits, will not seriously affect the safety of the structure.

The Capsizing of the "Eastland"

The terrible disaster in the Chicago River on Saturday, July 24, when the capsizing of an excursion steamer caused the death of nearly 1500 persons, takes rank with the loss of the "Titanic" and the sinking of the "Lusitania" among the most fatal marine disasters ever recorded. The two great transatlantic steamers, however, were sunk in the open ocean, where those who went to rescue survivors had great distances to cover. It would not have been deemed possible that a steamer capsizing in a narrow river, in the heart of a great city, in water so shallow that only part of the hull was submerged and with instant means of rescue at hand could prove as fatal a disaster, in the number of persons carried down to their death, as did the sinking at sea of each of the two great transatlantic liners.

The capsize of the "Eastland" is in fact so unprecedented in marine annals that had such a possibility been suggested by anyone prior to its occurrence it would have been scouted as an impossibility. Here was a great steel vessel built to stand rough weather on the lakes, and consequently with a hull of the regular lake and ocean steamer type of construction. She had a crowd of excursionists on board, but no more than she was licensed to carry and doubtless had frequently carried across the lake. While lying alongside the pier with a stream of passengers coming on board, the boat gradually lists over away from the pier and the list increases until the hawsers holding the boat to the pier are snapped and the vessel rolls over on its side, precipitating the passengers into the river and drowning most of those imprisoned within its hull.

Naturally a unanimous chorous of condemnation has arisen. The public rightly brands such a disaster as inexcusable and demands that the causes be determined



THE CAPSIZED STEAMER "EASTLAND" IN THE CHICAGO RIVER

and that those responsible for this terrible loss of life receive due punishment.

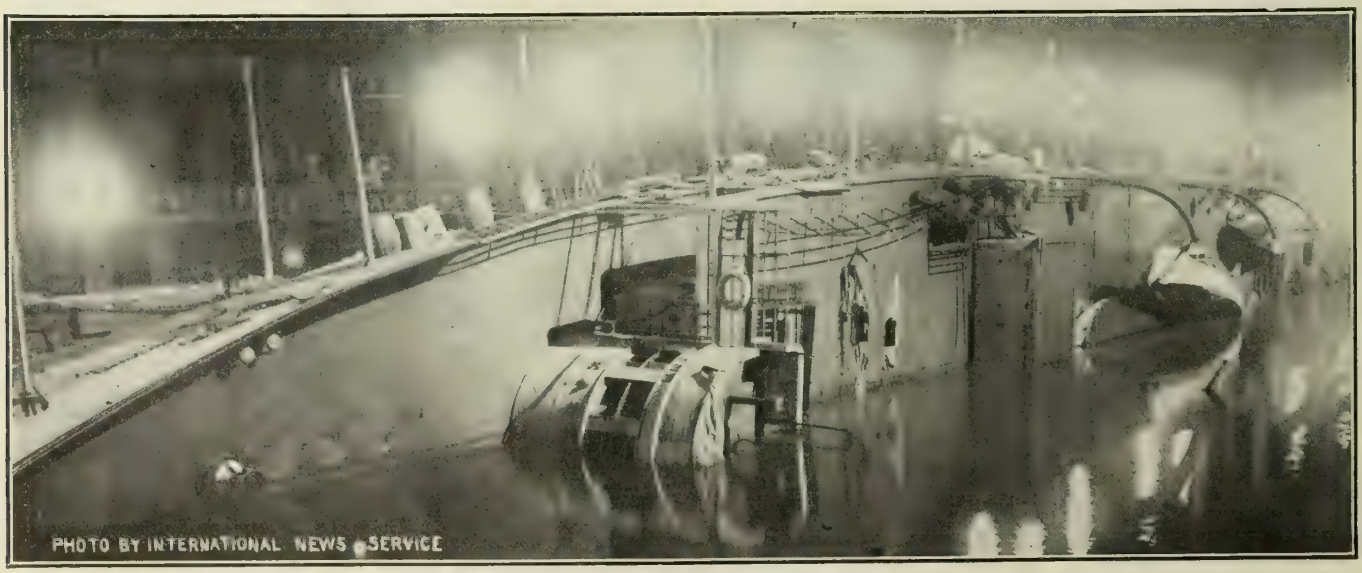
It will be evident at once to every engineer familiar with ship construction that the primary cause of the capsizing of the "Eastland" must be sought for in the condition of the vessel's water ballast tanks. Practically all deep-draft lake and ocean vessels of the present day have water-ballast tanks in the bottom of the hull by which the draft and stability of the vessel are controlled. When a vessel is laden with heavy freight she may have ample stability with the water-ballast tanks empty; when sailing without cargo, however, it is generally necessary to fill the ballast tanks to make the vessel stable and sometimes it is necessary to add extra ballast besides to make the vessel seaworthy in all weather.

In vessels for passenger service, considerations of stability are closely connected with considerations of steadiness and consequent comfort for passengers. If a vessel has too great stability it may be so "stiff" and have such a short period of roll as to be uncomfortable for passenger service. The late Charles H. Cramp, in a paper before the American Institute of Naval Architects and Marine Engineers a few years ago, pointed out that in the endeavor to build steamers with a slow and easy roll, some of the designers of vessels for transatlantic passenger service had gone so far as to build vessels which absolutely depend upon their water ballast for stability and would capsize should their ballast tanks be empty.

In studying the capsize of the "Eastland," a number of the causes which are being assigned by the newspapers for the accident may be at once dismissed. It is said, for example, that the boat was overcrowded. The boat owners and the steamboat-inspection service are assailed for permitting such a number on board. It is also said that the rush of passengers on the upper deck to one side to view some happening caused the careening and capsize of the vessel.

Such circumstances as these are wholly inadequate to explain the occurrence. The vessel had been crowded with passengers many times in its history. On a boat of this type, built without the overhanging guards common on the excursion steamboats used in shallow river and lake waters, it is impossible to throw weight enough to one side by the movement of passengers to have any serious effect on stability, provided the vessel itself is in a properly stable condition.

It is clearly evident from the accounts of the disaster thus far at hand that the vessel was not in its normal condition of stability. It is an elementary principle of vessel construction that the center of gravity of the vessel as a whole must be lower than the center of buoyancy in order that the vessel shall remain upright. During all the life of the "Eastland," from the day it was launched until last Saturday, with all the loads it has carried and with all the storms through which it has passed, this condition has remained fulfilled. But on Saturday morning, when the throng of excursionists crowded on board the boat and gradually filled its upper deck, the vessel gradually listed over away from the wharf and the center of gravity rose higher and higher as the number of passengers on board increased, until it must have actually risen above the point of support and created sufficient instability for the boat to roll over and snap the hawsers holding it on the other side, with fatal results.



A NIGHT VIEW OF THE CAPSIZED "EASTLAND"

What the actual condition of the vessel's water-ballast tanks was at the time of the disaster remains for the official investigation to determine. It has been stated that the draft of the vessel when loaded with passengers was such that the water ballast had been pumped out of the tanks in order to enable the boat to pass over the La Salle St. tunnel roof on its way down the river. It is a well-known and not unusual expedient in vessel operation to discharge water ballast when in the still water of a harbor in order to reduce draft; and if the vessel has the normal and usual stability there should be no danger in such a measure.

According to the reports gathered by the newspapers from various quarters, however, there is evidence that the "Eastland" was deficient in stability even with the ballast tanks filled. As originally built, in fact, she is said to have been so unstable that she was altered by the removal of an upper deck. It is even said that her deficient stability had been a subject of investigation by the United States inspectors.

All these things will doubtless be fully determined by the official investigations. The important thing to the engineering profession is that this unparalleled disaster will call general attention to the little-understood matter of vessel stability and its importance with respect to the public safety. It has been hitherto little realized by the public that the safety of a vessel against capsizing may depend not merely on the correctness of its original design, but also on the intelligence and good judgment of the officers who operate it.

Naval architects have urged that the stability requirements of a vessel should be made a part of its permanent record and put in charge of the captain, and that ships' officers should be made sufficiently familiar with the matter of stability that their vessels may not be loaded in a dangerous manner. The case of the "Eastland" is a terrible example of what may happen from ignorance of stability requirements in absolutely smooth water, with a vessel tied to her pier. Moreover, there is good reason to believe that not a few of the ships which every year sail from port and are never afterward heard from owe their loss to lack of stability and consequent capsizing. The terrible disaster at Chicago will lead the designers and builders of deep draft vessels to appreciate as never before the importance of stability calculations, and the importance also of making provision that a ship's original stability shall not be impaired by those in charge of its operation.

Serial Bond Issues Desirable

Engineers have been foremost in calling attention to the absurdity of a city or state borrowing money to pay for a public work by a bond issue which will not become due until long after the work for which the money is borrowed has been worn out or has become obsolete. In the New York Constitutional Convention, amendments have already been introduced which limit the maximum term of a bond issue by the life of the improvement for which the bond issue pays.

An innovation in public finance of equal importance, which has also been brought before the Constitutional Convention in proposed amendments, is the substitution, in place of the sinking-fund plan of providing for the payment of bond issues, of the serial bond issue under which an installment of the principal is paid off each year. Of course it makes no difference in theory whether a borrower accumulates year by year in a sinking fund the amount which will be sufficient to pay the debt when it is due or whether he takes the same money each year and pays off a fractional part of the debt; that is, it makes no difference if the investments for the sinking fund and the bond issue for which it is accumulated bear the same rate of interest. Experience has shown, however, that occasionally sinking funds accumulated for the payment of a bonded debt are not kept intact. Losses may occur through unwise investment; or some sudden emergency or deadlock in legislative bodies may prevent an annual payment to a sinking fund from being made.

The plan of making a bond issue payable serially—or, in other words, paying the debt on the annual installment plan—is therefore the safer plan for the borrower, and is safer for the taxpayers as well. There is no possible question in case of a serial bond issue as to the amount of money which must be raised each year for debt-paying purposes; and there is much less likelihood that when a large bond issue matures, the taxpayers of that day, who may be the children or grandchildren of those who originally created the debt, will find that the funds which should have been accumulated to provide for the payment of the debt have been frittered away.

Mail-Carrying Rates

The hotly debated question as to the fairness of the rate of compensation paid by the Government to the railways for carrying the mails is now to be tested in the courts. Seven New England railway companies brought suit in the Court of Claims on July 17 for the payment by the Government of $11,880,000, which is alleged to be the sum by which the amount received by these railways for mail transportation during the last six years falls short of fair compensation.

It is an old saying that it takes two to make a bargain. The rates of compensation for carrying the mails, however, have been for years arbitrarily fixed by the postal officials without regard to the claims of the railway companies. At present the Government pays the railways for transporting the mails on the basis of the average weight of mail carried, determining that weight by making tests every four years. No such tests have been made on the New England railways since the parcel post was established, and consequently the railways are carrying the vastly increased amount of mail due to the parcel post and receiving no greater compensation therefor.

The railways claim that the present rate of compensation is less than the actual cost to them of transporting mails, and that under the Supreme Court decision of last March in the North Dakota coal rate case railways cannot be compelled to render a service at less than cost and make up the difference by extra charges on other classes of traffic.

It will readily be understood that the contentions of the railway companies in this case are closely connected with the much-discussed matter of the rate of postage on publications and also with the general question of freight and passenger rates, since the railways maintain that they are obliged to charge more on other classes of traffic than would be the case if their postal business were remunerative.

Letters to the Editor

Pavement Foundations Over Filled-In Trenches

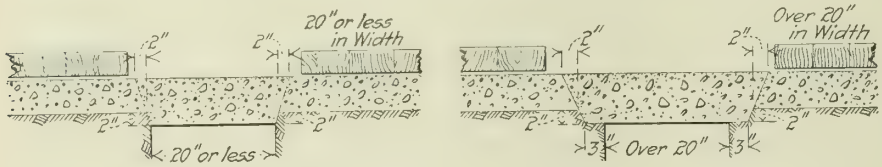
Sir—With reference to the letter of E. R. Horton, Jr., in *Engineering News*, June 17, on restoring pavement foundations over filled-in trenches, I wish to bring to the attention of your readers the practice in Detroit, Mich.

The accompanying sketch shows the method employed in restoring pavement foundations in Detroit since the beginning of the present year. This covers the relaying of foundations where trenches have been opened by any of the public-service corporations, plumbers and others.

The following regulations explain the methods employed:

All trenches and excavations shall be backfilled by such means as the Department of Public Works shall direct, depending upon the character of the excavated material and the condition of the weather, and in such a manner that all excavated material shall be replaced in the trench or excavation, without raising the grade of the roadway, making allowance for conduits, pipes, etc., placed in the excavation.

In the downtown district, where the streets and alleys are filled with pipes, conduits and underground construction, and traffic is heavy, inspectors must be called when the work of excavating is commenced, also at all times when excavations for trenches of any length are commenced. On ordinary excavations, for connecting with the water mains, or sewers, or repairing water mains or connections, the plumber or contractor must notify the permit division when ready to backfill the excavation. Material used for backfilling must be in proper condition, all wet, soggy dirt must be removed from the street and replaced with dirt of the proper consistency, or cinders. Coarse, lumpy or cloddy earth must be pulverized before being returned to the trench or excavation. From Nov. 15 to Apr. 15 all excavations in paved streets and alleys must be filled with crushed stone, thoroughly pounded down. All backfilling must be done by thorough, hard tamping, in layers not exceeding 4 in. in depth. Two able-bodied men, with heavy rammers or tamping irons to be in the excavation, for each shoveler outside. Where tunnels are made, the filling must be of concrete, consisting of 1 part portland cement to 4 parts of sand and 8 parts of broken stone or brick, satisfactory to the inspector, and under car tracks must be properly keyed up with brick or stone in addition to the concrete mixture.



METHOD OF RESTORING CONCRETE FOUNDATION OF FILLED-IN TRENCHES, DETROIT, MICH.

After backfilling is completed, the loose, broken stone must be placed on top and covered with the surface material, and left in a safe condition satisfactory to the inspector, and all the surplus dirt removed from the street, and the street properly cleared up. No backfilling whatever is to be done in the roadway or between the curb and lot-line, except in the presence of the inspector from the Department of Public Works.

No paving will be allowed on permit work unless satisfactory arrangements have been made for supervision when the permit is issued. When paving is done by contractor or corporation the trench shall be reinforced at the top by a portland-cement concrete foundation, at least 8 in. deep consisting of 1 part cement, 3 parts clean, sharp sand, and 6 parts crushed slag or hard limestone, properly mixed and tamped, the concrete to extend over the edges of the trench or excavation at least 6 in. on each side, and then properly guarded until it is set. This shall then be covered with a cushion of clean, sharp sand not exceeding 1½ in. deep. The surface paving material shall be the same as the surface of the street, the rules of the department in regard to new pavement to be followed at all times. When the surface is brick and new brick are necessary they must be of the same size or brand as those used in the street. The joints at the edges of the excavation are to be broken out and the brick properly tongued or keyed together. Whenever contractors are allowed to do the repaving in street or alley and are backfilling and concreting at the same time there must be two inspectors on the job, one to supervise backfilling and one to supervise concreting.

Besides these printed regulations the Department of Public Works issues a circular of instructions to inspectors to make sure that the regulations are followed.

GEORGE H. FENKELL,
Commissioner of Public Works.

Detroit, Mich., July 6, 1915.

Sir—It has been a rule in Kansas City, Mo., since 1911 for the city to repair all cuts made in pavements with its own forces, charging the party responsible for the cut a stated amount per square yard for repairs, and relieving the contractor having the pavement under maintenance from any further maintenance of that portion of the pavement which is actually repaired. The cut is made 6 in. wider on all sides than the actual size of the excavation, so that the concrete foundation which is replaced will have a bearing of at least 6 in. on undisturbed soil. The widening of the pavement cut is not made until the time for repairs. I believe this has done a great deal toward eliminating poorly repaired cuts.

CLARK R. MANDIGO,
Assistant City Engineer.

Kansas City, Mo., July 7, 1915.

A Garbage-Reduction Question

Sir—I noticed in your issue of May 27, 1915, an article on the success of garbage reduction in the cities of Columbus and Cleveland, Ohio.

While I do not, of course, question the facts submitted in this article, or that the plants have made a profit from the reduction of the garbage delivered to them, I wish to raise the question as to whether or not these plants are successful from an economic standpoint as parts of a general garbage-collection and disposal system. In Seattle the cost of collecting garbage—which includes not only garbage proper but all the ashes, refuse and other waste products of the city, even lawn clippings being included—is about three times the cost of disposal by the method of incineration. If, now, it is necessary to make one collection of the garbage taken to the reduction plant and another separate collection of the other forms of refuse, the extra cost of such collection may very easily over-

balance any profit which may be made in the reduction of the garbage proper. In other words, the total cost of this method may be more than the total cost of other methods in which the cost of disposal alone shows a loss instead of a profit, due to the extra cost of collection in the former method. It is, of course, praiseworthy that officials in charge of any particular plant should seek to operate it in such a manner as to give the very best possible results. Engineers, however, are interested in knowing not only the results of the operation of a particular portion of a plant but the results of the operation of the plant as a whole.

I should be glad to know if there are any data available in these cities showing the total cost of collecting and disposing of all the wastes.

A. H. Dimock,
City Engineer.

Seattle, Wash., June 25, 1915.

Patentees' Royalties Justified

Sir—In *Engineering News,* June 3, 1915, p. 1088, is a letter signed "Contractor," referring to the contract for a patented retaining wall let at Tiffin, Ohio, Apr. 20, 1915.

"Contractor" reasons badly in saying that the patentee who himself bid on his own patented plans had an advantage (by reason of specifying 63c. per cu.yd. as royalty) over others who bid on those same plans. He had specified that amount, approximately 10 per cent. of the contract price, for all bidders as his recompense for the use of his patent. In all but one or two states, court decisions have held that public lettings on patented devices are legal and fair when the amount of royalty is specified so that bidders may secure the right to use the patent. In some of the states this principle as established by the courts has been enacted into statutes, and it is desirable legislation for the reason that so many contractors are ignorant of the principles underlying fair competition in patented devices at public lettings.

Assuming that all the bidders figure the same cost and profit, then the patentee would file the same bid as the others if he included the specified royalty for himself. Since he can collect this specified amount from the successful bidder, he cannot reduce that amount in his own bid. If his bid proves to be lower than the others it is because he has cut his profits, not his royalty, for that royalty is available to him from any other successful bidder. And the patentee is thus on an equality with all other bidders. This principle applies regardless of how worthless the patent may be or how high the specified royalty, for how can the patentee cut his royalty in his own bid when that very amount is tendered him by his competitors? And if he could have deducted any part of the 63c. specified, who but the taxpayers would be the immediate benefactors? What the patentee did at Tiffin was merely to comply with court decisions.

Contractors and civil engineers very generally refuse to recognize the merits of the patent system. This is the more surprising because patents have much to do with our industrial progress, and so have contractors and engineers. In fact, industrial progress has been so extended by science that today the only man that can hope successfully to invent is the scientist. Hence, logically, the civil engineer should be the inventor of today. But he is not; and instead of blaming himself he excuses his own barrenness by charging the Patent Office with carelessness, a charge which is often heard but has never yet been substantiated except by a few exceptions, whose prominence is a good indication that carefulness is the rule.

"Contractor's" article contains another striking illustration of the harm that is done the community by the attitude of contractors and civil engineers toward patents. The patentee quoted the city $1200 for the use of his patented device. This was refused. Then a royalty of 63c. per cu.yd. was specified to be included in the bid.[1] The 4100 cu.yd. contained in the wall thus cost the city $2583, unless the contractor took chances on litigation, which he would hardly do, for this patent is held valid in that circuit. Notwithstanding this added royalty, the patented wall was bid one-third lower than the plain wall, with a saving of $15,000 to the city. Why did the city refuse to pay $1200 and then pay $2583 instead for what was so obviously of advantage? Probably because of criticisms aroused by contractors and engineers, of which the contribution to your journal by "Contractor" is an excellent example. Thus the continual "knocking" that is done against engineering patents not only is an obstruction to progress in the arts but also increases taxes.

Daniel B. Luten.

Indianapolis, July 10, 1915.

NOTES AND QUERIES

New York Standard Gate Valves—In "Engineering News," May 27, 1915, p. 1018, in an article on the standard waterworks valves of New York City, the price of a 16-in. valve was included, although a 16-in. valve is not one of the five standard sizes now in use. It was an oversight to include this in the list as it naturally raises the question of the city using other than the standard sizes, although the article states specifically that it does not. W. W. Brush, Deputy Chief Engineer of the Department of Water Supply, Gas and Electricity, states that the price for a 16-in. valve was quoted, as the department had purchased a few of these valves to be set on existing 16-in. lines where the conditions did not make it advisable to use the standard 12-in. valve. No price is given for 48-in. valves as no valves have been purchased under the department design of this size. The price of the 48-in. valve of the department design is problematical, due to the high cost of the pattern that would have to be charged if such a valve were now to be purchased. If a number of these valves were to be used so that the pattern cost would be negligible an approximate estimate of cost is $1200 each.

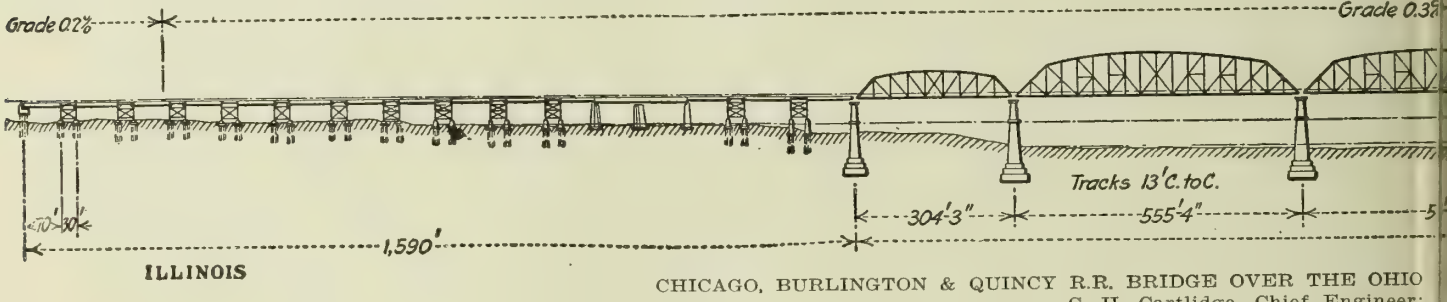
Oiled Roads Destructive of Fish Life—Near Southampton, L. I., there is a large fresh-water lake, separated from the ocean by sand dunes and fed by springs and surface water. The lake is about a mile long and in some places half a mile in width. It was formerly well stocked with fish. The water draining from the oiled roads in the vicinity, however, has killed all the fish and the question has arisen how this destruction of fish life may be prevented so that the lake may be restocked. It is estimated that there are at least ten miles of oiled roads, the drainage from which sooner or later reaches the lake. It has been proposed to build a large concrete tank in which the grit and sediment washed from the roadways would settle and could be removed at intervals, while the oil would rise to the surface and could be drawn off. The question is whether water drawn from between the top and bottom and discharged into the lake would be free of matter injurious to fish. It is thought possible that some of the tarry acids washed from the roads are soluble in water and that this plan therefore might not be successful. The engineer in charge of the work, A. L. Stevenson, 101 Park Ave,. Southampton, L. I., would be glad of information from any engineer having had charge of similar work.

[1]This is not precisely correct. The city notified prospective bidders that they would have to protect the city against patent claims. A patentee of a retaining wall then announced that he would charge 63c. per cu.yd. for all concrete put in on the proposed design.—Editor.

Ohio River Bridge for the C., B. & Q. R. R.

SYNOPSIS—This great bridge, now under construction, is notable for the use of silicon steel and for having the largest plain truss span ever built (723 ft.). It is a double-track bridge, designed for exceptionally heavy live loads. The article outlines the requirements of the steel and the loading.

The new Ohio River bridge at Metropolis, Ill., now under construction by the Chicago, Burlington & Quincy R.R., will have as three special features: The longest fixed truss span yet built, 722 ft. 11 in. c. to c. of piers (with four others of about 556 ft.); the use of silicon steel for the truss members; and provision for very heavy loading. A general drawing and description of the bridge were given in *Engineering News*, July 30, 1914, and the drawing is reproduced herewith. Preliminary work was started about that time, but was stopped very soon after, owing to financial conditions resulting from the war in Europe. The railway connections are nearly completed, however, and a car ferry is being established across the river. In June, 1915, it was decided to proceed with the bridge, and work is now in progress on the pier foundations and the fabrication of the steel.



CHICAGO, BURLINGTON & QUINCY R.R. BRIDGE OVER THE OHIO
C. H. Cartlidge, Chief Engineer;

The bridge was designed by C. H. Cartlidge, Bridge Engineer of the Chicago, Burlington & Quincy R.R. (and Chief Engineer of the auxiliary Paducah & Illinois R.R., which is building the bridge and its connections). All detail drawings were prepared in the Bridge Department, these being submitted for the approval of Ralph Modjeski, consulting engineer for the bridge. The Union Bridge & Construction Co., of Kansas City, Mo., has the contract for the substructure. The American Bridge Co. has the contract for the fabrication and erection of the superstructure, and is building the steelwork at its shops at Gary, Ind.

The structural design of the main trusses is very heavy. The top chords and end posts are of H-section, with two built-up channels for the sides and a continuous diaphragm. The top and bottom lacing is of angles and bars respectively. Some of the plates will have a thickness as great as 1¾ in. The largest pins are 15-in. diameter. The top chords are riveted throughout, and very large gussets are used.

An ordinary open-floor deck will be used on the truss spans, while the approach viaduct will have a solid deck of reinforced-concrete slabs for ballasted track.

The river piers will be of reinforced concrete, sunk by the pneumatic process to about 85 ft. below high water, and resting in a deep bed of gravel. Concrete piles will be used under the footings of the viaduct approaches in some cases, while in others these foundations will be on a bed of cemented gravel.

Character of the Steel Used

In the trusses, all main members except the eye-bars will be of silicon steel, the eye-bars and pins of nickel steel and all other material (including lacing) of medium steel. The material in the deck plate-girders and towers of the viaduct approaches will be of medium steel. This is the first use of silicon steel for heavy bridge work in this country. The purpose of using it is to combine high strength with a low increase of weight, in view of the high loading which the bridge is designed to carry. The cost is not very much in excess of that of medium steel and less than for nickel steel. It requires rather more care in the mills and the shops and will be rather slower for drilling. All the material will be openhearth steel.

All rivet holes in silicon steel (which will be ⅞ to 1½ in. thick) will be drilled from the solid to $\frac{1}{16}$ in. excess diameter, and this will apply also to medium structural steel 1 in. thick and upward. For medium steel less than 1 in. thick the holes will be subpunched and reamed. Any sheared plates or shapes in the trusses will have the edges planed or faced.

The rivet steel is similar in composition to the structural steel except that its sulphur limit is 0.04% and its maximum ultimate strength is 55,000 lb. with a yield point 55% of this. In unit stress the shear and bearing are 11,200 and 19,000 lb. respectively for shop rivets, and 9400 and 16,000 lb. for field rivets.

The nickel-steel eye-bars tested to destruction must show a minimum of 80,000 lb. ultimate tensile strength and 48,000 lb. yield point by drop of beam, also 10% elongation in 18 ft., with 25% reduction in area and a silky fracture. Full-sized material for these eye-bars, 1 in. thick and over, must bend cold 180° around a pin three times the thickness of the bar, without a sign of fracture.

The requirements for the three grades of steel are given in the accompanying table, and in regard to the chemical requirements it is specified that the material must be uniform or of approximately the same composition throughout.

CHARACTER OF STEEL FOR THE OHIO RIVER BRIDGE OF THE CHICAGO, BURLINGTON & QUINCY R.R.

	Structural Steel	Nickel Steel	Silicon Steel
Phosphorus, max. (basic)	0.05%	0.04%	0.04%
Phosphorus, max. (acid)	0.08%	0.05%	0.06%
Sulphur, max.	0.05%	0.04%	0.05%
Nickel, min.	.....	3.25%	.....
Carbon, max.	.....	0.45%	0.40%
Manganese, max.	.....	0.80%	1.00%
Manganese, min.	.....	0.50%	.....
Silicon, min.	.....	.....	0.25%
Ult. strength, min.	55,000	95,000	80,000
Ult. strength, max.	65,000	110,000	95,000
Yield point	30,000	55,000	45,000
Elongation in 8 in.*	1,500,000 / Ult.	1,500,000 / Ult.	1,600,000 / Ult.
Reduction of area, min.†	40%	25%	35%
Fracture desired	silky	silky	silky
Cold bend without fracture: ¾-in. thick	flat	d = 2t	d = t
Cold bend without fracture: ¾ to 1½ in.	d = t	d = 3t	d = 1½t
Cold bend without fracture: over 1½ in.	d = 1½t	d = 3t	d = 2½t

*Elongation in 8 in.—For silicon and nickel steel a deduction of 1% will be allowed from the specified elongation percentage for each increase of ¼ in. (or fraction thereof) in thickness above 1 in., but the elongation must not be less than 14%. In structural steel, a similar deduction will be allowed for a similar increase in thickness above ¾ in. †Reduction of Area—For material ¾ in. and less in thickness a reduction of 1% will be allowed for each increase of ⅛ in. above ¾ in., with a minimum allowable reduction of 24% for silicon steel.

Load and Stress Requirements

The very high live load for which the bridge is designed is a striking feature. The live load assumed for the truss design is as follows: On the near track, two engines of the 2 : 8 : 0 class of Cooper's E-90 loading, followed by a train load of 7500 lb. per ft. of track; on the far track, the train load only. For hangers and subdiagonals, however, two engines are assumed for each track. For the approaches the assumed live load for each track consists of two Cooper's E-90 engines followed by the train load mentioned.

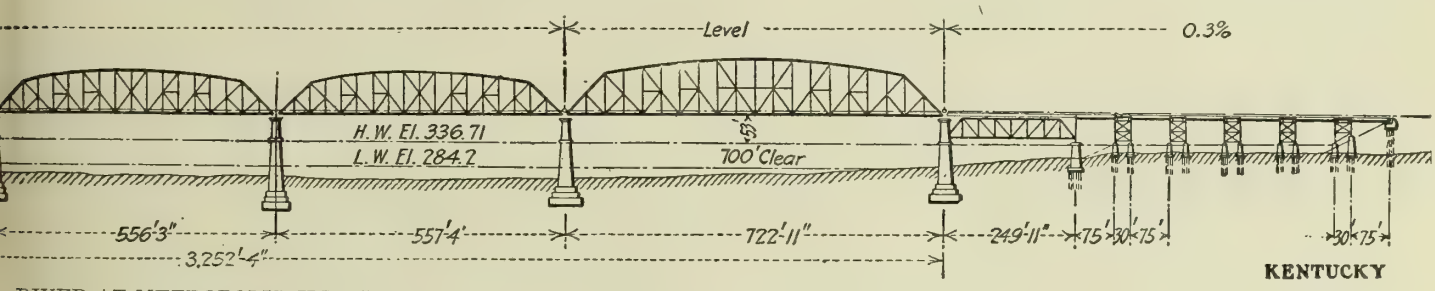
It was the engineer's opinion that the bridge should be designed and built for the ultimate probable load. The reason was that, with spans of varying lengths and with loads nearly equal to (or perhaps a little above) the present existing equipment, the resultant design would not provide the same percentage of strength after the loads should have reached the maximum allowable. This is due, of course, to the fact that the dead load of a long span is a much larger proportion of the total load on that span than it is of the total load on a shorter span. By proportioning the spans for the ultimate probable load a uniform relation between the dead and live loads is maintained, and when the loads for which the bridge is designed are finally realized the spans will be stressed throughout to the amounts decided upon in designing.

This applies particularly to the engines, and it was considered that 45-ton axle loads might reasonably be regarded as a maximum. For the train load, however, the same figure was used as for previous large bridges, since there is little indication of increase in weight per foot of track, in spite of heavier car loads and axle loads. Thus solid coal trains on the Chicago, Burlington & Quincy R.R. do not run higher than 4000 lb. per ft. of track, and with merchandise freight in solid trains it is only about 3000 lb. per ft. of track.

The dead load of track and deck is taken at 500 lb. per ft. of each track for the truss spans (with open floor construction), and 3350 lb. per ft. of each track for the ballasted concrete deck on the approaches.

Impact is provided for in the trusses by adding 10% to the live-load stress in all members, except that for floor hangers and subdiagonals 50% of the live load for one track is to be added on the near track. The 10% addition is increased to 20% for the 246-ft. deck-truss and 300-ft. through-truss spans. For impact on the approaches 22,500 lb. is added to each of the four drivers on one rail of each track for the engine which will cause the greatest stress.

Wind load on the trusses is taken at 30 lb. per sq.ft. of area of train and floor in elevation, for 20 ft. in height; also the same load for the area of truss members of two trusses not covered by this height. All are treated as moving loads. For the top laterals on through spans and the bottom laterals on the deck span, the wind load is taken at 50 lb. per sq.ft. on the exposed area of truss members for two trusses. This also is treated as moving load.



RIVER AT METROPOLIS, ILL., CONTAINING THE LONGEST PLAIN TRUSS IN EXISTENCE
Ralph Modjeski, Consulting Engineer.

For the approaches the viaduct towers are designed for a wind load of 50 lb. per sq.ft. on 1½ times the vertical projection of the structure unloaded; or 30 lb. on the same surface plus 400 lb. per lin.ft. of structure applied 7 ft. above the rail for assumed wind force on a train when the structure is either fully loaded or loaded on either track with empty cars assumed to weigh 1200 lb. per lin.ft., whichever gives the larger strain.

The traction, or longitudinal force, is provided for in the viaduct towers by an allowance for a longitudinal force of 20% of the live load applied at the top of the rail, on one track only. Only a short section of the land end of one approach is on a curve, but the specifications provide an allowance for centrifugal force of the live load applied at the top of the high rail. This force is considered as live load and is derived from the formula $60 - 2\frac{1}{2} D$, in which 60 is the speed in miles per hour and D the degree of curve.

The following unit stresses are allowed for the total dead load, live load and wind load:

	Silicon Steel	Medium Steel	Nickel Steel
Tension and compression*	30,000	20,000	35,000†
Tension and compression for wind	30,000	24,000	35,000
Shear, webs	.....	11,200	.....
Shear, pins	.....	.....	20,000
Bearing, pins	30,000	20,000	35,000
Bending, plates and shapes	30,000	20,000	.....
Bending, pins	.....	.....	35,000

*Compression as reduced by Gordon's formula. †Tension only for nickel steel (eye-bars).

For members having alternate stress, the gross and net sections required for compression and tension stresses respectively are determined and half the smaller section is added to the larger section. The net sections and gross sections are used where tension and compression respectively are the governing stresses. Pin plates are proportioned for the sum of both stresses, except where governed by the section required at pin holes. Members subject to both axial and bending stresses are so proportioned that the combined fiber stresses will not exceed the allowed axial stress.

Garbage-Disposal Propositions at San Francisco

The City Engineer of San Francisco, M. M. O'Shaughnessy, made a report to the Board of Supervisors of the city, on July 2, summarizing various propositions which have been made to the city for the disposal of its garbage and refuse. E. G. Borden offered to erect, at his own cost, a 50-ton experimental hydro-incinerator under the Heslewood patents. The incinerator may be briefly described as a modified gas producer. Mr. Borden claimed that the plant would produce low-grade fuel gas and clinker, both salable articles, and estimated the cost of a 50-ton plant at $8650. After the plant's success had been demonstrated he would sell it to the city at cost, the city to pay in addition $50,000 for the use of the patents covering its construction, with the right to erect such additional plants as it might require.

Collins & Pellett offered to install garbage incinerators with a capacity of 512 tons per day of 24 hr. for $340,000, guaranteeing them to be odorless and practically smokeless.

Fred T. Smith offered to reconstruct the old Thackeray incinerator plant belonging to the city for $255,000, so that it would have a capacity of 720 tons per day of 16 hr. As an alternate proposition he would rebuild the plant for $85,000 and operate it for ten years for 60c. per ton of garbage delivered, the city to guarantee an average of 500 tons or more per day. He also offered to construct a new plant of 720 tons' capacity per day of 16 hr. for $510,000, or for $175,000 with a ten-year operating contract. This proposition was accompanied by detailed specifications as to the operation of the incinerator without dust, smoke, odor or other nuisance.

T. J. Lacey, of San Antonio, Tex., offered a scheme for utilizing garbage in the manufacture of fuel briquettes. J. E. Briggs offered the De Carie incinerator. H. B. Harris, of Nashville, Tenn., offered a garbage incinerator of his own design. Charles Turner, Vice-President and General Manager of the San Francisco Disposal Co., proposed a separate collection of garbage and refuse, the latter to be disposed of in the Islais Creek incinerator and the former to be treated by the reduction method in a plant that his company has built and would enlarge to provide sufficient capacity for the city. J. M. Hirsch, of Chicago, offered a chemical treatment for garbage claimed to produce valuable byproducts.

Richard Schmidt asked for a 35-year franchise to dispose of all the garbage, refuse and waste matter collected in the city by dumping it on waste land and covering it with layers of earth, at a price of 60c. per ton delivered, including that delivered by private scavengers as well as by the city. For such a franchise he offered to pay to the city the sum of 3c. per ton during the first year of operation and 4c. per ton thereafter.

Mr. O'Shaughnessy has investigated the method of garbage disposal proposed by Mr. Schmidt, which is in use at Seattle, Wash., and submitted statements from the President of the Board of Health, the City Engineer and the head of the refuse-disposal department of Seattle, expressing satisfaction with this method as used in that city. Mr. O'Shaughnessy recommended that before entering into any negotiations for the disposal of San Francisco refuse by incineration or reduction, a thorough trial should be made of the method proposed by Mr. Schmidt.

Water Pollution Enjoined at Niagara Falls

The Supreme Court of New York issued an injunction on July 5 restraining the City of Niagara Falls from discharging the effluent of the municipal water-works filter plant in such a manner as to pollute the water taken from the Niagara River by the Western New York Water Co. The city and the company are competitors in furnishing water to the people of Niagara Falls. The municipal water-works, located about two miles above the city, takes water from the river through an intake extending some 2000 ft. beyond the shore, carrying it to a filter plant built in 1912. There is discharged into the river from this filter plant annually about 550 tons of suspended matter from the sedimentation basins, an equal amount of solids in effluents from the filter beds, and about 300 tons of chemicals used in treating the water at the filtration plant.

About two miles down the river from this municipal water-works filter plant is the intake of the Niagara Falls Power Co., from which the Western New York Water Co. draws its supply for domestic use. The water company claimed that the discharge from the municipal filter plant above materially increased the amount of suspended matter in its water supply, as well as the percentage of bacteria, thereby subjecting the company to greater expense in filtering the supply before delivering it to consumers. The river, however, carries a large amount of pollution anyway, and the attorneys for the city contended that, this being the case, it was immaterial that the effluent from the municipal filter beds was discharged into the river. The attorneys for the company, however, showed that there was a trunk sewer near the municipal filtration plant into which the effluent from that plant could be discharged as conveniently as into the river, and with little more expense, and which would deliver the effluent below the falls.

Under these conditions the court decided that it was reasonable to require the city to discharge the effluent from its filtration plant into the sewer instead of into the river itself. Issuance of the injunction was delayed for six months to give the city time to make this change. The case was notable for the conflicting evidence of the chemists testifying on opposite sides of the case. The court decided in favor of the testimony presented by the plaintiff on the ground that the tests made by its chemists were the more reliable, in that they tested the acidity of the gelatine used in their examinations. The experts for the plaintiff were H. F. Huy, of Buffalo, and James M. Caird and F. J. Longley, of Troy.

Concrete-Paved Automobile Racetrack

A two-mile automobile speedway or racetrack 60 ft. wide, with a 6-in. concrete pavement, is under construction near Fort Snelling, in the southwestern part of St. Paul, Minn. Races are scheduled for Sept. 4, and every effort is being made to rush the work.

A sketch plan of the track is shown in Fig. 1. It consists essentially of two short tangents (549.6 ft.) and two circular arcs of 1245.89 ft. radius, each 3130.4 ft. long and each connected to the tangents by easement spirals

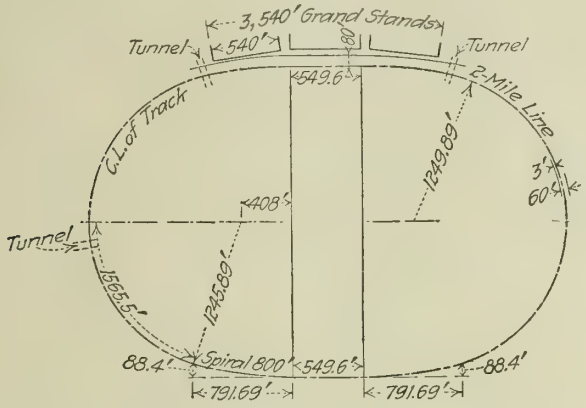


FIG. 1. SKETCH PLAN OF TWIN CITIES MOTOR SPEEDWAY

800 ft. long. The track proper is 60 ft. wide, but in front of the grandstands the width is 80 ft.

The curves are banked by an earth fill 13 ft. high. The concrete pavement on the higher half of the fill is reinforced. Fig. 2 is a cross-section on the 800-ft. easement curve, and the accompanying table gives the elevations of the four governing points on the spiral cross-sections.

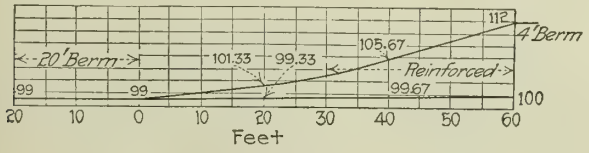


FIG. 2. CROSS-SECTION ON CURVES

The inner edge of the track is a level around the entire circuit.

The original surface was fairly level, of a sandy soil. The fills are made in 2-ft. layers thoroughly rolled damp with a 10-ton roller. As an additional safeguard against

TABLE SHOWING ELEVATIONS AT THE VARIOUS STATIONS ON SPIRAL

Station	0-Ft. Point	20-Ft. Point	40-Ft. Point	60-Ft. Point
15 to 15	99.0	101.33	105.67	112.00
16 and 37	99.0	101.11	105.00	110.67
17 and 36	99.0	100.89	104.33	109.33
18 and 35	99.0	100.67	103.67	108.00
19 and 34	99.0	100.44	103.00	106.67
20 and 33	99.0	100.22	102.33	105.33
21 and 32	99.0	100.00	101.67	104.00
22 and 31	99.0	99.77	101.00	102.67
23 and 30	99.0	99.55	100.33	101.33
24 to 29	99.0	99.33	99.67	100.00
38 to 38	99.0	101.33	105.67	112.00

settlement, the greater part of the pavement slab on the fill is reinforced, as noted.

The concrete pavement is being constructed with regulation pavement type of portable concrete mixers. Expansion joints are placed every 50 ft. diagonally across the track (at 30 deg. to the inner and outer edges). A continuous longitudinal joint extends through the length of the pavement. Concrete tunnels 60 ft. wide will give access to the interior of the speedway area.

This track is being built by the Twin City Motor Speedway Co., for which O. H. Case is chief engineer. Barnard & Frederick, of Minneapolis, are contractors for the 189,000 cu.yd. of earthwork. Hanlon & Akes, Sioux City, are contractors for the concrete, and J. F. Sperry, St. Paul, is contractor for the reinforced-concrete grandstands, which are designed to seat 75,000 spectators.

Repair of Defects in Reinforced Concrete

A comprehensive review of methods which have been employed to repair cracked elements of reinforced-concrete structures was given some time ago by Prof. S. Müller before the Deutsche Beton Verein. His account was based on extensive experience in carrying out such repair or reinforcement, chiefly of floor slabs and beams.

The defects in question include weakness of the slab due to inadequate thickness for proper service as compression element of the T-beam; separation of slab from beam; and diagonal or horizontal cracking of the beam web. Vertical cracking, which sometimes occurs, is due to shrinkage and is not considered dangerous.

Beams

In the earliest repair jobs on defective beams the plan adopted was to strengthen the floor by adding supplementary beams or by setting a column under the middle of the weak beam. In some cases a pair of I-beams has been placed alongside the weak concrete beam; but this is generally uneconomical, because the uncertainty of the load distribution makes it necessary to proportion the steel beams to take the entire load. Diagonal cracking, indicating a deficiency of shear reinforcement, has been repaired by placing vertical or inclined steel stirrups around the web of the beam and screwing them up tight. This method did not always prove satisfactory, however, especially in structures subject to vibration. The best method of repair yet developed is to place cramps over the crack, doweled into the sound concrete on both sides, and incase them in a shell of concrete, for which space may be made by chipping off the original concrete for a depth of an inch or so.

Slabs

Where a slab requires to be reinforced, to provide additional compression area for T-beam action, a good bond of the new top layer has generally been obtained. Thorough cleaning of the surface is first necessary, followed by roughening the old concrete by picking or otherwise; after wetting the surface, a 2-in. layer of concrete well reinforced by a strong mesh is placed. The mesh should be tied to the reinforcement of the old concrete by steel-tie members.

Where slab and beam have separated the scheme has been employed of adding such a reinforced upper layer on top of the slab and tying this down through holes in the slab to cross-bars passed through holes in the stem of the beam.

It has been found that painstaking work is necessary for success in repairing reinforced-concrete structures. With care, however, the patches or new elements can be made structurally integral with the old parts. Satisfactory appearance can be secured. In the best work the patches are practically invisible.

News of the Engineering World

Denver Plans Water-Works

The Public Utilities Commission of the city and county of Denver, Colo. on July 19 entered into a contract with Van Sant-Houghton Co., engineers and contractors of Denver and San Francisco, for making surveys, plans, specifications, and a detailed report preliminary to asking for bids on the construction of a complete new water-works plant for the city. All questions relating to water-supply, location, cost, etc., will be considered. The work will commence at once and will require several months for completion.

Imperial Valley Earthquake Tests Engineering Works

[CONTRIBUTED]

A few brief notes on the earthquake of June 22, 1915, in the Imperial Valley, California and Mexico, were given in *Engineering News,* July 1, p. 46. A more detailed examination has now been made than was then possible and shows that the early reports of damage were exaggerated; the shock, however, was severe.

Only those buildings suffered which were of inferior construction. Brick and concrete structures having any reinforcement at all were practically untouched. Frame buildings sustained very little damage. On reinforced-concrete work only the surface decorations were injured, except where there was some fire damage. In several structures hair-cracks were found penetrating as far as the reinforcement, but stopping there. Most of the damage was due to lack of proper ties and bonding in the cheap brickwork, which had been permitted with the rapid growth of the cities and in the absence of building restrictions.

The Masonic Temple in Calexico, Calif., a well-tied and anchored two-story brick building, was uninjured, though reported in the newspapers as a wreck. Calexico had two fires, but they were controlled, since the damage to water mains was slight. The loss in Calexico is estimated at $100,000 maximum; at El Centro it may rise to $500,000. Throughout the valley there was little injury to city improvements.

A most interesting result is the good showing made in river-protection and irrigation works. There was no injury of consequence at the old breaks of the Colorado River. On the Imperial Valley irrigation lines some of the embankments developed shallow longitudinal settlement cracks; the puddling around some structures cracked away, but not enough to cause serious leakage. In places timber work was found out of line.

The main canal was carrying 4500 sec.-ft. at the time of the shock, but it was not found necessary to diminish the flow. Along some of the minor canals which were running near their capacity water was shaken over the levee tops; but the disturbances did not continue long enough to cause serious breaks. The New River flume, a $90,000 project just completed, is intact. This flume is carried on a timber trestle, in some places elevated 50 ft. on pile bents driven 35 ft.

The net result of this earthquake probably will be beneficial. Only a few days elapsed before the towns began passing much needed ordinances regulating building construction. As a result of this severe test of the engineering works in the valley, the confidence of the people in their safety and value has been greatly strengthened.

The Naval Inventions Board

The invitation from Secretary Daniels to the principal national engineering societies to nominate representatives on the proposed Naval Inventions Board appears to have been due, partly at least, to the initiative of Frank J. Sprague. Mr. Sprague was graduated from Annapolis and spent five years in the navy after graduation, resigning in 1884 to engage in the pioneer work of electrical development. The following is quoted from Mr. Sprague's letter to Secretary Daniels:



TYPICAL EXAMPLES OF EARTHQUAKE DESTRUCTION IN CALEXICO, CALIF.

> Permit me to congratulate you upon having decided to create a Board of Invention and Development, to be aided by an advisory board of civilian engineers, a project the necessity for which I have long had in mind. The great necessity for and possible utility of such an organization cannot be better set forth than as stated in your published letter to Mr. Edison, for it is unquestionably true that the United States is woefully deficient not alone in the actual preparation for defense but in the knowledge of many things essential to such defense.
>
> On account of the limitations in authority and expenditure, and the routine hitherto pertaining to Government matters, it has been almost impossible for men with meritorious inventions to have them properly considered, or even if considered to have them developed. It has, therefore, fallen upon many in civil life to help develop and finance inventions of this character. Since my own resignation from the naval

service and the taking up of industrial development in the electrical field, I have had many matters presented to me which would have warranted thorough governmental investigation, and sometimes I have lent a hand.

It seems to me that provision for investigation and possible experimental equipment should take into account the needs of both services, for not only are many inventions equally valuable for the navy and the army, but researches can be carried out jointly far more effectively and with material saving in expense.

I am, perhaps, not warranted in offering advice, but on account of the vital importance of the proposed undertaking, and because such measure of professional success as has come to me is largely due to my naval training, I will venture some suggestions:

First. In view of the confidential character of most of the communications to the board and the possible attitude of "hyphenates" in critical times, your advisers, whether men of purely civil education or men in civil life who have had the advantages of West Point or Annapolis training, should be dyed-in-the-wool Americans from birth up.

Second. With sane inventors there should be included men who are also engineers who deal with constructive problems, and who can pass upon the practicability and value of inventions in the same manner as they now do for great commercial organizations—an essential if the highest efficiency is to be attained.

With regard to this latter suggestion it might be well to call into preliminary consultation the presidents of the various national, and perhaps some other, engineering societies before making a final selection. These include in their membership most of the prominent engineers and inventors in the country, the men on whose work much of our great industrial development has been founded.

As a past-president of three of these societies, I feel warranted in expressing the opinion that if the present presidents were requested by you to discuss the formation and membership of the proposed advisory board, and were asked to submit a number of names whom they could recommend for consideration as members, they would be glad to comply with your request.

Another East River Tunnel

A project for a tunnel under the East River from 59th St. in the Borough of Manhattan to Long Island City was approved by the Board of Estimate and Apportionment of New York City on July 21. It has hitherto been planned to carry subway trains over the East River from Manhattan to Long Island City by means of the Queensboro cantilever bridge, which is between 59th and 60th St. The original plans for this bridge, however, did not provide adequate strength for the operation of the subway trains, except by spacing them some distance apart. This matter was fully discussed in the report on the design of the bridge made at the time of its completion by Boller & Hodge and published in *Engineering News*. It has been estimated, however, that at an expense of about $2,500,000 the bridge could be strengthened so that it would be safe for the use of subway trains.

An offer was made to the city last spring by Michael J. Degnon, president of the Degnon Contracting Co., which has the contract for subway work at 59th St., offering to build a tunnel under the East River for the city at that point at an expense not to exceed $4,500,000; or, if both tracks of the tunnel were located under 60th St. instead of one through 59th St. and one through 60th St., as originally planned, for a maximum of $4,000,000.

It will be necessary for the city to prepare plans and specifications and advertise for bids for the tunnel construction; but Mr. Degnon's agreement to submit a bid not exceeding that amount in case such plans are adopted furnishes a guarantee to the city as to the maximum cost. Including interest charges on each of the works while under construction, the cost of dredging in connection with the tunnel and some other items, it is estimated that the additional cost of the tunnel plan over the bridge plan would be about $2,500,000.

The Public Service Commission, which had the matter under consideration in the spring, decided in favor of the bridge plan. The Board of Estimate, however, at the meeting referred to, reached a contrary decision and adopted resolutions notifying the Public Service Commission that it was ready to provide funds for proceeding with the tunnel plan. The arguments which have influenced the Board of Estimate in its decision in favor of the tunnel plan are that in view of the rapid increase in motor trucks and the rapid growth of Long Island City as a manufacturing district, as well as in population, the full capacity of the Queensboro Bridge will eventually be needed for vehicle traffic, and no more railway tracks should be placed upon the structure.

There is, further, a considerable operating economy in hauling subway trains through a tunnel under the river rather than across a bridge over it. The subway tracks are normally 20 to 30 ft. below the street level; and in order to rise from this level and pass over a bridge about 150 ft. above the water, power must be expended to lift the train the whole distance, and grades of over 5% must be used. In passing through a tunnel under the river, on the other hand, the vertical descent is very much less than the rise required to cross the bridge. Furthermore, the momentum gained by the train in running down the grade of one approach accelerates it without any consumption of power, and in ascending the grade on the opposite side the opposing grade serves to slacken the train's speed as it approaches the station.

Sanitary Engineering Bureau for Illinois

The Illinois Sanitary Engineering Bureau has been organized recently as a department of the State Board of Health, appropriations amounting to $11,550 per annum having been made to the board at the last session of the state legislature. This is the result of an active campaign by Dr. G. St. Clair Drake, secretary and executive officer of the board. The items provided in the bill are as follows, all except the last being annual amounts: Chief sanitary engineer, $3600; two assistant engineers, $1200 each; stenographer and clerk, $900; office and laboratory supplies, postage and expenses, $1750; traveling expenses, $1500; fixtures and other equipment for office and laboratory, $1400.

Plans for work which will be undertaken at the outset have been discussed only briefly, but the board has already received a large number of requests for advice and counsel on matters pertaining to sewer installations, garbage-disposal plants and sanitary investigation of school houses, the latter made necessary by a law recently enacted. It is desired also to formulate rules and regulations to govern the sanitary conduct of construction camps, summer resorts, picnic groves, and state and county fair grounds.

For the purpose of promoting the immediate organization of this new bureau, the State Board of Health has the services of Paul Hansen, Engineer of the State Water Survey, who will take a leave of absence from his present position long enough at least to develop this new service of the board. Eventually all positions in the bureau will be filled through competitive test conducted by the Civil Service Commission.

Progress on Hell Gate Bridge, New York City

The accompanying views show the Hell Gate bridge of the New York Connecting R.R. at one of its most interesting stages of construction. As these photographs were taken a very particular operation was being carried out by the erection forces of the American Bridge Co.

The two halves of the arch are erected as cantilevers, with temporary backstays holding them up, as shown in the sketch in *Engineering News,* Jan. 8, 1914, p. 62, and Apr. 8, 1915, p. 698. The east or Astoria end of the bridge has been erected for seven panels—about 300 ft.—with a backstay hitched to the end pin of the top chord (see *Engineering News,* Apr. 8, 1915, pp. 698 and 699).

For the rest of the half-arch a backstay leading over a higher point of support and hitched to the fifth panel point of the top chord is to do duty. The second backstay has been completed during the last few weeks, and



FIG. 1. EAST OR LONG ISLAND END OF HELL GATE ARCH ACROSS THE EAST RIVER AT NEW YORK CITY

on July 22 and 23 the load was transferred to it from the first backstay. At the time the view in Fig. 1 was taken a gang of men was at work driving out the last pin of the lower backstay.

On top of the new backstay supports and under the saddles of the second backstay were set two enormous hydraulic jacks, each of 2400 tons lifting capacity. The jacks were operated to lift the saddles until the short lengths of eye-bar which made the hitch of the first backstay were slacked off. As computed beforehand, this required a jack lift of about 20 in.

The eye-bars were watched, and they became slack at a lift within a fraction of an inch of the computed amount. Then the eye-bar pins were driven out, the upper saddles being blocked in position with plate blocking. There were eight eye-bars to each truss, four inside the chord and four outside, but both pins came out with no special difficulty.

The jacks will be used again in making the closure of the arch at the center.

The west or Ward's Island end of the arch is now three panels out, and the upper backstay is being erected. This end has reached about the same stage of construction as the east end had when the views in *Engineering News*, Apr. 8, 1915, were published. Work will be pushed until this end is as far along as the east end, and then both will be built forward to the center, and the two halves of the arch lowered to connection. The present season will see the arch closed at the crown. The viaduct approach from the west is nearing completion as shown in Fig. 3.



FIG. 2. THE HELL GATE BRIDGE ON JULY 23, 1915



FIG. 3. THE WEST APPROACH OVER WARD'S ISLAND

Cleveland to Have New Railway Terminal Facilities

The Cleveland, Akron & Canton Terminal Railway Co., backed by O. C. Barber, has received a franchise from the Cleveland City Council to build a subway from the lake to the southerly limits of the city, passing under E. 55th St. It is estimated that the proposed tunnel will involve an expenditure of $10,000,000 and will require seven years to construct. The plans contemplate the building of factories along the line of the tunnel, with direct connections to them from the tunnel line. The company has made contracts with the Osborne Engineering Co., of Cleveland, and the Foundation Co., of New York, to prepare plans for the subway, the freight stations, and the lake-front development at the foot of E. 55th St.

The City Council has also granted to the Cleveland & Youngstown Railway Co. a franchise to create a great freight terminal in the lower Broadway district. Some forty city streets will have to be vacated to make the terminal a possibility. The franchise ordinance has now been signed by the mayor, who withheld his approval until the company agreed to an amendment providing for electric traction. The adoption of such traction, however, is conditional upon its use by the railways with which the new line will connect. It is proposed also that the company should be required to build a union station on the Mall.

Cutoff at Camden Bend on the Missouri River

Near Camden, Mo., about 30 miles east of Kansas City, the Missouri River makes a long horseshoe bend. The length of the river channel around this bend is about 11½ miles, and the distance across the neck of the bend is only about 2 miles. During the recent high water in the Missouri, the river spread over the bottom lands and cut across the neck of the bend a channel through which practically the entire flow of the river is now passing. The average fall of the river is about 0.8 ft. per mile. The fall in the new channel across the neck of the bend is stated to be about 8 ft. This steep slope gives the water flowing through the cutoff a high velocity, and it is impossible for boats ascending the river to breast the rapid current.

A steamer belonging to the Kansas City & Missouri River Navigation Co., which was returning from St. Louis towing a barge, attempted to navigate the old channel around the bend. When it arrived at the upper end of the cutoff the strength of the current passing into the cutoff tore the barge free from the steamer, and it was carried down through the cutoff. The steamer turned back downstream and finally overtook the barge 22 miles below the point where it had broken loose.

About $80,000 worth of bank revetment work has just been completed by the government engineers along the Camden bend; and should the river maintain permanently its new location, this work will be useless. It is stated that at one time the land owners in the vicinity offered to obtain the right-of-way and present it to the Government if it would excavate a channel across the bend which the river has now made for itself. This is in accord with the well-known belief among laymen in the Missouri and Mississippi valleys that the way to regulate these great rivers is to cut off all the bends and make a straight course for the stream. The government engineers, of course, refused the offer, pointing out to those that made it that such a cutoff would undoubtedly cause destructive changes in the channel of the river above and below, to say nothing of the injurious effects upon navigation.

Track Subsidence on the Erie R.R. at Dunmore, Penn., caused three freight cars to sink 12 ft. into a coal-mine drift of the Pennsylvania Coal Co. The zone of settlement included three tracks of the line for a distance of about 100 ft., the depth being 12 ft. throughout this length. The hole was filled with ashes.

The Derailment of an Electric Car on the International Ry. at Queenstown, Ont., July 7, which caused the death of 15 persons, has been investigated by a coroner's jury. According to the testimony of the motorman of the derailed car, the usual speed in passing over the sharp curve where the derailment occurred was from three to four miles an hour. He estimated the speed as about 30 mi. an hour when the derailment occurred. The brakes worked all right, but the wheels skidded. He did not know whether there was sand in the sand boxes or not, said it was not customary to use sand in warm weather, and in any event the sand boxes were so located that they would not discharge sand on the rail at a sharp curve. When the motorman realized that the wheels were skidding, he released the air brake and reversed the motor, trying to stop the car by that means. But the trolley had come off the overhead wire and the attempt was ineffectual. Bearing on the overloading of the car at the time of the accident, the conductor said he had taken up 157 tickets before the car went off the tracks.

One of the Worst Marine Disasters ever recorded occurred in Chicago on Saturday morning, July 24, when the excursion steamer "Eastland" capsized while lying in the Chicago River alongside a wharf. About 2500 passengers had gone on board the boat, most of them employees of the Western Electric Co., for a day's excursion. The boat gradually listed over away from the wharf, finally snapped the hawsers securing her, and turned over on her side, precipitating the passengers, a large proportion of whom were on the upper deck, into the river. Up to 11 p.m. on July 25, 826 bodies had been recovered and the total number of missing, reported and estimated, was 691. Counting all the missing as lost, this makes the total casualties 1517. The "Eastland" was a steel hull lake vessel built in 1903, 265 ft. long, 38 ft. beam, with a draft of 23 ft. and a net tonnage of 1218. It was used for several years in excursion business from Chicago to South Haven, Mich., and was for five years in excursion service at Cleveland. Reports state that the vessel, which was built with fine lines for high speed, had been criticized by lake shipping men for its lack of stability, and that extensive alterations were made on the boat last winter to remedy this defect, the upper deck and staterooms being removed. It had been in service this season from Chicago across Lake Michigan to St. Joseph, Mich. Investigations of the accident are in progress by the Department of Commerce and Labor, under the personal direction of Secretary Redfield, by a coroner's jury, and by a federal grand jury.

A Building Lot Sale by the Government in the new town of Anchorage, the southwestern terminus of the Government railroad now under construction in Alaska, netted $133,000. The lots averaged 60x140 ft. and the price realized was about $300 per lot, or $1600 per acre. Three months ago a dozen pioneers constituted the population of Anchorage. On June 1 its population was estimated at 2500.

Reduction of the Engineering Staff of the Pennsylvania State Water Supply Commission has been made necessary by the failure of the legislature to pass an appropriation bill for $60,000 to continue the work of the commission's inventory department. The 1913 legislature appropriated $50,000 for the making of an inventory of the state's water-power resources. The sum of $60,000 was asked for from the 1915 legislature, but this was cut by the legislature to $15,000 and by the governor to $7500. Only two employees, and those are clerks, are to be retained. The engineer employees, 13 in number, including Farley Gannett, chief engineer, have been allowed to resign.

Sewage Disposal at Detroit and elsewhere along the Detroit River is being studied by H. C. McRae for the United States Public Health Service, acting under the direction of Prof. Earl B. Phelps in behalf of the International Joint Commission. In collaboration with Mr. McRae, studies of the sewage-disposal problem of Detroit are being made by Clarence W. Hubbell, Consulting Engineer for the Department of Public Works on Sewerage Investigations. Mr. Hubbell is considering various possible sewage-treatment schemes for Detroit, which may be summarized as follows: (1) Numerous small plants at some of the 53 sewer outlets into the river; (2) a smaller number of plants; (3) one plant for the whole city. The studies are taking into account typhoid statistics and other related data.

A Union Station for Kansas City, Kan. (across the river from Kansas City, Mo.) is proposed under a 200-year franchise for the Kansas City Terminal Railway Co., of Kansas City, Mo. Whether there shall be one or two union stations (the latter providing for two groups of roads) is to be decided by public vote. The franchise provides also for a four-track elevated structure from Armourdale to the union station, with a double-track extension to the Rock Island Lines. This is to keep the main-line traffic clear of the switching and industrial traffic in the West Bottoms. Three viaducts across the tracks are provided for, and if the Metropolitan Street Railway Co. builds tracks across these it is to pay either 50 or 66% of the cost (this proposition has not yet been agreed upon). Other provisions include a union ticket office in the city, a freight station handling freight independently of the station on the Missouri side, and agreements as to switching changes. If the franchise is accepted by the city commissioners it will be submitted to public vote at a special election.

A Reform in Federal Building Construction is inaugurated in an order issued by Secretary McAdoo on June 29 to the Supervising Architect of the Treasury Department. Heretofore the amount spent in building a post office or custom house has depended much more upon the energy and political strength of the Congressman from the district in which the building was to be located than upon the needs of the Government. The result has been the erection of costly and elaborate stone buildings in country villages, while localities where improved facilities were greatly needed received inadequate buildings or none at all. It is said that many post-office buildings have been erected at a cost of $50,000 to $150,000 in towns where the total postal receipts would not pay the cost of maintaining the building after completion. Under the order recently issued post-office buildings are divided into four classes—A, B, C and D. Class A buildings may be erected in places where annual postal receipts are over $800,000. Such buildings are to have marble or granite facings and to be fireproofed throughout, and when the locations for the buildings justify it they are to have elaborate architectural decorations. Class B buildings may be erected in cities having postal receipts of from $60,000 to $800,000; they are likewise to be fireproofed throughout, but to have limestone or sandstone facing and less expensive interior finish and decoration. Class C buildings are to be erected in towns having postal receipts of from $15,000 to $60,000, and are to be of brick with stone or terra-cotta trimmings. The floors are to be fireproof, but the roof not necessarily so. Finish and decoration are to be more inexpensive than for class B buildings. Class D buildings are designed for towns having less than $15,000 annual postal receipts. Such buildings need have only the first floor fireproofed, and should be structures which business men would consider a reasonable investment. Plans of buildings hitherto constructed are to be used in designing if they are consistent with the foregoing requirements. Standard specifications and standard details are to be prepared to economize in architectural and engineering work in connection with such buildings. The policy outlined has already been followed by the Treasury Department in the purchase of post-office sites. Of 303 sites for Federal buildings authorized Mar. 4, 1913, only 136 have so far been acquired, and the department has limited its purchases to towns where construction of a federal building is justified.

PERSONALS

Messrs. John A. O'Connor, Assoc. M. Am. Soc. C. E., and Arnold G. Chapman, Assoc. M. Am. Soc. C. E., of Albany, N. Y., have been appointed Executive Engineers of the Flood Abatement Commission of Olean, N. Y.

Mr. Edward E. Krauss, who recently retired from the position of Secretary of the American Concrete Institute, has become District Sales Manager, at Philadelphia, for the Penn-Allen Cement Co., of Allentown, Penn.

Mr. John A. Ferguson, Assoc. M. Am. Soc. C. E., recently Engineer of the Bureau of Building Inspection, Department of Public Safety, Pittsburgh, Penn., has been appointed Engineer and Secretary of the Pittsburgh Building Code Commission.

Mr. Prevost Hubbard, Assoc. Am. Soc. C. E., formerly Chemical Engineer in Charge of the Division of Roads and Pavements of the Institute of Industrial Research, Washington, D. C., has been appointed Chief of the Division of Road Material Tests and Research of the United States Office of Public Roads and Rural Engineering.

Mr. H. L. Beatty has been elected President and Mr. A. O. Beatty, Vice-President of M. Beatty & Sons, Ltd., Welland, Ont. Mr. Harris T. Dunbar, of Buffalo, has been elected a member of the Board of Directors. Messrs. V. R. Browning and B. F. Miles, Directors, and R. A. Greene, M. Am. Soc. M. E., General Manager, have resigned from the company.

Mr. W. E. Moore, Fellow Am. Inst. E. E., Vice-President and General Manager of the West Penn Traction Co., Pittsburgh, Penn., has resigned in order to devote his entire time to consulting engineering practice covering power plants and transmission, car shops and railway engineering; he will also undertake appraisals, property examinations for financing purposes, problems arising from public service regulations and advisory work in connection with public utility management.

Messrs. R. F. Wagner and Carl Monniche have formed a partnership under the firm name of Wagner & Monniche, Designing and Construction Engineers, with offices in the Krise Building, Lynchburg, Va. They will specialize in structural work in both steel and reinforced concrete. Mr. Monniche was for several years Assistant Engineer with the Isthmian Canal Commission on the design of the Balboa and Cristobal terminals. Mr. Wagner was also with the Isthmian Canal Commission in the Division of Fortifications.

OBITUARY

William B. Taylor, a civil engineer employed in the New York Sewer Department, committed suicide July 22.

Robert E. Bustard, Superintendent of Roads of Passaic County, New Jersey, died at St. Luke's Hospital, New York City, on July 19 in his 54th year.

Sir Sanford Fleming, Hon. M. Can. Soc. C. E., one of the oldest and most famous civil engineers of Canada, died July 22, in Halifax, N. S., aged 88 years. From 1871 to 1880 he was Chief Engineer of the Canadian Pacific Ry.

C. Lee French, Superintendent of the Cumberland division of the Baltimore & Ohio R.R., died at Atlantic City on July 18, 48 years of age. Mr. French had been suffering from anemia, and after undergoing a series of blood transfusion operations went to Atlantic City two weeks ago in an endeavor to fully regain his health.

Joseph Strawhorn, Superintendent of the St. Paul (Minn.) Union Depot Co., died at the Bethesda Hospital in that city on July 12, 51 years of age. Mr. Strawhorn was appointed Superintendent in 1903. Later he was Superintendent of the St. Paul Bridge & Terminal Co., and was reappointed Superintendent of the Union Depot Co. in 1912.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
Aug. 16-18 and 25-28. Annual meeting in Los Angeles, Calif., Aug. 16-18; in San Francisco, Aug. 25-28. Secy., J. C. Olsen, Cooper Union, New York City.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Aug. 24-27. Annual convention in Cincinnati. Secy., Clarence R. George, Houston, Tex.

NEW ENGLAND WATER WORKS ASSOCIATION.
Sept. 7-9. Convention in New York City. Secy., Willard Kent, Narragansett Pier, R. I.

TRAVELING ENGINEERS' ASSOCIATION.
Sept. 7-10. Annual meeting in Chicago. Secy., W. O. Thompson, N. Y. C. R.R., East Buffalo, N. Y.

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

Illuminating Engineering Society—At the ninth annual convention of the Illuminating Engineering Society, which is to be held in Washington, D. C., at the New Willard Hotel, Sept. 20-23, a session will be devoted to the subject of street lighting. At this session will be discussed gas lighting, arc lamps, new types of incandescent lamps, and ornamental street lighting. There will be ten sessions in all, with inspec-

tion trips and a reception and banquet among the entertainment features. The headquarters of the society are at 29 West 39th St., New York City.

Appliances and Materials

Equipment for Sand Photomicrography

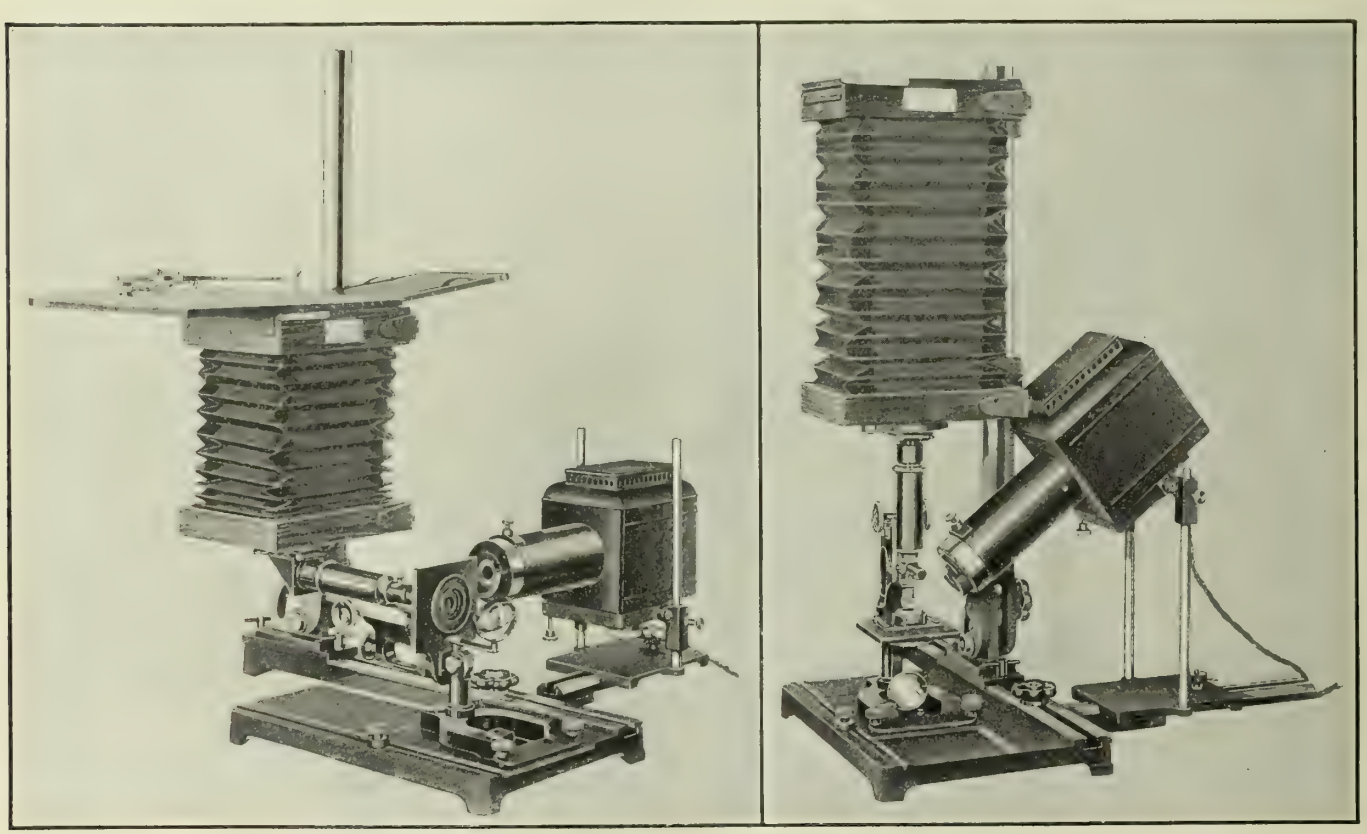
A summary of a paper by N. C. Johnson, entitled "Microstructure of Concrete" before the American Society for Testing Materials was given in "Engineering News," July 8, 1915. The photomicrographic apparatus used in Mr. Johnson's investigations was designed by the Bausch & Lamb Optical Co., of Rochester, N. Y., and is now generally available for concrete testing and investigation.

The apparatus, as illustrated, is assembled on a heavy cast-iron base, one side of which is extended to form a 25-in. milled bed, along which the optical bed carrying the camera may be adjusted. This 25-in. bed is graduated to 60 cm., and has a joint by which it may be inclined and clamped in any position between the horizontal and vertical. The camera-bellows frames have supports which are adjustable along the optical bed and for centering the camera with the microscope. A plate that slides along the base carries clamps to hold the microscope and has two adjustable lugs that permit the removal and return of the microscope without recentering.

The microscope, as illustrated, may be used in either a horizontal or vertical position, the former bringing the ground glass of the camera to a more convenient height for focusing and permitting the full length of the bellows to be utilized. Illumination is furnished by a 250-watt concentrated-filament tungsten lamp and reflector in a housing on two vertical rods projecting from a plate which is adjustable along an optical bed. For oblique illumination of the specimen the bed pivots about the camera-base lock and the lamp-house slides along the vertical rods and tilts on its blocks. The lamp-house, with base and supports, may be removed from the optical bed and used for visual work with the microscope alone. In this case the light is directed obliquely upon the object or from a vertical illuminator. When transparent objects are being examined, the light may be trained upon the mirror under the microscope stage. Photomicrographs of thin sections may be made in similar fashion. At the front of the lamp-house is an extension tube carrying a system of condensing lenses, an iris diaphragm for controlling the size of the beam of light and holders for a ground glass or ray filter.

For the estimation of the proportions of sand, water, cement and stone entering into a specimen of concrete, the planimeter is essential, and an attachment, shown in the view at the left, accommodates the instrument. The attachment is substituted for the focusing screen of the camera and consists simply of a circular ground glass set into a wooden slab. Upon this table runs the planimeter by which the areas of the ingredients, projected upon the ground glass by the microscope, are integrated. The proportion by volume is readily calculated from the areas thus obtained.

Accessories which may be obtained with this outfit comprise a mechanical stage for the systematic examination of the specimen, a specimen mounter, a planimeter attachment, and a lens for the photography of large specimens with the camera alone.



APPARATUS FOR PHOTOMICROGRAPHY OF SAND AND CONCRETE

* * *

Heat Insulation Bricks

A new light nonconductor brick is being made for boiler and furnace settings, breechings, stocks, kilns, ovens, etc., by the Armstrong Cork Co., of Pittsburgh, under the trade name "Nonpareil." Similar insulating bricks have been made in Europe for several years. In making these bricks a mixture of diatomaceous earth, clay and ground cork is molded, dried and fired. The cork is entirely burned out. Each brick is 9x4½x2½ in. and weighs 1½ lb. The conductivity is reported to be 0.5 (B.t.u. per sq.ft. per in. per deg. per hr.), compared with about 5 for firebrick. The material is nearly pure silica and will withstand relatively high temperatures, but it is not intended as a refractory lining. It is recommended as a backing for firebrick, etc. The bricks are laid in a special cement composed of diatomaceous earth and binder. The cost of these bricks is about $36 per M.

* * *

New Steel Pole

A new design of latticed steel pole for electric transmission or distribution lines has recently been marketed by the Carbo Steel Post Co., of Chicago. It is formed by two two-angle flanges riveted over the ends of diagonal lattice bars. The poles are intended to be buried about 4 ft., and below ground are double diagonal lattice bars and a heavy horizontal distance piece. Each flange rests on a triangular foot plate, to each corner of which it is connected by an angle brace.

High-carbon steel is used. It is claimed that the first cost of these poles is about equal to wood but that only half as many are needed on most lines.

Engineering News

VOLUME 74 AUGUST 5, 1915 NUMBER 6

An Ornamental and Cheap Concrete Bridge

By R. C. Hardman*

A reinforced-concrete viaduct that presents some more or less unusual features has recently been completed at Cañon City, Colo. Among these features, aside from the smallness of the city for which the work was done, was the low cost of the structure—approximately $1.40 per sq.ft. of roadway and walk.

Cañon City, having a population of 5162 in 1910, is situated in the center of a large apple-growing territory along the Arkansas River at the mouth of the famous Royal Gorge of the Arkansas. On the south bank of the river is South Cañon, Prospect Heights and Lincoln Park, with a tributary population of some 2000 persons. The river is spanned by three steel highway bridges. In an attempt to draw traffic, and incidentally business, from the tributary population to the old portion of the city, the taxpayers organized an Improvement District and voted bonds for the construction of the viaduct. Thus the structure was built for business reasons rather than from necessity.

The viaduct extends over an old swampy river bed, an alley, a large power and irrigation canal, the main line of the Denver & Rio Grande R.R., a small unused irrigation ditch, a roadway, the main line and three sidings of the Atchison, Topeka & Santa Fe Ry., joining a steel river bridge at the south end.

The structure has a roadway 23 ft. 11 in. in width between curbs and one sidewalk 4 ft. 11 in. in width. A vertical clearance of 26 ft. is provided over the Denver & Rio Grande and 23 ft. over the tracks of the Atchison, Topeka & Santa Fe. The north end, 27 ft. of which is an earth fill between retaining walls, has an ascending grade of 5.94% for a distance of 262.67 ft. Over the Denver & Rio Grande the grade is level for a distance of 65 ft., followed by 208.83 ft. of a 1.39% descending grade, which in turn connects with the river bridge by a descending grade of 8.11%, 255.5 ft. in length. The river bridge, a Pratt truss 105 ft. long, was raised 5 ft. at the north end in order to reduce the gradient of the connecting viaduct. The last 50 ft. of the 8.11% grade is an earth fill between retaining walls, from which an earth descent on a 10% grade affords access to the level of the tracks and roadway.

The total length of the viaduct is 742 ft., of which 665 ft. is of concrete and 77 ft. is earth fill. The structure is of a girder-and-slab type, which was selected in order to secure the required clearance over the railroad tracks for the full width of the rights-of-way without entailing the steeper approach grades which an arch type would have necessitated. No uniform length of span was feasible because of the fixed points at which so many of the piers were best located. The spans vary in length from 27 to 44 ft. for the regular spans, with one of 60 ft. and one of 65 ft. over the railroad tracks.



FIG. 1. REINFORCED-CONCRETE VIADUCT AT CANON CITY, COLO.
North end is to the left

The committee having charge of the building of the viaduct desired it to have as massive an appearance as possible compatible with low cost. For this reason the type of support shown in Fig. 2 was selected instead of the usual slender, heavily reinforced column. As will be seen, the support, or pier, consists essentially of three plain concrete posts joined at the top by semicircular arches, also unreinforced. These posts, which are 4x5

*307 Cheyenne Boulevard, Colorado City, Colo.

ft. in plan in four piers and 4x4 ft. in eleven piers, have battered bottoms resting upon a footing carried to an underlying bed of boulders at depths of from 3 to 9 ft. All piers were constructed before any superstructure was placed.

The superstructure is of the girder-and-slab type designed for a loading of 100 lb. per sq.ft. of roadway and walk, or a 15-ton road roller. The railroad rights-of-

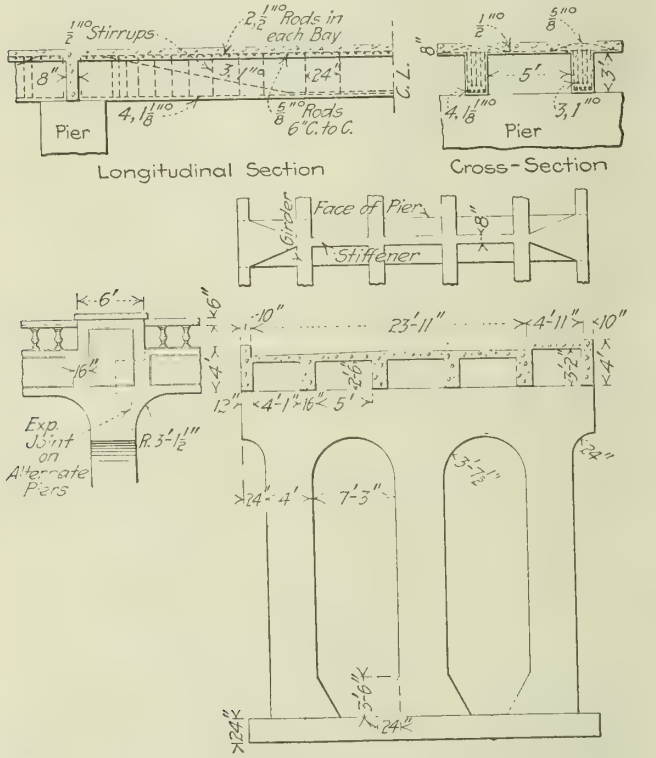


FIG. 2. DETAILS OF TYPICAL PIER AND GIRDER SPAN OF CANON CITY VIADUCT

way are spanned by steel plate-girders carrying a concrete floor-slab as shown in section in Fig. 3, in which a unique lateral stiffening was carried out. The outside girders in each span were incased in concrete on one side only, to conform in architectural treatment to the remainder of the structure. The method by which this was accomplished is clearly shown in Fig. 3.

Typical sections of the concrete spans, which present nothing unusual, are shown in Fig. 2. The placing of the girders on the piers is unique in that all piers are essentially free except for the meager bond between old

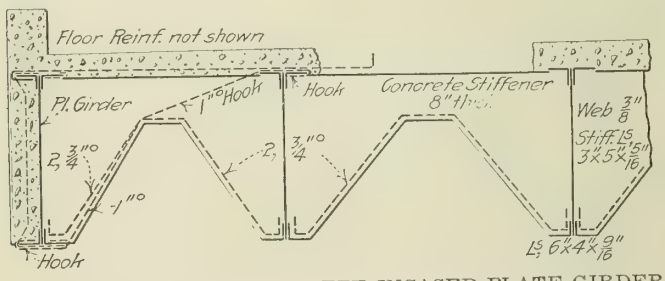


FIG. 3. DETAILS OF CONCRETE-INCASED PLATE-GIRDER

and new concrete, as no reinforcement was used to tie the pier and girder together.

In the construction of forms no timber heavier than a 2x4 was used for the piers, although continuous pouring of concrete to a height of 31 ft. was accomplished. For shoring doubled 2x4's and 2x6's were used with lateral and diagonal bracing of 1x6's and 1x8's. The forms for the girders were built complete on the ground. They were then hoisted by means of one gin-pole, placed in position on the piers, spaced and braced. Each girder form being entirely self-supporting, the floor joists and lagging was next placed, the shoring-up being left until the end.

As the amount available for the structure was limited, the keynote of the viaduct was simplicity in every detail, with a minimum of costly architectural treatment. Practically the only architectural treatment consisted of a few segmental haunches, paneling of the outside girders and a cast balustrade, neither of which was costly. There being no difficulties of design, the only problem was to obtain a combination of massive appearance with beauty and low cost. The degree of success attained may be judged by the accompanying view of the structure.

The bridge was designed and built by the writer as engineer for the Central Construction Co., of Colorado Springs, Colo.

As the site was examined, plans and details made, estimate prepared and contract let in but ten days' time, the viaduct will not, perhaps, stand as a model of engineering design, as many little refinements could well have been introduced had time permitted. However, as an example of what can be done for a comparatively low cost, it may merit this description.

Load Tests on Brick Piers*

The crushing strength of brick piers of large size is under investigation by the Bureau of Standards in Pittsburgh, Penn. So far more than 22 piers have been tested. As nearly as possible each pier was 30 in. square by 10 ft. high, except two piers which were built 5 ft. high. Each pier averaged 44 courses. The joints were about $\frac{5}{16}$ in. thick. The qualities of brick used, kinds of mortar, ages of piers and results of tests are tabulated in Fig. 1. Three typical styles of bonding were selected for test—header every other course, every fourth course and every seventh course; thus there were three types of bonding for each set of piers. One of the 5-ft. piers had steel-mesh reinforcing placed in every horizontal joint; the other, every four courses; but the results obtained were inconclusive (see Conclusion No. 7).

Method of Test

Each pier was constructed in the laboratory on a steel plate 1 in. thick, leveled on the floor. The plate surface which was to rest on the base of the testing machine was planed. A plate $1\frac{1}{2}$ in. thick, with eye-bolts for crane connections, was laid on the top of the finished pier, connected with the baseplate by four vertical rods, so that the piers could be lifted easily and set in the testing machine without injury. The top plate was removed after the pier was in place. The pier was leveled, the top covered with a thin coat of plaster of paris, and the head of the machine brought down, squeezing out superfluous material. The pier was then left for several hours to

*Abstract of paper by J. H. Griffith and J. G. Bragg, Bureau of Standards, Pittsburgh, Penn., presented before the recent meeting of the National Brick Manufacturers' Association. It is based on an investigation being conducted by the Bureau of Standards in Pittsburgh to determine the physical properties of large piers when tested to destruction. The investigation was inaugurated by the N. B. M. A. under its Committee on Technical Investigations (Prof. Edward Orton, Chairman) and was taken up in coöperation with the Bureau of Standards through Prof. A. V. Bleininger, Ceramic Chemist, who acted in an advisory capacity in the conduct of the work.

allow the plaster to set. Measurements of compression were made at several corners, as were also transverse measurements and strains between bricks.

As shown in Fig. 1, bricks laid up in cement mortar stood up best. Cement-lime mortar gave almost as good results. Piers using lime mortar were only about one-half as strong as those with cement; but it should be noted that vitrified brick laid up in lime mortar withstood a pressure of more than 1400 lb. per sq.in. The weakness of these piers was caused mainly by an almost entire lack of carbonation of the mortar on the interior, rather than by any special inefficiency of lime mortar when properly aged.

Characteristic Failure of Piers

At about three-fourths maximum load vertical haircracks began to appear. With continued loading the piers broke up into vertical laminations. This condition was induced by the bending of the individual bricks, causing them to split transversely. The bending is the result of nonuniform bearing proceeding from lack of homogeneity of texture in the pier, in an individual brick or in the mortars.

The progressive action of this cracking is most interesting. Sometimes very early in the test small haircracks formed in the upper or lower surface of a brick, usually just under or near the vertical joints, and widened at the surface as the load increased. Finally, subdued sounds

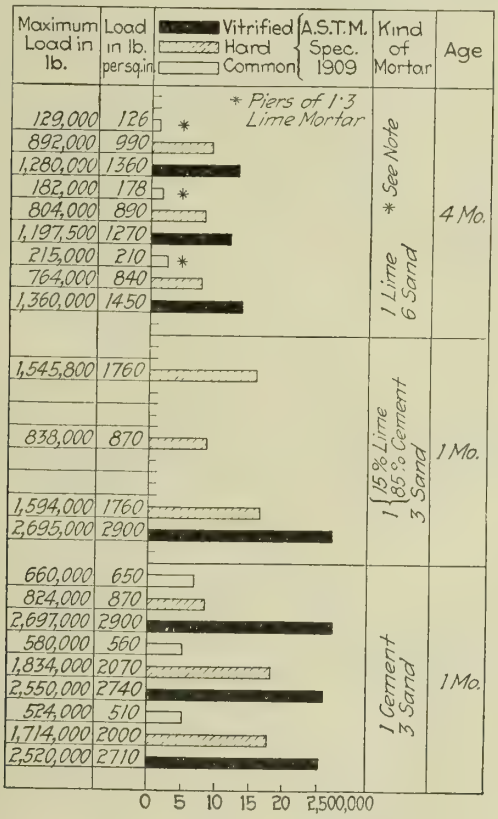


FIG. 1. DATA OF LOAD TESTS

were heard, which increased in volume until, in the case of vitrified and hard-burned brick laid up in lime mortar, a succession of popping sounds occurred, frequently increasing until the sound became a loud "bubbling" in the final stages. When a brick split, the ones above and below tended to do the same, until the structure became a succession of strips, and failed either by spalling out in large masses or as a group of thin, isolated columns.

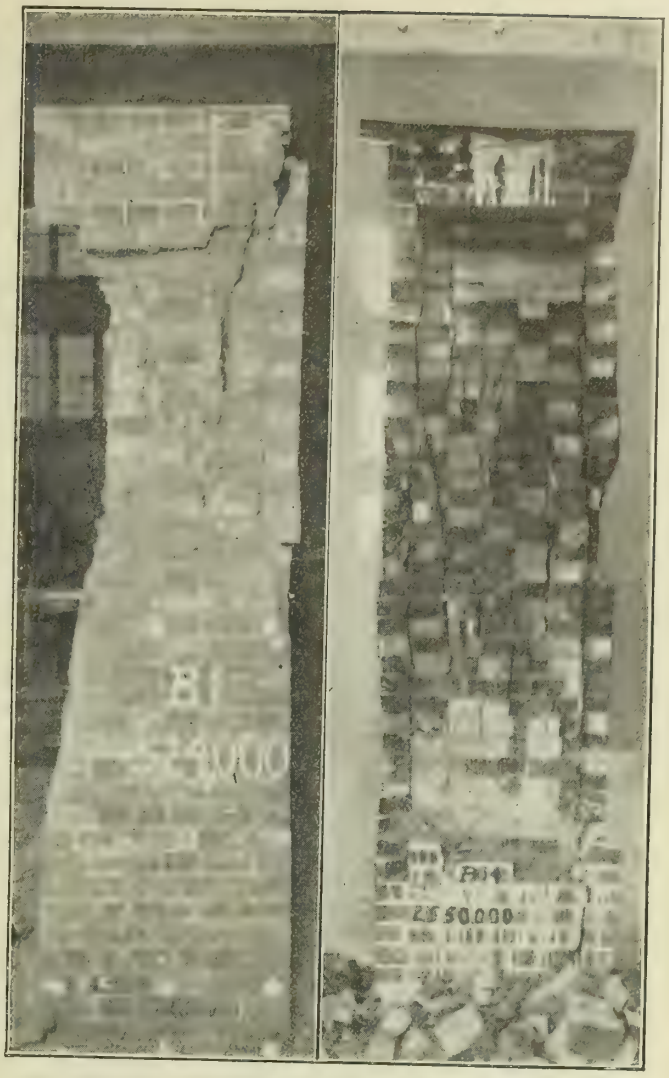


FIG. 2. FAILURE BY SPALLING (LEFT) AND BY VERTICAL CLEAVAGE (RIGHT)

Left—Common brick—cement mortar 1 : 3; maximum unit load, 580 lb. per sq.in. Right—Vitrified brick—cement mortar 1: 3; maximum unit load, 2833 lb. per sq.in.

The following are the main conclusions reached in the investigation:

(1) The strength of piers under vertical loading bears a close relation to the kind of brick used and the quality and age of the mortar.

(2) The low strength of piers laid in lime mortar is attributed in the main to insufficient aging, with a consequent lack of a proper carbonation of the mortar.

(3) Experiments seem to indicate that the strength of a pier is largely independent of the course bonding. The real function of bonds is to maintain a certain integrity and monolithic action of the masonry against initial strains induced through setting and "drying out" of the mortar rather than to give any great increase of vertical strength.

(4) The elastic limit of the piers laid up in cement and cement-lime mortar was approximately one-half the maximum load.

(5) Piers fail through a tendency to separate into vertical strips caused by bending failure in the individual brick produced by unequal distribution of the vertical load over the cross-section. This is aggravated by ineffective shearing and adhesive strength of the mortar.

(6) A high modulus of rupture of the brick is more desirable than superior crushing strength. Higher modulus of rupture would be realized in practice by increasing the thickness of the bricks or by laying them on edge.

(7) A further study of the action of steel-mesh reinforcing in the horizontal joints is recommended in order to ascertain the load efficiency of piers having an outer shell of hard brick with an inner core of softer brick. This construction would be used where a high-grade brick is not easily obtainable.

Sixty-Seven Breaks in a Cast-Iron Water Main

By C. E. Davis*

Sixty-seven breaks have occurred since 1893 in the 30-in. cast-iron main known as the Hartwell Ave. line of the Philadelphia water-works. This main is about 2½ miles long and delivers water from the Roxborough high-service standpipe to Chestnut Hill.

Over a large part of its length the pipe line is laid in unimproved country road, and it is nowhere subjected to heavy or frequent traffic. There has been no disturbance from adjacent excavations, nor has there been any settlement or yielding of the ground in which the line is laid. The pipe has a comparatively light cover of earth and is probably quickly affected by temperature changes.

A parallel main to the Hartwell Ave. line, drawing likewise from the Roxborough standpipe and leading to Chestnut Hill, is laid on Rex Ave. The accompanying profiles show the heads under which the two mains are operated. The Hartwell Ave. profile shows the locations of the several breaks.

The Rex Ave. line was laid in 1902 and has given no trouble. The Hartwell Ave. line, as before stated, has broken 67 times since it was laid in 1893. Both mains are operated under the standpipe head indicated on the profile, and under normal conditions this standpipe is directly connected with the discharge from the pumping station. The mains feed substantially the same distribution system at Chestnut Hill and are cross-connected.

The Hartwell Ave. pipe was furnished by the Reading Foundry & Machine Co., which discontinued the manufacture of pipe a number of years ago. The specifications under which it was manufactured are not available, and no record of tests of the pipe is extant. The thickness of the metal in the body of the pipe appears to be about what is called for under present standard specifications for the head under which it is operated.

The direct cause of these numerous breaks appears to be a poor quality of cast iron, as indicated by the following typical analysis, in which special attention is called to the high phosphorus:

Silicon, 1.85; sulphur, 0.097; manganese, 0.361; phosphorus, 1.33; combined carbon, 0.526; gr. carbon, 2.756; total, 3.282.

Some significance should be attached to the fact that in a distance of one thousand feet easterly from the Wissahickon Creek no breaks have occurred. An analysis of the iron in the pipes laid in this section is not available, but an external examination indicates that it is of a better quality than in the sections where the breaks have occurred. Reports from workmen replacing the broken pipes corroborate the conclusion that the iron is inferior in quality. These reports are invariably to the effect that the pipe is easily broken up.

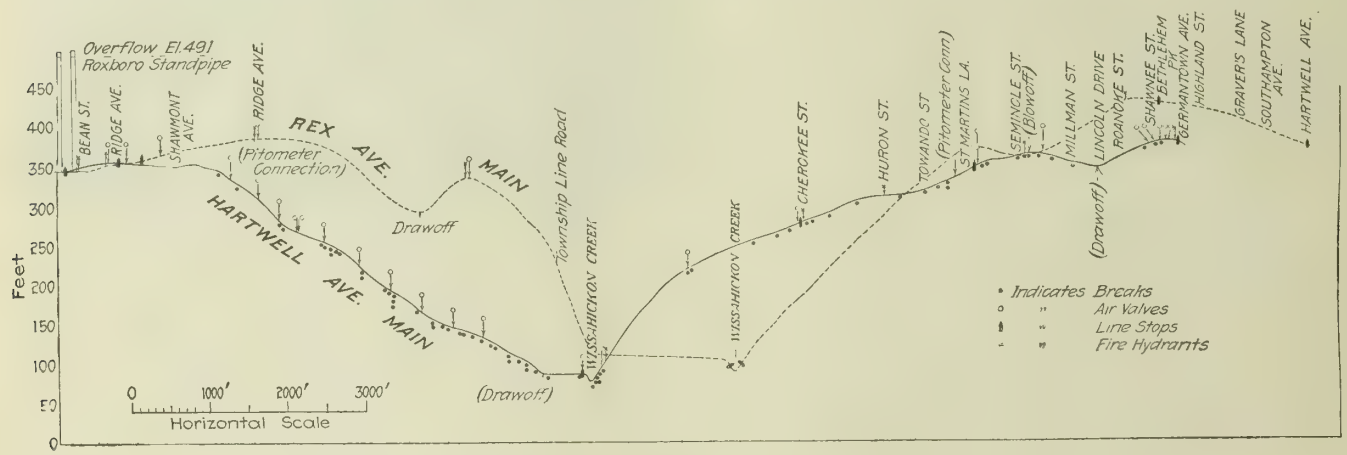
No particular significance can be attached to the character and location in the individual pipes of the several fractures, except that these still further corroborate the conclusion that the metal is poor. Frequently, a piece is found broken out bodily from the barrel of the pipe and entirely freed from the rest of the casting.

The following table gives a record of the 67 breaks by years since the pipe was laid and by months of the year:

BREAKS IN HARTWELL AVE. WATER MAIN

Year	Breaks	Year	Breaks	Month	Breaks
1894	3	1905	4	January	9
1895	5	1906	2	February	8
1896	5	1907	2	March	5
1897	0	1908	3	April	2
1898	2	1909	2	May	2
1899	7	1910	2	June	2
1900	2	1911	4	July	3
1901	6	1912	6	August	4
1902	0	1913	5	September	5
1903	2	1914	3	October	6
1904	1	1915	1	November	8
				December	13
Total for the 22 years			67		

The seasonal variation in the breaks may be significant, but there are no data available which indicate that any difference in the operation of the main could account for the slight variation in the number of breaks in an individual year, these breaks ranging from none to seven in a single calendar year.



PROFILES OF HARTWELL AND REX AVE. WATER MAINS, PHILADELPHIA

The joints on the Hartwell Ave. line are ordinary lead-and-gasket joints. They have given no unusual trouble either from leaks or from blowing out, all the difficulty having been concentrated in broken castings. Air valves are placed on the summits at the standpipe end of the main, and these have been operated regularly for many years. Additional air valves have recently been placed at frequent intervals throughout the entire length of the line. There is no definite record of the actual grades to which the main is laid, but the surface of the ground appears to preclude the probability of summits other than those indicated on the accompanying profile. This conclusion is corroborated by the fact that the additional air valves show no evidence of an accumulation of air in the pipes.

*Chief of Bureau of Water, Philadelphia, Penn.

The absence of air and hammer, the freedom from trouble in the parallel Rex Ave. main, the chemical analysis of the iron from the Hartwell Ave. pipe, and the corroborative testimony of the ease with which the iron is broken by workmen lead to the conclusion that a poor quality of metal was responsible for the frequent breaks in the Hartwell Ave. main.

Grand Trunk Pacific Ry.

The Grand Trunk Pacific Ry. was opened for through commercial traffic between Winnipeg and Prince Rupert, 1748 mi., on Sept. 1, 1914 (steel having been joined Apr. 7, 1914), thus completing the second transcontinental railway in Canada. The eastern section of the line from Moncton, N. B., to Winnipeg, constructed by the Canadian Government, was described in *Engineering News*, June 27, 1912. The western section was built by the Grand Trunk Pacific Ry., and is operated by that company.

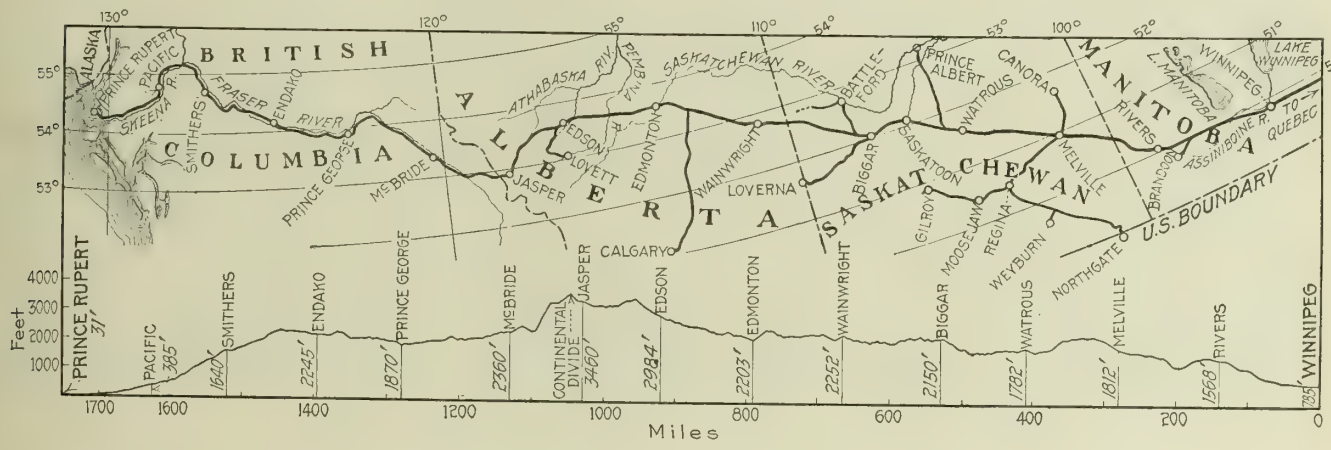
Construction was commenced in 1905, and has been under the direction of B. B. Kelliher, Chief Engineer. He resigned his position in the fall of 1914, and the work is now under H. A. Woods, who has been Assistant Chief Engineer for several years. Some of the difficult work along the Fraser River was described in *Engineering News*, Oct. 8, 1914. A condensed map and profile are given in the accompanying illustration. There is a total rise of 2938 ft. from Winnipeg (785 ft.) to the Rocky Mountain summit at Divide (3723 ft.), and a fall of 3705 ft. from Divide to the terminal at Prince Rupert (31 ft.). For operating, the line is divided into 14 divisions, or train districts, and the characteristics of these are shown in the accompanying table.

The remarkable feature of the profile and the location is the low grade secured through the Rocky Mountains, this being 0.4%, with the exception of a 20-mi. pusher grade of 1%. For the entire line the maximum grade is 0.4%, with an aggregate of a little over 100 mi. of 0.5%. The latter grades are against westbound traffic only, and the heavier traffic will be eastbound. The 1% pusher grade (against eastbound traffic) is on division No. 9. The changing character of the country is indicated by the change in curvature. For the first five divisions from Winnipeg (to Wainwright, 670 mi.) the maximum curves are 3°. For the next two divisions (to Edson, 250 mi.) this is increased to 4°, while on all the remaining seven divisions, 825 mi. to the coast, the maximum curvature is 6°.

The maximum elevation above sea level is 3723 ft. at the Continental Divide, in the Yellowhead Pass. About 30 mi. beyond this, along the Fraser River cañon, comes the sharp fall of the 20-mi. pusher grade. There is also a summit elevation of 3560 ft. at Obed, on the same division. The Canadian Pacific Ry. reaches an elevation of 5330 ft. at Stephen and 4330 ft. in the Rogers Pass, with grades of 2.2% in both cases (originally 4.2%). The Canadian Northern Ry. will use the Yellowhead Pass, and practically parallel the Grand Trunk Pacific Ry. for about 250 mi. from Edmonton.

The railway has been provided mainly with permanent structures, but there are a few wooden bridges of comparatively temporary nature which will be filled from time to time. There also remains the construction of additional stations, section houses and similar facilities as these become necessary with the development of the traffic. Division points, with the exception of that at Prince Rupert, have all been supplied with roundhouses, shops, coal- and water-handling plants, etc. The railway is in good condition for traffic, but (as on all new lines) considerable additional ballasting will be required where settlement occurs. This work will be done from time to time, and a further lift of ballast will be given over the entire line after traffic has thoroughly settled the roadbed.

At Prince Rupert, the Pacific port, temporary facilities have been provided for railway terminals and dockage. A very ambitious layout is contemplated for railway and water terminals, but it has been thought desirable to make extensive studies before commencing such an undertaking, and this preliminary work is still under consideration.



PLAN AND PROFILE OF THE WESTERN SECTION OF THE GRAND TRUNK PACIFIC RY.

CHARACTERISTICS OF THE GRAND TRUNK PACIFIC RY., CANADA

Train District	Elev. Above Sea Level, ft.	Miles	Ruling Grade, Per Cent. Westbound Per Cent.	Mi.	Eastbound Per Cent.	Mi.	Level, Mi.	Max. Curve, Deg.
1. Winnipeg (785 ft.) to Rivers	1568	142	0.5	17	0.4	1	36	3
2. Rivers to Melville	1812	137	0.5	14	0.4	18	26	3
3. Melville to Watrous	1782	129	0.5	19	0.4	35	10	2
4. Watrous to Biggar	2150	118	0.5	27	0.4	19	15	3
5. Biggar to Wainwright	2252	140	0.5	27	0.4	36	22	3
6. Wainwright to Edmonton	2203	125	0.4	29	0.4	35	20	4
7. Edmonton to Edson	2984	128	0.4	48	0.4	16	13	4
8. Edson to Jasper	3460	104	0.4	38	0.4	26	14	6
9. Jasper to McBride	2360	107	0.4	20	0.4	37	22	6
	....	pusher	..	..	1.0	20	..	..
10. McBride to Prince George	1870	144	0.4	18	0.4	36	32	6
11. Prince George to Endako	2245	116	0.4	24	0.4	7	36	6
12. Endako to Smithers	1640	127	0.4	4	0.4	28	26	6
13. Smithers to Pacific	385	105	0.4	4	0.4	67	15	6
14. Pacific to Prince Rupert	31	120	0.3	1	0.4	11	72	6

Sea Water to Rise into Fresh-Water Canal

By Paul Whitham*

In *Engineering News*, Nov. 26, 1914, p. 1088, there was an editorial commenting on the salting of Miraflores Lake on the Panama Canal as a "curious hydraulic paradox."

At Seattle, Wash., what is known as the Lake Washington Canal is now approaching completion. The community had always supposed that the water above the locks would be fresh, being fed by the overflow from Lakes Union and Washington, both fresh-water bodies. The unexpected invasion of Miraflores Lake by the sea water led to the belief that a similar condition would prevail at Seattle when the canal and lock are put in operation. The phenomenon is of such interest that it invites an analysis of the reasons therefor and the drawing of a parallel between the two cases.

Briefly, the conditions at Panama are as follows: The Miraflores locks are located about 8 mi. inland from

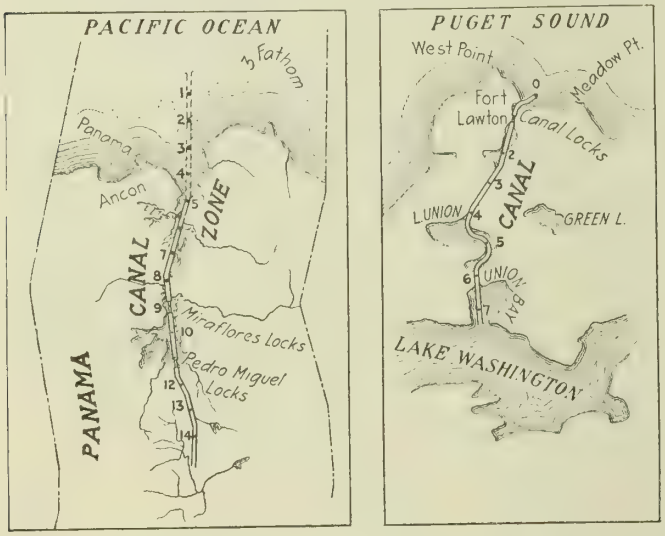


FIG. 1. PACIFIC END OF THE PANAMA CANAL AND THE LAKE WASHINGTON CANAL TO THE SAME SCALE

the Bay of Panama. The extreme tidal range is approximately 20 ft. Miraflores Lake, an irregular body, is about 2 mi. in its greatest length. The surface of the lake is 55 ft. above mean tide in the Pacific, and the bottom of the lake is above high tide in the sea-level section of the canal.

There are two pairs of locks, each 110x1000 ft., dividing the lift into practically two parts. By February, 1914, samples taken showed a diffusion of salt throughout the whole lake, the proportion of salt water running as high as 15 per cent. This necessitated the abandonment of Miraflores Lake as the source of domestic water-supply.

The conditions in Seattle are substantially as follows: The lock is located about a mile inland from the main body of Puget Sound. Salmon Bay, immediately above the lock, is a basin over a mile in length. Lake Union, approximately the same area as Miraflores Lake, begins about 2½ mi. above the lock. A canal connecting the two bodies is nearly 1½ mi. long. The extreme tidal range is approximately 17 ft. The surface of Salmon Bay, which will become a basin or lake, will be about 16½ ft. above mean tide, or only 8 ft. above high tide. The bottom of the basin will be from 24 to 32 ft. below high tide. The lock is 80x825 ft., there being but one lift.

From appearance the conditions here tending to pass sea water through the lock are decidedly more favorable than at Panama. At first thought one might look upon the statement that sea water will pass up the lock as an assertion that the law of gravity will be reversed by making water run uphill. When analyzed, however, the action is shown to be the result of natural laws, explained as follows:

Assume that a vessel enters the Seattle lock from the sea at mean tide. The depth of the water in the lock would be 33½ ft., not less than 80 per cent. of which probably would be salt water. Fresh water from above would then be let in at the bottom of the lock, which action should mix the fresh and salt water during the process of increasing the depth to 50 ft. The resultant mixture would then be approximately 60 per cent. of salt water.

Sea water may be said to weigh 64 lb. per cu.ft. and fresh water, 62.5 lb., a difference of 1.5 lb. The 60 per cent. salt water would consequently weigh 0.90 lb. per cu.ft. more than the fresh water, so that in the lock at a depth of 1 ft. below the surface there would be a head of 0.90 lb. per sq.ft. over that of the fresh water above the lock. On the upper sill, 36 ft. below the surface, the difference in weight would be 32.4 lb. per sq.ft., the equivalent of over 6 in. of head. When the upper gate is opened to let the ship into Salmon Bay this difference in head will be sufficient to cause the brackish water to flow out of the lock with an initial head of 6 in. along the bottom of the basin, while the fresh water will flow in from the top and take its place. When this heavy sea water has spread out and fallen half the distance there will still be a 3-in. head, which should be sufficient to produce a strong current of large volume, considering the resistance encountered in a wide channel. This difference in head operates in principle much the same as a common hot-water heating system, in which a slight difference in head created by the variation of temperature of the water in the up and down pipes is sufficient to produce a positive circulation against the high resistance of small piping.

Unless artificially disturbed, the salt water will tend to spread over the bottom of Salmon Bay and along the canal to Lake Union in wedge-shape form, thus losing head. The movement of boats, the churning of their propellers, and other causes will gradually diffuse the waters of the basins and canal until the entire body becomes brackish. The effect of this stirring up of the water would be mechanically to lift the salt, distributing it all the way up to the surface.

To illustrate: Take a point at some distance above the lock and assume that the 60 per cent. sea water has filled the bottom of the channel to one-fourth the depth, or 9 ft. This would be equivalent to a head of 1½ in. at the bottom of the channel. When the water is thoroughly stirred up, there still would be a 1½-in. head at the bottom, the salt creating the head having, however, a greater elevation—that is, the plane of mean head would be raised from 4½ ft. above the bottom to 18 ft., greatly increasing the volume of water tending to displace the fresh water further up.

*Consulting Civil Engineer, Seattle, Wash.

The effect would be that of having mechanically stored up energy by lifting the weight the additional height, the result being a progressive acceleration of the salt water up the canal and its distribution throughout the basins.

The lower temperature of the sea water—the difference between it and the lake water being quite appreciable in the summer—would tend to increase the effective head.

Practically there is a serious side to the salting of Salmon Bay and Lake Union. It is not known how salty the water will become, or whether it will sufficiently approach the condition of sea water to sustain the life of the teredo, or wood borer, that infests Puget Sound waters. In case it did, however, prevent the use of untreated timber piling it would frustrate one of the important benefits expected of the canal lock.

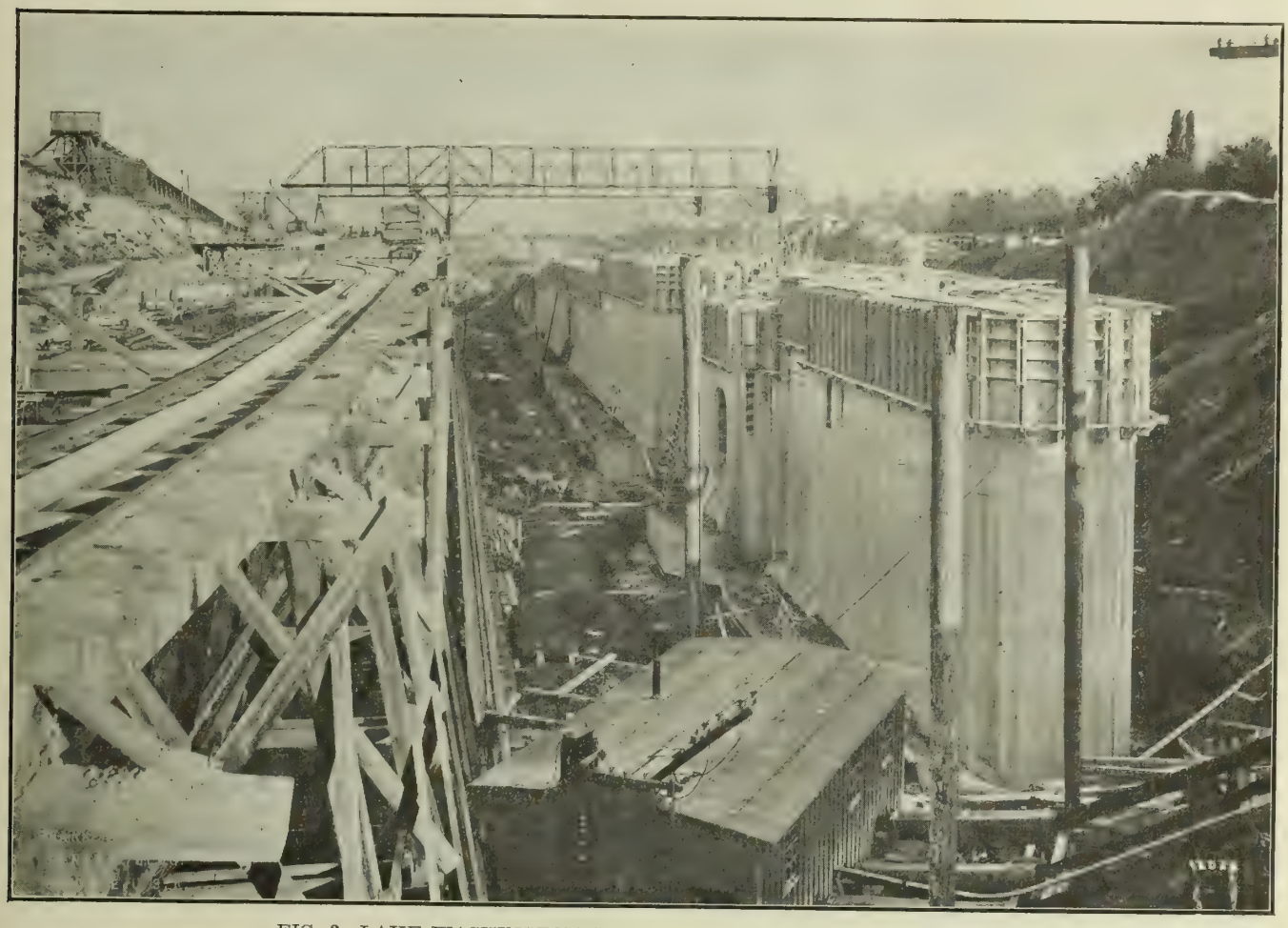


FIG. 2. LAKE WASHINGTON CANAL LOCK UNDER CONSTRUCTION

Industries have already located or purchased sites about Salmon Bay and Lake Union, anticipating the advantages they would enjoy in obtaining fresh water direct from the canal and lakes for manufacturing purposes. The salting of the water will wipe out the expected benefits.

It has been predicted that the fresh-water harbor would become the haven of vessels laid up when out of commission, where they would not be subject to the rapid accumulation of barnacles and other sea growths. Also, in the case of steel vessels, the chemical and galvanic corrosion would be much less in fresh water. These expected advantages, particularly the last-mentioned one, would be endangered by the salting of the water.

J. B. Cavanaugh, Corps of Engineers, U. S. A., is looking into the practicability of preventing or reducing in some manner the passage of salt water through the lock.

Engineers and Public-Service Commissions

In *Engineering News,* Apr. 29 (p. 842), were published suggestions formulated by a committee of engineers representing the national engineering societies for submission to the New York State Constitutional Convention. This general committee of engineers has since organized subcommittees to deal with the various subjects covered in its recommendations. The Subcommittee on Public Utilities has formulated and had introduced into the convention, through the courtesy of Prof. O. H. Landreth, of Schenectady, a member of the convention, a constitutional amendment (No. 708) reading as follows:

Article five of the constitution is hereby amended by adding a new section thereto, to be appropriately numbered, to read as follows:

A public service commission of five members shall be appointed by the governor by and with the advice and consent of the senate. Each commissioner shall hold office for ten years. The terms of the commissioners shall be so arranged that the term of one member shall expire upon the first day of February in alternate years. Each commissioner should have had experience in connection with public utilities which would fit him for the duties of the office.

The commission shall regulate and supervise all common carriers, all water supply, irrigation, drainage, gas, power, lighting, heating, intelligence-transmitting and other public utility corporations operating within the limits of New York state, including similar activities on the part of any other state department or political subdivision of the state.

Removal by the governor of any commissioner should be made only after the filing of charges and after affording the accused an opportunity to be heard in the matter, provided, however, that at any time within the first six months after making an appointment the governor may exercise the power

of summary removal. A successor to a commissioner who has been removed should be appointed to fill the unexpired term.

Vacancies caused by removal or otherwise should be filled under conditions similar to those governing original appointment.

The engineers' Subcommittee on Public Utilities, in order to support this amendment, has forwarded a statement to the chairman of the Constitutional Convention's Committee on Public Utilities, Hon. L. P. Hale. The statement is as follows:

The Subcommittee on Public Utilities of the General Committee representing national and local engineering societies, which has already memorialized the Convention respecting the changes they desire to see incorporated in the New York Constitution, respectfully submits the following:

The thing which we consider of greatest importance in any plan for organization of a State Public Utility Commission is the preservation of the principle of continuity, already established in the present Public Service Commissions.

By this we refer to the system whereby the term of office of the members of the Commission expire at different times, so that only one member of the Commission at a time goes out of office. Under this plan, a new member has the advantage of association with colleagues who have had years of experience in the work. Thus the plans, policy and methods of the Commission are continued with only such gradual change as experience may develop, and without the delays and unnecessary and at times undesirable changes which would be certain to occur if the entire membership of the Commission were changed at one time.

Experience has proved also that under this form of organization, the staff of the Commission is a permanent body. It can readily be understood that with the great responsibilities laid upon the Public Service Commission, the members of the Commission must devote their time to questions of general policy and the detail work must be done by the Commission's staff of engineers, attorneys, accountants, etc. The character of the work done by the Commission will depend very much on the sort of men it secures for its staff, and it can secure very much better men if those appointed hold their positions continuously as long as they display ability in the discharge of their duties.

If, however, a change were to be made in the public service law so that an entirely new commission would be appointed with each new gubernatorial administration, there would be danger not only that the commissioners would be appointees without the experience and knowledge necessary to formulate and carry on a sound constructive policy, but that the principal employees of the Commission would be changed for political reasons with the coming in of each new Commission.

QUALIFICATIONS OF COMMISSIONERS

The second important thing that we would urge upon your honorable body is the embodiment of some provision in the constitution setting forth the qualifications which candidates for the position of Public Service Commissioner should possess.

There is no doubt that state and federal control of those monopolies generally known as public utilities is here to stay; but it is a serious question whether these great powers of control will be so wisely and justly exercised that on the one hand the public will be satisfied and on the other hand the public utility corporations may be able to continue in business and meet the requirements made upon them.

The vast responsibilities placed upon these Public Service Commissions are hardly realized as they should be. Upon their proper handling of the very difficult questions before them, depends the welfare, the prosperity, the safety of millions of people.

It is unfortunately the case that many of the appointments to state public service commissions have been of men who had not sufficient experience or ability properly to fill these positions. We have, therefore, proposed for incorporation into the Constitution the requirement that any man appointed to membership in the Public Service Commission "should have had experience in connection with public utilities which would fit him for the duties of his office."

The questions which come before a Public Service Commission require for their intelligent decision intimate acquaintance with technical matters, financial matters, commercial matters, legal matters. There can be no question that men who are already familiar with matters of this sort from experience in the management of public utilities, can render much more valuable service in the control of these utilities than men who are without such experience.

There are to be found among those connected with public utility companies men with as broad conceptions of public rights and of the duties to be fulfilled to the public as can be found in other walks of life. We believe that such experienced men, knowing well what can be done and what cannot be done, would be able to deal more firmly with the companies than would members of a commission who lacked such technical experience.

It should be understood, moreover, that the constitutional requirement we have suggested—previous experience in connection with public utilities as a requisite to a commissioner's appointment—is not to be construed as a rigid limitation upon the governor's discretion in making appointments. The responsibility would properly be upon the governor to judge as to how much experience was requisite to fit a candidate for appointment. The value of such requirements, embodied in a statute or a constitution, is that they define the requirement which the governor should have in mind in the selection of candidates. It is not pretended that this requirement or any other which could be framed could prevent the selection of unfit candidates. It is believed that such clauses are of value, nevertheless, in setting up a standard to which most men in the long run will seek to conform.

The third important feature of our recommendation is that there should be one Public Service Commission for the whole state instead of two as at present. If your honorable body shall see fit in its discretion to provide for the perpetuation of the principle of continuous organization in the control of public utilities, and shall provide that public service commissioners shall have had previous experience which would fit them for the duties of their office, the main purposes of our committee will have been accomplished.

New Carquinez Straits High-Tension Crossing

The Pacific Gas & Electric Co., of San Francisco, has recently added two aërial cables across the Straits of Carquinez as part of the high-tension lines from its mountain power-houses to Oakland. The first cables of this crossing were slung 14 years ago, when the Bay Counties Power Co. completed its 142-mile transmission system from Colgate (as described at length in *Engineering News*, Oct. 3, 1901).

For this pioneer work no precedents had then been established. The main span was 4427 ft. and the cables were 20 ft. apart horizontally and vertically, as shown in Fig. 2. All four cables were anchored to a buried concrete block at each end; they passed over one leaning and two vertical towers, and were held at 208-ft. minimum distance above the water. Each tower saddle was formed by a five-sheave frame on a wood structure supported by six porcelain insulators and three wooden cross-arms (see Fig. 2). At the anchorages two housed strain insulators were placed between each cable and the concrete block. The strain insulators were iron frames with micanite barriers in oil-filled cylinders, as shown in Fig. 7.

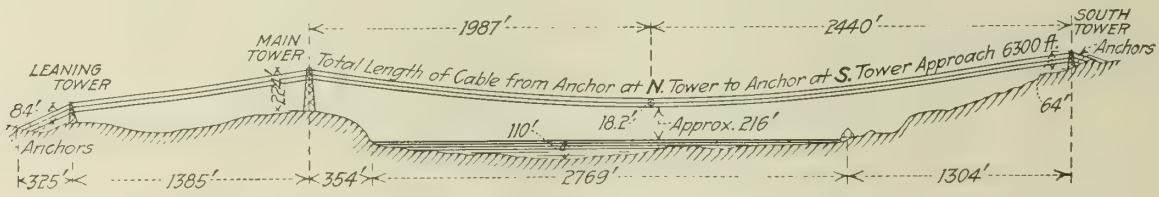
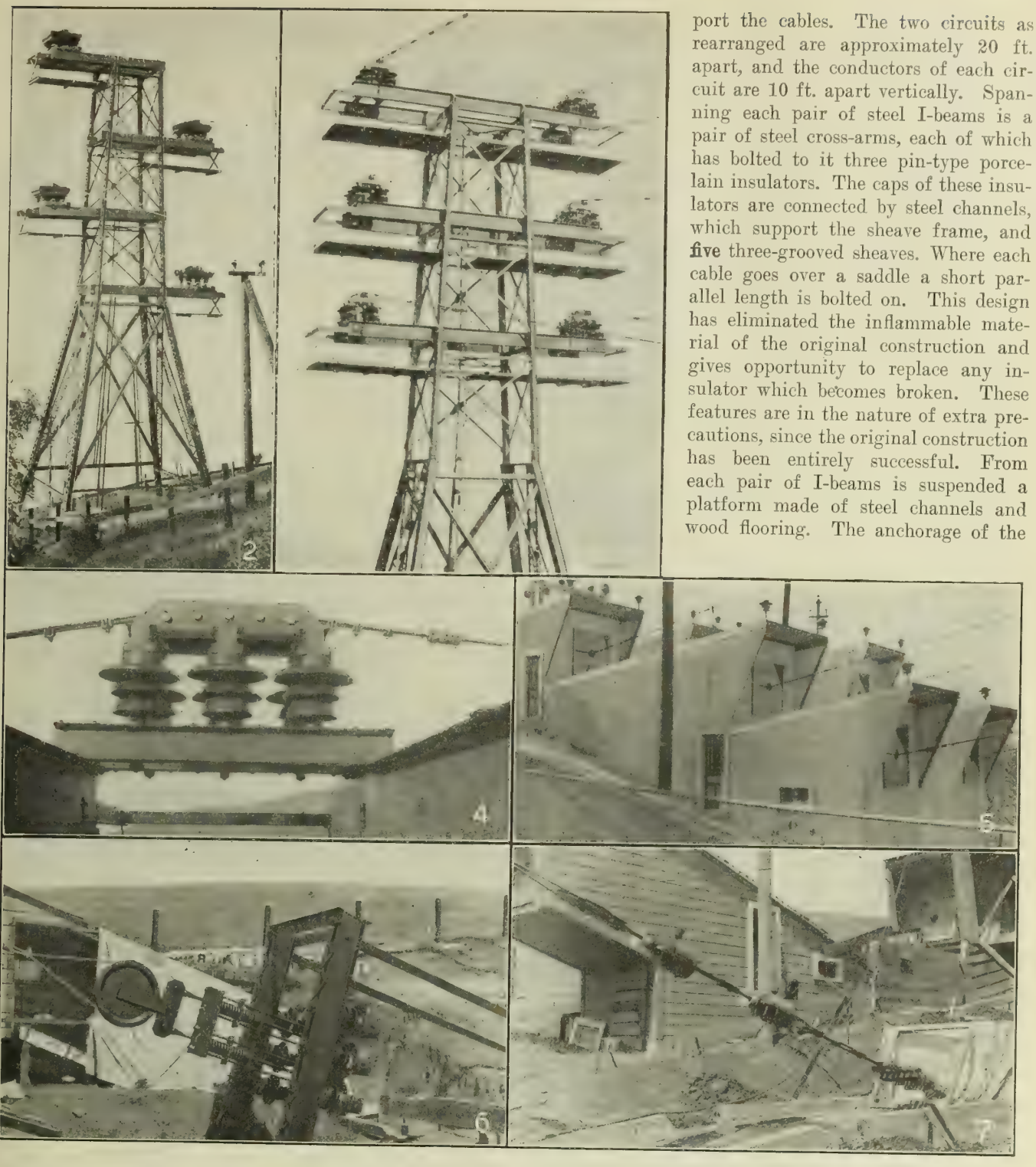


FIG. 1. THE REBUILT CABLE SPANS ACROSS THE STRAITS OF CARQUINEZ, CALIFORNIA



FIGS. 2 TO 7. DETAILS OF OLD AND NEW CONSTRUCTION AT CARQUINEZ STRAITS

Fig. 2—Old south tower. Fig. 3—New south tower. Fig. 4—New saddle. Fig. 5—New anchor houses. Fig. 6—New anchor and strain insulator. Fig. 7—Old strain insulator and anchor

port the cables. The two circuits as rearranged are approximately 20 ft. apart, and the conductors of each circuit are 10 ft. apart vertically. Spanning each pair of steel I-beams is a pair of steel cross-arms, each of which has bolted to it three pin-type porcelain insulators. The caps of these insulators are connected by steel channels, which support the sheave frame, and **five** three-grooved sheaves. Where each cable goes over a saddle a short parallel length is bolted on. This design has eliminated the inflammable material of the original construction and gives opportunity to replace any insulator which becomes broken. These features are in the nature of extra precautions, since the original construction has been entirely successful. From each pair of I-beams is suspended a platform made of steel channels and wood flooring. The anchorage of the

The new cables, which are duplicates of the old ones, are 7/8 in. in diameter and consist of 19 strands of galvanized plow-steel wire. They have a total ultimate strength of 48 tons, equivalent to 215,000 lb. per sq.in.; the normal load stress is about 11 tons on each cable. The cables were furnished in single pieces 6300 ft. long.

To accommodate the two new cables the tower tops had to be reconstructed. The old wooden cross-arms were discarded for three pairs of steel I-beams overhanging the sides of the towers, as shown in Fig. 3. Near the ends of these steel-beam arms are the saddles which support the new cables shows somewhat the same ideas in design. Two latticed-channel steel beams are set up in the concrete block foundations, inclined with their tops back-guyed into the blocks. On each of these beams are three pin-type porcelain insulators, with two caps cross-connected by horizontal double-channel cross-bars. Across these bars in turn and parallel with the main beams are other channels, with rods leading to the spring frame of the sheave around which the crossing cable is wrapped (see Fig. 6). All the anchors are covered with corrugated-iron houses, the cables entering through plate-glass windows.

Road-Maintenance Costkeeping in Pennsylvania

SYNOPSIS—Organization of maintenance division of Pennsylvania State Highway Department and the method of keeping costs on repairs.

It is always debatable how far the compiling of records and cost data should be carried. Elaborate costkeeping systems as safeguards in the expenditure of the people's money are perhaps more justified on public works than on private works. Moreover, the collection of elaborate records and cost data of operations which bid fair to become interminable, such as maintenance work on highways, is more justifiable than for construction work, which when once completed is of no further interest in itself.

The advantages generally claimed for a thorough costkeeping system are that it gives to the lowest laborer and foreman filling out their daily reports more interest in and knowledge of their work than might otherwise be the case; and that a proper study and utilization of the reports—from laborer up—condensed, compiled and systematized, give the office management a desirable check on field operations and data of value for future estimates, and for other purposes.

The disadvantages of too elaborate a system are that generally a good foreman or fieldman is a mighty poor clerk, and vice versa. The time spent in filling out multitudinous blanks of green, pink, yellow and white paper might perhaps be otherwise employed in building or repairing roads. The petty annoyances that the head office may cause an honest, well-intentioned foreman who makes mistakes, which, considering the man's characteristics, are perfectly excusable, has driven many a man to drink, or to something worse.

Hence, with these considerations in mind, in presenting here a brief outline of the record and costkeeping system of the Pennsylvania State Highway Department, it is not the intention to hold up a model of excellence but to show how far, at least, one state highway department has gone in collecting, compiling, tabulating and analyzing cost data on road maintenance. There is another purpose, and that is to give an outline classification of highway work, which could be made of great use in an engineer's library as the basis of an index and classification system—as detailed perhaps as has yet been attempted.

Organization of Maintenance Division

The maintenance and repair work on state and state-aid highways in Pennsylvania is handled by a division of the State Highway Department separate and distinct from that handling new construction. Day laborers are employed and paid directly by the state, which is divided into districts in charge of engineers under whom are superintendents, general foremen, foremen and laborers. General supervision, engineering and executive work are done by a maintenance engineer through his assistant engineers and chief clerk. Fig. 1 is a classification and diagram of the work and Fig. 2 is an organization chart.

The origin of all data is with the foreman directly in charge of the work, who in his Daily Report furnishes to his general foreman a complete statement of the number of men employed, the number of hours and the rate per hour for each man, with the charges distributed over the various operations under the proper heading. His report shows the location and extent of all work performed.

At the end of each week the general foreman, upon a General Foreman's Weekly Report, furnishes the superintendent with a summarized statement of work performed in his district, compiled from the Foreman's Daily Reports. A rearrangement of charges eliminating the individual laborer places all the data in the form required for the Superintendent's Semi-Monthly Progress Report,

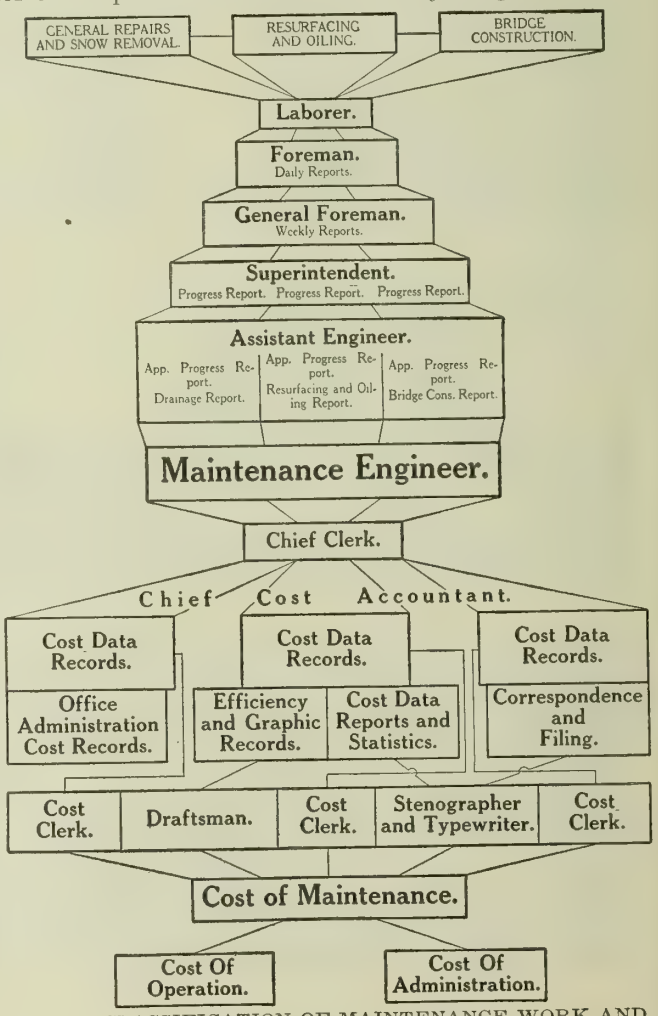


FIG. 1. CLASSIFICATION OF MAINTENANCE WORK AND METHOD OF HANDLING

which accompanies all payrolls, and enables him to readily summarize all costs.

The pay periods for all classes of employees paid on an hourly basis close on the 15th and last day of each month, and at this time the superintendent forwards to the assistant engineer all payrolls, with progress reports, showing distribution of all charges appearing on the payrolls. Through the assistant engineer, after the necessary checking and recording have been done, the payrolls are forwarded to the offices of the Maintenance Division, where they are thoroughly checked for correct distribution of costs and for consistency.

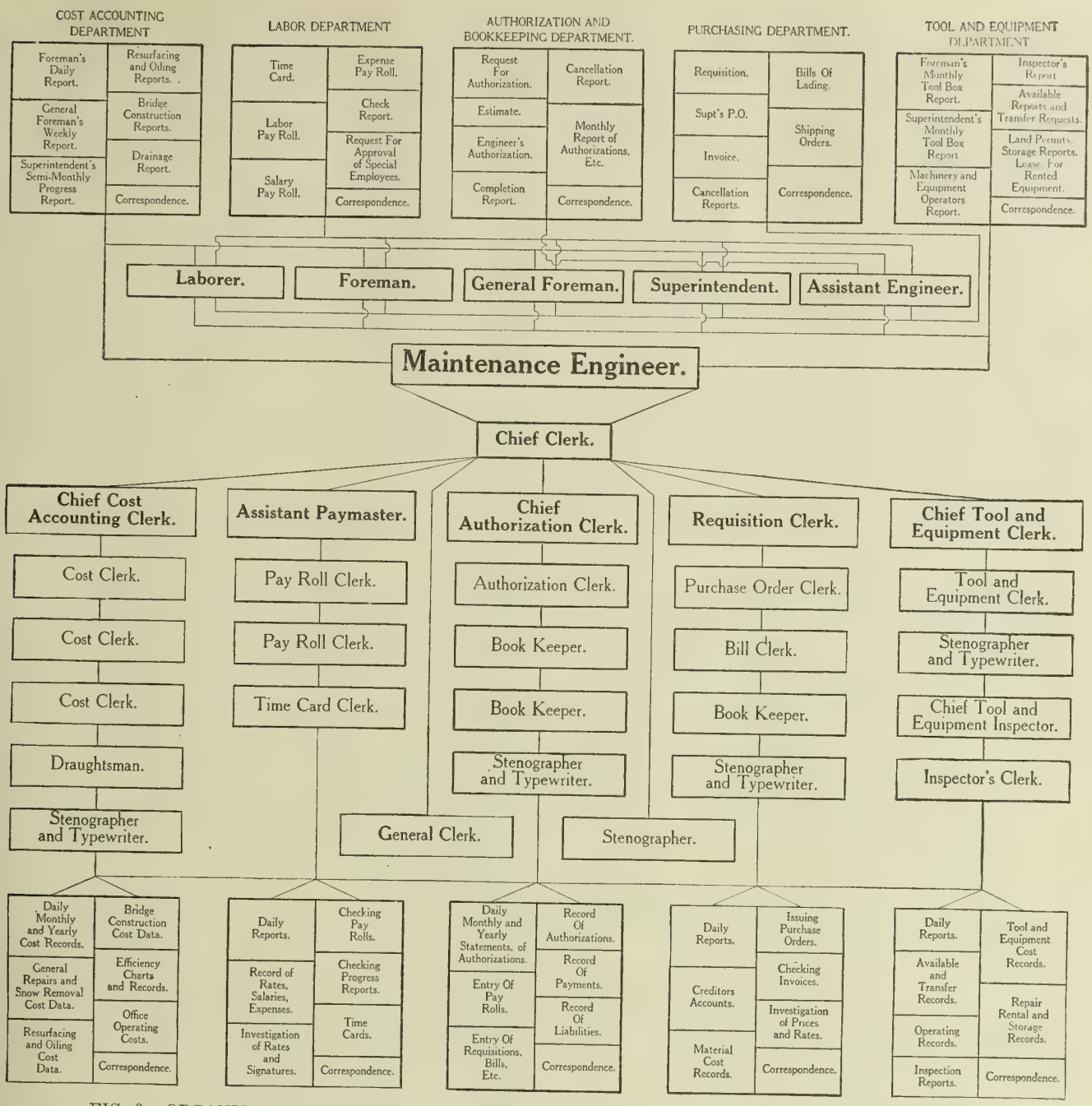


FIG. 2. ORGANIZATION CHART OF MAINTENANCE DIVISION OF THE PENNSYLVANIA STATE HIGHWAY DEPARTMENT

The method of classifying expenditures for material, supplies, rentals, salaries, expenses, etc., is similar to the method used in classifying labor expenditures—all bills presented being accompanied by progress reports, with the cost charged to the proper operation.

A list of the various forms (all made out in duplicate and some in triplicate) which originate or pass through the hands of the superintendents and assistant engineers follows:

85-H Department Authorization.
85-J Application for Authorization (Superintendent).
85-I Engineer's Authorization.
893 Requisition.
892 Department Purchase Order.
892½ Shipping Order.
894 Bill Heads.
Department Bill of Lading.
Department Memorandum Bill of Lading.
Identification Card (Engineers).
83 Time Card.
84 Foreman's Daily Report.
81-E Roller and Crusher Daily Report.
81-D Motor Truck Daily Report.
890 Time Book.
891 Superintendent's Purchase Order.
90 Superintendent's Report (Personal Weekly).
87 General Foreman's Weekly Report.
85 Payroll (Labor and Team).
85-C Payroll (Superintendent's Bill).
85-D Payroll (General Foreman).
85-F Payroll (Monthly Employees).
85-E Payroll (Monthly Employees' Expense).
86 Semi-Monthly Progress Report.
85-A Summary Sheet (Payroll).
898 Superintendent's Check Report.
85-K Report of Completion of Authorization.
81-C Receipt Book.
80 Superintendent's Salary Receipt.
80-A Monthly Employees' Salary Receipt.
895 Monthly Resurfacing Report (Water-bound macadam).
896 Monthly Resurfacing Report (Bituminous macadam).
897 Monthly Drainage Report.
900 Assistant Engineer's Monthly Maintenance Report.
88 Superintendent's Monthly Tool Report.
89 General Foreman's Monthly Tool Report.
9-D Land Lease.
10-A Resolutions, Board of Supervisors, for maintenance and repair of state-aid roads, agreeing to pay 50 per cent. of the same.
10-B Resolutions, Borough Council, for maintenance and repair of state-aid roads, agreeing to pay 50 per cent. of the same.
904 Annual Bridge and Culvert Report.
Traffic Census.

It is not necessary to go into the use of these in detail, as their titles and the charts, Figs. 1 and 2, are sufficient to make somewhat clear their applications. Some description of their contents, however, is essential. The requisition form requires a very complete analysis of the proposed expenditures. The detail progress reports, payrolls, and special reports on resurfacing, bridge work, traffic censuses, etc., are familiar to most engineers; they naturally require considerable time and labor. The Land Lease, 9-D covers all rentals of quarries, storage buildings, etc. The forms 10-A and 10-B are for agreements with local road authorities. It should be added that the list of forms given here has since been somewhat revised, extended and elaborated. These, it is to be remembered, are reports originating in the field.

In the office, checking reports for consistency of classification and operation is given careful attention, and the location of the work as shown upon the reports is checked with records of the maintenance engineer's office, which have been compiled from the surveys of the various roads and which show accurately stations for all township borough and county lines, together with the location of all improved and constructed roads.

The records are then taken in hand by the Cost Accounting Department under the chief clerk, and several dozen more blanks varying in size from an index card to sheets about 24x30 in. are filled out. The amount of data and general information thus accumulated and systematized is remarkably full and complete as the classification given herewith will make clear.

In the accumulation and compilation of these data, the route number or application number (in the case of state-aid roads), which is the legal designation of the road under the state-highway acts, is considered as the unit for the separation of all such costs.

The Cost Accounting Department is furnished with a monthly statement of expenditures upon each route under each classification by the Authorization and Bookkeeping Department, which is checked against the cost-data records.

Upon all routes or applications the work is classified as follows: General Repairs, Resurfacing, Bridge Construction, Oiling, Removing Snow. A list of the operations under each classification follows:

GENERAL REPAIRS

Superintendence
Removing loose stones, dirt, etc.
Filling ruts and washouts
Repairing gutters and berms
Dragging
Scraping and crowning
Excavating gutters
Grubbing and clearing
Grading (cuts and fills)
Quarrying and stripping
Crushing
Hauling stone and screenings
Spreading stone and screenings
Loading and unloading stone
Hauling and laying telford
Cost of stone
Removing snow
Cleaning and repairing drains
Repairing timber bridges
Repairing stone bridges and culverts
Repairing concrete bridges and culverts
Placing pipe drains
French drain
Tile drain
Scarifying
Sprinkling
Rolling
Erecting and maintaining guard rail
Handling equipment
Temporary bins, sheds, etc.
Patching and repairing asphaltic concrete
Patching and repairing asphalt and penetration macadam
Repairing brick road
Dry rubble masonry
Rubble masonry (mortar)
First class masonry
Concrete masonry
Cribbing
Repairing tools.

RESURFACING

Waterbound Macadam

Bottom course:
Grading
Rolling
Quarrying
Crushing
Loading and unloading
Hauling telford
Laying and napping telford
Berms and gutters
Cost of stone

Second and top course:
Quarrying
Crushing
Loading and unloading
Hauling stone, screenings
Spreading stone, screenings
Scarifying
Sprinkling
Rolling
Cost of stone

Drainage and miscellaneous:
Placing pipe drain
Placing box drain
French drain
Tile drain
Repairing drains
Repairing bridges
Catch basins and headwalls
Retaining walls
Supertintendence
Timekeeper
Handling equipment
Temporary bins, sheds, etc.

Asphaltic bituminous macadam

Bottom course:
Grading
Rolling
Quarrying
Crushing
Loading and unloading
Hauling telford
Laying and napping telford
Berms and gutters
Cost of stone

Second course and seal coat:
Quarrying
Crushing
Loading and unloading stone
Hauling stone and screening or mixing and hauling mixture
Scarifying
Spreading stone or mixture
Heating and pouring
Spreading screenings
Rolling
Hauling and spreading stone chips or torpedo sand
Cost of stone
Cost of mixture aggregate

Drainage and miscellaneous:
Placing pipe drains
Placing box drains
French drain
Tile drain
Repairing drains
Repairing bridges
Catch basin and headwalls
Retaining walls
Superintendence
Timekeeper
Handling equipment
Temporary bins, sheds, etc.

Asphaltic concrete

Foundation:
For telford (as above)
For concrete (as follows)
Grading
Rolling
Quarrying
Crushing
Loading and unloading
Hauling materials for mixing
Placing materials
Berms and gutters
Cost of stone
Cost of sand
Cost of cement

Asphaltic concrete course:
Quarrying
Crushing
Loading and unloading
Mixing and hauling
Spreading mixture
Rolling
Spreading screenings

Seal coat:
Heating and pouring
Hauling and spreading chips or torpedo sand
Rolling

Drainage and miscellaneous:
Placing pipe drains
Placing box drains
French drain
Tile drain
Repairing drains
Repairing bridges
Catch basin and headwalls
Retaining walls
Superintendence
Timekeeper
Handling equipment
Temporary bins, sheds, etc.

BRIDGE CONSTRUCTION

Equipment
Excavating channel

Temporary traffic
Fencing
Guard rail
Approaches
Excavating for foundation
Coffer-dam
Erecting forms and falsework
Removing forms and falsework
Materials for forms and falsework
Hauling materials for concrete
Mixing and placing concrete
Facing concrete
Cost of aggregates
Reinforcing bars, rods, I-beams
Expanded metal
Superintendence
Timekeeper

OILING

Surface
Sweeping, filling holes, etc.
Oiling (heating and distribution)
Hauling sand or screenings
Spreading sand or screenings
Rolling
Loading
Drainage and miscellaneous:
Superintendence
Timekeeper
Handling equipment
Temporary bins, sheds, etc.

As a means of readily identifying all accounts presented, each authorization is characterized by a serial letter and number as follows:

STATE HIGHWAY

Serial Letter	Serial Number	Classification
G	1-3000	General repairs
R	3001-4000	Resurfacing
O	4001-4500	Oiling
B	4501-5000	Bridge Construction
S	5001-6000	Removing snow
T	6001-7000	Purchase of tools and equipment
E	7001-8000	Repairs to equipment
Y	8001-8500	Storage

STATE AID

A	8501-9000	General repairs
A	9001-9500	Resurfacing
A	9501-9750	Oiling
A	9751-10000	Removing snow.

All accounts presented, whether labor, material, supplies, etc., show the authorization number in addition to the route and county to which they are charged. Under this system the actual cost of any special work, such as resurfacing, oiling or bridge construction—also the yearly maintenance cost on any piece of improved or constructed road—is readily obtainable; and valuable data on the maintenance cost of the various types of constructed roads are compiled from year to year.

Upon the completion of special work on any route or application, the Cost Accounting Department furnishes a detailed cost data report, showing location, character and extent, together with information such as rates paid the various classes of labor, price of material, length of haul, etc. By referring to this cost-data record at any time a specific operation on any road can readily be determined, including the exact location and extent and the elements of labor and material which have entered into the work. Yearly cost-data reports showing in detail the cost of general repair operations on every route or application are also compiled.

In addition to the yearly cost-data report, an accumulating graphic record, devised to cover a period of years showing the location, character, extent and cost of each classification of work upon every road in the form of a map, is compiled.

The Purchasing Department of the Maintenance Division keeps a record of the prices paid for all material, supplies, etc., which are embodied in the reports furnished by the Cost Data Department. Detailed records of the cost of tools and equipment and repairs, showing comparative costs in the different districts of the state, are kept in the Tool and Equipment Department of the division.

The most conspicuous feature of the work done in the office is the daily summary sheet, which every day gives the maintenance engineer a complete record of the work in each and every road district to date, the kinds of work, purchases made and authorized, payrolls passed, the amount of the appropriation and the part of the appropriation expended to date. This summary is elaborate and keeps the head of the department in intimate and constant touch with the work in all parts of the state. Then, there are similar but still more elaborate weekly and monthly summaries.

The foregoing is merely an outline, which may be used by the reader for a variety of purposes. To attempt to describe in detail the various operations and methods of costkeeping in use in Pennsylvania is beyond the scope of such an article.

The engineer of maintenance of the Pennsylvania State Highway Department who has worked out the system described is George H. Biles, who was recently appointed Deputy Highway Commissioner, with Robert J. Cunningham as Commissioner and W. D. Uhler as Chief Engineer.

Barge Canal Navigation Aids*

So much of the new Barge Canal of the State of New York is in rivers or lakes that it has been necessary to place various aids to navigators, such as buoys, beacons and range towers, which carry lights by night and show where in the expanse of river and lake lies the navigable channel. The localities to be thus buoyed and lighted require a total of about 550 buoys and 300 stake lights, together with about a dozen lighthouses.

The system of marking adopted is to use two buoys on the inside and one on the outside of each curve. The buoys on the inside of the curve are placed at the beginning of the curve, the buoy on the outside is placed opposite the middle of the curve. These buoys and their lights, with a few along the tangents, have been found to be very satisfactory. In addition to buoys and stake lights, long tangents are marked by a pair of range lights placed on shore in line with the prolonged center line of the canal. The rear range light is set higher than the front light, so the navigator will be on the correct center line if he keeps his craft in such a position that the two range lights appear in a vertical line, one above the other.

To meet another need of the navigator of the new canal there have been issued charts covering sections of river channel. On these charts are located all of the beacons, buoys, spars, bridge lights, range towers and lighthouses which mark the course and also explanation is given of the colors the various markers are painted, as well as the colors of the lights they display at night. Upon the charts are shown the river banks and the topographic features of the adjoining land for several hundred feet on either side, together with the names of inflowing streams, islands, villages, railways and the like. There appear also tables of distances.

The buoys and beacons which show red lights are painted red, while those showing white lights are painted black. The range towers have white lights, the channel rims at bridges are marked by red lights and the centers of lift-bridges show red lights when the bridges are closed and green lights when they are open.

*From the "Barge Canal Bulletin," June, 1915.

Large Coaling Stations on the Panama Canal

SYNOPSIS—At each end of the Panama Canal there is being erected a large coaling station of special design, for supplying fuel to passing steamers. This article describes the two designs.

The huge coaling stations at the Atlantic and Pacific terminals of the Panama Canal, which are to be completed during 1916, have unusual interest because of their size and equipment. The main station is located at Cristobal on the Atlantic side, since it is on this sea that the coal supplies are borne. The Cristobal plant is designed to meet all the military, commercial, railway and canal requirements; the Balboa station will probably handle little commercial coal. Except for the military necessity of an independent and additional supply on the Pacific end, the second station at Balboa probably would not have been built at this time. At both stations large underwater storage space has been provided for the permanent storage of coal without deterioration or danger of spontaneous combustion.

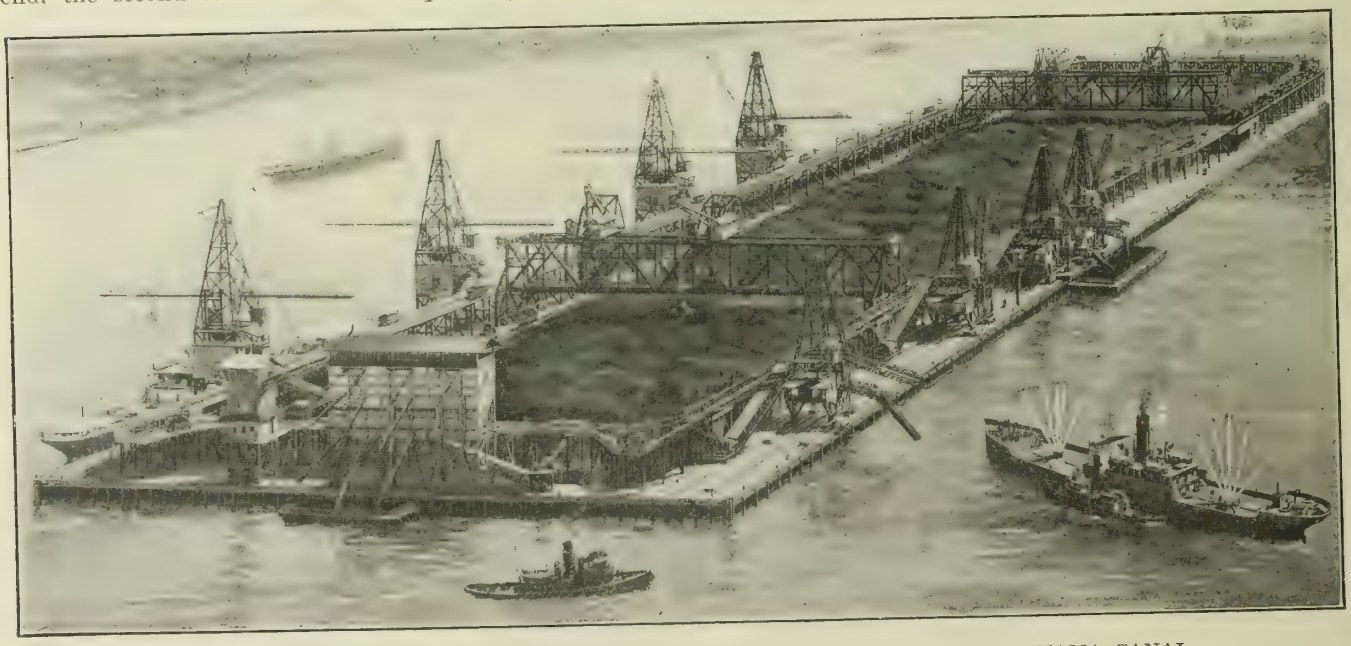


FIG. 1. BIRD'S-EYE VIEW OF CRISTOBAL COALING STATION ON THE PANAMA CANAL
Reproduction of a perspective drawing by E. W. Spofford, of New York City

Cristobal Station

The Cristobal plant consists essentially of a pier about 1825 ft. long and some 420 ft. wide. One side of this is designated as the "unloader wharf" and the other side as the "reloader wharf," connected by an "end wharf" with a bunker for tugs and other small craft. For 1065 ft. along the unloader and reloader wharf the bottom is dredged to 41 ft. depth. The southerly part of the pier is considered as a shore extension without waterfront.

The deep-water section of the pier consists of a steel and concrete dock deck supported on 6-ft. concrete cylinders going down from 50 to 75 ft. to solid rock. The cylinders were spaced and the deck frame designed according to the position of the loads. About 5000 tons of structural steel and 18,000 cu.yd. of reinforced concrete were used. The shore extension consists of concrete walls and piers supported by piles.

Between the long wharves is the huge coal pile (resting on natural bottom), with the submerged-storage section at the ocean end. The coal pile is spanned by two stocking and reclaiming bridges which can travel the full length of the pier. There is a steel viaduct, 29 ft. high, around the whole pier, and on this are two separate looped 3-ft.-gage tracks for the motor-operated cars.

On the unloading wharf are four one-man steeple-type towers, with the familiar long booms and a trolley carrying the lines of a grab bucket (2½ tons capacity). Each tower is supported on 16 wheels running on two 3-ft.-gage tracks, laid 24½ ft. c. to c. The combined capacity of the four unloaders is 1000 tons per hour. They are steam operated, and are the only pieces of equipment at the station so operated, all other machinery being driven by electric power. They discharge coal, through hoppers and steam-operated cutoff gates, into motor-driven cars.

These cars are a W-bottom type of 10 tons capacity and are propelled by two 3-hp. constant-speed alternating-current motors at a track speed of 200 ft. per min. The cars are stopped, started and dumped by trackmen stationed at desired points. Otherwise they have no attendants while in motion. The cars travel over a fixed route, and in normal operation no switching is done. Each stocking and reclaiming bridge carries on its lower chord a single track of the electric railway, connected to the viaduct at each end by sliding curves which pick up the cars from the viaduct as they approach the bridge and deliver them back on the other side of the pier. The coal is dumped into storage from this bridge track. For reloading coal two crane diggers are carried on the upper chord of each bridge, discharging into the same cars on the same track as previously noted. The cars

deliver to reloading towers, which replace the large and expensive wharf bunkers provided in most coaling stations.

The stocking and reclaiming bridges are heavy through-span structures, 315 ft. c. to c. of end bearings, and each weighs about 1400 tons equipped. Each end is supported a second conveyor carried at right angles in a hinged boom which runs out over the wharf and discharges through a telescopic chute at the end. The operator, in his elevated cab commanding a good view, moves the tower along the wharf and controls the position of the

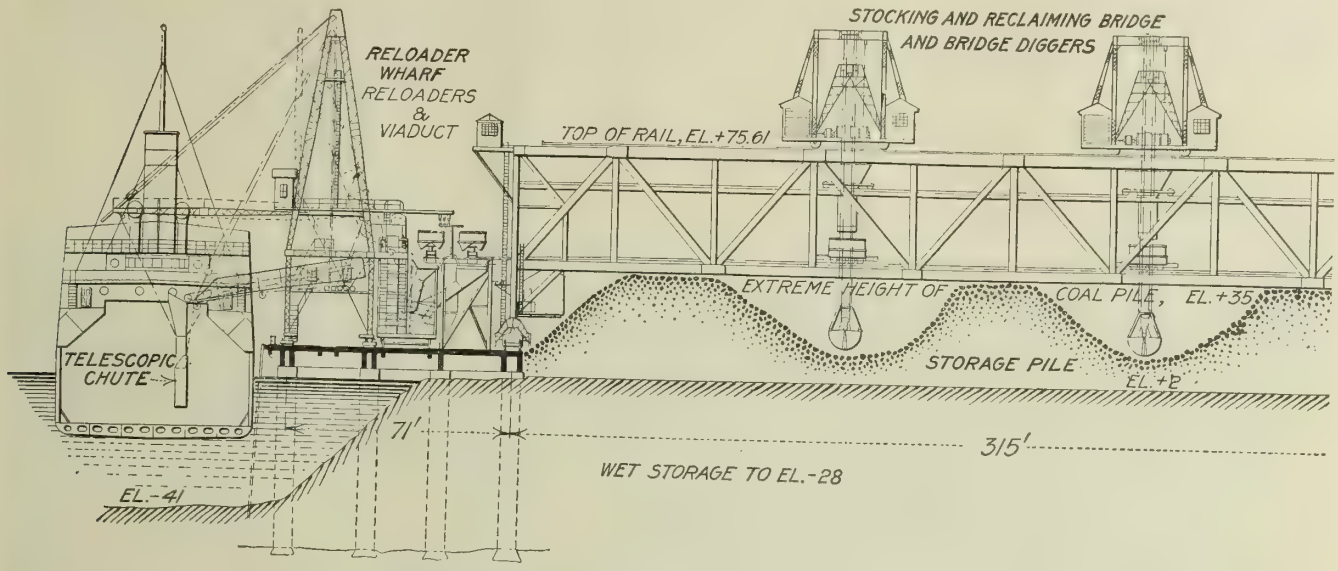


FIG. 2. PART ELEVATION OF THE CRISTOBAL COALING STATION

on two 16-wheel trucks with heavy cast-steel bolsters and equalizers. These trucks travel on the standard-gage tracks leading to the Panama R.R. The bridges are propelled by an independent 170-hp. motor at each end; a maximum track speed of 50 ft. per min. is attained. These two motors have separate speed controllers, which are worked by separate handles in the operators' cabs so arranged that they can be moved together or separately. This is necessary in order to keep the bridge square with the rails under all conditions of track and wind load. A large dial indicator shows the amount of variation from square.

The digger machines move along the top chords of the bridges so that they can reclaim coal from the entire storage area. Each has a 5-ton grab bucket swung from a patent boom frame which is hoisted by a cable running over a differential drum so that the grab bucket follows a fixed path in and out. This eliminates the independent trolley or boom engine and fixes the path of the bucket clear of the digger frame. This scheme gives speedy operation with a single attendant, who need have no special skill.

For reloading to boats there are four delivery towers on the reloader wharf, each supported on four four-wheeled trucks which run on two 3-ft.-gage tracks laid

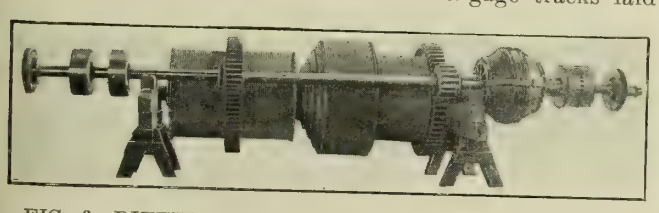


FIG. 3. DIFFERENTIAL DRUMS OF BRIDGE DIGGER

26 ft. c. to c. The arrangement of these reloaders is unique. Each has an inclined belt conveyor parallel to the running track and leading up from the discharge of a trailing hopper truck, which receives coal from the motor cars dumping through the viaduct. This belt feeds conveyor boom and delivery chute. Each reloader may be operated to give a capacity of from 60 to 600 tons per hr.

At the wharf bunker on the end of the pier an inclined conveyor carries coal from a receiving hopper under the viaduct and discharges it into a 1500-ton pocket, from which power-operated telescopic chutes let the coal into tugs and other small vessels. At the beginning of the shore extension of the pier is the transformer station of 2900 kv.-a. capacity. Three-phase 25-cycle current is received at 2300 volts, and is transformed to 440 volts for power and 110 volts for lighting. The administration tower, for the general control of the station, supports the conveyor leading to the wharf bunker.

The weight of coal handled is ascertained by semi-

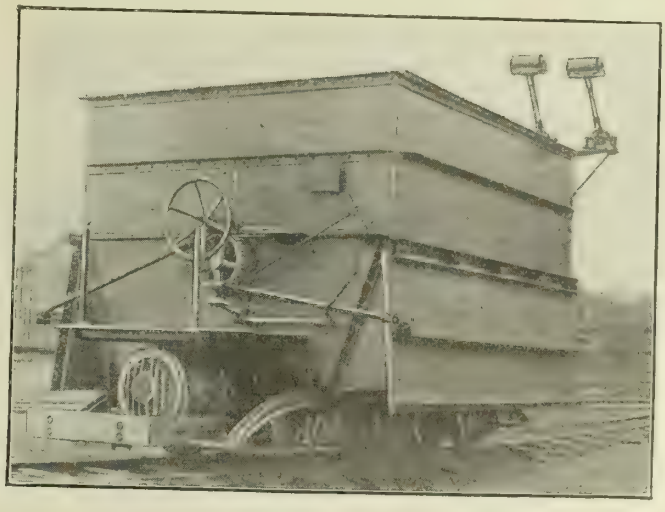


FIG. 4. MOTOR-DRIVEN COAL CAR

automatic scales at suitable points along the viaduct. A car must pass over a scale before reaching its point of discharge. The weight of coal delivered directly by the unloaders to standard-gage cars can be determined by track scales on the unloader-wharf track.

A complete system of communication and signals has been worked out. The total normal rated capacity of the station is 1000 tons per hr. unloading and 2000 tons per hr. reloading. To attain this, somewhat higher capacities had been specified for the individual units—1200 tons aggregate per hour for the unloaders and 2400 for the diggers and reloaders. The total wet-storage capacity is 100,000 tons; the dry-storage, 385,000 tons.

Balboa Coaling Station

The general arrangements at Balboa are quite different from those at Cristobal because of the different local conditions and the much smaller commercial importance of the Balboa station. Its equipment seems to be better adapted to the rapid reloading of coal than to rapid storage—in accordance with the military requirements. There are separate unloader and reloader wharves, but these are quay walls joining each other at an angle of 135 deg., the former being 850 ft. long and the latter 750 ft.

The reloader wharf substructure at Balboa is similar to the cylinder-supported deck construction at Cristobal. The unloader wharf is somewhat different in having a steel and concrete deck supported by rectangular concrete piers built in the open and dry.

There are two unloading towers similar to those at Cristobal and two reloading machines. There are no stocking and reclaiming bridges, but instead there are utilized the four berm cranes (rebuilt), used in the construction of the Pedro Miguel and Miraflores locks. There is a single-track viaduct running along the unloader wharf and up the center wall of the coal-storage platform, together with the two-track (loop) viaduct along the reloader wharf. The cars used at Balboa dump on one side only and in that way differ from the design for Cristobal. Coal is received either from the unloaders or from the cranes and is dumped into the hoppers of the wharf bunker or of the reloaders, or directly into the storage pile. The wet-storage basin is 310 ft. long and has a capacity of 50,000 tons of coal. The total dry and wet storage is 215,000 tons. The handling capacity is half that of the Cristobal station.

The general plans for the Cristobal and Balboa stations were made by the Division of Terminal Construction of the Panama Canal, under F. H. Cooke, Civil Engineer, U. S. N., as Designing Engineer.

The conveying systems and reloaders for both plants and the stocking and reclaiming bridges for the Cristobal station were designed and furnished by Augustus Smith, president of the Bergen Point Iron Works, Bayonne, N. J., the contract price being about $1,714,000. The unloading towers for both plants were furnished by the Hunt Construction Co., of New York, at a contract price of about $486,000. The heavy structural steel was subcontracted by the U. S. Steel Products Co. and the electrical equipment by the General Electric Co. The belt conveyors were furnished by the Robins Conveying Belt Co.

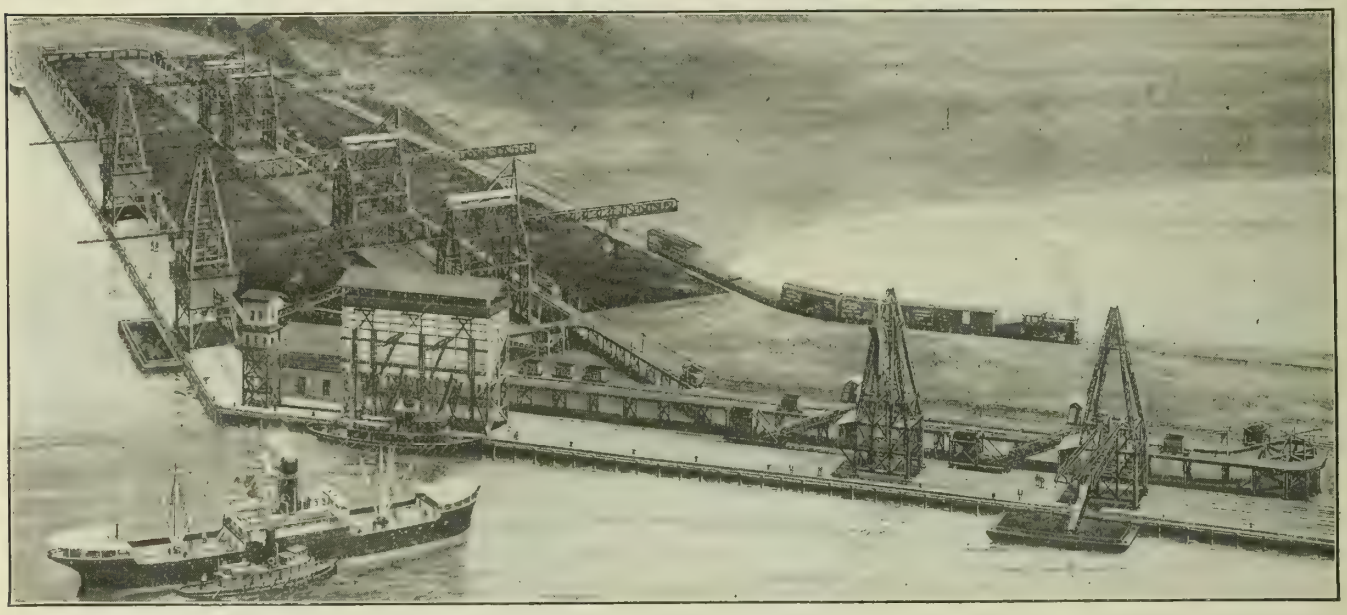


FIG. 5. THE BALBOA COALING STATION AT THE PACIFIC END OF THE PANAMA CANAL
From drawing by E. W. Spofford, of New York City

New Steel Plant in Australia—A new iron and steel plant belonging to the Broken Hill Proprietary Co., Ltd., has been erected at Port Waratah, Newcastle, New South Wales. It covers 264 acres and is situated near rich coal fields and limestone deposits and has excellent harbor facilities. The total cost to build and equip the plant was $7,000,000. The total yearly demand of Australia for steel rails is about 150,000 tons. The total imports of iron and steel for 1913 were 400,000 tons, with a local value of about $36,000,000. United States Commercial Attaché William C. Downs, Melbourne, stated recently that although this new enterprise will seriously affect the sale of American steel rails to Australia, which in recent years has amounted to about $5,000,000 per annum, it is gratifying that, after a careful study of the largest steel plants in Europe and the United States, American equipment was selected.

Prizes for Rubber-Factory Plans—It is announced at Rotterdam that the council of the International Association for Rubber Cultivation in the Netherlands East Indies offers an international competition for a plan for a complete rubber estate factory for making "crepe," and a plant for a complete rubber estate factory, for making "smoked sheets." Both plans are to be drawn in such a way that the capacity of the plant will amount in the beginning to 220,460 lb. of dry rubber per annum, which by three extensions can be increased to 551,156 lb. The plans should be accompanied by a detailed description of the plant and of the way in which the competitor considers the product should be treated, including the necessary machinery. The project may be detailed in English and should be sent in before Mar. 1, 1916, either to the office of the association, 13 Kneuterdyk, The Hague, Netherlands, or to the office of the Algemeene Vereeniging van Rubberplanters ter Oostkust van Sumatra, at Medan, Dutch East Indies. The first prize is for $603 and the second prize for $201.

Irrigation Weir, Measuring Rod and Discharge Card*

By Kenneth A. Heron†

An interesting type of weir and method of measuring canal flow are used in the Modesto Irrigation District, Stanislaus County, Calif. The greater number of the distributing structures in the canals and laterals are constructed of timber. At frequent intervals along the canals weirs of the type shown in Figs. 1 and 3 are placed. The primary object of these structures is to afford a vertical drop in grade, or a method of raising the head on a side gate to increase its discharge or to deliver water to high points. Movable flashboards are used to obtain the required head. The structures consist of two or more weirs, each about 3½ ft. in length, constructed on a downstream slope of between 35 and 45 deg. from the vertical.

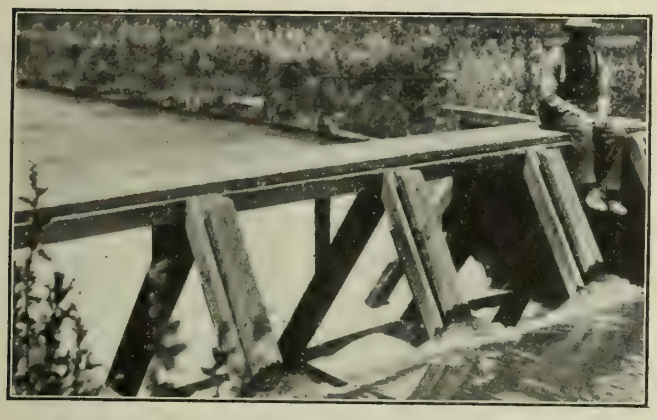


FIG. 1. WEIR IN MAIN IRRIGATION LATERAL
On downstream slope of about 40 deg. from vertical

A system that has been in use several years, of proportioning the canal flow by measurements made on these weirs, led the writer recently to conduct a series of experiments to determine its accuracy. The method of making measurements consists of holding vertically on the weir crest a ¾-in. smooth iron rod. A ring of water rises on the rod, which by measurements and computation has been found to approximate very closely the observed head plus the computed head of the approach velocity. From this head measured on the rod the discharge is computed by the Francis formula, as if there were no end contractions or slope to the weir.

The edge of the top board presents a sharp crest, and the center post and slide slots have the effect of forming fairly sharp end contractions.

Ditch tenders are furnished a card (Fig. 2) showing the discharge of a weir 1 in. in length under different heads. A measurement consists of merely observing the head with the ¾-in. rod and multiplying the tabulated discharge corresponding to the head by the length of the weir in inches, which gives the discharge in cubic feet per second for the stream.

OVERPOUR MEASUREMENT

Discharge in cubic feet per second for each inch of length of weir.
Multiply the length of the weir in inches by the multiplier opposite the head in inches and the result will be cubic feet per second.

Head Inches	Cu. Ft. Per Sec.	Head Inches	Cu. Ft. Per Sec	Head Inches	Cu. Ft. Per Sec.	Head Inches	Cu. Ft. Per Sec.	Head Inches	Cu. Ft. Per Sec.
½	.0024	5½	0861	10½	.2271	15½	.4074	20½	.6196
1	.0067	6	.0981	11	.2436	16	.4273	21	.6424
1½	.0122	6½	.1106	11½	.2603	16½	.4474	21½	.6655
2	.0189	7	.1236	12	.2775	17	.4679	22	.6889
2½	.0264	7½	.1371	12½	.2950	17½	.4887	22½	.7125
3	.0374	8	.1511	13	.3129	18	.5098	23	.7363
3½	.0437	8½	.1654	13½	.3311	18½	.5312	23½	.7605
4	.0534	9	.1803	14	.3497	19	.5528	24	.7849
4½	.0637	9½	1955	14½	.3687	19½	.5748	24½	.8096
5	.0746	10	.2111	15	3878	20	.5971	25	.8344

FIG. 2. DITCH-TENDER'S CARD FOR WEIR COMPUTATIONS

The original was 5¼x3¼ in.

The accuracy of the method has been demonstrated by carefully made current-meter measurements. In the following table weir measurements, made in the manner described, check very closely with the meter measurements:

Date	Lateral	Weir Measurements, Sec.-Ft.	Meter Measurements, Sec.-Ft.
5-11	1	51.31	51.41
5-22	3	78.00	77.36
5-22	4	120.00	121.51
6-11	3	241.00	245.08

Naturally, ideal conditions are not found at all of the structures. Such things as leakage and obstructions occur at times, but for all practical purposes, where measurements are necessarily made by ditch tenders of little special training, the results obtained are as close as could be desired. The method has a distinct advantage over measurements made by means of vertical weirs in that it is simple and does not require a special structure and, as shown above it is accurate enough for most purposes.

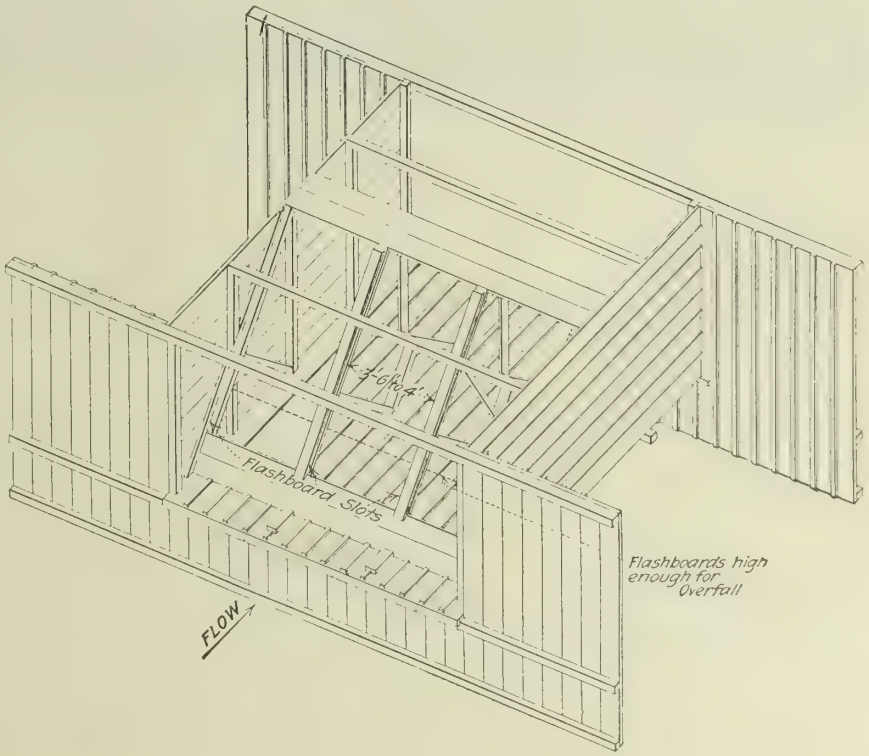


FIG. 3. SKETCH OF STANDARD STOP-GATE OR WEIR, MODESTO IRRIGATION DISTRICT, CALIFORNIA

*Abstracted from a report by the writer on "The Use of Water in the Modesto Irrigation District, Stanislaus County, Calif."

†Modesto, Calif.

Ninth Street Pier in Lake Erie at Cleveland, Ohio

SYNOPSIS—First large lake pier at Cleveland, used by the Detroit and Buffalo boats. Built by the steamship companies under the direction of the city and to revert to the city at expiration of lease. Construction is earth fill between gravity concrete walls. Special attention paid to architecture and arrangement of headhouses. Connected to trunk line railways.

The new pier in Lake Erie at the foot of Ninth St., Cleveland, Ohio, which was opened for service late in June of this year, marks a radical development in the harbor of that city. Hitherto practically all of the lake traffic steamers have docked along the tortuous channel of the Cuyahoga River, although an extended breakwater has for some years protected the lakefront of the city proper. About five years ago the city authorities initiated a project to enlarge an existing old pier at the foot of Ninth St. and to lease it to the steamship companies operating large passenger and freight steamers between Detroit and Cleveland and Buffalo and Cleveland.

Some difficulties with the arrangement immediately came up on account of arguments by the owners as to riparian rights at this location. In 1873 the city had appropriated for park purposes a strip of land along the lake extending from East Third to East Ninth St. All the area north of the railroad which runs along the lakefront here was then water. When it was planned to lease the waterfront for pier purposes the heirs of the owners from whom the land was appropriated instituted suit to restrain the city on the ground that the earlier appropriation was for park purposes and the front could not be used for commercial purposes. However, an agreement was entered into between the shipping companies and the city and work was started on the pier, but an injunction immediately served brought about legal controversies which were not settled until May, 1914. At that time work on the new pier began again in earnest and was completed in about a year's time.

The old pier which was replaced was 100 ft. wide and extended out from the bulkhead line 720 ft. It consisted of an earth fill between side and end bulkhead walls, which were made up of tight rows of round piles tied together with rods and waling pieces and filled with riprap, the earth fill backing against a row of sheet piles just inside of the bulkhead. Sections through these old bulkhead walls are given in Fig. 3. The new pier is also 720 ft. long and is 300 ft. wide; it is made up of a continuous line of concrete wall of gravity section, which along the east side and a part of the lake side is founded on the old pile bulkhead, and along the rest of the lakefront and on the west side is founded on new timber piles driven for the purpose. The old bulkhead piles were sawed off to 1 ft. below low-water level and embedded in the concrete of the wall 1 ft., so that the bottom of the concrete wall is 2 ft. below water level. The concrete wall is strengthened against the pressure of the interior fill by 2-in. anchor rods extending back into the earth fill and held by deadmen of two or three piles.



FIG. 1. NEW NINTH ST. PIER IN LAKE ERIE AT CLEVELAND

At the left, or west, at the dock, is one of the boats of the Detroit & Cleveland Navigation Co.; next is the pier of this company, then the pier of the Cleveland & Buffalo Transit Co. with the new "Seeandbee," the largest fresh-water passenger boat, at dock. The plaza in front lies between the lake and the railway lines which have sidings onto the piers

As will be noted from the sections in Fig. 2, the gravity section of the wall on the new piles has been designed to utilize the weight of the fill as a protection against overturning. That part of the wall built over the old bulkhead foots only on the outer piles of the bulkhead, and the inner and outer pile rows are tied together by a paving of concrete. The westerly bulkhead of the old pier is sawed off to 3 ft. 10 in. below the top of the new pier. The interior columns which support the structure on the pier are founded on prismatic concrete piers footing on timber piles.

The concrete wall has a remarkably good line and surface. Considerable care was taken to get a good finish on the outside and also in backfilling the wall.

In superficial plan the pier is in duplicate design on either side of a center longitudinal line, one-half being leased to the Cleveland & Buffalo Transit Co. and the other to the Detroit & Cleveland Navigation Co. Each half contains a freight shed with a headhouse, which is used as an office, a roadway running down to the end of the pier and up into the freight shed, and railroad tracks running out alongside of the freight shed. The floor of the freight sheds on the Cleveland and Buffalo side is of 3-in. oak on 5x5-in. sleepers laid in cinders. This is the side of the old pier; but the manager of that line was afraid of settlement which might damage a concrete floor and so built a timber floor. In the other freight shed the floor, though on a new fill, is of concrete.

The sheds are of fireproof construction, with steel frame and roof trusses, reinforced-concrete tile roof slabs and brick curtain walls. The headhouses, views of which are shown in Fig. 4, are quite pleasing in design. They are of brick and steel construction, with brick walls. The brick is a wire-cut mat surface; the lower ten courses are dark red and the rest of a grayish tone. In front of the headhouses is a strip of paving 75 ft. wide and 700 ft. long, on which runs one of the lines of the Cleveland street-railway system. The street-car fare to and from the public square is one cent. If the passenger does not have a penny, change is not made in less than nickels, but the regular Cleveland three-cent ticket may be used.

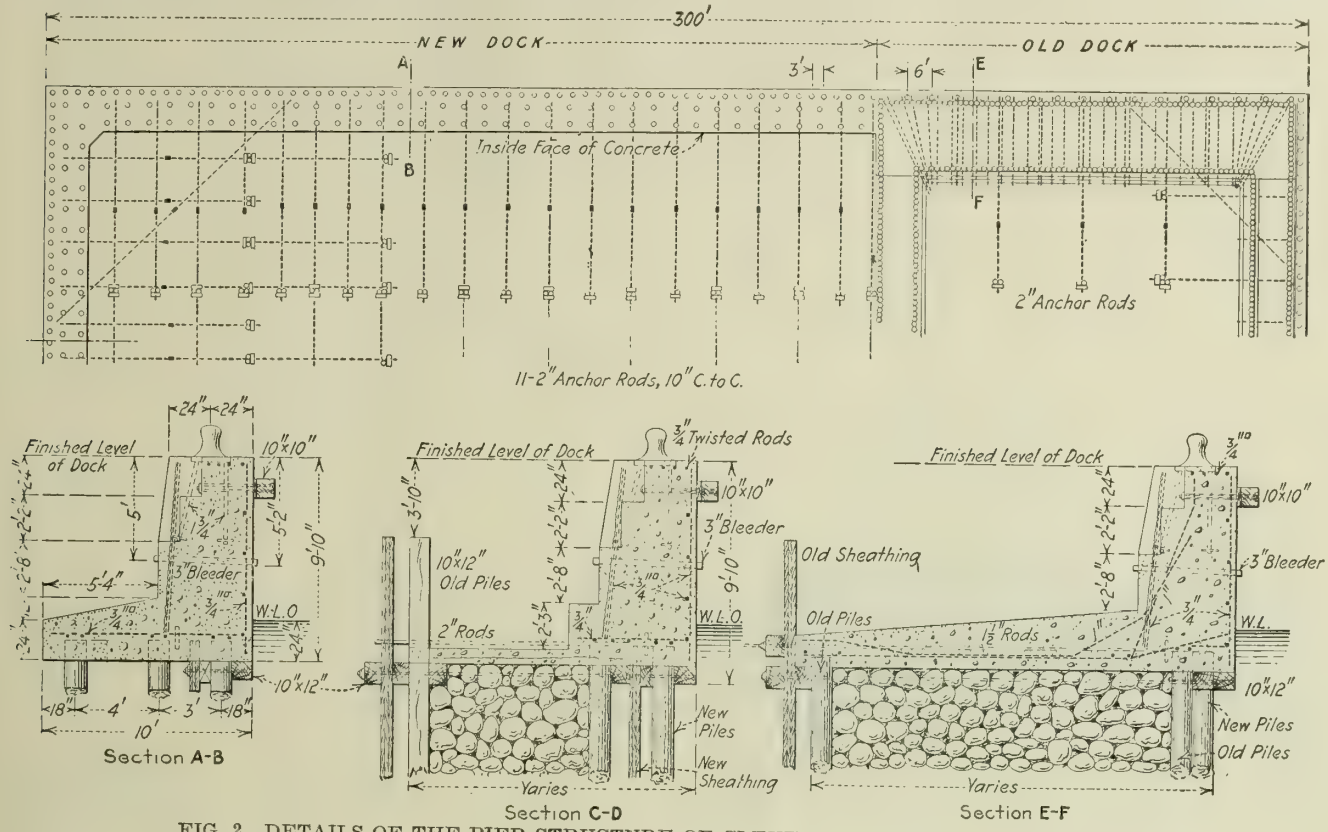


FIG. 2. DETAILS OF THE PIER STRUCTURE OF CLEVELAND'S NEW NINTH ST. PIER

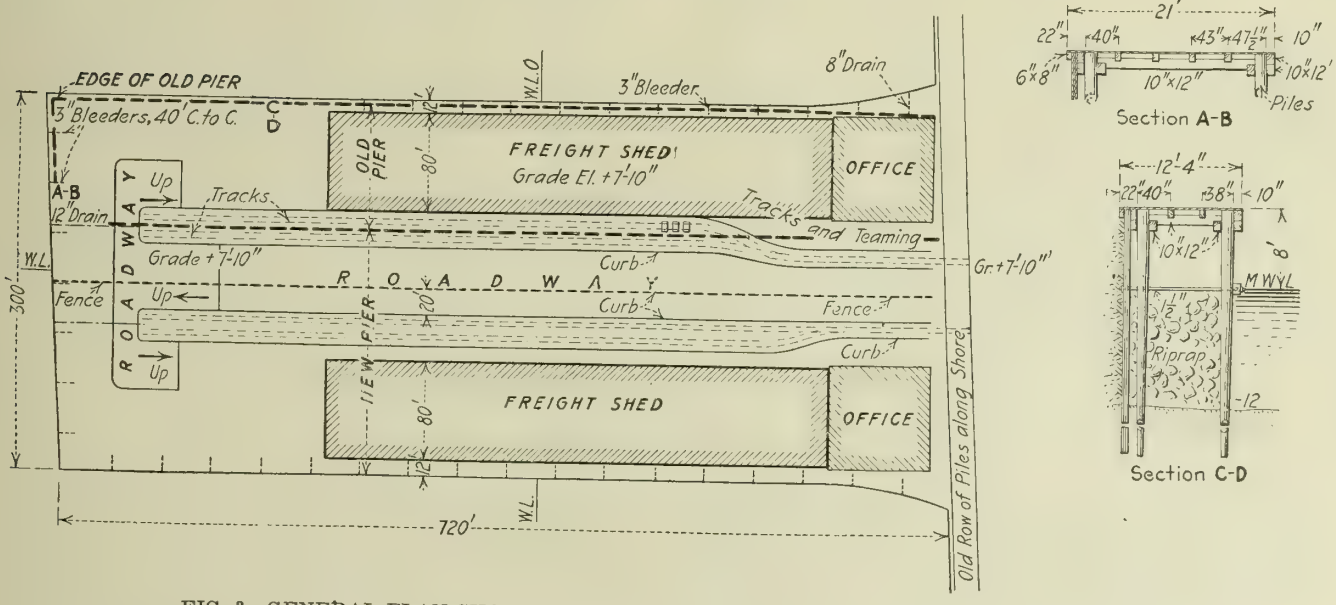


FIG. 3. GENERAL PLAN SHOWING OLD AND NEW NINTH ST. PIERS AT CLEVELAND

The design and construction of the pier had to be approved by the city of Cleveland, and E. B. Thomas, Assistant City Engineer, in charge of River and Harbor Department, was the city's representative. The lease between the Cleveland & Buffalo Transit Co. and the Detroit & Cleveland Navigation Co. on the one hand and the city of Cleveland on the other hand stipulates that the shipping companies shall have exclusive right to the pier from 1913 to 1953 on payment of an annual sum of $1000 and an assumption of the total cost of the whole construction, which amounted to about $450,000. At the end of the lease period the property reverts to the city. At any time before 1953 the city can obtain the property by a two years' notification and payment of the actual cost of the work; but the city cannot in such a contingency lease the pier to other parties engaged in a similar business. One curious feature of the lease is the stipulation that the lessees shall at no time permit the improvements to deteriorate or depreciate below "70% of their reconstruction value," said maintenance to be at the sole cost and expense of the lessees. It is, however, nowhere stated what is meant by the term "reconstruction value." The shipping companies employed W. S. Lougee, of Cleveland, Ohio, for the design of the pier and the contract for the work was held by George R. Cooke, of Detroit, Mich.



FIG. 4. HEADHOUSES OF NINTH ST. PIER, CLEVELAND

Stresses in Railway Track under passing trains have been investigated by J. T. Williams, professor of railway engineering, University of Kansas, and are described in a paper in the "Railway-Age Gazette." The apparatus used consisted of a recording instrument which measured the deflection of the track and Berry strain gages for measuring the stresses in the rails. Tests were made by senior students in the Department of Railway Engineering under the direction of Professor Williams, and measurements were made both on a main-line tangent where trains passed at full speed, on a 30-deg. curve, and on a tangent yard track near a station. Some of the important results obtained by the experiments are as follows: Stresses in the end of the rail were 25 per cent. greater than at the middle; the end of a rail at a joint is subject to intense vibration resembling that of a tuning fork, so that it was impossible to attach strain gages to the rail. Professor Williams thinks that these vibrations account to some extent for the crushing of angle bars. Freight cars cause fully as high stresses as passenger coaches, notwithstanding the greater wheel loads of the latter. The reason is thought to be the crude construction and condition of freight-car rolling stock. Flat spots on wheels increased the stresses 50 to 100 per cent. Variations in the speed of a train had no noticeable effect on the stresses. Stresses measured in the head of the rail averaged from 6000 to 10,000 lb. per sq.in. The maximum deflection of the track on stone ballast was about 0.3 in.

Reconstruction of Mississippi River Bridge at Keokuk

An interesting case of the reconstruction of large bridges to meet modern requirements of loading and traffic is the renewal of the superstructure of the Mississippi River bridge which connects Keokuk, Iowa, with Hamilton, Ill. The present bridge is of special interest from the fact that it was built as long ago as 1869. The original swing span was renewed in 1871, and in 1881 one of the fixed spans was knocked down by a steamer and rebuilt the same year. The steelwork is in good condition after 45 years' service, but the structure is too light for present traffic conditions.

The old bridge is 2194 ft. long between abutments, with ten fixed spans and a 380-ft. swing span, this last having been a notably large span at the time of its construction. It is a single-deck structure with through-truss spans, and its 20-ft. roadway serves for railway traffic (Toledo, Peoria & Western R.R. and Wabash R.R.), for the local street-car line and for highway and pedestrian traffic. Highway traffic is excluded when trains approach. It is a toll bridge and is owned by the Keokuk & Hamilton Bridge Co.

The masonry piers are at a slight skew with the bridge and are built on solid rock at very little depth. They are in good condition and require only small repairs; but they will have new tops and bridge seats of reinforced concrete to provide for the new structure. The rail level and highway deck will be 27.5 ft. and 56.7 ft. respectively above Keokuk datum, while the highest flood level in the river at this point is 14 ft. above datum.

The new bridge will be a double-deck structure, thus separating the two classes of traffic while maintaining a width which can be carried by the old piers. The railway track (for steam trains and electric cars) will be on the lower deck, and the highway and a single sidewalk will be on the upper deck. The swing span is at the Keokuk end and is 380 ft. long. Next to this are two fixed spans of 254 ft. 6 in., with curved top chords; and beyond these are eight parallel-chord spans of from 148 to 162 ft. The railway approaches consist of earth fill at the east end and 200 ft. of I-beam spans at the west end. The highway approach at this end (1.8 per cent. grade) has about 600 ft. of viaduct and a short fill to the street level. The highway approach at the east end (5 and 6 per cent. grade) has 12 girder spans of 30 ft. (on bents) and 300 ft. of retaining wall and fill.

The new bridge is designed for Cooper's E-50 loading for trusses and track, no highway load being considered for the trusses. The omission of the highway load for proportioning the truss members is based on the fact that while the unit stresses are approximately the same as those generally used for railway structures, the steel called for by the specifications is of a higher grade and has an elastic limit at least 20 per cent. higher than so-called commercial steel. Therefore the steel can be allowed 20 per cent. higher strain, and this excess in strength will take care of a highway load of 1500 lb. per ft., which is more than sufficient for any possible local conditions of traffic.

The upper floor is designed for a live-load of 100 lb. per sq.ft. and a 17½-ton road roller. The dead-load is about 3400 lb. per lin.ft. of bridge for the 160-ft. spans, 4200

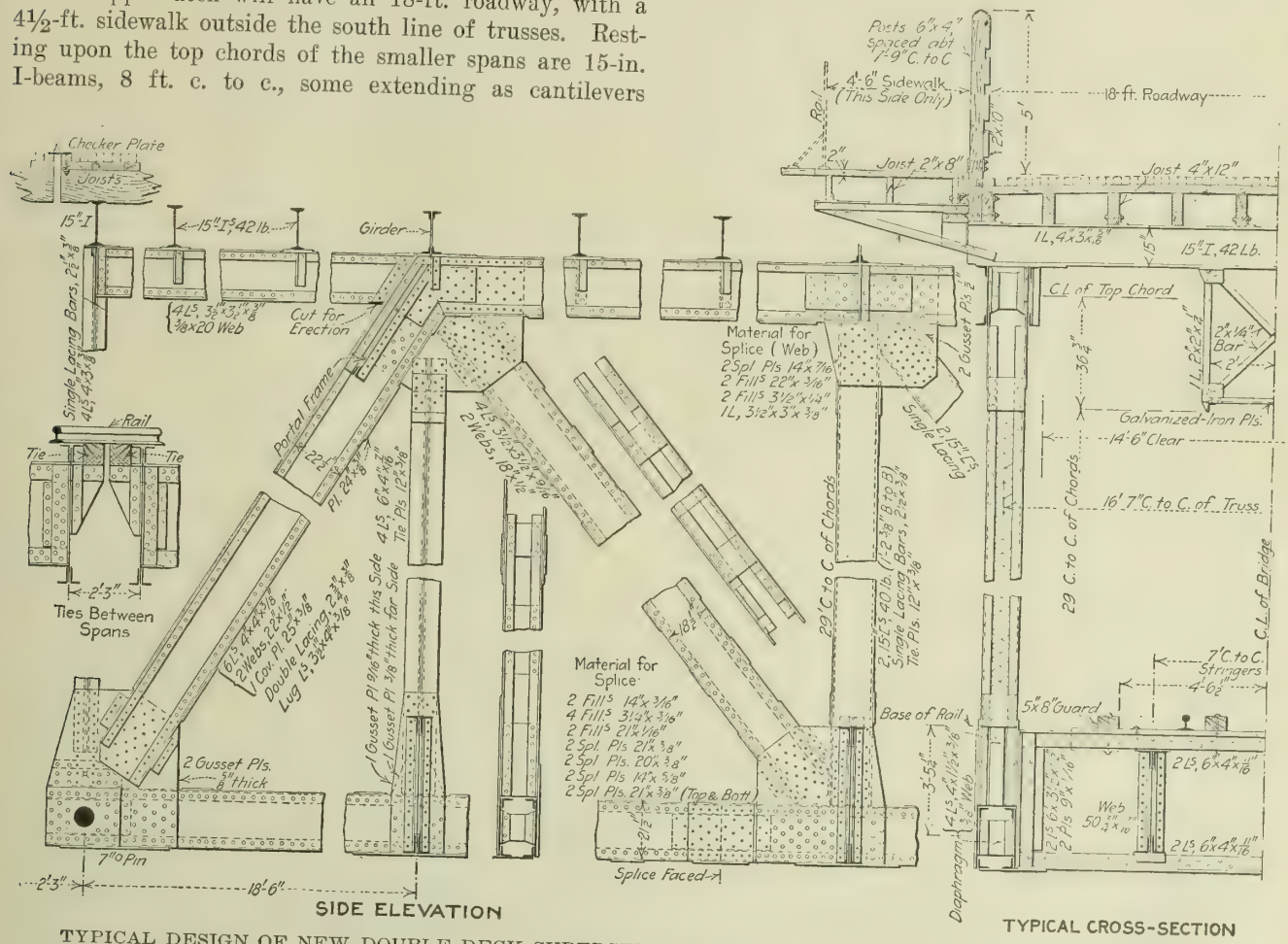
ft. for the 254-ft. spans and 4000 lb. for the draw span. For wind load, the top laterals (unloaded) and bottom laterals (loaded) are calculated for 500 lb. and 450 lb. respectively. The truss depth is from 29 to 32 ft. The trusses are spaced 16 ft. 7 in. c. to c. in the shorter fixed spans and 20 ft. 6 in. c. to c. in the two longer spans and the draw span. Openhearth steel is to be used, from 62,000 to 70,000 lb. ultimate strength for medium steel and from 52,000 to 60,000 lb. for rivet steel, with elastic limit not less than 37,000 and 30,000 lb. respectively.

The shorter fixed spans have riveted trusses, with pin bearings in the end shoes. The longer ones have riveted and pin-connected trusses. The swing span is riveted, except for the eye-bar ties from the tower to the hips of the trusses. The drum is 29 ft. diameter and 63 in. deep, with eight radial struts, and the trusses are placed upon it at four points of support.

The upper deck will have an 18-ft. roadway, with a 4½-ft. sidewalk outside the south line of trusses. Resting upon the top chords of the smaller spans are 15-in. I-beams, 8 ft. c. to c., some extending as cantilevers soted wood blocks. The sidewalk will have a single course of 2-in. untreated plank laid across the joists.

A wood fence will be placed on the outer side of the roadway, and the old iron railing will be replaced along both sides of the sidewalk. Electric wires will be carried across the bridge on cantilever brackets on the north side of the upper deck; but on approaching the navigation channel they are to be raised to about 50 ft. above the rail level and then swung inward to cross the drawspan on the center line of the bridge.

The lower deck will have 50-in. plate-girder floor-beams framed between the truss posts. Between these will run two lines of track stringers 7 ft. c. to c., set so low that the tops of the ties are 1½ in. above the floor-beams. The track will be laid with 8x8-in. ties, 12 ft. long, spaced about 12 in. c. to c. They are boxed out over the string-



TYPICAL DESIGN OF NEW DOUBLE-DECK SUPERSTRUCTURE FOR THE MISSISSIPPI RIVER BRIDGE AT KEOKUK, IOWA

on the south side and others having cantilever brackets attached to them. At the portals, plate girders take the place of the I-beams. In the swing span and the longer fixed spans, where the trusses rise above the road level, the floor-beams are framed between the truss posts, and the sidewalk is carried by cantilever latticed brackets outside the posts.

The floor-beams will carry ten wood joists 4x12 in. for the roadway and three 2x8-in. joists for the sidewalk. The roadway is to have a deck of 3-in. tongued-and-grooved planks laid upon the joists and covered with a three-ply layer of roofing felt mopped with hot pitch, and upon this will be relaid the old paving of 3-in. creo-

ers, and every third tie is to be fastened to them by hook bolts. At the ends of the spans the ties are placed close together, being carried on brackets on the end floor-beams, as shown. There will be two guard timbers, 5x8 in. The inner one (8 in. from the rail) will not be boxed, but bolted to every tie; the outer one will be boxed and bolted to every third tie.

The single track will be used by both steam trains and electric cars, interlocked connections being provided at each end. In order to protect the steel of the upper deck from the blast and gases of the engines an inverted trough of galvanized iron plate will be suspended by hangers from the I-beams of this deck.

The new bridge was designed by Ralph Modjeski, consulting engineer, of Chicago, and the work will be done under his supervision. The contract for the erection has been awarded to the Strobel Steel Construction Co., of Chicago. Work on the fixed spans will be commenced at once, and it is expected they will be completed by the opening of navigation in 1916. The drawspan will be left until next winter, when the river is closed to navigation. The old bridge will be kept in service, both as to railway and highway traffic, during the erection of the new structure.

Plastic Concrete Mattress for River Revetment

During the past year a number of experiments have been carried on in the Passaic River near Newark, N. J., with a machine designed to lay a plastic concrete mat as a protection against caving and erosion on the sloping underwater bank of a river. The results proved so successful that an effort is now being made by the inventor to have the Mississippi River Commission adopt the scheme for the subsurface protection of the banks of that river in place of the ordinary willow mattresses which have been used there for so many years.

The accompanying photographs illustrate the Passaic River work. The submitted design for the Mississippi River work is in its essentials the same as for the experimental work, but a somewhat more elaborate machine has been designed for the former. The machine and the method were invented by Alexander Crawford Chenoweth, who is well known as the inventor of a reinforced-concrete pile. The company which has the work in hand is known as the Chenoweth Concrete Revetment Co., Inc., with offices in the Woolworth Building, New York City.

Essentially the method of protection consists in laying a mat of reinforced concrete on a platform on a floating barge. By means of endless chains running underneath the mat, it is conveyed while still plastic to the underwater slope of the bank and paid out as made until the end of the mat has reached deep water, where erosion is not likely. The concrete is mixed sufficiently dry to prevent dissolving when submerged, and is paid over the side of the barge before it has set hard. Consequently the mat takes the conformation of the ground on which it is laid.

The machine used for making the experimental slabs was in accordance with the details shown in Fig. 3 and the views in Figs. 1, 2 and 4. An ordinary barge was equipped with a derrick and at its outer end an apron hinged to move in a vertical plane. The forming-board on which the mat was laid extended back on the barge and the

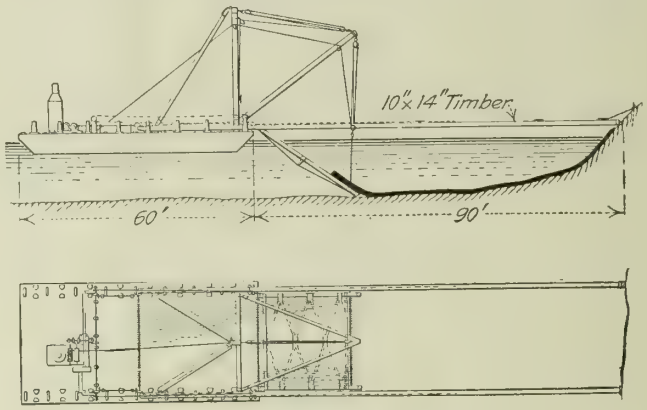
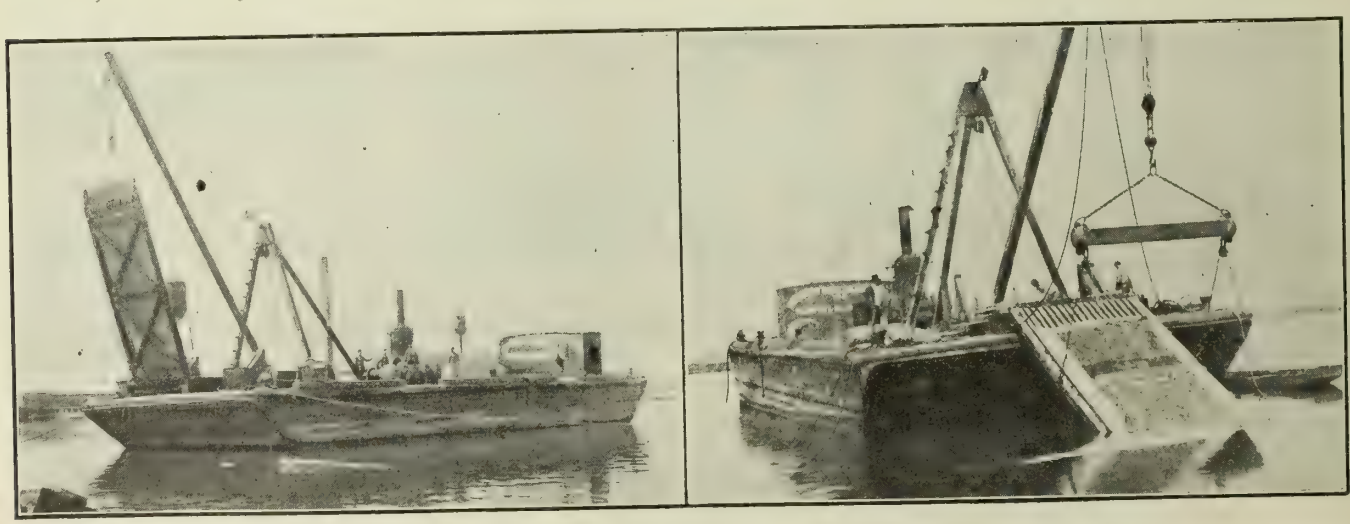


FIG. 3. PLAN AND ELEVATION OF PASSAIC RIVER REVETMENT MACHINE

endless chains were carried under this forming-board over the apron and back again. On the forming-board was first placed a layer of heavy commercial burlap. On this was laid the reinforcement, which consisted of triangular wire mesh crimped so as to form a Z section every 12 in. on a 4-in. fold. The crimping of the mesh serves to prevent the concrete from sliding down steep inclines before it has set, and also insures the location of some of the reinforcement in the middle of the section no matter what angle of bend the slab may take during placement. The burlap holds the concrete together and insures the continuity of the mattress.

In operation this machine deposited a reinforced-concrete covering 60 ft. long and 25 ft. wide. It worked offshore, being held in position by the longitudinal spuds shown. The concrete mat retained its integrity while being placed and apparently set hard under the water without any break.

The accompanying views show some of the work on the Passaic. Fig. 4 is a view from the barge looking offshore across the apron, with part of a concrete mat being pushed out along the apron. Fig. 1 is a general view of the



FIGS. 1 AND 2. PASSAIC RIVER CONCRETE REVETMENT SCOW WITH APRON UP AND DOWN

barge with the apron elevated, and Fig. 2 is a view of the barge with the apron depressed.

For the Mississippi River work a somewhat more complicated machine has been designed. The features of the method presented to the commission contemplate a reinforced-concrete covering 4 in. thick, made in widths of 30 ft. or more, and of sufficient length to permit depositing it in a continuous layer on the slope under water to a depth of 70 ft. from the water line. The machine (Fig. 4) consists of a barge with a recess in the mid-section forward containing a hinged apron 80 ft. long and 30 ft. wide. This apron is built up of air-tight tubes sufficiently buoyant to float the apron when not loaded.

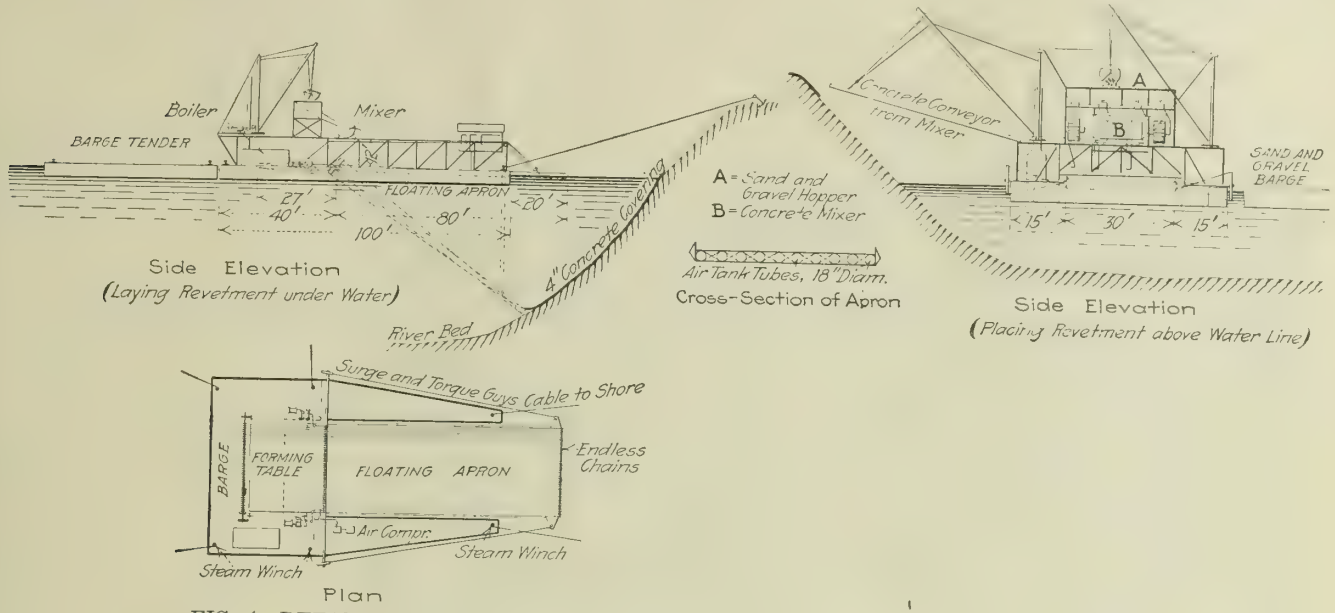


FIG. 4. DETAILS OF PROPOSED REVETMENT MACHINE FOR MISSISSIPPI RIVER

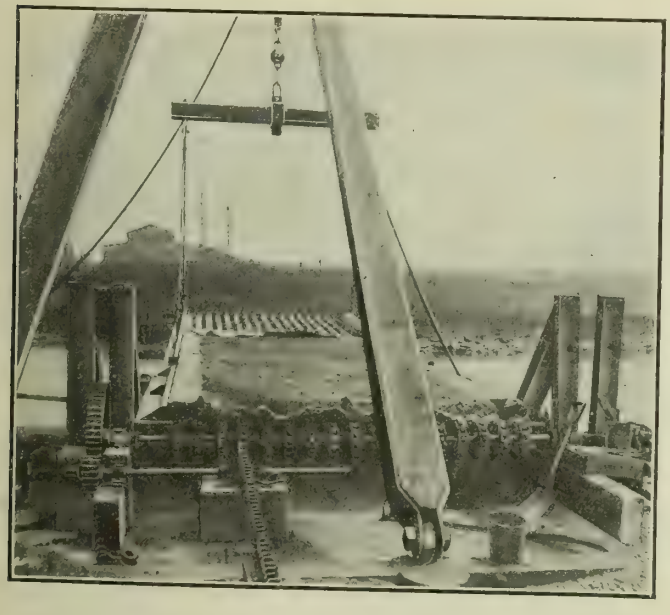


FIG. 5. LOOKING OVER THE APRON OF THE PASSAIC RIVER MACHINE

Air can be forced into the cylinders or water admitted to balance the apron during the operation. This balanced apron is necessary because a derrick to handle the heavy slabs intended for the Mississippi work could not be economically designed.

Back of the apron hinge is a forming table 30 ft. wide with sideboards 4 in. high (the thickness of the covering to be made). These sideboards also extend onto the apron. Over the top of the fixed table are endless link-chains, every third link containing a projection which engages the plastic slab cast on the forming board and carries it along overboard in a continuous sheet, the barge backing away from the shore so as to permit the paying-out operation. This backing away will be started by pulling in on an offshore anchor; but it is thought that as soon as any considerable length of mat has been cast the weight of the concrete will force the boat out into the stream, and then the backing can be controlled by shore lines.

It will be noted that the barge is equipped with a concrete mixing plant and also with derricks, so that it can be used for above-water revetment work.

It is the intention to cast the mats in 30-ft. widths and to overlap them about 2 ft. The plastic concrete should bond to the slab below at the overlap and form a continuous covering along the bank. Observations on the Passaic slabs for over a year lead the inventor to believe that a mat so formed will remain intact under the wash and wear of the river and will form a more effective and durable covering than the willow mattress.

Grade Elimination on Lackawanna at Buffalo—The progress being made on the extensive grade-elimination work on the Buffalo division of the Delaware, Lackawanna & Western R.R. is indicated by the recent formal opening of the new overhead crossing at the Nickel Plate junction, south of the intersection of Abbott Road and the Buffalo River, Buffalo, N. Y. By this improvement Lackawanna trains are no longer compelled to cross the Nickel Plate, Pennsylvania or Buffalo Creek railway tracks. This work was discussed with particular reference to the use of heavy plate girders in "Engineering News" of May 27. One of the most important items in this project was the construction of the foundations of a bascule bridge over the Buffalo River, which was described in detail in our issue of July 8. The grade-elimination work was done under traffic, and so as not to interfere with the movement of about 700 cars daily interchanged. When the bridge was built over the tracks, the intervals between trains on the cross lines averaged six minutes. The fill amounted to about 500,000 cu.yd. For the past two years about 200 men have been working on this project. The new bascule bridge was required on account of the straightening of the Buffalo River, under way by the city.

Should Ferry Service Be Free?

By H. M. Chittenden*

Certain ferries across Lake Washington and Elliott Bay in Seattle are built and maintained by the Port of Seattle, a municipality coterminous with King County, in which the City of Seattle is located. The county itself maintains a ferry across Lake Washington, and there is also a private ferry on the lake. All these charge for service, the rates being fairly uniform and quite low. No complaint is made that the charges are onerous or obstructive of use, but extreme advocates of public ownership argue that the ferries should be free, as an essential part of the public highway system, just as bridges, which perform exactly the same office of carrying the highway over bodies of water, are free. On the face of it the argument looks reasonable, and the purpose of this article is to inquire whether in fact it is so.

As an economic proposition, freedom of use of the public highway stands on a perfectly logical basis. In any case, whether free or toll, the user has ultimately to pay the cost of construction and maintenance. With the toll road he has to pay the additional cost of collecting the tolls and of profit to the holder of the privilege. Except for these extra charges, the account should balance itself so far as mere outlay is concerned. The private builder of the toll road may do his work more economically and thus somewhat reduce the burden; but at the same time his plans are sure to be less comprehensive, and in these days the work would surely be of a lower standard. But the chief economic objection to toll roads is that the toll restricts use. To avoid the payment of toll the user will resort to inferior roads when weather or other conditions make it possible, and this involves a waste of energy and a consequent burden upon traffic which must appear in prices or in a drag upon business activity. Absolute freedom of use means a maximum of use and increases to a maximum the utility of the work. Moreover, toll roads, when they were general, were mainly restricted to trunk lines, and the development of other roads suffered. Toll roads were undoubtedly a blessing at a time when the country was practically without other roads worthy of the name; but their day of usefulness has passed, and the world fully recognizes the economic advantage of perfect freedom of use.

Accepting, then, the principle of the free public highway as thoroughly sound, and admitting that culverts, bridges, etc., are an organic part of the road itself, subject to no special charge, why not treat the ferry exactly as we do the bridge? Both serve the same purpose of carrying the traffic of the public highways over otherwise impassable barriers—generally water courses. Why should we charge for one and not for the other?

The answer is this: The freedom of the public highway is a freedom of use. If anyone wishes to walk or drive along it or transport goods, the public makes no charge. But the public does not undertake to transport him or his goods, except in special cases, one of which is the ferry. It is impracticable for the user to operate the ferry. The owner or lessee must necessarily do that. And so the public, as owner, builds the landings and the boat and operates the property. It goes into a sort of compulsory transportation business to that extent. It not only provides the highway, but it carries the passenger and goods. The user is thus saved the expenditure of physical energy of himself and animals, wear and tear of equipment, expenditure of fuel oil, etc., in motor conveyance, over the route of the ferry. For this service, which is entirely special and in addition to that afforded by a bridge, it is right that the user should pay. He is simply paying for a service which, in the case of a bridge, he performs himself.

The strictly logical and consistent basis of public-ferry charge differs somewhat from that on private ferries. The latter must charge enough to cover service, upkeep, interest on outlay and a reasonable dividend. The former should really charge only for that service which is in addition to the ordinary highway; that is, for the transportation which it furnishes. It should not include the cost of maintenance of structures, or any interest on cost of construction, any more than it would make such charges for a bridge. These should be covered in the tax budget with other highway costs. The tariff should logically embrace wages of crew, expenditures for power, oil, and other directly operative outlays. This would of course make competition by private ferries on the same route impossible.

Another reason why there should be a ferry charge is found in the method of raising money for public highways. This is done by general taxation. As highway use is general and property values generally highest where roads are used most and the cost of maintenance greatest, the system is theoretically and practically equitable—as much so as any system would be which it is possible to devise. But ferries are special and exceptional facilities, affecting, as a rule, only limited portions of a community. They are in no sense so universal as bridges and the roadway itself. To make them free would thus be taxing a whole community for a special benefit to a limited portion.

*Brigadier-General, U. S. A., retired, 2010 Broadway N., Seattle, Wash.

Constructing an Outfall Sewer at Canton, Ohio

Lively work is being done on an outfall sewer at Canton, Ohio. The John F. Casey Co. contracted to build the sewer in 300 days. At the end of the first month a mile had been laid. Subsequently the pace was increased. The rapid progress is due to good equipment and management.

The sewer is being constructed from the corporate limits of the city to the new sewage-disposal plant. Of a total length of 31,000 ft. of sewer, 26,000 is of segmental hollow-tile block supplied by the American Sewer Pipe Co., of Akron, Ohio, and the remainder (three siphons) is reinforced-concrete pipe made on the job by the Lock Joint Pipe Co., of New York. The segmental-block section is 39 in. diameter and one of the siphons is a single line of 39-in. pipe, 1150 ft. long. The other two siphons are double lines of 30-in. pipe, with a combined (siphon) length of 3875 ft.

Segmental block were adopted because the sewage is acid in character, because of the smoothness of the interior surface and because the bids for the block were $20,000 lower than the lowest offer for the other materials bid on—brick and concrete. It may be added that the interior of the concrete pipe used for the siphons was smoothed by men wearing rubber gloves.

The sewer has a grade of 0.1 per cent., a friction coefficient of about 0.011, an estimated velocity of 2.87 ft. per sec., and a calculated capacity of 18,000,000 gal. a day. Figs. 1 to 4 are views showing some of the trenching and pipe-laying work. The depth of trench ranges from 6 to 22 ft. and averages about 12 ft. The material encountered is about 80 per cent. gravel and sand and 20 per cent. rock consisting of limestone and shale. The limestone is being drilled with Ingersoll-Rand Jackhamer drills, with air supplied by Westinghouse cross-compound pumps.

That portion of the sewer which is in gravel and sand is being excavated by an Austin trench machine and backfilled with a Marion steam shovel. All material is being hauled by teams from the nearest railway siding. An industrial railway has been used at some points, and a cableway was used on a side-hill.

The concrete pipe is being cast on the ground and lowered into place in the usual manner. The segmental blocks are being laid upon circular collapsible forms.

Ottamar Stange, of the John F. Casey Co., is in direct charge of the work, J. B. Bowen is field superintendent for the contractor, and G. H. Wynn is resident engineer for the city. W. E. Sarver is city engineer and Z. W. Kent is director of public service.

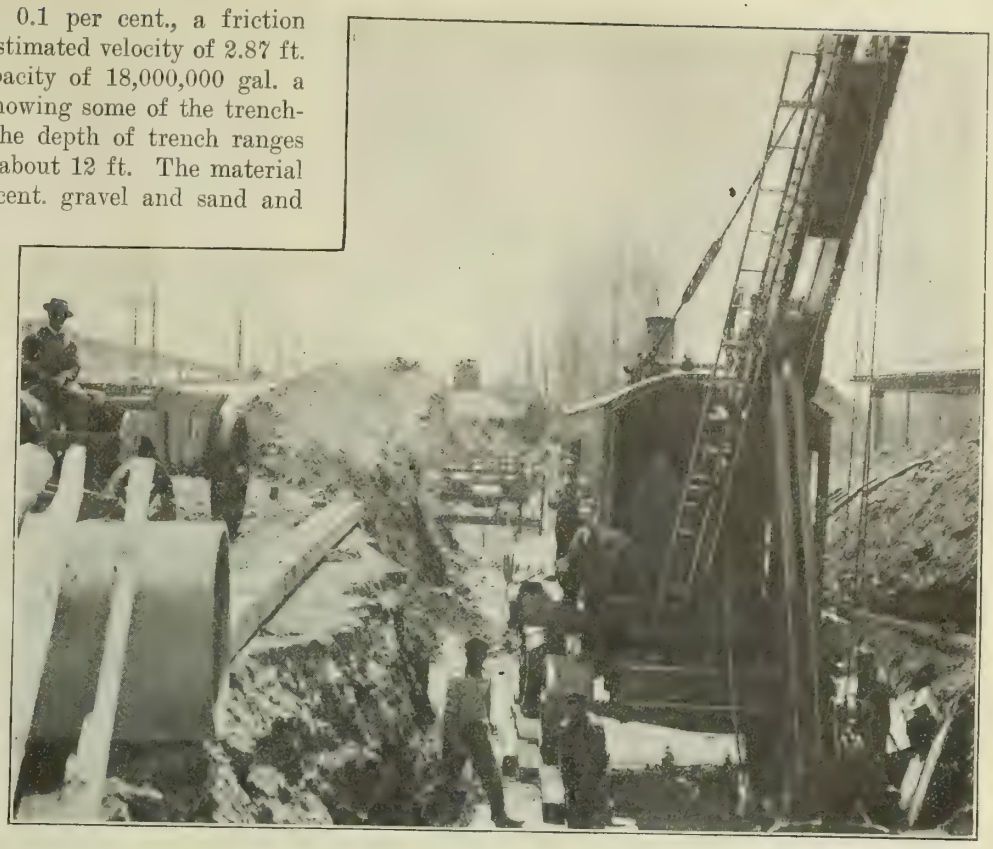
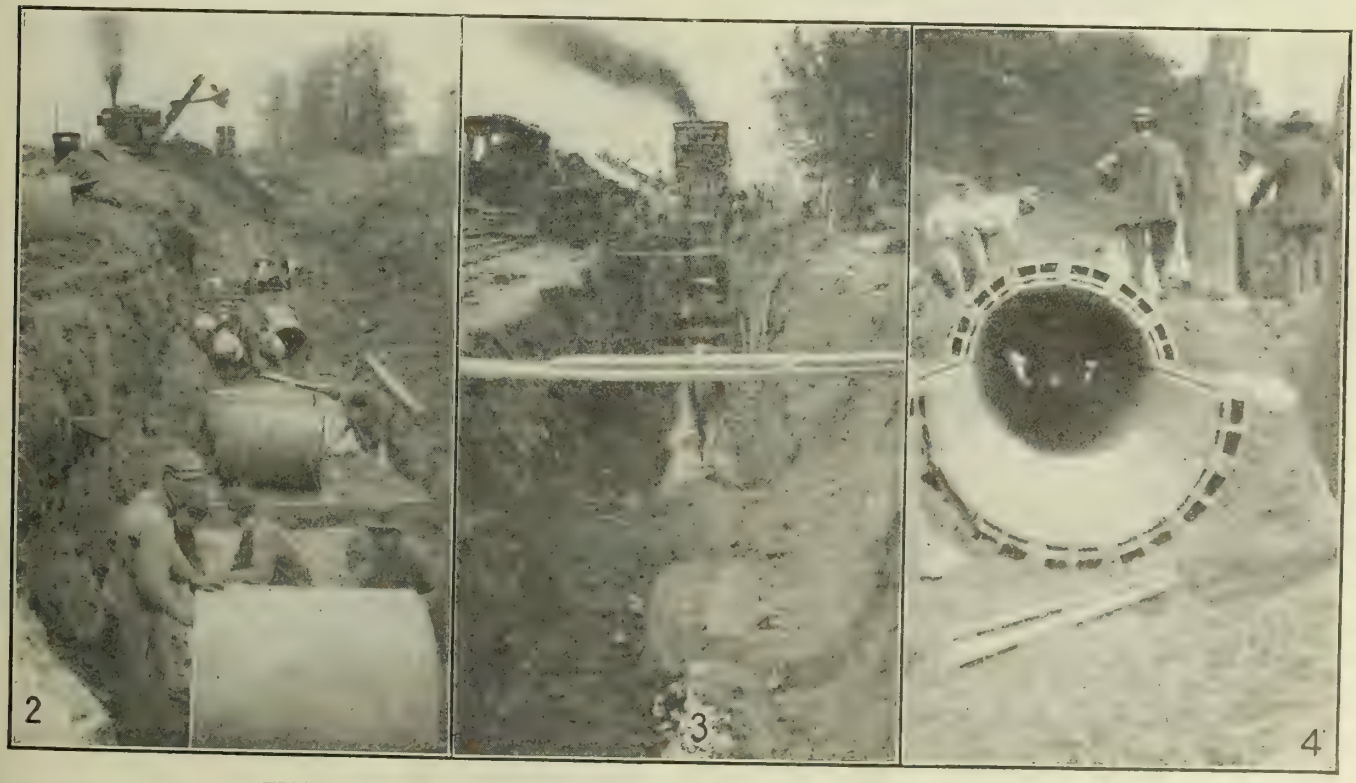


FIG. 1. TRENCHING FOR TWO 30-IN. CONCRETE SIPHONS, CANTON OUTFALL SEWER
Steam shovel in foreground, trench machine in background

The Proper Gage for Australian Railways is to be considered by an international board of engineers, according to a decision reached at a conference of the premiers of the Australian colonies. The board will be asked to investigate and report upon the need of a uniform gage, the best gage for adoption in view of present and future developments, the best method of changing existing lines to conform to the standard if adopted, and the probable cost of such gage changing.



FIGS. 2 TO 4. CONSTRUCTING THE OUTFALL SEWER AT CANTON, OHIO

Fig. 2—Steam shovel backfilling trench for double 30-in. siphon; trench machine in distance. Fig. 3—Trench machine and dinkey engine on 39-in. siphon. Fig. 4—Close view of 39-in. segmental block sewer

Field and Office

Concrete and Wood Park Seats

The seats in a new band park at Redlands, Calif., are made up benches formed by planks slid through concrete standards shaped so as to give the proper contour to the seat. The view in Fig. 1 shows the standards as cast and Fig. 2 gives an idea of how the seats look when placed on the earth slope rising from the band stand. The construction is novel and recommends itself not only on account of the ease of removal or transfer but also because of its pleasing appearance.



FIG. 1. CONCRETE FRAMES

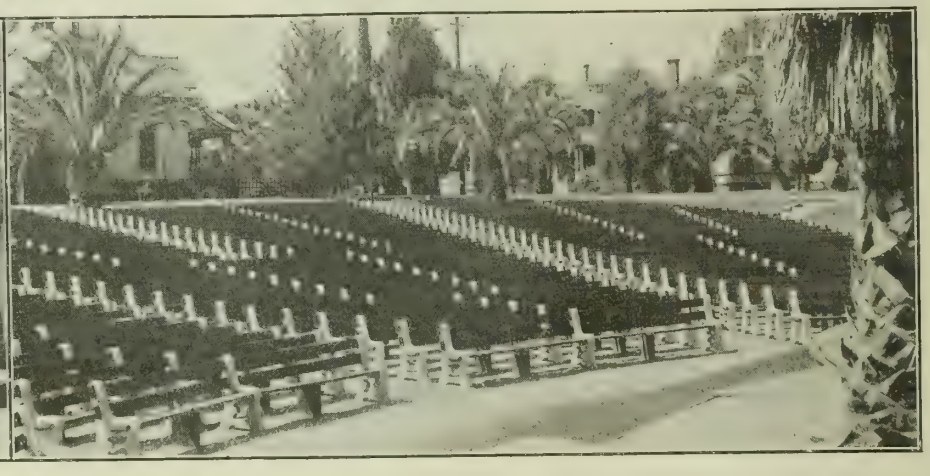
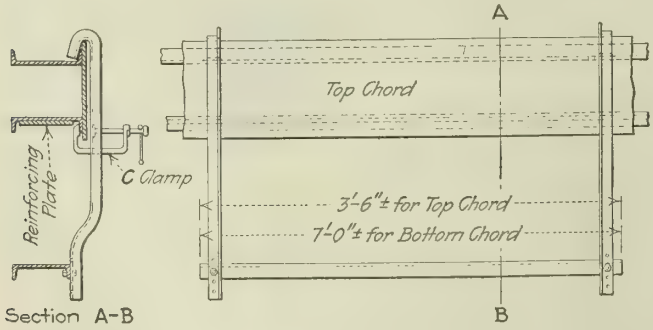


FIG. 2. SEATS MADE BY SLIPPING PLANKS THROUGH FRAMES

Successful Winter Drilling on the Barge Canal

By W. R. Brown*

Reinforcing three trusses on the upstream side of the New York State barge canal at Dam 5 necessitated the drilling of 8539 holes. More than 90% of them were $\frac{13}{16}$ in. in diameter. The remaining holes were $\frac{15}{16}$ in. It was found practical to drill $\frac{13}{16}$-in. holes and ream to $\frac{15}{16}$ in. This condition was brought about by the awkward positions from which some of the drilling had to be done and the difficulty experienced in operating big motors from such positions.



TYPICAL "OLDMAN" USED FOR DRILLING CHORDS

Throughout the winter the cold weather materially interfered with the drilling; the usual trouble with freezing of the motors was experienced, and the "soups" often froze before reaching the drill points. Alcohol was introduced freely into the pipe line both at the air tank and the hose connections, but during extreme cold snaps it was of little avail in lessening the number of "freeze-ups." Maintaining a coal fire every 30 ft. under the main air line did more to overcome freezing than any other expedient tried. But for the fact that a vertical air tank was employed it would have been impossible to keep the line open.

The "soups" consisted of a cheap grade of soap dissolved in water. During the cold weather it was necessary to make this in small quantities and keep it hot. To keep the mixture from freezing, and at the same time thin enough for use, was a problem. It was found that the greater the quantity of soap the slower was the freezing; but beyond a certain point the mixture became too thick to flow easily to the drill point and often froze in the spout of the squirt cans.

It was planned to lay out the holes with a template; but after finding that there was a great probability of bad holes, due either to carelessness in placing the template or a slipping of the drill, the plates were bolted in position and the holes drilled through the new plates. Drilling through the new plates with thick and freezing soups caused burned drills to be a much too common occurrence; but the speed with which holes were drilled in this manner more than balanced the expense due to damaged drills.

Special types of "oldmans" were made of channels and angles. The general type is shown in the accompanying sketch. The channels were in two lengths—one about 3 ft., for use on the top chord, and the other about 7 ft., for the lower chord. The former ordinarily covered 17 holes, the 7-ft. length about 28 holes.

The 8539 holes were drilled with 36 drills. The average thickness of the steel was $\frac{7}{16}$ in. Each drill was repointed about six times, and it was possible to use the drills until they were cut down to about 1½ in. in length.

*3 Cherry St., Ft. Trumbull Beach, Milford, Conn.

Owing to bad locations of many of the holes, high-speed drills could not be economically employed, and "Little Giant" No. 2 motors with Standard Tool Co. No. 6224 drills were used throughout and gave very good service. The total labor cost was $622.37, or about 7¼c. per hole. The cost of material may be estimated at not more than ¼c. per hole, making the holes average about 7½c. each. During the cold weather two men turned in on an average of from 70 to 90 holes a day. The best count made in one day of eight hours was 200, at a labor cost of $7.50, or 3¾c. per hole. The record for any period of time was 971 holes in 44 hr., at a labor cost of 4.37c. per hole.

Quick Solar Reduction by Slide Rule

Engineers and surveyors do not make as much use as they should of direct solar observations by transit to locate the meridian. The principal reason for this is the fact that the formula for the reduction is a little involved, and is easily forgotten. Recently a slide-rule was developed for solving this equation and the process is so much shortened that it may become popular. Accuracy is obtained by making the slide-rule scales 20 in. (50 cm.) long.

The front face of the slide-rule—a duplex type—carries 7 scales which solve the equation

$$\cos \text{Azimuth} = \frac{\sin d}{\cos h \cos l} - \tan h \tan l$$

in which d = declination, l = latitude, h = altitude of the sun, ascertained by observation.

The scales on the front of the rule are, in order downward: Regular D scale; $\sin d$ from 2° 22′ to 24°; $\cos l$ and $\cos h$ scale from 0 to 84° 15′; regular C scale in the middle of the slide; $\tan$ scale from 5° 43′ to 45°; inverted $\tan$ scale from 20° 50′ to 55° and at the bottom an enlarged $\cos$ scale with adjacent scale of equal parts, for angles from 0° to 60°. Either this scale or the $\cos l$ and h scale in conjunction with the C scale is used for getting the final result, the azimuth angle, from the $\cos$ Azimuth which is obtained by subtracting two slide-rule results.

The following example to illustrate the use of the rule is given by B. J. Campbell of the Keuffel & Esser Co., makers of the rule:

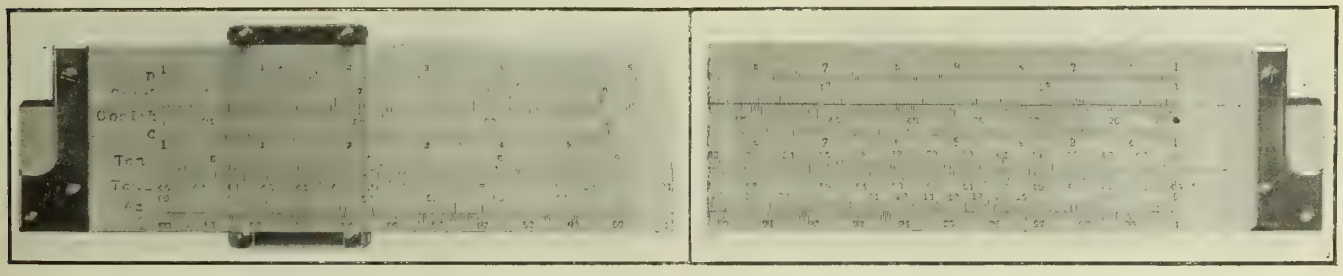
Latitude 40° 45′ N.; Longitude 74° 1′ W.; date Mar. 18, 1915, 3:57 p.m.,; observed altitude 23° 49′; horizontal circle 156° 30′. Required the bearing angle with the meridian of an east station at zero of the horizontal circle.

The refraction correction to the observed altitude is,

$$\frac{0.96}{\tan h} = 2.2'$$

which is to be subtracted from the observed altitude, making the corrected altitude 23° 47′. The declination, taken from the ephemeris as —1° 15′ 49″ is corrected for change from Greenwich noon by multiplying the hourly correction by the elasped time between noon plus the hour-angle of longitude of the place of observation west of Greenwich, in this case 59.3″ × (4 + 7½) = 8′ 50″, making the corrected declination —1° 7′. This gives all the quantities necessary for solving the formula. The first part of the equation is solved by setting opposite 1° 7′ on the scale of sin d* the value cos 23° 47′ on the top scale of the slide, then moving the runner to the 0 index of the slide and again shifting the slide to bring cos 40° 45′ under the runner. The index of the slide then reads 281, which is to be read as —0.0281. The second half of the formula is obtained by setting 23° 47′ on the tan scale opposite 40° 45′ on the tan inverted scale just below, and reading opposite the left-hand index of the tan inverted scale the value 3798 on the C scale on the middle line of the slide. This is to be read as 0.3798. Subtracting the second term from the first gives —0.4079 as cos Azimuth. Setting this value on the C scale we read on the cos l and h scale the angle 65° 56′. This is measured from the 180° point, as the cosine is negative; since the observation is in the afternoon, the actual azimuth is 245° 56′. Subtracting the reading of the horizontal circle gives the true bearing of the zero point as 89° 26′.

The slide-rule is of still further interest because of the equipment on its reverse side. This has the regular A, B, C and D scales (20 in. long), and on the middle of the slide an inverted C scale; and a pair of scales for reducing stadia observations, one of them a 34-in. scale for ($\frac{1}{2}$ $\sin$ 2 a), and the other a 6-in. scale for ($\cos^2 a$), giving respectively the elevation and the horizontal correction.



FRONT OF SLIDE-RULE FOR REDUCING SOLAR OBSERVATIONS FOR AZIMUTH

A 20-in. rule, of duplex construction. The rear face carries regular slide-rule scales and a pair of stadia reduction scales

Placing the Concrete Lining for Reservoirs

In putting the lining on the interior slopes of a rectangular reservoir of 14,000,000-gal. capacity at Omaha, Neb., the concrete is being placed in horizontal bands instead of up and down the slopes, as is the usual practice. The bands are about 5 ft. wide. Each one is completed around the reservoir on the day it is commenced. The reason for adopting the horizontal bands was that it permitted the use of a moister mix of concrete than is practicable with strips extending up and down the slopes.

The concrete is delivered in place by means of a chute, and the mixers are so placed as to minimize the distance required to transport it. After the completion of the slope work, a parapet wall 9½ ft. high will be built, a small hoist being used to raise the concrete to the top of the forms.

The same method of lining the slopes was employed last year for a reservoir of 11,000,000-gal. capacity at the Walnut Hill pumping station. Two concrete mixers were used, placed half-way along the east and west ends and elevated sufficiently to deliver the concrete by chutes to

*The sin d scale does not go below 2° 30′; but for smaller angles ½ sin 2d is equal to sin d, with very small error, and as one of the scales on the back of the rules gives ½ sin 2d, the present example uses this scale instead of sin d.

any desired point on the slopes. For the floor the chutes delivered the concrete to the foot of the slope, from which point it was distributed by wheeled carts.

The parapet walls in this case were only 2 ft. high. They were built after the slope lining had been placed, and the concrete was spouted directly from the mixers into the forms. The mixers for this reservoir being about 35 ft. above the ground, the tracks for their charging skips were extended downward for this distance, so that they could be loaded at the lower level and deliver the charge to the mixer at the higher level.

The work was done under the direction of George T. Prince, Chief Engineer of the Metropolitan Water District of Omaha. The district does all concrete work by its own force instead of by contract.

Rapid Erection of Temporary Timber Bridge

By S. Cameron Corson*

The old covered wooden bridge over the Schuylkill River between Phoenixville, Chester County, and Mont Clare, Montgomery County, Pennsylvania, was destroyed by a fire of unquestioned incendiary origin during the night of May 13 and 14, 1915. A few days before, petitions signed by leading citizens of the two boroughs, as well as by many other interested persons living adjacent to the bridge, were sent to the commissioners of Chester and Montgomery Counties requesting a new bridge. At a joint meeting of the commissioners the petitions were ignored because of "lack of funds." Then came the fire.

A contract for a temporary bridge at the site was awarded to the H. A. Bender Construction Co. for $7850, to be completed in thirty-three working days from the signing of the contract. Work was started June 21, 1915, and the bridge was opened for public use July 10, only 19 days later. There is a bonus of $20 per day for the remainder of the allotted time.

The view in Fig. 1 shows the bridge near completion. Fig. 2 gives the details of construction. There are 18 spans, 30 ft. c. to c., and the roadway is 16 ft. between guard rails. The design consists of floor plank laid diagonally on transverse joist which frame across I-beam stringers supported by timber bents. These bents are 6 ft. wide, 30 ft. long and 9 ft. 6 in. clear above mean water. There is a total of about 110,000 ft., b.m., of timber in the structure. The bridge was designed by Oscar E. Thompson, consulting engineer, Phoenixville, Penn.

*Borough Engineer, Norristown, Penn.

Computation of Survey Traverses

To the discussion of the use of traverse tables in *Engineering News*, May 27, 1915, Horace Andrews, of Albany, N. Y., contributes the following:

Why is it not better to use a good table giving the natural sines and cosines and have the multiplication carried on independently?

Many tables exist giving natural sines and cosines to five places, and one, that of Prof. W. Jordan, recently issued in its second edition, gives seven places for each 10 sec. of angle.

There are three very good tables for multiplication—Crelle's, Zimmerman's and Peters'; of these, the last named seems to be the best for use with traverse work. It gives products of every four-place number with all two-place numbers to 100. This large work costs 15 marks, while Zimmerman's, which is equally extensive, though not so convenient as Peters', costs only 5 marks.

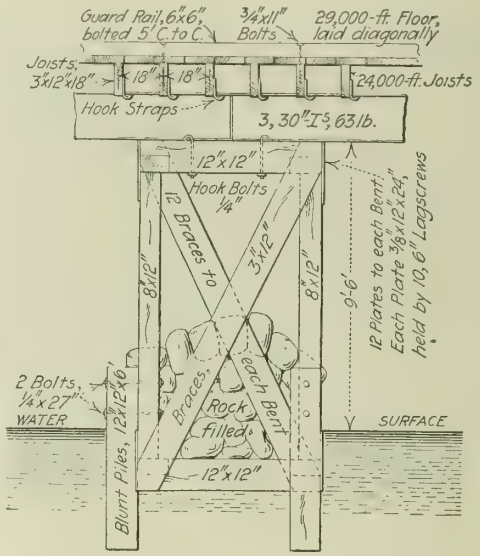


FIG. 2. SIDE ELEVATION OF PHŒNIXVILLE TIMBER BRIDGE AT SUPPORTING BENT

Where a computing machine is available, Jordan's tables and the machine could profitably be used. If a comptometer is used the multiplication given by Peters' tables would be a help with the machine.

I have frequently used the excellent five-place tables of Gauss for logarithmic computation, using a blank form specially ruled with printed headings, and then checked my work with the tables of natural sines and cosines using Gurden's tables; or those of Defert, which I prefer and regard as the best of the various traverse tables for ordinary use.

The Defert tables give for each minute of arc nine multiplications, from 10 to 90, with special tables for use when an angle less than 1 min. of arc is given. In all cases it is very necessary to check the numerical work of traverse computation by some means, and the best way seems to be to have one



FIG. 1. TEMPORARY BRIDGE ACROSS SCHUYLKILL RIVER BETWEEN PHŒNIXVILLE AND MONT CLARE

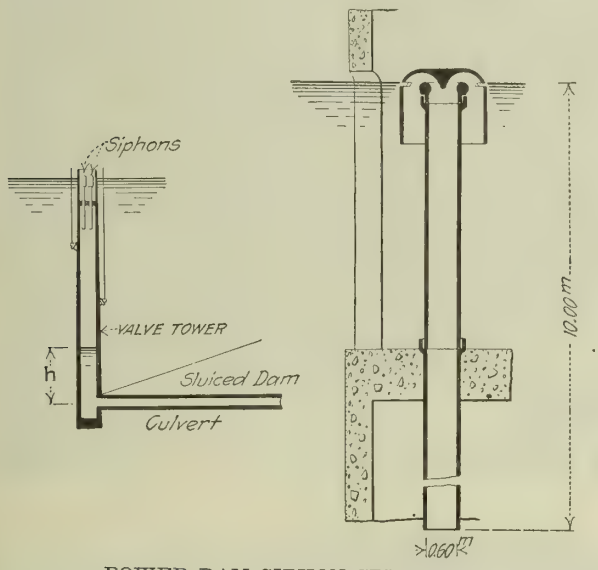
computation carefully made by the use of five-place logarithms and another by the use of traverse tables, or some other similar method as previously referred to.

Mr. Andrews states that four-place traverse tables will amply suffice for a large amount of ordinary field work. There are, he writes, at least 16 different traverse tables in existence.

Siphon Spillway for Power Dam

By T. K. Mathewson*

What is thought to be the first use of siphon spillways in America as the main discharge of a power reservoir was embodied in a recent design of the writer's. This type of spillway has found considerable use in



POWER-DAM SIPHON SPILLWAY

hydraulic works[1] and seems destined to wider application, so many advantages does it possess.

Shortly before the writer left Mexico, about a year ago, he studied a stream not far from Mexico City to report on a proposed hydro-electric development. A reservoir of 90 million cu.m. capacity (1950 million cu.ft.) formed part of the project finally decided upon for the initial development of 40,000 hp. The dam was to be a sluiced earth fill with masonry outlet and tower, similar to the Calaveras Dam, described in *Engineering News,* Oct. 1, 1914, p. 629. The depth of water would have been 45 m. (147.5 ft.). Every feature at the reservoir was favorable, except that the formation at the dam site was not hard enough to spill upon. Barrancas near by showed that the material would slowly but surely be eroded.

The writer saw that the culvert and tower might discharge the rainy-season floods, if only water could be got into the tower fast enough. There was no room at the top of the valve tower for an ordinary spillway of sufficient length, and it was believed that the well-known idea of the discharge of automatic sewer flush tanks could be applied to give the large flow without great rise in reservoir level. It was found that 16 vertical cast-iron pipes of 60 cm. (23.6 in.) diameter could be placed in the valve tower and would give the needed rate of discharge. The accompanying sketch shows the general scheme, though it does not give some details as finally worked out. Each pipe has a cast-iron hood, like those used in the flush-tank siphons, with a ring fitting into the upturned pipe bell to give the proper shape. Only one discharge rate had to be considered, since the siphons delivered their maximum or nothing. On account of mild climate, there was no chance of ice on the reservoir.

Probably there are not very many reservoirs where this design would be useful, but it was well worth considering in this case. Unfortunately, the construction has been indefinitely postponed due to the internal disturbances of that unhappy country.

*206 I. W. Hellman Building, Los Angeles, Calif.

[1]See "Movable Dam Crests," "Engineering News," June 4, 1914, p. 1264; "The Largest Pumping Plant in the World," July 9, 1914, p. 105; "Siphon Canal Locks," Oct. 13, 1910, p. 398, and Nov. 17, 1910, p. 530; "Siphon Spillways in Europe," Apr. 20, 1911, p. 467

Track-Raising in Building a "Hump" Station, New York Elevated Lines

In third-tracking the elevated railways of New York City, which work is now in progress, at many stations it is impossible to spread the tracks so as to admit island platforms between the tracks. There is always width enough to admit the center track, and in fact portions of

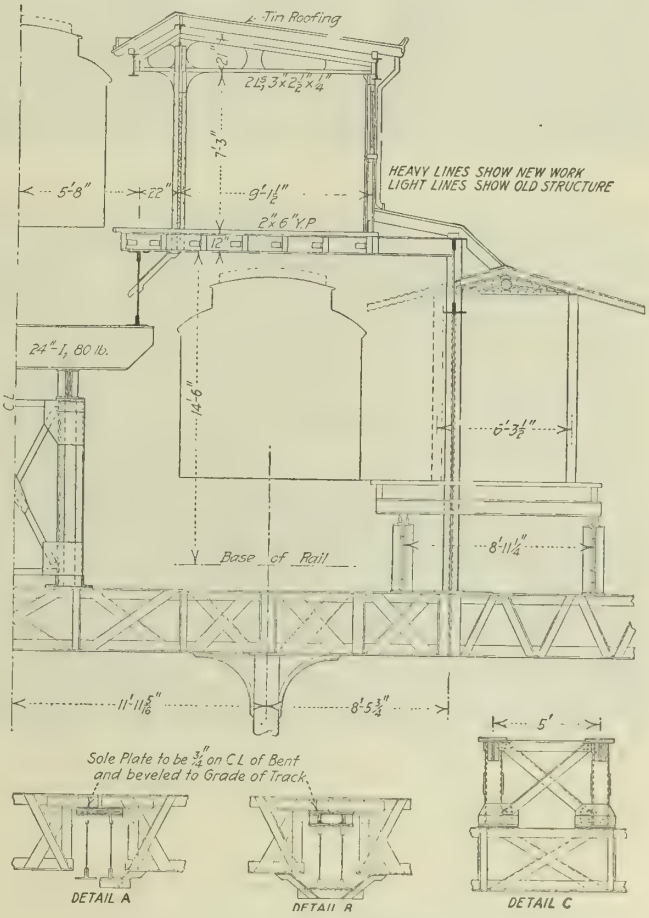


FIG. 1. CROSS-SECTION OF ELEVATED STRUCTURE AT STATION AND DETAILS OF EXPRESS INCLINE

this track were in place. To give access to the center track where island platforms were not feasible, platforms are being built at clearance height over the outer (local) tracks, and the center track is raised correspondingly, forming a long hump.

On the Ninth Ave. line a center track has existed for 20 years past, but new express stations are being built, most of them of the hump-station type. It is necessary to jack up the center track and its girders to form the hump. A typical job of this kind was done at 145th St. and Eighth Ave.

Here the hump construction comprises 9 new plate-girder spans at the station and 31 old lattice-girder spans raised to form the inclines on either side, 142nd to 148th St. The spans range from 43 ft. to 55½ ft., a total length of 1772 ft. The maximum height of the hump track above its old level is 12 ft. 3 in. The approach grades are 2.96 and 2.98 per cent.

During the construction of the incline the old center track was abandoned. After removing the track material, the bracing between the old track girders was cut out and the girders spread apart, so that the bents of the hump could be erected between them. Fig. 1 shows in detail the means by which the elevation of the center track was accomplished. At the starting and ending points of the incline packing plates (detail *A*) were placed on the existing cross-girders, of a thickness sufficient to raise the track girders to the new grade. The next form of support for the track stringers in their new location is illustrated by detail *B*, which shows a built-up seat. Detail *C* shows the general type of supporting bent used thereafter. Where the old truss girders were used in the construction they were braced to the bottom of the cross-girders by angles and kneebraces.



FIG. 2. EXPRESS INCLINES BUILT WITH OLD LATTICE AND NEW PLATE GIRDERS

Upper—Incline at 145th St. station on Ninth Ave.; the lattice girders of the old center track were used except at station proper, where there are nine spans of plate girders. Lower—Incline at Eighth St. station on Third Ave.; second deck of station being erected

The new material was delivered on the street in the order required for erection and hoisted directly to position by means of a sliding traveler of 6 tons' capacity, which rested directly on top of the longitudinal track girders of the express track (as shown in Fig. 3), where the work is under way. The traveler was equipped with a 40-hp. double-friction-drum electric hoist operated by a 550-650-

volt motor, current being taken direct from the contact rail on the structure. After setting bents, the track girders were placed in position on top of the bents and the sliding traveler moved forward to the next panel-point, where the operation was repeated.

The express-station and express-platform steelwork also was erected by this traveler when the site was reached. There is an express platform 12 ft. 4 in. wide by 350 ft. long on each side of the express track, one for northbound travel and the other for southbound. The platform is reached by two stairways located north and south of the old or lower-level station. The lower platform of the stairs is supported by a cantilever extension outside the

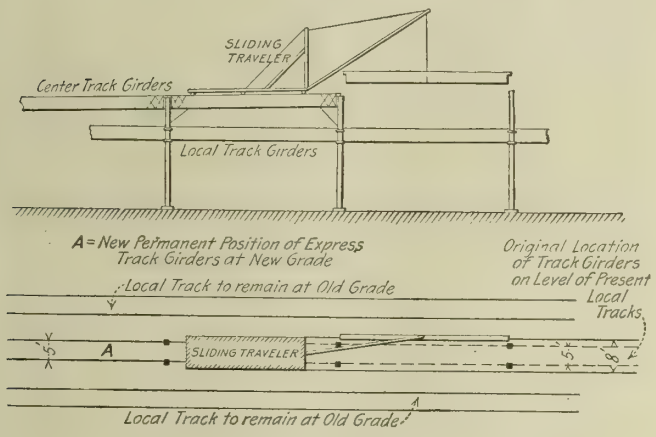


FIG. 3. METHOD OF ERECTING STRUCTURAL STEEL OF INCLINE

local platform. The upper platform of the stairs is supported by columns resting on top of the existing platform girders. The stairways connect with the platforms by a bridge 8 ft. 6 in. long.

The entire construction work, including the station, was done for the Interborough Rapid Transit Co. by the Snare & Triest Co. W. P. Rothrock was engineer in charge for the contractor and J. M. Ryan was assistant engineer. The structure was designed by the engineering department of the Interborough Rapid Transit Co., of which George H. Pegram is chief engineer, F. W. Gardiner, principal assistant engineer, and S. Johannesson, assistant engineer.

Controlling the Water-Supply to a Closed Tank

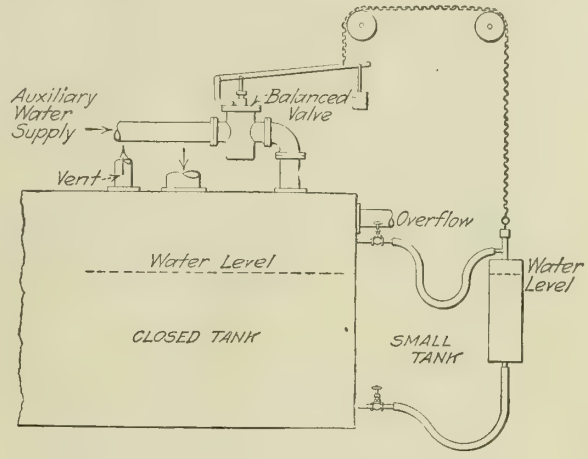
By B. C. Luce*

A simple and effective method of controlling the water supply to a closed tank without employing inaccessible devices like floats is shown in the accompanying sketch.

The device is well adapted to any service requiring a nearly constant water level—such as a boiler feed tank supplied by condensed steam from traps and with an auxiliary pressure connection automatically controlled.

The condensate from traps enters the closed boiler feed tank through a pipe marked "Main Supply." The auxiliary water-supply enters through a smaller pipe and is controlled by a balanced valve. This valve is operated automatically by a counterbalanced lever and the small cylindrical tank (about 8x20 in.) connected to the valve lever by a plumber's chain passing over pulleys. The two tanks are connected through flexible tubing at their tops and bottoms. The water level will be the same in both tanks.

A lowering of the water level decreases the weight of the small tank so that the counterweight pulls it up, opening the valve of the auxiliary water-supply. As the



CLOSED-TANK WATER-LEVEL CONTROL

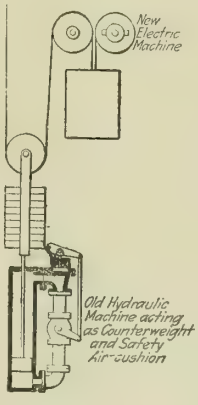
tanks fill, the small one becomes heavier and heavier until it overbalances the counterweight and closes the auxiliary-supply valve.

The limits of the water levels are to be determined by the vertical travel of the small tank, which in turn is determined by the length of the valve lever, the motion of the valve stem and the point of attaching the chain to the lever. The adjustment for proper amount of counterweight and sensitiveness of the device is easily determined by experimenting with different weights.

*Figardo, Porto Rico.

NOTES

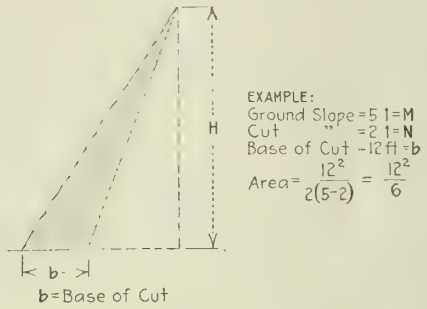
Converting Old Hydraulic Elevators—A number of old hydraulic elevators have been changed by C. R. Pratt, Consulting Engineer, of New York City, from their uneconomical arrangement to secure the advantages of electric operation. One of the methods devised by Mr. Pratt is shown in the accompanying diagrammatic sketch. The old underbalanced car is used and the old hydraulic equipment is undisturbed, or is used with a balanced-piston and speed-control choke valve in the circulating pipe for air, oil or water. The electric hoist can be put below by adding grooves to the winding sheave.



CONVERTED HYDRAULIC ELEVATORS

Inspection of Automatic Sprinklers—Sprinkler systems are examined every three months by the various inspection bureaus throughout the country. Experience has demonstrated that it is not necessary to make periodical tests; visual observation of experts has been found sufficient to insure the detection of faults which may impair efficient functioning. Renewing or testing the operative parts of sprinkler heads is quite unnecessary under average conditions. Under conditions which might affect the stability of the solder holding together the operative parts of the sprinkler, the sprinklers are carefully watched and sample devices removed every few years and tested to determine the condition of the solder. The condition watched is what engineers doing this work term "selective corrosion."—I. G. Hoagland, Secretary National Automatic Sprinkler Association.

A Table for Computing the Area of Side-Hill Cuts—The accompanying table of formulas has been found particularly convenient for computing the area of cuts in side-hill ground, knowing the slope of the ground and the slope of the cut.



SLOPE OF GROUND	SLOPE OF CUT ½:1 H	½:1 AREA	1:1 H	1:1 AREA	1½:1 H	1½:1 AREA	2:1 H	2:1 AREA
½:1								
1:1	2b	b^2						
1½:1	2b	b^2	2b	b^2				
	2	2						
2:1	2b	b^2	b	b^2	2b	b^2		
	3	3		2				
2½:1	2b	b^2	2b	b^2	b	b^2	2b	b^2
	4	4	3	3		2		
3:1	2b	b^2	b	b^2	2b	b^2	b	b^2
	5	5	2	4	3	3		2
3½:1	2b	b^2	2b	b^2	b	b^2	2b	b^2
	6	6	5	5	2	4	3	3
4:1	2b	b^2	b	b^2	2b	b^2	b	b^2
	7	7	3	6	5	5	2	4
4½:1	2b	b^2	2b	b^2	b	b^2	2b	b^2
	8	8	7	7	3	6	5	5
5:1	2b	b^2	b	b^2	2b	b^2	b	b^2
	9	9	4	8	7	7	3	6
5½:1	2b	b^2	2b	b^2	b	b^2	2b	b^2
	10	10	9	9	4	8	7	7
6:1	2b	b^2	b	b^2	2b	b^2	b	b^2
	11	11	5	10	9	9	4	8
6½:1	2b	b^2	2b	b^2	b	b^2	2b	b^2
	12	12	11	11	5	10	9	9
7:1	2b	b^2	b	b^2	2b	b^2	b	b^2
	13	13	6	12	11	11	5	10
7½:1	2b	b^2	2b	b^2	b	b^2	2b	b^2
	14	14	13	13	6	12	11	11
8:1	2b	b^2	b	b^2	2b	b^2	b	b^2
	15	15	7	14	13	13	6	12
8½ 1	2b	b^2	2b	b^2	b	b^2	2b	b^2
	16	16	15	15	7	14	13	13
9:1	2b	b^2	b	b^2	2b	b^2	b	b^2
	17	17	8	16	15	15	7	14
9½ 1	2b	b^2	2b	b^2	b	b^2	2b	b^2
	18	18	17	17	8	16	15	15

TABLE FOR COMPUTING AREA OF SIDE-HILL CUTS

The table may also be plotted as a diagram, using either the ratio of the slope of the ground or the angular slope of the ground as abscissas and the quantity of excavation as ordinates.—F. W. Groves, Civil and Hydraulic Engineer, Kelowna, B. C., Canada.

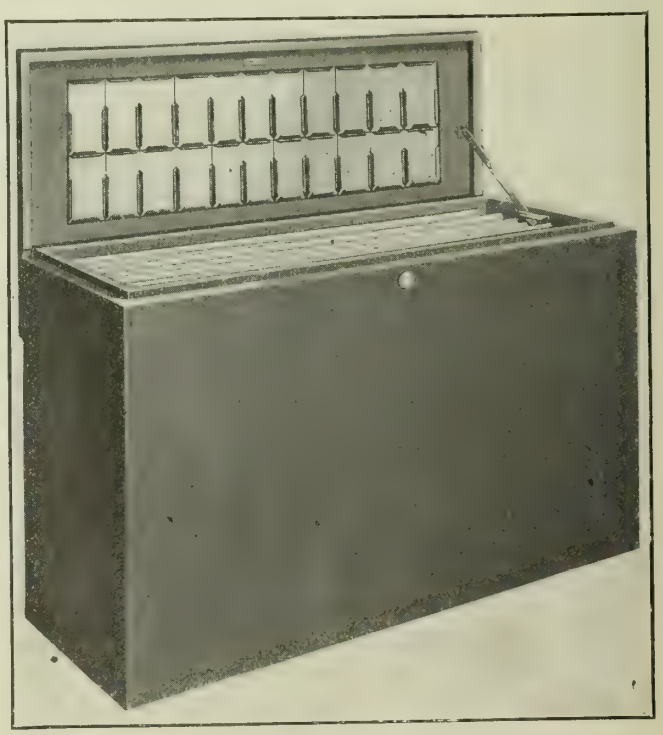
Flushing Out 40 Years' Accumulation of Sand in the Mains of the Milwaukee Water-Works—Over 51,000,000 gal. of water were used during 1914 in Milwaukee, Wis., in an effort to clear the water mains of an accumulation of sand carried into the system during forty years of operation. A special crew, under the supervision of the superintendent of water mains division, was engaged for several months, and the mains were flushed at 577 different points, the total amount of water used being nearly 35,000,000 gal. In addition to the work done by this special flushing crew, considerably more flushing than usual was done by the hydrant inspectors and mains-repair crew, which brought the total amount of water used to nearly 52,000,000 gal. While considerable deposits were removed in this way, a large number of meters were "sanded," and a considerable number of complaints of dirty water were received, owing to the fact that the flushing was done during the day and the house services used while the water was in a state of agitation. It has accordingly been recommended that the flushing hereafter be done at night while the house services are inactive.

In Tearing Down the Champlain Building, Chicago, the structural steel and other heavy wreckage is handled by a steel stiff-leg derrick mounted on the roof of an adjacent taller building. The new structure will form an extension of this building, and the derrick will be used in its erection.

The Longevity of Cast-Iron Pipe when used for plumbing fixtures has been demonstrated in the destruction of the old Astor House, New York City, to make way for the new Broadway subway. The Astor House was erected in 1834 and the soil pipe, cast in the foundry of the J. L. Mott Co., New York, is still practically as good as new.

Lowering a Water Main Under Pressure—It was recently necessary to lower 1000 ft. of a 36-in. water main in Waterbury, Conn., to conform to the new grade of the street under which it lies. As the main to a high-service pumping station branches off from this section, it was necessary to do the lowering before starting the branch line in order to avoid additional expense. To discontinue the use of the 36-in. pipe, which is the main line from the largest reservoir, for the length of time required for this work, would have resulted in great inconvenience. So it was decided to lower the main without shutting off the water by excavating a trench alongside the pipe, cutting away under each length, but leaving earth piers at each joint. Then, while surveyors kept track of the levels, the piers were weakened until the weight of the pipe line caused a little settlement. Working up and down the line in this way, the pipe gradually came down to the bed blocks, which had been set to the exact elevations. Owing to the pressure of about 100 lb. per sq.in. on this main and the proximity of two railroad tracks, the operation was attended with some risk and required close attention. Under the constant supervision of Assistant Engineer Charles W. Eddy, the work went on regularly and systematically and was completed without accident. After driving up the lead joints the line was as tight as ever.—From the 1914 Annual Report of R. A. Cairns, City Engineer, Waterbury, Conn.

Vertical Filing Cases for Storing Drawings in large quantities are being made in a variety of designs by the Art Metal Construction Co., of Jamestown, N. Y. The accompanying illustration shows a "plan-file" case adopted by the valuation department of the Interstate Commerce Commission and by several railroads. It is 30 in. deep over all, 6 in. longer and 8⅛ in. higher than the drawings to be filed. It holds



VERTICAL DRAWING FILE USED BY INTERSTATE COMMERCE COMMISSION

6000 tracings. There are 18 pockets formed by steel partitions with springs between to hold the drawings always flat and upright. The drawings are laid in tough-paper folders for filing in the pockets. Three to six folders can be used in a pocket and up to 60 tracings per folder. The index cards on the inner face of the cover give easy access to the contents of the file. The side walls may be single steel or double filled plates, as desired.

Editorials

Mortar Beds for Brick and Stone Pavements

Any practice that has been established for many years generally has some substantial reason for existence, and in such a case mere change does not necessarily mean progress. Particularly is this the case with street pavements. One has but to read old treatises on pavements to see how thoroughly the principles of good paving practice were understood years before engineers in general could be induced to apply those principles.

A good example of this is the wood-block pavement, introduced both in this country and England about 1837. By 1845 English municipal engineers had conclusively proved that the only proper way to lay a wood pavement was to use treated blocks on a concrete foundation, yet for many, many years, American engineers, notwithstanding the advice of experts both in this country and abroad, persisted in experimenting with every conceivable combination but the correct one. Only within the last twenty years, in general, have wood-block pavements in this country been properly constructed. The same thing is true of the use of concrete foundations for brick and stone-block pavements.

In view of this accumulated experience, any radical departure in practice from that which has been long established should be thoroughly tested before it is adopted, especially if the established methods have given satisfactory results. Such a departure from standard practice is the present tendency to experiment with a mortar bed for a granite-block pavement, and the laying of brick on a green concrete foundation without a sand-cushion course, as described in *Engineering News* of July 22.

So far as granite block is concerned, the omission of the sand-cushion course is neither recent nor novel. It was tried and discarded before most engineers of the present day began to practice. The sand-cushion has been retained because, with a rigid, unyielding material for the pavement surface, a certain amount of resiliency in the bedding is essential. This resiliency is furnished by a thin layer of clean sand, which, although practically incompressible, has by no means the rigidity of concrete. The necessary layer of sand may be very thin, perhaps with well-squared blocks ½ or ¾ in. is enough, although the best practice is a minimum of 1 in.; to omit it entirely is an experiment, the success of which cannot be demonstrated except by the years of service to which as yet it has not been subjected.

With wood-block and asphalt-block pavements the same arguments do not apply, for here we have a material that has a certain amount of inherent resiliency. In the case of a wood-block pavement the sand cushion has no other purpose than to take care of inequalities in the depths of individual blocks. This, to be sure, is one purpose but not the only purpose of a sand cushion in granite-block and brick pavements.

It has been claimed that the use of a mortar bed in place of a sand cushion prevents the failure of the pavement by the washing out of the sand. But what paving engineer ever heard of a properly constructed granite-block pavement that failed in this manner? On the other hand, it may be claimed that a very lean dry mixture of cement and sand does not set up into a hard rigid mortar, but has stability while still retaining a certain amount of elasticity or resiliency. But the thin sand cushion has these qualities also, so why use cement at all?

Attention is called to this matter because the reader may suppose that in view of these departures from ordinary practice having been described in *Engineering News* they are thereby approved by it. It is the business of a technical journal, however, to publish the news of what is actually being done by engineers, and it does not follow by any means that the new devices or methods described are approved by the editors. This may or may not be the case; and with respect to the laying of block pavement on a mortar bed it is merely desired to call attention to the fact that its success remains to be demonstrated.

Investigating the Capsize of the Steamer "Eastland"

The numerous official inquiries into the causes of the "Eastland" disaster at Chicago (no less than eight at one time being under way or planned) have resulted, as was to be expected, in a great deal of irrelevant matter. The most important testimony given before the coroner's jury was that of the assistant engineer on the "Eastland" to the effect that there were five water-ballast tanks on each side of the "Eastland," and that when the boat capsized, he and the chief engineer had been for some time engaged in trying to bring the vessel back to an even keel by pumping water into tanks 2 and 3 on the wharf side of the boat and out of tanks 2 and 3 on the river side.

According to the testimony of a number of witnesses the "Eastland" was in the habit of listing to one side or the other; but it is clear that none of the engine-room force or the ship's officers had any idea that the ship was deficient enough in stability to involve any danger. Those in the engine room who were trying to fill the tanks appear to have wondered why the ship did not come back on an even keel and sent a young oiler up to see if the boat was caught against the side of the wharf. By the time he reached the second deck the boat had listed so far that water was pouring into the hatchways and he had just time enough to jump onto the wharf.

In the investigation of any such disaster as this terrible one at Chicago, the matter of greatest importance is not by any means that on which the newspapers lay greatest stress—determining the persons responsible for the disaster so that proper punishment can be meted out. Such punishment, no matter how well-deserved, cannot bring

back to life those who have perished. It is a fair question, moreover, what severity of punishment is deserved by those whose acts may have brought about a calamity, but who had no idea at the time that what they were doing threatened danger to others or punishment to themselves. The object of punishment for crime in civilized lands is not retaliation. Society does not punish the criminal to "get even" with him, but as a warning to others tempted to commit similar crimes.

The primary object of any such investigation as this of the "Eastland" disaster should be to determine the causes which brought about the disaster and to make them known in such a manner as will be most likely to prevent similar disasters in future. In the light of what has happened at Chicago it is probable that vessels used for passenger service, and especially those carrying large crowds of excursionists, ought to be designed with sufficient stability to furnish an ample margin of safety, even when all their water ballast is discharged. Indeed it may be questioned whether vessels of this class should be built with water-ballast tanks. There is certainly no such necessity on them as there is on freight steamers where some means have to be provided for making the vessel stable when it is sailing without cargo.

In the comment on the stability (or lack of stability) of the "Eastland" in the last issue, it should have been said that the metacenter (not the center of buoyancy) must be higher than the center of gravity in order that a vessel may be stable. A floating body may be stable even though its center of gravity is above its center of buoyancy. A broad flat sheet of cork, for example, might float on the water with only a quarter of its bulk submerged and would be perfectly stable even though its center of gravity were above the center of buoyancy. The metacenter is the point at which a vertical line through the center of buoyancy of a floating body intersects a vertical line through the new center of buoyancy when the body is slightly inclined from its original position. If the flat sheet of cork were turned on edge, it would not float in water without falling over. Its metacenter would then be below the center of gravity.

The metacentric height of a vessel—the distance of its metacenter above its center of gravity—was an abstract and meaningless term to the general public a fortnight ago. It is so no longer. A line of passenger steamships sailing from Chicago is advertising that the "line of stability" on its vessels is 56 in. in height, whereas on ordinary vessels it is only 14 in. in height. There can be no doubt that stability calculations and the margin of stability of vessels will hereafter have an importance in the minds of vessel owners and builders which they have never before possessed.

Pier Designs and Leases

It was not so many years ago that the shipping pier had only two variations—a timber pile substructure carrying a timber frame flooring and an earth fill inside massive masonry walls. The advent of concrete, and particularly of reinforced concrete, offered opportunities for originality in design of which the engineers engaged in this sort of work have taken full advantage. In consequence, the different types of pier construction now are so many and so varied as to warrant the text-book on the subject, which, though yet unwritten, should soon attract the efforts of some sufficiently interested expert.

As a contribution to the art of pier design the new Ninth St. piers in Cleveland, described elsewhere in this issue, are noteworthy, not because any especially new idea has been developed there, but because of the excellence with which the general principle of an earth fill inside of masonry walls has been worked out, with due recognition of the needs and peculiarities of reinforced concrete and of the value of deadmen as reinforcement against earth pressure. At the same time originality in design may be noted in the adaptation of the old pier and the heavy fill foundation to the new wall.

In other respects than in the engineering design does the Cleveland pier demonstrate that times change. The franchise contract is the last word in municipal bargaining as applied to port facilities. The steamship companies using the pier not only paid for its construction but are required to pay a more than nominal rent for fifty years, at the end of which time the pier will become the city's property. How advanced this sounds in comparison with the famous Battery pier case in New York City, where after paying only a nominal and entirely inadequate rent for over a hundred years to the city of New York, a certain millionaire family demanded, and obtained through court procedure, nearly a million dollars in lieu of a single pier franchise granted to an immigrant ancestor in the early days of the republic.

Rights-of-Way in City Streets for Public Utilities

The Supreme Court of Ohio recently rendered a decision under which in the City of Cleveland consent of abutting property owners is not necessary for the construction or extension of a street-railway line that has been approved by the City Council. The principle thus laid down is important from the legal point of view, since the Ohio State law requires such consent of property owners. The court therefore ruled that the provisions of the City Charter were superior in authority to the general state law.

Of much greater importance, however, is the ruling that makes the City Council, and not the property owners along a street, final judge as to the passage of public utilities through that street. During what may be termed the period of exploitation of public utilities in the United States by private companies, there can be little doubt that the requirement that consent must be obtained of the majority of the abutting property holders in order to extend a street-railway line or an electric-wiring system has on the whole been a beneficial safeguard. Such provisions are generally defended on the ground that the passage of such public utilities through a street may result in greatly reducing the value of the adjacent property, and that the abutting property owners therefore have a right to interpose a veto to such construction.

There is, however, a changed attitude toward public utilities at the present day. The public is now recognizing that a city's system of street railways, or electric-current distribution, or water-supply mains, exists for and should be planned for the general public convenience of the city as a whole and should not be considered merely as a money-making scheme of a franchise-holding company. It is evident, however, that if the prejudices and opposition of property owners here and there throughout the city are sufficient to block development of utilities, it

may be impossible to plan a street-railway system or an electric-distribution system so as to serve the best good of the greatest number.

Under these circumstances it seems evident that the needs of a city as a whole ought to be superior to the rights of the individual property owner, even if it should be necessary to award damages to him for the loss of value that his property may have suffered through the construction of utilities in the streets, as actually happened, for example, in the construction of the elevated-railway system in New York City. The property owners ought not to have a veto power to prevent street-railway lines or electric wires, or conduits for water or gas or steam distribution, from being carried through the streets where public convenience will best be served.

Of course, in most states radical changes in existing statutes will be necessary to bring this condition about, and this doubtless will take a long time to accomplish. On the other hand, when the case is clearly stated to the public and it is realized that the building and extension of public utilities are matters that should be determined in the public interest and not in the interest of private property owners, there can be no doubt that overwhelming public opinion will support the change.

Why Not Sell Portland Cement by the Bag?

Twenty-eight years ago, in *Engineering News* of May 21, 1887, there was published an editorial entitled "Bags vs. Barrels for Cement." The editorial was written by the late D. McN. Stauffer and began as follows:

> It is probable that there will be manufactured and consumed this year in public works in the United States about 5,000,000 bbl. of natural hydraulic cement, worth in the market an average price of $1 per bbl. It is also safe to assume that three-fourths of this product will be packed and marketed in barrels costing about 30c. each, a package value alone of $1,125,000, which represents just so much money wasted in the destruction of the barrels as soon as their contents are used.

At that time bags were being used for the shipment of cement in the Middle West, but engineers in the East still generally specified that cement must be delivered in barrels. Mr. Stauffer, who had then recently visited the Vrynwy dam, then under construction in Wales for the water-works of Liverpool, described the use of cement in bags there as well as on numerous other important engineering works in England and on the Continent, and urged that there was no reason why bags should not be universally used for the packing of cement. It is noteworthy that at that time so little portland cement was made in the United States that it was not even mentioned in the editorial.

As every engineer knows, portland cement has displaced natural cement in the market, and the annual production is now nearly twenty times as great as the production of natural cement thirty years ago. Furthermore, the entire product, except that destined for ocean shipment, is packed in bags; yet all the cement produced still continues to be bought and sold by the barrel. The standard bag of cement contains 94 lb. of cement; and it contains this amount merely because cement was originally packed in barrels weighing 400 lb. gross. It seems worth while to raise the question whether the time has not come when the barrel as a unit may be dropped and the bag substituted in its place. In all the transactions connected with cement, from the original computations of the chemists in the laboratory until the finished cement is in place in a piece of work, calculations are continually being made from barrels to bags, and from bags back to barrels. An order for so many barrels of cement is actually counted out in bags as the cement is loaded and again as it is received.

It was easy to predict thirty years ago that the change from barrels to bags in the shipment of cement would soon be made. It would be decidedly unsafe to predict, however, at the present time when the barrel will be dropped as a unit of measurement, notwithstanding the fact that the barrel itself has well-nigh disappeared. There is a vast amount of inertia in commercial matters, and even the engineers, who have so long been accustomed to think of cement in barrels, would be loath to change to the smaller unit.

A misleading advertisement, circulated by a reputable engineering school, concerning the alleged large and increasing demand for engineers and the munificent salaries paid for engineering talent was recently commented on in these columns. In notable contrast to such advertising is a statement in the year-book just issued by the Michigan College of Mines. With reference to employment, the book says:

> Prospective students and those responsible for them should understand that the college cannot impart traits of character. The best it can do is to help the student develop properly those characteristics which he already possesses. His advancement in his profession will depend quite as much upon his character and ability as upon his technical training, whether gained in college or out of it. Upon completion of his college course he will, if his work has been properly done, be ready to begin his career in mining. . . . Only those who are willing to do hard and continuous work, both during their course at college and in the years following, should undertake to train for a career in mining. For those who are thus willing, and who have an aptitude for engineering pursuits, the outlook is promising.

What is true of mining engineering is true of other fields. That school is pursuing the proper course toward its students which impresses on them, at the start, that their technical training will be of small value unless they possess important personal attributes which cannot be taught, and that to merit large salaries they must cultivate habits of industry and efficiency.

"It's an ill wind that blows nobody good." The Imperial Valley earthquakes a month ago cost the inhabitants of that region a half million dollars or more; but, as shown in the news pages of last week's issue, the loss was largely due to the rattle-trap construction permitted under boom growth. Now the towns see the necessity of building better, and they are already passing restrictive ordinances. This is all the more promising because it is somewhat different from the course usually pursued by stricken communities. Too often it is assumed that calamities do not repeat themselves or that an attack of flood and fire confers the same immunity to a community as does an attack of smallpox to an individual. In the Imperial Valley there is also reported, as a result of the severe test just imposed, a stronger feeling of confidence in the value and safety of the irrigation engineering works on which depend the prosperity and even the very existence of this district.

Letters to the Editor

Quick-Closing Doors for Pressure Cylinders

Sir—Referring to the description of a quick-closing door for pressure cylinders which appeared in *Engineering News* of June 3, I would ask whether this principle has ever been applied to air locks of the "pot-lid" type for single-line bucket hoisting. Several years ago I conceived the idea of a door of precisely the design of that built by the Vulcan Iron Works, of Wilkes-Barre, Penn.

The hoisting rope was to pass through a gland set in a 5-in. or 6-in. diameter steel ball at the center of the door. The ball was to be retained by annular castings bolted to the door and the retaining packing. This would permit a limited universal motion of the door with respect to the ball; the operation is obvious. It appeared to me that with such a door the pot-lid type of lock, with its economy of air for lockage, might be made so tight as to have a decided advantage for small work. It would be interesting to know whether such a device has ever been tried.

Reginald Jackson.
Aluminum Ore Co.

East St. Louis, Ill., July 14, 1915.

Baltimore Tries Mortar Beds for Block Pavements

Sir—I have noticed recently several references in *Engineering News* to the use of a mortar bed under vitrified-block and granite-block pavements. We began with our contracts in Baltimore this year to lay vitrified-block pavements on a comparatively dry mortar bed. This is the case with all straight pavement work as well as track work. We use a mix of one of cement to five of sand.

The sand when delivered, coming right from the bay, is usually sufficiently moist, so that no water is added at that time. The cushion is spread on an average of 1 in. in thickness and thoroughly rolled with a hand roller, the same as in handling a sand cushion.

The brick are then laid and rolled, care being taken to roll up to the pavers each day. The culling is then done, and the brick are flushed with water, thereby adding more moisture to the cushion. Usually this procedure gives sufficient moisture for setting. The grouting is then proceeded with as usual.

Formerly when a rainstorm caught us with a sand cushion in place, with the brick rolled but not grouted, considerable damage was caused from wash, bringing the sand up in the joints. Under such circumstances, using a mortar cushion and provided the brick have been rolled no harm is done.

A great deal of our brick pavement with mortar bed has been down since about the first of March, and so far no defects have been discovered. With a sand cushion minor defects, such as grout shattering, etc., in spots, are frequently discovered within a month after the street is opened to traffic.

As to granite block, we experimented early this season with grout-filled joints and blocks on a mortar cushion in railway track crossings, with excellent results; so much so that we are now using a lean mortar cushion such as I have described under all block pavements. We believe that it is the proper thing to do, and have reached the conclusion that it is not as noisy as a sand cushion.

R. Keith Compton,
Chairman and Consulting Engineer,
Baltimore Paving Commission.

Baltimore, Md., July 22, 1915.

Definition of "Vitrification"

Sir—In connection with the article on "What Is 'Vitrified' Brick or Pipe," in the current issue of *Engineering News* a footnote reference states that "the new standard definitions of terms relating to sewer pipe of the American Society for Testing Materials define 'Vitrification' as 'fusion into a hard, glassy material under high heat.'" Permit me to call attention to the fact that the definition quoted is not, as stated, among the "new standard definitions of terms" of the Society, but was presented last year by Committee C-4 on Standard Specifications and Tests for Clay and Cement Sewer Pipe among a series of proposed standard definitions, which were to be published in the *Proceedings* of the Society for one year, with a view of eliciting criticism.

At the recent annual meeting, the committee in question recommended that the proposed definition of vitrification be changed to the following form: "The consolidation of material under high heat." This recommendation was formally approved, and the definition as thus revised will be subject to adoption among the standard definitions of the Society by a letter ballot, which is about to be instituted.

Edgar Marburg,
Secretary-Treasurer,
American Society for Testing Materials.

Philadelphia, Penn., July 26, 1915.

Public Speaking for Engineers

Sir—Under the head of "Engineering Students Should Practice Public Speaking," Mr. Benham of Oklahoma calls attention in *Engineering News*, July 15, 1915, p. 131, to the great importance of the acquisition by engineering students of the ability to express themselves in simple, well-selected words and to show their hearers the advantage to the community at large of engineering work. I wish to express my appreciation of this statement and to call to the attention of your readers the even greater importance of a systematic effort on the part of engineers and engineering societies to present to the public, through the public press, the needs and opportunities for engineering works. Mr. Benham describes a condition which is being widely appreciated, namely, that there is no other profession which should be more interesting to the public

than engineering; but the great trouble has been that our young men have not been trained to present the results of engineering in its larger relations and aspects.

From experience with several hundred young and middle-aged engineers, I may safely assert that there is not one out of ten, or possibly one out of a hundred, who has shown the ability to write the story of an important public work in such a way as to be readable by the public. It seems as though all natural ability in expression had been destroyed by the educational methods or the technical training. For example, a young engineer writing home to his family frequently gives a most fascinating account of his work; but ask him to write out the larger facts for publication and he immediately begins a cramped, dull description of relatively unimportant details or technicalities concerning which few people care to read. He seems to lose his sense of proportion or his perspective. He is unable to adjust his mental attitude if he is conscious that the material he is writing is to be read by any one except his favored correspondent.

Successful engineers must be men of imagination, men who can picture in their own minds the great possibilities latent in unattractive surroundings. This imagination so necessary for success is often unavailable as far as giving information to the public is concerned. The preservation of the freshness of statement and clearness of vision are among the important things which seem to be lost by the time a young engineer has achieved success in other lines.

It is of the highest importance, not merely to the engineering profession, but to the public in general, that we endeavor to bring forward systematically the man who can and will write out short interesting descriptions of engineering works and achievements. Each engineering society should regard it as a duty to the public and to the profession to find among its members the man who can do this and to encourage him in every possible way to aid in the diffusion of correct information and in the education of the local public, not through technical journals, which the public does not read, but through the daily newspapers and the Sunday editions which come into millions of homes.

F. H. Newell.

Urbana, Ill., July 21, 1915.

Large Sutro Weir Under Test

Sir—The equation for the curve made use of in the Sutro weir was developed by E. T. Pratt in a letter to *Engineering News* of Aug. 27, 1914, and entitled "Another Proportional Weir." This equation is

$$x = b\left(1 - \frac{2}{\pi} tan^{-1}\sqrt{\frac{y}{a}}\right)$$

where x = varying width, y = head above a certain datum, a = distance of datum above crest, and b = length of crest. By choosing b and a, the coördinates of the curve can be easily obtained and the curve cut out as shown in Fig. 1 herewith.

Mr. Pratt stated that the flow was directly proportional to the head, or, in other words, that

$$Q = ch + A,$$

where Q is the flow in cu.ft. per sec., c is a proportional factor, h is the height of water over the crest, and A is a corrective constant.

In connection with a thesis dealing with proportional weirs, Howard Livingston, a student at the University of California, actually built a weir of the Sutro type. A description of the weir, with the results of a test, follows:

The weir was cut out of a ¼-in. steel plate. The assumptions were: $a = {}^1/_{48}$ ft. and $b = 2$ ft. (Fig. 1).

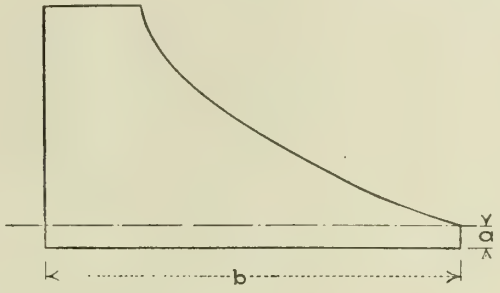


FIG. 1

It was so constructed as to fit the rectangular notch in the regular concrete weir box used in the hydraulics laboratory. Water was furnished by centrifugal pumps and a steady surface was maintained by means of baffles. The head on the weir was measured with a hook gage reading to thousandths of a foot, and the actual quantity was obtained volumetrically by timing the flow into a 7x7x12-ft. concrete tank equipped with a hook gage reading to millimeters.

By investigating the data included in Fig. 2 herewith and studying the curve plotted (head in ft. over the crest against quantity in sec.-ft.) it seems quite certain that the weir can be taken, practically, as a "proportional-

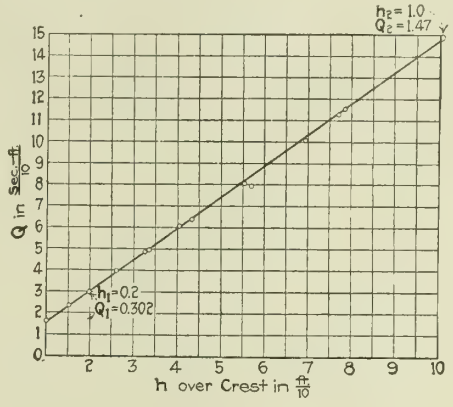


FIG. 2

flow weir." Out of the seventeen observations taken, only one point fell noticeably off the straight line, the equation of which is $Q = 1.46h + 0.01$.

The equation can be obtained quite simply from the curve by picking off two values for Q and the corresponding ones for h, then solving the two resulting equations simultaneously.

The above-described weir with a 1-ft. crest gives an approximate flow of 1,000,000 gal. per day per ft. over the weir's crest (exactly it is 950,000 gal. per day).

Ben D. Moses.

2236 Summer St., Berkeley, Calif.,
May 26, 1915.

The Novel Lever Lift Bascule Bridge over the Louisville & Portland Canal at Louisville, Ky., described in "Engineering News," July 15, 1915, p. 123, was fabricated by the Penn Bridge Co., of Beaver Falls, Penn. It was erected by the Middle States Construction Co., of Columbus, Ohio.

Additions to the Baltimore Sewage-Works

The opening of large additions to the sewage-works of Baltimore, Md., from time to time during the present year, is notable both for the nature of the additions and because the works are a part of one of the largest jobs of sewerage and sewage-disposal and storm-drainage construction ever carried out consecutively by a single city within a period of less than ten years.

Beginning in 1905, the Baltimore Sewerage Commission, under Calvin W. Hendrick, Chief Engineer, has built 700 mi. of sanitary sewers and storm-water drains, made 90,000 house connections, covered over Jones' Falls, a considerable stream in the business part of the city, erected a sewage-pumping station, and built sewage-treatment works for 600,000 people. The cost to date has been about $20,500,000.

The cost of all the work just outlined is met by the proceeds from bonds. Until recently these bonds ran for 50 years, but lately serial bonds have been issued. The interest rate has been successively 3, 3½, and 4 per cent.

The sewage-works of Baltimore consists of a grit and coarse screen chamber; three large settling tanks, each 103x420 ft. in plan, with 13 ft. of available depth; three sludge-digestion tanks, each 103x140 ft. in plan, with 13 ft. of available depth; sludge-drying beds with a total area of 40,000 sq.ft.; two revolving screens through which the settling-tank effluent passes; 12 acres of sprinkling filters; and two secondary or final settling tanks, 270x290 ft. in plan and 10 ft. deep. These works were designed to treat the sewage flow for the first few years of operation when comparatively few houses were connected to the sewers. It was deemed advisable to build additions to the tanks, filters and sludge beds only when the increase in flow made them necessary.

The additions to the works consist of 28 Imhoff tanks, four sludge-drying beds, two chambers for revolving screens, 18 acres of sprinkling filters and 16 sludge-digestion tanks. Some of the new filters and all of the sludge tanks have been in use since about Jan. 1, 1915, the sludge beds since about May 1, and it was expected that ten of the Imhoff tanks would be put in operation by Aug. 5, some of them having already been filled. The accompanying sketch and views show the Imhoff tanks and sludge beds and the sprinkling filters.

The 28 new Imhoff tanks provide for the sewage of an additional 112,000 people. They are 40 ft. in diameter and about 26 ft. deep from the sewage surface to the bottom of the sludge hoppers. Each of these tanks is designed to give two hours of sedimentation to the sewage of 4000 people and to provide a sludge capacity of about 1 cu.ft. per capita for six months.

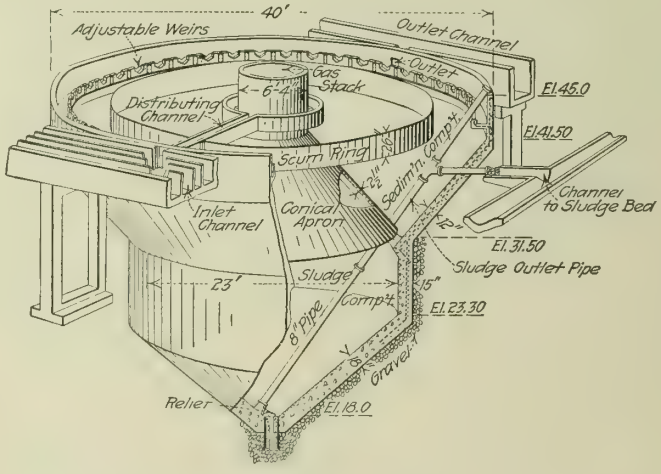
The Imhoff sludge beds have an area of about 45,000 sq.ft. and are designed to give somewhat over ½ sq.ft. of area per capita for six months. There are two beds, each 75 ft. wide. One is 404 ft. and the other is 189 ft. long. Each is subdivided by board partition into 26x75-ft. units. The beds consist of 4 in. of sand resting on 8 in. of gravel at the sides and 11 in. at the center. Beneath the center of the small dimension of each unit (i.e., 26 ft. c. to c.) is a 4-in. unglazed tile underdrain, laid in a gravel-filled trench.

Two new chambers for revolving-screens for tank effluent have been built. The screens will be built when the increased sewage flow makes them necessary.

The new sprinkling filters have an area of 18 acres; and together with the filters in operation since 1911, give a total filter area of 30 acres. The new filters are substantially the same as the old ones except that the latter had 6-in. terra cotta pipe inclosed in concrete for distribution while the new distributors are of 6-in. cast-iron pipe.

The addition to the sewage-works includes 16 new sludge-digestion tanks, one-half of them to take care of the sludge from the final settling tanks, and the other half to be used in conjunction with the three original rectangular sludge tanks. Each tank is 25 ft. in gross depth, 10 ft. of depth being in the hopper bottom. The sludge will be admitted to these tanks near their tops through an inclined 8-in. pipe set at right angles to the slope of the hopper-shaped bottom; and the supernatant liquor will be removed by reversing the flow through the same pipe. The sludge-outlet pipe, which discharges under the head of the contents of the tank, is parallel with the hopper bottom and empties into a channel or sludge distributor which leads to the sludge-drying beds.

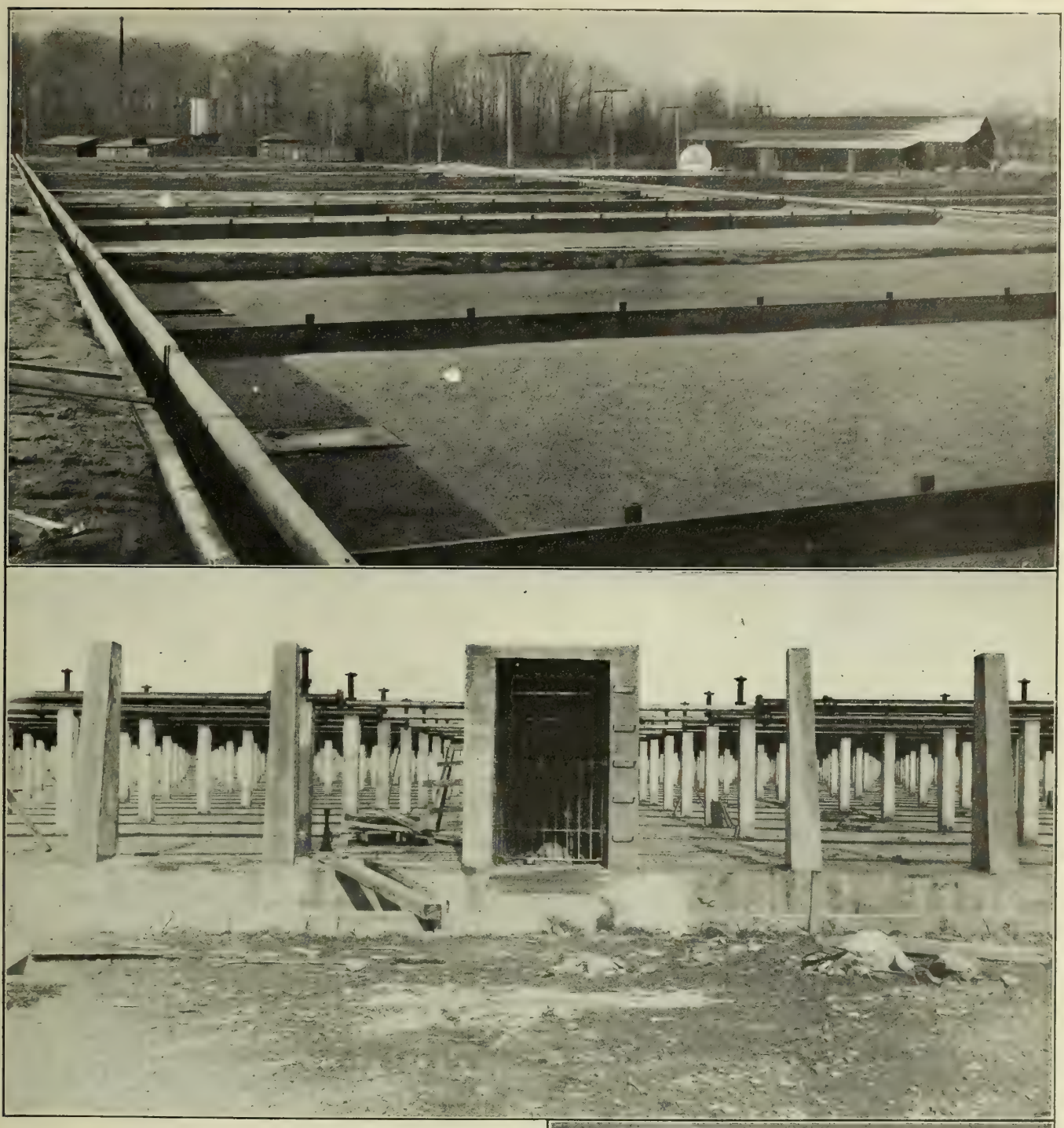
The sludge beds for these circular and original rectangular sludge tanks are four in number. Two of them are



SKETCH OF BALTIMORE IMHOFF TANK

400x100 ft. in plan and two are 486x150 ft. All are subdivided into small units by board partitions. One of the 400x100-ft. beds is an old bed, built in 1910, with its original sand depth of 36 in. reduced to 30 in. The other three beds are like the Imhoff-tank sludge beds, already described. The combined area of all the sludge beds, old and new, including also the Imhoff beds, is about 230,000 sq.ft., or about 5.3 acres.

Two of the Imhoff tanks have been adapted to activated-sludge experiments, and one of them has been provided with an anti-scum device, for testing out. In this tank the incoming sewage will strike the under side of an inclined but nearly horizontal screen stretched across the central scum compartment or gas tank, so as to break up the scum formation, keep it waterlogged, and force it down into the sludge.



VIEWS OF ADDITIONS TO BALTIMORE SEWAGE-WORKS

Top—Imhoff sludge bed. Middle—End of sprinkling filter, showing central inspection gallery, distribution and underdrainage systems, and posts to hold up dry rubble masonry end walls. Bottom—Looking along top of nearly completed Imhoff tanks; control house in left middle distance and sprinkling filters in operation in background.

The following are the principal contractors for the additions to the plant: Lane Bros. & Co., Altavista, Va., built the 18 acres of filter beds; the Standard Lime & Stone Co., Baltimore, supplied and placed the broken-stone filtering material; C. B. Clark & Co., Baltimore, Md., built the 28 Imhoff units, the 16 circular sludge tanks, and the sludge beds.

The additions were designed by Leslie C. Frank and Gustav J. Requardt under the supervision of Henry C. McRae, Division Engineer. Mr. Requardt was in charge of the construction work. Since February, 1915, when Mr. McRae resigned his position, Mr. Requardt has been acting as division engineer of the disposal plant. As already stated, Calvin W. Hendrick is Chief Engineer of the Baltimore Sewerage Commission.

Underground Pipes in New York City Streets

When the New York Rapid Transit Ry. was projected, nearly a score of years ago, it was realized that one of the difficult problems to be solved would be the underground pipes in the streets. Many engineers believed that since these pipes all had to be removed in building the railway the opportunity should be improved to construct pipe galleries in connection with the subways so that the pipes when replaced would be at all times accessible for inspection and repair and the making of service connections without tearing up the street surface.

Various plans were made for the construction of such pipe galleries, but all were finally abandoned; some because of the cost of construction and some because they proposed to utilize the space underneath the sidewalks, which aroused the opposition of property owners, who were accustomed to use this space as their own.

Therefore, after the completion of the subway itself, the piping system has been relaid over the roof of the subway and the space around the pipes filled in with earth. As described in the series of articles by Fred Lavis on the subway work, published in *Engineering News* a year ago, a special department has been established which attends to the removal and replacement of underground piping. The engineer in charge of this department, Charles N. Green, has recently made a report to Alfred Craven, Chief Engineer of the Public Service Commission, with reference to the congestion of this underground piping and its economic results.

As indicated above, a great deal of discussion took place a dozen or more years ago regarding the difficulties due to the congestion of underground piping in city streets, but little has been heard concerning it in recent years. Mr. Green's report makes clear that while conditions were bad at the earlier period, the large increase in the number and size of underground street pipes makes conditions much more serious at the present time. In the years since 1900 there has been a great extension in the underground ducts for electric wires. Many new water and gas mains have been laid, including the entire high-pressure fire-protection system of New York City.

Probably the best idea of the condition beneath some of New York City's streets is furnished by Mr. Green's statement that in order to backfill around the piping at some of these congested points after the mains have been replaced over the roof of the completed subway it will be necessary to screen the earth used for filling and flush it into place with a heavy stream of water. The following extract from his report gives figures as to the actual occupied area in the streets at some of these places:

> There is probably not a more congested underground condition in any city anywhere than now exists in Broadway between 17th and 24th St. Restoration here, besides being excessive in cost, cannot be done in a satisfactory manner owing to the size and number of structures. With curb lines but 37 ft. apart there are 17 pipes, 8 of which are gas, 4 belonging to one company. There are four banks of electric ducts ranging from 6 to 48 holes each, and two underground trolley tracks. The total section area of pipes only is about 25 sq.ft., including duct banks about 48 sq.ft., and including also the prisms of the two car tracks, 74 sq.ft.
>
> At the intersecting streets, each of which brings in a considerable number of mains and duct banks, the space left for backfill will be even less. To the above areas, 17th St. adds 12 sq ft., 18th St. 21 sq.ft. and 20th St., which is about the average, 6.6 sq.ft.

This is not the only example of such congestion in New York by any means. Mr. Green thinks that points on Third Ave. may be as badly congested, because the footings of the elevated railroad columns occupy large space in the street, and there are on certain blocks no less than 12 lines of gas mains.

It is evident that the large mileage of unnecessary mains in the streets is one cause of this excessive congestion. Under the law governing the rapid-transit railway construction, however, the Public Service Commission's engineers are required to relay all the mains which they remove from the streets, even those which are unused. Mr. Green says that the expense of relaying these needless mains amounts to an additional cost in subway construction of from $2000 to $15,000 per contract section. This, however, is by no means the worst feature of the situation. More serious is the fact that these duplicate mains occupy space which may be needed badly for other underground structures and increase the difficulty of access to the other underground piping.

New York is burdened with this great mileage of unneeded gas mains because of the mistaken economic policy which was followed by the city authorities forty years ago —the policy of creating competition in the public utility business. In pursuance of this policy, franchises were granted with a free hand to competing gas companies to lay pipes under the city streets. No less than eleven separate franchises for the manufacture and supply of gas were granted. It was even endeavored so to frame these franchises that competition between the companies holding them would be perpetual. The franchise granted to the Mutual Gas Co., for instance, specified that in case of any consolidation or pooling of interests the directors of the company should be imprisoned.

Neither this nor any other provision to prevent combination among the gas companies ever proved effectual. In 1884, at the end of a "gas war," six New York companies were combined to form the Consolidated Gas Co. Three other gas companies that still continue to do business in New York—the Standard, the New Amsterdam, and the Mutual—are controlled by the Consolidated Gas Co. through stock ownership.

The State of New York and most other states of the Union, however, have now adopted the policy of state regulation of public utility operations and have definitely abandoned attempts to perpetuate competition in this field. Unfortunately, "the evils which men do live after them." The mistaken economic policy in dealing with the gas franchises in New York forty years ago has resulted in burying under New York streets, according to Mr. Green's estimate, at least 500 mi. of useless gas mains. The dead investment in these mains constitutes part of the capital invested in the gas business; and on this basis the rates for gas supply are fixed.

There is a still more serious injury to the city, however, resulting from these buried and useless pipes. Something like 28,000 street openings are made in New York City per annum, about 60% on account of service connections. These street openings create enormous expense, delay traffic, interfere with business, and cause accidents for which the city often has to pay damages. Mr. Green says that on account of the crowded condition of the underground piping it is almost impossible to backfill these openings properly and it is impossible to restore the pavement to its original condition, thus permanently injuring an expensive street pavement.

It should be understood that most of these unnecessary mains are still in use and therefore require maintenance by the gas companies. According to Mr. Green, the reports of the gas companies in Manhattan for six years show an average maintenance charge of about $516 per mile of main, plus a charge of $389 per mile for gas unaccounted for. In the Borough of the Bronx, the average annual maintenance charge per mile of gas main is less than $200, indicating to some extent the expense to the gas companies of the congested condition under the street surface. In urging the removal of these unnecessary gas mains by the companies owning them, Mr. Green says:

> As the congested traffic conditions and the maintenance of pavement have forced the abandonment of unnecessary railroad tracks on the surface, so do the unnecessary and useless structures underground force the consideration of their abandonment. The time has come when all structures not being used or not needed by growth should be removed by the owning company. For the city this would reduce the cost of restoration, leave more room for other necessary structures, give space for repairs to sewers, water mains, etc., and reduce the cost of pavement. For the gas company it would reduce the maintenance charge, the loss due to unaccounted-for gas, the fire and explosion hazard and the amount on which a revenue must be earned.
>
> It would result in better pavements generally, less interference with business and traffic, fewer complaints, less leakage of both water and gas, easier and cheaper repairs to gas and water mains and all other structures.
>
> With the impervious pavement used today the fire and explosion hazard would be reduced and such an occurrence as that at Fifth Ave. and 23rd St. in March, 1914, would be less dangerous. Gas from leaking mains finds its way into sewers, cellars, subways, etc., sometimes following along the mains for 100 ft. or more.
>
> There is another phase of the situation which, while it only interests us indirectly, interests the city authorities to a great extent. Pneumatic mail tubes were put in the ground about 17 yr. ago, steam pipes about 35 yr. ago, and electric conduits less than 30 yr. ago, all well within the active part of a lifetime. Who shall say that in the future there will not be some conveniences found which will require still more underground space, conveniences or necessities not now known any more than was steam or high-pressure fire service 40 yr. ago. Refrigeration, the Catskill water-supply and larger mail tubes are already seeking space in certain portions of the city. May there not be some underground means found for the disposal of ashes, garbage, etc.? Assuming this to be the case, where will such structures be placed?

It is of interest to carry the discussion further even than the changes suggested by Mr. Green. Probably if an entirely new system of gas distribution were to be planned for a city at the present time, not only would the useless duplicate mains which now take up valuable space in the streets be eliminated, but the size of the mains would be greatly reduced by adopting a system of high-pressure distribution delivery through reducing valves to low-pressure feeders covering a small area or perhaps single buildings. It is likely also that the system of the future will be planned to distribute gas for fuel and not for lighting. With electric current generated at a cost of only about a half a cent per kilowatt-hour in central-power stations and with electric lamps which approach an efficiency of 1 watt per candlepower, the days of gas as a competitor of electricity for lighting are numbered. Of course, enormous quantities of gas continue to be used for lighting and probably will be so used for a long time to come, because of the many houses fitted for gas and not for electricity; and because those in control of the electric interests, who generally control the gas companies as well, maintain a high price for electric current distributed to the ordinary consumer rather than have the competition with the gas companies unduly severe.

Sooner or later, however, a change must come. Whenever the gas companies can definitely abandon the lighting field and confine themselves to the distribution of gas for fuel, they can make it at a much lower cost because relieved of the necessity of enriching it with expensive illuminants. They can distribute this gas through a system of high-pressure mains of small size with welded joints to prevent leakage, the whole representing a small fraction of the investment required for present gas-main distribution systems which being used for lighting are obliged to approximate a uniform pressure throughout the whole area covered.

The Building Data League

A new technical society, known as the Building Data League, has recently been incorporated in New York. It will be generally agreed, probably, that this is not a propitious time to start a new engineering society. Engineers are not in favor of the further multiplication of engineering organizations, and unless those promoting a new society make a strong showing as to its reasons for existence, few will be apt to join it.

The purposes of the Building Data League, however, are entirely distinct from those of the ordinary technical society. Its object is, in brief, to provide a systematic rating for the materials and appliances which are used in building. Engineers generally are familiar with the remarkable work which has been done in this field by organizations representing the fire underwriters. Valuable work has also been done in this connection by the United States Bureau of Standards and the American Society for Testing Materials. The Underwriters' Laboratories, however, naturally limit their work to appliances and materials which have to do with the safety of buildings, especially as that safety is menaced by the fire risk. The American Society for Testing Materials deals with materials only, and not with appliances.

The engineer responsible for the construction of a building, however, has the task of selecting from a great variety of appliances for heating, lighting, ventilating, cleaning, finishing, etc. Competing manufacturers urge upon his attention appliances which may appear to have great merit, if one could believe the salesmen's stories, and yet when actually installed may prove to be seriously defective. The purpose of the Building Data League is to provide, through the coöperative action of the engineers and architects associated in the league, for systematic testing and rating of appliances, etc., which are on the market for use in building construction.

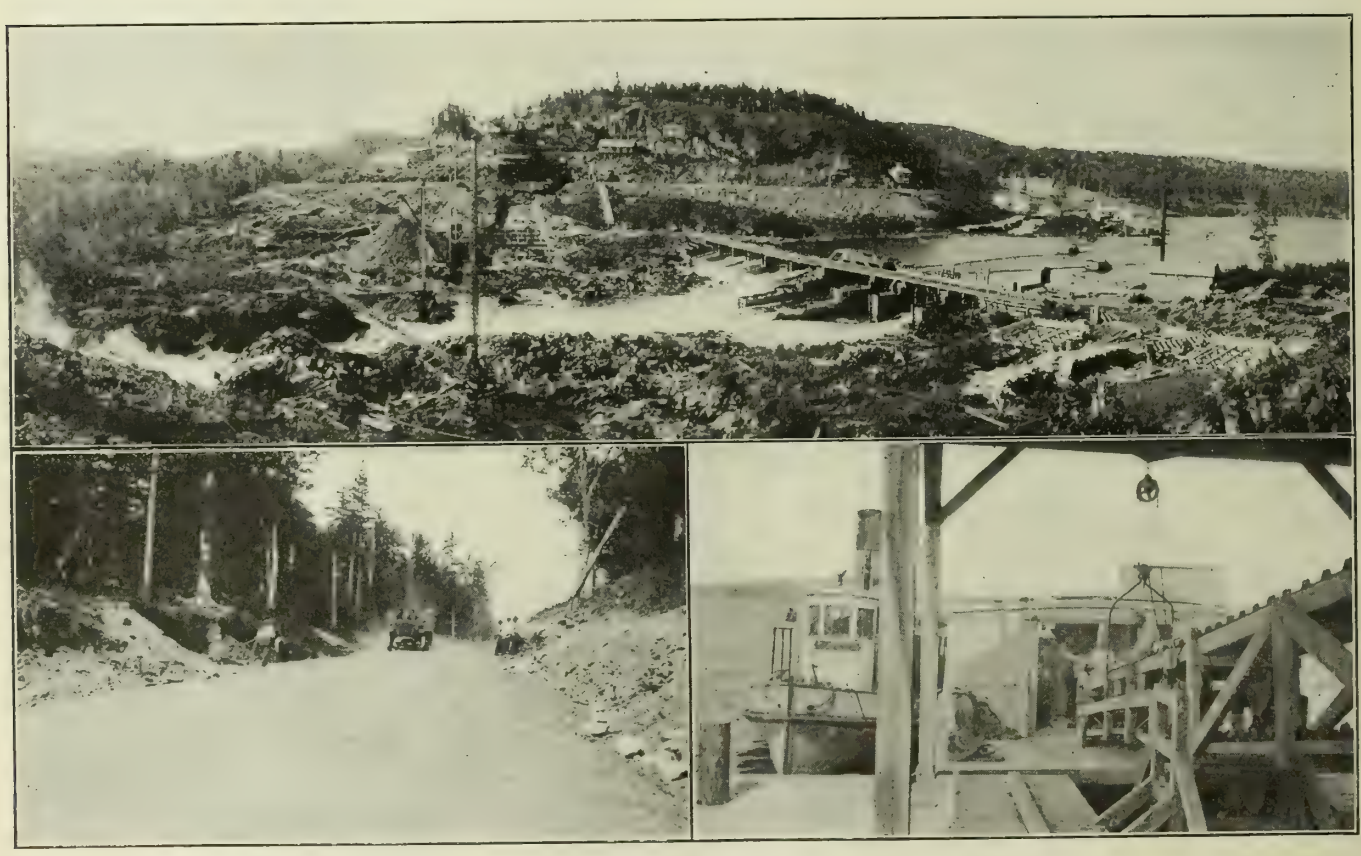
Among the incorporators of the league are such well-known engineers as Gustav Lindenthal, Henry C. Meyer, Jr., Prof. James F. Kemp, of Columbia University, and Prof. Arthur H. Blanchard. Among the prominent architects who have joined the organization are Guy Lowell, architect of the New York County Court House, Walter Smedley, R. Clipston Sturgis, Walter F. Ballinger, and Albert Kahn.

Associated with the league is the Building Data Co., a corporation which under the direction and authority of the league is to establish a bureau for the purpose of making tests, standardization, etc., apparently planned along lines similar to that of the Underwriters' Laboratories. The directors of the company are William A. Aiken, Louis K. Comstock and Bevan Jones. The offices of the two organizations are at 105 W. 40th St., New York City.

News of the Engineering World

Ripogenus Dam on the Upper Penobscot in Maine

There is being constructed at the head of the well-known Ripogenus Gorge on the Upper Penobscot in Maine a large masonry dam at a site 50 miles from the nearest railroad and 30 miles across the famous Maine woods, to a point on Moosehead Lake, the nearest terminus of steamboat or rail transportation. The dam is being erected for the Great Northern Paper Co. to create a storage reservoir for the mills of that company farther down the Penobscot. While the possibility of future hydro-electric power is considered in the design, no provisions are to be made at present to care for such power development.



BUILDING A CONCRETE DAM IN THE MAINE WOODS 50 MILES FROM A RAILWAY

Upper view—Looking across the river to the crushing and mixing plant. Temporary bridge at right and dam excavation in middle background. Lower left view—The motor highway for transporting material. Lower right view—Loading cement from point on Moosehead Lake

The accompanying views show the work in recent stages. The site was entered in March of this year, but from that time up till about the 1st of July, work was only preliminary to the actual placing of the concrete, which started early in July. It is hoped to complete the work in about one year's time. The dam will be about 1000 ft. long and will have a maximum height of 80 ft. It is of gravity section of mass concrete and will carry a bridge across its crest. The storage basin formed will be about 25 miles long, with a capacity of about 21,000,000,000 cu.ft. of water.

Because of the remoteness of the region, the problem of transportation of materials and supplies was most difficult and was solved only by the building, for 30 miles through the forest, of a wide highway, a view of which is shown at the lower left of the three views, from a point on Moosehead Lake, where the cement and supplies are delivered on a specially constructed scow shown in the lower right-hand view, by means of a belt conveyor, to motor trucks which transport the material over the road to the dam site. Nine 5-ton motor trucks, as well as a number of tote teams, are constantly traveling over the road, which is maintained by a regular section gang.

The stone for the concrete is obtained from a quarry just back of the rim of the gorge. The rock taken from this quarry is dumped into a crusher plant located practically in line with the dam and shown in the background in the view. The mixing plant is below the crushing plant, and the concrete is to be laid across the dam by chutes. Sand is obtained in a near-by bank and washed by a brook that is diverted from its natural bed to the top of the sandbank and banked up by a series of baffle dams so as to form settling basins.

The construction is being carried on by a force living at the dam site. A village of about 500 people has sprung up, complete, with its stores, stables, dining camps, offices and cottages. Thorough sanitary precautions have been taken, and electric lighting is furnished.

The dam was designed by Hardy S. Ferguson, 200 Fifth Ave., New York City, and is being built by the Aberthaw Construction Co., of Boston, with E. W. Prouty as Resident Engineer and W. D. Maxson as Superintendent of Construction.

Erection of 591-Ft. Steel Arch Begun at Cleveland

On Thursday, July 29, the first permanent steel for the 591-ft. main arch of the Detroit-Superior viaduct in Cleveland was set. The view herewith shows the end lower-chord section of the south arch set in place at the east river pier. The work on the west bank is about two weeks behind this stage.

The end-chord section is the heaviest erection piece, weighing about 30 tons. It connects to the cast shoe by a 16-in. pin and carries an end-post 90 ft. long. The backstay will be attached to the top of this post, but the attachment can be made only after erecting the first panel on falsework. The adjusting toggle in the backstay is only half erected at present; the remaining bars and the upper backstay eyebars will be set as the erection of the first panel proceeds.

The Detroit-Superior bridge design was described in *Engineering News,* June 18, 1914, p. 1348. The King Bridge Co., Cleveland, has the contract for the steel arch. F. F. Buck is in charge for the Ferro Construction Co., Chicago, erection subcontractors.



ERECTING THE END-CHORD OF THE DETROIT-SUPERIOR BRIDGE ACROSS THE CUYAHOGA RIVER, CLEVELAND

New York Utility Commissions' Power Limited

The recent decision of the New York Public Service Commission for the First District in the rate case of the Ulster & Delaware R.R. has raised questions in the minds of the commissioners and the railway men of the state as to the extent of the control over rates vested in the commission—at least so far as railways are concerned. The commission, by a vote of three to two, decided that it could not raise passenger rates above 2c. per mi. for mileage books and 3c. for tickets, on account of statutes fixing such limits. The dissenters hold that the legislature intended to delegate its entire control to the commissions—not merely its power to reduce rates; and that the old mileage-book law was allowed to remain on the statute books to serve as a general guide in making new passenger rates pending any ruling of the commission that should change them. The case will probably come before the highest state court.

A Court Receiver for the City of Nashville, Tenn.

The commission form of government was adopted for Nashville by an act of the legislature of Tennessee, Feb. 19, 1913. The city had previously been governed by a mayor and Board of Councilmen. The mayor who was elected under the old form of government in October, 1909, became the mayor and chairman of the new Board of Commissioners. There were four other commissioners. The city owns its water-works and the electric plant for street lighting, besides certain parks.

About the first of this year it became known that the finances of the city were getting in bad shape and that there was a growing deficit, said to amount to about $900,000. The annual expenditures of the city are about $2,000,000. An audit of the city's books was asked for and at first was refused by the commissioners; but later, after some negotiations, it was agreed to, with an "efficiency survey" also to be included with the audit. Bids were taken and the contract for the audit was awarded to James Cameron & Staff of New York, the audit to begin June 14.

On June 12 it transpired that some of the account books were missing from the City Hall, and the mayor tried to suspend the city controller. Litigation followed, various officials were arrested and one fled. On June 25 application was made to the courts for a receiver for the city, and this was granted July 27. In the meantime one of the commissioners was suspended, another resigned and successors were appointed. This left three of the old commissioners in office with two new ones. On July 27, two of the old commissioners were removed from office by the court and a receiver was appointed and given full power to take complete charge of the city and its affairs. Later, however, the Court of Civil Appeals annulled the order of the lower court appointing the receiver. This leaves the government of the city in the hands of three commissioners, who have the power to elect other members and complete the board. The city is therefore not in the hands of a receiver at present.

In the proceedings incident to the receivership it has been brought out by the evidence that there has been in recent years extravagance and more or less petty graft; also it is known that there has been defalcation, the exact amount of which is not revealed.

The city is not bankrupt, however, nor is it insolvent. There is assessable property of $80,000,000 value, subject to taxation, and the city has a bonded debt of $8,000,000. Default has not been made on this in principal or interest. There will have to be retrenchment, and the official audit is proceeding to determine just what is the city's financial condition.—John Wilkes, Nashville, Tenn.

Cafe Service in a Day Coach

A coach café is the latest addition to the rolling equipment of the Pennsylvania R.R. The new car is an all-steel coach with a broiler buffet from which meals will be served. It will be tried out as an experiment, and if it is found to meet a sufficient demand on the part of the traveling public, other cars of like character may be placed in operation. It will not be used, however, to supplant dining cars.



DAY COACH PROVIDED WITH DINING TABLES

The new car is intended for use on trains where a dining car is not warranted by the travel. The buffet occupies about 8 ft. of space at one end of the car and is similar to those installed in broiler-buffet Pullman cars, but is of an improved type, alcohol broilers being used instead of coal fires. Meals will be served on tables placed between the seats, with the outer ends resting on the arms. Both single and double tables are provided, the latter being used where two seats are turned to face each other. At a double table a party of four can eat together. No extra fare will be charged for riding in the coach café car. It will be in the regular service as an ordinary day coach.

The car has a seating capacity of 70, and except for the buffet it is exactly like the heavy modern steel day coaches used by the Pennsylvania R.R. It was built at the company's shops at Altoona, Penn. A supplementary use for the coach café car will be to serve breakfasts in sleeping cars on the same train, where no buffets or dining cars are provided. It will be remembered that some years ago this railroad inaugurated a quick-service lunch-room car on its Washington-New York line.

Hydro-Electric Plans Grow

At a banquet held in London, Ont., on July 22, to celebrate the formal opening of the London & Port Stanley Ry. (the first line in the province operated with power from the Hydro-Electric Commission), Sir Adam Beck, chairman of the commission, stated that shortly plans would be submitted to the Ontario government for the extension of the system. It was proposed to provide for the development of 100,000 hp. at Niagara Falls and at the spillways of the Welland Canal. The work would entail a capital expenditure of approximately $10,000,000, and would require three years for its completion. It was explained that of the water available on the Canadian side of the Falls only 6600 sec.-ft. was left, and that the engineering plans had been drawn to utilize this at maximum head. The plans would be capable of extension to develop finally 600,000 hp., including the output of a development at Chippewa Creek. Sir Adam predicted a sweeping cut in power prices when the new development had passed its initial stage.

Earth Slip Wrecks Cement Plant at Hudson, N. Y.

Early in the morning of Aug. 2 an earth slip on the site of the Knickerbocker Portland Cement Co.'s Greenport plant near Hudson, N. Y., caused the subsidence of nearly 15 acres of ground carrying down to practical destruction the power house, coal trestle, machine shop and several smaller buildings. A number of workmen were caught in the power house and were burned by the escaping steam, five so severely that they afterward died.

The plant was located alongside a small creek on a bed of blue clay through which no borings appear to have been recorded, but which was of such stability as to warrant the erection of the building footings without the interposition of piles. The group of buildings affected comprised the steel and brick power house, 77x85 ft. in plan, a concrete chimney about 175 ft. high, a concrete storage tower 10x10 ft. in plan and 60 ft. high, a concrete conveyor shed, and a frame barn. Alongside of the power house was a coal trestle and somewhat farther away a storage pile of broken trap rock, piled in conical shape about 160 ft. in diameter and 45 ft. high. It was estimated to contain about 30,000 tons of stone.

The first indication of the slip was an upheaval of ground about 50 ft. in length alongside of the creek; this was followed by the subsidence of the stone pile which dropped vertically about 25 ft. and caused the heaving of the ground around the buildings and their ultimate collapse. The power house collapsed and the barn was moved bodily over toward the creek, which in turn was so filled by earth as to divert it from its course. The concrete structures, while disturbed and shifted from their foundations, appear to have suffered little structural damage.

There are local stories of a similar slip on this same site many years ago, but these rumors seem not to have been of sufficient importance to warrant consideration when the plant was constructed. A small slide occurred between the power house and the creek behind it in the fall of 1914. This area, mostly cinder fill, was then protected by three rows of piles to a penetration of 40 ft. No further movement was noted, until this week.

The Maintenance of Water Meters cost $3.57 per meter in Chicago, Ill., in 1914. During the year an experiment was made by using a small motor truck for the work of the meter division in place of a horse and wagon. The operating expenses and fixed charges of this car, including interest and depreciation, were lower than the cost of operating the wagon, and a great deal more work was done by using the motor car. The cost of maintaining water meters in 1913 was $3.97 per meter.

Patrol of Transatlantic Steamship Lanes—A patrol of the Grand Banks in the vicinity of the transatlantic steamship lanes, for the detection of icebergs and ice floes and for warning vessels of these dangers, is being maintained in accordance with an international agreement entered into by the maritime nations of the world at the London Convention, held early in 1914. For the United States the Coast Guard cutters "Seneca" and "Miami" are assigned to this work. The "Seneca" carries a detail of four scientific men.

Progress in Toronto Harbor Improvements—In this, the second year of the Toronto harbor development, $2,000,000 is being spent on the city's water front between the Don and the Humber Rivers. Last year $1,400,000 was spent, of which $1,100,000 was expended in piles, cribs, dredging, and filling. The cost is about equally divided between the Harbor Commission and the Dominion Government. In spite of the war conditions prevailing, it is stated that the harbor-improvement work will continue without interruption. Of the total estimated cost of the improvements ($24,000,000,), contracts for nearly $11,000,000 have been let.

Chilean Railway Shops—As early as February, 1914, there was advertised an international competition for the plans and specifications of a central model workshop and four repair shops for the state railways of Chile. Full details of this competition were published in "Engineering News," of Mar. 5, 1914. The winner of the first prize of $20,000 was announced on May 1, 1914, by the Chilean Government to be the Niles-Bement-Pond Co., of New York City. A second prize of $10,000 was awarded to a Chilean firm. An article in the June 14 issue of the "Ultimas Noticias" of Santiago, Chile, indicates that construction work on these shops has not yet begun, although the land has been purchased in the town of San Bernardo, near Santiago. The shops were estimated to cost about $3,650,000.

Road Mirrors at Street Intersections—In a number of English towns and cities large mirrors have been erected at important road intersections to enable drivers of motor cars approaching the junction to see whether a car is approaching the corner on the other road. A recent United States Consular report quotes the "Times of India" as stating that the municipality of Bombay will erect a mirror 10 ft. long and 3 ft. high, at a dangerous street intersection in Bombay. The use of mirrors for the same purpose is also reported at Glencoe, Ill., where a mirror 8 ft. long and 6 ft. high has been placed at the intersection of two much-used streets. The idea is a simple one and may be worth extensive adoption. Probably it would be necessary to provide for the systematic cleaning of such mirrors if erected, however. One at a much-used road intersection, exposed to the dust and weather, might soon become so obscured as to give no clear indication, in which event it might be a source of danger rather than of safety.

A Flush Tank System in which the sewage itself is used for flushing was described by Isaac Shone, the inventor of the Shone compressed-air ejector for handling sewage, at the annual meeting of the Institution of Municipal and County Engineers of Great Britain. Mr. Shone, who is nearly 80 years of age, has developed this flush tank system to eliminate the disconnecting trap commonly required in British plumbing practice between the soil pipe system and the public sewer. The flush tank is a closed cast-iron chamber having a capacity of a dozen to twenty gallons. The sewage discharges into it until it is full, when it automatically empties itself by siphon action. Mr. Shone intends this apparatus, according to the description in his paper, for use on combined sewer systems where the rain water from the roofs as well as the house sewage is dischargd into the sewer. With the frequent rainfall in the humid climate of England, frequent discharge and consequent flushing of the lateral sewer would be much more effectively secured than would be possible where the separate system of sewage was in use or in a climate where long periods of drought occur.

A Remarkable Growth in Population is shown by the village of Hamtramck, Mich., a northeastern suburb of Detroit. The United States Census Bureau has just taken a special census of this village, which had a population of 3559 in 1910, and its present population is 21,520, an increase of 504% in five years.

A Hotel Dining-Room Floor Collapsed at Holland Station, Rockaway Beach, on the afternoon of Aug. 1, burying about 30 persons in the wreckage, nine of whom were injured. The outdoor dining-room of the hotel is built on a level with the boardwalk and extends out over the beach. Examination following the collapse showed that the floor-beams were badly decayed.

New York Subway Contracts aggregating $7,022,000 were awarded by the New York Public Service Commission last week, and it is expected that another contract amounting to nearly $1,700,000 will be awarded this week. The largest contract was for the Broadway subway extending from 38th St. to 51st St., which went to the Holbrook, Cabot & Rollins Co., at $3,740,000.

A Schedule of Rates for Engineering Work was adopted in 1912 by the Washington Association of Engineers, Seattle division. The charges are classified under three schedules: (a) Surveying, (b) structural engineering, (c) civil engineering. Provision is made for charges both on the basis of percentage and on per diem rates for a variety of classes of work, including court testimony.

A Record July Rainfall is indicated by the charts from the rain-gage at Chestnut Hill reservoir, Boston, Mass. For the month of July a total rainfall of 10.68 in. was recorded, which is the heaviest precipitation for that month in Boston, Mass., since 1863, and with the exception of 1835 and 1862, the heaviest since 1817. The record of the United States Weather Bureau at Boston was 8.85 in.

A Tunnel Under the East River from 60th St., Borough of Manhattan, to the Queensboro Bridge Plaza, Borough of Queens, favorable action on which was taken recently by the Board of Estimate of New York City, as reported in last week's issue, has now been formally approved by the Public Service Commission. At its eastern end the tunnel will connect with the lines of the rapid transit system running to Astoria to the north and Corona to the northeast.

A Railway-Terminal Plan proposed for London, England, provides for a ring of nine outlying main-line terminal stations connected by an electrically operated belt line. No trains, either main-line or suburban, would enter the inclosed area, but all passengers would have to change cars. The interior or local traffic would be handled by the present underground lines (high and low level) and the lines abandoned for main-line service, with suitable extensions and connections. This plan has been suggested by H. J. Leaning and is described in "The Engineer," of London, June 25. Unfortunately these various lines, built and operated by different companies at different times, form a very unsystematic "system" for the purpose proposed. The question as to whether main-line passenger terminals should be within or outside of the business district of a city has been discussed many times, but the almost universal tendency is to bring them as far as possible into that district. The plan proposed for London goes to the extreme of putting the stations far out in the suburbs.

PERSONALS

Mr. J. T. Breckon, Water-works Engineer of Vancouver, B. C., resigned from that position on July 31. He will resume private practice as consulting and construction engineer, with offices in Vancouver.

Mr. W. R. Cahill, formerly Superintendent of the Union Pacific R.R. at Omaha, Neb., has been made Superintendent of the Texas division of the Missouri, Kansas & Texas Ry. at Wichita Falls, Tex.

Mr. J. H. Elliott, Superintendent of the New Orleans division of the Texas & Pacific Ry., has been appointed General Superintendent, with headquarters at Dallas, succeeding Mr. J. E. Paussit, resigned.

Mr. D. C. Miller, for the past year Assistant Professor of the Department of Civil Engineering, Agricultural and Mechanical College of Texas, has been promoted to Associate Professor of Civil Engineering.

John Sweeney, formerly District Engineer for the Canadian Department of Public Works at Winnipeg, succeeds Mr. C. H. Mathewson as resident engineer for the Department on the Toronto Harbor Improvement Board.

Mr. O. E. Hunt, recently Assistant Chief Engineer of the Packard Motor Car Co., has been made Chief Engineer of the company under Mr. J. G. Vincent, M. Am. Soc. M. E., Vice-President in charge of Engineering.

Mr. C. H. Mathewson, Resident Engineer on the Toronto Harbor improvement project for the Canadian Government, has been appointed District Engineer for the Department of Public Works of the Dominion at Winnipeg, Man.

Mr. Kenneth C. Grant, M. Am. Soc. C. E., for the past two years with the Morgan Engineering Co., Dayton, Ohio, has been appointed by Governor Willis of Ohio to represent the state at the Fifth National Drainage Congress to be held in San Francisco, Sept. 17 to 21, 1915.

Mr. Philip P. Farley, M. Am. Soc. C. E., formerly President of the Jamaica Bay Improvement Commission and recently Consulting Engineer to the New York State Highway Department, announces the opening of an office at 103 Park Ave., New York City, for private practice.

Mr. S. T. Cantrell, former Assistant Superintendent at Cumberland, Md., of the Baltimore & Ohio R.R., has been promoted to the office of acting superintendent of the Cumberland division of that railroad. Mr. Cantrell was formerly Superintendent of the St. Louis & San Francisco R.R.

Mr. Ray Palmer, for the past three years Commissioner of Gas and Electricity of the City of Chicago, has resigned. During his term of office about $4,000,000 has been spent in rehabilitating the city lighting system and replacing old-style arc lamps with modern tungsten filament units.

Dr. A. S. McAllister, F. Am. Inst. E. E., has resigned as Editor of the "Electrical World" and has also severed his connection with the McGraw Publishing Co. Dr. McAllister is President of the Illuminating Engineering Society and a member of the American Society of Mechanical Engineers.

Mr. Theodore T. Seelye, recently Division Engineer of the Water Supply Commission of Pennsylvania, in charge of the examination of dams, has entered partnership with Mr. Farley Gannett, Assoc. M. Am. Soc. C. E., former Chief Engineer of the Water Supply Commission, with offices in the Telegraph Building, Harrisburg, Penn.

Mr. William A. Del Mar, M. Am. Inst. E. E., has resigned from the engineering staff of the New York Central & Hudson River R.R. to accept a position with the Interborough Rapid Transit Co., of New York City. Mr. Del Mar's time will be largely given to working out the problems of the operation of the new subways now nearing completion in New York City, which are to be operated by the Interborough Rapid Transit Co.

Mr. A. C. Love, for the past two years Associate Professor of Civil Engineering of the Agricultural and Mechanical College of Texas, has been appointed Professor of Railway Engineering and head of the newly created division of railway engineering in the civil engineering department of the college. Professor Love has had a number of years' experience in railway engineering work with the Atchison, Topeka & Santa Fé and Southern Pacific railways.

Mr. W. B. Poland, M. Am. Soc. C. E., former Vice-President and Chief Engineer of the Philippine Ry., has returned to this country after a several months' trip through Australia, Japan, New Zealand and South America. He has entered the service of the American Commission for Relief in Belgium, and will leave New York City for that country on Aug. 16 for a six months' absence. Mail should be addressed to the Commission for Relief in Belgium, 71 Broadway, New York City.

Lieut. Col. Thomas A. Flagler, Corps of Engineers, U. S. A., has been ordered to Washington, D. C., for duty in charge of the District of Columbia water-supply system and all rivers, harbors and fortification work in that vicinity, relieving Col. Henry C. Newcomer, Corps of Engineers, U. S. A., who will, however, remain in Washington as a member of the Board of Engineers on Rivers and Harbors and of the National Land Defence Board. In the summer of 1914, Lieut. Col. Flagler was in Vera Cruz, Mex., as Chief Engineer of the expeditionary force commanded by General Funston. Since last fall he has been on duty at the Army War College.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
Aug. 16-18 and 25-28. Annual meeting in Los Angeles, Calif., Aug. 16-18; in San Francisco, Aug. 25-28. Secy., J. C. Olsen, Cooper Union, New York City.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Aug. 24-27. Annual convention in Cincinnati. Secy., Clarence R. George, Houston, Tex.

NEW ENGLAND WATER WORKS ASSOCIATION.
Sept. 7-9. Convention in New York City. Secy., Willard Kent, Narragansett Pier, R. I.

TRAVELING ENGINEERS' ASSOCIATION.
Sept. 7-10. Annual meeting in Chicago. Secy., W. O. Thompson, N. Y. C. R.R., East Buffalo, N. Y.

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

San Francisco Meetings

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. 19-21. Secy., E. H. Harman, Room 101, Union Station, St. Louis, Mo.

INSTITUTE OF RADIO ENGINEERS.
Sept. 13-18. Secy., David Sarnoff, 71 Broadway, New York.

PAN-AMERICAN ROAD CONGRESS.
Sept. 13-18. Secy., E. L. Powers, Road Builders Association, 150 Nassau St., New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 16-18. Secy., Charles Warren Hunt, 220 West 57th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Sept. 16-18. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 16-18. Secy., Bradley Stoughton, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 16-18. Secy., F. L. Hutchinson, 29 West 39th St., New York City.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Sept. 16-18. Secy., J. J. Blackmore, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Sept. 16-18. Secy., J. W. Richards, Lehigh University, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Sept. 17-21,

INTERNATIONAL IRRIGATION CONGRESS.
Sept. 20. Secy., Arthur Hooker, Sacramento, Calif.; until Aug. 1, New Stockton, Calif.

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Sept. 20. Secy., F. F. Sharpless, 52 Broadway, New York City.

PACIFIC COAST ASSOCIATION OF PORT AUTHORITIES.
Sept. 20 and 21. Secy., Leo V. Merle, Ferry Bldg., San Francisco, Calif.

AMERICAN MINING CONGRESS.
Sept. 20-22. Secy., J. F. Callbreath, Washington, D. C.

INTERNATIONAL ENGINEERING CONGRESS.
Sept. 20-25. W. A. Cattell, Secy., Comm. of Management, Foxcroft Bldg., San Francisco.

INTERNATIONAL ASSOCIATION OF BRIDGE AND STRUCTURAL IRON WORKERS.
Sept. 20-30. Secy., Harry Jones, American Central Life Bldg., Indianapolis, Ind.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Sept. 21 and 22. Secy., F. M. White, Madison, Wis.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Sept. 23 and 24. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 23 and 24. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN ASSOCIATION OF REFRIGERATION.
Sept. 23 and 24. Secy., J. F. Nickerson, 431 South Dearborn St., Chicago, Ill.

ILLINOIS GAS ASSOCIATION.
Sept. 27. Adjourned meeting. Secy., H. H. Clark, 72 West Adams St., Chicago, Ill.

SAFETY CONFERENCE.
Sept. 27-30.

INTERNATIONAL GAS CONGRESS.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

Connecticut Society of Civil Engineers—The summer meeting will be held on Wednesday, Aug. 11, and will consist of an inspection of the plant of the New Haven Trap Rock Co. at North Branford, Conn., and an old-fashioned Connecticut clam bake at 1 p.m., the latter prepared under the direction of Capt. Tom Scott, who is alleged to "know how." The trip will be made in two street cars, which will leave Railroad Station, New Haven, at 9:45 a.m. The trap rock at North Branford is 150 ft. or more in depth, and the company owns about 600 acres. The president of the society is Charles C. Elwell; the secretary is J. Frederick Jackson, New Haven.

Engineers' Society of Western Pennsylvania—About 150 members of the society inspected the Magnolia Cutoff on the Cumberland division of the Baltimore & Ohio R.R. on July 17 as guests of the railroad. The start was made from Pittsburgh at 9 a.m., arriving home at 10 p.m.

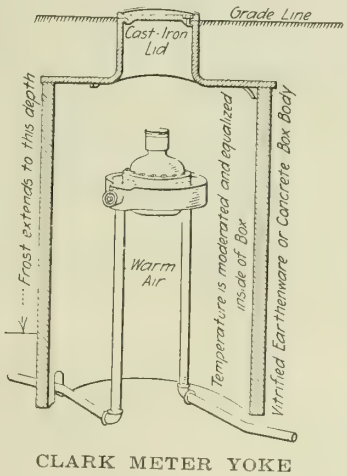
American Society of Civil Engineers—The 47th annual convention of the American Society of Civil Engineers opens in San Francisco, Calif., at 10 a.m. on Thursday, Sept. 16, with welcoming addresses and the annual address of the president, Charles D. Marx. The business meeting will be held immediately afterward. The afternoon will be devoted to visiting the Panama-Pacific International Exposition. The informal reception, dinner and dance will be held at Old Faithful Inn, Exposition Grounds, at 6:30 p.m. Very little business is scheduled for Sept. 17. In the afternoon there will be an excursion to Del Monte, where on Sept. 18 will be held a golf tournament, with dancing in the evening. Early on Sept. 19 the party will leave for Santa Cruz, thence to Big Tree Basin, going to San Jose for dinner and returning to San Francisco late the same evening. A general invitation is extended to all members of other societies and to other members of the International Engineering Congress to participate in the various features of the civil engineers' program.

International Engineering Congress—All meetings of the congress will be held at the Civic Centre Auditorium in San Francisco. The opening session will be at 10 a.m. on Monday, Sept. 20, at which there will be general addresses of welcome, with responses, and an address by Gen. George W. Goethals, honorary president of the congress, after which the John Fritz medal will be presented to Dr. James Douglas. A general session in the afternoon will be devoted to the Panama Canal. During the remainder of the week sectional meetings will be held morning and afternoon, ending with a brief closing meeting on Saturday, at 11:30 a.m. No meetings of the congress will be held in the evenings; but on the evening of the opening day there will be a general reception and ball and on the evening of Sept. 24 a subscription dinner will be given.

Appliances and Materials

Water-Meter Coupling Yoke

A yoke for the convenient setting of water meters has been devised by the H. W. Clark Co., of Mattoon, Ill., and is shown in the accompanying sketch. A cast-iron ring is fitted with brass water connections and a screw clamp for the meter. To install the yoke it is necessary to cut the service pipe only once. The cut ends are bent apart and threaded, and elbows and risers are screwed on. The ring section is screwed on to one riser and the brass-slide section to the other. No unions or right-and-left fittings are required. For basements the yoke is furnished with one piece tapped on top for the house pipe.



CLARK METER YOKE

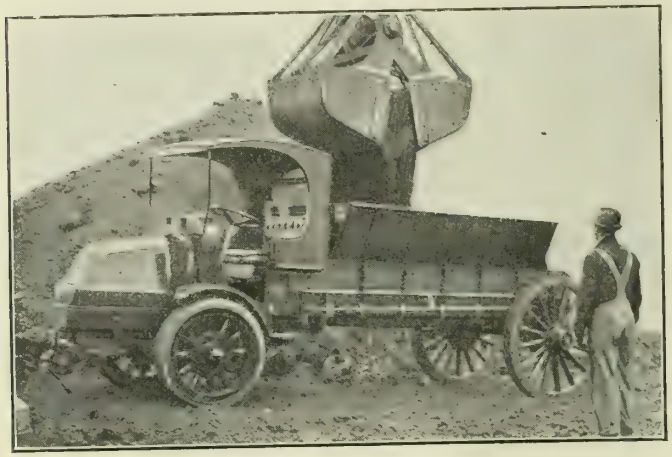
* * *

Bottom-Dump Motor Truck

A unique bottom-dump motor truck particularly designed for contractors has been developed by the Watson Wagon Co., of Canastota, N. Y. One of these trucks is shown in the accompanying illustration. The bottom-dump feature is made possible by the use of a front drive. This also permits the use of steel tires on the rear wheels and the distribution of load equally between front and rear—features which are reported to appeal to contractors from their experience with damp wagons. The body (5 tons or 100 cu.ft. capacity) is made of birch plank reinforced with 3½x7-in. steel angles and is lined with steel plates (steel and asbestos for asphalt carriers). The rear wheels are set back of the body and have 5-in. steel tires and roller bearings. A

service brake acts on all four wheels and an emergency brake on the rear ones. The winding of the dumping bottom is the same as in all Watson wagons.

The drive is of the Latil (French) type developed in America by the Walter Motor Truck Co., of New York City. The engine and transmission form a single group mounted on a three-point suspension over the front axle. The speed-change and differential gears are in a casing bolted to the rear of the crank case. Above and parallel with the main shaft is a secondary shaft driving the differential gear. Four forward speeds and a reverse are possible. Gear-shifting levers are on top of the transmission case in the center of



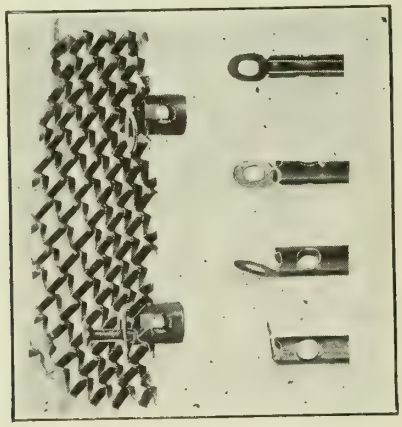
BOTTOM DUMP CAR

the cab. The drive from the differential to the front wheels is through two inclosed cardan shafts with universal joints. The gears and pinions driving the wheels are inclosed in a housing, which carries a stub axle and arm for the steering rod. The truck sells for $4000.

* * *

Post Support for Metal Lath

A new support for metal lath, designed to eliminate the troubles encountered with wood furring strips, and having depressions in the lath sheet to accomplish the same purpose, has been devised by the Wagner-Behm Co., 20 East Jackson Boulevard, Chicago. This device, called the "Furr-Easy Post," is shown in the accompanying views. It consists of steel tubes, of various lengths, left open on their sides and back



POST SUPPORT FOR METAL LATH

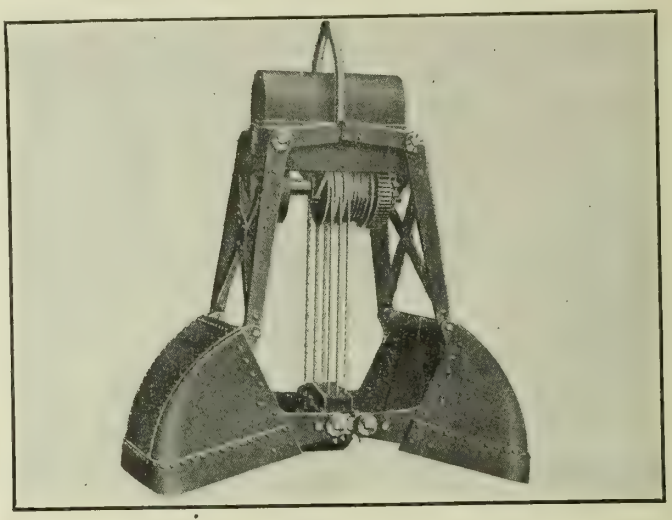
for the entrance of protecting plaster, and provided with a clinching lip. In use, a post is slipped through the lathing, the lip is turned down over one strand and a nail of any desired length is driven through lip and tube. A 26-gage lath sheet can be made stiff and rigid with 12 posts per square yard.

This fastening is also intended for use in spacing mesh reinforcement and light rods in concrete floor-slabs, in fastening wire screens and guards, etc.

* * *

Grab Bucket with an Electric Motor

A grab bucket operated by an electric motor mounted on the top head is now being made by the Mead-Morrison Manufacturing Co., of East Boston, Mass. It is intended particularly for use with electric traveling cranes. The closing purchase is secured by sheaves on the top and bottom heads and a six-part line going to a drum which is driven by the motor through a silent chain, reduction gear and slip clutch. The clutch is provided to operate in case the operator fails to shut off current as soon as the bucket has closed. The



MOTOR-OPERATED GRAB BUCKET

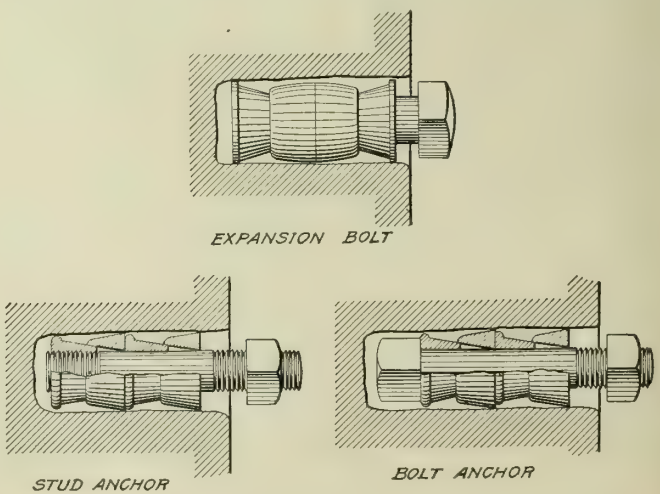
motor has a removable top cover. Power is furnished through a flexible cable running to a controller in the crane cab; a simple plug connection is used at the bucket. Ordinarily, no provision for reeling in the slack of the cable is needed, but that can be provided where desired. These buckets are made regularly in 1½- and 3-yd. sizes, weighing 4500 and 8900 lb. respectively.

* * *

Expansion Anchor Bolts

A system of bolt and stud anchorage, to be designated as the "Cinch" type, has been developed by the National Lead Co., of New York City. The expansion unit consists of a malleable-iron conical male wedge and a lead-composition female ring. The latter is expanded by driving it over the former until it engages the sides of the wall hole, as seen from the accompanying sketches. Three kinds of anchors are now made up—(1) expansion bolts, (2) bolt anchors and (3) stud anchors. The first consists of two or more expansion units, the leading one being threaded and every pair reversed so that the soft leads come together. The bolt anchor consists of plain units slipped on a machine bolt in regular order (alternate irons and leads). The stud anchor is like the bolt anchor, except that the first iron is threaded.

The expansion bolt is fastened in place the same as any other design—by turning the bolt head. The other anchors



IRON-LEAD ANCHORS

are fastened in place by hammer and tube. The expansion bolts and plain anchors are furnished in all commercial sizes and lengths from $\frac{3}{16}$x¾ in. ($8.70 per hundred) to 1½x20 in. ($285 per hundred). The stud anchors are sold in sizes from $\frac{3}{16}$x1 in. ($11 per hundred) to 1½x10 in. ($260 per hundred).

Engineering News

VOLUME 74 AUGUST 12, 1915 NUMBER

Concreting Plant for Large Chicago Warehouse

The new building of the Midland Warehouse & Transfer Co., at Western Ave. and 15th St., Chicago, is of reinforced-concrete construction, except for a three-track steel trestle which enters at a level 4 ft. below the second floor and forms a connection with the Chicago Junction Ry.

The building is approximately 405x260 ft. in plan, with four stories and basement, the stories being 11 to 14 ft. high. Typical floor bays are 18 ft. 6 in. by 18 ft. 8 in., of girderless floor construction on the Leonard four-way reinforcement system, supported on round columns which are reinforced both spirally and with vertical bars. The slab thickness ranges from 7½ to 13 in., according to the floor loads, which are as follows: 400 lb. per sq.ft. for the first floor, 350 lb. for the second (with tracks), 300 lb. for the third and 250 lb. for the fourth.

The building and its permanent steel trestle are supported on spread footings, the unit soil loading being such that adjacent trestle footings come within a few inches of one another. The large ground area of the building, and the impossibility of occupying any considerable portion of the streets which bound three sides of the building, or the railway right-of-way which bounds the fourth side, dictated the design of a concrete-handling plant based on the use of the steel trestle. This trestle was erected as early as possible to constitute a part of the construction plant used for all work except the footings of the building.

The general layout of the plant is shown in Fig. 2. Sand, gravel and stone are discharged from bottom-dump cars into storage piles below the trestle, and on top of a tunnel with A-shaped sloping roof; the sand and stone or gravel are separated by a plank bulkhead at the peak of the tunnel roof. Holes in the side of the tunnel, controlled by gates, admit stone and gravel into measuring hoppers at four points. The measuring hoppers have sloping bottoms and on the release of a swinging gate the measured charge is dumped into a Ransome 1-yd. skip car running on light rails. On a signal from a man in the tunnel the skip is pulled up an incline and automatically dumped into a ¾-yd. Marsh-Capron motor-driven mixer, which discharges the mixed batch of concrete into a 1-yd. Lakewood elevator bucket. The chute hoppers are then located at such elevations on the tower as to permit the chuting of the concrete to any place on the floor.

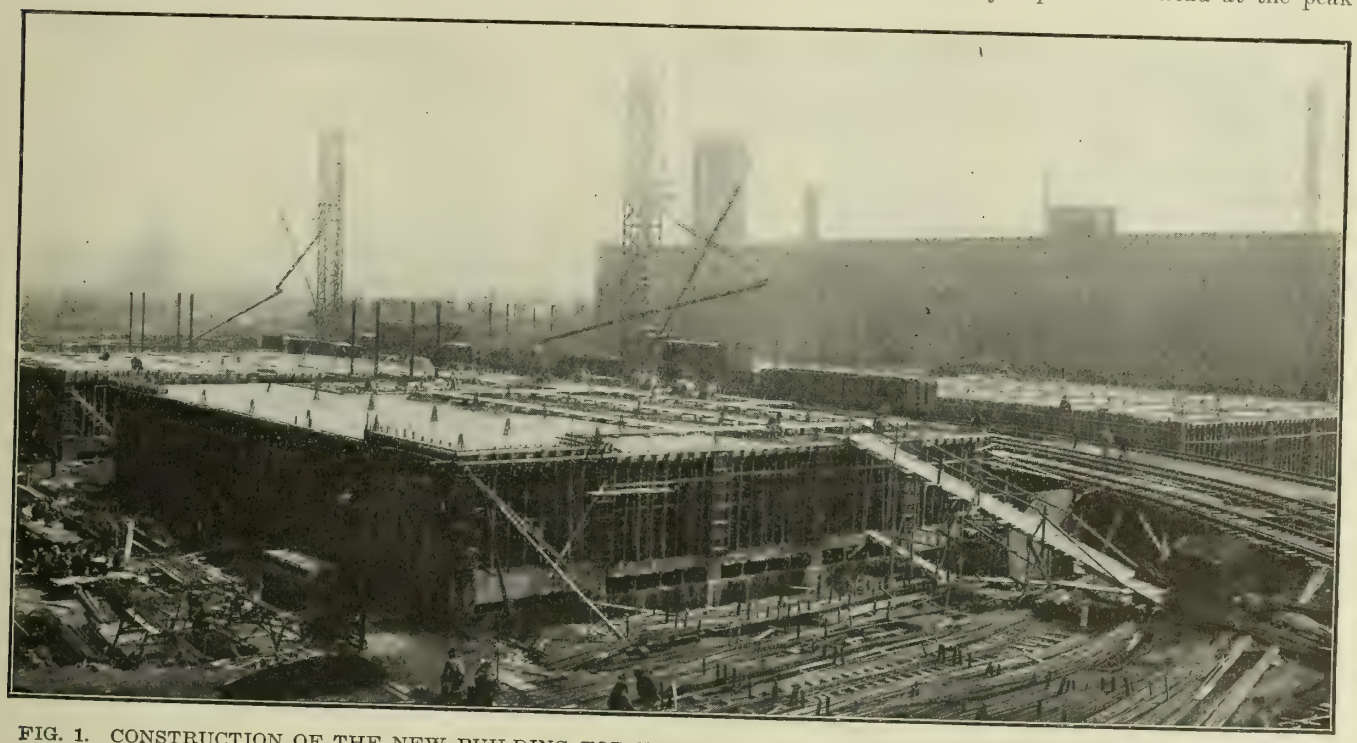


FIG. 1. CONSTRUCTION OF THE NEW BUILDING FOR THE MIDLAND WAREHOUSE & TRANSFER CO., AT CHICAGO
This view shows work on the second floor of the four-story structure. Supply cars are run in on the permanent three-track steel trestle which extends into the building. The storage piles are beneath this, and a cable-operated skip serves the two mixers in the elevator towers

Both the skip car and the concrete elevator bucket are handled by a 52-hp. motor-driven double-drum Thomas hoist. A mixer is located at each end of the tunnel directly in line with the track for skip cars. This track is continuous from mixer to mixer and is laid level under the storage piles for a short distance midway between the two mixers. This permits the skip car from either mixer to run down its incline by gravity and stop in the tunnel under any one of the four measuring hoppers. These hoppers are 12 ft. apart, and when the storage above one hopper has been drawn down so low that it will not flow freely into that hopper, the skip is loaded from the next hopper while the exhausted storage is renewed from the next carload of material on the trestle above.

About 450 yd. of stone or gravel and 350 yd. of sand are available in live storage—that is to say, storage that will run freely into the measuring hoppers. Below this is sand and stone in dead storage which can be fed to the measuring hoppers by hand shovels. This dead storage pile serves the double purpose of eliminating the cost of a timber structure sufficient for the purpose of live storage, and also affords an emergency supply in case of delay in delivery of materials. The live storage would ordinarily be considered insufficient, but this has been entirely offset by the exceptionally good car service due to the railway connections. It has been found possible so to arrange the arrival of stock that no shoveling has been necessary. The only labor required to deliver stone and sand to each mixer comprises two men inside the tunnel admitting sand and stone to the measuring hoppers and then into the skip car, and half the time of the engineman who operates both the skip and the concrete bucket.

Cement is unloaded directly from the car to the mixer platform by the use of a chute as shown in Fig 4. A reserve stock is carried in cement storage sheds under the trestle in the location shown in Fig. 2.

The method of handling the concrete after it leaves the elevator bucket is determined by conditions which will undergo change after the building reaches the third-floor level. The towers are located between the two tracks of the trestle; and as cars are continuously passing on the trestle, chutes are used to carry the concrete above the cars from the towers to hoppers located as required on each floor. For the third and fourth floors and the roof the chutes will be discontinued, as these slabs extend continuously over the trestle area. Figs. 1 and 3 show the plant and the work in progress.

The plant was designed to meet a schedule calling for the placing of all superstructure concrete between Mar. 18 and June 4. This was on the basis of 11 weeks for 17,300 cu.yd. of concrete, or an average of 1570 cu.yd. of concrete per week. On Apr. 15 a general strike of Chicago carpenters partly stopped work on the job, which at that time was one week ahead of the above schedule. General labor troubles came about May 1, completely stopping the job. The first- and second-floor slabs had been poured

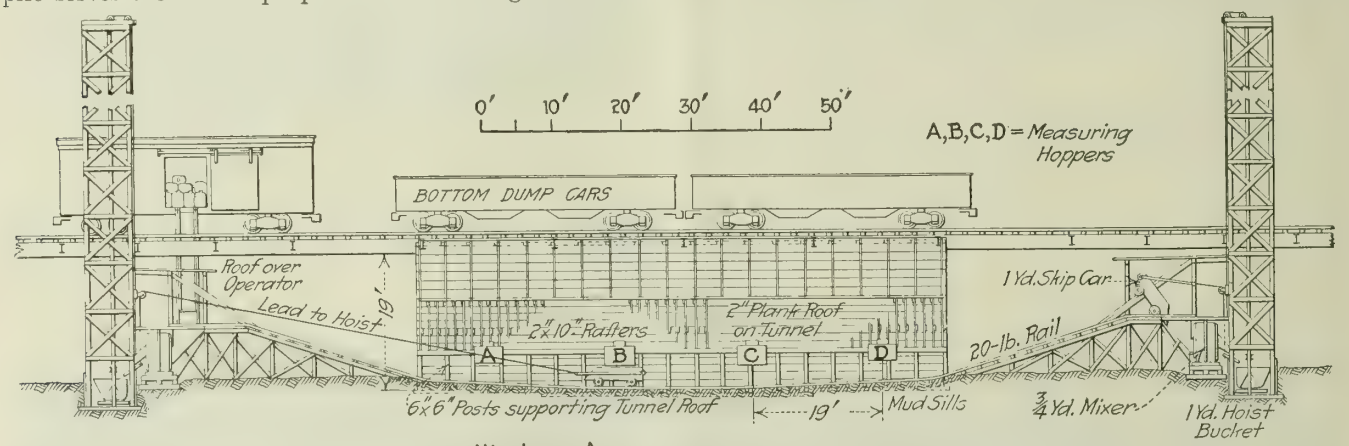


FIG. 2. CONCRETING PLANT FOR WAREHOUSE OF MIDLAND WAREHOUSE & TRANSFER CO., CHICAGO

The railway cars stand on a permanent three-track steel trestle at the second-floor level

and a sufficient amount of brickwork, window and partition work done to permit occupancy of most of the basement and first floor for warehouse purposes.

The actual production of concrete in the superstructure at the time of stopping work had been 1800 cu.yd. per week, or 370 cu.yd. more than required to meet the schedule. The first tier of columns and the first-floor slab (3200 cu.yd.) were completed between Mar. 19 and Apr. 2. The second tier of columns and the second floor slab (3100 cu.yd.) were completed between Apr. 6 and 14, six working days, which makes the average production of concrete for the second-floor slab 450 cu.yd. per day from two ¾-yd. mixers. The largest single day's run from the two mixers was 550 cu.yd. and the largest day's run from one machine was 308 cu.yd. These were all 8-hr. days.

The labor required for each mixer to deliver concrete into the hoist bucket ready for hoisting is as follows: Two men at the measuring hoppers in the tunnel, 1 man unloading cement from car to mixer platform, 1 man placing cement in mixer, 1 man operating mixer; half of hoisting engineman's time operating skip car; occasional services of train crew dumping stock off cars into storage. This force actually turned out concrete at the rate of 60 batches per hour for periods of several hours' duration.

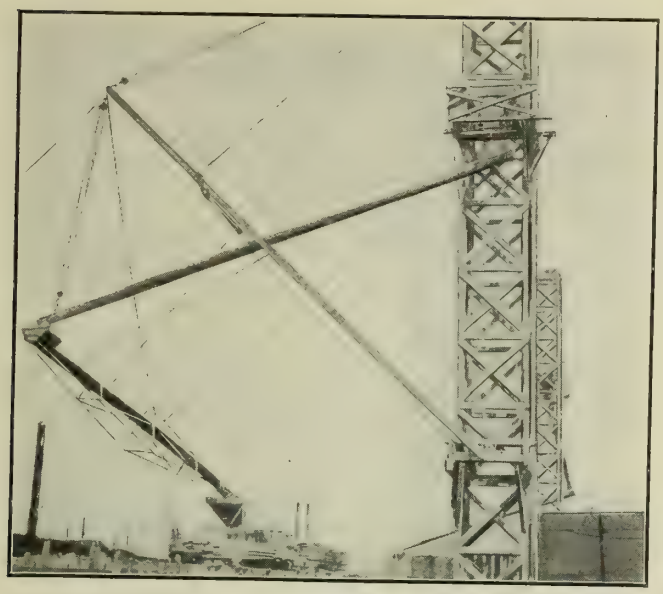


FIG. 3. METHOD OF SUPPORTING THE CONCRETING CHUTES FROM THE ELEVATOR TOWER

The reinforcing steel was furnished by the Concrete Steel Products Co. in connection with plans for the Leonard system of flat-slab construction. The steel received on the job was already fabricated as far as possible; that is, heavy bars were bent ready for placing, and the column spirals were delivered made up but collapsed to reduce bulk in shipment. Therefore no elaborate bending plant was necessary, and as a very small range of bar sizes was employed, no great storage space was needed. The bars for the four-way slabs were placed in long lengths, wired together at the intersections over the column heads. The network of wires at the column heads was sufficiently open to offer no particular obstruction to the placing and tamping of concrete.

The methods used in form construction follow closely the accepted practice for flat-slab jobs. Metal column forms of the Johnson system are erected inside of a four-post framework which supports the rectangular column head, which in turn carries the flared top section of the metal column form. The supporting framework for flat-slab forms is carried by the four-post structures around the columns. The center of each panel is supported by shores rendered adjustable by the usual double wedges.

Special construction will be necessary to carry the third floor over the 72-ft. space occupied by the trestle. Two lines of columns divide this space into 24-ft. spans, but the necessity of maintaining car operation on the trestle while this floor is being constructed makes it impossible to use any shores between columns, and the falsework around the columns must be kept within the limits of car clearances.

A small carpenter shop fitted with cutoff saw, rip and crosscut table saws furnished all the special equipment needed for the formwork involved. The abnormal speed requirements were met without difficulty by providing 20% more lumber than would otherwise have been required, by a thorough system of routing the forms and by designing them so as to involve the minimum of alterations.

The building was designed for the Midland Warehouse & Transfer Co. by S. Scott Joy, architect, of Chicago. It is being constructed by the Stone & Webster Engineering Corporation, of Boston and Chicago.

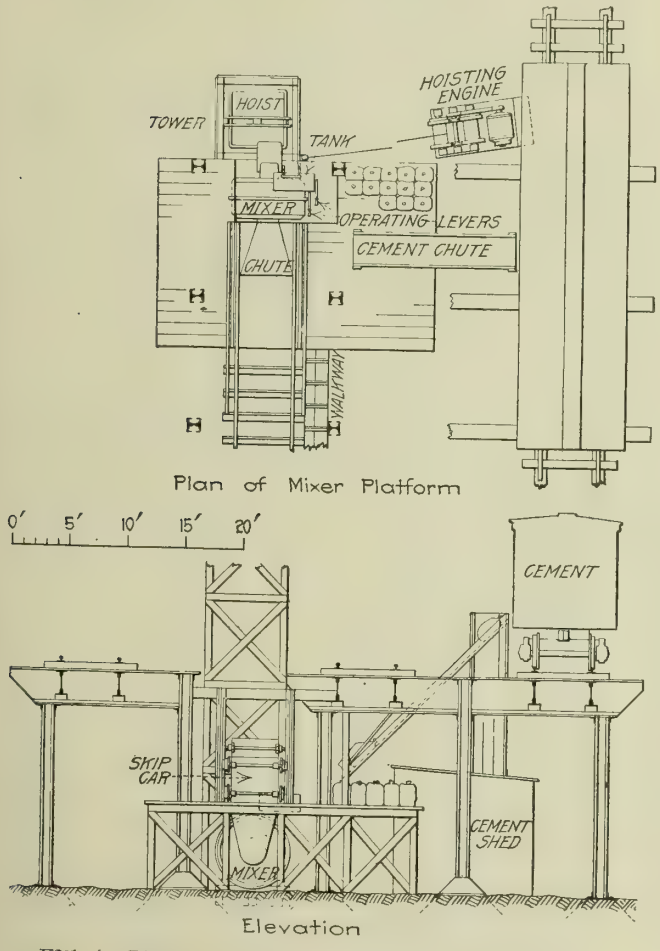


FIG. 4. DETAILS OF CONCRETE MIXER SHOWING CEMENT SUPPLY

A Novel System of Canal Towing has been operated experimentally on the Dortmund-Ems Canal in Germany and is described in a report to the Department of Commerce by United States Consul George Eager, at Barmen, Germany. In this system a line of 40-lb. steel rails is laid along the bottom of the canal and anchored against longitudinal motion by rigid lateral bars spaced about 175 ft. apart. These bars are hinged at their anchorages, thus permitting the rail to be raised from the bottom and even brought to the surface of the water if required. The tugboat has a pair of vertical shafts carrying grooved wheels which grip the rail. The wheels are rotated by the application of power and thus propel the boat forward. The tug is provided with means to grip or release the rail as desired, and also with a propeller for movement in harbors, rivers, etc. In order to provide for traffic in both directions, a double line of rails is laid along the canal. This necessitates the tugs being of sufficiently narrow beam to allow them to pass without dropping the rail.

A System of Foreshore Structures to prevent erosion was completed in July on the south shore of Limon Bay at the Atlantic entrance to the Panama Canal. Three permanent shore dikes were erected with the center one about a quarter of a mile west of the center line of the Canal. The system includes 25 timber groins, which will supplement the dikes in preventing shore erosion and consequent heavy silting in the Canal channel. The three dikes, according to the "Canal Record," are spaced 500 ft. apart c to c. and are parallel to the axis of the Canal. They extend north and south, lying practically at right angles to the original shore line. The longest is 700 ft., the center dike is 400 ft. long, and the third 200 ft. Each is about 8 ft. wide at the top, the sides sloping 1 on 1. The rock used in their construction was obtained from Gaillard Cut. The groins are heavy timber fences built at right angles to the shore line. Each extends about a foot above high water and down the slope of the beach from high-water mark to low-water. Their average length is 100 ft., and they are spaced 400 ft. apart.

Diagrams for Cost of Ties; Canadian Pacific Ry.

Diagrams for the determination of the economic value of ties have been prepared for the use of the engineers and the tie department of the Canadian Pacific Ry., under the direction of J. G. Sullivan, Chief Engineer (Western Lines), Winnipeg, Canada. There are three diagrams, and one of these is given herewith. They are based on a formula given by the Tie Committee of the American Railway Engineering Association in the 1915 "Proceedings" (except that as there printed it includes a typographical error). The formula is as follows:

$$I + A = \frac{CR\,(1+R)^N}{(1+R)^N - 1} = \frac{C\,(1+R)^N}{\dfrac{(1+R)^N - 1}{R}}$$

or

$$I + A = \frac{\textit{Amount of } C \textit{ after } N \textit{ years}}{\textit{Amount of \$1 annuity for } N \textit{ years}}$$

C = Final cost of tie in place;
R = Rate of interest;
I = Interest = $C\,R$;
N = Life of ties in years;
A = Annual contribution to sinking fund, which at compound interest will provide for renewal at end of life of tie.

Example: C = \$1.40. N = 20 years. R = 5%.

From table $(1+R)^N$ = 2.6533 . . log = 0.4237860

From table $\dfrac{(1+R)^N - 1}{R}$ = 33.0660 . . log = 1.5193817

$\bar{2}.9044043$

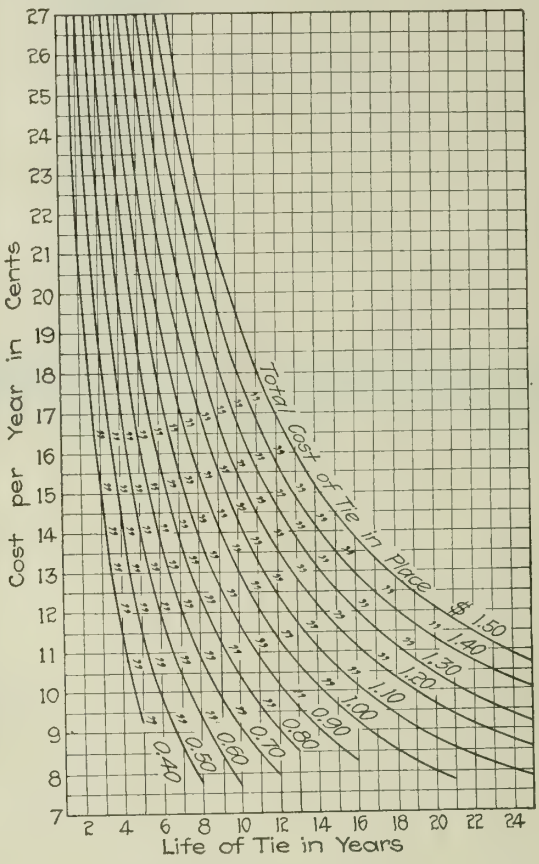
C = \$1.40 . . . log = 0.1461280

log = $\bar{1}.0505323$

$A + I$ = \$0.11234.

The three diagrams show the value of I plus A, from which the annual cost per tie can be taken for ties costing from 40c. to \$1.50 and varying in life from 2 to 25 years. Mr. Sullivan states that they could be made much easier if they only showed the value of A—that is, the amount required to be subscribed annually to form a sinking fund which would purchase a tie. To this would be added direct the interest on the first cost of the tie. This would have a slight advantage over the present form in a case where the cost of the present tie will differ from the estimated cost of the new tie.

The same result, however, can be obtained by taking from the diagram the annual cost, using the estimated value of the new tie, and deducting from this the interest per annum at the given rate on this difference. For example, if it is estimated that it will cost 80c. to renew a tie which cost in place 75c. and will last 8 years, money figured at 5%, take from the diagram the annual cost of an 80c. tie lasting 8 years, which is 12.4c., and deduct from this the interest at 5% on the difference in the actual cost and the estimated cost of the renewal, 5c., which is 0.25c. This makes the annual cost 12.15c. instead of 12.4c.



COST PER TIE PER YEAR
For ties varying in total cost and in length of life; money figured at 5% interest

With the diagrams are three tables giving the annual cost of ties lasting various lengths of time and costing (in place) various sums. These are figured for money at 4, 5 and 6%. One of the tables is given herewith.

TABLE OF ANNUAL COST OF TIES LASTING VARIOUS LENGTHS OF TIME, COSTING IN PLACE VARIOUS SUMS, MONEY FIGURED AT 5% INTEREST; CANADIAN PACIFIC RY.

Life in Years	Cost in Place \$0.40	\$0.50	\$0.60	\$0.70	\$0.80	\$0.90	\$1.00	\$1.10	\$1.20	\$1.30	\$1.40	\$1.50
1	0.420	0.525	0.630	....	....	....	....	....	....	....	....	....
2	.215	269	.322	0.376	0.430	0.484	0.538	....	....	....	....	....
3	.147	.184	.221	.257	.294	.331	.368	0.405	0.442	....	....	....
4	.113	.141	.169	.198	.226	.254	.282	.310	.338	0.367	0.396	0.423
5	.092	.115	.139	.162	.185	.208	.230	.254	.278	.301	.324	.345
6	....	.098	.118	.138	.157	.177	.196	.216	.236	.256	.276	.294
7	....	.086	.104	.121	.138	.155	.172	.190	.208	.225	.242	.258
8	....	.078	.093	.109	.124	.139	.156	.171	.186	.202	.218	.234
9	....	....	.0 4	.098	.112	.126	.141	.155	.168	.182	.196	.210
10	....	....	.077	091	.104	.117	.129	.142	.154	.168	.182	.195
11	....	....	....	.084	.096	.108	.120	.132	.144	.156	.168	.180
12	....	....	....	.079	.090	.102	.113	.124	.136	.147	.158	.169
13	....	....	....	....	.085	.096	.107	.117	.128	.138	.149	.160
14	....	....	....	....	....	.090	.101	.111	.121	.131	.141	.151
15	....	....	....	....	....	.087	.096	.106	.116	.125	.135	.144
16	....	....	....	....	....	.083	.092	.101	.111	.120	.129	.138
17	....	....	....	....	....	....	089	.098	.107	.115	.124	.133
18	..	....	....	....	....	....	.086	.094	.103	.111	.120	.129
19	....	....	....	....	....	....	.083	.091	.099	.108	.116	.124
20	...	...		....	....		.080	088	.096	.105	.112	.120
21	..	.		..	...	.	.078	.086	.094	.101	.109	.117
22					...	...	..	.084	.091	.099	.106	.114
23				...	.		. .	.082	.089	.096	.104	.111
24				....	...		. .	.080	.087	.094	.102	.109
25				..	....		.	.078	.085	.092	.100	.107

Automatic Sewage-Pumping and Metering Station

By Alan A. Wood*

The sewage from Washington Park, a small outlying residential section of the City of Providence, flows by gravity to a point about 100 ft. distant from the Providence River. From here it is lifted against a head of 30 ft. into the settling basins of the precipitation plant at Field's Point, several hundred yards away. The sewage is free from factory wastes. The pumping station is shown in the accompanying figures.

The pumping system is entirely in duplicate. A 12-in. cast-iron main discharges into the pump suction well. From here a Y-connection communicates with two rectangular storage chambers. Each storage chamber has a capacity of about 30,000 gal.; under normal conditions each basin has sufficient capacity to furnish storage for the total flow for a period of 24 hr. The normal dry-weather rate of flow is about 23,000 gal. per 24 hr.; a combined sewerage system is in use, so that this amount is frequently augmented by storm water. Before reaching the pumps the sewage passes through bar screens (bars at 1-in. intervals).

Each chamber serves as the suction well of a 12-in. vertical electrically driven pump with a normal rating of 800 gal. per min. Each pump is driven by a 10-hp. alternating-current motor mounted on the same shaft. The pumps are located below the motors in the basement, and are so placed as to operate under a maximum head of 6 ft. on the suction.

In order to minimize labor cost it was desired to have a plant as nearly automatic in operation as possible. The small volume handled makes it impracticable to run the pumps continuously. Therefore, each motor is equipped with a starting switch operated from a float in the pump-suction basin, automatically starting or stopping the motors when the suction level reaches a predetermined minimum or maximum. This arrangement has operated very satisfactorily for the year and a half in which the plant has been running.

An independent switch on the ground floor of the building controls the starting and stopping of the motors, regardless of the position of the float switch.

*16 Glendale Ave., Providence, R. I.

The apparatus is housed in a neat stucco building. In the first winter some trouble was experienced from freezing, although an attempt was made to heat the building by electric current. This proved expensive as well as unsatisfactory, so that a simple hot-water heating system was installed in its place and the heating problem apparently has been solved.

In order to obtain accurate knowledge of the amount of sewage from this district and to check the operation of the pumps, a 12-in. venturi sewage meter was installed. The venturi tube is placed in the common discharge line from the two pumps and is of sufficient capacity to take the discharge from one pump or from both. The tube is especially designed for this service, being equipped with cleaning devices for preventing the solids from clogging the vent holes and pressure chambers. These have been cleaned once since the plant was installed; early in June of this year about a pint of sludge was removed from the inlet and throat pressure chambers. The small amount of accumulation seems to indicate a tendency for solids to pass through the meter tube and not to adhere to the interior or pass into the vent holes.

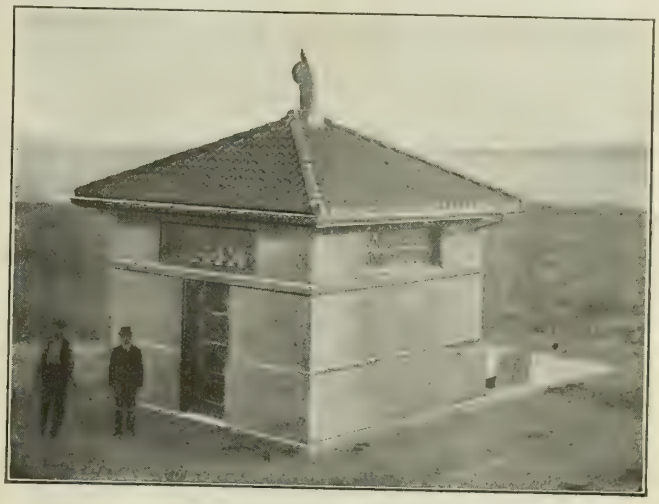


FIG. 1. WASHINGTON PARK SEWAGE-PUMPING STATION, PROVIDENCE, R. I.

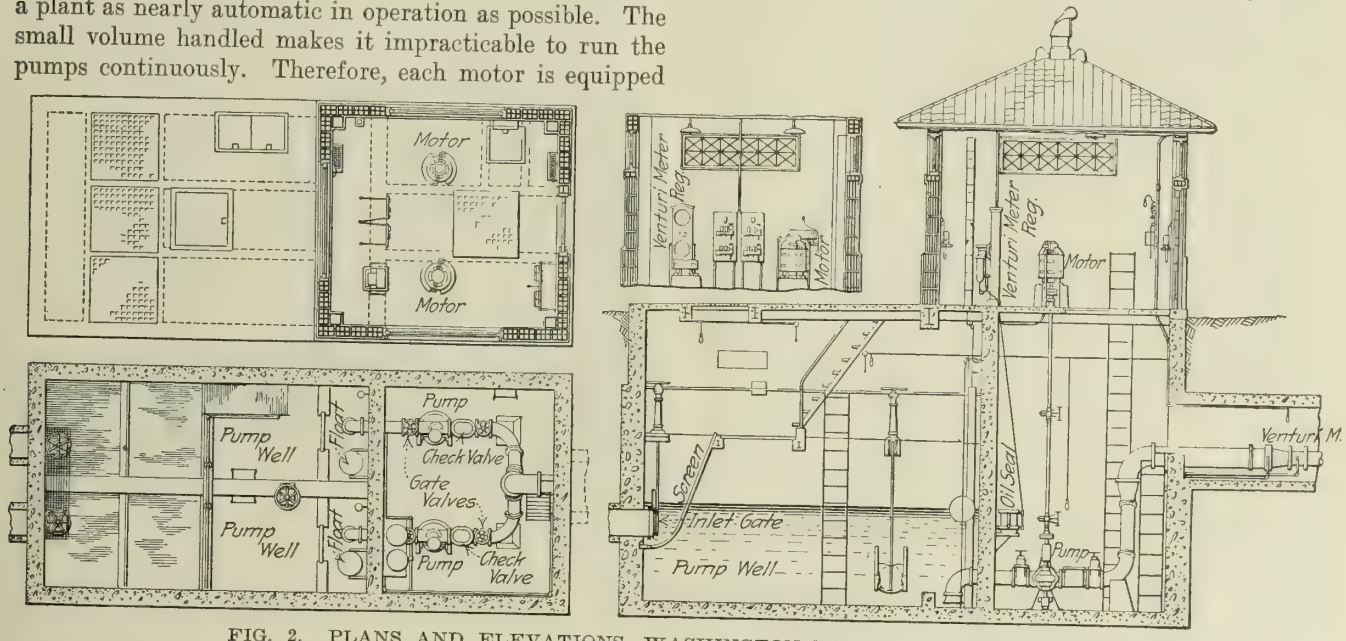


FIG. 2. PLANS AND ELEVATIONS, WASHINGTON PARK PUMPING STATION

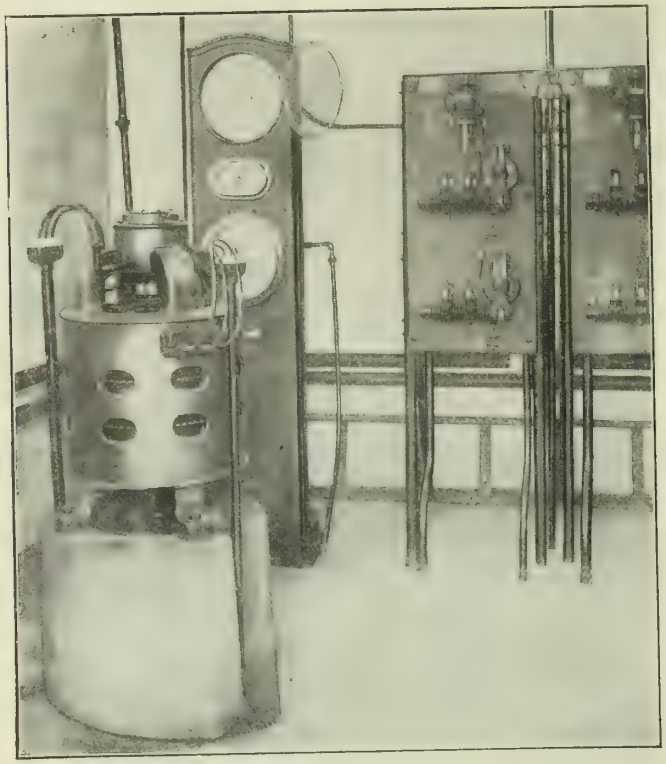


FIG. 3. PUMP MOTOR, VENTURI RECORDER AND CONTROL BOARD

With the venturi tube is employed the register-indicator-recorder shown in Fig. 3. This registers the quantity of sewage being pumped, indicates the rate, and also furnishes a record chart which reveals constantly the condition of the pump. The lower of the three dials is double-graduated, the outer circle indicating, in black characters, the rate in gallons per minute and the inner circle showing at the same time, in red characters, the rate of flow in gallons per 24 hr.

The utility of these charts has been repeatedly demonstrated. For instance, on Sept. 12 the west pump reached a maximum of 930,000 gal. per 24 hr. and maintained while in operation an average rate of pumpage of 750,000 gal. per 24 hr., compared with a rated capacity of 1,150,000 gal. On that day the pump casing was removed and the pump cleaned. On Sept. 13 the west pump momentarily reached a maximum rate of 1,325,000 gal. per 24 hr. and maintained while in operation an average rate of 1,200,000 gal. per 24 hr. Cleaning thus increased the rate of discharge by 42.5% and resulted in a 51.5% saving in current due to the increased efficiency of the pump. On Sept. 12 the pumps were running about ¾ hr.; this time was reduced 20% on Sept. 13.

The total labor charge against the plant, including cleaning of building and caring for heater, taking observations, etc., is the time of one man for 4 hr. per day.

The writer is indebted to the courtesy of Frederick O. Clapp, Assistant Engineer, for assistance in rendering the material for this article available. The plant was designed under the direction of Otis F. Clapp, then City Engineer.

Asphalt and Petroleum in the Philippines—The division of mines of the Philippine Bureau of Science has recently examined the deposits of asphalt in Leyte, which were reported a little more than a year ago. The principal result of this examination was the discovery of a large deposit of rock asphalt near the town of Villaba and at a point very much nearer to the coast than was the original discovery.

Evaporation and Seepage from Irrigation Reservoirs

By Kenneth A. Heron*

The Dallas and Warner reservoirs of the Modesto Irrigation District are formed by a series of low earth dams. When full the reservoirs will have a combined capacity of 28,000 acre-feet, will submerge about 2400 acres, and have an average water depth of a little less than 12 ft. Although constructed four or five years ago, the reservoirs had been used but little before the season of 1914.

When partly full or when water was passing through the reservoirs, the loss in seepage was quite noticeable. To determine just what portion of the reservoir water was lost in this manner, observations were made by the writer in 1914.

Ten borings 100 ft. apart were made. Although these did not reach across the reservoir, it is believed that they disclosed the material under the reservoir bed. All the holes showed a layer of hardpan (not very firmly cemented sand and gravel) from 2 to 8 ft. thick, covered and underlaid with sand, silt and adobe for an average thickness of about 12 ft. Under this was found a stratum of sand from 10 to 40 ft. thick. This in turn was underlaid with a gravel and clay conglomerate to an unknown depth. The hardpan stratum, which if continuous could be depended upon to prevent excessive seepage, is in this locality rolling and broken and of various thicknesses.

The water surface of the reservoirs is from 100 to 120 ft. above the water surface of the Tuolumne River to the south and is considerably above Dry Creek to the north. Each stream is near the reservoirs and each forms an excellent drainage channel for seepage. The great area of water surface and small depth result in a large amount of water being lost in evaporation during the hot summer months, and the large area of porous reservoir bottom submerged offers an underground outlet to vast quantities of stored water.

Records of Evaporation from Reservoir

To determine the amount of water lost through evaporation in the two reservoirs, an evaporation pan (Fig. 1) was placed in the Dallas reservoir. The pan was 3x3 ft. in plan and 18 in. deep, made of No. 16 gage galvanized sheet iron. It was firmly braced with angle irons. In its center, in a vertical position, was placed an iron pin $\frac{3}{16}$ in. in diameter and 12 in. long, with a sharp point. The pan was placed in an opening in the center of a 15x15-ft. float, in such a position that the average top of the water in the pan was even with the water surface of the lake. The float was provided with sides around the edges so as to prevent waves tipping it and was located in such a position that it was under the constant surveillance of the reservoir keeper. Its position was changed from time to time as the water in the lake lowered, and at all times it was kept in such a position as to make the evaporation conditions in the pan as nearly as possible similar to those which acted on the water surface of the reservoir. Records were started by filling the pan with water to the top of the pin. Once a week thereafter and on the last day of each month

*Irrigation Engineer, Modesto, Calif.

water was added with a measure in such an amount as to bring the surface again even with the top of the pin. Records of the amount of water required to do this were kept, as well as the amount of evaporation measured on the pin with a rule. Both methods checked very closely, but the water measurment was assumed as the correct amount of evaporation.

Reservoir Seepage Observations

During the month of May, 1910, the average maximum depth of water in the Dallas reservoir was 3.63 ft., the average submerged area was 310 acres, and the total loss in water depth was 1.14 ft. The recorded evaporation in May, 1914, was 0.425 ft. The seepage is therefore estimated at 0.715 acre-feet per acre of reservoir bottom at an average maximum water depth of 3.63 ft., and this is assumed to be the case at all times when the same conditions exist.

During the season of 1914 gaging stations were maintained above and below the reservoirs and records of inflow and outflow were kept. Gages were observed daily in both reservoirs. The rainfall during February, as recorded by the Grange Co. at Modesto, was 0.406 ft. The February observations are summarized in Table 1.

TABLE 1. EVAPORATION AND SEEPAGE FROM RESERVOIRS, FEBRUARY, 1914

	Mean Area Submerged, Acres	Estimated Evaporation, Acre-Ft.	Seepage, Acre-Ft.	Total Loss, Acre-Ft.	Maximum Depth, Ft.	Acre-Ft. Seepage per Acre Submerged
Dallas Reservoir.	1540	154	8446	8600	19.5	5.48
Warner Reservoir	367	37	1101	1138	6.5	3.00
Total	1907			9738		

During May, 1914, the recorded evaporation from the water surface of the Dallas reservoir amounted to 0.425 acre-feet per acre of water surface. Careful records were kept of all water in the canals during the month and the seepage from the reservoirs as determined is thought

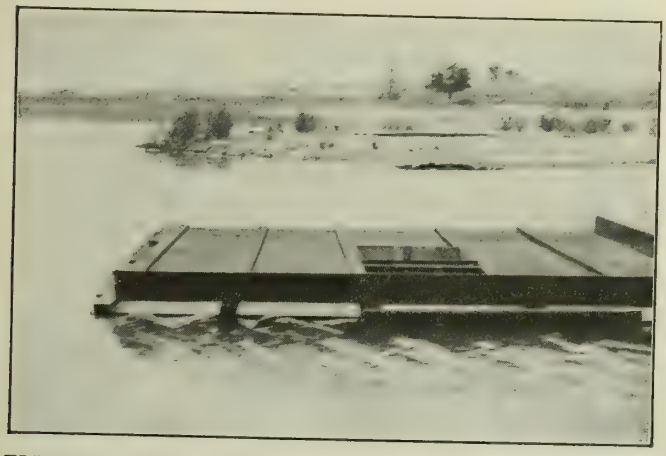


FIG. 1. EVAPORATION STATION NEAR MODESTO, CALIF.

to be very close. Assuming on account of the almost even depth of water in the two reservoirs that the seepage losses in each were proportional to the acreage submerged by each, the losses in the two reservoirs were as shown by Table 2.

TABLE 2. EVAPORATION AND SEEPAGE FROM RESERVOIRS, MAY, 1914

	Mean Area Submerged, Acres	Evaporation, Acre-Ft.	Seepage, Acre-Ft.	Total Loss, Acre-Ft.	Maximum Depth, Ft.	Acre-Ft. Seepage per Acre Submerged
Dallas Reservoir.	730	311	3319	3630	9.1	4.54
Warner Reservoir	367	155	1668	1823	9.5	4.54
Total	1097	466	4987	5453		4.54

It is apparent that these seepage losses are greater as the depth of water in the reservoir increases. From the data a curve has been drawn (Fig. 2) of the estimated mean seepage in acre-feet per acre of reservoir bottom at different average maximum depths of water in the reservoirs.

There is a possibility that the reservoirs will to some extent silt their bottoms and thereby decrease the seepage

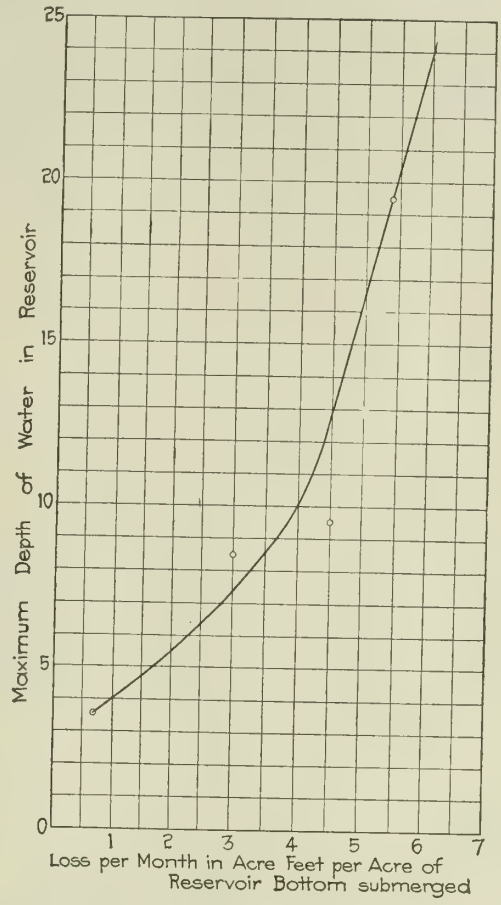


FIG. 2. RESERVOIR SEEPAGE LOSSES

losses. The water passing into them, however, carries very little suspended matter, as can be observed at the lakes at the reservoir intake, where very little sediment is deposited.

A Gasoline-Electric Car equipped with a 200-hp. engine has been built for the New Zealand Government railways by the Midland Railway Carriage & Wagon Co., of Birmingham, England. The car, which is described in London "Engineering" of June 25, is especially noteworthy because it is equipped with the Thomas transmission, an ingenious form of combined mechanical and electrical drive from the engine to the car wheel. The objection raised to the usual form of gasoline-electric drive is that when the engine and car are running at full speed it has a constant percentage of loss due to the conversion of the mechanical energy into electricity in the generator and back again to mechanical energy in the motors. In the Thomas transmission, the electrical generators are used only in starting the car and bringing it up to speed. The construction is such that there is a gradual change from electrical to mechanical transmission as the speed increases. The engine is an eight-cylinder machine of the V-type with a normal speed of 900 r.p.m. and a maximum speed of 1500. From experience with a similar car of 160 hp. in service on the South African Government railways, it is estimated that a fuel consumption of 1 gal. of gasoline per 200 ton-miles' run will be obtained. The car on which this engine is to be placed is 62 ft. 6 in. long and 7 ft. wide. It is to run on a 3 ft. 6 in. gage track and is mounted on two four-wheel trucks. The car with its underframe but without the body weighs 20 tons, of which the motive-power equipment constitutes about eight tons.

Cutting a City Street Through a Railway Station

SYNOPSIS—Cutting through a railway fill to connect two dead-end streets in Springfield, Mass. One street passes under two station buildings.

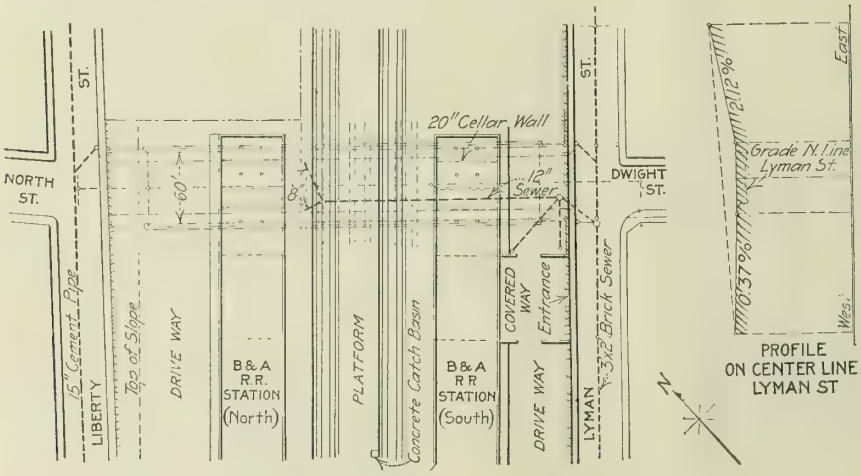
Springfield, Mass., is noted for long blocks between cross streets. Until recently the most notable examples of this shortcoming were the blocks paralleling the Boston & Albany R.R., which approaches from the northeast and from a geographical point of view cuts the city into nearly equal parts. But three streets formerly connected the northerly and southerly halves of the city in a distance of over two miles, or between the outskirts of the city and its waterfront on the Connecticut River, which flows approximately from north to south.

The main business section of the city lies along and between four streets nearly parallel to the river front and hence crossing the railway at right angles. In this part of the city the tracks are elevated, being carried on an earth fill between masonry retaining walls. Two of the streets had been carried under the railway at the time the tracks were raised, but the other two came to dead ends on each side of the railway fill. One of these was the waterfront street and the other the middle street between the two existing through streets.

The extension of Water St. along the river was complicated by its intersecting, not only the four tracks of the Boston & Albany R.R., but also the ends of two connections—the Boston & Maine R.R. going north on the river bank and the New York, New Haven & Hartford R.R. going south. The extension of the other, Dwight St., was complicated by its passing through the union station buildings, served by four tracks and used by all three railways. The station is in two parts of almost identical construction, one north and the other south of the tracks, with a covered island-platform between.



FIG. 2. NORTH SIDE OF UNION STATION, SPRINGFIELD, MASS., BEFORE BEGINNING UNDERPASS



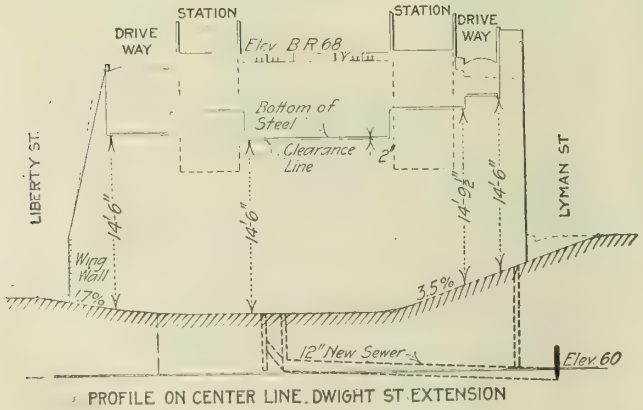


FIG. 1. GENERAL PLAN OF DWIGHT ST. UNDERPASS, SPRINGFIELD, MASS.

The north side of the station at the time of beginning work, March, 1914, is shown in Fig. 2 and the south side in Fig. 3. There was no particular difficulty in connection with excavation under the buildings. The walls and partitions were carried on needle beams and girders made of steel I-beams supported by a trestlework of timbers (Fig. 4). The work at Dwight St. involved the construction of a new refrigerator for the north station restaurant to replace one in the basement and the installation of an electric elevator to replace one of the plunger type; the entire rearrangement of water, steam and sewer pipes and the installation of two Kane gas-fuel boilers to replace the old boilers in the two basements. Temporary quarters had to be provided for the United States mail, two express companies and a news company. The restaurant in the south station was abandoned during construction under this building and the one in the north station was abandoned after the south station had been restored.

The original excavation was only sufficient to build the two abutments (see general plan Fig. 1 and Figs. 5



FIG. 3. SOUTH SIDE OF UNION STATION, SPRINGFIELD, MASS., BEFORE BEGINNING UNDERPASS



FIG. 4. NEEDLE-BEAMS AND GIRDERS FOR SUPPORTING BUILDING WALLS

and 6). When these were completed the permanent girders under the buildings' walls were placed (Fig. 8) by the use of a locomotive crane and a fixed revolving derrick, after which the excavation between the abutments and under the building was completed.

Before starting excavation under the tracks, piles were driven to from 5 to 10 ft. below the grade of the finished street, to form what might be termed a subterranean trestle. The piles were driven between the ties and the bents capped and stringers placed between train movements without disturbing traffic, notwithstanding there were 300 train movements a day between 8 a.m. and 6 p.m. Only one track at a time was out of commission. No excavation was done except what was absolutely necessary to place the caps and stringers of the trestle and to build the abutments, until the steel-floor system was in place. The backfill behind the abutments was made with wheelbarrows running on the bridge seat before placing the steel. Fig. 9 shows the scheme of excavation.

The steel-floor system (Fig. 7 for detail) was erected in three sections, one at a time, on the completed abutments under the island-platform canopy. The canopy and a pair of tracks were then removed, and by the use of hoisting engines a floor section 22 ft. wide under a pair of tracks was rolled into place. The section for the gap under the island platform was built last. Two weeks was allowed for the concrete of each section to harden before rolling it into place.

For the railway trestle white-oak piles and long-leaf yellow-pine timbers meeting the specifications of the New York Central & Hudson River R.R. (lessees of the Boston & Albany) were used. The cost of driving averaged 27c. per lin.ft., and 7099 lin.ft. of piles were driven. The temporary trestle cost $10,500. No piles were required for the foundations under the abutments, as the material is a hard-packed river sand.

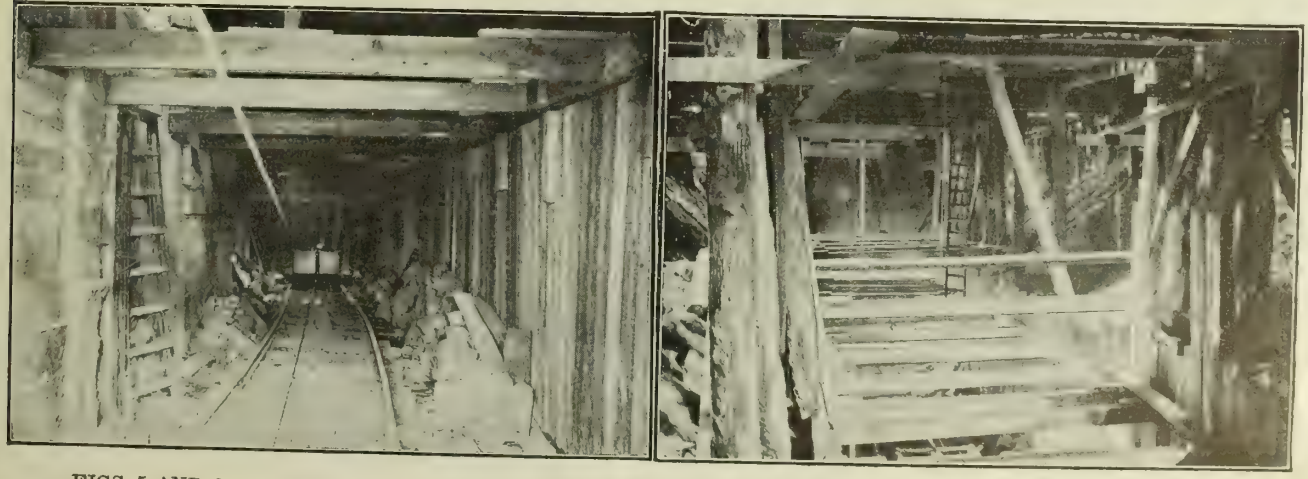
The following are the chief statistics of cost and materials:

Total cost of maintenance, including trestle and station changes	$45,500
Total cost of steel superstructure delivered	67,441
Steel contract, 1601.77 tons	65,160
General contract, including erection of steel	151,250
Mill and shop inspection	720
Total cost exclusive of sewers, paving, land damages and engineering	266,200

Quantities

Excavation	25,735	cu.yd.
Backfilling	5,341	cu.yd.
1:3:5 concrete abutments	5,065	cu.yd.
1:2:4 bridge seats	241	cu.yd.
1:2:4 reinforced concrete	558	cu.yd.
Gunite facing of abutments	1,300	sq.yd.
6-in. tile drain	490	lin.ft.
Reinforcing steel	26,213	lb.
Steel superstructure	1,601.8	tons
Timber left in place	20,790	ft. B.M.
Waterproofing track platform	1,000	sq.yd.
Waterproofing driveway slabs	600	sq.yd.
Total length of Dwight St. underpass	387	ft.
(width)	60	ft.
Length under steel	332	ft.
Clearance under steel	14 ft. 8	in.

The general contractor was the Holbrook, Cabot & Rollins Corporation, Boston, Mass.; the subcontractor for the erection of the steel, was Jobson, Gifford & Co., New York City; the contractor for the steel was the Phoenix



FIGS. 5 AND 6. EXCAVATION UNDER STATION BUILDINGS FOR ABUTMENTS, DWIGHT ST. UNDERPASS

Bridge Co. The engineers were the Samuel H. Pitcher Co., Worcester, Mass.; Earl W. Green, Resident Engineer; and F. C. Freeman, Chief Engineer of the Boston & Albany R.R., who had general supervision of the building of the trestle and restoration of the tracks. Work was commenced Mar. 17, 1914, and completed Dec. 8, 1914, some five months ahead of the contract time limit.

Particulars of Water Street Underpass

The work here was very similar to that at Dwight St., except that it required considerable change in grades of surrounding property and the wrecking of some factory buildings. There are 10 tracks over one abutment and 12 tracks over the other on this underpass, so that the pile trestle to temporarily carry the tracks during excavation was more complicated. The details of the completed structure, however, are much the same as in the Dwight St. structure. The statistics of the Water St. bridge follow:

Total cost of maintenance of tracks, including trestle	$58,500
Total cost of steel superstructure delivered	42,500
Steel contract, 916.45 tons	42,400
General contract, including erection of steel	82,104
Mill and shop inspection	412
Total cost exclusive of sewers, paving, land damages and engineering	184,700

Quantities

Excavation	33,204 cu.yd.
Backfilling	4,308 cu.yd.
1 : 3 : 5 concrete abutments and retaining walls	3,480 cu.yd.
1 : 2 : 4 concrete piers and bridge seats	339 cu.yd.
1 : 2 : 4 reinforced concrete	553 cu.yd.
8-in. tile drain	692 lin.ft.
Reinforcing steel	38,344 lb.
Steel superstructure	916.45 tons
Timber left in place	8,070 ft. B.M.
Impervite facing on abutments and retaining walls	1,175 sq.yd.
Track platform waterproofing	1,500 sq.yd.

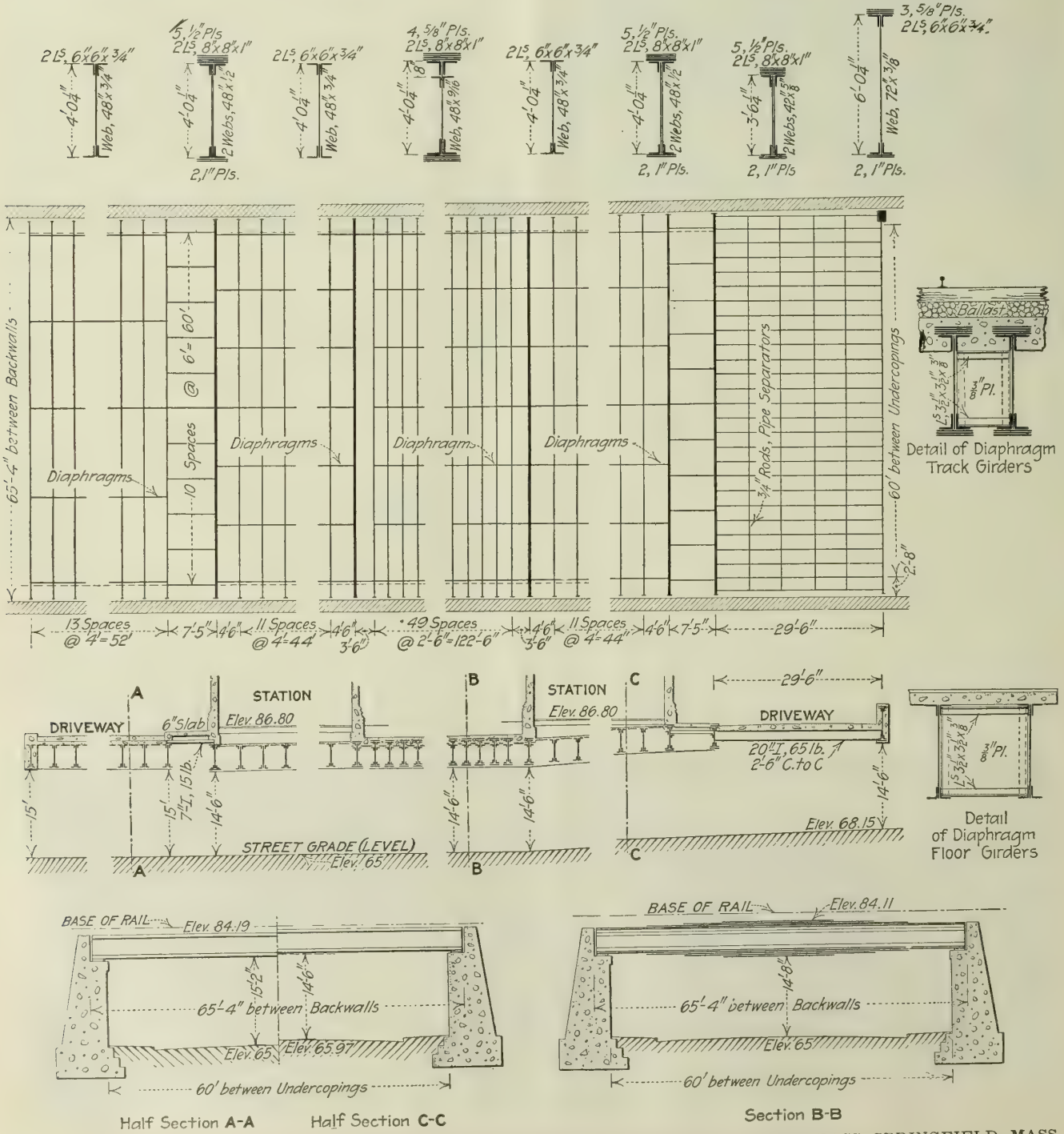


FIG. 7. DETAILS OF CONCRETE AND STEEL FLOOR SYSTEM FOR DWIGHT ST. UNDERPASS, SPRINGFIELD, MASS.



FIG. 8. GIRDER UNDER SOUTH STATION IN PLACE

The cost of pile-driving, 36c. per lin.ft., was more than at Dwight St., because there was about 15 ft. more penetration into hard-packed river sand. Some 21,463 lin.ft. of piles were driven. The trestle cost $55,000, the work being done by the Boston & Albany R.R. There was no delay or obstruction to railway traffic during construction; trains were detoured on temporary tracks when necessary.

One section of the steelwork, weighing 225 tons, was erected outside the abutments on falsework, and this was

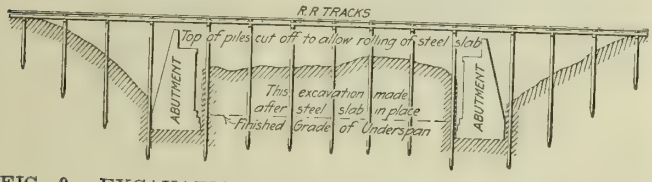


FIG. 9. EXCAVATION SCHEME UNDER UNION STATION BUILDING, DWIGHT ST., SPRINGFIELD, MASS.

rolled into place in 9 min. All the rest of the steelwork was erected in place, a section at a time. The steel-and-concrete-floor system complete is 60x191 ft. The clearance over the street is 14 ft. 2 in.

The contractor for the Water St. underpass was the O'Brien Construction Co., New York City. The subcontractor for steel erection was the Perth Construction Co., New York City. The contractor for the steel and the engineers were the same as for the Dwight St. work.

Car-Pullers for Switching at Industrial Plants

The use of car-pullers for shifting railway cars at industrial plants seems to be increasing materially, partly on account of their convenience where only a few cars are handled and partly on account of the charges made by the railways for switching service. Some of these devices have ordinary cable drums, and others have horizontal or vertical winch heads or capstans. The vertical capstans enable the pulling rope to lead off in any direction. The service of some motor-driven and belt-driven car-pullers built by the Stephens-Adamson Co., of Aurora, Ill., is noted below.

At one plant a machine with a 7½-hp. electric motor hauls three 40-ton cars on level track, the length of haul being from 200 to 800 ft. About ten cars are handled daily. A ¾-in. hemp rope gave trouble by breakage, and



FIG. 10. VIEW OF DWIGHT ST. UNDERPASS COMPLETED

a ⅜-in. wire cable which replaced it was found to cut the capstan, so that a capstan of chilled cast iron was considered desirable. Another plant uses a belt-driven machine to haul three cars on level track, and handles 12 cars daily. At a third plant, the railway company sets the loaded cars on the switch track, and the car-puller then hauls them singly 100 to 300 ft. to the track scales and thence into the plant. The empty cars are hauled from the plant to the switch track for empties. From 2 to 10 cars are handled daily.

Two motor-driven car-pullers are used at a glass-works to serve the coal-handling plant and the batch-handling and storage plant respectively. The maximum length of haul is about 300 ft. in both cases. The former machine, with a 20-hp. motor, can handle ten loaded coal cars on a slight down grade, and shifts from 6 to 10 cars daily. The latter, with a 15-hp. motor, can haul from 6 to 8 cars on level track, and shifts from 5 to 8 cars daily. Although a switch engine is at the works most of the time, the car-pullers were installed because it was impracticable to call for the engine every time it was desired to move a car.

Electric capstans for shifting cars are used extensively in Europe, but more for railway terminals, dock sidings, coaling stations, etc., than at manufacturing plants.

Timber From the National Forests in Alaska will be largely used for the Alaskan railway structures. The Alaskan Engineerinc Commission, which is to build the Government railway from Seward to Fairbanks, has received a permit from the United States Forest Service to cut 85,000,000 ft. of timber in the Chugach National Forest. The permit is in conformity with the act of Mar. 4 last, which authorized the Secretary of Agriculture to permit the Alaskan Engineering Commission and the Navy Department to take from the national forests free of charge earth, stone, and timber for use in government works. The timber will be cut in designated areas along the right-of-way of the proposed railroad, which runs through the Chugach National Forest for several miles. Experiments and tests of Alaskan spruce and hemlock are being made at the Forest Service laboratory at Seattle, Wash., and so far have substantiated the opinion of foresters that Alaskan timber is sufficiently strong for practically all structural purposes. While these tests are going on Forest Service employees in Alaska are marking the timber to be cut along the proposed railroad, the cutting to be done so that only mature trees are taken; the young trees being left uninjured and the condition of the forest improved. This cut of 85,000,000 ft. will be the largest amount of timber ever felled in the Alaskan forests in one operation. At the average rate per M ft. b.m. obtained for timber sold from the Chugach Forest during the fiscal year 1914 it is worth approximately $145,000 on the stump. It will be nearly twice as much as the total quantity of national forest timber now cut and used annually for local purposes throughout Alaska.

Mile-Long Highway Tunnel in Pittsburgh, Penn.

Bids on County Highway Tunnel No. 1 which is to extend from East Carson St. near Third St., to Warrington Ave., near Boggs Ave., in Pittsburgh, Penn., were received by the County of Allegheny on July 12. After a consideration of the alternative bids for a brick, a con-

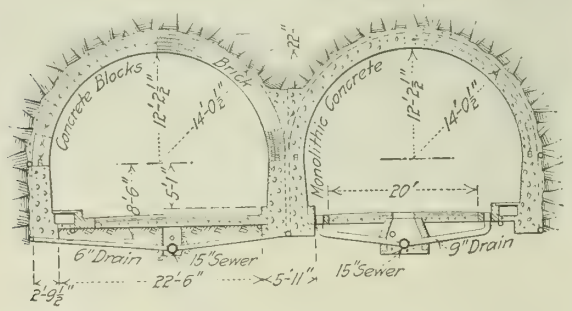


FIG. 1. SECTION THROUGH COUNTY HIGHWAY TUNNEL, PITTSBURGH, SHOWING ALTERNATIVE LININGS

The monolithic concrete lining shown in the right-hand arch is to be used

crete-block and a monolithic-concrete lining, the contract was awarded to Booth & Flinn, Ltd., 1942 Forbes St., Pittsburgh, for the monolithic lining at a total cost of $1,347,018.50. The accompanying drawings give the details of the design and the accompanying table the alternative bids of the successful contractor, with the range of bids submitted.

The tunnel will be 4875 ft. between portals with open-cut approaches, bringing the total length up to 5800 ft. It is in twin section, with two roadways each 20 ft. wide and two sidewalks each 2 ft. 9 in. wide. Ample provisions

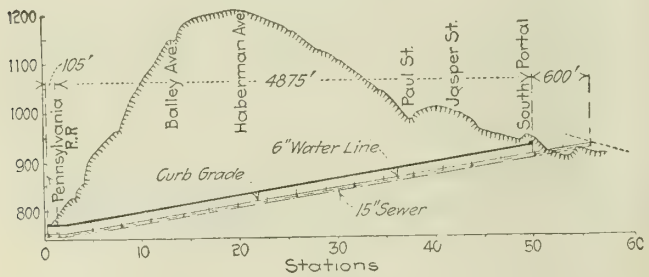


FIG. 2. PROFILE OF COUNTY HIGHWAY TUNNEL, NO 1, PITTSBURGH

are made for drains, conduits, sewers, etc. The alternate designs shown in the drawing called for a lining of concrete block, of brick or of monolithic concrete. Although the successful bidder submitted a lower price on the concrete-block, a consideration of the subject resulted in the acceptance of the monolithic-concrete lining. It will

BIDS ON COUNTY HIGHWAY TUNNEL NO. 1, ALLEGHENY COUNTY, PITTSBURGH, PENN.

	Successful Bid of Booth & Flinn, Ltd.		Range of Unsuccessful Bids	
Tunnel Proper:	Cost per lin.ft.	Total Cost	Cost per lin.ft.	Total Cost
Brick lining	$280.00	$1,365,000	$279–417	$1,360,125-2,032,778
Concrete-block lining	229.50	1,118,812	268–435	1,306,500-2,120,625
Monolithic-concrete lining	235.00	1,145,625	251–420	1,223,625-2,047,500
Approaches		201,393.50		164,543- 298,950

be noted that up to the springing line of the arch all three of the designs were the same.

Work on construction is about to start under the direction of the county authorities. A. D. Neeld, of Pittsburgh, is Consulting Engineer.

Improvements in Small Coaling Stations

In the smaller class of railway coaling stations, serving a limited number of locomotives, it is especially desirable to keep the cost of construction and operation low, the latter being attained by making the operation as nearly automatic as possible. Two recent developments in this direction are described herewith. Both are specialties of the T. W. Snow Construction Co., Chicago, and the car-unloading device is the invention of A. B. Seaverns of that company.

Coaling Station with Car Unloader

A common arrangement is for the cars to dump the coal into a track hopper, from which it is fed by gravity to a conveyor which delivers it to the overhead bin. The pit and underground construction add considerably to the cost of the plant, particularly in wet or bad ground. The new Snow coaling station (Fig. 1) dispenses with all this underground work and takes coal directly from

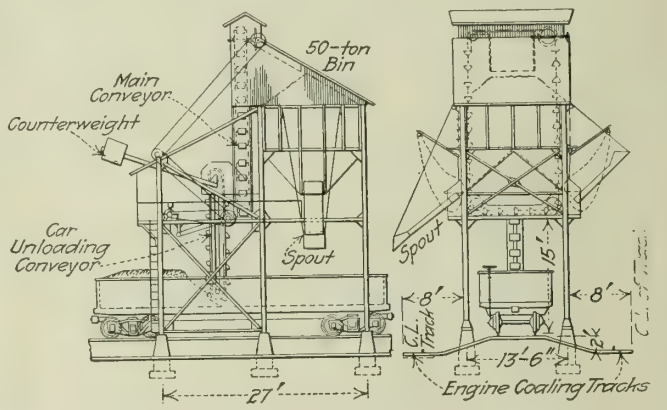


FIG .1. COALING STATION WITH UNLOADING CONVEYOR

the cars. Less storage capacity is needed when coal is held on the cars in this way, so that there is a saving also in the height and size of the structure.

The bin is carried by a structure spanning the coal track, and has an inclined bottom delivering through flexible spouts to engines standing on either side. At one end of the structure is a platform on which is mounted a bucket conveyor, which has a vertical movement within guides and is carried by a counterweighted lever. It stands normally about 15 ft. clear of the track, so as not to foul cars. When a coal car is spotted in position, the conveyor is lowered into it to excavate the coal, being swung laterally, in order to cover the entire width of the car. The car is moved forward as the unloading progresses. Only about 10 per cent. (or less) of the coal has to be shoveled into the conveyor buckets.

The movable conveyor delivers coal to a fixed conveyor, traveling at right angles to it, which elevates the coal and dumps it into the storage bin. An operator on the platform controls the height and the lateral swing of the unloader conveyor, and by means of a drum and cable governs the movement of the coal car. The apparatus can handle any size of coal up to 6-in. lumps. It has a capacity of 50 tons per hour. Similar equipment has been supplied for a sand-and-gravel-handling plant.

The hoist shown in Figs. 2 and 3 is designed for coaling stations of the double-bucket type, in which the loaded bucket ascends, while the empty bucket descends. The

special feature is that the drum is driven by a worm gear running in oil, so that in the event of power being cut off or because of some other accident the heavy loaded bucket (with 1 or 2 tons of coal) cannot overhaul the hoist and drop.

In the general view of the new hoist (Fig. 3) the large gear wheel for the drum is inclosed in the circular casing, beneath which is the cylindrical casing for the worm. At the left is the connection to the shaft of the motor or engine. The bevel gears for driving the worm shaft in opposite directions are inclosed in the rectangular box, at the side of which may be seen the clutch mechanism. A winch, or niggerhead, for a cable hauling cars on the coal track is mounted on the drum shaft. There is a clutch connecting the drum to the shaft; but this clutch cannot be released so long as there is a strain on the drum cable. Ordinarily the shaft is longer than that shown (to put the niggerhead in a convenient position and clear of the hoist mechanism), and has an outer bearing on a concrete pier or pedestal.

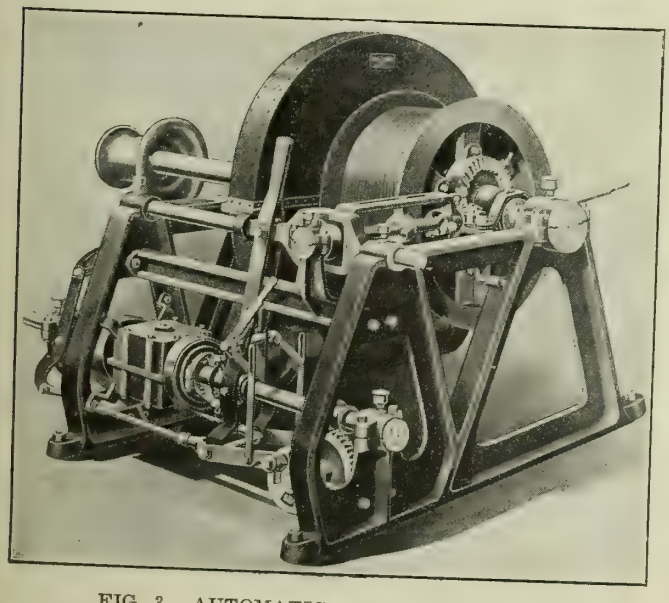


FIG. 3. AUTOMATIC REVERSING HOIST

The controlling mechanism is of interest. The bevel gear on the face of the drum drives a threaded shaft on which rides a nut, having a projection engaging the frame *B*. At the end of its travel the lug on the nut engages a stop lug, and the nut is then revolved with the shaft, turning the frame, and with it a cam, which shifts the clutch shaft laterally. Through the clutch lever this shifts the clutch to the neutral position. This constitutes an automatic stop. The stop lug can be turned on the threaded shaft for adjustment of the position of the stop.

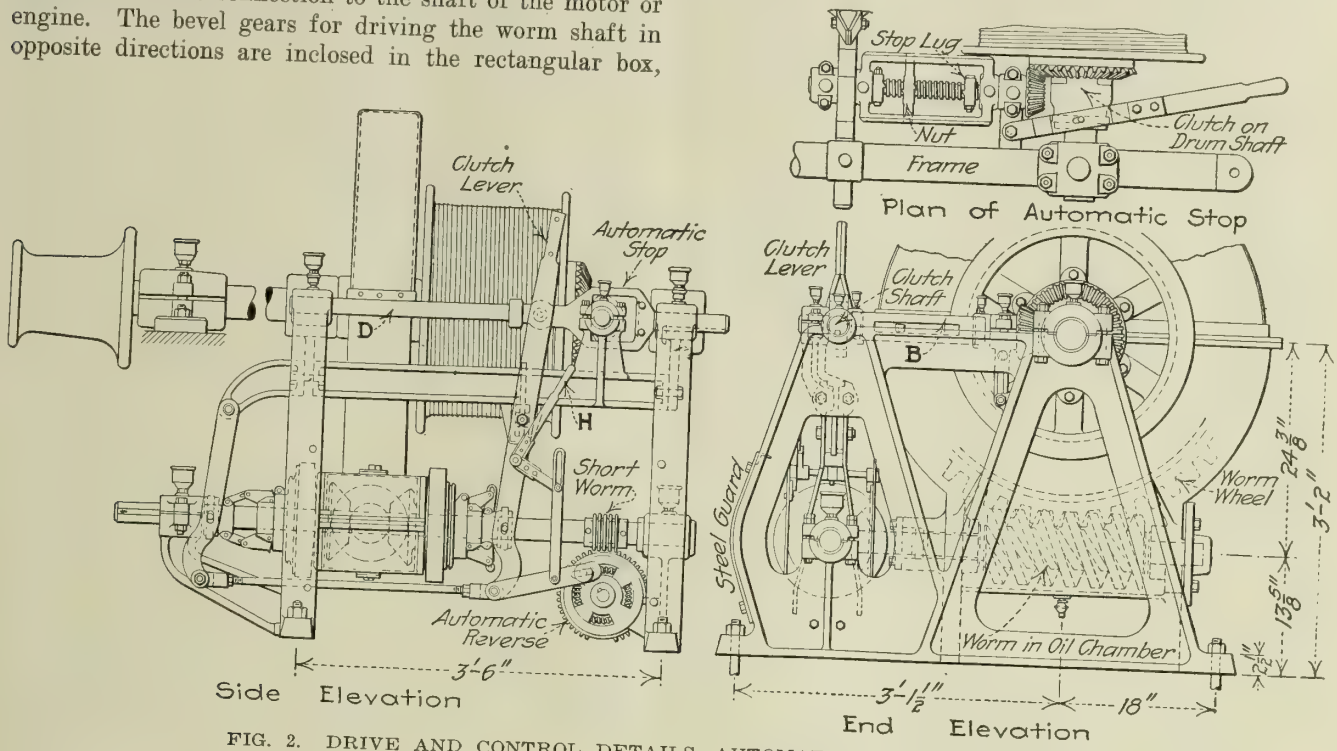


FIG. 2. DRIVE AND CONTROL DETAILS, AUTOMATIC REVERSING HOIST

For the automatic reverse, the driving shaft carries a short worm, engaging a worm wheel the teeth of which are cut away at two opposite points on the circumference. A link connects this wheel with the clutch lever. The movement of the lever to the stop position (by means of the device described in the foregoing) thrusts this link forward so as to turn the gear wheel far enough to engage the worm, and the wheel then makes a half revolution, pulling the link over so as to move the clutch lever and put the clutch into reverse position.

When this is effected, the wheel is again freed from the worm by its interrupted gear. The hoist then makes its reverse movement, is again automatically stopped, and again automatically reversed. The clutch lever can be operated by hand, and a bell-crank provides for disconnecting the link from the automatic reversing mechanism.

In the type of coaling station using these hoists the railway cars dump the coal into a track hopper, from which it is delivered to the buckets alternately through gates which are opened and closed automatically by the motion of the buckets.

Railway Mileage in Argentina amounts to 22,826 mi., of which 559 mi. were added in 1914, according to the annual message to Congress of the President of Argentina. The State railways were increased by 200 mi. during 1914, giving a total mileage of 3209, of which 2908 mi. are narrow-gage.

Stripping Water-Works Reservoirs

By Frederic P. Stearns*

SYNOPSIS—A study of data for unstripped New York reservoirs and stripped Boston reservoirs, combined with general considerations, leads the author to conclude that stripping large reservoirs lessens organic growths and improves the quality of the water. The benefit in a given case may or may not warrant the necessary outlay.

Engineering News of May 6, 1915, contains an article on "Stripping Water-Works Reservoirs," by Allen Hazen and George C. Whipple, which leads the writer to think it advisable to present some other phases of the subject of reservoir stripping.

He wishes to state at the outset that there are many instances where the conditions are such that stripping the surface soil from a reservoir would not produce good water, and other instances where the cost may not be warranted, notwithstanding the excellent results to be obtained from this practice; but that there are still other cases where stripping is desirable.

The writer will follow the precedent set in the article referred to and make comparisons between the unstripped reservoirs of New York and the stripped reservoirs of Boston.

The Object of Stripping

The main purpose of stripping is to diminish the food supply for microscopic organisms and in this way restrict their growth in the reservoir, and especially the summer growths, which cause so much taste and odor in the water of unstripped reservoirs. A secondary, but important, purpose is to prevent the water from taking up the soluble organic matter or the products of decomposition of the organic matter, and particularly to prevent the putrefactive decomposition which takes place in the bottom of deep unstripped reservoirs in the summertime. The stripping of large reservoirs also improves the color of the water and its chemical composition, features which will be referred to subsequently.

Many misleading comparisons have been made between stripped reservoirs, unstripped reservoirs and natural ponds because of a failure to take into account the possibility that the food supply may be contained in the influent water, independent of the environment of the reservoir.

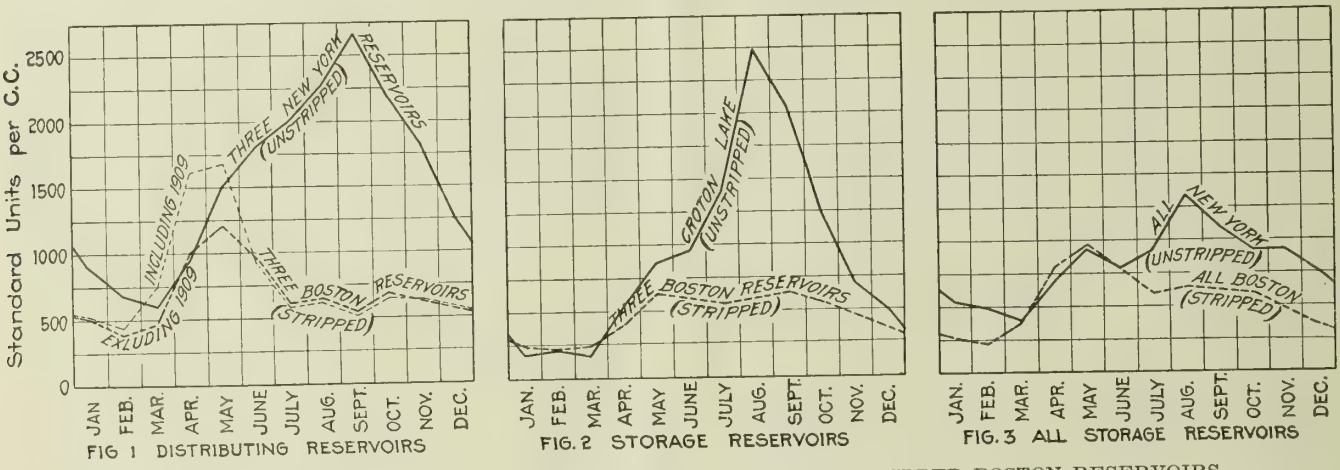
Importance of Food Supply

The importance of the food supply is generally recognized when the influent water comes from the ground, because it has been so well demonstrated that ground water contains a food supply sufficient to develop abundant growths of organisms, even when the water is stored in a clean, uncovered distributing reservoir.

It is not so generally recognized that influent water from surface sources may also contain an ample food supply as the result of a large population upon the drainage area, of the flooding of unstripped reservoirs, or, in cases where the streams become turbid after rains, of the washing into the reservoir of the surface soil from the drainage area.

Where there is an ample food supply in the influent water, stripping will not prevent abundant growths of organisms; but it is effective when the reservoirs are fed by clear-water streams flowing from drainage areas containing only a limited population.

An instance of the effect of a change in the amount of food supply in influent water is furnished by Lake Cochituate of the Massachusetts Metropolitan Water-Works. This is a natural lake which originally had an area of about 560 acres, but was raised, without stripping, about 67 years ago to nearly its present level, increasing the area to 776 acres. Because of the long lapse of time since the raising took place, it is probable that the effect of the unstripped portion is small. There has been a very large increase in the population upon the drainage area, with a consequent increase in the food supply for organisms. The effect of the increased population has been intensified since 1908 or 1909 by the low flow of the streams during all the years since that time. The result has been a very great increase in the number of microscopic organisms, as is shown by the following comparison, in which the increase in the amount of



ORGANISMS IN UNSTRIPPED NEW YORK RESERVOIRS AND IN STRIPPED BOSTON RESERVOIRS

*Consulting Engineer, 1 Ashburton Place, Boston, Mass

chlorine above the normal amount in this location gives an approximate measure of the increase in food supply:

Date	Excess of Chlorine Above the Normal	Standard Units of Microscopic Organisms per C.C. Surface	Bottom
1893-1900	0.25	741	592
1901-1910	0.28	1107	909
1911-1914	0.46	3406	5400

By improperly using the recent records of this lake in comparison with the records of unstripped reservoirs one might reach the misleading conclusion that a natural lake is inferior to an unstripped reservoir, although there is abundant evidence that natural lakes in unpopulated districts are far superior under normal conditions.

Messrs. Hazen and Whipple have classed the distributing reservoirs in Central Park as stripped reservoirs, although it is evident that where the water in a reservoir is frequently changed it can, in the long run, make little difference in the food supply whether the reservoir has a concrete lining or is an unstripped natural reservoir, because the water could not continue indefinitely to take up an appreciable amount of food from the bottom. The organisms in such reservoirs obviously obtain their food from the influent water, and in the case of the Central Park reservoirs this water comes from unstripped reservoirs. These distributing reservoirs should, therefore, on account of the source of the water, be classed as unstripped rather than as stripped.

Massachusetts Metropolitan Reservoirs

The whole history of the stripped reservoirs of the Metropolitan water-supply has made it clear that the water held in and supplied from stripped reservoirs, when not affected by the bad character of the influent water, not only does not promote the abundant growth of microscopic organisms at any season of the year, but practically prevents the abundant growth of the summer organisms which are so likely to give water an unpleasant taste and odor.

There has been, however, one exceptionally abundant growth, occurring in one reservoir in one year, although the total experience with the Ashland, Hopkinton, Sudbury and Wachusett reservoirs of this supply aggregates 74 years. This exceptional growth was one of Asterionella in the Wachusett Reservoir, which started in the autumn of 1908, the year the reservoir was first filled to high-water mark, and developed in large numbers from February to June, 1909.

Water from the Wachusett Reservoir is discharged into the Sudbury Reservoir, thence into Framingham Reservoir No. 3, and thence into the distributing reservoirs of the Metropolitan District, and consequently all of these reservoirs contained a large growth of Asterionella, which had been supplied to them from the Wachusett Reservoir. The growths did not originate in these reservoirs.

In any tables or diagrams of the numbers of organisms, a growth of Asterionella would have as much weight as the same number of other organisms of the same size, although there are many other microscopic organisms, such as Synura, Uroglena and Anabæna, Aphanizomenon and other blue-green algæ, which would produce stronger and more disagreeable odors when in smaller numbers.

Messrs. Whipple and Jackson have published a table[1] which shows that it takes a very large number of Asterionella to produce more than a faint odor. A part of this table follows:

Odor	Number of Asterionella per. C.C.
Faint	1,000 to 5,000
Distinct	3,000 to 15,000
Decided	10,000 to ....

Messrs. Hazen and Whipple, in their comparisons of the numbers of organisms in the New York and Metropolitan water-supplies, state that although "different kinds of organisms produce different tastes and odors and in different amounts," the plottings show only the gross number of organisms, rated as standard units. They also state that "for a part of the period covered by these records, copper sulphate has been used in the New York reservoirs from time to time," and add that "this has, no doubt, tended to reduce somewhat the growths of organisms in the New York reservoirs."

The comparison of the numbers of organisms is of importance mainly as a measure of the tastes and odors of water, but in drawing their conclusions no allowance appears to have been made either for the difference in the character of organisms, as affecting the tastes and odors, or for the effect of the copper sulphate used in the New York reservoirs, although none was used in the reservoirs of the Metropolitan supply.

The character of a water supplied to a community is best shown by the character of the water in the distributing reservoirs from which the water is drawn for use. Fig. 1 is based on monthly records for the three distributing reservoirs of the City of New York in Central Park for the years 1903 to 1914 and for the three principal distributing reservoirs of the Metropolitan water system for substantially the same period. For Boston two lines are given, one including and the other excluding the year 1909, when the abnormal growth of Asterionella occurred. During the first four months the results do not differ very much and the number of organisms is not large, but in the remaining months the number of organisms in the New York reservoirs is much greater, the maximum in these reservoirs being fully four times as much as in the Boston reservoirs during the same month. This wide difference in the hot weather is important, because it is the time when the more objectionable organisms develop in large numbers in the waters of unstripped reservoirs, and because the tastes and odors caused by the organisms are much more noticeable in warm than in cold weather.

New York and Boston Reservoirs

Fig. 2 shows a comparison between the number of organisms in Croton Lake from 1903 to 1908 inclusive and in the three completely stripped reservoirs of the Metropolitan water-supply for the same period.[2] As before, the upper line represents the New York records, and the lower line the average of the three Metropolitan reservoirs for the same period. Substantially the same results are reached by comparing the storage reservoirs as by comparing the distributing reservoirs.

Fig. 3 shows a comparison between the numbers of microscopic organisms in the New York and in the Boston storage reservoirs, based upon all available records

[1] "Jour. New England Water Works Association," Vol. XIV, p. 12.

[2] The numbers in Croton Lake are taken from the report of the Department of Water Supply, Gas and Electricity for the year 1908, p. 48, which contains the only printed statement of monthly records available to the writer. All other monthly records of the New York supply referred to in this article are taken from tables, or scaled from diagrams, prepared by Messrs. Hazen and Whipple.

which it seems proper to use. The New York records cover all years when observations were made, from 1903 to 1913 or 1914, and include observations at the surface of the Old Croton Lake and the New Croton, Croton Falls, Cross River, Muscoot, West Branch, Titicus, Bog Brook, East Branch, Middle Branch and Boyd's Corner reservoirs, representing in all 1383 monthly records.

The Boston records cover all years when observations were made, from 1893 to 1914, and include the Wachusett, Sudbury, Hopkinton and Ashland reservoirs, which were fully stripped, and Framingham Reservoir No. 3, which was partly stripped—representing in all 1107 monthly records.

This comparison shows the same general characteristics as the others, but the differences are somewhat smaller, owing in part to the inclusion in this case of the older New York reservoirs from which much of the food supply furnished by the soil in the bottom has been exhausted.

It should be borne in mind that these diagrams do not show the full difference between the normal number of organisms in the waters of the two places, because the number of organisms in the New York supply has been diminished by the use of copper sulphate in the storage reservoirs and by the chlorination of the water in the Croton Aqueduct on its way to the distributing reservoirs.

Opinions of Consumers

Thus far the comparison has been made of the gross number of organisms of all kinds, although these are not a satisfactory measure of the tastes and odors of waters, which is really the comparison desired. The opinions of the consumers as to the taste and odor of the water furnished are the true criteria as to the effect of stripping or nonstripping, but as the consumers do not publish their opinions, they are best reflected by the statements which may be found in the water reports. Reference is made to the tastes and odors of the Boston water in all the Metropolitan reports from 1904 to 1914 and in the New York reports beginning in 1909. The Metropolitan reports indicate that in ten years out of eleven, the exceptional year being 1909, there was little or no complaint from the water takers. The New York reports indicate that complaints are the rule rather than the exception. Brief extracts from the reports follow:

NEW YORK REPORTS

1909. Microscopic organisms increased greatly and caused several complaints. Aphanizomenon has been the chief offender, and has been the source of disagreeable tastes and unsightly scum in bath tubs. It has also interfered with the small sand filters installed in apartment houses and hotels.

1910. In the latter part of August complaints about the disagreeable taste and odor in the water became frequent, this condition of the water being caused by the heavy growth of Aphanizomenon, the microscopic algæ growth which imparts a very disagreeable taste and odor to the water.

1911. These growths (of microscopic organisms) were, however, sufficiently numerous to give a decided taste and odor to the water and cause some complaint. The Aphanizomenon algæ was the main cause of the taste and odor.

1912. Report not available.

1913. Objectionable tastes and odors, due to microscopic growths in the distribution reservoirs, especially in Central Park, have disagreeably affected the quality of the water.

METROPOLITAN REPORTS

1904. The organisms (in Wachusett Reservoir) have not been abundant . . . In the Sudbury Reservoir and in Framingham Reservoir No. 3 the microscopic organisms were more abundant in the latter half of the year than usual, causing an odor which was quite persistent, and which was reported from week to week by the biologist. The odor did not, however, become sufficiently strong to cause complaint from the water takers.

1905. In the Wachusett Reservoir there has been an increase, as compared with the previous year, in the number of organisms, but they were not such as to cause disagreeable odors.

In the Sudbury Reservoir and Framingham Reservoir No. 3 the microscopic organisms, while quite abundant, gave no trouble.

1906. In the Wachusett Reservoir the number of organisms has been small throughout the year, and never of a character to give the water an objectionable taste or odor.

In the Sudbury Reservoir the number of organisms has been much larger than usual, . . . causing at times an objectionable odor. The odor disappeared before the water reached the gate-house at the lower end of Framingham Reservoir No. 3.

1907. The number of organisms present (in the Sudbury Reservoir) was not sufficient to cause objectionable taste and odor in the water delivered to the Metropolitan District.

1908. A small growth of Uroglena was present in the Sudbury Reservoir in January, but it did not cause a noticeable taste in the water supplied to the district.

1909. Early in the year a growth of the microscopic diatom Asterionella developed in the Wachusett Reservoir. The numbers of the organism gradually increased, and as the water from the Wachusett Reservoir was delivered into the Sudbury and Framingham No. 3 reservoirs growths of the organism appeared in those reservoirs, and early in March were present in the water delivered to the consumers in sufficient numbers to cause complaints of a geranium taste and odor. . . . From the first of April until the middle of June the water drawn from the taps, with the exception of that supplied from Spot Pond to the northern high-service district, had a very disagreeable taste and odor. . . . . After July 1 the water delivered to the district was unobjectionable for the remainder of the year.

1010. The water in the Wachusett and Sudbury reservoirs and Framingham Reservoir No. 3 . . . . has been almost entirely free from organisms causing objectionable tastes and odors. . . . No complaints have been received from the water takers.

1911. The number of microscope organisms present in the water has also been somewhat above the average, but there has been no growth of organisms of sufficient magnitude to cause objectionable tastes and odors in the water as drawn from the taps. . . . The water has been generally of good quality and very few complaints have been received from the water takers.

1912. The number of microscopical organisms present in the water has been above the average, but the water supplied to the district has not contained objectionable tastes or odors in sufficient degree to cause complaint.

1913. Small growths of Uroglena, Chlamydomonas, Dinobryon and Synura have occurred in the several distributing reservoirs and for short periods have given the water a slightly unpleasant taste, but very few complaints of the quality of the water furnished have been received.

1914. Objectionable microscopic organisms have been present in several of the reservoirs, but not in sufficient numbers to cause objectionable tastes and odors in reservoirs from which the supply was drawn.

Source of Seeding

It has frequently been stated that the water discharged from the Croton Aqueduct is seeded in the Central Park reservoirs, and that this seeding accounts for the abundant growths of organisms in these reservoirs. The writer's experience leads him to believe that trouble from this cause would not continue for any long time if the influent water did not contain an abundant food supply for organisms from the unstripped reservoirs.

A similar trouble occurred in one of the distributing reservoirs of the Metropolitan system, which had for many years before the Metropolitan supply was turned into it been used for the storage of ground water, and consequently had contained abundant growths of organisms. Before turning the Metropolitan water into this reservoir, it was cleaned as well as practicable in view of the granite-block paving laid without mortar on the sides of the reservoir; but enough of the deposits of organic matter remained in the interstices of the paving

to supply sufficient seed and food to produce abundant growths of organisms in this reservoir for a year or two after the new water was turned in. After this time, the growths became more limited, and soon corresponded to those in the other Metropolitan reservoirs.

It has been stated that the effect of stripping is not permanent, and that organisms and other organic matter will drop to the bottom of the reservoir and soon form a deposit which affects the water in the same manner as the soil originally upon the reservoir bottom. The latter part of the statement is based largely upon examinations of deposits on the bottom of unstripped reservoirs, or of distributing reservoirs supplied from unstripped reservoirs. There appears to be no ground for supposing that similar occurrences will take place in connection with stripped reservoirs which do not receive a food supply or a supply of organic matter with the influent water, or that such reservoirs will ever deteriorate except as the result of a change for the worse in the character of the influent water.

Progressive Improvement of Water

Many observations have shown that natural lakes and ponds which have been in existence thousands of years, and which are supplied with good water, contain water which is even better than that of stripped reservoirs in respect to the number of miscroscopic organisms, tastes and odors. There seems to be no reason why all deep reservoirs, whether stripped or unstripped, supplied with water of the character stated, should not ultimately reach the condition of the lakes and ponds which have been in existence for so long a time.

Stripped reservoirs will furnish good water in the beginning, and still better water at subsequent periods, and unstripped reservoirs will furnish much poorer water at first, but ultimately the character of the water will be the same as if the reservoirs were stripped. How long a time this will take is not definitely known. Many reservoirs show a great improvement in from ten to twenty years, but some, like the Ludlow Reservoir at Springfield, Mass., show little improvement at the end of forty years.

The Ashland Reservoir was first filled in 1886. Twenty-one years later, when it was drawn down 23 ft. below high-water mark, the writer examined the bottom of the reservoir and found it to be free from deposits except in some small hollows and flat places immediately below the inlet.

Another test of the permanence of the favorable conditions due to stripping is shown by the number of microscopic organisms in the Ashland and Hopkinton reservoirs, which have been recorded in standard units from January, 1893, and May, 1894, respectively:

	Ashland	Hopkinton	Average
First quarter	98	550	324
Second quarter	363	471	417
Third quarter	415	365	390
Fourth quarter	499	399	449

These reservoirs now have an average age of 25 years, and the average number of microscopic organisms in them in the last two years has been only 341, which does not indicate that they are deteriorating.

Vertical Circulation

It is well known by those engaged in water-supply problems that in the summer the surface water of deep reservoirs becomes warmed, while that toward the bottom remains cold, so that there is no circulation from the surface to the bottom. Under such circumstances the character of the bottom water depends largely on the presence or absence of organic matter. If decomposing organic matter is present in large quantities, as for instance, in unstripped reservoirs, all of the dissolved oxygen in the water near the bottom becomes exhausted, and the water is deeply stained and foul smelling. The foul odors result from the putrefactive decomposition of the organic matter, and are largely due to the presence of sulphureted hydrogen. The stain is due in part to the iron dissolved in water of this kind.

Such bottom water is offensive if drawn from the reservoir during the period of stagnation, and affects the quality of the water at all depths when the vertical circulation takes place in the autumn. The stagnant layer in the bottom of normal stripped reservoirs and deep lakes contains dissolved oxygen and does not become stained or offensive. For instance, the writer has drawn water in September from the stagnant layer 100 ft. below the surface of the Wachusett Reservoir, and the water has been as clear and free from stain as that at the surface, entirely free from taste and odor, as cool as spring water and entirely palatable.

Mr. Whipple states in his book on "The Microscopy of Drinking Water" that he "once collected a sample from Lake Champlain at a depth of nearly 400 ft. The temperature was 39.2 deg.—i.e., maximum density—and the water was probably in a state of permanent stagnation. The sample was bright, clear, colorless, and without odor. The material on the bottom was found to be almost perfectly clean gravel."

Color and Chemical Composition

The water stored in the Wachusett Reservoir is effectually decolorized, the average change in the color from the inlet to the outlet being from 44 to 15, a reduction of 66 per cent. The decolorization would have been far less if the reservoir had not been stripped.

The change in the chemical composition of the water by storage in the Wachusett Reservoir is indicated by the records from 1908 to 1914:

	Parts per Million	
	At Inlet	At Dam
Residue on evaporation:		
Loss on ignition	14.4	11.5
Fixed residue	24.3	18.8
Total residue	38.7	30.3
Albuminoid ammonia	0.158	0.128
Oxygen consumed	4.7	2.6

The table shows a decided improvement in the chemical composition of the water, while there are many instances of a decided deterioration in the chemical composition of water caused by storage in unstripped reservoirs.

The favorable showing made for stripped reservoirs when there is a proper comparison of the stripped Boston reservoirs with the unstripped reservoirs of the New York water-supply may be supportetd by a proper comparison of many other stripped and unstripped reservoirs.

From the writer's point of view, the question between stripping and not stripping reservoirs which are supplied by clear-water streams and unaffected by a large population on the drainage area is not whether the water will be materially improved by stripping but whether the cost of stripping is warranted. The water in the reservoir will be of much better quality if the reservoir is stripped, but the cost of stripping may be too great. The problem should be solved for each particular case.

Superstructure of Chicago Municipal Pier

SYNOPSIS—Details of methods of erecting steel and making and pouring concrete on new city pier in Lake Michigan at Chicago. Notable for long distance chuting of concrete.

The new Chicago municipal pier,[1] extending 3000 ft. into the lake, has on each side a steel-frame two-story shed with concrete floors and concrete slab roof. These two sheds are each 2340 ft. long by 100 ft. wide, and are separated by an 80-ft. driveway with concrete slab base. Their construction requires the placing of about 40,000 cu.yd. of reinforced concrete (with 1300 tons of steel bars) and 6700 tons of structural steel. The contractor for this part of the pier is Edward L. Scheidenhelm, of Chicago, and the contract price is $1,091,800.

The contractor's material yard is at the side of a slip opening from the river. Crushed stone (from ¼ to 1 in. in size) is delivered by deck scows, the stone being carried in 3½-yd. wooden skips or boxes piled upon the deck. A steam stiff-leg derrick, with an 80-ft. boom, mounted on a platform above the ground, picks up each box separately, swings it over the top of the stock pile and lowers it to rest so that the chain sling is slack. A man on the pile then unlatches the end door and unhooks one loop of the sling, so that the derrick raises the box by one end, and the stone is discharged.

Torpedo sand from the St. Joseph River, in Michigan, is delivered by a large steel suction-dredge, or sand-sucker, with hopper of 100-cu.yd. total capacity. Locomotive cranes on its deck pick up the sand with 1½-yd. grab buckets and dump it upon a belt conveyor on a pivoted boom swung out from the side of the vessel. This conveyor deposits it in the stock pile. Beneath the stock piles is an inclined belt conveyor 270 ft. long. The sand and stone, in adjacent piles, are fed directly upon the conveyor, which delivers the materials into an elevated bin having hopper-bottom compartments for 20 yd. of stone and 20 yd. of sand.

The material is handled from the bins to the mixer plant in 12-car trains of 1½-yd. side-dump steel cars. These ride on tracks of 36-in. gage laid with 45-lb. rails and wood ties. A 16-ton four-wheel saddle-tank locomotive handles the trains. Because of the large amount of



FIG. 1. CONCRETING PLANT FOR THE FLOOR AND STEAMER SHEDS OF THE MUNICIPAL PIER AT CHICAGO

The plant is shown placing the concrete deck in advance of the steel superstructure. At the center is the traveling mixer outfit, with the bucket elevator for stone and sand, and the belt conveyor in the rear for the sacks of cement. At the front end is the tower for the concrete elevator, with the 120-ft. distributing spouts on either side. Hanging from the spouts will be seen the vertical pipes for delivering concrete at intermediate points. One of these at the right is discharging to an extension chute. At the side of the outfit is the material track, raised on a "hump" at the hopper from which the bucket elevator raises the material. At the left are the piles of sand for spreading over the clay fill to level the surface and form the base for the concrete slab. Beyond the concreting plant, on both sides of the pier, may be seen the discharge pipes from the suction dredges, extending over the concrete wall and making the interior fill.

[1] "Engineering News," July 29, 1915.

timber in falsework and forms, the smokestack of this engine is fitted with a tall wire cylinder as a spark arrester. The engine, when it brings back a train of empty cars, is uncoupled and switched off, leaving the cars to run into a siding. The engine is then coupled to a train of cars standing on the track under the bin. These it moves forward gradually, and each car is loaded (with sand or stone as required) by means of a slide-gate in the hopper. The engine then takes this train out on the pier, while the empty train is backed onto the loading- or bin-track by means of a crab and cable.

At the mixer the track is raised by blocking to form a hump or long vertical curve. The engine hauls its loaded train over this hump, pushing before it the empty train through a switch, and then couples onto this empty train to haul it back through a siding past the hump track. A cable leads from a drum on the mixer plant to a snatch-block and then back along the track. This is hitched to the train of loaded cars and pulls it back over the hump, each car being dumped at the summit to deliver its contents into a hopper at the side of the track.

Cement is brought out in horse wagons and motor trucks, which are hauled out easily on the finished concrete deck. The sacks of cement are wheeled to a platform behind the traveling mixer plant. From this storage pile they are thrown upon a belt conveyor which carries them to the mixer floor.

The mixer plant is a timber structure about 14x28 ft., 30 ft. high, having an elevator tower 8 ft. square and 125 ft. high. It weighs about 45 tons. This outfit is supported by rollers on plank runways laid on the sand fill, and is moved ahead by a cable attached to an anchor pile and operated by the drum mentioned above. The machine is moved about 300 ft. at a time (at intervals of seven days), and makes this move in about four hours.

At the rear of the machine is a bucket elevator raising the sand and stone from the hopper to the elevated bins, which hold 80 yd. of stone and 80 yd. of sand. The mixer is of 1-yd. capacity, mounted on the lower deck, and delivers the concrete into a 1-yd. elevator bucket. At the proper height this is tripped and dumped sideways to discharge the concrete into a hopper fitted with a gate and a flexible-pipe spout leading to the discharge chutes. The equipment of the mixer outfit includes a 20-hp. motor for the mixer, a 15 hp. motor for the stone bucket elevator, and a 100-hp. motor for the tower elevator. This concreting plant is shown clearly in Fig. 1.

From each side of the tower projects a trussed frame 120 ft. long, carrying the sheet-iron chute. The frame is trussed horizontally also to give it lateral stiffness. The upper end of each frame and the hopper within the tower are raised and lowered by cables passing over sheaves on top of the tower. For the upper deck of the sheds and for the roof slabs (which were poured in forms on the completed upper deck) the concrete is delivered in place by spouting to a hopper and chute which travels on the roof framing, as shown in Fig. 2. Wheeled carts are used to reach some of the more distant sections.

For concreting the lower deck, the lower end of the trussed chute is supported by a timber horse or A-frame 8 ft. high, mounted on small wheels. From this, portable lengths of sheet-iron spouting are carried on light timber falsework and blocking. At the outer end of the floor, the slope of this spouting is rather slight, and men push the slushy concrete along with hoes. With a 1-yd. mixer and elevator bucket, handling a batch about every minute, the delivery of concrete from the chute is almost continuous. The bottom of the trussed chute has two trap openings, with flexible pipe spouts to deliver concrete at intermediate points. The trap swings up, so as to block the chute.

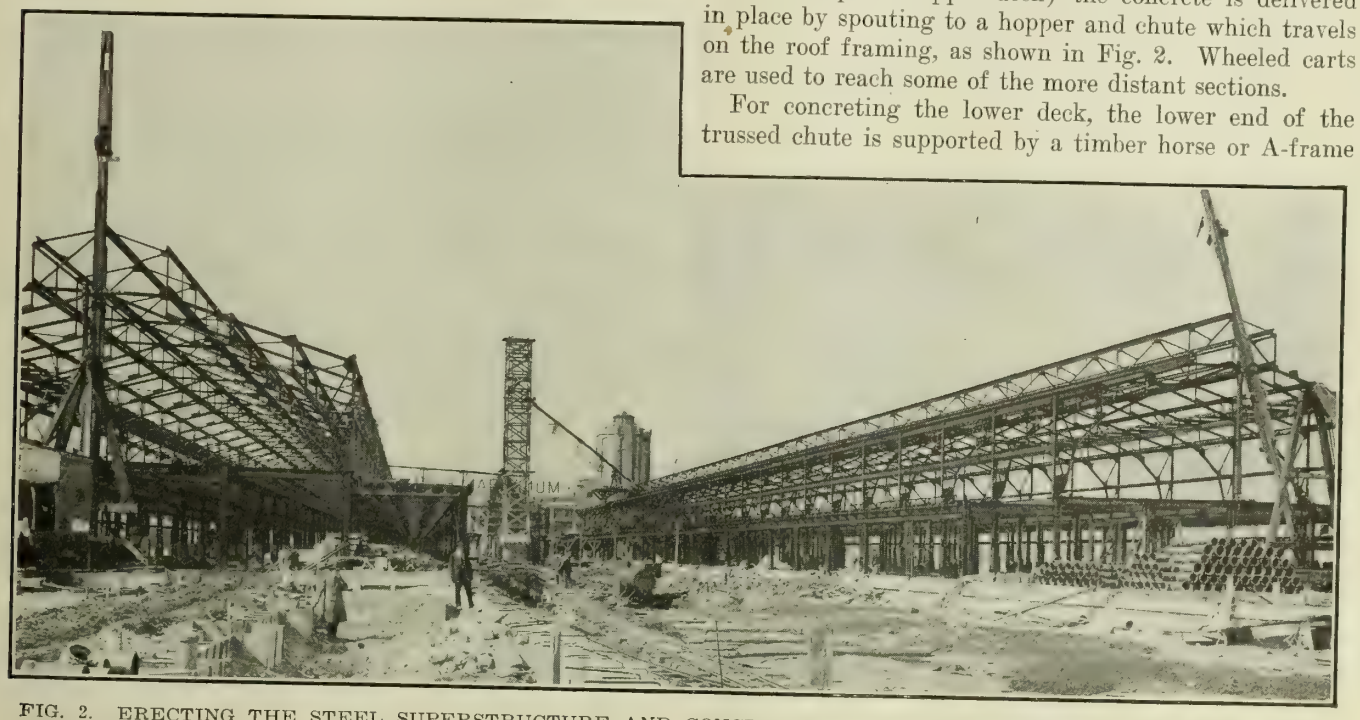


FIG. 2. ERECTING THE STEEL SUPERSTRUCTURE AND CONCRETING THE UPPER DECK OF STEAMER SHEDS

The two derrick cars, with 60-ft. booms are placing the steel work. Between the sheds is the traveling concreting plant, with one 120-ft. chute delivering to a hopper and spout which travels on the roof framing and discharges the concrete into the floor forms.

In advance of the concreting, pits are dug in the fill for the column footings over the foundation pile clusters, and trenches are cut for the longitudinal girders between the footings. Light timber forms are placed in these, with forms also for pedestal footings where required. The rods are cut and bent on the work, and are held in place by blocks and wiring.

The space between the girder forms is leveled off and the clay fill covered with a bed of sand, and over this is

placed the network of reinforcing rods for the slab. The concrete is deposited in the trenches and upon the sand and is worked into place with hoes, while the surface of the slab is leveled by means of shovels. This will be covered with a cushion bed of sand for 3-in. creosoted-block paving in the sheds.

For the flat-slab upper deck, the bottom form is supported by timber falsework in the usual way, and the surface of the concrete is troweled to form the finished floor. After this floor has set, it is covered with sheet-iron plates and a layer of roofing paper, and rectangular forms are placed upon it for the 4-in. roof slabs. These are 3 ft. 4 in. by 8 ft., and weigh about 1500 lb. each.

An iron loop is set in each end of the slab for attaching a chain sling. The slabs are hoisted and set by a small traveler moving along the roof framing and having its cable led to a hoisting engine on the deck below.

Erection of Steel Framing

The structural-steel framing of these sheds is erected by a traveling stiff-leg derrick with 60-ft. timber boom and operated by a 30-hp. steam engine. This backs out along

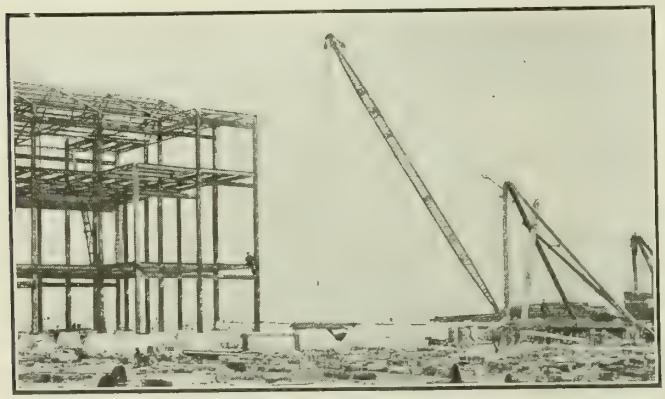


FIG. 3. ERECTING STEEL FRAME FOR TERMINAL BUILDING

the pier, placing material as it goes. This work is done by the Kelly-Atkinson Construction Co., Chicago, under a subcontract.

The lower deck consists of columns and I-beam framing, while the upper deck has three-hinged arch trusses of 68-ft. span. Each half truss is assembled and riveted up on the site and then raised into place, the outer end being supported temporarily on a vertical shore, with a screwjack at the base to allow of adjusting the ends of the adjacent half trusses to receive the crown-pin. The 60-ft. boom has a maximum vertical reach of 55 ft., so that it can place not only the trusses but also the monitor-roof framing above them. The heaviest loads handled are about 6000 lb. The steelwork, which is delivered on the site by wagons, will total about 7000 tons.

Erection of the Terminal Building

This is a steel frame building on the pier, at the end of the sheds previously described, and about 2500 ft. from the shore. Its construction is not included in the work so far mentioned. The John Griffiths & Son Co., of Chicago, has the contract. The construction plant, with the partly finished structure, is shown in Fig. 3.

The steel was erected with a derrick having a 90-ft. steel boom. The trusses were delivered all assembled complete at the shop. All the steel was brought out on scows to the site of the building, and was unloaded with a derrick, which was a part of the scow. The stone, sand and cement for the concrete were brought out to the site on derrick scows and unloaded with clamshell buckets operated by the derricks. The concrete is not spouted in place, but hoisted to the different floors with building hoists.

An Earthquake-Proof Concrete Tower

A gate tower 229 ft. high for the Calaveras reservoir of the Spring Valley Water Co., San Francisco, Calif., was designed recently by A. V. Saph for the particular purpose of getting an earthquake-proof structure. The tower is located close to the upstream toe of the hydraulic-fill dam, a short distance to one side of an arch culvert which carries storm water through the dam during construction. The Calaveras fault line is near by, and as this is believed to be a center of tectonic earthquake shocks, it was necessary to make the tower strong enough to withstand earthquakes.

Earthquake Intensity

The tower was designed at every horizontal section of sufficient strength to withstand a lateral push on the structure above that section equal to a horizontal acceleration of 6.44 ft. per sec., or one-fifth the acceleration of gravity. This makes the computation simple, as the lateral forces are just one-fifth the corresponding weights, and are applied at the centroids of those weights.

In arriving at the above-stated value of acceleration, the California and the Japanese earthquake studies were gone over. Omori, who has made a classification of Japanese earthquakes, classifies as No. 4 those earthquakes which have a maximum acceleration of 2000 mm. per sec. per sec., in which all factory chimneys are broken, and most of the ordinary brick buildings partly or totally destroyed, etc. This corresponds to Class B of the scale of the California Earthquake Commission, which is defined as comprising "fairly general collapse of brick and frame buildings when not unusually strong; serious cracking of brickwork and masonry in excellent structures; the formation of broad wavelike folds in paved and asphalt-coated streets," etc. The symptoms described were taken by the designer of the tower as defining the most severe earthquake to be expected in California, though not as violent as the most severe observed in Japan, where it is reported accelerations as high as 10,000 mm. per sec. per sec. occurred.

In designing a chimney for a pumping station in San Francisco on rock, the city specified an acceleration of 6.2 ft. per sec. per sec., practically identical with that assumed here. It is worth noting that structures on rock foundations suffer less in earthquakes than structures on soft ground. The gate tower will also rest on rock foundation.

Tests were made on low brick piers fixed to a shaking table. The piers broke near the base at an acceleration which on the average was 0.8 of the calculated breaking acceleration, computed from other tests of the strength of the brickwork, assuming that on the shaking table there is a "gradual application" of the force. On the other hand, it has been noticed that chimneys destroyed in earthquakes broke a little above midheight, and only

rarely were they damaged near the base; so that the strength of the tower near its middle may be regarded as the critical element. This midheight strength being sufficient to resist an acceleration somewhat greater than that of the assumed earthquake, the tower is safe throughout its height.

The chief other question considered was the period of vibration. In strong earthquakes the period of the earth movements is below 1 sec. for the principal movements. To avoid resonance effects, which might lead to indefinite multiplication of the stresses, it was aimed to make the period of vibration of the tower as far different as possible from the period of earth movement. The tower's natural period is 1.03 sec. (tower empty in air) to 1.45 sec. (tower full of water in air). However, the damping effect of the water surrounding the tower will probably make the question of period of vibration relatively unimportant.

For protection against the destructive effects of resonance, the upper part of the tower shell was increased in thickness on the recommendation of Prof. Charles Derleth from 12 in. to 18 in.; the periods previously given apply to the heavier section. Further, to give a larger margin of strength for any chance resonance effects, additional circular and longitudinal steel was placed in the shell beyond what was required on the basis of the acceleration calculations.

Proportions of Tower

The tower, 220 ft. high above the base and 229 ft. high above rock, is of 20 ft. inside and 28 ft. outside diameter at the base, and of 10 ft. inside and 13 ft. outside diameter at the top. The footing slab is octagonal, 50 ft. in least diameter and 9 ft. thick. Both inner and outer faces are built to a smooth taper, on the ground that offsets would form definite planes of weakness, while a cylindrical inside would mean either unduly large diameter at the top or too small a diameter at the bottom. The tapered form also gives lower center of gravity and decreased water displacement, hence greater effective weight of the tower.

Stresses under the maximum assumed earthquake conditions were taken at 20,000 lb. for the steel and 730 lb. for the concrete. A gravel concrete equivalent to 1:2:4 mixture is specified to be so made as to have a 28-day strength of 2000 lb. per sq.in. The steel was proportioned for the computed stresses, except that it was nowhere allowed to fall below 0.25% (increased on Professor Dereleth's recommendation to 0.33%). The longitudinal steel averages from 0.3% to 0.4%; in the lower section of the tower it consists of an inner ring of forty 1-in. square rods and an outer ring of forty 1¼-in. and forty 1-in. rods; at the top it consists of an inner ring of twenty ⅝-in. and an outer ring of forty ⅝-in. square rods. Circumferential reinforcement is arranged in inner and outer rings, ranging from ⅞ in. square to ⅝ in. square and spaced uniformly 12 in. apart vertically. The steel is kept at least 4 in. inward of the concrete surface.

The horizontal reinforcement was designed for resistance against collapse of the shell under the horizontal forces due to earthquake acceleration. The steel was proportioned by an arbitrary formula for moment as follows:

$$M = 7.5\,Ad$$

where A is the area of the cross-section of tower in square feet, and d is the diameter in feet. This formula, Mr. Saph states, represents the resistance of a ring 1 ft. high to the action of the stated acceleration acting on a ring 4 ft. high. No further account is taken of the horizontal shear transmitted by the part of the tower above the section under consideration.

Full Tower or Empty Tower

As originally designed by Mr. Saph, the tower was to be empty or dry, the outlet pipe extending down through it from gate-controlled inlets at various levels. The choice of the empty tower was determined by the belief that the water in a full tower would add to the possible earthquake effect.

In reviewing the report, Prof. Chas. Derleth took the opposite view, holding that a full tower would be safer as regards earthquake effect, and he laid great stress on the fact that a full tower is free from all possibility of trouble by uplift, and hence is also safer against sliding. He therefore recommended detailing the tower as a full tower, to contain water standing at reservoir level. This recommendation was adopted by the company.

Tests of Fireproofed Wood

At the recent annual meeting of the National Fire Protection Association, the Committee on the Uses of Wood in Building Construction presented an extended report[1] dealing with tests made of wood treated with various fire-retarding compounds at the Government Forest Products Laboratory in Madison, Wis. These tests were made under the direction of Robert E. Prince and included also tests of the relative inflammability of various species of wood untreated and of various paints claimed by their manufacturers to have a fire-retardant effect.

The conclusions arrived at as a result of the tests may be briefly summarized as follows: The widely held idea that certain kinds of lumber are much more resistant to fire than others was not supported by the results of Mr. Prince's tests. It should be said, however, that his tests were made on the soft woods such as are in general use for building construction. It is of course recognized that the hard woods are less easily ignited than the woods from most evergreen species, but this is not a fact of practical importance, since the hard woods are generally unsuitable for exterior use.

Turning to the tests on lumber fireproofed with various chemicals, it was found that some of these chemicals injured the strength of the wood or discolored it, and had a corrosive effect on the cylinders used for treating. The best results in fire retardation were obtained from wood treated with ammonium salts and sodium borate. These chemicals are obtainable at prices which are not a serious handicap to the use of wood treated with them. The fire-retardant paint tests showed that a number of these paints have considerable value in decreasing inflammability, especially those which are designed for interior use. Extended tests were made also with various methods for reducing the inflammability of shingle roofs, and it was found to be practicable to effect this by various methods at a reasonable cost.

[1]The committee report has been reprinted as a separate pamphlet and can be obtained from the Secretary of the National Fire Protection Association, Franklin H. Wentworth, 87 Milk St., Boston, Mass.

Maintaining Concrete and Brick Roads in Illinois

By B. H. Piepmeier

SYNOPSIS—Gives a description of the methods of maintaining concrete and brick pavements on state-aid highways in Illinois, for which a special motor truck was made by rebuilding a small runabout; also by the use of a hand-drawn kettle. Gives cost data on practically all the more important state roads.

Inasmuch as the Illinois state-aid road law requires the state to stand the whole upkeep cost, the State Highway Commission has deemed it advisable in the majority of cases to have the roads constructed of some of the more durable types of pavement, such as brick and concrete. The state-aid routes are the main traveled thoroughfares and will necessarily require considerable attention, even when constructed of the most durable types of pavement.

The highway law has been in effect but two years, and there has been, in round numbers, only about 100 miles of road constructed under state supervision and with state aid, so it would seem at first thought that the upkeep cost on these roads would be almost negligible at this time. It is indeed expected that the maintenance cost will be very light the first few years, but it is quite important that the roads should receive such attention as is needed.

The 100 miles of pavements that have been constructed are widely separated in many different counties

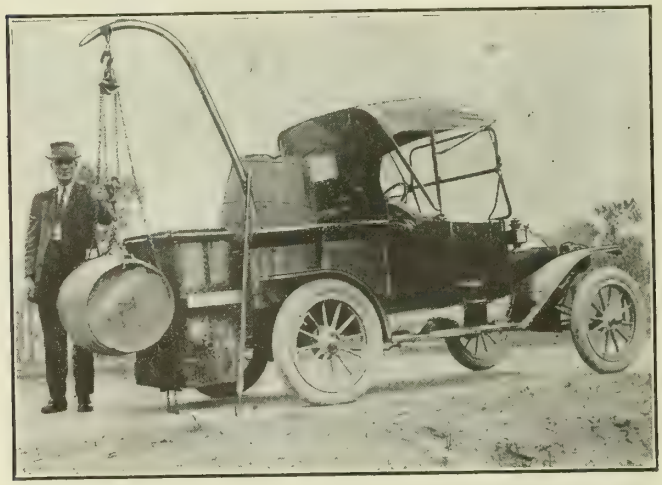


FIG. 1. SMALL MOTOR TRUCK FOR CONCRETE ROAD MAINTENANCE, ILLINOIS

of the state. However, about 50 per cent. of the concrete pavements are within a radius of 75 miles of Chicago, or within the Northeast division. The other six divisions of the state have both concrete and brick pavements, widely scattered.

Equipment for Maintenance Work

On account of the present small mileage of improved roads as well as their wide distribution throughout the state, it was thought expedient to furnish a small portable heating kettle, steel broom, heavy barn broom, a scratching tool and pouring can to only four of the seven divisions; two of the divisions being able to borrow from



FIG. 2. PORTABLE HEATING KETTLE FOR CONCRETE ROAD MAINTENANCE, ILLINOIS

adjoining ones, and thus take care of the necessary work for the next two years.

The Northeast division, which has about 50 per cent. of the state-aid concrete pavements, is provided with a small motor truck for maintenance work. The principal use of the truck is to transport the necessary heating apparatus, bituminous filler and sand. The maximum load that is transported to different sections of road does not exceed 1000 pounds. A light truck that could be easily converted into a car for use of the division engineer was considered the most satisfactory.

For this service a Ford runabout has been equipped by replacing the rear hood with a 42x36-in. demountable body (Fig. 1). To the lower corners of this body are attached 3x3x⅜-in. angles, which project in the rear sufficiently to support a 32x30x16-in. heating kettle. In the corner of the body a socket is provided for holding a light derrick equipped with a differential chain block for hoisting drums and barrels of bituminous material into the truck and for dismounting the heating kettle when other use of the car is desired. The derrick is made so that one man can handle any load he wishes to put into the truck, and it can be removed easily and carried at a suitable place under the body of the car. On account of the load the car is required to carry, oversize tires (31x4 in.) with demountable rims are placed on all four wheels.

The rectangular heating kettle mounted on the rear of the truck has a tight-fitting lid. Beneath the kettle are mounted six standard cup gasoline burners, supplied from the car's gasoline tank. Gasoline is used for heating the bituminous material in preference to other fuel, largely on account of its weight, cleanliness and convenience.

It has been found that about 1 gal. of gasoline will supply sufficient heat for one day's work. The burners

*Maintenance Engineer, Illinois State Highway Department, Springfield, Ill.

may be started quickly and when the bituminous material is once hot, a single burner will keep it at the proper temperature throughout the day. The burners work satisfactorily while the car is running, so there is practically no time lost in getting the material heated. When the car is needed for other use, the kettle is dismounted and a small gasoline can is hooked to the side of the kettle and connected with the burners by a short hose.

Details of Operation of Truck

A great deal of dependence can be put in the efficiency of maintenance with this truck, for an expert can be placed in charge of the work. The expert then is the only one who goes with the truck from place to place, and he hires all the help required for any particular job. If the truck crew consisted of more there would be many days in which, on account of weather conditions, they could not work. Under the present system bad weather causes but little loss of time, as there are usually a number of things that can be done by the man in charge, such as cleaning out ditches, clearing culverts, fixing up the side roads, etc.

Where a portable heating kettle (Fig. 2) is used without the truck it is necessary to depend upon the average laborer to do and supervise a majority of the work. On account of the delays in shipping the kettle from place to place, it is not always convenient to have an expert follow it. The division engineer merely directs the shipping of the equipment and arranges with some local men to do the work in accordance with his directions. However, under this scheme the division engineer is required to give considerable of his time to maintenance work.

Materials Used in Repair Work

The State Highway Department during the last four years has investigated the use of various materials for filling cracks and joints in concrete pavements. It is evident that a well-selected bituminous material and clean coarse sand, if properly applied, meet the requirements. Mexican, Texas and California asphalts and some refined tars have been used. A proper grade of refined tar seems to give the best results, but with any of the bituminous materials it seems to be necessary and advantageous to cover all cracks and joints twice each year, once in the spring and again in the late fall.

While the small truck referred to has been very dependable and has fulfilled most of the requirements

STATE OF ILLINOIS
STATE HIGHWAY DEPARTMENT
UPKEEP COST ON STATE AID ROADS
----------*County, Route*----------*Sec*----------
DESCRIPTION: Length...Ft; Width...Ft; Sq. Yd...; Built...191, Total Length Longitudinal Cracks...Ft; Transverse...Ft; Joints...Ft;
COST OF MAINTAINING SLAB, JOINTS, CRACKS, ETC.

DATE	COST OF MATERIALS						COST OF LABOR		COST OF TRANSPORTATION					ESTIMATED DEPRECIATION ON EQUIP'T.	CHARGED TO SPECIAL MAINT. FUND	CHARGED TO GENERAL MAINT. FUND	CHARGED TO STATE ROAD BRIDGE FUND	TOTAL COST
	SAND	BITUMEN F.O.B.	COAL	GAS FOR HEATING	HARDWARE		SKILLED	COMMON	STORAGE	TEAMING	FREIGHT	GAS, OIL & REPAIRS	LABOR					
TOTAL COST																		
COST PER SQ. YARD																		

UPKEEP COST ON ROAD SIDES & DITCHES

DATE	MACAD. SH'LD'RS.				EARTH SHOULDERS				DITCHES & DRAINS				VEGETATION				CLEANING				CULVERTS				BRIDGES				CHARGED TO SPECIAL MAINT. FUND	CHARGED TO GENERAL MAINT. FUND	CHARGED TO STATE ROAD BRIDGE FUND	TOTAL COST
	SKILLED LABOR	COMMON LABOR	MATERIALS	EQUIPMENT	SKILLED LABOR	COMMON LABOR	MATERIALS	EQUIPMENT	SKILLED LABOR	COMMON LABOR	MATERIALS	EQUIPMENT	SKILLED LABOR	COMMON LABOR	MATERIALS	EQUIPMENT	SKILLED LABOR	COMMON LABOR	MATERIALS	EQUIPMENT	SKILLED LABOR	COMMON LABOR	MATERIALS	EQUIPMENT	SKILLED LABOR	COMMON LABOR	MATERIALS	EQUIPMENT				
TOTAL COST																																
																									GRAND TOTAL UPKEEP COST							

"*" Indicates Items charged to State Road and Bridge Fund; "+" Indicates Items charged to General Maintenance Fund.
Remarks: Fix Depreciation on Auto Maintenance Truck at $ 2.00 per Mile of Pavement, portable Kettles at $ 1.00 per Mile

---------- *Division Engineer*
---------- *Maintenance Engineer*

FIG. 3. FORM FOR COST DATA ON ILLINOIS STATE-AID ROAD MAINTENANCE

One of the principal difficulties encountered in the use of bituminous materials is the tendency of the material to run in hot weather. This is especially true of the refined tars. Sand is used to overcome this tendency, but it is difficult to get the sand to stay in the cracks. Sometimes it is necessary to apply the material and sand several times before the cracks are filled. Where the cracks are wide, the sand is not necessary, and the material can be applied with a pouring pot. Where the cracks are narrow, a hand squirt can is used. The material is applied hot, and the cracks must be dry and clean.

Where the cracks are wide, the sand is not necessary, and the material can be applied with a pouring pot. Where the cracks are narrow, a hand squirt can is used. The material is applied hot, and the cracks must be dry and clean.

imposed upon it in the way of upkeep on the macadam and earth shoulders, side roads, ditches, etc., it was not designed for this purpose. It is expected that in the near future a much larger truck, operated in the same manner, will be equipped to handle the upkeep on all gravel and macadam roads, macadam and earth shoulders, side roads, ditches, etc.

System of Reports of Work Done

The truck operator is required to make a daily report on a post-card form to the maintenance engineer at the headquarters office, giving the date of his arrival on the job, the amount of road covered each day, the approximate time of finishing work and other relevant remarks.

The truck operator also sends post-card reports to the division engineer to keep him advised of when the road will be completed and when the truck will arrive at the next point. This is required that the division engineer may know what progress is being made in his division and arrange to visit the respective jobs as he finds it possible.

Upon the completion of a route or section of a state-aid road, the operator or man in charge of the work makes a detailed report of all expenditures on the accompanying form, Fig. 3. This report is checked by the division engineer, if possible, and then forwarded to the headquarters office, where the maintenance engineer makes a final check on all items of expenditure. In addition to the work report, the maintenance engineer and the division engineer are each required to make a monthly statement to the chief state-highway engineer of all money received and expended on the maintenance and upkeep work during the month.

Some Cost Data of Maintenance Work

The following data have been taken from some work recently done with the portable heating kettle and the automobile truck. Only cost data in maintaining the slab, or pavement proper, are given. The upkeep costs on macadam and earth shoulders, side roads and ditches are not included.

It will be noted that the average cost of maintenance where the truck was used is about one-third less than where the portable hand kettle was used. This will be offset considerably more in favor of the truck when the cost of supervision is included and the time required for doing the work is taken into consideration. The division engineer must necessarily give considerable of his time to maintenance work where the portable hand kettle is used. However, he has the opportunity to select good weather for all work done with the outfit and accordingly does not have any men charged against maintenance work when they are not able to work on the roads, as has been the case with the truck outfit.

It will be noted from the table that the cost of filling cracks and joints ranges from 0.1 to 0.57c. per sq.yd. of pavement, usually varying in proportion to the discontinuity of the pavement. Discontinuity is represented by the figure found by dividing the total length of all cracks and joints, in feet, by the square yards of pavement. The expression of discontinuity is figured for each road on which work is done, as it serves as a guide to compare the cost of maintenance work. It also gives a basis for comparing the condition of surfaces on various pavements.

The specifications under which the state-aid roads were constructed required a ¼-in. felt joint to be placed at an angle of 75 deg. with the center line of the pavement and at intervals of 100 ft.; joints were also required at the close of each day's work, but in no case were they to be spaced less than 40 ft. unless specified by the engineer. The 10- and 18-ft. pavements constructed under these specifications have, under normal conditions, a discontinuity of from 0.09 to 0.1.

If joints had been placed at 50-ft. intervals instead of 100-ft., the discontinuity of the surface on the normal 10- and 18-ft. pavements would have been from 0.18 to 0.2. From a maintenance standpoint, therefore, it would be an advantage to have as few joints as possible. Four years' experience in maintaining concrete pavements in Illinois indicates that joints, even though protected with armor plates, require about the same attention as do the ordinary cracks.

Definitions of the Terms Used

It is evident that the term "maintenance" has been greatly misused, or at least used to express two or three

COST DATA SHOWING THE RELATIVE EFFICIENCY OF DIFFERENT METHODS OF MAINTAINING CONCRETE PAVEMENTS BY FILLING CRACKS AND JOINTS WITH BITUMINOUS MATERIAL

	Conditions						Cost of Labor				Materials						
County	Section	Built	Width	sq.yd. (a)	Total Length in ft. of Cracks and Joints (b)	Expression of Discontinuity of Pavement, b/a	Skilled	Common	Teams, Freight, Storage, Transportation	Bituminous Material	Sand and Stone	Dep. on Equipment[1]	Supervision[2]	Total Cost	Cost per sq.yd.	Per Mile 10-ft. Road	Per Mile 18-ft. Road
Portable Heating Kettle Used																	
Cass	A	1914	10	7,279	917	0.126	$11.00	$3.50	$9.96	$1.92	$0.60	$1.25	....	$28.23	$0.0039	$22.80	
Iroquois	A	1914	10	13,433	1753	0.130	3.90	4.80	8.85	5.17	.40	2.30	....	25.42	.0019	11.70	
Iroquois	B	1914	10	14,784	1980	0.134	3.30	4.40	10.60	4.63	.42	2.60	....	25.95	.0017	10.00	
Sangamon		1912	18	12,600	6065	0.472	10.00	17.67	11.25	20.87	2.00	1.21	....	63.00	.0050		$52.80
Sangamon	B	1914	18	4,400	854	0.194	5.00	7.30	8.75	3.75	.00	0.40	....	25.20	.0057		60.20
Sangamon	C	1914	18	4,400	577	0.131	3.00	1.22	1.25	1.87	.20	.40	....	7.94	.0018		19.00
Sangamon	D	1914	18	4,000	774	0.193	3.00	1.22	1.25	1.87	.20	.40	....	7.94	.0020		21.10
Sangamon	E	1914	18	4,700	690	0.147	5.00	4.12	3.75	1.87	.30	.45	....	15.49	.0033		34.80
Menard	A	1914	10	2,667	290	0.108	3.85	0.70	3.61	1.25	.25	.45	....	10.11	.0038	22.20	
Average cost per square yard															$0.0032		
Auto Truck Used																	
Cook	D	1914	18	32,470	3120	0.096	$13.00	$8.00	$3.35	$9.69	$0.00	$6.00	....	$40.04	$0.0012		$12.65
Lincoln	A	1914	10	4,000	458	0.115	3.00	2.00	.56	1.74	.10	1.40	....	8.80	.0022	$12.90	
Lincoln	D	1914	10	4,000	503	0.126	3.00	2.00	.70	2.17	.10	1.40	....	9.37	.0034	19.90	
Livingston	A	1914	10	13,810	2240	0.162	12.00	3.75	2.80	5.57	.50	4.70	....	29.32	.0021	12.30	
Kankakee	A	1914	10	10,500	1711	0.163	14.00	4.00	1.30	5.30	1.00	3.60	....	29.20	.0028	16.40	
Will	A	1914	10	10,666	2000	0.188	18.00	4.60	4.89	4.62	.20	3.60	....	35.91	.0034	19.90	
Cook	E	1914	18	38,884	5488	0.141	21.00	8.00	4.54	8.92	.40	7.40	....	50.86	.0013		13.70
Cook	B	1914	18	14,222	1821	0.128	4.50	3.00	1.26	5.72	.10	2.75	....	17.33	.0012		12.70
Cook	A	1914	18	5,246	706	0.135	1.50	1.00	.57	1.11	.00	1.00	....	5.18	.0013		10.50
Average cost per square yard															$0.0021		

1. Under depreciation $1 per mile of pavement maintained is charged against the portable heating kettle equipment and $2 per mile for the truck. 2. The cost of supervision is prorated against the maintenance and upkeep at the close of the season.

widely different things connected with the taking care of roads. Some have divided the term, using "strict maintenance," "partial maintenance," "total maintenance," etc.

It would seem proper to confine "maintenance" to taking care of the wearing surface of the road and to use it in connection with those operations necessary to keep the traveled way true to its original type, and to use the term "upkeep" in the broader sense and to connect it with those operations necessary to keep or restore the entire road to its original surface. The upkeep should apply particularly to the sideroads, ditches, etc. The term "repairs" should be used to denote all operations necessary to restore the traveled portion of the public highway to its original condition.

Low-Lift Screw Pumps Installed at Terrebonne, La.

Two large screw pumps, one of which is shown in the accompanying views, have recently been installed in Subdistrict No. 1, Upper Terrebonne, La. These have a capacity of 45,000 gal. per min. (100 sec.-ft., or 65 million gallons per day) against a 4-ft. head. They are used for draining 4240 acres of marsh land, lifting the discharge against a total head varying from 4 to 6 ft. In general outline the pumps resemble the larger screw pumps of the New Orleans city drainage works (322 million gallons capacity against 12 ft. head) described in *Engineering News*, Jan. 15, 1914. The design, briefly described, consists of a siphon-elbow section in which a screw impeller rotates. Special effort was given in the designing and construction to reduction of flow friction.

The most interesting features of this particular type are: The conical inner case with cylindrical extensions, which surrounds the impeller shaft and which, with the outside case, forms a carefully shaped flow passage to and from the impeller; the stationary vanes guiding the water as it leaves the impeller and furnishing middle supports for the inner case; the impeller with a cast-iron center and cast-in cast-steel blades; the separate support bearings, stuffing-boxes and roller thrust bearing. Each impeller is driven by a single-cylinder 60-hp. oil engine at 200 r.p.m. This is a high speed compared with that for a centrifugal pump for such service. An efficiency of above 70% is expected over a wide range (based on actual performance of a similar 30-in. pump in New Orleans regularly pumping 24 sec.-ft. against 7 ft. head).

These pumps were designed by A. B. Wood, Mechanical Engineer of the New Orleans Sewage and Water Board, and were built by the D'Olier Centrifugal Pump & Machine Co., of Philadelphia. The driving engines were built by Fairbanks, Morse & Co., of Chicago. The J. A. Kruse Co., of New Orleans, were engineers for the plant.

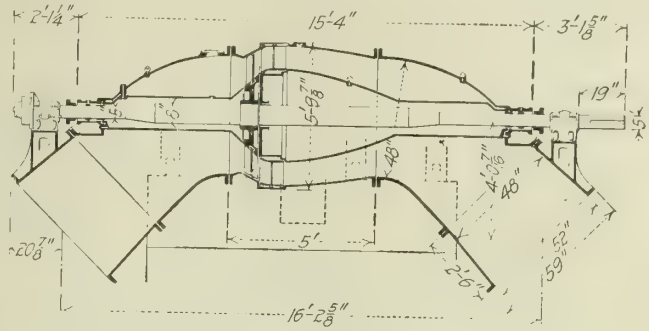


FIG. 2. SECTION THROUGH TERREBONNE PUMP

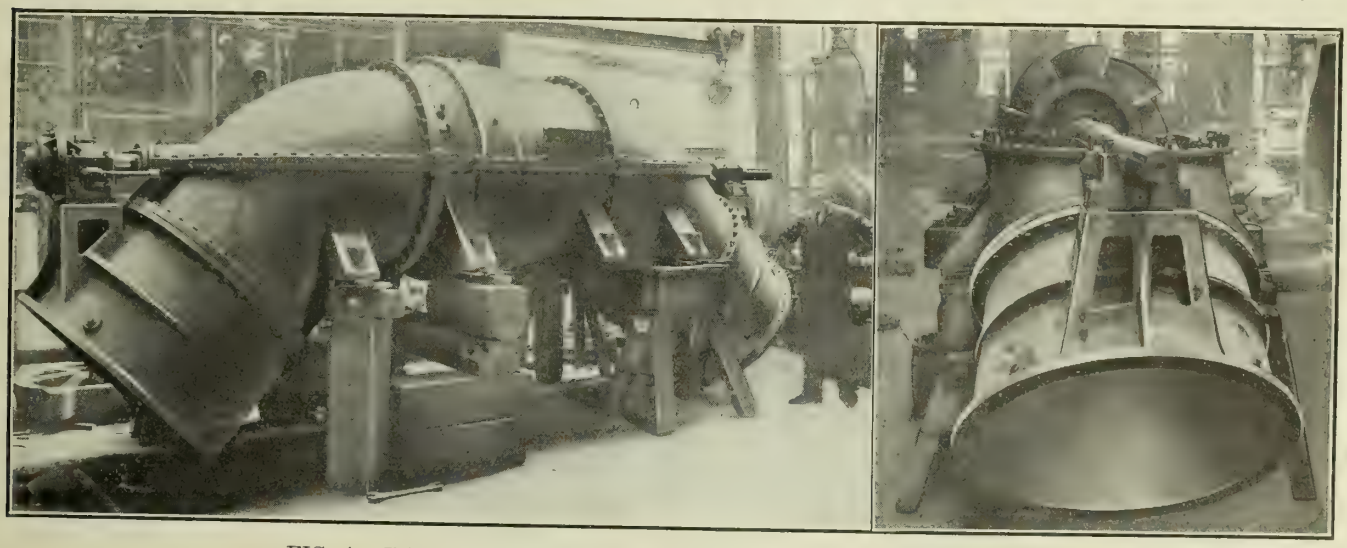


FIG. 1. HIGH-EFFICIENCY SCREW PUMP FOR TERREBONNE, LA.

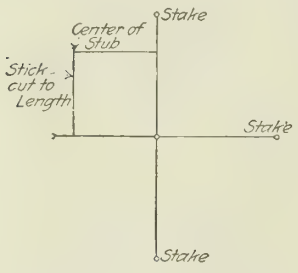
Unemployment in the Winter Season and what can be done by engineers to reduce it in amount has been investigated by a special committee of the Oregon Society of Engineers, made up of J. P. Newell, E. G. Hopson and others. The committee in its report showed that in the mild winter climate of the north Pacific coast a large proportion of engineering operations could be conducted as economically in the winter as in the summer, and that habits and custom have as much to do with the slackening of engineering work in the winter as the inclemency of the season. It is a fallacy to conclude that winter work is more costly than summer work, because on the face of the figures the cost per cubic yard of dirt handled is a little higher in winter than in summer. The economic loss to the community from having a large number of workingmen idle during the winter season must be taken into account. During the crop season there is always plenty of demand for labor on the farms, and those in charge of public work should therefore attempt to do as much work as possible in the winter rather than in the summer. The committee enumerates various pieces of contract work performed during the winter in Portland and vicinity, such as building erection, park construction, grading, street and sewer work and highway construction, and shows that the advantage to contractors of holding their organization together and the ability to secure a better class of labor during the slack season operates to make such work, on the whole, quite as economical for the taxpayer as that done during the summer season. The commission suggested the appointment by the Governor of a commission of engineers to supervise all state engineering operations in the interest of winter employment.

Field and Office

Laying Out Tower Foundations Without Template

J. A. Walls in a paper on "Tower Foundations," in the June *Proceedings* of the American Institute of Electrical Engineers, gives the following method of laying out transmission-tower foundations:

The engineer stakes the center of the tower and marks the tower height on the reference stake; in addition to this two stakes are put down in the direction of the line and two stakes across the line. These four stakes give the center line of the base. A cord is strung across two of the stakes and the distance from the center stake to a line through the center of two holes on the same side is measured by means of a stick cut to length. The point is marked with a pin, and the operation is repeated on the other side of the center. By swinging the cord 90 deg. to the other stakes two more points are located. By laying out two sticks of a length equal to half the base width of the tower from two adjacent points found in the first operation, and then swinging them till their ends meet, the center of one corner is located. The operation is best understood from the accompanying sketch.



LAYING OUT FOOTING WITHOUT TEMPLATE

In this way two men can lay out the base in less than five minutes, and no heavy tools are required. One man is provided for each hole, and the foreman is able to take care of from three to four gangs. This method avoids the transportation of a template. When a man starts to dig a hole he first makes a circle, approximately 16 in. in diameter, around the stake and keeps inside this circle.

Repairing Asphalt Pavements Without a Plant*

By F. N. Bingham†

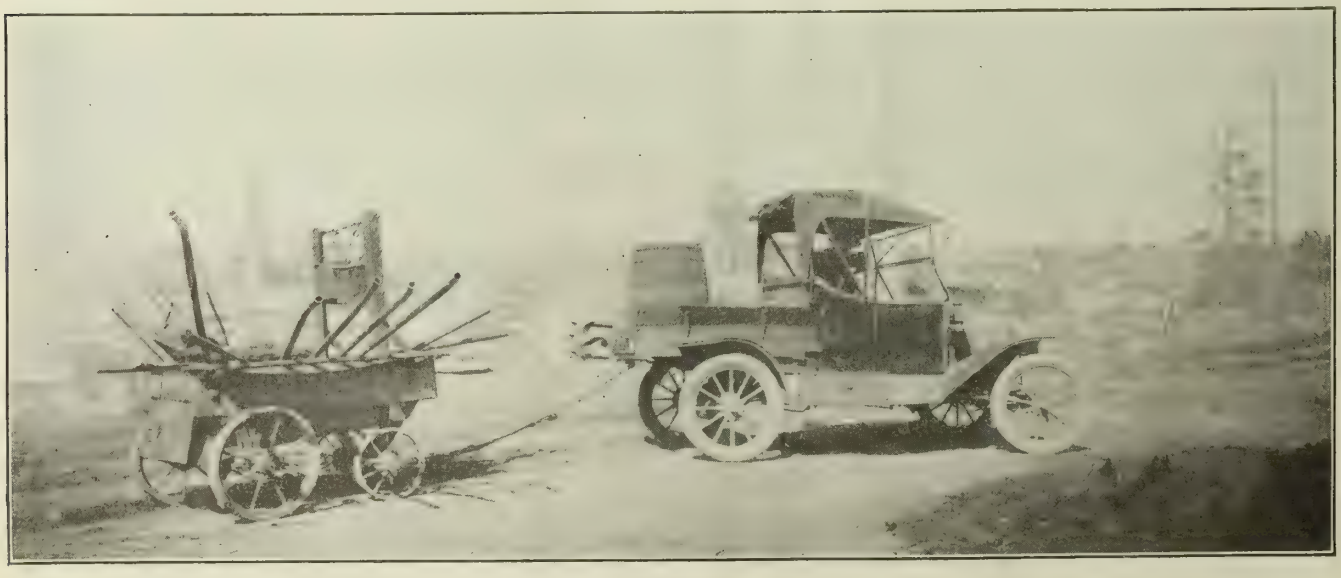
During the winter months, when asphalt paving plants are closed down, there are often many cuts made in asphalt pavements from various causes. These are not large at the time they are made, but if they are allowed to remain unrepaired for weeks or sometimes months, the abrasion of traffic will cause raveling and disintegration to take place, and the cut to be repaired will be much larger than it was originally. The postponing of repairs to warm weather thus leads to disputes between the city and the person who made and has to pay for repairing the pavement cuts. Not only do these cuts ravel and disintegrate if left unrepaired, but with the coming of spring thaws and rains the water invariably gets under the pavement for a considerable distance and causes the destruction of correspondingly large areas of pavement.

It is not feasible to start up an asphalt plant to turn out such a small quantity of material as is usually needed to fix a few winter cuts. In order to take care of these repairs as needed when our Spokane municipal plant is closed down, we have found it very economical and practical to proceed as follows:

Before the plant is closed down for the winter we make up a hot mixture of sand, filler, stone and asphaltic cement, as though it was for immediate use, the only difference being that we use a mixture richer in asphaltic cement than is usual. This mixture is then lightly spread by means of rakes to a uniform depth of 3 in. on a smooth plot of ground that has been lightly sanded and, while

*For further information on this subject the reader is referred to "Engineering News," Feb. 11, 1915, p. 258, an article on "Patching Bituminous Pavements Without an Asphalt Plant or a Steam Roller," by Samuel H. Lea, City Engineer, Charlotte, N. C.

†Superintendent of the Municipal Asphalt Plant, Spokane, Wash.



OUTFIT FOR REPAIRING ASPHALT PAVEMENTS IN SPOKANE, WASH., DURING THE WINTER MONTHS



MACHINE FOR BORING TIE-ROD HOLES IN PILES UNDER WATER, CHICAGO MUNICIPAL RY.
In service, the sills on which the men are standing rest on the pile heads

still hot, is marked off into cakes approximately 2 ft. square, care being taken not to pack or compress this hot mixture in any way while it is cooling. When cool the asphalt layer is easily broken up into cakes and is ready for use.

Our emergency-repair equipment consists of a small motor truck with a sheet-iron heating pan with gasoline burners. These burners are so placed that they are not only used to heat the contents of the pan, but to heat the tamping and smoothing irons as well. The truck is then loaded with the asphalt cakes, which are carried to the cuts to be repaired. While the cut is being prepared, the asphalt cakes are heated in the pan and brought to their original plastic consistency. The cut is filled, tamped, smoothed and finished in the usual manner. The truck driver and two men make a crew, and the cost of this work is surprisingly low per square yard.

The value of the results obtained in keeping holes and cuts promptly repaired is obvious. Such repairs can be made in freezing weather, even when it is necessary to sweep away snow to get at the pavement. Oftentimes when a small gas- or water-pipe cut is partly filled with ice, the big warming pan is placed directly over the cut while the asphalt cake is being heated, and the cut is dried out at the same time and with the same heat. This method can be used to equal advantage in small towns or on highways, where permanent asphalt-mixing plants are not always available.

Machine for Boring Under-Water Holes in Piles

The new 3000-ft. Municipal Pier at Chicago has on each side a concrete wall supported on three lines of round piles and a line of sheet piling. Tie-rods extend between the rows of piles, and in the outer part of the pier there are heavy tie-rods extending across the entire width of the pier, to tie the walls together. The boring of these numerous tie-rod holes under water, and keeping them in proper line and level in the piles and sheet-piling, would have been a tedious and troublesome job. Therefore a special machine, shown in the accompanying view, was devised and built by the contractor, the Great Lakes Dredge & Dock Co., of Chicago.

The machine consists of a pair of sills 30 ft. long, with two depending frames, which slide along them and carry horizontal guides for the augers. The end of each auger rod is connected by a universal joint to a long rod driven by a pneumatic drill held by a man on top of the frame, as shown. The sills rested on the pile heads and the auger guides were set at the desired height and position. With the holes bored in this way there was no difficulty in placing the tie-rods.

Concreting Trains for Track-Elevation Work

For building the concrete retaining walls and bridge abutments on the Chicago track elevation of the New York, Chicago & St. Louis R.R. an outfit of concreting trains has been used by the Brownell Improvement Co., of Chicago, which has the contract for the work. One of these trains is shown in Fig. 1; the towers of two other trains may be seen in the distance.

The special features of the arrangement are that the train is a complete unit of material cars and mixing plant and that all material is handled directly upon the train. This latter point is important when the train is located beside (or sometimes between) main tracks and there is practically no space available outside of the construction train. The mixer car is at the head of the train, then come two cars of broken stone, two cars of screenings and a boxcar for cement (in sacks).

Planks laid across the open cars carry two runways, each two planks wide. If the load is piled up so that the cross-timbers cannot be placed, brackets are fitted

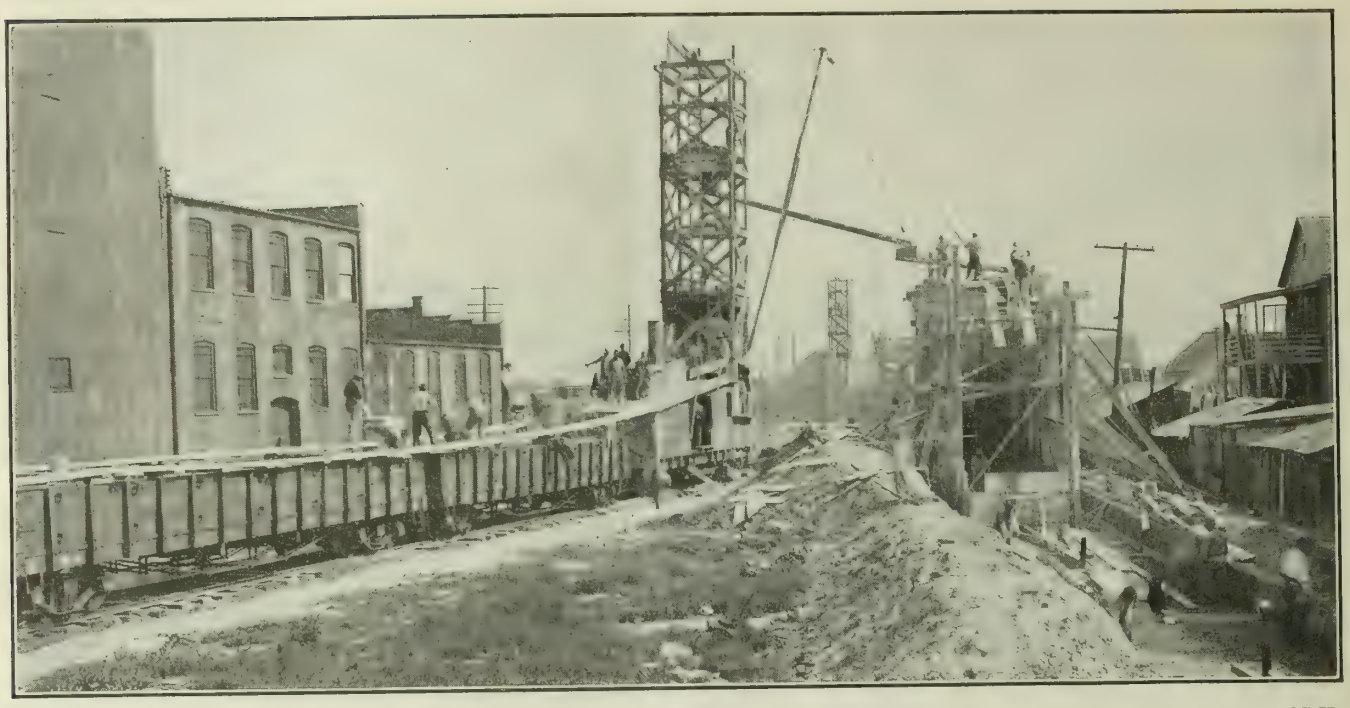


FIG. 1. CONCRETING TRAIN FOR BUILDING ABUTMENTS AND RETAINING WALLS ON TRACK ELEVATION WORK AT CHICAGO; NEW YORK, CHICAGO & ST. LOUIS R.R.

The towers of two similar trains on the same work can be seen in the background

on the side of the car, carrying the runway planks at the proper elevation. Similar brackets are fitted on the sides of the boxcar. The cement, stone and screenings are loaded into wheelbarrows and wheeled to the mixer, the empties returning on the same runway.

When the material cars are empty the planks and brackets are thrown off and the cars are hauled away, while another set of five loaded cars is run up to the mixer car. The runways are quickly set in position and work is resumed. It takes only from 15 to 25 min. to switch the cars and get the work started again.

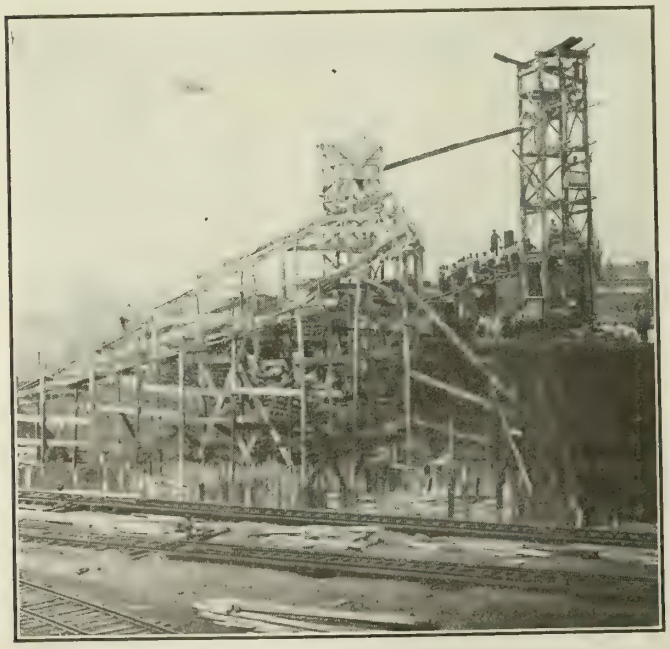


FIG. 2. SPOUTING CONCRETE ACROSS MAIN-LINE RAILWAY TRACKS

Pennsylvania Lines. Track elevation work at South Chicago, Ill. The taller tower, with elevator bucket, is on the front car of the concreting train. The steel chute carries the concrete across the two main tracks to the stationary tower, from which several lines of chutes extend to the forms.

The mixer plant consists of a special boxcar, with a 1-yd. drum mixer mounted at the forward end. Behind this are the engine and boiler, while the sloping roof forms the wheeling platform, with a charging chute to the mixer. Directly over the mixer is a tower 8 ft. square, and about 55 ft. high above the rails. In this is mounted the receiving hopper of the distributing spout. The elevator bucket travels on leads placed not in the tower but ahead of it, far enough from the front face of the tower to enable the bucket to clear the end sill and drop below the level of the car floor to receive the concrete from the mixer.

The bucket is narrow and deep, and, at the upper end of its travel, rollers on the top engage inclined guide rails so that the bucket is pulled over, tilting to such an angle as to insure complete discharge of the material. The two jointed sections of the steel spout, each about 28 ft. long, are guyed from a 31-ft. boom stepped on the tower. Fig. 1 shows a third spout laid longitudinally along the forms and delivering the concrete in place.

With this arrangement the concrete can be spouted across running tracks. This was done on the South Chicago track-elevation work of the Pennsylvania lines, where the two main tracks extended between the concreting train and the retaining walls. There was no trouble from the spattering of concrete upon the trains. This South Chicago work is shown in Fig. 2.

In the view Fig. 1 the tower is guyed to a building. This was done because the train stood on a rough temporary track. Ordinarily no such support is needed. The tower is not built in removable sections, but that part extending above the roof of the car must be dismantled when bridges are to be passed or the outfit is to be shifted. The machinery is selected to suit the contractors' ideas as to the best combination, and on the outfits shown herewith it includes a Foote concrete mixer, Archer elevator bucket and steel spouting, and a Clyde hoist and engine. For the temporary trestle of the south ap-

proach to the elevation of the New York, Chicago & St. Louis R.R., the piles were driven by a McMyler 35-ton piledriver running on a track parallel to the trestle. This machine has a revolving horizontal truss, the outer end of which carries the 53-ft. leads.

This arrangement of concreting trains has been used by the Brownell Improvement Co. on nearly all its numerous contracts for track-elevation work in Chicago. The work was in charge of A. H. Bannister, General Superintendent of the company. With three of these trains on the New York, Chicago & St. Louis R.R. work shown in Fig. 1 about 27,000 cu.yd. of concrete were placed in 62 working days.

Portable Track Crossings in a Contractor's Yard

Portable track crossings in a construction track layout are in use at the temporary storage yard of Walter H. Gahagan, Inc., contracting engineer, at East New York, Borough of Brooklyn, New York City. A narrow-gage construction track turns out of a standard-gage track, a third rail being laid in the spur. A stub switch in one rail provides the connection.



FIG. 1. MOVABLE RAIL IN PLACE OF FROG



FIG. 2. ANGLE IRONS FOR RAILS OF NARROW-GAGE TRACK AT CROSSING

To avoid the cost of a special frog, a frogless crossing was designed. The outer rail of the narrow-gage turnout is raised to cross over one rail of the standard-gage track. This crossing rail can be swung off the standard-gage rail by hand, to allow cars to move on the latter track. When the swinging-rail is in place to allow standard-gage movement, it is braced by a bar placed between it and the opposite narrow-gage rail. This arrangement, shown in Fig. 1, is a simplification of the frogless turnout used to a limited extent in main-track service.

At the other end of the yard, where the narrow-gage track crosses several standard-gage tracks, angle irons supported by timbers are used instead of rails for the narrow-gage track. This does away with the necessity of blocking up the small narrow-gage rails to the height of the standard-gage rails. The arrangement is shown in Fig. 2.

Water-Works Transportation Methods were made the subject of thorough study in Chicago, Ill., in 1914. A transportation section was organized in the division of water-supply extension with a head motor-truck driver in charge. One 5-ton and three 2-ton Pierce-Arrow trucks were used in the experiments. The cost of hauling averaged about 13c. per ton mi. for the 5-ton truck and varied from 14c. to 32c. per ton mi. for the 2-ton trucks, depending on the conditions and efficiency with which they were used. The hauling under contract by teams cost on an average 26.9c. per ton mi. The hauling by teams hired by the day was still higher. The recent annual report of the city engineer for the year 1914 states that the use of motor trucks and the general study of transportation have shown that the motor trucks are economical and efficient when properly handled, that the hauling of certain materials by contract is advisable, and that teams hired by the day are not efficient.

Comparative Costs of Laying 16- and 12-Ft. Pipe

The introduction of 16-ft. lengths of cast-iron pipe for city water mains was noted in *Engineering News,* May 6, 1915, in an editorial on "Longer Cast-Iron Pipe." Although answers to inquiries concerning experience with the new 16-ft. pipe lengths showed general satisfaction, few of the cities which have introduced the longer pipe have kept sufficient cost records to enable an exact comparison to be made of the merits of the new 16-ft. lengths and the old 12-ft. lengths.

Since then, S. L. Etnyre, superintendent of the waterworks department of Council Bluffs, Iowa, has sent the accompanying table of three very similar jobs of pipe laying, in April, 1915, the first example being a 6-in. main in 16-ft. pipe lengths, while the second and third examples are 6-in. mains in 12-ft. pipe lengths. All these mains were laid with 5 to 5½-ft. cover, and careful records were kept to make an accurate comparison of costs.

Floating Concreting Plant with Mixer in Tower

A large floating concreting plant of unusual layout, in which the cement, sand, gravel and water are dumped into a bucket and hoisted up in the tower to a Hains mixer, is being used in concrete-pier construction for the Lehigh Valley R.R. at Pier 8, North River, New York City. The mixer is installed about two-thirds of the way up the 55-ft. tower, the bucket containing the unmixed materials being hoisted by a two-drum Lambert hoisting engine. The apparatus is mounted on an old car float, 310x36 ft. in plan, which was purchased for the purpose by the Henry Steers Contracting Co., 17 Battery Pl., New York City.

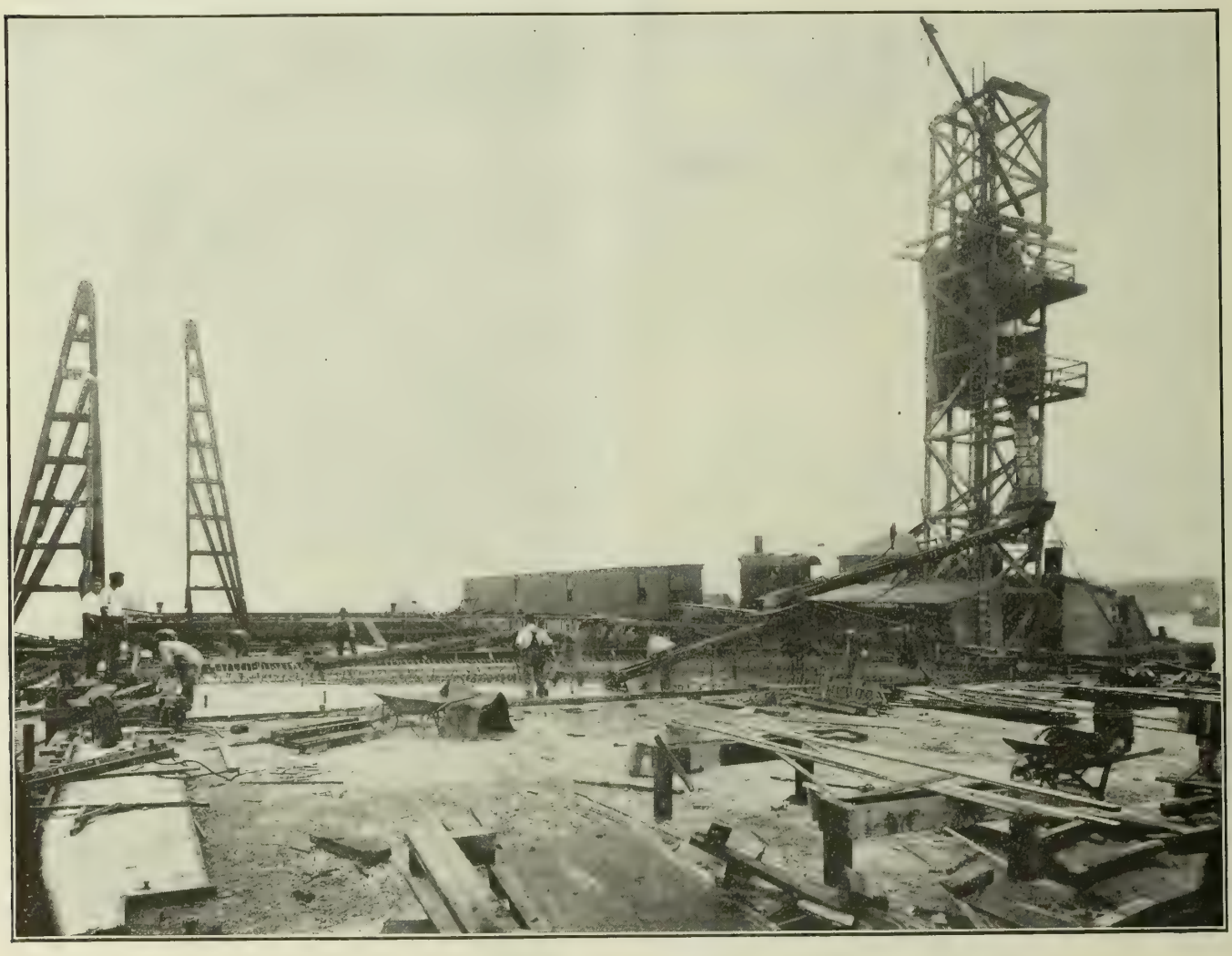


FIG. 1. GENERAL VIEW OF PIER AND PLANT

Chute is lower than in Fig. 2, owing to concreting being nearer the floating plant.

The sand and gravel arrive already mixed, this having been done at the contractor's pit on Long Island. The handling at the site is thus simplified, one scow only being necessary where otherwise two would have been required. The sand and gravel are handled from the

COMPARATIVE COSTS OF LAYING 16- AND 12-FT. LENGTHS OF 6-IN. CAST-IRON PIPE

				— 6-In. C.I. Main on Ground —					Ex. and B.F. Cost at 20c. per Hr.		— Pipe Laying Costs —							
No.	Street	From	To	No. of Lengths	No. of Ft.	Wgt. in Lb.	Price per Ton	Amt.	Price per Ft., Cts.	Amt.	Bell Holes at 25c. per Hr.	Caulking at 25c. per Hr.	Lead at 4c. per Lb.	Laying, Jute, Fuel, Etc.	Total Cost	Cost per 1000 Ft.	Average Cost per 1000 Ft.	Diff. in Cost per 1000 Ft.
1	High St...	10th Ave.	15th Ave..	103	1648	57,470	$23.95	$688.20	16½	$269.09	$14.78	$11.02	$38.54	$44.37	$1066.00	$646.85	$646.85	
2	Fairmount Ave.....	Graham..	Fairmount Park....	97	1164	42,104	22.95	483.14	16¼	189.18	13.49	10.03	38.41	30.65	764.90	657.13	$666.93	$20.08
3.	15th Ave..	High St..	Fairmount Ave.....	94	1128	42,341	22.95	485.86	15	175.80	15.09	9.90	40.00	36.70	763.35	676.73		

deck-scow by a 60-ton locomotive crane, equipped with a 1-yd. bucket, running on a track laid on the mixing float. The crane delivers the material to a 20-yd. hopper, located at one end of the float, in the lower portion of the tower. The cement arrives on covered barges and is unloaded onto a belt conveyor which runs the length of the float. This conveyor runs through a long cement-storage shed (shown at the left in Fig. 1) which has a capacity of 1500 bbl. of cement. When concreting is in progress the cement bags are laid on the conveyor as required, and thus moved to the tower-end of the float. Here the cement is dumped into a 1-yd. bucket, in which also is placed sand and gravel from the hopper, and water for the batch.

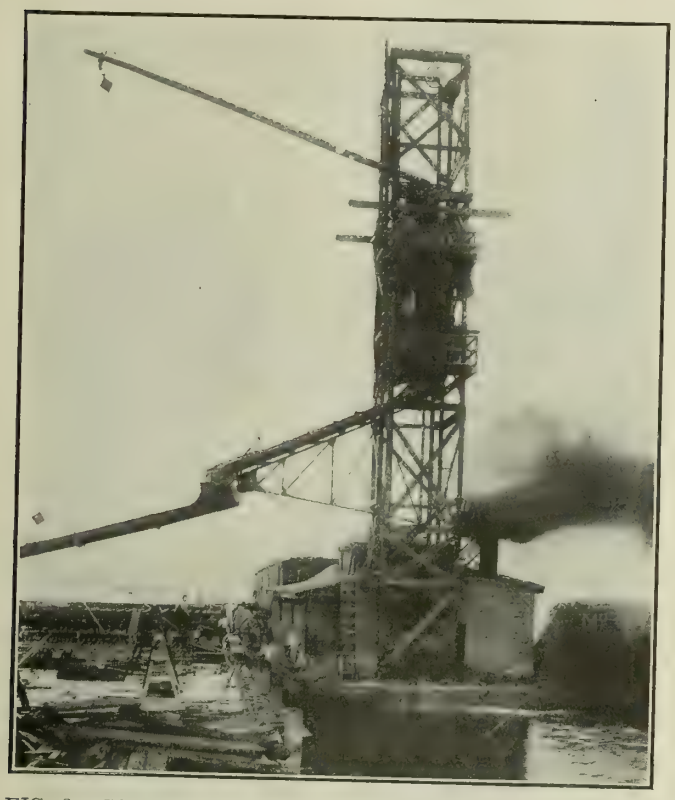


FIG. 2. CONCRETING PLANT, WITH SAND AND GRAVEL SCOW AT RIGHT AND NEW PIER AT LEFT
Note method of supporting first chute, in its highest position

The bucket is then elevated in the tower to the mixer, the lower hopper of which is at an elevation of about 30 ft. above deck. When the unmixed materials have been dumped into the top hopper of the mixer, the gate in the bottom of this hopper is opened, allowing the mix to drop into the second hopper, thence by a similar procedure into the bottom hopper, which discharges into the chuting system. A water pipe runs up the tower, so that the mixer man can add more water if required.

The chuting system is swiveled in such a way that the chutes can be swung about easily. Approximately two-thirds of the width of the pier can be reached by the main chute and extension which are supported by a boom on the tower. To concrete the farther side of the pier, extension-chutes supported on bents are placed. The chutes are raised and lowered by steam power, the cable for this purpose running to the hoisting engine. They are swung sideways, either by hand-tackle or by lines run to a winch-head on the engine.

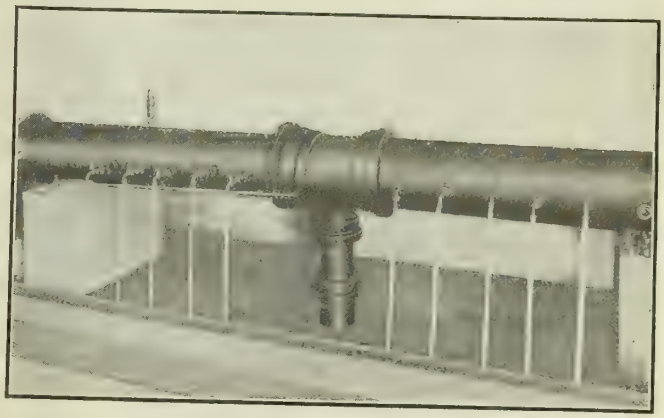
J. Y. Higginson, Superintendent for the contractor, states that about 40 yd. of concrete can be laid per hour on this class of work by this plant.

The Lehigh Valley R.R. pier is of a design not at all familar to New York City. The concrete legs rest on a pile substructure cut off at about mean water line. The bents are spaced 10 ft. c. to c., and the bent piling 3 ft. 8 in. c. to c. crosswise. The piles in each bent are clamped at the top instead of being capped, and the spaces between the piles form a key to hold the foot of the concrete leg in position; also, rods driven in the head of the piles extend up into the concrete, and the bents are braced longitudinally by three lines of concrete diaphragms, and in addition timber bracing is provided at the sides of the pier. There is a continuous heavy fendering on each side of the pier from m. l. w.

The pier was designed and is being constructed under the supervision of E. B. Ashby, Chief Engineer of the railroad; J. J. McCleece, architect, was in charge of the designing.

NOTES

Demonstrating the Cost of Water Waste to private consumers has become a valuable aid to many city water-works departments in reducing useless water consumption and conserving water supplies. In St. Louis, Mo., in order to obtain an idea of the amount of water which may be wasted through a faucet at a pressure representative of the average pressure throughout the city, the device shown in the accompanying illustration has been prepared. Ten faucets of the type ordinarily used for domestic purposes are so arranged that



DEVICE OF THE ST. LOUIS, MO., WATER-WORKS DEPARTMENT FOR SHOWING WASTE FROM SMALL LEAKS

the streams vary from ⅝ in. in diameter at the right down to 1/32 in. in diameter at the left. The size of each individual stream, the rate of flow in gallons per minute and the cost of the water per 24 hr. are shown in the table. The smaller of these streams represents a small, ordinary leak, while the larger ones represent a condition where there is a careless or willful waste of water due to allowing faucets to remain open when not in use. The accumulative waste and loss in dollars and cents may be readily figured when it is remembered that there are several hundred thousand faucets in use in the city daily.

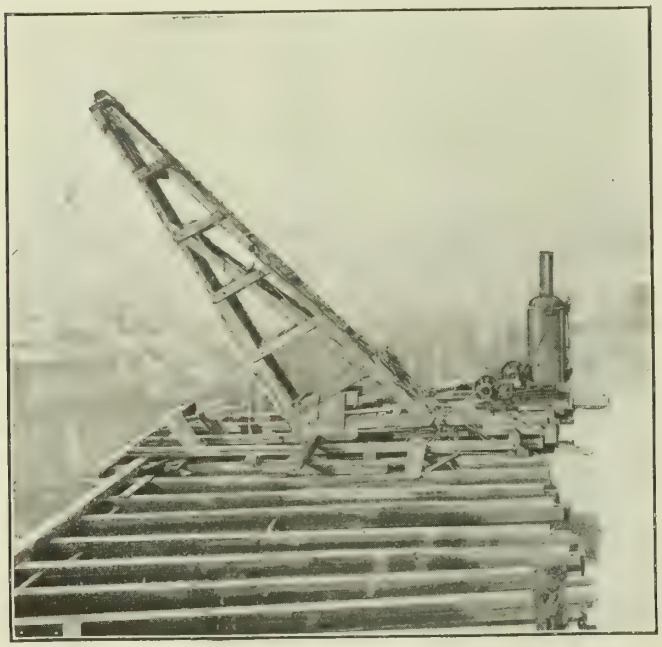
Size of Stream Through Faucets	Rate of Flow, Gal. per Min.	Cost of Water Flowing Continuously for 24 Hr. at 9 c. per 1000 Gal.
⅝ in.	4.86	$0.630
½ in.	4.16	.540
7/16 in.	3.24	.420
⅜ in.	1.90	.247
5/16 in.	1.50	.195
¼ in.	1.29	.167
3/16 in.	1.10	.142
⅛ in.	.86	.112
1/16 in.	.44	.057
1/32 in.	.13	.017

A somewhat similar idea is employed in several city-budget exhibits. A glass-encased water meter, with a thin stream of water continually flowing through, is displayed. Here, the householder can actually see how small a leak is sufficient to make the wheels go round; and a prominently posted notice

informs him what the water is costing per day, per month and per year. This is said to be a very effective means of bringing home to the negligent consumer the advantage of good plumbing.

Concrete Field-Test Beams are used to control the concreting operations in the land spans of the Detroit-Superior viaduct, Cleveland. When concrete is being poured the engineers of the county field office take samples as it goes into the forms, and pour unreinforced test beams 4x6 in. by 3 ft. These are allowed to set in the field and at the age of 14 days are tested by center load on a 30-in. span. The aim is to secure a modulus of rupture of 300 lb. per sq.in., which corresponds to a center load of 960 lb. (or for depth of test beam 5¾ in., which is usually the actual depth, the load would be 880 lb.). The tests made have given failure loads of 800 to 1200 lb., and the lowest test so far obtained was 760 lb. K. D. Cowen is resident engineer in charge of the field office.

Batter Piles Were Driven at the new Southwark Piers on the Delaware River at Philadelphia with the piledriver shown in the accompanying view. This machine consists of normal piledriver leads fixed at the required angle by an extension frame at the bottom. This frame was then fastened to a base



PILEDRIVER RIGGED TO DRIVE BATTER PILES

frame on which the engine rested and which was moved where required on rollers underneath. The drophammer moved in guides which kept it from swinging out beyond the leads. The work is being done by the Snare & Triest Co. under the direction of John Meigs, Director of the Department of Wharves, Docks and Ferries.

Filling an Old Tunnel by Hydraulic Sluicing is an interesting piece of work in progress at Tacoma, Wash. The tunnel was started about six years ago as an entrance for the Union Pacific Ry. into Tacoma, but was abandoned when a trackage agreement was made with the Northern Pacific R.R. The tunnel was for a single track and on a grade of 1.5%. The work was done by Twohy Bros., of Spokane; but the tunnel was excavated for only about 2600 ft., and none of this was concreted. As the route was under city streets and improved property, the continual caving and settling due to the decay of timbers was a menace to the community, and the City Council ordered the tunnel filled. The contract was let to Stillwell Bros., of Seattle, who are now doing the work. Their method consists of sluicing earth from a hill about 1800 ft. from the upper end of the tunnel. The earth is carried in a closed pipe on a steep grade into the tunnel and water escapes at the lower end. It is said to be too early to state whether this method will insure a solid fill for the entire area. It is not practical to blow off the roof and fill from above on account of the streets and improvements immediately overhead. Various shafts have been sunk at points between the ends, and this will aid somewhat in the filling operations. For information we are indebted to W. C. Raleigh, city engineer of Tacoma.

The Traffic-Control Signal shown in the accompanying view has been found useful in Pittsburgh. It is commended by the director of safety and the superintendent of the Pittsburgh Railways Co. The diagram shows the installation at Smithfield St. and Sixth Ave. The signals are simple lamps made of No. 22-gage iron and fitted with 10½-in. colored lenses, tilted 10 deg. down from the vertical. Sixty-watt lamps give a distinctive indication, though in locations where the sun could shine directly on the lens small hoods might be needed. The lamps are operated by a four-way circuit controller. This has an auxiliary latched handle by which all the red lights can be shown at once or red on one street and green

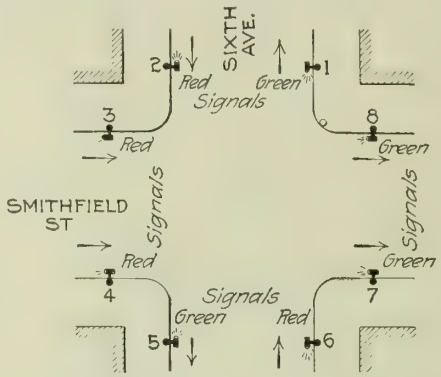


FIG. 1. TRAFFIC SIGNALS AT A PITTSBURGH CORNER

on the other, or all can be extinguished. This facilitates holding up traffic as needed for passing fire teams and ambulances.

Heavy Viaduct Railing is to be placed on the steel highway viaduct now being built by the city of Cleveland, Ohio, across the Cuyahoga River valley on the line of Clark Ave. The railing is 4 ft. high. Its main members are 4-in. I-beam posts

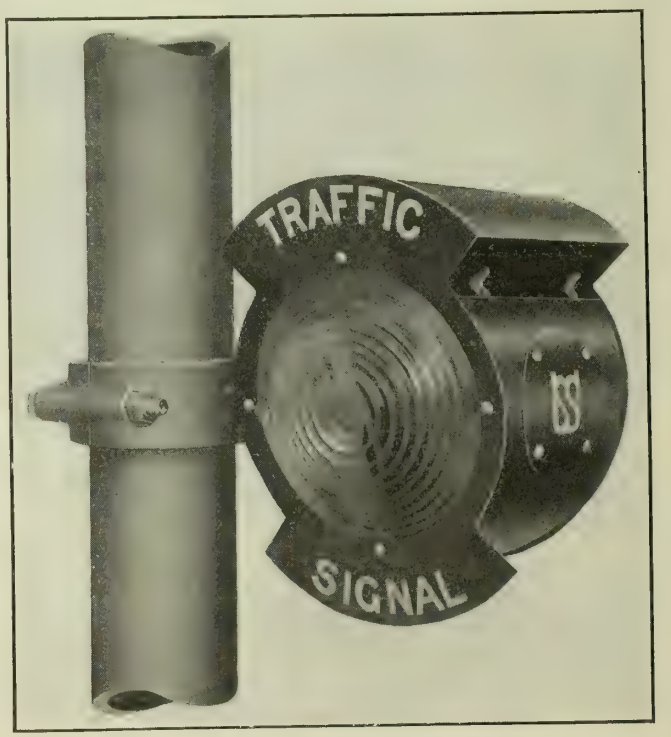


FIG. 2. PITTSBURGH TRAFFIC SIGNAL

spaced 16 ft. apart, 3-in. channel bottom and middle rails, and a top rail of 3-in. steel pipe seated in a 2½-in. channel. The filling is vertical ¾-in. square rods, set 4¾ in. apart, passing through the webs of the channels, riveted over on top and held in the other rails by special locking clips. It is built by the Van Dorn Iron Works. H. Brockelbank worked out the design of the structure under the direction of F. D. Richards, city bridge engineer.

Marketed Production of Chromic Iron Ore increased in 1914, according to J. S. Diller, of the United States Geological Survey. The output sold was 591 long tons, valued at $8715, as against 255 tons in 1913. Almost all of it came from Shasta County, California. The largest producers of chromic iron ore are New Caledonia, Rhodesia and Russia.

Editorials

Lesson of the Erie Flood

The Erie flood gives a knockout blow to a principle which has been put forward many times—that it does not pay to provide waterway for the very largest storms; that it is cheaper to let culverts wash out once in fifteen years or so. Ask any one of the thousands of Erie citizens affected by the flood whether it would not have been economy to provide a more capacious channel, and he will answer promptly. He can see very clearly in the light of his present troubles that the principle mentioned means nothing more or less than that the builder wants to shift the burden of risk carelessly upon a future generation.

The principle is one which railway engineers have used in their work, and this in regions where a washout of the culvert would affect no one but the railway itself. There is no evidence that any engineer ever applied it to culverts or bridges in a city or village, where destruction other than the mere wrecking of the culvert would be likely. But the very existence of such a theory of alleged economy tends to influence practice in fields where it was never intended to apply. Who will say that a fashion of "close" proportioning of waterways existing, say, among the railway engineers of the eighties would not find unconscious followers among municipal engineers? The latter did not have long-time records of rainfall to tell them what would be the probable maximum storm. They had only the physical evidences furnished by the valley topography itself, and this was practically never regarded, as was brought out so strikingly by the 1913 flood in Ohio and Indiana.

But why speak of engineers alone? The situation at Erie was that any private owner along the stream could do with the channel just about what he pleased, and many of them did so. The city never had authority to control the channel and never tried to get such authority. The Pennsylvania legislature, exactly like other state legislatures, left the entire subject of stream control and protection to the dark mysteries of judiciary riparian law. The legal mind in the legislature has ever preferred that matters be left in this headless shape, waiting for the teachings of experience to demonstrate the need of administrative provision. The city of Erie has just paid several million dollars and three dozen lives for a bit of such experience.

It is to be hoped that the rainfall and runoff experts will seek out and study the engineering facts of the Erie flood in such a way as to improve our knowledge. The maximum flood flow needs to be determined, and also its relation both to the physical character of the region and to the peculiar nature of the storm. In view of the fact that greater rainstorms than the one of Aug. 3 have occurred elsewhere, an estimate should be made of the maximum flood which may be expected in Mill Creek. Meanwhile it must be assumed as probable that in almost any stream area such a distribution of rainfall maxima may occur as will make the interval coincide with the runoff period of the stream and thus create a cumulative flood.

Concrete Chuting Predominant

Engineers who have had the opportunity to travel widely during the last year or two have been impressed by the almost universal use of the chuting method of placing concrete and the ingenious adaptations of that method, which only a few years ago was restricted to well-defined limitations of area and local topography. In this issue of *Engineering News* this development is emphasized by four articles describing radically different kinds of construction, in each of which the chuting system was used, though each case shows a different variation of the general principle. Thus, the four plants comprise a lake pier superstructure with a high central tower, a low retaining wall with towers traveling on railway trains, a river pier substructure with a floating tower, and a warehouse with two towers controlled from a central mixer. Any method or principle that can be adjusted to meet so many phases of a problem surely deserves success.

In this demonstrated success, so widespread that the chuting system has practically driven out of use every other method of placing concrete, it is somewhat curious that a former criticism seems now to have been forgotten. A year or more ago when the chuting system was first booming there were many and frequent complaints that its use required an excess of water in the concrete, and an excess of water was regarded as a set-retardant and a reducer of early if not of final strength. This complaint naturally enough came from the engineer or owner who had let the concreting for a fixed price and not from the contractor who was interested in the cost reductions the chuting method was bound to show. Today, while this criticism is still occasionally heard, its force must certainly have abated, else the concrete tower and chute would not be the predominant feature in most concrete jobs.

In spite of this passive resistance, if in fact there is left any resistance to the chute, there was probably much of truth in the claim that a gravity flow of concrete requires a too wet mix, unless great care is taken to insure a short radius of control or a great height of tower. It is because there seems to be no definite standard of wetness of concrete nor any very good service tests showing the relation of wetness to strength that the voices opposed to the chuting method have been reduced in volume if not in number.

Selecting the Right Occupation

Many men go through life discontented and unsuccessful because in their early years they entered an occupation for which they were unfitted. Those in charge of public and private educational work have for a dozen years past been taking increasing interest in vocational guidance, or the systematic advising of young men and women as to the sort of work in which they are most likely to succeed. A somewhat similar problem faces those in charge of the employment of help in large industrial establishments, where applicants for employment must be exam-

ined and a determination reached as to whether they are worth hiring and in what department they can do the best work.

Where an organization is built up slowly from small beginnings through a long period of years, employees are selected one by one and carefully tried out, and by a process of the survival of the fittest an efficient organization is created. These are days, however, of extremely rapid changes in industrial organizations. A good illustration is furnished by the sudden fluctuations in demand and supply brought about as a result of the war. Factories have been set going with 5000 to 15,000 employees on tracts where a year ago there was not a stone or a stick of timber.

Not from choice but from necessity the worker is obliged to shift rapidly from place to place in accordance with changing markets and conditions; and this applies not merely to the ordinary wage worker but to foremen and superintendents and managers, and the office force. It is therefore an extremely important matter to know how to select men who are capable of good work and to assign them to the class of work for which they are best fitted by ability and experience.

Under these conditions a certain class of business doctors has come forward with the claim that the task of picking the right man for the job need no longer be conducted by the cut-and-try methods hitherto used. Instead we are told that the selection of men and women for a task has now been reduced to a science and that by taking a course of correspondence instruction one can learn how to tell by the length of the fingers, the shape of the nose or chin or ears, the bumps on the skull and various other physical characteristics what sort of work the man is fitted to perform with success.

Another scheme for scientific selection is represented by leading experts in the science of psychology. These reject *in toto* the claims of the efficiency doctors just mentioned, but maintain that by a practical application of modern principles of psychology it is possible to determine by easily applied tests what sort of mental abilities a person has and thus what he or she is good for.

Certainly, if the claims made by either of these groups have a substantial foundation, their scientific plan of selecting men would be one of the most important discoveries of the present century. The success of an individual may be influenced very largely by his choice of an occupation, and the success of an organization depends very largely upon the character of the men who direct it. If, therefore, either of these systems furnishes a test by which the capabilities of men and women for particular tasks may be accurately determined, its value could hardly be overestimated.

Prof. Herman Schneider, Dean of the College of Engineering, University of Cincinnati, and well known as the originator of the famous coöperative courses at that university, has recently published a statement concerning this question that deserves general attention. In a paper entitled "The Problem of Selecting the Right Job" he relates his experiences with different methods of testing the capabilities of men. Success in the coöperative-education course is largely dependent, Professor Schneider states, on carefully selecting men who are naturally adapted to the work for which they are to be trained. He therefore determined to analyze the different methods of selecting men for the job, just as an engineer would analyze an engineering project. The plan of selecting men by their physical characteristics Professor Schneider discusses as follows:

> A group in the scientific management field affirmed that an examination of physical characteristics, such as the shape of the fingers and shape of the head, disclosed aptitudes and abilities. This seems to be a development of the old idea of phrenology. For example, a directive money-making executive will have a certain shaped head and hand. A number of money-making executives were picked at random and their physical characteristics charted. We did not find that they conformed at all to any law. Also we found men who had the physical characteristics that ought to make them executives, but they were anything but executives. A number of tests of this kind gave negative results. We were forced to the conclusion that this system was not reliable.

Professor Schneider turns next to the claims of certain professors of psychology. The experimental psychologist claims that certain mental qualities, such as memory, attention, observation, suggestibility, apperception, and so on, are indicative of a person's ability and adaptation to certain fields of work. Professor Schneider has tested these claims by examining the members of the graduating classes in the coöperative course at the university. These men had been in the university for five years in school work and shop work and a fair knowledge of their abilities had thus been obtained. Two of these graduating classes have been tested by the psychological method, and a third is now being tested. The records of the men's work since graduation are also being kept in order to determine whether there is any correspondence between the results obtained by the psychological test and the results shown by these men in business. Professor Schneider states that the test has not shown that the psychological method is reliable or practical.

Turning then to the old-time method of trying a man on the job, Professor Schneider concludes that this is still the only method by which the abilities of a man can be finally determined. This does not mean, however, that there is nothing which can be done by a keen and skilled observer in the selection of men otherwise than at haphazard. On the contrary, Professor Schneider enumerates a number of physical and mental characteristics which can be determined by careful examination and which do indicate to a certain degree what sort of task a man can reasonably hope to succeed in.

Of course, at the start it is evident that for an occupation requiring physical strength men of large muscular organization will be selected. It is almost as easy to determine whether a man has manual dexterity or is lacking in that quality. Again, some men naturally assume responsibility, while others shrink from it. Some men have no originality, while others are not contented with routine work but demand something new.

Professor Schneider sums up the results of his studies as follows:

> The conclusions so far drawn from our experiences with about a thousand mature students in school work and practical work are: (1) A worker's failure is as significant as his success and should be a guide to a new and fitting job. (2) The characteristics developed by analysis of many successes and failures furnish a basis for placement which works better than any plan we know. (3) The method is crude and unscientific; it requires a period of time much greater than other methods proposed, but it insures a reliable verdict.

Professor Schneider also sounds a warning against the abuse of the vocational guidance course already incorporated in a number of the public schools. He believes that not enough is known to warrant any man in saying to a child: "This is your job and that is not your job."

Licensing Structural Engineers in Illinois

Hitherto there has been practically free trade in the engineering profession throughout the United States. An engineer or an engineering firm in Boston or Philadelphia or Chicago or San Francisco has been free to carry on professional work anywhere in the United States. The trifling exceptions relate solely to work which is invariably done by men resident in the locality.

In a number of cities, for example, land surveys within the city boundary can only be made by city surveyors who have received licenses to perform that work. The State of Wyoming has for several years required engineers who lay out irrigation ditches to have a state certificate showing their qualifications to perform such work. In a number of states where mining is an important industry, engineers practicing mine surveying have to secure a state license.

These and similar exceptions, however, relate to work which would normally be done by men resident in the locality anyway. The structural engineers' license law just enacted in Illinois is the first interference by state legislation with general engineering work and may be said to be, therefore, the first barrier to free trade in this field in the United States.

Hereafter on every structure erected in the State of Illinois which is important enough to require the services of a structural engineer in any capacity upon its design and construction, that engineer must have a state license. To obtain such a license is not at present a difficult matter. Any resident of Illinois now practicing structural engineering may be licensed to practice without examination on payment of a fee of $50. Engineers not residents of Illinois who wish to practice structural engineering within that state must apparently be prepared to take an examination before the board, no matter how extensive their experience, according to the wording of the law.

There is indeed a clause permitting the State Board of Examiners in its discretion to issue an Illinois license without examination to structural engineers who are licensed under the laws of any other state or territory, or of any foreign country, providing such engineers have received licenses in their home state under a law as stringent as the Illinois law. As there are no states which have such laws, this clause is of no present importance.

Under this law, railway companies which have bridges or stations to construct or repair in Illinois must have the engineering work done by an engineer licensed under the state law. If the company's own bridge engineer resides in some other state, he will have to go to Illinois and take an examination or relinquish responsibility for the work to someone else. A manufacturing corporation may have plants in several different states and be accustomed to carry on repairs and enlargements from its general offices. If it wants to do any work on a plant located in Illinois, however, the engineer at the head office will need an Illinois license or will have to engage some engineer resident in Illinois to do the work.

As has been fully recorded in these columns, the Illinois law is the result of a situation forced upon the structural engineers of Illinois by the previous enactment of the Illinois architects' license law. The architectural profession has already traveled a considerable distance along the road toward the establishment of state boundaries for professional practice.

One possible result of the Illinois law may be the more general requirement of engineering skill in structural design. The language of the law is that structural engineering is necessary for structures "in which safe design and construction require that loads and stresses must be computed, and the size and strength of parts must be determined by mathematical calculations based upon scientific principles and engineering data."

This clause would seem to mean that any structure important enough to have the stress in any of its parts computed must be in charge of a licensed structural engineer. This may have a salutary effect upon the country highway bridge business.

More Civilian Officers for the Army Engineer Corps

A very, very narrow door is again opened by which engineers who are graduates of engineering schools other than West Point may possibly obtain a commission in the Corps of Engineers of the United States Army. The United States Civil Service Commission will hold examinations on Aug. 25 and 26 for candidates for the position of Junior Civil Engineer in the Engineering Department. In order to take the examination an engineer must be over 21 years old, either a graduate from an engineering school of good standing or have had at least four years' experience in engineering work. Those who pass this examination, provided they are not over 29 years old, are unmarried, and are graduates from an approved technical school, will be eligible for an examination to be held about Oct. 25 next of candidates for commissions as Second Lieutenants in the Corps of Engineers.

Of course, without knowing the character of the examinations to be given to the candidates in these two successive tests, one could not say definitely how large an opportunity is here presented for the enlargement of the Corps of Engineers from civil life. It is a good rule to judge the future by the past, however, and it is known that the much-advertised opportunities opened previously for engineering-school graduates to obtain commissions in the engineer corps have resulted thus far in the admission of just two men. Incidentally, and without prejudice, it may be said that every first-class engineering school in the country is superior to West Point, as an engineering school, and that the honor men of West Point who enter the Corps of Engineers are required to take supplementary work in engineering.

It is a question worth consideration whether the approaching session of Congress may not be a favorable time to put forward again the plan which has been before the engineering profession for more than thirty years of establishing the Federal Government's engineering works upon a basis that will be fair to the engineering profession. There is no doubt that preparation for national defense will be one of the things which will most seriously engage the attention of Congress, and there would seem to be good ground for argument that the army officers in the Engineering Department ought to be able to devote much more time to the military side of the profession instead of being occupied almost wholly in work which many believe should be in charge of civilian engineers.

Letters to the Editor

Using Barometric Leveling for Logging Surveys

Sir—In *Engineering News* of July 15, 1915, p. 132, appears a letter from James H. Bonner, professor of forest engineering at the University of Montana, criticizing the methods of making topographic surveys for logging purposes as described by me in an article in the June 10 issue.

The professor evidently missed one of the main points of the article—the fact that the work described is conducted "in the dense timber and thick brush of the coast country" and not in the open, scattering timber of the Rocky Mountain country nor in a park. The "Abney method" of leveling is ordinary trigonometric leveling, where the distances are measured with a tape and the angles with an Abney hand level or slope clinometer. If this method were substituted for barometric leveling by the topographers in a brushy country, it would require a couple of axmen to each topographer to cut out his lines and would decrease his speed one-third. This would increase the cost of taking the topography about six times and for a very doubtful benefit.

The professor may also mean that we should level over our parallel sight-compass lines, used as a base system for taking the topography, by the Abney method instead of direct leveling. These lines are from two to three miles long between transit lines, and usually have a total change of elevation of from 1000 to 3000 ft. Considering their nature, I do not believe that any practical engineer will take Professor Bonner's idea very seriously.

In comparing the costs of the two methods the professor fails to take into consideration the main cost items. He takes the cost of topographic surveys done by a slightly different method in a country totally free from brush and, if we dare say it, almost from timber, and compares it with the cost of work done in an almost tropical undergrowth. He overlooks the fact, or does not know it, that a country full of running streams is more broken up and more difficult to work in than the

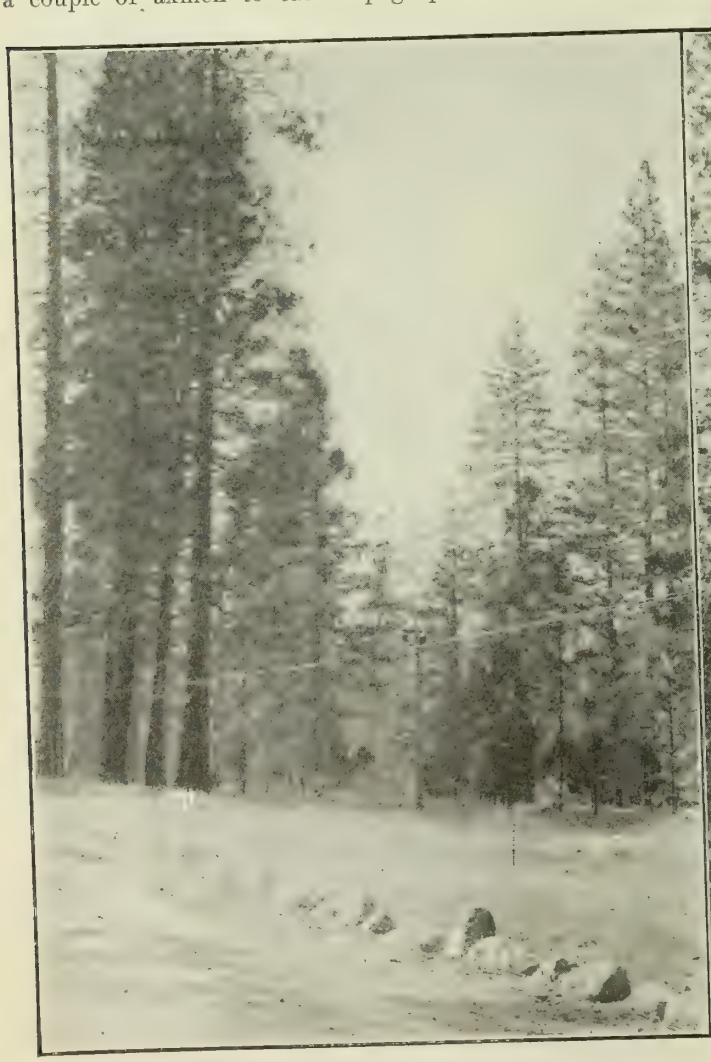


FIG. 1. OPEN TIMBER LAND OF THE ROCKY MOUNTAIN REGION

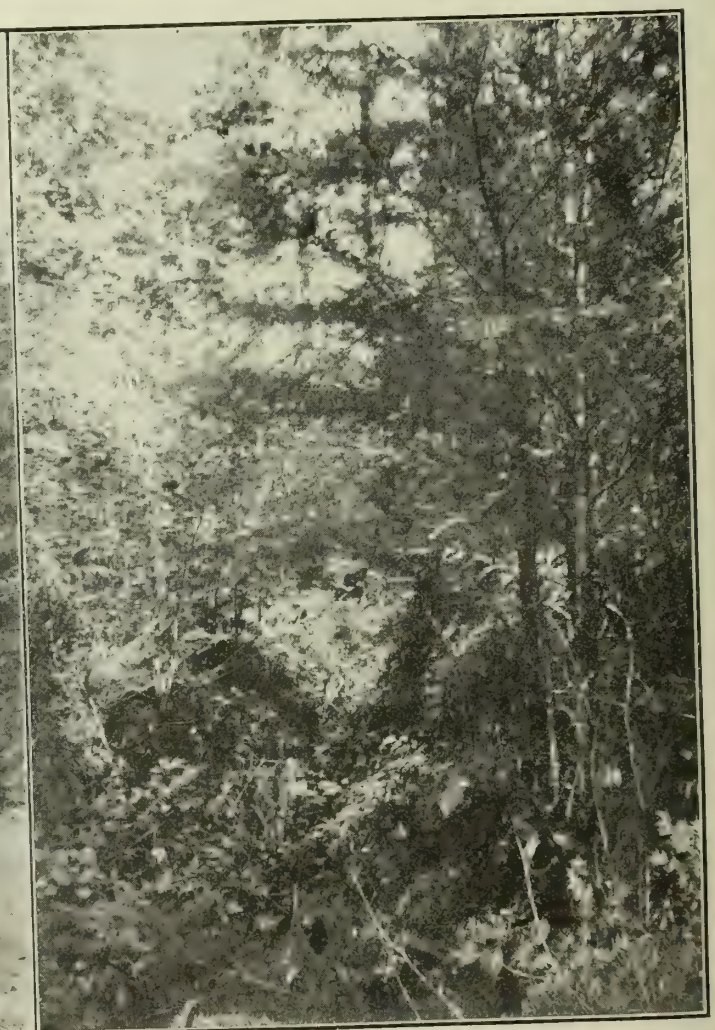


FIG. 2. DENSE UNDERGROWTH IN THE FORESTS OF THE PACIFIC COAST

regular slopes he is used to. So that your readers may see the difference more clearly, I am submitting views of typical wooded country. One of these shows open timber as in the Rocky Mountain region and the other typical woods of western Oregon and Washington, northwestern California and British Columbia. It is in this latter region that most of the timber is found, and it is here that the contour methods described in my article are particularly adaptable.

EARL A. MARSHALL.

Portland, Ore., July 24, 1915.

Earnings of Graduate and Nongraduate Engineers

Sir—An editorial in *Engineering News* of July 1, 1915, p. 33, in regard to the advertising of engineering schools states some facts in regard to the compensation of engineers in a way that may, I believe, be misunderstood.

Your statement that, "comparing . . . graduates . . . . with . . . nongraduates . . . the nongraduates were receiving the larger salaries," while in a sense correct, as shown by the reference (*Engineering News*, Jan. 7, 1915, p. 36), is in general incorrect, for the reason that in the diagram referred to the average for the graduates is brought down by the large numbers in the class of short-experience (low-pay) graduates. That is to say, there are many graduates working at low pay (to start), which reduces the average pay of graduates. Now the point is this: These statistics are for a special class—members of the American Society of Civil Engineers. There are not, as would appear from this, more graduates than nongraduates in the first years of the profession (quite the contrary), but of those of short experience who have joined the American Society, the relative proportion of graduates is large. This is because they are looking to a better future and also because they can better afford the expense of joining.

The following figures gathered by myself as to fifty engineers of less than five years' experience show that during this period also the graduates get more pay, though only slightly more:

Experience, Years	Graduates per Month	Nongraduates per Month
One	$67	$67
Two	86	78
Three	104	101
Four	110	110

These figures show that even at the start the graduates get more pay, and in later years the difference widens.

CIVIL ENGINEER.

Nashville, Tenn., July 31, 1915

[This letter makes it worth while to raise the question, When does the "experience" of an engineering-school graduate begin? If one desired to make a strictly fair comparison between the graduates and the nongraduates, ought he not to assume that the graduate engineer's experience began when he entered the engineering school, not when he graduated from it?

Here is a high-school graduate of 17 or 18 years. He can, let us assume, either get a job in an engineer's office or enter an engineering school and begin his actual work four years later. To make a fair comparison and ascertain whether he earns more money ten years later as a result of taking the engineering-school course, one should compare the salary of the man who has been working ten years in the field and office with that of one who has had six years of such work since his graduation.

Probably such a comparison would show an even poorer result for the graduate engineer than that given by our correspondent. Notwithstanding this, we assume that almost every engineer of large experience would advise a course in an engineering school for a boy who had the natural ability requisite for making a good engineer and whose parents could afford the expense.

It is a fact that a great deal of the routine work of the engineering office or survey party or inspection force can be learned in the school of hard knocks, and a good deal of it has to be learned there anyway. But the boy who aspires to do some day more than routine work, and who wants the stimulus of large ideas in the years while he is doing routine work makes no mistake in securing a thorough engineering education.—Editor.]

How Not To Build a Road

Sir—The design and construction methods now being used in building the section of the Paramus road between Arcola and Ridgewood, N. J., would seem to merit the condemnation of road builders, and it is difficult to believe that the finished road will be permanently satisfactory.

The old macadam roadway, although in an extremely worn and pocketed condition, will perhaps serve as a satisfactory foundation, but is not wide enough to include the proposed macadam strips alongside the new center. The new road is to consist of a central "Amiesite" roadway about 20 ft. wide, separated from side strips of macadam by concrete curbs. These curbs are only about 8 in. wide and 2 ft. deep and are without foundation or reinforcement. The macadam side strips will be new and apparently without any great amount of foundation. The question, then, is whether the curb will break, heave or move sideways, or whether the macadam side strips will sink below the level of the curb, leaving a permanent ridge on each side of the central strip.

Referring to the methods of work, it is to be regretted that there is no centralized authority having sufficient power to prevent dangerous and obstructive practices during road improvement. In the case of this road, the concrete curbs were built miles in advance of the filling, and after some months still remain as barriers along the driveway. In addition to the obstruction caused by the height of the curbs above the old roadway, there was left a gutter along each side of the curb. As the distance between curbs is only 18 or 20 ft. and the road surface is in very bad condition. It is not uncommon for vehicles to have to be jacked up out of the gutters.

R. D. C.

New York City, July 27, 1915.

Fruit Trees on Water-Works Drainage Areas—Robert B. Morse, Chief Engineer of the Maryland Department of Health, calls the attention of "Engineering News" to a report that the city of Frederick, Md., has received $1000 as its half of the peach crop from 4000 trees on land recently bought by the city to protect its water supply. The other half of the crop went to the tenant on the land. Mr. Morse adds:

It seems to me that, if proper sanitary precautions are observed during harvest season, many watersheds under municipal ownership might be made with safety to yield considerable amounts of revenue from fruit raising.

Many cities have planted forest trees on their water-works drainage areas. The returns from these are far more remote than from fruit trees, but a city can wait for revenue, and forestry operations present less danger of water pollution than does fruit raising.

Erie Rainstorm and Flood

SYNOPSIS—Remarkable rainstorm with three heavy downpours an hour apart produced a sudden flood in a hillside stream flowing through Erie. The discharges from the three periods of greatest rain synchronized. The creek channel was constructed by some twenty culverts, all overflowed.

A rainstorm of great intensity and remarkable distribution produced a destructive flood in Mill Creek in the city of Erie, Penn., on Tuesday, Aug. 3, 1915. About 200 houses were destroyed or damaged, and many persons were killed; at last accounts 35 dead had been found.

Contrary to press reports, no dams failed. The flood was nothing more than a phenomenal concentration of rainfall runoff, going beyond all past experiences. It rose high above the banks of a channel constricted by buildings alongside and over the creeks and by numerous culverts on which streets and railway lines crossed the creek. The flood was so great, however, that it might perhaps have overflowed even the natural unobstructed channel.

Mill Creek and Its Channel

Mill Creek is a short, steep brook running in a rock bed—shale under the earth cover is exposed along most of its course. The drainage area, according to the best data available, is about 17 sq.mi.[1]

The land slopes up southeastward from the Lake Erie shore at a fairly uniform rate of about 60 to 65 ft. per mile, except that a mile width along the lake is a plain about 60 ft. above lake level. The creek enters the city near the middle of its southern border, 2½ mi. from the lake, flows northwest toward the lake (i.e. straight down the slope) for a mile, then turns and flows directly north along a depression in the flat plain to the lake. A profile of the stream bed is almost exactly a straight slope; thus, the fall within the city is as follows:

26th St. (El. 131) to 18th St. (El. 98) 33 ft. in 2700 ft. = 1.22%
18th St. (El. 98) to 8th St. (El. 48) 50 ft. in 4100 ft. = 1.22%
8th St. (El. 48) to mouth (El. 0) 48 ft. in 4200 ft. = 1.14%

The channel averages from 30 to 50 ft. wide, and from 10 to 20 ft. deep; but on each side the ground slopes up from the top of the banks for a distance of from 500 to 600 ft., rising some 20 ft. in this width, so that the valley is a shallow trough with a narrow channel.

Between 26th St. and 13th St. the creek is paralleled on the west by State St., 150 ft. away; this is the main business street of the city. French St., occupied by dwellings, parallels the creek on the east at the same distance. Both streets lie in the valley trough, and both served as overflow channels for the flood waters, running from 2 to 8 ft. deep over the pavement in the worst period of Tuesday evening. But State St. lies slightly higher than French, and as the buildings along it form solid blocks they limited the cross-flow of water. The greatest destruction, therefore, was in French St.

After a wet July—with rain on 19 days out of the 31, and a total precipitation of 5.14 in. against the normal figure of 3.21—some rain fell in Erie on Aug. 2, but only a trace. The next day, however, rain started at 3:30 p.m. and continued 13 hr. to 4:42 a.m., Aug. 4, in which time a depth of 5.77 in. fell. Almost from the moment of starting, the rain was very heavy, and it became maximum in three great downpours lasting from 20 to 30 min. each; the last of the three, ending at 6:53 p.m., was the worst, and the flood-destruction followed soon after, 7:30 to 9 o'clock.

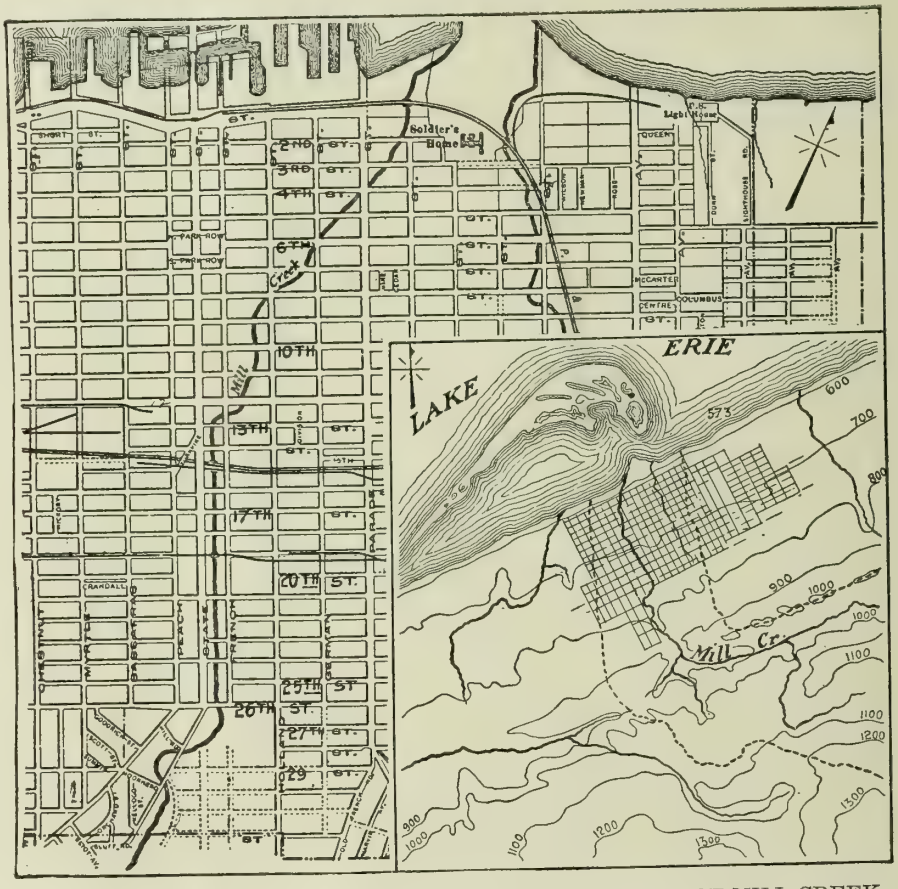


FIG. 1. SKETCH MAP OF ERIE, PENN., SHOWING COURSE OF MILL CREEK

The extraordinary character of the storm lies in its three high peaks occurring about an hour apart: At 4:20, 5:30 and 6:45 p.m., respectively, with precipitations of 0.9 in., 1.2 in., and 1.4 in. This feature is best shown in the curve of rainfall intensities, Fig. 2, which *Engineering News* has plotted from the rainfall records.[2]

[1] So stated by investigators of the State Department of Health six years ago. The city engineer has no figures from measurements of his own.

[2] Local Forecaster Harry O. Geren, head of the United States Weather Office at Erie, courteously made his records available and supplied the corrections and detail time readings from the autographic chart. He also directed attention to the fact that the record of the gage (at State and 12th St.) may be too low to represent the rainfall in the upper part of the Mill Creek area, two or three miles south of the city. His observation indicates that storm rainfalls may frequently be much higher in the hills south of the city, at an elevation of from 350 to 500 ft. above the lake, than in the city itself.

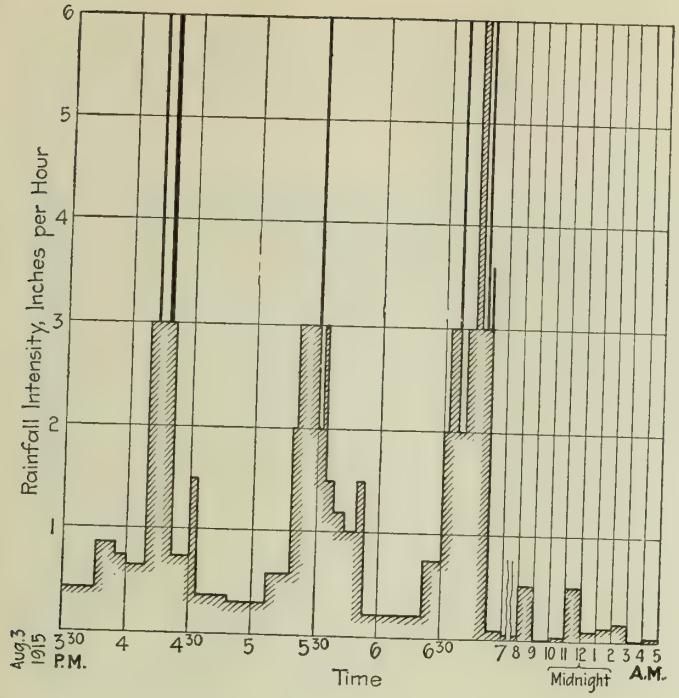


FIG. 2. INTENSITY CURVE

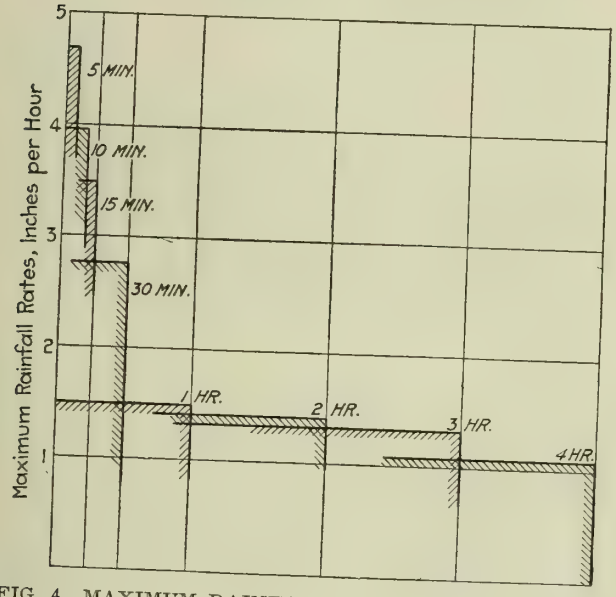


FIG. 4. MAXIMUM RAINFALL RATES IN ERIE STORM OF AUG. 3, 1915

The importance of this rainfall distribution is due to the fact that Mill Creek is so short and steep as to have a flood-concentration time of not more than one or two hours. City Engineer B. E. Briggs states that high water in Mill Creek ordinarily comes down within an hour or an hour and a half after the rain. On Aug. 3, therefore, the water of the second rainfall-peak flowed into the creek from the lower part of the drainage-area just when the first flood wave from the upper reaches went down through the lower channel; and with even greater effect the third rainfall-peak superimposed its runoff on the flood wave of the second peak.

A further picture of the three-wave character of the Erie storm is given by Fig. 3, which represents the curve of accumulated rainfall.

One interpretation of the storm is found in the figures for maximum intensity of rainfall maintained for various periods of time. The short-time intensities are high,

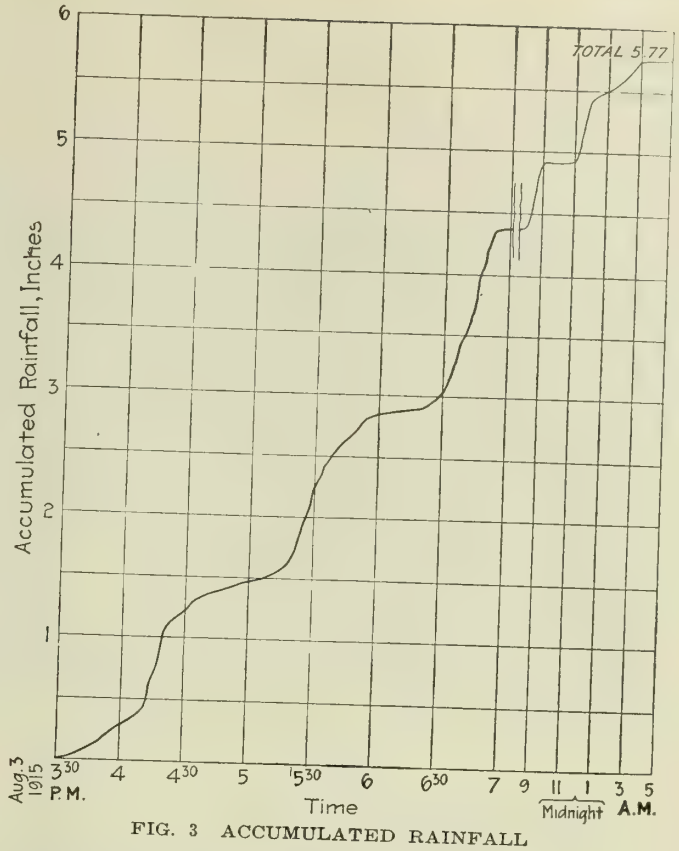


FIG. 3 ACCUMULATED RAINFALL

but not phenomenal; even the maximum 1-hr. fall was not exceptionally large. But the 2-hr., 3-hr. and 4-hr. rates are nearly as large as the 1-hr., being kept up by the succession of separate heavy downpours. The figures as computed by the local forecaster are:

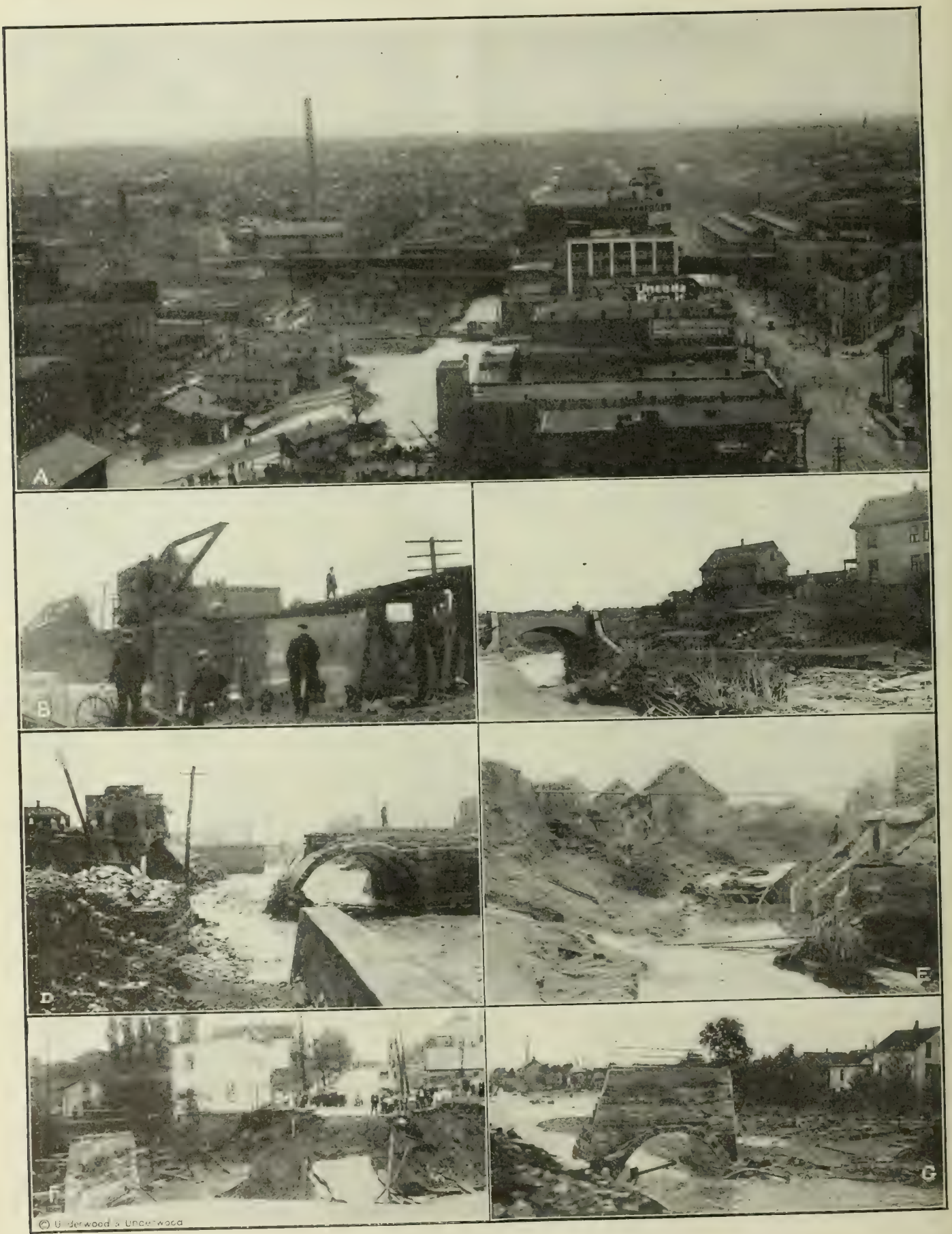
Heaviest Periods	Precipitation, In.	Rate, In. per Hr.
5 min. (6:44-6:49)	0.39*	4.68
10 min. (6:43-6:53)	0.66	3.96
15 min. (6:34-6:49)	0.87	3.48
30 min. (6:24-6:54)	1.38	2.76
1 hr. (5:53-6:53)	1.50†	1.50
2 hr. (4:53-6:53)	2.84	1.42
3 hr. (3:53-6:53)	4.04	1.35
4 hr. (3:24-7:24)	4.31	1.08
Total	(3:30 p.m.-4:42 a.m.)	5.77‡

*Exceeded in August, 1913, with 0.41 in., rate of 4.92 in. per hr. †Exceeded June 27, 1900, with 1.67 in. in one hour. ‡Maximum rainfall in history of local weather office, 42 yr.

In diagram form these figures are represented by Fig. 4, which portrays clearly how the rainfall rate was held up to a nearly constant figure for all periods from 1 to 3 hours, by the succession of rainfall peaks. The curve makes it practically certain that a precipitation of at least 1.4 in. per hr. came into concentration; and in view of the saturated condition of the ground nearly the entire quantity must have appeared as runoff. For the 17-mile area this precipitation supplies a quantity of 15,000 cu.ft. per sec.

Dam, Bridges and Culverts

About half a mile outside the city, in a park, the creek is ponded by a low dam of the hollow reinforced-concrete type, built by the city ten years or so ago. It is about 5 ft. high, 40 ft. long, and has wing-walls 4 ft. high above the crest. Water flowed over the dam at least 7 ft. deep but did not injure it. However, the water washed out the ground at the west end of the dam, flowing around it, and also flowed over a 100-ft. length of bank east of the dam and along a road at the foot of the hill slope. Early reports had it that this dam broke in the flood and discharged its pond down upon the city; these reports were in error.



FLOOD DAMAGE IN MILL CREEK, ERIE, PENN.

A—Looking up Mill Creek from top of Commercial Bldg., 12th St. Note flow of water toward French St. at left. B—Washout of Nickel Plate embankment, showing old filling trestle. Concrete culvert shows at left; old stone piers belong to an earlier girder span. C—At Second St.; large washout at east side of culvert (to right). D—Washout west of culvert at 22nd St.; a typical case. E—Washout alongside concrete arch culvert at Fifth St.; back of arch abutment at right of view. F and G—Washout at 26th St., over 100 ft. wide, with only the downstream headwall left of the culvert. Views east and north respectively

In the half mile between the dam and 26th St., where the stream enters the built-up area of the city, one bridge remains (it was bypassed by a broad flow over low marsh ground to the west) while two bridges were carried out. They were overflowed about 5 ft. over the floor. The lower of the two had previously been overflowed slightly.

At 26th St. is the first of a series of 20 street crossings over the creek; in addition two railways cross, the Nickel Plate by a 20-ft. concrete arch culvert in its embankment, the Lake Shore & Michigan Southern by a 24-ft. stone arch. The street crossings are all made by 20-ft. cudverts, most of them brick with concrete arches with upwards of 6-ft. rise, but a few are flat concrete spans. The height of the culvert roadway ranged from 10 to 25 ft. above creek bed. All the culverts were overflowed several feet, but only two were carried out. Washouts of embankment occurred at many of the others, however. The water flowing through these washouts and along the nearby streets was the direct cause of practically all the destruction of houses and loss of life.

The condition of the creek channel was determined not alone by the presence of the culverts, but by numerous sections of retaining-wall or channel wall. For several blocks in the middle of the city private abutters had built walls along both sides, 20 ft. apart and less than 20 ft. high, and at one or two points these sections were even covered by platforms or by buildings. Being founded on solid shale, the walls in most cases remained uninjured; a few were overturned by the pressure of the earth backing.

Further, at the diagonal crossings under street intersections in the lower section of the creek, as at Sixth St. and at Fourth St., the necessary length of the culverts—several hundred feet—operated to limit the flow capacity.

Underscouring of foundations of buildings did some damage, but more was done by the push of the flowing water shoving frame houses off their foundations and wrecking them.

Débris carried down by the creek on the rise of the flood was a large factor in increasing the damage. Trees, wreckage of houses and bridges, etc., blocked culvert openings and thus raised the flood level and diverted more water through the streets. Apparently this effect was mainly local.

Of the many peculiar effects of the flood on the structures along and over the channel, the destruction of the 26th St. culvert is particularly interesting. This was a stone arch with rather deep fill over it, bringing the roadway 24 ft. above creek bed. Three years ago its headwalls were found to be in bad condition, and the downstream wall was rebuilt in concrete. The flood tore out the arch (it is claimed by the blocking effect of the débris of the two road bridges washed out just above), besides washing out sections of the street embankment on either side, making a gap of 150 ft.; but the concrete headwall on the downstream side still stands.

The sudden failure of the 20th St. embankment is charged by many with doing the worst part of the flood damage. Occurring when the flood already was high, it is said to have sent a sudden rush of water down the channel, which acted as a destructive wave.

The Nickel Plate was cut in two by the washing out of 200 ft. of embankment from the creek to French St., although the concrete culvert was left standing, bare but uninjured. The same thing occurred at many of the street culverts. Eddies caused by the deflection of the water currents probably produced the erosion of the embankments. In at least one case the erosion did not work through the entire thickness of the roadbed, but left the pavement supported along the downstream side while the upstream side spanned a gap.

Sewers and Piping

The sewer system of the city was little damaged, in spite of the fact that there are 43 public sewer outlets into the creek and a large sanitary intercepting sewer alongside the creek for over a mile. Two large sewer outlets blocked by dirt and débris, and some minor damage, are reported. The water system and other piping systems were also little damaged. The natural-gas supply was interrupted by a break in the line, and the public lighting system was paralyzed.

The local health authorities are being assisted by men from the state health department in taking care of sanitation and disease prevention. Engineers of the state Water-Supply Commission are studying the flood phenomena and gathering data on the flood flow.

The above account is based on personal observation and on information given by City Engineer B. E. Briggs, Local Forecaster Harry O. Geren, and others.

ENGINEERING SCHOOLS

University of Arizona

A new system of short courses has been arranged for all mining men desiring to improve their knowledge of the industry. In arranging these courses the requirements of three classes of men have been kept in mind: (1) Young men of common-school education who may become shop bosses, floor and furnace foremen, etc.; (2) young men with a high-school education who can be trained to be mine or mill foremen and for other positions requiring partial technical training and sound practical experience; (3) graduates of scientific schools who need training, especially for administrative work.

For the first group a series of different short courses two weeks long have been arranged. Each subject is to be given alone and intensively, taking up both theory and practice. The subjects will follow each other in logical order, and a student may select as many courses as he wishes. For the second group it was considered that practical experience in successful mines and reduction works was more needed than additional training. The regular four-year course is recommended for these men with half of each week in the last year given up to applications of theory at successful properties within reach of Tucson. For the third class a graduate school has been organized giving advanced courses.

Pennsylvania State College

A summer school of scientific management is now in progress. This session is planned for the accommodation of works managers, superintendents, heads of departments and all others interested. The time is restricted to two weeks to meet the needs of employees whose vacation period is limited to that time. The shops have been especially provided with means for teaching and demonstrating applied methods of scientific management.

Extensive Earth Slippage Shuts Down Cement Plant

SYNOPSIS—Clay surface slips toward creek in vertical slices 50 ft. wide by 20 to 30 ft. deep, causing $250,000 property damage and five deaths. Area of disturbance, 15 acres. Knickerbocker Portland Cement Co., Hudson, N. Y., will be shut down for months until new power station can be erected and equipped.

The extensive subsidence which shut down all operations at the Greenport plant of the Knickerbocker Portland Cement Co., near Hudson, N. Y., on Aug. 2, as noted in *Engineering News* of Aug. 5, was apparently the result of the successive slippage of large slices of the clay soil in the direction of Claverack Creek. The first visible incident in the disturbance was the movement of a section of earth 50 ft. wide by at least 30 ft. deep and 200 ft. long,

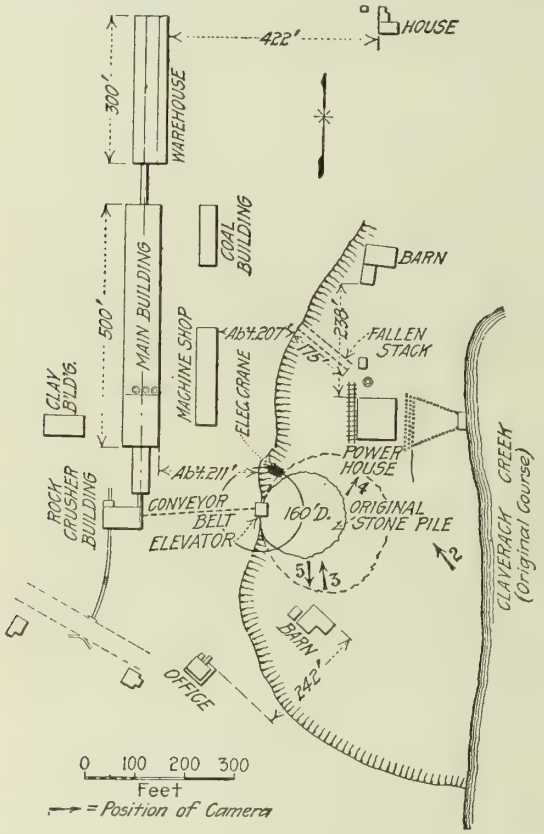


FIG 1. PLAN OF GREENPORT PLANT OF KNOCKERBOCKER PORTLAND CEMENT CO.

about 200 ft. southeast of the power house, and this section toppled over into the creek flowing 120 ft. east of the power house. This slide was followed immediately by others in ever-lengthening arcs, until a huge storage pile of crushed traprock was undermined. The pile then sank 20 to 25 ft. over its area (160 ft. in diameter). This sinkage caused the settlement and destruction of the coal trestle and power house, in the order mentioned. Witnesses state that the last objects to be disturbed were the crane and elevator tower used in connection with the circular storage system.[1]

[1]This system, produced by the Link-Belt Co., Chicago, Ill., was described briefly in "Engineering News" of July 15, p. 126.

The disturbance extends over 15 acres of ground. The creek was pushed from 40 to 200 ft. out of its original course and its channel was dammed so that a new channel had to be blasted almost immediately to prevent the flooding of the plant. The water in the Claverack is from 6 to 8 ft. in depth. The entire earth movement was over in 2½ min. The total damage will probably reach $250,000.

Soil and Topography

The buildings of the company are on flat footings with no piling. The soil is the blue clay common to the Hudson Valley. The general slope is toward Claverack Creek (30 ft. wide) which bounds the company's property on the east, the water level being about 15 ft. below that of the property. The slope is about 1 on 2.

Local reports speak of a substratum of quicksand, but inspection of the site and the geology of the country do not support this theory.

The nature of the slippage indicates that water seeping through cracks at the foot of the bank caused a section of the bank to cave in, and this started a succession of similar movements, each farther away from the creek than its predecessor. Whether a lateral flowing of the clay subsoil under the heavy superincumbent load had anything to do with the caving cannot be determined.

Other slides have occurred along the line of this creek in the past ten years or more, though only one of serious nature is on record. In the fall of 1914 a small slide occurred at the power house. Warning of this was given by the parting of several pipes. Back of the building and between it and the creek was a cinder fill; after the slide this was protected by a group of wooden piles driven to a depth of 40 ft. in the manner shown in Fig. 1. No subsequent disturbance occurred, certainly none after February, 1915.

Damage to Buildings

The greatest damage was caused at the power house, not only because of the value of the building and equipment, but also because the entire cement plant depended upon it for power. This building had concrete foundations and a brick superstructure, and contained six 402-hp. Heine water-tube boilers, which supplied steam to two 2000-kw. Curtis turbo-generators. Alongside the building and between it and the stone pile was a timber coal-trestle. The subsidence of the rock pile apparently caused the trestle and the power house to collapse, as shown in Fig. 4. The boilers did not burst, but escaping steam from broken pipes caused the death of five men. The turbines were located in the right-hand portion of the station, as viewed in Fig. 2, where they are visible in the wreckage.

On the creek bank east of the turbine room was located the reinforced-concrete condensing-water intake house. This settled at one end, because of being undermined, but was otherwise undamaged. A reinforced-concrete chimney, 175 ft. high, located behind the power house, appears to have slid away from the creek about 75 ft. before falling over in the direction of its motion. The stack turned over intact from its base and flattened under the impact of its fall; it now lies in the position indicated on Fig. 1.



VIEWS TAKEN IN ZONE OF DISTURBANCE, SHOWING DAMAGED STRUCTURES

Fig. 2—Panorama of settled area; stone pile at left was formerly 45 ft. high; note sharp bank formed in front of main plant buildings. Fig. 3—Elevator tower and crane used in the circular storage system, with collapsed power house in the distance. Fig. 4—Near view of the wrecked power house. Fig. 5—Barn out of plumb in the zone of subsidence, on opposite side of stone pile from power house

The 30,000 to 40,000 tons of traprock in the huge pile which sank formed a part of what was intended to be the winter's supply for the mills. It was intended that this supply should ultimately exceed 100,000 tons. The rock was transported from the quarry to the crusher house, a distance of less than a half-mile, by cars which entered the crusher building on the trestle shown at the upper left of Fig. 2, and in the drawing in Fig. 1. An underground belt conveyor carried the crushed rock from the crusher house to a reinforced-concrete elevator, 60 ft. high, located in the middle of the storage area. There it was lifted to a chute and dumped onto the pile, to be rehandled to any point in the storage area by a 2-yd. 65-ft. radius electric crane, running on a circular track 160 ft. in diameter. The arc of the crane track which lay within the zone of subsidence sank with the crane, but the latter was undamaged (see Figs. 1 and 2). The elevator settled 30 ft. and swung far out of plumb, but does not show any structural damage other than minor cracks.

Part of the roof of the reinforced-concrete packing house collapsed when the building was affected, but fortunately the day force had not yet arrived.

The frame barn shown in Fig. 5 settled 45 deg. out of plumb. The touring car which appears to be preventing the barn from slipping was inside, being cranked, when the trouble occurred. The steep bank at the right of the view is a blowup formed by the subsidence. Part of the rock pile is shown in the foreground.

Plans for the Immediate Future

While plans for rebuilding the power plant and the other damaged structures are necessarily unsettled just now, arrangements are under way tending toward the resumption of business at the earliest possible date. The power station cannot, of course, be replaced for several months. In the meantime, a certain amount of electric power will be bought from the Albany Southern R.R. Co. Myron Hammond is Superintendent of the Knickerbocker Portland Cement Co.

News of the Engineering World

An Engineer Wanted

The Upper Scioto Drainage and Conservancy District, with headquarters at Kenton, Ohio, expects to proceed with the preparation of a plan of flood prevention, drainage and conservation for that portion of the drainage area of the Scioto River which is within Hardin County. The directors of the district, through a notice signed by Kent P. Johnson, attorney and acting secretary for the district, have invited proposals until Aug. 21 for "performing the engineering services necessary and incident to the formation and adoption" of a plan for the proposed work. The services of the engineer are "to be advisory and supervisory only." The engineer is to engage the necessary staff for the work, both engineering and clerical, and the district is to pay the actual expense of the staff. Proposals for the engineering services just outlined may be made in writing prior to 9 a.m., Aug. 21, or applicants for the position may appear in person at Kenton on that date.

Watervliet Water-Supply Plans

The plans and specifications have recently been completed and bids have been asked for the new municipal water-works of Watervliet, N. Y. These show in detail what has been previously outlined in these columns. The water is to be obtained from the Normanskill at French's Mills, in the town of Guilderland, about 12 mi. west of the city of Watervliet. At this point there will be a reservoir formed by building a reinforced-concrete dam across a rocky gorge. The dam will be 36 ft. high at maximum section and 380 ft. long, with a spillway of 324 ft. The reservoir will cover an area of about 460 acres and will have a capacity in the top 10 ft. of 1120 million gallons.

About 1400 ft. downstream from the dam will be a power station with two hydraulic turbines directly connected to two centrifugal pumps, each having a capacity of 2¼ million gallons per day. The pumps and turbines will be served from the same water-supply. A force main will run to a 15 million-gallon service reservoir just outside Watervliet. This main will be of cast-iron, or of wood pipe with a few cast-iron sections. The service reservoir will have four earth walls and will be partly in cut and partly in fill. The inside slope will be lined. Between the service reservoir and the city distribution line will be a 3 million-gallon filter plant with aerator and clear-water well. In the city there will be about 22 mi. of cast-iron pipe of from 4- to 14-in. diameter.

Railway Line Surveyed by Engineering Students

The news bulletin issued by the Ohio State University on Aug. 6 contains the following item under the title "New Traction Line Under Construction":

"The Cleveland & Ohio Central Electrical Ry. is the name given to the traction line which is to run between Wooster and Cleveland," said Prof. C. E Sherman, of the department of civil engineering of the Ohio State University. "A final survey, which was conducted by the university, has been completed. The road will bisect a strip of territory some 15 mi. wide which has no railroad nor traction facilities at the present time. The final survey was made by the department of civil engineering of the Ohio State University.

"This work constituted the annual summer camp for civil engineering students this summer. Three parties were placed on the survey, in charge of Instructors R. C. Sloane, G. F. Schlesinger and W. Neilson. The work was completed at an estimated cost of $1200. Other work undertaken by the summer camp was the making of a topographic survey of parts of the Ohio State University farm, and in addition a cemetery in Springfield, Ohio.

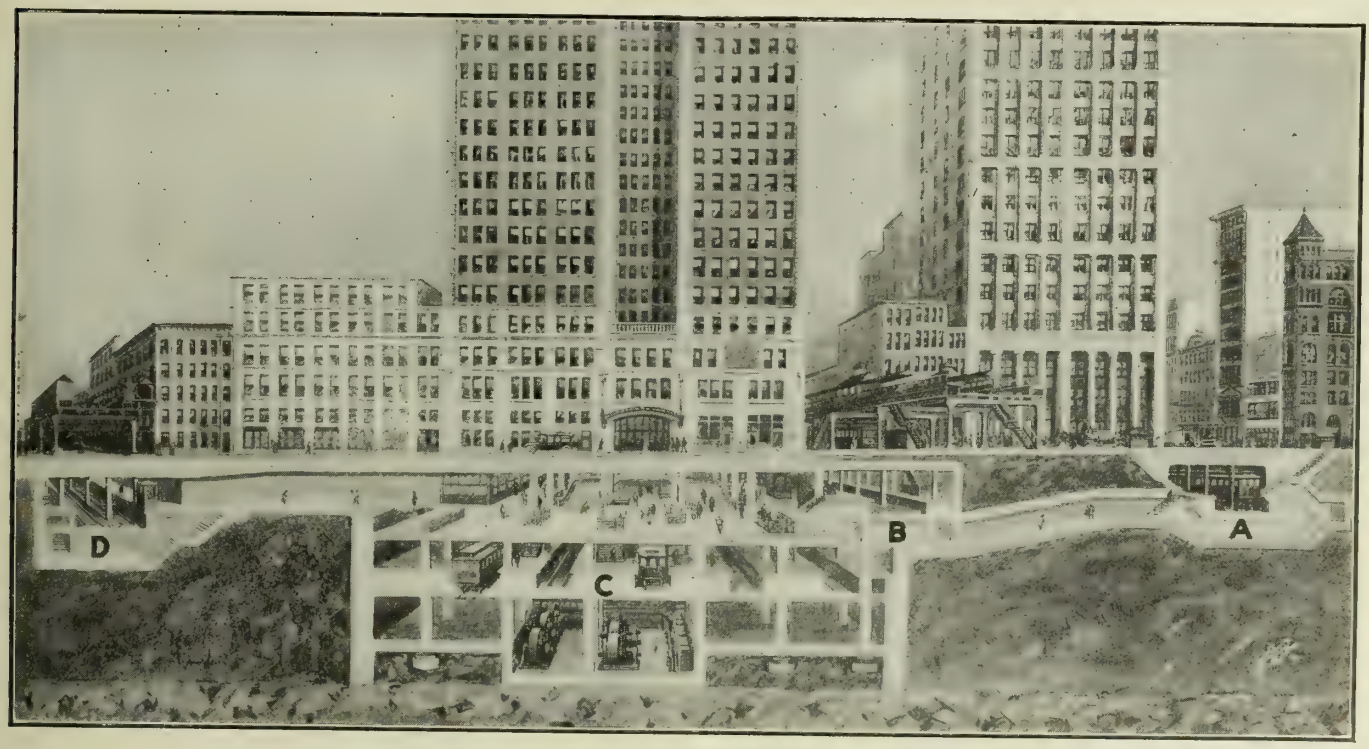
"The location chosen for this line is very nearly ideal. At no place is there more than a 2° grade, and the sharpest curve is but 3°. One of the features of this road will be the using of gasoline-electric cars. The electricity will be gen-

erated by gasoline engines located in the car, and will afford a convenient driving power.

"It is now the intention of the company to continue the line at a later date to Columbus and ultimately to Cincinnati, thus affording a continuous air line from the southwestern part of the state to the lakes."

Downtown Union Subway Station, New York City

There are four principal union or intercommunicating stations in the new dual subway rapid-transit system of New York City. One is at Times Square, 42nd St. and Broadway; the second is at the Grand Central Station, a wash drawing representation of which was given in *Engineering News* of Oct. 24, 1912; the third is at Brooklyn bridge and the Municipal building, and the fourth is at Dey St., between the Hudson Terminal buildings. A reproduction of a wash drawing of this latter station is shown herewith.



DOWNTOWN UNION SUBWAY STATION, NEW YORK CITY; CROSS-SECTION THROUGH DEY ST.
Reproduced from a wash drawing by courtesy of J. Vipond Davies, Chief Engineer of the Hudson & Manhattan R.R.

The Dey St. station is of particular interest because it gives connection with all the northbound and southbound subway trains of lower Manhattan. In the accompanying illustration *A* is the present Interborough Rapid Transit Co.'s Broadway-Fourth Ave. line; *B* is the Brooklyn Rapid Transit Co.'s Church St.-Broadway line now under construction, which extends south to Brooklyn through two new Battery tunnels now being built and north under St. Paul's churchyard to Broadway. Above *B* is the Sixth Ave. elevated line of the Interborough Rapid Transit Co. The letter *C* indicates the downtown terminal station of the Hudson & Manhattan R.R., which runs to Jersey City, Hoboken and Newark; *D* is the new Seventh Ave. line of the Interborough Rapid Transit Co.'s subway, which is to go south to the present Battery tunnels of that company and north to Times Square. Above *C* is the present Ninth Ave. elevated line of the Interborough Rapid Transit Co. Four blocks north of the point *C* this new subway has a branch extending east under Park Place, thence to William St., to Old Slip, where two new tunnels are being built under the East River to Brooklyn.

Thus a person coming from New Jersey or arriving at any of the railway terminals on the Jersey side of the Hudson River between the Pennsylvania R.R. and the Delaware, Lackawanna & Western R.R. stations may reach any point on the Manhattan, Brooklyn, Queens and Bronx rapid-transit system without emerging into the light of day, so to speak, or he may go direct to the Grand Central station and away again without seeing anything but a subterranean city.

A Second-Hand Bridge Fails—On July 28 a 240-ft. span on the south end of a highway bridge between East and South Aberdeen, Wash., fell into the Chehalis River. It carried with it an automobile in which were five persons, none of whom was injured. A street car had crossed the bridge a few minutes before the accident. The bridge was a combination timber and steel structure and formerly spanned the Willamette River at Portland, Ore., until condemned as inadequate for the service to which it was there subjected. It was placed in its present position in 1905 and operated as a toll bridge. A few years ago the steamer "Norwood" smashed into the same span and pushed it into the river. From accounts of witnesses, the middle of the span began to sag and totter and finally gave way.—Roy A. Klein.

Permits for Liquid Chlorine Water-Disinfection plants to be installed by the Annapolis Water Co. and by the Piedmont Water-Works Co. at Annapolis and Piedmont, Md., have been issued by the Maryland Department of Health.

Electrification of Railways Entering St. Paul, Minn., is contemplated by an ordinance introduced in the City Council by Oscar Kellar, Commissioner of Public Utilities. The ordinance forbids the use of steam locomotives within the city limits. A delegation of railway employees appeared before the City Council on July 12 to oppose the adoption of the ordinance.

An Engineers' Special Train from New York to San Francisco is to be run over the New York Central Lines and Santa Fé system, leaving New York on Sept. 9. Accommodations on

the train have already been reserved by members of the national engineering societies and their friends sufficient to fill 11 cars. Stops will be made on the way at Niagara Falls, Colorado Springs and the Grand Cañon.

Electrification of the Railways Entering Cleveland is to be investigated by a special committee of the City Council appointed July 12. The committee will make use of data and specifications prepared in 1913 by E. T. Roberts when city smoke inspector. This report recommended that on several of the railways entering Cleveland electrification be extended into the suburbs beyond the city limits.

Plans for a Sewerage System and sewage-treatment Works for the Little Falls Branch drainage area of Montgomery County, Maryland, are being made for the county commissioners, in compliance with an order of the State Department of Health. The preliminary estimate of cost is $125,000. The project follows the recommendations of a report on sewage collection and disposal in the vicinity of the District of Columbia, recently made by the Department under the direction of Robert B. Morse, Chief Engineer.

Fixing Rates for Public Utilities by snap legislation in the State of New York may be checked in future if the constitutional amendment should adopted which has been recommended by the Committee on Public Utilities of the State Constitutional Convention now in session. The amendment recommended by this committee contains the following clause: "The legislature shall not enact any law prescribing a rate, or charge, or a standard of service, equipment, or operation for any public utility until after it has received from one of the commissions a report thereon made after investigation and hearing at which interested parties may introduce evidence, or until after the expiration of such time following a request for such reports as may be prescribed by law."

United States Public Land Surveys—All records were broken during the last fiscal year in the making of surveys of public lands, according to reports submitted to Secretary Lane by Commissioner Tallman, of the General Land Office. The total of accepted and approved surveys aggregated 14,339,349 acres. This was nearly double the amount surveyed during the preceding year and 4,589,872 acres more than was surveyed in 1909, the previous high-record year. These surveys are made, not by the contract system with private surveyors, as was the practice for half a century, but by the direct-survey system put into operation two years ago, whereby all of the 150 surveying parties are made up of regular employees of the Department of the Interior. Greater accuracy and efficiency have resulted from this system.

Progress on the Rogers Pass Tunnel of the Canadian Pacific Ry. has been very satisfactory. It will be remembered that this 5-mile double-track tunnel is being driven from intermediate headings reached by crosscuts from a pioneer tunnel or heading parallel to but outside the line of the main tunnel ("Engineering News," Apr. 2, 1914). The pioneer heading has been completed and there remain to be driven 2.05 mi. of main heading and 3.31 mi. of enlargement to the double-track section. The concrete lining of the earth section is nearly completed, and it is expected that the concreting of that portion of the rock section which requires lining will be finished during this year. The tunnel will probably be completed and ready for operation in September, 1916. The progress made during 1915 is given, from a statement furnished by Foley Bros., Welch & Stewart, the contractors. A. C. Dennis is superintendent for the contractors.

	East End			West End		
1915	Pioneer Heading, Ft.	Main Heading, Ft.	Enlargement for Double Track	Pioneer Heading, Ft.	Main Heading, Ft.	Enlargement for Double Track
January	592	443	443	932	699	210‡
February	620	440	422	650	634	247
March	595	196*	379	617	752	413
April	751	442	553	569	741	588
May	658	417	718	730	618	685
June	776	471	659	808	393	729
July	682	538	726	731	969†	812

*Half-month. †Two headings. ‡Timbered.

An Investigation of the Lumber Industry of the United States is to be undertaken by the Federal Trade Commission in coöperation with the Forest Service and the Bureau of Foreign and Domestic Commerce. The forest resources of the United States are being depleted at the rate of 80 billion feet or more per year. Lumber prices, however, have continued on a low level for a number of years, and the admission of lumber from the North Pacific coast to Atlantic-coast markets through the opening of the Panama Canal is likely to prevent any material advance in prices for at least a dozen years to come. Where an increase in market prices of lumber has taken place, it appears to be due to an increase in stumpage prices obtained by owners of standing timber and possibly to longer freight haul, since lumber is now brought in general from greater distances. One unfortunate result of the low prices is that much low-grade timber is not marketable. Consequently, notwithstanding the rapid inroads on the country's forest reserves, the annual timber consumption continues undiminished.

PERSONALS

Dr. Wm. J. Gallivan has resigned as Health Commissioner of the city of Boston, Mass.

Mr. E. H. Olson has been appointed Office Engineer of the Atchison, Topeka & Santa Fé Ry. at Topeka, Kar., succeeding Mr. M. C. Blanchard, promoted as noted elsewhere.

Mr. Samuel M. Gray, M. Am. Soc. C. E., a consulting engineer of Providence, R. I., has been appointed Consulting Engineer of the Providence Water Supply Board at an annual salary of $10,000.

Mr. M. C. Blanchard, Office Engineer of Atchison, Topeka & Santa Fé Ry., at Topeka, Kan., has been promoted to be Engineer of the Eastern district, Eastern lines, with headquarters at Topeka.

Mr. H. P. Drake, Assoc. M. Am. Soc. C. E., former Assistant Engineer, Water-Supply Commission of Pennsylvania, is now with the engineering staff of the Pennsylvania State Department of Health, Harrisburg.

Dr. Francis X. Mahoney, for the last three years Chairman of the Board of Health of Boston, Mass., has been appointed Health Commissioner of the city by Mayor Curley, at a salary of $7500 per annum.

Mr. Ross M. Riegel, former Division Engineer of the Water-Supply Commission of Pennsylvania, has taken a position with the Morgan Engineering Co., Dayton, Ohio, on the proposed flood-protection work.

Mr. Gilbert J. Bell, recently Division Engineer of the Atchison, Topeka & Santa Fé Ry., at Marceline, Mo., has been promoted to be Engineer of the Western district, Eastern lines, with headquarters at Newton, Kan.

Mr. H. T. Gritchlow, formerly a member of the engineering staff of the Water-Supply Commission of Pennsylvania, is now a member of the United States Geological Survey on hydrographic work, with headquarters at Madison, Wis.

Mr. Gerard Hendrik Matthes, M. Am. Soc. C. E., formerly Division Engineer of the Water-Supply Commission of Pennsylvania, has accepted a position with the Morgan Engineering Co., Dayton, Ohio, on the proposed flood-protection work.

Mr. P. L. Pierce, Assoc. M. Am. Soc. C. E., former Assistant Engineer, Water-Supply Commission of Pennsylvania, is now a member of the engineering staff of the Wisconsin River Power Co., in charge of the construction of transmission lines near Madison, Wis.

Mr. W. F. Faber announces that the Faber Engineering & Construction Co. has opened offices in the Bessemer Building, Pittsburgh, Penn., for the conduct of a general contracting business, specializing in sewage disposal and reinforced-concrete construction.

Mr. E. W. Lewis, M. Am. Soc. C. E., formerly Assistant Engineer of the New York, New Haven & Hartford R.R., at New Haven, Conn., announces that he has opened an office for the general practice of civil engineering at 234 Union St, New Bedford, Mass.

Mr. H. B. Phillips, M. Am. Soc. C. E, Valuation Engineer of the Atchison, Topeka & Santa Fé Ry., at Chicago, Ill., has resigned to become Assistant Secretary of the Presidents' Conference Committee on the Federal Valuation of Railroads, with offices in Chicago.

Mr. Lewis Littlepage Holladay, M. Am. Inst E. E., former Consulting Engineer of the McLeod Manufacturing Co., Chicago, Ill., and Mr. Henry Nedstad announce the formation of the firm Holladay, Nedstad & Co., Consulting Engineers on power plant utilities and industries, with offices at 109 No. Dearborn St., Chicago.

Mr. John N. Carlisle, former State Highway Commissioner of New York, has resigned his position with the State Highway Department, which he has held since last spring, when he was superseded as Commissioner by Mr. Edwin

Duffey. Since his resignation as State Highway Commissioner Mr. Carlisle has been retained in an advisory capacity at a salary of $33 per day.

Mr. Thomas J. Gannon, M. Am. Soc. M. E., recently Mechanical Engineer of the Department of Water Supply, Gas and Electricity, New York City, announces that he has opened an office at 143 Liberty St., New York, for the practice of mechanical and hydraulic engineering, specializing in power plants, water-supply and sewage disposal, coal and fuel economy and mechanical equipment and testing.

Mr. D. F. Stickley, M. Am. Soc. C. E., for several years Supervising Engineer of the New York State Barge Canal, and for the past year Consulting Engineer of the Lake Erie and Ohio River Canal Board of Pennsylvania, in charge of preliminary investigations for the proposed waterway, has returned to Albany, N. Y., where he has opened an office in the Arkay Building for the general practice of civil engineering.

Mr. H. S. Philips has been granted leave of absence from his duties in the city engineering department, Toronto, Ont., to accept the position of Assistant Engineer in the Buffalo, N. Y., office of the International Joint Commission, under the direction of Prof. Earle B. Phelps, of the United States Public Health Service. A part of the work of this commission is the investigation of a means for the control of the pollution of the Niagara River.

Mr. Edward W. Parker, M. Am. Inst. M. E., whose resignation as Chief of the Bureau of Coal Statistics of the United States Geological Survey was noted in these columns of May 13, 1915, is now in charge of the Anthracite Bureau of Information, supported by the anthracite coal mining operators of the United States, with offices at 1032 Miners Building, Wilkes-Barre, Penn. The work of this bureau has been combined with that of the Bureau of Anthracite Coal Statistics, which was formerly under the direction of the late W. W. Ruley, and since his death in charge of Mr. A. A. Armstrong. Mr. Armstrong will remain in charge of that portion of the work.

Mr. E. C. Black, Assoc. M. Am. Soc. C. E., formerly of the firm of Worley & Black, Reliance Building, Kansas City, Mo., announces the reorganization of the firm under the name of Black & Veatch, with offices in the Inter-State Building, Kansas City, Mo. Mr. J. S. Worley, M. Am. Soc. C. E., resigned from the firm of Worley & Black Jan. 1, 1914, in order to give his entire attention to the Interstate Commerce Commission's railway valuation work. Mr. N. T. Veatch, Jr., Assoc. M. Am. Soc. C. E., of the new firm, was formerly Assistant Engineer of the Kansas State Board of Health and for the past year and a half has been with the American Water-Works & Guarantee Co., of Pittsburgh, Penn.

Mr. H. M. Roy, formerly Chief Field Engineer with the American Zinc & Chemical Co. on the construction of its zinc smelter plant, modern town and coal mine at Langeloth, Penn., has accepted the position of the Stone & Webster Engineering Corporation at Keokuk, Iowa, on construction of a zinc-smelter plant. He was graduated from the University of Illinois in 1905, and after spending two years in the United States Coast and Geodetic Survey on harbor surveys and precise leveling, entered the engineering department of the Pennsylvania Lines West of Pittsburgh, where he was engaged on various construction and maintenance work until 1913, when he left the railroad to accept the position with the American Zinc & Chemical Co.

OBITUARY

Alexander Dempster, a prominent Pittsburgh business man and formerly an engineer employed on the low grade division of the Allegheny Valley R.R. (in 1869 to 1870), was killed in an automobile accident near Ligonier, Penn., on Aug. 2. About 1871 he was assistant to W. H. Kennedy, M. Am. Soc. C. E., on city work in Pittsburgh, Penn., and from 1872 to 1876 was City Engineer

Henry Stephen Hawley, President of the Railroad Supply Co., of Chicago, died July 28 at his home in Saunderstown, R. I., at the age of 64 years. In earlier life he was a prominent railroad contractor and had a contract in the seventies for the construction of a section of the Grand Trunk Ry. in Indiana and Illinois. Later he held various offices with the Chicago Great Western R.R. and Chicago & Northern Pacific R.R. (later the Northern Pacific Ry.).

Charles Dod Ward, M. Am. Soc. C. E., died at his home in New York City, July 30, at the age of 78. For several years previous to 1910 he was an engineer in the Department of Water Supply of Brooklyn. Mr. Ward achieved considerable fame in 1904 when he presented to the American Society of Civil Engineers a paper on the then proposed earth dam for the Panama Canal, in which was first suggested that the dam be located at Gatun instead of at Bohio, as was then being considered by the Isthmian Canal Commission. Mr. Ward's investigations and clear-cut suggestions, which were included in the Commission's report, had much to do with the final location of the great earth dam at Gatun. He was one of the oldest members of the American Society of Civil Engineers, having been elected in 1869.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
Aug. 16-18 and 25-28. Annual meeting in Los Angeles, Calif., Aug. 16-18; in San Francisco, Aug. 25-28. Secy., J. C. Olsen, Cooper Union, New York City.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Aug. 24-27. Annual convention in Cincinnati. Secy., Clarence R. George, Houston, Tex.

NEW ENGLAND WATER WORKS ASSOCIATION.
Sept. 7-9. Convention in New York City. Secy., Willard Kent, Narragansett Pier, R. I.

TRAVELING ENGINEERS' ASSOCIATION.
Sept. 7-10. Annual meeting in Chicago Secy., W. O. Thompson, N. Y. C. R.R., East Buffalo, N. Y.

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

San Francisco Meetings

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. 19-21. Secy., E. H. Harman, Room 101, Union Station, St. Louis, Mo.

INSTITUTE OF RADIO ENGINEERS.
Sept. 13-18. Secy., David Sarnoff, 71 Broadway, New York.

PAN-AMERICAN ROAD CONGRESS.
Sept. 13-18. Secy., E. L. Powers, Road Builders Association, 150 Nassau St., New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 16-18. Secy., Charles Warren Hunt, 220 West 57th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Sept. 16-18. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 16-18. Secy., Bradley Stoughton, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 16-18. Secy., F. L. Hutchinson, 29 West 39th St., New York City.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Sept. 16-18. Secy., J. J. Blackmore, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Sept. 16-18. Secy., J. W. Richards, Lehigh University, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Sept. 17-21,

INTERNATIONAL IRRIGATION CONGRESS.
Sept. 20. Secy., Arthur Hooker, Sacramento, Calif.; until Aug. 1, New Stockton, Calif.

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Sept. 20. Secy., F. F. Sharpless, 52 Broadway, New York City.

PACIFIC COAST ASSOCIATION OF PORT AUTHORITIES.
Sept. 20 and 21. Secy., Leo V. Merle, Ferry Bldg., San Francisco, Calif.

AMERICAN MINING CONGRESS.
Sept. 20-22. Secy., J. F. Callbreath, Washington, D. C.

INTERNATIONAL ENGINEERING CONGRESS.
Sept. 20-25. W. A. Cattell, Secy., Comm. of Management, Foxcroft Bldg., San Francisco.

INTERNATIONAL ASSOCIATION OF BRIDGE AND STRUCTURAL IRON WORKERS.
Sept. 20-30. Secy., Harry Jones, American Central Life Bldg., Indianapolis, Ind.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Sept. 21 and 22. Secy., F. M. White, Madison, Wis.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Sept. 23 and 24. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 23 and 24. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN ASSOCIATION OF REFRIGERATION.
Sept. 23 and 24. Secy., J. F. Nickerson, 431 South Dearborn St., Chicago, Ill.

ILLINOIS GAS ASSOCIATION.
Sept. 27. Adjourned meeting. Secy., H. H. Clark, 72 West Adams St., Chicago, Ill.

SAFETY CONFERENCE.
Sept. 27-30.

INTERNATIONAL GAS CONGRESS.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

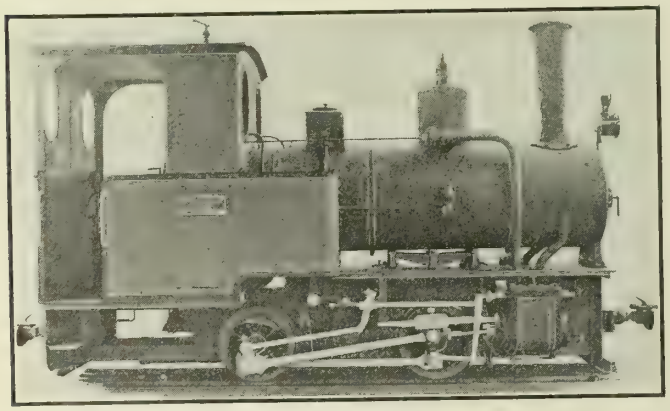
AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

Appliances and Materials

Dinkey With Underhung Tank

Dinkey locomotives generally carry their water-supply in a saddle tank over the boiler, but the illustration herewith shows an engine having the tank fitted between its plate frames. This lowers the center of gravity, tends to make the engine more steady, and reduces the liability of derailment on rough track. The machine shown is one of the industrial railway specialties built by the Orenstein-Arthur Koppel Co., of Koppel, Penn.

The 6½-ton engine for 24-in. gage has 6x11-in. cylinders and four 22-in. wheels on a 4-ft. wheelbase. In several respects the design of the engine follows European practice, notably in the use of plate frames and copper firebox and staybolts. This use of copper reduces the liability of burning or cracking of the firebox in rough handling. The boiler pressure is relatively high, 176 lb. The throttle valve is placed outside of the dome, with an outside steam pipe, and the exhaust pipes lead into the sides instead of the bottom



CONTRACTOR'S LOCOMOTIVE WITH TANK BETWEEN FRAMES

of the smokebox. The valve gear is also on the outside, so that there is ample room for the 130-gal. tank between the frames. The coal bunkers, forward of the cab, have a capacity of 540 lb. The tractive power is 2700 lb. A slightly larger engine, for the same gage of track, weighs about 7½ tons and has 6¾x11-in. cylinders. It has the same wheels and wheelbase as the other, but carries more fuel and water, and has a tractive power of 3400 lb. Both engines can traverse curves of 30-ft. radius.

* * *

Independent Electric Hoist Drive

An independent electric-motor outfit has been put on the market by the Mead-Morrison Manufacturing Co., of East Boston, Mass., for hoisting where it is desirable to substitute electric power for steam without discarding old equipment. A base plate carries the motor and two bearing pedestals which support a jackshaft geared to the motor. On one end of this shaft is mounted an automatic band brake, and on the other is a flexible coupling to be connected to the hoist crankshaft. A drum-type controller is mounted on the old hoist frame; instead of the ordinary handle a geared vertical hand-lever is used, working like the old engine throttle.

To connect a steam hoist to one of these outfits, the drive and eccentric rods are taken off the engine, the motor jackshaft and the engine crank-shaft are aligned, and the flexible coupling is fastened to the crank disk.

* * *

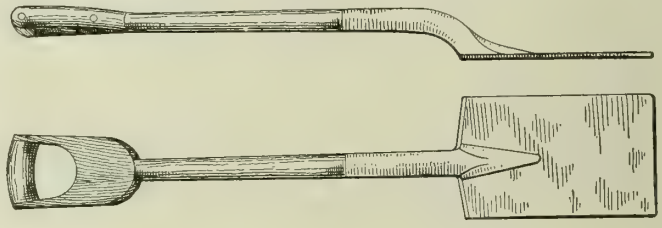
Recording Conveyor Scale

An integrating and recording weighing machine for conveyor systems has been devised by the Richardson Scale Co., of Passaic, N. J., and given the trade name of "Weightometer." There are a pair of weighing levers and a beam similar to those of platform scales, but arranged so that the weighing levers carry a short free section of the conveyor line. The beam also has no ordinary sliding weights but instead an iron cylinder suspended from near the long end and partly immersed in a mercury bath. Change of load on the levers is compensated for by the rise or fall of the float giving a movement of the beam proportional to the load. A totalizer on the beam end is worked by a pulley on the conveyor, so that it combines the number of loads and theoir weights. For cases where it is desired to tare the empty carrier, an automatic counterbalancing attachment is provided. A magnetic counter also duplicates the scale reading at any distant point.

* * *

Spade For Concrete Work

A special shape of spade for working concrete in the forms is shown by the accompanying sketch. It is intended for crowding the aggregate back and allowing the grout to flow against the face of the form, thus giving a dense surface to the finished work. The novel feature of its design is a perfectly straight blade in line with the handle. With this



SPECIAL CONCRETE SPADE

shape there is no liability of clogging by reason of concrete sticking to the spade, and the work is done more easily and effectively than with ordinary spades. The blade is 8x12-in.

This tool was designed by A. H. Bannister, general superintendent of the Brownell Improvement Co. (contractors), of Chicago, after several years' experience with concrete on track elevation and other large construction work. The right to manufacture it has been given to the Conneaut (Ohio) Shovel Co. and it is to be known as the Bannister special concrete spade.

* * *

New Railway Air-Brake System

An attachment to railway air-brake triple-valves, which is claimed to prevent the valve from causing quick action in a service application of the brakes, has been invented by J. R. Schneider and is being manufactured by the Pittsburgh Air Brake Co., 309 Classon St., Pittsburgh. This "no-kicker attachment," as it is called, is applicable to any standard triple valve. According to a paper read by Mr. Schneider before the Air Brake Association on May 6, this attachment, besides eliminating undesired quick action, enables the emergency action to be obtained at any time before or after service application and prevents the emergency action from "dying out" on very long trains.

Besides this device, the company manufactures a car-control valve and an engineer's brake valve. This latter can be used either with present standard automatic air brakes or with electro-pneumatic brakes.

* * *

Non-Corrosive Iron Alloy

An iron alloy resistant to oxidation or corrosion but capable of being machined is being made by the Bethlehem Foundry & Machine Co., South Bethlehem, Penn. The nature of the alloy is not disclosed. The metal for it is supplied by the Lennox Foundry Co., of London, England. Percentage losses of small specimens for 72-hr. immersion in various reagents have been found as follows: 98-per cent. sulphuric acid, 0.02; 1.4 nitric acid, 0.00; 25-per cent. tartaric acid, 0.03; 60-per cent. acetic acid, 0.00; saturated solution sodium hypochlorite, 0.01; 30-per cent. zinc chloride, 0.00; saturated ammonium chloride, 0.01; fused ammonium nitrate, 0.00.

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Sheepshead Bay Motor Racetrack

The 2-mi. wood-paved speedway now nearing completion on the flatlands between Jamaica Bay and Sheepshead Bay, Brooklyn, N. Y., is designed to be the fastest automobile racetrack in the world. The pavement, 70 ft. wide, is of 2x4-in. timbers on edge, laid longitudinally of the track on concrete, or concrete and steel, ribs or girders. Inside of the track is a 6-in. concrete pavement 15 ft. in width on the straightaways, gradually widening to 30 ft. at the middle of the turns. This, however, is a factor of safety and not a part of the racetrack proper.

The outer edges of the 70-ft. track on the two 180-deg. turns are given a maximum superelevation of 25 ft. 6 in., ft. radius, 2095.4 ft. long, with spiral connections to the tangents each 697.04 ft. long. On the straightaway sections the elevation of the outer edge is 1 ft. above the inner edge. The rise from the level of the straightaway to the superelevation of the curves is effected by a 3⅓-per cent. grade with 120-ft. vertical curves at each end. The track layout is given in Fig. 2.



FIG. 1. VIEW OF SHEEPSHEAD BAY MOTOR RACETRACK, LOOKING TOWARD GRANDSTAND AND FINISH LINE

Laying Out the Curves

To make a half-mile curve of steel-work fit together without a hitch required some accurate survey work. It was accomplished as follows: A plan of the curved portions of the track was made showing the deflection angles for the 180-ft. chords of the spiral and the 100-ft. chords of the circular arc in both directions from P.C. to P.T. and from P.T. to P.C. of the outside edge of the track. Each outside spiral had four equal 180-ft. chords. With one 60-ft. chord on the 2260-ft. circular arc it was easily possible to establish the outside curve entirely by angular deflections.

A survey party using a blueprint plan in lieu of notes was started at each end of a curve; the two parties worked toward the middle, met and continued on to check up each other's work. They were required to check on the starting points within ½ in. Transits reading to 20 sec. were used. The tapes for the field-work were first compared with those used by the steel

computed for a speed of 96 mi. per hr. by the common railway formula $C = \frac{dv^2}{gR}$. The width d was taken in five 14-ft. strips, commencing at the inside of the track, and the superelevation computed for speeds of 40, 52½, 65, 77½ and 96 mi. per hr. This gives a cross-section theoretically of a parabolic curve, and in forming the steel ribs by cold-bending a true parabolic cross-section was obtained by rolling each rib to a carefully made wood template.

The length of the track is measured on a line 3 ft. from the inner edge. There are two straightaway stretches of 1790.52 ft. and two turns of 3489.48 ft. each. The turns are divided into circular arcs of 853-

company to lay out the steelwork, and they were found to be the same length. From the hubs thus established the inner edge of the curve was marked by running radial lines to the curve centers, which were established on the ground. The hubs were further checked by measuring the radial distances to the curve centers.

The exact lines of the inner and outer edges of the curved track being thus established, the locating of the ribs or girders was comparatively simple. The spacing of these is 6 ft. 8 in. on the outer line of the curved portion of the track, or three to every 20 ft., and they are, of course, on radial lines. The spacing of the girders on the tangents is 6 ft. 7 in. In the 10,560 ft. of track are 1654 of these girders.

Bringing the Concrete Surfaces to Grade

The concrete girders or walls are 8 in. wide and the foundations in general extend to about 2 ft. below ground level. The concrete was designed to be carried to a maximum height of 6 ft., above which it was estimated that a steel structure would be cheaper. Owing to variations in the ground level some of the concrete girders are higher than 6 ft. on the outer ends. The concrete was mixed 1 : 3 : 5.

The forms were made of old boards and 2x4's in 14-ft. units. The grades of the top of the concrete were established on forms about 40 ft. apart (6 bays), and strings for each 14-ft. width of cross-section were stretched between these to give grade for the tops of intermediate girders. Nailing strips bent to the required parabolic cross-section of the track were then nailed on one side of the inside of the forms and the finished concrete surface was troweled by hand to this template.

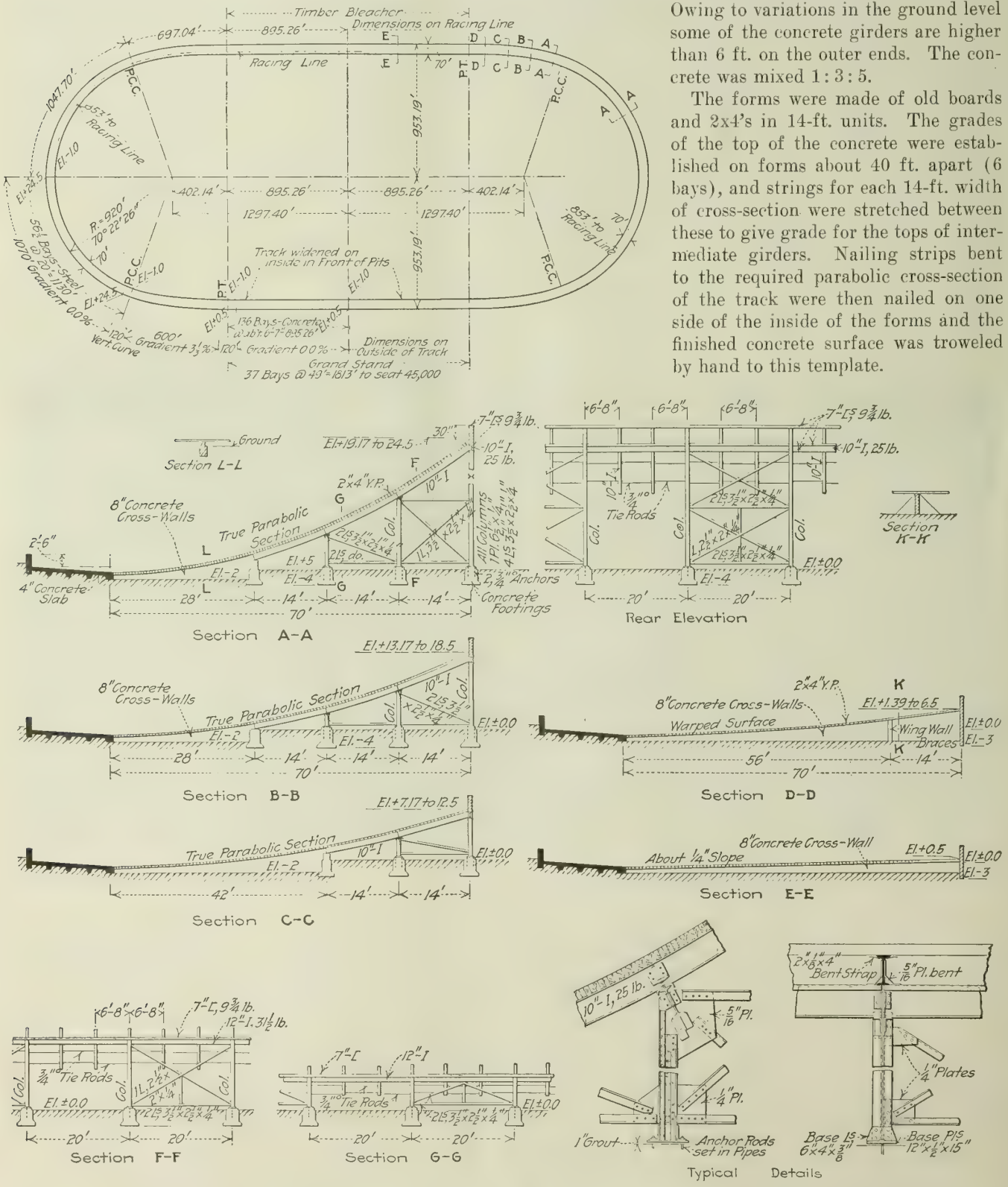


FIG. 2. PLAN AND CROSS-SECTIONS OF SHEEPSHEAD BAY MOTOR RACETRACK, BROOKLYN, N. Y.



FIGS. 3, 4, 5 AND 6. CONSTRUCTION VIEWS OF THE SHEEPSHEAD BAY MOTOR RACETRACK
3—Staking out concrete track supports. 4—Filling concrete forms. 5—Nailing wood flooring. 6—Steel erection

Nearly 1600 tons of steel was used, all of which was erected with a single home-made, horse-operated traveler, shown in Fig. 6. This was designed and built on the job by the foreman of the erection gang, J. R. Ashley. The panels of diagonal bracing came in complete units shop-riveted with ¾-in. rivets. All field connections are bolted with ¾-in. bolts.

The structure is designed to meet the specifications of the New York City building code for a permanent structure. The assumed live-load is of 3000-lb. motor cars on 5x10-ft. wheelbases for the full width of track. An impact allowance of 100 per cent. was made. The steel specifications are the standard of the American Steel Manufacturers Association for manufacture and fabrication.

A view of a part of the completed steelwork is shown in Fig. 7. No difficulties were encountered in erection.

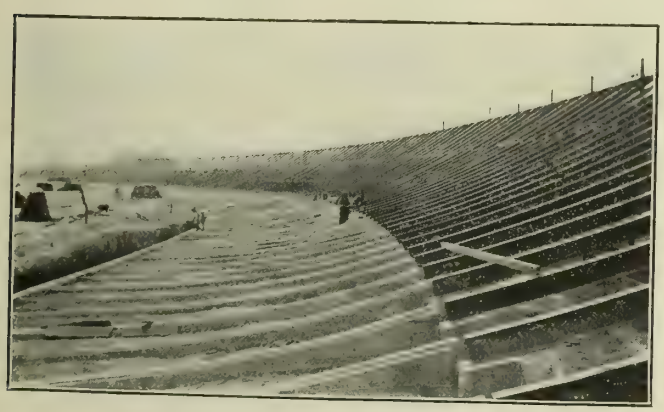


FIG. 7. CONCRETE AND STEEL FLOOR SUPPORTS OR JOISTS

The column pedestals were all accurately located and there was not a single hitch in the erection work. The 2x4-in. floor is fastened to the steelwork by steel angle slips and drift bolts, there being a pair of clips to about each 14-ft. width per panel.

Other Details—Floor, Drainage, Etc.

The 2x4-in. timbers forming the floor are finished on one side and one edge; 16 per cent. were in 14-ft. lengths, 16 per cent. in 16-ft., 18 per cent. in 18-ft. and 50 per cent. in 20-ft. lengths. The intention is to have no single timber which does not rest on at least two supports. The 2x4's are laid so as to have at least 2 ft. lap at adjacent joints and are spiked with 20d. nails about every foot. Traverse expansion and swelling are allowed for by 3-in. open spaces at each edge of the flooring, and about a ⅛-in. space is provided between each timber by leaving the heads of the nails projecting, instead of driving them home. When completed the flooring will be given a paint coat of creosote.

Except where the sandy soil provides sufficient drainage, 8-in. tile drains are laid 2 ft. inside the inner edge of the track. A large number of fire hydrants distributed about the grounds provides ample fire protection.

Entrance to the oval within the track is by means of a concrete-lined subway, the track structure being carried on the concrete walls between passageways. These were built after the practical completion of the track structure.

In front of the grandstand are a series of concrete pits for repairing, oiling and fueling the racing cars. On the opposite side of the track is a subway giving pedestrians access to the timber bleachers from the interior of the oval.

The main grandstand is approximately 1800 ft. long, and is built of structural steel. It has a main deck and a gallery. The timber bleachers are also 1800 ft. long, on the opposite side of the track from the grandstand. These details will be described in subsequent issues of *Engineering News*.

The construction work was started in the spring, and as many as 2000 men have been employed at one time. Little grading was required. On the side near the grandstand there was a cut of 3 or 4 ft. for about 1000 ft., which was done by hand and by small steam shovels. On the farther side was a swamp where a considerable fill was required. Here the column and track foundations are on piles. The track is to be put to use early in October, if the present plans are carried out.

Personnel and Statistics

The track is being built by the Sheepshead Bay Speedway Corporation, of which Everard P. Thompson is manager and vice-president; Blaine H. Miller, formerly chief engineer of the Indianapolis speedway is chief engineer in charge of design and construction, and his principal assistant engineer is H. B. Thorn, in charge of surveys. C. F. Gardner is designing engineer. The general contractor is the Coast & Lakes Contracting Corporation, of New York. The steel is furnished by the Lackawanna Steel Co., and is fabricated and erected by the Lackawanna Bridge Co., of Buffalo, N. Y.

The track structure contains about 3,000,000 ft. b.m. of southern long-leaf yellow pine timber, which cost about $27 per M, and 1570 tons of structural steel at about $57 per ton in place. There are 12,000 cu.yd. of concrete, which cost about $8 per cu.yd.

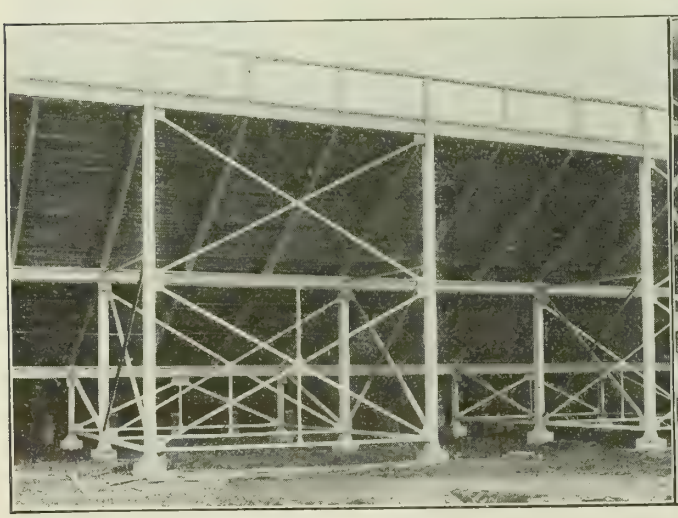


FIG. 8. REAR VIEW OF STEEL FRAME FOR BANKING OF CURVES

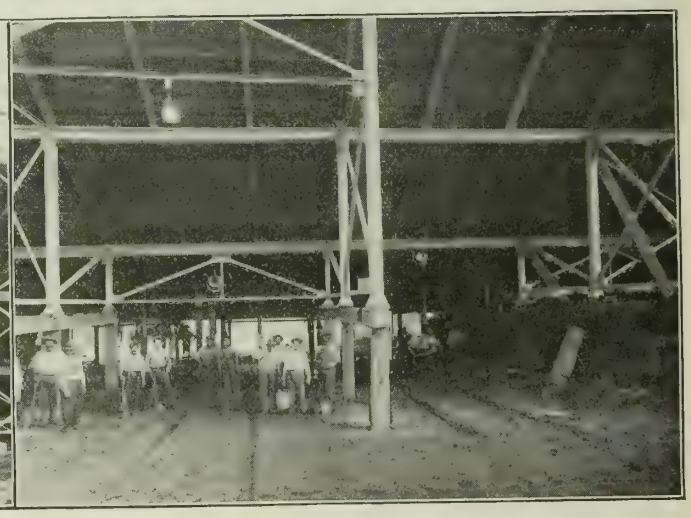


FIG. 9. SUBWAY UNDER TRACK FOR CARS AND PEDESTRIANS, DURING CONSTRUCTION

New Technology Laboratory Plans Announced

In the new buildings of the Massachusetts Institute of Technology, at Cambridge, a space of about 74,000 sq.ft. has been allotted to the civil and mechanical engineering laboratories. These may be divided as follows: Steam, hydraulic, steam-hydraulic machinery, strength of materials, cement and concrete, heat treatment, gas, compressed-air, power measurement and refrigeration. No attempt has been made to keep each section separate from the other sections. While the plans have been made primarily for needs of instruction, there is ample opportunity for research work. The departments of electric engineering, chemistry, mining, physics, and sanitation of course have their own laboratories.

Hydraulic Laboratory

The equipment and arrangement were planned by the mechanical and civil-engineering departments, with the advice of Prof. C. M. Allen, Clemens Herschel, F. P. Stearns, C. T. Main, and Harry Gay. The laboratory occupies the basement and first and second floors of Building No. 7.

In the basement there are about 700 ft. of canals 5 ft. deep. A 5-ft. and a 3-ft. (width) canal leads from a reservoir at one end. The smaller canal is tapped off into two 26-ft. sumps with 16- and 3-in. special filling valves having long conical seats. The canals and sumps are supplied with water from Charles River through a 14-in. cast-iron pipe. The canal discharge is led outside the building and pumped back into the river.

Between the two canals is a 90-ft. weir box leading from a turbine draft chamber and fitted with quieting screens, open and submerged weirs, hook-gage boxes, etc. The draft tube itself, coming down from the first floor, has a 10-ton gridiron valve with adjusting cutoff grid for holding draft-tube water-level at any desired height.

Hydraulic Machinery

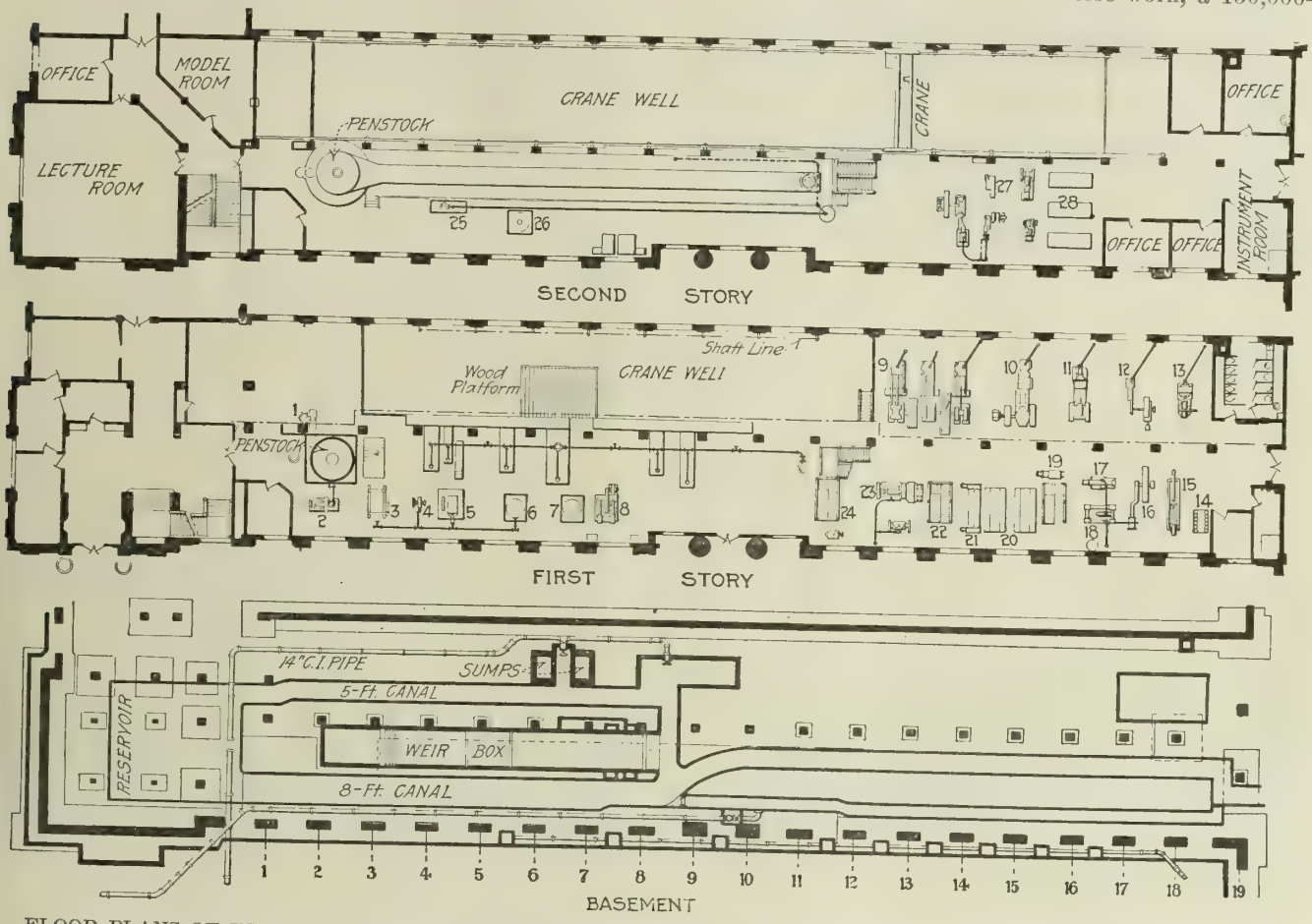
The basement also has a motor-driven rotary pump of 1000 gal. per min. capacity supplying a 5x32-ft. pressure tank carrying up to 500 lb. per sq.in. and a similar low-pressure tank good for up to 80 lb. These tanks are for determining the flow from orifices and nozzles.

For supplying water under pressure for the general hydraulic experiments there will be three triplex pumps, two steam-driven centrifugals, a large engine-driven centrifugal, an underwriter's fire pump and two duplexes. All are cross-connected except the large centrifugal pump, so that one or all may be used. This machinery is in the basement.

For the measurement of large quantities of water—up to 8000 gal. per min—there are two 10x10-ft. cali-

brated open tanks, provided with gage verniers, shifting entrance gates and 10- and 15-in. hydraulic valves. Overhanging the calibrated tanks are two long chutes with weir boxes, taking water from nozzles, orifices and small wheels on the floor above. On the first-floor level is a wooden platform over the sumps, on which pulsometers aid similar apparatus may be tested with various friction depths.

Rising up through the first floor is a 12-ft. steel cylinder used as a penstock for a turbine placed 8 ft. above this level and discharging into the large basement weir box.



FLOOR PLANS OF HYDRAULIC AND STEAM LABORATORIES, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Machinery shown as follows: (1) 50-hp. motor, (2) Trump turbine, (3) (4) (5) impulse wheels, (6) (7) pressure tanks, (8) two-stage compressor, (9) Allis engine, (10) McEwen engine and generator, (11) Mackintosh & Seymour engine, (12) Corliss engine, (13) Curtis turbine, (14) air-storage tubes, (15) (17) (18) (19) air compressors, (16) Brown engine, (20) indicator tables, (21) Alberger condenser, (22) (23) Westinghouse engine, (24) launch engine, (25) hydraulic ram, (26) high-pressure tank, (27) small engines, (28) work benches

There are here also three impulse wheels discharging into the basement weir boxes.

On the second floor is a 5x5-ft. steel canal, 135 ft. long, supplied through a 30-in. Venturi meter and stilling cone from the large centrifugal pump in the basement. This canal supplies the turbine penstock.

A 10-ton electric traveling crane runs along the ceiling of the second floor and half of the first and second floor is cut away for a length of nine columns to form a three-story crane well, into which a dray can be backed on the basement floor.

Testing-Materials Laboratory

The laboratory for the testing of materials is located in Building No. 5 (adjoining the hydraulic laboratory on the south). This laboratory occupies the whole of the basement and first floor and two-thirds of the second and third floors. In the basement is a laboratory for cement and sand accommodating twelve students. Here is a 50,000-lb. compression machine and space for mixing and storage rooms. The mixing space is served by a 10-ton crane, and has in it a mixer, bar bender, and form and material storage bins. Much of the space in the basement is taken up by foundations for heavy testing machines above and by machines for testing road materials.

On the first floor are the following machines: A 400,000-lb. universal Riehle, a 1,000,000-lb. Amsler-Laffon hydraulic compression, a 300,000-lb. Emery, a 200,000-lb. Olsen with extensions for transverse work, a 150,000-lb. rope tester, and a 100,000-lb. beam machine. All of these are served by a 10-ton crane. The rope machine has a special 2-ton traveler.

Many of the small testing machines are on the second floor, including the following machines: Three vertical and one horizontal wire, a wire-tension, a 20,000-lb. Riehle, a 50,000-lb. hand Olsen, a large, a medium and a small torsion machine, a 1000-lb. universal Riehle, and two 100,000-lb. universal Olsens. A removable floor allows access for the cranes to the several floors and basement. Travelers are placed above all of the larger machines.

On one side of the third floor are three 75,000-lb. universal machines with overhead travelers. A cold bending machine, two machines for transverse tests on cast iron, an oil tester and several repeated-stress machines. On the other side of the same floor is a laboratory for heat treatment of steel, containing furnaces, pyrometers and tempering baths, grinding room, etc.

Rebuilding the Omaha Water-Intake Cribs

By Geo. T. Prince*

SYNOPSIS—The timber and stone face walls of the twin intake cribs of the Omaha water-works have recently been faced and extended with a reinforced-concrete wall. A novel feature of the work was the formation of a coffer-dam, which was built into the lower part of the wall, by means of what were, for convenience, termed steel boxes. These boxes were composed, front and back, of interlocking steel piles sawed lengthwise, and on the sides, of steel lattice work, as described below. It may be added that these intake cribs are located on or near the shore line, instead of in the river.

The Metropolitan Water District of the City of Omaha supplies water for public and private use to Omaha, South Omaha, Florence, East Omaha and Dundee, having a total population of about 175,000. The source of the supply is the Missouri River at Florence, Neb., located about seven miles north of the business center of Omaha.

Water is passed through a series of coagulating and settling basins having a combined storage capacity of about 68,000,000 gal.[1] Sulphate of alumina and lime are used as coagulants, and before delivery into the supply mains, the water is treated with chlorine gas. The Florence Station, including the settling basins, was first used in 1889. The intakes at the river then consisted of two timber cribs (Figs. 1 and 3) of rectangular construction and dimensions sufficiently large to accommodate two 48-in. suction mains in each crib. Over each crib a building was constructed, in which were located the screens and necessary hoisting apparatus.

The walls of these intake cribs were built of timbers of large dimensions, well fastened together by iron drift bolts. The outer walls, next to the river, were extended as retaining walls along the river front, both above and below the two intake cribs, for a total frontage of about 180 ft., being back-filled with rock and earth and reinforced against overturning into the river by heavy horizontal iron rods extending well into the filled material and secured to suitable anchors imbedded therein.

The outer, or river, face of this timber retaining wall was covered with ¼-in. iron plates securely bolted to the timber backing, as is shown in Fig. 5.

In 1914 it became evident that this timber retaining wall, as well as a large portion of the crib walls, would have to be replaced. The river at this point is about 1100 ft. in width; the bed of the river is of limestone which slopes gradually from the intakes to the north, south and east.

At the intakes the rock bed is practically at zero elevation, or city datum. The water in the river ranges between El. 7 and 24 ft., and for approximately eight months of the year, it is at about El. 13.

To make this reconstruction of a permanent character, reinforced concrete was adopted. Careful soundings along the retaining walls showed that the bed of the river was a water-swept rock bottom and practically level. Briefly, the method followed in rebuilding the intakes may be described as follows:

A row of 1½-in. holes was drilled into the rock bottom to a depth of about 6 ft. These holes were spaced about 4 ft. apart and extended in a line parallel with the timber retaining wall and about 6 ft. from the same. Into these holes were sunk 1¼-in. iron rods, having a length of about 12 ft.; hence the tops of these rods, when sunk to place, were about 6 ft. above the rock bed of the river. The space around the rods was filled with grouting applied through pipes extending above the surface of the water.



FIGS. 1 AND 2. ORIGINAL AND RECONSTRUCTED CRIBS OF OMAHA WATER-WORKS AT FLORENCE, NEB.
1—Original timber and stone cribs. 2—Reconstructed cribs with reinforced-concrete walls

Second-hand 12-in. steel sheetpiling was sawed into 15-ft. lengths. Each pile was then sawed along its longitudinal axis, and the ball half riveted to a ¼-in. steel plate, 4 ft. wide and 15 ft. long. The socket half of the pile was riveted to the other side of the steel plate, thus forming a pile about 4 ft. 7 in. in width, over all, and 15 ft. long, the steel plates constituting the web of the pile.

Two of these sheets or piles were placed 4 ft. apart and connected with lattice bars, thus forming a box approximately 4 ft. square. (See Section *AB*, Fig. 3, and the view, Fig. 4.)

These boxes were sunk to the rock bottom, one of the iron anchor bolts, above referred to, being practically in the center of each box. Each section, or box, having its

*Chief Engineer, Metropolitan Water District of the City of Omaha, Neb.

[1]A basin now under construction will increase the capacity to 82,000,000 gal.

ball connection, was entered into and secured to the next box by the companion socket connection. When this row of steel boxes had been sunk in proper line, the boxes were filled with concrete, thus making a coffer-dam of concrete, 4 ft. thick and 15 ft. high, extending along and parallel with the old timber retaining walls and leaving a 4-ft. open space between the steel boxes and the timber retaining wall. This space was filled with concrete, but before the concrete was placed a row of 1½-in. holes was drilled into the rock bottom and along a line parallel with and about 1 ft. in front of the old timber wall. These holes were spaced from 2 to 4 ft. apart, dependent upon the character of the filling behind the old timber wall some of this filling being of large stone extending back more than 20 ft.; hence, the new wall did not require so much steel reinforcement to resist overturning into the river. Into these holes 1¼-in. iron rods 12 ft. in length were grouted in a manner similar to the rods referred to in anchoring the steel boxes.

The steel boxes near the end of the timber wall were drawn in toward the wall, thus forming a triangular structure, and were secured by suitable anchor bolts embedded through the old walls and extended into substantial filling to a good firm anchorage.



FIGS. 4 AND 5. STEEL-BOX INTERLOCKING PILES, OMAHA WATER-WORKS INTAKE WALL

4—Lowering one of the boxes to place. 5—Top ends of several boxes in place. See Section AB, Fig. 3, for position of boxes in finished wall

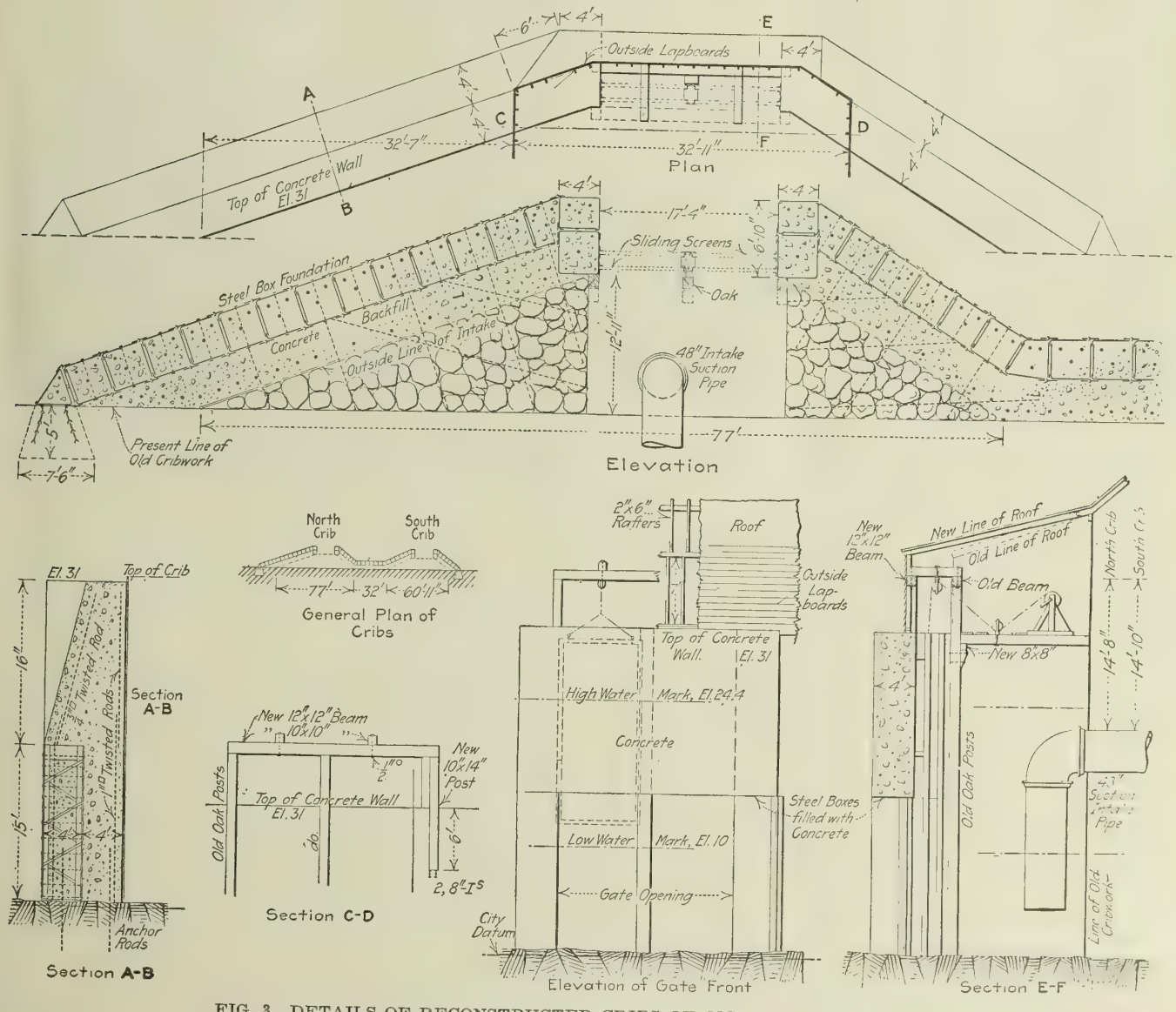


FIG. 3. DETAILS OF RECONSTRUCTED CRIBS OF OMAHA WATER-WORKS

The general layout is shown by the small sketch plan. The details relate to the north crib

With the boxes filled with concrete, there was formed a wall having a vertical face extending 15 ft. above the rock bottom. From this point the wall was extended for a distance of 16 ft. above the top of this box or 31 ft. above the rock bottom. The back face of the wall is vertical (see Section *AB*, Fig. 3). The wall has a width of 4 ft. on the top and is battered 4 ft. on the front or water face, from the top, for a vertical distance of 16 ft., so as to meet and conform with the front or river top of the steel boxes. Thus, the section of the completed wall is 4 ft. at the top at El. 31 ft. above river bottom, 8 ft. at El. 16 ft. below the top, or 15 ft. above river bottom, and 8 ft. at the river bottom.

Suitable openings were left for the admission of water into the intakes, with channel bars well anchored into the jams or sides of these openings for placing a portion of screens, over which were built brick houses.

The mixture of concrete used was 1:3:5. Much of the stone, however, was of large size, especially in that portion between the old wall and the steel boxes. A considerable portion of the filling was removed from the rear of the old wall and replaced by cyclopean masonry, which was possible after the construction of the coffer-dam formed by the steel boxes and filling.

It should be noted that conditions were very favorable for the type of construction which has been described.

Automatic Block Signals for Single-Track Railways

A special railway-operating condition which block-signaling is being introduced to meet is that of single-track lines carrying heavy traffic. Increasing the number of passing tracks may enable the number of movements to be increased, but with additional delay. The construction of a second track will both facilitate movements and eliminate the delays, but at very considerable cost. The introduction of the automatic block-signal system increases the facility and safety of operation at comparatively light cost, and greatly reduces delays, while it is quite conceivable that under some conditions it may so increase the capacity as to postpone the necessity for double-tracking.

One development of automatic-signaling equipment is designed to give special increase in facility of handling heavy traffic. Under this system each block (extending between two passing sidings) is subdivided by means of intermediate signals in such a way that two or more following trains may proceed through the block at one time (all under protection of the signals), while no opposing train can advance until all the other trains have cleared the block.

The system is "permissive block" in that it allows two or more trains (moving in the same direction) to occupy the block between sidings. The intermediate signals may be either absolute or permissive as prescribed by the rules of the railway. That is, the "stop" indication may mean "stop and stay until the signal indicates proceed," or "stop and then proceed under control." This is known as the absolute-permissive automatic block system, and the installations described below have been made by the General Railway Signal Co., of Rochester, N. Y.

The St. Paul and Duluth line of the Northern Pacific Ry., 163 miles in length, has a very heavy traffic for single-track, and the heaviest traffic occurs when weather conditions are unfavorable. The largest part of the traffic is in coal, and this is moved in greatest volume during the four months from November to February, at which time low temperatures prevail and storms are frequent. While the limit of single-track capacity had not been reached, and double-tracking was not an imminent necessity. It was desirable to increase the facility and safety of operation on this division.

One method of relief would have been to introduce the manual block system; but experience with this has not been favorable on the Northern Pacific Ry., where it has now been displaced almost entirely by the automatic block system (which aggregates 680 mi. of single track and 1180 mi. of line). As stated by officers of the railway, it has been found, so far as this railway is concerned, that the saving due to the reduction in the force of manual operators when the automatic system is installed is sufficient to pay for the maintenance of the latter. The decrease in pay of overtime to train crews due to the expedited train movements is found to pay for the interest on the investment in the plant, while the increased safety (which is considered to be beyond doubt) is obtained without cost. The officials are strong believers in automatic block signaling and consider that they are justified in adopting it for other reasons than that of merely increasing the traffic capacity.

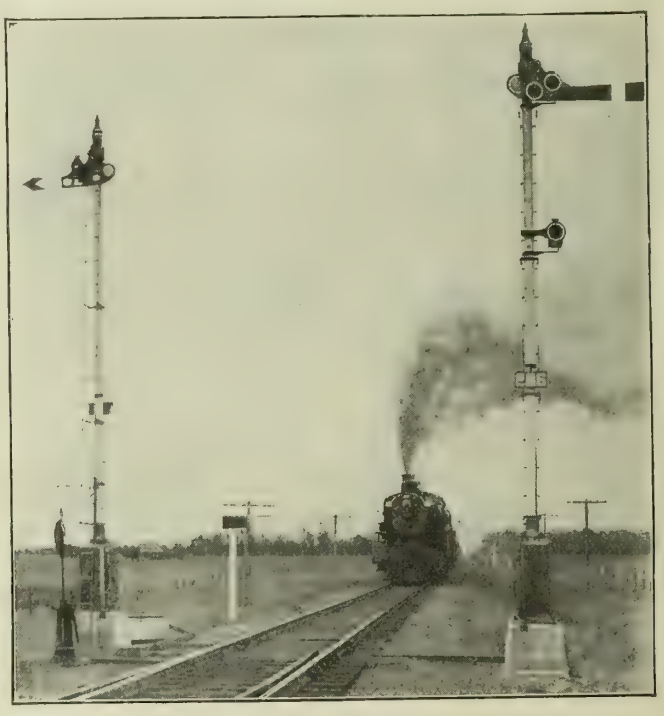


FIG. 1. AUTOMATIC BLOCK SIGNALS ON SINGLE-TRACK LINE; NORTHERN PACIFIC RY.

The entering signal at the left, governing the approaching train, is a "permissive" signal. Its position indicates "stop and then proceed into the block under control." The leaving signal at the left, governing opposing trains, is an "absolute" signal. Its position indicates "stop and remain until signal changes to indicate proceed"

The installation on the St. Paul & Duluth line covers a distance of 146 mi., and has a total of 236 signals. At each end of each siding are two signals—the leaving signal, which controls movements into the block (say *B* to *C*), and the entering signal, which controls movements into the adjacent block (say *B* to *A*). The former is an absolute or stop-and-stay signal, distinguished by a square-end blade and a fixed red marker light vertically

below the main signal light. The entering signal is a permissive or stop-and-proceed signal, distinguished by a pointed blade. On some roads it has also a fixed red marker light below, but to the left of, the main signal light. This is not used on the Northern Pacific Ry.

The equipment at one end of a siding is shown in Fig. 1. At the right is the leaving absolute signal, in the "stop" position, and below it is the marker lamp. This signal indicates only "proceed" or "stop until signal clears." At the left is the permissive signal in the position indicating "stop and proceed." The approaching train will come to a stop and then proceed under control (as prescribed by the rules), prepared to find the block occupied or the track otherwise obstructed (by misplaced switch, broken rail, etc.). The intermediate signals are similar to the entering signal.

For opposing movements, the control of an absolute or leaving signal, and also the control of intermediate signals governing movements in the same direction, extends to the opposing leaving signal (at the other end of the block), and is effected by the track circuits. For following movements the control of all signals extends from signal to signal. For such movements the signal indicates "caution" if the next section of the subdivided block is clear and "proceed" if two sections of the block are clear. The signal indications are as follows: (1) "Stop and proceed," horizontal arm, red light; (2) "proceed but prepare to stop at next signal," arm inclined 45 deg., yellow light; (3) "proceed," arm vertical, green light.

The Lehigh & Hudson River Ry. has installed a similar block-signal system for about 72 mi. on account of heavy freight traffic and the necessity of providing for fast passenger service. The question of double-tracking had been considered, but it was felt that the limit of single-track capacity had not been reached, even without the use of signals. High-speed passenger trains had to be operated at night, however, and it was considered undesirable to handle such traffic without the protection of automatic signals, so that the signal installation was made primarily to protect and secondarily to facilitate the movement of traffic. The traffic averages 42 trains daily.

The installation is similar to that of the Northern Pacific Ry., but with some modifications. The absolute leaving signals are identical with those described in the foregoing, and one is shown at the left in *A* (Fig. 2). The permissive signal at the entrance to the block, however, serves also to govern movements into the siding. For this purpose it has a second (and lower) arm to indicate the position of the switch. This is shown at *A*, in Fig. 2. The arm is horizontal or inclined upward 45 deg., according as the switch is set for the main track or the turnout. The intermediate signals are shown at *B*.

The ordinary permissive signal at the "stop and proceed" position requires a train to come to a full stop before proceeding; but where the signal is on an ascending grade this might interfere with train movements due to the difficulty and delay of starting a heavy train on the grade. To meet this condition the signal at such a point is provided with a second (lower) arm, as shown at *C*, in Fig. 2. This arm is horizontal when the main (upper) arm indicates "proceed," but is inclined upward 45 deg. when the main arm indicates "stop and proceed." This special cautionary signal (known as a tonnage signal) permits the train to proceed slowly under control.

The control of the signals is as previously described. To provide against trains meeting at a siding and both being held by "stop" signals, the circuit for the entering signal at each end extends to the far end of the track circuit beyond the leaving signal at the opposite end. This overlap affords increased safety at meeting points. Opposing trains approaching a siding simultaneously would find the entering signals at the "stop" position, but as these signals are permissive, both trains can proceed slowly or under control after coming to a stop.



FIG. 2. AUTOMATIC BLOCK SIGNALS ON THE SINGLE-TRACK LINE OF THE LEHIGH & HUDSON RIVER RY.

A—Signals at end of block. At the right is the permissive entering signal, its inclined upper arm indicating "caution." The lower arm relates to the passing siding and indicates that the switch is set for the main track. At the left is the absolute leaving signal governing opposing trains. B—Intermediate signals, governing movements in opposite directions. C—Tonnage signal, installed where the intermediate signal is on a grade. It permits an ascending train to proceed slowly without coming to a dead stop when the signal indicates "stop"

A Variable-Capacity Hotel Sewage-Treatment Plant

By George L. Robinson*

To meet both an increased quantity of sewage and the demands of the State Department of Health some interesting additions have recently been made to a small plant built years ago to treat the sewage of the Buck Hill Falls Hotel & Cottage Community, at Cresco, Penn. Two new and larger settling tanks have been built and a sludge-and-scum-digestion tank, a sprinkling filter and a secondary settling tank have been added. The works are so designed that units may be cut out or cut in, as may be needed to meet seasonal changes in the hotel population.

The daily sewage production varies from about 2000 gal. in January to over 100,000 gal. in July and August. The sewage is carried through a 6-in. vitrified sewer from the buildings for a distance of about ¾ mi., with a fall of over 100 ft., to the site of the plant.

The original plant, which has been outgrown, consisted of a 5000-gal. stone-masonry settling tank, a 4000-gal. automatic-dosing siphon chamber, and seven sand beds controlled by gate chambers, the total area of the sand beds being 0.9 acre.

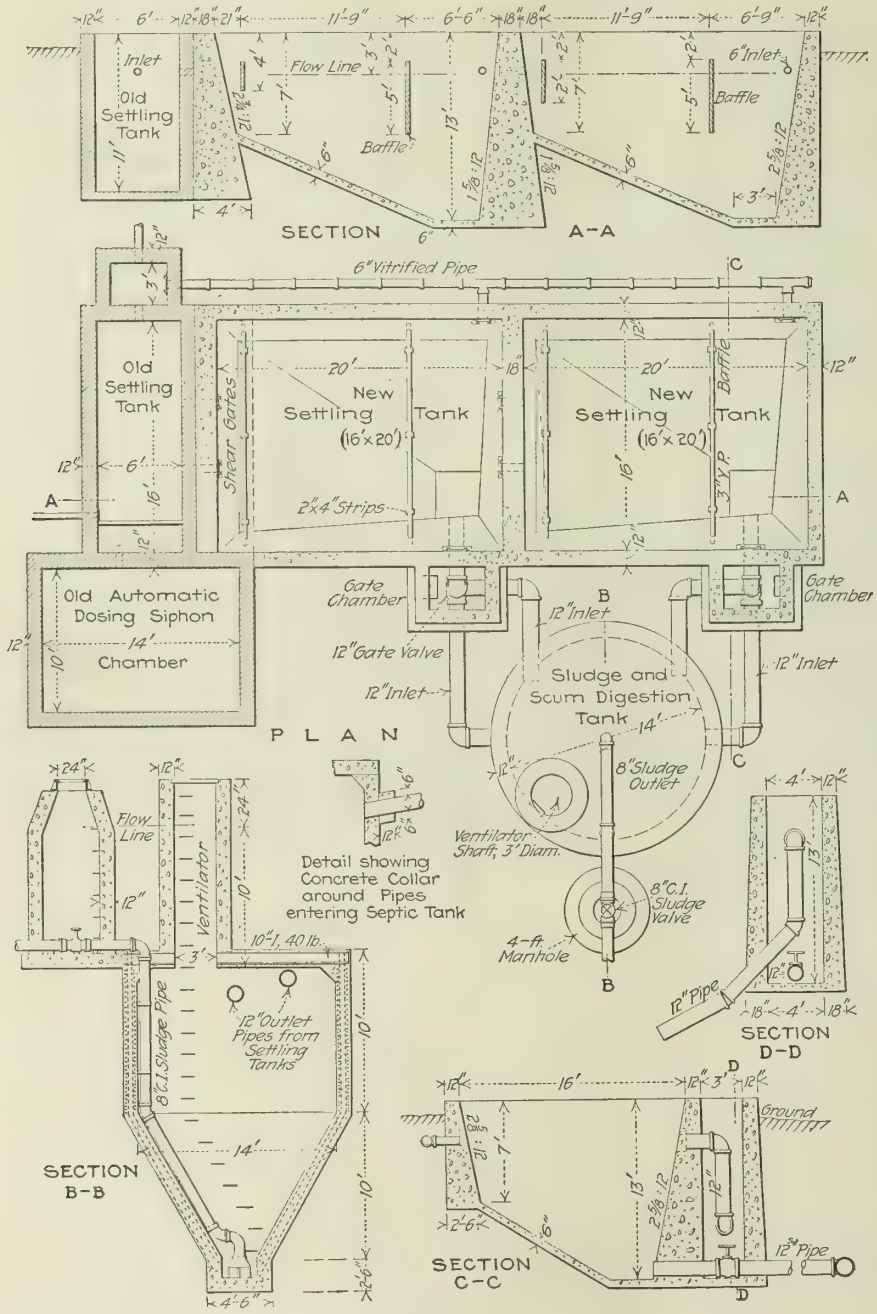


FIG. 1. OLD AND NEW SEWAGE-SETTLING TANKS FOR BUCK HILL FALLS INN, CRESCO, PENN.

Old and New Settling Tanks

The Pennsylvania State Department of Health ruled that the period of retention in the tanks should be at least 6 hr. As the existing tank holds 5000 gal., the plant was designed so that two new tanks would act in conjunction with it, the idea being that the old tank would receive the sewage produced from the winter population, which might run from 0 to 150 persons. This would give a period of retention of 6 hr. for a maximum of 5000 gal. at the rate of 15,000 gal. per day of 24 hr.—that is, 10,000 gal. during the daytime and 5000 gal. at night. The second tank (new) will give a period of retention of 6 hr. for 15,000 gal. at the rate of 45,000 gal. per day of 24 hr.—that is, 30,000 gal. during the day and 15,000 gal. at night, taking care of a population of 450 persons. The third tank will act in a similar manner and the three together will take care of a population of 1050 persons, allowing a period of retention of 6 hr. and assuming 100 gal. per person per day.

The existing settling tank is 16 ft. long, 6 ft. wide and 8 ft. deep at the lower end. The new tanks are each 20x16 ft. in plan, with battered walls of concrete, as shown by Fig. 1. The floor and walls pitch sharply to one corner where the maximum depth of 10 ft. is reached.

The sewage enters each tank at the flow line, where the flow is regulated by a shear gate. Each tank is subdivided by means of two creosoted-plank baffles. At the low-level point of the floor a 12-in. iron draw-off pipe leads to the digestion chamber through the manhole outside, and at a point directly above, 12 in. below the flow line, another draw-off pipe, controlled by a shear gate, leads to the manhole. These pipes permit the withdrawal of floating scum on the top or sludge on the bottom of the settling tanks, as each tank is provided with these pipes.

The digestion tank is a circular reinforced-concrete structure 14 ft. in diameter and 22 ft. deep at the maximum. There is a reinforced-concrete roof through which a gas vent manhole rises to a point 2 ft. higher than the flow line in the adjacent settling tanks. An 8-in. cast-iron sludge pipe extends from the bottom of

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the digestion tank to a valve manhole where an 8-in. gate valve is placed.

It is proposed to draw the scum and sludge from the two settling tanks to the digestion tank, so that the theory developed in the Imhoff tank system may be closely approached for the disposal of sludge, at the same time taking advantage of the removal of the floating mat directly to the digestion chamber.

It will be observed that by keeping the valve in the sludge manhole closed and opening the valves from the settling tank it will be possible to develop a head which will permit the removal of sludge by closing the valve at the settling tank and opening the valve at the manhole beyond the digestion tank. This operation permits the digested sludge at the bottom to pass off to the drying bed beyond. The amount of sludge removed will equal the capacity of the gas manhole from the valve level to the flow line. In this way only digested sludge at the bottom will be removed, and with each discharge new scum may be drawn in from the settling tanks. It is expected to operate at frequent intervals, thereby keeping the settling tanks free from gasification and promoting digestion in the sludge tank.



FIGS. 2 AND 3. SPRINKLING FILTER FOR BUCK HILL FALLS INN SEWAGE-WORKS

Fig. 2—Feeder pipe on piers and nozzle-feed pipes with valves. Fig. 3—Nozzle-feed pipes, nozzles and underdrains

Sprinkling or Percolating Filter

The sprinkling filter has an area of approximately $^1/_{18}$ acre and will receive sewage at the rate of 1,800,000 gal. per acre per day, or 300,000 gal. per day per foot of effective depth. It consists (Figs. 2 and 3) of 3-in. broken stone, 5 to 6 ft. in depth, upon a 6-in. concrete floor, sloped for drainage. The underdrains are 12-in. half tile placed side by side the full length of the bed. The stone is allowed to take its natural slope on the outside—about 45 deg. Taylor hexagonal spray nozzles are used. They are 8⅔ ft. c. to c., and are underfed by 4 in. galvanized-iron pipe, which is supported on cast-iron saddles in 2-in. galvanized pipe brought up from the concrete floor. Each of the eight lines of distributing pipe heads in an 8-in. wrought-iron feed pipe. The supply to each 4-in. pipe is controlled by a valve.

Secondary Settling Tank

Beyond the sprinkling bed will be a resettling chamber of concrete, 20 ft. long, 15 ft. wide and 5 ft. deep, arranged with baffles so as to prevent the passing of floating humus.

It is proposed to operate the plant during the late fall, winter and early spring—when the population is at a minimum—with the present settling tank and sand beds. When the rate of 15,000 gal. per acre on the sand beds is reached the new settling tanks and sprinklers will be put in operation.

This plant was designed by Robinson & Wagner, Consulting Engineers, New York City. It was constructed by Charles N. Thompson and Harvey R. Springer, of the Buck Hill Falls Co., Cresco, Penn.

Tension Rivets Successful

Referring to the discussion current in *Engineering News* on the use of rivets in tension, their successful tensile service in New York Central railway bridges is brought to mind by C. R. Hill, of the bridge engineering department of that road.

It was common practice on the New York Central years ago to design railway bridge floors with sole reliance on rivets in tension to carry the floor. A typical case is bridge 660, crossing the Erie Canal at Newark, N. Y., built in 1863 and replaced in 1901. It was a 154-ft. double-track span of three trusses 16 ft. on centers, panel-length 6 ft. 8½ in. The floor consisted of 9-in. 30-lb. I-beams spaced about 27 in. on centers, *placed under the lower chord* and fastened by 1-in. rivets (in tension) through the horizontal leg of the chord angle and the top flange of the I-beams. Without impact, and assuming a reasonable distribution of the load, the computed stress on these rivets was about 6000 lb. per sq.in.

Further bearing on the same matter is the fact that cantilever brackets on many highway bridges, and practically all such brackets in buildings, depend on rivets in tension. Mr. Hill cites tests on rivets:

> Tests have shown that the strength of the head is greater than the tensile strength of the shank; such tests were conducted by W. B. Petch, United States inspector of hull material ("Scientific Facts of Rivets," published by the Champion Rivet Co.), and by the German Government ("Der Eisenbau," 1912). The writer has recently made a number of laboratory experiments which confirm the results of the above tests whenever the material connected did not fail before the rivets, and found that rivets developed a tensile strength commensurate with that of the rod from which they were made.
>
> The writer does not advocate the use of rivets in tension when avoidable, but believes that when it is necessary to use them in this service they can be designed to carry their respective loads with safety.

Coast Erosion and Protection on Long Island and New Jersey--I

By Gerald O. Case*

First of three articles on the general problem of coast erosion and protection, with special reference to the coasts of Long Island and New Jersey, where in recent years the damage to beach and beach structures has been so great as to demand immediate attention. The author is an English engineer who has for years specialized in the subject and who has written several authoritative textbooks upon it. He has been for several months past studying the problem presented by the Atlantic coast of the United States.

SYNOPSIS—Analysis of the causes of the littoral drift of sand along the coast, which is the primary manifestation of the erosion of the shore line. Study of the direction of this drift first on Long Island and next on New Jersey coasts. Cause of formation of sand spits and islands.

Littoral Drift

In recent years a very considerable amount of erosion has taken place on the New Jersey and Long Island coasts, resulting not only in the destruction of valuable property but also in the deterioration of the harbors. The material thus eroded is transported along the coast, accumulates inside the natural harbors and forms bars, which obstruct the entrances to the harbors, to the serious detriment of navigation. A careful study of the causes of littoral, or alongshore, drift is essential in order to enable engineers to design suitable works to combat the erosion and improve the harbor entrances and bathing beaches. In this article the subject of littoral drift will be considered.

Sources of Material Supply

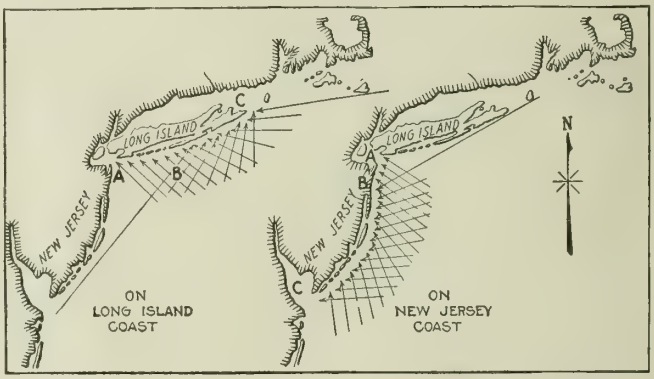
It may be stated as a general principle that the land is the only source of supply of material on these coasts. Numerous writers have expressed a doubt as to whether the vast deposits of sand, found on so many parts of the world's shoreline, are of recent formation. It is probable that at the breaking up of the glacial period the rate of sand formation was much greater than it is now.

At the present time sand and shingle are being formed by the erosion of the coast and attrition of detritus, and from the land surface by subaërial agencies. Attrition is constantly reducing the size of particles on the sea coast; but when the particles have reached the size of sand, attrition is then an almost negligible factor. This may be partly due to the particles being separated from one another by a thin film of water which prevents contact when in motion, or to the reduction of the violence of impact due to their very small mass. A balance may be struck when the particles are reduced to such a size that the impact is unable to disintegrate the material.

Subaërial agencies—wind, rain, frost, chemical action and running water—have a very powerful effect in eroding the land surface, and large quantities of silt and sand are transported from the land to the coast by rivers.

Littoral Drift Caused by Tidal Currents

The main currents produced by tidal action usually run parallel to the New Jersey and Long Island coasts, except close to the entrances to the inlets, where the flood current sets onshore and the ebb current offshore. In the last edition of the United States Coast Pilot it



FIGS. 1 AND 2. DIRECTION OF PREVAILING OBLIQUE WAVES ON COASTS OF LONG ISLAND AND NEW JERSEY

is stated that observations made between Nantucket and Cape May have developed the existence of weak tidal currents, veering round the compass, accompanied by a general drift southwestward amounting to about 7 mi. in 24 hours. The flood and ebb currents have, as a rule, nearly equal and very small velocities along the open coast, their velocities only becoming comparatively rapid at the entrances to the tidal inlets.

In the middle of the passage between Block Island and Montauk, at the northeast end of Long Island, the maximum surface velocity of the flood is about 2.5 ft. per sec. and of the ebb nearly 3.3 ft. per sec. Approaching New York harbor bar from the seaward the surface velocity of the flood current rarely exceeds 1.7 ft. per sec.; but the ebb current from the harbor, owing to its being reinforced by the river water, is about 10 per cent. more than the flood current, except near the Coney Island and Sandy Hook shores, where the velocities are about equal. At the Swash, Main and Gedney channels, at the entrance to New York harbor, the maximum surface velocity of the westerly flood current is 1.7 ft. per sec. and the easterly ebb current 2.1 ft. per sec. The flood current flows from two hours after low water to about high water and the ebb current from one hour after high water to one hour after low water. Assuming the bottom velocities to be about 80 per cent. of the surface velocity—and experience has shown this to be so for moderate depths—then even at the entrances to

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the wide inlets, where the currents are obviously swifter than along the open coast, the observed maximum velocities are only sufficient to move sand on the bottom by the formation and forward movement of sand ripples. A bottom velocity of about 2.4 ft. per sec. is necessary to destroy the sand ripples and move the sand in a continuous sheet.

Transportation of sand by currents with bottom velocities between 0.85 and 2.4 ft. per sec. takes place at a very slow rate. Experiments made by G. F. Deacon[1] showed that with a surface velocity of 1.5 ft. per sec. the velocity of motion of the sand was only $^1/_{2160}$ part of the surface velocity of the current, and at a surface velocity of 2 ft. per sec. the ratio was reduced to $^1/_{480}$.

Where there is a narrow inlet on the sandy beach and a large harbor or tidal reservoir, as is found in a number of places on the New Jersey coast, the tidal currents landward and seaward will have greater velocities near the entrance than at a wider entrance like New York harbor. In such cases the velocity of both flood and ebb is no doubt sufficient to move sand in a continuous sheet. As is well known, the transporting power of the ebb current through a narrow harbor inlet will exceed that of the flood owing to the gradient of the shore and the ebb being reinforced by land waters.

On the open coast the alongshore tidal currents oppose one another as transporting agencies, and owing to the gradient of the shore the tendency must be for material to move seaward.

There is little doubt that tidal currents along the open coasts of New Jersey and Long Island, unaccompanied by wave action and wind currents, have little direct effect in causing littoral drift, their chief effect being to transport material previously suspended or disturbed by wave action.

Littoral Drift Caused by Wind Currents

During gales wind-formed currents are created; and in tidal seas it is often difficult to separate the effects of such currents and tidal currents. In the author's opinion the effects of the wind-formed currents have been often underestimated. Many of the important shore features ascribed to tidal action by hydraulic engineers are produced on the shores of lakes and tideless seas by wind action alone. During gales alongshore wind-formed currents, especially when reinforced by tidal currents, have a powerful effect in causing the alongshore movement of sand and silt stirred up by breaking waves.

Littoral Drift Caused by Wave Action

Waves caused by an onshore wind which strikes the shore at right angles to the coastline do not themselves cause any alongshore movement of material, but owing to there being a surface current landward and a compensating undertow seaward, onshore winds cause the shore to be flattened out by dragging down material in a seaward direction. Waves which strike the shore at an oblique angle have, however, a very powerful influence in causing littoral drift. When an oblique wave breaks, the u. sh travels up the shore at an angle. The velocity may be considered as the resultant of two components—one at right angles to and one along the shore. When the oblique wave travels up the beach the velocity at right angles to the shore is gradually destroyed by gravity, while the other component is unaffected, except by friction, the result being that a particle of sand or shingle is carried up in a curved path and down again; the individual path of each particle being approximately parabolic, such as is described by a projectile thrown at an angle into the air. Hence oblique waves cause a travel of material alongshore. The more oblique the impact of the breakers is to the coastline, the more powerful is their effect in causing littoral drift. The power of oblique waves to transport material alongshore is also dependent on the strength of the wind and the fetch or distance of open sea across which the wind blows before reaching the coastline.

In considering the movement of material by wave action it is important to keep in mind that the transporting power of waves rapidly decreases as the depth of water and distance seaward of low water increase.

After carefully studying the conditions on the New Jersey and Long Island coasts, the conclusion arrived at is that as a general rule the littoral drift is mainly due to oblique wave action. It must be remembered, however, that during gales currents greatly assist the movement of sand and silt suspended or disturbed by breaking waves. During gales, when oblique waves were moving material in an opposite direction to the flood tidal current, the author has frequently, at high tide, found an alongshore wind-formed current seaward of the breaking waves, which measurements showed to have a surface velocity of from 0.5 to 1.0 ft. per sec. in opposition to the normal flood current.

During onshore gales, when the waves and wind-formed currents themselves have no direct effect in causing littoral drift, sand is frequently moved alongshore in the direction of the flood current. This is due to the fact that in some places the flood current commences to flow an hour or more after low water, while the ebb current does not commence to flow until an hour or more after high water. On such shores the upper part of the foreshore is only acted upon by the flood current, and sand disturbed by the onshore breakers would be suspended and carried some distance by the flood current before being deposited; but the ebb current, flowing at its strongest when the upper part of the shore was bared, would have no effect in bringing such particles of sand back again.

It is important to bear in mind that there may possibly be some local exceptions to the general rule here advanced, that oblique wind waves are the chief cause of littoral drift on the New Jersey and Long Island coasts. Before designing any coast-protection works it is necessary to examine carefully the local conditions in each case, in order to determine with certainty the relative effects of wind waves and tidal currents in causing littoral drift.

Littoral Drift Caused by Wind

At low tide oblique and onshore winds transport sand from the foreshore to the land. The chief effect is to erode the foreshore between the tide limits and build up above high-water mark sand dunes, which will themselves be moved inland in course of time, unless overgrown by vegetation. The erosion of the coast resulting from the formation and inland movement of sand will

[1] Minutes Proceedings, Institute of Civil Engineers, Vol. CXVIII.

be dealt with in the article on the causes of coast erosion.

If, as already stated, oblique wind waves are the chief cause of the littoral drift, then the direction of predominant drift should be in the direction of the prevalent or strongest waves causing the formation of such oblique waves.

Littoral Drift Off Long Island

Fig. 1 shows the action of oblique waves on the south coast of Long Island. It will be noticed that the shore is sheltered from the northeast winds, while the south and southeast winds, which strike the shore almost at right angles to the coast, will have little or no effect in causing littoral drift. The winds which will cause the formation of oblique waves are those coming from the east-northeast, east-southeast and southwest. Reference to the map will show that the section of shore from *A* to *B*, while sheltered from the southwest oblique waves, is exposed to those from the east-southeast and east-northeast, while the shore from *B* to *C* is exposed to oblique wind from the east-southeast, east-northeast and southwest. It is therefore reasonable to suppose that the predominant drift will be from *B* to *A* and that the drift between *B* and *C* will depend on the relative strength and duration of the winds causing oblique wave action in opposite directions.

While the northerly winds predominate on this coast, it will be noticed that the shore at the northeast end of Long Island is exposed to a greater range of winds capable of causing oblique wave and littoral drift in a northeasterly direction than to winds capable of causing littoral drift in a southwesterly direction. Moreover, the distance of fetch or open sea between New York harbor and the northern part of Long Island will enable the winds blowing from the west-southwest to cause oblique wind waves capable of effecting a certain amount of drift.

We may therefore expect that the direction of littoral drift will not be very clearly defined, but that near the northeast end of the Island it will probably be found to be from southwest to northeast.

A study of the local conditions shows there is abundant evidence that the predominant drift is from *B* to *A*. The spits and sand islands[2] in front of Fire Island, Jones and East Rockaway inlets have all moved in a westerly direction. According to the *Coast Pilot,* the spit in front of Fire Island inlet has for many years been moving westward at a fairly uniform rate. From this inlet to Coney Island the evidence of a predominant westerly drift is everywhere apparent. Between Fire Island inlet and the northeast end of the island the evidence of a predominant drift is not very clear. It appears that at Shinnecock Bay a spit may possibly have grown out from both sides of the bay, as the entrance is about in the center; but there is no conclusive evidence that this is so.

Littoral Drift Off New Jersey

Reference to Fig. 2 will show that from *B* (Bay Head) to *A* (Sandy Hook) the New Jersey shore is to some extent sheltered from oblique waves formed by northerly winds and exposed to oblique waves from the south and southeast; while the shore from Bay Head to *C* (Cape May) is exposed to oblique wave action caused by both northeast and southeast winds. As the northerly winds predominate, we may expect to find the littoral drift to be in a southerly direction from some point near Bay Head to Cape May and in a northerly direction from Bay Head to Sandy Hook.

A careful examination of the local conditions shows that this is so. Everywhere between Bay Head and Sandy Hook we find evidence of a predominant northerly drift.

A study of the reports of the U. S. Weather Bureau, shows that, between Long Branch and Sandy Hook, during the summer months, the prevalent oblique onshore winds are from a southerly direction causing a northerly movement of material. In the winter months northwest winds predominate and have little direct effect in causing littoral drift. Very severe winds from the east-northeast occur during the winter, but owing to the trend of the coast do not strike at a very oblique angle and cause a seaward movement of material. The amount of littoral drift taking place during such storms is insufficient to compensate for the drift caused by the prevalent southerly onshore waves.

Sandy Hook spit has gradually advanced toward the Long Island coast. A comparison of Keith's survey made in 1685 and the coast survey of 1885 shows that between these dates the northward advance has been about 4700 ft. Surveys made between 1836 and 1885 indicate that the spit sometimes increased in length and sometimes decreased, the net result being a northerly growth of about 300 ft. between the above-mentioned dates.

Formerly the Shrewsbury and Navesink Rivers had their outlets across the neck of the spit, but these have been dammed up by the littoral drift and the outlets for their waters driven northward along the land side of Sandy Hook.

The spit in front of Shark River has steadily worked northward until it has closed up the outlet; after a time a new outlet was formed further south during storms and floods or one has been artificially formed. In 1890 the outlet was closed by the northerly drift, and a new outlet was cut further south. This outlet immediately started to move northward, the movement being at the rate of about 20 ft. a day during a week when the outlet was under observation.[3] The spit in front of the Manasquan River outlet has also progressively moved northward until a new entrance has been formed to the southward by storms and floods, when the new entrance commenced to move northward again.

Everywhere between Bay Head and Sandy Hook we find evidence to prove that the predominant drift is in a northerly direction. South of Bay Head, on the contrary, we find conclusive evidence of the predominant drift being in a southerly direction.

Barnegat inlet moved southward about 2300 ft. between 1840 and 1874, the spit at the northside of the inlet advancing southward and erosion taking place on the south side, the width of the inlet remaining about the same.[4] Long Beach by its southern movement has

[2]The term "spit" is here used to designate the long sandy formations which have grown out across the inlets and locally termed "beaches." In places where the spit has been cut through and an island formed the term "sand island" is used.

[3]"Transactions," American Society of Civil Engineers, Vol. 23.

[4]Report of New Jersey State Geologist, 1905.

become joined to what was formerly Tuckers Island. In 1841 Little Egg inlet between Long Beach and Tuckers Island was about 7200 ft. wide; by 1885 the points of land had become joined together. Between 1772 and 1885 Five Mile Beach on the east shore of Cape May had moved southward about 3750 ft. At Great Egg harbor the "new inlet" which intersected the beach near Longport progressed to the southward until it joined the old inlet about the year 1859.[5]

Formation of Sand Spits and Sand Islands

The general tendency is for the sea to fill up the bays and plane down the headlands. Spits in front of bays and estuaries are formed where there is a predominant drift. If there is an abundant supply of littoral drift and an embayment in the coast, the sand is moved by wave action and currents in a more or less continuous manner, and instead of being moved back into the reëntrant angle is often built out in the form of a long spit. The action of oblique waves and currents is alone instrumental in building the spits or sand embankments which border the New Jersey coast up to the level of about low-water neap tides. After that level is reached the wind plays an important part in their formation. At low tide the onshore winds blow sand against the sea-constructed bank and wind-formed dunes are then brought into existence.

On the New Jersey coast the sand spits are mainly formed by littoral drift transported by oblique wave action, although assisted by currents. The formation of Sandy Hook has frequently been attributed primarily to tidal currents. In a report to the Coast Survey, 1856, it is stated that "it turns out that the growth of the Hook . . . goes on regularly and according to determinable laws. The amount of increase depends upon variable causes . . . and the cause of this is a remarkable northwardly current . . . along the shores of the Hook. For more than seven hours out of the twelve there is a northwardly current through the False Hook Channel. This northward current runs inside for eleven hours out of twelve. It is this conflict of these two northwardly currents outside and inside and the deposit of material which they carry to the point of the Hook which cause its growth."

As the cause of the littoral drift is a matter of considerable importance, the author has carefully looked into the latest available Government information about the tidal currents on this part of the coast. On the outside shore of Sandy Hook the flood and the ebb have practically the same velocity, while the ebb flows for a little longer time, and is in fact slightly more powerful, there being a general drift in a southerly direction amounting to about 7 mi. in 24 hr.[6] The flood and the ebb, therefore, oppose each other as transporting agencies. It is true that the upper part of the shore is only acted upon by the flood current, as the ebb commences to flow about one hour after high water; but from one hour before to one hour after high water the velocity of the flood current is very small, and it is doubtful if it is even sufficient to move sand by the slow forward movement of sand ripples. The maximum velocity of the flood current at the entrance channels to New York Bay is two hours before high water on the part of the shore, which is also acted upon by the ebb current. In the author's opinion it is physically impossible for Sandy Hook to have been formed primarily by the tidal currents, and that its formation is due to littoral drift caused by oblique wind waves and tidal and wind currents.

A spit built out across a bay may, in course of time, extend right across and form a lake behind it. Southward of Sandy Hook many bays which formerly indented the coast have been closed up by the formation of spits which have grown right across. Lakes have thus been formed at Elberon, Deal, Asbury Park, Ocean Grove, Ocean Park, Lake Como, Spring Lake and Seagirt.

Where a considerable quantity of land water drains into a bay or indentation, the land water may at times of flood break through the sand spit in one or more places. Where rivers discharge into bays the sea is often unable to maintain a continuous spit across, and during floods the river water may break through it in one or more places—long, narrow sand islands being thus formed. Spits in front of Shark and Manasquan River outlets have, as previously mentioned, been constantly breached and then built up again by littoral drift. History also shows that the Sandy Hook spit between Low Moor and its extremity has been broken through on several occasions, when the waters of Shrewsbury river would for a time empty directly into the sea.

On the Atlantic coast of America we frequently find a series of elongated sand islands more or less inclosing lagoons. In fact, such sand islands are more characteristically exhibited on the Eastern coast of the United States than on the coasts of other continents. These sand islands will often travel across the bay and join on to the coast, or the sand islands themselves may unite.

Where rivers discharge, the position for the entrance of the tidal waters and the exit for the river waters are in many places constantly changing; as while the sea is endeavoring to close the bay by a continuous sand embankment along which it can move fresh supplies of material, the land waters are trying to find an outlet. In many cases it is a continuous warfare, in which neither side is entirely successful.

Where there is an inlet or harbor having a narrow entrance, the flood current sets into the harbor, and during gales when the waves on the coast stir up material the current carries in suspension large quantities of silt and sand. At slack water this material is deposited in the harbor or inlet, especially where salt marsh plants have obtained a footing. This material is not picked up again by the ebb current, there being no wave action to stir up the material on the sheltered inlet, and consequently salt marshes form and increase in area. At and near the entrance to the inlet the ebb currents are more powerful than the flood currents owing to the gradient being seaward and to their being in many cases reinforced by land water.

The growth of a spit across an inlet by narrowing the entrance and increasing the size of the tidal reservoir increases the tidal scour at the entrance and may prevent the further growth of the spit alongshore, in which event an apposition form of spit is formed as at the extremity of Sandy Hook. The formation of salt marshes inside the harbor or under the shelter of the spit, on the other hand, tends to decrease the volume of tidal water, and consequently the scour.

[5] Report of New Jersey State Geologist, 1885.
[6] "United States Coast Pilot," Vols. IV and V.

Maintenance and Repair of Asphalt Block Pavements

By Edwin J. Morrison*

SYNOPSIS—Explicit directions for the repair and maintenance of asphalt-block pavements by an engineer of over 20-years' experience in the asphalt-block industry. Renovating old asphalt-block pavements by a surface treatment of asphaltic oil.

There are three principal things to be guarded against in the maintenance and repair of asphalt-block pavement: (1) Allowing small defects to go unrepaired until they grow into actual holes in the wearing surface; (2) making an incomplete, and therefore ineffectual, repair by simply "plugging the hole" and failing to make a repair of sufficient area to restore the surface of the pavement to its original grade and contour; (3) neglecting or failing to utilize the old blocks in a proper and effective manner.

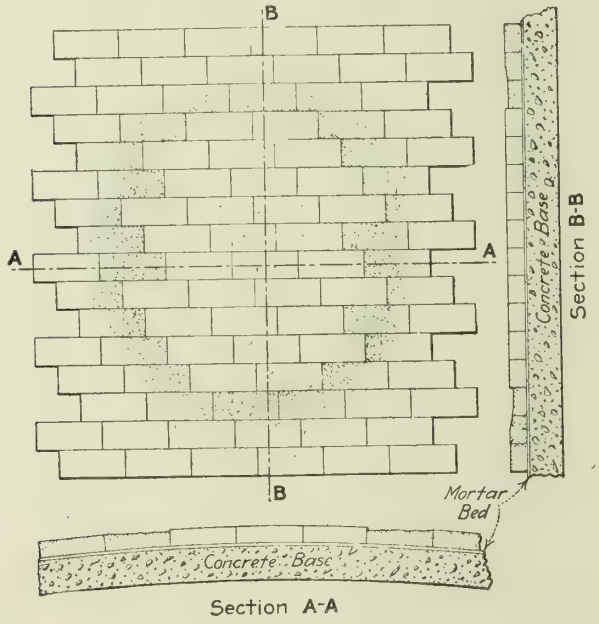


FIG. 1. WRONG WAY TO MAKE PATCHES IN ASPHALT-BLOCK PAVEMENT

Large numbers of old blocks, which properly relaid with asphalt-filled joints would have given good service for many years, have been thrown away; and in many cases where they have been used the relaying has been carelessly done and the joints filled with sand, leaving the blocks peculiarly susceptible to deterioration during winter weather.

The maintenance work, under the supervision of the writer, has averaged for a number of years somewhat over 1,000,000 sq.yd., and in speaking of the serviceability of the old blocks properly relaid and the economy resulting from careful attention to this feature of repair work he is speaking from a practical and well developed experience and not advancing a new or untried theory.

Blocks that are ten or more years old are generally hard and "dry" (the reason for which will be described later), and in taking up and relaying them the edges and corners are liable to be damaged. If the joints are simply filled with sand, the edges crumble under traffic, producing a rough and unsightly surface. The only proper method of treating the joints is by the use of an asphaltic filler. Where the joints are large or the edges and corners badly chipped, they should be filled with dry trap-rock grits before pouring the asphaltic filler. The joints should be made water-tight. The asphaltic filler is spread out by traffic, thus protecting the surface of the block as well as the joint.

The importance of treating the joints in this manner cannot be overstated. Such a repair results in a smooth surface, which under the action of traffic renders the patch indistinguishable in a very short time, whereas a patch made with the same blocks, with sand-filled joints, generally produces a rough surface with a percentage of bad joints which are subject to deterioration under traffic during the winter. The cost of applying the asphalt filler (which will be described later) is small and insignificant when balanced against the benefits accruing from it.

In making repairs to asphalt-block pavements the old blocks should be used to the utmost extent, and the new ones should be placed in continuous areas by themselves. The old blocks which are of the same formula, age and wearing quality will thus be brought together, and from the new blocks, laid by themselves, will be derived their utmost serviceability.

Contrary to much that has been written and said, the old blocks can be utilized to a very great extent in making repairs, if proper attention is paid to this point. Practically every whole block can be salvaged and efficiently used. This is true even where the blocks have one surface badly mutilated and are of unequal thickness, since the bad and irregular surface can be bedded in the mortar and the smooth surface of the blocks exposed to traffic.

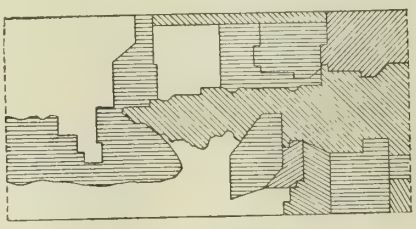


Fig. 2

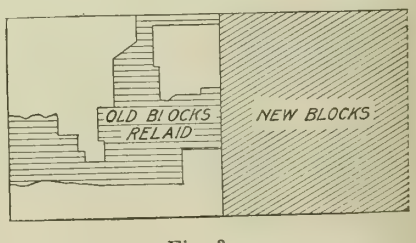


Fig. 3

FIG. 2. INEFFECTIVE PATCHES IN AN ASPHALT-BLOCK PAVEMENT

	Sq.Yd.	Per Cent.	Unit Price	Total Cost
Repaired with new block	129.6	64.8	1.60	$207.36
Original surface not repaired	70.4	35.2	....	.....
Totals	200.0	100.0	....	$207.36

FIG. 3. CORRECT METHOD OF REPAIRING AN ASPHALT-BLOCK PAVEMENT

	Sq.Yd.	Per Cent.	Unit Price	Total Cost
Continuous repairs with new blocks	93.3	46.65	1.60	$149.28
Repaired with old blocks	43.1	21.55	0.60	25.86
Original surface not repaired	63.6	31.80	....	.....
Totals	200.0	100.0	....	$175.14

*President of the Hastings Pavement Co., New York City. President of the Asphalt Block Pavement Co., Toledo, Ohio.

The sketch (Fig. 1) illustrates an incomplete repair, the unshaded surface representing new blocks and the shaded area showing old blocks left in their original position, slightly depressed. These should have been taken up and relaid, restoring the pavement to its original contour. Such an incomplete repair has generally resulted in unnecessarily rapid wear of the old blocks which are left in a slight depression around the original patch.

The sketch (Fig. 2) shows an actual condition on a street in the Borough of Manhattan, New York City, where the foundation was found to be very defective. The



FIG. 4. CONDITION OF OLD ASPHALT-BLOCK PAVEMENT BEFORE TREATMENT

hatched areas indicate a series of individual patches made during a period of about two years, resulting in a gross repair, aggregating 64.8 per cent. of the area shown, made entirely with new blocks. This made an irregular and unsatisfactory surface, because the individual repairs were of the kind indicated in Fig. 1.

Fig. 3 indicates what should have been done with this particular section of street. The hatched area marked "new blocks" contained many small depressions and defects. This area should have been taken up from curb to curb and repaved with new blocks to perfect line and grade in one operation. Of the old blocks removed there would have been more than enough of good quality to make the repairs in the area indicated as "old blocks relaid," and the result would have been satisfactory.

The method indicated by Fig. 2 resulted in an unnecessarily large use of new blocks, in no utilization of old blocks at all, and in a relatively unsatisfactory pavement surface; while the method indicated by Fig. 3, although requiring a much smaller expenditure of new blocks, would have placed them in one continuous area with perfect surface, utilizing at the same time a considerable percentage of old blocks, which in the other case were thrown away. The net result at prevailing unit prices for new blocks shows a saving in cost of over 15 per cent.

While a small section of pavement requiring unusually extensive repair has been taken for illustration, it serves very forcibly to indicate the ultimate, if not the immediate, economy of making a complete repair of defective conditions, thus saving and utilizing much old material instead of making a partial repair and allowing the small defects to go until they result in complete destruction of the surface.

The repair and treatment of asphalt blocks for maintenance purposes cannot be scientifically handled without some knowledge of the physical characteristics of the blocks themselves. This makes it important to review briefly the history of asphalt blocks and to show the general trend of the varying methods and formulas used during the past 20 yr.

Character of the Old Blocks

Asphalt blocks began to be used extensively in New York City about 1895. At that time, and for a period of about 10 yr., the asphaltic cement was prepared by fluxing refined "Trinidad" asphalt with from 6 to 8 per cent. of Pennsylvania or Ohio residuum oil, of 22 to 24 deg. gravity Bé. This resulted in a very hard cement, gradually growing harder with the lapse of years as the volatile matter in the flux oil evaporated. The hard blocks had a tendency to brittleness during the winter. In order to overcome this tendency a larger amount of heavier flux oil was used.

During the transition period which followed, the fluxing material was varied by using 9 per cent. of Ohio residuum oil of from 16 to 18 deg. Bé., 12 per cent. of 14 deg. Bé. oil and from 16 to 18 per cent. of 10 to 12 deg. Bé. asphaltic base oil. This process of evolution ended in the adoption, about 8 yr. ago, of a semiliquid flux derived from an asphalt—base oil, treated with air, steam or sulphur.

A fluxing material produced in this manner has all of the lighter volatile oils removed in the process of preparation and is very stable, being but slightly affected by temperature changes, and it does not liquefy under summer heat. These changes in the fluxing material, together with other changes in the kind and quantity of filler used and the grading of the mineral aggregate, have resulted in a gradual increase of bitumen in the block, accompanied by a gradual softening of the asphaltic cement, as indicated by the penetration.

We now know from the experience of later years that all the old blocks were not only too hard when they were made but have been gradually increasing in hardness



FIG. 5. PAVEMENT AFTER REPAIRS HAD BEEN MADE

ever since. This defect is cumulative in its effects, resulting in a chipping of the joints in winter and in the course of time in a pitting and scaling of the entire surface of the block; although otherwise these old blocks have, in a majority of cases, given excellent service.

Surface Treatment

The brittle condition of the old blocks led to the inauguration, some two or three years ago, of a series of experiments to determine a satisfactory and economical method

of surface treatment which would soften the hard asphaltic cement and prevent the chipping of the blocks in winter. These experiments embraced the use of a great many materials, applied in many different ways and under widely varying conditions. Complete success has been attained, and while a different treatment has to be applied to suit varying conditions of traffic and of the old blocks to be treated, the basic principle is substantially the same for all.

The method which experiment and experience have shown to produce the desired result is to dissolve a heavy bituminous oil in a volatile solvent and apply it to the



FIG. 6. RELAYING OLD BLOCKS IN GUTTERS

surface of the old blocks in the form of a thin wash or paint coat, giving one or more applications, as considered necessary. The solvent penetrates a considerable distance into the blocks and then evaporates, leaving a coating of heavy stable bitumen, which mixes perfectly with the old asphalt softening and giving it new life, while producing a malleable surface on the old blocks very similar to that produced by the formulas now used in the manufacture of new blocks.

After the application of the paint coat the entire surface of the pavement should be covered with a very thin layer of dry, fine trap-rock screenings, passing a ⅛-in. mesh screen; or any clean, dry sand will answer the purpose if trap rock is not available. The fine trap rock, sand and dust serve the double purpose of preventing the oil from being picked up by the shoes of pedestrians and tires of vehicles and, what is more important, cause the oil to be ground by traffic into the joints and inequalities of the surface. Where the joints are only slightly broken down this simple application is all that is needed to restore the surface of an old asphalt block pavement to a satisfactory condition. The cost of this surface treatment when applied to large areas will range from 2 to 4c. per sq.yd.

Brooklyn Example

Eighteenth St., from Sixth Ave. to Prospect Park West, covering an area of over 7000 sq.yd., was paved in 1906 with 3-in. asphalt blocks on a concrete foundation (by a company then just starting in the asphalt-block business). The materials and methods of manufacture were poor, and the condition of the surface of this street became so bad by 1914 that it was considered useless to make further repairs in the old way. It was admitted, however, that if the blocks could be saved and utilized by a surface treatment the value of the treatment would be fully demonstrated.

A contract was accordingly awarded in the summer of 1914, but on account of unexpected delay the actual work could not be started until Oct. 30, and it was not finished until Nov. 28, under somewhat unfavorable weather conditions. This work was done under the supervision of Herman H. Schmidt, Chief Engineer of the Bureau of Highways, by the Hastings Pavement Co.

The parts of the specifications covering the taking up, culling and relaying of old blocks and the special asphaltic filler for the treatment of joints follow:

The work shall consist of the removal of the present asphalt-block pavement and mortar bed; the repair of the present concrete foundation; the repaving of the roadway with asphalt blocks made up in part by new blocks and in part by old blocks taken from the present pavement, the treatment of the surface of the old blocks and all work incidental thereto, all in accordance with the plans and specifications on file in the Bureau of Highways, and over such areas as the engineer may direct.

The thickness of the mortar bed used under the culled blocks which are repaved over the above areas shall be approximately ½ in., but sufficient to bring the upper surface of the relaid blocks to an even grade with the adjacent pavement surface.

The asphalt blocks forming the present pavement, as taken from the street, shall be carefully culled and blocks which show a depth of 1½ in. or over and are otherwise suitable shall be piled separately and used for repaving.

The old asphalt blocks which can be used again shall be used to repave such areas as the engineer may direct. In addition the contractor shall furnish and lay, as directed by the engineer, new asphalt blocks, which shall conform in all particulars with the current asphalt block specifications of the Bureau of Highways, Borough of Brooklyn, which, so far as they apply, are made a part of this specification.

The surface of the present pavement which has not been disturbed, and those areas which have been repaved with blocks culled from the present pavement, shall be thoroughly broomed over with steel brooms and the joints cleaned and freed from all dirt and loose material.

Into the joints between the blocks shall be poured quartz gravel, crushed granite or trap rock, which shall be clean, approximately cubical, free from all foreign materials and



FIG. 7. JOINTS FILLED WITH ASPHALT AND GRITS

shall pass a ¼-in. mesh screen and be retained by a 20-mesh screen. It shall be artificially heated and dried in proper appliances placed near the work before being placed in the joints, if required by the engineer.

Immediately following the application of the gravel the joints shall be poured with an asphaltic cement conforming to the following requirements:

The block filler shall be a "blown" asphaltic oil product, or residual asphalt: (a) It shall contain not less than 99 per cent. of bitumen soluble in carbon bisulphide. (b) It shall contain not less than 98½ per cent. of total bitumen soluble in carbon tetrachoride. (c) It shall have a penetration at 77 deg. F. under a load of 100 grams for 5 sec. of not less than 55 nor more than 75. (d) It shall have a penetration at 32 deg.

F. under a load of 200 grams for 60 sec. of not less than 25. (e) It shall have a penetration at 115 deg. F. under a load of 50 grams for 5 sec. of not more than 200. (f) It shall have a ductility at 77 deg. F. of not less than 5 cm. nor more than 25 cm.

When these specifications were prepared it was expected that the work would be done in midsummer and that the treatment of the joints, as previously described, would be sufficient for their protection, and that the summer traffic would distribute the asphaltic filler over the surface of the blocks sufficiently to protect them against any tendency to pit or rough up during the succeeding winter.

This treatment would undoubtedly have been sufficient if the work had been done in midsummer, but as it was actually done in the cold weather of late November it was considered advisable to add to the treatment described



FIG. 8. PAINT COAT WITH SPRINKLING OF GRITS

in the specifications a surface treatment of the entire area of old blocks. This consisted of a paint coat composed of crude oil and a heavy asphaltic maltha of about 12 deg. gravity Bé., mixed half and half, applied hot and squeegeed over the surface, followed by a thorough sprinkling with fine trap-rock grits and dust passing a 20-mesh screen.

The result demonstrated fully the value of the treatment. The old blocks passed through last winter without exhibiting in the slightest degree any of the former tendency to break down at the joints or to pit on the surface.

The conditions on this street were peculiar in that certain sections and areas of the blocks showed very much more serious wear than others. These worst areas are fairly illustrated by Fig. 4. These areas were, of course, selected for taking up the old blocks from curb to curb, for the conditions were such that no amount of patching could produce a satisfactory surface.

On other parts of the street the general surface of the pavement was in very good condition and the original contour very well maintained, except for small defects here and there, particularly along the gutters. These portions of the street were repaired as shown in Fig. 5, by patching the defective places with old blocks reclaimed.

The sequence of operations is the relaying of the old blocks along the gutter (Fig. 6), spreading the trap-rock grits over the surface, filling joints with the trap-rock grits, the surplus being swept off; pouring of joints with the asphaltic filler, the surface treatment and application of the paint coat (Fig. 8), and finally covering with trap-rock grits (Fig. 7).

The area treated was 7184 sq.yd., of which 3022 sq.yd. was repaved with new blocks; 752 sq.yd. of old blocks were relaid and 3358 sq.yd. of old blocks were left in their original position, receiving only the joint and surface treatment. Thus 57 per cent. of the old blocks was reclaimed, a good average considering the very bad condition of this street. On other contracts of a similar nature the percentage of old blocks used has averaged between 80 and 95 per cent.

Eliminating Railway Grade Crossings in Los Angeles

A report on the elimination of railway grade crossings in the city of Los Angeles has recently been presented to the Municipal Board of Public Utilities by Franklin D. Howell, the board's Chief Engineer. Besides the elimination of grade crossings, Los Angeles has other problems which press for solution. Among these are the rerouting of its street-car service to reduce congestion and increase speed and the delays in the operation of interurban cars within the city.

The steam railway grade-crossing problem is easier of solution in Los Angeles than in many other cities because all the steam railways enter and leave Los Angeles in the valley of the Los Angeles River. The city's industrial district is located adjacent to the railways in this valley and generally on the same level as the railway tracks. It will not be feasible, therefore, to change the general level of these railway tracks, and Mr. Howell proposes that the principal thoroughfares crossing them and the industrial district through which the railways run should be carried by overhead viaducts. These should be wide enough to provide for the street-car traffic as well as the vehicle traffic, and would thus greatly relieve the present congestion and prevent delays which now result from street railways crossing steam railway tracks at grade.

Mr. Howell has made plans for six of these viaducts to have a minimum of 22-ft. clearance over the railway track and 14-ft. clearance over streets, increased to 15½-ft. clearance over street-railway lines. In the construction of such viaducts he proposes a two-column bent with spans of 40 to 50 ft. In crossing railroad yards, however, he advises longer spans to reduce the number of columns that would be endangered by derailed rolling stock. A span of 93 ft. would clear six tracks. For crossing the Los Angeles River he proposes a double-deck structure.

Special problems arise from the operation of the Pacific Electric Ry. Co.'s interurban system. This company's heavy interurban cars, weighing 35 to 40 tons and geared for high speed, are at present running from the outskirts of the city to its center on the city street railway tracks. These interurban cars add to the congestion on the street railway line, while the delay in reaching the heart of the city seriously affects the efficiency of the interurban service. Mr. Howell therefore recommends that the interurban lines should operate on a private right-of-way and should be required to elevate or depress their tracks above or below the street surface throughout the congested districts.

Engineering Literature

Heat Engineering

Reviewed by H. E. Longwell*

HEAT ENGINEERING: A Textbook of Applied Thermodynamics for Engineers and Students in Technical Schools—By Arthur M. Greene, Jr., Professor of Mechanical Engineering, Russell Sage Foundation, Rensselaer Polytechnic Institute; Sometime Junior Dean, School of Engineering, University of Missouri. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xiv + 462; 198 illustrations. $4, net.

Should one dissect an average textbook treating of any specific type of heat engine, he will find that if the gossipy historical chapters, and the chapters on thermodynamic theory, and the chapters that deal with pure machine design, only, and the chapters that are written from commercial catalogs with the aid of a pair of scissors and a paste-brush, were all eliminated, an imposing volume will generally shrink to a comparatively insignificant book.

Since the same thermodynamic theory applies equally to steam engines, steam turbines, gas engines and compressors for air and other fluids; and since the same phenomena of heat transmission are common to boilers, condensers, evaporators, intercoolers, heating coils, refrigerating coils, cold-storage rooms, etc., it is evident that if a textbook has competent chapters on these general underlying principles, it is possible, on this common foundation, to present an adequate discussion of all the principal specific types of apparatus in a series of additional chapters so brief that they might almost be called appendices.

This is what Professor Greene has done. Emulating Doctor Eliot, who accomplished the prodigious task of crowding all the essentials of the world's literature on a bookshelf five feet long, he has succeeded in compressing a very respectable library of works on heat engineering to such a degree that it has ample elbow room on a bookshelf only one and one-half inches long.

The book opens with a most excellent and comprehensive chapter on thermodynamics, which the author characterizes all too modestly as "an outline only of the thermodynamic theory." This is followed by a short chapter (10 pages) on Heat Engines and Efficiencies, explaining the methods of reporting the performance, and giving a number of examples in which the efficiencies of various types of engines are computed from the observed data. With the addition of Chapter III on Heat Transmission we have a substantial foundation for the study of all the various engineering structures which involve the principles discussed in these three introductory chapters.

Chapter IV deals with Air Compressors; Chapters V and VI, with Steam Engines, simple and multiple expansion; Chapter VII, with Steam Nozzles, Injectors and Steam Turbines; Chapter VIII, with Condensers, Cooling Towers and Evaporators; Chapter IX, with Internal Combustion Engines, and Chapter X, with Refrigeration.

From this brief résumé of the contents, it will be seen that the work covers very broadly the entire field of heat engineering. This breadth of scope, however, is not, as one might suspect, obtained by superficiality. The author has selected and condensed his material with rare good judgment, and has left unsaid practically nothing that any reasonable reader would regard as essential to a complete exposition of the subject.

The author has wisely refrained from entering into the matter of the physical construction of the several machines discussed, a subject that pertains purely to machine design and which has no logical place in a work of this sort. One who can deal ably with thermodynamic theory is not apt to discourse in a particularly illuminating manner on bearings, cylinders, flywheels, governors and other mechanical details of machines, and when expert machine designers attempt to expound thermodynamic theory, they are often more amusing than instructive.

Naturally in a work of this sort mathematics is very much in evidence, but it is handled in an unusually lucid manner. The reader will not be confused by typographical errors in the mathematical expressions, and the many numerical examples worked out in detail make the meaning and application of the formulas readily understandable.

A complete table of the symbols used in the text and a comprehensive index finish off a well planned and admirably executed work.

In addition to being an excellent textbook for students, the practicing engineer will find it an efficient and convenient instrument for polishing up his memory in spots that may have become rusty.

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Machinists' Handbook Revised

Reviewed by Rossiter R. Potter*

AMERICAN MACHINISTS' HANDBOOK and Dictionary of Shop Terms: A Reference Book of Machine Shop and Drawing-Room Data, Methods and Definitions—By Fred H. Colvin, M. Am. Soc. M. E., Associate Editor of the "American Machinist"; author of "Machine Shop Arithmetic," "Machine Shop Calculations," "American Machinists' Grinding Book," "The Hill Kink Books," etc., and Frank A. Stanley, M. Am. Soc. M. E., Associate Editor of the "American Machinist"; author of "Accurate Tool Work," "Automatic Screw Machines," "American Machinists' Grinding Book," "The Hill Kink Books," etc. Second edition, thoroughly revised and enlarged. New York and London: McGraw-Hill Book Co. Leather; 4x7 in.; pp. xxvi + 673; numerous illustrations. $3.

During the seven years since the publication of the first edition this book has become very generally accepted as the standard handbook for machinists, machine-shop foremen and superintendents. The second edition shows an increase of more than 25 per cent. (160 pages). Nearly one-third of this increase is comprised in additions to the sections on milling and milling cutters, and on horsepower, belts and shafting. Of the twenty pages added to the latter section, the greater part presents in tabular form unusually complete data on the power requirements of various machine tools under different conditions. In the section on milling, ten pages of the new material cover the Cincinnati Milling Machine Co.'s experiments, which have led to the development of a new form of tooth for milling cutters. It is of interest to note that the results of these tests have also led the authors

*Department Manager, Blood Brothers Machine Co., Allegan, Mich.

to reverse themselves in their explanation of the grade of finish obtained on milling-machine work. The major part of the new pages (chiefly tables) in this section is devoted to plain and differential indexing.

Some twenty-five pages are used to present six entirely new sections, as follows: Cold Saws; Turning and Boring; Oilstones and Their Uses; Broaches and Broaching; Steam Hammers and Drop Forgings; Knots, Eyebolts, Ropes and Chains. In the section on broaching, the S. A. E. standards are given for six and ten-splined holes. Many users of the book will wonder why the S. A. E. standards for square broached fittings were omitted. Other important additions are to the sections on Spiral Gears, eleven pages; Grinding and Lapping, twelve pages; Screw Machine Tools, six pages; Miscellaneous Tables, seven or eight pages, including dimensions and capacity tables for the leading types of modern ball bearings.

Noticeable effort has been made to improve the book in other ways besides the addition of new material. Most commendable perhaps of these improvements is the reduction to a more reasonable size of some of the simpler line cuts. The authors have succeeded in adding not a little to the convenience and value of the book. There is one careless error, in the use of an arithmetical sign, on p. 403, that has been carried over from the first edition. It is not a mistake that will be apt to cause much misunderstanding, but it sets a bad example to one class of users of the book and may diminish the respect of another class.

Engineering Economics

REVIEWED BY LEONARD METCALF*

ENGINEERING ECONOMICS; First Principles—By John Charles Lounsbury Fish, M. Am. Soc. C. E., Sometime Division Engineer Lake Shore & Michigan Southern Ry.; Professor of Railroad Engineering at Leland Stanford Junior University; author of "Earthwork Haul and Overhaul," etc. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xii + 217; illustrated. $2, net.

The author states that his "book is intended to meet the first needs of the student and to render effective service in the office," and that it was written "in the belief that to the engineer a working knowledge of first principles is as essential in the economics as in the mechanics of structures; and that special study and drill in the application of principles is as advantageous in the one case as in the other." The object of the author is a worthy one and the book gives evidence of careful study and thought.

The treatment appears to the reviewer didactic and unfortunate. A simple and more direct approach, reasoning from well-selected examples to principles, would seem likely to be more interesting to the student and to give point to the individual character of most economic engineering problems. Completeness of treatment in such problems is rarely to be obtained in practice, and the most reliable estimator is the one who has the keenest sense of the important elements in his problem, coupled with the most direct and simplest methods of approach to and solution of it. While it is desirable that the student should be instructed in the general methods of analysis and application of formulas, it is of far greater importance that he should develop a sense of perspective, be shown how to grasp the really important elements of his problem, and then work out in the simplest manner his analysis or formula indicating the influence of the various factors.

One of the greatest dangers in much of the cost estimating or valuation being done today lies in the failure to grasp and weigh the relative importance of the various factors involved, including hazard and the human problem, and in the failure to make proper allowance for the different conditions surrounding the different works, cost records of which have been obtained, and to compare the sum of the assembled individual cost sheets of different branches of the work with the final actual cost of the entire work. It is the failure to do this that has brought the estimates of so many engineers into disrepute, as unreliable in the opinion of bankers, owners and builders of such works. The author's failure to emphasize this side of the subject is unfortunate, as is the purely mathematical rather than constructive method of treatment adopted by him.

After a brief introduction, the elements of the problem of economic selection are treated, including simple and compound interest, sinking funds and annuities, first cost, and salvage value. In discussing the latter the term depreciation is given a significance totally at variance with accepted practice—depreciated value being defined as salvage value. Elements of yearly cost of service, amortization, interest and other fixed charges, operation, maintenance and outstanding data are then discussed. Next estimating is taken up. This includes general practice, effect of laws of error, and quantities of some particular types.

The solution of the problem of economic selection is then treated under four bases: Yearly cost of service, the capitalized cost of service, cost per unit of service, and capitalized cost per unit of service, per year. This is followed by methods of procedure for economic selection, with examples.

A fair bibliography, depreciation and life tables, and tables of formulas follow.

The book is disappointing from the point of view of the practicing engineer and might advantageously be simplified from that of the student, as it tends to bring into undue prominence formulas rather than methods and the relative importance of the elements of the problem.

AN INTRODUCTION TO TOWN PLANNING: A Handbook Dealing with the Principles of the Subject and a Consideration of the Problems Involved, Powers of Local Authorities, etc.—By Julian Julian, Borough Surveyor, Cambridge. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Co. Cloth; 5x8 in.; pp. vi + 149; illustrated. $1.75, net.

In contrast with most of the other books on town or city planning, this volume is small, handy, and contains but few illustrations—all line cuts.

After a brief but interesting review of the history of town planning the author takes up the powers of local authorities under the earlier by-laws and the 1909 Town Planning Act. He then considers some of the practical details of the preparation of town plans and passes on to "A Town Planning Tour," which consists of brief notes on salient features of the plans of a number of British and Continental cities. Appendixes deal with garden cities and suburbs, examples under the Town Planning Act of 1909, and extracts from Congressional resolutions, from the procedure schedule of the Town Planning Act and from a few books and papers on town planning.

*Consulting Engineer, 14 Beacon St., Boston, Mass.

As may be inferred, most of the space is devoted to British practice, which is exactly what many people this side the Atlantic would like to know about. The other matter in the book, however, is perhaps of more interest to Americans generally. The book is readable.

A Contractors' Textbook

THE ECONOMICS OF CONTRACTING: A Treatise for Contractors, Engineers, Manufacturers, Superintendents and Foremen Engaged in Engineering Contracting Work; Vol. II.—By Daniel J. Hauer, Construction Economist; Editor of "The Contractor." Chicago (Rand McNally Building): E. H. Baumgartner. Cloth; 6x9 in.; pp. 334; 27 illustrations. $2.50.

The earlier volume of this two-volume work (reviewed in *Engineering News*, Feb. 15, 1912, p. 325) laid down the principle that contracting had now become a profession and as such could be successfully discussed in a textbook. As was pointed out in the review of that first volume, however, contracting is primarily a business and one of the most complicated businesses in the world. Its principles, therefore, may be broadly outlined in any textbook, but the essentials of its practice are hardly reducible to words. In so far as it is possible to make such reduction, Mr. Hauer has succeeded admirably, but the fact remains that his two volumes are for the most part interesting and instructive reading for the present or prospective contractor rather than a *vade mecum* or handbook without which his business would suffer.

The second volume seems to have been conceived after the first was written, for there are many duplications of thought and hardly any strict differentiation of subject matter in the two volumes. This does not prevent the second part from having much that is new and interesting, because the subject is so broad that complete treatment could not be expected in one volume. The chapter headings of Volume II are as follows: Estimating and Bidding upon Contracts; Making Contracts and Obtaining Bonds; Financial End of Contracting; Preventing Law Suits; Planning Construction Jobs; Handling and Training Men; Office Filing Systems; Organization of a Construction Company; Lines of Contracting and Specialization and the Standing of Contractors. Generalizing broadly, it might be said that the chapters on office systems and financial organization will prove the most valuable part of the book and the sections devoted to the handling of men will be read with the most interest. Those chapters which attempt to outline methods of work could well have been omitted.

English Surveyors' Handbook

SURVEYING AND BUILDING CONSTRUCTION for Agricultural Students, Land Agents and Farmers—By A. H. Haines, Head of the Estate Management Department and Lecturer in Surveying at the South Eastern Agricultural College, Wye, Kent, England; Member of the Board of Studies in Agriculture of London University, and A. F. Hood Daniel, Lecturer in Building Construction at the South Eastern Agricultural College. New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. xiii + 339; 222 illustrations. $3, net.

A typically English book. It combines subjects which are never associated in a single textbook in this country, and it contains many terms wholly unfamiliar to American engineers. Judging by the text, the work of an English surveyor includes farm building construction and a variety of things under farm management and the handling of estates which have never been grouped into a distinct profession on this side of the water.

The text is both elementary and practical. The first chapter on mensuration includes much elementary matter, tables, etc., usually to be had in our engineering pocketbooks. Rules are given for ascertaining the contents of ash heaps, the weight of cattle, the contents of dung heaps, of haystacks, cornstacks, etc.—information of a character which is rarely if ever found in American books.

It would seem that Gunter's chain (invented by Edmund Gunter in 1620) is still universally used for rural surveys. The steel tape, now so exclusively used for all survey work in this country, is in England used for land surveys "when very accurate measurements are required." Acres there are still divided into roods and perches.

Surveying equipment consists of ranging rods, poles, pickets, pegs or false pickets, offset poles, etc. Even the standard field notebook is different from ours, being 8 in. long by 4½ in. wide and opening on the end instead of on the side. The notes are not kept in the same manner either; the traverse is generally represented by a double line with station distances written between. Instrument station distances are inclosed in rings.

Surveying instruments, to judge from the illustrations, are of the type which was used in this country about 1850; at least some similar illustrations of levels and theodolites may be found in a Pike's catalog of surveying instruments published in New York in the fifties. These include a theodolite with high standards, with the vertical arc between the standards, such as few engineers in this country are old enough to remember having seen in use.

Under building construction is the usual collection of material on brick laying and masonry, carpentry and joinery, to be found in many of our American handbooks. There are a short chapter on hygiene (of the farm) and several pages of regulations of the local government board on dairy sanitation, farm water-supplies, drainage, etc. There is probably much of interest to American agricultural students in these parts of the book, although, as we have endeavored to show, there is little in the chapters on surveying that is common to American practice.

Tree and Shrub Field Book

FIELD BOOK OF AMERICAN TREES AND SHRUBS: A Concise Description of the Character and Color of Species Common Throughout the United States. Together with Maps Showing Their General Distribution—By F. Schuyler Mathews, author of "Field Book of American Wild Flowers," "Field Book of Wild Birds and Their Music," "Familiar Life of Field and Forest," Familiar Features of the Roadside." New York and London: G. P. Putnam's Sons. Cloth; 4x7 in.; pp. xvii + 465; profusely illustrated. $2, net.

Those who wish a small book to aid in the identification of the trees and shrubs of North America and to give some general information regarding their physical characteristics, industrial uses and geographical range will find this volume both useful and handy. The author states that he has given particular attention to the esthetic side of his subject, including color, form and proportion, and to scientific accuracy, particularly in his descriptive nomenclature.

The plan of the book is to give a general description of the tree or shrub under consideration, particulars of its bark, branching system, foliage, flowers and fruit, and then to state its geographical range and the character and value of its wood for timber purposes (if a tree). Pen sketches of two-thirds natural size show the leaves, flower and fruit of many of the trees and shrubs described in the text, and water-color and crayon sketches give general im-

pressions of the looks of typical specimen trees. Detail views of the bark of 18 trees serve as a key for the identification of trees by their bark. By similar ingenuity the distribution of trees and shrubs throughout the United States is shown by a series of 70 maps. Beneath each map are page references to the description of the several trees, the location of which is shown by it. A few other maps and diagrams add to the value and interest of the book. An index by common and botanical names completes the volume.

Electrical Engineers' Handbook

AMERICAN HANDBOOK FOR ELECTRICAL ENGINEERS: A Reference Book for Practicing Engineers and Students of Engineering—Compiled by a Staff of Specialists, Harold Pender, Editor-in-Chief; Professor of Electrical Engineering, University of Pennsylvania; formerly Director of Electrical Engineering Research Laboratory, Massachusetts Institute of Technology. New York: John Wiley & Sons, Inc. London: Chapman & Hall. Flexible leather; 4x7 in.; pp. xviii + 2023; illustrated. $5, net.

With at least two good handbooks for electrical engineers available, this one may be expected to show, and it does show, every evidence of careful and deliberate editing.

To many engineers, especially those dealing with the more practical application of electricity and electrical machinery, this volume will make a stronger appeal than some earlier ones because of the wide separation of theoretical discussion and practical description and the arrangement of relatively short notes in alphabetical order. To other engineers, particularly designers, the absence of logical grouping for sequence may prove disconcerting.

With the present arrangement a very good index is essential, since few persons would make the same alphabetical distribution of topics. A high degree of excellence has been secured in the index, though there still remain a few tortuous paths before some seekers will locate the information which they desire. For instance, one trail leads to "shunt wound—see name of apparatus," "dynamos—see generators and motors," and "generators, direct-current . . . . field winding, 671 . . . .," etc., before the reader rounds up the several items which may cover "shunt-wound dynamos." This may possibly be excused by the claim that no self-respecting electrical engineer would ever refer to "dynamos."

The scope of the handbook is very broad indeed, giving as it does—in addition to the principles and phenomena of electricity and magnetism, to all sorts of electrical instruments, apparatus, service equipment, practices and methods, and to closely related non-electrical matters—approximately 350 pages, or 18 per cent. of the whole text, on non-electrical matters of not very close relation. Such topics include the economic ideas of depreciation, interest and annuities; notes on general materials like timber, brick and concrete masonry, irons and steels, fuels, gases, acids and explosives, and also notes on mechanics and common machinery, simple structures, steam engineering and thermodynamics, hydraulics, dam construction, and waterwheels.

The book is so comprehensive in its purely electrical features that a detailed summary and criticism of its contents cannot here be attempted. It must suffice to state that a careful examination, coupled with a few weeks of desk reference, gives every indication of a comprehensive but concise treatment reasonably responding to a variety of demands for information. The general inclusion of cost data and a bibliography for each topic is sure to merit approval, even though the cost figures can give only a general idea of expense and the bibliographies reflect some personal preferences and lapses.

Study of a few sections will show the typical treatment of electrical subjects to be found throughout the book.

For instance, the chapter on "Primary Batteries" briefly but effectively passes over fields of service, theory of action and features of typical cells in five pages, while four pages are devoted to dry cells, their life, service, capacity, testing and cost (dry batteries have become of surprisingly great commercial importance).

"Storage Batteries" illustrates a more extended treatment of a subject. The theory and design of the alkaline (Edison) type are given in 2½ pages; performance features require about four pages; testing, one page; dimensions, weight, cost, etc., 1½ pages. The lead type of storage battery is similarly discussed in 17 pages. Applications of storage batteries in general are given in 16 pages.

The distribution of the component parts of a broad subject is well shown by "Electric Lighting." This is taken up under the separate topics of electric arc, arc lamps, incandescent lamps, distribution and transmission systems, laws of vision, laws of illumination, photometry, photometric quantities, street illumination and interior illumination. Under "Arcs" are brief notes on current through metallic-vapor streams, temperatures, luminosity, voltage-current relations, musical arcs, high-frequency oscillations caused by arcs, etc. Under "Arc Lamps" are such subtopics as voltage drops, increasing luminosity, commercial open and inclosed arcs (with tabulated performance data), flaming and magnetite arcs, regulating mechanisms, mercury-vapor lamps, and first and annual costs. Under "Incandescent Lamps" are short descriptions of incandescence phenomena, commercial carbon- and metal-filament types, typical performance data (which are already somewhat incomplete due to six months' advance in the development of certain tungsten lamps), cost of light, reflectors, etc. Under "Distribution and Transmission Systems" are found fairly complete notes on constant-current and constant-potential lines, direct and alternating systems, typical city circuits, efficiency, regulation, load balance, etc. "Laws of Illumination" covers the fundamental "inverse-square" and "cosine" laws for the propagation of light and illumination calculations. "Interior Illumination" describes direct, indirect and semi-indirect disposition of illuminants, quantity of light required for various arrangements, best location of lamps and maintenance. "Street Illumination" gives the requirements of various streets, types of lamps available, desirable spacings and suspension heights, and costs. Under "Photometry" is presented a review of laboratory practice in measuring candlepower and flux-distribution characteristics of illuminants. "Photometric Quantities" defines the terms involved. "Laws of Vision" includes a summary of the rod-cone theory, and of intensity, extensity, color and duration sensations. It summarizes data on amount of light flux needed for best vision.

ZEITSCHRIFTENSCHAU AUS DEM GEBIETE DES WASSERBAUES, Heft I: Im Auftrage des Ministerium der öffentlichen Arbeiten—Herausgegeben von Wilhelm Ernst & Sohn, Berlin, Germany. Paper; 11x14 in. Yearly price, 12 Marks.

An index, with abstracts, covering periodical literature in the field of hydraulic construction is something

new in the publishing world. This is its first issue, Heft I. We are not informed how often it is to appear, but the price of annual subscription is stated. The scheme of grouping is to place all the matter under about 110 heads. In each issue all the abstracts under "Sewerage," for example, are placed together, and occupy one or more quarter-page units, each headed by the words "Entwasserung von Städten (siehe auch Abwasser.)"

The arrangement is designed for clipping and filing. Each page is ruled into quarters $4\frac{7}{16}$x$6\frac{1}{8}$ in., treated as units which may be clipped out and filed in a card file of corresponding size. The paper is heavy, for this purpose, and the printing is on only one side.

BUILDING THE NEW RAPID-TRANSIT SYSTEM OF NEW YORK CITY—By Fred Lavis. From Personal Studies for "Engineering News," with Use of Official Data and Photographs of the Public Service Commission. (Containing also Design of the New Elevated-Railway Lines by Maurice E. Griest, Assistant Designing Engineer, Public Service Commission for the First District.) [Reprinted from "Engineering News."] New York and London: McGraw-Hill Book Co., Inc. Cloth; 9x12 in.; pp. 78; 99 illustrations. $1.50.

In presenting this collection of carefully prepared matter the publishers perform a creditable service in making generally available a comprehensive study of subway-building methods. Fred Lavis' observations of the way different contractors on the New York subways are handling their work are no doubt the better for being based on years of experience in construction. This is fortunate in view of the fact that no summary of the construction methods has been published by the Public Service Commission or by other competent source. Probably it will be some years before any such summary will be issued, if at all. Until then Lavis' account is the only thorough collection of data available.

Special mention is due M. E. Griest's complete statement of how the New York elevated-railway lines were designed. First-class structural-steel practice is represented in these lines, and careful analysis and reasoning were employed in fixing the details. Mr. Griest's monograph is a classic of the subject.

BUILDING CODE RECOMMENDED BY THE NATIONAL BOARD OF FIRE UNDEDWRITERS, NEW YORK: An Ordinance Providing for Fire Limits, and Regulations Governing the Construction, Alteration, Equipment, Repair, or Removal of Buildings or Structures. Fourth Edition, Revised. New York (76 William St.): National Board of Fire Underwriters. Linen; 5x8 in.; pp. 326; illustrations.

Nominally this is a revision (4th edition) of the "model" building code first prepared by the National Board of Fire Underwriters in 1905. In reality it is a completely new building code and may be described as one of the most progressive documents in this field which has come out in recent times. The structural and fire-protection elements of the code have been revised throughout. The question of incombustible roofings is treated quite carefully, and a test for degree of inflammability is given. Just as radical are the requirements for certificates of occupancy for buildings; for certain occupancies sprinklers are required. Drastic new provisions are made for fire escapes; ordinary iron balconies connected by ladders or steps are not regarded as fire escapes except under special circumstances. In general, horizontal exits, smokeproof towers and outside stairways are called for. Exits are proportioned according to the number of occupants instead of floor areas. The new Forest Service grading rules for timber are included, and load tables for timber beams are given, based on considerably higher fiber stresses than heretofore used, namely, 1600 and 1200 lb. per sq.in. for yellow pine of grades 1 and 2, 1500 lb. for Douglas fir, 1000 lb. for spruce or Norway pine, 1300 lb. for western hemlock, and 1400 lb. for oak.

The inclusion of full specifications for the use of hollow blocks in walls, without discrimination, may also be considered a progressive requirement.

Every one concerned with the administration, preparation or improvement of building codes needs the book, and all who contemplate building a house should study its provisions.

A useful classified reference list of books and articles on city planning has just been published by the Public Library, Riverside, Calif.

A pamphlet of rules and instructions for the guidance of applicants for the approval of plans for the repair, alteration and construction of dams has been prepared by the engineering department of the Water Supply Commission of Pennsylvania (Harrisburg). Specimen plans are shown.

A bulletin on "The Regulation of the Jitney Bus," by Andrew Linn Bostwick, Librarian, Municipal Reference Branch, has been issued by the St. Louis Public Library. It contains a useful digest of the municipal ordinances which have been enacted in some twenty-five cities of the United States where jitney busses have been extensively used.

A complete account of the construction of the new mechanical filtration plant at St. Louis, Mo., the largest of its type in the world, is contained in the Annual Report of the Water Commissioner of St. Louis for 1914-15, just received. The report contains much matter descriptive of the St. Louis water-works not generally found in a publication of this kind. There is also a bibliography of all publications, articles, etc., on the water-works from 1865 to 1914. A supplemental report on water-supply by Edward E. Wall, Water Commissioner, covers in detail the improvements authorized in 1912 and now practically completed, including the filter plant, which was described by Mr. Wall in *Engineering News* of Oct. 23, 1913. Other features of the new construction have also been described in the issues of Dec. 25, 1913, May 14, 1914, and Jan. 28, 1915.

There are now available for distribution the standard specifications adopted by the American Society of Municipal Improvements at Boston in 1914 for Sheet Asphalt Paving, Brick Paving, Creosoted Wood-Block Paving, Stone-Block Paving, Cement Concrete Paving, Broken Stone and Gravel Roads and Sewer Construction. The specifications for Bituminous Paving are not yet issued, but are kept waiting for a report of the committee on bituminous paving. George W. Tillson, Consulting Engineer of the Borough of Brooklyn, New York City, is Chairman of General Committee on Standard Specifications. The specifications are copyrighted but any municipality will be given the right to use them or any part of them upon application to the secretary of the society. The

separate specifications in pamphlet form are 25c. each and the complete set of eight may be had in a bound volume for $2. They may be obtained of Charles C. Brown, Secretary of the American Society of Municipal Improvements, 702 Wulsin Building, Indianapolis, Ind.

NEW PUBLICATIONS

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor, the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

GARDNER AIR-LIFT PUMPING: Condensed Suggestions for the Installation of an Air-Lift System of Water Pumping —Some Tables of Efficiency, also Some Descriptive Data of Various Standard Types of Gardner Air Compressors. Quincy, Ill.: The Gardner Governor Co. Paper; 6x9 in.; pp. 16.

A catalog which, besides describing the compressors of this manufacturing company, gives a very interesting and complete discussion of air-lift pumping. It describes several ways of piping the well for air lift and reviews the advantages of the system. One table gives pressure and amount of air required to raise water, and another one, the horsepower required to compress air.

THE COLORADO STATUTE INCH AND SOME MINER'S INCH MEASURING DEVICES—By V. M. Cone. Bulletin No. 207, based on the work done in the hydraulic laboratory at Fort Collins, Colorado, under a cooperative agreement between the Colorado Experiment Station and the Office of the Experiment Stations, United States Department of Agriculture. Fort Collins, Colo.: Colorado Experiment Station. Paper; 6x9 in.; pp. 16; illustrated.

FORESTRY IN RELATION TO CITY BUILDING: An Address by T. P. Lukens. Throop College Bulletin, July, 1915. Pasadena, Calif.: Throop College of Technology. Paper; 6x8 in.; pp. 34; illustrated.

The author urges reforestation and also fire control in forested areas. He states that the yield of the collecting area of the Pasadena water-supply has doubled since 1899 and attributes it to the absence of fires in that area—the last large fire having occurred in 1895, when at least 12 of the 20 sq.mi. of drainage area was burned over.

GUIDEBOOK OF THE WESTERN UNITED STATES—Washington, D. C.: Superintendent of Documents. Paper; 6x9 in.; illustrated.

Part A—The Northern Pacific Route, with a Side Trip to Yellowstone Park—By Marius R. Campbell and Others. Bulletin 611.

Part B—The Overland Route, with a Side Trip to Yellowstone Park—By Willis T. Lee, Ralph W. Stone, Hoyt S. Gale and Others. Bulletin 612.

Two other of these interesting and useful guidebooks will be published, covering the Santa Fé route and the Shasta route and Coast Line. Owing to the possible large demand and the limited number of copies available, those wishing the guidebooks must obtain them from the Superintendent of Public Documents, price $1 each.

WATER PURIFICATION PLANTS AND THEIR OPERATION —By Milton F. Stein, Assoc. M. Am. Soc. C. E., Assistant Engineer, Cleveland Filtration Plant. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. viii + 258; 95 illustrations, 11 charts. $2.50, net.

HISTORY OF THE PANAMA CANAL: Its Construction and Builders—By Ira E. Bennett. Associate Editors: John Hays Hammond, Patrick J. Lennox, B. A., Litt. D., William Joseph Showalter, Capt. Philip Andrews, U. S. N., Rupert Blue, M. D., D. P. H., J. Hampton Moore. Builders' Edition. Washington, D. C.: Historical Publishing Co. Cloth; 7x11 in.; pp. 583; illustrated. $5.

INTERNATIONAL ASSOCIATION FOR THE PREVENTION OF SMOKE: Proceedings of Annual Convention Held at Grand Rapids, Mich., Sept. 9-11, 1914. Chicago (608 City Hall): S. H. Viall, Secretary. Paper; 6x9 in.; pp. 79.

THE MANNHEIM (COMPLETE MANUAL) AND THE DUPLEX SLIDE RULES—By William Cox. Hoboken, N. J.: Keuffel & Esser Co. Paper; 6x9 in.; pp. 60; illustrated. 50c.

MODERN PLUMBING ILLUSTRATED: A Comprehensive and Thoroughly Practical Work on the Modern and Most Approved Methods of Plumbing Construction; the Standard Work for Plumbers, Architects, Builders, Property Owners, Boards of Health and Plumbing Examiners, and for Trade Classes in Plumbing—By R. M. Starbuck, Author of "Questions and Answers on the Practice and Theory of Sanitary Plumbing" (2 Vols.), "Questions and Answers on the Practice and Theory of Steam and Hot Water Heating," "Mechanical Drawing for Plumbers," etc. Third Edition Revised and Enlarged. New York: Norman W. Henley Publishing Co. Cloth; 8x11 in.; pp. 407; fully illustrated by 58 detailed plates made expressly by the author for this work. $4.

LEVEE AND DRAINAGE LAWS OF TEXAS: Bulletin No. 4— Austin, Texas: State Reclamation Department. Paper; 6x9 in.; pp. 89.

MASONRY AS APPLIED TO CIVIL ENGINEERING: Being a Practical Treatise on the Design and Construction of Engineering Works in Stone and Heavy Concrete—Adapted for the Use of Students and Those Engaged in the Practice of the Profession by F. Noel Taylor, author of "A Manual of Civil-Engineering Practice." New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. xi + 230; 212 illustrations.

A MODEL HEALTH CODE FOR TEXAS CITIES—By Robert M. Jameson, Secretary of the Bureau of Municipal Research and Reference. Municipal Research Series No. 8. Austin, Texas: University of Texas. Paper; 6x9 in.; pp. 95.

MOTION OF LIQUIDS—By Lieut.-Col. R. De Villamil. New York: Spon & Chamberlain. London: E. & F. N. Spon, Ltd. Cloth; 6x9 in.; pp. xiv + 210; 86 illustrations and 30 tables. $2.50.

PRACTICAL MECHANICS AND ALLIED SUBJECTS—By Joseph W. L. Hale, Associate Professor of Engineering, the Pennsylvania State College, Detailed as Supervisor Apprentice Schools, Pennsylvania Lines East of Pittsburgh and Erie; Member of the National Association of Corporation Schools; Member of the National Society for the Promotion of Industrial Education; Associate Member of the American Institute of Electrical Engineers; Author of "Practical Applied Mathematics." New York and London: McGraw-Hill Book Co., Inc. Cloth; 5x7 in.; pp. 225; 201 illustrations and text figures. $1, net.

NATIONAL FIRE PROTECTION ASSOCIATION: Proceedings of Annual Meeting Held at New York City, May 11-13, 1915. Boston, Mass. (87 Milk St.): Franklin H. Wentworth, Secretary. Paper; 6x9 in.; pp. 497. For Members Only; $1 a copy.

PRACTICAL TRACK WORK—By Kenneth L. Van Auken. Chicago, Ill.: Railway Educational Press, 14 East Jackson Boulevard. Cloth; 5x8 in.; pp. 216; illustrated. $1.50.

THE PREPARATION OF FERTILIZER FROM MUNICIPAL WASTE—By J. W. Turrentine, Scientist in Soil Laboratory Investigations, Bureau of Soils. (From Yearbook of Department of Agriculture for 1914.) Washington, D. C.: Department of Agriculture. Paper; 6x9 in.; pp. 309.

THE PRINCIPLES AND PRACTICE OF LINEAR PERSPECTIVE, Developed Along Original Lines: Being a Practical Handbook for Architects, Civil and Mechanical Engineers, Art Designers, Engravers, and for Draughtsmen Engaged in All the Industrial Arts, Including a Self-Explanatory Linear Perspective Chart in Simplified Form—By Herman T. C. Kraus, C. E. Second Edition, Revised and Enlarged. New York: Norman W. Henley Publishing Co., 132 Nassau St. Cloth; 10x13 in.; pp. 53; 15 plates of practical examples. $2.50.

PUBLIC HEALTH IN SPRINGFIELD, ILLINOIS: A Survey by the Department of Surveys and Exhibits, Russell Sage Foundation—By Franz Schneider, Jr. New York: Department of Surveys and Exhibits, Russell Sage Foundation. Paper; 6x9 in.; pp. 159; illustrated. 25c.

Among other topics treated this report deals with water-supply, sewerage and sewage disposal, and typhoid fever. Among recommendations for the improvement of the health department of the city is the employment of a full-time health officer.

THE SLIDE RULE: A Practical Manual—By Charles N. Pickworth, Editor of "The Mechanical World"; author of "Logarithms for Beginners"; "The Indicator: Its Construction and Application"; "The Indicator Diagram: Its Analysis and Calculation." 13th Edition. New York: D. Van Nostrand Co. Manchester, England: Emmott & Co. Cloth; 5x8 in.; pp. 122; 37 illustrations. $1.

The preface states that the contents have been further extended so as to include descriptions of various new slide rules and calculators. A note on the extraction of fifth root, etc., has also been added.

PUBLIC SERVICE COMMISSION FOR THE FIRST DISTRICT OF THE STATE OF NEW YORK: Report for the Year Ending Dec. 31, 1913; Vol. II, Statistics of Transportation Companies. Report for the Year Ending Dec. 31, 1914; Vol. I, Report and Appendices A to D, Inclusive. Linen; 6x9 in.; pp. 861 and 813.

PUBLIC WORKS DEPARTMENT, MADRAS PRESIDENCY: Administration Report for the Year 1913-14. Part II, Irrigation. Madras, India: Irrigation Branch of the Department. Cardboard; 8x13 in.; pp. 283; illustrated. 4 shillings, 3 pence.

STANDARD HAND BOOK FOR ELECTRICAL ENGINEERS Prepared by a Staff of Specialists—Frank F. Fowle, S. B., Editor-in-Chief, Consulting Electrical Engineer, M. Am. I. E. E., Illuminating Engineering Society and National Electric Light Association. Fourth Edition, rewritten and greatly enlarged. New York and London: McGraw-Hill Book Co., Inc. Leather; 4x7 in.; pp. 1984; illustrated. $5, net.

PURCHASING: Its Economic Aspects and Proper Methods—By H. B. Twyford, Otis Elevator Co. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. xvi + 236; 121 illustrations. $3, net.

THE THEORY AND PRACTICE OF ORE DRESSING—By Edward S. Wiard, S. B., Member, Min. and Met. Soc. of America. First Edition. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 426; 254 text illustrations. $4, net.

ULTRA-VIOLET RAYS: A List of References to Material in the New York Public Library—Compiled by William B. Behrens, Division of Technology. Paper; 7x10 in.; pp. 20.

RESEARCH WORK, METROPOLITAN WATER BOARD, Eleventh Report—By Dr. A. C. Houston, Director of Water Examination, Metropolitan Water Board. Together with Index to Research Reports, Nos. I-X, inclusive. London, England: Metropolitan Water Board (Savoy Court, Strand, W. C.). Paper; 8x13 in.; pp. 52 + vii. 2½ shillings.

The larger part of this report is devoted to an account of a continuation of Dr. Houston's experiments on the excess lime method of water treatment. Detailed chemical and bacterial results are given. The report also contains a "Note on 'Water Microbes,' Giving the Cholera Red Reaction on First Test."

Field and Office

Cost of Fence Wire, Wood and Steel Posts

The report of the Committee on Signs, Fences and Crossings, presented at the annual meeting of the American Railway Engineering Association, gives some interesting figures of cost for two sections of test fence on the Philadelphia division of the Baltimore & Ohio R.R. One section had metal posts and the other had wood posts. Each section, erected in May, 1913, was 4620 ft. long and had electrically welded wire fence of No. 9 galvanized wires. The figures given in the report are tabulated below:

	Steel Posts	Wood
Labor, driving and tamping intermediates	$0.0573	....
Setting end or anchor posts	1.22	....
Total	$1.2773	....
Digging holes, distributing and setting	....	$0.0879
Erecting fence on posts, per rod	.18	.1576
Erecting fence on posts, per mile	57.60	50.43
Stretching wire, per rod	.0613	.0672
Stretching wire, per mile	19.62	21.50
Posts, price	.245 (line)	.18
Posts, cost in place	.3023	.2679

Relaying Street-Railway Track at Cincinnati

The Cincinnati Traction Co. has been raising its grade slightly and replacing light rails with heavy rails for about two miles on Madison Ave., practically without interruption to its traffic. The city repaved this section of the street last year. The company was not able to relay its tracks at that time, and merely filled in its space, and in some instances roughly replaced the old asphaltic concrete paving. The new work this year was thereby facilitated, as it was easy to remove the filling and get at the rails.

The earth and stone around the rails were dug out with picks, so that the spikes and splices could be removed and the rails taken up and hauled away. The excavation to grade was about 19 in. deep (below the street surface), and was made by means of a Thew shovel, operated by current taken from the trolley wire. The ties were taken up by hand as the shovel reached them. The excavated material was carried off in wagons and largely used in filling for property owners in the vicinity, the ground being very uneven. Following the shovel work, a few men trimmed the rough edges of the excavation. The surface was then rolled in readiness for the ties, which were supported at the required elevation by means of blocking.

The concrete was mixed by a Foote mixer mounted on a truck and was delivered in place by a steel spout. The mix was 1:2:7, using sand and gravel. The cement was delivered in sacks and piled at intervals along the sidewalk. Sand (and in some cases gravel) was hauled by the company's work cars and dumped along one side of the work, while most of the gravel was hauled by wagons and dumped on the opposite side in a continuous pile. Water was taken from the city's fire-plugs and paid for according to the cubic yards of concrete placed.

With this arrangement, and the mixer moving along slowly but continuously, 1020 lin.ft. of concrete base, 9½ ft. wide and 6 in. deep, was laid in one night on Vine St. On Madison Ave., however, the work was slower, as it was all done during daylight working hours, the principal interference being the operation of the cars. About 300 lin.ft. per day of work was a good average for the shovel, and about the same for the concreting.

The chief feature in the handling of the car traffic during the work was the use of a temporary third track, made up in 30-ft. sections, with steel ties, so that it could be laid or taken up rapidly. This was laid for a distance of several blocks, and advanced as the work progressed. It enabled the cars to be operated virtually without interruption, and at the same time allowed one track to be given over completely to the reconstruction work.



MADISON AVE. STREET RAILWAY RELAYING, CINCINNATI, OHIO

Upper View—General view, showing material in place and temporary car track. Lower View—Track concrete mixer working

At one point, however, where it was desired to improve a bad curve, both tracks had to be relaid together. Up to that point the work had been handled on the outside track, while both tracks here had to be moved inward several feet. Taking advantage of a few hours of free time at night and of the short intervals between the cars, the old tracks were taken up, the new ones laid, and the concreting went ahead under the cars. The concrete was tamped with picks to insure thorough filling under the ties.

The concrete is 9 in. thick and comes within 3 in. of the top of the ties. After this has set, the paving contractor places 6 in. of concrete (of the same mixture), which leaves just room enough for the granite paving blocks. The laying of these completes the job.

The work was under the direction of C. Henderson, Engineer for the company, with J. Hysam as Superintendent.

Reducing Square Feet to Decimals of Acres

The accompanying table has been found valuable for readily and accurately determining the areas of small tracts of land. In making descriptions to be embodied in a deed after the area has been determined in square feet, the acreage can be obtained by reading directly from the table for areas between 0 and 1000 sq.ft. and by a single mental addition for areas between 1000 and 100,000 sq.ft. Thus for 665 sq.ft. follow down the column headed 600 to line opposite 60 and find 0.01515. In same column on line opposite 70 find 0.01538. So 665 sq.ft. equals 0.015+ acre. Again, suppose the area is 49,524 sq.ft. In column headed 500 on line 40,000 read 0.92975. In column headed 0 on line 20 read 0.00046 and on line 30 read 0.00069. Hence interpolating for 24 ft. and adding gives 0.930 acre as the area to the nearest thousandth of an acre for 40,524 sq.ft. There is an interesting fact in connection with the making of this table, namely, the use of a computing machine, which can be used in a like manner to advantage in making any similar table. By starting in a column headed 0 and reading down to line 90, then beginning at the top of column headed 100 and reading down to line 90 and continuing reading in this way across the sheet to 990, it is observed that there is a regular increase of 10 sq.ft. each time. The value of 10 sq.ft. in acres is determined to the eighth figure beyond the decimal. This is placed in the "Millionaire" computing machine with the regulator set on addition and the multiplier lever set at 1. Then the crank is turned with the left hand and the results after each turn are set down with the right from 10 sq.ft. to 1000 sq.ft.

TABLE OF SQUARE FEET REDUCED TO DECIMALS OF AN ACRE

Feet	0	100	200	300	400	500	600	700	800	900
0	0.00000	0.00230	0.00459	0.00689	0.00918	0.01148	0.01377	0.01607	0.01837	0.02066
10	0.00023	0.00253	0.00482	0.00712	0.00941	0.0171	0.01400	0.01630	0.01859	0.02089
20	0.00046	0.00275	0.00505	0.00735	0.00964	0.01194	0.01423	0.01653	0.01882	0.02112
30	0.00069	0.00298	0.00528	0.00758	0.00987	0.01217	0.01446	0.01676	0.01905	0.02135
40	0.00092	0.00321	0.00551	0.00781	0.01010	0.01240	0.01469	0.01699	0.01928	0.02158
50	0.00115	0.00344	0.00574	0.00803	0.01033	0.01263	0.01492	0.01722	0.01951	0.02181
60	0.00138	0.00367	0.00597	0.00826	0.01056	0.01286	0.01515	0.01745	0.01974	0.02204
70	0.00161	0.00390	0.00620	0.00849	0.01079	0.01309	0.01538	0.01768	0.01997	0.02227
80	0.00184	0.00413	0.00643	0.00872	0.01102	0.01331	0.01561	0.01791	0.02020	0.02250
90	0.00207	0.00436	0.00666	0.00895	0.01125	0.01354	0.01584	0.01814	0.02043	0.02273
1,000	0.02296	0.02525	0.02755	0.02984	0.03214	0.03444	0.03673	0.03903	0.04132	0.04362
2,000	0.04591	0.04821	0.05050	0.05280	0.05510	0.05739	0.05969	0.06198	0.06428	0.06657
3,000	0.06887	0.07117	0.07346	0.07576	0.07805	0.08035	0.08264	0.08494	0.08724	0.08953
4,000	0.09183	0.09412	0.09642	0.09871	0.10101	0.10331	0.10560	0.10790	0.11019	0.11249
5,000	0.11478	0.11708	0.11938	0.12167	0.12397	0.12626	0.12856	0.13085	0.13315	0.13545
6,000	0.13774	0.14004	0.14233	0.14463	0.14692	0.14922	0.15151	0.15381	0.15611	0.15840
7,000	0.16070	0.16299	0.16529	0.16758	0.16988	0.17218	0.17447	0.17677	0.17906	0.18136
8,000	0.18365	0.18595	0.18825	0.19054	0.19284	0.19513	0.19743	0.19972	0.20202	0.20432
9,000	0.20661	0.20891	0.21120	0.21350	0.21579	0.21809	0.22039	0.22268	0.22498	0.22727
10,000	0.22957	0.23186	0.23416	0.23646	0.23875	0.24105	0.24334	0.24564	0.24793	0.25023
11,000	0.25252	0.25482	0.25712	0.25941	0.26171	0.26400	0.26630	0.26859	0.27089	0.27319
12,000	0.27548	0.27778	0.28007	0.28237	0.28466	0.28696	0.28926	0.29155	0.29385	0.29614
13,000	0.29844	0.30073	0.30303	0.30533	0.30762	0.30992	0.31221	0.31451	0.31680	0.31910
14,000	0.32140	0.32369	0.32599	0.32828	0.33058	0.33287	0.33517	0.33746	0.33976	0.34206
15,000	0.34435	0.34665	0.34894	0.35124	0.35353	0.35583	0.35813	0.36042	0.36272	0.36501
16,000	0.36731	0.36960	0.37190	0.37420	0.37649	0.37879	0.38108	0.38338	0.38567	0.38797
17,000	0.39027	0.39256	0.39486	0.39715	0.39945	0.40174	0.40404	0.40634	0.40863	0.41093
18,000	0.41322	0.41552	0.41781	0.42011	0.42241	0.42470	0.42700	0.42929	0.43159	0.43388
19,000	0.43618	0.43847	0.44077	0.44307	0.44536	0.44766	0.44995	0.45225	0.45454	0.45684
20,000	0.45914	0.46143	0.46373	0.46602	0.46832	0.47061	0.47291	0.47521	0.47750	0.47980
21,000	0.48209	0.48439	0.48668	0.48898	0.49128	0.49357	0.49587	0.49816	0.50046	0.50275
22,000	0.50505	0.50735	0.50964	0.51194	0.51423	0.51653	0.51882	0.52112	0.52342	0.52571
23,000	0.52801	0.53030	0.53260	0.53489	0.53719	0.53948	0.54178	0.54408	0.54637	0.54867
24,000	0.55096	0.55326	0.55555	0.55785	0.56015	0.56244	0.56474	0.56703	0.56933	0.57162
25,000	0.57392	0.57622	0.57851	0.58081	0.58310	0.58540	0.58769	0.58999	0.59229	0.59458
26,000	0.59688	0.59917	0.60147	0.60376	0.60606	0.60836	0.61065	0.61295	0.61524	0.61754
27,000	0.61983	0.62213	0.62242	0.62672	0.62902	0.63131	0.63361	0.63590	0.63820	0.64049
28,000	0.64279	0.64509	0.64738	0.64968	0.65197	0.65427	0.65656	0.65886	0.66116	0.66345
29,000	0.66575	0.66804	0.67034	0.67263	0.67493	0.67723	0.67952	0.68182	0.68411	0.68641
30,000	0.68870	0.69100	0.69330	0.69559	0.69789	0.70018	0.70248	0.70477	0.70707	0.70937
31,000	0.71166	0.71396	0.71625	0.71855	0.72084	0.72314	0.72543	0.72773	0.73003	0.73232
32,000	0.73462	0.73691	0.73921	0.74150	0.74380	0.74610	0.74839	0.75069	0.75298	0.75528
33,000	0.75757	0.75987	0.76217	0.76446	0.76676	0.76905	0.77135	0.77364	0.77594	0.77824
34,000	0.78053	0.78283	0.78512	0.78742	0.78971	0.79201	0.79431	0.79660	0.79890	0.80119
35,000	0.80349	0.80578	0.80808	0.81038	0.81267	0.81497	0.81726	0.81596	0.82185	0.82415
36,000	0.82644	0.82874	0.83104	0.83333	0.83563	0.83792	0.84022	0.84251	0.84481	0.84711
37,000	0.84940	0.85170	0.85399	0.85629	0.85858	0.86088	0.86318	0.86547	0.86777	0.87006
38,000	0.87236	0.87465	0.87695	0.87925	0.88154	0.88384	0.88613	0.88843	0.89072	0.89302
39,000	0.89532	0.89761	0.89991	0.90220	0.90450	0.90679	0.90909	0.91138	0.91368	0.91598
40,000	0.91827	0.92057	0.92286	0.92516	0.92745	0.92975	0.93205	0.93434	0.93664	0.93893
41,000	0.94123	0.94352	0.94582	0.94812	0.95041	0.95271	0.95500	0.95730	0.95959	0.96189
42,000	0.96419	0.96648	0.96878	0.97107	0.97337	0.97566	0.97796	0.98206	0.98255	0.98485
43,000	0.98714	0.98944	0.99173	0.99403	0.99633	0.99862	1.00092	1.00321	1.00551	1.00780

	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
40,000	0.91827	0.94123	0.96419	0.98714	1.01010	1.03306	1.05601	1.07897	1.10193	1.12488
50,000	1.14784	1.17080	1.19375	1.21671	1.23967	1.26262	1.28558	1.30854	1.33149	1.35445
60,000	1.37741	1.40036	1.42332	1.44628	1.46924	1.49219	1.51515	1.53811	1.56106	1.58402
70,000	1.60698	1.62993	1.65289	1.67585	1.69880	1.72176	1.74472	1.76767	1.79063	1.81359
80,000	1.83654	1.85950	1.88246	1.90541	1.92837	1.95133	1.97428	1.99724	2.02020	2.04316
90,000	2.06611	2.08907	2.11203	2.13498	2.15794	2.18090	2.20385	2.22681	2.24977	2.27272

100,000	2.00000	3.00000	4.00000	5.00000	6.00000	7.00000	8.00000	9.00000	10.00000
2.29568	4.59136	6.88704	9.18272	11.47840	13.77408	16.06976	18.36544	20.66112	22.95680

[The "Millionaire" computing machine[1] is of Swiss manufacture and is claimed to be the only computing machine that operates on the multiplication principle. Only one turn of the crank is required for each figure in the multiplier or quotient, instead of one turn for each unit of each figure, as with machines which operate on the addition principle.—Editor.] A single shift of the carriage gives the value for 100 sq.ft. to be added each time in the part of the table commencing 1000 and the process of turning with left hand and setting down results with the right continues, excepting that we now go across the lines instead of running down the columns. After computing the values to 43,900 sq.ft., another shift in the carriage is made to give the value of 1000 sq.ft. each time, and the value of 40,000 sq.ft., already found, set in the sum column on the machine. Another shift at 100,000 for the value of 100,000 and the table is carried to completion with very little labor.—B. F. Sperow, Carolina, Clinchfield & Ohio Ry., Johnson City, Tenn.

[The above indicates one of the many uses that may be made of a computing machine in engineering offices. Apparently because of their high cost, engineers have been reluctant to adopt mechanical devices for those tiresome and routine computations which have been the bane of many a man's practice. For computations in banking and insurance offices mechanical computers are now used exclusively. An article descriptive of other computing machines and their use for survey work was published in *Engineering News*, Jan. 7, 1915.—Editor.]

[1]Made by Hans W. Egli, Zurich, Switzerland, and handled in America by W. A. Morschhauser, 1 Madison Ave., New York City.

Retracing Old Compound Railway Curves

By F. W. Green*

In retracing old railway curves, it is sometimes found that the original notes and chaining show considerable discrepancies. When compound curves are to be re-established any discrepancy in the chaining is likely to cause inconvenience. In such cases, when the notes show the degree of curve for each branch, it is a simple matter to locate the P.C. and P.T., and then to chain the distance

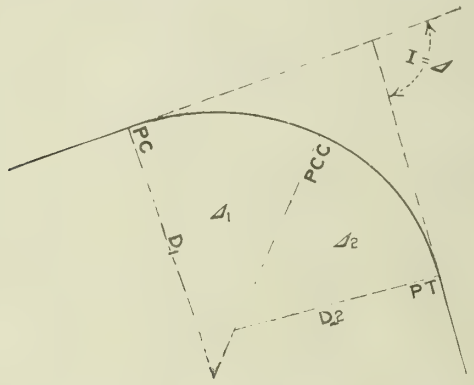


DIAGRAM OF COMPOUND CURVE TO BE RETRACED

from P.C. to P.T. The P.C.C. may then readily be located by the following method, which, so far as I can learn, is original:

(1) Given a compound curve (as in the accompanying plan), the intersection angle I, the location of P.C. and P.T., and degrees of curves D_1 and D_2; to find the station of the P.C.C. Let L_1 be the length of first curve, in stations; L_2 the length of second curve, and L the length of both curves. And let $I = \Delta$. Then:

$$\frac{\Delta - \Delta_2}{D_1} + \frac{\Delta_2}{D_2} = L.$$

Example: P.C. at Sta. 5502 + 00, $D_1 = 1°$, $D_2 = 2°$
$L = 27.37$, $\Delta = 38° 15'$

$$38.25 - \frac{\Delta_2}{1} + \frac{\Delta_2}{2} = 27.37$$

Whence: $\Delta_2 = 21.76° = 21° 45.6'$

$$L_2 = \frac{21.75}{2} = 10.88$$

$L - L_2 = L_1 = 27.37 - 10.88 = 16.49.$

Sta. of P.C. = 5502 + 00
Add L_1 = 16 + 49
Sta. of P.C.C. = 5518 + 49
Add L_2 = 10 + 88
Sta. of P.T. = 5529 + 37

(2) Given Δ_2 and Δ; D_1 and L; to find D_2

Transposing (1); $$D_2 = \frac{\Delta_2}{L - \frac{\Delta - \Delta_2}{D_1}}$$

Example: $\Delta_2 = 21.76$, $L = 27.37$, $\Delta = 38.25$; $D_1 = 1°$

$$D_2 = \frac{21.76}{27.37 - \frac{38.25 - 21.76}{1}} = 2°$$

Installing a Half-Mile Sewer System; Gilbert, Minn.

In the spring of 1915 the village of Gilbert, Minn., built about 3000 ft. of 8-in. pipe sewers in a recently annexed territory. The attached cost analysis shows how cheaply this work was done by municipal day labor. The rates of wages paid for an 8-hr. day were: Common labor, $2.25; teams, $5.50; masons, $6.40; pipe layer, $2.75. The average cost per linear foot of sewer completed, including manholes, was $1.50.

The sewer main to which these new sewers were to be connected was at a depth of 7½ ft. At the junction, a hole 7 ft. in diameter was dug uncovering about 4 ft. of the pipe. A manhole was then built over the pipe with the 8-in. pipe connection for the new sewer through the wall. The main sewer was then broken and the concrete invert through the manhole completed. The trench for the new sewer was started at the manhole, and as fast as the excavation was brought to grade, the pipe was laid and used to drain off any water which came into the trench.

COSTS, GILBERT, MINN., SEWERS
Started May 1, 1915, Finished June 14, 1915

Line A, 885 ft. in Length	
Excavation	$675.00
4 manholes	216.24
8-in. pipe and Y's	160.59
Filling trench	175.26
Teams and cement	33.55
Labor for laying pipe	43.00
Engineering and foreman	105.00
Total cost for line	$1408.64
Line C, 1037 ft. in Length	
Excavation	$747.00
5 manholes	283.59
8-in. pipe and Y's	201.94
Filling trench	194.00
Teams and cement	65.45
Labor for laying pipe	50.00
Engineering and foreman	80.00
	35.00
Total cost for line	$1656.98
Line E, 1053 ft. in Length	
Excavation	$488.48
3 manholes	124.87
8-in. pipe and Y's	200.07
Filling trench	146.25
Teams and cement	31.05
Labor for laying pipe	40.00
Engineering and foreman	70.00
Total cost for line	$1100.72

12 manholes cost $624.67.
Average cost per manhole $52.05.

Approx. 2479 cu.yd. earth, $1910.48.
Average of 77c. per cu.yd.

2479 cu.yd. filling, $515.51.
Average of 20c. per cu.yd. (hand filling).

2975 ft. of pipe laid for $133.00.
Average of 0.0475c. per lin.ft.

8-in. tile sewer pipe @ 18¾c. per lin.ft.
Sand-lime bricks @ $12 per M.

Line A, total cost	$1408.64
Line C, total cost	1656.98
Line E, total cost	1100.72
Total cost of system	$4166.34
Cost of lumber	72.05

In one of the trenches quicksand of the worst sort was encountered, and the ditch could not be kept open five minutes with the ordinary bracing. After trying many methods the following one succeeded: Iron rods, 2 in. in diameter, about 10 ft. long, were driven at intervals of 5 ft. Pieces of 2-in. plank 24 ft. long were laid horizontally, behind the rods, and between the planking and the sand hay and green boughs were wedged as tightly as possible.

White sand-lime brick costing $12 per M were used for building the manholes. Instead of using the ordinary tile stoppers for the Y's, galvanized-iron covers were put

in. When the Y's were ready to be opened and connected to the house drains, a hook was stuck into the cover and it came out easily. Tile covers have to be broken, and the chances are that part of the cover goes into the pipe. The 8-in. tile pipe cost 18¾c. per lin.ft., and the Y's, 6x8 in., cost 75c. each.—A Cohn, Gilbert, Minn.

Steam Shovel Burrows Its Way Out of Cut

The accompanying photographs, taken May 3, illustrate resourcefulness in operating a steam shovel. The shovel shown herewith was used in making the second cut in





FIGS. 1 AND 2. VIEWS OF STEAM SHOVEL DIGGING ITS WAY OUT OF CUT

Fig. 1—Timbering of second cut shown in rear. Fig. 2—Shovel nearing the completed tubes of Long Island R.R., in East New York. Observe character of side slopes in both views

a section of the grade-crossing elimination work which the Long Island R.R. has had under way for the last three years in East New York.

When this section of the second cut had been finished, the disposition of the shovel presented something of a problem. It would not do to lift it out of the cut, because the slopes might slide, nor could it be backed out by the way it had entered, because of the timbering shown in the rear, Fig. 1.

The four tubes of the tunnel had been completed to a point where the second cut on this section began. It was decided that the simplest way of moving the shovel to the surface was to have it dig its way down to one of the concrete tubes, the floor of which was 22 ft. below the floor of the second cut, and then to run the shovel out to the portal on the track laid inside the tube.

The spoil handled by the shovel was lifted out of the cut by a crane equipped with a bucket. In order to keep the water distributed uniformly in the boiler and the fire burning properly, the rear truck of the shovel was removed and the shovel was skidded on timbers down an 18-per cent. grade. Walter H. Gahagan, the contractor, states that the entire operation was performed without any particular difficulty.

Erection of Steel Arch Span, Detroit-Superior Viaduct

Cantilever erection of the 591-ft. steel arch forming the main span of the new Detroit-Superior viaduct in Cleveland is being carried on with unusually simple plant for so large a span. The principal work will be done by a timber top-chord traveler carrying two 25-ton stiff-leg derricks which were previously used on the ground in setting anchorage steel. The total weight of the traveler with derricks and hoisting engines is only about 70 tons. The hoists are 52-hp. electric machines built by the Thomas Elevator Co., Chicago. They have a pulling capacity of from 7500 to 8000 lb.

The traveler rolls on a track made of two 8x16-in. timbers laid flat side by side, resting on 8x8-in. by 3½-ft. ties laid on the top chord. In the three end panels of the arch the track is above the chord (being started on a flatter slope than the end sections of the top chord), and the track stringers rest on short falsework bents set on the chord. Beyond this portion of the track the traveler carriage follows the changing slope of the top chord, but the derricks are kept vertical by an adjustable link connecting a shoe at the rear end of the fore-and-aft leg to the back of the carriage (see Fig. 1).

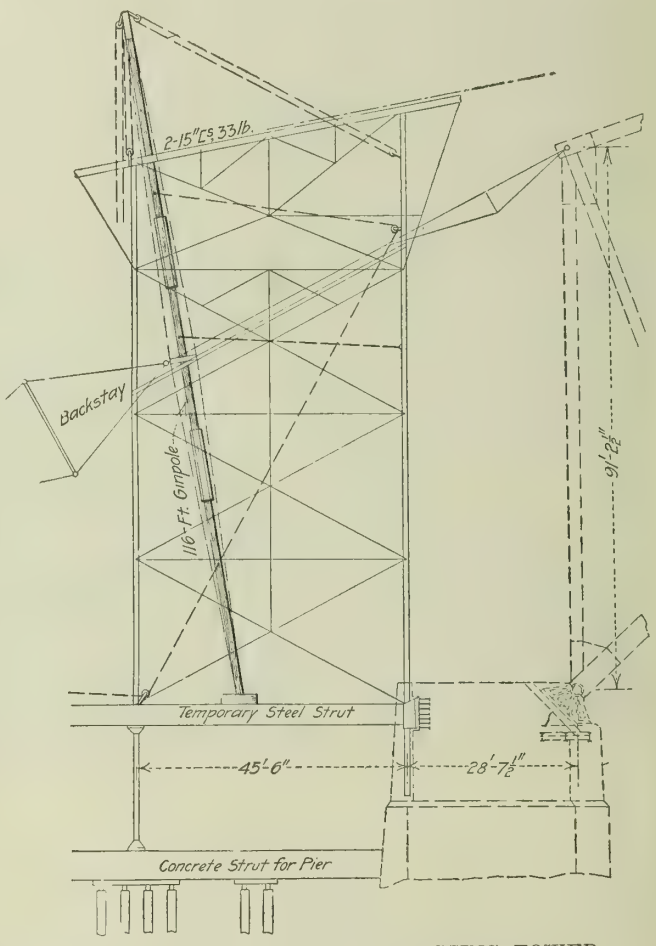


FIG. 2. GIN-POLE USED IN ERECTING TOWER

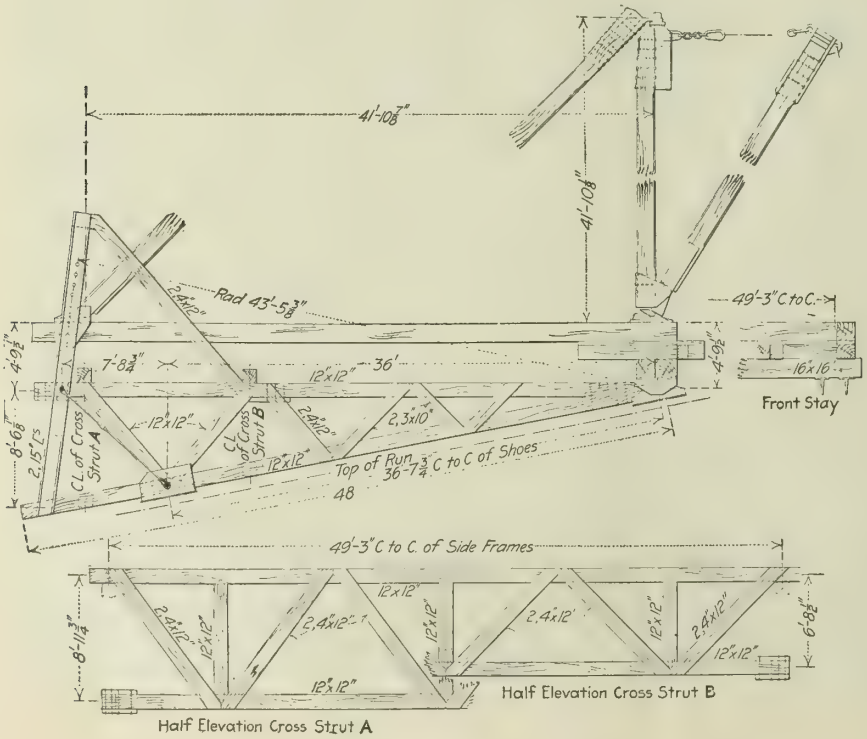


FIG. 1. ERECTION TRAVELER, DETROIT-SUPERIOR ARCH

The capacity of either derrick is sufficient to lift the heaviest member other than the lower-chord end section. Most of the material will be hoisted from scows in the river direct to place in the arch. Working forward from both piers to junction in the middle, the travelers will erect only the arches and their bracing. Then returning, they will placethe floor steel—two decks, the whole viaduct being a double-deck structure.

The eyebar backstays which hold the half-arches in place until joined at the center are remarkable for the shape of the toggle, which has least depth at the screw, so as to put the screw in tension.[1]

[1]See sketch in "Engineering News," of June 18, 1914, p. 1348, where drawings and details of the bridge are also given.

To carry the weight of backstay and toggle, and to support the traveler at the start, a steel erection tower has been built behind the main pier, on each bank. These towers were erected by a gin-pole. As the towers are about 90 ft. high, a 116-ft. gin-pole was built, shown in sketch Fig. 2. It was made of three lengths of 12x12, spliced at both joints by four 12-ft. pieces of 4x12, bolted through, and was stayed by four hog-rods made of ⅝-in. wire rope with turnbuckle connection at the bottom to a 1-in. rod. Four sets of double-part 1-in. guy lines extended back to blocks hitched to the tower, and led down the pole to a fastening at the foot. The pole was further steadied by a belly-guy near the upper quarter-point, leading through a snatch-block on the tower to a spool on the engine so that a strain could be held on it; and by a pair of slack guys lower down, near the middle of the length, hitched to two posts of the tower back of the pole.

This gin-pole was first set by a derrick at the lowest falsework level, to erect the lower part of the tower; later it was lifted to the level of the pier top, and in this position erected the upper part of the tower and the traveler carriage; it was then hoisted another story, to lift the first derrick to place. After the pole erected the east tower it was dismantled and reërected on the west bank (Fig. 4).

In erecting the first arch steel the backstays can not be used because they connect to the end pin of the top chord, which pin can be driven only after the entire first panel is in place. The first panel is therefore being set on falsework comprising a framed bent of 12x12's, set on the ground to support the lower chord just back of the first panel-point.

The first panel includes the heaviest member of the arch—the 30-ton end section of the lower chord. As

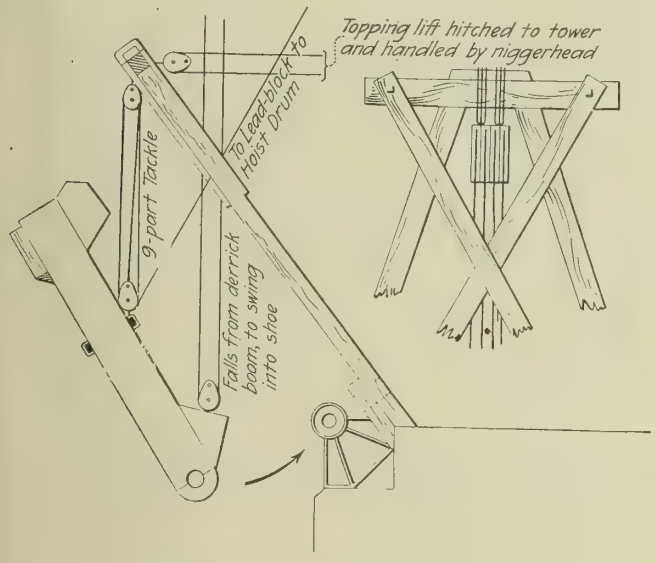


FIG. 3. SETTING OF SHEER-LEGS FOR HOISTING 30-TON CHORD

the traveler derricks could not safely lift this from their position on the forward overhang of the erection tower (Fig. 2), a pair of sheer-legs was set on the front edge of the pier, as shown by Fig. 3. With a 9-part hoisting tackle, this handles the weight of the chord-section from the ground; the derrick-falls then swing the L0 point to seat in the shoe.

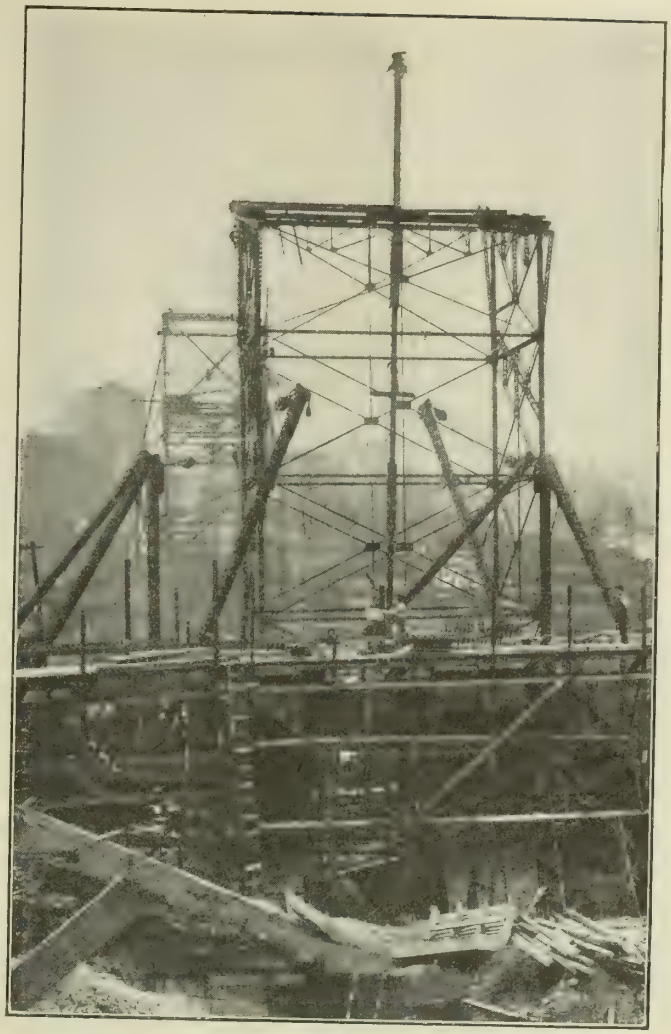


FIG. 4. GIN-POLE 116 FT. HIGH, ERECTING WEST TRAVELER TOWER

Lower story of tower is concealed by pier 2. The gin-pole is stepped at the level of the bottom of the lower story

The arch panels are about 25 ft. long (24 panels = 591 ft.). The traveler will have to make a maximum reach of about 32 ft. in lifting steel from scows. The heaviest member it must handle is the 23½-ton post U2 L2.

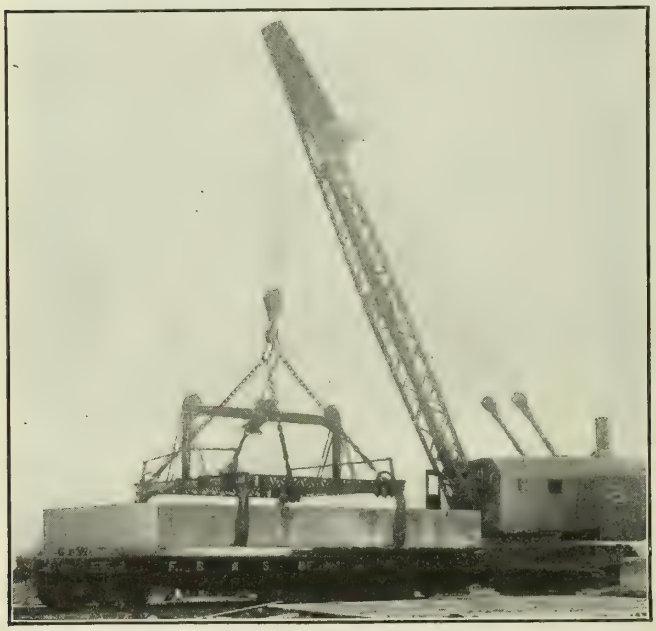
The Ferro Construction Co., of Chicago, is erecting the arch; F. C. Fisher, President, designed the erection appliances. Both the arch steel and the traveler tower were fabricated by the King Bridge Co., of Cleveland. F. F. Buck, superintendent of erection, is in charge of the field work for the Ferro Construction Co. The first steel of the main arch was set July 29, as noted in the news pages of *Engineering News* of Aug. 5, 1915. It is expected that the arch will be closed by October, and the floor put in place by the end of the year.

Beaching a Vessel at High Tide for repairs to the hull is very common practice in the case of small vessels, and has been resorted to at the Pacific end of the Panama Canal for even such large vessels as the seagoing suction dredge "Culebra." As the range of tidal levels at the Pacific end is 20 to 21 ft., a vessel beached at high tide on the broad, sloping, sandy beach will be left high and dry at low tide. This method has been so successful with large-size vessels that, although a dry dock is now available at Panama, the "Culebra" was recently beached for minor exterior repairs to her hull because the work could be done in that way more cheaply and quickly than by drydocking.

Handling 62-Ton Concrete Blocks at Halifax

In the construction of the new Ocean Terminals for the Canadian Government Railways at Halifax, N. S., the quay walls are being formed of huge concrete blocks, most of which are 22x31 ft. in plan and 4 ft. thick. These are cast with a number of vertical openings and laid in place in the quay wall one on top of the other. The openings are matched and later filled with concrete so as to form a continuous solid wall 31 ft. wide.

For handling these blocks, the largest of which weigh 62 tons each, the crane shown in the accompanying view is being used. This is a regular "160-ton wrecking crane," made by the Industrial Works, of Bay City, Mich., equipped with a lattice boom instead of the ordinary crane arm. It was designed to handle a load of 70½ tons at approximately 33 ft. radius. As is shown in the view, the handling is facilitated by the use of a fairly compli-



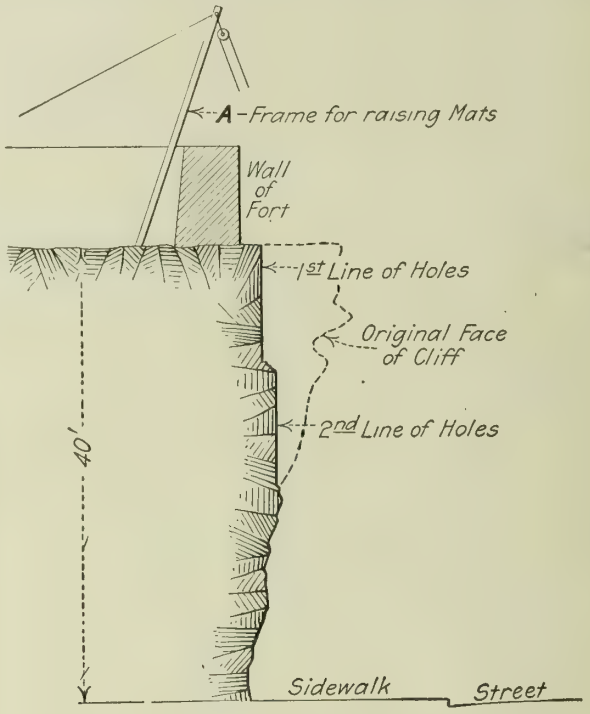
A TRACK CRANE LIFTING A 60-TON CONCRETE BLOCK AT HALIFAX TERMINAL

cated sling made of a structural frame provided with hooks controlled by a toggle-lift.

The work is in charge of James McGregor, Superintending Engineer for the Halifax Ocean Terminals, and is being executed by Foley Bros., Welch Stewart & Farquier, for whom L. G. Fuller is Superintendent.

NOTES

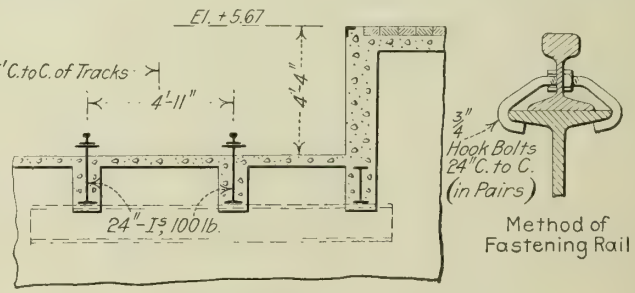
Facing-Off an Overhanging Cliff—Trimming a jagged cliff on which is perched Fort Horn, a relic of the days when the Indians threatened Manhattan Island, was a problem undertaken recently by the Degnon Contracting Co. for the Parks Department of New York City. About 25 years ago 123rd St. was cut through to the general level of the region north of Morningside Heights and as a result, Fort Horn, which consists of three rubble stone walls about 7 ft. high and 5 ft. thick built around three sides of a 30-ft. square, was left perched on the edge of a 40-ft. cliff. Deep holes and heavy charges of explosive had been used, and the rock in the upper part was badly shattered, so that later it began to crumble and pieces continued to slip down on the sidewalk below. To face off this cliff and eliminate the danger from falling fragments a line of 8-ft. holes on 4-in. centers was drilled the length of the dangerous portion (about 60 ft.), 18 in. out from the wall of the fort. A second row of holes was then drilled, starting at the foot of the first line, as shown in the accompanying sketch. After the bulk had been shot away, the face was carefully scaled. For the drilling, a gasoline air compressor of 150 cu.ft. of free air per minute capacity was set up near the foot of the cliff and served to operate two and



TYPICAL SECTION THROUGH FORT HORN

sometimes three "Jackhamer" precussion hand drills. The drill steels were made in 2-, 4-, 6- and 8-ft. lengths, with the starters 2 in. in diameter, and were gaged ⅛ in. between changes. Six-point bits were used as being less likely to stick in the seams. With a 60-lb. air pressure the actual drilling time for an 8-ft. hole in sound rock (Manhattan schist) was about 40 min. Ten holes were a good day's work. The drillrunners worked with ropes around them as a precaution in case of a slip. Each shot was covered by heavy rope mats held by blocks-and-falls from A-frames set back of the wall. About 100 cu.yd. of rock was removed without accident. Ed Connors was general foreman for the contractor.—Francis Donaldson, New York City.

A Special Track Design has been adopted for the depressed railway tracks on the new Southwark Piers now being completed by the Department of Wharves, Docks and Ferries, of Philadelphia, Penn. The main structure carrying the track consists of concrete crosswalls with embedded I-beams on



METHOD OF CARRYING RAILWAY TRACK ON SOUTHWARK PIERS, PHILADELPHIA

which rest stringers of I-beams embedded in concrete. The upper parts of these stringers protrude above the concrete and carry the track rails laid directly on the stringers. The details of the design and the method of fastening the rail to the stringers are shown in the accompanying drawing. This fastening consists of hook-bolts arranged in pairs and spaced at intervals of 2 ft. John Meigs is Director of the Department.

Editorials

Delays in Flood Protection

Flood-protective construction is easily the livest issue in the civil-engineering field at the present time. The organization of the Miami conservancy district and other reclamation districts in Ohio after more than a year of legal discussion means the start of definite planning on a large scale for many millions of expenditure.

It is a misfortune that the work has not yet reached the construction stage. With the contracting business in a state of starvation, as it is, the dike and dam and dredging contracts of Central States flood protection would have been a most desirable item to help in keeping the business alive and to maintain contractors' working organizations. The low contract prices which now prevail would not have been affected, so that the people who need the flood protection would have benefited in fullest measure from the slack condition of the business.

The reason why these desirable results are not realized is the fact that an excessive mental inertia had to be overcome. The teachings of the great flood—that protective works are urgently necessary—did not sink in. No city, county or state was willing to start. Not only this, but the Ohio Legislature directly evaded the problem; amid political intrigues it hurried its session to an end and adjourned, leaving the flood problem untouched for many months. The people of Columbus even rejected by popular vote a definite project for local protection. Under these circumstances one need not be surprised that it has taken more than two years to get the planning started and that the 1915 season finds practically no flood-protective work under way.

The destruction wrought by the Erie freshet ought to act as a warning alarm to those who still feel unsympathetic toward the movement for stream control. It directs attention also to the potential dangers residing in small streams. Heretofore it was commonly thought that the hydraulic possibilities of brooks and creeks are well known, since they are likely to get their maximum flow from a local thunderstorm. The Erie experience destroys this belief and shows that even insignificant little rivers need study and control.

Estimating the Value of New Inventions

The recent move made by Secretary Daniels to establish in the Navy Department a New Inventions Board to examine new inventions offered to the navy and select for development such as appear to be of promise calls attention to a very difficult but very important class of engineering work.

Many business men and not a few engineers look upon all work of this sort with frank skepticism. They will flatly deny that anyone, no matter what his experience and technical acquirements, is competent to pass judgment upon the merits of a new and untried invention and to say in advance of its actual demonstration whether it is promising or worthless.

In fairness to those who hold this belief, it should be said that in many cases where an opinion has to be given upon a new and wholly untried invention, the opinions of even the best technical experts may prove mistaken. Some factor which has not been taken into account may eventually cause a very promising invention to fail; or on the other hand may make a success of an invention which seemed hopeless.

But because an engineer's opinion on the merit of an invention may be in error is no more reason for rejecting it as worthless than it would be to reject the opinion of an attorney on a difficult legal question or that of a physician called in consultation in a serious case. The engineer who is competent to pass upon the merits of a new invention can give an opinion at least as reliable as the opinion of the able lawyer or the famous physician.

Further, the engineer can do what the lawyer or the physician cannot, that is, resort to physical tests to determine doubtful points and thus gradually accumulate data on which a reliable opinion can be based. This course will very often be advisable in the case of new inventions of radical novelty. Before deciding whether a new scheme is worth taking up for commercial development, tests of some of its cardinal features can be made, which will show whether its design is based on correct principles.

There is another reason for the widespread belief that nobody can tell in advance whether a new invention will succeed or fail. And this reason is that engineers competent to examine and pass upon new inventions and plan the development of those which are approved are comparatively rare.

It need hardly be said that if an engineer is to form reliable judgment upon the merits of an invention, he must be reasonably familiar with the art to which the invention applies. Hardly less important is it that he be of a fairminded and judical disposition and able to weigh without prejudice the claims of the inventor. A very large proportion of engineers are constitutionally disqualified for undertaking work of this sort. When an engineer is thoroughly familiar with an art he often acquires an unconscious prejudice against anything new and revolutionary which is proposed in it. He will demand of the inventor of a new appliance that it shall reach a degree of perfection in operation which old and familiar appliances have never attained. Such an engineer overlooks the defects in the methods and materials and appliances with which he is familiar because ways have been established for getting along with them, and he fails to appreciate that similar ways would eventually be found for the new and revolutionary method or appliance which is offered. It is the mental inertia of men of this class which makes the task of the inventor of a new appliance so difficult, as a rule.

While engineers with such a mental habit are disqualified for the task of passing on new inventions, there are engineers of another class who are equally disqualified.

These are the men of such sanguine temperament that they see advantages in everything new and fail to appreciate adequately the troubles that may develop.

One of the commonest mistakes made by engineers in passing upon inventions is to reject a scheme offhand because it is not new. Of course, from the limited point of view of patent protection the question of novelty is of importance; but in considering whether an invention may have merits justifying commercial development the matter of novelty should take a subordinate place. An invention may be brought forward and prove a failure at one time and after years of neglect it may again be taken up and the progress of the arts in the intermediate period may make it a great commercial success. Ball and roller bearings to reduce friction were invented very early in the history of mechanics, but they did not become of commercial importance until the development of accurate mechanical processes of producing balls and rollers at low cost made such bearings commercially practicable. Their extensive use, however, has come in very recent years, when instead of being made to order in small quantities such bearings are put on the market in standard sizes at so low a figure as to be available for use without serious expense in ordinary machine design.

Another highly important question to be settled in passing upon a new invention is that of its advantage over existing practice. Hundreds of ingenious schemes are brought forward every year to overcome difficulties that exist chiefly in the imagination of the inventor. An engineer must be intimate enough with an art to weigh fairly the advantages which the new invention proposes to establish over previous practice.

It is well to bear in mind also that the work of a competent "new inventions board," such as is proposed for the navy, and such as actually exist in the organization of progressive industrial concerns, is only begun when the promising new inventions are sifted out from among the impossible ones. The next step is to develop the selected inventions to the stage of mechanical and commercial success, and here again engineering ability of the very highest order is called for if the work is to be done with economy and practical advantage.

It will be evident that the work of a "new inventions board" is not a task to be undertaken by a set of men whose time is already fully occupied with their own business and professional work, such as those whose names have been announced from Washington. Nor is it work that can properly be done as a free contribution to the country's welfare. There is no more reason why such important and valuable work should be done for the Government without payment by members of the engineering profession than there is to expect the Government's most difficult tasks in the Department of Justice to be performed gratis by a committee of lawyers.

It is to be hoped that the eminent engineers and inventors and manufacturers who are to be brought together in the New Inventions Board may have a clear appreciation of the task before the Government and the way it should be handled, and that they may induce Congress to provide ways and means for the organization of such a board on a permanent basis, with a corps of carefully selected and well paid experts to carry on its work. By such means, and such means only, can the United States Navy be enabled to keep pace with its foreign rivals in the race for efficiency.

Assessing Costs of Railway Grade-Crossing Removal

In the present general scheme of railway improvement a prominent and costly item is the elimination of street crossings at grade in cities and towns. Work of this kind is in progress and in contemplation in many places, and is increasing steadily. It applies not only to the large cities but also to many smaller places where the danger or interruption to traffic reaches a degree that leads the municipality to demand an improvement in the conditions.

The aggregate cost of this work is enormous, and by far the greater proportion of this cost is paid by the railways. On the other hand, the benefits are mainly in the interests of the public and the municipality. Such benefits as accrue to the railway result from a reduction in liability to accidents and claims for damages and some greater facility in handling the traffic, especially where traffic is heavy and movements are hampered by a long succession of crossings, with their gates and watchmen. In certain cases the elimination of crossings may effect or permit a reduction in grade or other similar improvement, but such incidental improvement is obtained usually at a cost far in excess of the value of the improvement, and far beyond what the railway could reasonably or economically pay under ordinary conditions.

The work is of a costly character throughout. Limitations of right-of-way and cost of land usually necessitate masonry retaining walls for either a cut or a fill. The bridge work is costly, and must usually provide for solid waterproof decks. In many cases ornamental treatment of the metal work, or its incasement in concrete with such treatment, adds materially to the cost of the bridges. In addition to this every case involves special problems and difficulties, all tending to increase the cost. Another important cause of expense is the necessity of keeping both streets and tracks in service during the execution of the work.

Interference with sewers and water mains and changes in street grades involve additional cost, which may be borne in part or wholly by the municipality. Maintaining connections with industries under the altered conditions may also involve heavy cost, which may be borne (or at least shared) by the industries. Where a railway grade crossing has to be eliminated in addition to the street crossings there is a further and material increase in cost.

In considering problems of grade-crossing elimination the solution should be sought on a mutual basis of consideration for the interests of the public, the municipality and the railway. Unfortunately, it is too often a case of antagonism and opposition, the municipality trying to get all the concessions possible and to assume the smallest possible share in the expense, while the railway seeks to head off the demands and to limit the cost of its work. The result may be a compromise not really satisfactory to the city or the company, and involving a certain amount of ill-feeling on both sides.

As an instance, in one case a city endeavored to compel a railway to depress its tracks to such an extent as to require no change in street grades, the entire cost of the work to be imposed upon the railway. The latter opposed this successfully in the courts. The adopted plan included a partial depression of the tracks, elevation of

the streets, and a sharing of the cost. On the other hand, a railway proposed to carry its track elevation across a public square by a bare steel viaduct with open floor. This was opposed by the city, and the adopted plan provided for a water-tight deck and the masking of the steel structure with concrete for the sake of appearance.

With problems of this kind on the increase it is to be hoped that there will be a more general recognition and impartial consideration of the public and private rights.

A Real State Engineer

A merry to-do is likely to arise over the new Wisconsin law which concentrates the whole engineering work of the state government in the hands of one man—a state chief engineer. It is a revolutionary law. It will deprive the highway bureau's engineer, for instance, of his title to independence and will make him a mere subordinate of the chief engineer. Such a state of affairs is subversive of all established practices in state administration—and the same is true of city and national administration. As in many other matters, Wisconsin leads with a piece of radical legislation.

The question is: What is engineering work? Are the topographical survey operations conducted by the state geological survey to be classed as engineering service? Is a state building inspector an engineering employee? Today, nobody knows; even the American Society of Civil Engineers does not know. But we will know in a short time, possibly, when the Wisconsin courts decide on the interpretation of the new law. Of course the intent of the law is obvious—to bring under the control of one technically competent head all such state work as must be performed by engineers. If the topographical surveyor is an engineer, then the chief engineer under the law ought to have jurisdiction over him. Conversely, those state officials and employees who by the Wisconsin court decisions are placed under the chief engineer's jurisdiction will thereby be classed as engineers. This result will be very helpful, since no definition of "engineer" has been formulated hitherto. But the wonder of it—that Wisconsin law courts should give instruction to the American Society of Civil Engineers.

One Field That Is Booming

The world has always spent a good deal of money in amusing itself, but it is doubtful if ever before there has been a time when this money has so benefited the building constructor as at the present, when, to say the least, new enterprises for construction are not frequent. Whatever may be the prospect for increased construction work in the more practical fields, there seems to be no lack of capital for amusement enterprises.

In this issue of *Engineering News* there are illustrated two large pieces of such engineering work, aggregating in total cost some $3,000,000 and involving not only a fairly intricate design, but a construction made doubly complicated by requirements of exceptional speed. These two—the Sheepshead Bay Speedway and the Boston Ball Park—are but typical of a great quantity of such work under way or recently completed in widely distributed sections of the United States.

Of course every city worthy of the name has its ball park, but most of these mean work only for the local carpenter and builder. In the "big-league" towns, however, the ball park has become a formidable piece of engineering construction, more or less standardized to be sure, but nevertheless requiring careful design and as a rule rapid construction. The same may be said of the ever-increasing number of stadiums, without which nowadays no university can properly instruct youth. To call to mind the enormous piles of concrete at Harvard, Princeton, Chicago, Syracuse, College of the City of New York, to say nothing of the municipal stadiums at San Diego and Tacoma, can but emphasize the great number of dollars invested in property which has brought nothing but, to quote the economist, "psychical wealth" to the world.

The motor speedway is a more modern development, but is a natural growth from the horse racing and later cycle track, with the additional requirements of size to care for attendance running up toward 100,000 and of strength imposed by the high-powered and high-speed automobile. Engineering talent is required in the design and layout of such tracks and constructive ability of a high sort in their quick erection. The Sheepshead Bay track is the largest of the lot, but similar tracks in Philadelphia, Providence, Louisville, Chicago and St. Paul are under way. At another time attention will be called to some of the problems of design in such tracks and particularly to the great variation in the surfacing used on the tracks so far built. Meanwhile, it is pleasant to note that the engineer and contractor are getting a part, though only a small part, of the vast sums of money spent by the American people in recreation.

Busy days are in prospect for engineers who go to San Francisco to attend the numerous conventions of technical societies which are to be held there in September and October. Only a few of these societies have as yet sent out their programs for the convenience of those who wish to plan their time in advance. Under "Society Proceedings," elsewhere in this issue, will be found a synopsis of the program of the International Engineering Congress, prepared from an advance typewritten copy.

Without disclosing any secrets, it may be stated with certainty that the program, entertainment and exhibit committees of the New England Water-Works Association have done their part toward making the convention which is to be held in New York from Sept. 7 to 9 a success. The membership at large may be counted on to do the rest. The convention will meet a day earlier in the week than usual, for the convenience of members who wish to take the Engineering Congress train for San Francisco on Sept. 10.

For the second time in two years the conventions of the American Public Health Association and the New England Water-Works Association clash. This seems to be a shortsighted policy in view of the members and officials common to both organizations. It seems as though a conflict of dates might be easily prevented in the future if only some attention were given to the matter by those having the interests of each association at heart. It may be added that the convention of the American Public Health Association at Rochester on Sept. 7 to 10 promises to be a good one. This makes it all the more a pity that the two conventions come on the same days.

Letters to the Editor

How Engineers Earn Fees

Sir—The writer noticed an article recently in one of the road journals entitled "Has the Contractor a Snap?" This article set forth items of contingent cost that are generally overlooked by contractors. It occurred to me that the contractor is not alone in being misunderstood for few people outside the engineering profession realize what the engineer has to contend with, especially in municipal work. In my practice I have continually been told that engineers earn their money only too easily. I am therefore prompted to write this letter to you.

The question "Has the Engineer a Snap?" may be answered perhaps better after itemizing the expense and trouble which the engineer must undergo, some of which are as follows:

1. Expense of looking over the proposed work and closing the contract for employment.
2. Expense of making necessary investigations and surveys.
3. Expense of getting out report.
4. Expense of traveling and time in submitting report.
5. Expense of time in convincing clients and local "home-grown" or "native" engineers that the report, plans and specifications are correct, or rather *trying* to convince them.
6. Expense of defending plans, specifications and ideas against the "butting-in" engineer.
7. Expense of assisting clients to carry on a campaign of education against the onslaughts of the public.
8. Expense of getting out the final working plans, specifications and estimates.
9. Expense of attending letting for construction work and for purchasing of materials, machinery, etc., and assisting clients in getting *legal* contracts closed up.
10. Expense caused by having to defend plans and specifications against the "salesman-engineer," who has something to sell, and promoters of "blue-sky" schemes, who pose as public benefactors and do everything that they possibly can to have the specifications drawn so that competition is eliminated. (These same fellows are always the first ones to howl if the specification is closed against their particular article, and I have noticed that their particular article is always the best.)
11. Expense of time in examining forms or bonds to be furnished by the contractors.
12. Expense of time in approving manufacturer's plans of machinery, details, etc.
13. Expense of time in getting contractor started on his work.
14. Expense of starting resident engineer out on the work.
15. Expense in straightening a hundred trivial matters as the work progresses. (The resident engineer can handle the situation, but clients always want the "main guy" on the ground in person.)
16. Expense of making final inspection and test of the work.
17. Expense of getting out complete record, plans and maps.
18. Expense of time in getting plant running in good shape.
19. Expense of time in getting what is coming to one of the "balance due."
20. Expense of taking a vacation to recuperate and nurse oneself back to health.

W. L. Benham.

Oklahoma City, Okla., July 26, 1915.

Engineering Students Should Practice Public Speaking

Sir—There have been several interesting articles of late in *Engineering News* regarding the status of the engineer and why as a professional man he does not hold the positions he should relative to the other professions. I think Mr. Benham, of Oklahoma City, Okla., struck the keynote in his article, "Engineering Students Should Practice Public Speaking," in the issue of July 15, 1915.

Nearly everyone will admit that no profession renders greater service to mankind than the engineering profession, not only materially, but in the comforts and conveniences it brings and in the impetus it gives to better things—to religion, culture and philosophy. These questions then naturally arise: Why does the engineer not enjoy the prestige other professional men do? Why does he not receive the credit due him for the service he renders? Why is he not a properly balanced man?

And the reason? The engineer does not receive enough publicity. He is too unassuming. He does not "mix." He does not assert himself and his deeds enough. In fact he requires a publicity agent; and he must needs be his own, for no one else is willing to fill this office for him. In the apt words of the young philosopher: "He who tooteth not his own horn the same shall not be tooted."

The fault lies, it seems to me, in our colleges and schools where the future engineers receive their training, although it is being remedied at present in some instances. In the university the engineering students constitute the hardest working, most self-centered and self-contained group. (And no doubt the engineer educated in the university is broader than his brother of the technical school, or at least he should be.) They have few interests outside their own studies, which occupy nearly all their time. They are not good "mixers" as a rule. They take no part in literary societies or public exercises of any sort. They are quiet, hard-working, unassuming, and therefore little known among the student body. And do not these characteristics prevail among the older engineers of your acquaintance who are practicing their profession? The fault must lie, then, in their early training.

Where is the remedy? It, too, lies in our colleges and schools. There should be literary societies, public speaking or entertainments of some kind that would place the student before the public or before an audience and give

him valuable training as well as valuable advertising. This is an age of advertising, and the engineer must "get into the game" and advertise himself.

I heard a prominent highway official of this state say not long ago that the art of public speaking was one of the most important attainments of the engineer of today. This official is an able speaker himself, and he owes his success largely to his ability to talk to an audience entertainingly on technical subjects.

It behooves our schools of today to prepare the engineer of tomorrow for elevation to the position he deserves to hold among the other professionals.

J. S. Miller.

Wharncliffe, W. Va., July 31, 1915.

Danger in Vessel Operation

Sir—The capsize of the "Eastland" has revealed to the public an amazing disregard of public safety in connection with the stability of vessels and has given rise to a general public demand for a more efficient inspection of passenger transport by water than that now existing. With reference to this, two personal experiences of the writer may be worth putting on record.

In 1892 while living in Chicago I went on several excursions between Chicago and Michigan City by the exact route, I believe, which was to have been followed by the "Eastland" on the day when it came to its disastrous end. The boats I traveled on in those days were so unstable that the stability of the craft was maintained by a rolling ballast operated as follows: On the lowest deck there were about twenty heavy barrels, specially hooped and containing lead for weight. Against the center post in the lower deck was suspended a wooden pendulum about 10 ft. long. A foreman sat on a box and watched the pendulum, and as the dear people were enjoying themselves and moving from one side of the ship to the other on the upper decks, he would swear and yell at his men to roll the barrels to the side necessary to trim the boat, as indicated by the motion of the pendulum. Just what "formula" was used to make the travelers safe I never knew, and I doubt very much whether in any other country in the world such trifling with danger would be permitted.

Another trip I once made was from Seattle to San Francisco on a steamer whose name as I now remember it was "The Queen." She was a beautifully painted vessel with a lot of woodwork above her water line and the usual big steel smoke-stacks coming up through the decks. Shortly before beginning this trip "The Queen" had lost one of her propeller blades, and the chief engineer told me, in explaining why he was running the engines at such high speed, that the captain had determined that he would take his 300 passengers into San Francisco on time by using forced draft to make up for the loss of efficiency resulting from the missing blade. In consequence of this forced draft, the smoke-stacks were so hot all the time that we enjoyed the spectacle of laborers sitting on each deck playing a hose on the woodwork around the stacks for 2½ days during the entire trip to San Francisco. We reached there on time and of course hugely enjoyed the extraordinary provisions for our safety and comfort.

I doubt very much, however, whether similar laxness would be permitted in any other country in the world. With you and all other good citizens I hope some day for the existence of a nonpolitical, practical and highly scientific vessel-inspection system in the United States that will protect our country from such disgraceful occurrences as the appalling "Eastland" disaster.

C. L. H.

New York, July 31, 1915.

Give the Experienced Engineer a Chance in Highway Work

Sir—If city and state highway departments would or could employ experienced engineers instead of young college men with little or no practical experience thousands of dollars would be saved the public on work the cost of which annually mounts into millions of dollars.

One doesn't find a young and inexperienced physician acting as head surgeon in a big hospital, nor a young law student acting as counsel of a big corporation, but to see an inexperienced young college man directing the expenditure of thousands of dollars on public road work is common.

It is very easy to waste money in highway work on account of poor location, a branch of engineering which requires long and thorough experience both in preliminary and construction work. The inexperienced man in nine cases out of ten takes the easiest route known to the general public, simply because he has little or no confidence in himself and fears the result of a mistake. On the other hand, I know many old railway locating engineers who are out of employment at the present time because of poor business conditions throughout the country—men who have successfully located miles and miles of railroads in the United States, yet today they would be glad to make $75 per month.

Our engineering societies ought to make some protest over this condition of affairs. Are those men who have met with success in engineering and whose employment would save the public many thousands of dollars to be allowed to sit idle, or should they and the public be given a helping hand?

The great trouble in getting men for highway work is generally that a man must travel several miles to a large city to take a written examination, and in a written examination the younger college men will beat the experienced engineer every time. It often happens in the Central West that a big university is turning out men in the very city where the Chief Highway Engineer is located and that these students get in on the ground floor when it comes to filling up the Highway Department staff.

There should be a system similar to that which the great railroad companies have of hiring men on their record of past experience. I do not want college students to misconstrue my meaning in writing this letter, for although it looks as though I was down on the college man, this is far from true. The college man is the best man without a doubt, but he should start from the bottom of the ladder and work up, the same as others have, as far back as I can remember, until this state highway work started up.

A. R. Mielly.

New Orleans, La., Aug. 7, 1915.

The Mineral Production of Alaska to the close of 1914 is estimated at $268,150,000, of which $244,000,000 was gold. The territory's mineral production in 1914 was valued at $15,764,000 and included about 21,500,000 lb. of copper.

National League Ball Park at Boston, Mass.

SYNOPSIS—The largest ball park in the country. Seats 40,000 people. Built in five months. Reinforced-concrete stands, fence and club house. Nearly 100,000 cu.yd. of grading required.

The Boston National League Base Ball Club opened on Aug. 18 its new park in the Allston district, only 15 min. by street car from the business center of Boston. The park is located on a tract of land which up to last spring was a golf club, situated between Commonwealth Ave. on the south and the tracks of the Boston & Albany R.R. on the north, with the Charles River beyond. The site was not turned over to the contractor until Mar. 20 of this year, and the opening game in the practically completed park was held on Aug. 18. This remarkably fast contract work comprised the excavation and transfer from cut to fill of about 100,000 cu.yd. of earth, the placing of a number of piles under the footings of the stands, the erection of stands capable of seating 40,000 people, the construction of a large club house and a reinforced-concrete fence entirely surrounding the grounds, and the leveling of a parking space outside of the grounds where automobiles and street cars can stand during the game.

Fig. 4 shows the general layout of the park and Fig. 1 is a view of the grounds looking north across them, taken about the first of April, just as work commenced. It will be seen that there existed on the golf course a sizable pond which had to be filled in at the beginning of the work. The ground was rolling, and steam-shovel excavation consisted in leveling up the playing field, in filling the pond, and in excavating for the lower part of some of the stands, the fill being taken by horse and wagon to make the slope in the upper part of the stand. This operation resulted in the level of the playing field being nearly 20 ft. lower than the level of the concourse back of the stand, and also it required the lower part of some of the stands to be built directly on the ground, as shown in Fig. 5, while the upper parts are built on the customary columns.

The distinguishing feature of the field from the lay viewpoint is its extreme size. As may be noted in Fig. 4,

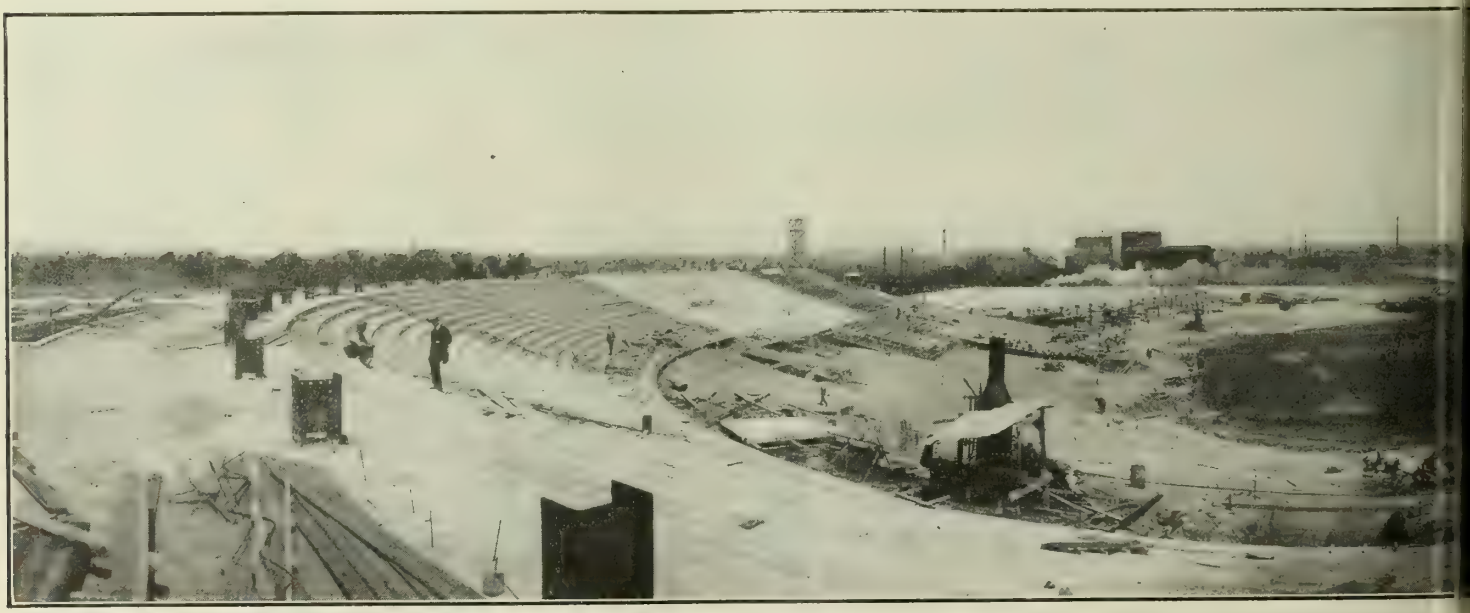


FIG. 2. BOSTON "BRAVES" BALL PARK ON JUNE 23, 1915, AFTER THREE MONTHS'

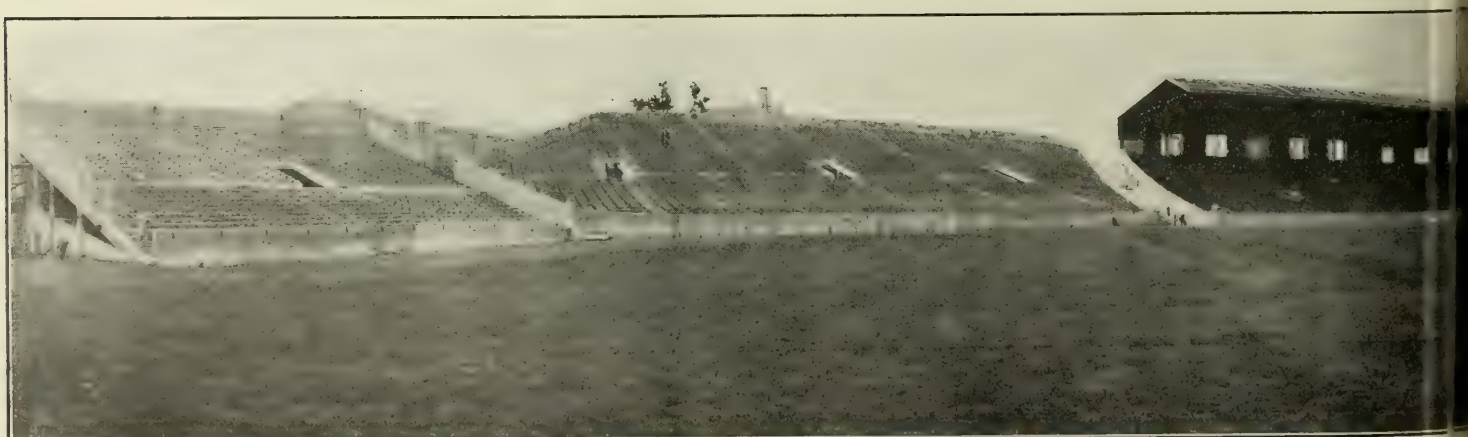


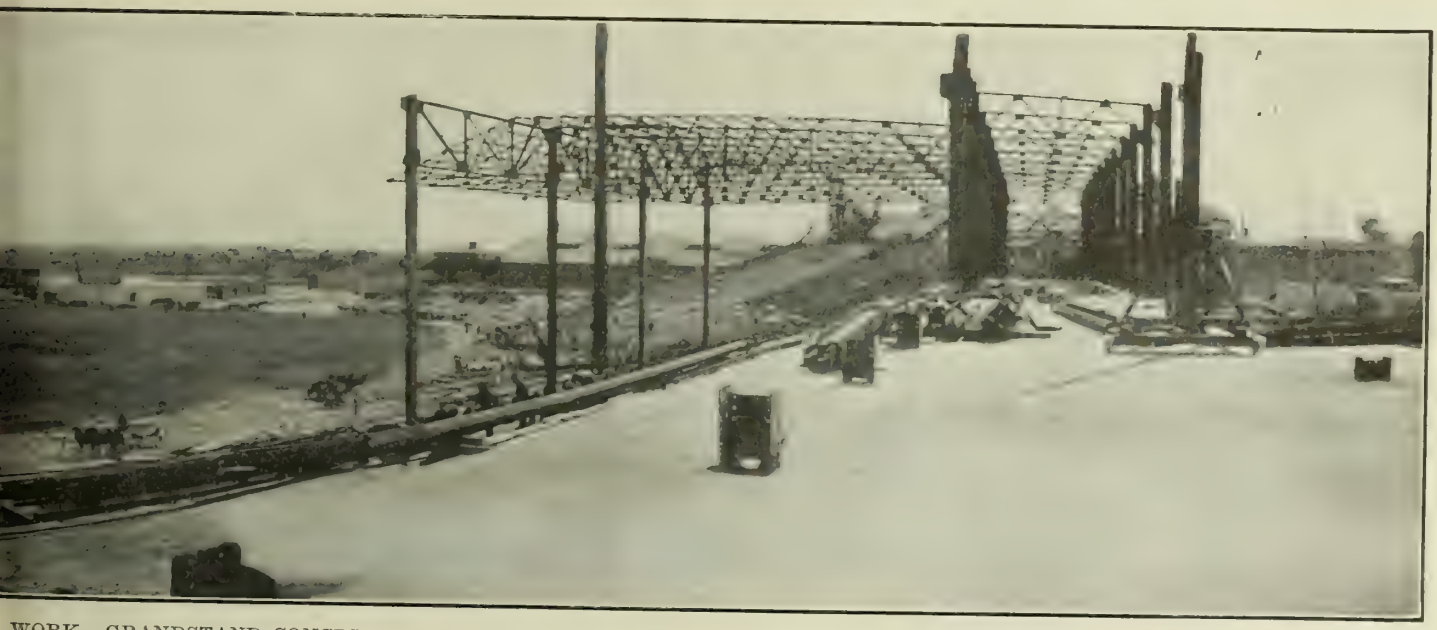
FIG. 3. LOOKING OVER THE PLAYING FIELD TOWARD THE STANDS, AUG. 16, 1915, TWO

the home plate is 350 ft. distant along the foul line from the nearest point on the stand, while the bleachers and the far side of the pavilions are so far distant from the diamond as to remove all danger of batting a fair ball into a stand. The total area of the inclosure is 15 acres.

Three types of structure were used in the stands—the grandstand, the pavilions and the bleachers, graded according to price of admission. These were laid out in circular plan as shown in Fig. 4. A detail of a section through the grandstand is shown in Fig. 5. The ground



FIG. 1. SITE OF BALL PARK ON APR. 1, 1915, ABOUT A WEEK AFTER WORK COMMENCED



WORK. GRANDSTAND CONCRETE COMPLETED, PAVILION CONCRETE BEING LAID



DAYS BEFORE THE OPENING OF THE PARK. TWENTY WEEKS FROM FIG. 1 TO FIG. 3

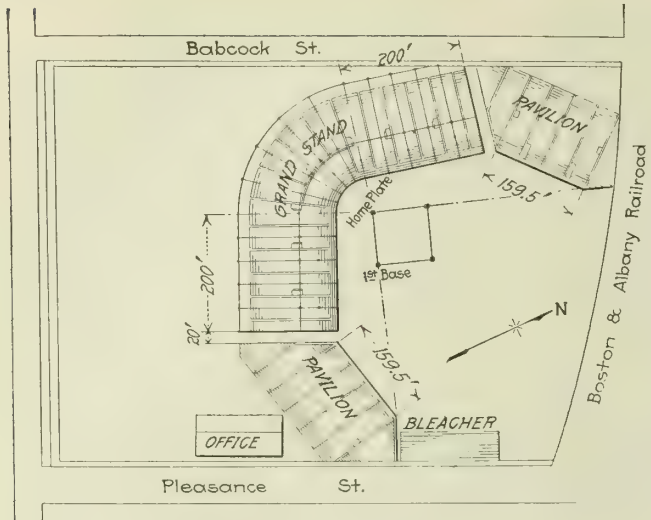


FIG. 4. GENERAL LAYOUT OF BOSTON NATIONAL LEAGUE BALL PARK

on which the grandstand was built is partly in cut and partly in fill, though the fill is not shown in the particular section drawn in the figure.

The slope of the stands is designed to afford a good view of the diamond from every point. The lower steps, in front of the boxes, have a 3-ft. tread and 3-in. rise, and the main steps increase in rise from 5½ in. at the bottom to 10½ in. at the top, with a uniform tread of 2½ ft. The seats themselves rest on concrete steps in the lower part laid directly on the ground and reinforced along the bottom with a plane of wire mesh. Above the ground the steps are of the same relative slope and size, but are of reinforced concrete, of the design shown in Fig. 5, resting on stringers, which in turn rest on columns spaced 20 ft. transversely and 10 to 17 ft. longitudinally, according to the requirements of the layout.

The columns and stringers are of structural-steel members framed together at the junctures and incased with concrete, according to the details shown in Fig. 5. At the

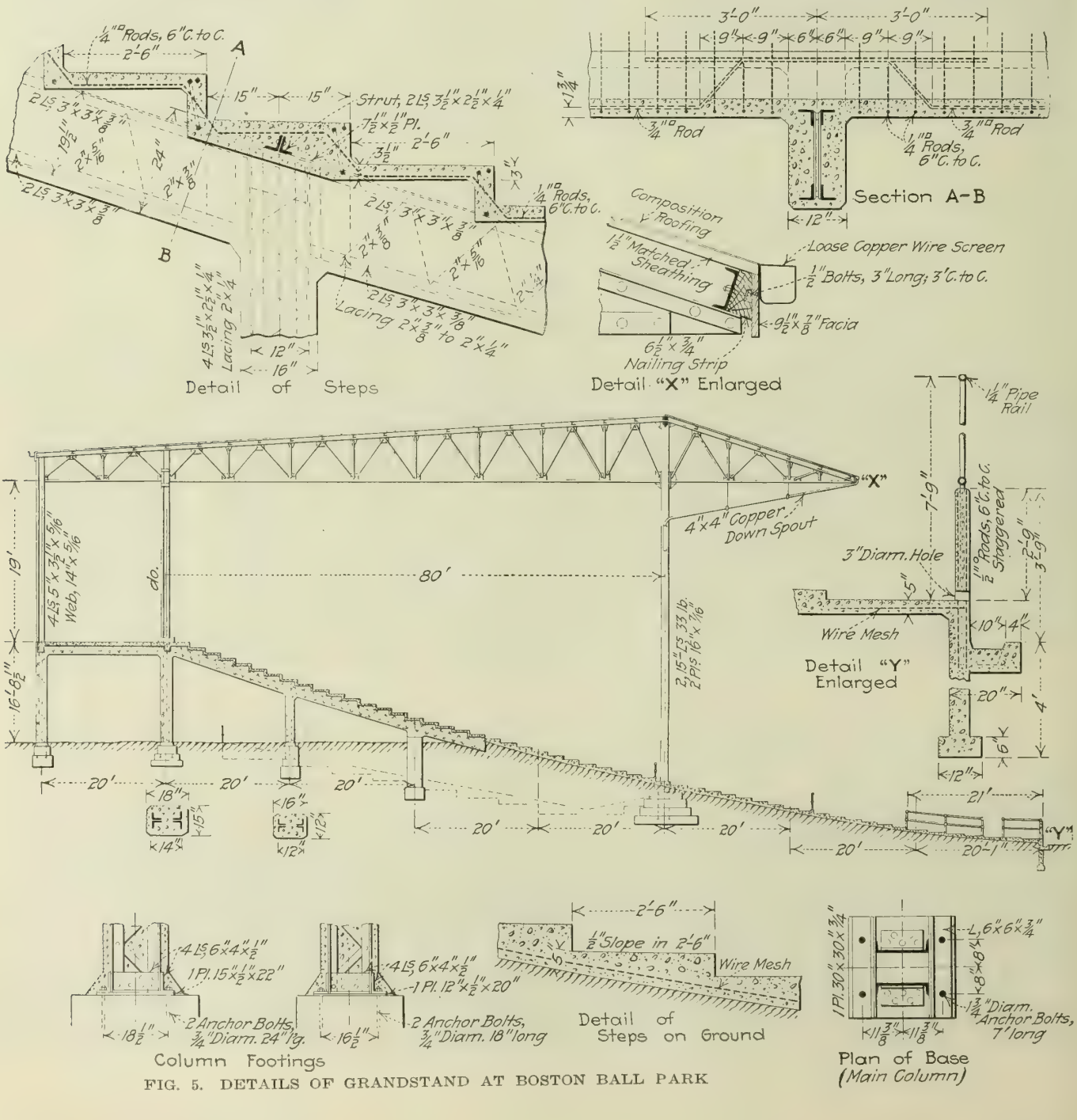


FIG. 5. DETAILS OF GRANDSTAND AT BOSTON BALL PARK

rear bay of the span the structural steel of the concrete and steel columns is extended up to form the columns for the grandstand roof, which extends forward and is carried on columns rising directly from footings near the forward end of the stand. The rear columns are connected by hollow-tile plastered to form curtain walls. The stands are separated from the field by a reinforced-concrete fence shown in Fig. 5. In the grandstand the seats are of the folding individual type, bolted down to the concrete steps.

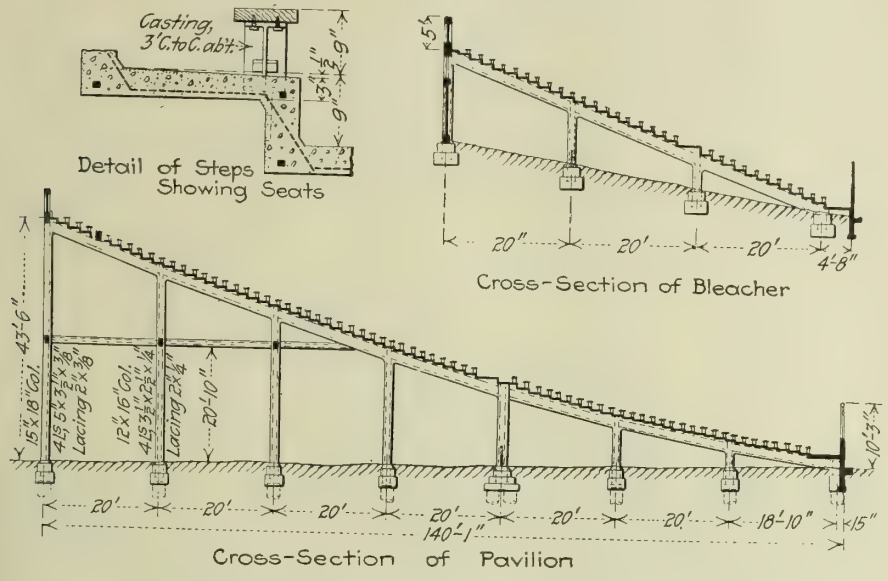


FIG. 6. PAVILIONS AND BLEACHER SECTIONS

The pavilions and bleachers are of the general section shown in Fig. 6 and of structural detail corresponding to the typical detail given in Fig. 5. The difference between these stands and the grandstand is that there is no cover, and that instead of folding seats there are benches screwed down to permanent cast-iron standards. The framing details are the same as in the grandstand, except where space required cross-bracing girders to stiffen the columns. All stands are approached by ramps through the structure and up to the rear promenade. The boxes at the front of the grandstand are entered from downward-sloping inclines, as shown by dotted lines in Fig. 5.

All the columns under the grandstand and pavilion B were founded on concrete piles of the "pedestal" type, driven by the MacArthur Concrete Pile & Foundation Co. For these footings 305 piles, of an average length of 20 ft., were driven singly or in groups of from two to thirteen per footing. The soil consisted of the loam fill, brought in most cases from the remainder of the field and underlain with sand and gravel. Piling was especially required over the site of the old pond.

The office and club house at the entrance to the field is a three-story building of pleasing design, mainly of reinforced concrete. The fence which surrounds the site is 12 ft. high and has a vertical reinforced-concrete slab between posts spaced every 12 ft., with an expansion joint at every fourth post. At the rear of the playing field the revised ground elevation is so far above the tracks of the Boston & Albany R.R. that a 19-ft. concrete retaining wall was required to protect the tracks, the usual 12-ft. fence being superposed on the wall.

Construction work was naturally carried out by a very large force on account of the short time which was permitted for the work. Steam-shovel excavation into wagons cared for the cut and fill in the first part of the work. Then followed the erection of the steel reinforcing the columns and girders in the upper part of the stand and the direct laying of the concrete steps at the lower part of the seats. As soon as the steelwork was up, the girders were connected with wooden forms and the concrete poured from a high tower and chute which permitted the movement of the chute to any location on a very large section of the stand. There were two such plants and the towers moved from place to place to cover the section under way.

The making of a playing field was one of the first things started in the work. As soon as the leveling-up process was completed subsoil and sodding work was started, so that even before the stands were fairly along the diamond and the outlying parts were well toward completion (Fig. 2). This was necessary so that the field would be in perfect condition by the time the first game was played.

The view in Fig. 3, taken Aug. 16, only two days before the opening game, shows that the park was practically completed in the very short time allowed—less than five months.

The structural design of the stands was in charge of the Osborn Engineering Co., of Cleveland, Ohio, and the construction was carried out by the James E. Gaffney Co., the president of which, James E. Gaffney, is also president of the Boston National League Club. R. G. Collins, Jr., was Engineer of Construction.

More Flood-District Filling in Pittsburgh Begun

Following the extensive flood-filling enterprise carried out by the city of Pittsburgh on the north side (Allegheny) a few years ago, a large piece of filling work on the Pittsburgh side was recently started by M. O'Herron, contractor.

The work is on Duquesne Way and Penn Ave. and the transverse streets from Water St. to 7th or Sandusky St., with some minor work extending as far as 11th St. This territory is to be raised to El. 33.9, the Allegheny filling having been carried up to El. 33.

The work is distinguished by the novel street drainage system adopted. The streets were laid out without longitudinal slope, so that gutters will not perform their ordinary service. Longitudinal 12-in. drains are laid under the street near the curb, receiving branch pipes from street inlets located in the curb about 40 to 60 ft. apart. These special storm sewers discharge into the transverse or main outfall sewers in the cross streets.

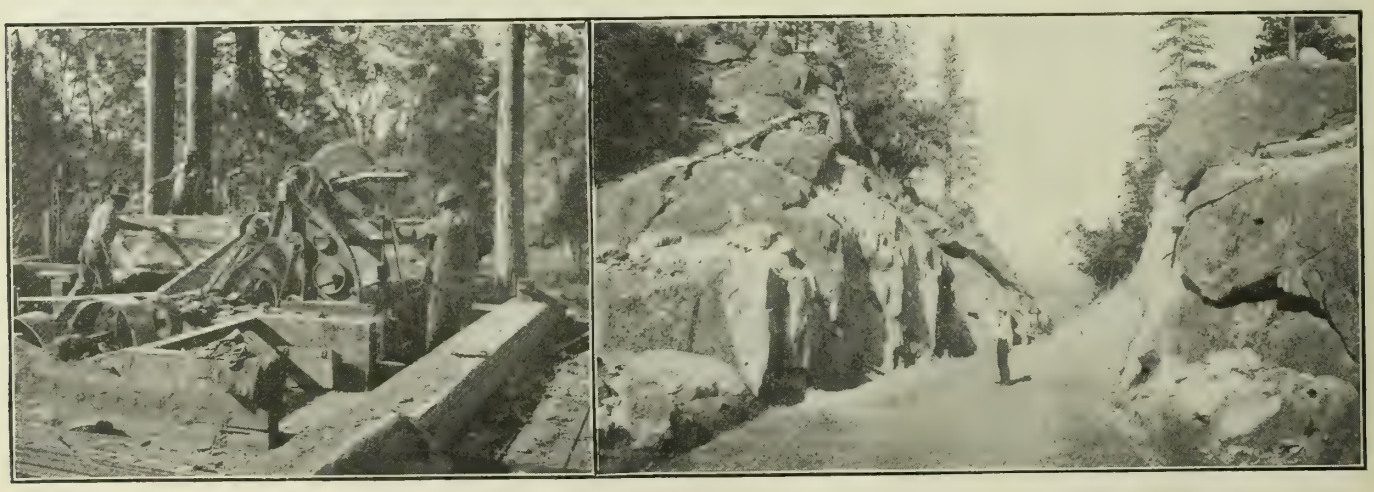
Lime Production in 1914—The lime made in the United States in 1914 as reported by the United States Geological Survey amounted to 3,380,928 tons, valued at $13,247,676. The plants operating were reduced from 1023 in 1913 to 954 in 1914. The number of kilns in operation increased from 2338 in 1913 to 2374 in 1914. The most marked feature of the lime industry since 1906 has been the rapid growth in the production of hydrated lime, which in 1913 had increased over 300% in both quantity and value.

News of the Engineering World

Progress on Hetch Hetchy Water-Supply

Despite the fact that construction work on the Hetch Hetchy water-supply for San Francisco has been greatly handicapped by lack of funds, as a result of the European War and the consequent stringency of the money market which has prevented the sale of 4½-per cent. municipal bonds, all of the work necessary to comply with the terms of the Raker Act is being rushed by City Engineer O'Shaughnessy, and the great task of bringing Sierra water to San Francisco is well under way.

Work has been started at Early Intake on a tunnel 10½ ft. in diameter, which will be a part of the permanent main aqueduct, and pass through a formation of solid granite for a distance of 20 mi. to a forebay reservoir, and thence to the Moccasin Creek power station. The Early Intake is 12 mi. downstream from Hetch Hetchy Valley, at an elevation of 2320 ft. above sea level. To facilitate the proposed tunnel construction, work is being rushed on a branch wagon road 3 mi. long and 14 ft. wide from Early Intake to the main transportation road, 10 mi. of which has recently been completed by the Utah Construction Co. The Early Intake road runs from the crest of the ridge to the bottom of Tuolumne River cañon, through a particularly rugged country, all of which is in a granite formation. This branch road is now 80 per cent. completed.



CONSTRUCTION WORK ON NEW HETCH HETCHY WATER-SUPPLY, SAN FRANCISCO, CALIF.

Left—City sawmill cutting lumber for forms and camp buildings. Right—Cut on new road built by city

San Francisco owns a large amount of timber on Cañon Ranch, an area of 160 acres, between Hog Ranch and Hetch Hetchy Valley. Because of the high cost of lumber in the open market, the city engineer deemed it advisable to erect a sawmill on Cañon Ranch. A contract for the mill equipment was awarded on Apr. 19, 1915, to the Eby Machinery Co. The mill was put in operation on July 30 and will be run continuously. All of the timber for the forms to be used in concrete construction in and near the dam, railroad ties for use in the transportation road, lumber for camp buildings and other purposes will be supplied by this mill.

Work will be begun during August on clearing of timber that portion of the floor of Hetch Hetchy Valley that will be flooded by the construction of the Hetch Hetchy diversion dam. A wagon road has been completed from the bench above the dam site to the floor of the valley. All of the timber cut in the reservoir will be used for tunnel work, railroad ties, poles and forms. On account of the inaccessibility of the valley it would not be profitable to sell any of the wood to outside markets.

A portion of the Hetch Hetchy Valley will be flooded this winter by the construction of a small diversion dam and diversion tunnel to bypass the waters of the Tuolumne River around the main dam while the latter structure is being built next year. That portion of the reservoir which will be under the waters of the lake thus formed will be the first to be cleared of timber.

A very extensive study was made of the design of a cyclopean concrete dam to be constructed on the Tuolumne River at the lower end of Hetch Hetchy Valley. Every type of arch and gravity section was considered, and a gravity dam, arched as an additional safety factor, was tentatively chosen as the type best adapted to local conditions at the dam site. This dam will be 300 ft. high and will have a crest length of 750 ft. Its cost will be approximately $4,000,000. The design has just been completed by the city engineer.

City Engineer O'Shaughnessy has been exerting strenuous efforts to make an arrangement by which contractors would construct the 67 mi. of railway from Rosasco, on the Sierra R.R., to the Hetch Hetchy dam site this year, and accept 4½ per cent. Hetch Hetchy bonds in payment. Two local representatives of one of the largest contracting firms in America are now in the valley, figuring on this work. The cost of this railway is estimated by the city engineer at approximately $1,850,000. He is hopeful that funds will soon be procured for this purpose.

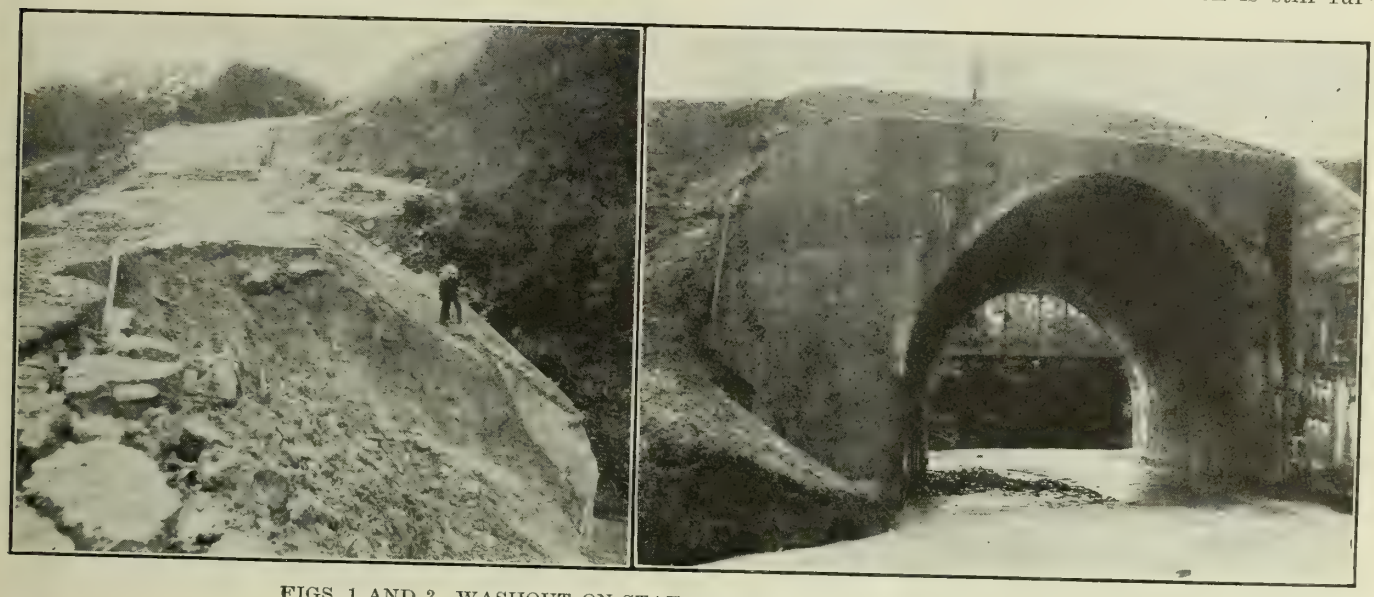
Road and Culvert Washout

The accompanying photographs show a washout on a new fill on the New York State road near Westfield, N. Y., caused by the very heavy rain of Aug. 9. The fill had recently been made over the arch bridge shown in Fig. 2, and was retained mainly by the wings of that bridge. After preliminary gullying the fill was washed out, as shown in Fig. 1, following the failure of one of the wing walls, as shown in Fig. 2.

A State Civil and Mechanical Engineer and Architect

A notable law has just been passed by the Wisconsin legislature and approved by the governor, creating the office of state engineer with a broad range of duties.

The chief engineer is to be appointed by the Railroad Commission and may be removed by the governor upon hearing. This chief engineer has three lines of duty—engineering for all state departments and bureaus, architectural services to the state, and supervision over and improvement of power, heating and similar plants of public institutions.



FIGS. 1 AND 2. WASHOUT ON STATE ROAD NEAR WESTFIELD, N. Y.
The two men are standing at about the same place in each view

Engineering—He is to have charge of all engineering performed by or for the state or any of the departments, boards, or commissions of the state, or in the promotion of any engineering or architectural projects undertaken by the state. He shall furnish engineering services to any branch or department of the state upon requisition. Provision is made for having engineering or architectural work done by contract, in which case, however, the chief engineer shall act with the administrative officers in letting such contracts, and he shall audit claims under it. Where any department, board, etc., requires permanent engineering service the chief engineer will appoint assistants to do such work, to be designated state highway engineer, state architect, university architect, etc., as may be appropriate.

Architectural Service—The duties of the chief engineer as to architectural service are described by exactly the same wording as that defining engineering service. To what extent outside architects will be called in for state work apparently will depend on the future attitude of the heads of state departments and the opinions of the chief engineer combined.

State Power-Plant Supervision—The chief engineer is required to examine and inquire into the matter of operating all state-owned power and electric plants, pumping or heating stations and to direct such changes in the methods or processes employed as will result in the most economical and efficient operation thereof. The superintendents of such plants must keep suitable records as directed by the chief engineer. In his annual report the chief engineer must show in tabular form the cost of operation per unit of product or service of each power or electric plant, heating or pumping station operated by any state institution.

This is the first case of a state creating the office of chief engineer to handle all classes of engineering service for the state, not to speak of architectural service. The importance of the railroad commission is still further increased by the new law. The railroad, utilities, and water-power work of the commission's engineering department presumably will be handled in future merely by one of the departments or branches under the chief engineer.

"Spiral Mushroom" Flat Slab Also an Infringement

As noted in *Engineering News* of June 24, 1915, p. 1245, a perpetual injunction was issued on June 9 against C. A. P. Turner, of Minneapolis, Minn., restraining him from "directly or indirectly making, constructing, using or vending to others to be used . . . reinforced-concrete flooring for buildings, containing or employing the invention described and patented in Norcross letters patent No. 698,542, or any . . . flooring . . . similar to those heretofore constructed . . . by . . . C. A. P. Turner under and in accordance with letters patent Nos. 985,119 and 1,003,384." Subsequent to that the C. A. P. Turner Co. marketed a type of flat-slab construction known as the "spiral mushroom," which was illustrated in

Engineering News of July 15, 1915, p. 144. Under date of Aug. 3, 1915, the United States District Court at Minneapolis decided that this later design came in the same category as Mr. Turner's previous design and that the injunction still held against the later design. The court fined Mr. Turner $200 for violating the injunction.

Train Goes Through a Trestle Just Weakened by a Blow

An unusual railway accident occurred on a trestle at Rainier, Wash., on the Gray's Harbor branch of the Chicago, Milwaukee & St. Paul R.R., in which three persons were killed and sixteen injured, as noted in *Engineering News,* July 15. Just before the Milwaukee passenger train appeared, a freight passed under the trestle on the tracks of the Northern Pacific Ry. A crane arm carried on a car of the freight train worked loose, and swinging out caught a diagonal cross-stringer of the trestle, tearing out a bent. Although an attempt was made to flag the passenger train, it was impossible to stop it before it reached the trestle. The wreckage is shown in the three accompanying photographs, furnished by J. R. West, Chief Engineer, Port of Seattle, who with his family was traveling in the parlor car of the passenger train. Of the three cars this was the only one that remained on the trestle.

The cause of the trouble was the insecure roping of the crane on the freight car. This was done by an inexperienced employee of the construction company owning the crane. The Northern Pacific Ry. did not inspect this car and crane. George F. Yantis, prosecutor of Thurston County, Washington, stated in his formal findings that "while there is some evidence of negligence on the part of the Northern Pacific agents in receiving and moving the car on which was the crane, it does not seem that the negligence was of such nature as should render the agents criminally liable under our law."

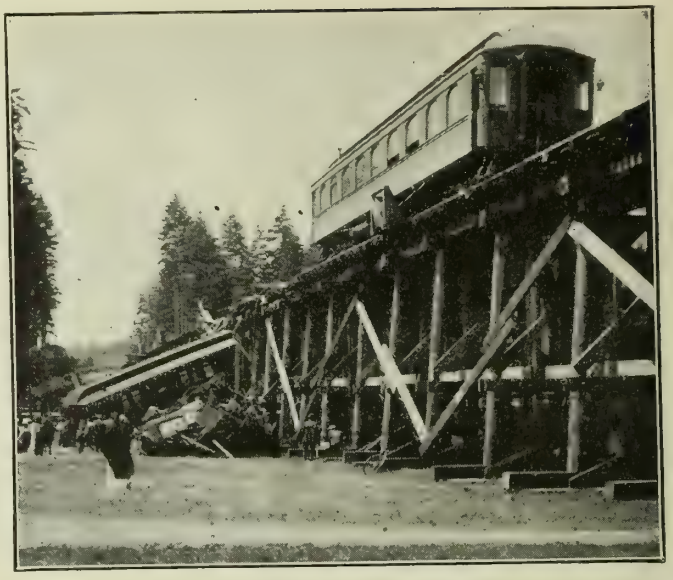
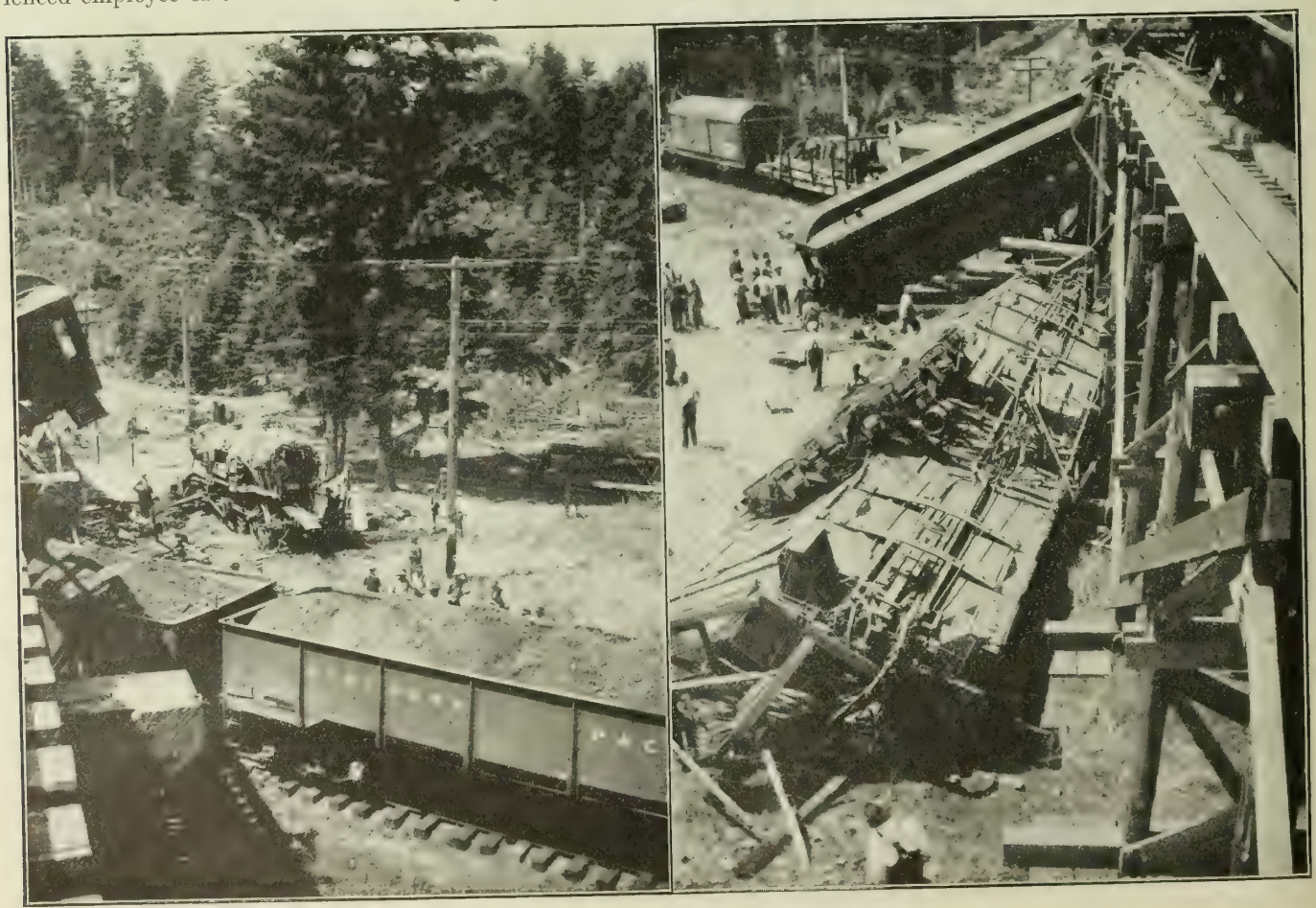


FIG. 3. PARLOR CAR LEFT ON TRESTLE; DAY COACH SMASHED; SMOKER PROPPED AGAINST TRESTLE



FIGS. 1 AND 2. VIEWS OF THE WRECKAGE

Fig. 1—View from front end of parlor car; shows Northern Pacific train on lower level, locomotive in distance. Fig. 2—Smashed day coach in which 17 of the 18 passengers were badly injured

The office of coroner has been abolished in Thurston County, which of course prevented an inquest. Instead, a justice of the peace took evidence and furnished the prosecutor with a transcript. It was the duty of the prosecutor to file formal findings and these took the place of a coroner's jury verdict.

Commission to Make Plans for New York Harbor

The committee on port and terminal facilities for the City of New York (made up of the Comptroller, the President of the Borough of Manhattan, the President of the Borough of Brooklyn, and the Commissioner of Docks and Ferries) has recommended to the Board of Estimate and Apportionment that a commission be appointed with instructions to investigate thoroughly the problem of dock improvement in the City of New York and to produce a plan for the proper development of that port. The committee further recommended the appointment to that commission of John F. Stevens, the well-known railway engineer and former chief engineer of the Panama Canal; George F. Swain, professor of civil engineering in the Graduate School of Applied Science of Harvard University, and William C. Loree, who retired from the position of general manager of the Baltimore & Ohio Southwestern R.R. about a year ago. The committee states that these men were selected after consideration of about thirty names of engineers and railroad experts.

Messrs. Stevens, Swain and Loree have submitted a statement of their understanding of the work to be done, in which they say:

> We understand the problem is the study of the terminal facilities of New York City and the formulation of some plan which will correlate, simplify and facilitate the methods of collection, storage and distribution of freight in New York City. This problem involves the study of the various railroad and steamship terminals, their relation to business centers, the method of carrying freight through the streets, the interchange of freight between railroad and steamship lines—in general, the entire terminal facilities of the city.

They also submitted a schedule of the cost of organization of the proposed commission, which includes annual salaries of the three commissioners at $15,000 each and a secretary, a field engineer, a transportation engineer, a designing engineer and chief draftsman, and a real-estate expert, each at $5000. Other expenses for engineers, clerks and offices would bring the annual expenditure up to about $125,000 per year. The committee says that the work should take at least two years.

It is understood that the Board of Estimate and Apportionment will approve this scheme on Aug. 26, and that the commission, as suggested, will soon go into effect.

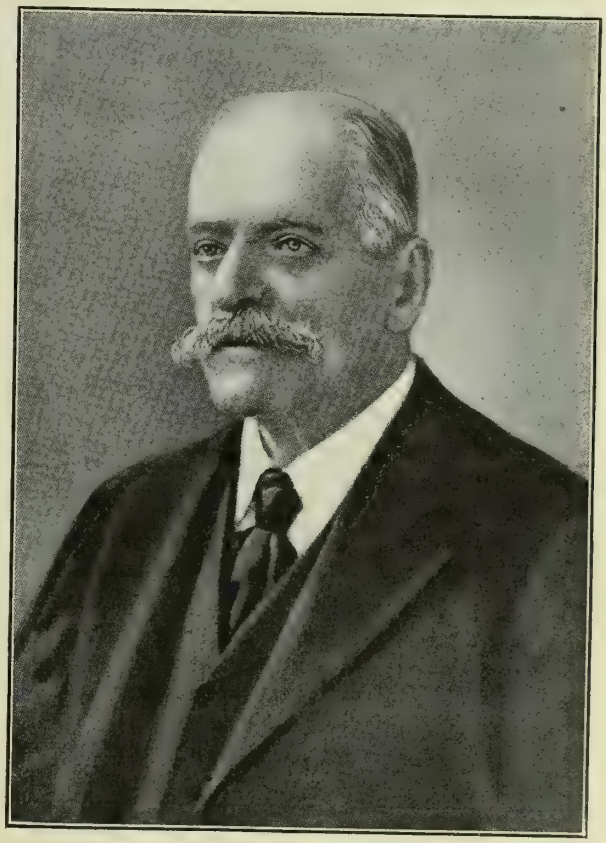
Death of Mendes Cohen

Mendes Cohen, past president of the American Society of Civil Engineers, and prominent in the early days of American railway engineering, died Aug. 13 at his home in Baltimore, Md., aged 84 years.

He was born May 4, 1831, soon after the Baltimore & Ohio R.R., one of the first railways in America, was put into operation. His father was a banker of Baltimore who helped to finance many of the early public works of this country.

The death of Mendes Cohen's father in 1847 resulted in the young man's starting out to earn a living at the age of 16 years. His first work was as apprentice machinist in the Baltimore locomotive works of the famous Ross Winans, builder of many early American locomotives. In 1851, at the age of 20 years, Mr. Cohen was appointed assistant engineer of the Baltimore & Ohio R.R. on work connected with the construction of the Broad Tree Tunnel.

On the completion of this work he was transferred to the motive-power department of the railway. Two important duties were assigned to him during this period—the adaptation of the wood-burning passenger locomotives to coal burning and the handling of traffic on the famous 10-per cent. temporary grade over the Kingwood Tunnel, a remarkable achievement in railway operation.



MENDES COHEN

At 24 years of age he became assistant superintendent of the Hudson River R.R., with which company he remained until 1861, when he succeeded Gen. George B. McClellan as operating head of the Ohio & Mississippi R.R., first being superintendent and later president and superintendent. Shortly after the end of the Civil War Mr. Cohen retired from this position and for a short time was connected with the Philadelphia & Reading Ry.

From 1868 to 1871 he was comptroller and assistant to the president of the Lehigh Coal & Navigation Co. In 1872 he was chosen president of the Pittsburgh & Connellsville R.R., which was subsequently consolidated with the Baltimore & Ohio R.R. system. For many years he was a prominent consulting engineer of Baltimore, and in 1892 was elected president of the American Society of Civil Engineers, of which he had been a member since 1867.

Irrigation in Southern Alberta

Extensive irrigation schemes affecting about 500,000 acres of new land in Southern Alberta are being developed by the irrigation branch of the Canadian Department of the Interior, under the direction of H. Peters, irrigation commissioner. The nucleus of the system now being planned is being opened up this season, covering 30,000 acres in the Taber district east of Lethbridge, which is under development by the Canadian Pacific Ry. The government engineers are now conducting a survey for the extension of this system for a considerable distance east of Taber. The second branch of the new system will include the area lying east of Stirling to Foremost, along the Lethbridge-Weyburn branch of the Canadian Pacific Ry. A third branch will cover the area east of Coutts along the international boundary. It is proposed to furnish the water for these branches of the system through three main arteries tapping the St. Mary's, Belly, Waterton and Milk rivers. As a considerable amount of the Milk River water will be diverted by an American irrigation project, the government engineers are planning to bring water from the Waterton and Belly rivers to make up for that to be thus diverted. An artery from the Milk River, a little to the West of Milk River town, will furnish the supply for the third branch. Survey parties are now in the field making an accurate survey of the course of the river.

Another scheme, the surveys for which have been already made by the government engineers, is known as the Old Man River diversion project, by which it is proposed to irrigate 100,000 acres of the lands to the north of Lethbridge. These various works will not be built and operated by the government, which simply proposes to undertake the necessary surveys so that they may be in readiness when construction is undertaken by local organizations. Under recent legislation adopted by the Alberta government the farmers are authorized to organize irrigation districts, bonding each district for the cost of the system, the farmers paying for the use of the water. This law will apply to all irrigation systems undertaken in the future. While the Old Man River project is likely to be executed in the near future, the construction of the other systems may be deferred for some time until the country to be served by them is more thickly settled.

Street-Railway Tracks in certain Ohio cities may be laid without the consent of abutting property owners, according to a decision of the Ohio Supreme Court on July 20. The decision affirms the right of a city to introduce into its charter a provision permitting street-railway tracks to be built by order of the City Council without obtaining the consent of a majority of the abutting property holders. In the city of Cleveland, certain wealthy property owners along Euclid Ave. between East 22nd and East 40th St. made an agreement years ago to give no consent for the laying of street-car tracks on the avenue unless all property owners joined therein. Under the decision now made by the court of last resort, the city authorities of any city in Ohio having a charter for self-government can rule as to the construction of street-railway extensions.

Disposal of Industrial Wastes—The headquarters for the investigation of methods for the disposal of industrial wastes, now being carried on by the United States Public Health Service, have been moved from Washington to Cincinnati, in order to coöperate with the Ohio River investigation in charge of Passed Asst. Surgeon W. H. Frost, U. S. Public Health Service. The industrial waste studies are under the supervision of Earle B. Phelps, Professor of Chemistry, Hygienic Laboratory, Washington, D. C., with H. B. Hommon in charge of the Cincinnati and field offices. The staff consists of Sanitary Chemist H. C. Colson, Jr., in charge of tests at tannery, Luray, Va.; Sanitary Bacteriologist Walter E. Brown, in charge of tests at strawboard plant, Noblesville, Ind.; Sanitary Engineer H. R. Crohurst; Sanitary Bacteriologists, W. v. D. Tiedeman and Emery J. Thierault, assisting in the studies of industrial wastes on the Ohio River watershed in the vicinity of Cincinnati.

The Kaw Valley Drainage Board will add 4 or 5 ft. to the height of its levees on the Kaw or Kansas River in Kansas City, Kan. This will bring the levee grade to the level of the floors of the highway bridges and to the top of the ties of the railway bridges. The freeboard room thus provided will accommodate a volume of water equal to the estimated entire flow of the river in the flood of June 30, 1903 (300,000 to 350,000 sec.-ft.). The Kansas City Southern Railroad Co. has agreed to raise the level of its bridge at the foot of Ohio Ave., which means a new and longer bridge, estimated to cost $135,000. The only other railroad bridge which is similarly obstructive is that of the Chicago Great Western (used also by the Missouri Pacific) at the mouth of the river. Efforts are being made to get this bridge raised also. The levees will be raised vertically in some places and on the present slope of 2 to 1 in others, widening portions of the top to 40 ft. The dirt will be obtained from the river channel by means of a dredge being built by the drainage board. Estimates of the yardage are now being made. S. H. McNeil is chief engineer and E. B. Murray, of Kansas City, is consulting engineer to the Kaw Valley Drainage Board, whose address is care of Osage & Pyle, Kansas City, Kan.

PERSONALS

Mr. G. E. Byars, recently City Engineer of Waco, Tex., has been appointed Superintendent of Buildings and Grounds of the Agricultural and Mechanical College of Texas at College Station.

Mr. O. P. Hand, former Advertising Manager of the Minneapolis Iron Store Co., of Minneapolis, has been appointed Director of Publicity of the Burd High Compression Ring Co., of Rockford, Ill.

Mr. J. Borge, formerly Chief Engineer of the National Incinerator Co., of New York City, and of Lewis & Kitchen, Chicago and Kansas City, has organized the Borge Incinerator Corporation, with offices in the Flatiron Building, New York City. He has been elected its President.

Mr. Gardner S. Williams, M. Am. Soc. C. E., Consulting Engineer, of Ann Arbor, Mich., has opened an office in Chicago, Ill., for the general practice of engineering specializing in the design, supervision and construction of hydro-electric developments, water-power and water-supply.

Mr. George M. Lehman, M. Am. Soc. C. E., Chief Engineer of the Lake Erie and Ohio River Canal Board, has been appointed by Gov. Martin G. Brumbaugh, of Pennsylvania, to represent the state at the Fifth National Drainage Congress, to be held in San Francisco Sept. 17 to 21, 1915.

Dr William S. Franklin, F. Am. Inst. E. E. resigned as Professor of Physics at Lehigh University, South Bethlehem, Penn. Dr. Franklin has been associated with Lehigh University since 1897, when he went there from Iowa State College as Professor of Physics and Electrical Engineering.

Mr. Morris Knowles, M. Am. Soc. C. E., Consulting Engineer, has acquired the engineering business formerly conducted by the late L. E. Chapin, of Pittsburgh, Penn., and Canton, Ohio. Mr. Knowles was associated with Mr. Chapin from 1902 to 1907. His offices are in the Oliver Building Pittsburgh, Penn.

Mr. A. H. Whiteside has resigned as Sales Manager of the Goulds Manufacturing Co., Seneca Falls, N. Y. The sales department of the company is now divided into two parts, one directed by Mr. R. E. Hall, former Manager of the Boston office, and Mr. W. E. Dickey, former Manager of the New York office, both Vice-Presidents of the company.

Mr. H. H. Henderson, recently representing the Goulds Manufacturing Co., of Seneca Falls, N. Y., in northern West Virginia and southeastern Ohio has been appointed Manager of the company's Pittsburgh office in the Oliver Building. Mr. E. C. Wayne, of the main office at Seneca Falls, has been appointed Assistant Manager of the Pittsburgh office.

Mr. Lorenzo C. Dilks, Assoc. M. Am. Soc. C. E., recently General Manager of Sales of the Eastern Steel Co., New York City, has been elected President and General Manager of Milliken Brothers, Inc., New York City. Mr. Dilks has had many years' experience in the structural steel business with the Pencoyd Iron Works and the American Bridge Co.

Mr. J. H. Staats, M. Am. Soc. C. E., Vice-President and Treasurer of R. P. & J. H. Staats, Engineers and Contractors, has been elected Vice-President of the Snare & Triest Co., Contracting Engineers, also of New York, which has acquired the equipment, plans, records and good-will of the contracting business of R. P. & J. H. Staats. Mr. R. P. Staats, M. Am. Soc. C. E., has retired from active business.

OBITUARY

William B. Dixey, of the Blaw Steel Construction Co., of New York City, died Aug. 11 at his home in Westfield, N. J.

Thomas Bliss Stillman, Chemical Engineer, former Professor of Engineering Chemistry at Stevens Institute of Technology, died recently at his home in Plainfield, N. J. He was born in 1852 and graduated from Rutgers College, New Jersey, in 1873. In 1883 he received the degree of Doctor of Philosophy from Stevens Institute of Technology, with which institution he was connected for many years, retiring in 1909 as Professor of Engineering Chemistry. He was at various times State Inspector of Oils of New Jersey, Examiner in Chemistry of the New York City Municipal Civil Service Commission, City Chemist of Jersey City and Bayonne, N. J., and Chemist of the Medical Milk Commission of Newark. He was a member of many scientific societies and the author of a well-known textbook on engineering chemistry.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
Aug. 16-18 and 25-28. Annual meeting in Los Angeles, Calif., Aug. 16-18; in San Francisco, Aug. 25-28. Secy., J. C. Olsen, Cooper Union, New York City.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Aug. 24-27. Annual convention in Cincinnati. Secy., Clarence R. George, Houston, Tex.

NEW ENGLAND WATER WORKS ASSOCIATION.
Sept. 7-9. Convention in New York City. Secy., Willard Kent, Narragansett Pier, R. I.

TRAVELING ENGINEERS' ASSOCIATION.
Sept. 7-10. Annual meeting in Chicago. Secy., W. O. Thompson, N. Y. C. R.R., East Buffalo, N. Y.

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 12-14. Annual convention at Dayton, Ohio. Secy., Charles Carroll Brown, 702 Wulsin Bldg., Indianapolis, Ind.

San Francisco Meetings

INSTITUTE OF RADIO ENGINEERS.
Sept. 13-18. Secy., David Sarnoff, 71 Broadway, New York.

PAN-AMERICAN ROAD CONGRESS.
Sept. 13-18. Secy., E. L. Powers, Road Builders Association, 150 Nassau St., New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 16-18. Secy., Charles Warren Hunt, 220 West 57th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Sept. 16-18. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 16-18. Secy., Bradley Stoughton, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 16-18. Secy., F. L. Hutchinson, 29 West 39th St., New York City.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Sept. 16-18. Secy., J. J. Blackmore, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Sept. 16-18. Secy., J. W. Richards, Lehigh University, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Sept. 17-21,

INTERNATIONAL IRRIGATION CONGRESS.
Sept. 20. Secy., Arthur Hooker, Sacramento, Calif.; until Aug. 1, New Stockton, Calif.

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Sept. 20. Secy., F. F. Sharpless, 52 Broadway, New York City.

PACIFIC COAST ASSOCIATION OF PORT AUTHORITIES.
Sept. 20 and 21. Secy., Leo V. Merle, Ferry Bldg., San Francisco, Calif.

AMERICAN MINING CONGRESS.
Sept. 20-22. Secy., J. F. Callbreath, Washington, D. C.

INTERNATIONAL ENGINEERING CONGRESS.
Sept. 20-25. W. A. Cattell, Secy., Comm. of Management, Foxcroft Bldg., San Francisco.

INTERNATIONAL ASSOCIATION OF BRIDGE AND STRUCTURAL IRON WORKERS.
Sept. 20-30. Secy., Harry Jones, American Central Life Bldg., Indianapolis, Ind.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Sept. 21 and 22. Secy., F. M. White, Madison, Wis.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Sept. 23 and 24. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 23 and 24. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN ASSOCIATION OF REFRIGERATION.
Sept. 23 and 24. Secy., J. F. Nickerson, 431 South Dearborn St., Chicago, Ill.

ILLINOIS GAS ASSOCIATION.
Sept. 27. Adjourned meeting. Secy., H. H. Clark, 72 West Adams St., Chicago, Ill.

SAFETY CONFERENCE.
Sept. 27-30.

INTERNATIONAL GAS CONGRESS.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

Cleveland Engineering Society—At the meeting of the executive board held on July 3, C. E. Drayer was appointed secretary of the Cleveland Engineering Society. Mr. Drayer is also secretary of the Committee on Engineering Coöperations of the society.

Texas Good Roads Association—Interesting sessions were held at the Aug. 5-6 convention of the Texas Good Roads Association, held at the Agricultural and Mechanical College of Texas. Two of the subjects under discussion were, "Are Special Road Laws Advisable" and "County Convict Labor." James P. Nash read a paper on "Economic Road Materials of Texas." Mrs. March Culmore explained why women favor good roads.

International Engineering Congress—A preliminary program of the International Engineering Congress to be held at San Francisco Sept. 20-25 has been prepared. The printed program will be issued at a later date. Discussions will be held on the following subjects on the days mentioned: General session, Sept. 20; Waterways, Sept. 20-23, mornings; Irrigation, Sept. 23-25, mornings; Municipal Engineering Sept. 21-24, mornings; Railway Engineering, Sept. 21-24, mornings; Materials of Engineering Construction, Sept. 21-23, afternoons; Mechanical Engineering, Sept. 21-24, afternoons; Electrical Engineering, Sept. 22-23, afternoons; Mechanical Engineering, Sept. 21-22, afternoons; Metallurgy, Sept. 21-24, afternoons; Naval Architecture and Marine Engineering, Sept. 21-24, afternoons; Miscellaneous, including Refrigeration, Agriculture, Education, Heating and Ventilating, Sept, 22-24.

Builders' Association of Kansas City—This association was recently formed for the purpose of "promoting and projecting the interests of its members; to maintain just and equitable treatment of their relations with each other and with their employees; to promote steadiness of employment in the building trade; to promote and facilitate the settlement of labor disputes; to prevent strikes, and to encourage the formation of an association of contractors." The officers are: President, James E. Taylor; first vice-president, J. Q. Smithers; second vice-president, E. L. Winn; treasurer, E. L. Marty; secretary, J. A. G. Badorf. On Aug. 5 the property and funds of the Master Builders' Exchange of Kansas City were transferred to the new association. The constitution of the Builders' Association provides for the following standing committees: Ways and means; finances; contracts; legal action and legislation; grievances; membership; promotion and publicity; trade relations. Provision is made for the recall of members and officers.

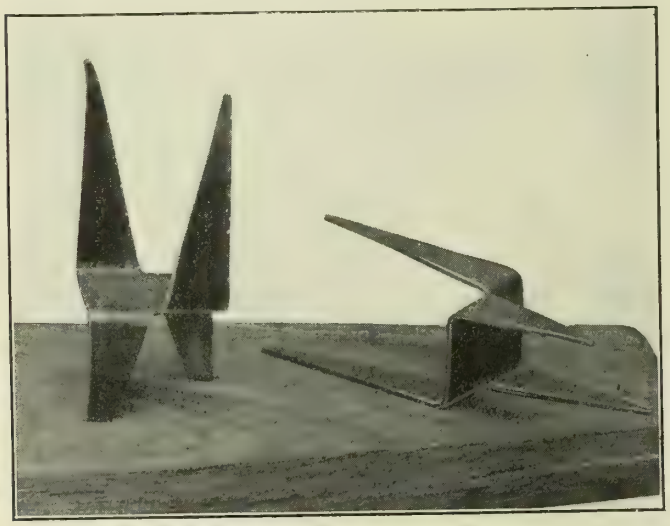
Concrete Road Building Conference—The organization of subcommittees for the Second National Conference on Concrete Road Building, to be held in Chicago, Feb. 15-18, 1916, has been completed. Seventeen committees have been named, each to investigate and submit a report upon a specific topic in

connection with the construction of concrete roads. The committees' subjects are as follows: (1) Drainage and preparation of subgrade; (2) economical widths of pavement and shoulders; (3) problems of design, thickness, crown and grade; (4) aggregates; (5) handling and hauling materials and water supply; (6) organization of concreting crew; (7) proportions of materials and consistency of concrete; (8) mixing and placing concrete; (9) reinforcing; (10) joint location and construction; (11) expansion and contraction; (12) finishing and curing; (13) construction of shoulders and curbs; (14) methods and cost of maintenance; (15) form of specifications; (16) cost of construction; (17) estimating and inspection problems. The Advisory Committee has again elected Dr. W. F. M. Goss, Dean of the College of Engineering of the University of Illinois, chairman and J. P. Beck, secretary.

Appliances and Materials

Chair for Reinforcing Bars

The chair shown in the accompanying view has been designed to support reinforcing bars in the forms during the placing of concrete. It differs somewhat from most devices for the purpose in that it is driven into the forms previous to placing the reinforcement, thereby insuring permanently the correct placing of the steel. Each chair is of heavy sheet steel cut and bent to develop two pairs of sharp prongs. The



REINFORCING-ROD CHAIR

lower pair are driven into the form floor and after the reinforcement has been placed the upper prongs are hammered down to grip the bars. The chairs are being marketed by the Shop-Fabricated Reinforcement Co., 1900 Euclid Ave., Cleveland, Ohio. They have been used recently on several Cleveland buildings. While it was thought by some that there might be difficulty in removing the forms, on account of the grip of the chair, no trouble of this sort has arisen.

* * *

Automatic Wheel-Flange Lubricator

For the lubrication of the wheel flanges of locomotives various automatic lubricators have been devised. One of the latest is the "Detroit Automatic," made by the Detroit Lubricator Co., of Detroit, Mich. The machine consists of an oil tank mounted in any convenient place—usually under the running board, a feed valve, and a delivery nozzle close to the flange. A loose ball in the feeder by impact momentarily opens the control valve. The lift and flow is controlled by spring tension. On switching engines the lubricator body is placed parallel to the boiler, so that shocks of stopping and coupling operate the valve. On road engines the lubricator is at right angles to the boiler and the ball is thrown by rolling on curves, etc. The device can be installed for one or more wheels.

* * *

Contractors' Geared Locomotive

While the Shay geared locomotive in various sizes (up to about 190 tons, noted in "Engineering News," Nov. 26, 1914) has been employed extensively in railway service, its application to construction lines is comparatively new. It has been used, however, on several large contracts for gravel and concrete roads. The engines thus employed are mainly of 13 and 18 tons' weight, the former being used generally for tracks of 24-in. gage. The accompanying illustration shows a 13-ton unit built by the Lima Locomotive Corporation, of Lima, Ohio, for H. W. Reed & Sons, of Mishawaka, Ind.

This type of geared locomotive has vertical cylinders at one side of the firebox, driving a crank axle parallel with the track. The engine is mounted on a pair of four-wheel trucks, and each wheel on the driving side of the engine has a



CONTRACTORS' GEARED LOCOMOTIVE

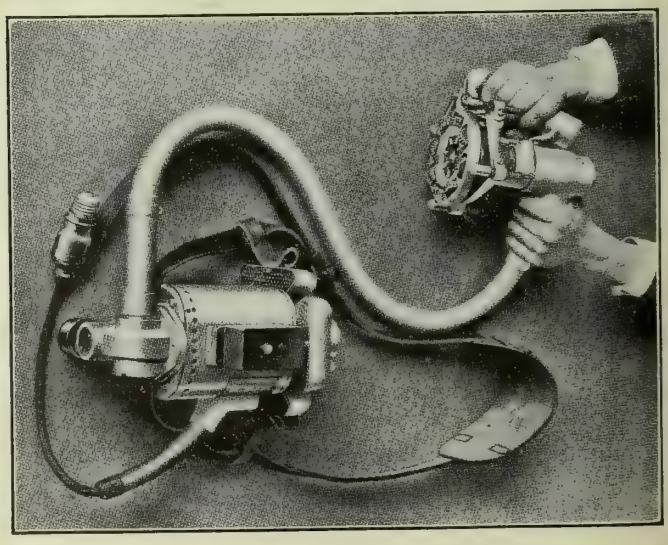
bevel gear bolted to its face. In the truck frame is carried a short shaft with bevel pinions engaging these gears. The truck shafts are connected to the crank axle by intermediate shafts having flexible couplings to allow for the swiveling of the trucks and for vertical irregularities of the track. The 13-ton engine has two 6x10-in. cylinders and 22-in. wheels. The truck wheel base is 4 ft. and the total wheel-base 18 ft. 10 in. The frame which supports the boiler and cylinders supports also the rear bunker, which holds ¾ ton of coal and 400 gal. of water. The maximum tractive effort is 6050 lb.

* * *

Concrete Surfacing Machine

A portable electric-driven tool for removing form marks, pits and irregularities from concrete walls, floors and ceilings has been devised by J. O. Berg and is being made by the Elevator Supply & Repair Co., Willow Ave. and 15th St., Hoboken, N. J. The machine is adapted also to remove metal scale, old paint, etc.

It comprises a small electric motor carried by the operator and a disk tool with 16 hardened-steel rotary chipping wheels



CONCRETE SURFACING MACHINE

driven by a flexible shaft. The entire outfit weighs 30 lb.; the tool alone weighs 9 lb. The motor is for use on both alternating- and direct-current lines of either 110 or 220 volts as desired. The machine is claimed to prepare 100 sq.ft. of wall per hour ready for float finish; 70 sq.ft. per hr. can be cut down to even color, and the aggregate exposed at the rate of 60 sq.ft. per hr. A cost reduction by machine-work of 50 to 75 per cent. below hand-work cost is reported.

Engineering News

VOLUME 74 AUGUST 26, 1915 NUMBER 9

Concrete Dome for the New Technology Buildings

The crowning architectural feature of the new buildings for the Massachusetts Institute of Technology on the banks of the Charles River, Cambridge, Mass., is to be a large dome surmounting the central one of the group, which is located at the extreme inside end of the forecourt leading up from the river. While externally this dome, with its building, will be of limestone in architectural keeping with the rest of the buildings, its structure is of reinforced concrete, the same as the other structures. The view on this page shows a recent stage in the building of the dome, which is now almost completed.

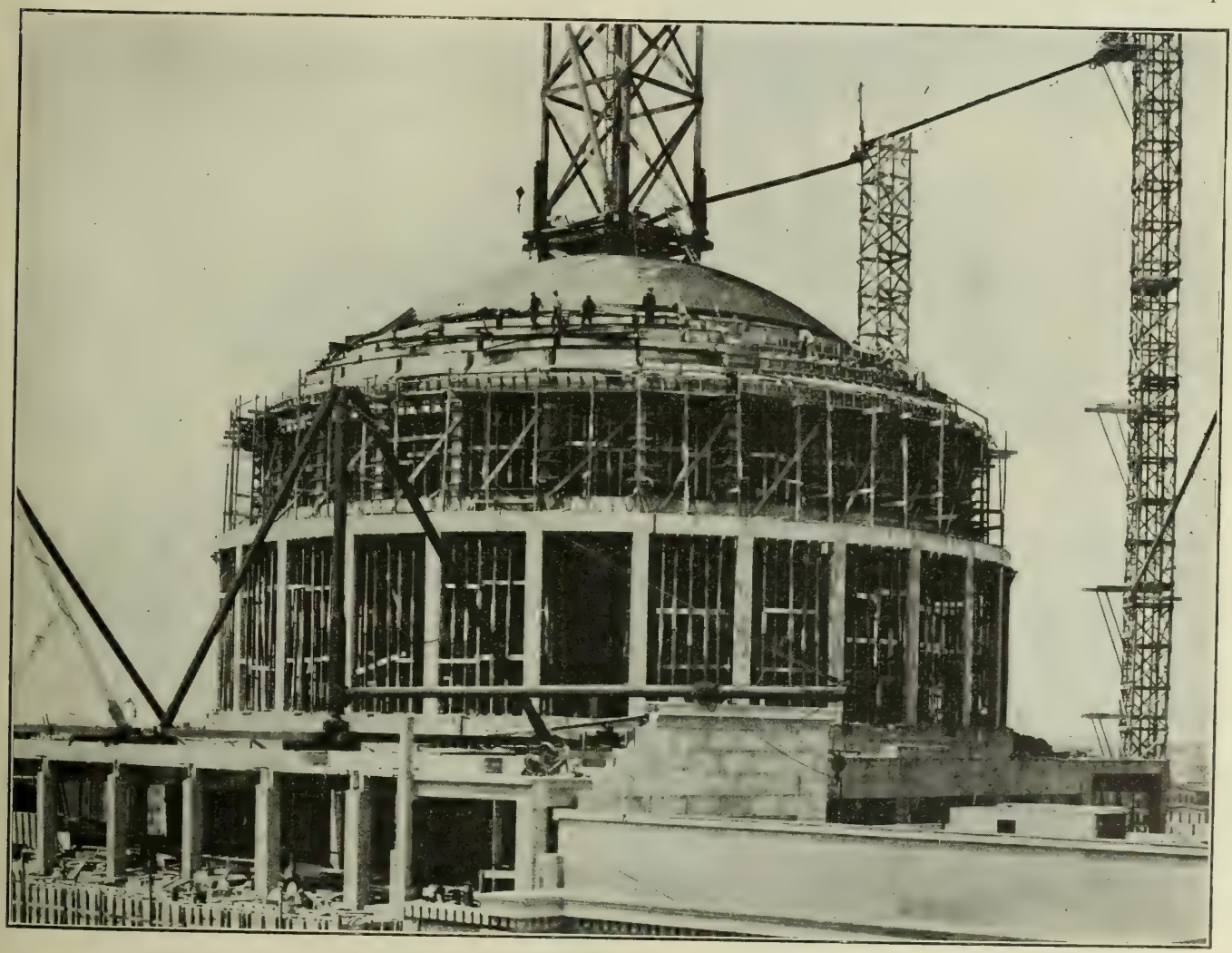


FIG. 1. CONCRETING THE DOME OF NEW TECHNOLOGY BUILDINGS, CAMBRIDGE, MASS.

That portion of it which rises above the five-story reinforced-concrete building upon which it is located consists of two tiers of cylinders, or drums, surmounted by the dome proper, the lower half of which is in the form of steps and the upper half in the form of a truncated sphere the flat top of which has an opening to admit light to the interior. The drums are supported on two circumferential rows of columns, the outside row of the lowest drum resting on a ring girder spanning the beams of the fifth floor of the main building, and the outside row of the upper drum spanning radial beams connecting the outer and inner columns of the lower drum. The inner columns of the two cylinders are continuous through to the building below, being located on the corners of an octagon.

The step portion in the lower half of the dome is of reinforced-concrete slabs formed to step shape and resting on radial inclined girders spanning the outer and

inner columns of the upper drum. The upper part of the dome is a portion of a sphere, and abuts at its lower plane on a ring girder spanning the inner columns of the drums, the upper plane being formed by a ring girder on the rim of the top opening. This slab varies in thickness from 5 in. at the top to 8 in. at the bottom, and is reinforced with a cross-webbing of twisted rods of the type shown in the view, Fig. 3.

The dome is 147½ ft. above the general level and 65 ft. above the parapets of surrounding buildings. The di-

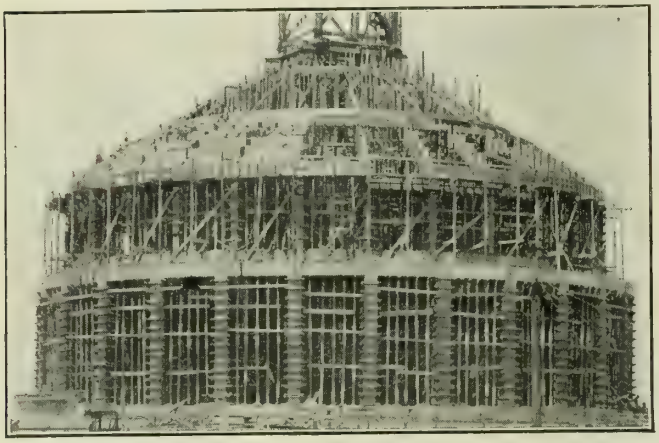


FIG. 2. FORMWORK ON TECHNOLOGY DOME

ameter of the lower cylinder is 120 ft. and its height 37 ft. The diameter of the upper cylinder is 108 ft. and its height 18 ft. The spherical portion of the dome, including the steps, is 23½ ft. above the top of the upper drum and is curved to a radius of 56½ ft. The two hemispherical dome portions are 70 ft. in diameter.

The view in Fig. 2 shows an earlier stage in the formwork and illustrates fairly well how the dome was carried up. The main framework presented no particular difficulties, inasmuch as it could all be supported from the ring girders, but the central spherical dome had to be supported from the roof of the main building, which required

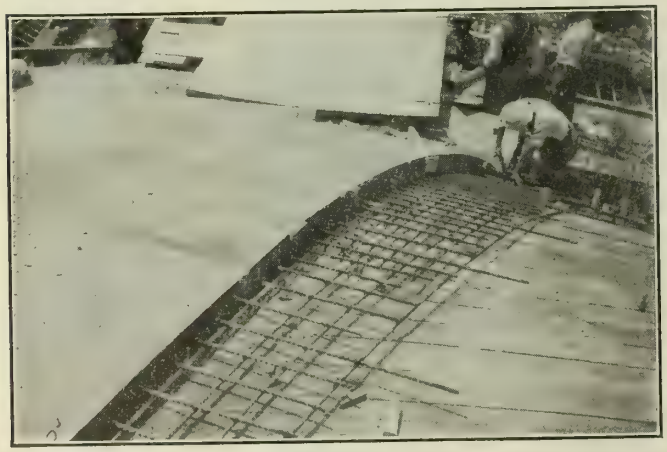


FIG. 3. NEAR VIEW OF REINFORCEMENT IN PLACE ON DOME

thoroughly cross-braced falsework posts from 50 to 70 ft. high. The lower side of this base form for the roof of the dome was made in a continuous operation, forming, in fact, a complete timber dome, as shown in Fig. 2. On this the reinforcement was laid above the step portion while the step portion was poured against vertical forms, the tread of the steps being screeded. This lower section is shown to the right in the dome in Fig. 1. The upper forms for the spherical portion of the dome were laid in the form of small panels of varying shapes to accommodate them to the radius of the dome, 21 of these being used at a time. When the group of forms had been placed, the segment was poured all at once and the operation repeated on the next segment; six segments were required to complete the dome.

Concreting was done from a tower 190 ft. high, located about 100 ft. away from the dome center, the chute being supported, as shown in Fig. 1, by an intermediate tower located on the dome proper. The central tower shown in the views is a continuous timber tower 18 ft. square and 119 ft. high, built up from the roof of the main building. To each corner of this tower is attached a boom, which is used for the conveying of forms and the limestone covering which is now being placed on the dome.

The buildings of the Massachusetts Institute of Technology are being built by the Stone & Webster Engineering Corporation, 147 Milk St., Boston, which firm is in charge of the engineering design as well as the construction. William Welles Bosworth, of New York, is the architect.

The Largest Tunnel in the World

The largest tunnel ever undertaken is that which has been partly driven at Marseilles, France, for the Marseilles-Rhône Canal. The tunnel is 72 ft. wide and the height from the bottom of the tunnel to the crown of the arch is about 40 ft. The total length when completed will be about four miles, and when its great cross-section is taken into consideration in connection with its length, the total volume of excavation will doubtless be greater than that of any tunnel for traffic purposes ever constructed. The total amount to be excavated is in the neighborhood of 2,500,000 cu.yd. E. L. Corthell, in the course of a visit to notable engineering works in the Mediterranean countries, examined this tunnel two years ago and gives a brief description of it in *Professional Memoirs of the Corps of Engineers* for May-June, 1915.

The accompanying drawings show cross-sections of the tunnel and the general method of construction, with a map of the navigation scheme of which the tunnel forms a part. A part of Mr. Corthell's description of the work is as follows:

We arrived at Marseilles on Feb. 22, 1915. Mr. Batard, Chief Engineer of the Port, and Mr. Bourgougnon, Chief Engineer of the Marseilles-Rhône Canal now under construction, were on the dock to meet us and take us first in Mr. Batard's sea-going launch about 5 mi. (8 km.) along the route of the new canal, the terminus of which is in the port of Marseilles, straight to the entrance of the tunnel now under construction through the rocky ridge that separates the Bay of Marseilles from the "Etang de Bolmon," and thence along the shores of the large "Etang de Berre," about 8 mi. (12.8 km.) in all, and thence along the outlet of these lakes to the "Golfe de Foz," along the northern shore of that water direct to ancient Arles, following the latter part of the way the course of the Rhône.

The total length, Port of Marseilles to the Rhône at Arles, is somewhat less than 50 mi. (80.5 km.). It is built to bring the Rhône River traffic from Lyons and above direct to Marseilles. It is being built by the French government, with some assistance from the Chamber of Commerce of Marseilles. The large Rhône barges can then avoid the dangerous route of 25 mi. (40.2 km.) around Cape Couronne from the mouth of the Rhône, or rather from the mouth of the St. Louis Canal to Marseilles.

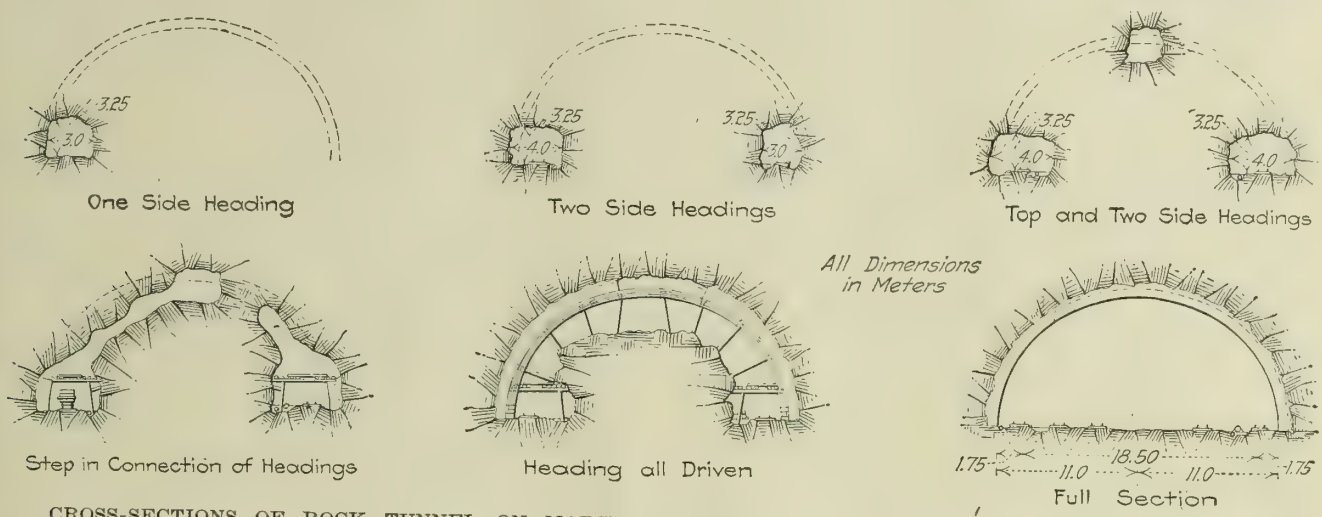
Before describing the tunnel, which is the principal feature of interest, let me say that the mouth of the Rhône has an interesting history. For centuries the question of improving it for the Rhône navigation had been a matter of study, projects and efforts, until the government started to build dikes to close the smaller outlets of the delta and two jetties at the principal mouth. But two serious errors were made, the jetties were too far apart and the methods of construction were too slow. The silt and sands protruded beyond the advancing jetties, always in advance, the bar moving outwards until, weary of "chasing a rainbow," it was decided to build a lateral canal (Canal St. Louis), about 3½ mi. (5.6 km.) long to debouch into the Gulf of Foz.

The disappointment and its causes are shown, with sketches, in my "History of the Mississippi Jetties," published by John Wiley & Sons in 1880. The conditions and history were carefully examined by Captain Eads at the time of his visit to Europe in 1874 to learn the facts about many improved river mouths, to support his arguments for the bill then before Congress for improving the mouth of the Mississippi River by means of jetties. His opponents were using the history of the mouth of the Rhône as an argument in favor of the Fort St. Philip Canal from the Mississippi to Lake Borgne and against the jetty proposition. Now, the Canal St. Louis is to be practically abandoned and one 50 mi. (80.4 km.) long is to be built.

The tunnel is probably one of the most interesting rock tunnels ever undertaken in that it is, no doubt, the largest and one of the longest barge-canal tunnels in rock. The tunnel, lined throughout its nearly 4½ mi. (7.2 km.), is 22 m. (72.2 feet) wide inside the lining, and the crown of the arch (nearly semicircular) is 9.90 m. (32½ feet) high. The depth of water is to be 3 m. (10 feet). The plans illustrate the whole process of excavation, centering and lining, and are well worth the study of tunnel and canal engineers.

Briefly, as the detail plans are too extensive and numerous to be published entire, the process is as follows: A heading on the left at the base 3x3.25 m. (9.8x10.7 ft.), then one on the right at the same level and same size, then the enlargement of the two inward to give room for a track and ditch for drainage, then a small heading at the summit of the arch, then the enlargement upward of the two side headings to connect with the top heading, with a staging to receive the falling rock to be dropped into small dump-cars on the track, the permanent lining at the same time started on each side, then the enlargement of the excavation under the roof on both sides, which gives a chance to put in heavy centering on short posts, resting on the same mass core of unexcavated rock, then the masonry lining over the advancing centering completed, the centering then removed and carried forward and the bench removed.

The work is done by compressed air and it has the usual ventilating machinery and pipes, compressed-air pipes, drainage ditches, etc. The rock is quite varied in character: Dolomite of the Upper Jurassic, limestone, sequannian (above the Jurassic), and a mixture of the two. Suitable stone for the lining is found in the materials removed by the tunnel excavation. The contractor for the entire work is M. Chagnaud, who has recently completed the Loetschberg tunnel and approaches between Bern and the Simplon.

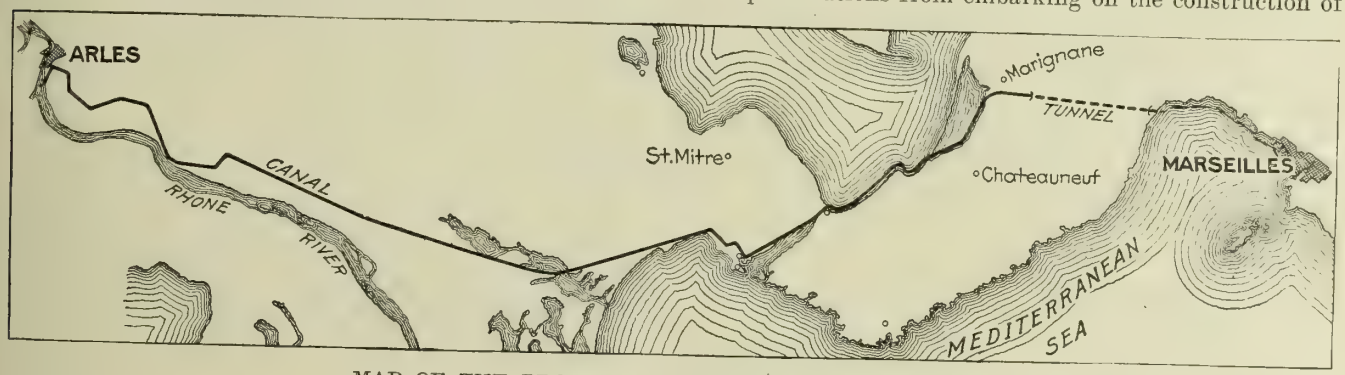


CROSS-SECTIONS OF ROCK TUNNEL ON MARSEILLES-RHONE CANAL, SHOWING SUCCESSIVE STEPS IN EXCAVATION AND LINING

At the time the sections were taken which are here reproduced (July 1, 1912), the tunnel had been completed and lined for a distance of 600 meters and the advance headings were driven 500 meters farther. It is perhaps needless to say that work upon the tunnel, as on practically all other constructive engineering works in the belligerent countries of Europe, is now suspended.

It is doubtful whether it will ever be resumed. The vast burden of debt due to the war will prevent the European nations from embarking on the construction of any public works not absolutely necessary for a long time to come.

Apart from this, however, the proposition to build this enormous and enormously costly tunnel, merely to save the dwindling traffic by river barges a few miles of navigation in the open Mediterranean, would appear to be a scheme absolutely quixotic from the economic point of view. Probably the tunnel will take its place with other abandoned engineering dreams.



MAP OF THE PROPOSED MARSEILLES-RHONE CANAL

Coast Erosion and Protection on Long Island and New Jersey--II

By Gerald O. Case*

SYNOPSIS—Takes up in detail the causes of coast erosion and illustrates the effects with general cases and specific references to the New Jersey coast. Theory and behavior of sand dunes.

Causes of Coast Erosion

A study of the causes of coast erosion is essential before it is possible to say what are the best means of combating it. Erosion is due to many causes, and coast protection works cannot be expected to be successful unless they are designed after a careful consideration of the causes of erosion at the particular place it is desired to protect. Many of the coast-protection works constructed on the New Jersey coast have proved a failure, and this has undoubtedly been due in a great measure to an imperfect knowledge of the causes of the erosion. The author has known of cases where the erosion was due to wind action in moving inland the natural sand embankments but where the protection works have been designed and constructed to prevent erosion by wave and current action. Of course, they were a failure and the erosion continued, which could have been certainly stopped by very inexpensive works had the correct cause of the erosion been recognized.

Subsidence of the Land

A new cycle of coastline changes are inaugurated by any important alteration in the relative levels of land and sea. Subsidence of the land or rise of the sea will, of course, cause erosion. Although there are evidences of local changes in the tide level on the New Jersey coast, there is no evidence of a gradual sinking of the land, as has been supposed by many people. Recent precise leveling in the vicinity of New York harbor confirms the surveys made in southern New Jersey, by proving an absence of any tilting of the land, and shows further that mean sea level is the same now as it was more than a quarter of a century ago at Sandy Hook.[7] The forces—wind waves, wind currents, tidal currents and wind action—now operating on the New Jersey and Long Island coasts are fully capable of causing the great changes which have undoubtedly taken place in recent years.

Inequalities in Amount of Littoral Drift

There is practically no such thing as static equilibrium of a foreshore, the surface layers being constantly in motion. When a shore is met with which is in apparent equilibrium, neither erosion nor accumulation taking place, it does not follow that movement is absent, but simply that removal and deposition approximately balance each other. Anything disturbing this balance at once becomes evident in a gain or loss to the foreshore. The effect of obstructions, such as a headland or a break in the continuity of the coastline, which will interfere with the littoral drift is therefore very important. Wherever an obstruction checks littoral drift, erosion very often takes place, under natural conditions, on the leeward shore.[8]

There are also peculiar conformations of the coastline which allow a certain part to be sheltered from particular winds, which are active in eroding material from other parts of the coast. In such a case littoral drift may commence at the particular point where the shelter, say, of a headland, ceases to be effective, thus producing severe erosion owing to the absence of drift from the other side to fill the place of the material removed.

The amount of littoral drift taking place on any part of the coast is dependent partly on the gradient of the foreshore and sea bed. With a very flat gradient the tendency is for the ends of oblique waves, on entering the shallow water, to be retarded and for the line of waves to swing round and come in at right angles to the coastline. The flatter the gradient, the less material will be moved by wave action per unit area. Erosion of the coast, under natural conditions, tends to flatten the gradient, and accretion to steepen it. If from any cause a shoaling of the sea bed takes place on any part of the coast, then the tendency will be for accretion to take place on the foreshore opposite the shoaling, and for erosion to take place on the leeward shore, due to interference with the alongshore supply of drift.

The general tendency is for the sea to erode headlands and projections. Reference to Fig. 3 will show that waves G which roll in parallel to the general coast line are oblique to the flanks of the headland and so tend to transport material from the point to the shore on either side—that is, from C to B and C to D. The action of oblique waves from either side also tends to move material away from the point of the headland. If the predominant waves causing littoral drift on the coast are coming from the direction F, most of the movement will be from C to D, but oblique waves H which may sometimes be formed will also cause a movement away from the point, in this case from C to B.

Given a straight coastline composed of alternate layers of hard and soft material, then the effect of the sea will be to form bays and headlands by erosion of the soft material; but after a time, perhaps several years, the projecting headlands would shelter the bays, and erosion of the soft and hard strata might then take place at the same rate. There is also a limitation to localized erosion due to other causes, and it is very important to bear this in mind. If from any cause, such as interference with littoral drift, erosion is caused along a certain length of coast, then if this continues a bay will be formed, the direction at which the waves strike the coast and also the gradient of the shore will be altered and the headland will shelter the bay. There are

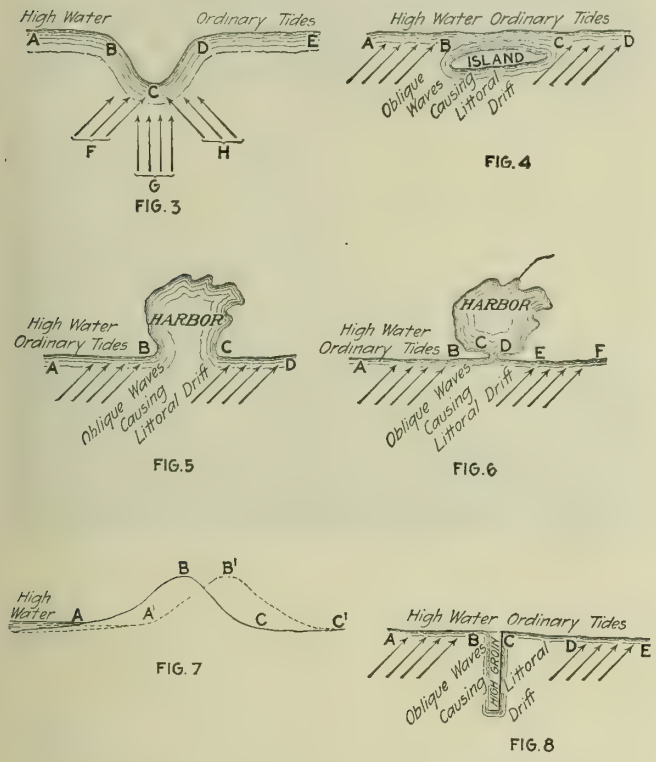
*Consulting Engineer, Case Coast Protection Co., 1170 Broadway, New York City.

[7]Annual reports of the New Jersey State Geologist, 1912, 1913.

[8]The leeward side of a natural or artificial obstruction to littoral drift is the side sheltered from the wind waves causing the predominant drift, and the windward side, that exposed to the wind waves causing the drift.

therefore three things tending to stop the localized erosion and cause erosion to take place at the same rate all along the coast.

An outlying island has an important effect in interfering with littoral drift, causing accretion to take place between the island and the mainland and erosion to take place on the leeward shore. This action is seen by reference to Fig. 4. It is obvious that the coast from *B* to *C* is sheltered from the predominant oblique wave action; there is, therefore, a constant feeding in of material from *AB* and accumulation takes place between the island and the mainland. Material eroded from the sea face of the island also tends to accumulate in the form of spits built out toward the mainland. As little or no material will be moved on to the foreshore between *C* and *D* to make up for what is moved away from there by oblique wave action, erosion will take place. This effect may also be seen if a wreck is stranded near the shore. When the island has become joined to the mainland and a headland thus formed, the erosion of the sea face of the island will still continue, the material



FIGS. 3 TO 8. ACTION OF WAVES CAUSING DRIFT

from which will then be moved to the shore between *C* and *D*, causing the localized erosion there to stop and the coastline to be gradually straightened out again.

Thus there are some cases of localized erosion which may go on for some years, but which will inevitably be stopped in course of time by the operation of the laws of nature.

Erosion on the Leeward Side of Inlets

Where there is a predominant littoral drift, a large supply of material, and a river outlet cutting through the coastline, erosion as a rule takes place on the leeward side. When the drift encounters the mouth of the river or inlet it is trapped and carried into the inlet or out to sea. The flood tide, setting into the inlet with much greater velocity than on the open coast, carries in sand to form shoals and silt to form salt marshes, while the ebb current, on the contrary, tends to transport material out to the sea bed. Referring to Fig. 5 it will be seen that owing to the littoral drift being intercepted at *BC* little or no material may be moved to the leeward shore *CD* to replace that moved from there by oblique wave action.

If the amount of littoral drift traveling along *AB* toward the inlet is greater than the flood tide can move into the inlet or the ebb transport to seaward, as is often the case, then a spit is formed part of the way across the inlet, from *B* toward *C*, or in some cases is built right across and closes it up, when material can once more be transported to the shore between *C* and *D*, and the erosion there will then cease. All the time that the inlet exists part of the supply may be often cut off from the leeward shore *CD* and erosion often takes place.

The spit on the north side of Barnegat inlet has grown out in a southerly direction, and a very considerable amount of erosion at the same time took place at the south side of the inlet. A comparison of the surveys of 1840 and 1886[9] shows that between these dates the leeward shore at the south side was cut back for a distance of about 2300 ft., and the east shore eroded from 100 to 1000 ft. for a distance of 1¼ mi.

The coastline changes which have taken place at Hereford and Turtle Gut inlets also illustrate the general rule that when accretion takes place on the windward side of inlets, erosion takes place on the leeward side. Between 1842 and 1901 the shore at Anglesea (Five Mile Beach) on the leeward (south) side of Hereford inlet was considerably eroded—in places the high water line advancing 1500 ft., while considerable accretion took place on the windward (north) side. The same thing happened at Turtle Gut inlet between 1842 and 1901. Five Mile Beach on the windward side was built out in a southerly direction, and at Two Mile Beach on the leeward side extensive erosion took place at the same time.[9]

In places where the windward side of an inlet is being rapidly eroded owing to inequalities in the amount of littoral drift or other causes, then the tendency is for accretion to take place on the leeward side. This is partly due to the action of eddy currents depositing material in the form of shoals and partly to alterations in the conformation of the coast. Thus at Absecon, Great Egg and Corson Inlets rapid erosion has, in recent years, taken place at the north sides and some accretion at south sides of these inlets.

When a spit is formed in front of a harbor or inlet into which a river discharges, and, as frequently happens, it closes the inlet and in course of time a new entrance is opened by storms and floods on the windward side, we may then have a spit on both sides with the entrance at or near the middle (Fig. 6). By the action of littoral drift the windward spit *BC* will at once commence to grow and pushes the entrance gradually toward *D*. The extremity of the spit on the leeward side *D* will then be gradually eroded. This erosion may be partly due to the river cutting off the supply of littoral drift and partly to the action of the ebb currents concentrated on its end. If, as is often the case, the amount of accretion on the end of the windward spit is more than the

[9] Annual report of New Jersey State Geologist, 1885 and 1905.

amount of the erosion on the end of the leeward spit, then the spits will gradually unite again and close the inlet.

The northerly movement of Shark River spit has frequently closed up the inlet there, and when a new entrance has been formed further south by floods and gales, the entrance has immediately begun to move northward again; the spit on the southern side increasing in length by littoral drift, and the southern end of the spit on the north side being at the same time eroded. At Manasquan River the same thing has taken place.

Effect of Onshore Winds

Winds blowing directly onshore cause a denudation of the upper part of the beach to take place, and a consequent advance of the high-water line results. This is due to a surface current being formed in a landward direction, which is compensated for by an undertow seaward. At the same time the waves break further seaward and are also forced shoreward by the wind, having their frequency of impact increased. There is no time for the regular sequence of plunge, uprush and backwash to take place; the waves hurry in on top of one another, and a surf is formed. The character of the wave also alters from an oscillatory to a translatory at a considerable distance from the shore, thus aggravating the surface drift due to direct wind action, and consequently the undertow seaward. In this state the sand is churned up for some distance from the shore, and naturally the quantity in suspension is greatest near the bottom, where the undertow is at work transporting it seaward.

Direct Impact of Waves

The direct impact of waves is a potent factor in the disintegration and removal of cliff material, and its action can be observed during gales on any part of the New Jersey coast where there is a cliff or bluff exposed to wave attack. During gales at Avon the waves have sometimes struck the 10-ft. high cliff with sufficient force to cut it away for 50 ft. and send the spray 40 ft. high into the air.[10]

Large masses may also be torn off by the alternate compression and expansion of the air in crevices exposed to the wave stroke, or by the transmission of the blow of the waves to the sides of fissures and cavities which are filled with water. The destruction of cliffs is chiefly brought about by the undermining action of the waves aided by subaërial agencies—rain, frost, etc. The constant percolation of rain water through cracks tends to disintegrate the cliffs, and the action of frost is well known in pulverizing the surface and splitting off fragments. The continued erosion is, however, dependent on the waves and currents moving alongshore or seaward the material eroded by wave impact, and thus allowing the waves again directly to attack the cliff. If the undermining action is prevented by the accumulation of débris at the base, then the cliff will in time assume an inclination of repose, due to the action of subaërial agencies.

Formation and Movement of Sand Dunes

On the sandy coasts of New Jersey and Long Island, wherever there is a fairly wide expanse of sand dry at low tide, there is a tendency for sand dunes to form above high-water line of ordinary tides. At low tide a certain amount of sand is dried by the wind and sun, and as soon as it becomes dry the wind is able to transport it inland. Onshore winds are more effective in moving sand inland than the weaker and less frequent seaward winds in moving it back again seaward.

Above high tide the sand is arrested by stones, grasses, trees or other obstructions; the various grasses and shrubs which grow just landward of high water being very effective sand collectors, cause the formation of sand dunes. Dunes may also be formed by wind action alone; but on the coast margin the formation of irregularly shaped dunes is chiefly due to vegetable life and obstructions such as sea-formed sand embankments.



FIG. 9. HEAVY WAVES STRIKING AGAINST VERTICAL SEA WALLS

The views show clearly the inefficiency of vertical sea walls and their effect of shore erosion. During gales the waves hit the face of the wall and the falling water scours out material from the front of the wall, hastening its collapse

The shape of sand dunes (Fig. 7) when not interfered with is much the same as that of sand ripples. The windward (seaward) slope is usually from 4½ to 10 deg. with the horizontal, and the leeward (landward) slope any angle up to the angle of repose of sand. On the coasts of New Jersey and Long Island the dunes commonly vary in height from 10 to 40 ft.

Sand dunes, unless fixed either naturally or artificially by vegetation, move inland in much the same way as sand ripples. The velocity of inland travel is the rate of advance of the crest, which takes place by the accumulation of sand on the steep leeward slope *BC* (Fig. 7). The supply is brought by the wind in two ways—first, by rolling of coarse sand grains up the windward slope *AB* and over the crest *B*; and, second, by the deposit of part of the flying sand caught by the eddy on the

[10] "Transactions," American Society of Civil Engineers, Vol. 23.

leeward side and not tossed away again. Experience has shown that the rate of inland travel of unfixed dunes varies from 3 to 100 ft. per annum.

In places where the sand blown in from the foreshore is not replaced by sand brought by the sea, erosion of the foreshore naturally takes place; the inland movement of the sand dunes being followed by the inland movement of high-water line. Reference to Fig. 7 shows that when the crest has been moved from B to B' the high-water line will have moved from A to A'. While considerable attention has been given to the important effects of waves and currents in causing erosion, little attention has been paid to the also important effects of wind action in causing erosion of the New Jersey and Long Island coasts.

In some places sand dunes which became naturally clothed with vegetation, and were therefore fixed, have subsequently moved inland at a rapid rate owing to the destruction by man of the vegetation of the dunes. The advantage of vegetation for protecting sand dunes and preventing their inland movement was recognized in the United States in early days. On Dec. 16, 1758, an act was passed to prevent the destruction of the vegetation on the sand dunes. It prohibited farmers from turning cattle out to graze on the dunes of Long Island and other parts of the Atlantic Coast where they formed a natural protection against coast erosion. This act was renewed by state law in 1789.

Sand-dune embankments are also moved inland by wave action during gales and very high tides, material being moved by the waves up the windward slope and deposited on the leeward slope, thus causing a gradual inland movement of the sand ridge. Near Barnegat inlet and at other places, especially where the dunes are low, they are overflowed by the waves during gales.

All along the New Jersey coast evidence is to be found that sand-dune embankments and sand islands have moved inland a considerable distance. At Squan Beach, near Loveladies Island Life Saving Station, north of Beach Haven, Brigantine Beach, Peck's Beach and many other places salt marsh turf is found exposed on the foreshore at low tide, in which can be seen the imprints of cows' and horses' hoofs. The salt marsh was undoubtedly formed at the back of the sand dunes and under their shelter, and the dunes have moved inland and encroached on the salt marshes.

The rate at which the sand spits and sand islands move inland is difficult to determine with accuracy. In the "Annual Report of the New Jersey State Geologist for 1885" it is stated that "the lateral movement has in many cases amounted to more than the breadth of the beach since the settlement of the state, and is at present (1885) going on with undiminished activity." Captain Allgor stated that at Island Beach the westward movement had taken place at the rate of about 1.05 ft. per annum for the 40 years previous to 1885. When a sand spit is built up across a bay from the mainland on one side to the mainland on the other, then it will be moved inland at the same rate as the inland movement of the high-water line due to erosion of the mainland on either side.

In addition to causing coast erosion the inland movement of sand dunes in some places also causes the devastation of large areas of fertile land, and the dunes in their inland advance have buried houses, and even villages of considerable size. There are some places on the New Jersey coast where orchards have been buried within the lifetime of their owners and timbered lowlands have in several cases been overwhelmed and the timber destroyed by the encroaching sand.

Erosion Caused by Groins

Harbor piers and jetties projecting into deep water have practically the same effect as headlands and promontories in checking the littoral drift, and causing accumulation on the windward side and erosion on the leeward side.

Badly designed high groins constructed on the foreshore for coast-protection purposes in many cases stop littoral drift and cause a serious danger instead of a protection, owing to the great scour which takes place to the lee side of such structures. Fig. 8 shows a plan of a high groin erected across the foreshore. Material moved by oblique wave action is trapped on the corner at B. The shore material moved away from the leeward shore at DE is, therefore, not compensated for by littoral drift from the windward side of the groin and erosion must result. As material is scoured out from DE, material from CD moves into the hollow and erosion therefore takes place from C to E. After the high groin is full up on one side a water-falling action takes place. When waves roll obliquely up the shore on the windward side AB and the water falls over to leeward, stirring up material and scouring out the foreshore between C and D, and in course of time undermining the groin.

Erosion Caused by Sea Walls

Badly designed sea walls and bulkheads are also a very frequent cause of serious erosion. Waves striking the face of a vertical or nearly vertical wall project great volumes of water skyward, which, falling at the back of the wall, will scour out the backing, and falling at the toe will certainly dredge out the material in front of the foundations and cause the structure to collapse (Fig. 9). Even without the actual projection, the backwash of a wave from a curved smooth surface has a powerful scouring action.

Artificial Removal of Shore Material

The artificial removal of foreshore material for building and other purposes is also a cause of sea encroachment. If the foreshore is lying at its normal level, neither erosion nor accumulation going on, and material is removed from any part, an immediate result is to cause a gradient sloping to that part from all around it, and a consequent feeding in of material from the adjoining foreshore to fill the place of that which has been removed, so that the removal of material from a foreshore belonging to one person may prejudicially effect his neighbor's property.

Erosion of the coasts of New Jersey and Long Island cannot be traced to any one cause. There are, as has been pointed out, many forces and agencies at work on the coast line tending to cause erosion, and it is only by a close study of the conditions prevailing on any particular shore that engineers with experience in coast works can trace the cause or arrive at any conclusion as to the best means of coast protection.

Reinforced-Concrete Tower Tank at Middleborough, Mass.

By George A. Sampson*

SYNOPSIS—A 500,000-gal. tank, 41 ft. in diameter and 60 ft. high, supported on a cylindrical tower; total height, 165 ft. Tank has a hemispherical bottom. Details of design and specifications.

The application of reinforced concrete to standpipes and elevated tanks for the storage of water covers a period of only twelve years, during which time about thirty of particular note have been constructed. Some engineers consider its use purely experimental as yet and have grave doubts about the adaptability of concrete to such work, while a few unequivocally condemn its use in such structures of any considerable size. Further progress in transforming the field of experiment to one of recognized general practice can be accomplished only by a thorough discussion and study of the design, construction and success or failure of similar structures. With this end in view, an outline of the principal features of the design of the Middleborough tower tank is herewith presented.

Middleborough Water-Works

The supply is surface ground water collected in a large open well, aërated and filtered for the removal of iron and manganese, and pumped to a 230,000-gal. steel standpipe 20 ft. in diameter by 103 ft. in total height, situated in a residential portion of the town. The pressure is sufficient for domestic uses, but entirely inadequate for fire protection, which is now furnished by direct pumping. Under the present laws of Massachusetts, this requires the employment of six men at the pumping station, three of whom must be licensed engineers.

After careful inspections, in 1911 and 1913, it was recommended that the steel standpipe built in 1885 be discontinued as somewhat unsafe. After due consideration of the various features of the problem, it was decided to build a structure of adequate capacity and with the storage at a sufficient elevation to meet the demands of the combined domestic and fire service without resorting to direct pumping. The present population supplied with water is 5000, and the average daily consumption is 350,000 gal. Allowing for future growth, assuming that the pumps would be operated only by day and supposing that a large fire should occur in the early morning, demanding eight effective fire streams for two hours, the desired storage capacity was fixed at 500,000 gal.

The most available location for a new structure was on Barden Hill, about one mile southeast of the center of the town and 35 ft. above the present site. To furnish suitable fire-fighting facilities at the business center of the town, with due regard for the hydraulic factors involved, demanded that 386,000 gal. of this quantity be stored at a height of 121 ft. above the ground at Barden Hill, or 53 ft. higher than the top of the existing standpipe.

Types of Structure Considered

Four types of structure were considered: First, a steel standpipe about 40 ft. in diameter by 160 ft. high, which would have a total capacity of 1,500,000 gal.; without engineering this was estimated to cost $44,000; second, a concrete standpipe of the same general dimensions and capacity, at a cost of $39,000; third, a steel tank of 500,000 gal. supported on a steel tower about 110 ft. high, at $22,000; and fourth, a concrete tank of 500,000 gal. capacity, supported on a concrete tower and estimated at $24,000.

The first type was not further considered on account of its cost and large maintenance expense; nor was the second, because of its cost and the impracticability of constructing a satisfactory concrete structure subject to a 160-ft. head of water. The decision rested then between a steel and a concrete tower-tank. For comparison it was assumed, as an average period, that a steel structure would require two coats of paint inside and outside every five years, and if so treated would have a life of thirty years. The annual cost of painting would amount to $340. Also direct pumping into the mains for several days during the time of painting would be necessary. This should be avoided if possible, especially in view of the growth of the town. For preserving the quality of the water, maintaining it at a more uniform and desirable temperature and adorning the landscape, the concrete tank was preferable. In first cost, the steel tank was about $2000 less, and possessed the advantage of being a common type of structure.

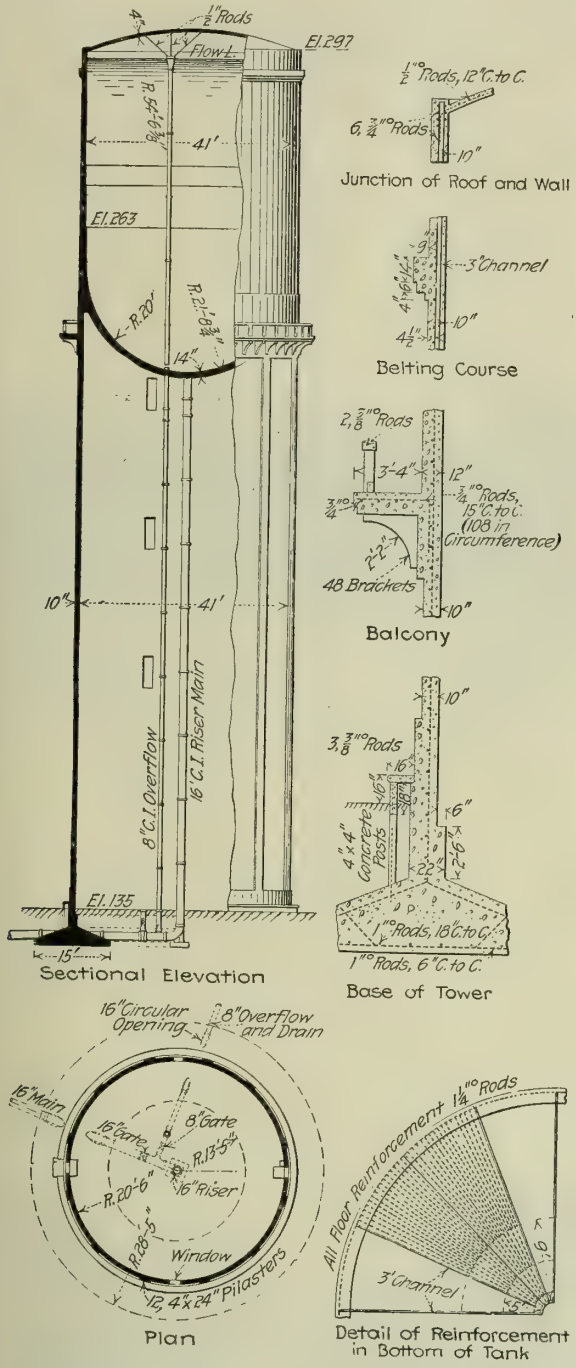
With the foregoing and other considerations in mind, the one question to be decided was: Can a concrete tank be constructed that shall remain sufficiently watertight at all times to prevent unsightly discoloration and disintegration from seepage and leakage, combined with freezing temperatures? The method of supporting the tank on a concrete tower was of secondary importance and was considered capable of a reasonable solution. After an exhaustive study of existing concrete standpipes and tower tanks, together with the apparent causes contributing to their good and bad features, it seemed a conservative conclusion that a reinforced-concrete tower tank of 500,000 gal. capacity could be built so as to warrant its use.

Design of the Tank

In the design the question of the foundation was the first to be considered. The soil upon which the footing will rest is extremely fine, well-compacted sand, overlaid for about one-quarter of the area with a thin bed of gravel. The safe bearing power of this fine material was determined experimentally by loading a timber set at the elevation of the bottom of the footing. At a loading of from 1 to 3½ tons per sq.ft., the settlement was uniform and slight, being only $\frac{1}{32}$ in. for each additional ½ ton; but 4 tons per sq.ft. produced a relatively large

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settlement—$\frac{5}{32}$ in. for the last ½ ton. The maximum loading was therefore fixed at 3½ tons per sq.ft. The total dead-weight on the foundation soil is 4485 tons, or 2.28 tons per sq.ft. The wind load was determined from an assumed velocity of 70 mi. per hr., producing a wind pressure of 30 lb. per sq.ft. on the horizontal projection of the cylinder, thereby adding 0.68 tons per sq.ft. with a full tank, and producing a total maximum pressure of 2.96 tons. Although the wind pressure is slightly



DETAILS OF DESIGN OF THE MIDDLEBOROUGH REINFORCED-CONCRETE TOWER TANK

more than doubled with an empty tank, it is more than offset by the reduction in the dead-weight of the water, so that the maximum mentioned represents the worst condition.

A cylindrical tower was adopted in preference to a number of columns, because with it a more ready and definite computation of stresses was possible; while it could be made to present a more pleasing appearance, was better adapted to the contours at the site, and seemed more economical to construct. The plain aspect of a simple cylinder was relieved by the addition of twelve 4x24-in. pilasters which were also assumed to take their proportion of the load. The appearance of solidity at the base is accomplished by the use of a concrete seat supported on the foundation to prevent settlement. The compression at the bottom of the 10-in. tower wall resulting from the dead load is 483 lb. per sq.in., which is increased to a maximum of 631 lb. by a wind of 70 mi. per hr.

Details of the Tank Proper

The tank proper is 41 ft. in inside diameter and 64 ft. deep from under side of the dome (El. 300) to the inside of the hemispherical bottom (El. 236), the dome having a rise of 4 ft. and the bottom a depth of 20 ft. The straight walls of this tank vary in thickness from 10 to 16 in. and are reinforced to care for increasing pressure toward the bottom. The bottom varies in thickness from 14 in. at the lowest part to 18 in. at the connection to the tank walls. Its reinforcement is given in the detail in the accompanying figure.

By far the most important part of the structure and the most difficult to design and construct is the tank proper. The writer wishes to emphasize the use of a hemispherical bottom, which should prove superior to the flat beam and slab construction commonly employed for small elevated tanks, and to the dome bottom used in a few instances for tanks of considerable size. The advantages of the hemispherical over the dome design lie in a 47-per cent. increase in capacity for the same height of vertical wall, or a 34-per cent. decrease in the height of wall for the same capacity; a practically self-cleaning bottom; a better distribution of stresses because the enormous thrust in the dome bottom, which is concentrated at the bottom of the tank, the most critical point, is replaced by a uniform tensile stress coincident with and analogous to the tension in the tank wall. The only other stress at the junction between wall and bottom is a vertical downward load which is easily calculated and cared for. The reduction in height of vertical wall is of prime importance in reducing the chances of leakage. The hemispherical bottom will be poured continuously to make a monolithic bowl up to the point where it becomes a part of the supporting tower. The cost of storage should be no greater than for the dome bottom.

The thickness of concrete at and near the bottom of the wall of the tank and in the hemispherical portion is such that without any assistance from the steel reinforcement its stress in tension is about 250 lb. per sq.in. The tensile stress in the steel, acting independently, would be approximately 14,000 lb. per sq.in.; and with both materials acting in conjunction, the computed tension in the concrete is 215 lb. and in the steel 2150 lb.

The tank is covered to guard against the growth of algæ not uncommon in filtered water exposed to the light, and to prevent freezing. The roof is a dome with its thrust carried by steel reinforcement embedded in the top of the tank wall.

The connection between tank and water main is through a 16-in. flanged riser pipe fitted with an expansion joint. An 8-in. flanged overflow, also with an expansion joint, discharges at a safe distance from the foundation.

The essential qualities of the cement required is fineness of grinding, strength and a slow initial set. The sand, in addition to the usual requirements, shall show a tensile strength equal to standard Ottawa sand, and for the tank it may be necessary to mix sands from two or more sources to obtain the proper gradation of sizes. The coarse aggregate for the tank is gravel varying in diameter from ¼ in. to 1¼ in., and, if necessary, screened into various sizes and combined in the proportion deemed expedient to secure maximum density. Either gravel or broken stone may be used for the other parts of the structure.

The steel reinforcement is hard grade round rods, plain or deformed, and conforms to the specifications for concrete reinforcement bars adopted by the Association of American Steel Manufacturers in 1910, and revised in 1912. The laps are at least 40 diameters, and in addition thereto each joint in the tank is secured by two "Crosby" wire clips, or their equal. Vertical channels are employed to support the horizontal reinforcement of the tank, drilled to the exact spacing of the rods and provided with suitable means for rigidly holding them.

The proportions of concrete for the foundation are 1:2.5:5; for the tower, 1:2:4; for the hemispherical bottom and wall of the tank to El. 279, 1:1:2; from El. 279 to 293, 1:1.5:3, and above El. 293, including the roof, 1:2:4. The relative amounts of sand and stone may be varied, the percentage of cement to the sum of the aggregate to remain as stated.

Details of the Construction

The concrete must be mixed thoroughly and by an approved machine. Care must be taken in placing to prevent the separation of the ingredients, and for the wall of the tank concreting will be carried on each successive day. No special waterproofing ingredient is required, nor is a metal dam being used at the junction between days' work. All laitance is to be removed from the surface at the end of the day's work before the initial set occurs. The old surface is to be cleaned with a wire brush and, immediately before placing new concrete, coated with a neat cement grout and a layer of mortar. It is hoped that it will not be necessary to resort to any waterproofing lining or coating on the interior.

Steel forms designed and made by the Blaw Steel Construction Co. are being used for the outside surface of the tower and tank. The height of each ring is 4 ft.; and at least two complete rings are required to insure the placing of concrete on successive days. No permanent bolts, wires or other ties that would be cast in the concrete are being used to secure either the steel or wooden forms.

The steel forms are producing a smooth, uniform surface which will require very little finishing. The exposed base of the tower below El. 139 will be rubbed to such surface with a carborundum block and water.

The following clause in regard to water-tightness may be of interest:

> The concrete in the bottom and wall of the tank shall be substantially water-tight at all times. Any leakage amounting to jets or visible seepage shall be repaired by and at the expense of the contractor and by methods approved by the engineer. Small damp spots, if few in number, which do not increase, nor disfigure the appearance of the concrete, will be considered to meet the requirements hereunder. It is intended that the work shall be sufficiently waterproof that severe freezing will not at any future time threaten the integrity of the concrete, and that the general appearance of the structure will not suffer through efflorescence or other disfiguring stains.

The contract for the work has been awarded to the Hennebique Construction Co., of New York, for $23,140, and the structure is now under construction. Alvin C. Howes is chairman of the Water Commissioners and Thomas F. Dorsey is Resident Engineer for the writer, who is responsible for the design and construction.

Provo Reservoir Company's Irrigation Project

By Clarence S. Jarvis*

The Provo Reservoir Co. was organized in 1908 to construct a high-line canal 40 mi. long from Provo River, capable of supplying water to some of the most desirable lands in Utah and Salt Lake valleys.

Beside filings for 150 sec.-ft. of the surplus water in Provo River, which is ordinarily available until after



FIG. 1. TRIAL LAKE, UNION RESERVOIR CO.
Used jointly by a number of irrigation companies. View taken from top of dam. Note the ice sheet in the distance

the middle of June, appropriations were made for storing flood water in more than thirty lakes and meadows near the head of Provo River. Other irrigation companies are jointly interested in the larger reservoirs (through the Union Reservoir Co.), the maximum area of a single storage basin being about 140 acres for a 40-ft. depth of



FIG. 2. A 30-FT. RESERVOIR OUTLET CUT

storage. The lake basins (Fig. 1 is an example) appear to be pockets formed by glacial action. Outlet cuts (Fig. 2) through the terminal or lateral moraine that forms the rim of each basin provide means of drawing the lake surface down to the desired depth. Short rock-fill dams

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(Fig. 3) inclosing a core of puddled clay, mountain soil and rock waste are built where necessary.

These reservoir sites are situated at El. 9500 to 10,500 above sea level. Due to the remoteness from inhabited districts, the high altitude, the consequent inclement weather and short seasons for construction, and the rocky and rugged character of this locality, construction has proceeded more slowly than was expected; but the reservoirs already built have demonstrated the value of this storage system and its efficiency. The water when released from the reservoirs flows down the natural channel of the Provo River a distance of about 60 mi. to the intake of the Provo Reservoir Co.'s canal; and with the 40 mi. of canal the delivery will be through 100 mi. of waterway.

The canal takes out of Provo River about 1 mi. above Olmstead in Provo Cañon. Thence it proceeds through a 6x7-ft. tunnel for 1000 ft. through solid limestone; thence through 2100 ft. of No. 144 Maginnis steel flume, a 200-ft. section of which has recently been replaced by a 6-ft. corrugated ingot-iron pipe over a mud slide; thence through a 260-ft. rock tunnel; thence 2600 ft. in a 60-in. redwood

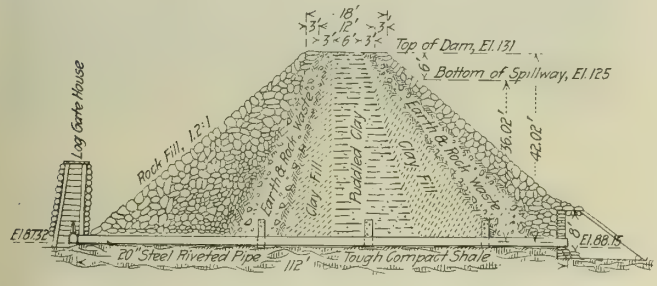


FIG. 3. EARTH AND ROCK-FILL DAM

The 20-in. steel outlet pipe was made from ¼-in. plates. The sections were 20 ft. long, joined by $\frac{5}{16}$x2½-in. steel angle flanges and lead gaskets

stave pipe used as an inverted siphon for crossing Provo River, and delivering on Provo Bench.

To cross Dry Creek, north of Lehi, the water is delivered through 1000 ft. of wood-stave pipe of 49-in. diameter, with a maximum pressure head of 80 ft. on the inverted siphon.

At Jordan Narrows a riveted steel pipe, 1458 ft. long, 40 in. in diameter, has been constructed out of ¼-in. and $\frac{5}{16}$-in. steel plate. The approach to this pipe is a reinforced-concrete conduit 1700 ft. in length and approximately 48 in. in diameter. The maximum pressure head that the steel pipe may have to withstand is 270 ft.

The gradient used in tunnels, flume and pipe lines ranges from 0.002 to 0.004; and in the canal from 0.0005 to 0.002, dependent upon the required cross-section and the type of soil encountered.

The canal system has delivered in excess of 100 sec.-ft. of water satisfactorily to the lands from Provo Bench to the Bull River Canal north of Lehi Junction. It is intended ultimately to deliver in excess of 170 sec.-ft. through this canal system, about half of it to be carried into the West Jordan district, in Salt Lake County.

The lands to be directly benefited are about 8000 acres in Utah County, and the same area in Salt Lake County. As these tracts include some of the most fruitful and desirable lands in this district, well situated for markets and along railroad lines, the project has decided advantages. However, it might be well to point out some of the chief difficulties, which are as follows:

1. The actual cost of storing water in such reservoir basins as are included in this reservoir system ranges from $6 to $20 per acre-foot.

2. The patrolling of stored water from the head of the river for a distance of 60 mi., passing numerous headgates and dams in the lower valleys that have been accustomed to diverting the entire flow of the river during the low-water season, has been rendered more difficult through lack of definite data on loss in transit, the varying flow of the river, the primitive measuring devices and the crude regulating structures in use in some of the canals; and from an innate prejudice felt by owners of old water rights against the new applicants that cause a change in the regulations of the river.

3. Acquiring right-of-way for more than 10 mi. across improved farm and city property, through orchards, between houses and barns, where the right-of-way far exceeded the cost of construction, and where numerous bridge, culvert and flume structures were necessary along the canal line.

4. The definition of the term "surplus water." Some authorities hold that all water in a river that is not being applied to beneficial and economical use is surplus and subject to appropriation, even though a careless or wasteful use of water might consume the entire flow of the stream. Upon this definition depends in large measure the success or failure of a new irrigation project. Efforts are being made to reach a compromise agreement, providing that when all old rights are satisfied on a basis of 50 or 60 acres per second-foot of water, then all of the surplus above this amount belongs to the Provo Reservoir Co. until its acreage is supplied on a basis of 70 acres per second-foot; after which all further surplus shall be divided pro rata according to the acreage and the needs of the various classes of soil.

Throughout the construction of this project Joseph R. Murdock has been president and manager of the company; C. S. Jarvis has been Chief Engineer, and E. D. Clyde has been Superintendent of Construction on the reservoirs. I. H. Jacob is Resident Engineer, and has had charge of water distribution since 1912.

The Production of Radium on a manufacturing basis by the U. S. Bureau of Mines from Colorado carnotite ore has recently been announced by F. K. Lane, Secretary of the Interior. The Bureau has been studying the production of radium with a view to decreasing the cost. The figure reached is $36,050 per gram of radium bromide and this includes the cost of ore, the insurance, repairs and depreciation on plant, the development cost of the process and all expenses. Radium bromide has been selling for $120,000 to $160,000 per gram. This reduction in cost does not mean an immedate drop in selling price, since the carnotite claims are closely held. Ten claims are being operated at Long Park, Colo., by the National Radium Institute, with which the bureau has been coöperating. A concentrating plant for low-grade ores has been erected by the Institute. Grinding and sampling machinery and an extraction plant have been set up in Denver, the present capacity being for three tons of ore per day. The average recovery has been 85 per cent., and with the last five carloads of ore it has been 90 per cent.

United States Public Lands unappropriated and unreserved amounted on July 1, 1915, to 279,000,000 acres. Of this area 173,000,000 acres has been surveyed and 106,000,000 acres is unsurveyed. These public lands belonging to the Federal Government are in 25 states. The bulk of the land, however, is in the 10 arid states. Nevada heads the list with 55,000,000 acres, and then follow in the order named Arizona, Utah, Wyoming, New Mexico, California, Montana, Colorado, Idaho and Oregon. Oregon's public lands amount to 15,442,000 acres. South Dakota has nearly 3,000,000 acres, and Washington a little over 1,000,000 acres. In most of the other states where public lands are located the amount is comparatively small.

Paving Problems of Queensboro Bridge, New York

A number of difficulties have arisen in maintaining the wood-block pavement on the Queensboro (Blackwell's Island) Bridge, New York City, some of which are peculiar to the bridge structure, but others throw some light on the wood-block paving problem in general. The bulging, "volcanic" blowups exhibited in some other wood-block pavements have been particularly pronounced on the main spans and steel-supported sections of the Queens approach.

The original construction of the bridge-floor system consisted of longitudinal buckle-plates, 5 ft. wide between stringers from 12 to 20 ft. long between floor-beams or cross-frames, with from two to four buckles to each plate. The buckle-plates were not stiffened. On this floor was placed a solid concrete base from 1½ to 4½ in. thick. On the concrete was placed a cushion or bedding course of ½ in. of dry sand and cement to receive the pavement of 4-in. creosoted wood blocks.

No great trouble was experienced with this pavement for about two years, but with increased traffic the buckle-plates deflected and vibrated to such an extent under heavy loads that the concrete base was badly broken up. Where the base did remain intact the sand-mortar cushion, having no drainage, was continually damp and after every rainstorm was completely saturated. When these storms were followed by sudden changes in temperature the blocks heaved and blew up to an alarming degree, sometimes forming "pimples" in the roadway 3 ft. high.

The roadway is 52 ft. 3 in. wide, with a car track on each side, and no longitudinal expansion joints were provided along the rails. In this great width of pavement the expansion and contraction of the steel-floor system and the loose unhardened cushion course provided



FIG. 1. OLD QUEENSBORO BRIDGE PAVEMENT, SHOWING BREAKS

a constantly shifting base for the blocks, and further aggravated the pavement troubles. On one or two occasions vehicle traffic over the bridge had to follow the street-car tracks to avoid the humps and billows.

In the fall of 1912 Edward A. Byrne, then Assistant Chief Engineer of the Department of Bridges of New York (now Acting Chief Engineer), designed a new pavement foundation, which has since been experimented

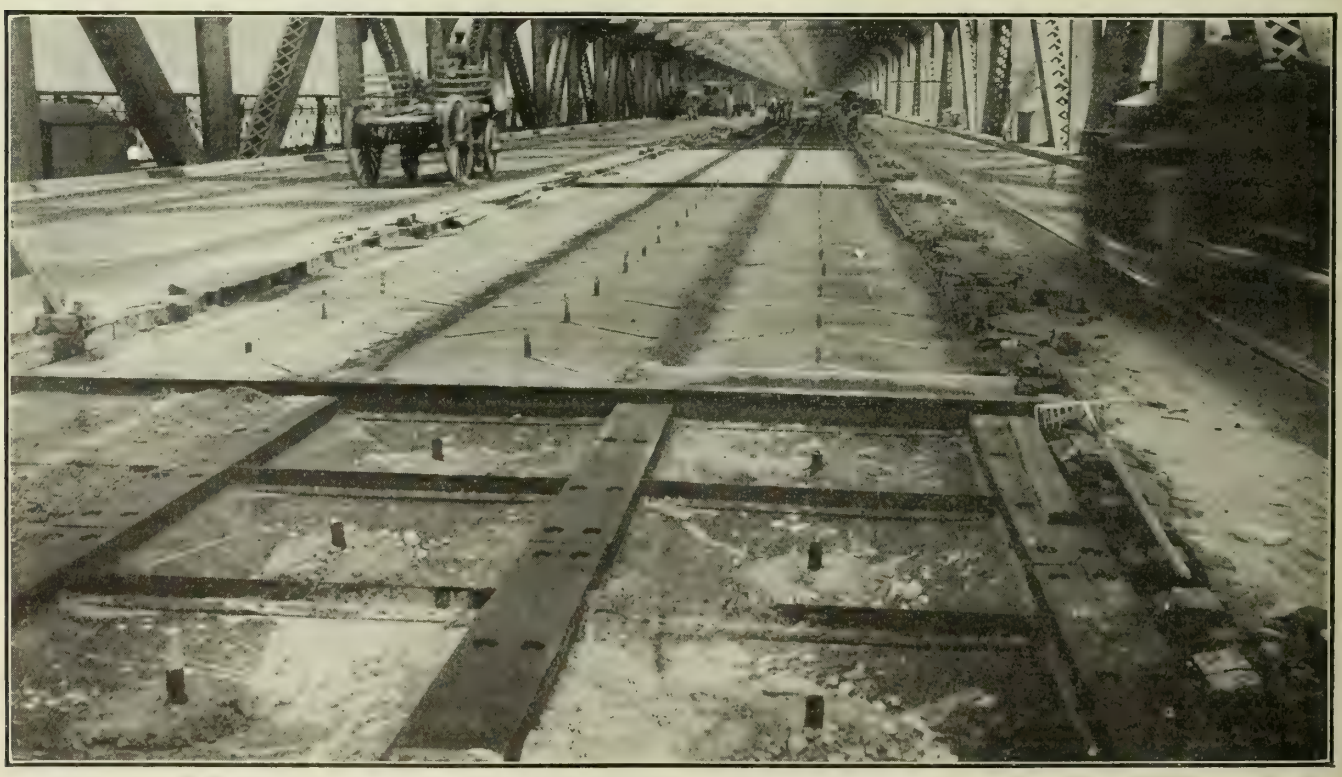


FIG. 2. LOOKING ACROSS QUEENSBORO BRIDGE DURING PAVEMENT RELAYING

Buckle-plates stripped of concrete in foreground; drain pipes in place; Z-bar and angle-iron reinforcement; new concrete foundation in background

with and found successful. A considerable stretch of the bridge floor has been paved by this new method, and work is now in progress on other sections of the bridge, as the accompanying illustrations show.

The first consideration was that no appreciable dead load be added to the bridge. It was essential, however, to stiffen the buckle-plates by riveting a 3x3x½-in. angle across the fillets of each buckle-plate (see Fig. 2). On the Queens approach spans the angles are put on the upper side of the buckle-plates, so that their top edges are flush with the top of the new concrete foundation, but on the main span 3½x3½x½-in. angles are riveted to the bottoms of the buckle-plates.

The tops of the steel stringers carrying the buckle-plates are capped with 3x12-in. yellow-pine planks, treated with carbolineum. The planks are dressed to a uniform thickness of 2½ in., laid flat and bolted through the flanges of the stringers by machine bolts placed 30 in. apart. The heads of the bolts are countersunk to be flush with the top of the plank.

Every two panels, averaging about 50 ft., a transverse 6x$\frac{9}{16}$-in. Z-bar is riveted to the flanges of the floor-beams. This projects 3 in. above the top of the new concrete foundation, so that two perpendicular faces are provided for the paving blocks on either side to bear against. These Z-bars divide the pavement into distinct sections, and prevent the creeping of the blocks which occurs in the old method of construction. The new pavement is in longitudinal strips 15 ft. wide, each strip separated by an expansion joint.

The buckle-plates are first cleaned of all the old concrete foundation and repainted. The drain holes are then cleaned out, and 6-in. sections of iron pipe reaching just below the top of the new concrete foundation are inserted. The pipes are held in place by first filling a little concrete around them in the buckles. Wooden plugs are inserted to keep the inside of the pipe clear of concrete.

A new 1:2:4 concrete foundation is then placed with its surface flush with the tops of the 3x12-in. planks. Strips of wood about ½x1 in. are laid on the green concrete from the center pipe to the upgrade sides of the buckle-plates. When these are removed after the concrete has set, shallow drainage gutters are left. On this foundation 3-in. creosoted wood blocks are laid without a cushion or bedding course, and with sand-filled joints.

Mr. Byrne states that the blocks, resting partly on the wood stringer caps, and partly on the concrete, might reasonably be expected to splinter to some extent, but this has not been serious, and there has been no heaving of the blocks in the new pavements. There are 34,600 sq.yd. of pavement on the buckle-plates, and as yet on account of lack of funds but a small percentage has been relaid as described. The cost has varied from $4 per sq.yd. for the first experimental sections to $3, exclusive of reinforcing buckle-plates.

The traffic on Queensboro Bridge has become extremely heavy. The average daily traffic for two July days was:

AUTOMOBILES			
Trucks	Delivery	Pleasure	Totals
1172	692	6312	8176
HORSE-DRAWN VEHICLES			
One-Horse	Two-Horse	Three- and Four-Horse	
782	868	60	1710
Total for one day			9886

Such a heavy, fast-moving traffic is unusually severe on any pavement, but the difficulties encountered are laid chiefly to the foundation conditions.

New Specifications for Rails; Pennsylvania R.R. System

Revised specifications for 100-lb. rails of carbon steel have been adopted by the Pennsylvania R.R. system (including the lines east and west of Pittsburgh). The chemical requirements are given herewith. A special feature is the requirement for chemical tests of finished openhearth rails (after passing the physical tests). The purpose of this is to guard against the segregation of the metal, which has been discovered in so many of the rails that have broken in the track.

The following paragraphs are given direct from the specifications, with their original numbers attached. Certain unimportant paragraphs are omitted.

CHEMICAL COMPOSITION OF RAIL STEEL

4. The chemical composition of the rails rolled from each melt of steel, determined as described in Section 6, shall be within the following limits:

Elements	Bessemer Process	Openhearth Process
Carbon	0.45 to 0.55%	0.60 to 0.75%
Phosphorus	not to exceed 0.10%	not to exceed 0.04%
Manganese	0.80 to 1.10%	0.60 to 0.90%
Silicon	0.05 to 0.20%	0.10 to 0.30%

Note 1—In the event of nickel and chromium being present to the extent of 1% and 0.35% respectively, these elements will be considered as the equivalent of 0.07% of carbon in the above requirements.

Note 2—When the analyses for carbon by the mill chemists and by the railroad chemists do not agree, a tolerance of two points below the minimum or two points above the maximum will be allowed to cover such variation before condemnation.

5. It is desired that the percentage of carbon in an entire order of rails shall average as high as the mean percentage between the upper and lower limits specified.

ANALYSES OF RAIL STEEL

6. In order to ascertain whether the chemical composition is in accordance with the requirements, analyses shall be furnished as follows:

(a) For bessemer process, the manufacturer shall furnish to the inspector, daily, carbon determination for each melt before the rails are shipped, and two chemical analyses every 24 hr., representing the average of the elements, carbon, manganese, silicon, phosphorus and sulphur, contained in the steel, one for each day and night turn respectively. The analyses shall be made on drillings taken from the ladle test ingot not less than ⅛ in. beneath the surface.

(b) For openhearth process, the makers shall furnish the inspectors with a chemical analysis of the elements, carbon, manganese, silicon, phosphorus and sulphur, for each melt.

(c) For openhearth process, a check analysis will be made by the purchaser of a piece of rail representing a melt, after the rails from that melt have passed the physical requirements. On request of the inspector, and in his presence, the manufacturer shall furnish from one of the drop-test pieces representing the melt, drillings satisfactory to the inspector, taken with a ⅝-in. flat drill, parallel to the axis of the rail, at a point one-third of the distance from the upper corner to the center of the head [designated as point "O"]. The analysis from these drillings shall conform to the chemical requirements specified in Section 4, and failure to meet these requirements shall be sufficient cause for the rejection of the entire melt.

(d) For openhearth process, after the rail has passed the physical requirements, additional drillings will be taken from the same rail, and in the same manner as specified in Section 6 (c), at the junction of the head and web [designated as point "M"]. The carbon determination from these drillings (Note 2, Sec. 4) shall be within 12 per cent. of the amount found at location "O." If the test from the top rail fails to meet this requirement, all the top rails from the melt shall be rejected, and a similar determination shall be made from location "M" of a second rail. If this test fails, all the second rail from the melt shall be rejected, and a similar determination shall be made from location "M" of a third rail. If this test fails, all the remaining rails from the melt shall be rejected.

(e) If, however, the segregation found at location "M" in any rail in a rolling exceeds 25 per cent., when determined as provided for in 6 (d), the progressive testing of the second and third rails will not be permitted on any subsequent melts; but on such melts the failure of the top rail to pass the requirements provided for in 6 (d) will cause the rejection of the entire heat.

Expansion Joints in Granite-Block Pavement

The remarkably smooth grouted granite-block pavements of Worcester, Mass., were described in detail in *Engineering News* of Oct. 22, 1914. Some of these pavements are now 14 yr. old and practically nothing has been spent for real maintenance, most of the expenditures being for repairs to openings in the pavements. The chief difficulty has been that the pavements have outlived the street-car tracks, and many of the rail joints, especially in Main St., have been in very poor condition for some time past.



FIG. 1. BLOCKS FROM OLD PAVEMENT

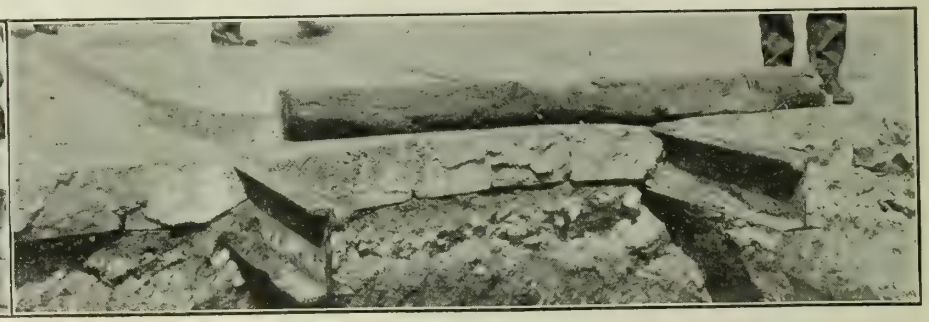


FIG. 2. MONOLITHIC STRUCTURE OF OLD GRANITE-BLOCK PAVEMENT

When at last compelled to renew its track, the street railway company strenuously objected to replacing grouted granite blocks over its roadbed, because of the difficulty in making track repairs in this kind of a pavement; but the city eventually won its contention, and the street is being restored to its original condition. While a grouted granite-block pavement is admittedly difficult to open for track repairs, this is chiefly an argument for building better track structures.

The monolithic condition of these pavements is illustrated by Figs. 1 and 2. Many blocks were broken through as easily as they could be broken apart at the joints. About 50 per cent. of the blocks were reclaimed by chipping off the grout by hand, the cost of which was about 1c. per block. The broken blocks were crushed to make concrete aggregate for the foundation of the new pavement, at a saving of about 80c. per ton over other material.

Expansion Joints

Two innovations are being introduced in relaying the pavement. Expansion joints separating the track pavement from the rest of the street pavement are being tried in both the foundation and block courses. Fig. 4 shows the track preparatory to placing the foundation concrete with a Barrett specification expansion joint about ½ in. thick by 6 in. wide, nailed to the ends of the ties. The concrete base is 6 in. thick.

Concrete is not being placed under the ties, which, however, are gravel ballasted; the foundation is of uniform thickness across the entire width of street. The ties used are not treated with preservatives. The old 95-lb. girder rails are being replaced with 125-lb. grooved girder rails.

The expansion joint in the pavement surface is shown in Fig. 3. This is of the same character as the joint in the foundation and is put a block-width from each outside rail of the double track. The course of blocks next the outside rail are laid lengthwise, as shown in the illustration. The blocks keyed into the old pavement have broken joints of at least 2 in.



FIG. 3. EXPANSION JOINT IN GRANITE-BLOCK SURFACE

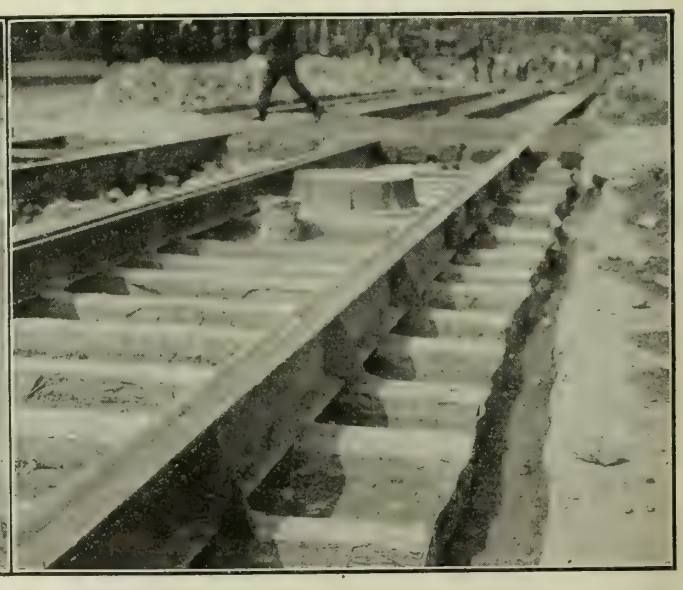


FIG. 4. EXPANSION JOINT IN CONCRETE FOUNDATION

The purpose of these expansion joints primarily is to prevent the rumbling noise caused by the heavy suburban street cars. It is expected that the expansion joints will permit the track to vibrate under the cars without affecting the rest of the pavement. That the rumbling was

noticeable in the old track was probably because the monolithic pavement was carrying a part of the load on the tracks, which it would seem could also have been eliminated by a more rigid track foundation.

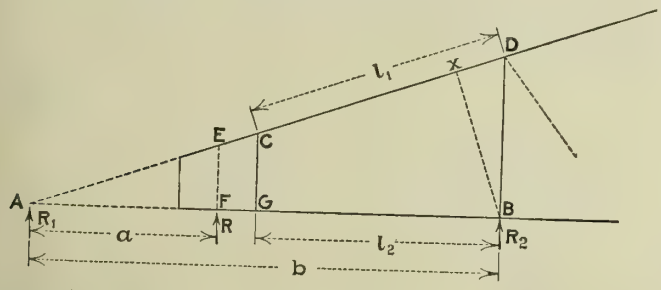
The track pavement work is being done by F. A. Wilkerson, Superintendent of Tracks, Worcester Consolidated Street Ry., in conformity with the city's specifications. The city engineer of Worcester is F. A. McClure.

Moments at Eccentric Heel-Joint of Roof Truss

By Edward Godfrey*

It appears that the solutions proposed in *Engineering News* of May 20, 1915, p. 990, for the problem of the heel-joint of roof trusses, suggested by the writer, Apr. 22, p. 783, are to go unchallenged and an approximately correct solution is not forthcoming. This is a very important problem in structural engineering.

The solutions given by the correspondents are all wrong in the most important item of the problem, namely the magnitude of the bending moment taken by the chord members. Nor did any of them say anything about finding the direct stress in the chord members which is another important part of the problem. Furthermore, they all



seem to consider the chord members as pin-ended at the second panel point, whereas they are continuous.

The bending moment is given as Ra (see the sketch herewith). This is manifestly incorrect, for it would mean that the moment in the chords for a given shape of truss would increase uniformly as R is moved toward the position R_2, whereas the moment must be zero for the position R_2. The fact is the moment in the chords as R moves to the right is a maximum where a equals ½ of b, and it describes a parabola as R moves from A to B.

Part of this problem is to find the direct stresses in the chords. This is a simple operation by the method of moments, but in a graphic diagram trouble is apt to be met with in closing the polygon. As the reaction R does not strike the intersection of the chords, some method must be devised of substituting members or forces that will intersect. This could be done by assuming members BE or DF, but the direct stresses of the chords would not then be correct.

If a section be cut vertically through the truss between EF and DB it will be seen that the shear in this section is equal to R. Part of this shear is taken up in the vertical component of the stress in the top chord ED. The remainder of the shear will be taken up by the two members ED and FB in bending, and the amount of the bending moment will be dependent upon the horizontal distance between CG and DB. It will thus be seen that this horizontal distance has much to do with the bending moments, though the published solutions referred to consider only the distance a.

To find the bending moment in the chords it is necessary to find the difference between R and the shear in ED due to direct stress. By moments

$$\text{Direct stress in } ED = \frac{R(b-a)}{BX}$$

$$\text{Shear in } ED = \text{stress} \times \frac{DB}{AD} = \frac{R(b-a)\,DB}{BX \cdot AD}$$

Substituting for DB/BX its equivalent AD/b, we have

$$\text{Shear in } ED = \frac{R(b-a)}{b} \qquad (1)$$

It will be seen that this shear is just what would be the left-hand reaction of a beam AB, hence the remainder or what would be the right-hand reaction of a beam AB passes to the right through the chords in transverse shear producing bending, and the next step in the problem is to distribute this shear according to the rigidity or stiffness, not only at C and G, but also at D and B. The chords are more rigidly held at C and G than at D and B, but they are merely continuous at all of these points and no great error is entailed in considering C and D equally rigid, as well as G and B.

If the top and bottom chords are of the same section it would be close enough to consider all four points C, D, B and G equally rigid, with the bending moment

$$M = \tfrac{1}{2} R \frac{a}{b} \times \frac{l_2}{2} = \frac{Ral_2}{4b} \qquad (2)$$

If the chords are of different sections, and if the lengths l_1 and l_2 be taken into consideration, as they should in an exact solution, the stiffness of the two chords will be directly as their respective moments of inertia and inversely as the cubes of l_1 and l_2. If I_1 and I_2 represent the moments of inertia of the top and bottom chords respectively, and if M_1 and M_2 represent the bending moments in the top chord (at C and D) and in the bottom chord (at G and B) respectively, we have

$$\frac{M_1}{M_2} = \frac{I_1 l_2^3}{I_2 l_1^3} \qquad (3)$$

But

$$2M_1 + 2M_2 = \frac{Ral_2}{b} \qquad (4)$$

Solving

$$M_2 = \frac{Ral_2^2}{2b\left(1 + \frac{I_1 l_2^3}{I_2 l_1^3}\right)} \qquad (5)$$

Also M_1 is found to be an expression of similar form, with I_1 and l_1 replacing I_2 and l_2 respectively.

If member DB is not vertical the problem is more complicated. A close approximation may be arrived at by using the mean between l_2 and the horizontal projection of l_1 in place of l_2 in eq. (2) and (4).

In many cases the top chord will be so much stiffer than the bottom chord that the full moment could be assumed as taken by that chord. The moment would then be Ra/b times one-half of the horizontal projection of l_1.

In order to work out the stresses in the graphic diagram the truss should be considered as extended to A and instead of using R the two forces R_1 and R_2 should be used. These are the reactions at A and B that would be found for a beam of span b loaded with the force R.

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Report on Life of Wood Pipe*

By D. C. Henny†

SYNOPSIS—Results of an investigation of the lasting qualities of wood pipe carrying water. Made under instructions from the director and chief engineer of the Reclamation Service. A life of from 12 to 25 years is shown where conditions allow complete saturation of the wood.

This inquiry on the life of wood pipe covered three general types—continuous wood-stave, section wood-stave and sectional bored. The information contained is tabulated according to the following classification: Table 1, continuous-stave, uncoated fir. Table 2, continuous-stave, uncoated redwood. Table 3, continuous-stave and wire-wound, coated fir. Table 4, continuous-stave and uncoated Texas, Colorado and yellow pine.

The term "fir" is applied to the most common wood of the Pacific Northwest. Scientifically it is a bastard spruce, first named by Douglas. Locally it is known as fir or Douglas fir, and distinction is sometimes made between yellow and red fir. These come from the same kind of tree, the yellow fir being most common. The large trees yield yellow fir, while the wood from smaller trees is apt to show a reddish tint. Sun exposure also appears to affect the color to some extent. In California the wood is termed Oregon pine. This wood is strong, and can be obtained in long lengths. Mill run of commercial sizes probably averages over 20 ft. in length. It contains pitch, which forms in seams and pockets, normally occurring even in commercially clear wood within certain limits. The trees usually yield less than 25 per cent. of wood free from sap and knots. The expense of eliminating these defects has led to the practice, as regards pipe construction, of permitting some small and sound knots and sap.

Redwood grows on the Pacific coast from Santa Cruz north into southern Oregon. By reason of the average large diameter of the trees, the logs are cut shorter than in the case of fir, and the commercial mill run averages about 16 ft. in length. The wood is not as strong as fir. About 50 per cent. of the wood cuts up clear and free of

*From the August issue of the "Reclamation Record" of the United States Reclamation Service.

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TABLE I. CONTINUOUS-STAVE FIR PIPE, UNCOATED

Location	Length, mi.	Diameter, in.	Pressure, ft.	Soil	Built	Remarks	Life	Serial No.
Astoria, Ore.	7.5	18	0–150	Loam and sand with decaying vegetable matter	1895	Gradually increasing leakage due to decay of wood	16	1
						Replaced by redwood pipe in 1911		
Basin, Wyo.		40–96		Not stated	1906	In good condition except where not constantly full	8+	2
					1908			
Belle Fourche, S. D.	0.3	36		Clay and gumbo	1912	In good condition	3+	3
	0.4	42						
Clarkson, Wash.	7.0	48		Volcanic soil, also loose rock	1907	Where in loose soil or rock, decayed near top; 400 ft. replaced in 1911; 1000 ft. replaced since	4	4
	4.0	40						
	1.5	32						
						Balance O. K.	8+	
Everett, Wash.		20	50–125	Clay and loose soil	Before	Decayed except where buried in clay	6	5
					1909	Replaced 2600 ft.	6+	
Gothenburg, Neb.	0.2	72	0–46	Loose, sandy, partly uncovered by wind	1890–1891	Decayed, especially where uncovered, causing increasing leakage; new wood pipe built in 1913, covered 2 ft. and uncoated.	22	6
Logan, Utah	1.2	60	15–80	Not buried	1904	Decayed at pitch seams, otherwise O. K.	11+	7
Loveland, Cal.	8.0	12	0–200	1–3 ft. cover	1902	Some decay on top of pipe	13+	8
Ogden, Utah	5.0	72			1897	Small amount at upper end decayed where pressure light and soil very porous; no decay where exposed	18+	9
Post Falls, Idaho	5.0	42	0–40	Loamy gravel, loose	1910	1 mi. with maximum pressure badly decayed	5	10
						Remainder partly decayed	5+	
Preston, Utah	0.6	60	0–300	Not covered	1905	In good condition except leaking in places due to settlement	10+	11
Pueblo, Colo.		48		Adobe	1906	Commenced leaking, due to decay, in 1909. Serious decay in 1913 had gone one-half through wood. Then incased in concrete	7	12
Seattle, Wash.	0.5	54		Clay, sand, gravel	1899–1900	Part has decayed and has been reconstructed		
	13.5	44				Superintendent's estimate:		
	8.5	32				In sand and gravel	7–12	13
						In clay	12–20	
						Pipe buried in clay is reported as good as new	16+	
Sugar City, Colo.	4.0			Soil not stated, cover 2-4 ft.	1904	Wood not decayed; ½-in. bands corroded; replaced in 1910 with ⅝-in. iron	11+	14
Sunnyside, Wash.	2.1	55	25–130	Volcanic ash, gravel, sand, about ⅔ laid on ground not covered	1908	Uncovered portion badly decayed in 1913		
	0.3	48	130		1908	Uncovered and coated 1913-14		
						Relaid 1914–15:		
						In open soil	6	15
						In air or water	7+	
Utah power pipes	1.6	36		On saddles	1903	Decayed	12	16
					1904			
	2.1	36	6–226	In open trench	1907	In good condition	8+	17
	3.1	58	8–180	Laid on earth	1910	In good condition	5+	18
	1.5	30	4–91	In open trench	1908	In good condition	7+	19
	4.7	30	12–13	On earth	1910	No decay	5+	20
	1.8	24	10–37	On earth	1907	Wood from old circular flume, built in 1901, in fair condition	14+	21
	2.7	78	24–44	On earth	1913	Wood in good condition	2+	22
	4.3	132		On concrete saddles	1914	Wood in good condition	1+	23
	0.8	102	15–125	On wooden saddles	1908	Some decay at butt joints	7+	24
	1.3	74		Buried	1909	Some decay where back fill porous	6+	25
	1.2	24		On earth	1908	In good condition	7+	26
Wenatchee, Wash.	1.7	44	*	Buried in clayey soil except where crossing bridge	1903	The upper end for 750 ft. did not run full at all times, and was replaced in 1908, and was again replaced later		
						Balance of pipe, where buried, O. K. so far as known	12 (?)	
						Pipe where exposed in good condition	12+	26a
	2.3	42	*	Buried in clayey soil except where crossing bridge	1907	Buried pipe decayed where no pressure, renewed in 1914		
						Balance O. K.	8—	26b

* 0 to about 100 ft.

sap, which has led to the custom of demanding freedom from knots and sap in ordinary pipe specifications.

Continuous-stave pipe consists of staves breaking joint and clamped together with bands, which since 1888 have universally been made up of steel bolts and lugs, the latter being made of cast iron, malleable iron, or pressed steel. The butt joints are made tight by a metal or wooden plate.

Wire-wound or machine-banded pipe is pipe made up in sections from 10 to 24 ft. in length. It consists of staves held together by galvanized wire, spirally wound around the pipe under heavy tension. The wood is usually kiln dried, which is not the case with continuous-stave pipe. The ends of each section are machine turned to an exact diameter, sometimes slightly tapered. Sections are united by some form of sleeve, a sleeve made up of staves and wound around with wire or individual bands being most common.

Wire-wound pipes for light pressures are often provided with mortise and tenon ends, dispensing with the necessity of sleeves. Under the head of wire-wound pipe in the tables a few cases have been grouped of bored-log pipe, which is wound not with wire, but with flat iron or steel. Such pipe is often jointed by metal sleeves, generally riveted iron or steel.

The wood surface in continuous-stave pipe is, with a few exceptions, uncoated, while sectional pipe is heavily coated, the coat consisting of asphaltum and tar, with sawdust on the outer skin.

The investigation has had in view especially the life of pipe as affected by the durability of the wood. The life as given in the tables refers to the wood alone, and is further confined as to sectional pipe to wood in the pipe sections and not to wood in the sleeves. Figures followed by the plus sign show age rather than life. The information collected is based mostly on reports received from managers or owners, and in small part on personal observation. It is not as complete as is desirable, which, however, is not due to failure to elicit further information.

Reviewing the information as grouped under its headings, it may be estimated that under conditions of continuous water pressure the life of various kinds of pipe may be as follows:

Wood	Condition	Years	Serial No.
Fir	Uncoated, buried in tight soil	20	13
Fir	Uncoated, buried in loose soil	4–7	4, 10, 12
Fir	Uncoated, in air	12–20	9, 16, 21
Redwood	Uncoated, buried in tight soil, loam or sand, and gravel	Over 25	27, 29, 38, 41, 48
Fir	Well coated, buried in tight soil	25	63, 64, 75
Fir	Well coated, buried in loose soil	15–20	51, 52, 69, 70

Under conditions interfering with complete saturation of the wood, the life is cut down materially. These conditions are in the case of uncoated pipe brought about by open soil and low water pressure. The effect of coating appears to be equivalent to tight soil cover, with possibly the additional advantage of tar in the coating acting as a disinfectant. The effect of unfavorable conditions as to lack of complete saturation is serious in redwood, resulting in a life which may be shorter than 15 years

TABLE 2. CONTINUOUS-STAVE REDWOOD PIPE, UNCOATED

Location	Length, mi.	Diameter, in.	Pressure, ft.	Soil	Built	Condition	Life	Serial No.
Butte, Mont.	9.1	24	0–150	Loam, mixed with gravel and loose rock	1892	Sound except some deterioration where covered with loose rock only	23+	27
	6.2	26	0–150	Loam, mixed with gravel and loose rock	1899	Sound except in few places where pressure is light	15+	28
	8.5	24	0–150	Loam, mixed with gravel and loose rock	1900	Sound except in few places where pressure is light	15+	28
Denver, Colo.	16.4	.....	. .	Covered	1890	Still in use	25+	29
	*	.....	.....	Soil not stated				
Greensboro, N. C.	1.3	18	20–200	Covered	1907	Sound. both wood and bands; superintendent would use nothing else	8+	30
	3.0	20	20–200	Soil not stated				
	2.5	24	20–200					
Hollywood, Calif.	0.3	12	50	Loam	1898	Much of wood decayed in 1910, probably due to light pressure and dry soil. Possibly not full at all times. (Finkle.) Company gives far better report	12	31
	6.9	14	50					
Ithaca, N. Y.	†	†	†	Not stated	1905	No maintenance cost; so far as known in good condition	10+	32
Logan, Utah	1.5	18	0–70	Gravelly soil	1893	In excellent condition; wood sound; metal slightly rusted	22+	33
Los Alamitos, Calif.	3.5	18	30–50	Not stated	1906	Used 4 mo. each year for disposing of waste from sugar factory; wood slightly deteriorated. Most bands replaced	.....	.....
Mount Nebo, Utah	0.3	48	0–70	Not stated	1895	Wood sound; no corrosion in bands reported	20+	34
	1.1	‡72	0	On wooden saddles	1895	Wood slightly decayed. Bands rusted; some replaced	20+	35
North Yakima, Wash.	0.2	32	0–90	Heavy soil partly exposed on rocky side hill	1894	Wood decayed some at upper ends of siphon; bands somewhat rusted	21+	36
	0.2	32	0–90	Heavy soil partly exposed on rocky side hill	1903	Wood sound; bands slightly rusted; replaced in 1914 by larger pipe in connection with concreting of canal	12+	37
Ogden, Utah	5.5	24	.....	Not stated	1890	4674 ft. light pressure replaced in 1911 but still used as overflow. Balance still in use in good preservation. Where exposed and protected from sun by board wood perfectly sound	25+	38
Palo Alto, Calif.	1.4	12	0	Salt marsh	1900	Used as outfall sewer; runs one-half to one-third full; bands badly corroded. Replaced in 1908 on 3000 ft.; replaced in 1911 on 1025 ft.	15+	39
Poso, Calif.	0.03	72	10	Sand	1893	Used for irrigation; full part of each year; reported in fair condition	22+	40
Provo, Utah	5	14	0–125	Clay, gravel, light loam.	1891	In light loam, nearly gone; in gravel, fair; in clay, sound	24+	41
	0.5	60	.....	Clavey soil except 500 ft. on bridge	1910	Staves show decay at ends where many joints leaking and where not covered. No water for 4 mo. in year	5+	42
Redlands, Calif.	0.4	48	Light	Partly in earth; partly on trestle	1892	Decayed considerably where in contact with earth; was replaced with ditch as a matter of precaution in 1912	20+	43
Temple, Tex.	1.7	18	5–35	Not stated	1899	In good condition as to both wood and bands; only trouble where wood damaged by sharp rocks thrown in for back fill	16+	44
Utah Power & Light.	2.1	26	6–144	Exposed; on earth	1910	In good condition	5+	45
	1.1	28	5–176	Exposed; on earth	1907	In good condition; staves show tendency to buckle up at joints	8+	46
	1.7	22	3–137	Buried	1907	In good condition so far as known; no maintenance expenses	8+	47
Yuma, Ark.	2.1	26	90–120	Adobe, sand, gravel	1892	In good condition; has replaced a few staves; superintendent says as good as 20 years ago	23+	48

* Partly Texas pine. † Not stated. ‡ One-half circumference of flume.

TABLE 3. FIR PIPE, CONTINUOUS-STAVE AND WIRE-WOUND TYPES, COATED

Location	Kind of Pipe	Length, mi.	Diameter, in.	Pressure, ft.	Soil	Built	Character of Coat	Condition	Life	Serial No.
Belle Fourche, S. Dakota	C.-S.	0.3	60	0–20	Clay and gumbo	1914	2 coats asphalt compound	Wood, sound	1+	49
Butte, Mont	W.-W.	4.4	14	0–300	All kinds soil	1911	Mfrs.' standard	Good condition	4+	50
	W.-W.	*	*			†1895	Mfrs.' standard	Good condition	20+	51
Clarkston, Wash	W.-W.	*	*	60–300	Volcanic soil	†1903	Mfrs.' standard	Good condition, except wood in some collars is soft and spongy, losing strength and causing leakage. Some decay in 4-in. size attributed to sap	12+	52
Colfax, Wash	W.-W.	14.0	8–10	0–200		1904	Mfrs.' standard	Good condition, except decay and leakage in upper section, also 1500 ft. section over Gerber Hill, where pressure is light; upper section not now used	11+	53
								Gerber Hill section replaced by same kind pipe laid on lower grade in 1910	6	54
Greeley, Colo	W.-W.	38.0	20	0–205	Not stated	1907	Mfrs.' standard	Good condition; 6 staves decayed presumably account sap. Some collars decayed where pressure light	8—	55
Hood River, Ore	W.-W.	5.6	2–20	10–150	Loam	†1905	Mfrs.' standard	Wood sound; few leaks in joints	10+	56
Lewiston, Idaho	W.-W.	*	*	100–300	Not stated	1906	Mfrs.' standard	Good condition, except collars, which in some instances have decayed	9+	57
Montrose, Colo	W.-W.	*	*		Strongly alkaline	1905	Mfrs.' standard	Wood in fair condition; some staves in pipe decayed where pressure light after 5 years; decay in collars first noted after 5 years; chief difficulty, erosion of wire, being replaced by endless number of clamps	10+	58
North Platte, Neb.	C.-S.	0.4	24		Light, sandy loam	1914	Tar, 2 coats, 1–16-in.	Good condition	1+	59
	W.-W.	0.3	18		Light, sandy loam	1913	Mfrs.' standard	Good condition	2+	60
	W.-W.	0.1	16			1913	Mfrs.' standard	Good condition	2+	61
North Yakima, Wash	W.-W.		4–20	10–200	Loam and gravel	†1905	Mfrs.' standard	Wood in pipe sound; wood in some collars spongy and decaying; some leakage in joints	10+	62
Olympia, Wash	W.-W.	10.0	2–12	100–220	Clay soil with some gravel in places	1896–1912	Mfrs.' standard	In excellent condition, including wire	19+	63
	Bored-log	4.5	2–8	100–200	Same	1890–1900		In good condition, including flat iron hoops	25+	64
Post Falls, Idaho	W.-W.	5.0	12–24	0–50	Gravelly clay open	1910	Mfrs.' standard	In good condition except decaying collars	5+	65
Provo, Utah	W.-W.	2.5	21	‡	Gravelly	1907	Mfrs.' standard	Decayed; sleeves replaced with concrete; requires rebuilding	8	66
	W.-W.	2.6	18–24	§	Gravelly	1911	Mfrs.' standard	Some decay in pipe; heavy maintenance account decay in collars	2	67
Pueblo, Colo	C.-S.	3.0	24	‖	Adobe, loam, and shale	1904	Probably manufacturers' standard	Wood so far as known all right; wire began to fail in 1911; 4,000 ft. replaced in 1912; remainder in 1913	8+	68
South Bellingham, Wash.	C.-S.		20	0–200	Clay and loose soil same as in Bellingham	1900	Asphalt	In excellent condition	15+	69
Spokane, Wash	W.-W.	*	*	**	Gravelly soil			After 5 years begins to trouble in seams and joints, not from decay, but water ram		
Sunnyside, Wash	Bored-log	*	*	0	Volcanic ash, gravel, etc., buried 4 to 8 ft.	1893	Mfrs.' standard	Main canal turnouts taken up in 1905-6 because too small, pipe found in excellent condition	13+	70
	Bored-log	0.4	13	3–15	Volcanic ash, 1.5 to 2 ft. cover	1903	Mfrs.' standard	Sound, tight, metal little corroded	12+	71
	W.-W.	0.4	4	10–60	Volcanic ash	1898	Thinly painted with creosote	Decayed in 4 years	4	72
	W.-W.		24			1906		Sound, but extensive repairs on wooden collars	9+	73
	W.-W.		14	0–25	Sandy loam	1908	Mfrs.' standard	Sound, except 1000 ft. at upper end, had not run full; lasted 3 years, renewed in 1912; balance gives trouble with leaky joints; otherwise will probably last 10 to 20 years	7+	74
Tooele, Utah	Bored-log				Buried	1890	Probably manufacturers' standard	Wood in good condition where kept wet; pipe has flat iron hoops	25+	75

* Various sizes. † And later. ‡ Light pressure. § Heavy pressure. ‖ Not stated. ** Water-works pressure.

(No. 31), but is much more marked in fir, where it may be as low, in spite of coating, as six years (No. 54).

Shortened Life

It is quite possible that the life of individual pipe is not merely affected by surrounding conditions, but may have been shortened by the quality of the individual pieces or the treatment of the wood. The wood from the bottom of a tree is close grained and likely to last longer than from the top of the tree, even though free from sap. Bastard-sawn staves, especially in fir, resist penetration of the water in the pipe to a greater extent than diagonal- or vertical-grained wood and may show a shorter life. Again, too rapid kiln drying, which may at times have been practiced on lumber from which staves for wire-wound pipe were run, may have partially destroyed the vitality of the wood.

In this investigation it has not been found practicable to differentiate between the causes which in this manner may have shortened the life of the wood in pipe,

TABLE 4. VARIOUS WOODS, CONTINUOUS-STAVE PIPE, UNCOATED

Location	Wood	Length, mi.	Diameter, in.	Pressure, ft.	Soil	Built	Condition	Life	Serial No.
Denver, Colo	Colorado pine				Not stated	1884	Top staves above water line decayed rapidly; part near river in wet soil still in use in 1912	18+	76
	Yellow pine	7.7	24, 30, 37		Not stated	1886–1887	Some lasted till 1907, when replaced with fir		
	Texas pine	16.4	30		Not stated	1890	Still in use	25+	77
Pueblo, Colo	Texas pine		*28		Adobe	1900	Condition in 1913: Decayed irregularly one-half to three-fourths of stave; some new staves account decay; bands near leaks or in moist soil corroded rapidly	23+	78
Pueblo, Colo	Texas pine		†54		Not stated	1890	Coated part with tar, part with asphalt; 1500 ft. running partly full, replaced in 1895 with redwood	5	
							Portion painted with asphalt replaced in 1910	20	79
							Portion painted with tar sound in 1910	20+	

*Partly redwood. † Coated.

nor to ascertain what has been the effect of permitting some sap in the wood from which decay may have spread to the adjoining sound wood. Unquestionably much wire-wound pipe has been manufactured without being subjected to strict supervision and inspection.

Conclusions

On the whole the following conclusions seem justified as regards the relative life of fir and redwood in pipe:

(*a*) Under favorable conditions of complete saturation fir well coated may have the same life as redwood uncoated.

(*b*) Either kind of pipe will have a longer life if well buried in tight soil than if exposed to the atmosphere. Such life may be very long, 30 years and over, if a high, steady pressure is maintained.

(*c*) Either kind of pipe will have a longer life if exposed to the atmosphere than if buried in open soil, such as sand and gravel and volcanic ash, provided in hot and dry climate it be shaded from the sun.

(*d*) Under questionable conditions, such as light pressure or partially filled pipe, fir, even if well coated, may have only from one-third to one-half the life of redwood.

(*e*) Under light pressure the use of bastard-sawn staves in fir pipe should be avoided.

(*f*) The use of wooden sleeves in connection with wire-wound pipe is objectionable and has caused endless trouble and expense. It is possible that the objection may be partially overcome by dipping ends of sleeves in creosote and by applying a heavy coating of tar to the ends of the sleeves. Saturation of sleeve wood will never be as perfect, however, as of the straight pipe, and full creosote treatment of the wood or else some form of metal sleeve, either riveted iron or steel heavily coated, or cast iron will probably be well worth the extra cost.

(*g*) If wooden sleeves are employed, they should be provided for sizes at least from 10 in. up with individual bands to permit taking up leaks.

Special Comments

Pitch seams do not occur in redwood. In fir they should be distinctly limited as to size, frequency, and depth. In respect to knots, there appears to be no reason for making any distinction between the two classes of wood. Small, sound knots, if not passing through the full thickness and not occurring close to edges or ends might be permitted in either wood. Sap is objectionable, and the higher cost in prohibiting it entirely or of putting narrow limitations on it is probably justified in both fir and redwood.

Wood pipe is not suitable in cases where it can not be kept full and under pressure during periods of use. Coating can not under such condition be expected to afford protection against decay. Coating should be continuous and heavy, not less than one-sixteenth inch to be fully effective, and should preferably consist of more than one individual coat of a mixture of asphaltum and tar, or of an application of gas tar followed by one or more applications of refined coal tar. Little experience, however, can be quoted in support of all-tar coating.

All tentative conclusions herein presented are necessarily based on the limited data which could be collected and will undoubtedly require amendment as further experience accumulates.

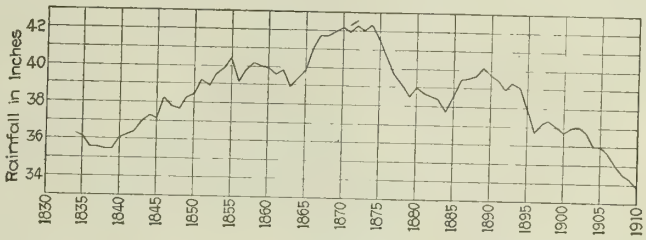
Long-Term Rainfall Records in New York State

By Edward H. Sargent*

That we are still in a "trough" of a cycle of rainfall is shown by the accompanying hydrograph of rainfall in New York State. The diagram represents the mean of the progressive ten-year averages of the precipitation from 1829 to 1914 inclusive at Albany, Rochester and New York City, the rainfall records at these stations constituting the only long-term continuous records in New York State.

The method used in computing and plotting the hydrograph was as follows: The average rainfall for the first ten years (1829-1838) was computed for each of the three stations and the mean of these averages computed and plotted as for the year 1834. These ten-year periods were then arranged successively, each beginning and ending one year later than the preceding.

The hydrograph shows a well-defined cycle of increasing and decreasing precipitation. The three stations used, Albany, Rochester and New York City, are so distributed



RAINFALL AT ALBANY, ROCHESTER AND NEW YORK
Mean of progressive 10-year averages of rainfall, 1829 to 1914, inclusive

that they should give a fair average of rainfall conditions over the entire state during this period. This is checked by the fact that the average rainfall in New York State as planimetered from the long-term isohyetal map is 38.80 in., while the average for the above-cited three stations is 38.14 in.

The mean annual precipitation for the first and last halves of the period covered by the hydrograph for each station was as follows:

	Albany	Rochester	New York City	Average
1829-1871	40.33	32.94	43.60	38.76
1872-1914	35.36	33.59	43.63	37.53

From this tabulation it is seen that at Rochester and New York City the mean rainfall is greater for the last half of the period than for the first half, while the reverse is the case at Albany.

Coal Consumption in Brazil—Brazil is a tropical country; coal for power purposes, therefore, is practically the only source for which there is any demand. Of this the greater portion is consumed by the various steamship lines. The railways also require a certain amount. In this connection it is interesting to note that one of the railways has installed several oil-burning locomotives. Factory requirements are not large, as electric power generated hydraulically is relatively cheap. Until the European war started, Cardiff and Newcastle were the prevailing types of coal used. In unloading from steamers coal is delivered on the dock by the steamer's derrick and then worked by hand. In coaling ships the coal is carried by laborers in baskets; this method is considered the most economical, labor being cheap. The average cost of unloading or loading is stated by Consul General A. L. M. Gottschalk, Rio de Janeiro, to be 50 to 60c. per ton.

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Piledriving Destroys a Tunnel by Clay Pressure

An 8-ft. brick tunnel crossing under the Cuyahoga River on the line of Clark Ave., Cleveland, Ohio, was completely crushed by lateral pressure and flow of the clay subsoil produced by piledriving for bridge piers within a few feet of the tunnel. This remarkable accident required complete rebuilding of a tunnel for a total length of some 200 ft.—about 100 ft. at each of the two river piers.

The tunnel contains a 4-ft. steel riveted water-main seated centrally in the 8-ft. tunnel on chairs. It was built about five years ago. The Clark Ave. viaduct, which the city is now building, has its center line about 25 ft. south of the line of the tunnel. The piers carrying the river span have substructures 66x96 ft., thus extending over the tunnel. The bottom of concrete is at El. —29; the top of the tunnel is about El. —46, or only 17 ft. below the base of the piers. Although the piers rest directly on the stiff clay subsoil of the Cuyahoga Valley and adjacent uplands, the city bridge engineer, F. D. Richards, considered it desirable to drive piles to get reliably solid bearing. This required piles 40 to 50 ft. long. As piles of such length could not be driven in the tunnel area, it was decided to keep the long piles 15 ft. apart, or 2½ ft. clear of each side of the tunnel brickwork (see sketch Fig. 2), and cover the intervening space with short piles whose points would be 3 or 4 ft. above the tunnel. Some reinforcing steel was placed in the bottom of the pier over this space to help distribute the weight uniformly among the entire pile group.

The short piles over the tunnel were driven first; then the driving of the long piles was begun with the rows nearest the tunnel in order to progress outward on both sides so that any crowding action of the clay would act away from the tunnel. By the time the whole footing had been piled (938 piles), water in the tunnel shafts indicated that something was wrong with the tunnel. An examination showed so serious a condition of affairs that it was necessary to shut off the water main; and after the completion of the piledriving in both piers the tunnel had to be rebuilt in these sections.

Under the east pier the tunnel was totally destroyed. Its sides had been forced in on the whole width of the pier (about 70 ft. along the tunnel), and the clay and broken brickwork filled nearly the entire cross-section around the pipe (see Fig. 1). The pipe was lifted off its chairs for 100 ft. or more each way. Nowhere had a pile actually touched the tunnel; the damage was caused wholly by the crowding pressure of the clay. At the west pier the tunnel was not crushed in this way, except for local damage at one point where one pile came close to the shell. However, on the width of the pier the tunnel was lifted from its original position by a maximum amount of from 2½ to 3 ft. To reconstruct the tunnel, the clay and brickwork were removed by carrying forward a circular drift, to the line of the outside of the new brickwork plus the thickness of a solid timber lining of 12-in. segment. This was done in short sections and the timbering kept close. When the drift was forward far enough to expose an entire length of the pipe this was unbolted and removed, and thereupon the corresponding length of new brickwork was laid up inside the timber lining. The same procedure was followed through the whole damaged section. At each end where the connection with the old brickwork was made, care was taken to tooth in as well as possible. While it might be thought from the nature of the accident that the clay is plastic, it is on the contrary very hard and firm. This was shown some months earlier, in tearing out the old west shaft of the tunnel, which being within the area of the west pier had to be replaced by a shaft 100 ft. farther west. On removing the brick-

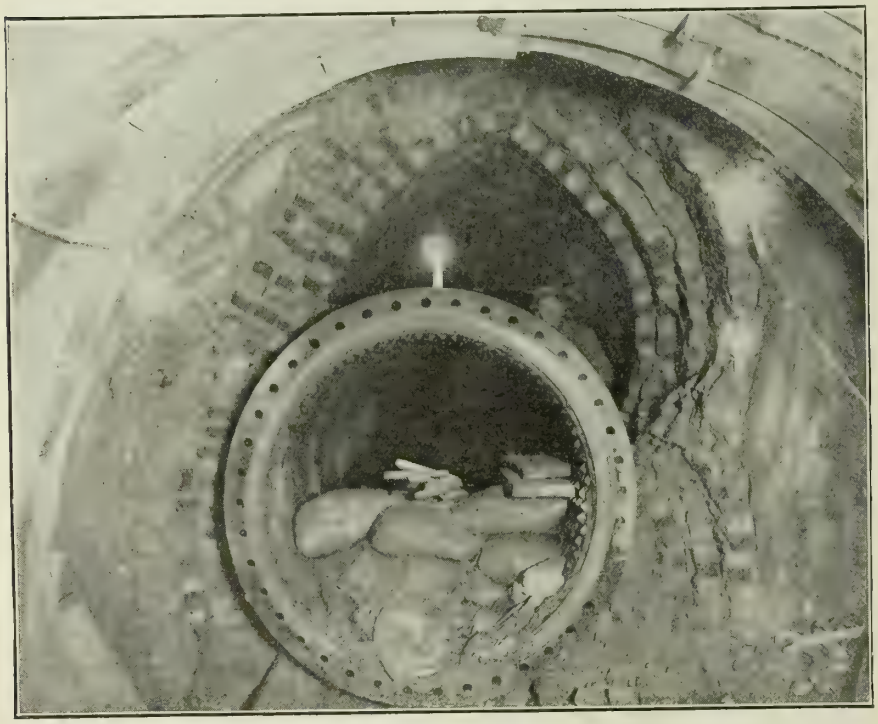


FIG. 1. INTERIOR OF CRUSHED CLARK AVE. TUNNEL UNDER EAST PIER OF VIADUCT

During reconstruction. Segmental timber lining in foreground. Candle on original center line of tunnel

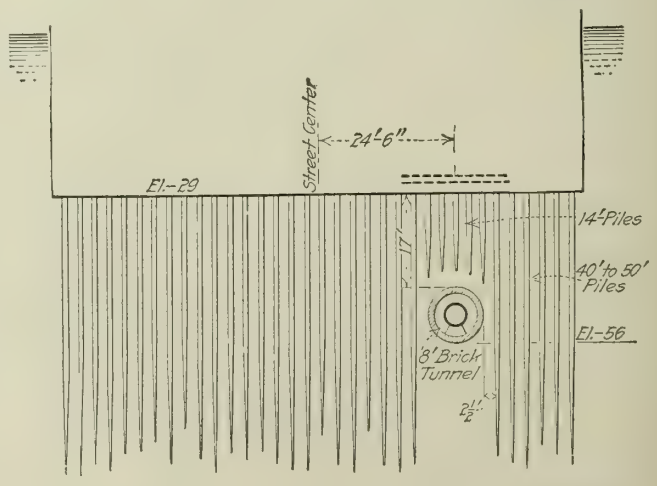


FIG. 2. SKETCH OF PIER AND TUNNEL ON SECTION TRANSVERSE TO CLARK AVE.

work of the old shaft the clay back of the lining was found to stand clear of the lining and to show the mattock marks made when it was built.

A. B. Cook, resident engineer under Mr. Richards on the viaduct construction, had supervision over the tunnel repair work also. The contract for this was let to the Manson Co., Engineers' Building, Cleveland, Ohio. The work cost about $20,000, the aggregate length of the two rebuilt sections being 180 ft.

Rapid Tunnel Driving Under the Bonus System

By J. R. McFarland*

The rapid advance made on some of the recent "record" tunnels, notably the Mount Royal, Arizona Copper, St. Louis Water-Works, Laramie Poudre, and Los Angeles Aqueduct, seems to have been due very largely to the bonus system of wages. This system was used at all the tunnels mentioned, and is the only practice of note that was common to those five contracts. Different types of drills, some with and some without carriage mountings, both long and short rounds, and different methods of handling the muck were used.

The cost of tunnel driving is practically constant for each day's work, but the cost per foot varies with the rate of progress. From past performances the average advance per day, week and month is known, and it is expected that under normal conditions this rate of progress will be maintained. If exceeded, there is of course a considerable saving to the contractor; and where the bonus system is in force he pays his men a certain amount, as their just portion of the saving effected, for each linear foot of advance in excess of the base rate. The saving realized by the bonus system in the labor cost is shown in the tabulation which follows:

LABOR SAVING BY BONUS SYSTEM

	Per Cent.
Mount Royal Tunnel	15
Arizona Copper Tunnel	20
St. Louis Water-Works Tunnel	50
Laramie Poudre Tunnel	31

The cost of driving the tunnels during the record months under the bonus system has been compared with the cost of driving before the bonus system was adopted. Before considering the several projects separately the accompanying tables should be examined. Table 1 gives some general data as to character of rock, size of heading, etc., while Table 2 shows the approximate number of men at work.

TABLE 1. DATA OF TUNNELS WHOSE RECORDS ARE COMPARED

	Mount Royal Tunnel	Arizona Copper Tunnel	St. Louis Water-Works Tunnel	Laramie Poudre Tunnel
Rock	Trento limestone with igneous dikes	Granite porphyry; good drilling	Both hard and soft limestone	Moderately hard, gray or red granite
Size of tunnel heading	8x12 ft.	8x8 ft.	8 ft. diameter (circular)	7½x9½ ft. (elliptical)
Average cross-section	3.56 cu.yd. per ft. advance	70.04 sq.ft.	95 sq.ft.	62 sq.ft.
Record advance in 31 days	810 ft.	799 ft.	745 ft.	653 ft.

TABLE 2. TOTAL LABOR ON TUNNEL CONSTRUCTION

	Mount Royal Tunnel	Arizona Copper Tunnel	St. Louis Water-Works Tunnel	Laramie Poudre Tunnel
Superintendents	2	..	1	1
Foremen or bosses	3	1	3	3
Drillers and helpers	24	12	24	15
Muckers	24	15	22	18
Miscellaneous labor of all classes	59	12	51	22

*5710 Kimbark Ave., Chicago, Ill.

The bonus paid to the men at the Mount Royal tunnel was 7% of their daily pay for every foot over 14 ft. per day. The influence of the bonus system on the work at this tunnel is shown by Table 3.

TABLE 3. MOUNT ROYAL TUNNEL

Costs	A Typical Month Without Bonus	Record Month With Bonus
Labor	$9,989.00	$15,883.00
Equipment and supplies	2,927.00	4,750.00
Total, including overhead	13,916.00	21,633.00
Advance, at 14 ft. per day	434.00	810.00
Per foot (labor)	$23.00	$19.61
Per foot (labor, equipment and supplies)	29.76	25.47
Per foot (total)	32.06	26.70
Per cubic yard (labor)	6.48	5.51
Per cubic yard (total)	9.00	7.51
Saving (in labor) in cost per foot, by bonus system	....	3.39
Saving (in labor, equipment and supplies) per foot	....	4.29
Saving (total) per foot	....	5.36
Saving in total cost per cubic yard	....	1.50

At the Arizona Copper tunnel the men received regular wages, and for every foot of advance over 350 ft. per month a bonus of $7 was divided. This was only a trial, but although it was found that the bonus was excessive, it was not reduced, as the duration of the test was short. The tunnel was driven the first month without a bonus and the three succeeding months with a bonus. A comparison of the advances and the costs per foot of tunnel in each case is shown by the figures in Table 4.

TABLE 4. ARIZONA COPPER TUNNEL

	Without Bonus	With Bonus		
Costs	First Month	Second Month	Third Month	Fourth Month
Labor	$3773.00	$5314.24	$5802.69	$6574.77
Equipment and supplies	2013.33	2013.33	2013.33	2013.33
Labor, equipment and supplies	5786.33	7327.57	7816.02	8588.10
Advance in feet	350	582	664	762
Per foot (labor)	$10.78	$9.13	$8.74	$8.63
Per foot (labor, equipment and supplies)	16.53	12.59	11.77	11.27
Cubic yards of rock removed, labor, equipment and supplies	6.33	4.82	4.51	4.32
Saving on labor, per foot, by bonus system	....	$1.65	$2.04	$2.15
Saving on labor, equipment and supplies, per foot	....	3.94	4.76	5.26
Saving on labor, equipment and supplies, per cubic yard	....	1.51	1.82	2.01

Three shifts per day were employed at the St. Louis Water-Works tunnel. A minimum advance of 72 ft. per week was set, and for all over that amount the following bonus rates were paid: Superintendent, 50c. per ft.; heading foreman, 50c.; muck foreman, 30c.; drill runners, 30c.; drill helpers, 20c.; nipper, 20c.; muckers and cage men, 10c. Each shift was credited with one-third of the extra progress and received one-third of the bonus.

TABLE 5. ST. LOUIS WATER-WORKS TUNNEL

Costs	Estimated Cost per Day Without Bonus	With Bonus
Labor	$381.75	$381.75
Total bonus per day	.....	66.80
Advance, feet per week	72	745
Labor per foot	$37.09	$18.66
Labor per cubic yard rock removed	10.54	5.30
Saving in labor, per foot, by bonus	.....	18.43
Saving in labor, per cubic yard, by bonus	.....	5.24

Three shifts per day were employed on the Laramie Poudre tunnel. For the first part of the work each underground workman was paid a bonus of 25c. per day for each 25 ft. in excess of 400 ft. per month. This system was soon discontinued, as it was found to be not only cumbersome but excessively high, and the following system was adopted: When the rate of driving for any calendar month exceeded 400 ft. and was less than 500 ft., each underground employee was paid $10 extra; between 500 and 600 ft. the bonus was $15, and between 600 and 700 ft.

it was $20. In order to distinguish the bonus money from the regular wages the bonus was paid by check. The itemized account is given in Table 6.

TABLE 6. LARAMIE POUDRE TUNNEL

Costs	Estimated Cost per Day Without Bonus	With Bonus
Straight wages	$242.65	$242 65
Total bonus per day	.....	29 68
Advance per month in feet	400	653
Labor, per foot	$18.76	$12.94
Labor per cubic yard removed	8.16	5.60
Saving per foot due to bonus	.....	5.82
Saving per cubic yard due to bonus	.....	2.56

The bonus system at the Los Angeles Aqueduct tunnels proved to be a great success, and all tunnels here were driven under this system. The bonus was shared by the tunnel foreman, shiftboss, miners and muckers. All back-trimming was done by the crew, which shared the bonus. Overbreakage was about 30%.

The bonus varied from 20c. to 40c. per ft. over the base rate, depending on the class of material encountered. At the start it was estimated that a reasonable progress would be 8 ft. per day with three 8-hr. shifts. A bonus system based on this advance gave 40c. per ft. in excess of the 8 ft. Thus it was expected that the monthly advance would not fall below 248 ft.; as a matter of fact, 10.8 ft. per day was averaged, giving a monthly progress of 330 ft. The standard tunnel crew consisted of 16 men in untimbered tunnels and 23 men in timbered tunnels. In dry tunnels miners received $3 per day, and muckers and timbermen $2.50 per day; in wet tunnels each man received 50c. more per day. The itemized account is given in Fig. 7.

TABLE 7. DAILY COSTS, LOS ANGELES AQUEDUCT TUNNELS

Average daily progress	10.8 ft.
Average cost, direct charge	$51.10
Equipment	6 50
Pipe lines and operation	.46
Roads, trails and maintenance	1.40
Buildings	1.49
Surveys	.24
Division administration	2.12
Executive administration	1.92
Miscellaneous losses, test, phone, operation, etc	.53
Grand total cost per foot of tunnel	$65.76

Springfield Water-Works--I

SYNOPSIS—Organization of the Springfield, Mass., water-works; plant and equipment, which include a thoroughly uptodate shop, garage and stable and a material yard equipped with electric-locomotive crane. A later article will describe other features of interest.

The public water-supply of Springfield, Mass., dates from 1843. In 1872 the water-works was purchased by the city from the private company that had owned and operated it up to that time. There are at present two principal sources of supply—filtered water from the Westfield Little River and water from impounding reservoirs in the adjoining towns of Ludlow and Belchertown. The total population served is estimated to be 101,735, not including the town of Ludlow, which also uses water from the Ludlow reservoirs. The number of metered taps is 13,491 or 95.5 per cent. of all services.

The water-works of Springfield, Mass., is managed by a board of three water commissioners, of whom the mayor, ex officio, is one. Under this board are three separate divisions—one under a superintendent of water-works, one under a water registrar and clerk of the board, and one under a chief engineer. The duties of these officers are apparent from their titles. This article is confined to the division under the superintendent of water-works.

The superintendent, Alfred E. Martin, has three principal assistants—an assistant superintendent, who has general supervision of installing mains, two construction gangs, a gate-inspection service gang, service-pipe gangs, and of emergency work; a master mechanic of shops and plant; and a superintendent's assistant, who has general oversight of many small details. The organization scheme is shown in the chart, Fig. 1.

The plant proper consists of a shop, a stable and a materials yard (Fig. 2). The shop was completed in 1913 at a cost of $50,000 and embodies what were then considered the best features of a number of similar plants inspected and studied by the Springfield officials. The brick building is 50x140 ft., of which the shop takes up one-half (see Fig. 2). The basement of the whole has a concrete floor, walls, columns and ceiling, and is used for a storeroom, boiler room and locker room. There are two shower baths in the basement for the use of the day laborers and one for shop employees on the second floor. Above the basement the building is of slow-burning mill construction, except the garage and stable, which have reinforced-concrete floors, walls and columns. The building has an elevator and electric power and is fitted throughout with reels of hose for fire protection and self-closing fire-doors.

The first floor of the shop is finished off for offices and as a storeroom for small stock. The second floor

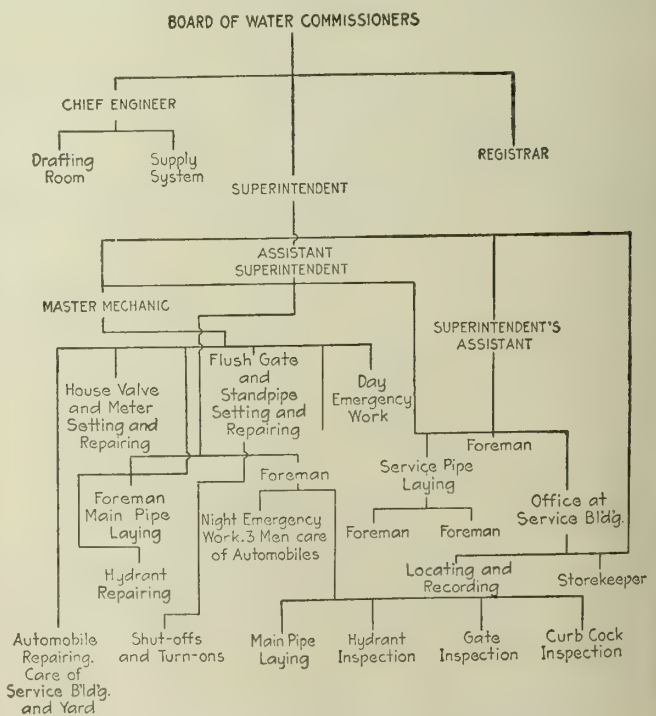


FIG. 1. ORGANIZATION CHART OF THE SPRINGFIELD, MASS., WATER-WORKS DEPARTMENT

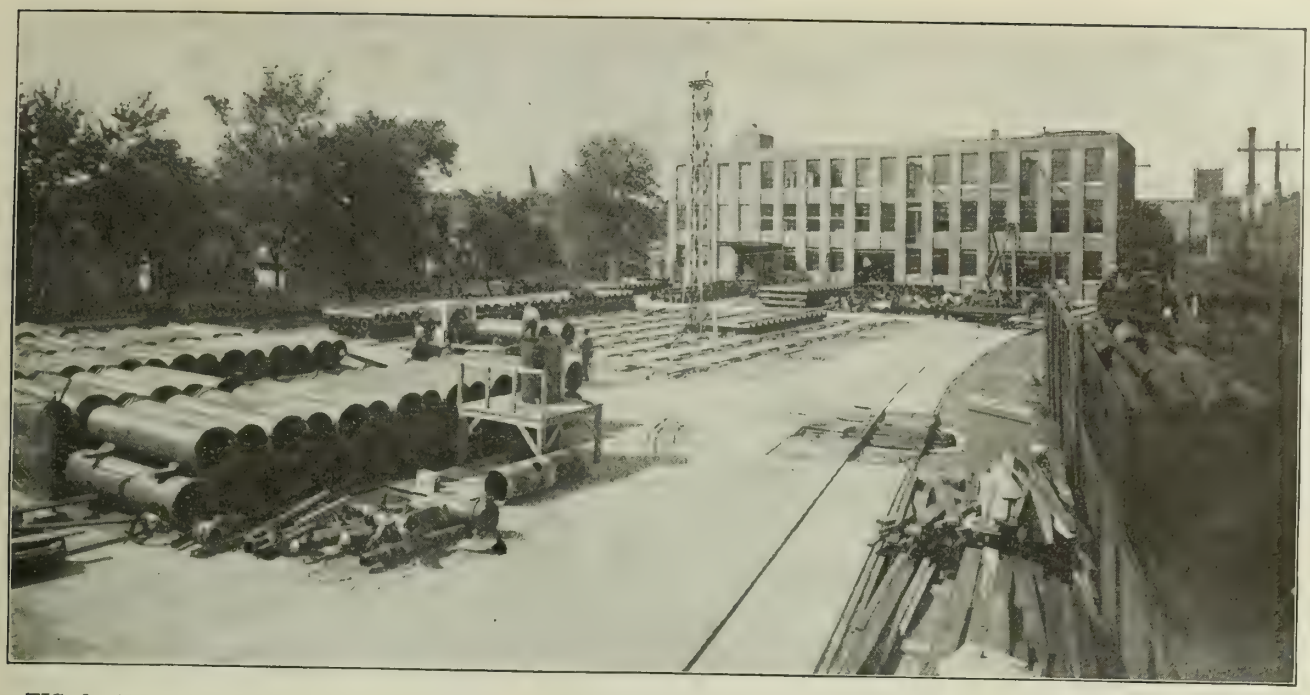


FIG. 2. GENERAL VIEW OF SHOP, GARAGE AND STABLE AND YARD, SPRINGFIELD, MASS., WATER-WORKS

has a meter-repair shop (Fig. 3) and a meter-testing room (Fig. 4). The former is equipped with a number of machine tools, such as a lathe, a 6-in. pipe-threading machine, a small pipe-threading machine, a drill press, an air compressor and various small tools. Meters are cleaned by sand blast, repainted and sent out as bright as new.

The meter-testing room is equipped with standard meter-testing apparatus (in front of windows, Fig. 4) consisting of a Gow meter-clamping device, with a Mueller & Chapman quick-opening valve on a 2½-in. diameter delivery main, for testing meters up to 2-in. diameter services. A 36-cu.ft. weighing tank is used, and all meters are tested for flows of 10 and 100 cu.ft. For large meters there is a 6-in. main connection (right of Fig. 4) with a slip-joint clamping device and a Chapman quick-operating valve. The large measuring tank holds 330 cu.ft. and has a calibrated glass gage. A ½-ton

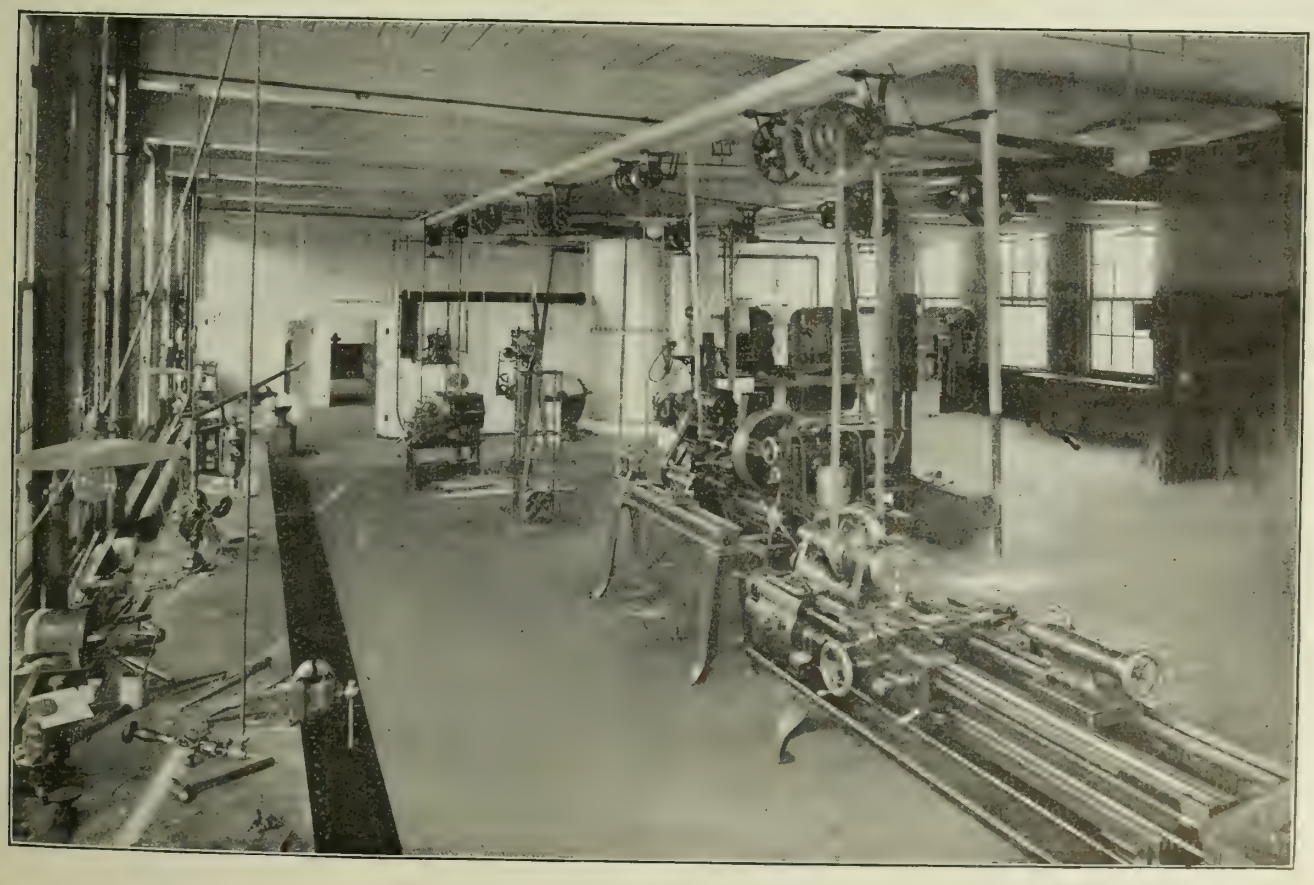


FIG. 3. MACHINE SHOP OF SPRINGFIELD, MASS., WATER-WORKS PLANT



FIG. 4. METER-TESTING ROOM OF SPRINGFIELD, MASS., WATER-WORKS PLANT

chain is used to place large meters in position to test. All meters are tested one at a time.

A small electric-driven pump and pressure tank make possible a pressure of 400 lb. for testing valves (foreground of Fig. 4) and also the testing of service cocks. Regulation corporation cocks are tested to a pressure of 220 lb. per sq.in. The equipment of the shops also includes three Smith pipe-cutting machines for making taps in mains up to 12 in. in diameter; when it is necessary to make larger taps a machine is hired.

The third floor is a storeroom and at present a museum of water-works relics, including some interesting pieces of pipes, valves and fittings of real historic interest. The most curious is a section of glass pipe about 2 in. in diameter, incased in cement mortar, dug up a few years ago in the vicinity of the United States Arsenal.

The first floor of the right-hand end of the building (Fig. 2) is occupied, as noted, by a garage and wagon shed, separated from the shop by a concrete wall. There are eight water-works automobiles, a 3-ton truck, a 2-ton truck, an emergency car, a repair car for making shutoffs, etc., a superintendent's car, an assistant superintendent's car, one for the use of the meter foreman and one for the chief engineer of the water-supply. The stable is on the second floor; horses are kept for four wagons. There are harness rooms, a steam-heated blanket dryer, a washstand and other facilities of a first-class stable. The third-floor storeroom extends over the stable, with a partition wall between.

The yard is small for the amount of material handled, but has unusual facilities for storing and handling. There is an electric locomotive crane capable of lifting 1½ tons on a 50-ft. radius. The standard-gage track consists of one main line (left of Fig. 6) which is directly connected with the New York, New Haven & Hartford R.R. This track extends the length of the yard, about 10 ft. from one side, with two branches at right angles extending the width of the yard about 100 ft. apart. Iron turntables are used to transfer the crane from the main to the branch tracks, enabling it to cover practically every foot of the yard. Power for the crane is transmitted from a central tower through a flexible cable, of which the slack is taken up on a self-winding drum.

In order to have sufficient storage the pipes are piled in tiers, sometimes 12 or 15 pipes high. To facilitate handling the lower ones the bottom tier is laid

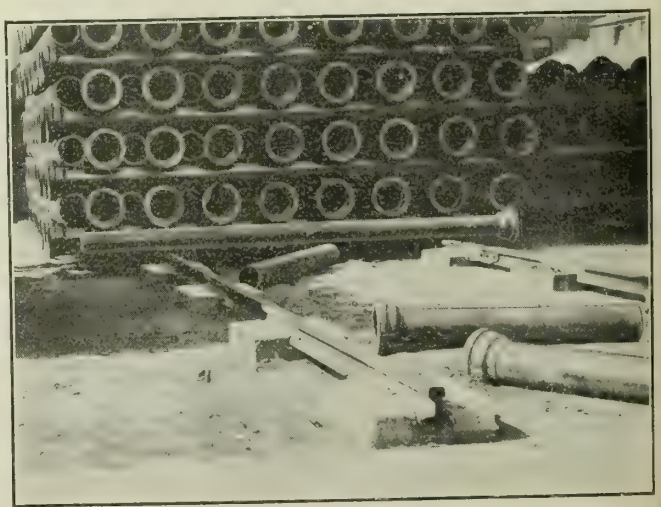


FIG. 5. RAILS FOR PILING TIERS OF PIPE

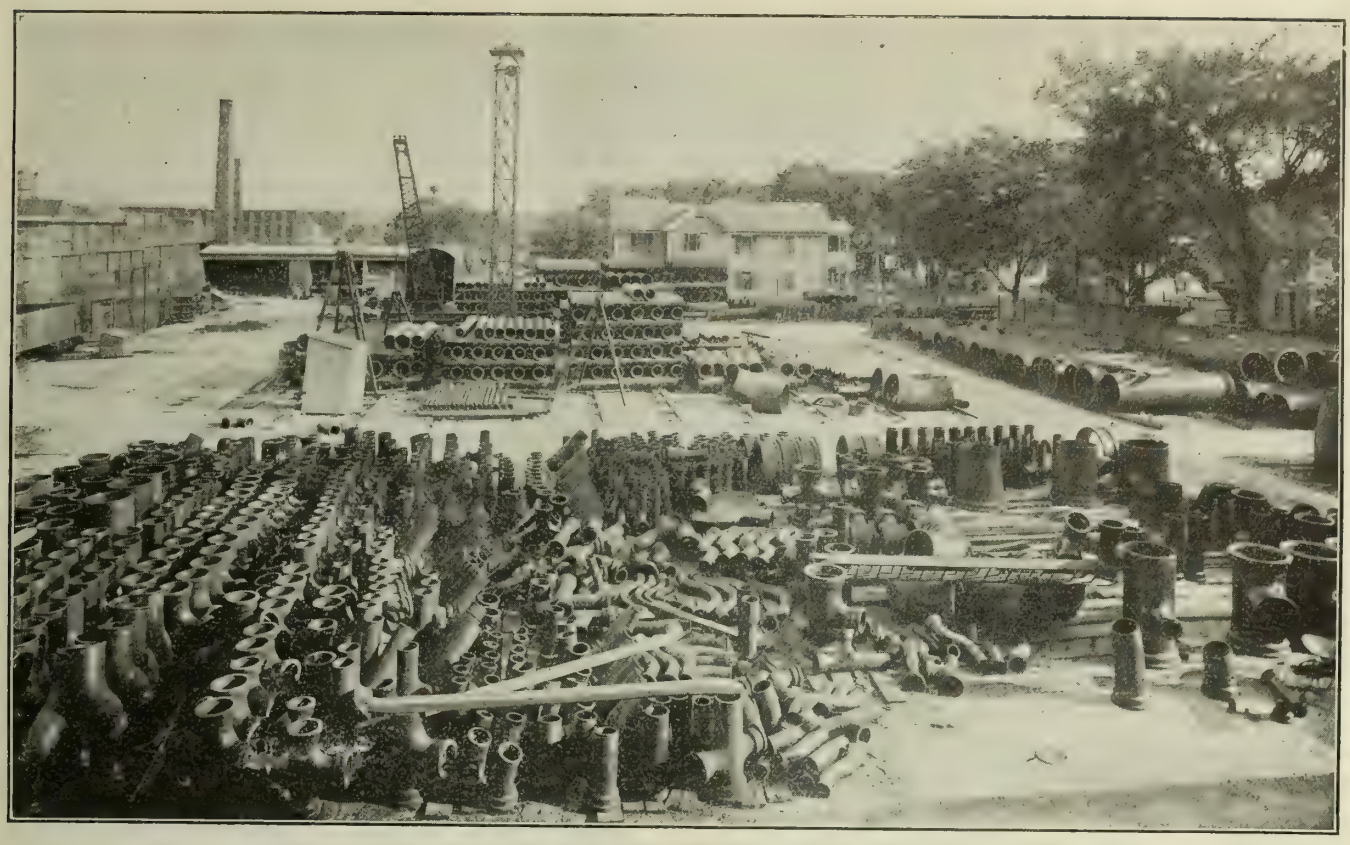


FIG. 6. MATERIALS YARD OF THE SPRINGFIELD, MASS., WATER-WORKS PLANT

on two parallel railway rails molded into concrete blocks, as shown in Fig. 5. There are facilities for painting the pipes and special castings, including a small hoist and dipping tank for the special gate boxes. In the far corner of the yard are sheds for storage and for shelter of workmen employed on various jobs about the yard.

The whole force employed in the shops and yard is about 15 men. The emergency force consists of any of the men under the shop foreman during the day. There are three men constantly available at the garage until 1 a.m., after which there are two men until the shop opens at 7 a.m. There is a private telephone between the garage and the foreman's house, which is near-by.

Missouri River Improvement Work May Be Stopped

The river transportation enthusiasts in and around Kansas City are considerably perturbed because Lieut.-Col. Herbert Deakyne, Corps of Engineers, U. S. A., the engineer officer in charge of the Missouri River district, has recommended to his superior that the improvement of the Missouri River be restricted to snagging operations. Mass meetings of those interested are being held in protest against these recommendations and the usual local press campaign in favor of the river improvement is in full swing. The gist of Col. Deakyne's report is as follows:

The commerce to be considered is present and prospective, and the advantages that commerce will obtain from the improvement are the actual saving in freight charges by the use of the river and the effect on railroad freight rates produced by the possibility of water transportation.

The items that are not benefited by improvement of the river are the sand and gravel barged and the logs and lumber rafted. They amount to 309,684 tons. Ferry traffic is not counted in reporting the commerce of the Missouri River.

Eliminating the logs and the sand and gravel barged, the remaining traffic is 37,551 tons, divided into the classes which are carried over average distances of from 8 to 291 mi. The total freight charge on this traffic was about $41,000. The Kansas City Missouri River Navigation Co., the only through line on the river, operating between Kansas City and St. Louis, charges 80 per cent. of the railroad freight rates. Assuming this to be the relation between the rail and water rates for the entire traffic, the saving to shippers by the use of the river in 1913 was about $10,000. It is evident that this saving is entirely inadequate to warrant the serious consideration of an expenditure by the Government of $1,100,000 per year in interest and maintenance.

In some cases the improvement of a stream is justified even at high expense, where the absence of rail transportation leaves the territory along the stream entirely dependent on water transportation. This is not the case with the Missouri River between Kansas City and the mouth. Over a great part of the distance the river is paralleled with railroads on both banks, and there are few localities that have no railroad within easy reach.

There remains to be considered the question of prospective commerce, and in my opinion the improvement must stand or fall by this criterion. In the survey report upon which the present project is based, the prospective commerce was given by the president of the Missouri Valley River Improvement Association as 1,000,000 tons. That estimate was based upon a 10-ft. channel with six or seven boats especially adapted to the navigation of the Missouri River, handling cargoes of 2000 tons each, and making one round trip per week during a navigation season of ten months. The fact is that anyone can make almost any estimate he sees fit as to the prespective commerce. I am of the opinion that the present and reasonably prospective commerce on the Missouri River between Kansas City and the mouth is not sufficient to warrant the continuance of the present project. I think the snagging should be continued, so that commerce may have the advantage of the natural depth of the river and the river shall not be allowed to become entirely obstructed. Any attempt at partial improvement seems futile, because the draft of boats, and therefore their cargoes will be determined by the least existing depth. If the river is improved at all, the work should be complete as to protection of banks and control of channel. For the same reason it seems to me injudicious to spend any money in keeping up the works already built. If in another generation the improvement of the river becomes advisable, the present works will be of little value and in the meantime the channel depths in the portions that have been improved are not likely to be less than in the portions wholly unimproved.

Field and Office

Reinforcing Concrete Columns to Carry Additional Stories

By Paul R. Prufert*

It was necessary to resort to a somewhat unusual method of construction in the addition of two stories on the machine shop of the Washburn-Crosby Co. mill in Minneapolis, Minn. This structure was one of the first

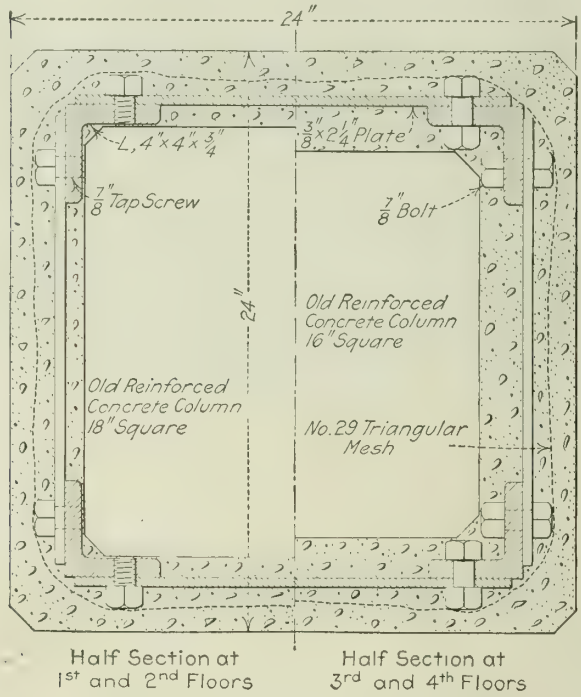


FIG. 1. HALF SECTIONS THROUGH COLUMNS, SHOWING METHOD OF REINFORCING

reinforced-concrete buildings erected in that city and covers an area of 60x78 ft. It is five stories high, has brick bearing-walls strengthened by brick pilasters and six interior reinforced-concrete columns. The floor construction is of the girder type, 6-in. slabs with two-way reinforcement. The wall footings went down to bedrock, about 9 ft. below grade, but no accurate data could be found regarding the size or depth of the six column footings. On figuring the old structure, the writer found that the concrete columns were not of sufficient strength to carry any additional stories; they were actually too weak for their present requirements. Neither was the roof-slab, of course, strong enough to be utilized as a floor. In fact, the only parts of the building that would stand additional loading were the walls.

Another condition that added to the difficulty was that neither the continuous use of the elevator nor the lower four floors of the building could be interfered with, and as two floors were used for flour storage, it was essential to guard against leakage. Obviously the first step was to examine the column footings, to see whether they rested on bedrock and were of sufficient size to carry the additional load. They were uncovered, and five of them were found to go down to the limestone ledge, while the sixth one rested on a layer of shale about 18 in. thick. To secure solid bearing this footing was "plugged" in sections of about 1-ft. width and in that way carried to the ledge. All of them were in good condition and of ample size.

As the old concrete columns could not be utilized, it was decided to transmit the load of the new stories to the footings by means of structural-steel members built around the old columns. Four holes were cut in the floor-slabs at each column and 4x4x3/4-in. angles lowered down from the roof to the footings. They rested on a structural-steel base, made in two parts and bolted together. The angles were connected by 3/8x2 1/4-in. straps every 6 in. alternating, 7/8-in. tapscrews being used for connections at the two lower floors, where the original

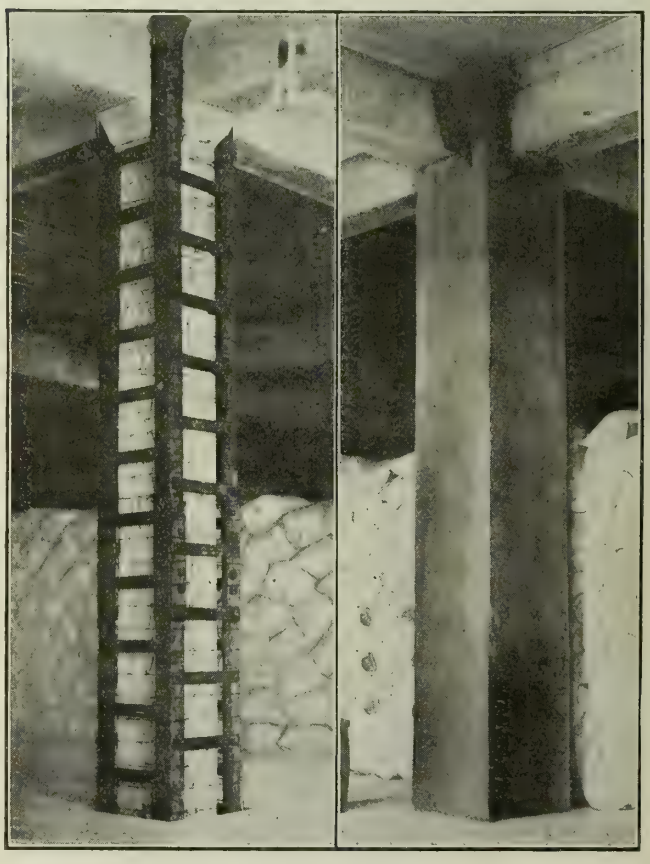


FIG. 2. REINFORCED COLUMNS BEFORE AND AFTER BEING FIREPROOFED

columns were 18 in. square, and bolts on the upper two floors, where the old columns were 2 in. smaller. After the angles were connected up, No. 9 triangular mesh was wrapped around them and the concrete for fire-protection poured, one floor at a time. The finished columns were 2 ft. square, an increase of 6 in. over the old ones.

The old roof-slab and the fifth-story columns were then wrecked, structural-steel caps bolted to the tops of the

*Engineer, John Wunder Co., building contractors, Minneapolis, Minn.

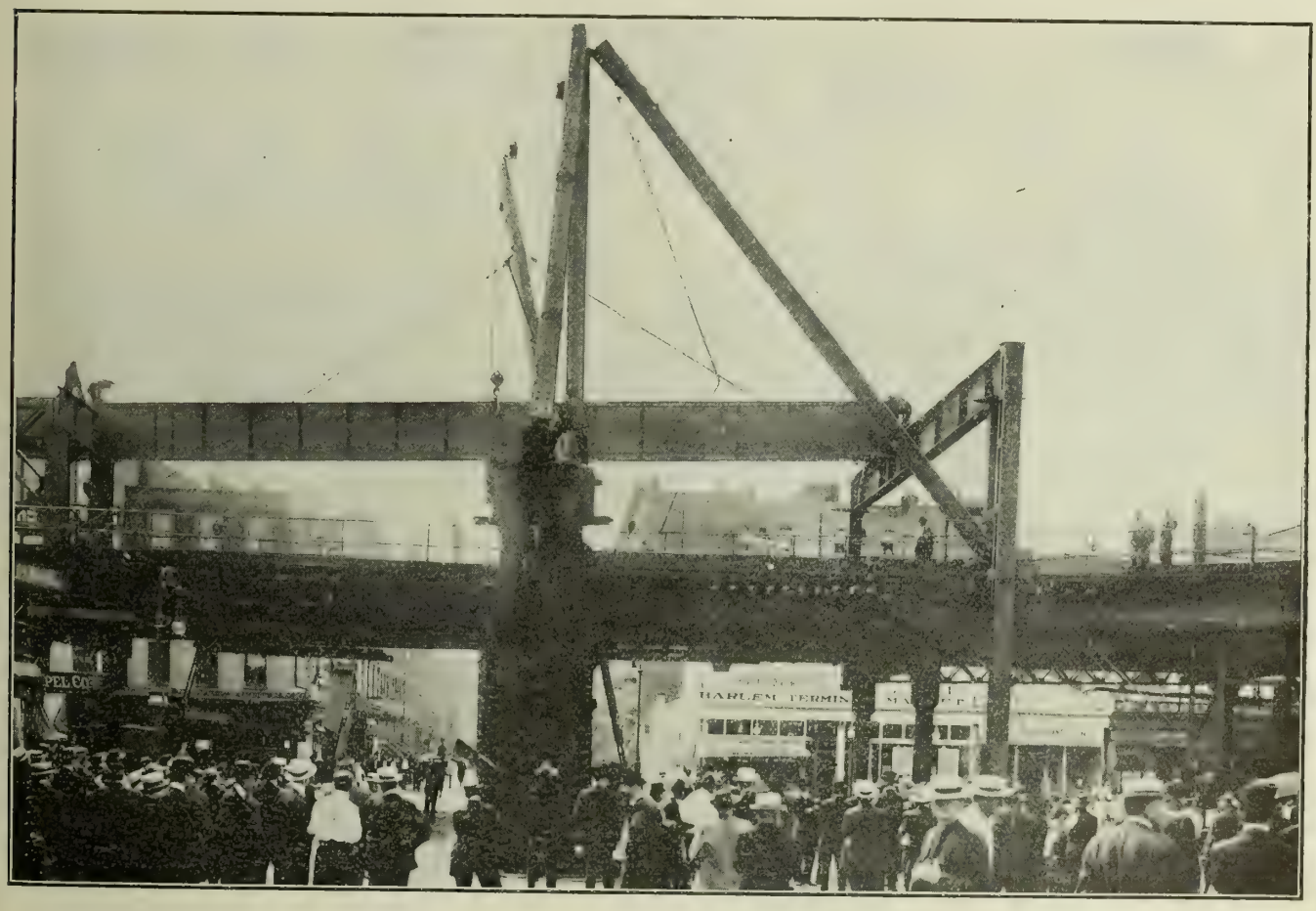
angles and the columns for the new superstructure poured on these.

The new floors were of flat-slab construction, without drops or column heads. Three weeks after the old roof-slab was wrecked, the new one was poured, and not a single sack of flour had been spoiled although the rainfall had been considerable during that period and stopped construction for several days.

The work was done by John Wunder Co., Minneapolis, Minn., contractors and engineers, with the writer in charge of design and construction.

Handling Heavy Girders on Elevated Railway

Double-decking the Third Ave. Elevated Line where it is to cross the Harlem River, New York City, at 129th St., on the new double-deck bridge that is being built to take the place of the old single-deck structure involves the handling of girders that are longer and heavier than those used at most other points on the third-tracking work. The accompanying view shows a stiff-leg derrick set up in a rather awkward location, handling a 17-ton girder of 88-ft. span. One of the stiff-legs rests on the elevated structure, running lontitudinally with it. The other stiff-leg juts out over the street at right angles to the first leg and is carried on a timber bent resting on the street. The derrick is at work on the elevated structure at 128th St., erecting the express deck. Where possible in third-tracking the elevated railways of New York a derrick car was employed, but this car was designed for handling loads only up to eight tons and could therefore not be used on the heavier work on Third Ave. from 127th to 129th St. The car was described by J. M. Ryan, assistant engineer, Snare & Triest Co., in *Engineering News,* of May 20, p. 986.



SETTING A LONG-SPAN GIRDER IN DOUBLE DECK OF THIRD AVE. ELEVATED LINE
Photograph obtained from Broderick & Bascom, which furnished ⅝-in. hoisting cable of derrick

Reconstruction of Street-Car Tracks at Kansas City, Mo.

By E. B. Murray*

With the repaving of the main streets in the downtown district of Kansas City, the Metropolitan Street Ry. Co. took the opportunity to reconstruct its tracks and build a new foundation in advance of the paving work.

In each street it was necessary to keep the car lines open. As various routes converge on these streets, the traffic is very heavy, and during the busy hours there were 134 cars per hour to be handled. The street was closed to ordinary vehicular traffic, however, for about four blocks at a time. A temporary track was laid for the street cars at each side of the street, close to the curb line, so that passengers could be landed on the sidewalk. Plank crossings for pedestrians and street vehicles were placed at street intersections, and extra trolley wires over the temporary tracks were attached to the original span wires.

It was decided to reconstruct both tracks at once and to close the street entirely to ordinary vehicles, rather

*Consulting Engineer, 920 Walnut St., Kansas City, Mo.

than to work on one track and keep one side of the street open. In the latter case it would still be necessary to use the open side of the street to store material, so that it would not be possible to leave much room for traffic. Consequently both the construction work and the street traffic would be badly hampered. Work was done on only one street at a time, and in sections four blocks in length. The work on a section occupied from 18 to 21 days, ten days being allowed for the setting of the concrete base.

Portable Turnouts to Temporary Tracks

The temporary tracks were connected to the permanent tracks by turnout curves of 100-ft. radius and Kerwin portable turnouts or crossovers. These turnouts are placed directly on the rail, an incline or feather rail engaging and raising the car wheels. This is shown in the accompanying view. In this way the crossover can be used without any disturbance of the track or paving.

Where the temporary tracks intersected the tracks from a side street, the same idea was utilized in a portable crossing. This was made similar to a regular crossing, but was laid directly upon the rails and had feather rails projecting in four directions so as to allow the cars coming in any direction to mount the crossing and pass



PORTABLE TURNOUT LAID ON STREET-RAILWAY TRACK TO DIVERT CARS TO A TEMPORARY TRACK

over. It is believed this is the first time the principle has been applied to a crossing.

The temporary tracks were laid with second-hand ties and T-rails of about 50 lb. per yd. The rails were not reinforced by tie-rods or rail braces, but were simply spiked to the ties. The tracks were ballasted with 6 to 8 in. of material excavated from between the tracks (before traffic was diverted). This consisted of earth and broken stone and was laid upon the street paving. The rain water was taken care of by leaving a narrow ditch between the curb and the end of the tie, the ballast not being filled close against the curb.

As soon as traffic was diverted to the temporary tracks the old paving and tracks were torn up, the material being removed by the railway company's work cars. Then the concrete base was broken up to allow of removing the old ties. This was done by hand sledging, the concrete being split into large pieces by means of chisel and sledge.

Constructing New Track Foundation

The excavation for the new subgrade was done by hand, and was carried down to 6 in. below the bottom of the ties and to the top of the old cable railway foundation. It was decided not to disturb this old foundation, as it was approximately 4 ft. thick and very solid. The old concrete that was broken up was shoveled into cars and used for ballast and filling on open-track lines. The new foundation was made of fresh material. It was placed after the new ties had been put in position, blocked up to the required height and the rails securely spiked to them.

The material for the new concrete base was brought to the point of distribution on work cars or trains and deposited adjacent to the mixer in the middle of the street. These cars are constructed of steel and each carries three self-dumping pockets of 6-yd. capacity. The mixing plant was mounted on a small push car and was motor driven. Its loading platform was so constructed as to allow the men to load their wheelbarrows at the side of the street and empty them directly into the hopper of the mixer.

For the distribution of the concrete there was a special end-dump car, having a capacity of one batch, or approximately ⅓ cu.yd. It had originally a hinged end, but it was found impossible to get the joints clean after dumping and to make the joint tight enough to retain the grout. The car was then redesigned so as to have the entire body dump forward. This car ran on the new track. Wherever it was possible, the mixer emptied directly into chutes conveying the concrete to the point of distribution.

The new concrete foundation on top of the old cable-track foundation was placed to a depth of 6 in. under the new ties and half way up on the rail, making a total depth of 21 in. The mix was 1 : 3 : 6, using 2-in. broken stone and Kaw River sand. The concrete was allowed to set for ten days. Then the railway company laid granite blocks on both sides of the rails and wood blocks (with asphalt filler) between the tracks.

Relaying Track

The new tracks are laid with white oak ties 6x8 in., 8 ft. long, 36 in. c. to c. These are entirely embedded in the concrete, and are estimated to have a life of 20 to 30 yr. The rails are secured by ¾-in. screw spikes. The spike holes were bored by electrically operated augers, and the same machines, fitted with socket wrenches, were used to screw in the spikes. Current was taken from the trolley wires.

The original rails were relaid in this new construction. As soon as the old rails had been exposed and the splice plates removed, the dirt and scale around the joints were removed by a portable sand blasting plant. This consisted of a motor-driven compressor (50 cu.ft. of free air per minute) and a sand tank, mounted on a push car and having a 50-ft. hose line with nozzle and valve connections. Current was taken from the trolley line. In this way a joint could be cleaned in about 10 min. The joints on the relaid rail have plates held in place by bolts and tie-rods.

Current for the augers, spike wrenches, sand-blast machine and concrete mixer was obtained from the trolley wire over the permanent track by means of an extension pole with hook on the end. This did not interfere with the cars, as these were operated from temporary wires placed over the temporary tracks.

The Metropolitan Street Ry. Co. carried on the reconstruction with its own forces, the number of men varying according to the different stages of the work.

At some points where track intersections were involved the work was done at night to avoid interruptions to traffic. The work was carried on with a view to rapidity and to the convenience of adjacent business houses, the results being satisfactory to all parties. The method of handling the work, as well as much of the equipment used, was devised by A. E. Harvey, Chief Engineer of the company, who was in direct charge of the work.

Ornamental Plants on Sewage Bed, Harrison, N. Y.

The sprinkling filters of the sewage-works of Harrison, N. Y., have been ornamented with plantings at the intersections of the sprays. The disposal works, even when the sprays are not in action, is sightly, but when the sprays are in operation the effect is very attractive, and the expense was trifling.



ORNAMENTAL PLANTS ON SEWAGE SPRINKLING FILTER, HARRISON, N. Y.

As will be seen from the view, 2-ft. lengths of 6-in. vitrified pipe, filled with earth, are embedded in the broken stone of the filter, and the moisture from the sprays and in the stone produces thriving plants.

The photograph also shows that in designing the pumping station a slightly greater expense than was required by the stern necessities of the case was incurred by adding a little cut-stone trimming.

The effect both of the plants and of the stone trimmings on the general appearance of works devoted to such a purpose as sewage disposal is worth while, and engineers should more frequently insist upon such slight additional expenditure.—Alexander Potter, Consulting Engineer, New York City.

Hydrated Lime to the amount of 0.1 cu.ft. to each 1 cu.ft. of cement is to be used for all concrete in the culverts, bridges and pavement of the 6½-mi. section of the Coleman du Pont Road in Sussex County, Delaware. A concrete pavement is now being constructed in Somerset County, Maryland, under the direction of Henry G. Shirley, Chief Engineer of the State Roads Commission, in which a percentage of hydrated lime is also used. Previous experience in Maryland with hydrated lime for pavements was noted in "Engineering News," Mar. 11, 1915, and June 3, 1915.

Laying Submerged Outfall Sewer in Surf

By A. J. Cleary*

To lay cast-iron pipe in calm water does not present any unusual engineering difficulties. To perform the same work through a heavy surf, under such adverse conditions as prevail at Baker's Beach, near the entrance to San Francisco harbor, demands ingenuity.

The Baker's Beach outfall is an 18-in. cast-iron, flexible joint sewer pipe, which extends 800 ft. from the shore line and will have a discharge chamber 32 ft. below mean low tide. On account of the difficulties incident to laying the submerged pipe at the location specified, the city engineer allowed the contractor to try several methods, only insisting that the finished line and outfall absolutely conform to the specifications. The two unsuccessful and the final and successful method tried are here described.

First, the whole 800 ft. was laid just above high-tide mark parallel to the water's edge, the joints leaded and the two ends sealed and buoys attached. An attempt was then made to float the pipe into position at right angles to the shore, remove the buoys and allow the pipe to



FIG. 1. SECOND ATTEMPT TO LAY OUTFALL SEWER

*Assistant City Engineer, San Francisco, Calif.

settle to its final position. This trial resulted in failure, as described in *Engineering News* of Feb. 18, 1915, page 325.

It was then decided to try laying the pipe in short sections. The lead was melted out of every fourth joint, producing sections 48 ft. long, two of which were subsequently united. A skidway 24 in. wide was built from



FIG. 2. OUTFALL SEWER SUCCESSFULLY LAID FROM TRESTLE, SAN FRANCISCO

shore to beyond the first line of breakers and a platform consisting of five 8x8-in. runways was erected adjoining the skidway, as shown by Fig. 1. The 48-ft. sections of pipe were placed on this platform so that they could be rolled in rapid succession onto dollies that would carry them down the skids. The three joints in each 48-ft. section were recalked while the pipe was on the platform. A barge was anchored 800 ft. from shore, and a hand-winch set up on the barge. The intention was to pull a 48-ft. section far enough out on the skidway to allow the next section to be rolled in line behind it. The joint was then rapidly poured and calked and four sealed empty barrels wired to each pipe length to buoy up the line, as in the first attempt. When the two 48-ft. sections were joined and the barrels attached, the winch on the barge was operated and the pipe pulled 48 ft. seaward. The above operation was then repeated. Anchors, all equipped with block and tackle, were placed in two lines, each line 50 ft. from the proposed center line of the pipe. As the pipe was pulled seaward, lines from the anchors were fastened to it and kept taut to hold it in its proper position.

June 5 was chosen as a suitable day for launching the pipe in the manner just described, as all indications on the day before were favorable for a calm sea and little wind. Accordingly, work was begun on the morning of that date and all went successfully until 240 ft. of pipe had been floated to sea. With the turning of the tide a strong breeze set in through Golden Gate and heavy swells began to break on the beach, greatly impeding the work. Finally, a particularly high breaker swept the pipe off the skids, stove in many of the barrels and the half-laid line sank gradually to the bottom of the ocean.

It was then decided that the surest and safest method of laying the pipe would be to drive a pile trestle along the proposed line of the sewer, lay the pipe thereon and later lower it into place. Forthwith a pile trestle as shown in Fig. 2 was built and the pipe laid and successfully lowered. The reason that this was not done originally was because during the winter and spring seasons the ocean in the vicinity is not calm enough for periods sufficiently long to permit of anchoring a pile driver along the line of the sewer.

Testing Surveyors' Tapes by the Canadian Government

By J. A. Macdonald*

The Surveyor General's office of Canada is required by law to test and certify to the length of Dominion surveyors' standard tapes. To carry out this work and make tests of other surveying instruments a special building has been erected and equipped.

This building consists of two rooms, an office with vestibule and the testing room. The testing room is 150 ft. long by 10½ ft. wide. The 4-ft. walls consist of five thicknesses of brick, a 1-in. air space, sheeting, tar paper, 18 in. of shavings, sheeting, a 4-in. air space, tar paper and double sheeting. Between the ceiling and the roof is a layer of shavings 4 ft. thick and beneath the floor a 2-ft. layer of shavings, under which is 5 ft. of cinders to solid rock.

The only openings other than the entrance are two air intakes, one at each end of the room, and four adjustable ventilators in the ceiling. The air intakes are at the base of the wall and the quantity of air admitted is easily regulated or completely shut off. Electric fans at each end of the room give circulation to the air and insure a uniform temperature throughout the room. The exit into the outer room consists of two doors, with a 4-ft. air space between. The outer door is of the ordinary type, but the inner one is an insulated, air-tight door of the kind used for refrigerators.

To maintain a temperature of 62 deg. F. in cold weather there is an electric heating system. The apparatus is of the three-heat type, giving low, medium and high heat. The degree of heat is controlled from a marble switchboard. The heater and wire conduits are shown near the base of the wall in Figs. 1 and 2.

Tapes are compared with a base, the ends of which are lines scratched on polished surfaces. The distance between the marks is determined by an invar bar, 4 m. long, standardized at the International Bureau of Weights and Measures at Paris. The marks are established on

*Topographic Surveys Branch of the Department of the Interior, Ottawa, Ont.

concrete piers extending to bed rock. The marks are at intervals of 0, 4, 8, 10 and 12 m., at 50 ft., at 16 and 20 m., 66 ft., 24, 29 and 30 m., 100 ft. and 32 m.

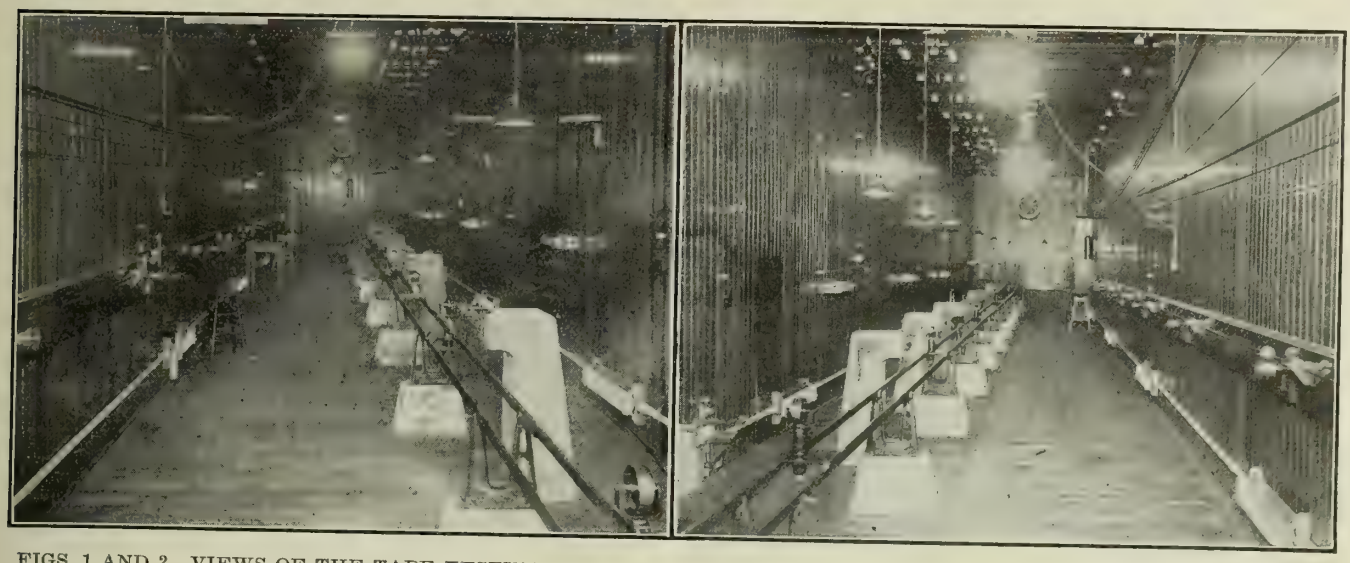
The invar bar is kept in a wooden case and only the graduations in use are exposed. The temperature of the bar is taken from two thermometers inside the case, read through openings in it. There are 12 thermometers suspended in protective guards at equal intervals along the walls of the room. These are graduated to 0.1 deg. C. and can be estimated to 0.01 deg. C. A mean of the readings gives an accurate determination of the room temperature.

The bar is supported on a carriage traveling on rails and is quickly and easily moved to any part of the base (Figs. 3 and 4). The carriage with microscope has slow-motion adjustment for both vertical and horizontal movements. Small 2-cp. electric lamps to illuminate the graduations are mounted on the concrete piers.

The track which carries the bar trucks is supported every 2 m. by cast-iron U-shaped frames, resting on concrete piers carried down to solid rock. The U-shaped frames permit the tape when being tested to sag unobstructed. The pulley supports (see Figs. 1 and 2) for suspending a tape may be placed at any point along the track and clamped in position by two thumb-screws.

The cord or wire from the end of the tape passes over a grooved pulley and is attached to a weight to give the standard tension desired. The pulley has ball bearings and may be aligned vertically and horizontally by means of thumbscrews. Intermediate ball-bearing pulley supports may be placed as desired.

The testing room is also equipped with the ordinary apparatus for testing transits for the stadia constant and for testing transits and levels for errors of collimation. All surveying instruments sent out to Dominion land surveyors, as well as those used in the government geodetic surveys are tested here before shipments. The building and equipment are in charge of W. C. Waye, of the Topographic Survey staff, from whom the writer obtained the foregoing information.



FIGS. 1 AND 2. VIEWS OF THE TAPE-TESTING ROOM OF THE TOPOGRAPHIC SURVEYS BRANCH OF THE DEPARTMENT OF THE INTERIOR, OTTAWA, ONT. (FROM OPPOSITE ENDS OF THE ROOM)

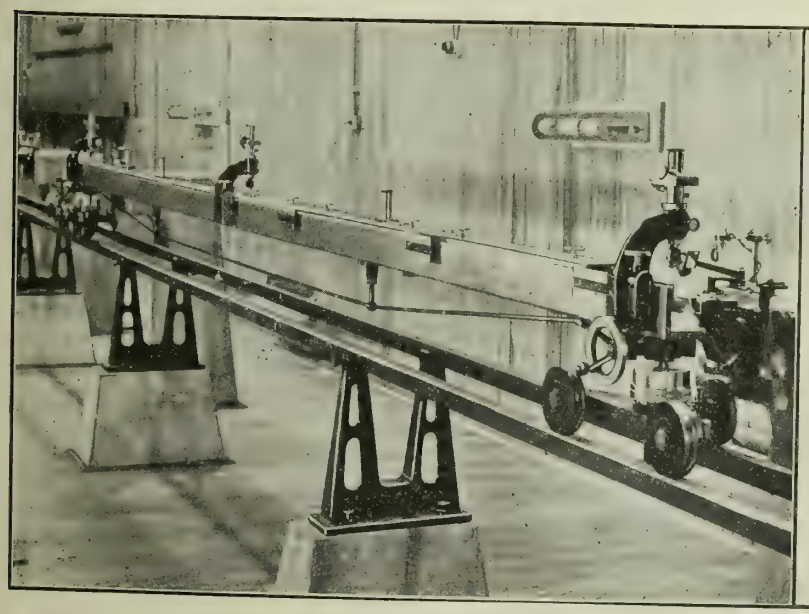


FIG. 3. FOUR-METER INVAR BAR FOR DETERMINING LENGTH OF STANDARD BASE

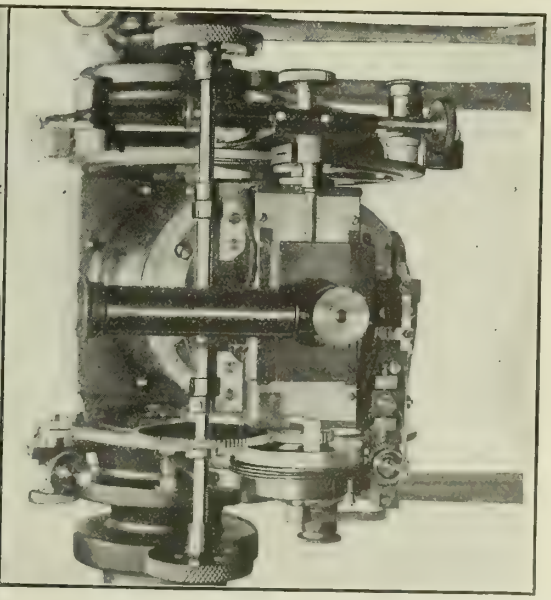
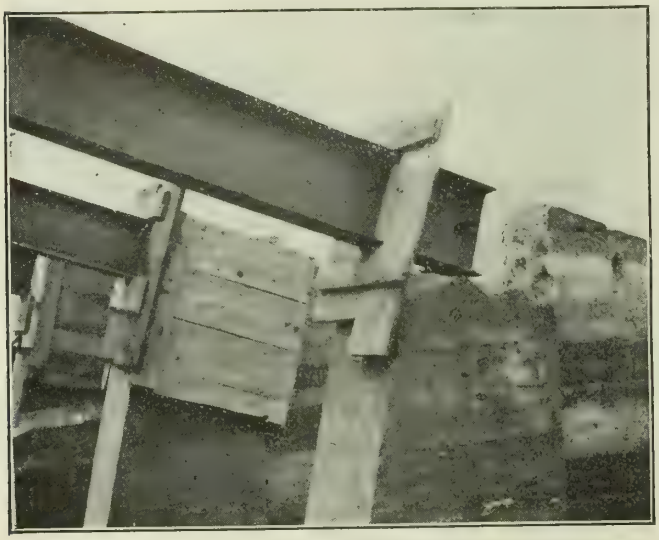


FIG. 4. NEAR VIEW OF MICROSCOPIC COMPARATOR, INVAR STANDARD

NOTES

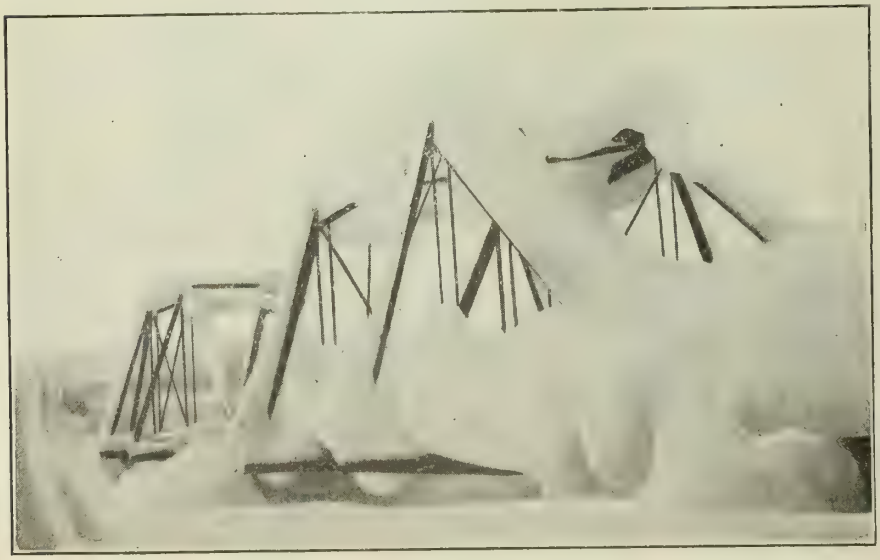
The Steel and Concrete Floor Supports of the Sheepshead Bay automobile racetrack were joined as shown in the accompanying illustration. The track is a 2-mi. oval, 70 ft. wide, with a wood floor made of 2x4-in. timbers on edge. The floor is supported on concrete ribs, or walls, spaced 6 ft. 7 in. on the straightway sections and 6 ft. 8 in. (on the outside



SHEEPSHEAD BAY MOTOR RACETRACK FLOOR CONSTRUCTION

edge) on the turns. The concrete is carried to a height of 6 ft., above which the floor is carried on 10-in. I-beams. The concrete walls were constructed with the corner omitted, as shown, and the base for the I-beam was left about 2 in. below grade. The I-beam was then blocked up and inclosed in special forms, as shown. A ¾-in. bolt was placed crosswise through the web for an anchor.

Cutting Lock Jointed Steel Sheetpiling, where the thickness of each joint was 2¼ in., was easily and quickly accomplished recently by an oxyacetylene torch on a bridge-foundation job in Florida. About 860 ft. of piling had to be cut off to a uniform height. The work was in connection with the construction of the piers for a large drawbridge over the St. John's River at Jacksonville, Fla. The piling was the Lackawanna Steel Co.'s lock-joint type with ⅜-in. web. On account of the thickness to be cut at the lock joints the operator was handicapped in making speed, but nevertheless between 40 and 50 ft. of cutting was done in 7 hr., with only one torch. Prest-O-Lite gas was used.



SNOW ON AN ALASKAN BRIDGE

Medieval Piledriving Methods were resorted to in building the Sheepshead Bay automobile racetrack, Brooklyn, N. Y. The east side of the track lies in a salt marsh near the shores of Jamaica Bay, and it was necessary to put piles under the concrete floor-walls and column pedestals. The accompanying view shows one of the two piledrivers used. The job was



TWO-HORSEPOWER PILE DRIVER, SHEEPSHEAD BAY RACETRACK

one requiring as much speed as economy, and the two-horsepower piledriver shown filled the bill. The hammer was a round block of hard wood about 3 ft. long by 30 in. in diameter, raised by a block and fall and dropped by a man-operated tripping line. Only 6 or 8 ft. of penetration in muck was required. The track was described in "Engineering News," Aug. 19, 1915, p. 337.

New York City Water-Supply Distribution System—Excluding tunnels and masonry conduits there are 2800 mi. of mains of sizes varying from 4 to 60 in. in diameter, to which are connected 60,000 valves, 43,000 hydrants and over 360,000 services. Over 500,000,000 gal. daily are delivered through this system. In addition to the domestic water-supply system there are three separate high-pressure fire systems covering over 7200 acres, with 170 mi. of mains from 8 to 24 in. in diameter, on which are located 4100 hydrants and 6650 valves. To the existing distribution system there is to be added, probably in the present year, the great Catskill water-supply system, with its 17 mi. of rock tunnel, 22 feeding shafts, and 16 mi. of delivery mains, varying on land from 48 to 66 in. in diameter, and including two miles of 36-in. submerged pipe, connecting the boroughs of Brooklyn and Richmond.—W. W. Brush, Deputy Chief Engineer, Department of Water Supply, Gas & Electricity, New York City, in a paper presented to the American Water Works Association.

An Alaskan Snow Load—The accompanying view of a highway bridge heavily loaded with snow, taken in the winter of 1914, shows the two 60-ft. spruce-timber trusses of the Stewart Creek highway bridge on the Valdez-Fairbanks Road in Alaska. The view first appeared in "Professional Memoirs, Corps of Engineers, United States Army and Engineer Department at Large," for July-August, 1915, in an article by Capt. G. E. Edgerton entitled "Wooden and Combination Highway Bridges." In the article Captain Edgerton states that in rare instances in Alaska the snow load reaches as high as 60 lb. per sq.ft. on the floor of the bridges, but does not state whether or not this particular load is that maximum. It is evident from the view that not only the floor load but the snow load on the chords of such timber bridges must be taken into account in design. The article further states that "light snow weighs from 5 to 12 lb., and packed snow weighs from 15 to 45 lb. per cu.ft. Where a long series of weather observations is obtainable, the writer recommends that the maximum observed annual snowfall in inches be multiplied by 0.1 to obtain the proper snow load in pounds per square foot for the design of the bridges that are not to be regularly cleaned of snow. For bridges regularly cleaned, the maximum recorded snowfall in inches for a single storm should be multiplied by 0.9 to obtain a proper figure for the snow load in pounds per square foot."

Editorials

Lessons of Galveston's Storm

The Galveston seawall has been more fortunate than most engineering structures in the degree of appreciation it has received. In the popular mind it has shared somewhat the fame of the Holland dikes, for like those sturdy earth ridges it serves to protect human life and habitation against not only a battering but an engulfing sea. Merely as a matter of pride in their profession and its works engineers should be glad that the wall withstood its latest test, for the notoriety of its failure would have been as widespread as has been the fame of its success.

Aside from this just pride, though, engineers will recognize that the seawall at Galveston was not an exceedingly complicated piece of engineering construction and that given the type of beach and foundation available anything more than superficial damage to the wall was hardly to be expected. Apparently the only improvement that could be wished is an increase in height which would have prevented the overtopping and consequent scour of the boulevard and beach structures.

The wall admirably served its primary purpose—to keep the Gulf waves from battering down the structures that line the south shore of Galveston Island; but its secondary fnnction—to act as a dam to keep the high water out of the streets—was made successful only by the aid of the less spectacular but equally efficient grade elevation, which was in reality the most important work following the disaster of 1900. The fact that most of the flood damage seems to have been on the north side of the island where grades are still nearly as low as they were before 1900 points the way to future work.

Another feature of the latest Galveston disaster deserves pointing out. By far the greatest damage to structures was due to the wind. Against wind action engineers have only the most elementary of defenses. For the other destructive elements, fire and flood, preventive as well as protective measures can be taken, and these preventive measures are the most important part of the defense. Nothing has as yet been discovered that will prevent wind nor divert it from its destined path, and its vagaries of force and direction are all too little understood. In structures of sufficient importance the wind danger is properly considered, with more or less close approximation to pressures as they actually exist, but the vast majority of buildings in which the engineer has no part are designed with shameful disregard to the stresses to which they may be subjected in times of storm. It is only the rare occurrence of such winds as those which recently swept over Cincinnati and later over Galveston that saves such buildings from widespread destruction. Incidentally it may be remarked that the failure of the small house in wind or hurricane is practically always the result of insufficient anchorage. Almost any workmanlike framing will hold a house together if only it can be kept solid on its footings. And yet how many dwellings are anchored firmly to their cellar walls?

Pestilence and Floods

The notion that flood is followed swiftly by pestilence still persists in the minds of newspaper reporters and headliners, as has been shown since the recent Erie flood and Galveston storm. The notion appears to be founded more upon accumulation of dead bodies or perhaps a stoppage of sewers than upon possibly contaminated water and food supplies and the crowding together of homeless and helpless people.

To a large extent danger of a pestilence is popularly associated with a stench rising from decomposing organic matter rather than with the real danger of infection from the germs of communicable disease. This is not strange in view of long-continued persistence in the popular mind of the filth-theory of communicable disease.

It is a notable fact that epidemics of virulent communicable diseases, the real meaning of pestilence, did not follow the Johnstown, the original Galveston, the Austin (Penn.) nor the Dayton floods. However much this may have been the result of putting skilled sanitarians at once in control of the flood-swept districts, it is none the less true that the greatest dangers in each case were not because of the dead but because of the living.

This is the difference between the old and the new health-protective work: The first was directed against inert organic matter, which at worst could only cause a stench if left in place and not allowed to infect water and food used by human beings; the second goes swiftly and surely to the control of each infective human being, the destruction of emanations containing disease germs, and the protection of water and food from such germs as may possibly escape the utmost vigilance.

But for the moral effect upon the uninformed and the more or less indirect benefits arising from the destruction of relatively small amounts of infective matter, much of the strictly cleansing work considered so essential by the half-informed might be left undone after floods and other catastrophes causing loss of life with little increase in the number of cases of communicable disease. Nevertheless, sanitary authorities and the public alike are warranted in insisting upon rigid measures of cleanliness at such times, provided only they are carried out with a true conception of their health-protective efficiency and do not either directly or indirectly lessen the untiring vigilance with which health measures that count most should be conducted.

Sprinkling vinegar in a sick room was once considered a safeguard against virulent communicable disease. Scattering about some chemical reagent of unknown disinfecting value and many other measures practiced or advocated at the present day are equally futile against real dangers of pestilence. These must be combated with the weapons of modern sanitary science—the nature of which has not yet been sufficiently grasped by press reporters and headliners to fit the exigencies of news reports on great floods.

Fast Tunnel-Driving Records Under the Bonus System

The value of the bonus system of paying wages to secure rapid progress in driving tunnels is well shown by an article appearing elsewhere in this issue. This system was tried successfully at five recently built tunnels, where high-speed records were attained; and as it was the only important practice that was common to all these contracts, the records made can be attributed logically to the bonus system.

Deciding upon a reasonable base rate—that is, a rate of advance above which a bonus is to be paid—is the first essential step in applying this system to a job. Past performances and the law of continuity are the only accurate guides in arriving at a decision. A base rate may, in the light of altered conditions, become obviously unfair, in which case it should be changed. The bonus paid should not be excessive, but should be liberal enough to be a distinct incentive. A fair bonus system would be one which doubles wages if the rate of progress is doubled.

The principal saving effected through the bonus system of paying wages comes through shortening the time of driving a long tunnel and thus reducing the interest charges on the work. The sooner it becomes operative, the sooner it will begin to earn an income. There is also a saving to the contractor in reduction of charges for interest and depreciation on his plant and bond and insurance payments; while the saving in labor per linear foot of tunnel driven is also considerable. There is very little difference in the cost of supplies, as this tends to be nearly constant per linear foot of tunnel.

That men appreciate the opportunity to earn extra money is shown by the figures for the record month on the Mount Royal tunnel work at Montreal. The minimum or base rate was 14 ft. per day, making the total advance required in 31 days 434 ft. The rate of bonus was so proportioned that the men in the hole would just about double their wages if they doubled progress, no one outside of the tunnel participating in the bonus. The actual progress attained was 810 ft., which gave the workmen in the hole an 85% addition to their usual pay. The actual saving was only about 13% on the tunnel payroll, but was a saving of nearly 50% on the construction overhead, outside payrolls, interest, etc. Practically all the work on this contract was on a bonus basis.

An actual instance of the effect of the bonus system on the industry of the men is given by F. P. Brown, Chief Engineer of the Canadian Northern-Montreal Tunnel & Terminal Construction. Seven muckers were employed in the heading under normal conditions, three in advance throwing the muck back from under the bar and the four other men loading onto the cars direct. Mr. Brown says that normally a mucker thinks he is doing a good day's work when he shovels 7 cu.yd. of loose muck into a car, and that really this is all that can be expected of him. During the record month at the Mount Royal tunnel, however, the four muckers who were loading onto the cars handled up to 15 cu.yd. per man per shift, and averaged over 12 cu.yd. In order to appreciate that this is probably a mucking record, it must be remembered that nearly two hours were lost out of the eight in blasting, as two shots were fired regularly every shift. On this work a foreman never had to hire or discharge men during periods of rapid progress. If a man failed to do his share of the work, his comrades ran him out of the tunnel and brought in a better man to take his place.

In tunneling under the bonus system it is important to guard against a tendency toward carelessness on the part of the men in their endeavor to make high speeds. Where timbering is necessary, it should be regularly inspected.

Rainfall Troughs and Humps

In a brief article on long-time rainfall records in New York State written some time ago, but published in this issue of *Engineering News,* the author calls attention to the fact that we are "still in a 'trough' of a cycle of rainfall." The experience of the past six weeks and particularly of the past ten days might lead to the belief that, in the Eastern half of the country at least, this "trough" has become a hump. Of course students of meteorology know that abnormal weather conditions loom much larger at the time of their occurrence than they do in the records, but nevertheless the wide distribution, long continuance and occasional severity of the July and August rains of 1915 make them out of the ordinary.

Fortunately so far there have not been the coincidences of distribution and severity which bring about overtopped levees and terrible floods, but there have been any number of local "cloudbursts" and consequent floods varying in magnitude from the water-soaked cornfield to the flooded streets of Erie. Taken altogether the money and life loss has been as great as in one widespread flood.

From the data now available it would appear that one rainfall record has been broken—that is for amount of fall in 24 hr. At St. Petersburg, Fla., as noted in the news pages, a 24-hr. precipitation of 15.45 in. was recorded on Aug. 1-2. In Jewell, Md., on July 26, 1897, 14.75 in. of rain fell, and Galveston, Tex., has records of 12.16 in. in 12 hr. and 14 in. in 24 hr. on Oct. 22, 1913, and July 13, 1900, respectively. These seem to be the nearest approach in the United States to the recent Florida downpour, although the tropics could probably produce greater concentrated rains if the records were available. However, anyone who has seen an inch-an-hour rain can appreciate what a terrific display of the elements there is when a dozen inches are concentrated in as many hours, as was evidently the case at St. Petersburg. That city was extremely fortunate in not being located at the bottom of surrounding hills or else its destruction would have been certain.

Aiding Public when Roads Are Closed for Repair

A spirited correspondence has been going on in one of the New York morning papers over the difficulty motor tourists are having in finding their way through side roads, where a portion of the Albany Post Road has been closed for reconstruction. This happens to be a particularly popular road, and the objections of automobile owners here seem to be well founded, as they probably are in many similar cases. Every one who has toured over the roads of an unfamiliar country knows how annoying it is to be detoured from a good pavement to the ordinary earth road. Add to this a hilly topography with crooked roads and the aggravation is increased.

The highway engineer should never lose sight of the fact that he is a public officer, and his chief aim should be to give the public satisfaction so far as he can without interfering with the conscientious performance of his work as an engineer. Where annoyance to the traveler is inevitable, as must be the case where a portion of a through road is closed to traffic, let the annoyance be as slight as possible. Spend a few extra dollars and properly mark the detour throughout its whole length, or make it part of the contractor's duty to do so.

It might perhaps be well to go a little further where a detour is to be used for several months, and spend a few hundred dollars in making the worst portions of it a little more passable. This might be arranged with the local road officials, so that the improvements in the side roads could be made of permanent value.

The voluntary appraisal of a municipal water-works plant for the sake of readjusting rates on a financially sound basis and with due regard to justice to its consumers is sufficiently unusual to justify putting on record when it occurs. The water rates of the municipally owned plant of Alliance, Ohio, we are informed, were arrived at, as has so generally been the case in both municipal and private plants, on a hit-and-miss basis. The result, it is stated, is that the rates have not brought in sufficient revenue to pay the cost of operating the plant. The city officials have wisely decided to conduct a reform. In order to have the rates so adjusted that they will bring in sufficient revenue to pay operating expenses, and also make a proper return on the investment, the authorities have engaged Chester & Fleming, consulting engineers of Pittsburgh, Penn., to appraise the works.

It is not only municipally owned works, as intimated in the immediately preceding paragraph, that conduct some of their operations on a hit-or-miss plan and that finally realize this fact and call in outside engineers to put them right. The firm of engineers already named has just been engaged to operate the plant of the Upper Sandusky Water-Works Co., of Upper Sandusky, Ohio, and has for some time past been operating two other privately owned water-works. In each case these engineers are engaged on a yearly basis and are responsible for the entire management of a plant, including not only its operation, but also its financial affairs. Of course this is by no means the first time that engineers have been engaged to operate public utilities, but the practice might well be more common, especially as regards water-works, with profit to engineers and utilities alike.

Letters to the Editor

Patentees and Royalties

Sir—In the July 29, 1915, issue of *Engineering News* appears a letter from Daniel B. Luten in which he attempts to justify the bidding of a patentee on his own patented plans. The writer takes issue with some of Mr. Luten's statements in the matter.

Mr. Luten assumes that if "all bidders figure the same cost and profit, then the patentee would file the same bid as the others if he included the specified royalty for himself." This is perfectly obvious. However, on the qualification, "if he included the specified royalty for himself" hinges the whole argument. Suppose he doesn't?

A hypothetical case will be given and then followed by an actual case. Suppose a piece of work is to be done. Its estimated cost, plus profit and royalty, is $30,000. The royalty of 10% will be $3000. The cost and profit, as assumed by Mr. Luten, is the same in the case of all bidders. The bid will be: Cost, $23,478.26; 15% profit, $3521.74, royalty, $3000; total, $30,000. The patentee-contractor will receive $3000 regardless of who receives the award. But supposing the patentee-contractor is hungry for a job, and the work presents few difficulties so that the profit is fairly assured. Will the patentee-contractor let the other fellow have the work and take his $3000 royalty or will he "knock off" $500 from his figured royalty and take the job himself? In one case he will be assured of $3000, in the other case he has a good chance of making $6021.75, his estimated profit and $2500 royalty. Human nature being as it is, and contractors being the gamblers they are, it would be logical to assume that the patentee-contractor would take the chance at the $6021.75. While the patentee-contractor may not be so unfair as to take advantage of a competitor in this way, he might salve his ethical conscience by saying to himself: "Now, I've got that $3000 'edge' on the other fellows, I'll cut $500 off my profit." The writer is not a pessimist in the matter of the honesty of his fellow-men, but gives the foregoing merely as an example of what might happen. He will now give an example of what did happen.

A year or so ago the writer submitted a bid on a small arch span in competition with the representative of the owner of the numerous cost-saving patents on this type of structure. The two submitted bids were $2265 and $2275, the writer's being the lower by $10. Both bids were rejected, and the patentee-contractor, as he will be called, was awarded the job the same day at a private letting for $1975, a reduction of $300 from his original bid.

The writer's bid was as follows: Cost, $1698.75; 20% profit, $339.75; royalty, $226.50; total, $2265.

The patentee-contractor's bid, figured on the same basis would have been: Cost, $1706.25; 20% profit, $341.25; royalty, $227.50; total, $2275.

The limit at which work may be let at private letting is $2000. The bid was let at $1975. The queries arise: Did the patentee-contractor, whose profit and royalty amounted to $568.75, (?) deduct the $300 from his profit, leaving himself but $41.25, or did he eliminate the royalty entirely and deduct $72.50 from his profit? What would have happened had the low bidder deducted $300 in order to get the work? The answer to the first query is that it makes no difference which he did. The answer to the second is that he would not have done it. In this

case the patentee-contractor most assuredly had an advantage—and used it!

The writer agrees with Mr. Luten, however, that such lettings are fair, if certain qualifications are present. These qualifications are that all parties to the letting be fair and honorable and that the patent have merit. Mr. Luten mentions the attitude of engineers and contractors toward patented plans and intimates that the attitude is unfavorable. He fails to make any distinction between the relative values of patents. Toward patents having intrinsic merit and value engineers and others are fair and have no disinclination toward paying royalties; indeed are very anxious to do so if they are enabled to save money thereby. Unfortunately for the profession, however, a great many patents are issued which have no value whatever from an engineering standpoint.

R. C. Hardman.

Colorado City, Colo., Aug. 14, 1915.

Mortar Cushions for Granite-Block Pavements

Sir—While agreeing with what you say about the general unwisdom of rashly departing from well-established engineering practice, in your editorial of Aug. 5, 1915, on "Mortar Beds for Brick and Stone Pavements," I am of the opinion that this is one of the cases where such departure is warranted.

The arguments you present in favor of sand-cushions are old and standard, but are open to challenge. You admit that the sand cushion is not elastic, but claim that it has some "resiliency" under travel. Now resiliency and elasticity are practically synonomous terms; but it is made plain that by resiliency you mean that kind of yield which, in sand, is better expressed by mobility—that is, shifting, a property or condition that engineers agree is deleterious if not fatal to a pavement.

The fact doubtless is that a body of sand, thoroughly compressed in a confined space, is absolutely rigid and can have only such elasticity as is possessed by the individual grains. This elasticity probably differs little from that of a granite block itself and is too infinitesimal to have any effect on travel over the street. The sand cushion under a properly constructed granite-block pavement doubtless becomes in time as rigid as the concrete foundation, otherwise constant yielding must in time either cause the sand to disappear or disturb the pavement.

I have given a good deal of attention to this matter and was once, many years ago, so rash as to recommend for a highway a brick pavement with the brick set flatwise on a bed of soft, rich mortar, the joints to be filled with the same mortar (and, by the way, was promptly "turned down" by both the local engineer and the brick manufacturers). Hence, I take a lively interest in the present discussion and experiments, which I believe will in time lead to the abandonment of sand cushions.

We now build our pavements with a concrete foundation to carry the loads and a wearing surface to resist wear, interposing between the two a bed of sand possessing no strength for either function. Why not rather unite foundation and wearing surface in a way to utilize their combined strength by making the structure monolithic? The obvious way to do this is by setting the brick or stone in a rich mortar bed placed on the green concrete foundation and grouting the joints, all the work being done before the cement in any part begins to set.

This would enable us materially to decrease the thickness of both the foundation and the wearing surface. The full thickness of the whole pavement would be utilized to carry loads. Neither granite blocks nor bricks require the depth now common in practice to take care of the surface wear upon them.

A granite block or a brick 3 in. in depth will give about as much service as one 7 in. in depth if it can be securely and rigidly held in place on the street; and if supported on a 4-in. concrete foundation, the pavement would have about the same load capacity as one built with a 6-in. concrete foundation, the usual sand cushion, and 6-in. granite blocks—barring the possible arch action of the blocks.

Such a construction would obviously reduce the first cost, and there is no reason to believe it would increase the cost of maintenance. The return in service rendered per dollar invested would certainly be materially increased. There is not, so far as I am aware, any reliable evidence that such a pavement would be appreciably less "resilient" or less easy upon traffic than those with sand cushions.

Years ago, the brick manufacturers asserted that brick laid on their sides would not wear well because of the direction of the "grain," due to the method of manufacturing them. It is not clear how a vitrified brick can have much grain, but in any event it is now claimed that this alleged difficulty has been overcome.

S. Whinery.

New York City, Aug. 9, 1915.

[The questionable "resiliency" of a sand cushion could be very easily demonstrated or not by breaking cubes of stone under impact, one test to be with the cubes resting on a sand bed and the other test with the block set in mortar or concrete. No one can deny that however closely coarse sand is packed, there is still a large percentage of voids in the material, while certainly a "rich mortar" ought not to have many voids. A material with 30 per cent. voids has probably more cushioning effect than a rigid solid.—Editor.]

NOTES AND QUERIES

Louisville Bascule Bridge—The novel lever lift bascule bridge over the Louisville & Portland Canal at Louisville, Ky., described in "Engineering News," July 15, 1915, p. 123, was fabricated by the Penn Bridge Co., of Beaver Falls, Penn. It was erected by the Middle States Construction Co., of Columbus, Ohio.

Water-Works Bill Receipting and Clipping Machine—J. Walter Ackerman, Chief Engineer and Superintendent of Water-Works, Auburn, N. Y., informs "Engineering News" that he at one time used a machine for receipting the bill and coupon or stub of a postal-card form of water-works bill. This machine perforated the date on both the coupon and the stub and then cut the two apart. Mr. Ackerman desires to get a machine which will do this and which in addition will deposit the coupon in a receptacle provided for the purpose. His original machine was made by the B. F. Cummings Co. Mr. Ackerman has recently been using a rubber stamp for dating and receipting his water-rate bills. He finds that sametimes the date made by the rubber stamp becomes obliterated. He adds, as of possible interest to readers of "Engineering News," that "after his postal card form of water bill has been receipted and the coupon clipped off, a stamp-affixing machine is used to place a one-cent postage stamp over the original stamp on the card, after which the postal is mailed back to the consumer as a receipt."

Shipping Piers in Southwark District of Philadelphia

SYNOPSIS—Two shipping piers 550 ft. long, 170 ft. wide with 200-ft. docks. In center of Philadelphia's shipping district. Concrete substructures on timber piles. Steel and concrete superstructure.

The city of Philadelphia is now completing two large shipping piers on the Delaware River within one mile of Market St., the center of the city's active waterfront, and are known as the Southwark piers, and are designated as Nos. 38 and 40 South Wharves.

The city is about to embark on a very large harbor development, in which is contemplated the construction of a series of twelve or more large piers with uptodate mechanical equipment and direct railroad connections. These piers will range in size from 300 ft. in width to 1200 ft. in length, and will be located at the south end of the city's waterfront, in a district not now adequately developed on account of adverse railroad connections. The



FIG. 1. RECENT VIEW OF HEADHOUSES OF SOUTHWARK PIERS FROM MARGINAL STREET

within easy teaming distance of the principal warehouse district. These piers are distinguished by their exceptional design and freight-handling equipment. On account of the old district in which they are located they new plan, however, contemplates also the entire revision of the railway yard and tracks at the south end of the city, so that ample railway facilities will be afforded to the pier district, and, in addition, a better development

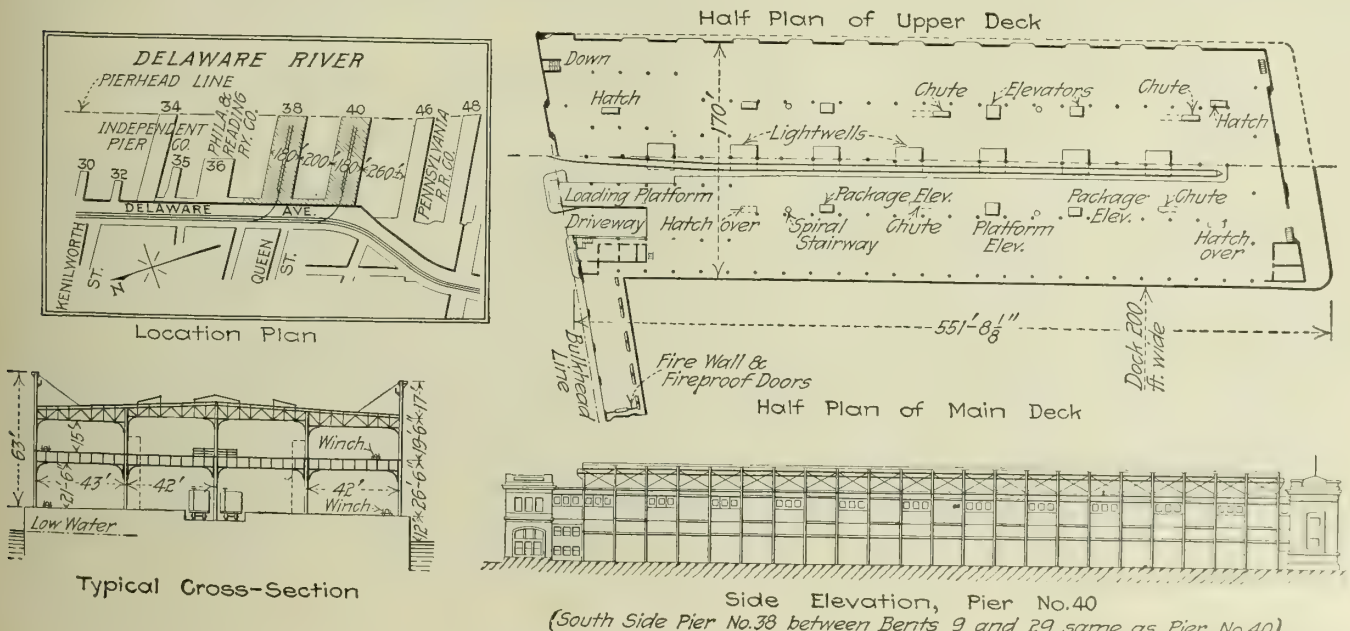


FIG. 2. GENERAL DETAILS OF SOUTHWARK PIERS NOW NEARING COMPLETION ON DELAWARE RIVER

of the railway terminals will be had. These piers, one of which has just been started, are entirely separate from the Southwark piers, which are in the part of the waterfront already under development and which are intended not only for permanent future use but to provide ample steamship accommodations until the new pier area is completed.

Piers 38 and 40 are each 170 ft. wide by 550 ft. long, with docks 200 ft. in width flanking each pier (Fig. 2) on a timber platform with concrete retaining walls on the outside; (3) a solid earth-fill pier with outside retaining wall and the interior columns carried on timber piles; (4) a solid earth fill of the same type, except that concrete piles were substituted; (5) a timber and concrete design in which the pedestals for the pier sheds were of concrete and all the rest of the substructure timber; (6) a type similar to the first one named, except that instead of a concrete cross-wall, extending clear from the

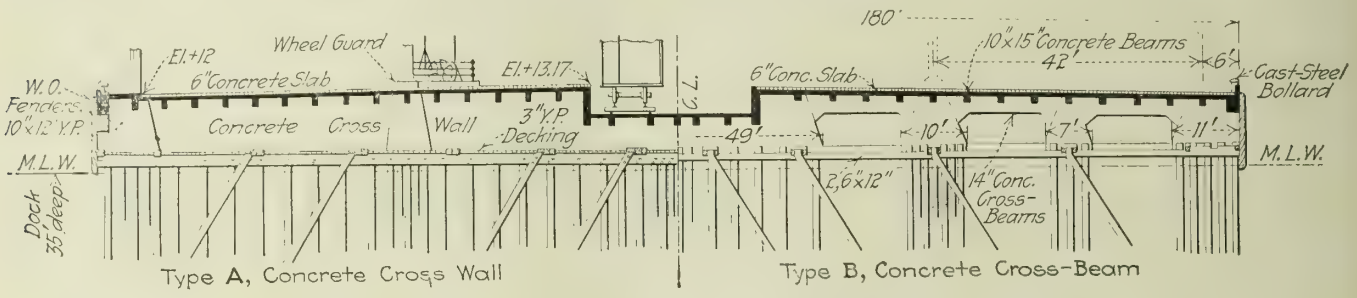


FIG. 3. TWO ALTERNATE DESIGNS FOR SOUTHWARK PIERS
Type A was used for Pier 38 and Type B for Pier 40

The superstructures of the two piers are identical, comprising two-story steel-and-concrete sheds, with inshore and outshore headhouses for office purposes and a line of bulkhead shed 30 ft. wide paralleling the marginal street and connecting the two piers. The headhouses are covered with concrete of pleasing architectural design.

The substructures to the new piers are practically identical, differing only in a minor particular. In 1914 the Department of Docks, Wharves and Ferries made a number of alternate designs for the substructure of the then proposed Southwark piers and called for bids on the different types. These designs and the bids were described in *Engineering News* of May 28, 1914, p. 1212. All the substructures had timber piles for footings, the variation being in the method of carrying the pier above the tops of the timber piles, which were cut off at mean low water. The different designs comprised (1) a concrete cross-wall carrying a concrete floor; (2) an earth fill floor of the pier to the cappings of the piles, concrete pedestals under the columns rested on pile cappings and were connected by reinforced-concrete beams.

After going over the submitted bids it was decided to build Pier 38 after the first-named type—that is, with concrete cross-walls—and Pier 40 after the last named—that is, of concrete cross-beams. A section through these two alternate designs is shown in Fig. 3. Fig. 4 shows the details of the design of the substructure of Pier 40—the one with concrete cross-beams. Except for the detailed differences shown in the comparative designs in Fig. 3, the details of Pier 38 are the same as those shown for Pier 40.

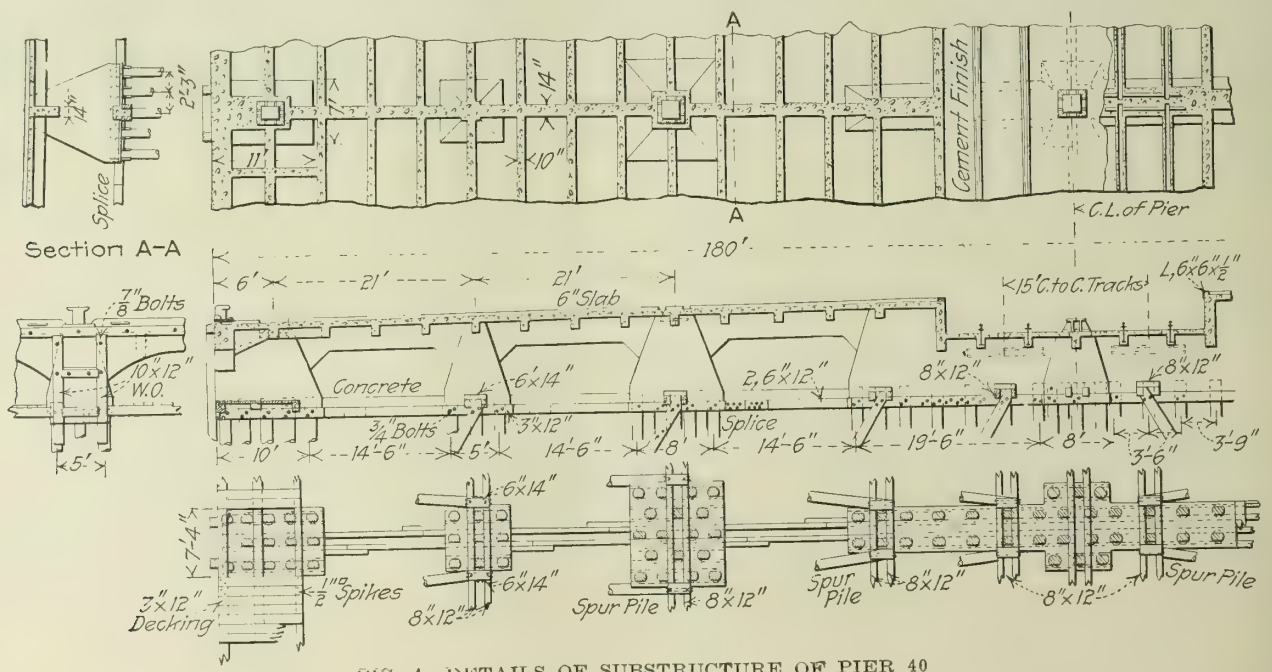


FIG. 4. DETAILS OF SUBSTRUCTURE OF PIER 40

The substructures consist of groups of straight and battered timber piles carrying longitudinal and transverse timbers tying the pile groups together. On top of this is poured the concrete structure with a reinforced-concrete slab floor, on which is erected the steelwork of the shed.

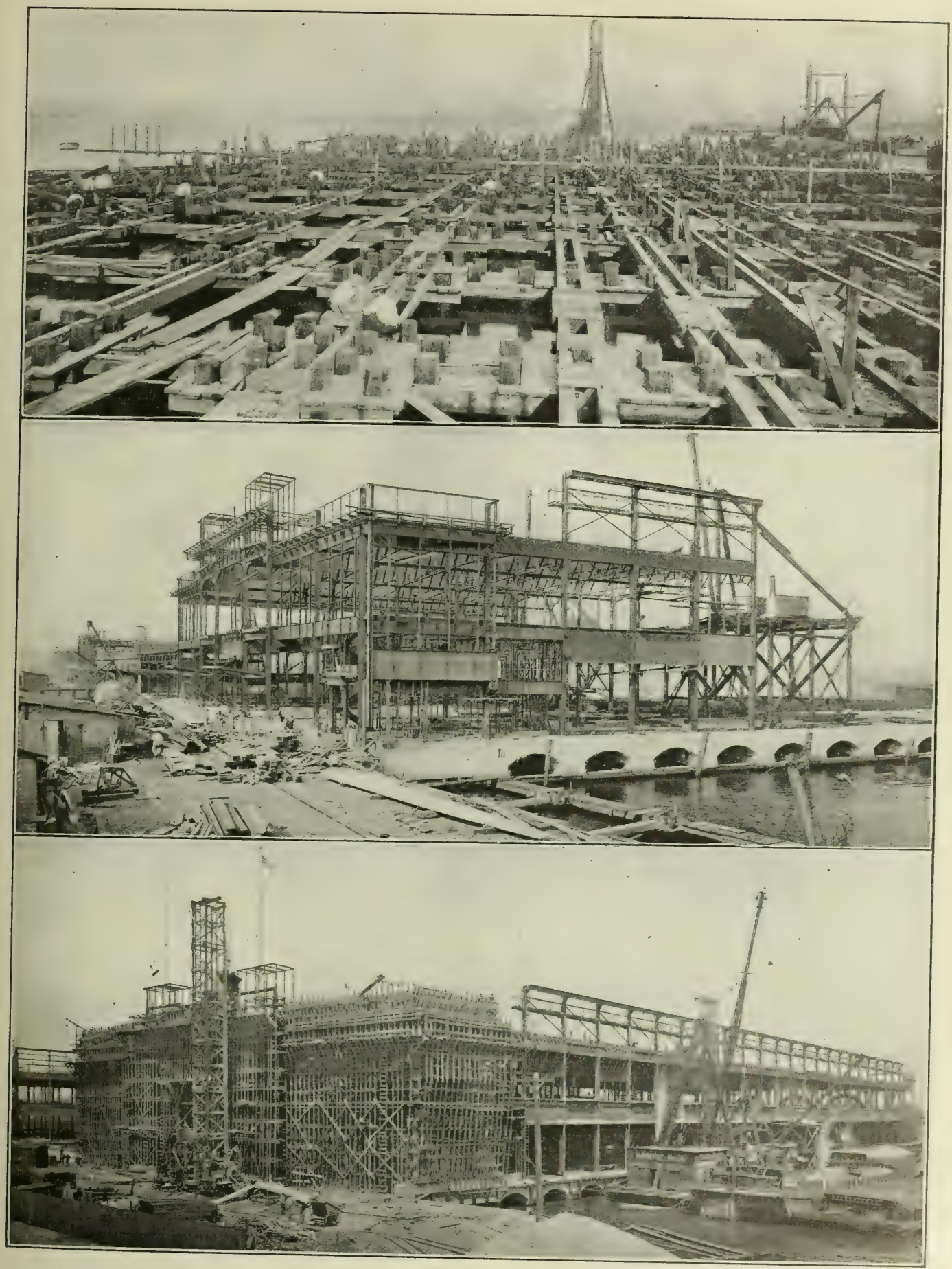


FIG. 5. VIEWS OF SOUTHWARK PIERS, DELAWARE RIVER, PHILADELPHIA, DURING CONSTRUCTION

5-A—Timber piles and connecting beams with cross platforms on which cross walls were laid. 5-B—Street headhouse steel under erection. 5-C—Steelwork erected; concrete covering to street headhouse being placed

In the center of the piers are two depressed railroad tracks, which are connected with the tracks of the Philadelphia Belt Line R.R., from which any of the trunk lines entering the city can be reached.

The first floor of the shed is designed for loadings of 600 lb. per sq.ft., and the second floor for a loading of 400 lb. per sq.ft. Special attention has been given to loading and unloading facilities, and the inshore end of the car pit has been enlarged for this purpose. This space, together with that along the bulkhead shed, will permit from 40 to 50 teams to be unloaded simultaneously on each pier on the platforms at the level of the dray body without interference with cargo-handling operations on the pier decks. The main deck is raised about 3 ft. above the street level, in order to bring it to the level of the floors of the cars and the central depressed pit, and is approached by short ramps inside the pier entrances leading from the marginal street.

The mechanical cargo-handling equipment of the piers will include electrically operated elevators of both the platform and the continuously operating cage type, cargo chutes and hatches for transferring freight between the upper and lower decks, and portable electric winches with portable controllers. Fig. 5A is a view of the substructure timbering in Pier 38 before the placing of the concrete. Fig. 5B shows the Pier 38 substructure completed, with the inshore headhouse steelwork under way, and Fig. 5C shows the same pier with the falsework for the inshore headhouse concrete in place. This was rather peculiar, in that the entire falsework was placed for the two stories at one time, the concrete protection not being carried up by stories, as is generally the case in reinforced-concrete buildings. The view in Fig. 1 shows the present condition of the improvements as seen from the marginal street. Pier 40 is in the foreground.

The new Southwark piers are being built by the city of Philadelphia under the direction of the Department of Wharves, Docks and Ferries, of which John Meigs is director. The contract for the entire work is held by the Snare & Triest Co., of New York City.

Galveston Survives Hurricane

SYNOPSIS—Gulf hurricane sweeps over Gulf of Mexico, causing damage all along shore, mainly at Galveston. Protective measures there prove successful. Although temporarily undermined at two points, the gaps beneath the seawall were filled in by the receding tide and the wall left intact. Backfill and pavements damaged by water that rushed through the gap and overtopped the wall. The 8200 ft. of earth approach to causeway demolished, but the 2500 ft. of reinforced-concrete arches and the 100-ft. rolling-lift steel bridge practically undamaged.

The city of Galveston, Tex., was subjected on Aug. 16 and 17 to one of the most violent wind and rain storms in the history of that hurricane-swept city. Thanks to the precautions in the way of seawall and grade elevation taken subsequent to the disastrous storm of 1900, the loss of life and damage to property was comparatively small in the city although the loss of life along the Gulf shore will probably total 250.

The storm broke over the city at 5 o'clock Monday afternoon, Aug. 16. The wind, it was estimated, had attained a velocity of about 60 mi. per hr. This was the wind from the north, and it continued to blow the water in from the bay, flooding the streets and cellars. By 9 o'clock the water was from 4 to 6 ft. deep in Market St.

The wind, still blowing from the north, continued to increase in velocity until about 2 a.m., Aug. 17. At that hour, it is estimated, it had reached a velocity of 90 mi. per hr. Meanwhile it had veered from the north around to the east and then came directly out of the south. This south wind, sending in the waves from the gulf to break against the seawall, damaged the southern part of the city and the boulevard.

The center of the storm passed west of Houston, Tex.,[1] at 4:35 a.m., Tuesday, when the barometer read 28.21 in., which probably is the lowest on record in the United States. The wind was violent, in pounding gusts, and was accompanied with driving rain on Monday and Tuesday. The maximum velocity recorded at Houston was 80 mi. per hr. but was probably higher at times as the anemometer failed to record for an hour and a half when the wind was most violent. The rainfall at Houston totaled 6.50 in. for the storm and 9.09 in. for the entire period of rainfall. The storm passed northwest, being central near Bryan, Tex., at 9 a.m., Wednesday, and curved northeast, giving torrential rains in eastern Texas and Missouri, where flood trouble also was experienced later in the week. The storm reached New York State on Sunday, Aug. 22, causing small floods and resulting in minor damage there.

For two or three days Galveston, where the greatest damage was done, was cut off from communication. *Engineering News* immediately wired instructions to a representative to try to reach Galveston. This correspondent did reach there in time to prepare the article which follows this general description of the storm itself.

The damage was not confined to Galveston, but was distributed well along the Gulf coast. On account, however, of the history of Galveston and its island, and the efforts made to protect it against such storms, the conditions there are of most interest to engineers.

History of Storms

The city of Galveston is located on the eastern end of Galveston Island. The original elevation of the ground was in many places but little above ordinary high tide of the Gulf, and at extraordinarily high tides the water came into the streets in many places. This condition was helped somewhat by filling up in low places.

About 1875 a general system of levels was taken through the city, and grades to the streets were established. The elevation of the natural surface of the ground in the streets was nowhere greater than 8.9 ft., and the average elevation from 6th to 39th St. is about 5.8 ft. The average elevation of the ground west of 39th St. is much less.

[1] Information by wire from R. Bunnemeyer, United States Weather Bureau observer, Houston, Tex.

The higher parts of the city are generally above overflows during storms, and it is only during phenomenal storms that the city is completely or to a great extent submerged. The district, however, is subject to these phenomenal storms. Within the memory of those living they have occurred in 1834, 1837, 1847, 1854, 1867, 1875, 1866, 1900, and 1909[2]; that is, at intervals of never less than

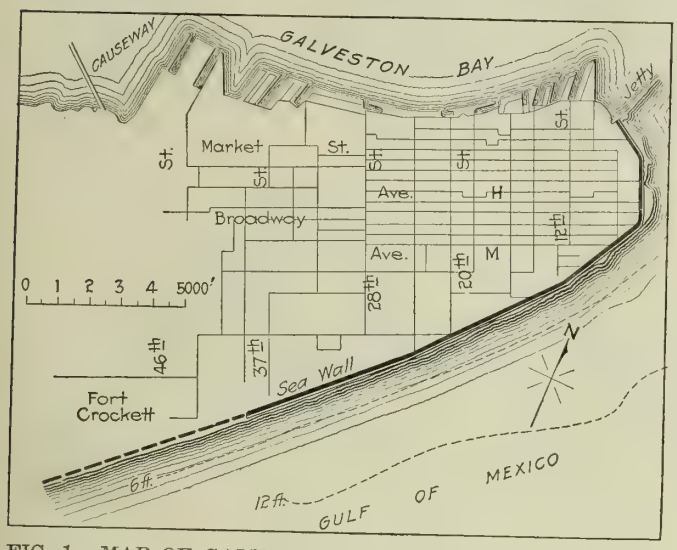


FIG. 1. MAP OF GALVESTON, TEX., SHOWING SEAWALL

Main seawall shown by black line along south and east coast. Dotted line at west end of city is the wall built later by the Federal Government.

three years and never more than 13 years. In early storms the actual height of the water is of course not known, but in the devastating storm of 1900, which caused the practical destruction of the city and the deaths of about 5000 people, the water reached a height far exceeding any previous record. At that time, at 8th St. and Ave. B the elevation of the water was 15.7 ft., and at the Southern Pacific wharf near the Galveston end of the causeway (see map), the lowest water on the island, the gage read about 10 ft. above mean Gulf level. At that time the wind reached a velocity of at least 100 mi. per hr., and the damage was due equally to the wind and the force of the water, which drove into the city in huge waves.

Protective Measures

Following the 1900 storm the abandonment of the city site was at first considered, but inasmuch as the Government had settled upon Galveston as the one harbor in the Gulf west of New Orleans which warranted improvements (on account of the possible great working depth there), it was decided to rebuild and to protect the island against similar storms. This protection, which was later undertaken, was designed by Alfred Noble, H. C. Ripley, and Gen. Henry M. Robert. It consisted in its final form of a seawall around the south end of the city from the jetty extending out into Galveston Bay at the north, to the beginning of the Government reservation at 39th St. on the Gulf shore. This wall was 3⅓ mi. long and was afterward continued about 1½ mi. by the Federal Government along its reservation at Fort Crockett.

A general section through the wall is shown in Fig. 2. It consists, as will be noted there, of a gravity section concrete wall, reinforced by a single line of rods near the curved face, resting on piles and protected in front by riprap and a line of sheetpiling. This wall was originally intended to be protected at its rear by an earth fill of a width of 100 ft.; that is, for the width of the Boulevard which paralleled it. A later project, however, involved the filling behind the wall for such a distance as would raise the grade from 10 to 16 ft. over the entire island. Only a part of this project was completed, but this part was sufficient to elevate the south half of the island on a slope which increased from the previous elevation at the Galveston Bay side up to the top of the gravity wall. The filling amounted to about 12,000,000 cu.yd. and cost approximately $2,000,000. It was made by hydraulic dredges pumping from a canal dug along the inside of the city limits of Galveston. It was finished about 1906.

[2]The 1909 flood, while second in intensity to those of 1900 and 1915, caused very little damage.

Galveston Causeway

The other important engineering structure in Galveston is the famous Galveston Causeway. This carries railways and a roadway across the two miles of Galveston Bay from the island to the mainland. It was started in April, 1909, and opened in May, 1912. The causeway consists of 3696 ft. of earth fill approach on the mainland, 2455 ft. of reinforced-concrete viaduct made up of twenty-eight 70-ft. arches, and 4523 ft. of earth fill on the Galveston side. The center of the viaduct contains a 100-ft. Scherzer rolling lift bridge. The concrete viaduct is 66 ft. wide and the causeway approaches are 119 ft. wide, carrying two railroad tracks, two elevated railroad tracks and a 40-ft. roadway. The structure was designed by the Concrete Steel Engineering Co., of New York City, and built by the A. M. Blodgett Construction Co. The concrete-arch section was of the regular reinforced-concrete arch design, with the piers founded on timber piles. The approaches were sand-and-gravel fills and for most of the length had the slopes protected by concrete slabs, resting on concrete sheetpiling.

As noted in Mr. Babbitt's article, which follows, the main damage in Galveston consisted of the destruction of buildings by wind and, along the seawall, by the force of the overtopping waves, and the washing out of the causeway approaches. The total number of killed has not yet been ascertained, but it promises to be very small. Practically the only injuries or deaths were in the frame buildings which were blown down. The water of the Gulf in backing up flooded the northern part of the city where filling had not been made, but this flood had not the force of the 1900 wave, and was not particularly destructive. The main carrying the city water-supply across the causeway was wrecked with that structure and was not replaced until Aug. 24, when an 8-in. temporary main was laid.

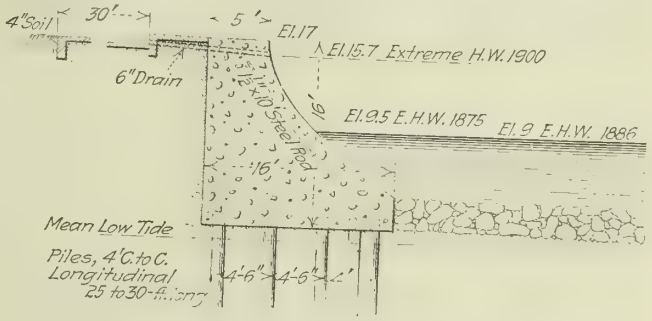


FIG. 2. SECTION THROUGH GALVESTON SEAWALL



FIGS. 3 TO 6. VIEWS IN GALVESTON AFTER THE WINDSTORM OF AUG. 16

Fig. 3—23d and Market St., on north side of island, showing flood backed in from Galveston Bay. Fig. 4—Houses torn from foundation at 33d St. and Boulevard on the seawall. Fig. 5—House at 14th St. and seawall. Débris in right foreground from paved boulevard paralleling seawall. Fig. 6—Looking along seawall at 23d St. Buildings in background blown down by wind. Note stone monuments against curb near house torn up from top of seawall by force of waves

Effect of Galveston Storm on Seawall and Causeway

By R. P. Babbitt*

By wire from Houston, Tex., after special investigation at Galveston

Galveston's seawall is intact but its causeway to the mainland is destroyed, except for the reinforced-concrete arched portion and the rolling-lift steel bridge.

The West India hurricane which swooped down upon the Gulf Coast on Aug. 16 was the third greatest storm in its history. The wind came from the northeast for 30 hours with but little abatement. Had it not been for the seawall there would now be only a heap of ruins to mark the site of this great Texas seaport.

This magnificent wall, extending for approximately three miles along the Gulf front of the city, was impregnable to the fury of the waves which beat against it but were baffled at every point. In spite of this tremendous assault the seawall stands today as perfect a structure as the day it was completed. Not a crack or defect resulted from the furious attack of the forces of nature.

Seawall Temporarily Undermined

At two places only did the waters of the Gulf pierce beneath the wall—temporarily and without injury to the wall itself. One of these was near Fort Crockett, at the southern end of the wall; the other, at the northern end, between Broadway and 21st St. At each of these points the Gulf waters undermined the structure, hollowing out the sand until the piles upon which the wall rested were exposed to view. But with the return of the tide these gaps were refilled with sand and not a fault developed in the wall. Although the seawall was not damaged, some injury was caused by the material which was swept through the two temporary gaps beneath the wall.

Effect of Water Overtopping Seawall

Further injury was wrought to the backfill and pavements behind the seawall by the tremendous masses of water that were projected over the seawall to a distance of 200 ft. or more. Where this occurred pavements were undermined and the backfill was washed out, forming a wide stretch of beach behind the wall.

It should be explained, in passing, that upon the completion of the seawall the United States Government backfilled that portion of the structure for the building of which it was responsible. Unfortunately, as recent events have proved, the Galveston authorities failed to continue the backfill as far cityward as was needed, so that when the waters of the Gulf were driven before the hurricane of Aug. 16 they overleaped the wall, tore up the backfill, and worked havoc with the streets and boulevards in the vicinity.

Where there was sufficient backfill to prevent the overfalling water from getting under it, as at 25th St., damage to the pavement was prevented and the boulevard is in surprisingly good condition.

The damage to backfill and pavement caused by the water which passed through one of the gaps beneath the wall was studied by the writer at 23rd St. Here the backfill was washed out and silt swept in by the inrushing water, thus forming a beach several hundred feet wide. So far as could be discovered by an examination the seawall here, on both the Gulf and the island side, is in as perfect condition today as when completed. At 19th St. the seawall was also found intact, but the overfall of the water undermined the pavement and caused it to settle.

Complete the Seawall and Raise the City

One great lesson was demonstrated to the Galveston people, and that is the necessity of completing the seawall about the entire city front, then raising the level of the city above the level of the top of the seawall. Had Galveston been above the level of the present seawall during the hurricane of Aug. 16, the water damage to the city would have been very slight, for the overfall would then have drained back into the bay on the one hand and into the Gulf on the other, and the water damage caused in the central portion of the city would have been comparatively slight. The water damage to the business district of the city was surprisingly small considering the violence and duration of the storm.

In 1900 the waves from the Gulf swept the city, which then had no seawall to protect it. This caused the tremendous loss of life and property which occurred at that time. During the recent storm the water that rose in the city from the bay was caused by the pressure of the waters from the Gulf. There was no wave motion in the streets of the city in 1915, as was the case in 1900.

It is probable that the seawall will be extended, entirely encircling the city, and the city raised above the level of the top of the wall.

Earth-Fill Causeway Destroyed

Although the seawall, or outer line of defense, saved the city from destruction and proved its own integrity, the city's only line of communication with the mainland was not only broken but in larger part destroyed. The only portion remaining intact is the 2450 ft. of 28 reinforced-concrete arches, 70-ft. span, and the rolling-lift steel bridge of 100-ft. span in the center of the arches. This part of the causeway was practically undamaged.

Had the entire causeway been of reinforced concrete, Galveston would not have been cut off from the mainland and her water and food supply would not have been reduced to the low point that was brought about by the demolition of the two end sections.

From this permanent structure a "protected roadway" extended eastward approximately 37 ft. to the mainland and westward for about 4500 ft. to Galveston Island. Both these sections were demolished.

These protected roadways consisted of sand-and-gravel fills 119 ft. wide on top, with their side slopes protected by 6-in. concrete slabs. The toes of this slope paving rested, on each side, upon tongue-and-grooved reinforced-concrete piling. After the piles were driven the grooves were poured full of concrete, thus forming a solid wall. The concrete sheetpiling was then capped.

So far as could be discovered, the lines of concrete piling were intact at every point, but the sand-and-gravel fill was scooped out by the action of the water, letting down the concrete slabs.

As has been said, the reinforced-concrete arch section of the causeway is practically uninjured. Not a break was found in piers or in arches.

*Civil Engineer, Dallas, Tex.

News of the Engineering World

Progress on 46th St. Piers

The view on this page shows a recent stage in the construction of the 46th St. piers on the North River, New York City. The inside of the huge coffer-dam is shown with the drilling and blasting going on in the rock bottom of the river. This coffer-dam, as described in *Engineering News* of July 23, 1914, p. 212, consists of a series of connected cylinders made up of interlocking steel sheet-piles, the cylinders being filled with earth so as to form a solid wall. In addition the inside and the outside of this wall are heavily backed with riprap, as shown in the view.

The dam is now holding back about **60 ft.** of water, with comparatively little leakage.



INSIDE OF THE 60-FT. COFFER-DAM HOLDING THE NORTH RIVER AT 46TH ST., NEW YORK CITY

⁂

Flood at St. Louis

The damage done by the recent storm in and around the Gulf was largely localized and resulted almost entirely from the wind. In Missouri, however, the concentrated rain of Aug. 19-20 caused considerable damage in and around St. Louis. The record for the 24 hr. between 7 p.m., Aug. 19, and 7 p.m., Aug. 20, shows a maximum in St. Louis of 9.35 in. with a wind velocity of 48 mi. per hr. This is a rainfall nearly double any previous 24 hr. record in St. Louis. The fall was fairly steady and the intensity was not exceptional. Consequently, little more sewer trouble was reported than from the heavy short rains during the summer.

The River des Peres, which runs through the western part of the city of St. Louis, however, caused considerable damage. This river, which has a drainage area of about 110 sq.mi., practically a quarter of which is in St. Louis itself, broke all records for high water, overtopping nearly all of its crossing bridges except the high concrete arch at Clayton Road. All street-car traffic and trains to the west were suspended, and the driveway on Clayton Road was for over 12 hr. the only communication line across the stream. In the West End residence district of St. Louis the river flooded from half a mile to a mile wide, tore up some wood-block pavements and washed out several of the small street bridges. Although plans for controlling the stream had been prepared, no money had ever been appropriated for the work. It is thought that now the stream control will be undertaken at a cost of about $5,000,000.

Later in the week, the Meramec River, which empties into the Mississippi just south of St. Louis, was in flood because of the same rainstorm. This river rose many feet and spread over a considerable area of the lowland, causing some damage to summer residences on its banks.

⁂

Day's Rainfall of Over 15 In.

A precipitation of 15.45 in. for the 24 hr. ending 5 p.m., Aug. 2, was recorded in St. Petersburg, Fla., on the rain-gage maintained by the *Evening Independent* for the use of the United States Weather Bureau. The first phase

of the storm lasted only a few minutes. The heavy precipitation commenced at 8 p.m., Aug. 1, and ended about 1 a.m. the following day. From that time to 1:30 p.m. there were only intermittent light showers. L. W. Brown, who furnishes us with this information, states that it is safe to say that not much more than ½ in. of rain fell outside the 12-hr. period from 8 p.m. to 8 a.m. There was practically no wind accompanying the rain. Periodic readings were not taken.

The greatest damage in the city was done to brick paving, especially where the paving ended along the waterfront; here it was undermined to a considerable extent. Similar damage was done to the brick paving of a boulevard surrounding Mirror Lake—a 10-acre body of water located in the north-central part of the town. There was a rise in the lake during the night of about 7 ft. Drain pipes from the lake and storm sewers in the streets were far too small to handle the runoff. Booker Creek, normally a small stream flowing through the southwestern part of the town, went out of banks, and washed out approaches to several concrete bridges, and carried away some of the weaker bridges crossing it. Portions of concrete wall along this stream in the Roser Park section were washed out. The total damage is estimated at $25,000.

Outside of St. Petersburg the roads were badly washed and most of the small bridges were carried out. These roads were constructed principally of marl—which is really little more than a good stiff clay. They are not being permanently repaired, as it is the intention to pave them with brick during the next few months.

The telephone system was crippled for one day, mainly through trouble with the underground cables. Interurban car lines were also out of operation for one day, on account of washed-out bridges. The traffic on two railways, touching at this town, was stopped for about the same length of time.

The rain was general in Florida, but particularly severe in the southern portion of the state.

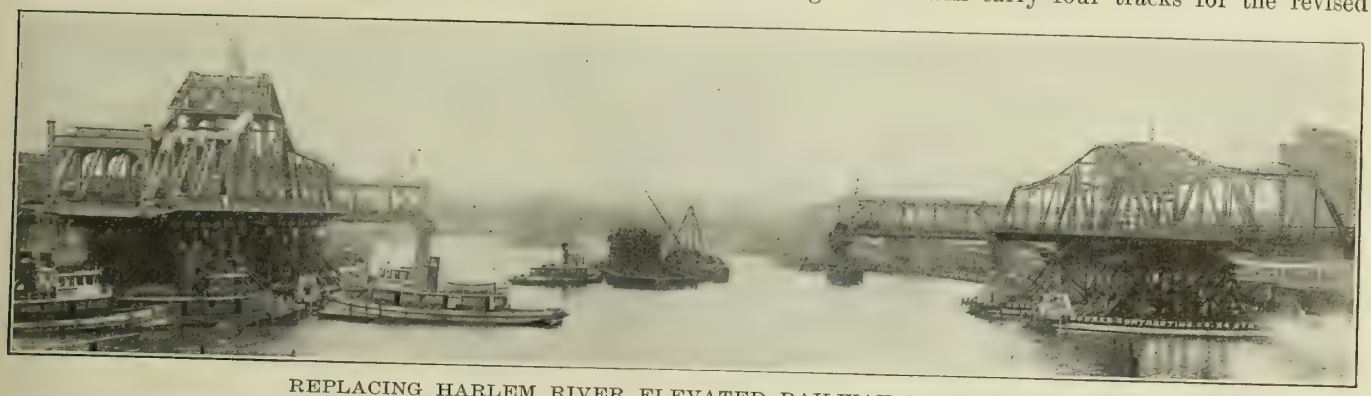
Projected Automobile Speedway for Louisville, Ky.

Plans are being prepared by a company organized by George L. Martin, 237 South Fifth St., Louisville, Ky., for the construction of a 2-mi. automobile racetrack near the present Douglas Park horse-racing track. The new speedway is to have a plank floor on concrete walls, according to present plans. Four grandstands with a seating capacity of 15,000 each are to be built.

About 300 acres of land has been purchased, most of which is low-lying and will require considerable drainage, but little excavation. A topographic survey of the plot has been made by Stonestreet & Ford, 414 Louisville Trust Building, Louisville, engineers for the speedway company. The cost of all improvements is estimated at between $250,000 and $300,000. It is intended to have the track completed by the spring of 1916.

Harlem River Draw Replaced

The accompanying view shows a stage in the process of floating out the old drawbridge of the Third Ave. and Second Ave. Elevated R.R. bridge across the Harlem River in New York City and floating in the new double-deck drawbridge which will carry four tracks for the revised elevated lines now under reconstruction. The moving took place Sunday, Aug. 22, 1915, on one tide. A description of the method of transferring the spans will appear in the next issue of *Engineering News*.



REPLACING HARLEM RIVER ELEVATED RAILWAY SWINGBRIDGE

Looking north, Sunday, Aug. 22, 1915. Old bridge at right, single-deck double-track rim-bearing bridge built 1878. New bridge at left, a double-deck four-track center-bearing bridge

Ordinance on Fire Safeguards

In continuation of the work on the revision of the Building Code of New York City, Rudolph P. Miller, expert to the building committee of the Board of Aldermen, has drafted an ordinance, "Safeguards Against the Spread of Fire," replacing the old section, "Fire Walls and Shafts."

Fire walls are required to be constructed like exterior walls. Openings are restricted to 80 sq.ft. in area and must be provided on each side of the wall with approved automatic fire doors.

Fire partitions (providing an area of refuge) must be 8 in. thick if brick or 4 in. if reinforced concrete. Shafts over 9 sq.ft. in area must be walled with fire partitions. If not over 9 sq.ft. they may be walled with 2-in. tile, concrete or the like, properly tied. Existing elevators in nonfireproof public buildings are required to be inclosed the same as new elevator shafts.

Fire doors (or shutters) or fire windows are required on openings above the first story in fireproof and nonfireproof business buildings which are more than 40 ft. in height, unless any such openings are more than 30 ft. from any other exterior opening or more than 50 ft. above the adjoining roof. Openings to fire escapes will practically have to be built of fire windows inasmuch as the fire shutters or fire doors that might be provided must be made self-closing and so arranged as not to obstruct. A

provision is made, suggested by the National Board of Fire Underwriters, that wherever in buildings over 40 ft. high no fire windows are called for, a 3-ft. space of solid masonry must be left between the top of one window and the sill of the window above it. It is also provided for that all fire doors and shutters shall be closed at night by the tenants, unless equipped with automatic devices.

Wire glass when permitted or required must be used in panes not greater than 720 sq.in. and must be at least ¼ in. thick.

American Port Statistics in Foreign Trade, 1914-15

The rank of the different domestic ports in handling the unprecedented foreign trade of the United States in the fiscal year ended June 30, 1915, is indicated by the following compilation prepared by the Bureau of Foreign and Domestic Commerce of the Department of Commerce. It shows that ten districts handled 85 per cent. of the total trade. New York alone is credited with 48 per cent., having increased its leadership during the year. In 1914, 45 per cent. passed through its custom house.

The following table shows the total trade of the 10 leading customs districts as indicated by the commerce passing through the custom houses at their leading ports, with comparisons covering the fiscal years 1914 and 1915:

	Total Foreign Trade		Imports		Exports	
	1914	1915	1914	1915	1914	1915
Ports and Districts	(In Millions of Dollars)					
New York	1905	2125	1040	931	865	1194
New Orleans	283	289	89	80	194	209
Boston	226	260	160	153	66	107
Galveston	268	240	12	10	256	230
Philadelphia	161	164	96	73	65	91
San Francisco	130	158	67	76	63	82
Baltimore	144	157	34	25	110	132
Detroit	129	143	26	25	103	118
Seattle-Tacoma	110	136	55	68	55	68
Buffalo	118	105	30	31	88	74
Total, 10 districts	3474	3777	1609	1472	1865	2305
Total, all other	785	666	285	202	500	464
Grand totals	4259	4443	1894	1674	2365	2769

Of 54 Water-Treatment Plants in New Jersey in the middle of the present year, 23 were filters for protection against water pollution, 22 were plants for iron removal, 1 was for the removal of carbon dioxide, and 8 were for disinfection purposes.

Bids for Reconstructing Compton Hill Reservoir, St. Louis, Mo., received on Aug. 13, 1915, ranged from $280,187 to $385,615; the estimated cost was $410,000. The lowest bid was submitted by the Hiram Lloyd Building & Construction Co. E. E. Wall is water commissioner.

Reinforced-Concrete Retaining Walls totaling 1½ mi. in length will be used in raising portions of the levees of the Kaw Valley Drainage District, Kansas City, Kan. (see "Engineering News" of Aug. 19, 1915, p. 382). Bids for these walls are to be received on Sept. 3. S. H. McNeil is chief engineer of the Kaw Valley Drainage Board.

United States Naval Radio Stations now number 47, of which 21 are open to commercial messages, while the others are reserved for official business only. A station at Point Isabel, Tex., and a Great Lakes training school station are under construction. Plans have been made for radio communication between San Francisco and Manila by way of Honolulu, but work on this project will not be commenced until fall.

The Topographic Survey of Ohio will be completed, according to present estimate, by the end of 1915. Only a small strip in the southwestern part of the state remains to be surveyed. The work is being carried on jointly by the United States Geological Survey and the State of Ohio. Prof. C. E. Sherman of the department of civil engineering of Ohio State University is inspector for the state in the work, which has been in progress since 1900. The scale of the map made from the survey is 1 in. to the mile.

Increased Mileage of Concrete Roads—According to a new bulletin of the United States Department of Agriculture, the estimated amount of concrete pavement in the United States in 1914 was 19,200,000 sq.yd.; in 1909 it was only 364,000 sq.yd. In addition to discussing the engineering details of construction, the bulletin calls attention to the fact that ordinarily from one-third to one-half of the total cost of constructing a concrete pavement is for labor after the materials are delivered. This emphasizes the importance of efficient organization and proper equipment. Failure to take these factors into consideration frequently results in adding from 10 to 20 per cent. to the cost of a concrete pavement.

The Production of Spelter in the United States for the first six months of 1915 amounted to 207,634 tons made from domestic ores and 8898 tons from foreign ores, a total of 216,534 tons, as compared with 177,991 tons for the preceding six months and 175,058 tons for the first six months of 1914, according to C. E. Siebenthal of the United States Geological Survey. In addition there was produced by distillation from drosses and skimmings 13,546 tons of secondary spelter. No statistics were obtained of the spelter produced by remelting skimmings, drosses, etc., but it was probably not less than 12,000 tons. The total output of spelter from both ore and skimmings was therefore about 242,000 tons, or at the rate of 484,000 tons per year. The number of retorts in operation in June, 1915, was about 127,000. Additional retorts to the number of over 32,000 have since been completed, are under construction, or are planned. The apparent domestic consumption for the first six months of 1915 was 160,906 tons.

The Illinois Road Law, known as the Tice Road Law, has been amended so that the county boards now have the power to determine the type of pavement to be constructed in their respective counties. This was formerly, and more properly the duty of the State Highway Department, which, with its experienced and technically trained staff, is better equipped to determine the most economical type of road surfacing and less liable to be influenced by agents for particular road-building materials. An amendment provides that full information as to the cost of different types of construction shall be published before the county board decides what material shall be used. Provision has been made in the law so that the county boards may purchase various kinds of high-priced machinery and lease it to the townships. It has been proved that few townships can afford to purchase their own machinery of this class (tractors, rollers, etc.). Road dragging by the townships is compulsory. From $3 to $5 per mile must be used for this purpose every year. The recent legislature appropriated $2,000,000, and as much more is to be raised by the counties for state-aid road work, so that $4,000,000 is available for highway work in Illinois during the next two years.

PERSONALS

Mr. J. H. Lendi, formerly assistant to Mr. A. G. Carlson, Mechanical Engineer of the Universal Portland Cement Co., Chicago, has been made Electrical Engineer in the engineering department of that company.

Mr. George F. Stickney, M. Am. Soc. C. E., former Consulting Engineer of the Lake Erie and Ohio River Canal Board, Pittsburgh, Penn., has opened an office in the Arkay Bldg., Albany, N. Y., for the general practice of civil enginering.

Dr. John W. M. Bunker has resigned from the department of hygiene and sanitation of Harvard University to organize and direct the bacteriological research department of the Scientific Laboratories of the Digestive Ferments Co., Detroit, Mich.

Mr. Charles Upham is Chief Engineer of the Coleman du Pont Road, Inc., with offices in Wilmington, Del. Work on the Coleman du Pont road has been resumed, and approximately 20 mi. of concrete pavement will be put under construction before Nov. 1.

Mr. Joseph A. Caviezal, Superintendent of the Alabama, Tennessee & Northern R.R., York, Ala., has been promoted to be General Superintendent, with headquarters at York. The office of Superintendent has been abolished, and Mr. Caviezal will be in charge of the operating and maintenance departments.

Mr. G. R. G. Conway, M. Can. Soc. C. E., whose resignation as Chief Engineer of the British Columbia Electric Ry. Co., Ltd., and the Vancouver Power Co. was noted in "Engineering News" of July 15, has opened an office at 409 Royal Bank Bldg., Toronto, for the general practice of civil and hydraulic engineering.

Mr. Howard B. Waha, who graduated in civil engineering from the Pennsylvania State College in 1909, and who has

been employed in engineering work wtih the United States Forest Service in New Mexico and Arizona since graduation, has accepted the position of Assistant Professor of forest engineering in the New York State College of Forestry, Syracuse University.

Mr. Kenneth A. Heron, formerly connected with the Modesto Irrigation District, has been appointed Chief Engineer of the Goose Lake Valley Irrigation Co., Lakeview, Ore. This company has an irrigation system under construction that will ultimately include a large part of the Goose Lake Valley in Oregon. About 15,000 acres will be brought under irrigation very soon.

Mr. H. C. Phillips, M. Am. Soc. C. E., whose resignation as Valuation Engineer of the Atchison, Topeka & Santa Fé Ry. was noted in "Engineering News" of Aug. 12, has been appointed Assistant General Secretary (and not Assistant Secretary, as noted previously) of the Presidents' Conference Committee on Federal Valuation, with offices in the Commercial Trust Bldg., Philadelphia, Penn.

Messrs. Henry A. Wise Wood and Elmer A. Sperry have been selected by the American Society of Aëronautic Engineers as members of the Civilian Advisory Board of the United States Navy. Mr. Wood is President of the society and was a member of the aërodynamics laboratory committee appointed by President Taft in 1912. Mr. Sperry is the inventor of the Sperry gyroscopic stabilizer for aëroplanes, which a year ago was awarded the first prize of $10,000 by the French Government.

Mr. Farley Gannett, Assoc. M. Am. Soc. C. E., Consulting Engineer, of Harrisburg, Penn., and recently Engineer of the Water Supply Commission of Pennsylvania, has become associated with the Harrisburg Water Laboratories, which has been organized for the chemical and bacteriological examination of water, sewage, trade wastes, etc. The organization consists of Mr. Lesley McCreath, Jr., member of the firm of Andrew L. McCreath & Son, Analytical and Consulting Chemists, of Harrisburg, who still retains his interest in that firm; Dr. George R. Moffitt, City Chemist and Bacteriologist of Harrisburg Hospital, and head of the Moffitt Bacteriological Laboratory.

Messrs. Howard E. Coffin and Andrew L. Riker have been designated by the Society of Automobile Engineers to serve on the Civilian Advisory Board of the United States Navy, at the request of Secretary Daniels. Mr. Coffin is a graduate of the University of Michigan, and has been connected with the automobile industry since 1902. At present he is Vice-President of the Hudson Motor Car Co., Detroit, Mich. Mr. Riker is well known for his work in the design of heavy trucks, particularly electric vehicles. Both are prominent in the Mechanical Branch of the Association of Licensed Automobile Manufacturers, and both are Past-Presidents of the Society of Automobile Engineers.

OBITUARY

A. V. Nesbitt died Aug. 5 at the home of his sister in Boerne, Tex., at the age of 55 years. He was born in England and came to the United States when a young man. For a number of years he was engaged in railway surveying throughout the Southwest. Later he went to Mexico as a railway locating engineer. Of late years he had been connected with the Pearson Engineering Corporation, for which he made many preliminary reports on various projects in Brazil, Spain and Mexico.

Mendes Cohen, whose death was noted in "Engineering News" of last week, was an honorary member of the Engineers' Club of Baltimore. The biographical sketch given should have been supplemented by mention of the service rendered the City of Baltimore by his disinterested and active efforts as Chairman of the Sewerage Commission of that city from 1903 to 1909 to introduce a modern system of sewerage. During these six years Mr. Cohen without compensation devoted his untiring energy to the interests of the city to which he was strongly attached, and the investigation was probably the most comprehensive one that had been made up to that time for any American city. For many years and until over 80 he was active in the management of the Maryland Historical Society, first as Corresponding Secretary and then as President. Mr. Cohen was a man of great depth of character, high ideals, and of broad and liberal views. In manner he was a gentleman of the old school, dignified but sympathetic to a marked degree, winning the esteem and affection of his large circle of friends.—Kenneth Allen, New York City.

ENGINEERING SOCIETIES

COMING MEETINGS

NEW ENGLAND WATER WORKS ASSOCIATION.
Sept. 7-9. Convention in New York City. Secy., Willard Kent, Narragansett Pier, R. I.

TRAVELING ENGINEERS' ASSOCIATION.
Sept. 7-10. Annual meeting in Chicago. Secy., W. O. Thompson, N. Y. C. R.R., East Buffalo, N. Y.

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 12-14. Annual convention at Dayton, Ohio. Secy., Charles Carroll Brown, 702 Wulsin Bldg., Indianapolis, Ind.

SAN FRANCISCO MEETINGS

INSTITUTE OF RADIO ENGINEERS.
Sept. 13-18. Secy., David Sarnoff, 71 Broadway, New York.

PAN-AMERICAN ROAD CONGRESS.
Sept. 13-18. Secy., E. L. Powers, Road Builders Association, 150 Nassau St., New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 16-18. Secy., Charles Warren Hunt, 220 West 57th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Sept. 16-18. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 16-18. Secy., Bradley Stoughton, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 16-18. Secy., F. L. Hutchinson, 29 West 39th St., New York City.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Sept. 16-18. Secy., J. J. Blackmore, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Sept. 16-18. Secy., J. W. Richards, Lehigh University, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Sept. 17-21,

INTERNATIONAL IRRIGATION CONGRESS.
Sept. 20. Secy., Arthur Hooker, Sacramento, Calif.

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Sept. 20. Secy., F. F. Sharpless, 52 Broadway, New York City.

PACIFIC COAST ASSOCIATION OF PORT AUTHORITIES.
Sept. 20 and 21. Secy., Leo V. Merle, Ferry Bldg., San Francisco, Calif.

AMERICAN MINING CONGRESS.
Sept. 20-22. Secy., J. F. Callbreath, Washington, D. C.

INTERNATIONAL ENGINEERING CONGRESS.
Sept. 20-25. W. A. Cattell, Secy., Comm. of Management, Foxcroft Bldg., San Francisco.

INTERNATIONAL ASSOCIATION OF BRIDGE AND STRUCTURAL IRON WORKERS.
Sept. 20-30. Secy., Harry Jones, American Central Life Bldg., Indianapolis, Ind.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Sept. 21 and 22. Secy., F. M. White, Madison, Wis.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Sept. 23 and 24. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 23 and 24. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN ASSOCIATION OF REFRIGERATION.
Sept. 23 and 24. Secy., J. F. Nickerson, 431 South Dearborn St., Chicago, Ill.

ILLINOIS GAS ASSOCIATION.
Sept. 27. Adjourned meeting. Secy., H. H. Clark, 72 West Adams St., Chicago, Ill.

SAFETY CONFERENCE.
Sept. 27-30.

INTERNATIONAL GAS CONGRESS.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

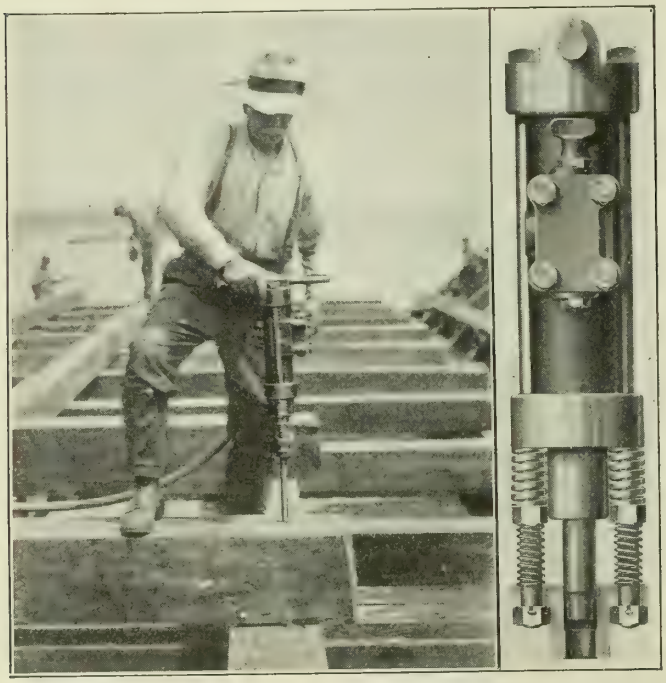
AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

Appliances and Materials

Drill Attachment for Driving Spikes

The McKiernan-Terry Drill Co., New York City, has placed on the market a special attachment for its B-1 pneumatic-hammer drill, which facilitates the use of the drill for driving spikes in dock, crib or any heavy timber construction. The attachment, which holds the head of the spike, may be removed and the drill used for rock-drilling if desired. The following are the essential specifications: Length overall, 22 in.; cubic feet of air per minute at 80-lb. pressure, 70; size of hose, ½ in.; size of hexagon steel, 1 in.; weight complete, 55 lb.; cost, $85 net.



ATTACHMENT TO SMALL PNEUMATIC HAMMER DRILL FOR DRIVING SPIKES IN TIMBERS

* * *

A New Type of Diesel Oil Engine

Improvements on the Diesel oil engine, invented by Leonard B. Harris, of Philadelphia, have been embodied by the Southwark Foundry & Machine Co., of Philadelphia, in a new engine which is being built for marine and stationary service. The Harris engine is a two-stroke-cycle engine in which the scavenging pump generally used on European Diesel engines is replaced by a stepped piston, of which the upper and smaller diameter is the piston of the oil-engine cylinder and the lower and larger diameter acts as an air compressor and also as a cross-head and guide for the engine piston. These air-compressing pistons are likewise used for starting the engine, so that compressed air is not discharged into the oil-engine cylinder to cause its refrigeration just previous to the entry of the fuel. Another important feature of the Harris-Diesel engine is that there are no valves in the cylinder head, except the atomizer which introduces the fuel. The scavenging air is introduced near the bottom of the cylinder as the piston completes its stroke. By this construction the engine is able to start under load like a steam engine.

One of these engines has recently been installed on the yacht "Southwark," owned by C. P. Vauclain. This boat is 98 ft. long and of 16 ft. beam; the engine is of about 240 hp. During a trial trip on June 26 a run of 35 mi. was made at a speed of 12 mi. per hr. on about 29 gal. of Mexican oil.

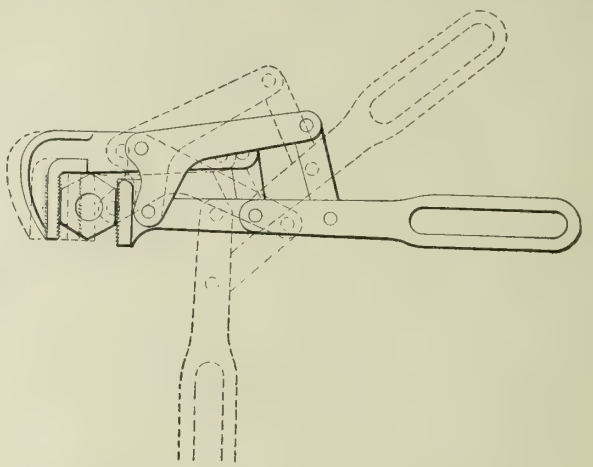
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Automatic Control of Gas Lamps

Valves for the distant control of gas lamps are being made by the Lombard Governor Co., of Ashland, Mass. These are of a so-called "magnetic" type, with two electric circuits (two wires and a pipe return) turning on and off the gas and controlling the pilot flame. It was at first intended to use these for control of street lamps and a quite perfect clock was developed for use with them on lamp posts. The demand for valves for control of store and building lamps was greater than for street lighting, however.

New Pipe and Nut Wrench

A new design of quick-acting pipe and nut wrench, known as the "Hayward Automatic," and shown in the accompanying sketch, has been devised by the Hayward Wrench Co., 700 Cass Ave., St. Louis. Turning the wrench on the pipe or nut automatically adjusts its jaws and causes them to grip.



QUICK-ACTING PIPE AND NUT WRENCH

* * *

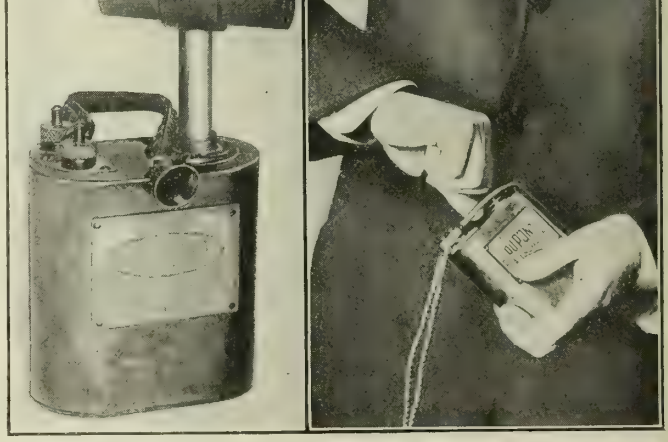
A Three-Wheeled Fire Fighter

A chemical engine suitable for small towns or large industrial works is being manufactured by the Davis Sewing Machine Co., Dayton, Ohio. It is equipped with a special Holloway type chemical tank of 35-gal. capacity, 200 ft. of F. D. chemical hose, extension ladder, fire extinguishers, ax, crowbar, pike pole, lanterns, etc. The motor is started by the rider in the saddle with a downward stroke on either pedal, and it is claimed that the machine can average from 30 to 45 mi. per hr. on fire runs. Its stream range is equal to the height of a four-story building, and its extension ladder equipment will reach the second story.

* * *

Pocket-Size Blasting Machine

A small blasting magneto, capable of firing three or four electric blasting caps, has been developed by the E. I. du Pont de Nemours Powder Co. for the convenience of coal miners, quarrymen, agricultural blasters, and for those generally who require small blasts. This little instrument is 4½ in. high by 3⅝ in. wide by 2½ in. thick, and weighs 4½ lb. It has rounded edges and is just the right size and shape for the side coat pocket. In operating the machine it is not necessary to find a level spot on which to stand it. It is held in the left hand, the right grasping the key. A sharp twist of the key generates the current and fires the shot. After use the key is removed and the cap is screwed on, providing a handle. The machine sells for $10 f.o.b., Pompton Lakes, N. J.



SMALL BLASTING MACHINE WITH FIRING KEY IN PLACE

When key is removed socket-cap shown in left-hand view can be screwed on keyhole, to serve as handle; or magneto may be carried in pocket

Engineering News

VOLUME 74 SEPTEMBER 2, 1915 NUMBER 10

Architecture of Kensico Dam

By Alfred D. Flinn*

Of New York's great Catskill aqueduct, now nearly completed, most structures are underground or else they appear simply as long mounds of earth punctuated by occasional buildings, housing sluice gates or other apparatus. When the works are finished, there will be but little visible manifestation of the magnitude of the project. Olive Bridge dam, which restrains Esopus Creek in Ashokan reservoir, is impressive by its bulk of masonry and earth, but did not lend itself naturally to architectural composition. Furthermore, it is remote from the city—a hundred miles away. One structure, however, by its size, its proximity to the city and to lines of travel, its setting and its character, was early recognized as suitable to be made expressive of the dignity and the strength of the whole system—Kensico masonry dam, one of the notably large masses of masonry in the world.

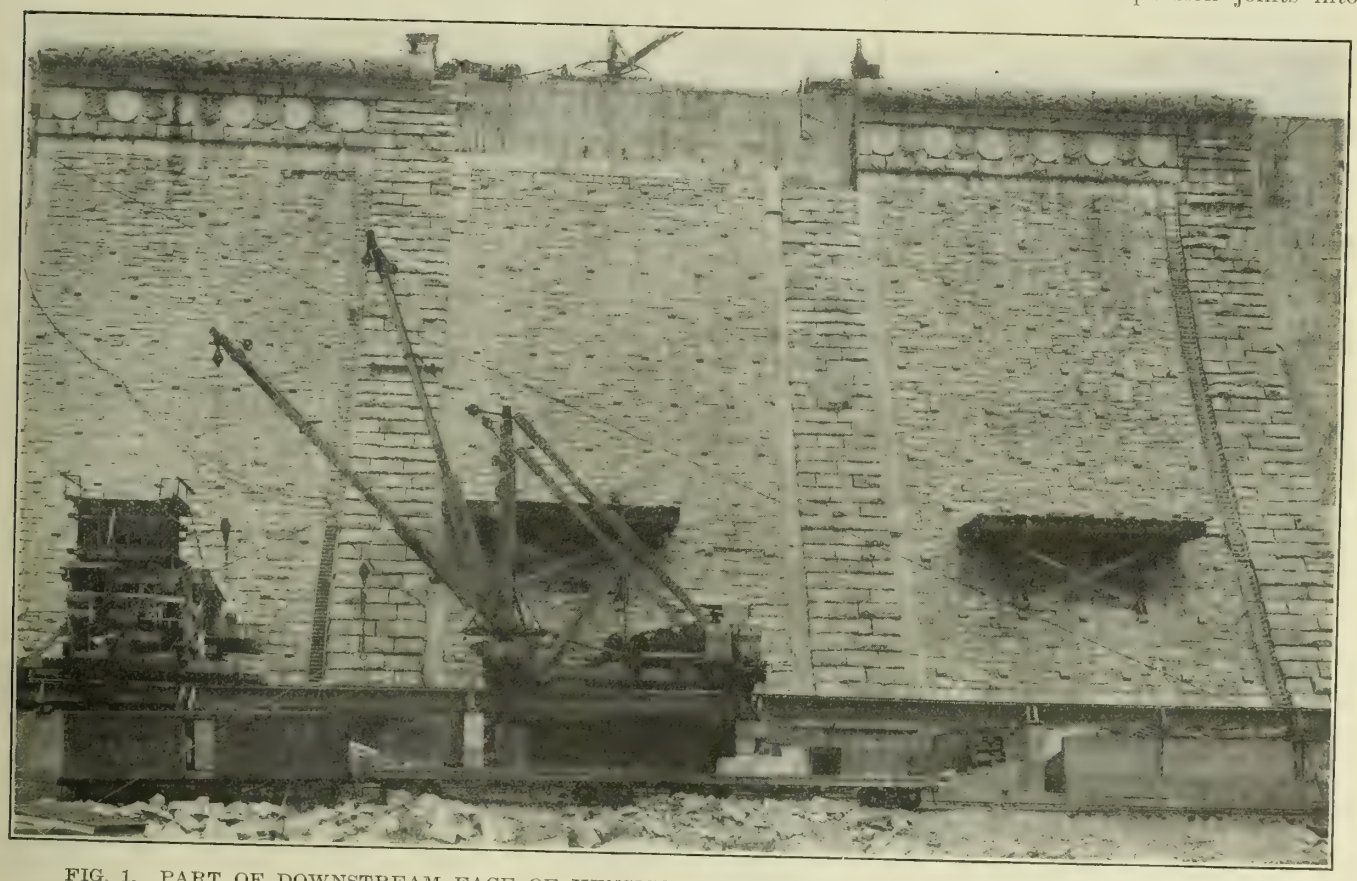


FIG. 1. PART OF DOWNSTREAM FACE OF KENSICO DAM, NEW YORK CITY BOARD OF WATER SUPPLY

Kensico dam is only 13 mi. from New York City's northern boundary line, at the terminus of the Bronx River parkway, which extends northward from one of the city's largest parks, and is within a few hundred feet of a four-track suburban railway. Highways cross it, pass in front of it and extend by both its ends. It is easily accessible. This dam is 1850 ft. long on top and has an exposed height of 133 ft. for a length of 1025 ft. It is divided by contraction and expansion joints into 21 parts each approximately 79 ft. long, and two terminal structures. It contains nearly a million cubic yards of masonry. Its maximum total height is 310 ft.

Selection of Architect

Treatment of Kensico dam as the conspicuous expression of the importance and grandeur of the greatest municipal water-supply system ever undertaken, and not merely as a utilitarian wall for retaining water, puts it partially into the field of architecture. Therefore the Board of Water Supply directed that the requisite services should be secured. As there was much other architectural work to be done, an architect was appointed on the staff of the chief engineer and given a small corps

*Deputy Chief Engineer, Board of Water Supply of the City of New York.

of designers and draftsmen. To aid him it was decided to engage the services of a consultant to be selected from among New York's most eminent architects. The method of selecting the consulting architect was unique. Experience elsewhere indicated that the usual competition, based upon submitted drawings, would not do. Instead, the following steps were taken: First, from the many competent architects in New York City a preliminary list of 25 was selected (individuals and partnerships), any one of whom was considered able to furnish advice of the character desired. By careful inquiry, and by examination of some of the structures built by these architects and of drawings and photographs of structures too remote to visit or not yet built, this list was reduced to six. From this short list a final selection was made by the aid of personal conferences, of more detailed examination of work done and of the styles of the several parties. Advice was confidentially sought, also, from a few of the older leaders of the profession. This final selection was made by the chief engineer, and on his recommendation appointment was made by the board.

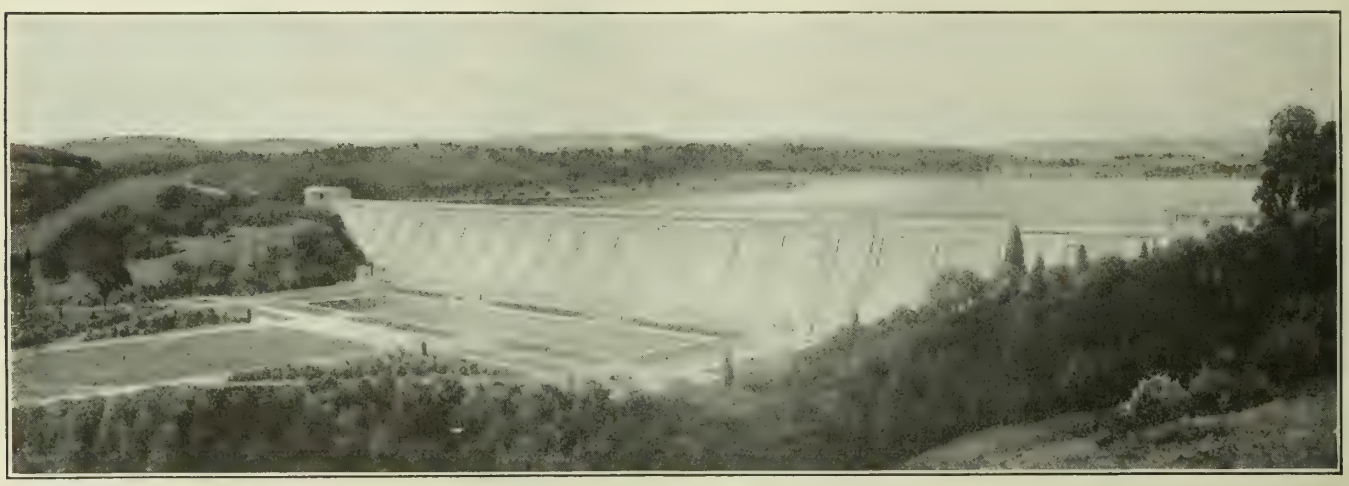


FIG. 2. WASH DRAWING SHOWING KENSICO DAM AS IT WILL LOOK WHEN COMPLETED

General Architectural Treatment

After visiting a number of masonry dams, the architects remarked that all these dams lacked a definite, visible base, that few had satisfactory cornices or entablatures, that architectural composition had been neglected, and that in most of these structures there was little to give scale—no feature of readily appreciated size with which the beholder could measure the main structure and gain some adequate apprehension of its magnitude. Architecturally, then, the problem of Kensico dam may be stated as the securing by means of suitable composition and embellishment of an adequate expression of the strength, magnitude, importance and dignity of this great mass of masonry, and the water-supply system of which it is a part, in harmony with its purpose and its elemental structural character.

To indicate the solution of this problem is the aim of the following paragraphs and the accompanying illustrations. However, a just appreciation of the architects' work will be possible only several years hence, when the dam and its surroundings will have been completed and sufficient time will have elapsed for the trees and other planting to have grown sufficiently to perform their functions in the whole composition.

The long, lofty, straight, level line of the dam's top as viewed from downstream, the equal of which is not to be found in any other kind of masonry structure, has been preserved unbroken, but is strongly terminated by massive circular pavilions of cut granite, which will serve also as shelters for visitors. Between the pavilions extend stone parapets of very simple design, about 3 ft. high, bounding the roadway. From these pavilions beautiful views can be enjoyed across the reservoir and the surrounding hill country. In the base of each pavilion storage space is available for tools and materials. On the upstream side of the dam steps and ramps lead down to the water surface from these pavilions. The roadway on top of the dam is to be paved with vitrified brick blocks.

For a base in the architectural composition of the downstream face of the dam a paved, level terrace has been provided, 30 ft. wide and 1025 ft. long across the valley bottom, and continued up the hill slopes by ramps 20 ft. wide terminating at the circular pavilions marking the ends of the top of the dam. The terrace pavement is 10 ft. above the ground immediately in front of it and is supported by a massive cut-stone wall. Beneath the terrace are a valve chamber and storage spaces. The downstream face of the dam is naturally divided into three parts—the central portion of uniform height and two triangular wings on the hillsides. This division is emphasized architecturally by placing a pylon at each end of the central portion, with two small square pavilions at the foot of each pylon, on the terrace, and steps leading down to the ground level, between these pavilions.

Since the contraction joints are an evident structural feature, they were made also a dominant motif in the architectural composition, as will be at once observed when looking at the dam or pictures of it (see Fig. 2). A broad, rusticated band of large, very roughly cut stones marks one edge of each contraction joint. The space between adjacent bands naturally becomes a panel, bounded top and bottom by the entablature and the base, or terrace. Around the margin of each panel is a narrow border of relatively smoothly cut stones, while the field is composed of "roughly squared" stone masonry, relieved and controlled by square cut-stone headers projecting slightly and arranged in a diamond pattern. One notable characteristic of the masonry facing is the coarse-

ness and simplicity of the stone cutting; another is the very large size of many of the stones, and the third is the strong color contrasts in the stone.

In the torus of the entablature all stones are 4 ft. high; many are 5 to 8 ft. long, and weigh 9 to 14 tons each. The frieze is 6 ft. 6 in. high, in one course, and most of its stones weigh 10 to 14 tons or more. Only sufficient carving of the crudest sort has been done on these frieze stones to develop the very simple design. At the bottom of each rusticated band is a kneeler made up of five stones, weighing together 51 tons. In the panel fields no stones have exposed faces less than ½ sq.ft. in area, and at least 50 per cent. of the exposed face of the roughly squared stone masonry in the dam consists of stones each having a face area greater than 6 sq.ft. In general, as many stones as possible are as large as it is practicable to handle. To give further boldness and suggestion of strength to the masonry, most fully taken advantage, although in so doing they have sturdily disregarded the older conceptions of good engineering masonry, for which it was commonly specified that the stone should be uniform in color and texture and in which very narrow joints were regarded as necessary. Structural convenience led to building the heart of the dam and its upstream concrete block face to full height before setting the stone masonry on the downstream face. To receive the stone facing the heart masonry was built in steps graduated to the heights of the stone courses and the face stones set in cement mortar into the steps so formed. This building the dam proper before the face work was started permitted an organization of the current season's work focused upon stone masonry which has secured remarkable progress in keeping with the record-breaking rate at which the cyclopean masonry was placed last year. Incidentally, the hoisting of large numbers of dripping buckets of con-



FIG. 3. NEAR VIEW OF ENTABLATURE AND PANEL OF DOWNSTREAM FACE OF KENSICO DAM

of the joints are wide and are recessed. The struggle has been to secure a general surface texture which would not seem too smooth and flat, and consequently uninteresting when beheld from a point remote enough to afford a comprehensive view.

Variety of Stone

Fortunately, the local gneissoid granite, which for economic reasons was used for the concrete and cyclopean masonry, proved to be a beautiful stone for the architectural features. Its grain varies from that of a straight-banded gneiss through curly and knotted varieties to that of a true, massive granite. Large pegmatite intrusions are frequent. In color the range is from light gray to strong pink, with green, black and white streaks and areas, due to different mineralogical ingredients, and deep russets and browns on seam faces. Of all these characters of the stone the architects have skillcrete over the lower portions of completed face masonry is being avoided; also the disfigurement resulting therefrom so common heretofore in dam building and so seldom wholly cured by the cleaning-down.

Forecourt Treatment

To provide room for the large pit for the foundation of the dam, the disposal of surplus excavated materials, the concrete blockyard and portions of the construction plant and camp, an extensive area of land was purchased downstream from the dam line. In the landscape and architectural scheme this area is being utilized as a foreground for the dam. Its conspicuous features are the pools, the main one having a water surface 720 ft. long by 135 ft. wide, paralleling the terrace and 50 ft. therefrom, with two smaller pools, 35 by 180 ft., at its ends; the fountains, and the broad avenues leading to the dam and affording vistas of important parts.

Models were necessary as aids to the determination of many important architectural questions. Besides small-scale plaster models of the whole dam and larger-scale models of portions of the dam, also in plaster, two full-size stone models of a portion of the entablature and of the panel and rusticated band beneath were made and modified until satisfactory proportions and textures were secured. These stone models were built by the contractor near the dam, under provisions of the contract, and the final, approved model has been preserved for the guidance of the stonecutters and masons as well as of the engineers and inspectors.

But few masonry dams in this country have had their visible portions designed in toto as architectural structures, treated as integral parts of the design of the dam; (5) the pools, or artificial water, below the dam; (6) the foreground layout which also is connected intimately with the design of the wall itself; and (7) the planting of this foreground in such a manner as to give the best effect and to require the least expense to maintain.

Architects, Engineers and Contractors

The staff architect of the Board of Water Supply is H. Lincoln Rogers; York & Sawyer are the consulting architects; Charles W. Leavitt, Jr., was consulted on landscape design. All this work has been done under the supervision of J. Waldo Smith, Chief Engineer of the

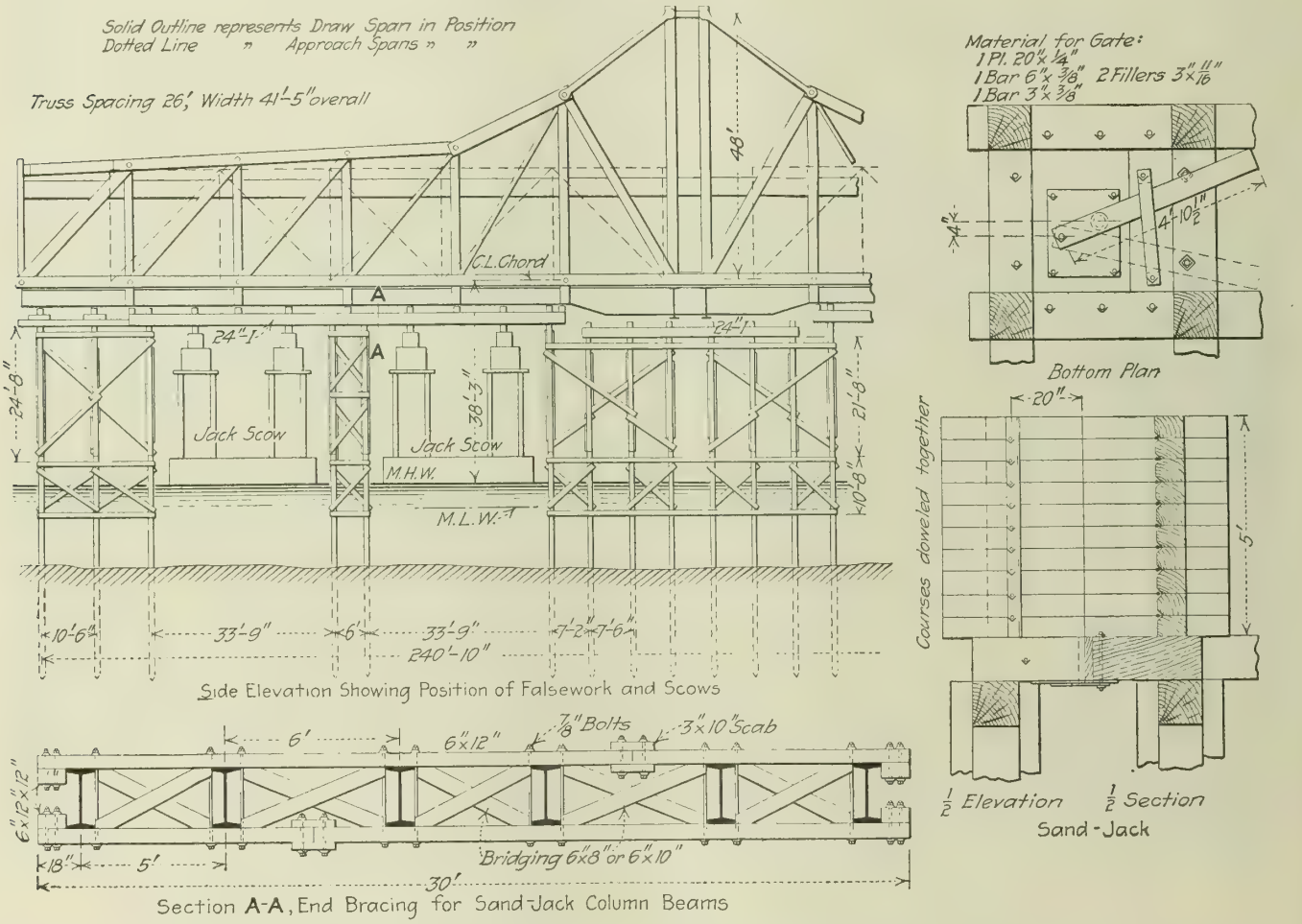


FIG. 1. FALSEWORK, SCOWS AND SAND-JACKS FOR FOUR-TRACK SWINGBRIDGE

Harlem River draw of elevated railway, Interborough Rapid Transit Co., New York. Floated into place Sunday, Aug. 22, 1915

tures, and but few have been so situated or of such importance as to merit or need it. The problem is a very unusual one for an architect, but the solution adopted for Kensico dam proves that masonry dams need not be ugly and that architectural treatment can harmonize with the structural character.

Elements in Design

There appear, therefore, as original elements in the architectural design of this dam: (1) The division of the wall into panels by bands of rusticated stone indicating the contraction, or expansion, joints; (2) the substitution of an adequate treatment for the usual "cornices"; (3) the provision of a base and ramps which receive the flanking hills; (4) the introduction of smaller

Board. The engineering designs were prepared under the direction of the writer and later of Thaddeus Merriman, as department engineers of headquarters department, by Designing Engineers Charles E. Gregory and Fred. F. Moore. Fred E. Winsor has had general charge of construction, as Department Engineer of the Southern Aqueduct department; Wilson Fitch Smith has been Division Engineer in charge of Kensico reservoir, and, as Section Engineer, Edwin L. Sprague, Jr., has had immediate charge of the building of the dam. For the contractor, H. S. Kerbaugh, Inc., Beverly R. Value, as engineer, and George Angel, as superintendent, have given hearty coöperation in carrying out the spirit of the architectural design and accomplishing a satisfactory result.

Double-Deck Swingbridge Floated in Place

The double-track swing-span of the Interborough Rapid Transit Co. which carries the Third and Second Ave. elevated railways across the Harlem River at 129th St., New York City, was replaced on the morning of Sunday, Aug. 22, 1915, by a new span carrying four tracks on two decks. It had been built on falsework along the river bank close by, the falsework being so laid out as to admit scows for lifting the span off and moving it to the bridge site. The span was practically completed by June 1, and June 6 was originally scheduled for the moving. The center-pier masonry had been prepared to receive the new center support and was also in readiness. But it was found desirable to make changes in the operating machinery of the span, and the moving was therefore postponed.

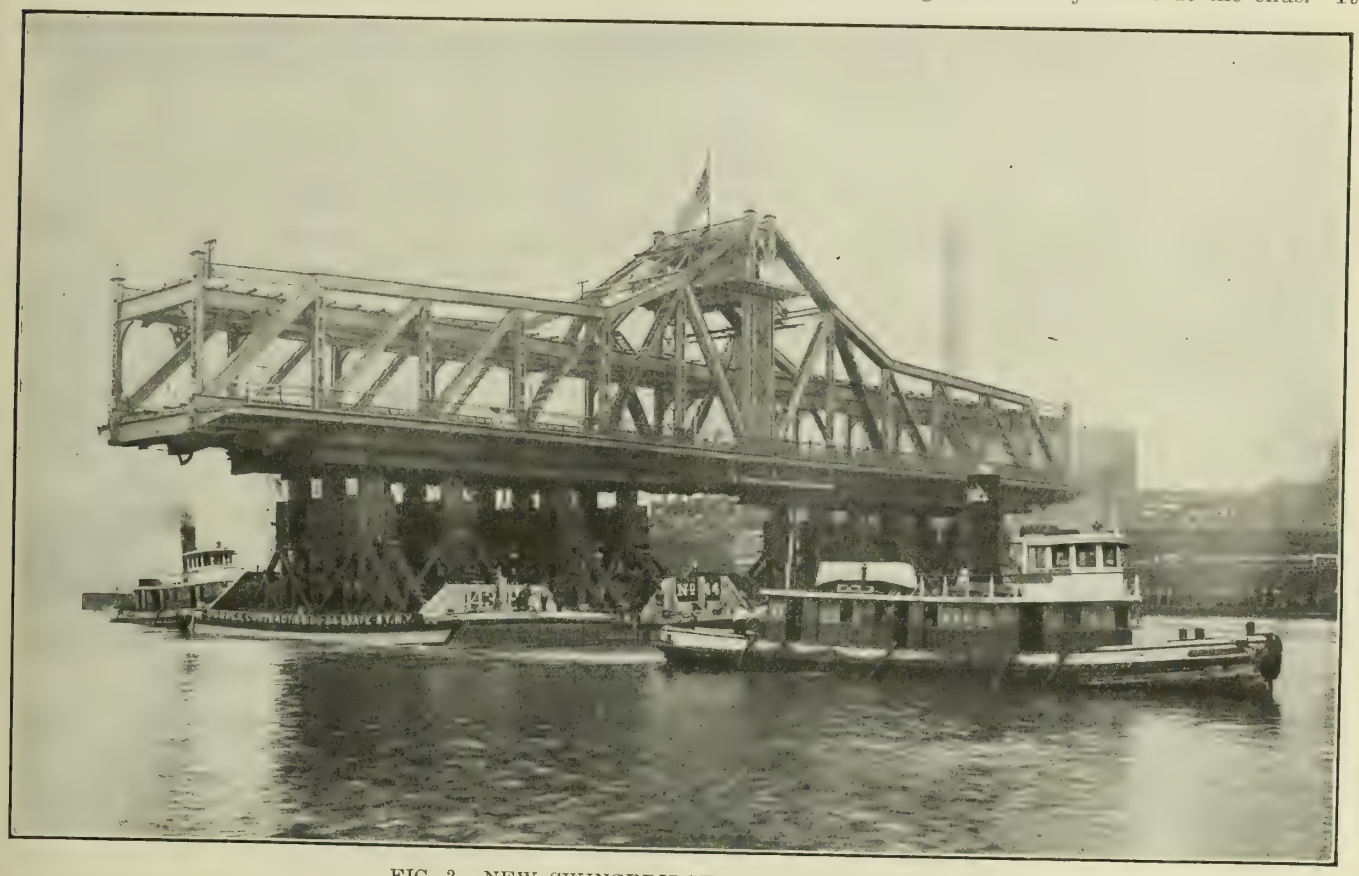


FIG. 2. NEW SWINGBRIDGE BEING FLOATED IN

View looking north. Center pier is back of left-hand scow. Bronx rest-pier shows under middle of draw. Note timber stiffening of eyebar diagonals and top-chord members

The floating was done by the tidal rise (about 4½ ft.). The old span weighed 500 tons, and the new span 1100 tons. Scows about 30x95 ft. were used, two for the old span and four for the new, requiring in both cases about 3 ft. immersion to take the weight. By floating the old span and the new one simultaneously, the operation was done in one tide, so far as interrupting railway and river traffic was concerned, though the preceding tide was used to float the new span off its falsework and get it ready on the scows.

Scows were put under the new span the middle of the afternoon of Aug. 21. The rise of the tide lagged somewhat behind the expected curve on account of the east wind. The span lifted off near 6 p.m., and was pulled off the falsework and moored near by. At low tide, 2 a.m. Sunday, Aug. 22, the two scows for the old span were floated into position and the span blocked up on them. The scows were then jacked down about a foot (the blocking being arranged for jacks) in order to get the span free early enough to prepare the new bearings by flood tide. The old span was rim-bearing, and its spider and center casting had to be removed. The spider exceeded in weight the available derrick capacity, and had to be burned apart into quarters by oxygen flame, causing the loss of some time. The new center casting and the base castings of the side wedges were set on previously prepared beds. The old span had floated off by 6 a.m.; at 8 a.m., flood-tide, the new span was brought along by tugs and put into exact position by mooring-lines and by tackle at the ends. It was seated on 24 sand-jacks, six on each scow. They were lowered in 3-in. stages, and worked easily and smoothly.

The sand-jack boxes were 39 in. square inside, built of courses of 8x8s solid, tied together in each course by bolts ample for full hydrostatic pressure. In the bottom was a 4-in. hole, closed below by a cutoff gate made of a 6x⅜-in. steel bar (see sketch in Fig. 1).

The span came to bearing on the center support at 10 o'clock. After further lowering of the jacks to reduce the buoyancy of the scows, the end and center wedges were driven, and the eight balancing wheels adjusted to bearing on the track. The first train passed over the bridge shortly before 1 p.m. Sunday.

Terry & Tench, Inc., did the work, with Holton D. Robinson as engineer and Wade L. Cline as superintendent. For the Interborough Rapid Transit Co., George H. Pegram, chief engineer, F. W. Gardiner, principal assistant engineer, S. Johannesson, designing engineer, and B. O'Rourke, resident engineer, were active.

Coast Erosion and Protection on Long Island and New Jersey—III

By Gerald O. Case*

SYNOPSIS—Failure of high groins and vertical bulkheads as coast protection works. Proper method of design and construction of low groins, which have proved successful. Application to construction in New Jersey and Long Island.

Coast Protection Work

Residents along the sea coast and others who have observed the great amount of damage done during gales and the enormous destructive power of waves often have the idea that works to prevent coast erosion must necessarily be very strong and designed to oppose the forces of nature. To fight against the destructive forces of the sea is a very costly business and the chances of success are very small. The sea has, however, a constructive as well as a destructive power, and if we utilize the constructive power, instead of opposing the destructive power, it is in most cases possible to prevent erosion and in many cases to do so by very simple and inexpensive means.

Broadly speaking, coast-protection works may be considered as falling under one of two heads, either "passive" or "active" defenses. In the first group the chief aim is to increase the resisting power of the natural barrier or cliff against the sea, by substituting a harder and more durable material for that already existing, or by increasing the size and height of the natural barrier, thus providing a greater factor of safety. Seawalls, bulkheads and artifically created littoral sand dunes are examples belonging to the first division. Under certain circumstances groins may also be put in for the sole purpose of holding the existing material on the shore and preventing further loss; but as a rule they have a much wider use and come under the head of active defenses.

Disadvantages of Seawalls

In the passive types of protection works—seawalls, bulkheads, etc.—the difficulty is to get the advantage of the passive resistance without at the same time introducing some new factor which exercises a deleterious influence. That such a factor may be introduced is too often to be seen on the New Jersey and Long Island coasts, where many of the vertical or nearly vertical bulkheads have caused erosion, often so serious as to far outweigh any good effects they might have.

Where erosion of the foreshore is taking place due to wave and current action, seawalls or bulkheads cannot in any way prevent its continuance. All they will do is to postpone the erosion of the mainland. If, for example, a bulkhead is constructed at high-water line on a shore which is being eroded by the alongshore movement of sand or shingle which is not compensated for by material moved in from the windward side, then after the bulkhead is completed, even if it does not itself injuriously effect the foreshore, the erosion due to littoral drift will still go on; the water at the toe of the bulkhead will gradually get deeper and deeper until the structure is undermined and collapses. We are therefore driven to the conclusion that seawalls and bulkheads constructed on a shore which is being eroded by wave and current action are doomed to destruction if the erosion continues, unless they are themselves protected by a natural barrier of beach or sand kept in place by groins or other means. If, therefore, a barrier of sand or shingle is necessary in front of a wall or bulkhead, what are the uses of these structures? Their only uses are to protect valuable property while the groins are building up a barrier of sand or shingle, and after that has been accomplished are of advantage as a temporary protection in case the barrier of sand or shingle is suddenly scoured away, due to a breakdown in the groins or other cause. In that event, however, it will be necessary as soon as possible to build up the shore again in front of the wall or bulkhead.

Seawalls or bulkheads should never be put in to protect agricultural land and should only be constructed in front of valuable building land, where it is absolutely necessary to preserve the high-water line while the groins are doing their work. It is expensive to build a wall or bulkhead which will not itself cause scour, and the existence of either makes it more difficult and expensive to collect the protecting barrier of sand; more groins being, as a rule, required than would be necessary if the wall was not there.

Wave Screens of Little Value

Many attempts have been made to prevent erosion by reducing the violence of the attack by constructing wave screens, but they have met with little success, and this is not to be wondered at when the enormous force of wave impact is considered, amounting as it does sometimes to 2 or 3 tons per sq.ft. If a permeable screen is erected, then if the spaces are too large the waves are not checked sufficiently to do any appreciable good, and if they are small the cost of the structure is prohibitive if it is successfully to withstand the force of the waves.

At Seabright, N. J., and other places, some of the bulkheads are "protected" by rows of piling set some distance out in the sea, with the object of breaking the forces of the oncoming waves. The storms of the past two winters plainly showed that if the piles are sufficiently close together to protect the beach; they are quickly demolished; but if the space between the piles is large enough to enable the screen to withstand storms, then the waves pass through with sufficient force to destroy the bulkheads. In several instances houses which were protected by bulkheads and wave screens, were wrecked by the waves passing through the screens, destroying the bulkheads and then undermining the houses.

Breakwaters Too Expensive

The accumulation which, under natural conditions, takes place between an outlying island and the mainland, or between a wreck near low-water mark and the coastline, suggests a means of coast protection. There is no doubt that if it were possible to build a cheap and lasting structure seaward of low-water line, which would protect the shore behind it from oblique wind waves, it would form

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a very effective protection and cause accretion of the shore to take place. It must, however, be remembered that to protect the shore from wave action a very strong structure is necessary if it is to be lasting. A breakwater such as is built to protect harbors in deep water would no doubt be a very effective protection against coast erosion if built some distance seaward of low-water line parallel to the shore, but its cost is prohibitive and, moreover, unnecessary, as protection can be effected at a very reasonable cost by a proper system of low groining.

If built in shallow water subject to wave and current action during storms, a protection work built parallel to the shore is subject to considerable erosion on the sea face. In the case of an outlying island it is always found that the sea side is subject to erosion, and that while accretion takes place between the island and the mainland, erosion of the exposed side of the island generally goes on at a rapid rate.

Value of Sand Dunes

Where localized erosion is caused on the leeward side of headlands, river outlets or other obstructions to the littoral drift, little or no material may be available with which to build up the foreshore. In such cases long low groins may be usefully constructed for the purpose of holding the material already there and preventing further loss. If there is a cliff at high-water mark, the erosion will stop if we prevent material being moved away from the base, as the continued erosion is dependent on the waves and currents moving away the débris eroded by direct wave impact. The loss of fine material, clay, etc., cannot be prevented; but if we stop the movement of sand and shingle, then there will be a sort of automatic protection by the sea against itself due to the formation of a bank of material at the base of the cliff.

Where erosion is due to the formation and inland movement of sand dunes, it can be prevented by collecting the inblown sand a short distance back from high-water line, and the formation of a littoral coast protection dune, which, when built up by the wind, under the guidance of man to a proper height and inclination, serves several useful purposes. In the first place, such a littoral dune prevents inland sand drift and the formation of sand wastes; secondly, it acts as an embankment or second line of defense against coast erosion; and, thirdly, it enables the reclamation of any existing areas of bare sand behind the littoral dune. Where a large littoral dune is formed, which prevents the inland movement of sand, the tendency is for land to be gained from the sea by the gradual formation of small irregular-shaped dunes in front of the protection dune.

Use of Vegetation

Vegetation plays a very important part in preventing coast erosion, by building up, binding and consolidating natural or artificially formed littoral dunes, and enables them to be of service as a barrier or second line of defense in case of gales at exceptionally high tides. If covered by vegetation a littoral dune forms a very effective sea embankment. The roots of the various grasses bind the sand surface and the foliage catches sand blown in, the vegetation being able to accommodate itself to a slowly rising surface level.

By sand binding grasses, with stems bending to the elements, and deep, wide roots binding the sand together in a network of strong fibers, Holland largely holds the land she has wrested from the sea. That fair, fertile, rich province, the peninsula of Eiderstadt, in the south of Friesland, has on the point toward the sea only a short row of dunes—some 6 mi. long; but the people talk of their fringe of sand hills as if it were a border set with pearls. They look upon it as their best protection against Neptune.

While sand-dune embankments, when raised to a proper height and slope and fixed by vegetation, are undoubtedly a very cheap and effective means of preventing erosion by the inland movement of dunes and form a valuable second line of defense, such embankments will not, however, withstand some damage by waves during high tides and gales. They require constant attention, and it is necessary immediately to repair, by collecting fresh sand and replanting where necessary, any breach formed.

Where erosion, due to the movement of littoral drift, caused by wave and current action, is taking place on the foreshore in front of the dunes, it is essential to stop it by groining; otherwise in course of time the littoral dune will inevitably be undermined.

Long Low Groins Best Protection

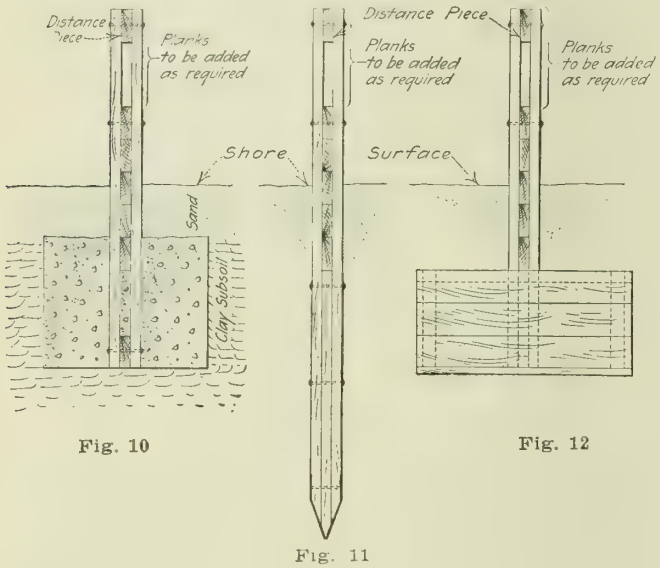
Where the erosion of the New Jersey and Long Island coasts is taking place and being actively aided by high groins and vertical or nearly vertical bulkheads, it would be necessary to cut down or otherwise modify these structures before any successful protection works can be built at a reasonable cost. The keynote of success is, firstly, never to build any structure which offers a large surface to direct wave blow, and, secondly, to utilize the constructive forces of the sea to build up a natural protecting barrier of sand or shingle up which the waves can harmlessly roll and gradually expend their energy before reaching high-water mark. This can only be accomplished by long low adjustable groins gradually built up as the shore is added to by accretion. Wherever high groins or jetties exist, they should be cut down so that not more than about 2 ft. of groin projects above the shore. Where there are vertical or nearly vertical sea walls or bulkheads, which have more than 2 ft. exposed to wave impact at high tides, then an outer row or rows of timber or concrete piling or other construction must be put in so as to form a stepped wall, no step to be more than 2 ft. high above the one below. In this way the energy of the waves will be gradually diminished as each step is encountered, and the backwash instead of rushing down with gradually accelerated velocity, will, as it pours from step to step, have its velocity destroyed.

Action of Groins

Coast protection by means of groins is of very ancient origin, dating back certainly 300 years; but, strange to say, until quite recent years very little, if any, advance was made in the methods of applying them.

Groins can accumulate material in two ways—either by trapping sand or shingle moved along the bottom or by slowing down the littoral currents and thus cause them to deposit material held in suspension. To trap material moved along the bottom appears to have been until recent years the sole reason for erecting groins; but a very large amount of sand is churned up by wave action and carried along in suspension by oblique waves and wind-formed and tidal currents. A groin should, therefore, be designed to slow down the littoral currents as well as collect material moved along the bottom.

While almost any obstruction built across the foreshore will suffice to collect shingle, the same is not true for sand. If, therefore, we erect a groin suitable for collecting sand, we may be sure that it will also catch and retain shingle; but the converse of this is by no means true. Groins should not be built so as to entirely stop the littoral or alongshore currents, but built so as to permit them to flow, bearing their burden of suspended sand,



FIGS. 10 TO 12. THREE TYPES OF TIMBER GROINS

and check their velocity, and thus cause them to deposit material in the proper place.

In designing groins for collecting sand care must be taken to see that their effect is not to divert the alongshore currents in a seaward direction, either by making them too high or putting them in other than at right angles to the main direction of the flow of the littoral currents.

The action of a groin in accumulating material may also be due to the reflection of oblique waves landward. When an oblique wave strikes a groin, there is a tendency for it to be reflected landward along the groin, and the disturbance due to impact will stir up sand on the bottom and carry it toward the land. There is, no doubt, an escape seaward of the reflected water, but it would naturally not be so concentrated as the currents due to the wave impact on the groin, and so would not be so effective in carrying away such material brought in.

Height of Groins

Before the introduction of the low groin system the general practice was to construct what may be termed "high groins," which commenced at high water and were seldom carried right down to low-water line. They were built up to the full height in the first place, and the tops were usually at an unvarying gradient, being simply inclined in a straight line seaward without any regard to the varying curvature of the foreshore. It is a matter of common observation that, in most cases, where groins are put in exceeding 2 or 3 ft. in height above the shore level irregular accumulation occurs. There is usually no building up of the shore on the leeward side, but actual denudation.

High groins are unnecessarily costly, since they expose a large surface to the sea and must consequently be built very strong. The important thing is to build the groins low, and only raise them as the shore surface is raised. In this way a groin which is technically a low one may eventually, as the shore builds up, be very high, when measured from its foundations; but it should never be high above the shore surface.

Direction and Length of Groins

The efficiency of a groin depends on its ability to intercept drift, which is another way of saying that it depends partly on its effective length—that is, on the distance to which it extends across the littoral currents. It is obvious that for a current flowing parallel to the coast line any departure from the right angle direction means a reduction in efficiency for a given length of groin. On a sandy shore the groin, if put in obliquely and directed away from the side from which the prevalent wind waves come, must have an injurious effect, for not only is there more surface exposed to the wave stroke and a consequently greater liability to scour, caused by the rebound of the waves, but also water flowing down the foreshore from the backwash of the waves is intercepted by the groin, which thus diverts a serious current to one part of the shore. Instead of having the water spread out in a thin layer over the foreshore it is concentrated along the groin, producing a channel down which sand is swept. Any divergence from the right angle direction tends to divert the alongshore currents in a seaward or landward course, which is detrimental to sand accumulation.

On sandy shores oblique groins not only have serious disadvantages compared with right-angle groins, but are

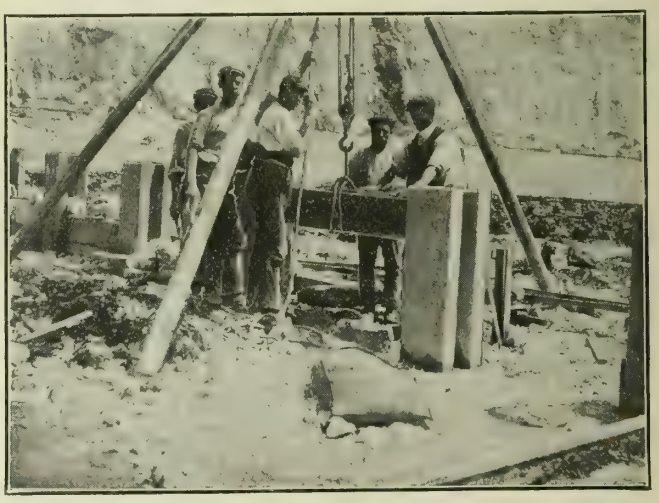


FIG. 13. REINFORCED-CONCRETE CASE GROINS NEAR BRIGHTON, ENGLAND

also more costly, as they are more liable to be damaged by waves and a longer groin is required to extend from high- to low-water line.

On shores where the material is chiefly shingle, and the littoral drift almost entirely due to oblique wind waves moving material along the bottom, groins constructed at or nearly at right angles to the prevalent oblique wind waves are effective in preventing shingle travel; but as most of the shores of New Jersey and Long Island are of a sandy nature it is not necessary to consider their action or the relative advantages of oblique and right-angle groins for preventing shingle travel.

Groins should always extend from high- to low-water line, and, if possible, be extended seaward of low water. The longer the groin, the greater will be its efficiency. The success of submarine groins has been amply proved.

There is usually a large amount of material traveling just seaward of low water, owing to the length of time the tide hangs about this point and to the sea bed being always exposed to the action of currents and waves.

Distance Apart of Groins

The distance apart of groins should not be greater than the distance between high- and low-water lines, and in some cases should be considerably less. If the groins are not built up more than 2 ft. above the shore level, and added to as accretion takes place, they may be placed 200 ft. apart. Provided they are not put in sufficiently close together to cause the formation of an eddy or swirl from one groin to the other, the closer together they are put, the more quickly will the shore be raised. The distance apart, therefore, depends to some extent on the amount of building up which is necessary. If the groins are only required to hold material already there, or to build up the shore to a small extent, they may be put farther apart than in cases where it is necessary rapidly to accrete material in order to prevent serious erosion.

Materials of Construction

In selecting mateials for constructing coast-protection works, durability and high specific gravity are the principal qualities to be sought after. Durability is affected by ordinary decay, erosion by moving sand and stones, chemical action, and exposure to changes of temperature, as well as by the direct blow of the waves and by the destructive action of sea worms.

Many methods have been tried to prevent timber from being destroyed by marine borers. In Holland "teredo nails" are used with fairly satisfactory results. They are flat-headed iron nails driven in close together; on rusting they form an impervious skin over the surface of the timber. Creosoting is the method used in many places to prevent the destruction of timber by the teredo and limnoria. While it undoubtedly preserves the timber to a certain extent, the author has, in numerous places, seen timber impregnated with the maximum amount of creosote possible quickly attacked and eaten by these borers. When creosoted timber is immersed in sea water, the creosote is gradually expelled and its place taken by the salt water; but if there is no soft uncreosoted timber available for the teredo to eat up, they will attack the creosoted timber almost as soon as it is put in.

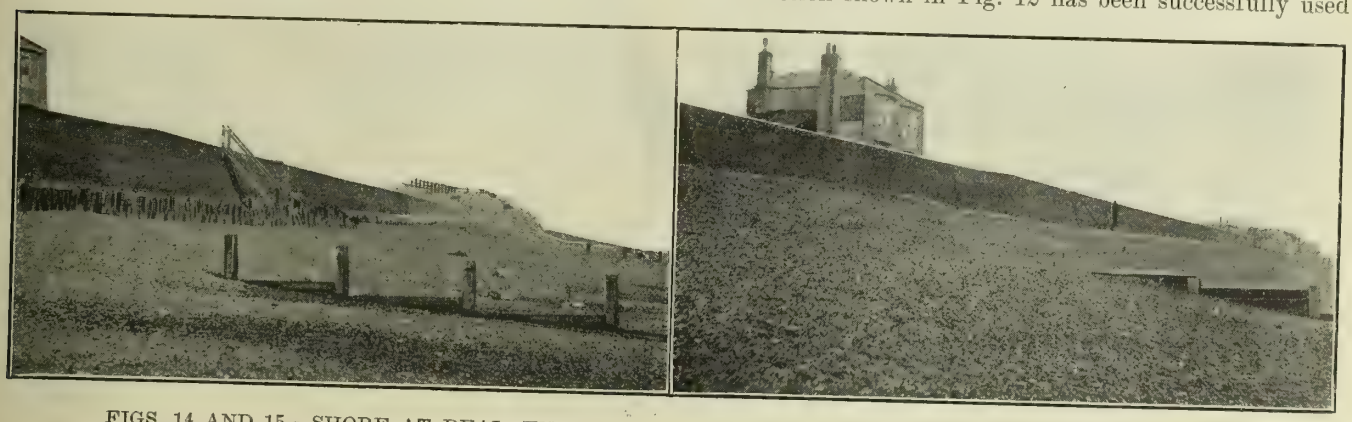
After many years' practical experience in the design and construction of coast-protection works the author has no hesitation in saying that, as a general rule, reinforced concrete is the best material to use for constructing groins and sea walls. It is more durable than timber and has the advantage of having a higher specific gravity.

Methods of Constructing Groins

The method of constructing the groins to get the best results must be such that the groin can be added to from time to time, as accumulation takes place, and therefore, as a general rule, some form of construction consisting of piles or columns and planks or slabs is the best and cheapest to use.

Figs. 10, 11 and 12 show three methods used for constructing Case timber groins, and Fig. 13 illustrates the construction of reinforced-concrete Case groins near Brighton in England.

For shores where there is a subsoil of clay or other hard material at a reasonable distance under the surface, the practice of fixing the piles by embedding their lower ends in concrete rammed into holes dug in the foreshore is the best possible method and the cheapest. The piles practically become welded into the substratum and in clay, where canting of driven piles is such a common difficulty owing to the small amount of surface exposed, permitting them to force the clay aside. A pile set in concrete gives a better grip to the shore and will not cant or be displaced as easily as a driven pile. The method of construction shown in Fig. 12 has been successfully used on sandy shores where there was no subsoil within a reasonable depth. The method of fixing the planking or slabs is of no special importance, provided that if a single pile is used every plank is firmly fixed to the pile, and in the case of a composite pile that the top plank is rigidly fixed to the pile. The use of the composite pile does away with the necessity of rigidly fixing all the planks and makes it impossible for the lower planks to come off, which often occurs during storms when a single pile is used.



FIGS. 14 AND 15.—SHORE AT DEAL, ENGLAND, BEFORE AND AFTER BEING BUILT UP BY GROINS

Care must always be taken to see that the planking is put in sufficiently far below the shore surface to avoid risk of underruns.

If low groins are put in there is no necessity for having struts, which are, of course, essential in the case of high groins. Struts not only add considerably to the cost, but on sandy shores scour often takes place round each strut.

Efficiency of Long Low Groins

Where there is a plentiful supply of material traveling, long low groins cannot fail to collect sand or shingle and build up the shore, if they are properly constructed and put in at the correct distance apart and at the proper angle to the coast line. If the groins are constructed of

timber it is necessary to keep them in a proper state of repair and renew any piles or planks as soon as they are eaten away by the teredo. Reinforced-concrete groins, if properly built in the first place, are practically everlasting, and it is only necessary to add the planking slabs as accumulation takes place.

When the Case system of groining was adopted at Dymchurch, England, in 1894, the seawall, which is about 3 mi. long and protects 60,000 acres of low-lying land from inundation by the sea, was in a very precarious condition, and its upkeep cost an enormous sum of money. Breaches in the wall had to be constantly repaired. The foreshore at that time consisted of wet sand, mud, and pools of water. By 1898 the conditions had so improved that hard sand had taken the place of the mud and pools of water, and from 7 to 8 ft. of sand had in places accumulated near the toe of the wall. Over the whole distance of 3 mi. the shore has on the average been raised 4 ft. 6 in. and the low-water line has been driven seaward about 400 ft.

At Deal, England, between 1872 and 1898 high-water line had advanced 40 ft. and low-water line 160 ft., the Borough Council being constantly obliged to spend large sums of money in repairing the sea wall and promenade road, which in various places were breached by the sea. According to a report made by the borough engineer, a total of 58,878 tons of material was accumulated by the Case groins between 1898 and 1900, and low-water line was driven seaward an average distance of 50 ft.

Formation of Littoral Dunes

When sand moves inland and erosion is due to the inland movement of sand dunes, it is necessary artificially to raise the height of the existing dunes on the coast margin or form a littoral dune. The best place for the littoral dune is about 100 ft. landward of highwater spring tides. The first step to be taken is the erection of a continuous line of paling fencing. This should consist of boards about 6 ft. long by about 6 in. wide and 1 in. thick, the bottom ends being pointed. The planks should be driven about 3 ft. into the sand, a space of 1 in. being left between the planks. Sand transported inland then accumulates on both sides of the fence, and when it has risen to within a few inches of the top of the planks they should be pulled up about 3 ft. This can be accomplished by means of levers and the process repeated until a littoral dune has been built up high enough to prevent sand from being drifted inland. Experience has shown that the height required to prevent inland drift is, as a general rule, about 40 ft. The best slope for the sea face is 7 deg. and for the land face 22 deg. with the horizontal. By altering the position of the fence, or putting in a double row of fencing a few feet apart, the slopes can within certain limits be regulated at will.

When the dune has been built up it should be planted with sand-loving grasses or shrubs on both faces. Sometimes difficulty is experienced in getting the vegetation to grow on the sea face. In that case it may be protected from sand drift while the plants are establishing themselves by putting up a temporary fence on the sea side.

In France tufts of marram grass are planted in wintertime in front of the fences in quinquex order, and between the plants seeds of other grasses are sown. On the sea side of the dune 121 marram plants and 5¼ lb. of grass seed are used to each acre of surface.

The increase in height of the dune will depend on its size; and it is useless to attempt systematic planting until the size of the dune is such that the increase in height of the slopes is not more than 1 ft. per annum. Suitable grasses and shrubs will, by upgrowth, adjust themselves to a surface level which is rising at this rate.

In places where the foreshore has become lowered in front of the dune by littoral drift and where the supply of inblown sand has practically ceased for some reason, the dune face will be exposed to wind action, salt spray and wave action during storms and very high tides, and in such situations it is difficult for the vegetation to grow on the lower part of the sea face. To protect the dunes while groins are building up the foreshore again an artificial facing of fascines or reinforced concrete is often used in Holland on the lower part of the dune slope just above high-water line.

Protection Works on the New Jersey Coast

The coast-protection works constructed on the New Jersey coast have, on the whole, met with little success, although vast sums of money have been spent in constructing groins or jetties and bulkheads. Many of the works put up are striking examples of the futility of combating the waves and currents. Instead of protecting the coast, many of the works are most efficient coast eroders and splendid examples of how not to construct coast-protection works. The money spent has unfortunately been more than wasted, since the failures have, in a large degree, hindered the adoption of other plans, based on wider experience. Most of the systems adopted are very similar and consist of pile groins filled with brush and stone, usually built up 4 or 5 ft. above the shore surface. A certain amount of accumulation takes place on the windward side and considerable erosion on the leeward side. If the property is valuable and the erosion continues—as it usually does—a vertical, or nearly vertical, bulkhead is constructed a little back from high water and parallel to the shore line. These works cost from $15 to $50 per ft. run of frontage. The erosion still goes on and in course of time the bulkhead is destroyed. The houses in front are then moved back and the same process begins all over again.[11]

The reasons for the general failure of the works are: Firstly, the groins are built too high, are not long enough and have not the proper slope; secondly, the vertical or nearly vertical bulkheads greatly assist the erosion; thirdly, proper steps have not been taken to prevent the inland movement of the sand spits and sand islands.

After many years' experience in designing coast works on all kinds of shores, the author is firmly of the opinion that the New Jersey coast could be permanently protected at a moderate cost by constructing a comprehensive system of long, low, reinforced-concrete groins, extending out to and beyond low-water line, modifying the existing jetties by cutting them down and, where they are essential, forming the bulkheads into stepped sea walls, and lastly by raising and planting where necessary the natural sand embankments or forming a littoral dune to prevent the inland movement of the sand spits and sand islands.

It is probable that the cost of permanent works would be little more than the cost of constructing the timber groins and bulkheads which have proved a failure and which moreover only last a few years.

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[11]See transactions, American Society of Civil Engineers, Vol. 23 and Report of State Geologist of New Jersey, 1905 and 1913.

Springfield Water-Works—II

SYNOPSIS—Description of some noteworthy features of construction work and some unusual developments in routine maintenance work. Supplement to Part I on the organization, plant and equipment, in "Engineering News," Aug. 26, 1915.

All water mains in Springfield, Mass., are laid by municipal day labor under the general supervision of the assistant superintendent of the water-works. Two gangs are constantly employed during the working season, each in charge of a foreman, and he and one or two of the more experienced laborers are the only permanent employees in this branch of the service. All service connections are

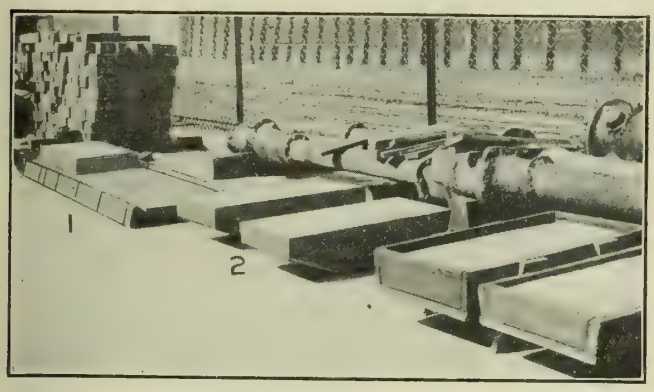


FIG. 1. CONCRETE BLOCKS FOR HYDRANT SETTINGS

made by a separate gang. For service pipe the city uses galvanized wrought-iron and lead-lined wrought-iron pipe. In the past, cement-lined pipe has been used for both mains and services. The pressures are high (87 to 147 lb.). Lead and leadite are employed for calking joints.

There are two or three details in connection with the construction work in setting hydrants which are of particular interest. Owing to the high pressures at hydrant connections, trouble was experienced with leaks caused by the lead-packed joints coming loose, due to the hydrant pushing out or settling in soft ground. To prevent this, a flat concrete block (about 12x18x6 in.) is placed under the base of each hydrant, at its junction with the main, and back of this connection a heavy double wedge-shaped block (about 24x12x6x4 in.) is inserted, which effectually prevents loosening of connections. These blocks (Fig. 1) are made in collapsible molds at the water-works plant on rainy days and in the winter time.

Another specialty is a gate-box of the water-works superintendent's (A. E. Martin) own design (Figs. 2 and 3). It was found that small changes in street grades were a constant source of annoyance to the water department, which is called on to reset the gate-boxes to the new grade. A telescopic box was designed, the lower part of which is of the standard type, but the upper half has a spiral flange or deep thread cast upon the exterior, and has slots to fit the prongs of a special wrench in the flange which holds the cover. Hence, to adjust the box to any new street grade it is only necessary to remove the cover, insert the special wrench (Fig. 3) and screw the box casting up or down, as the case may require. This casting is made in a local foundry and is not patented.

Records of all main gate valves, hydrants and services of 3 in. or over are kept in flexible-covered notebooks 8¼x11¼ in. in size. Fig. 4 is a reproduction of a part of a page. Each page covers a numbered section of the city, 1500x2000 ft., on a scale of 1 in. = 250 ft., and at least one valve without the border of the section on all

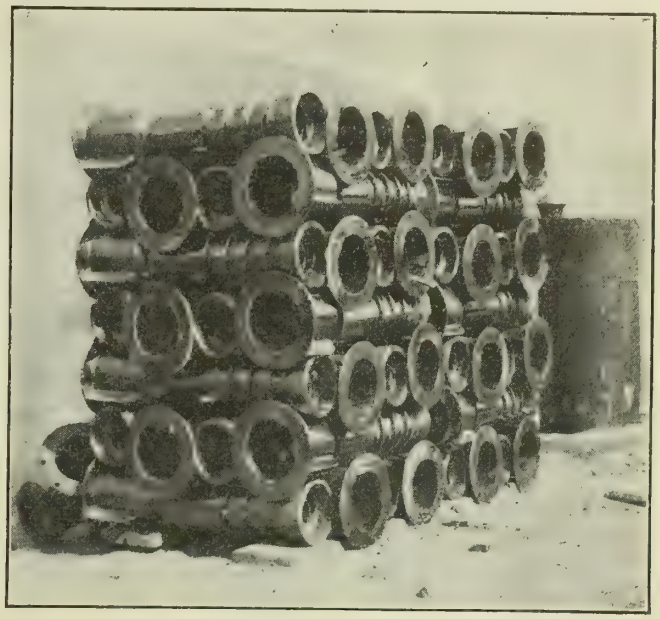


FIG. 2. SPECIAL GATE-VALVE BOXES

main entering or leaving this section is shown. Only three or four copies of this notebook are kept, one of which of course is part of the emergency-truck equipment.

Each valve is numbered, as shown, within a circle. Those numbers inclosed in squares or rectangles are sewer flush gates, which are two 2½-in. wheel valves (without the wheel) in ordinary valve boxes. A description of each gate location arranged consecutively by numbers is bound in a separate cover. These are printed in two rows to a page in large type and read as follows:

> **389**
>
> **Winchester St., at Monroe, 4′ M.**
>
> **22′ 8″ from N. E. corner, 33′ 6″ from N. W. corner of Monroe and Winchester Sts., 11′ 10″ S. of N. line of Monroe St. Spiral.**

To find all the valves on a certain street or to locate a particular valve on the map, a printed index is provided, which is also bound into the notebook. The following is typical of the entries:

INDEX.

LOCATION	Main or Side	Numb
CHESTNUT ST.		
Worcester St.,	C	188

Wherever there is a chance of valves being added, blanks are left under each street heading to be filled in as may be necessary. Each foreman has a book of valve locations which is carried about in a canvas bag. When permanent objects to use as ties are lacking—as in the



FIG. 3. SPECIAL WRENCH FOR CHANGING VALVE-BOX ELEVATION

outlying, sparsely settled parts of the city—a concrete slab 8x1½ ft. by 4 in., not unlike a grave-stone in appearance, is set up beside the road and ties made to this. Fig. 5 shows such a slab. The letters W. G. (water gate) and the distance out to the valve in feet are cast on the face of the slab.

Every service connection is located and the records kept on cards 4x6 in., of which Fig. 6 is a small-size reproduction. The cards are filed under the name of the street and the number on the street. The rough sketch on the reverse side (Fig. 7) is made in the field with a small field drawing kit consisting of a board about 10x14 in. with straight-edge and triangles attached and is the original record from which the typewritten description on the face of the card is made. These little surveys of the service connections were made at odd times by the superintendent's assistant until the records were brought up to date. Now it is a very simple matter to make the record when the service is installed. The record cards can be taken out of the files and to the job when it is necessary for any particular reason to find and dig out a service connection. During the winter there are the usual regular inspections of hydrants to prevent their being found frozen and useless in case of a fire. That this may not be considered merely perfunctory, and to have proof of careful inspection in case of complaint



FIG. 5. CONCRETE TIE SLAB

by the fire department, a system of recording these inspections has been devised.

Every hydrant has a number tag, and the numbers of the hydrants inspected are recorded on a special slip, which each day is turned over by the inspector to the foreman in charge of this work. The slip contains space for any remarks, such, for instance, as: "Worcester and Fish Ave., number tag gone. No. 98—1 ft. of water; No. 419—3 ft. 6 in. of water."

The inspection slips are signed by the foreman and filed at the office, where a permanent record of all inspections is kept. These records are on blue-ruled cross-

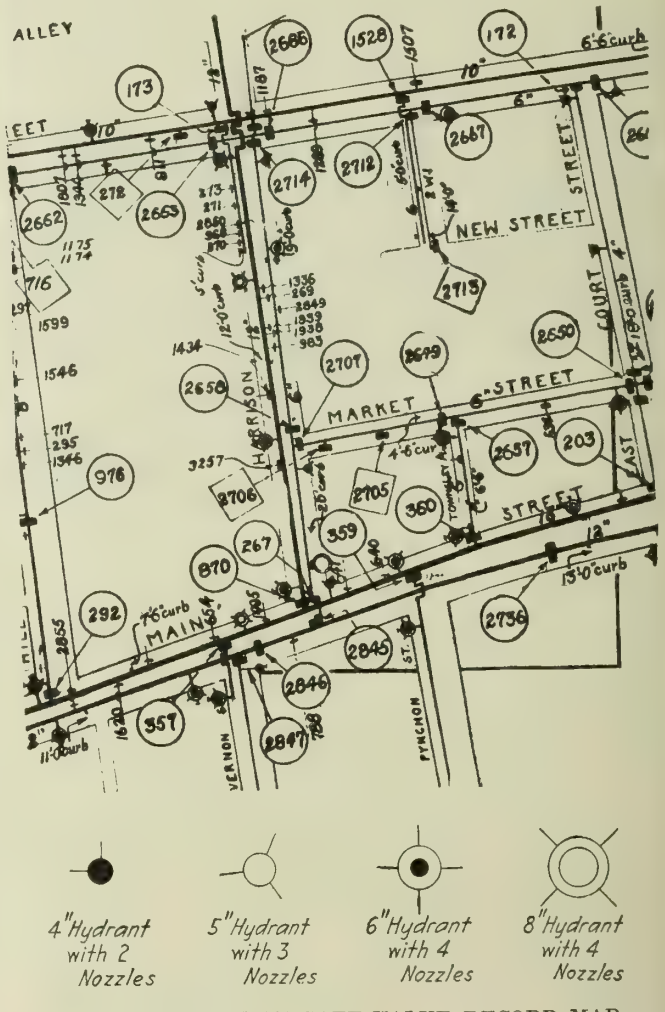


FIG. 4. PORTION OF GATE-VALVE RECORD MAP

section paper, 15½x19½ in., which in vertical columns, gives the number of the hydrant, a description of its location, and a blank square for every day, each sheet sufficing for two months. A check mark in the square under the date of inspection signifies that the hydrant is in good condition, *F* means it is frozen, *W* full of water, 2 that there was 2 ft. of water in the hydrant, etc. Every hydrant is thus accounted for at least twice a week, and in severe weather every day or two.

An unusual feature of the water-works maintenance work is the regular employment of a water-gate testing gang. This is another of Mr. Martin's innovations. It was found that the gate-boxes frequently became clogged up, or the gates so set that to open and close them in an emergency was sometimes difficult, so a regular gang was organized whose sole duty it is to travel about the city

opening and closing, oiling and packing gate valves, and where necessary, in new street work, changing the elevations of the gate-boxes.

The gang is composed of a foreman and three men and is outfitted with a one-horse wagon (Fig. 8) and an equipment of picks, shovels, spoons, etc., for cleaning gate-boxes, wrenches and other small tools, not the least important of which is a small mirror for reflecting the rays of the sun into the gate-box. From 1200 to 1500 gates are tried each month, or every gate is tested at least twice a year. It is expected eventually to have a specially designed small motor truck for this service. This gang inspects hydrants during the four winter months.

No. 94 Shattuck Street
Owner F. W. & R. Zilinski S.R. 22047

Date	Work Done
5/22/15	Service pipe laid by Patrick Casey

Stop in walk I.K. (1") 9'0" from N line of St., 14'0" W of E line of body of house . Corp 15'0" from S line of St., 25'6" from stop in walk, online with same.

WATER DEPT., SPRINGFIELD, MASS. Library Bureau 511541 -A STOP LOCATION

FIG. 6. RECORD CARD FOR SERVICE CONNECTION



FIG. 8. GATE-VALVE TESTING GANG, SPRINGFIELD, MASS., WATER-WORKS

number of half-turns to operate the valve makes it possible for the office to check the completeness of his inspection, as well as to determine whether the gate is properly operating.

There are a number of advantages in such a regular gate inspection. It not only keeps the valve boxes free of dirt and in working order, but it familiarizes the men with the location and operation of all these valves, which is very important in cases of bad breaks. The gate valves are obviously an important part of a water-works system, and to have an efficient system every part of it should be kept in good working order.

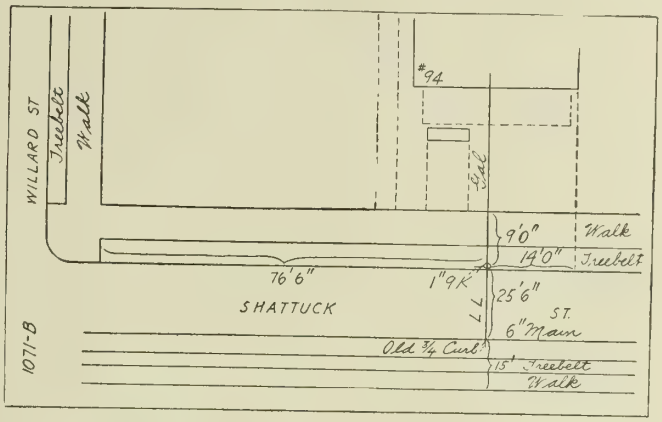


FIG. 7. REVERSE OF RECORD CARD FOR SERVICES

CITY OF SPRINGFIELD
WATER DEPARTMENT
FOREMAN'S RETURN
GATE INSPECTION
April 12 1915

GATE NO.	NO. OF HALF TURNS	KIND OF COVER	REMARKS
	Hayden st		
988	41	Spiral	
1421	19	"	14'9" from E. lines of st.
984	36	R. I. W.	

FIG. 9. FOREMAN'S GATE-INSPECTION RETURN

WATER GATE
SPRINGFIELD MASS. NO. 3358
DATE SET Sept. 13, 1910 LOCATION Albany St at 30" Circuit Main SHEET NO. 37
SIZE 8" MAKE Smith KIND PURPOSE Street Main OPENS Right
FULL TURNS TO OPEN 26 NORMAL CONDITION Open COVER Spiral
INSPECTION RECORDS

DATE	CONDITION FOUND	CONDITION LEFT	REMARKS	FOREMAN
8-23-11	Open	Open		Hubley
5-25-12	"	"		"
11-9-12	"	"		"
6-16-13	"	Open 7/8 turns	Cast leak caused by Sewer Dept.	Miller
7-29-13	Part Open	Open		Hubley
8-26-13	Open	Half open	For fear of settlement of new trench	"
9-6-14	Half open	Open		"

FIG. 10. INSPECTION RECORD OF GATE VALVES

Mr. Martin, in his annual report to the Board of Water Commissioners for the year 1914, when this part of the work was inaugurated, states: "This work (regularly operating the gates and keeping the boxes raised to grade) I consider of vital importance, as in the case of a break, minutes lost looking for a gate box are very valuable, to the extent sometimes of hundreds or even thousands of dollars." In making this statement he writes from many years' experience with such breaks; a serious one occurred just before the inauguration of the gate-inspection work noted in this article.

Rebuilding Rural Roads in the Southern States

By G. B. Buchanan*

SYNOPSIS—The peculiarities of Southern rural-road improvement are explained in the light of ante-bellum conditions. Methods and costs of reconstructing corduroy roads are given.

There are in the Southern States many miles of rural roads which are never seen by cross-country tourists and therefore are seldom considered in the widespread good-roads propaganda. Nevertheless they are important thoroughfares to the communities they serve, and their improvement is becoming urgent. While not calling for much engineering design, the improvement of these roads might very properly come within the practice of local surveyors and engineers, and the improvement may be extravagant or economical, according to the judgment and experience of the engineer.

Early Road Conditions in the South

A brief résumé of early conditions is essential to an understanding of some peculiarities now met with in Southern road work. It is well known that previous to the Civil War the South was preëminently an agricultural region of large estates and few railroads. Transportation to the market from the interior for distances of 100 to 200 mi. was by freight wagons; passenger travel was by stage, carriage and quite largely by horseback.

Road laws were perhaps the most negligible of any of the laws. While the Southern highway commissions are now gradually developing efficiency in rural-road work, they are often hindered by the old-time county-supervisor system. With competent business men in office this system works well, but there are still too few uptodate men connected with these county-supervisor boards.

Before the Civil War the rural South had very few really public roads. The passenger or stage roads were mostly toll roads, built and maintained by individuals and not communities. The greater part of the freight tonnage was carried on other roads built and maintained over private lands by the owners of estates. This system had disadvantages. It was a handy vengeance to close the freight roads over one's estate to the wagons of an enemy. As these estates seldom contained less than 1000 acres and often many thousands, the closing of roads compelled a roundabout way to the market. There was also the possibility that cliques could "freeze out" other proprietors by combining to close avenues for freight hauling.

Haphazard Manner of Road Location

For years following the Civil War the old private-road system held sway, strangling many fine farms. Together with the scarcity of intelligent farm labor, it was one of the factors in the temporary stagnation of much Southern farming after the war. Even the incompetent labor left could have accomplished something had there been outlets for crops, which were not liable to be closed over night. Thousands of acres of once fertile lands were abandoned. Since then these large estates have been cut up into farms which one family can handle—from 25 to 300 acres—with some sort of highway guaranteed.

In many Southern road districts it has become an established legal principle that "roads existing when the estate was subdivided shall be roads for the different parts." At the same time such of the old freight and passenger roads as were desired were brought under the wing of the county-road organizations. This was the inception of practically the South's whole rural-road system, so it can be seen that in dealing with these roads we are dealing with highways largely planned and executed in accordance with private ideas or even temperamental whims. Records are meager, but those available show that the best roads were built by estate owners of military experience.



FIG. 1. SURVIVAL OF ANTE-BELLUM TRANSPORTATION METHODS; MOVING A 4½-TON BOILER FOR A SAWMILL

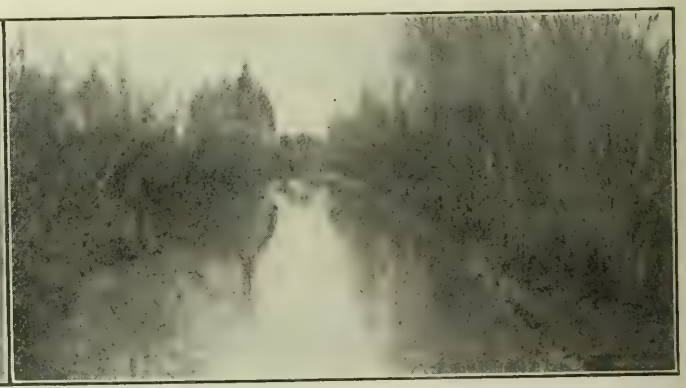


FIG. 2. EXAMPLE OF SOUTHERN CORDUROY ROAD BUILT IN CUT THROUGH BOTTOM LAND

Corduroy Roads Become Unendurable

Years ago plank roads built as toll roads were much in vogue. Evidences of planking frequently appear on old Southern passenger roads, but for freight traffic sawed lumber was considered extravagant. Plenty of suitable poles, however, were generally handy to the wet places of these roads and there was likewise plenty of labor, so

*Surveyor, Woodford, Va.

corduroy roads were laid on soggy stretches. This habit persisted until very recently, when the popularizing of the automobile made corduroy roads no longer endurable.

The corduroy surfaces were rough, but of more importance, they had been laid largely in creek and river bottoms subject to overflow. In building a corduroy road a level surface was essential for the length of the pole; and labor being plentiful and earth-moving equipment scarce, the ante-bellum road builder obtained this level surface by digging and not by filling, as would be done now. We thus have roads through bottom lands as low or lower than the surrounding surface.

So heavy is the rainfall in the South and Southeast that high floods are customary, and while often a long-legged steer or horse could get over the submerged roads, modern low-hung automobiles cannot. Flood levels of 6 to 8 ft. or more are often found on these old corduroy roads making them quite impassable.

Reconstructing the Old Roads

The predominating kinds of timber dug out of the later-built roads are ash, sweet gum and pine. Much cedar, locust, sassafras, oak, etc., was used previous to the war. Long-lasting woods, like cedar, sassafras, white oak and locust, are still good, and if it were known that these woods only had been used, the improvement could be made on top of the old road. Other woods have decayed, or are decaying, and therefore the removal of the corduroy road must be considered in rebuilding these highways.

Five methods of rebuilding are practicable: (1) Machine excavation; (2) hand excavation; (3) burning; (4) filling over the corduroy; (5) relocating the road.

Plan 5 is much used. In the first place there was no inclusive scheme used in laying out these roads—there may be several roads in the course of a few miles and there may be 5 mi. between the next two. Grades are either steep, or the road over the elevation is unnecessarily roundabout. As the surface of roads should be high enough to provide drainage, it is usually found more costly to fill the excavation made for a corduroy road than to grade a new roadbed.

Where cleared land is available for a new location and condemnation proceedings are not forced, a relocation is the most economical solution of the problem. Nevertheless this cannot always be done. Again, the corduroy roads have been mostly in river-bottom lands, where timber or heavy brush is generally found, so that any estimate for a relocation must consider the cost of clearing a new right-of-way.

Plan 4 is used where relocation is undesirable and where the finished surface of the roadway is to be 30 in. or more above the buried wood. In this case, for the gravel road now largely being built throughout rural Virginia, at least 18 in. of soil from near-by borrow pits is filled in over the old road, then 12 in. of bank-run gravel is spread for surfacing material. The cushion of soil is usually compacted by rolling in about 18-in. layers. The gravel is not compacted except by the teams and wagons hauling it.

Control of the Traffic Loads

Thus cheaply built and well-maintained, this type of soil-gravel road has been found suited to moderate automobile traffic, and it will hold its surface if heavy loads are prohibited while the surface and soil cushion are soggy from thawing or long wet periods. In the South roads are subjected to continuous freezing and thawing all through the winter, which is extremely trying to any type of earth road. Frequent rains are experienced also. By several state laws boards of supervisors are given authority to control loads on improved highways, and this authority is now largely exercised, the limit being 1000 lb. per wagon when the roads are thawing or soggy.

Perhaps 75 per cent. of the heavy traffic over Southern rural roads has heretofore been in lumber and allied industries, the little country sawmills sending their product to rail or water by two-, three- and four-mule wagons. Lately, some tractor hauling has been tried with fair results, although it is found that curves are of too short radius and grades too abrupt for much success at this time with the wagons used. No effort has been made to secure special trailers, and a long string of ordinary wagons is very unwieldy.

Cross-ties, excelsior, pulp and cordwood are produced whenever farm work is slack, as well as sawed timber. Regulations limiting loads are opposed by many at first. This quickly ceases, however, when it is seen that reducing the loads for the short periods required enables good loads to be hauled all through the winter, instead of diminishing the load as the winter proceeds because of the total demolition of the road surfaces.

Where a road cannot be relocated and filling over the old corduroy surface is impracticable, the poling can be removed in one of three ways. It depends on conditions which is the most economical. Burning is not extensively



FIG. 3. FLOOD PROTECTION BY WOVEN BRUSH
Screens of woven brush are fastened to the fence posts to prevent scour



FIG. 4. A 70-YEAR-OLD RURAL ROAD
Drainage ditches 12 ft. deep, overgrown with brush and dangerous

practiced and is confined to roads in clay soils generally classified as gumbo. A fire dries out this material so it can be compacted without gumming up the road-roller wheels. This kind of clay must be well compacted, for otherwise the gravel will work down into it and in rainy weather ruts will cut clear through the gravel. However, the burning of the poling is only a part of the fire applied, much brush being burned also.

To burn the poling the earth covering is first dragged off with a road scraper with the blade set horizontally. The poles are then allowed to dry out, when some handy inflammable fluid is applied. This will cover the poles most effectively if sprayed on in a moderately heavy spray. The fire should be set to burn against the wind, as otherwise it will sweep over the poles without generating its full heat.

No cost data are at hand to show the relative efficiency of machine and hand methods of uncovering the poling, but it is evident that with the ordinary road machine found in most Southern districts, hand digging is not any more expensive. The only machine usually available is the blade scraper, which has so low a clearance that the outfit must stop every few feet to clear out the material from under it. In hand digging the earth covering the poling is first scraped off, when a heavy subsoil plow may be run near each end of the poles, the point plowing down under the poles. This rips up the sound poles, which are then carried off to suitable piles. The rotten poles are broken up by this process and must be dug out by hand.

Sound poles of lasting wood, like cedar, locust, white oak and sassafras, can be dried out and worked into fence posts selling from 10 to 25c. each.

It would appear sound to estimate from $100 to $500 per mile for digging out old corduroy roads when bidding on Southern road work, where much poling is found and the specifications require its removal.

***

The Australian Transcontinental Ry. will be finished by the end of 1916, according to a recent report by the Chief Engineer, N. G. Bell. On the West Australian section the final locating survey has been made for a distance of 260 mi. and preliminary surveys as far as the South Australian boundary. The line has been completed ready for track laying for 240 mi. in West Australia and 264 mi. in South Australia.

New Trenching Machines

A special class of excavating machinery which has been developed very extensively is that for digging the deep and narrow trenches required for water mains, sewers and tile drainage. Two excavators, of different types, for this class of work, are shown in the accompanying illustrations. They are being introduced by the Pawling & Harnischfeger Co., Milwaukee, Wis.

Ladder Excavator

The machine shown in Fig. 1 has an endless chain fitted with buckets, the chain being carried by a boom or ladder frame which has its upper end pivoted to fixed frames on the deck of the machine. The ladder is a heavy box girder, which is held at the required position by tackle from the cantilever ends of the fixed frames. Its weight serves to hold the buckets against the breast of the cut, and the method of suspension enables it to swing up if the buckets strike a heavy boulder or other obstacle.

The buckets are of cast steel, with removable teeth of tool steel, and are attached to a chain composed of cast-steel links having a pitch of 10 in. The buckets can be changed readily to give the desired width of trench. Ordinarily the range of work is 12 ft. in depth and 27 to 39 in. in width; but an extension of the ladder provides for a depth of 15 ft., while buckets of greater width can be used if necessary. The contents of the buckets are dumped upon a transverse 24-in. belt conveyor of suitable length, which can be extended on either side. A scraping device insures the complete discharge and cleaning of each bucket.

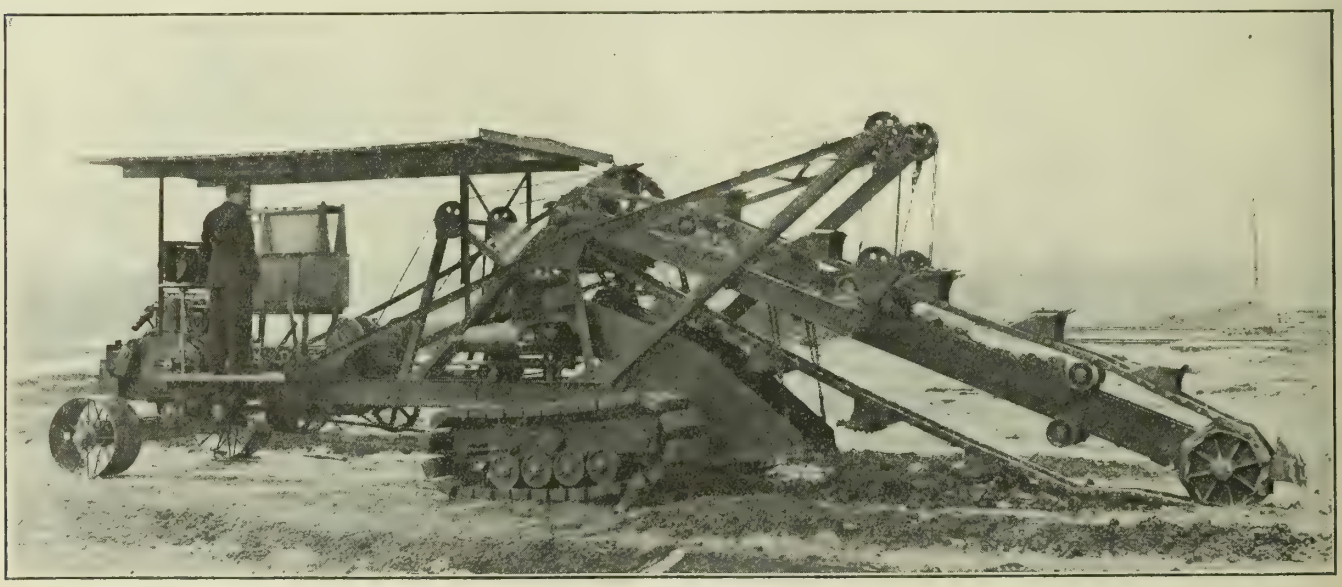


FIG. 1. TRENCH EXCAVATOR OF THE LADDER TYPE FOR SEWERS, WATER MAINS, ETC.

The machine has a steel frame 22 ft. long, to which are attached the cantilever frames carrying the end bearings and the hoisting sheaves of the ladder. It has a pair of 34-in.-wide tired wheels at the front, while at the rear are a pair of caterpillars 7 ft. long and 30 in. wide. These caterpillars have their frames pivoted on a heavy cross-shaft, so that they can accommodate themselves independently to the inequalities of the ground. They are driven by sprocket chains. A bevel-gear differential equalizes the strains when turning curves, and brakes on the chain sprockets provide independent control of the caterpillars to assist in making very short turns.

Power is furnished by a 70-hp. four-cylinder vertical engine, which can work on gasoline, kerosene or motor spirit. This is geared to a countershaft, from which the upper tumbler of the ladder chain is driven by a steel roller chain. The caterpillars, the feed gear and the ladder hoist are all driven from this shaft by means of chains. The feed is through a gear train which gives six rates of speed, ranging from 1¼ ft. to 5 ft. per min. The ladder hoist is operated through bevel gears and a worm gear. The steering is effected by a hand-operated gear driving a shaft having drums, from which chains are led to the front axle.

The operating levers are so grouped that all movements can be controlled by one operator. The machine is 52 ft. long over all, and weighs about 22 tons in working order. It has been used on sewer trenching work in Chicago.

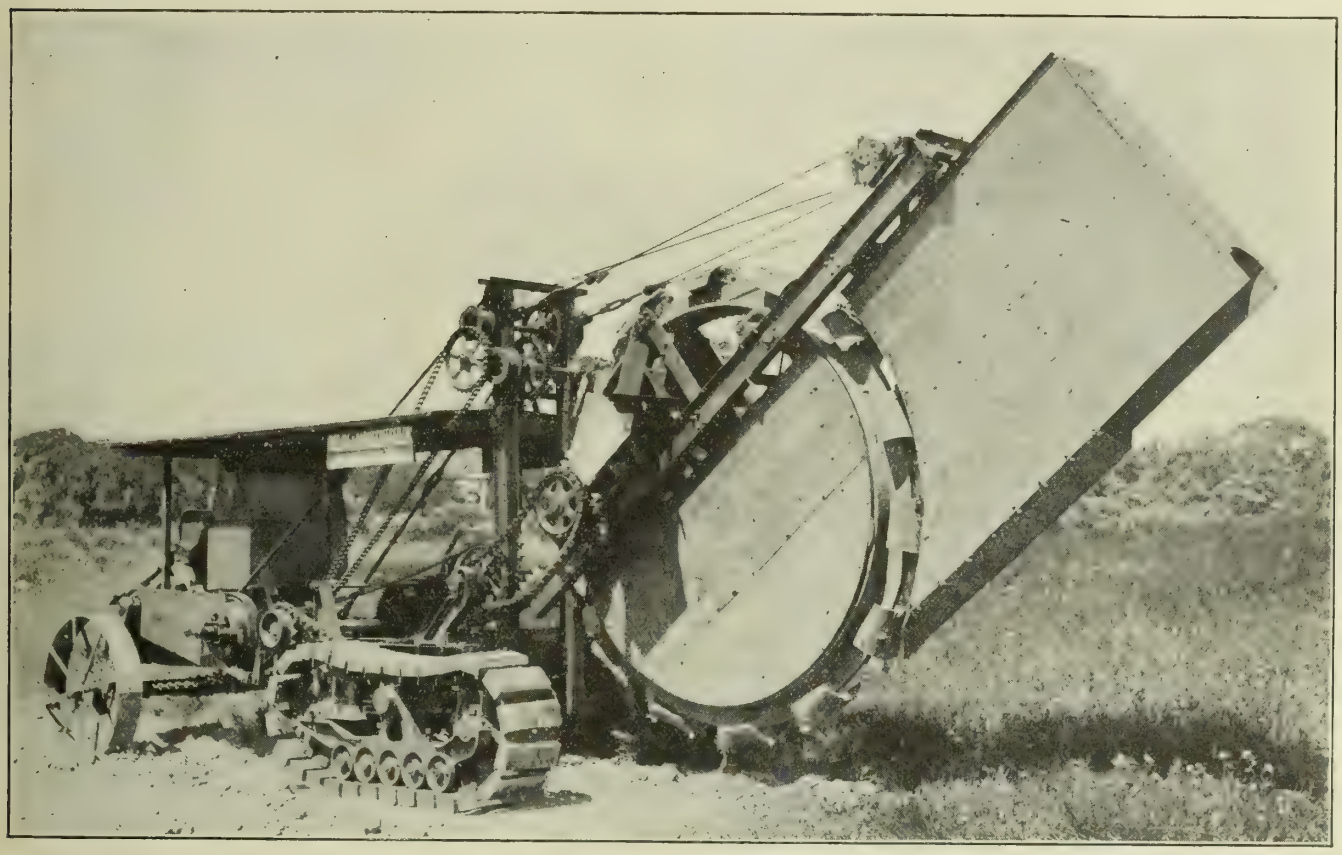


FIG. 2. TRENCH EXCAVATOR OF THE WHEEL TYPE, USED MAINLY FOR TILE-DRAINAGE WORK

Wheel Excavator

This type of machine is used mainly in tile ditching or drainage work, but is also employed for pipe lines, etc. The wheel which carries the excavating buckets has no axle, but the inner face of the rim rides on friction rollers carried by a frame within the wheel. A pinion driven by a sprocket chain engages an internal gear on the rim. The wheel is inclosed by a steel housing as shown in Fig. 2 which serves to support the sides of the trench.

The box in the rear of the wheel is for the protection of the tile-layer, preventing the trench from caving in upon him. The bottom of the box forms a shoe to smooth the bottom of the trench and give it a concave form to receive the tile. The buckets are cleaned by a stationary spade or scraper, and knives or rooters can be added for work in hard material. The excavated material is delivered on either side of the trench by a steel chute when the spoil is to be delivered close by or by transverse conveyors composed of steel slats when it is to be carried some distance.

The main frame of the machine is supported by a pair of wheels on the steering axle and a pair of caterpillars at the rear. Upon it is a gallows frame carrying two pairs of drums. The upper drums are for the topping-lift cables which lead to the outer end of the boom carrying the wheel. The lower drums are for cables which are attached to a crosshead on the inner end of the boom, raising and lowering it in the vertical frame.

These machines excavate trenches up to 7½ ft. deep and 12 to 24 in. wide. Power is furnished by an internal-combustion engine of 20 to 45 hp., and the rate of feed varies from 1¾ to 7½ ft. per min. in machines of different sizes.

The accompanying table gives the record of work done by a wheel machine of the type shown on this page, used by C. D. & J. T. Pierson, of Terre Haute, Ind., for drainage ditching in gumbo soil.

PERFORMANCE OF A WHEEL EXCAVATOR ON TRENCH WORK FOR TILE DRAINAGE

Record	A	B	C	D	E	F
Hours worked	10½	11	11	11	11	12
Hours delay (incl. noon)*	3	3	2	2	3	2
Net working hours	7½	8	9	9	8	10
Gasoline, gals. (at 11½c.)	12	13	15	15	13	20
Cost of fuel and lub. oil	$1.68	$1.85	$2.17	$2.17	$1.85	$2.90
Number of men	3	3	3	3	3	4
Labor cost per day	$6.50	$6.50	$6.50	$6.50	$6.50	$8.00
Total cost per day	$8.18	$8.35	$8.67	$8.67	$8.35	$10.90
Trench (11½ in.), depth	42 in.	42 in.	42 in.	44 in.	42 in.	36 in.
Trench, length, ft.	1650	1952	2887	2310	2838	5032
Cost per lin.ft.	0.50c.	0.43c.	0.30c.	0.37c.	0.29c.	0.21c.
Cost per cu.yd.	3.98c.	3.45c.	2.41c.	2.89c.	2.37c.	2.04c.

* Delay includes 30 min. or 1 hr. at noon, and is mainly the time required to move the machine from one trench to another

Difficulties Overcome in Sinking a Deep Well

By P. E. Green*

SYNOPSIS—In sinking a well about 1550 ft. deep at Oglesby, Ill., various difficulties such as cave-ins, lost tools, plant breakdowns and mine flooding were met and overcome by the contractor and the engineer.

Oglesby, Ill., situated in the Illinois River Valley near the junction of the Illinois and Vermilion Rivers, has recently completed a deep well for water-supply purposes. Some of the difficulties encountered during the work seem to be worth recording.

In the immediate vicinity of Oglesby the strata are very badly folded and broken up, but in the main there are about 20 ft. of overlying soil, about 500 ft. of various kinds of shales, all having a tendency to cave and disintegrate when exposed, about 300 ft. of dolomite and limestone with occasional layers of shales, and from that point to the St. Peter sandstone which was encountered about 1550 ft. below the surface, the rock is generally a variation of close-grained limestone, being solid and fine grained from 900 ft. on.

The city is situated over coal mines, the first at 225 ft. and the second about 500 ft. below the surface. These mines are absolutely dry mines, and hence there has been no provision made for drainage. These facts were brought to the attention of bidders for the well. In a well drilled about one mile distant, salt water had been encountered some 585 ft. below the surface and had developed a head of approximately 400 ft. The attention of bidders was called to this fact, also, but the successful bidder failed to make adequate provision for taking care of the salt water.

The well-drilling plant consisted of a large timber tower for handling the well casing, drills, etc., a steam boiler and a single-cylinder noncondensing steam engine driving through a belt about 35 ft. in length a 10-ft. diameter wheel. This wheel, operating through a friction clutch and wire rope over the tower, handled the casing, tools, bailers, etc. The wheel also directly operated a large timber walking beam by means of which the drills were churned up and down. The tower was made of sufficient height to handle two 20-ft. lengths of pipe casing at one time.

Work was actually started Feb. 23, 1915. The first 20 ft. to bedrock, through loam and clay, etc., was cased with 18-in. internal diameter steel drive-pipe. No water was encountered. Then for 330 ft. the hole was cased with 14-in. internal diameter wrought-iron pipe, of the heavy screw-drive coupling type. The hole was dry all the way. At this depth, the 14-in. casing was set on a good shoulder and drilling proceeded with a 12-in. hole, which was cased with 10-in. wrought-iron drive pipe.

The casing passed through two coal mines, parts of which have been worked out and abandoned. In the second coal mine the 10-in. pipe passed through an old entry, from which the track had not been removed, though the entry (in solid rock) had been filled with débris from the active part of the mine. This casing ended 600 ft. below the surface, where it was set on a shoulder and sealed to the 14-in. casing with a lead packer. The hole continued dry to a point 815 ft. below the surface, where a small vein of salt water was encountered amounting to about 320 gal. per hr. At 875 ft. a heavy flow of salt water was struck, amounting to 2400 gal. per hr. This water was kept down with a bailer (an 8-in. cylindrical tube or pipe, about 25 ft. long, with movable bottom) which held 60 gal., and was operated by the tower and steam engine. The bailer, working at the rate of one trip per minute, could lower the water and permit intermittent drilling.

Cave-In of Uncased Well

At this time occurred a cave-in of the uncased well, the 10-in. casing on its shoulder being about 200 ft. above the bottom of the well. This cave-in was of such a character that the tools had to be abandoned temporarily and the rope was cut about 20 ft. above the top of the drill. A few hours later the boiler broke down, because of bad water. Here is where the real trouble started. The salt water now rose around the outside of the 10-in. casing and into the abandoned entry of the second mine, which was about 550 ft. below the surface of the ground and 330 ft. above the bottom of the hole. Ordinarily the weight of casing on its rock shoulder would shut off any water and prevent it from rising outside the casing, but the 10-in. casing had been sealed to the 14-in. with a lead packer to keep the salt water out of the well itself. Hence the 10-in. casing did not bear its full weight on the stone shoulder, but on the packer, and while it kept the salt water out of the well, it did not prevent its entering the mine. This mine had been worked for 40 years and was an absolutely dry mine; there was no provision for drainage and the entrance of 40 gal. of water per min. became a serious matter.

A Mine Flooded

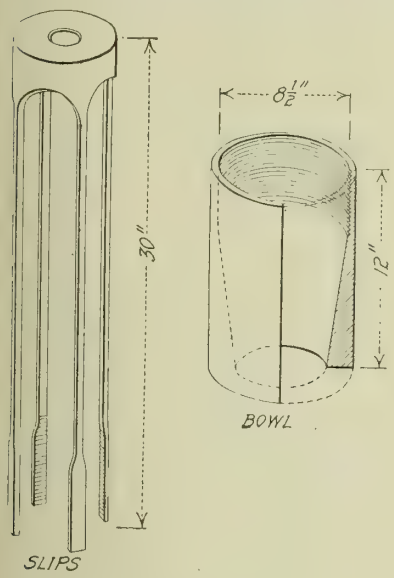
As soon as it was seen there might be trouble with the salt water, men were set to work by the mining company clearing out the abandoned entry, the distance to be cleared amounting to about 600 ft. Since the entry was low, only a few men could work at one time, and it took one week of work of two shifts of three men each to get to the well. The temperature in the entry was about 90 deg. F. and the ventilation poor. About the time the entry was cleared and the well casing exposed, the contractor's surface-boiler broke down, as stated, and several tubes had to be replaced. In addition the friction clutch, because of constant operation with the bailer, gave way and had to be repaired. The water at once rose rapidly into the mine and caused a great deal of apprehension, since thousands of dollars worth of property would be damaged by flooding and several hundred men thrown out of work. It took several days to get new tubes for the boiler.

*Civil Engineer, Aetna Engineering Bureau, 17 North La Salle St., Chicago, Ill.

The tools were lost on Apr. 4. The boiler and bailer had been worked continuously until Apr. 8, when the boiler broke down as related. The contractor had no other pump, the new boiler tubes ordered had not arrived, and in this emergency the engineer took charge and ordered a 5-in. deep-well pump, 600 ft. of drop pipe and a steam head, shipped by express from Chicago. They were ordered the night of Apr. 10 and arrived in Oglesby the next afternoon. The same morning, the boiler tubes arrived, were installed, and bailing was resumed.

Sealing the Mine Entry

The plant had been out of commission for three days, during which time several hundred feet of the mine had been completely flooded. Fortunately, for the entire distance of 600 ft., the mine sloped toward the well. During the morning of Apr. 11 the bailer started to lower this water and by the afternoon of Apr. 13 the water had been lowered so that the work of sealing the entry around the well casing could proceed. The heat in the entry was intense, only two men could work to advantage at a time and all material had to be brought from the surface down the shaft and through the main entry, a distance of one mile. When the well casing was finally exposed it was found that the drill in coming through the mine had threshed around considerably and that a cone-shaped hole extended for about 20 ft. below the floor of the mine entry. This hole was about 24 in. in diameter at the top, decreasing to about 14 in. at the bottom. It was carefully cleaned out, the walls washed and scrubbed and then filled with rich cement mortar. The well casing exposed in the mine was then cased in a column of reinforced concrete 6 ft. sq. quite to the roof of the mine. In less than 24 hr. after this was completed the bailer on the surface broke down, but the cement had set sufficiently so that the water was entirely shut off. After the bailer broke, the salt water continued to rise inside the well reaching a height of 785 ft. from the bottom, which was within about 100 ft. of the surface of the ground, the total head of salt water varying from 715 to 770 ft. From 815 to 840 ft. the material encountered was a good hard limestone, yet the first salt water flow was from this material. From 840 to 850 ft. the material was a slate. From 850 to 875 ft. were layers of limestone, clay and slate mixed and at 875 ft. the sand vein, from which the heavy flow of salt water came, was encountered.



BOWL AND SLIPS FOR RECOVERING WELL TOOLS

After the mine had been sealed off, operations were started for the recovery of the tools. When the tools were lost the contractor had ordered about 1000 ft. of 8-in. oil-well casing, the intention being to force this casing down through the cave-in and over the tools and then get hold of the tools with a grab tong or bowl and slip. The casing was ordered about Apr. 5 but did not arrive until Apr. 23 having been lost in the railway yards at Chicago in the meantime. From Apr. 14 to 23 the water stood at full depth in the well. Since the lower 200 ft. of the well was uncased at the time, the water caused the material to soften and disintegrate and much more of the well caved in, there being finally about 200 ft. of débris on top of the lost tools. This made their recovery very difficult. It had been the intention to drop the 8-in. pipe down over the tools, as it was thought that the first cave-in was simply a bridge, and that the 8-in. pipe could easily be driven through it. This was found impossible on account of the fact mentioned before that the well had further caved in for a distance of 200 ft.

Bowl and Bowl Slips

The débris was then drilled through in much the same manner as the original well, and when it was thought the drill was within 10 or 15 ft. of the tools a casing bowl was put on the lower part of the 8-in. pipe with the intention of forcing this over the tools. This bowl (see accompanying sketch) is a piece of pipe having one end threaded to screw over the 8-in. pipe, while in the other end the interior is cone shaped, with the small diameter at the bottom. The plan of operation was to force it down around the tools, then lower the grab tongs or bowl slips, as they are called, over the tools. The bowl slips (see sketch) consist of four spring steel prongs about 30 in. long, with the lower ends of the prongs flattened out to form a sort of paw, the four prongs constituting a cylinder. The inside of the paw end of the prongs has cut threads like a pipe wrench. Since these prongs are long they have a very considerable spring to them and hence the bowl attached to the pipe when pulled up tends to force the paws tight into the tools. The entire length of 800 ft. of casing is then pulled and the slips, contracted by the cone of the bowl, tightly clasp the head of the tools.

The first attempt failed, because the bowl could not be forced over the tools, for the reason that the original 20 ft. of rope which had been cut off when the tools were abandoned was found to have been churned into such a mass that the pipe could not be forced through it. All the 8-in. casing had then to be pulled out, the bowl taken off, the pipe dropped down and drilling started again.

Much trouble was encountered before the bowl was finally forced over the ends of the tools. On Apr. 27, 28 and 29 the space surrounding the lost tools was drilled with a spud, thus enlarging the hole and cleaning out and exposing the tools farther down. It should be noted that all drilling for the recovery of the tools was through the 8-in. casing hung from the top of the well. On Friday, Apr. 30, a hold on the tools was finally obtained with the bowl and slips. It was found impossible to budge the tools, however, with a straight pull. A double block was then put on the derrick with a bull hitch and when this was pulled the 8-in. casing pulled apart at the top nipple. The nipple was probably poorly threaded. The pipe was rethreaded and a new nipple supplied and then the linked "elevator," or cross arm upon which the straight pull was applied, pulled apart. This was Friday, May 7. The entire week had been taken up with these two unsuccessful attempts. On Saturday, May 8, a 6¼-in. drill was installed and again the drilling around the tools started, and for six days continued, when the hole around

the tools was 40 ft. deep. The 8-in. casing and the bowl and slips were dropped down over them and this time the tools pulled up for 10 ft. to refusal. They were then driven down with drills, the bowl and slip dropped over them again and the tools finally recovered on May 17, a total of six weeks after losing them. The cost of fishing was $720 for labor, and $180 for other expenses, making a total of $900.

After the tools had been recovered the drilling proceeded without any difficulties, the 10-in. casing having been set on a shoulder at 600 ft. below the ground and sealed at its junction with the 14-in. casing with a lead seal in order to keep the salt water out of the well, and at a distance of 950 ft. below the surface of the ground the 8-in. pipe was set on a good solid rock shoulder and then sealed to the 10-in. casing making a continuous and tight pipe to the shoulder. The wall at this point was a very close grained, dense limestone and there was no reason for any further casing.

Straightening the Drill Hole

At 1200 ft. below the surface of the ground the drills, for some reason not exactly understood, began to get out of the perpendicular line. This was probably caused by a projection over which the drills slid; at any rate it was found that there was a deflection of several inches from the perpendicular in the drill hole. The drills were withdrawn and 50 ft. of boulders and small pieces of cast iron were dumped into the hole, tamped down and drilled through again, thus straightening the hole, and no further trouble was encountered. At 1275 ft. the great timber walking beam split and this caused a delay of four days while a new one was being made. The cost of this incident was $100.

The fine grained limestone in this section, that is, between El. 1000 and 1400 ft., was found to yield about 60 gal. per min. of clear water of excellent taste. The salt water had been effectually cut off by the weight of the 8-in. casing resting on the rock shoulder.

At a depth of 1400 ft. the cast-iron saddle of the walking beam broke twice in succession, causing a week's delay. At 1445 ft. the St. Peter sandstone was encountered. About here the bottom 6 ft. of the drill broke off. It was recovered with slips operating at the end of the drill cable. At 1548 ft. a clay formation was encountered and the well declared finished. It was tested for capacity, and 300 gal. per min. for 13 hr. was pumped without exposing the well cylinder, which was set 250 ft. below the surface of the ground.

The contract price of the well complete was $6628, delivered to the city. The cost to the contractor on account of lost tools, etc., was about $1100. The mine cost (concreting, cleaning entry, etc.) was $460. The cost to the city for use of the rush order pumping machinery was about $275. The contractor under the specifications must stand this entire expense, but the city did not force him to pay for the extra pumping equipment.

The contractor, H. H. Adkins, of Sullivan, Ind., worked hard and faithfully, and, though lacking somewhat in necessary equipment, handled his work very skillfully. The writer was consulting engineer for the city of Oglesby.

Reinforced-Concrete Flagpole at Panama

By G. C. Dobson*

A reinforced-concrete flagpole erected on Administration Hill at Balboa Heights, Canal Zone, presents a unique piece of construction. It stands on the principal axis of the Administration Building and 59 ft. in front of it. Its position at the head of a spacious flight of steps from the terrace to the main townsite gives it added prominence.

The pole has a clear height of 70 ft., a ground penetration of 12 ft. and rests on natural soil. It is sixteen-sided

*Assistant Engineer, Permanent Building Division, Panama Canal.



FIG. 1. RAISING THE REINFORCED-CONCRETE FLAGPOLE IN FRONT OF ADMINISTRATION BUILDING

and has a diameter of 8½ in. at the top and 17 in. where it joins the ornamental base. It is reinforced longitudinally by eight square bars, which are 1½ in. in thickness at the base, graduate down to ¾ in. at the top, and

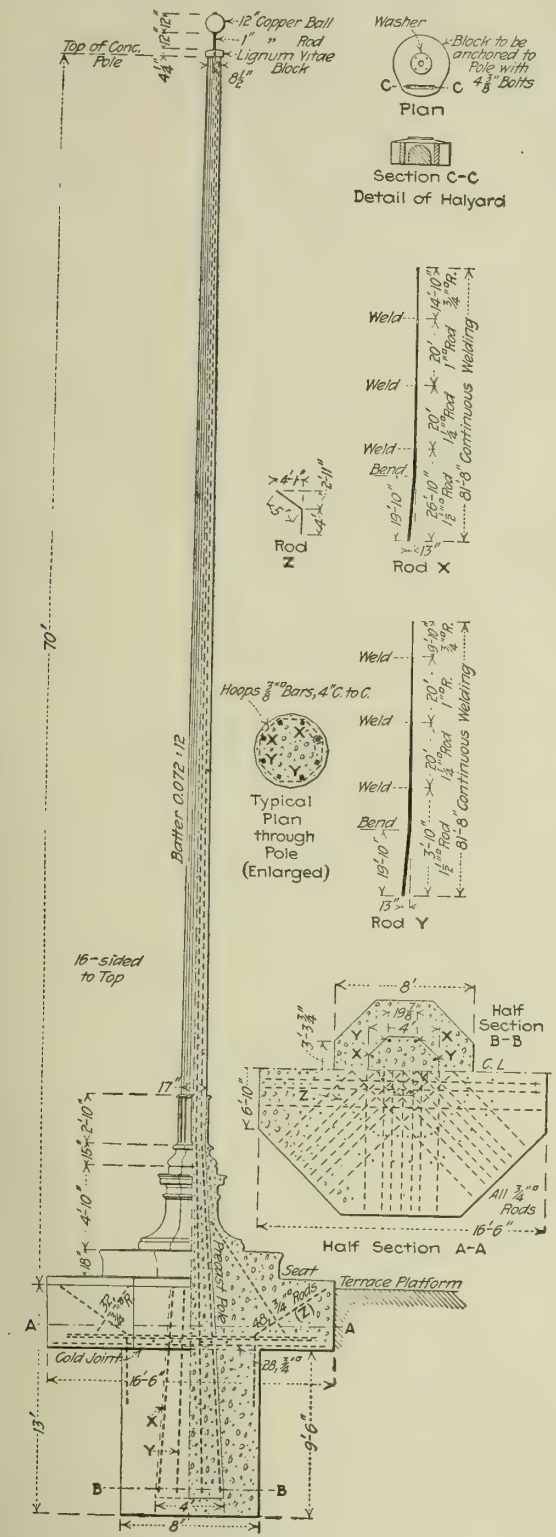


FIG. 2. DESIGN OF REINFORCED-CONCRETE FLAGPOLE AT PANAMA CANAL

are welded so as to form continuous bars. The welds are reinforced and staggered. The pole is also reinforced by hoops of ⅜-in. square bars spaced every 4 in.

The pole was precast in position for erection in wood forms, which had to be constantly adjusted to keep the pole in alignment, due to the settling of the fill on which the forms were set up and to blasting in the neighborhood. The concrete was a 1 : 1 : 2 mixture. Eighteen days after pouring it was erected. Stresses were developed during erection much greater than would be caused by a hurricane of 100 mi. per hr.

The lower 10 ft. of the pole consists of a spreading octagonal base of flutes and plain moldings, with a seat and platform at the bottom. These members were all precast and set up after the pole was erected. They are about 3 in. thick and heavily reinforced with mesh. The pole itself received a thin coat of stucco after erection to true up the arrises and to remove all form marks.

To the top of the pole is secured a very heavy cast-brass pulleyless block, through a groove in which slides the flag halyard, and through the center a 1-in. brass rod projects 1 ft., carrying a 12-in. copper ball, double gold leafed. The center of this ball is about 167 ft. above sea level. At the base the halyard passes through the cap molding and is secured to a cast-brass cleat directly below it.

The method of erection is shown very clearly in the accompanying photograph. Two electric winches were employed.

The pole was designed and erected by the Permanent Building Division, Supply Department, Panama Canal. The erection was done under the direct supervision of the Division Engineer, Frank Holmes. The architectural design was handled by S. M. Hitt, Architect of the Panama Canal, and the engineering design by the writer.

An Automatic Speed-Control and Train-Stop System has been given a trial on the Chicago, Burlington & Quincy R.R. The installation covers 6 mi. of single track, with several track contacts or block stations for movements in both directions. The special feature is the control of train speed by "Caution" indications and the application of the brakes by "Stop" indications. The contact rail is normally energized and causes a lamp to be lighted in the cab, indicating that the engine has entered the block section. The engineman presses a button, by which the lamp is extinguished and a record made of his action. In starting from a terminal, only a limited (and prescribed) speed can be attained, and a whistle in the cab sounds until the engine passes a contact point at "Clear," after which the engineman has full control of the speed. For a "Caution" indication, the contact rail is partly energized, and causes the train-control apparatus to reduce the speed to the prescribed limit. It also causes the cab whistle to sound continuously. If the indicator at the next contact point is "Clear," the train-control will be made inoperative, but if the indication is "Stop," the brakes will be applied and another whistle sounded. In order to proceed, the engineman must unlock and open a box and set the apparatus for the slow-speed condition. He cannot set it for full speed, this being done only automatically when the engine shoe strikes an energized contact rail. The opening and closing of the box and the setting of the apparatus are all registered, so that all the actions of the engineman are on record. This system has been installed by the Gollos Railway Signal Co., 76 W. Monroe St., Chicago. Hiram J. Slifer, Rookery Building, Chicago, is consulting engineer for the company.

Difference Between Investment and Value of a small public-utility property is illustrated by the recent appraisal case of the District of Columbia Public Utilities Commission in re Washington & Maryland Ry. Co. This company operates a short, struggling electric railway extending out from the outskirts of Washington. The amount expended in construction and equipment as shown by the records was $119,558, while the reproduction of cost was $67,047, and the reproduction cost less depreciation was $61,381. In determining cost of reproduction 5 per cent. was allowed for engineering and superintendence, 3 per cent. for interest during construction and 3 per cent. for the legal, organization and insurance items, omissions and contingencies. Many of the original investments were wasted expenditures. Some parts of the installation were abandoned after a short time; others were not in service for considerable periods and were not well maintained. Most of the plant now actually used and useful has recently been built or rebuilt.

Three-Mile Approach Viaduct, St. Louis Municipal Bridge

A total length of 16,300 ft. and a steel weight of about 23,000 tons characterize the viaduct[1] which forms the east approach of the St. Louis municipal bridge over the Mississippi. Its size makes it one of the most important pieces of viaduct construction in this country. About two-thirds of the length of the structure is railway viaduct and about one-third highway viaduct, the two being of different types.

Features of the design are: Simplicity of the general arrangement; extensive uniformity and duplication without sacrifice of economy; the use of the main girders as track stringers in the highway floor, saving both in stringers and in floor-beams; and provision for expansion in every intermediate span.

The footings of the viaduct columns are on piles. The concrete piers extend about 15 ft. above ground, to get above flood level.

General Arrangement

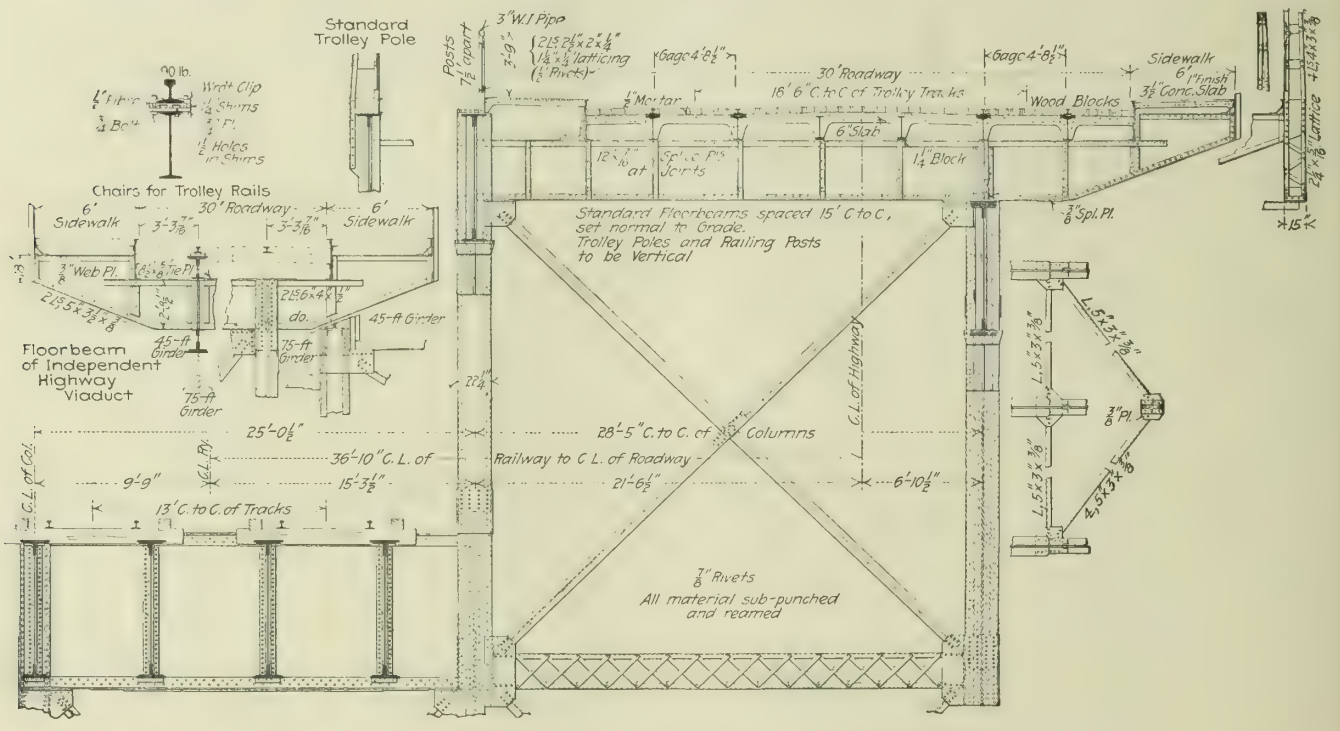
The approach passes almost directly eastward from the east end of the river bridge, crossing over all the railways in the east bottoms. The length of viaduct from the bridge to the east end of the approach is 13,300 ft. The first 2300 ft. is combined highway and railway viaduct, and at its end the highway viaduct diverges northeastward, extending 3000 ft. to Tenth and Pickett Ave., East St. Louis, while the railway viaduct continues east for 11,000 ft.

The design includes provision for two future turnout viaducts for railway connections—(1) a turnout to the northward, starting near the river bridge, for connection with the Pennsylvania R.R. tracks, and (2) a turnout to the south starting at the point where the main railway and highway viaducts diverge, for connection with the Illinois Central R.R. These are not being built at the present time.

The gradients of the approach are 2.015% on the highway structure and 0.128 to 0.983% on the railway structure.

The drawing herewith shows the combined portion. The separate railway viaduct in its arrangement of parts is identical with the railway half of the combined viaduct. The separate highway viaduct differs from the highway half of the combined structure in having its roadway centered over the columns and its longitudinal girders raised up so that the floor-beams connect to their webs.

The determining feature of the arrangement is the 15-ft. floor panel of the highway viaduct, which was maintained uniform throughout the structure (except for a few end panels of slightly different length). This panel-length permits of using rolled I-beams as stringers with considerable economy. The panel length determined the spans as multiples of 15 ft. The columns being braced in sets of four as towers, according to regular viaduct practice, the normal spans adopted are 45 ft. for the towers and 75 ft. for the intermediates.



CROSS-SECTION OF EAST APPROACH VIADUCT TO ST. LOUIS MUNICIPAL BRIDGE

Highway Viaduct

The street-railway tracks are set close to the curb of the 30-ft. roadway, leaving a single wagonway in the center, large enough to accommodate two lines of vehicles. The position of the tracks is such that the main longitudinal girders serve as outer-track stringers. The floor is a 6-in. reinforced-concrete slab carrying creosoted-wood blocks on a mortar bed. The track rails are ordinary T-rails, laid on shim plates (to make up for the varying thickness of the girder flange plates) capped with a ½-in. sheet of hard fiber to decrease noise and vibration.

In the independent highway viaduct, where the 32-in. floor-beams frame into the webs of the girders, the webs are slotted to pass a top flange tie strip for supporting the sidewalk cantilever bracket. In the combined highway

[1]Contract for the steelwork was let to the American Bridge Co. July 9, 1915, as noted in "Engineering News," July 15.

and railway section, the highway floor-beams are shifted toward the free side in such a way as to give approximately equal loading on the two columns.

Railway Viaduct

The railway viaduct, double-track throughout, has the same normal span lengths as the highway portion—45 ft. and 75 ft. The tower bracing in transverse planes is in a single panel; but although the greatest height of the viaduct is 71 ft., the structure is wide enough to give the diagonals a satisfactory slope.

Expansion is provided for in each 75-ft. span. The railway stringers of these spans are deeper than those of the tower spans, but near the expansion end the lower flange of the intermediate span is curved upward in ogee form to the level of the bottom flange of the tower-span girder, which gives sufficient depth for the expansion pocket. The riveting of girders and stringers to the floor-beams is the same at expansion points as at fixed points, so that no difference in the floor-beam web punching is required.

The design for the viaduct was made by Boller, Hodge & Baird, 145 Broadway, New York City, consulting engineers to the city of St. Louis for the municipal bridge. The estimated cost of the east approach, including real estate, is $2,750,000. The present contract covers only the fabrication of the steel, the price being in the neighborhood of $43 per ton delivered.

Aqueduct Outlet Cascades

By Burt A. Heinly*

The "cascades" of the Los Angeles aqueduct are at the outlet of the last tunnel on the aqueduct, 27 mi. northwest of Los Angeles. Emerging from the tunnel portal the full 20,000 miner's-inch flow of the aqueduct, in a stretch

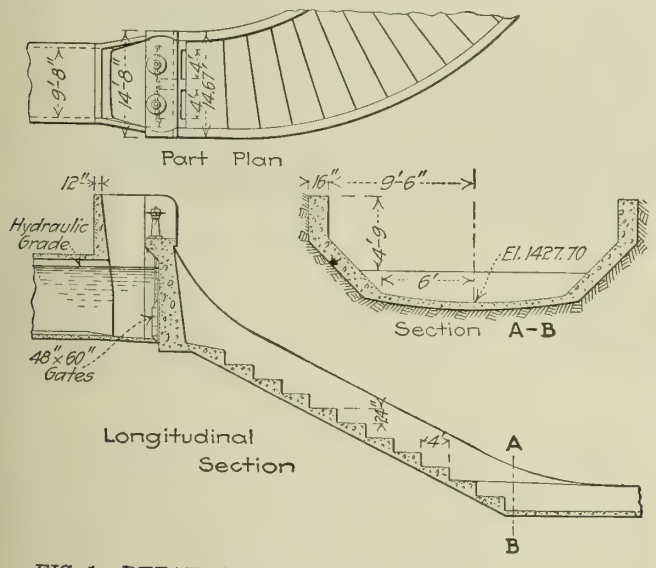


FIG. 1. DETAIL OF TUNNEL PORTAL AND STEPPED PORTION OF CASCADES

of 1037 ft. of rock-embedded masonry conduit, descends a distance of 167 ft. and produces the effect of a natural cascade.

The purpose of the structure is chiefly æsthetic although it has a high practical value in its thorough aëration of the water. Ultimately, however, it will be eliminated, as the total fall of 294 ft. from the outlet of the aqueduct to the high-water elevation of the prospective upper San Fernando Reservoir makes possible a hydro-electric development of 9685 hp.

A problem of design was to adapt the structure to the natural surroundings, within a 75-ft. right-of-way, simulating in concrete, so far as possible, a natural water course. The terminal tunnel has a height of 10½ ft. and a width of 9⅔ ft., with a flat slope of 2⅛ ft. to the mile, the exit opening from the precipitous slope of the range onto a spur or hogback.

Following the construction of a permanent road up the east side of the hogback, the face of the cliff from which the tunnel emerges was cut back 20 ft. to a hard con-

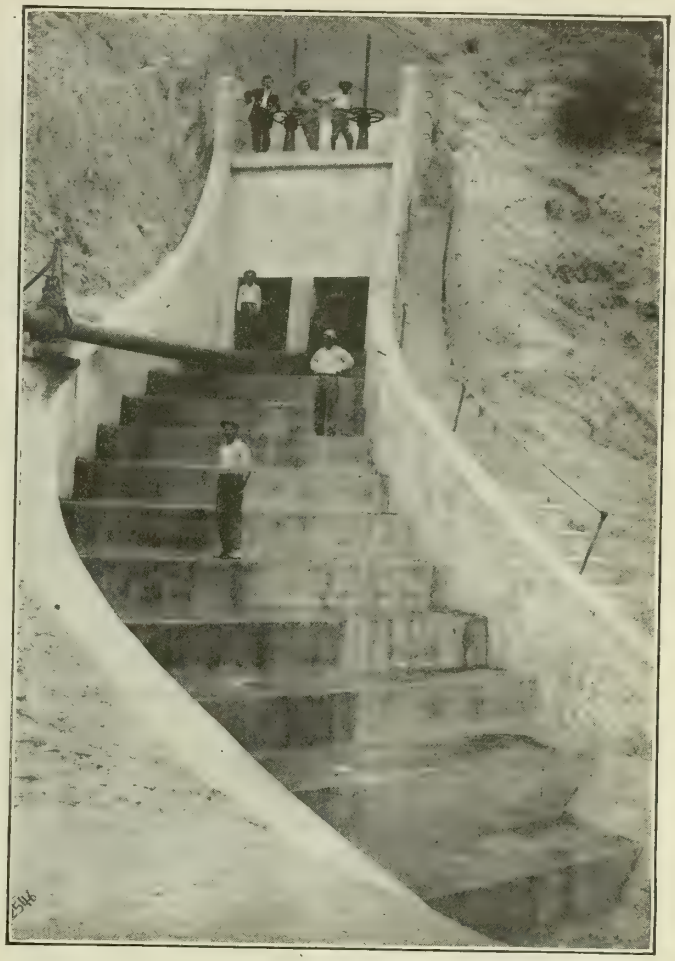


FIG. 2. TUNNEL PORTAL AND CASCADES HEAD

glomerate and a bulkhead of concrete built 3 ft. wide at the base to 2 ft. wide at the top with an overhang for the gate stands. The bulkhead was raised to a height of 13½ ft. above the floor of the tunnel. (See Figs. 1 and 2.) Besides containing two portholes (not shown in Figs. 1 and 2) 1 ft. high by 4 ft. wide, set 1 ft. below hydraulic grade, the bulkhead is 5 ft. forward from the mouth of the tunnel in order to provide for a safety overflow to relieve the pressure should the gates in the bulkhead ever be closed when the aqueduct is under flow. In the bulkhead are set two cast-steel sluice gates, 4 ft. high by 5 ft. wide, with bronze bearings, lifted by a 2¼-in. screw and operated by hand.

The first drop of 22 ft. in a distance of 49 ft. was taken care of by benching off the foundation in a series of 11 steps, each of 2 ft. rise., 4 ft. tread and ranging in length from 12 ft. at the top to 19 ft. at the bottom. The side walls to prevent overflow rise vertically 4½ ft. above

*645 South Olive St., Los Angeles, Calif.

the floor of the step and are of concrete, 16 in. thick, of 5½ parts of washed gravel to 1 part of Monolith cement. This cement—which was manufactured by the municipal cement mill and which as a municipal product was subjected to much criticism from certain quarters—was used throughout in the building of the "cascades." After being for more than a year subjected to flows under a very high velocity, it shows no signs of the wear or disintegration so freely prophesied.

From the foot of the stairs to the bottom of the cascade, the canal or conduit varies from 19 ft. in width and 4 ft. in depth to 72 ft. wide and 6 ft. in depth. This height at the bottom was made necessary to connect with the open-lined conduit at the foot of the cascade.

The grade for the 49 ft. of steps is 50 per cent.; for the next 750 ft. the canal varies in width from 19 to 37½ ft., with a grade of from 1.4 to 24 per cent.; for the remaining distance of 220 ft. the canal is from 37½ ft. to 72 ft. wide and has a grade of 30 per cent. On this last section the boulders were strewn as shown in Fig. 3. Considerable difficulty was experienced in the matter of elevation and location necessary to give the spectacular effect of a mountain torrent that was desired. The result is shown by Fig. 4. A total of 60 cu.yd. of boulders was required. These were selected to run about 1 ft. in diameter and were placed about 1 ft. apart. They were dropped into the concrete after it had been shoveled so that there was at least 1 in. of concrete between the base of the boulders and the subgrade. The concrete was then trowelled down. This left from 4 to 6 in. of the boulders protruding.

At the foot of the cascade, intersection is made with the open-lined conduit at an angle of 63 deg. Here almost all of the momentum and agitation of the water is taken up in a distance of 75 ft., the water entering the straight-away of the conduit as a smooth-flowing stream. Because of the great range of velocities in this open-lined conduit, in its length of 7975 ft., considerable allowance for difference in velocity-head had to be made. This was done without noticeable drop in the conduit by making long transitions in which the allowance for the difference in velocity-head in addition to the flow-grade was distributed along the transitions. In this way allowances of from 1 to 3 ft. difference in velocity-head are made which are unnoticeable to the ordinary eye.

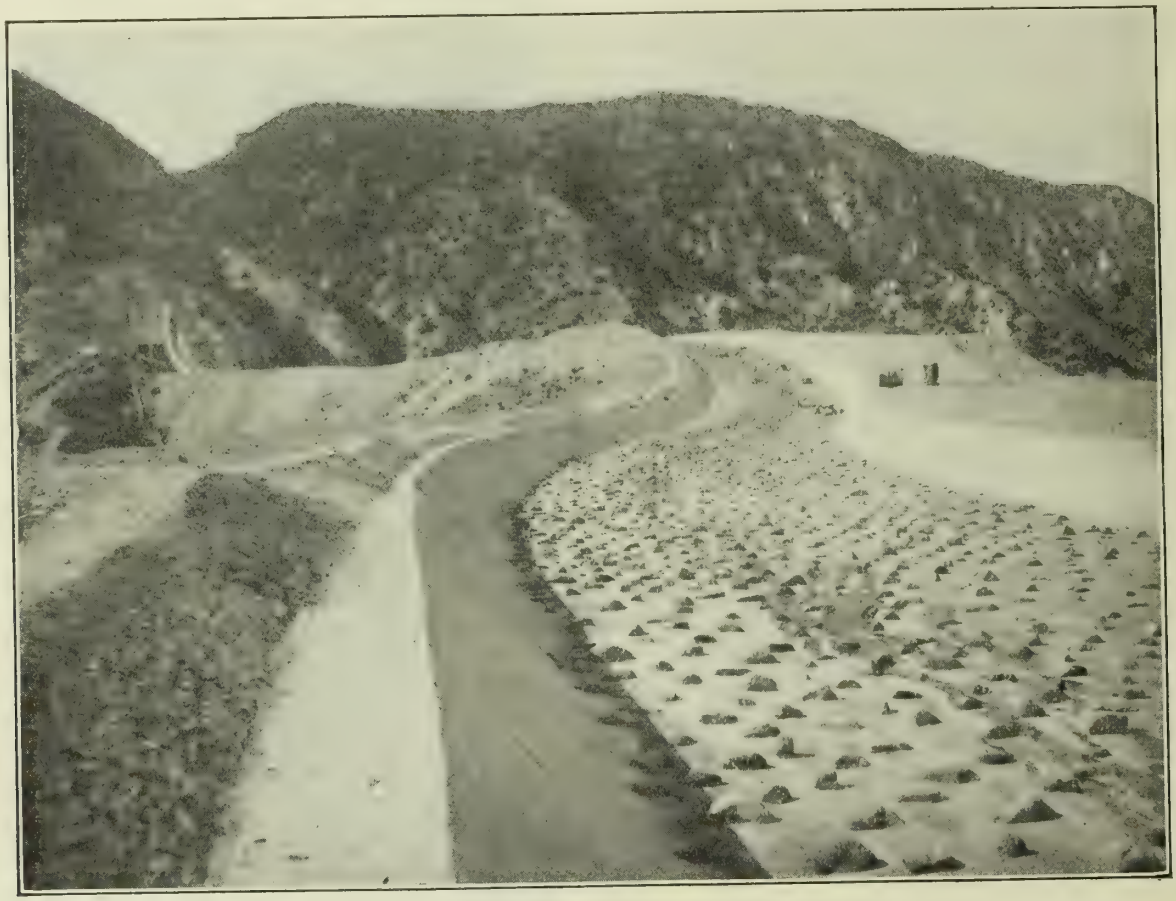


FIG. 3. VIEW OF LOS ANGELES AQUEDUCT CASCADES BEFORE WATER WAS ADMITTED

The work was carried on under the direction of William Mulholland, chief engineer; E. A. Bayley, field engineer, and Henry L. Jacques, construction superintendent.

Unusual Activity in Canadian Power Development

The water-power industry in eastern Canada presents almost the only evidence of engineering and construction activity throughout the Dominion, where large building construction is generally halted. In Toronto a $3,000,000 union railway-terminal project, for which contracts were let, has been shut down (though disagreement among the interested railroads may be largely responsible), and the harbor development is not progressing as fast as had been anticipated.

In Montreal there is nothing new of size being undertaken except a $400,000 extension to grain elevator No. 1. Old works like the Sun Life building and the Canadian

Northern Ry.'s Mount Royal tunnel and terminal are going ahead rather slowly.

The construction being done stands out by its comparative isolation. In Quebec the union railway station, a $300,000 project, has been started and some steel is being put up; a large addition to the post office is being made and there is some river improvement. The Province of Quebec is taking advantage of the low cost of labor to build some 60 steel highway bridges, one of $150,000 cost; tenders on the work after the war began showed a decrease in cost from those before of from 15 to 20%. Railway activity seems confined to Government trans-continental lines and the great Quebec bridge, on which steady progress is seen. In Halifax the large railway and harbor development scheme, aggregating in cost possibly $4,000,000, is now well under way. The Welland Ship Canal enlargement around Niagara Falls is being prosecuted with some vigor. Both of these projects have been described in recent issues of *Engineering News*.

In view of the general depression, the increasing activity of the water-power companies is striking. Contracts have been let for $1,500,000 of work on the upper St. Maurice River storage and flow-regulation scheme. This will be one of the largest conservation developments on the continent, benefiting such large power concerns as the Laurentide and Shawinigan companies. A company known as the St. Maurice Construction Co. has been organized to carry on this work, the Shawinigan Power & Water Co. and Fraser, Brace & Co. (builders of the great Cedars Rapids development) being largely interested.

Construction work on the huge Laurentide hydro-electric station at Grand Mere, which ceased on the outbreak of war, has been resumed. The Shawinigan company has acquired the old Dorchester light and power company in Quebec, taking advantage of the financial difficulties of the latter, and will immediately run a 90-mile transmission line to Quebec.

The Quebec Streams Commission is asking for tenders on a $400,000 project on the upper St. Francis River. This is a storage and flow regulation project similar to that on the St. Maurice. Pulp mills will be the chief beneficiaries.

It is generally expected that construction work on the 500,000-hp. hydro-electric project on the Saguenay River above Quebec, backed by the Duke interests from the United States (Southern Power Co.), is about to be started, though no official information is obtainable. The preliminary work seems to be progressing, however. This development involves building a new town, at an anticipated expenditure of $5,000,000 or more, for the fertilizer and other electro-chemical industries here.

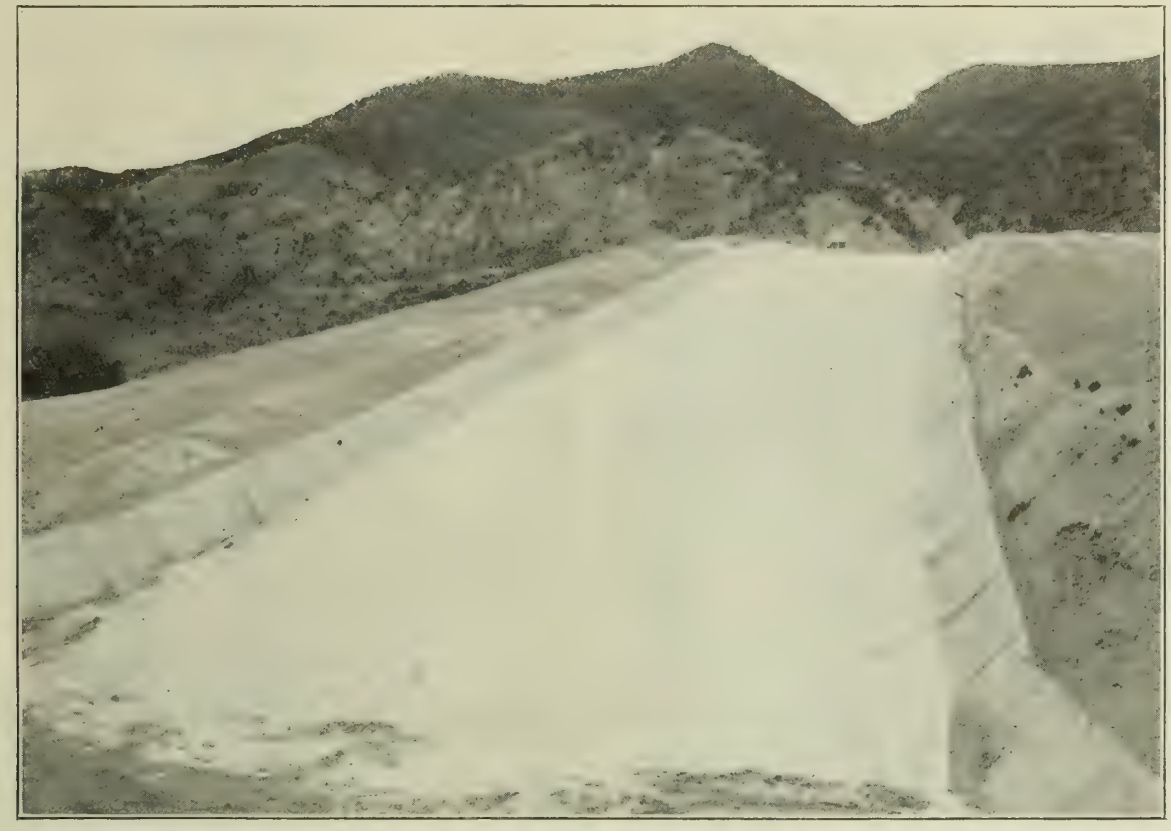


FIG. 4. EFFECT PRODUCED BY BOULDERS IN OUTLET TO LOS ANGELES AQUEDUCT TUNNEL

Part of the improvement in the power situation is probably in consequence of the manufacture of war materials. A great deal of it can be traced to the aluminum industry. The French and Scandinavian supplies are shut off and a great increase in the demands on American works has been felt. A small part of the aluminum demand is for military goods, like water bottles, motor-car and aëroplane parts, etc., but the greater portion is for the usual commercial purposes.

Owing largely to the demands of the aluminum works at Messina, N. Y., which take 60,000 hp. from the great Cedars Rapids plant near Montreal (described in *Engineering News* of Mar. 25, 1915, p. 566) the load on this station has jumped up to nearly full figure, though the station has been running only about eight months. Consequently extensions originally projected for construction several years from now will probably be made much sooner.

Field and Office

Drainage and Foundations on the Maine Post Road

The first state highway work undertaken in Maine, under the $2,000,000 appropriation made by the 1913 legislature, has been the building of a 21-mi. bituminous-macadam road from Portland to Brunswick. The contract for this entire work was let in 1914 to R. F. Hudson, Melrose, Mass.

On the first 6½ mi. of road out of Portland, an examination of the soil conditions during the spring of the year showed the necessity of special foundation and drainage treatment. There was a great scarcity of stone for filling subdrains, and it was decided to use a V-type gravel drain 30 in. deep in the center and a 4-in. tile drain with side outlets, in the bottom, where stone could not be



DRAIN TILE IN V-SHAPED GRAVEL TRENCH, MAINE POST ROAD

obtained. Of the whole distance of 6.63 mi., 1.33 mi. (20%) was built with a V-shaped gravel ditch and tile drain, 0.46 mi. (7%) with V-shaped ditch and stone drain, 0.67 mi. (10%) with an 8-in. stone base, and 1.36 mi. (20%) with a 4-in. gravel foundation.

A case of underdrainage was encountered just beyond the second mile, for about 100 ft., where it was necessary to resort to a combination of special stone drain and tile drain. The stone foundation was made 24 in. deep at the sides of the road and 30 in. at the center, while in the center and at a depth of 4 ft., a 4-in. tile drain was placed with side outlets of tile at intervals of 25 ft. This was found effectively to remove a bothersome and long-feared "honey-pot" of large area.

The highway work in Maine is in charge of a commission of three members, for whom Paul D. Sargent, former Assistant Director of the United States Office of Public Roads, is Chief Engineer.—William J. Dougherty, Portland, Maine.

Central Plant for Concreting Over Large Area

By F. L. Shea*

The concrete footings and basement wall and piers of the recently built Circle Building, New York City, were poured from a central plant, the layout of which is shown in the accompanying sketch and view. The shed sheathed with tar paper, as shown in the view, is for cement storage. The bin to the right of the tower in the same photograph is for gravel (500 cu.yd. capacity), and the one behind the tower is for sand (280 cu.yd. capacity).

The charging hopper of the mixer is on a level with the platform of the sand and gravel bins. Directly above this hopper and extending to the level of the floor of the cement storage house is a hopper lined with galvanized iron, into which the cement is discharged. When the bins were full the sand and gravel were shoveled to the mixer hopper; when material in the bins was level with the platform or below it, the sand and gravel were wheelbarrowed to the hopper. To avoid this operation the bins were kept filled above the platform level until the work no longer required storage.

The cement storage house was built of tongue-and-grooved boards, and was sheathed on the outside with two-ply tar felt, well lapped and secured with wood battens. The roof was covered with felt secured with roofer's nails and disks. To prevent the cement from coming in contact with rain-water running down the back wall and seeping in at the joints of felt and sheathing, a V-shaped gutter was provided at the rear and lined with felt.

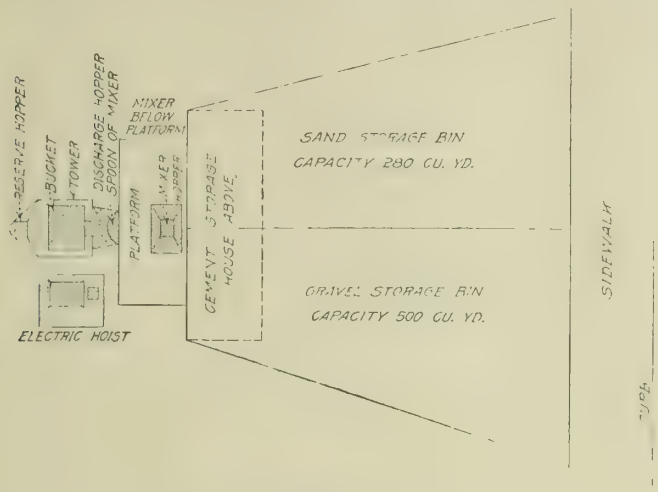
The trucking of material was done with a view to avoiding unnecessary handling. The top of the bins was level with the sidewalk and the sand bin was planked over to permit driving over and dumping directly into it through trap doors. The gravel bin was not covered, material was discharged into it from the top of the sand bin. The floor of the cement house was on a level with the truck platform, so that the cement could be unloaded from trucks into the house. The rear of the cement house opened on to the cement hopper.

The ¾-yd. bucket in the tower could be lowered into a pit 5 ft. below ground level, and the spoon of the discharge of the mixer was but 2 ft. above ground. This spoon delivered into a wooden hopper holding a ¾-yd. batch, so that while one batch was being mixed another was being discharged from this reserve hopper to the bucket and a third was being fed into the hopper of the

*Superintendent of Construction, Columbus Circle Construction Corporation, 2 Columbus Circle, New York City.

mixer—three batches moving at one time. The bucket was hauled up to the level of the chute hopper by the electric hoist, and was automatically tripped.

The reserve hopper was provided with a pin-hung discharge chute, which was operated by the bucket. As the



LAYOUT OF CONCRETING PLANT AT SITE OF CIRCLE BUILDING

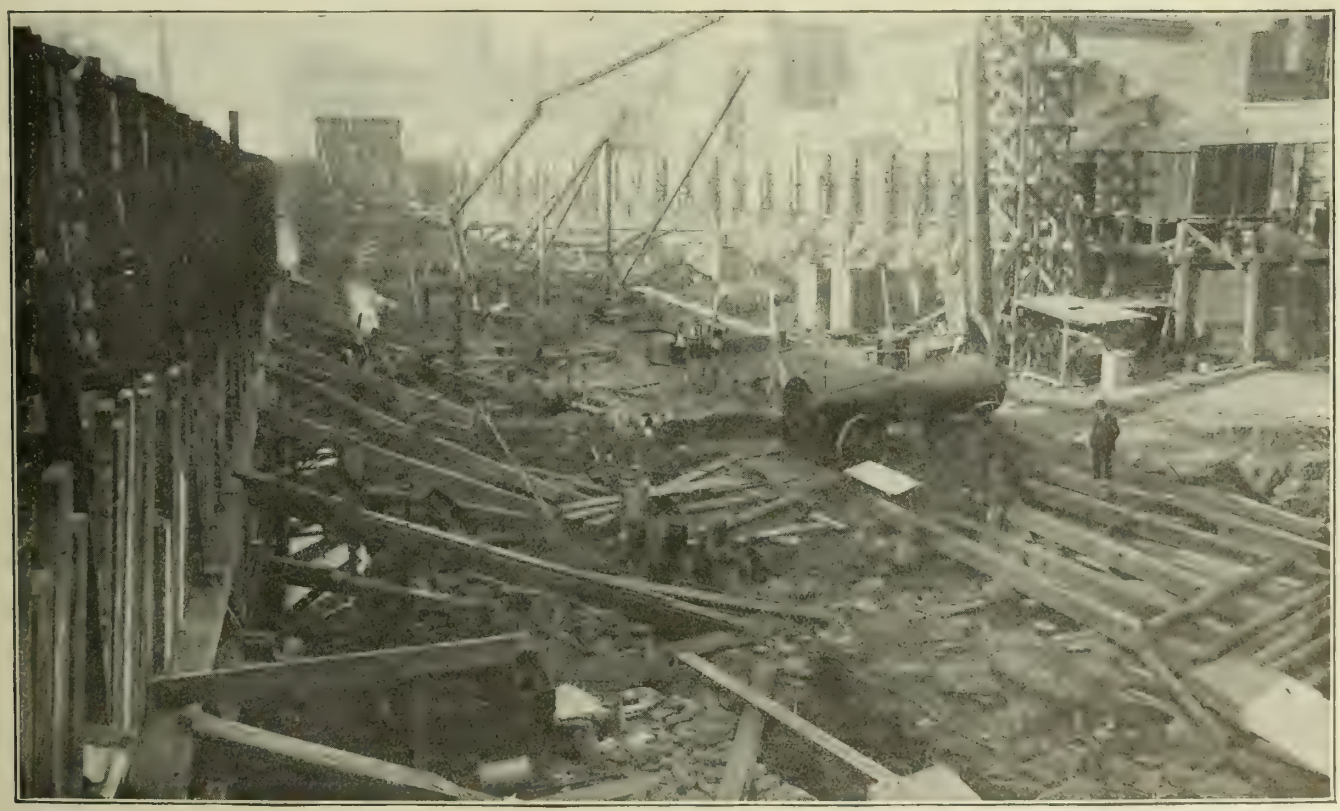
bucket ascended in the tower it turned this chute up and held the concrete in the reserve hopper, and when the bucket descended and passed the end of the chute it pulled it down and allowed the bucket to be filled. Later on, as the work progressed, the reserve hopper was abandoned and the concrete was fed direct from mixer to bucket by means of a galvanized-iron pipe slide chute.

It was found that the drippings from the reserve hopper settled in the pit at the bottom of the tower and interfered with the proper operation of the bucket. When the latter was discharging at the rate of a batch a minute this accumulation necessitated stopping the mixing and discharging at least three times in eight working hours in order to clean the pit. This cleaning operation took from five to eight minutes, which offset to a large extent the time saved by having a reserve batch.

A second reserve hopper was secured to the base of the tower, adapted to be filled by a length of chute to receive wheelbarrow loads. The purpose of this second hopper was to provide concrete for filling the minor pier holes while the chute was being shifted.

The chutes were in 30-ft. sections, the intersections being supported by ginpoles. This method was considered to be more satisfactory than using A-frames, as is ordinarily done. It permitted easy handling of the chute sections and shifting without disconnecting. The steel A-frame bracket which supports the first or tower chute was fixed in position so that the chute would be held permanently at the 65-ft. elevation during the entire course of the concreting. This elevation was maintained even when the concreting was at a point very close to the tower, making the descent of the concrete rapid. The chuting distance varied up to 200 ft.

Expense-Money Advances to Assistant Engineers—An engineer in New York City with a number of assistants who spend more or less time traveling has adopted the following means for keeping them supplied with expense money: To each assistant is advanced $50, for which he gives his note. At the end of each week the assistant puts in his expense account for the week. On the following Monday morning a check is given him for the account as approved, thus restoring and maintaining his $50 advance. This practice obviates what is a sore point with a large number of engineering and other employees throughout the country who are called upon to advance out of their own funds money for traveling and other expenses. Of course in some cases $50 would be an insufficient advance, but it serves to illustrate the principle. It may be added that one case has been reported to us in which a young man in the Federal employ was obliged to advance $600 personally for expenses before he got any of the money back.



GENERAL VIEW OF PLANT AND SITE SURROUNDED BY FOUNDATION-WALL FORMS

Engineering Work Preliminary to Pavement Construction

The engineering work preliminary to pavement construction or renewal varies in different cities. Generally a center line survey with cross-sections every 25 or 50 ft., with specifications, is about all the information given the contractor to bid on. A great many details are usually left to be decided by the supervising engineer, who is often called upon to do considerable supplementary survey work, such as giving lines, grades, etc. More often than in other branches of engineering work, the details of design, except at complicated side-hill crossings, are neglected.

Detail Survey and Design

In St. Louis, Mo., the Board of Public Service has organized a division of design—sewers and paving—one of the objects of which is to reduce to a minimum the engineering work required after the pavement construction has actually begun. The purpose is to furnish the contractor and supervising engineer with so much preliminary detail that there will be no call for survey or engineering work other than inspection and supervision, after the construction of the pavement has been started.

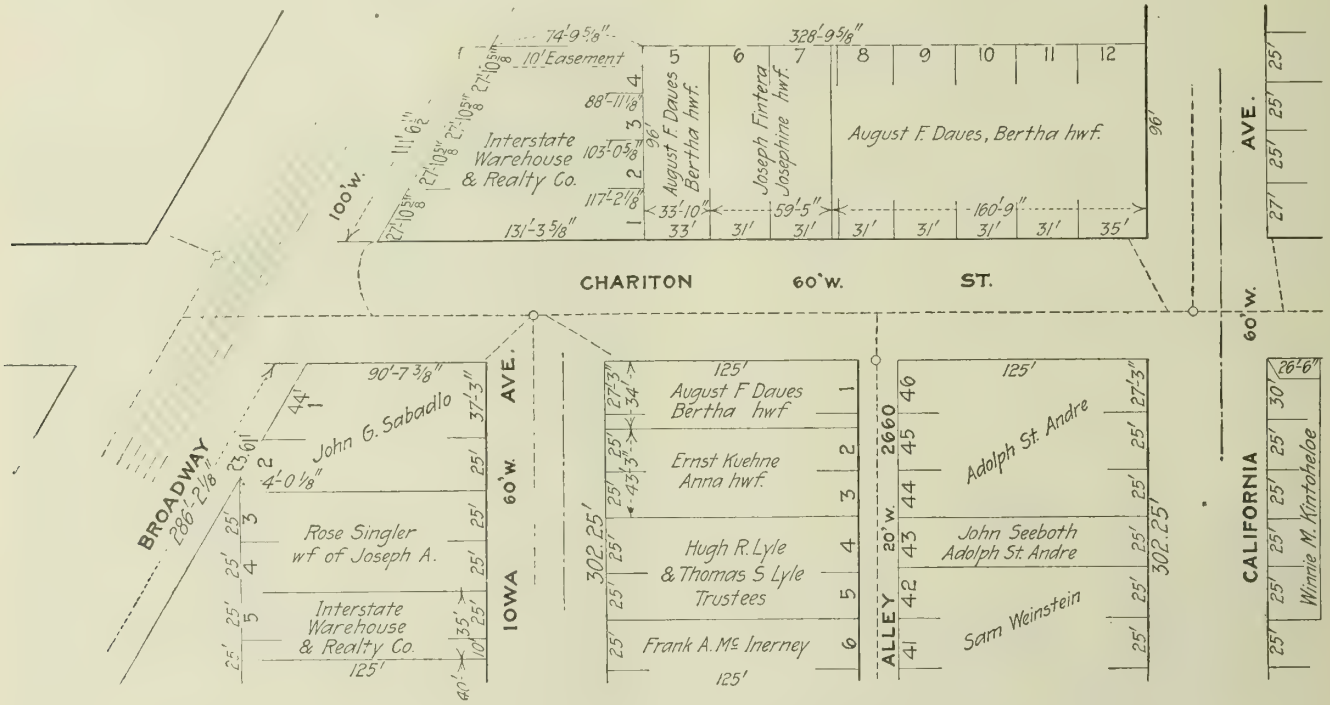


FIG. 1. ASSESSMENT MAP OF BENEFIT DISTRICT, PAVING IMPROVEMENTS, ST. LOUIS, MO.

The payment for street-improvement work in St. Louis, both new construction and renewal, is by assessments on abutting property. Hence the first step is the preparation of a property map of the benefit district. For pavement work one third of the cost is assessed against the frontage on the improvement and two-thirds pro rata against the area within the benefit district, which usually extends half way to the next public street. For sewer work the assessment is by area. This map, of which Fig. 1 is a typical section, is compiled on a scale of 60 ft. = 1 in., chiefly from the record plans on file in the city. The original lot subdivisions are shown as well as their present division and ownership. Discrepancies in street lengths are adjusted if necessary after making the detail street survey, which is described in the following. While of considerable assistance to the contractor in making his estimates, the primary purpose of the detail plan is to facilitate the work of the construction or supervising engineer. A study of a section of a typical plan (Fig. 2) will show that the field engineer is relieved as far as practicable of all calculations, small details, etc., which would require office work on his part. This allows him to give his whole time to supervising the work of construction; and of course has made it possible greatly to reduce the field force, although it has correspondingly added to the designing staff. While the ultimate economy of the new method is not yet proved, very satisfactory results have been achieved thus far.

Preliminary to drafting the plan, a very complete survey of the street is made, and the corners of all intersecting streets and alleys are definitely fixed by reference to permanent structures or by setting monuments. All telegraph or telephone poles, lamp posts, fire hydrants, sprinkling hydrants or standpipes, valve boxes, sewer inlets, manholes, trees, curbs set on intersecting streets, street-railway tracks, sidewalks, and all else that probably will be affected or need adjusting in any way because of the new pavement construction are located and recorded in this preliminary survey.

With this information at hand the final details of the pavement design are worked out. The completed plan (Fig. 2) on a scale of 40 ft. = 1 in., contains all the record notes pertinent to the location of the street lines, the established grades, elevation of benchmarks, crown of pavement at various cross-sections, details of corners of intersecting streets, summaries of curbing required, inlets and manholes to be built, rebuilt or adjusted, water or gas mains to be lowered, pole lines to be adjusted, obstructions to be removed, and a preliminary estimate of the cost of construction.

This system of handling the pavement work, whether more economical in actual cost or not, has resulted in distributing the work of the engineering staff of the city

uniformly throughout the year, and gives an opportunity for greater accuracy, as well as furnishing valuable record plans of street conditions and changes.

Under the new city charter of St. Louis, the public works are controlled by a Board of Public Service, of which E. R. Kinzey is President. The chief of the division of sewer and pavement design is W. W. Horner, and S. Sammelman is in direct charge of the paving section.

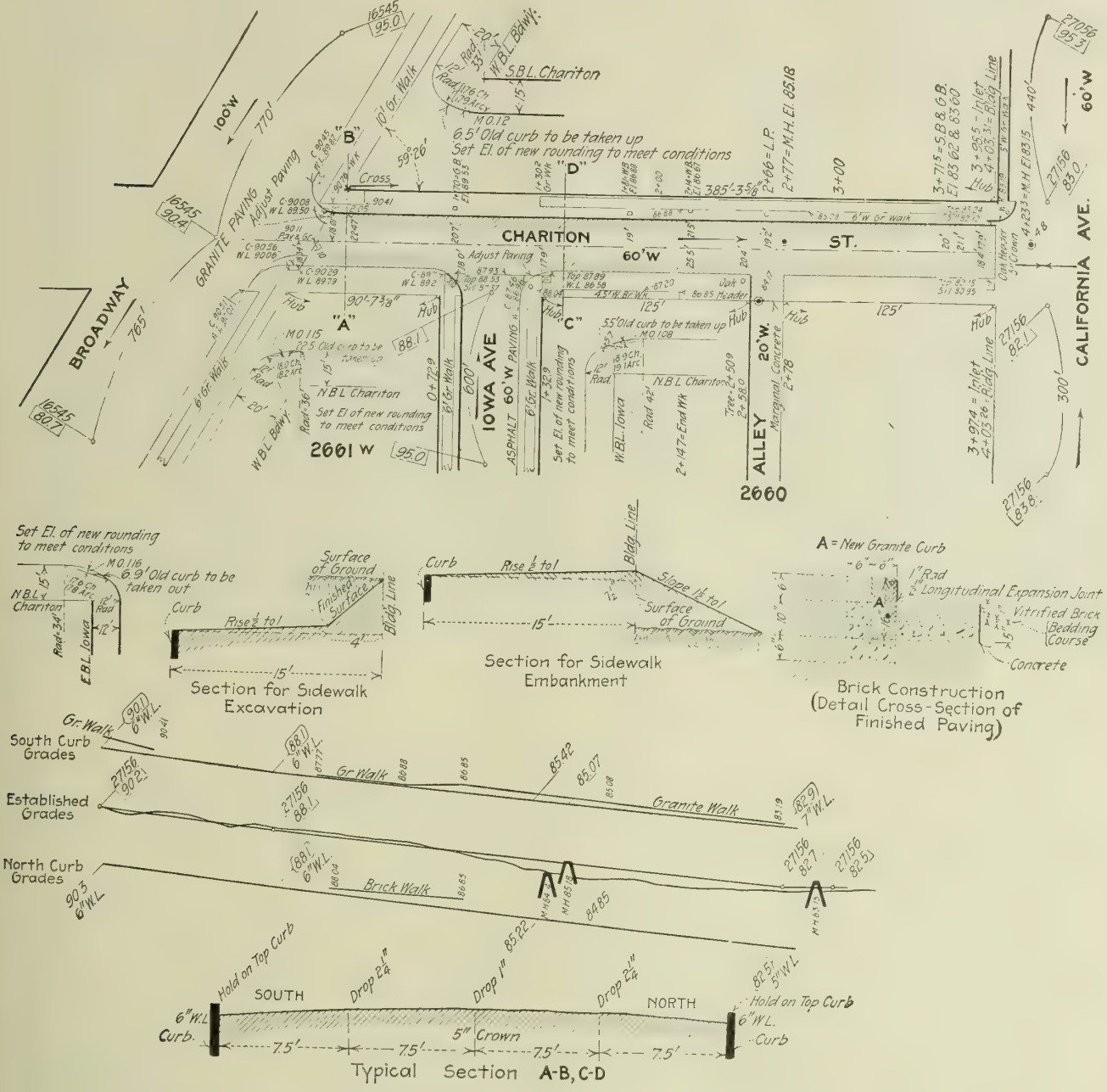


FIG. 2. PLAN, PROFILES AND CROSS-SECTIONS FOR PAVING IMPROVEMENT, ST. LOUIS, MO.

Cardboard Templets for Laying Out Structural Work

The practice of laying out rivet-holes in structural steelwork with the aid of wooden templets is pretty thoroughly established in this country. The Templet Co., of Ashtabula, Ohio, is making a promising attempt to change this practice by substituting cardboard for the more costly templet lumber.

Cardboard templets have been used only for small pieces, such as gusset-plates. Long cardboard strips, as required for flange, angle and girder templets, are too troublesome to handle. The improvement introduced by H. B. Ash, of the Templet Co., consists of a new method of preparing, handling and applying cardboard for all lengths of templets.

Preparing and Handling

Experience has shown that cardboard expands and contracts, in consequence of moisture variations, about $\frac{5}{16}$ in. every 7½ ft. To eliminate this troublesome action the concern has developed a treatment by which the cardboard is finished with a sort of varnish gloss. It is claimed that this prevents all change of dimensions.

For girder web-plate templets, up to 8-ft. width and 30-ft. length, cardboard sheets of exact width are supplied by the company in rolls of 12-in. diameter, from which

the templet-maker simply cuts off the required lengths and at once proceeds to locate the rivet-holes.

For angle flange-plate and bar templets, one edge of a long, narrow piece of cardboard is inserted between a pair of maple clamping strips, which hold and stiffen it, and enable the cardboard to be handled conveniently in all lengths, besides serving as a guide in locating the holes. The clamping screws, spaced 18 in. apart, are so seated as to separate the clamping strips positively when the screw is turned in the release direction. Short pins in the jaw of the lower strip take hold of the cardboard and insure against its slipping. The strips may be made with a 1/8-in. scale marked on them to facilitate locating the holes; but on long lengths it is preferable to work with a steel tape. The width of the gripping jaws for holding the cardboard is 7/8 in., and cardboard for angle and flange templets is made regularly 7/8 in. over the even width; for example, 3 7/8 in. wide for a 3-in. flange.

Applying the Templets

The templets are laid upon the iron to be marked in the same way as wood templets, with the advantage that the frame serves as a guide and rests upon the flange, and it is unnecessary to turn the iron to mark the opposite flange as is the case with a wooden templet.

The greatest saving with cardboard templets is in the templet-maker's time, as he is using a material which is more easily worked. On this point Mr. Ash gives the following figures:

Of a 15-ft. templet for a 6x6 angle, the total cost is about 35c. for wood and 17c. for cardboard. The saving of 18c. includes 15c. saving in cost of material (at $45 per M ft. for lumber and $8 per M lin.ft. for 6-in. cardboard), and 6 min. or 3c. saving in labor (elimination of sawing and trimming, while punching holes in cardboard can be done twice as fast as drilling them in wood).

For a 42-in. web-plate templet 15 ft. long the total costs are about $1.20 and 88c.; there is a 12c. saving in material cost and a 36-min. or 20c. saving in labor.

Handling Steel Centers for Concrete Arches

By Harold E. Ketchum*

The centering for the Detroit-Superior High Level Bridge was complicated by the number of different rises and spans of the arches. Arches 6, 7 and 8 have the same span and have been centered with similar three-hinged steel arches supported on steel columns (Fig. 1). Arches 2, 9 and 10 are shorter and are being centered by removing one section of the standard arch-truss and placing a new end post. Arches 1 and 5 will take the standard centering and arch 3 will have an extra section added to the trusses previously used. The remainder of the arches are being centered with timber except the arch over the Erie Railroad, which is provided with structural reinforcing strong enough to act as a support for the concrete.

At the crown of the steel centers a toggle adjustment provides a simple and satisfactory means of striking. It gives a clearance of 6 in. at the crown and about 1 in. at the haunches. The toggles are also used to bring the arches to proper grade before concreting.

The haunches of the trusses are pin-connected to cast-steel and structural-steel shoes having a wide base to roll on. Four-inch steel rollers in nests of five are placed under the shoes. Three 12x12 oak timbers protected by a 1/4-in. steel plate and supported by sectional steel columns serve as a runway on which to move the centering.

Erecting the Centers

The steel trusses arrived on the job in sections on cars. The unloading and handling during the assembling were done by the cableways. All parts are bolted together (3/4- and 7/8-in. bolts). A tower of 8x8-in. posts and 2x8-in. braces is placed to support a pair of half arches near the crown of one pair of trusses while the opposite trusses are erected and pins driven. Each truss weighs 12 1/2 tons and while the rated capacity of the cableways is 8 tons there has been no difficulty in handling the heavier loads.

The cables of the cableways are located midway between each pair of ribs and the trusses had to be erected under the cables. When the two steel arches forming the centering for one concrete arch rib are erected, the end pins are connected with cables and turnbuckles. Enough tension is brought to bear on the cables with the turnbuckles to raise the centering off the tower. The centers are then jacked over into position, two 10-ton track jacks being used.

When the steelwork for both ribs is in position, cross-bracing is placed between the pairs of centers, and diagonals of the turnbuckle rods in the lower chord. When

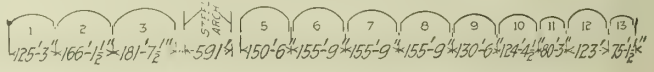


FIG. 1. DIAGRAM OF ARCHES, DETROIT-SUPERIOR BRIDGE

the trusses are braced together they make a stable unit, but as a matter of safety a 5/8-in. wire-rope guy is fastened on each side of the crown and secured to deadmen with turnbuckle connections for adjustment.

Upon striking the centers after having concreted one pair of ribs they are moved as a unit to the other side of the bridge into position for concreting the other pair of ribs. A hoisting engine and five-part blocks are used in moving. When the trusses have been struck for the last time they are rolled between the arch ribs and supported by turnbuckles hung from steel girders resting on the arch ribs, while the pins are driven out. The cableway is then used to remove the trusses.

The average time of erecting one complete set of centering for one rib is about 6 hr. To roll the trusses from one side of the bridge to the other, the distance traveled being about 46 ft., requires from 4 to 8 hr.

The Hunkin-Conkey Construction Co., of Cleveland, Ohio, is the contractor for this part of the bridge work.

A Comparison of Railroad Wages in 1871 and **1914** is made in a bulletin issued by the New York, New Haven & Hartford R.R., as follows:

	1871	1914
Average monthly pay:		
Passenger engineers	$90 and $100	$131.39
Passenger firemen	50	75.35
Passenger conductors	100	133.73
Passenger brakemen	45 and 50	78.07
Freight engineers	$75, 85 and 90	177.51
Freight firemen	45 and 50	92.52
Freight conductors	85	118.88
Freight brakemen	45 and 50	82.10
Av. rate per pass., per mile	$0.02538	$0.01712
Decrease, 32.5 per cent.		
Av. rate per ton of freight, per mile	.04295	.01415
Decrease, 67 per cent.		

It is to be recalled that payments in 1871 were on a paper basis and not on a gold basis. Taking that into account, the increase in wage rates is even greater than the above table indicates.

*Superintendent, Hunkin-Conkey Construction Co., Cleveland, Ohio.

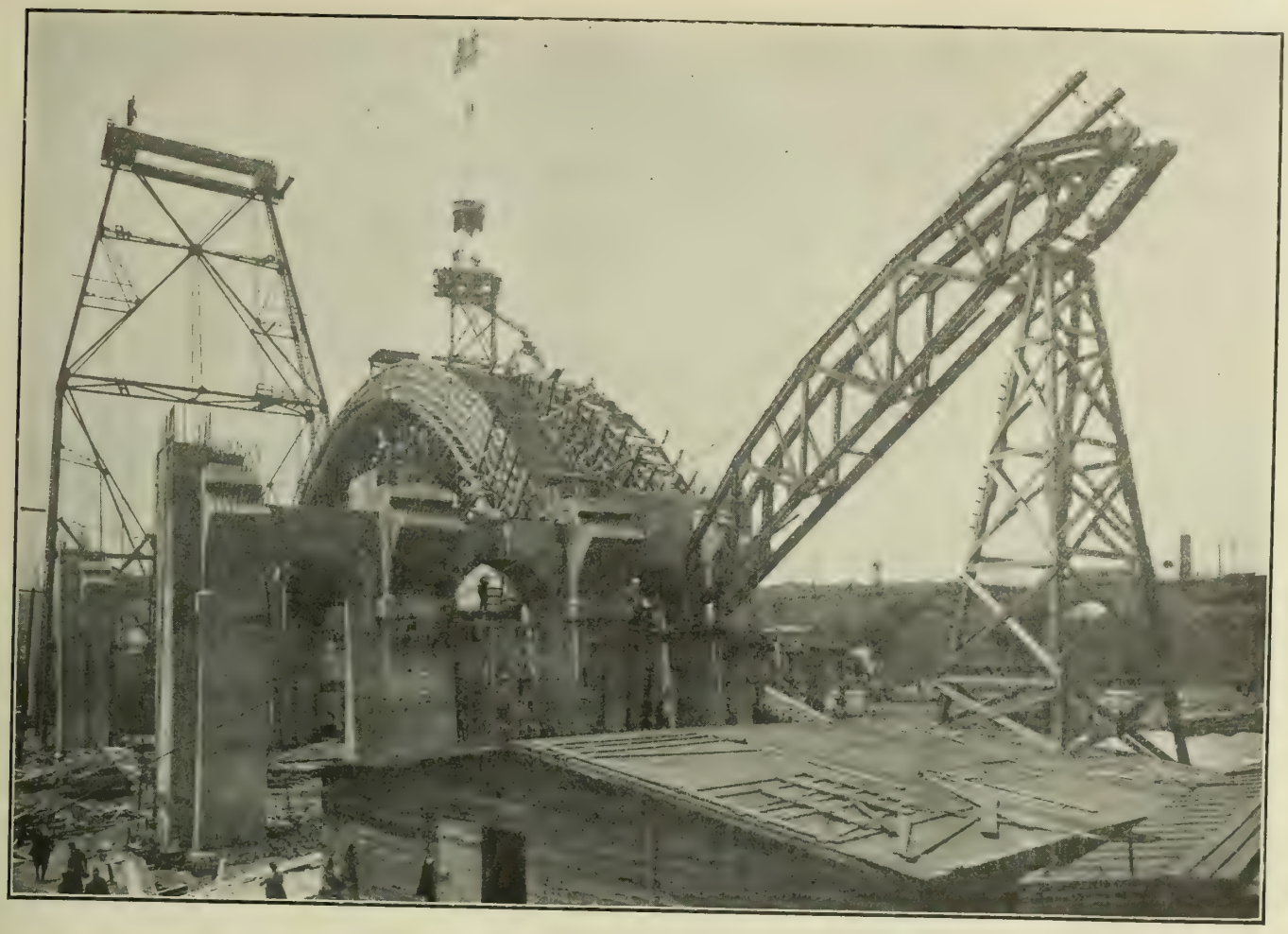


Fig. 2—Setting halves of the three-hinged arch centers on temporary tower

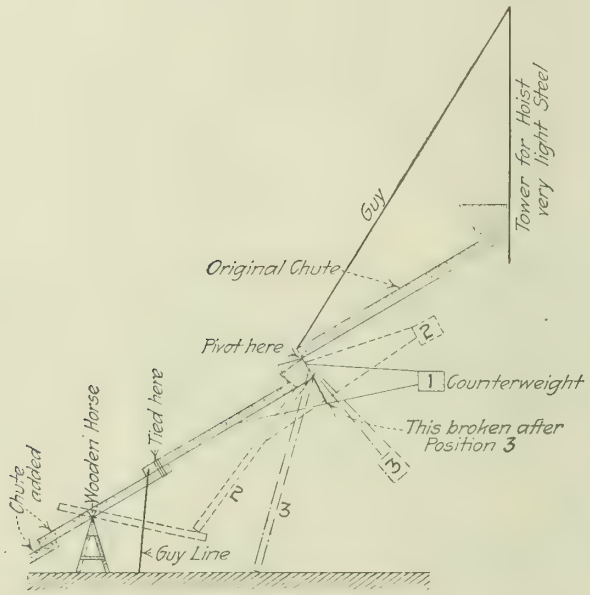


Fig. 3—Cableway placing last piece of centering for a pair of ribs

FIGS. 2 AND 3. ERECTING CENTERS FOR CONCRETE ARCHES OF THE DETROIT-SUPERIOR VIADUCT

NOTES

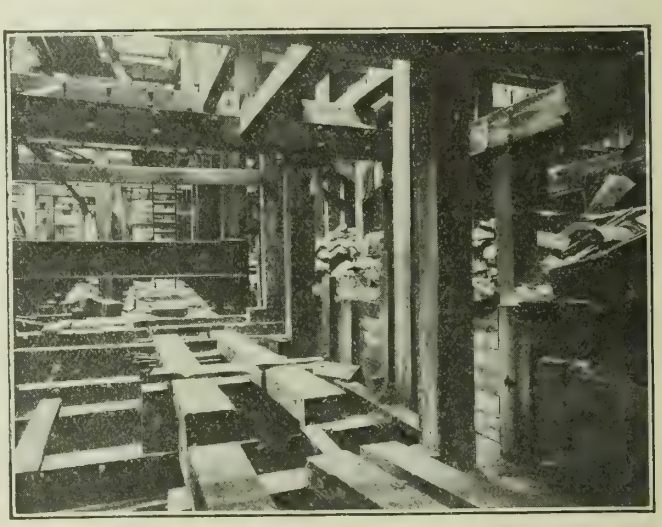
Neglected Turning Moments in the construction of a concrete distributing chute recently caused a Cleveland, Ohio, contractor considerable annoyance and expense. The manufacturer of the chute supplied a light skeleton steel tower with two lengths of chute, one attached to a carriage on the tower which could be elevated to suit the different floor levels the second pivoted to the end of the first length and balanced by a counterweight. These two lengths of chute, however, were not long enough to reach across the building,



COLLAPSE OF CONCRETING CHUTE FROM NEGLECT OF A LITTLE COMPUTATION

and the contractor added two lengths as shown by the full lines in the accompanying sketch, partly supported from the tower and partly by a wooden horse. The first batch of concrete wrecked the chute, for the counterweight was not sufficient to support the weight of the wet concrete when it ran into the first of the added lengths of chute. The structure assumed the position indicated by the dash lines marked 2. After hanging a few minutes in this position the counterweight arm commenced to bend, reducing its lever arm, the horse was pulled over and the chute and counterweight assumed the position marked 3. This accident resulted in about a 4-hr. delay in placing concrete and a lot of unnecessary labor, all of which might have been avoided by the use of some intelligence in supporting the chute.—A. D. Williams, Cleveland, Ohio.

Use of Horizontal Sheeting in Subway Work—Horizontal sheeting has been used in a number of instances as the back form for concrete in the construction of the Flatbush Ave. subway, Brooklyn, N. Y. The soil is firm sand, clay and boulders. At one point where the excavation was very close to the building line, horizontal sheeting was placed all the way to the bottom of the cut, which was 30 ft. deep at this point. The timber sheeting was of the usual 2x8-in. size and was braced horizontally every 5 ft. In placing the sheeting it was guided and held by 6x10-in. vertical rangers or posts, which were driven down as the sheeting was placed. These rangers were spaced 5 ft. apart. In shallow cuts, such as where the six tracks are depressed, horizontal sheeting was placed and held every 5 ft. by two 6x12-in. bolted continuous cross-



HORIZONTAL SHEETING ALONG CUT FOR DEPRESSED TRACKS

braces or needles butting directly against 4x10-in. vertical rangers placed flat against the horizontal sheeting. The work is being done by the Cranford Co.

A Convenient Time Card is that shown in the accompanying illustration. It was devised to prevent dispute with the day laborers employed by the maintenance division of the Pennsylvania State Highway Department over the amount of pay due them from the state. The men are employed usually in small gangs, and each day the timekeeper or foreman punches the card for the date and number of hours worked. The rate of pay is also shown in a similar manner. The workman keeps his time card as a certified statement of the pay due until the semimonthly pay day, when it is surrendered and becomes a signed receipt for the files of highway department. For purposes of identification the workman makes a signed statement on the back of the card certifying to the correctness of the record. He also has a numbered brass check which he must show before cashing his time card. This time card does not replace the usual time-book record, but is supplementary to it, giving a check on the timekeeper's summaries. The time card must be approved and signed by the foreman before it becomes valid. This simple device has proved quite successful in use and has prevented many misunderstandings. George H. Biles, former Maintenance Engineer, now Second Deputy Commissioner of the Pennsylvania Highway Department, devised the system and card.

In accepting this card, I declare that I am a citizen of the United States.

Name ..... Post Office Address.....

Route No..... County..... Township..... Classification of

Appl. No. ..... County ..... Township..... Labor .....

Check No..... Pay Period ending ..... Pay Roll No.....

Rate .....
Hours .....
Amount .....

STATE HIGHWAY DEPARTMENT
Maintenance Division

Rate per hour					
5	6	7½	8	9	10
12½	15	16	17½	20	22½
25	27½	30	32½	35	37½
40	42½	45	50	52½	55
60	65	70	75	80	100

In filing this card each employe must certify to the correctness thereof by signing the form on opposite side. Any attempt to deface, mutilate or fraudulently punch this card will be dealt with to the full extent of the law, and the card will be declared null and void and payment withheld.

LABORERS' TIME CARD, PENNSYLVANIA STATE HIGHWAY DEPARTMENT

Editorials

Art in Water-Works Design

Few if any public works designed by the engineer afford such numerous and varied opportunities for artistic expression as those devoted to the water-supply of cities. That these opportunities were eagerly grasped and effectually improved in ancient, medieval and early modern times is shown by aqueducts, fountains and wells in various parts of the world.

With the advent of the thousands of water-works of the later modern type, made possible by pumping machinery, by iron, steel and improved forms of wood pipe, and by iron and steel standpipes and tower-tanks of the same materials or of wood, there came an era of water-works structures that needed no excuse for ugliness because they were buried or at most but rarely seen, on the one hand, and on the other, of structures whose inexcusable ugliness rose heavenward in the sight of thousands. Exceptions to these examples of quite unnecessary ugliness were occasional masonry-inclosed standpipes and tanks and here and there a pumping station which, either through sheer fitness for their purpose or else by chance, or again and more rarely through careful design, were pleasing to the eye.

The increasing demand for water storage on a large scale to keep pace with the enormous city growth of the last half century, has caused the erection of thousands of masonry dams, small and large, throughout the civilized world. Most of these dams have been designed in blissful ignorance of everything entering into what, for want of a better term, may be called architectural composition. As a rule, structures so designed are bound to fall short of their highest possibilities, yet many of them may nevertheless possess much artistic merit because of that sheer fitness of form to function which has already been mentioned.

How many times architects have been called in to aid in the design of dams would be interesting to know; as a guess, not many—at least not in this country.

Unquestionably the most notable attempt to treat a dam in accordance with architectural principles is the Kensico Dam, described in detail elsewhere in this issue. For reasons, methods and results, and much of value about the underlying principles of architectural design as applied to dams, the interested reader is referred to the article just mentioned.

Reverting now to tanks and towers, a class of water-works structures which are employed more to insure pressure than to provide storage, changes in purely structural design, such as curved for flat-bottomed steel tanks, and the growing use of reinforced concrete for standpipes and for elevated tanks, have in themselves wrought marvelous improvements in the looks of water tanks, towers and standpipes and have made further improvements easily possible.

One opportunity for art in water-works design there is which has gained considerable recognition but deserves far more. It comes through the heightening or, if need be, the creation of landscape and waterscape effects. An interesting example is afforded by the cascades of the Los Angeles Aqueduct, illustrated elsewhere in this issue. Landscape architecture, too, is a notable feature of the immediate surroundings of the Kensico Dam, already mentioned. Effective landscape work has also been done around some of the reservoirs of the Massachusetts Metropolitan Water District. To mention only one foreign example, nature and man have done nobly by the water-storage reservoirs of Leicester, England.

A typical example of lost opportunity which painfully impresses at least one person every time he passes by daylight over the horseshoe curve of the Pennsylvania R.R. is the bare and ugly embankments of the Altoona water-works reservoirs. A small expenditure there, under skillful direction, would at least ameliorate the blot on the landscape now caused by the dams, and perhaps bring these into harmony with the natural landscape and the pleasing effect of the water surfaces of the two reservoirs.

New England Water-Works Convention Attractions

An unusual program is offered by those responsible for the success of the annual convention of the New England Water-Works Association which is to be held in New York City, Sept. 7-9. For many years past the September conventions of this association have consisted of relatively few papers, an excursion or two and a considerable amount of open time. This year there are on the program 22 technical papers and addresses and one committee report, distributed through five sessions. In addition one afternoon will be devoted to an excursion by water and another to the Kensico Dam of the Board of Water-Supply of New York City—the architectural features of which are described elsewhere in this issue.

One reason for the unusually large number of papers this year is that the program includes two sessions for superintendents with six papers and discussions at each session. Another reason is that particular pains have been taken by the program committee to present to the visitors a number of interesting features of the design, construction and operation of the water-works of New York City. The range of subjects is almost as notable as the number of papers. And the subjects are live ones, too.

As may be judged from the foregoing statement, there is reason to anticipate a large and enthusiastic gathering of water-works men in New York City next week. The program offers instruction and entertainment a-plenty for each and all. The city in which the meeting is held has attractions of its own besides those in the water-works field which are so liberally represented on the program. Best of all in many respects will be the unlimited opportunities for quiet personal exchanges of water-works and other experiences and for the enjoyment of the good fellowship that prevails at all the water-works conventions, of whatever name and in whatever place.

It hardly needs to be said in conclusion that the New England Water-Works Association is local only in name. Its membership is well distributed throughout the United States and Canada. Although there may continue to be, for a while longer, more than one water-works association in America, there is only one water-works fraternity and all its members will be welcome in New York next week.

The Unstable Earth Fill

It seems almost like rubbing it in to call attention just now to the defects in the design of the earth section of the Galveston Causeway. A careful examination of periodical literature does not show a single protest against the protected earth fill which joins the short concrete arch section to mainland and island, on both sides nearly a mile away. As far as the records go, this part of the design was considered as reliable as the long line of concrete arches on their wooden piles. Today, in the light of its so complete failure, the truth is quite obvious. No earth slope can long stand up under water overflow. Protection in the way of paving or revetment will put off the evil hour, but sooner or later the initial crack develops and through the opening so offered the final destruction is only a matter of time.

This fact is well-known to builders of earth dams and river levees. Doubtless it was appreciated by those responsible for the causeway, though its importance must have been outweighed by considerations of economy or by an unwarranted trust in the calmness of Galveston Bay. The integrity of the concrete sheetpiles which survived the terrific assault of the hurricane and the stability of the concrete arches testify to the workmanlike manner in which the structure was built. It seems a shame that the extra cost of a rock fill was not ventured or a permanent pile-and-girder design of some sort utilized. At least some effort could have been made to avoid that unprotected ballasted roadway which was undoubtedly the "Achilles heel" of the whole structure.

Truly, as the poet says, "Hindsight is better than foresight."

Contract With an Inducement for Economy

Some time ago this journal received from the chief engineer of a prominent Western railway an inquiry as to whether any form of percentage contract had ever been tried under which the contractor would receive the actual cost of the work plus a percentage which would be so graduated that he would have a strong financial inducement to make the cost as low as possible.

It has been learned that such a contract was framed for the construction of the Cambridge subway, which was built for the Boston Elevated Railway Co. by the contracting firm of Hugh Nawn, of Boston. The contract between the company and the contractor, according to information furnished by C. S. Sergeant, Vice-President of the company, contained the following provision for payments:

The contractor received in the first place the actual cost of the work plus 10% of such cost. Upon the final completion of the work, the total cost, including the 10% paid to the contractor, was ascertained and compared with the estimated cost as determined by the engineer of the company, provision being made, in case this estimate was unsatisfactory to the contractor, for revision by a board of referees of three engineers. If the total cost of the work exceeded the estimated cost, then one-fourth of this excess was deducted from the 10% to be paid the contractor. In case, however, the final cost of the work was less than the estimated cost, the contractor was entitled to receive one-fourth the amount saved.

In computing the cost of the work, the cost of machinery, tools and appliances purchased for and used upon the work was included, less the value of such machinery, etc., at the conclusion of the work, to be agreed upon between the contractor and the company. This did not include, however, the small tools and supplies used, the entire cost of which was charged to the work.

A general and well-founded objection to the carrying on of contract work on a percentage basis is that the contractor has no incentive to practice economy in the conduct of the work. On the contrary, the more costly it is the greater is his profit. The use of the percentage form of contract, therefore, is generally limited to firms of well-established reputation which are carrying on work for private corporations which are not bound by the legal restrictions governing most public work as to advertising the contract and letting it to the lowest bidder.

Under the plan described, however, there is no reason apparent why such a form of contract might not be made applicable to the carrying on of public work let by open bidding. Those bidding on such a contract would state in their bid the percentage they would accept in addition to the actual cost of carrying out the work according to specifications, provisions for deductions from, and additions to, that percentage being included according to the plan outlined or such other plans as might be deemed advisable under the local conditions.

Everglades Drainage Problems and Florida Rainfall

Anyone who witnessed the destruction wrought as the result of a rainstorm of less than 6 in. at Erie, Penn., as reported in detail in *Engineering News,* of Aug. 12, can form some idea of what an inundation must result from a rainfall of over 15 in. in 24 hr., reported at St. Petersburg, Fla., on page 428 of last week's issue. The Florida storm, however, fell in a comparatively level country. St. Petersburg is on the Gulf Coast, with no opportunity for such a flood to gather as swept down the steep slopes on the upper part of the Mill Creek drainage basin at Erie.

The Florida rainfall is of especial interest, however, in connection with the much-discussed project for the drainage of the Everglades. In the various engineering reports that have been made upon this project, two points have been emphasized. One is that in any system of drainage canals from Lake Okeechobee, or from the Everglades itself, suitable provision should be made for control gates, so that the level of the lake and of the ground water in the swamps may be prevented from falling too low in times of long continued drought. A special reason for this precaution is that at such times danger exists of fire getting into the dried-out upper portion of the swamp and causing widespread damage.

The second point made in the engineering reports upon the project has been the necessity for providing drainage canals of sufficient capacity to take care, to a reasonable extent at least, of the large runoff due to the heavy rainfalls which often occur in this section and which flood the canals.

Both these recommendations by engineers receive additional force in the light of recent events in the Everglades. According to the best information, Lake Okeechobee was last spring at the lowest stage ever recorded. The canals from the lake to the ocean which have been already completed contain no provision for checking the flow of water, and during a long period of dry weather the lake waters were drained away until a large area of the lake bed was bare. The Seminole Indians, who are accustomed to navigate the lake with light canoes, had great difficulty in getting across it.

Following this stage of unusually low water have come the recent storms. It is stated that at the time of the recent 15-in. rainfall in St. Petersburg, a heavy rainfall was general throughout Florida and particularly severe in the southern portion of the state. As a result Lake Okeechobee is reported at its highest stage. The drainage canals thus far completed are inadequate to carry off the water. Lands which were expected at this time to be drained and available for agriculture or town building are reported to be under 5 to 6 ft. depth of water. It is a common experience of engineers to find their recommendation of provision for extreme rainfall and runoff in hydraulic works falling on deaf ears. The widespread floods of the present season are a valuable object lesson to the public that engineers' recommendations as to provision for floods are based on practical realities and not on pure theory.

Letters to the Editor

Initial Tension in Rivets

Sir—In the fourth paragraph of a letter from Edward Godfrey, of Pittsburgh, printed on p. 184 of your issue of July 22, the following statement is made in regard to rivets in tension: "Pulling on the head of a rivet does not increase the stress on the rivet, but relieves the pressure on the plates," etc.

This statement seems to me to be in error, as follows: The theory of the initial tension is that the rivet in cooling contracts so that the distance between its heads would be less than the combined thickness of the plates joined, if an equal (or greater) resistance to compression were not offered by the plates. The initial stress is therefore due to the reluctance of the plates to reduce their combined thickness, the air and paint between them contributing slightly to the thickness. Any strain which tends to increase this combined thickness—such as tensile pulls—will obviously increase the stress.

In the symposium, of which Mr. Godfrey's letter is a part, I have not noticed any reference to the fact that the actual initial tension in a hot-driven rivet is very materially reduced by the simultaneous shrinkage of the plates. The heat from the rivet is very largely absorbed by that part of the plates adjacent to the holes, and any riveter can tell you that the plates get hot—hot enough to expand—nearly as hot as the rivet itself at the finish of driving. In cooling, both rivet and plates contract, the rivet only slightly more than the plates. Many a rivet is passed for "tight," on a hammer test, whose shank fills the hole and whose heads only barely touch—quite a proper condition, it seems to me.

Like Mr. Godfrey, I believe that rivets in tension, if used in properly designed details and only used where essential, are not entirely to be forbidden, as the initial tension (except in long rivets) will not be extremely high in rivets driven in the field.

Ira W. Dye.

872 N. Farson St., Philadelphia, Penn., July 24, 1915.

Water-Ballast Tanks and the "Eastland" Disaster

Sir—I have noticed with interest your comment on the water-ballast tanks of the "Eastland." It is true that when they contain water they tend to lower the center of gravity of the whole vessel; but unless the tanks are filled, the presence of water in them would in many cases decrease the positive metacentric height, righting moment and stability, the exact condition depending on the relationship between the vessel's beam and water line of flotation and the ballast water surfaces.

The metacentric height is represented by

$$GM = \frac{I - GB \times V - \Sigma i}{V}$$

In which I is the moment of inertia of the water plane of flotation, GB the distance between centers of buoyancy and gravity, V the volume in cubic feet of displacement and Σi is the summation of moments of inertia of water surfaces inside, such as water-ballast tanks, boilers, bilges, etc. It will thus be seen that in some cases the partial filling of water-ballast tanks may be "the last straw that breaks the camel's back."

The statement in your issue of Aug. 5, that the "Eastland" was in the habit of listing to one side or the other, is interesting to say the least. This condition is frequently observed in cargo-carrying freighters when light and with practically no coal on board. One often sees in New York harbor, a freight steamer high out of the water with a list to one side or the other. The reason for this is that the ship has been designed with an initial negative metacentric height; that is, in a light position she is unstable by a small margin. When she starts to roll to one side or the other, which she must necessarily do, she finally comes to a position of stability because the listing increases the breadth of the plane of the water line or line of flotation, which greatly increases the "I" in the formula to the point where GM, the metacentric height, is greater than zero, and the list goes no farther.

When the freighter is loaded with cargo, the center of gravity being lowered, the negative metacentric height becomes positive, so that when ready for sea the vessel is stable. A ship so designed must of course be loaded with ballast to make her safe when no cargo is available.

It is advisable for many reasons that the metacentric height of a ship should not be excessive, although to the layman it might appear that the greater the metacentric height, with the consequent righting moment, the safer a ship.

There are, however, disadvantages in a ship with too great a righting moment—that is, too high a metacenter—because she will be too stiff, and will roll in a sea-way with a sudden jerky movement that is very likely to snap her masts off, besides being extremely uncomfortable for passengers and crew. An easy, gentle roll is preferable for comfort, and also better for the ship, both as regards the effect on her structure and the possibility of shifting her cargo.

An experienced naval architect, or an engineer familiar with problems of vessel stability, would have known, in the case of this particular ship, from the statement made as to her inclination to list to either side, that when unloaded her metacentric height was slightly negative instead of positive. I will not comment upon the effect of the juggling done in trying to bring her to an even keel by filling water-ballast tanks on one side and emptying them on the other; but I am quite sure that anyone who has ever tried to right a listed vessel under these conditions by juggling with the water-ballast tanks will realize how futile the effort was.

Your closing paragraph I think is misleading, because it is just as well that the general public should not know too much about the metacentric height of a vessel. "A little knowledge is a dangerous thing" and might give rise to false ideas of security, such, for instance, as those apparently held by many of the passengers during the "Titanic" disaster, and later the "Lusitania," that these great ships were unsinkable.

A 56-in. metacentric height would undoubtedly give more righting moment to the same vessel than a 14-in. metacentric height; but if the 14-in. is sufficient, this will make a much more comfortable vessel, and the passengers will not be nearly so likely to suffer the disagreeable sensations of seasickness. Furthermore, a 56-in. metacentric height, if brought about by the addition of water-ballast, may be gradually reduced, or become nonexistent, if the water-ballast tanks are only partially full. The steamship line advertising the great stability of its vessel may have neglected to consider the negative effect on the stability of the free water careening in the partly filled tanks.

I disagree entirely with your concluding statement that "there can be no doubt that stability calculations and the margin of stability of vessels will hereafter have an importance in the minds of vessel owners and builders which they have never before possessed." The design, computation and construction of vessels in the hands of those capable of being entrusted with such work have always received all the care and consideration which you rather intimate will only now be given them as a new problem. As a matter of fact it is a very old problem.

F. R. Harris,
United States Navy Yard.

Philadelphia, Aug. 9, 1915.

Opposition to Concrete Chutes

Sir—Under the heading of "Concrete Chuting Predominant" there appeared an editorial in *Engineering News* of Aug. 12 to which I feel it necessary to reply. The protest against a free use of chuting concrete has been reduced in volume perhaps, so far as printed objections represent volume, but from conversation with engineers I am convinced that the voices in opposition have not been reduced in number.

For a number of years I have insisted that while "wet" concrete is preferable to the old-fashioned "dry" concrete, there must be care used in the amount of water. I have held that concrete which pours readily from a wheelbarrow is not the ideal concrete. It is too easy to add just the amount of water that will hurt the material. In the olden days when dry concrete was the rule we never heard of the dusting of floors. Today with finer grinding of cement and the use of considerable water it is difficult to obtain a nondusting floor. Perhaps if fine grinding of cement had not come in about the time the excessive use of water became common there might have been less heard of unsound concrete and the dusting of concrete surfaces. The ideal amount of moisture produces a mass that is sticky and pasty rather than free flowing. Such material requires to be assisted from a wheelbarrow by shovel or hoe. It is not necessary to state that a mixture of this kind cannot be chuted.

Those who wonder at the increasing use of chutes and the great popularity of this system of delivering concrete seemingly do not take into consideration the wonderful power of advertising. The makers of chuting devices advertise them extensively. They are able to produce records of very low costs in the delivery of concrete from mixer to forms and the contractor who does not use a chute when he is permitted to do so is a foolish contractor. I would do it myself if I were a contractor and the engineer permitted the use of chutes. As an engineer I forbid the use of chutes on work of any importance where the introduction of reinforcement allows a great reduction in section and the compressive strength of the concrete is relied on to the limit. Much of the unsoundness, so-called, of concrete reported is certainly due to the use of an excessive amount of water. The only thing to be done so long as chutes are being exploited is to await results and no results worth having can be secured for two or three years to come, when some of the chuted concrete will have attained an age of five or more years.

Ernest McCullough.

Monadnock Block, Chicago, Aug. 16, 1915.

Paper Bags vs. Cloth Bags for shipping hydrated lime was discussed by F. E. Kessinger before the National Lime Manufacturers' Association. Mr. Kessinger is attorney for the rope-paper-bag manufacturers. Comparing the cost of the two types of bag, he stated that paper bags holding 40 lb. each can be purchased for $17 per thousand. At this rate, when used for shipping cement, the cost for the bags would be about 17c. per bbl. The cloth bags holding 100 lb. and costing about 15c. each can be used for about four trips on the average before being worn out or lost. This makes the cost of the cloth bag per barrel of cement shipped about 15c. The difference of 2c. against the paper bag, however, is claimed to be more than made up by eliminating the trouble with customers in connection with the return of bags. Mr. Kessinger stated that the railroad freight Committee on Uniform Transportation of the railroad freight authorities is for the present permitting the use of paper bags in less than carload shipments as well as in full carloads. It is hoped that this condition can be made permanent, introducing a specification for the quality of paper bags that will be acceptable.

Galveston Storm Damage

The City of Galveston is quickly recovering from the recent storm; an 8-in. main across the bay is temporarily supplying water, cleaning up of the débris along the seawall boulevard and the silt and dirt in the north side streets is practically completed and a pile trestle is in process of construction as a substitute for the destroyed causeway approaches. Advices from the city state the most hopeful spirit prevails and suggestions that Galveston's prestige as a seaport has suffered a permanent setback are indignantly resented.



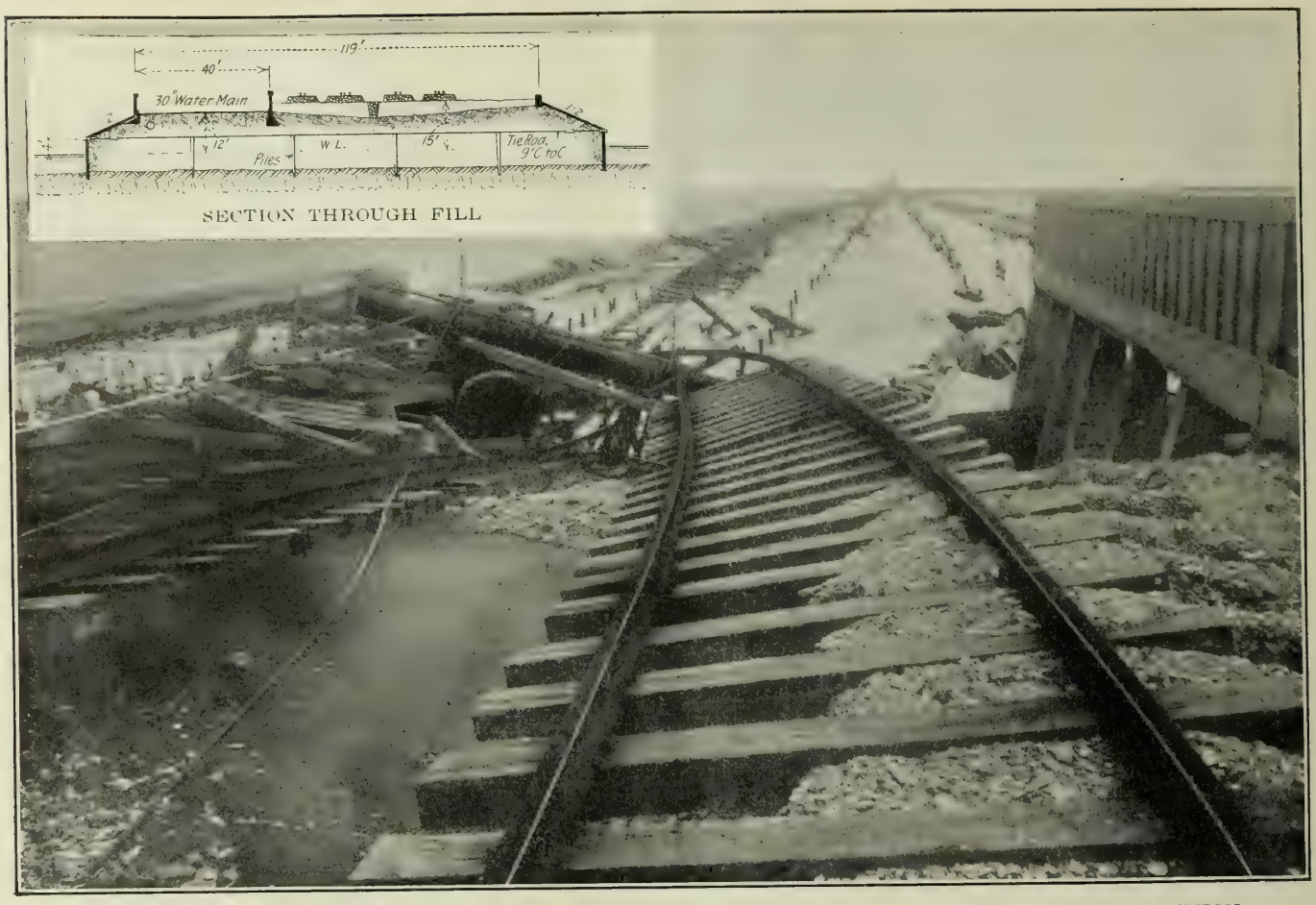
FIGS. 1 TO 3. ALONG THE GALVESTON SEAWALL AFTER HURRICANE OF AUG. 16, 1915

Fig. 1—Damage to pavement and boulevard caused by overfall of water at 19th St. Fig. 2—Looking east from 25th St. Fig. 3—Damage to pavement and backfill at 23rd St.

Seawall a Good Protection

As was pointed out in last week's issue of *Engineering News* the seawall successfully protected the south front of the city against the inundation which caused most of the 1900 damage. The additional views given herewith (Figs. 1 to 3) are from photographs of the Gulf front after the storm. Fig. 2, a view at 25th St., shows the Boulevard in surprisingly good condition. Here the waters of the Gulf were baffled and the overfall was unable to obtain a hold under the backfill, which extended a sufficient distance back from the seawall to prevent damage to the pavement. At 19th St. (Fig. 1), on the contrary, the concrete sidewalk was seriously damaged, though the seawall is intact. Fig. 3 shows the damage to pavement and backfill at 23d St. At this point the seawall was temporarily undermined and the backfill was washed out with consequent serious damage to the brick pavement.

The views in Figs. 4 to 7 show remarkably well the complete destruction of the earth-fill approaches of the causeway. The bay between Galveston Island and Virginia Point on the mainland is over 10,000 ft. wide and averages about 5 ft. in depth. The causeway, which was completed in 1912, consisted of a middle section 2555 ft. long made up of 28 reinforced-concrete arches with a 100



SECTION THROUGH FILL

FIG. 4. LOOKING FROM EAST END OF CONCRETE VIADUCT TOWARD GALVESTON. RAILROAD SECTION

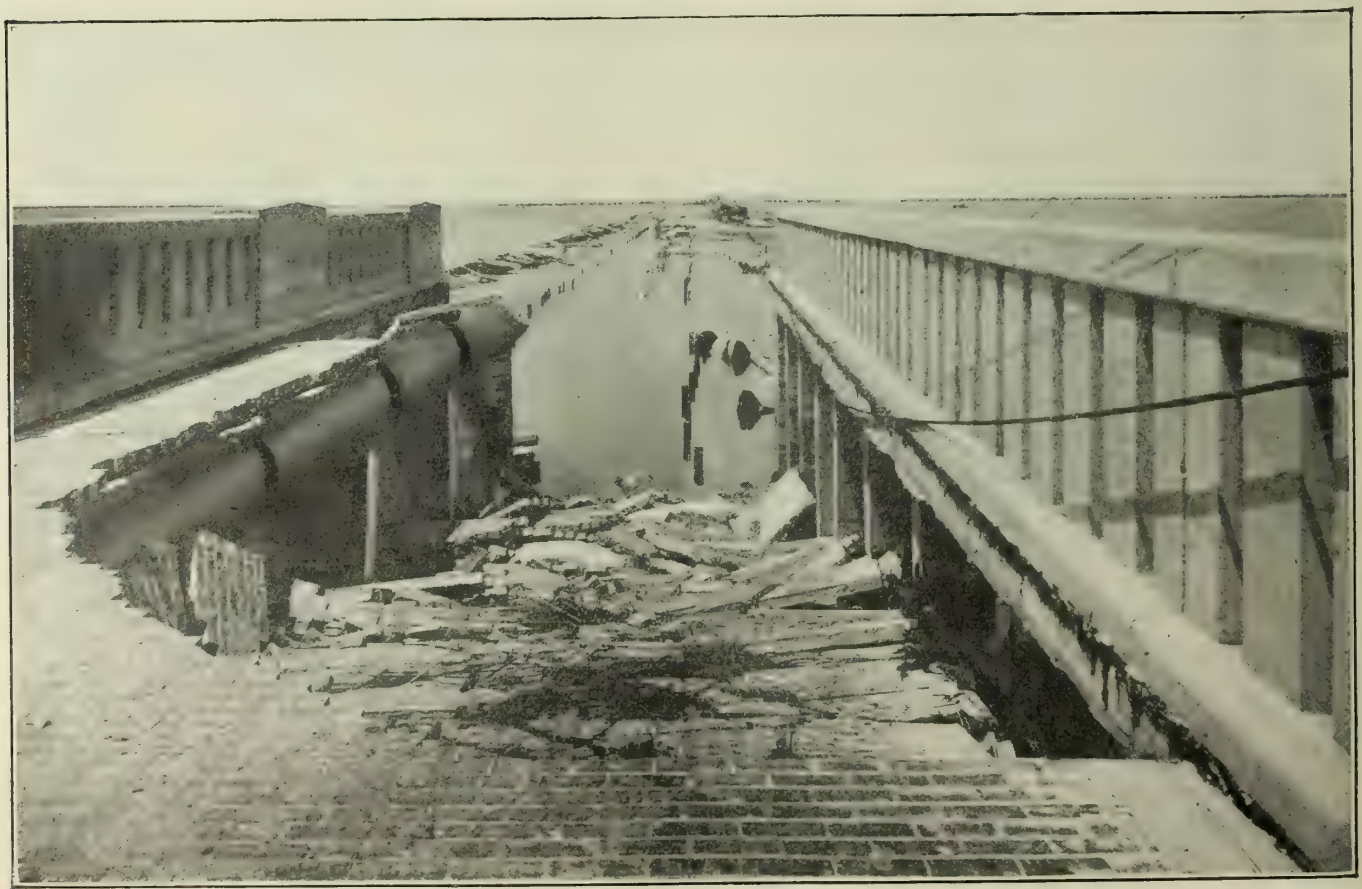


FIG. 5. LOOKING FROM WEST END OF CONCRETE VIADUCT TOWARD MAINLAND. BRICK-PAVED ROADWAY WHERE PROTECTED FILL BEGAN



FIG. 6. LOOKING FROM EAST END OF CONCRETE VIADUCT TOWARD GALVESTON. ROADWAY SECTION

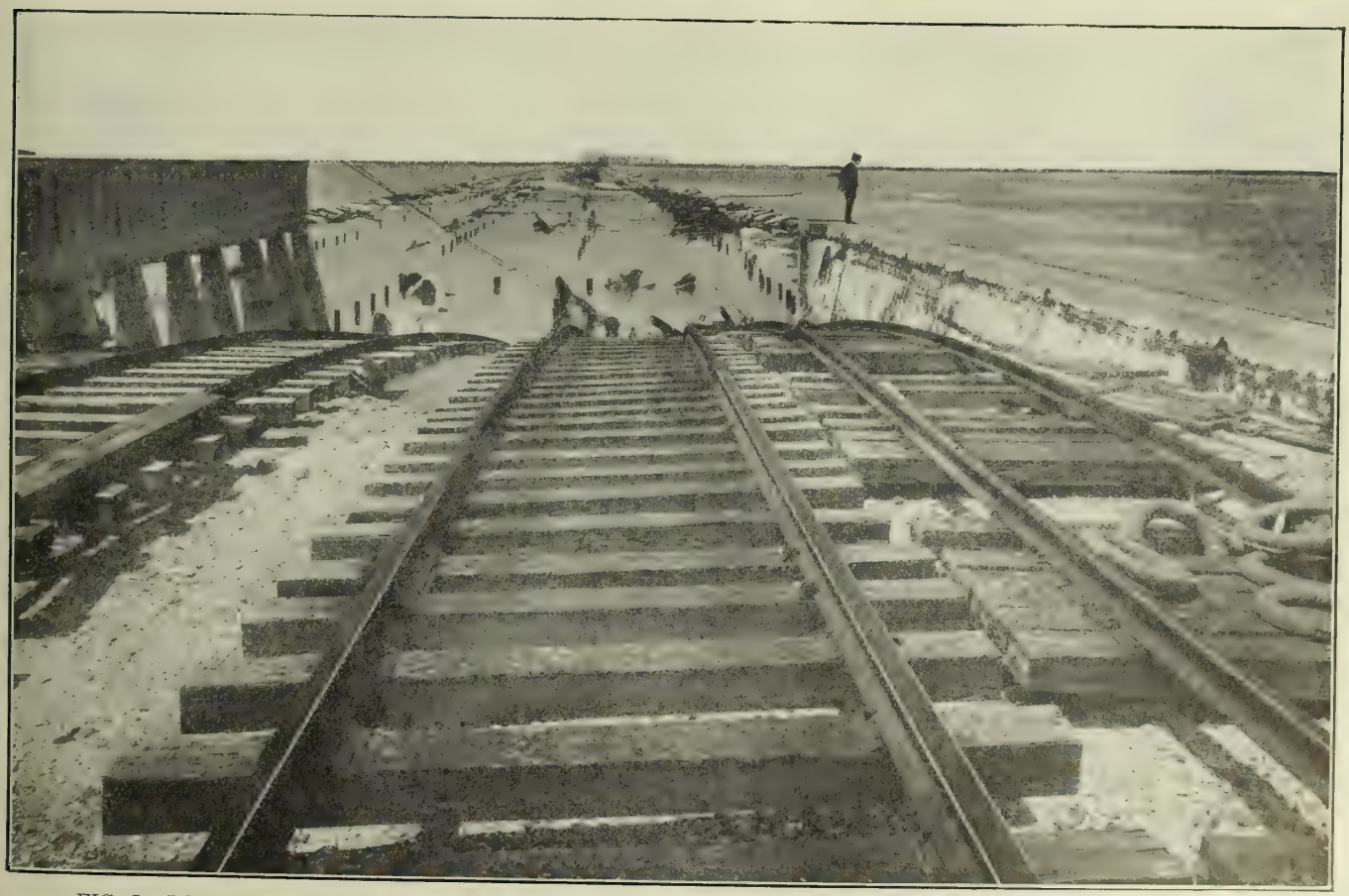


FIG. 7. LOOKING FROM WEST END OF CONCRETE VIADUCT TOWARD MAINLAND. RAILROAD SECTION. VIRGINIA POINT IN DISTANCE

ft. bascule, and two approaches of similar design, 3697 ft. long on the Galveston side and 4523 ft. long toward the mainland. The arch section and the bascule remain today practically as they were before the storm, except for the damage near the ends. The approaches, on the other hand, are destroyed as approaches although, as the views show, a large part of their structure remains.

The sketch in Fig. 4 gives a section through the approaches to the causeway. Briefly, the structure is an earth fill retained between a continuous row of tight reinforced-concrete sheetpiles and protected on its slopes with a continuous pavement of 6-in. concrete slabs. The sheetpiles were tied together every 9 ft. by tie-rods which rested on light wooden piles. The roadway was divided into two parts by a balustrade, one one side being a paved highway and on the other a sand-filled and ballasted railway carrying four tracks. Under the roadway ran the 30-in. water main. The views, taken from both ends of the concrete section, show the earth fill to be washed away, there remaining only the torn-out slabs and the light piles supporting the now useless tie-rods. As was to be expected the back-wash tore out a part of the fill and roadways over the last arches of the concrete part of the causeway.

Causeway Approach Design Faulty

An interesting comment on the design of the earth fills across Galveston Bay has been received from Wilmer Waldo, an engineer, of Houston, Tex. Mr. Waldo says in part:

"Economy may have dictated to the engineers engaged in the design of the Galveston Causeway, but even if it did much light-hearted confidence in the elements ruled somewhere in the councils of those in authority. The bare fact is that the design of the greater part of the causeway did not justify the evident confidence reposed in it.

"The central portion, that is, the arches and lift span, withstood the power of the storm as was to be expected, both being practically standard construction, but the balance of the structure at each end, about two-thirds of the whole, collapsed like an empty barrel with the hoops removed.

"The weakness in the protected roadway was not a theoretical one. It was visible to any layman who took the trouble to examine the construction. It required no technical demonstration to prove such weakness, especially to anyone who went through or who had observed the effects of the storm of September, 1900. Today the bulkheads of concrete piles forming the container for the filled roadway are standing and the water inside the bulkhead is somewhat higher than the bay level outside, showing that this part of the construction was tight and is tight yet. The fill above the level of the bulkhead, protected on its slopes with reinforced-concrete slabs had no more chance to stand than any other sand or earthen dump built in an exposed position.

"I was on the causeway at 5 p.m. Monday, Aug. 16, in order to make some observations in connection with the suspected weakness of the filled portion. Even at that hour the weather was very thick and it was growing dark, but the water could be seen piling up against the east side of the causeway and the wind and water were lashing the ballast from under the tracks. It seems that the pressure against the fill was enough to push it out bodily when once it was weakened under the protecting slabs. At any rate the storm continued long enough to eat the fill away gradually and drop the slabs into the bulkhead.

"Properly filled with rock, this work would have cost a few hundred thousand dollars more and would now require the mere relaying and ballasting of tracks in order to operate trains. It has been rather costly experience where none was necessary."

Conditions After the Storm

Further word from R. P. Babbitt, who went to Galveston immediately after the storm at the request of this journal, gives some details of the conditions in the city:

"The seawall prevented a repetition of the 1900 disaster for it broke the force of the waves and the demolition of buildings was confined to a comparatively small area along the Gulf front. The waters of the Gulf driven by the wind swept around the city and backed up in the bay to the northeast, gradually submerging the city streets to an approximate depth of 6 ft., choking the sewers with sand and silt, and putting the gas mains and electric-light system out of commission. The 30-in. water main which supplied the city with fresh water from the mainland was broken when the approaches to the causeway were washed away. A second water main which paralleled the causeway on the bottom of the bay was also broken, cutting off completely Galveston's water-supply. The people of the city suffered considerably from a lack of drinking water. Some of the more destitute dipped water from the gutters and other stagnant pools and attempted to subsist on this. For several days the luxury of a bath was denied and in fact it was difficult to obtain fresh water in which to wash one's face and hands. The food supply of the city ran low, and the people were placed on short rations, consisting principally of canned stuff.

"Practically every retail establishment in the business district of the city was flooded by the ocean that backed in from the bay. Thanks to the seawall, the waves did not roar through the streets of the city as they did in 1900. When the pressure of the Gulf waters crowding into the bay was relieved, owing to the cessation of the wind, the waters in the city streets subsided, leaving a coating of sand and silt behind in the stores, on the walls of the buildings inside and out and on the streets and sidewalks.

"The telephone system, which had been put out of commission by the storm, was partially resumed by installing an automobile engine in the telephone-exchange building and connecting up 1200 phones throughout the city. The Galveston *Tribune* resumed operations, driving its presses by motor-truck power, connecting its press with the rear wheel of a truck and getting out its issues regularly."

The New York Fire Department in 1914—Fire Commissioner Robert Adamson, of New York City, in a report to the Mayor states that there was an increase of 52½% in the number of fire-prevention orders complied with and 29½% in the number issued. A lawsuit was won which established the fire commissioner's right to recover the cost of extinguishing a fire due to "culpable and willful negligence." The total number of fire alarms received was 16,245, of which 1820 were false alarms. The total fire loss was $8,217,811, an average of $464 for a fire. In 1913 the loss was $7,467,911 in a total number of 12,598 fires. The population increased in this city in 1914 by 216,000. The Fire Marshal's Bureau reported 173 incendiary fires for the year. This was only a small part of the actual number of fires of this character. There were 50 arrests for arson and 37 convictions. The gradual passing of the fire horse is emphasized by a reduction of 174 last year; 1167 remain. Contracts were let for 76 pieces of motor apparatus to take the place of the horses retired.

Quebec Bridge Work in 1915

At the beginning of the 1915 working season the condition of the St. Lawrence Bridge Co.'s work on the Quebec Bridge was as follows: On the north side the anchor arm was only partly erected, nearly two panels not yet having been set; on the south side the approach spans were up, but nothing had been done on the anchor arm, not even the falsework being started.



FIG. 1. PRESENT STAGE OF ERECTION OF QUEBEC BRIDGE
North cantilever arm three panels out; south anchor arm about half erected, two months ahead of last year's work on north anchor arm

By the latter part of August the north anchor arm had been completed and three panels of the cantilever arm erected, as Fig. 1 shows. On the south side the anchor arm falsework had been put up, the floor placed, the lower chords completed, and three panels of bottom posts and lower diagonals placed.

Progress on the north side is slightly ahead of schedule. Comparing this year's work on the south side with last year's work on the north, the 1915 work is eight weeks ahead.

The north cantilever should be completed this season, whereupon the traveler will be taken down, transferred three miles downstream to Sillery, and reërected (in part) for the construction of the suspended span. The foundations for the falsework on which the latter is to be erected are now going in. By the time the south cantilever is finished, in 1916, the suspended span ought to be fully erected and ready to be moved and hoisted into place in the bridge. Thus the bridge may be in service at the close of 1916—a season ahead of what was thought probable.

In speed of erection the contractors have made a notable record. A specially high performance was the erection on the south shore of 1,240,000 lb. (bottom chords and laterals) in one week in July, and a total of 10,040,000 lb. for the month, in addition to transferring the interior falsework and setting the main-post shoes.

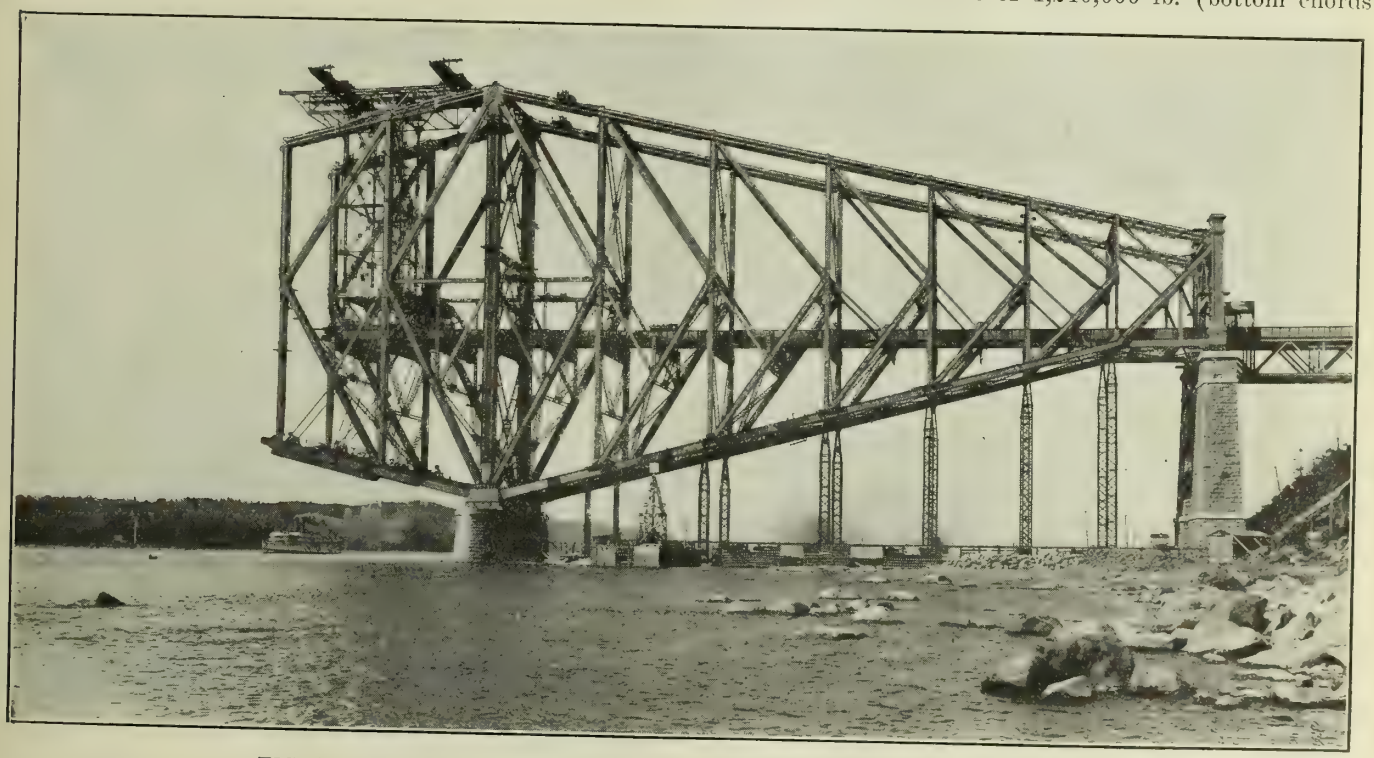


FIG. 2. NORTH CANTILEVER ARM OF QUEBEC BRIDGE ON AUG. 3, 1915

Precision of Setting Members

This speed is attributed by the contractors partly to the general design and largely to the excellence of the shopwork. Every connection is fully assembled in the shop. The bottom chord members (each panel of the

bottom chord is in four parts, being split longitudinally and divided once transversely between panel points) are machine-faced when fully assembled, and special attention has been paid to securing uniform temperature for all four webs. By the scheme of field erection for the chord, perfect bearing has been secured in every joint—not even a "feeler" being admitted.

The north shore main posts were set to a measured length only 0.002 ft. greater than the 292 ft. height between pin centers top and bottom, although of course such accuracy was accidental. This post was in 24 pieces and weighed 3,000,000 lb.

Particular effort has been made to have in the shop only work demanding accuracy. Rougher work, such as some of the falsework fabrication, was sublet.

Joining Large Compression Members

The bottom-chord erection scheme of G. F. Porter, Construction Engineer of the St. Lawrence Bridge Co., has worked perfectly. This is illustrated by the views

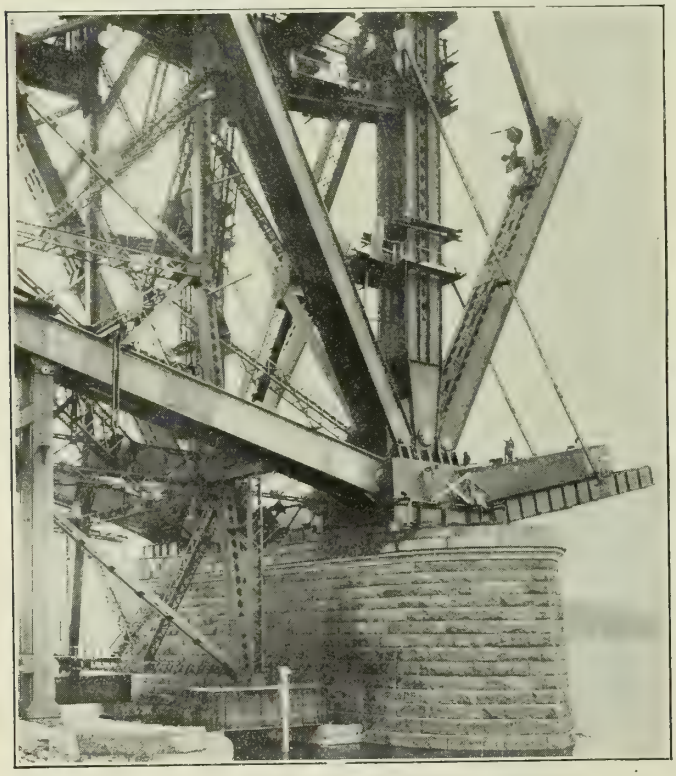


FIG. 3. ERECTING THE FOUR-PIECE MEMBERS OF THE BOTTOM CHORD ON FLYING BRIDGE

Figs. 3 and 5, taken on the north cantilever arm. A flying bridge projecting forward from the finished work is set just under the location of the chord to be set; it is hung by suspension rods from pins in temporary brackets attached to the web members. The quarter sections of the bottom-chord member are lowered into place on jacks, and the top flanges of the abutting sections are connected by temporary brackets, pins and links. Then lowering with the jacks throws the whole joint into full bearing, so that the bolting and riveting can be done.

Sunshine on the outer webs has frequently made a difference of a few thousandths of an inch in the bearing of these chord joints, but the riveting has been started if the difference did not exceed 0.012 in. In all cases the discrepancy disappeared as the riveting proceeded.

On the anchor-arm, instead of using the flying bridge, floor-beams are set longitudinally on the outer falsework to support the sections of the bottom chord. The whole anchor-arm chord is erected straight, from anchorage to main post, and after riveting all splices the falsework column jacks are lowered to give the proper camber

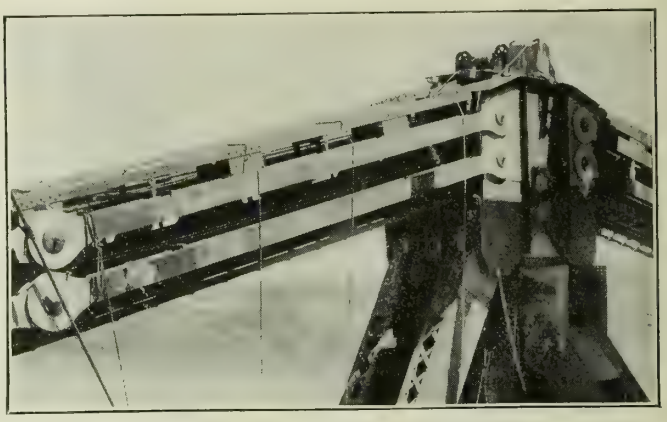


FIG. 4. THE DOUBLE EYE-BAR CHORD AT MAIN POST TOP

(about 6 in.). The cantilever arm is erected with the proper slight camber in each panel, and this flattens out under the increased load as the erection proceeds.

With three cantilever panels nearly completed, the effect of lifting on the anchor arm just begins to be appreciated. A rise of about $\frac{1}{16}$ in. is apparent at the first four panel points. This is not a lifting off the falsework, but merely a decrease of the compressive shortening of the falsework columns.

Moving the Traveler

Moving the traveler forward is accomplished as follows: The traveler cranes are run back, which eases up on the front truck springs. The erection brackets (bolted to the ends of the track girders to distribute

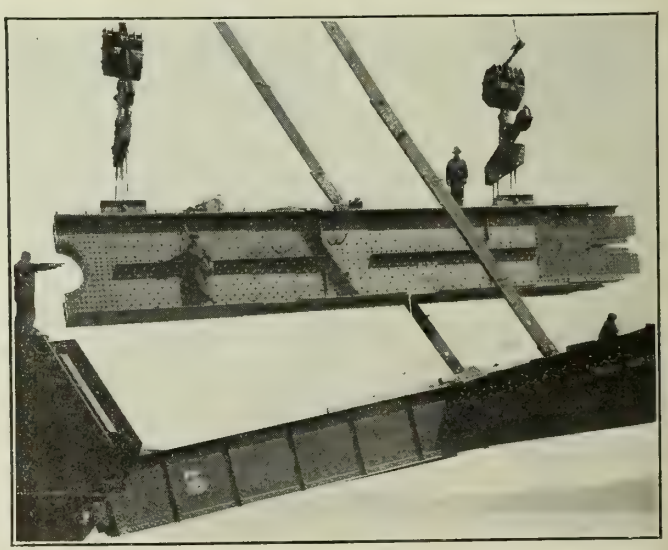


FIG. 5. SWINGING ONE OF THE BOTTOM CHORD PIECES INTO PLACE

the traveler load on two floor-beams—these being designed for only half the traveler load) are then taken off, which allows the setting of the new forward stringers track. The traveler is moved forward on the new length of track, the cranes being moved forward as the traveler

advances so as to distribute the load over the front and rear trucks. When the front of the traveler comes above the next pair of floor-beams ahead, pedestals are mounted on these floor-beams, and the traveler shimmed up on the pedestals by manipulating the cranes, thus cutting the truck springs out of action and getting a rigid bearing.

New Buildings in Rensselaer Polytechnic Institute

Construction of a dining-hall and six initial units of a dormitory quadrangle for the Rensselaer Polytechnic Institute at Troy, N. Y., is now under way. As shown in the accompanying view, there will be 27 separate dormitory units, built about three sides of a court, east of the gymnasium and athletic field and adjacent to 15th St. and Ave. B of the City of Troy. Across the end of the court will be a dining-hall accommodating about 400 men. All the buildings will be of Harvard brick, with limestone trimmings, and of fireproof construction, the floors and partitions being of brick and concrete.



PROPOSED DORMITORIES AND DINING HALL; RENSSELAER POLYTECHNIC INSTITUTE, TROY, N. Y.

Each separate unit of the dormitory system will house twelve students, four on each floor. Two students will use one study and each man will have a separate bedroom. There will be a bathroom on each floor.

Six of the units will be larger than the other 21, the larger ones costing $16,000 apiece and the others $12,500.

A. T. White, of Brooklyn, N. Y., has given the sum of $50,000 for four units of the dormitory, and Capt. Robt. W. Hunt, of Chicago, $16,000 for one of the larger units, which will contain the main entrance to the group. Mrs. Russell Sage has given $100,000 for the dining-hall.

Air Analyzer for Determining Fineness of Cement

Experiments during the past three years at the United States Bureau of Standards have resulted in the development of an air-analyzer which is claimed to give results superior in accuracy to the sieve methods prescribed for the determination of cement fineness. For some time it has been felt that the variation in sieve results obtained under the standard methods is entirely too great for practical purposes. The mechanical construction of the sieves does not seem to be constant, and the method of operation can be varied to give different results.

The device is described in detail in "Technologic Paper No. 48," which may be obtained from the Bureau of Standards, Washington, D. C. It is described as follows:

> This apparatus consists of a vertical brass pipe about 3 in. in diameter and 5 ft. long, at the lower end of which is attached a glass bulb in which the cement to be tested is placed. Air at constant pressure is blown into the cement through a glass tube or nozzle in the side of the bulb, and as the air can escape only through the vertical stack, it carries with it the cement dust, which is caught in a flannel hood surmounting the stack. The air flow in the stack is very uniform, and in a short time all the dust will be removed from the cement, leaving a granular residue in the glass bulb. This residue is weighed, and the amount of dust is determined by subtracting the weight of the residue from that of the original sample of cement.
>
> Different grades are obtained by using different-sized nozzles, and thus a number of separations can be made in the very fine portion of the cement. With the aid of the microscope the size of the largest particles in any given separation can be readily determined, and in this manner the apparatus is standardized without reference to the size of the nozzles and other parts of the apparatus or the air pressure used.
>
> It has been found that the cement "flour," that is, the portion of cement which contains no perceptible grit when rubbed between the fingers, consists of particles less than 0.0007 in. in diameter.
>
> The apparatus may be used for separating and grading any hard-grained materials, such as ground quartz, emery and other abrasives. The air-analyzer in modified form is also capable of separating many other powders; for example, paint pigments, plasters, clays and similar materials.

The Cement Trade of Australia has not interested the United States greatly, on account of the high freight rates compared with those from England and Scandinavia. The Interstate Commerce Commission has been investigating this industry in Australia, and finds that in 1913, the last year for which full statistics are available, 200,000 tons of cement were produced in Australia, and 124,100 tons were imported. The average wholesale price per cask of 400 lb. was $3.04 with duty paid, the duty during that period being 18c. per 112 lb. for cement from England, and 24c. per 112 lb. from other countries. The imports were distributed as follows: England, 31,000 tons; New Zealand, 2700; Germany, Austria and Belgium, 81,000; Scandinavia, 9000; United States, 400. The local production was divided among five factories—two in New South Wales, with a capacity of about 145,000 tons; two in Victoria, with a capacity of about 38,000 tons; one in South Australia, about 17,000 tons. According to Commercial Attaché William C. Downs, Melbourne, the effect of the war on the cement situation was to raise the price to $5.48 per cask; it then dropped to $4.38, varying thereafter from this figure to $4.87. Contracts for cement at the last figure have been placed in Scandinavia and Japan. Freight rates from Norway and Sweden are reported to be from $8.52 to $9.73 per ton.

News of the Engineering World

Phenomenal Rise in the Meramec During Recent Flood

The rain of Aug. 19-21 in the St. Louis district caused disastrous floods in the Meramec River to the south and west of the city, the greatest damage probably occurring at Valley Park, about twenty miles to the southwest. The total drainage area of the Meramec is 3619 sq.mi.; at Valley Park it is probably 3530 sq.mi. The valley extends about one hundred miles in a straight line above Valley Park and the length of the river through that stretch measured along the thread of the stream is probably over two hundred miles. The drainage basin is rugged and hilly and comparatively thinly populated.[1]

The town of Valley Park is built on a level about 30 ft. above ordinary low water in the river and has never before been seriously damaged. There are a number of industries located at this point, the principal one of which is the Valley Park Glass Co., and above the town on both sides of the stream summer camps and club houses are located.

According to the best reports the river rose about 7 ft. on the night of the 19th and about 17 ft. additional on the 20th. It was practically stationary during Saturday the 21st and it was generally assumed that the high water had been reached, but during the night of the 21st and the day of the 22nd an additional rise of 19 ft. occurred, making a total of 43 ft. above low water. This submerged practically the whole town well above the ordinary second-story level, and a large part of the rise having come during the night, it appears that a majority of the people were marooned in their own houses. As far as can be ascertained, however, no lives were lost, but the damage to the property has been enormous.

This stage of the Meramec was probably partly a result of the condition of the Mississippi River, into which the former discharges twenty miles below Valley Park. The Mississippi rose from a gage of 22 on Thursday to a gage of 30 on Sunday, which is danger line.

Bids for Albany Sewage Pumps and Grit Chamber

Bids for a 75,000,000-gal. automatically operated electric sewage-pumping station and for a large grit chamber will be received by the City of Albany, N. Y., on Sept. 7. The pumps will work under a maximum head of 39 ft.

The pumping equipment will consist of six vertical centrifugal pumps each direct-connected to a vertical motor. Three of the pumping units will be operated by 2200-volt constant-speed alternating-current motors, each unit having a capacity of 10,000,000 gal. in 24 hr. The other three units will be operated by 575-volt variable-speed direct-current motors, each of these units being designed to pump from a minimum of 5,000,000 to a maximum of 15,000,000 gal. in 24 hr.

In a number of ways the pumping station is somewhat unusual in design. The pumps are located in a circular dry well, an annular well outside of the dry well being utilized to serve as the suction well. Unusual care has been taken in designing the station to provide easy access to all parts of the mechanical and electrical equipment and especial arrangements have been made to prevent deposits in the suction well.

The grit chamber is believed to be the largest one of its type yet designed in this country. Special means are provided for maintaining a practically uniform velocity through the grit chamber with a wide range of sewage flow.

The pumping station and grit chamber, as well as the sewage-disposal works which are now under construction, were designed by Hering & Gregory, Consulting Engineers, New York. Wallace Greenalch is Commissioner of Public Works, Frank Lanagan is City Engineer and Stephen B. Vernon is engineer of intercepting-sewer design and construction.

Am. Soc. C. E. Admission Rules

The Board of Direction of the American Society of Civil Engineers has recently adopted by letter ballot the following rules to be applied in interpreting the society's constitutional requirements for the admission of new members:

The requirements fixed by the constitution are intended to mark the minimum which should be recognized for admission to membership, and the maintenance of a high standard necessitates that these provisions should be interpreted conservatively to the end that the fitness of applicants shall be established beyond doubt.

In order to shape more definitely the requirements in the classification of applicants for admission or for transfer, and to assure as far as possible that applicants for membership meet the spirit of the requirements established by the constitution, it is the sense of this board:

1. That no applicant should be admitted to any grade whose qualifications do not clearly exceed the minimum requirements of the constitution.

2. That each applicant for admission or for transfer shall furnish whenever possible, the names of persons, whether members of the society or not, who have personal knowledge of his work in each of the positions enumerated in his application and when possible shall have more than five references, and his application shall state in detail the character and extent of the works upon which he has been engaged, and the degree to which he was responsible for their design and execution.

3. That an applicant for membership or for transfer who, at the time of making his application is engaged on work for which an engineering education or training is not clearly essential, shall not be elected or transferred unless he shall have markedly superior qualifications as to professional experience.

4. That the professional work required for admission to the grade of member shall be of a markedly higher order, and the degree of responsibility materially greater than for the grade of associate member.

5. That unless a candidate is eminently qualified for the highest grade, admission to that grade should be by transfer from the grade of associate member.

[1] See discharge measurements in water-supply papers of the United States Geological Survey, Vol. 7, No. 10. Progress report of stream measurements for the calendar year 1904, Part 8.

Dexter Brackett*

Dexter Brackett, Chief Engineer of the Metropolitan Water-Works of Massachusetts, died at his home in Brighton, Mass., on Aug. 26. He had been in poor health since last February, but the severe illness which resulted in his death was short. He was born in Newton, Mass., in 1851 and in 1868 was graduated from the Brighton high school near Boston. The next year he entered the city engineer's office, Boston, where he remained for 26 years. In 1874 he was assigned to the supervision of the distributing system of the water-works. In this position he was largely instrumental in developing an unusually adequate piping system for the city and in creating a plant exceptionally efficient in other respects.



DEXTER BRACKETT

In 1895 he resigned his place with the City of Boston to accept the position of engineer of the distribution department of the Metropolitan Water-Works. In this capacity he had charge of the construction of the pipe system, pumping stations and distributing reservoirs within the limits of the Metropolitan District.

From 1907 to the time of his death, Mr. Brackett was Chief Engineer of the Metropolitan Water-Works. He had always been greatly interested in questions relating to the consumption and waste of water and had written several papers and reports upon the subject. He persistently advocated the use of meters within the Metropolitan District as a means for reducing the waste of water, and had the privilege of seeing his views adopted and the consumption of water thereby reduced. Up to 1907 the consumption had been increasing so rapidly as to point out the necessity for an additional supply within a few years, but the gradual introduction of meters reduced the consumption of water so rapidly that no additional supply will be needed for many years, the consumption now being less than two-thirds of what it would have been had the rate of increase continued. Mr. Brackett was a member and for three years a director of the American Society of Civil Engineers. He had been president of the Boston Society of Civil Engineers and of the New England Water-Works Association, and was a member of the American Water-Works Association. In addition to his papers on consumption and waste of water, he contributed papers on many other subjects relating to water-works engineering. He was married in 1875 and leaves a widow and a son, Herbert D. Brackett.

*Contributed by Frederick P. Stearns, Consulting Engineer, Boston, Mass.

Novel Protest Against a Dam

Three engineers testified against the safety of dams, at a hearing on a water-supply dam being built for Coatesville, Penn., held at Harrisburg on Aug. 24, 1915, before the Pennsylvania Water-Supply Commission. The hearing was on application of mill owners in Coatesville, who want the permit for the dam to be revoked. The three engineers testified in their behalf.

Health Commissioner Samuel G. Dixon took the lead in conducting the hearing, as he has been the chief figure in ten years' work to secure a new water-supply in place of the polluted and dangerous raw river supply which Coatesville borough now enjoys. He referred repeatedly to the 1912 typhoid epidemic in the borough, when over 300 deaths occurred, and demanded that the protest should take the form of a definite project for securing another supply without delay. The protestants made a general proposal for a dam in another valley.

The protested dam is already under contract. It is to be a hollow concrete structure 35 ft. high, on granite foundation, and crosses Rock Run 2 mi. above the borough. Half a dozen mills are in the valley below; the owners claimed that failure of the dam would sweep away their mills. The protest was made in the name of Worth Bros., the Lukens Iron & Steel Co., the Coatesville Boiler Works, Craig, Ridgeway & Sons Co., and some 1300 individual signers of a petition. The population of the borough is 12,000. The mill owners urged that this population depends on the mills, and that the mills would be driven away if the dam were built. They proposed that another stream, Buck Run, be dammed, which could affect only a village of 100 houses. The mill owners have previously made many efforts to kill off the Rock Run project, including several court actions, which failed.

The engineers' testimony, abstracted from notes made by a representative of *Engineering News* at the hearing, was as follows:

E. P. Dawson, Assistant Chief Engineer, Philadelphia & Reading Ry.—Failure of the Rock Run dam would flood the valley for a long distance, damage much property, and possibly cause loss of life. He has not studied the plans or considered the strength of the dam. His protest, for the railway company, is based wholly on the location of the dam.

Maj. Cassius M. Gillette—The failure would cause more appalling destruction than the Austin (Penn.) dam failure. The Rock Run site is good and the specified foundation is good, and a good dam can be erected. A dam built strictly to the design and specifications would be "a good dam as dams go." An earthquake even would probably not destroy it, but dynamite could do so. There is small risk in a well-built dam. The chief danger is from violence. German emissaries could destroy all plants in the valley by dynamiting the dam. Strikers could do the same. However, if abandoning the Rock Run site means indefinite delay in providing a new water-supply, he favors the dam. Typhoid is more of a menace than the dam.

Herbert W. Hatton, Wilmington, Del.—Many dams fail; 18 dams failed in 1912, many of them in Pennsylvania, the smallest being 15 ft. high. He has no criticisms of the design, but thinks it would be safe. However, dams fail from causes not anticipated. Even rock foundation is not a guarantee of safety; the Stony River Dam, of the same type as that proposed, was on rock.[1]

Dr. Dixon shut off further testimony on the risk remaining in dams built with best engineering skill, by the statement that bridges could not be built or railways run on the principle that perfect safety must be provided, free from every possibility of accident.

The Water-Supply Commission has not yet announced its decision on the protest.

A Tunnel Cave-In occurred in the 15-ft. sewer under construction between Macon and Halsey St., Brooklyn, N. Y., Aug. 26. The collapse is reported to have been caused by the failure of the shoring. One man was killed and two injured.

A Bridge Collapsed under a passenger train on the Atchison, Topeka & Santa Fé Ry., Aug. 27. The bridge was over Date Creek, 70 miles north of Phœnix, Ariz., and had been weakened by a recent flood. The engine passed over the bridge safely, but the smoking car fell through, causing the death of four persons and injuries to twelve others.

The Explosion of a Tank Car of Gasoline in the Westchester freight yards of the New York, New Haven & Hartford R.R. on Aug. 23 destroyed five other carloads of freight. More than a dozen cars were set on fire by the burning oil. The damage was estimated at between $50,000 and $55,000. The cause of the explosion is unknown.

The St. Paul Union Station is temporarily held up following a second rejection by the Chief of Engineers, Gen. Don. C. Kingman, of the submitted plans for the changes in the Mississippi River channel and harbor lines at and about the new station. These plans were submitted by the railroad companies building the station. General Kingman's memorandum accompanying the returned plans makes it clear that the revisions must be made more with a view to improving the navigability of the river than to accomodating the needs of the station. Any new scheme submitted will evidently have to come through the city authorities and will have to guarantee a better accommodation for freight transshipment. The proposed station was described in "Engineering News," Mar. 11, 1915.

United States Leads in Exports—According to the Department of Commerce the United States for the first time in its history leads the world as an exporter. Our total exports in the fiscal year 1915 aggregated $2,768,600,000, as against $2,170,100,000 for the United Kingdom, the figures representing in the case of the United States an increase of 17 per cent. and in the case of the United Kingdom a decrease of 30 per cent. when compared with last year. American exports in the fiscal year 1915 included domestic products to the value of $2,716,200,000, against $2,329,700,000 in 1914; and foreign products, $52,400,000, against $34,900,000 in the preceding year. British exports in the same periods included British and Irish produce, $1,744,100,000 in 1915, against $2,557,200,000 in 1914; and foreign and colonial produce, $426,000,000 in 1915, compared with $526,500,000 in 1914.

An Excursion of Engineers through western Canada, in connection with the International Engineering Congress, has been arranged by committees representing the members of the principal British, Canadian and American civil engineering societies who reside in British Columbia and Alberta. A special excursion train is to leave San Francisco Sept. 25 for Seattle. The passengers will travel from Seattle to Victoria by boat, and after a day spent in sightseeing at Victoria will leave for Vancouver on the morning of the 28th. Here two days will be spent in visiting water-power plants of the British Columbia Electric Ry. Co. and other engineering works. The special train will start from Vancouver eastward over the Canadian Pacific on Thursday, Sept. 30. Stops are scheduled at Ruskin, to see the plants of the Western Canada Power Co., and at Glacier, where the seven-mile tunnel now being driven through the mountain by the Canadian Pacific Ry. will be visited. Sunday will be spent at Lake Louise. Further stops at Seebe, Calgary, Bassano and Brooks are scheduled.

[1]This dam, which failed Jan. 5, 1914 (see "Engineering News," Jan. 22, 1914), was distinctly not founded on rock. It had a cutoff wall reaching shale over a part of its length, but the section that failed was founded on clay.—Editor.

PERSONALS

Mr. Vannoy H. Manning, M. Am. Inst. M. E., Assistant Director of the United States Bureau of Mines, has been appointed Director to succeed the late Dr. J. A. Holmes.

Mr. Robert A. Zentmyer, a civil engineer of Tyrone, Penn., has been appointed a member of the Pennsylvania State Water-Supply Commission at a salary of $3000 per annum.

Mr. Samuel Rea, M. Am. Soc. C. E., President of the Pennsylvania R.R., is seriously ill at the Polyclinic Hospital, Philadelphia, where he was taken about two weeks ago for a minor operation.

Mr. William C. Pickersgill, for the past nine years Assistant Engineer of the Board of Water-Supply of the City of New York, has been appointed Designing Engineer of the Providence, R. I., Water-Supply Board.

Mr. C. D. McArthur has again assumed the office of Chief Engineer of the Blaw Steel Construction Co., after more than a year's absence. He is in personal charge of the engineering-service department of the company.

Mr. E. A. Moritz, Assoc M. Am. Soc. C. E., Engineer of the United States Reclamation Service, Washington, D. C., has been appointed Office Engineer of the newly established executive office of the Reclamation Service at Denver, Colo.

Mr. Harvey C. Miller, M. Am. Soc. C. E., Consulting and Contracting Engineer, formerly at 1 Madison Ave., New York City, is now agent for the American system of reinforcement (unit wire fabric, unit spirals and unit frames), with offices at 40 West 32nd St., New York City.

Mr. C. E. Hicks, who was graduated from Stevens Institute of Technology in 1876, has been appointed City Engineer of Mechanicsville, N. Y., under the new commission-plan city government. Mr. Hicks has had many years' experience in private practice at Mechanicsville.

Mr. B. F. Bush, President of the Missouri Pacific and Iron Mountain railways, has been appointed Receiver of these railways. Mr. Bush is a civil engineer by education and early experience. He entered the railway service in 1882 as a rodman on the Northern Pacific Ry., and subsequently was Locating Engineer and Division Engineer.

Mr. L. C. Fritch, M. Am. Soc. C. E., Assistant to the President of the Canadian Northern Ry., has been appointed General Manager of the lines east of Port Arthur, Ont. Mr. Fritch was formerly Chief Engineer of the Chicago Great Western R.R. He is a graduate of the University of Cincinnati and began his railway work in 1884 as a supervisor's assistant on the Ohio & Mississippi Ry.

Mr. A. J. Himes, M. Am. Soc. C. E., Valuation Engineer of the New York, Chicago & St. Louis R.R., Cleveland, Ohio, has been appointed Engineer of Grade-Crossing Elimination of the company, which department has just been restored. Mr. Himes was formerly in charge of grade-crossing elimination work in Cleveland, which was completed about two years ago. Since then he has been Valuation Engineer.

Mr. J. A. MacRae, formerly Mechanical Engineer of the Michigan Central R.R. at Detroit, Mich., has been appointed Mechanical Engineer of the Louisville & Nashville R.R., with headquarters at Louisville, Ky. He is a graduate of the mechanical engineering course of the University of Illinois and began his railway experience as a draftsman in the office of the Mechanical Engineer of the Chicago & Northwestern Ry.

Mr. John T. Beamer, of Chicago, Ill., and associates have purchased the American-Rio Grande Land & Irrigation Co., which developed the 100,000-acre irrigation project near Mercedes, Tex., claimed to be one of the largest private irrigation developments in this country. The company was organized about 10 years ago by Mr. B. F. Yoakum and others, of St. Louis, Mo. The purchase price is reported to have been $3,500,000.

Prof. Charles Lee Crandall, for many years head of the department of railway engineering and geodesy in the college of civil engineering of Cornell University, has retired from active service. Both the University faculty and the trustees have passed resolutions in appreciation of his services to the University, which began in 1872. Professor Crandall was graduated with the first class of the University in that year. He was City Engineer of Ithaca from 1870 to 1891.

Messrs. George F. Swain and John F. Stevens, M.'s Am. Soc. C. E., and W. C. Loree, former General Manager of the Baltimore & Ohio Southwestern R.R., have been appointed a commission to formulate plans for a more efficient system of port and terminal facilities for New York City. The com-

mission is appointed to serve for three years, but its estimated annual expenses of between $100,000 and $110,000 have not yet been appropriated by the City Board of Estimate and Apportionment.

Mr. E. N. Layfield, M. Am. Soc. C. E., Acting Secretary of the Western Society of Engineers has been appointed President of the new State Board of Examiners of Structural Engineers, in accordance with the recently enacted state license law for structural engineers. Other members of the Board are Messrs. John T. Hanley, Chicago, Secretary; Ira O. Baker, Professor of Civil Engineering at the University of Illinois; John W. Musham, Secretary of the Condron Co., Chicago, and C. C. Stowell, Civil Engineer, of Rockford, Ill.

Mr. Thomas C. Atwood, M. Am. Soc. C. E., former Supervising Engineer of the Yale Committee of Twenty-One, Inc., on the construction of the Yale Bowl, has opened an office in the Chamber of Commerce Building, New Haven, Conn., and in addition to his work on the Yale Bowl will engage in the general practice of civil engineering, specializing in college athletic fields and in water and sewerage works. He is a graduate of the Massachusetts Institute of Technology and has had several years' experience with the Metropolitan Water-Works of Boston, Mass., the water-works of Philadelphia, Penn., and the Catskill water-supply of New York City.

OBITUARY

Christopher Bell Bouton, President of the Union Foundry Works, Chicago, Ill., died Aug. 26, aged 76 years.

P. A. Gorman, former Street Commissioner of Waco, Tex., and a pioneer railway builder of the Southwest, died Aug. 15, at his home in Waco, aged 63 years.

William Graver, President of the William Graver Tank Works, of East Chicago, Ind., died at his residence in Chicago on Aug. 25. He was born at Chambersburg, Penn., in 1842, and went to Chicago in 1884.

Edward Bates Pleasants, Chief Engineer of the Atlantic Coast Line R.R., died Aug. 26, from apoplexy, while in his private car en route from his home in Wilmington, N. C., to Baltimore, Md. He was 65 years old and a native of Baltimore.

Max Hebgen, Vice-President and Chief Engineer of the Montana Power Co., died Aug. 24 at the Presbyterian Hospital, Chicago, Ill., aged 46 years. He was born in Milwaukee, Wis., and began his career in the shops of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Penn., about 1886. Soon after he went to Butte, Mont., where he was employed as a lineman by the old Butte Electric Light & Power Co. He remained continuously in the employ of this company through its various absorptions of other companies, and at the time of his death was Vice-President and Chief Engineer of the consolidated concerns, the Montana Power Co., which is one of the largest hydro-electric companies in the world in the extent of its developments. He was an intense worker; a man entirely self-educated. He entered his profession endowed with magnificent health, a sound intellect, a distinct inventive capacity and an unlimited capacity for hard and successful work. He was beloved by all who knew him, and it is probable that no more successful or popular officer of any corporation has existed than Mr. Hebgen, who, while occupying this position of great popularity in the organization, was also a thorough disciplinarian. His popularity was based on the profound respect which his organization held for his character, his abilities and his physical and moral courage. He is survived by a wife and one son.—H. M. Byllesby, Chicago, Ill.

ENGINEERING SOCIETIES

COMING MEETINGS

NEW ENGLAND WATER WORKS ASSOCIATION.
Sept. 7-9. Convention in New York City. Secy., Willard Kent, Narragansett Pier, R. I.

TRAVELING ENGINEERS' ASSOCIATION.
Sept. 7-10. Annual meeting in Chicago. Secy., W. O. Thompson, N. Y. C. R.R., East Buffalo, N. Y.

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Oct. 11-12. Secy., Will P. Blair, Engineers Bldg., Cleveland, Ohio.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 12-14. Annual convention at Dayton, Ohio. Secy., Charles Carroll Brown, 702 Wulsin Bldg., Indianapolis, Ind.

SAN FRANCISCO MEETINGS

INSTITUTE OF RADIO ENGINEERS.
Sept. 13-18. Secy., David Sarnoff, 71 Broadway, New York.

PAN-AMERICAN ROAD CONGRESS.
Sept. 13-18. Secy., E. L. Powers, Road Builders Association, 150 Nassau St., New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 16-18. Secy., Charles Warren Hunt, 220 West 57th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Sept. 16-18. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 16-18. Secy., Bradley Stoughton, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 16-18. Secy., F. L. Hutchinson, 29 West 39th St., New York City.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Sept. 16-18. Secy., J. J. Blackmore, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Sept. 16-18. Secy., J. W. Richards, Lehigh University, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Sept. 17-21,

INTERNATIONAL IRRIGATION CONGRESS.
Sept. 20. Secy., Arthur Hooker, Sacramento, Calif.

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Sept. 20. Secy., F. F. Sharpless, 52 Broadway, New York City.

PACIFIC COAST ASSOCIATION OF PORT AUTHORITIES.
Sept. 20 and 21. Secy., Leo V. Merle, Ferry Bldg., San Francisco, Calif.

AMERICAN MINING CONGRESS.
Sept. 20-22. Secy., J. F. Callbreath, Washington, D. C.

INTERNATIONAL ENGINEERING CONGRESS.
Sept. 20-25. W. A. Cattell, Secy., Comm. of Management, Foxcroft Bldg., San Francisco.

INTERNATIONAL ASSOCIATION OF BRIDGE AND STRUCTURAL IRON WORKERS.
Sept. 20-30. Secy., Harry Jones, American Central Life Bldg., Indianapolis, Ind.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Sept. 21 and 22. Secy., F. M. White, Madison, Wis.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Sept. 23 and 24. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 23 and 24. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN ASSOCIATION OF REFRIGERATION.
Sept. 23 and 24. Secy., J. F. Nickerson, 431 South Dearborn St., Chicago, Ill.

ILLINOIS GAS ASSOCIATION.
Sept. 27. Adjourned meeting. Secy., H. H. Clark, 72 West Adams St., Chicago, Ill.

SAFETY CONFERENCE.
Sept. 27-30.

INTERNATIONAL GAS CONGRESS.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

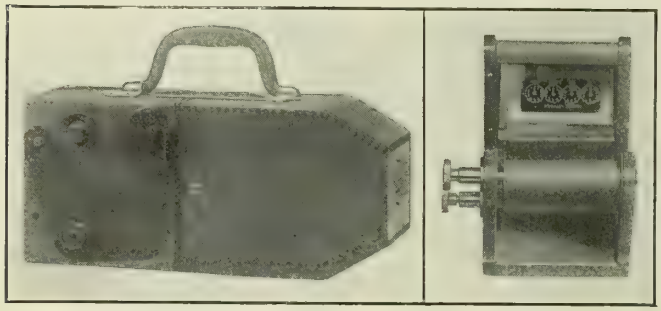
AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

New England Water-Works Association—The program for the annual convention at the Waldorf-Astoria Hotel, New York City, Sept. 7-9, includes an illustrated address by J. Waldo Smith, Chief Engineer of the Board of Water-Supply of New York, on the present status of the Catskill water-supply of the city; a paper on the sanitation of a large watershed; short papers on joints for water mains and the laying of various kinds of mains, detecting leaks, etc.; descriptions of the water-supplies of Norwalk, Conn., Salem and Beverly, Mass.; short papers and discussions on valve types and installations, testing fire-line meters and pump-slip tests; an illustrated lecture on the Kensico reservoir, New York; papers on the decolorization of water by storage, forestry work in watersheds, infiltration galleries of Long Island water-supplies, New York State control of public water-supplies, Fall River (Mass.) water-supply, grubbing a large reservoir and a progress report on service pipes. Excursions include a sightseeing trip on Fifth Ave. for the ladies, a boat trip in the harbor and an inspection of the Kensico Dam.

Appliances and Materials

Camera for Reading Meters

A camera for obtaining reliable meter readings, applicable to gas, electric and water installations, has just been placed on the market by the Eastman Kodak Co. The reading is made by placing the front of the camera against the meter dial and pressing downward on the exposure lever. This action automatically turns on light, operates the shutter and turns off the light. With this instrument mistakes of reading



THE "FACTOGRAPH" CAMERA FOR REGISTERING METER READINGS

are obviated, and in the case of a disputed reading the records are at hand. A reading of the peak on maximum-demand meters can be made before the meters are reset for the next month.

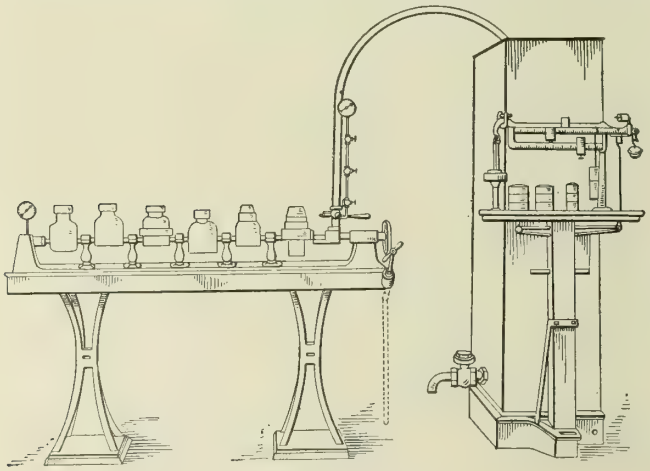
The camera measures 4¼x5¾x12¼ in., is incased in mahogany and equipped with a simple automatic shutter permitting exposures varying from $\frac{1}{8}$ to ½ sec. Light is furnished by four 3.8-volt tungsten miniature lamps operated by two 4-cell dry batteries stored in the case. The film is 1½x2⅛ in. and of the cartridge type. Pressing a button converts the camera into a flash lamp for locating meters in dark cellars.

The "Factograph" can be leased on payment of $22.50 each. Films are supplied in spools of 75 readings per spool. These are packed in cartons of 50 spools, 10 cartons to the case. The price is $125 per case, $12.50 per carton. The dry batteries cost $36 per 100, the miniature lamps $8.50 per 100 and a desk reading stand can be purchased for $2.50.

* * *

Water-Meter Tester

The outfit shown in the accompanying sketch has been devised by the H. W. Clark Co., of Mattoon, Ill., for the convenient, quick and economical testing of ⅝- to 2-in. water meters. It comprises (1) a standard-type Fairbanks scale with a special beam, (2) a 100-gal. galvanized-iron tank with quick-opening outlet valve, (3) a test table on which six



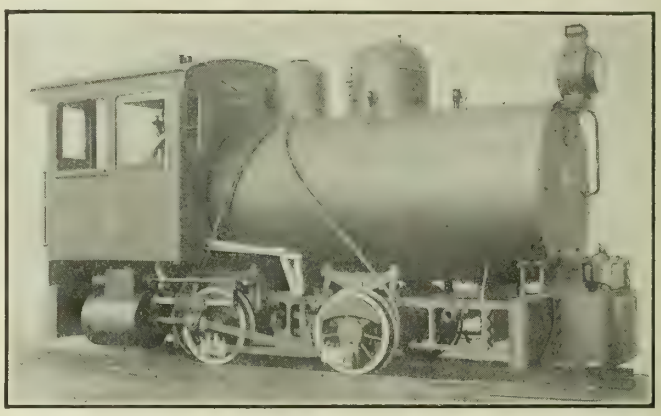
CLARK METER-TESTING OUTFIT

⅝-in. meters, or various combinations of other sizes, may be set up in series, and (4) special self-cleaning sensibility-test valves for $\frac{1}{32}$, $\frac{1}{16}$ or ⅛ normal flow. A slow-opening inlet valve is used to eliminate water hammer; gages at inlet and outlet show the loss of head through the meters. A unique feature is the percentage bar on the scale beam, showing meter error. The price ranges from $38 up.

Steam-Storage Industrial Locomotive

The fireless or steam-storage locomotive shown in the accompanying view has been put into service by the Ohio Wood Preserving Co. for switching on the standard-gage tracks at its plant. The storage tank has a capacity of 250 cu.ft. and is intended to carry a maximum pressure of 180 lb., so that no reducing valve is required between the tank and the cylinders, as in some European engines of this type which employ a higher pressure. The tank is kept about half full of water. It is recharged with steam four or five times a day from the boiler plant of the creosoting works, a boiler pressure of 150 lb. being desirable. A steam dinkey engine would have to refill its water tank about the same number of times.

The cylinders are 17x16 in., this large size being used to



STEAM-STORAGE LOCOMOTIVE FOR THE OHIO WOOD PRESERVING CO.

enable the engine to develop a fair proportion of its maximum power at low pressure. In fact, it can be run by itself on a pressure as low as 5 lb. With one charge it can run about five miles with two or three ordinary freight cars on level track. The cylinders are placed at the back end, to give a better balance. The slide valves are driven from a valve gear of the Stephenson type, and the exhaust may be discharged at rear, top or side as desired. The factor of adhesion is based on a tank pressure of 60 lb. The engine was built by the H. K Porter Co., of Pittsburgh, Penn.

* * *

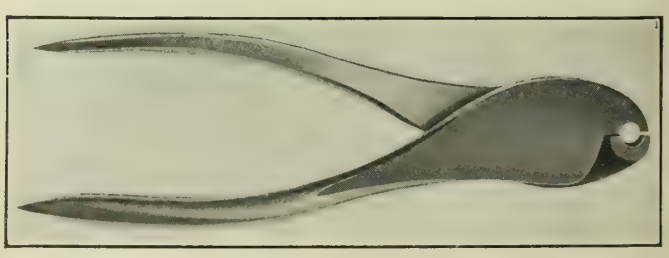
Spacers for Reinforcing Rods

A device known as the "Securo" locking spacer, for supporting concrete reinforcing rods in the forms, serves not only to support them at the proper height and give them the proper spacing, but also locks them in position so that they cannot be displaced before or during concreting. The device is a light bar passing beneath the rods and having depending lugs which rest on the bottom of the form and so keep the rods at the desired height. At the location of each rod the bar has two flexible clips which are bent around it, and these serve to insure the use of the proper number of rods. The device is made by the Metal Building Materials Co., of Chicago, Ill.

* * *

Handy Blasting-Cap Crimper

A new cap crimper, comprising the crimper proper and with the handle pointed at one end for making holes in dynamite cartridges, and shaped at the other end to serve as a screwdriver, is shown in the accompanying view. The crimper makes a cylindrical crimp of the blasting cap to the



NEW CAP CRIMPER

fuse, thus eliminating the possibility of cutting off the powder train in the fuse and consequent misfires. It also leaves a vent alongside the fuse for the escape of smoke from the burning powder inside the cap, thus allowing a stronger spit into the fulminate charge. It is manufactured by the E. I. du Pont de Nemours Powder Co.

Engineering News

VOLUME 74 SEPTEMBER 9, 1915 NUMBER 11

Fast Concreting on Brooklyn-Brighton Viaduct, Cleveland

Rapid progress marks the construction of a long concrete arch viaduct which Cuyahoga County is building in the southwestern part of Cleveland, Ohio. The viaduct is 1726 ft. long, and includes six 128-ft. arches besides many shorter ones. An existing steel viaduct carrying a heavy traffic complicates the work, as it interferes with the new structure and requires it to be built in longitudinal halves to maintain traffic. In less than 11 months' time, including the winter shutdown, the Bates & Rogers Construction Co., Chicago, has completed the west half.

Construction began in September, 1914, shortly after the contract was signed. By the end of the season one abutment and a few piers were partly built, while most of the foundation pits had not even been started. The view Fig. 1 shows how the viaduct appeared July 28, 1915, as seen from Brookside Park road, to the west. The structure looks practically complete, but the entire east half is yet to be built (see view Fig. 2). The contractors expect to finish by the end of the present season.

The design, shown by Fig. 3, is unusually successful as regards esthetic effect. This lies partly in the general proportioning, partly in the arch-rib curvature (adjusted to the dead-load pressure line, with short end curves joining the piers tangentially) and partly in the omission of heavy pilasters over the piers in favor of a column system throughout, with columns intentionally so spaced that they do not come over the piers.

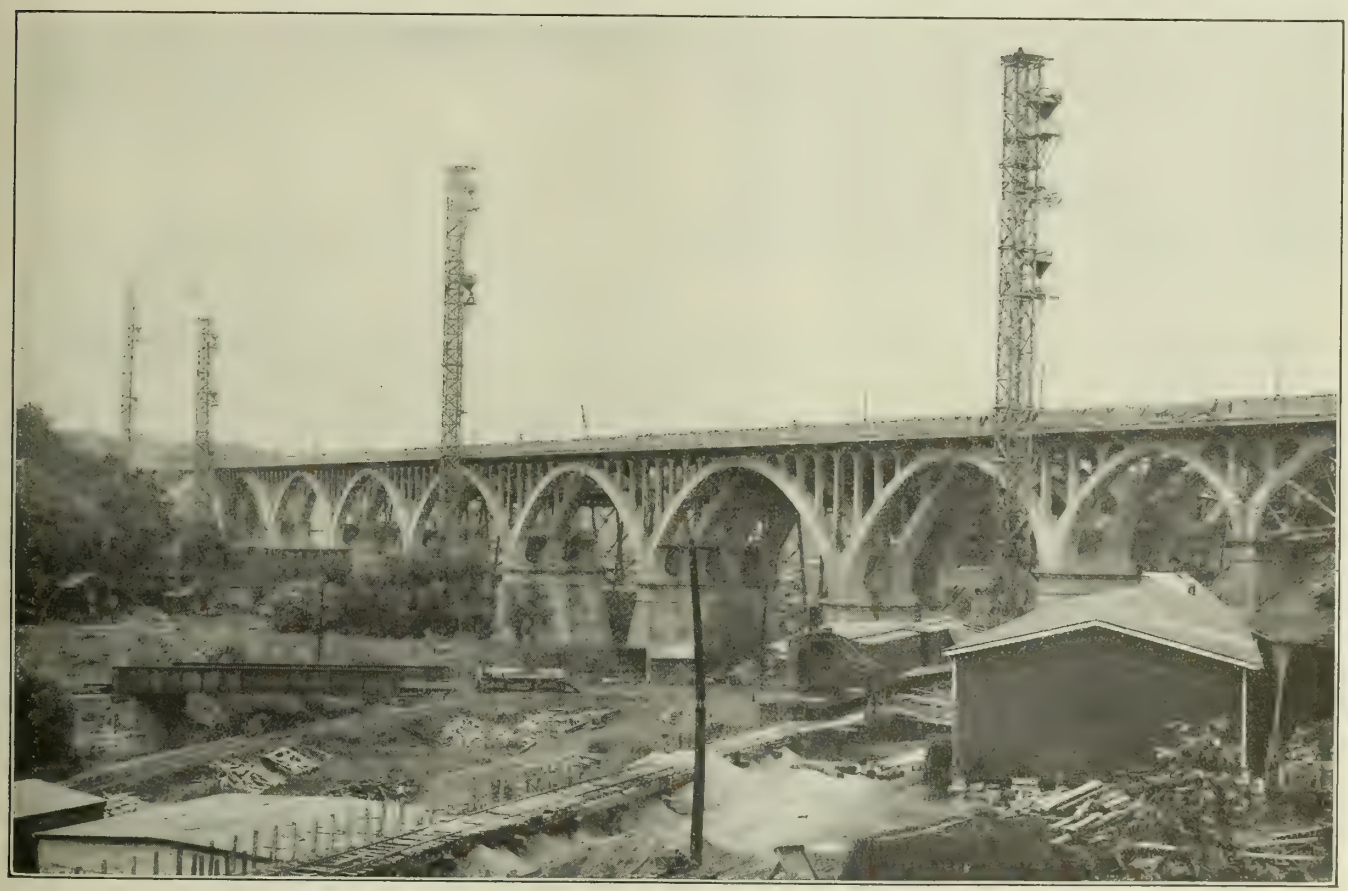


FIG. 1. BROOKLYN-BRIGHTON VIADUCT, CLEVELAND, AT COMPLETION OF WEST HALF

The six largest arches have a span of 128 ft. clear (139 ft. c. to c. piers) and a rise of 43 ft. clear. A prominent characteristic of the viaduct is the use of unsymmetrical arches—with one skewback at higher elevation than the other—at the side slopes of the valley. This permits of starting both arches on a pier from the same spring elevation and at the same time keeping the pier tops about the same distance above ground at all piers.

All the arches, in fact, are unsymmetrical, though most of them are only slightly so. Throughout the middle part of the viaduct the plane of the spring lines is parallel



FIG. 2. EAST FACE (MIDDLE) OF BROOKLYN-BRIGHTON VIADUCT

View taken same day as Fig. 1

to the roadway slope (0.4% up toward the south). The arch curves themselves have vertical axes, except for the short terminal curves near the spring line, whose radii are adjusted to give the proper terminal elevation.[1]

The floor-panel length was made uniform (11 ft. 7 in.) with a view to duplication of floor forms as well as to securing good appearance. Span lengths were adjusted to be multiples of this length.

The extrados faces of the ribs in adjoining spans are connected by a curve. In the transverse plane the feet of the four ribs on each pier are joined by heavy filleting in the form of an elliptical invert arch that has value for both appearance and rigidity of the structure.

Expansion joints in the floor, located over every pier, are at mid-length of a stringer. The two half-stringers act as cantilevers and for this purpose are made deeper than the regular stringer (see cross-section in Fig. 4). The joint is perfectly open and has no load to transmit, to interfere with free expansion as in the case of a stringer-end sliding on a seat.

The floor, a normal arrangement of slab, stringers and floor-beams, is depressed 8 in. on the width of the double-track street-car line to make space for the track (4-in. steel I-shaped ties, 7-in. rails, 1-in. depth of ballast cushion under ties). The roadway is divided between tracks by a low concrete curb-wall, inclosing and fendering the 10-in. sockets of the trolley-poles.

The pavement is to be of 4-in. granite block on half the width, and "Durax" granite block on the other half, both laid on sand cushion on asphalted burlap waterproofing.

Interference with the Old Viaduct

West 25th St. is carried south across Big Creek valley by an old steel viaduct. The site of the new viaduct, on a slightly revised alignment, is west of the old structure, but overlaps it on most of the length, as the plan in Fig. 3 shows. However, it was possible to build the west half of the concrete viaduct complete without disturbing the old viaduct except to cut a narrow strip off its west side for a length of some 200 ft. at the north end. The

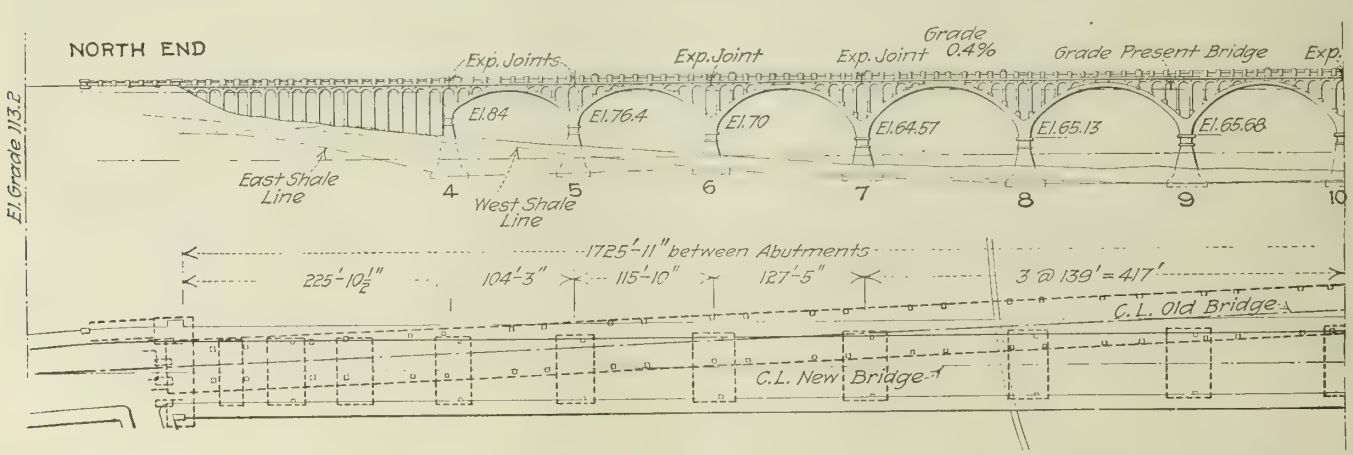


FIG. 3. BROOKLYN-BRIGHTON VIADUCT ACROSS

There are some other features of the design that merit study. The four ribs have no transverse connection, but are independent for the entire span length; only the floor and columns connect them. A low cross-wall 18 in. thick, between ribs just over the piers, provides some lateral stiffness. There is also a pair of diagonals between the inner posts nearest each pier.

[1]The terminal curves are shorter than they appear in the elevation of one arch in Fig. 4, as the drawing has the main curves somewhat off scale.

completed half could then carry the traffic, whereupon the old viaduct could be torn down and the east half of the new structure built. This procedure was followed.

The old viaduct floor-beams in the northerly interfering section were burned off by oxygen flame, and the cut ends of the remaining width supported on temporary timber bents. Cars operate over a single track in this narrowed portion, turning out to double track beyond.

The new structure was started at the south end and built northward in regular progression. Floor construction near

the south end, arch-rib concreting north of here, pier concreting beyond, and footing work and excavation at the north end went on simultaneously.

One of the conditions that facilitated this arrangement was the uniform and excellent character of the foundation soil. Hard shale in massive deposit lies near the surface, outcropping even high up on the bluffs. Therefore the construction of the footings was simple work, free from risk of delay or necessity for change of method. The excavation was done with the use of steam tripod drills except at the pier just south of the creek, where the cutting was so deep that 20-ft. holes were put down by hand drills, as the machine drills tended to stick. The muck was handled by a stiffleg derrick set up alongside the pit, into carts which hauled it away to approach fills.

The supply route of materials determined the type and placing of plant and thereby largely dictated the construction methods. Two railways pass through the valley, not far from the third-points of the length of the viaduct; the stone, sand, cement and other materials could thus be brought in direct and unloaded immediately alongside the viaduct at two different points. This meant storing and mixing in the valley and hoisting the mixed concrete.

The contractor chose tower hoisting and spouting in preference to handling by cableways. A layout showed that four towers could command the whole length—two located at the points of storage and mixing and two so located as to receive concrete from the spouts of the other two and rehoist it to be chuted again. Fig. 5 shows diagrammatically the location of the towers relative to the viaduct length; transversely they were set to clear the west face of the deck about 5 ft. The tower locations and heights were laid out for a chute angle of 2¾ to 1.

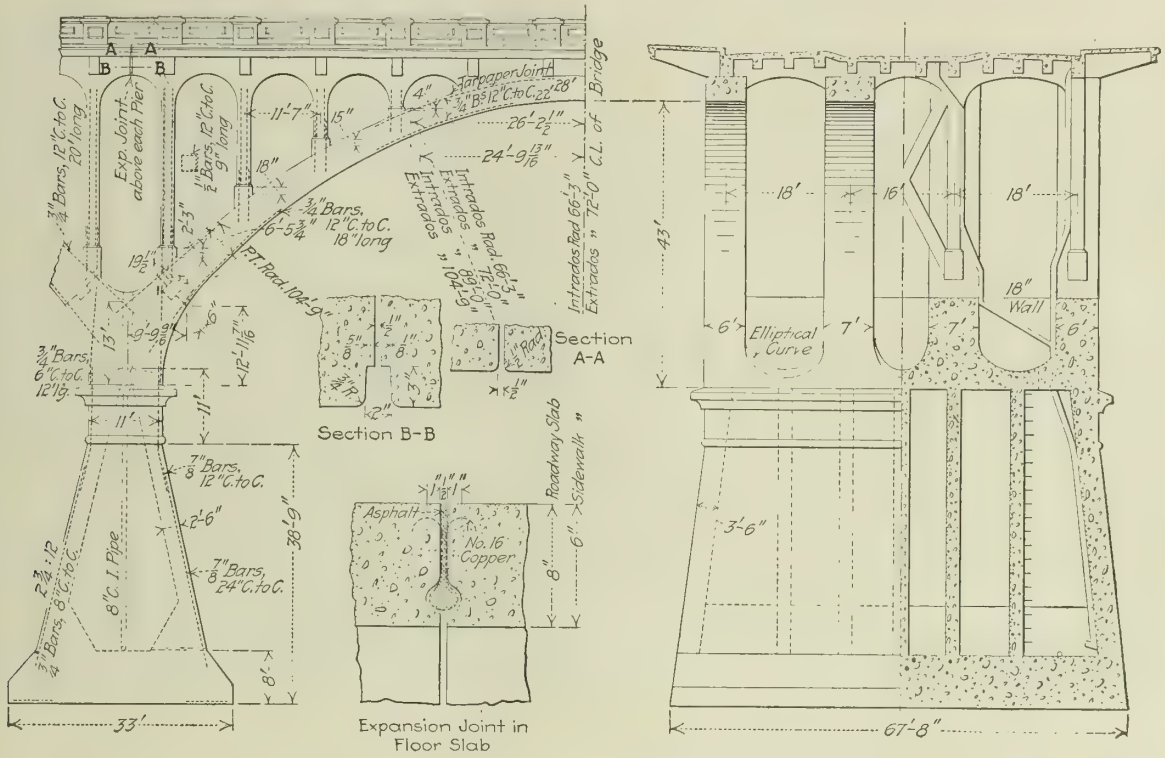
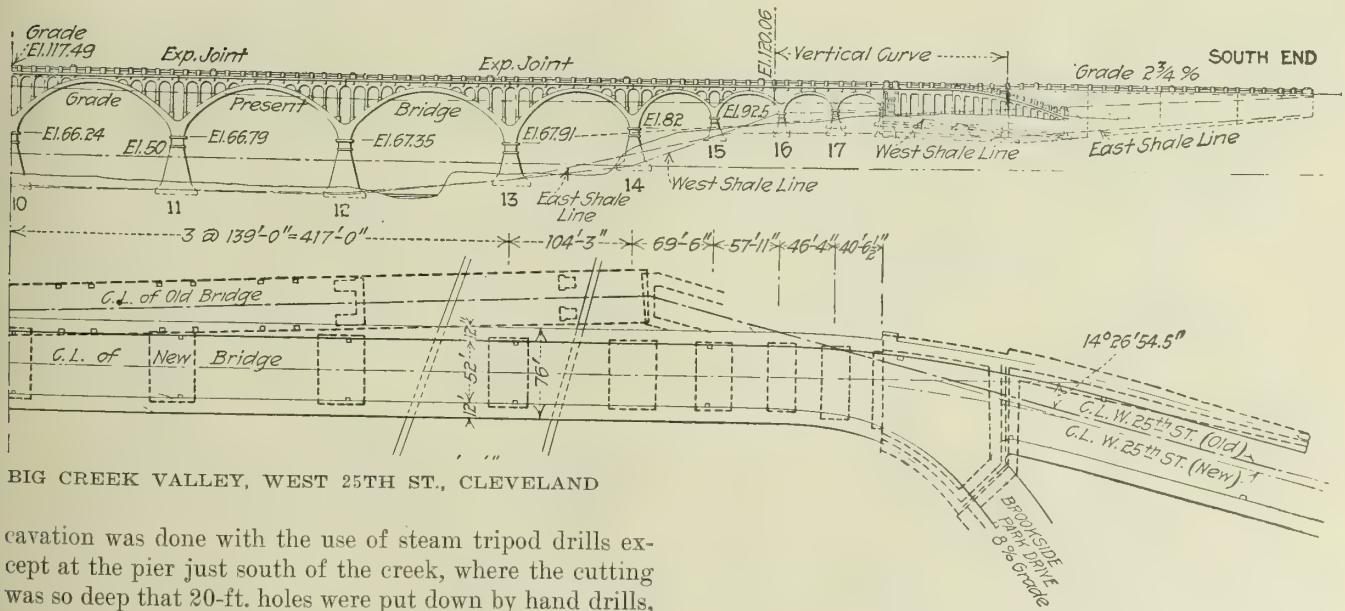


FIG. 4. TYPICAL DETAILS OF ARCH CONSTRUCTION



BIG CREEK VALLEY, WEST 25TH ST., CLEVELAND

As the piers were designed to take unbalanced dead-load thrust, the centering and concreting could go on in any desired order.

Steel centers of the three-hinged arch type were adopted, with a view to using the centers of the large 128-ft. spans also for the shorter spans by taking off sections. The tie-rods of the centers were used only in setting and in slacking; when in place the centering arch was supported vertically by blocking on the skewback belt-course and horizontally by wedges against the arch stubs that had been centered with the piers. The sketch Fig. 6 shows how the centers for a pair of ribs are braced together and

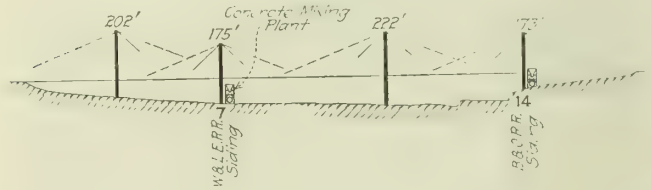


FIG. 5. LOCATION OF CHUTING TOWERS

how they are sectionalized for ease of erection and handling. The American Bridge Co. built the centers at its Ambridge plant.

Centers were provided enough for six spans (two ribs each, the ribs being concreted in pairs). For the three small spans at the south end, trussed wooden centers were built. These were intended to be used over once; the pair of centers in each span was left in place—these spans having been concreted last April—and will be rolled over next month to do service for the construction of the two easterly ribs of the same span.

Handling the Centers

The centers were erected by two 80-ft. gin-poles, each of which lifted a half-arch of one truss (see Fig. 6; the two sections of the half-arch were bolted together on the

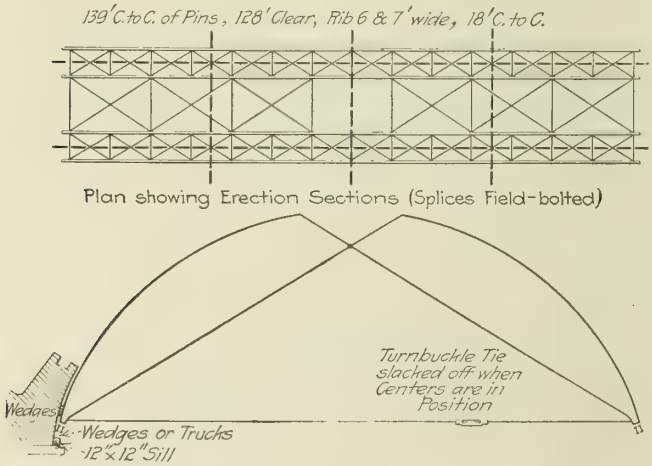


FIG. 6. SECTIONALIZING AND BRACING OF ARCH CENTERS

ground) and set it to join with the other at the crown pin. The tie-rod being put in and screwed up and the arch guyed, its mate was similarly hoisted and set and the pair braced by placing the lateral members. Then the parallel pair of centering arches was set and the bracing between the pair put in, completing the centers for a pair of ribs.

In taking down the centers, falls hung from the finished concrete arch were used to lower the half-trusses to the ground. Here they were unbolted, lifted on wagons and trucked to the next arch that was to be centered.

Arch and Pier Forms

The forms for piers and arches were made to be used only once; the contractor did not consider it economical to build sectional forms made to be used repeatedly.

The arch forms are shown typically by the sketch Fig. 8. Horizontal side sheathing was scribed to the bottom lagging and its upper line left irregular. Vertical wales with tie-rods through the arch held the sheathing. Top lagging was nailed to the under side of a 2x2-in. curve batten nailed on the inside of the sheathing; 1-in. bevel fillets were tacked in the four corners of the form.



FIG. 7. VIEW UNDER MIDDLE OF WEST HALF, BROOKLYN-BRIGHTON VIADUCT

The appearance of the staining is due to heavy rain just before the picture was taken

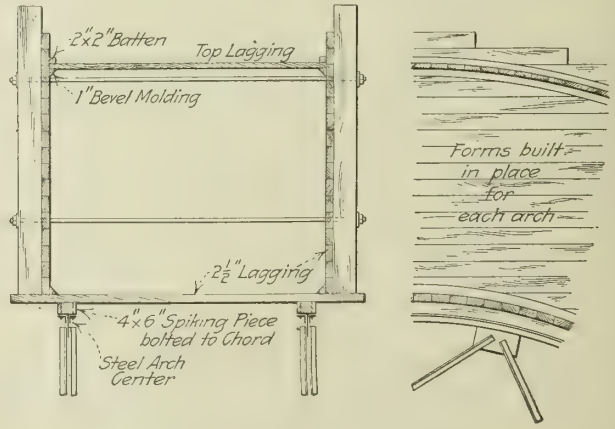


FIG. 8. ARCH-RIB FORMS

These forms proved rapid and simple in construction, and did not call for any hoisting appliances.

In designing both arch and floor forms, special care was taken to limit the deflection; ⅛ in. was considered the maximum permissible deflection. The two chief limits

in design were deflection in bending and cross-grain crushing under washers and wales.

Alternate Concreting of the Ribs

The steel centers were capable of carrying one panel excess load on either side. Therefore the concrete was placed in a sequence that kept the load balanced within one panel-load.

Fig. 10 sketches the procedure. Concrete from the chute was allowed to run down the outside of the top lagging on one side of the middle, to a hole cut a few feet above the spring. When the rib had filled up to the level of this hole the hole was closed and the spout was swung to discharge on the other side of the middle.

The concrete running down on that side went through a hole cut at an elevation several feet higher than the other. After this another lift on the first side was concreted, and so on alternately until the central section was reached. Top lagging was omitted for a length of 12 ft. at the middle, and the chute discharged direct into this open space, filling the middle 50-ft. length of ring.

The arch-rib top lagging was removed the day after concreting. The sides were taken down the second day. The centers were struck in 21 days; but in two spans the time was only 15 days, without injurious effect.

Column and Floor Forms

The column forms, like all the others, were unlined, that is, had plain wood faces. Special care was taken in building them to get a smooth face. Two coats of paraffin form oil were put on.

The floor forms and column forms were always built up together, but the columns were poured two days before the rest. The day after, the column forms were stripped—the floor-beam forms being supported independently on transverse 12x14-in. by 38-ft. outlooker timbers—and the columns rubbed.

The floor forms were built sectional and this in such a way as to make the path of transmission of load in the forms the same as in the finished structure. The stringer forms rested on ledges of the floor-beam forms, and the slab forms on the stringer forms. All parts were designed with 1-in. clearance horizontally, and the clearance space was covered with a 2-in. strip of tin nailed over (see view, Fig. 9).

Floor forms were built for 600 ft. length of floor, and floor concreting progressed without much interruption. Because of the sectional construction the panels of form removed from the rear were simply carried to the front of the work and built up.



FIG. 9. A SPAN OF FLOOR FORMS, BROOKLYN-BRIGHTON VIADUCT

The heavy items of reinforcing steel were handled on the forms by small gantries (large wooden horses) from which a chain block was hung. The floor-beam reinforcement was the principal item, weighing about 5 tons. This was assembled on blocking just above the floor-beam, and when all wired was lowered into the form.

Floor concreting went on at the rate usually of about 70 ft. (half of a large span, 139 ft. c. to c. piers) per day.

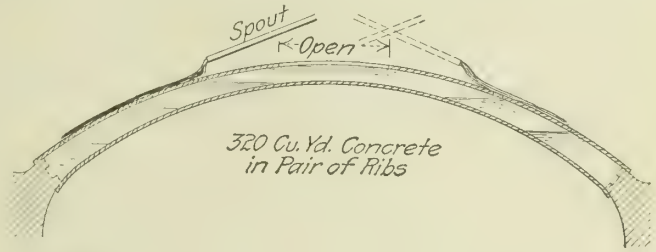


FIG. 10. METHOD OF CONCRETING ARCH RIBS

Thus the forms amounted to about 10 days of floor work—about the normal time of stripping. In one instance the whole 139-ft. length was concreted in a day of 8 hr., taking 350 cu.yd.

Rubbing Concrete Surfaces

All surfaces that would be seen in an elevation of the bridge were rubbed by the use of a wooden float and water. This work was done as soon after the concrete was poured as was possible to strip forms. On all walls where

no stresses were being carried by concrete the forms were stripped within 24 hr. and the concrete rubbed. Thus on this basis all surfaces shown as an elevation of the bridge were rubbed within 24 hr. after the concrete was poured. In addition to this all of the piers were rubbed to the springing line, as this portion of the work is very easily seen from the ground. None of the surfaces on the underside of the arches were rubbed, nor those underneath the floor system.

Rapid Concreting Record

The usual time required for pouring a pair of arch ribs (the westerly two ribs of one span) was 7 to 8 hr. This involved 320 cu.yd. of concrete in the case of the large (128-ft.) arches.

Much faster concreting was done in some of the pier work. In one pier 539 cu.yd. was placed in 9 hr.—a depth of 29 ft. of concrete. The South plant did this work, with a 25-ft. Smith tipping mixer.

In the case of this pier it was found that the concrete was still quite fluid 12 ft. down, and pasty to stiff 18 ft. down, a depth corresponding to about 5 hr. run. But the concrete materials were heated, which should accelerate the set.

There was little trouble from clogging of the chutes. The North plant in fact has plugged only once during the season. The concrete was of several mixtures and used three sizes of stone—1-in. for the superstructure, 1½-in. for retaining-walls, and 2-in. for piers and footings. The larger sizes gave a little more trouble in the chutes than the smaller.

Progress of Construction

The work accomplished in 1914 was: West half of south abutment, piers 16 and 17, and half the height of piers 12 and 14 concreted, and some further excavation made and two footings poured.

In February, 1915, the North concreting plant was put up. Early warm weather allowed concreting to begin Mar. 8, on pier work. The first arch was poured Apr. 13 and the last one July 13—just three months' time—including all four ribs in three of the spans (pier 12 to 15). Floor concreting began May 9 and was finished July 21, a total of 1726 ft. in length, all of it on only the west half.

Floor work is now in progress in the three spans whose cast ribs are in place, and some footing excavation is being done around the piers of the old viaduct. By the middle of August it is expected that the new viaduct will be carrying traffic and the demolition of the old one begun. As already stated, the contractors expect to finish the entire work by the end of the year. The paving is a separate contract.

Work is now one week ahead of the schedule made out last winter for the season's work. This gain was made in spite of a net loss of a week from delay of materials, etc.

The foregoing is based on information given by C. S. Smith, superintendent for Bates & Rogers Construction Co. on the work, with respect to the construction, and by A. W. Zesiger, Bridge Engineer of the county, as to the design. Mr. Zesiger is responsible for the design, under W. A. Stinchcomb, County Engineer. W. H. Baker is resident engineer for the county.

Enlarging an Irrigation Canal

By Kenneth A. Heron*

The main canal of the Modesto Irrigation District, California, was originally built to carry 535 sec-ft., but it was found to have a capacity of less than 300 sec.-ft., when first used in 1904. Since that time it has been enlarged several times, until at present it is being constructed to a final capacity of 2000 sec.-ft. The canal diverts water from the Tuolumne River at the La Grange Dam and for the first mile or so is located on a steep hillside about 100 ft. above the river bed. This first mile was the most difficult to locate and construct in the first place, and since construction it has presented the great obstacles to be overcome when enlargement was considered. Originally, the first 4000 ft. consisted of a timber flume laid on a shelf excavated in the hillside (Fig. 1). The canal capacity at that time is said to have been about 250 sec.-ft.

During a long period of litigation and financial trouble in the district, when the money could not be obtained to complete the irrigation works, this flume stood with very little water in it, and decay was rapid. When the time to replace it arrived, however, conditions in the district were better and the timber structure was taken out entirely and a concrete-lined canal section, as shown in Fig. 2, was substituted. This section had a varying width of

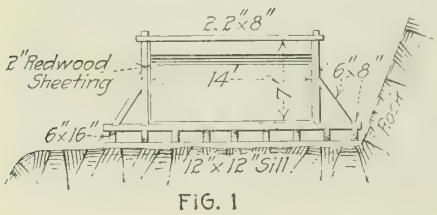


FIG. 1

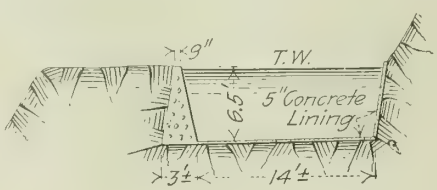


FIG. 2

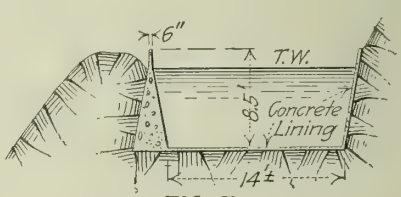


FIG. 3

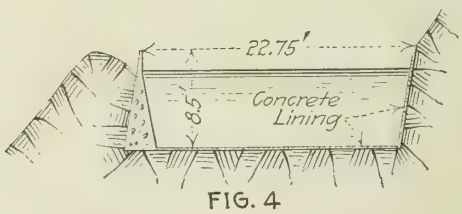


FIG. 4

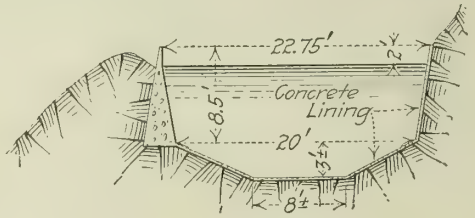


FIG. 5

FIGS. 1 TO 5. THE DEVELOPMENT OF AN IRRIGATION CANAL

Fig. 1—First stage: A timber flume. Fig. 2—Flume replaced by concrete-lined canal. Fig. 3—Lining raised to increase capacity. Fig. 4—Canal widened from 14 to 20 ft. Fig. 5—Canal deepened 3 ft. at center

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14 or 15 ft., a lining about 6 in. thick and a concrete wall on the lower side having a gravity section where there was no bank. This was backfilled with rock and earth, and the whole canal was located farther in the hillside than was the first structure. The capacity of this section was about 400 sec.-ft.

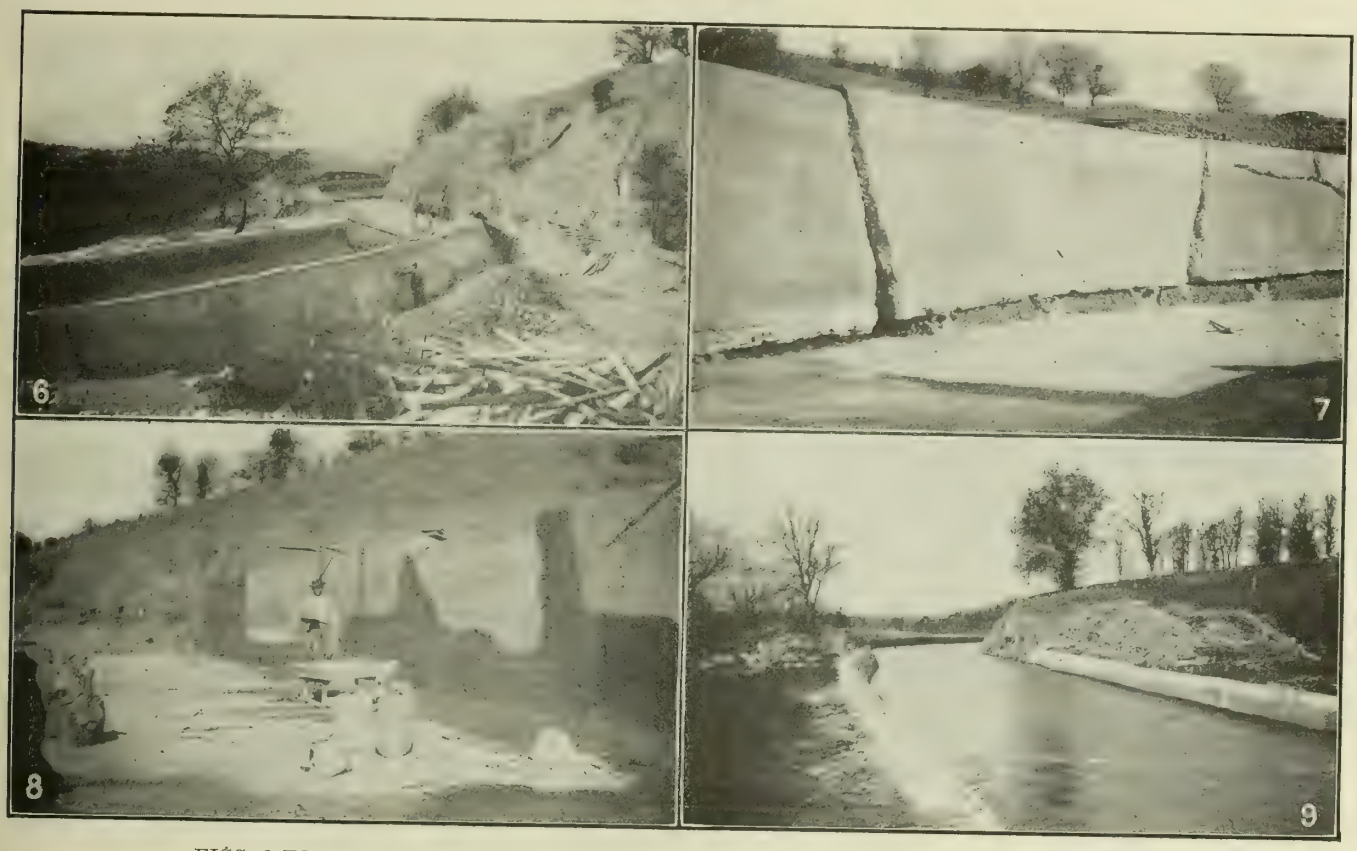
As the district developed and more land was brought under cultivation it was necessary to "crowd" the canal as much as possible, until it became customary to allow very little freeboard. The danger of the water topping the wall and washing out the backing and the necessity of obtaining more water led the district authorities to raise the concrete walls and lining about 2 ft. (Fig. 3). When this work was completed the canal capacity was increased about 100 sec.-ft. The rapid development of the district and the bringing of more lands under irrigation again required that the canal capacity be increased and in 1908 steps were taken to enlarge the size of the canal once more. Owing to certain fixed conditions at the headworks the hydraulic grade could not be raised without great expense, and it was decided to widen it to 20 ft. (Fig. 4). To do this it became necessary, in those portions of the canal which were concrete-lined, to tear out one wall, make the necessary excavation and replace it in the proper position.

This was done in places by excavating behind the wall to be moved and then carefully dynamiting it to break it into pieces of such sizes as could be easily pushed out on blocking with jacks. When moved to the proper position, the wall sections were carefully adjusted to fit as closely as possible and all cracks were plastered with cement mortar. New concrete was placed under the sections for foundations. The backfill was then placed behind the wall. Because of the care with which the work was done no more leakage developed than if the whole wall had been molded in place, and in appearance it is just as substantial. The capacity of the new canal section was approximately 800 sec.-ft.

Since this work was done the development of the district has been very rapid, and the recent construction of a reservoir which is supplied by this canal, together with new lands to be brought under cultivation, led the district authorities a year ago to call for plans and estimates for a canal of 2000 sec.-ft. capacity. At the time I was called upon to make surveys for this enlargement, two plans were under consideration. One called for the removal of 80,000 cu.yd. of rock and the placing of 7500 cu.yd. of concrete, at a total cost of $250,000. This plan necessitated widening the canal 10 ft. on the upper sides and lining it with concrete. As the average rock cut would be about 28 ft., the difficulty of the work is apparent.

The other plan considered consisted of a tunnel which would reach from the canal headworks to a point some 6000 ft. down the canal. The length of the tunnel was placed at 4000 ft., and the estimated cost was $500,000. It was found that by lowering the present canal bottom about 3 ft. and at this depth reducing the bottom width to 80 ft. and lining the entire section, a water area of about 180 sq.ft. would be secured below a 2-ft. freeboard.

There is sufficient fall in the first two miles of the canal to secure a velocity of 11.1 ft. per second and a canal capacity of 2000 sec.-ft. The cost of carrying out this work is estimated at $135,000 and new improvements are being made in line with this plan (Fig. 5).



FIGS. 6 TO 9. BREAKING THE CANAL WALL INTO SECTIONS AND MOVING IT BACK

Fig. 6—Wall bared in rear and broken into sections. Fig. 7—Broken wall moved to new position. Fig. 8—Pieces of wall set up and joined. Fig. 9—Widened canal

Motor Race-Track at Chicago

SYNOPSIS—This new two-mile automobile speedway is the first to have a wood deck, or track, supported on timber trestling. Rapid construction was a special feature of the work, as not only the track but also buildings, sewers, drains, water supply, etc., had to be provided complete and ready for use in very short time, in order to be ready for races on a given date.

The automobile speedway at Maywood, Ill., just outside the western limits of the City of Chicago, which was opened June 26, is said to be the first to have a timber floor, or track, supported on timber trestling. It proved very satisfactory during the races on the opening day, and the maximum speed attained exceeded any previous records.

The track has a length of two miles on the measuring line (near the inner edge) and consists of two parallel straight sides connected by end curves. Its major and minor axes are about 4053 ft. and 2060 ft. respectively. Because a railway cuts diagonally across one end of the oblong site the end curves or turns are not symmetrical. The north turn has a long curve of 5° 48′ united to the tangents by short spirals. The south turn is composed mainly of two long spirals united by a short length of circular curve. The spirals have 100-ft. chords, with a difference of 38′ 40″ in each station. The long spirals Nos. 1 and 2 reverse at stations 11 and 13 respectively, being symmetrical on opposite sides of these stations, except that the lengths are not the same. The arrangement of the turns and spirals is shown in the table at the bottom of the page.

The instructions for survey work required all tangents to be run out and checked before commencing to run spirals and curves, and points of curves and spirals to be located by measurements from the intersections. All work was to be checked by back deflections, and coördinates measured if further check seemed desirable. Each station was marked by a gas-pipe post driven so deep as not to be disturbed by excavations for footings. The grading excavation was done in advance of the final location measurement.

The width of the track proper is about 65 ft. on the straight, increasing to 75 ft. on the banked turns. Inside of this, on the curves or turns, is an 8-ft. dead space (which is level all the way round). The transverse inclination, or banking, on the turns is about 1 on 3 (or 22°) on the circular curves and runs out on the spirals with a 3% grade along the outer, or high, side. Vertical curves of 150 ft. length connect the ends of this grade with the horizontal portions of the higher and lower ends. The banking is identical at both ends in spite of the difference in curves. This is due to the fact that while, theoretically, a steeper banking would be required for the sharper curves at the south turn, practically, any steeper slope might be unsafe for a car having to slacken speed on the curve.

The banking was designed originally according to accepted formulas for speed and weight, but in construction the results thus obtained were modified on the basis of empirical data and according to the advice of experienced drivers. It was designed for a speed of 75 m.p.h., but the maximum speed record upon it was at the rate of

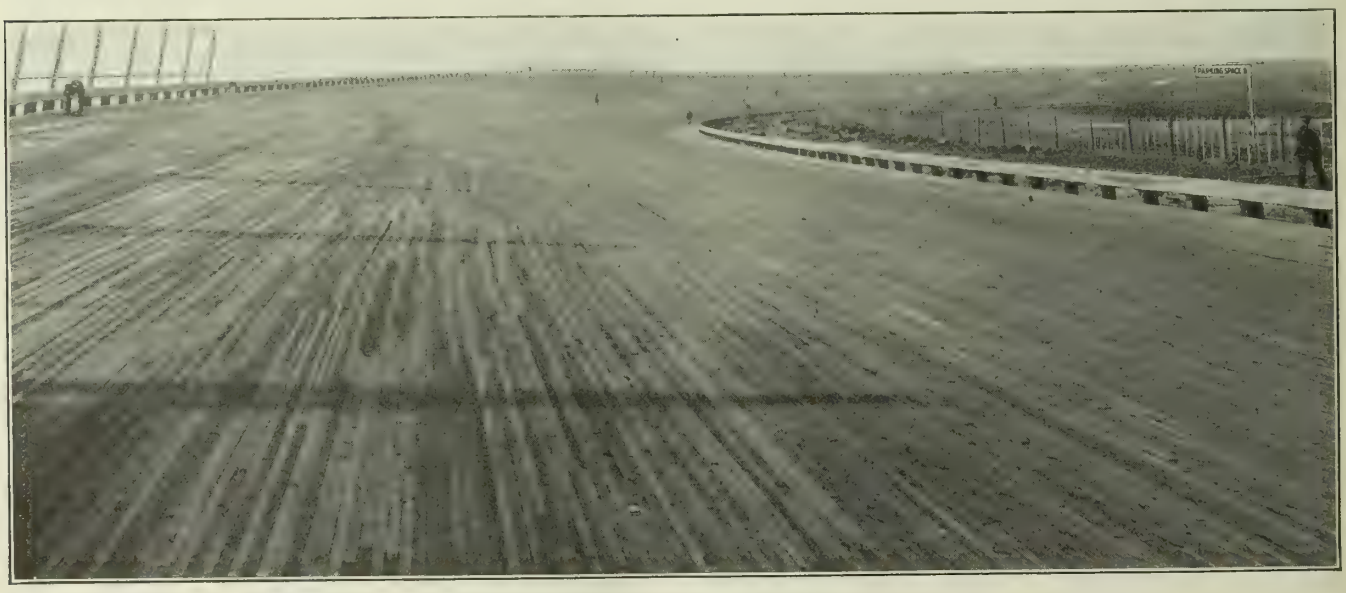


FIG. 1. THE NORTH TURN OF THE MAYWOOD TWO-MILE AUTOMOBILE SPEEDWAY (NEAR CHICAGO)

The view shows the banked west end of the curve, where it runs (in the foreground) into the level home-stretch. The maximum elevation is about 25 ft. in a width of 75 ft. The floor track is of 2x4-in. timbers, placed on edge

LAYOUT OF THE MAYWOOD AUTOMOBILE SPEEDWAY (CHICAGO)

	Curve	Radius	Cen. Angle	Length, Ft.
Tangent, home stretch....	....	....	....	1,335
Spiral curve.....	....	....	66° 30′	1,400
Circular curve.....	4° 21′ 55″	1312 ft.	29° 29′	675
Spiral curve.....	....	....	90°	1,800
Tangent, back stretch....	....	....	....	1,450
Spiral curve.....	....	....	23° 12′	800
Circular curve.....	5° 48′	988 ft.	[illegible]° 19′	2,300
Spiral (to home stretch)..	....	....	25° 12′	800
Total length (two miles).....				10,560

SPIRALS

	No. of Chords	Radius in Feet: Entering	Middle	Leaving
No. 1. From home stretch.	14	8890	(Sta. 11) 808	1111
No. 2. Into back stretch..	18	1111	(Sta. 13) 684	8890
No. 3. From back stretch.	8	8890	.....	1111
No. 4. Into home stretch..	8	1111	.....	8890

over 100 m.p.h. The average speed for the 500-mile race on June 26 was 97.58 m.p.h.

The combined change in longitudinal grade and transverse inclination forms a warped surface, which is given by cutting the supporting posts to carefully calculated lengths.

Near the starting point is the row of 35 supply pits, with a stretch of concrete paving 20 ft. wide between them and the inner side of the track. Here the cars stand while those in charge of them are taking supplies, renewing tires, making repairs, etc.

Particulars of Speedway-Track Construction

The deck, or flooring, of the track consists of longitudinal 2x4-in. tamarack sticks placed on edge. They average about 16 ft. in length, and each course laps the other about 24 in., the line of joints running diagonally across the track. The floor rests on joists 2x12-in., spaced 24 in. c. to c., on the straight stretches. The floor timbers are spiked together at intervals. In case of wear of any one stick, it can be cut out (spikes and all) and a new one dropped into place, the latter being then spiked or toe-nailed from below. With the exception of the track all timbering is of pine.

Concrete pedestals, or footings, 30 in. square and set 3½ ft. below the ground surface extend 12 in. above the ground line and support the framing for the track. There are five rows of these. On the level tangents they are spaced 12 ft. 6 in. c. to c. longitudinally, and carry 8x12-in. stringers upon which the transverse joists are laid. On the turns the pedestals support the posts of transverse bents, as shown. These posts are 10x12 in., each secured to its pedestal by a 1-in. pin 12 in. long. As the bents are placed radially the concreting and carpenter gangs had to be supplied with plans showing the location of the pedestals as well as the elevations of the warped surface of the deck.

Each bent has a cap composed of two 3x12-in. planks framed into the posts; upon these are 3x12-in. stringers spaced 5 ft. 3 in. apart and braced by cleats. Across the stringers are the track joists, 2x10-in., with bridging between them. All bents are thoroughly braced, and along the back and front of the bents is diagonal bracing in every fourth panel, forming braced towers. At intervals of 400 ft. a fire-stop is made by nailing metal lath to both sides of a bent and covering it with plaster. This extends from the ground to the deck.

The posts on the outer, or high, side are extended 20 in. above the track deck, and to their faces is bolted an oak guard timber 6x12 in. Short intermediate posts alternate with the main posts, so that the rail is supported at intervals of 6 ft. 3 in. Along the inner side of the track is a similar guard timber, carried by short posts 6 ft. 3 in. c. to c. These guards are to check any runaway cars. At the grandstand and bleachers a screen of wire netting is erected to stop tires that may be thrown off by speeding cars.

Four subways pass under the turns of track and give access to the infield. Here special construction is required, the spacing between bents being increased to 17 ft. 6 in. for the two driveways. The posts are 12x12 in., with cast-iron caps for a pair of cap timbers 8x18 in. Across these are laid stringers 4x14 in., 45 in. c. to c., upon which the track joists are placed. Each subway has two 15-ft. driveways and two 6-ft. sidewalks at a higher level. The driveways are paved with concrete and have approach grades of 5%. Each is divided by a central concrete curb to keep vehicles in line.

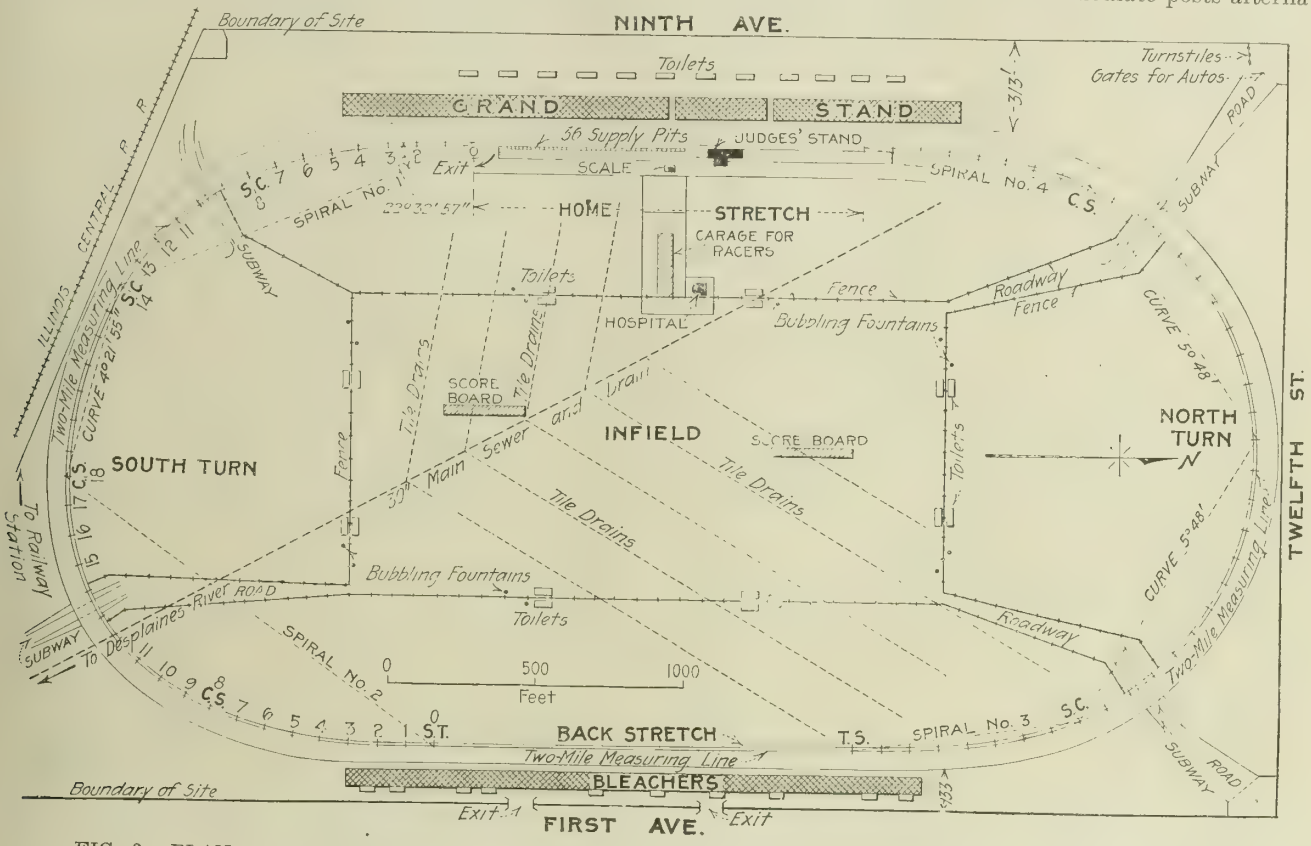


FIG. 2. PLAN OF THE TWO-MILE AUTOMOBILE SPEEDWAY AT MAYWOOD, ILL. (NEAR CHICAGO)
Note the unsymmetrical layout of the two turns, due to the shape of the site

To provide facilities for the accommodation of a crowd of 100,000 people or more was no small part of the work. Water is obtained by connection with the mains of the village of Maywood, a 6-in. main being laid into the grounds. This is under a pressure of 40 lb. and provides fire-protection service. Pipes are laid into all the buildings and along the bleachers and the grandstand, with bubbling fountains at intervals of 250 ft. The 6-in. main extends close around the outside of the track, with fire hydrants 400 ft. apart. There are about five miles of water pipe.

Numerous free toilet rooms are provided, with first-class fixtures. The buildings are of wood, but it is proposed to place concrete floors later. From these toilets extend separate vitrified tile sewers, connecting with a 30-in. main trunk drain discharging into the Desplaines River.

The ground being a heavy black loam, quickly converted into mud, it was necessary to drain the site to keep the front ends of the trusses extending as cantilevers in order to avoid the use of posts near the front of the grandstand. The "bleacher" stand is 1940 ft. long, and will accommodate about 40,000 persons. Both stands are designed to carry safely a load of 200 lb. per sq.ft., with allowance for movements of crowds. These structures will be dealt with in a separate article.

Scoreboards, Fences and Roadways

Two scoreboards in the infield are conspicuous structures, each being 275 ft. long and 65 ft. high. These were built entirely of wood, owing to the short time available for their construction. They have on each side rows of openings for roller curtains on which are painted figures 4 ft. high. These are operated by men on the inside. The scoreboards show the spectators the progress of the races and the performance or standing of the competitors. A

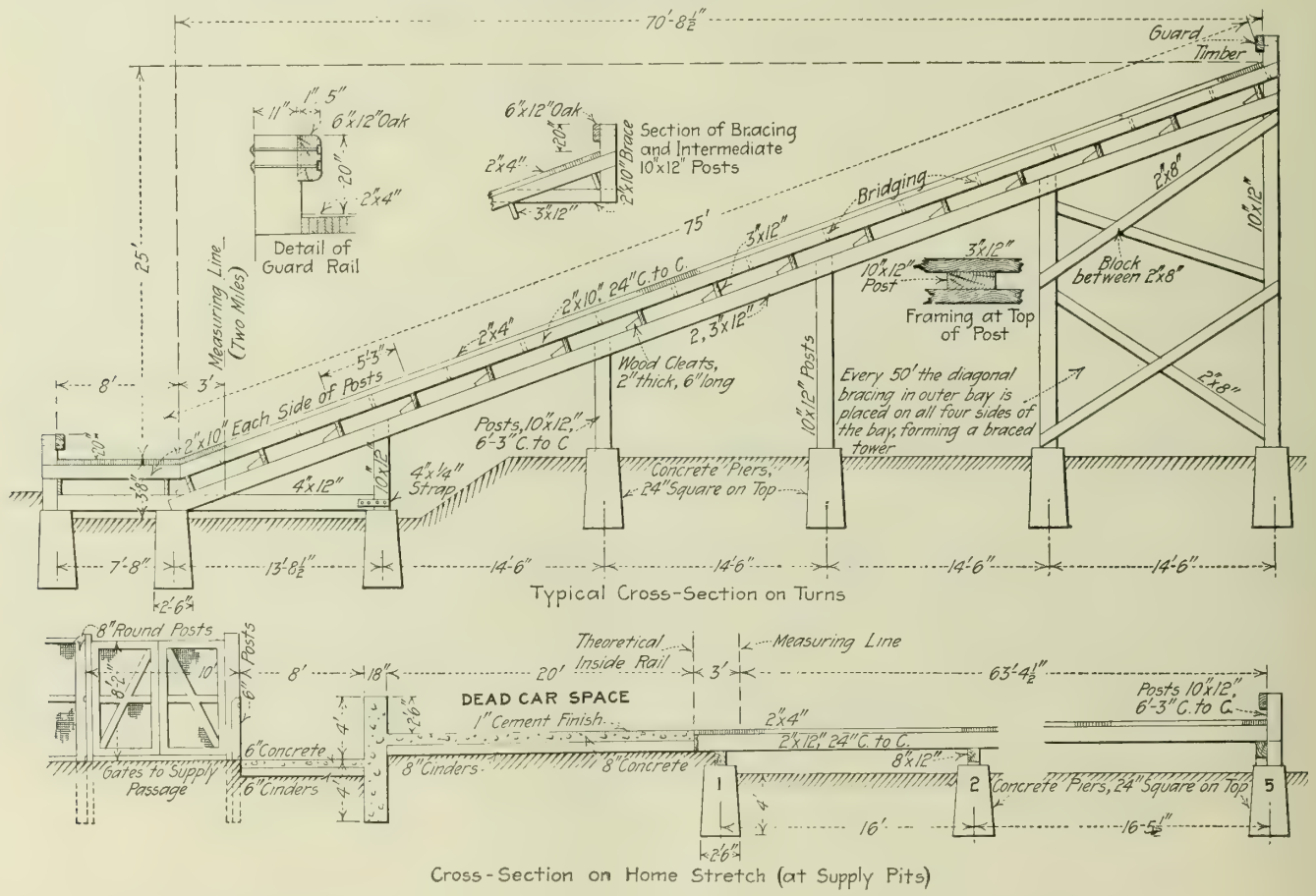


FIG. 3. TYPICAL SECTIONS OF THE SPEEDWAY ON TANGENTS AND TURNS

roadways and infield serviceable in wet weather. There are about 12 miles of drains, laid out in herringbone fashion, with lines of 5- and 6-in. pipe 200 ft. apart and connecting with the 30-in. main drain running diagonally across the site. The trenches were excavated to a minimum depth of 30 in. by trenching machines and by hand.

To drain the depressed subways, each has a sump in the middle of the roadway (at one end) with a vertical-shaft 2½-in. centrifugal pump driven by a 5-hp. gasoline engine on a platform level with the dead space of the speedway track. Later, these will be operated by electric motors.

The grandstand is 2240 ft. long and seats about 60,000 persons. It has six-post bents 12 ft. c. to c. A steel roof extends for the full length, having trusses 24 ft. apart. These are supported on two rows of posts, the complete telephone system connects the score-men with the time-takers at different points along the course, and with the judges' stand.

A tight board fence 10 ft. high and 3½ miles long surrounds the site. Entrances are provided at three corners, and there are additional exits at intervals. The automobile entrances have four or five gateways 16 ft. wide, with men in charge to collect tickets. A balcony in the entrance structure provides for an inspector, who can watch the movement of the lines of vehicles. To avoid crush, no change is given at the entrance gates for pedestrians. Tickets or the exact fee are handed in at the turnstiles.

The main driveways are of concrete. Those of the infield, etc., are of screenings on a bed of cinders well rolled into the graded and rolled surface of the earth.

Plank roadways were also provided inside the grounds temporarily. The site was reached by rough gravel and earth roads, and in order to provide for the heavy teaming the contractor was obliged to pave the main approaches with broken stone. These macadam roads were well rolled and later oiled to give a compact surface and avoid a dust nuisance during the heavy automobile traffic on the days of the races.

Details of the Construction Work

The Speedway Park Association let the general contract to the Shank Co., of Chicago. This contract covered all the work (track, buildings, stands, sewerage, water-supply, etc., complete), with instructions to have the speedway ready for the races set for June 19. The material included some 13,500,000 ft. b.m. of timber and 20,000 cu.yd. of concrete. The track alone required 7,000,000 ft. b.m. of timber and 7000 yd. of concrete. The necessity of framing the speedway bents to give the warped surface of the turns made this part of the work relatively slow and difficult. All framing and cutting of timber was done on the site. Material was brought in by wagons and motor trucks, and this traffic made it necessary to keep a repair gang at work to maintain the approach roads in passable condition. A sawmill was erected as part of the plant.

Grading machines were used to level the ground and form the roadways, and a trenching machine excavated the trenches for drains, sewers, and water mains. Post-hole diggers were used to excavate the holes for the concrete pedestals.

For the numerous small pedestals and footings and the concrete roadways, a number of small concrete mixers were used, being shifted from place to place. A part of the time a night shift was worked by the aid of acetylene torches on stands 10 or 12 ft. high. The number of men at work ranged from 500 to 1500.

The contract with the Shank Co. was signed April 19, and work was started April 21. The track was undertaken first and was completed on June 5. A night shift was tried (for placing the 2x4-in. deck only), but a few nights' experience proved this to be inefficient, and it was given up. The actual working time on the track was a little more than a month. In the remaining time all the other work was finished with the exception of 120 ft. of timber construction of the grandstand.

Heavy rains delayed work at the end, but the Chicago street-car strike led to the races being postponed for one week, to June 26, by which time the work was practically completed, except for finishing touches.

The general plans were prepared by Graham, Burnham & Co., of Chicago, architects for the Speedway Park Association. The Shank Co., of Chicago, had the contract for the entire work, and maintained a staff of engineers who laid out, detailed and superintended all the construction work and the structural designs. The president of this company, George H. Shank, personally supervised the work in the field; Frederick Grim was Chief Engineer; Alfred H. Marshall, Principal Assistant Engineer; C. T. McClelland, Field Engineer, and Charles A. Shank, General Superintendent.

The fencing, walks and scoreboards were built by Van De Venter & Rider, as subcontractors. The steelwork for the cantilever roof of the grandstand was built by the Hansell-Elcock Co., but was erected by the general contractor.

With so much work of so many kinds to be done in a short time, and with an absolute time limit (the day of the races), it was important that there should be no delay because of friction or misunderstanding between the general contractor and the owners. For this reason C. F. Wiehe, F. N. Foster and D. B. Reid, officials of the Speedway Park Association, composed an Executive Board which advised in all matters of policy and administration.

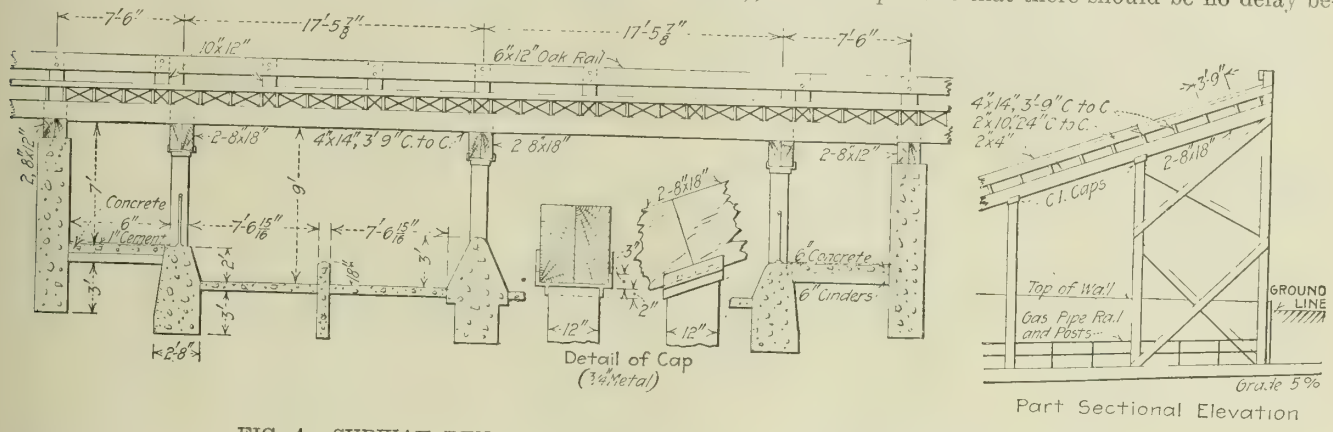


FIG. 4. SUBWAY BENEATH THE TRACK OF THE MAYWOOD SPEEDWAY

Manufacturing Portland Cement in Brazil—A government concession to use certain large deposits of shells in the Bay of Bahia, suitable for use in the manufacture of cement, is held by two residents of Bahia, Brazil. United States Consul Robert Frazer, Jr., states that these men claim they can manufacture a first-class cement at a cost of $2.50 to $2.75 per bbl., as against the minimum cost in normal times of $4.32 for an ordinary grade of foreign cement, duty paid. The project includes the erection of a factory in a small harbor opening off the large bay, at a point where steamers can approach to within 100 ft. of the shore. Near this site are large deposits of sea shells mixed with coral and a suitable clay. One of these beds of shells is 1½ mi. long by ¾ mi. wide, and has been tested to a depth of 7½ ft.

A Proposed Standard Box Car of steel construction has been designed by the Committee on Car Construction of the Master Car Builders' Association and was reported at the annual convention at Atlantic City for criticism. The car is of steel construction throughout, with side sheathing of steel sheets ⅛ in. thick and end sheets ¼ in. thick. The cubic volume of the car body under the carlines is 3096 cu.ft. The principal dimensions are as follows:

Length of frame over striking casting	42 ft. 6 in.
Width over sheathing	9 ft. 1⅜ in.
Length, inside	40 ft. 6⅛ in.
Width, inside	8 ft. 6 in.
Height, inside	9 ft. 0 in.
Height, from rail to bottom of bolster	2 ft. 6 in.
Height, from rail to floor	3 ft. 8½ in.
Height, from rail to top of running board	13 ft. 1½ in.
Height, from rail to top of brake staff	14 ft. 2 in.
Width, at eaves	9 ft. 2⅜ in.
Height, at eaves	12 ft. 5¾ in.

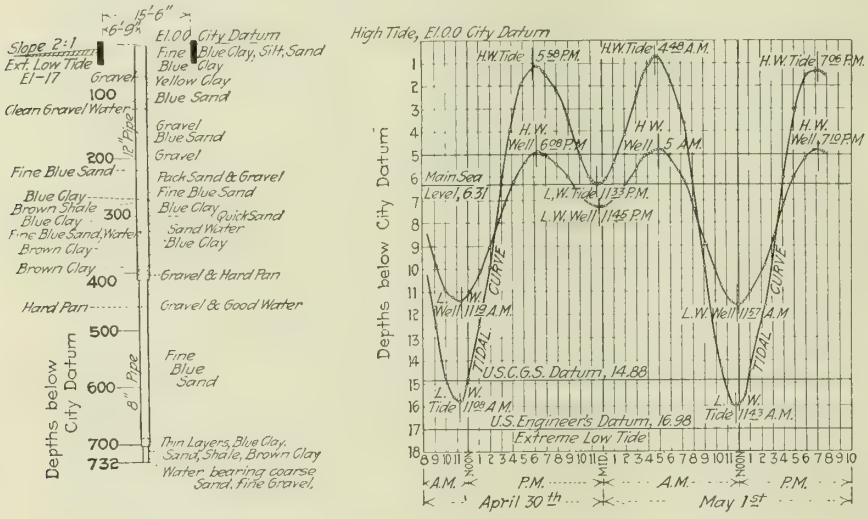
The underframe of the car has been designed to withstand safely a total end force of 250,000 lb.

Tidal Influence on Artesian Well at Seattle

By H. M. Chittenden*

The Port of Seattle has recently sunk a deep well on the shore of Elliott Bay to provide water for a cold-storage plant which it has erected there. The well is 732 ft. deep. It consists of a 12-in. casing down to a depth of 400 ft., an 8-in. casing from that point to a depth of 700 ft., and a 6-in. casing 20 ft. further. No satisfactory supply of water was found until the last water-bearing stratum was pierced. The supply found there is abundant in quantity, satisfactory in quality and entirely fresh. The water rises to the surface of the well without pumping.

A singular fact connected with this well is that it is subject to tidal influence. The water in the casing rises and falls with the tide in the harbor, the oscillations being almost synchronous and the range in the well being nearly 50 per cent. that of the tide. The accompanying diagram shows the well and the strata through which it passes, and also the curves of oscillation in the harbor and in the well. There is no opening in the casing within 400 ft.



TIDAL EFFECT IN WELL ON SEATTLE WATERFRONT

of the bottom of the harbor, while the foot of the tube is nearly twice that distance from salt water. The water from the well is totally different in quality from that in the harbor. A mile or so out from the shore the harbor bottom reaches a depth of some 300 ft., but the slope from the shore is gradual.

It is difficult to account for this tidal effect in the well. It certainly does not come from any direct aqueous communication with the bay. Infiltration through such thickness of strata would be impossible, or if possible, it could not act so quickly. Moreover, the difference in quality of water precludes any such hypothesis. The only explanation which occurs to the writer is that the bed of the harbor rests like a saucer in the stratum of water which furnishes the supply to the well. The vertical pressure on the bed of the harbor varies with the tide from an average of over 3 tons per sq.ft. to an extreme of over 5 tons. It is possible that this change of pressure is communicated through the harbor bed to the water stratum underneath and thus acts on the well. As such a water stratum could hardly be entirely uninterrupted by harder material, and as the harbor bed cannot be wholly elastic, the full effect of change of pressure on the bed could hardly be felt in the stratum of water underneath. This may account for the much smaller oscillation in the well than that of the tide.

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Some Provisions of the New Highway Law of Ohio

A revision of the laws governing highway construction and maintenance in Ohio has been accomplished, and on Sept. 5 an entirely new code went into effect. The new law comprises 15 chapters, 305 sections, and occupies 124 pages of text. It is obviously a series of compromises and an attempt to keep as much of the old scheme of highway control as possible, yet there are several distinctive provisions which should advance good roadbuilding in this state, and the most important is better pay for the county road officials.

There are still three partly independent roadbuilding authorities—the township trustees, the county commissioners and the state highway commissioner. Each authority has its own employees, who are rather curiously interrelated, as the following abstract will show. The township trustees hire their own employees directly or through the county highway superintendent, the county commissioners do their work through the county surveyor (highway superintendent), an elective officer, and the highway commissioner, of course, has his own employees.

The following section of the law covers the roads under the jurisdiction of the township trustees:

Township roads shall include all public highways of the state other than state or county roads as herein defined, and the trustees of each township shall maintain all such roads within their respective townships; and provided further, that the county commissioners shall have full power and authority to assist the township trustees in maintaining all such roads, but nothing herein shall prevent the township trustees from improving any road within their respective townships, except as otherwise provided in this act.

The township trustees are authorized to levy taxes not exceeding three mills per dollar for improving, dragging, repairing or maintaining any public road which they may designate. For such work they "direct" the county highway superintendent (county surveyor) to make surveys, plans and specifications, which may or may not be adopted by the trustees. The township trustees may then let contracts for roadwork and appoint some competent person or persons "to act under the general direction of the county highway superintendent," as an inspector. The inspector's pay is not to exceed $4 per diem, and is paid by the township.

Township Highway Authorities

Each township is divided into not less than one nor more than four road districts. For each such district the trustees appoint a township highway superintendent, who, "under the direction of the township trustees," has control of the roads in his district and the keeping of them

in good repair. He is appointed by the trustees to hold office until removed, but his removal may be accomplished either by the trustees or by the county highway superintendent "for incompetence or gross neglect of duty." His compensation is not fixed by law. He is required to make an annual report to the county highway superintendent, and to file a duplicate report with the township trustees. He is also subject to the orders of the county highway superintendent "to attend to any demonstration for the purpose of exhibiting the best method of dragging highways." Otherwise the township superintendent does not appear to be under the immediate supervision of the county superintendent, and there is no provision in the law to prevent the township trustees from reappointing a township superintendent who has been removed by the county superintendent.

County Highway Authorities

County roads are described as follows:

> County roads shall include all roads which have been or may be improved by the county by placing brick, stone, gravel or other roadbuilding material thereon, or heretofore built by the state and not a part of the intercounty or main market system of roads, together with such roads as have been or may be constructed by the township trustees to conform to the standards for county roads as fixed by the county commissioners, and all such roads shall be maintained by the county commissioners.

The board of county commissioners is given authority to construct or improve any road except the intercounty and main market roads (state highways). The county commissioners may coöperate with the township trustees, but nevertheless have jurisdiction over the trustees and may construct or improve roads on their own initiative or on petitions directed to them by land owners. The county commissioners "order" the county surveyor (highway superintendent) to make the necessary surveys, plans and specifications, but "the profile and grade" are subject to approval of the commissioners. The county highway superintendent is then required to make estimates, supervise contracts and do other necessary engineering work.

The law provides that the present elective county surveyors shall be the county highway superintendents. The county highway superintendent is to give his whole time to the county, and his salary is to be computed as follows: "One dollar per mile for each full mile of the first 1000 mi. of public roads in the county, and in addition $40 for each full 1000 of the first 15,000 of the population of the county; $30 per 1000 for each full 1000 of the second 15,000; $25 per 1000 for each full 1000 of the third 15,000; $15 for each full 1000 for the fourth 15,000; and $5 per 1000 for each full 1000 in excess of 60,000." Thus a county of 1500 mi. of roads and 75,000 population would pay its highway superintendent a salary of $1000 + $40 × 15 + $30 × 15 + $25 × 15 + $15 × 15 + $5 × 15 = $2725 per annum.

This salary covers all services for township, county or state (as hereafter described), and is paid out of the county treasury. The county superintendent is allowed necessary expenses and such assistants as the county commissioners see fit to provide.

Where the county superintendent also has charge of the state highways in his county, one-fifth of his salary is paid by the state. The state highway commissioner may or may not designate the county superintendent to take charge of the state highways, but if for any reason he does not do so the county superintendent loses one-fifth of the salary provided for in the foregoing paragraph.

The state highway commissioner may appoint an engineer other than the county superintendent to have charge of the state work in the county. This, however, can apparently be done only after the state highway commissioner has filed with the county commissioners a written statement to the effect that the county superintendent is not qualified to handle the state work; but the county superintendent, being an elective officer, the county commissioners are powerless to remove.

The county superintendent is required to make a report at least once a year to the county commissioners, a copy of the report to be filed with the state highway commissioner. He is also to furnish such special reports as may be called for by the county commissioners or the state highway commissioner, or to attend conferences with the state highway commissioner if necessary. He is also required to make an annual report for the year ending Nov. 15 to the state highway commissioner, a copy of which is filed with the county commissioners. The law does not make it clear whether or not this report shall refer exclusively to state highways; it shall contain "such matter and in such form as may be prescribed by the state highway commissioner."

In general the county highway superintendent seems to be in full charge of all the roadwork in his county. He "may request advice and assistance from the state highway commissioner in all matters relating to his duties," and by the same section of the law "shall be governed in the conduct of his work by the instructions of the state highway commissioner, as issued from time to time for the guidance of county highway superintendents." At the same time the county superintendent "shall from time to time issue such instructions to the township superintendents as he deems best."

Again, it is provided that the county highway superintendent, "under the direction of the state highway commissioner, shall provide for the maintenance and repair of the roads of the county, under such system as may be deemed expedient, so that each section of the highways of the county shall be under proper supervision and be effectively and economically improved, maintained and repaired."

State Highway Authorities

The following section of the law defines the state highway authority:

> State roads shall include such part or parts of the intercounty highways and main market roads as have been or may hereafter be constructed by the state, or which have been or may hereafter be taken over by the state as provided in this act, and such roads shall be maintained by the state highway department.

The state highway department is declared to be established "for the purpose of affording instruction, assistance and coöperation in the construction, improvement, maintenance and repair of the public roads and bridges of the state." The governor appoints the highway commissioner, whose salary is $4000 per annum, and the commissioner appoints three deputy commissioners, whose annual salaries are $3000 per annum. One of the deputies is designated as chief highway engineer.

The law provides that all these deputies must be competent civil engineers, one to be experienced in road con-

struction and improvement, one experienced in road maintenance and repair, and the third experienced in the design, construction, maintenance and repair of culverts and bridges. Their necessary expenses, not exceeding $1200 per annum, are allowed. The highway commissioner may also appoint, within the limits of his appropriation, as many division engineers, superintendents and inspectors as are necessary. The maximum salary of a division engineer is $2500 per annum.

The duties of the state highway commissioner are prescribed as follows:

The state highway commissioner shall have general supervision of the construction, improvement, maintenance and repair of all intercounty highways and main market roads, and the bridges and culverts thereon. He shall aid the county commissioners in establishing, creating and preparing suitable systems of drainage for highways, and advise with them as to the construction, improvement, maintenance and repair of highways; and he shall approve the design, construction, maintenance and repair of all bridges, including superstructure and substructure, and culverts or other improvements on intercounty or main market roads; and in the case of bridges and culverts on other roads, when the estimated cost thereof exceeds $10,000, the plans therefor shall be submitted to and approved by him, before contracts are let therefor. He shall cause plans, specifications and estimates to be prepared for the construction, maintenance or repair of bridges and culverts when so requested by the authorities having charge thereof, and he shall cause to be made surveys, plats, profiles, specifications and estimates for improvements whether upon state, county or township roads. He shall make inquiry in regard to systems of road and bridge construction and maintenance wherever he may deem it advisable and conduct investigations and experiments with reference thereto, and make all examinations, in his opinion, advisable, as to materials for road construction or improvement.

The state highway commissioner or the chief highway engineer "may call upon the county highway superintendent, at any time, to furnish survey maps and any other information that may be required," the information to be furnished in such form as the commissioner requires. The county superintendent, in turn, may call upon the township trustees or township superintendent to furnish a part of the information required by the state highway department.

A Covered Slip and Pier with Gantry Cranes for Handling Lumber

A new idea in the shipping and handling of high-grade mill lumber is being introduced by the Carpenter-O'Brien Co., of Jacksonville, Fla., which has lumber docks at Eastport, Fla., and Staten Island, N. Y. It includes special pier design, special mechanical handling equipment, special steamers, and the handling of lumber in unit packages instead of in loose pieces.

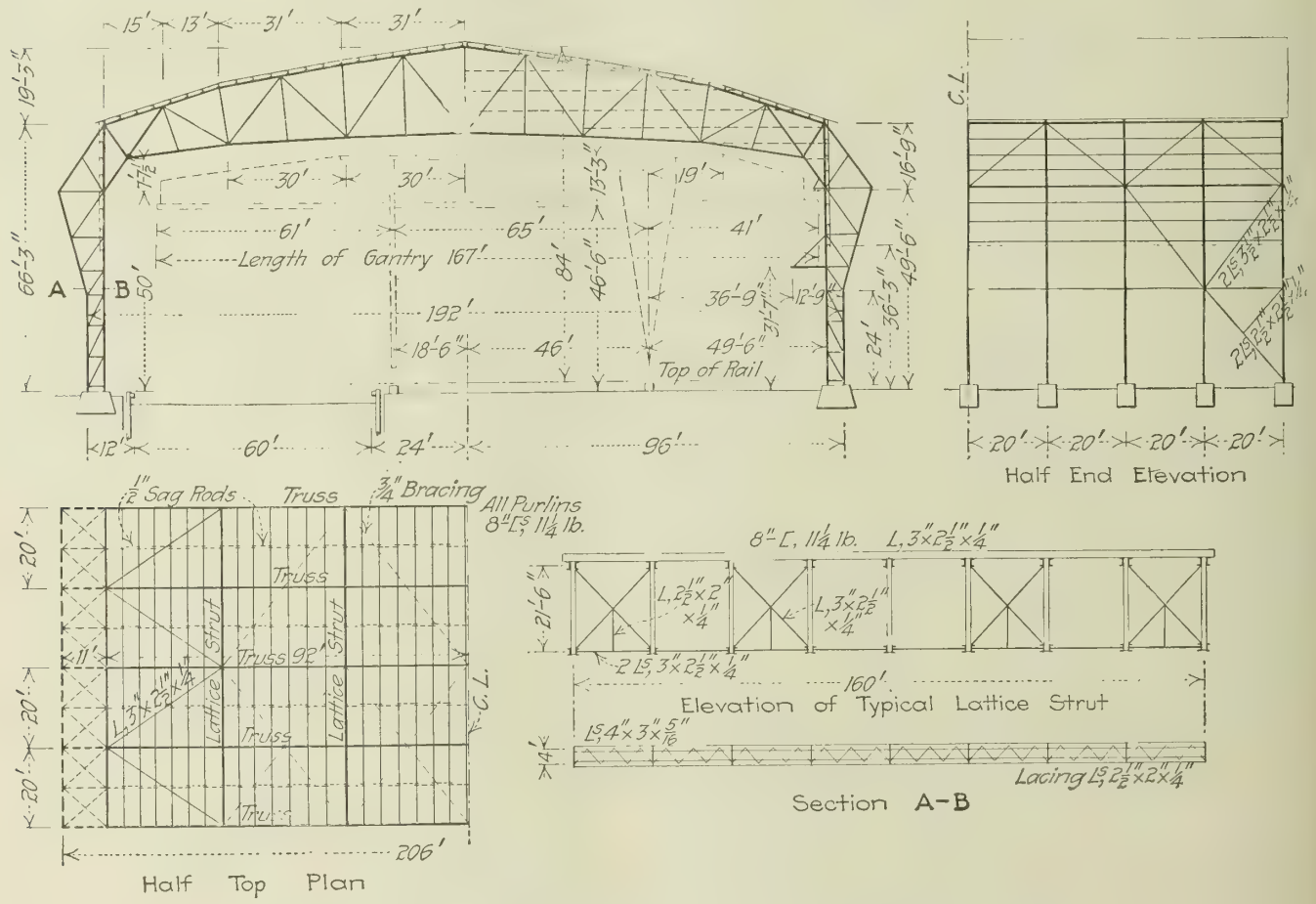


FIG. 1. STEEL SHED OVER STEAMSHIP SLIP AND PIER, STATEN ISLAND

In order to reduce the time of loading and unloading vessels, all lumber will be put up at the Eastport mills in "packages," or units, 4 ft. square and of varying length. These will be carried by a telpher line to a dock equipped with special loading machinery. There they will be placed on steamers having hatches arranged for convenient loading and a hold arranged for suitable stowing of the unit "packages." At Staten Island, the cargo will be unloaded in the same way and the units stored on the dock, to be loaded into barges for distribution as required.

In this way the lumber steamers (like the ore steamers on the Great Lakes) will spend but a small proportion

of their time in port. It is expected that they will make the round trip in eight days—six days at sea and one day in each port.

Another feature is the protection of the lumber (much of it kiln-dried) from rain and snow. For this purpose it will be handled entirely under cover, the pier shed extending over the slip. This arrangement is the same both at Eastport and New York, except that the shed at Staten Island was designed for a snow load in addition to the wind and dead loads, and with unit stresses, etc., as required by the Department of Docks. This design is shown in Fig. 1.

Pier, Shed and Gantries

The slip is 60 ft. wide and is covered by the pier shed for a length of 160 ft. The shed is about 184 ft. wide, with a clear height of about 65 ft. above the floor. Lateral stability of the structure is afforded by lattice columns, which widen toward the upper end and which transmit

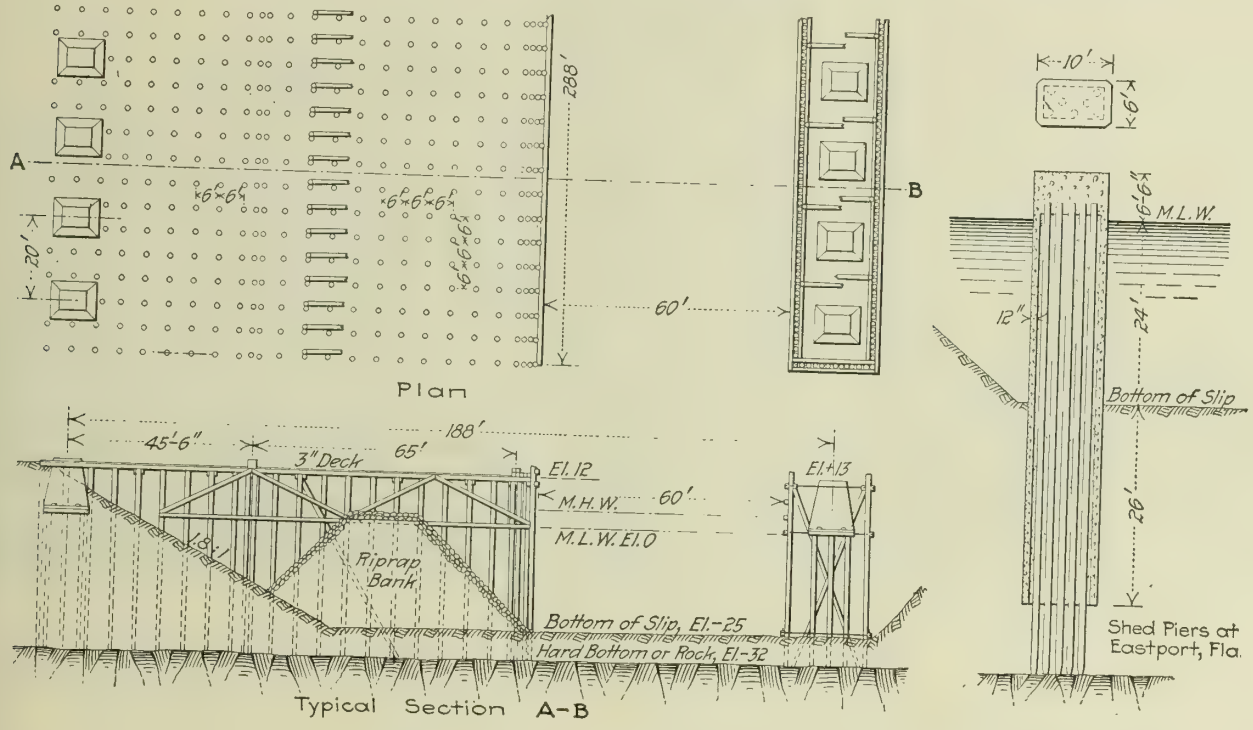


FIG. 2. FOUNDATIONS FOR PIER SHED AND FOR GANTRIES

to the foundation the bending stress due to wind pressure. They are practically vertical trusses whose tops merge with the roof truss, as shown. The columns are spaced 20 ft. c. to c. The frame is sheathed with corrugated iron.

Within the shed are two 20-ton traveling gantry-cranes each 167 ft. long, carried by a tower 65x40 ft., giving cantilever arms of 61 ft. over the slip and 41 ft. at the rear (Fig. 1). There is a single line of rails on each side, and each leg of the tower is carried on two wheels. The maximum load per wheel is 50,000 lb. on the front (or water) side and 65,000 lb. on the rear side. The clear spacing between the legs is 26 ft. at the top, increasing to 40 ft. at the base, so that there is ample room for handling the "packages" of lumber. On the gantry travel two hoisting trolleys. The dock space between and beyond the legs of the gantry tower is available for storage.

The foundations of the dock at Eastport, Fla., are piers composed of groups of piles inclosed in concrete caissons, because of the presence of the teredo in the waters of the St. John River. The caissons are 6x10 ft. in plan, with 12-in. walls reinforced by horizontal and vertical steel bars. The piers on the slip side were constructed first, by sinking the caissons to a depth of at least 26 ft. below the bottom of the slip. The material was dredged out, and eight piles in each caisson were driven to refusal. The caisson was then filled with river sand to within 6½ ft. of the top, the sand being compacted by settling in water. The pier was completed by a heavy concrete cap in which the anchor bolts for the superstructure column were embedded. The piers on the slip side are protected by fender piles. This construction, shown in Fig. 2, was designed by Mr. Cline, of the Carpenter-O'Brien Co.

The foundation design for the Staten Island dock is shown in Fig. 3. After the slip and approach channel have been dredged to 65 ft. of water there remains only 7 ft. for soil over the rock, and the small penetration thus available for pile footings on the side adjacent to the slip creates a special problem. The same condition exists at the opposite side and is corrected here by banking and riprapping, as shown.

The shed foundation on the slip side is a rock-filled fender crib with concrete pedestals for the columns. Although excessive thrust of the diagonal cross-timbers is not expected, it is provided for by two lines of longitudinal stringers and rails cross-connected by tie rods. The foundation for the gantries consists of close lines of piling, upon each of which are two tiers of stringers for the rails.

Personnel

The pier sheds were designed and built by the Wisconsin Bridge & Iron Co., of Milwaukee, Wis. The gantry cranes and the telpher system from the mill to the dock at Eastport were built by the Pawling & Harnischfeger Co., of Milwaukee. The steamers were designed by E. S. Hough, consulting marine engineer, San Francisco, Calif.

Double-Deck Freight Station at Pittsburgh

The Pennsylvania R.R. has built at Pittsburgh, Penn., a new freight station and office building (on the North Side) for the Conemaugh Division. The office building, 110x41 ft., is at Federal and No. Canal St., and behind it the station extends 893 ft. along No. Canal to Anderson St. and crossing Sandusky St. Fig. 1 gives a general view of the station, and Figs. 2 and 3 show the construction.

The freight station is a long narrow structure, parallel with the elevated main tracks. The inbound and outbound houses are arranged in line. The former extends 450 ft. from the office building to Sandusky St., and the latter 383 ft. from Sandusky St. to Anderson St. The lower floor is for wagon service and the upper for car service. The latter spans Sandusky St. and has a cantilever projection along the No. Canal St. side.



FIG. 1. OFFICE BUILDING AND DOUBLE-DECK FREIGHT STATION AT PITTSBURGH, PENN.; PENNSYLVANIA R.R. (CONEMAUGH DIVISION)

There are five parallel stub tracks, as shown, each with a capacity of 25 cars. Between tracks Nos. 3 and 4 is an island transfer platform 1000 ft. long. The three outer tracks (Nos. 1 to 3) are for transfer purposes, and the two next the freighthouse (Nos. 4 and 5) are for handling inbound and outbound freight. The island platform is built on concrete pile bents 18 ft. c. to c. Its canopy roof is carried by three lines of I-beams supported by cross-frames on a central row of H-beam columns.

Foundations

The site had been filled with loose materials to an average depth of 15 ft. Concrete walls would have been preferred for the foundations, but their cost was prohibitive. Concrete piles were adopted, different designs being considered in view of the fact that there were timbers and old foundations buried in the fill. It was decided to use piles of the "Simplex" type, poured in place, a cast-iron point and steel shell being driven for each pile. The shell was filled with concrete and then withdrawn and redriven. This type of pile proved very satisfactory, as a number of shells were successfully driven through timber and limestone foundations. While driving through the stonework there was very slight penetration, but on the discovery that the foundations were not resting on a stable base it was decided to drive deeper until proper penetration was reached. Under the conditions at the site it was thought advisable to assure the perfect completion of the piles by having at all times several shells in place between the shell that was being driven and the one that was being poured and withdrawn. There were about 1200 piles, with lengths of 30 to 60 ft.

On account of the removal of the filled material in excavating for the basement of the office building, it was decided to build concrete wall and pillar foundations for that structure. At 8 ft. below the basement level a tough, stable blue clay was encountered, and upon this the foundations were built.

Superstructure and Bridges

The tracks are elevated over Anderson St., and both tracks and station extend over Sandusky St. The streets are spanned by steel-girder bridges of the half-through type, with solid waterproof floors and abutments of concrete. The long subways thus formed are lighted by electricity, and to improve their appearance as well as the lighting, the faces of the abutments and ceilings were finished to a white surface. For the abutments this effect was obtained by depositing a face mortar of 1 part white cement and 1 part marble dust while the other concrete was being placed, so that the white surface finish was monolithic with the abutment concrete. In order to give the walls the appearance of granite stonework, half-round strips were nailed on the forms. Suspended from the bridges are light angle frames carrying steel lath, which is plastered with the above-described mortar.

The frame of the superstructure of the station and office building is of steel. The south side of the structure rests

on a continuous concrete retaining wall, the top of which is some 13 ft. above the elevation of the wagon floor. The north side of the building rests on steel columns 18 ft. c. to c. The columns are of H-beams on cast-iron bases which rest on concrete footings and capped piles.

The width of the wagon floor is 25 ft. at one end, running to 35 ft. at the other end. The width is spanned by built-up girders, which extend as cantilever arms 8 ft.

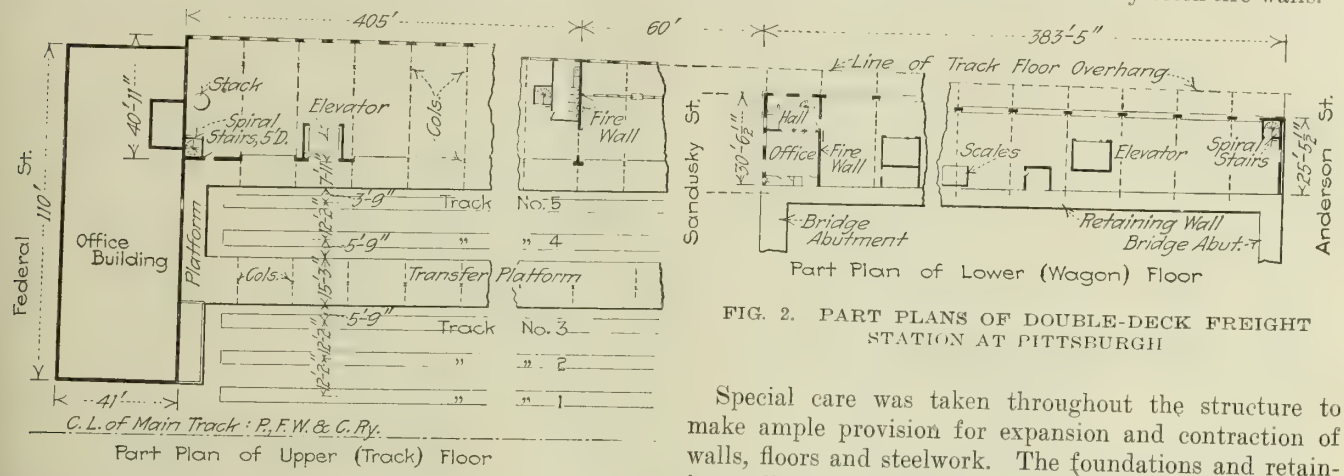


FIG. 2. PART PLANS OF DOUBLE-DECK FREIGHT STATION AT PITTSBURGH

beyond the line of columns, to increase the area of the upper floor and to form a shelter for teams and trucks along the wagon floor. Between the girders are 18-ft. I-beams, which support the reinforced-concrete floor.

The roof of the outbound warehouse is supported on steel trusses, and as there is a contemplated future development in the form of an additional floor in the inbound warehouse, the roof of that part is supported on girders

The wagon floor has a 12-in. base of granulated furnace slag, thoroughly wetted and tamped. Upon this are 4½ in. of concrete and a 1½-in. mastic top dressing hardened by a patent process that was used on all the concrete floors. The track floor has 6 in. of reinforced concrete. The roof consists of reinforced-concrete slabs on which a slag roofing was applied. The warehouse doors are of the steel rolling type. Both floors are divided by brick fire-walls.

Special care was taken throughout the structure to make ample provision for expansion and contraction of walls, floors and steelwork. The foundations and retaining walls have vertical dovetailed expansion joints 54 ft. apart and located midway between the bearings of the girders. The joints were made by bulkheading the forms at every third bay (54 ft.), the amount poured each day. The groove of the joint was molded in each bulkhead, the cross-section dimensions of which equaled one-third of the top width of the wall. The molded groove was faced with tar paper before the next section was built, and in cold weather a greater amount of the paper was used to

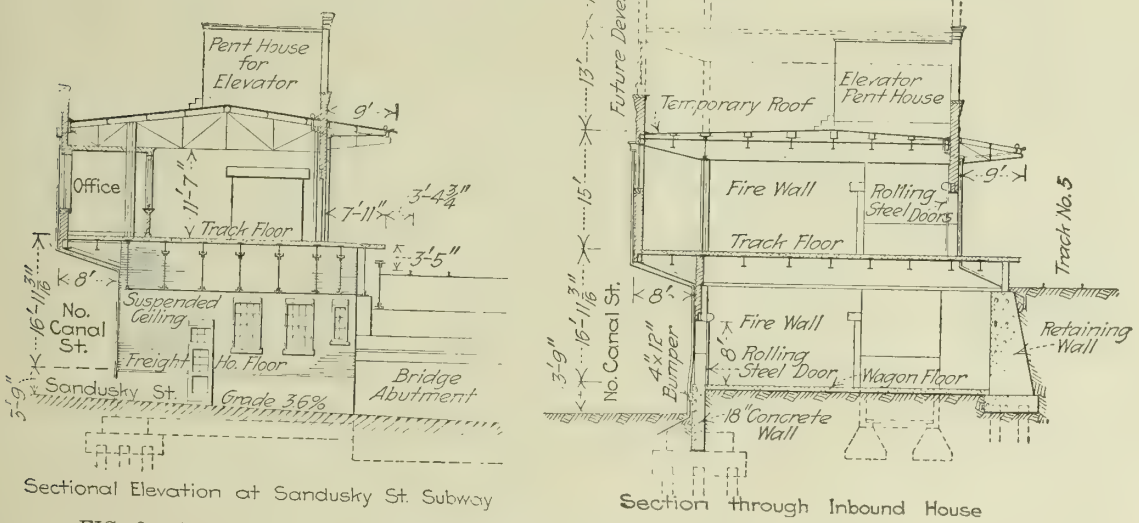


FIG. 3. CROSS-SECTIONS OF DOUBLE-DECK FREIGHT STATIONS; PENNSYLVANIA R.R.

that will later support the additional floor. This is shown in Fig. 3. The steelwork of the office building is similar to that of the freight station. The walls of the latter are of light brick laid in cement mortar, with concrete door sills, lintels and coping. The walls of the office building are of ornamental terra-cotta, and the windows and doors are finished with copper. A circular reinforced-concrete smoke-stack at the rear of the office building is 86 ft. high above the basement elevation.

increase the thickness of the joints. The bridge abutments were cared for in the same manner.

The concrete floors were all made with expansion joints 18 ft. apart. The joints of the reinforced-concrete track floor were made midway between girders, so as to overcome the tendency of cracks in the floor directly over each side of the girders, as the concrete was thinnest at these places owing to the cover plates and rivets of the girders. Special reinforcement was placed in the concrete over the

girders as a further prevention against cracking which would damage the floor. The steelwork was provided with expansion slots at each side of the Sandusky St. bridge. Expansion of brick walls and roof is provided for at the same places as the steel work.

Equipment and Miscellaneous

There are six electric freight elevators of 8500-lb. and two of 12,000-lb. capacity, all equipped with safety gates and having controllers on the cars. Automatic platform scales are provided in both warehouses. Spiral stairs are used, to economize space. Provision is made for electric lighting, steam heating and fire-prevention equipment.

To facilitate the handling of freight between wagons, trucks and platforms, North Canal St. has been regraded and paved with creosoted wood blocks laid on a sand cushion on a concrete base. Changes are made in the grades of Sandusky and Anderson St., to conform to the new grades of North Canal St.

For plans and information *Engineering News* is indebted to J. M. David, Engineer in Charge for the Pennsylvania R.R.

The Boulevard System of San Francisco

By James M. Owens*

Topographically the peninsula of San Francisco offers unequaled opportunities for the development of scenic boulevards—over rolling hilly country, through forests, along the bay shore, around the precipitous cliffs of its famous Golden Gate straits, or skirting the shores of the Pacific Ocean.

Recently a progressive municipal government has completed two of these boulevards; three are in course of construction, and plans have been adopted and funds set aside for others. These boulevards (see map) may be enumerated as follows: (1) Junipero Serra Boulevard (finished), (2) Sloat Boulevard (finished), (3) Portola Drive (75 per cent. finished), (4) Market St. Extension (Corbett Ave. Plan 1) (proposed), (5) Market St. Extension (Plan 2) (proposed), (6) 19th Ave. Boulevard (partly completed), (7) Ocean Boulevard (partly completed), (8) San Bruno Ave. Extension (partly completed), (9) the Great Highway and Esplanade (proposed improvement of).

The construction of the Junipero Serra Boulevard, the first of these scenic boulevards to be built, was briefly described in *Engineering News,* Feb. 18, 1915. Another important link—probably the most important if we consider its relative size and position—is the Sloat Boulevard, extending from Ocean Ave. to the waters of the Pacific, where it connects with the Great Highway.

Sloat Boulevard

The portion of Sloat Boulevard just completed is an asphalt pavement 30 ft. wide and 2.16 mi. long. This strip was designed as part of a proposed boulevard 135 ft. in width, with a double-track electric railroad in the center occupying a 35-ft. right-of-way, with 10-ft. walks on either side and 2-ft. concrete gutters.

Sloat Boulevard as originally constructed was 70 ft. wide, with a 35-ft. railroad right-of-way to the north, leaving a net available width of oiled-macadam roadway of 35 ft. In the design of the new 135-ft. boulevard, of which only a 30-ft. strip could be built at this time, it was thought advisable to use the grade of the old road as near as practicable, to save the old road base, which had become thoroughly compacted by years of travel, as a foundation for the new road. When the necessary property has been obtained on the northerly side of the boulevard the contemplated improvement can be made in its entirety, and will give to the city one of the finest automobile boulevards west of the Rockies.

Portola Drive

Portola Drive is the third link in the city's boulevard system. The construction of this boulevard is practically completed. It has a length of approximately 1.29 mi., a width of roadway of 40 ft., and a grade that does not exceed 5.92 per cent. for fully 90.5 per cent. of its length, and a maximum grade of 7.12 per cent. on the steepest portions of the remainder. Its lowest point is at an elevation of 260 ft. above city datum and its highest at an elevation of 586 ft.

The pavement has armored concrete curbs throughout and storm-water inlets at the various street intersections. The crown is 5 in., the base is of 6 in. of concrete, the asphaltic binder course is 1½ in. thick, and the asphaltic surface coat is 1 in. thick.

The road winds in and out through a forest of eucalypti and pines, with occasional vistas of the Pacific. It is almost devoid of tangents, and in general is made up of long and easy curves. It adjoins some of the finest residential tracts in the city. Along the line of this drive and its future easterly extension are two of the highest points in San Francisco, namely, Mt. Davidson and the Twin Peaks; while close to its westerly end lies the west portal of the Twin Peaks tunnel, just a little to the north.

Market Street Extension

Plan 1—Commencing at the present easterly termination of Portola Drive is a proposed extension which will be known as Corbett Ave. This is a part of the proposed extension under what is known as Plan 1 of Market St. to 24th St., where it will join with the remaining portion of the Market St. extension and continue on to Market St. at 17th St.

The section to be built under Plan 1 will consist of an asphaltic pavement 0.87+ mi. in length and 25 ft. in width. The base will be of concrete 6 in. thick, the asphaltic binder course 1½ in. thick, and the asphaltic surface coat 1 in. thick. A 5-ft. shoulder on the inner side, a 3-ft. concrete gutter, and an armored concrete curb complete the cross-section of the road as planned.

The average grade will be somewhat less than 6 per cent., and the maximum grade, which applies only for a short stretch, will not exceed 7.5 per cent. The highest point reached by this stretch of road will be at elevation 591, and the lowest, 511 ft. above city datum. This will be exceeded in height by only one other proposed boulevard, namely, the scenic drive that is planned to go around Twin Peaks mountain and reservoir. The estimated cost of this section of the Market St. extension, $40,000, is practically assured by the supervisors.

Plan 2—Beginning at 24th St. and joining with the section proposed under Plan 1, a second and final section of the Market St. extension is planned. This in its upper reaches will follow a winding course around the hills and connect with Market St. at 17th St., its extreme easterly

*Assistant City Engineer in charge of pavement design, San Francisco, Calif.

end, close to the east portal of the Twin Peaks tunnel. It is expected that when this link is completed it will be one of the most popular of the scenic boulevards in the entire city, affording as it will from its upper reaches an unsurpassed view of the city, the bay, the bay cities and a portion of the Golden Gate straits. On the other side of the ridge are stretches of forest, occasional clearings and the Pacific Ocean to the west.

Nineteenth Ave. Boulevard

Nineteenth Ave. Boulevard, one of the oldest oiled-macadam boulevards in the city, is being reconstructed to form an asphalt pavement. One contract recently let has been completed, so that there is now a stretch of asphalt pavement 40 ft. wide and 4000 ft. long. There is also being paved a second stretch of 3320 ft., and proceedings are under way to finish the paving of the entire boulevard, which is a little over 2 mi. in length.

This boulevard runs almost due north and south and connects the Sloat Boulevard and Lincoln Way, passing through the Sunset district, one of the largest residential sections in the city. The specifications for paving this boulevard are similar to those of the other boulevards. The estimated cost of these two contracts is $71,940.65.

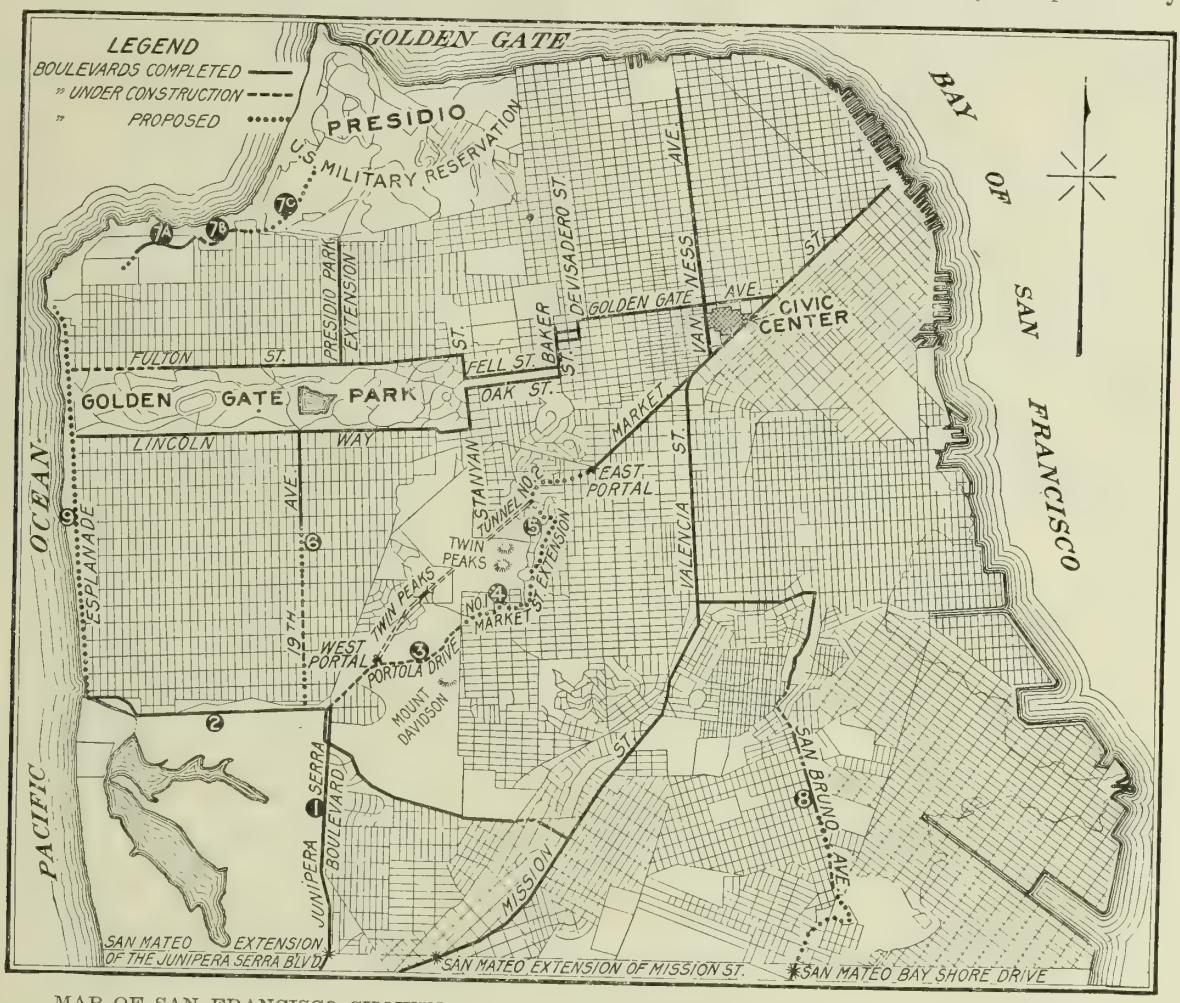
Ocean Boulevard

From the point of view of scenic beauty the boulevard planned for the north shore of the city, already partly constructed through the efforts of the city, the Panama-Pacific International Exposition Co. and the property owners, will probably surpass all the others. Although the alignment has been somewhat changed, the general plan proposed by the city engineer in 1913 very aptly describes the route as follows:

> A proposed Ocean Boulevard connecting the Exposition Grounds with the Cliff House and Ocean Boulevard, following the meanders of the bay shore, passing through the Presidio Reservation by way of Fort Winfield Scott, along Bakers Beach to Lincoln Park, and through Lincoln Park by way of Fort Miley Military Reservation to the Cliff House, thence to the Ocean Beach.

San Bruno Avenue Extension

Contracts have been let for paving and grading almost the entire unfinished portion of San Bruno Ave. so that when completed it will give a fine road to the county line, where it will join the recently completed Bay Shore Boulevard of San Mateo County. This will become a very popular drive, as it will afford egress from the eastern portion of the city, just as Mission St. affords a middle route and the Junipero Serra Boulevard a western exit down the Peninsula.



MAP OF SAN FRANCISCO SHOWING EXISTING AND PROPOSED SYSTEM OF BOULEVARDS

The Esplanade

With the assurance of an appropriation of $50,000 by the supervisors the initial work on the proposed Esplanade along the beach will no doubt soon be inaugurated, and in time the present antiquated and irregular, though scenically beautiful, Great Highway will give way to one of the most popular and elaborate boulevards in the system.

The entire work on this boulevard system is under the supervision of the City Engineer, M. M. O'Shaughnessy.

Building the Earth Embankment for Hill View Reservoir

By Arthur W. Tidd*

SYNOPSIS—Equalizing reservoir for Catskill water-supply system of New York City. Located just north of city line. Article details the method of stripping soil, laying 4-in. inner face, 2-ft. outer face, cleaning up slope and planting outside face.

Hill View reservoir, on the line of the aqueduct for the new Catskill water-supply for New York City, is located just north of the northern limit of the city of New York. It is an equalizing reservoir, the 900,000,000 gal. of water in the reservoir serving to modify the effect of the hourly fluctuation in the rate of draft in relation to the more uniform rate of inflow, and to maintain a nearly uniform head on the distribution system throughout the city. It also affords two or three days' supply in case of an accident to the aqueduct above the reservoir, and provides an ample supply for such an emergency as a large conflagration or a bad break in a street main in the city. The site is at the extreme southerly end of a comparatively narrow ridge, the highest site available for a reservoir in or near the city. By referring to the plan of the reservoir on page 501, noting the elevations of the adjoining property shown and knowing that the axis of the ridge runs from the position of El. 299 to that of El. 253, a very good mental picture of the site can be made.

Nature of Embankment

The reservoir is of the earth embankment type, an excavation having been made in the top of the ridge and the material so obtained placed around the edge of the site to form the reservoir embankment. About 3,000,000 cu.yd. of excavation were involved, the maximum cut being 44 ft. and the average cut 25 ft. The depth of water in the reservoir will be 36½ ft., the capacity about 900,000,000 gal. and the area of water surface about 90 acres. The elevation of the flow line is 295. The reservoir is uncovered and roughly rectangular, about 3000 ft. long and 1500 ft. wide. The formation is a very hard-packed, dense, glacial drift, containing many stones and boulders but no ledge rock. The material is well graded from a coarse sand down to a very fine rock flour, and is a most excellent one for a reservoir embankment. The sides of steam shovel cuts stood perpendicular for two years without change other than the scaling off caused by the action of frost.

The embankment may be described as an earthen dam constructed of carefully selected and thoroughly compacted material, and backed up by the remainder of the excavated material, which equals and in many places exceeds in volume that of the especially treated portion. The embankment on the water side was rolled in layer not thicker than 4 in. when compacted, while in the outer portion 2-ft. layers were allowed. It was on the outer portion that material unsuitable for the special impervious (4-in.) embankment was deposited together with the boulders or stones that the contractor did not elect to use for other purposes. The entire dependence for water-tightness was placed on the 4-in. or special impervious embankment (the former term was commonly used during construction, the latter one being the wording of the contract); the material in situ was impervious and no cutoff wall or core wall was provided. The bottom of the reservoir and the lower half of the inside slope were faced with concrete, but with no intention of providing additional water-tightness. No ledge rock and no springs were encountered in the excavation and no evidences of porous strata were ever observed; in fact, there was no stratification of any kind.

Preparation of Base of Embankment

The bonding of the base of the embankment with its foundation was done with extreme care. Portions of the site of the reservoir had been developed, roads laid out and several dwellings built, and there was one area of some 25 acres in use as a farm with house, barns, store houses and various outbuildings. The stripping of the top soil (which was done as a part of the contract) usually uncovered the original material; but around the dwellings a great amount of slow and painstaking work was required. Blind drains, pipe trenches, abandoned sewers, cesspools, and old cisterns were uncovered in the most unexpected places, and large fills of rubbish were found around the barns. Some fills were apparently made from cellar excavations and without careful scrutiny might have passed as material in its original position. All drains and pipes were followed to a terminus, the excavation being carried well below and on each side of the pipe. Over some areas a face cut was carried and the suspicions usually confirmed. As a final precaution before beginning the construction of the embankment, long test trenches were dug to intersect anything overlooked in the previous search.

From the finally stripped surface, small boulders and all stumps and large roots were removed. Large firmly embedded boulders were allowed to remain if there was room between them sufficient to operate the 10-ton steam rollers. Trenches were either filled by hand ramming or sloped enough to allow the roller to ride into and across them. Cisterns and the like were generally filled by hand ramming, as it was found that when filled by puddling it would be several weeks before the roller could cross them. Earth was placed around the boulders and rammed until sufficiently mounded to permit the roller to ride up onto them. Similar explorations were made over the base of the 2-ft. embankment.

Building the 4-In. Embankment

The stripped surface under the base of the 4-in. embankment was thoroughly scarified, usually with a road plow, to a depth of 3 or 4 in., and a thin layer of embankment material deposited and rolled. An excellent bond was thus effected between the original and the fresh material, and it may be stated here that this method was

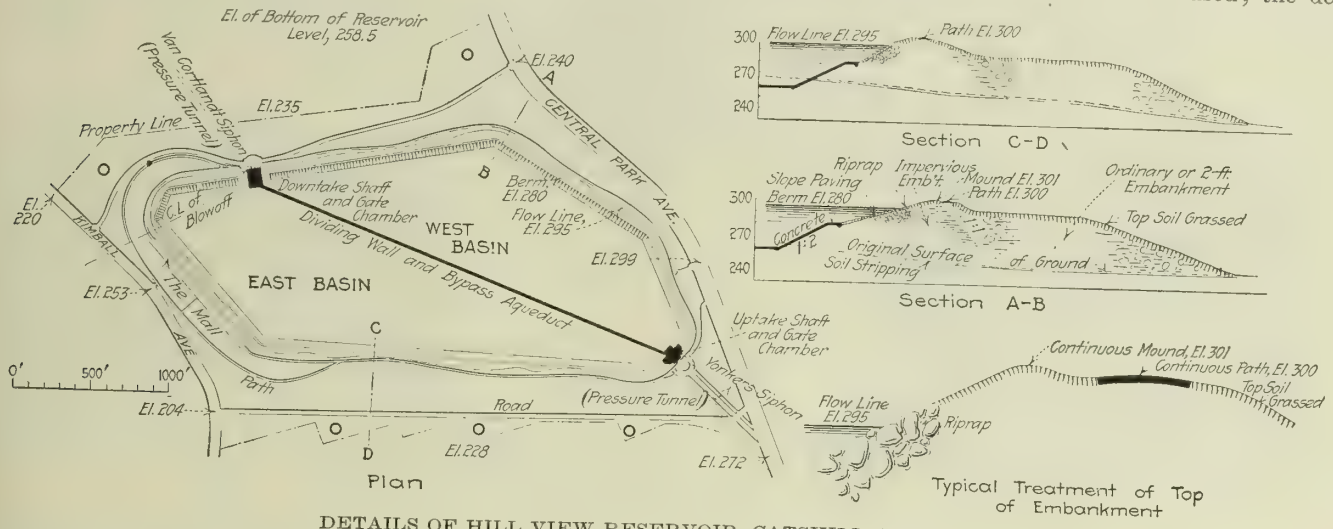
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used throughout the entire construction of the embankment whenever work was started on an area that had lain untouched for a time. The 4-in. layers were then started, beginning in the lowest part, keeping the top of the embankment practically level both normal and parallel to the axis of the embankment.

No system could be introduced into the work until a considerable area had been leveled up; the dumping areas were restricted, irregular in shape, disconnected and often obstructed by boulders. As soon as possible, 3-ft. gage track with 65- to 70-lb. rails was laid on the embankment and the material brought on in cars—4-yd. side-dumping cars in 10-car trains hauled by 10- to 15-ton locomotives. The tracks were laid in straight stretches as long as possible; which was nearly 2000 ft. on the two long sides of the reservoir. Two parallel lines of track were used until the embankment became too narrow to accommodate them, that point not being reached, however, until near the top. The trains were dumped in succession along the full length of the track and the material spread and leveled with a spreader-car into a layer about 6 in. thick.

As soon as the spreader-car had finished, usually in about four trips, the track was pulled away a certain definite distance, lined up exactly parallel to the previous position and was ready for trains again (see view No. 9). The track was pulled approximately into position by three or four teams of horses and then lined up by a track gang, who adjusted the ties and did any necessary spiking and bolting. The amount of the track throw was determined from careful observations taken on the compacted layers, for each layer when spread must just connect with the edge of the previously spread layer and when rolled must be 4 in. thick. The steam-shovel runners became expert in loading the cars to the limit and at the same time with a very uniform volume, for it was on that uniformity of volume that the success of the whole method depended. The system worked admirably and was used for the bulk of the bank. The track throw was in general 14 ft. The spreader-car was not able to spread the full width even when counterweighted, 10 ft. being about its limit, so the remainder was spread with a 4-horse road scraper. A stone gang worked continuously picking out and removing the boulders and stones larger than 3 in., in order to allow the roller to get onto the layer at the earliest possible moment. Here again the steam shovel runners coöperated by avoiding the larger boulders when loading for the 4-in. embankment.

Ten-ton rollers with grooved front wheel and cleated side wheels were used. They were run back and forth parallel to the track, moving over the width of the side wheel (about 18 in.) on each trip, thus making four rollings on each layer. During hot weather, the material required sprinkling to insure proper bonding with the preceding layer and thorough compacting. The watering was done by an ordinary street sprinkling cart drawn by horses, and the water was applied to the rolled layer before the new layer was dumped. A sprinkling car was tried, but given up, as it interfered too much with the regularity of the train movements. Shallow test pits were dug from time to time in the 4-in. embankment to prove the thoroughness of the compacting. The results were entirely satisfactory; the line of demarcation between successive layers could not be detected except where different colored material had been used; the degree of compactness was very uniform. That the bank was practically impervious was evidenced by the behavior of the small ponds of rain water that collected from every storm.



DETAILS OF HILL VIEW RESERVOIR, CATSKILL AQUEDUCT

The run of the excavation was constantly watched, but very seldom was there found material unsuitable for use on the 4-in. embankment. Material once worked over, such as trimmings from slopes and temporary road or track embankments when removed, was sent to the 2-ft. embankment, as it was found to be unsuitable for 4-in. work, the physical characteristics having been quite changed by the second handling. Wherever ponds collected after rain, the water and mud were removed before fresh material was deposited. On portions of the bank where no work was being done, the ponds were allowed to evaporate; but all material washed or disturbed in any way was removed before preparing to resume work.

Some difficulty was experienced in securing thorough compacting wherever the direction of track shifting was reversed. This occurred at points where the work of one track connected with the portion of the same horizontal layer placed by the other track and also along the edges of the bank. In such cases it was necessary to place two layers one on top of the other before the track was shifted, and in the rush to take care of the material as fast as it was sent out from the steam shovels, great vigilance was required to insure that the proper amount



BUILDING the HILLVIEW RESERVOIR for CATSKILL AQUEDUCT NEW YORK CITY

① Typical cut for large steam shovels
② Excavation operations in progress
③ Building 4-in. embankment (on left) and 2-ft. embankment (on right)
④ Outside slope before smoothing up
⑤ Smoothing up and grading outside slope
⑥ Placing top soil by Koppel car method
⑦ Outside slope finally graded and top-soiled
⑧ Wheelbarrow seeding machine and roller
⑨ Pulling track on 4-in. embankment
⑩ Spreader car on 4-in. embankment
⑪ 4-in. embankment being built

of rolling was given the under layer. Modifications of the system were of course necessary at such places as temporary roadways, around structures and at the sharper changes of alignment in the embankment. Sometimes a big track shift would be made on a Sunday, leaving a portion of the bank unfinished. Here, the trains were usually supplemented by wagons (see view No. 3); but if of sufficient volume would be handled by a special single track where time could be taken to spot the cars and make the frequent necessary track changes. Altogether, only about 30 per cent. of the material was brought on in wagons. All spreading and leveling of the wagon dump was done with 4-horse road scrapers, after which it was rolled in the usual manner. In general, the bank was kept level as it was built up, but necessary depressions, as where the tracks came up out of the excavation, were left with a very flat slope in all directions. When the depression was filled and wherever the bank was brought up against a sloping surface, the layers were kept horizontal, each one being feathered out to a thin edge when it reached the sloping surface.

With the exception of a few very small local areas in the angles of the two gate chambers, the entire bank was consolidated with 10-ton steam rollers; hand ramming or puddling was done over those areas. No pipes or drains were allowed to be placed anywhere in the bank; all the water impounded in the excavation from storms was pumped out over the top of the embankment until the concrete conduit built for the purpose of draining the reservoir was completed. This conduit was located in the original material well below the base of the embankment, was thoroughly bonded with the sides of the trench excavated for it and provided with several concrete cutoff walls. It was absolutely the only opening through or beneath the embankment, the aqueduct entering and leaving by vertical shafts within the reservoir.

The delay on the 4-in. embankment caused by rain was slight where a systematic effort was made to keep the top on a light grade crosswise to insure a runoff. Where the top did not drain, the last layer would soften, ponds would collect and it might be several days before the bank would be properly dried out and ready to receive fresh material. If work was started before the bank was pretty thoroughly dried out, it soon became of a quaking, rubbery consistence, sinking under the roller and trains and coming to a smooth surface again after they had passed. Additional layers did not improve matters for they promptly developed the same characteristics. Such conditions of compacting were thought to be undesirable and were avoided. Work was continued into the fall as long as the fresh oncoming material would thaw out the frost in the preceding layer, that point being passed when the frost would have set in about an inch during the night. When the frost was entirely out in the spring, as determined by test pits, the bank was carefully scraped down to undisturbed material and work resumed. No especial treatment was given the bank during the winter.

Building the 2-Ft. Embankment

The outside or "2-ft." portion of the reservoir embankment, slightly more in volume than the inside or "4-in." portion and backing it up, so to speak, was built up practically in conjunction with it. When conditions of frost or rain prevented material being placed on the 4-in. bank, the output of the shovels would be sent to the 2-ft. bank with the result that it might be raised above the 4-in. Under favorable conditions, when all efforts were concentrated on the 4-in., that might get ahead of the 2-ft., but the two were never very far apart. The 2-ft. bank was brought up in layers about 2 ft. in thickness, the top being kept roughly horizontal. All material unsuitable for use in the 4-in. work, together with the boulders, was sent to the 2-ft. bank, perishable material of course being excluded. Boulders were not allowed to be nested, a minimum limit of 6 in. of earth in the clear between them being required. No especial consolidation of the layers was required. In general the material was delivered in trains. No such system was developed as on the 4-in. work, although a certain regularity was introduced by sending the entire output of some shovels to this bank. Wagons were used on this bank also, about 30 per cent. being placed by them.

It was somewhat difficult to keep the outer face of the bank to the proper lines. Contours of this face were given on the working drawings, showing a rolling, undulating surface and stakes were set on each 5-ft. contour to bring the bank up roughly in accordance with them. The fact that the contours were not straight lines often necessitated considerable track movement, which was not always properly timed. The inside face of this bank, that is, the junction between the 4-in. and the 2-ft., was a plane surface on a 1 on 1 slope and was readily carried up to line. Work was allowed to extend into the winter until settled freezing temperature obtained. It was not resumed in the spring until test pits showed that all frost was out of the ground.

Settlement of Embankment

No settlement of the 4-in. embankment was ever detected, and from the evidence deduced from concrete structures built upon it and grade stakes given, the settlement must have been extremely slight if any at all. In the 2-ft. embankment, the layers settled about as fast as placed, reaching a condition of equilibrium well within a year after placing, subsequent to which no further settlement was appreciable. The embankment was five years in building.

The relative volume of excavation and embankment could not be determined, as it was impossible to separate the material in excavation between 4-in. and 2-ft. embankment; furthermore no estimate could be made of the volume of the boulders.

Excavation Methods

All the material was excavated by steam shovels and about 70 per cent. sent out on trains (see views Nos. 1 and 2). As long as the complete steam shovel plant could be operated, that is until the bank became so narrow on top that the dumping area was restricted, the material was taken up out of the basin by two tracks, one at the north and one at the south end, using pushing engines when the grade required them. Both lines were relocated and regraded several times as the banks rose. The steam shovels used for the bulk of the excavation were four heavy ones (about 70 tons) and four light ones (about 30 tons). The large shovels worked in the heavy cuts, taking the full cut, 40 ft. at the deepest point, at one time. These cuts were, however, shot ahead of the shovel with black powder. The small shovels took the lighter cuts, and in a few cases ran through in two lifts. The material was handled in 4-yd. side-dumping cars in 10-car trains by 10- to 15-ton

locomotives running on 3-ft. gage track laid with 65- to 70-lb. rails.

A large number of boulders of all sizes up to 1 yd., and in some cases 2 or 3 yd. in volume, were encountered everywhere throughout the cuts and their handling became an important factor in the general excavation problem. The original policy adopted by the contractors was to save them in the basin for future use in paving, riprap or for crushed stone for concrete or road construction, but the accumulation interfered so much with succeeding excavation operations that the following seasons as many as possible were sent out onto the bank either to be buried in the 2-ft. embankment or rolled over the edge for disposal at a more convenient time. A large force using a portable gasoline air-compressor for drilling was employed continuously breaking up boulders. Winter work helped some, but the problem was an ever present and troublesome one. The embankment was designed to take care of the entire volume from the excavation and the work was so done. There was no surplus to be disposed of and no shortage to be made up from outside borrow pits.

The distribution of steam-shovel yardage over the five years' work from 1910 to 1914 inclusive is as follows:

Years of Service	Tons Rating	Total Excavation, Cu.Yd.
1	60	21,600
5	60	600,300
5	70	694,000
4	70	409,900
3	65	249,600
4 ½	30	277,500
4 ½	30	176,200
2	30	122,300
4 ½	30	289,400
		2,840,800

Although monthly outputs ranging from 20,000 to 24,000 cu.yd. per shovel were not uncommon from the large shovels in the early part of the work, the yearly figures shown are much more indicative of the rates that may be useful for future studies. The shovels were in use practically all the time.

Final Grading of Top and Outer Slope

Less than 15 per cent. of the area of the top and outside slope of the embankment was required to be finished to fixed lines and grades, those areas being the paths, the access roads to the gate chambers, the marginal path around the reservoir and the mall at the southerly end. The marginal path was on a level grade with a ridge or mound uniformly one foot higher on the water side to prevent surface water from the path entering the reservoir. No fixed or formal treatment was given the rest of the slopes, in fact every effort was made to avoid such an effect. The grading was done entirely by eye, the slope being treated in long stretches and on broad lines to secure, in so far as possible, the effect of natural hill slopes.

The roads and paths controlled the grading in their vicinity and therefore were graded first together with the laying of all drains for taking care of the surface water. A tentative location had been made and stakes set for them while the bank was being brought up, but the whole question was now studied afresh, using actual cross-sections of the bank. Both horizontal and vertical alignment were modified to minimize the amount of material to be moved and still carry out the proper effect from a landscape point of view. The curves were of long radius and the grades easy. Plows, slip scrapers and hand casting usually sufficed, but some wagon work was necessary at times. The marginal path and mound were brought up with a car dump, but the work was carefully done and was finished principally by hand with some scraper work (see views Nos. 4 and 5).

On the balance of the slope, plows and slip scrapers were used supplemented by a small force of men with hand tools. Very little movement of material longitudinally along the slope was required, the desired effect being obtained usually by rounding off the upper portions and slipping the material down the slope. In many places large gullies had been eroded by the elements during the several seasons that had elapsed while the bank was being built, but in most cases these were filled or leveled by local treatment without the necessity of bringing on additional material. Some of the boulders encountered in the "smoothing up" process were rolled down the slope and removed while many others were buried.

Placing Topsoil on Slope

The bank as finally graded was ready for the placing of topsoil without further treatment. The surface was loose as a result of working over it, and an excellent bond with the soil resulted. A small amount of soil was placed in the fall of 1914, and from the experience of that year, the two methods used for the rest of the work were evolved. The balance of the work was done in 1915. The soil had been stripped from the reservoir site in advance of all other work and deposited in five large piles around the edge of the taking and beyond the toe of the embankment slope, a total amount of about 100,000 cu.yd.

By one method the soil was loaded from the soil pile by hand into 1⅓-cu.yd. Koppel cars running on a 2-ft. gage industrial track, hauled up the slope with a cable by an electrically operated hoist located at the top of the slope, and dumped and spread by hand (see view No. 6). Two cars were handled at a time. They were hauled from the soil pile to the foot of the incline by a horse. The track was shifted after a section of soil had been deposited the full height of the slope. By running the hoisting rope around a sheave at the head of the incline, the sheave being anchored to a deadman by an adjustable line and moved whenever the track was shifted, the hoisting engine could handle a long stretch of slope from one position.

By the other method the soil was loaded from the soil pile by steam shovel into 4-yd. dump cars running on a 3-ft. gage track, hauled to the top of the slope in six-car trains by two 15-ton locomotives and dumped over the edge of the slope. Previously constructed permanent access roads and paths provided a convenient location for most of the track. From the track the soil was spread down the slope by one-horse slip scrapers. A modification of this method was used on some of the longest slopes whereby each car was dumped into a flat wooden box on runners holding a car-load. The box was hauled down the slope by a hoisting engine located at the foot of the slope, emptied by means of an additional rope from the hoist, and hauled back to the train again to receive the next carload. The soil was handled longitudinally along the slope from the windrow of loads by one-horse slip scrapers as before. By this modification the train was held longer than by the original method, but the scraper haul was much shortened. On all slip-scraper spreading, it was necessary to supplement the scrapers with a small force using hand tools to obtain a uniform depth of soil and a properly finished surface.

The Koppel-car method was economical where the haul was short, as on the east side, but the train method was better adapted to the long hauls.

The thickness of the layer of soil was generally 9 in. measured normal to the slope. The thickness was kept constant by means of short stakes or pegs driven at frequent intervals over the area being covered where soil was placed by the Koppel-car method, but where slip scrapers were used, it was necessary to test the thickness by small test holes.

Planting the Slope

The surface was prepared for seeding by a force with iron garden rakes. On the prepared surface, Bradley's seeding-down manure was spread to the amount of 600 lb. per acre, and the following mixture of grass seed sown:

	Lb.
Kentucky blue grass	10
Rhode Island bent	15
Red top	25
White clover	10
Timothy	5
Total per acre	65

In addition, rye to the amount of 15 lb. per acre was sown on the areas seeded in the fall, but in less amounts or omitted entirely on the spring work. The rye and fertilizer were sown by hand, but the rest was sown by a Thompson wheelbarrow seeder, sowing a swath 13 ft. wide (see view No. 8). After sowing, the soil was lightly raked and then rolled with a light wooden roller about 8 in. in diameter and 6 ft. long. On the slope, a small wheel was bolted to the handle and the roller lowered down and pulled back by a rope. One man could handle it on a short slope, but as most of the slope varied from 100 to 200 ft. in length, a light windlass mounted on a wooden frame was usually used. Two men were required on the windlass and one to guide the roller.

Sprinkling was necessary in the fall of 1914 to supplement the rains, a line of 2-in. pipe being laid with outlets for hose connections. Some revolving lawn sprinklers were used and on some areas a hose and nozzle. In general the grass came quickly and satisfactorily. Some annoyance was caused by weeds coming up from seed brought on from the soil piles.

The grass did not get a good start in places on the area sown in the fall of 1914, and some gullies were cut by the rains during the following winter and spring. There was no sloughing off or sliding of the soil down the slope. Repairs were made by driving down the slope with a wagon, dumping the soil where needed and spreading it with hand tools. The steepest slope was 1 on 2 and that obtained for only a few hundred feet near the downtake chamber, usually the steepest portion was nearer 1 on 3. No berms were built anywhere. The surface water intercepted by roads or paths was led by gutters to catch basins and taken into the drainage system built for the purpose. Gutters were usually paved but were grassed where the grade was light. At the time of writing the results obtained by the above described methods are entirely satisfactory. A small amount of erosion of the fresh top soil occurred during the heaviest storms on the slopes where the grass had not attained a good growth. Repairs were made by a small gang of men carrying sacks of soil, sprinkling it where needed and immediately scattering grass seed.

A previous article (*Engineering News* of Oct. 16, 1913) described the sanitary features of the Hill View reservoir work, quoting the sanitary provisions of the contract and giving in detail the way they were worked out. A large camp was built for the accommodation of the labor force, all wastes were disposed of by incineration or septic tank treatment and a constant supervision maintained over the health and living conditions of the employees. Portable pan closets were provided for the use of the men on the work. They were moved about as needed. One heavy galvanized iron pan, 15x18x8 in., was supplied to each closet. The pans were changed daily and the contents incinerated in a central incinerator.

J. Waldo Smith is Chief Engineer of the Board of Water Supply with Department Engineer Frank E. Winsor and Division Engineer Charles E. Wells in charge in the field. The contractor is the Keystone State Construction Co. of Philadelphia, Penn.

Statistics of the Earnings of Graduate Engineers

The dean of one of the state universities in the Middle West recently undertook an inquiry as to the incomes earned by graduates from the university's engineering school. Until 1905, the engineering instruction in the university was given by a department of civil engineering, but in the latter year a separate college of engineering was organized.

The graduates were asked to give their income derived directly or indirectly from their work as engineers or contractors for each year since graduation up to the present time, so far as they were able to report their income in earlier years from memory or records.

The blank sent to be filled out was inclosed in a blank envelope which was inclosed in an outer addressed envelope so that those compiling the records could not identify the person reporting or even his locality. It is noteworthy that only half a dozen of the graduates reporting were members of the American Society of Civil Engineers.

Replies were received from 46.5 per cent. of all the engineering graduates, and from these replies the statistics in the accompanying table were compiled.

INCOME STATISTICS OF GRADUATES IN ENGINEERING FROM A WESTERN STATE UNIVERSITY

Years Out of College	Number Reporting	Highest Income	Lowest Income	Average Income	Per Cent. Above Average	Per Cent. Below Average
1	166	$4,000	$150	$884	40	60
2	152	7,000	400	1,115	28	72
3	136	4,000	300	1,225	34	66
4	119	4,500	600	1,379	31	69
5	94	5,000	420	1,498	32	68
6	80	4,000	600	1,596	48	52
7	73	3,400	720	1,697	48	52
8	63	5,000	650	1,786	47	53
9	53	7,000	840	1,996	38	62
10	50	8,300	1,020	2,296	30	70
11	43	10,300	800	2,530	28	72
12	34	13,200	800	2,819	26	74
13	35	20,000	900	3,127	21	79
14	30	40,000	900	3,927	13	87
15	31	33,000	1,000	3,884	13	87
16	28	21,800	800	4,252	11	89
17	25	27,500	* . .	3,440	16	84
18	23	37,000	1,000	4,671	13	87
19	21	27,000	1,500	4,663	19	81
20	17	23,000	2,000	5,946	24	76
21	17	33,000	2,100	7,734	29	71
22	16	42,500	2,100	8,006	19	81
23	16	46,000	2,000	7,687	25	75
24	13	33,500	2,100	8,172	23	77
25	10	14,800	2,100	4,630	30	70
26	7	13,500	2,100	4,671	14	86
27	5	19,700	1,500	6,340	20	80
28	5	22,500	1,500	6,980	20	80
29	3	4,200	3,000	3,567	33	67
30	3	4,500	3,000	3,833	67	33
31	3	4,500	3,000	4,075	75	25
32	3	4,500	3,700	3,983	33	67
33	2	5,000	3,700	4,350	50	50
34	1	5,000	5,000	5,000	0	0
35	1	5,000	5,000	5,000	0	0

*Indefinite loss reported for this year.

Field and Office

Efficient Traveling Derrick

The Dravo Contracting Co., Pittsburgh, in its construction work on Ohio River dams and bridge piers, uses many self-contained rotating derricks of an original type. In the company's work these are called "whirler derricks." The drawing, Fig. 1, shows the standard 10-ton derrick as designed and built by the company. The structure is framed of timber and the power comprises a standard hoisting engine and a separate swinging engine. The hoisting engine also takes care of traveling, a line carried ahead and passed around a spool of the engine being used to move the derrick forward on its track.

The derrick comprises an underframe of 10x12 and 12x12, mounted on six small truck-wheels on 14-ft. gage. This underframe carries a circle rail about 16 ft. in diameter. The upper or derrick frame has a similar circle rail on its under side. Between the two rails is a roller or wheel ring held at proper spacing by a circular angle, which also serves as bullwheel for the swinging rope.

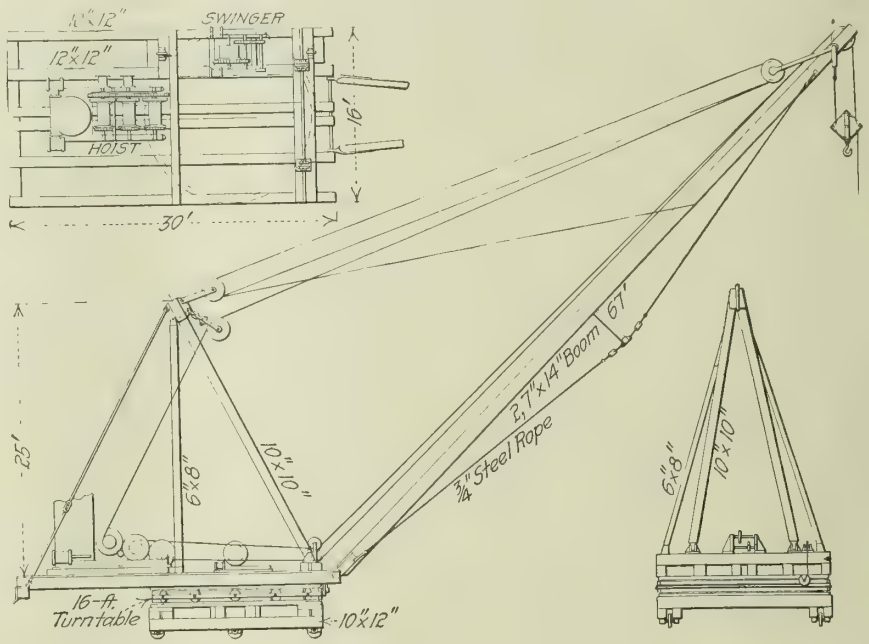


FIG. 1. STANDARD 10-TON WHIRLER DERRICK OF DRAVO CONTRACTING CO.

The mast (inclined) and the boom are both made of two timbers set in A-shape, which gives lateral stiffness in swinging. The boom is journaled on a shaft seated in the forward end of the main frame timbers, and thus transmits its thrust directly back to the tension guys at the rear of the frame.

These machines operate on a short section of track, which is shifted from the rear to the front of the machine as it moves forward. By this ready portability and their simplicity and ease of handling they prove convenient in a variety of locations, on cribs or coffer-dams as well as on land surface. They are easily dismantled for shipment.

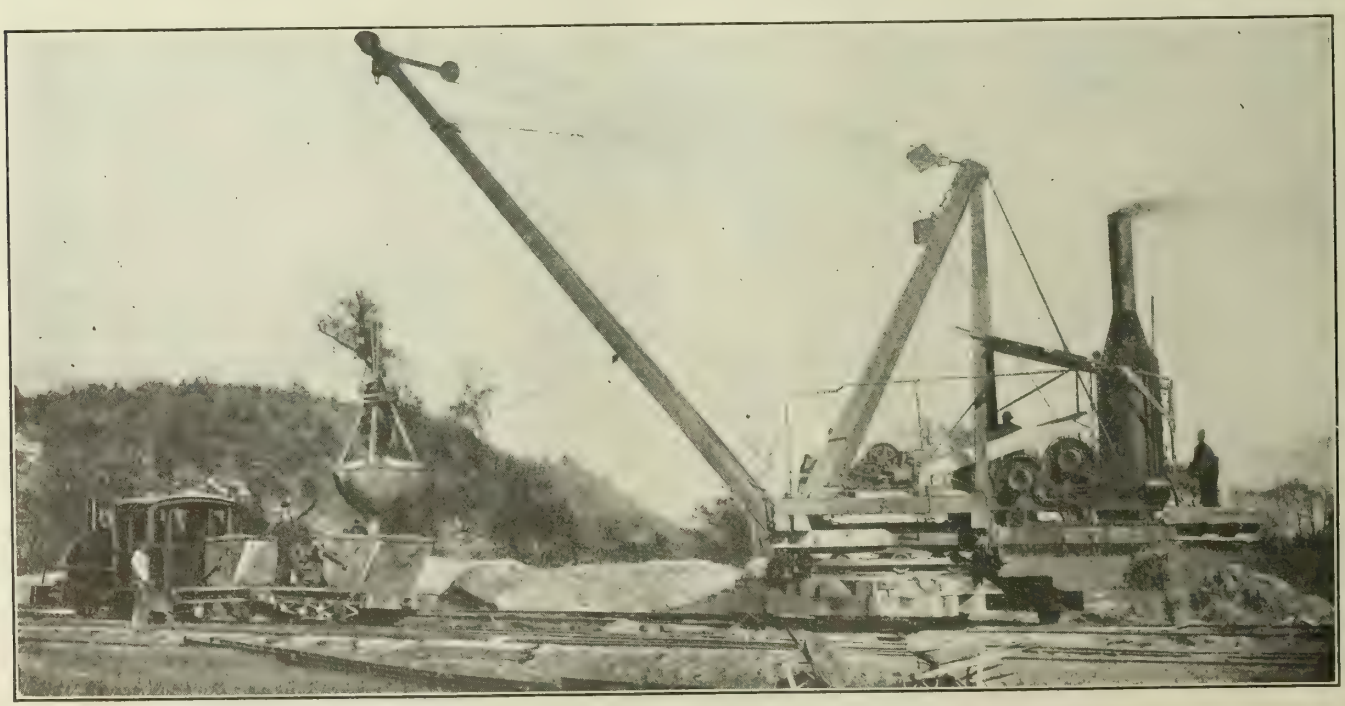


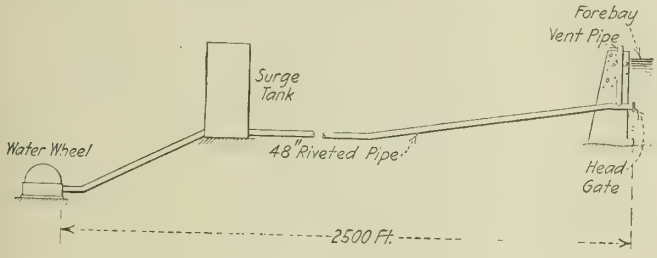
FIG. 2. DRAVO WHIRLER DERRICK ON PIER EXCAVATION FOR SCIOTOVILLE BRIDGE

Opening Headgate Causes Penstock Surges

By W. D. Spengler*

A most unusual and startling case of penstock surges has been dealt with by me, and as the trouble was so extraordinary the details are presented here for professional discussion.

There was a 48-in. penstock about 2500 ft. long laid nearly level for 90 per cent. of its length. There



PENSTOCK WHICH GAVE FILLING SURGES

was a drop of some 15 ft. in the first 100 ft. and a drop of 25 ft. in the last 50 ft. At the intake a 6-in. vent pipe was installed immediately back of the headgate for the specific purpose of furnishing air to the penstock when it was being drained. A head of about 12 ft. was imposed on this gate and the operation of opening was slow and somewhat more difficult than expected, for although 48 in. in diameter, it had no bypass or pilot valve.

In testing the penstock just after erection the foreman proceeded to open this gate and fill the penstock. The gate had been lifted a little, possibly an inch, when an explosion occurred and a spout of water shot out of the vent pipe and up into the air 60 to 80 ft. At the first explosion the foreman had jumped to a place of safety, but after a few seconds he returned and started to open the gate further. Then came a second explosion and water-spout. Without hesitating longer, he stepped to the bank of the ravine where he was safe and from here noted the recurrence of this phenomenon for several minutes. Each succeeding one was less violent, but all

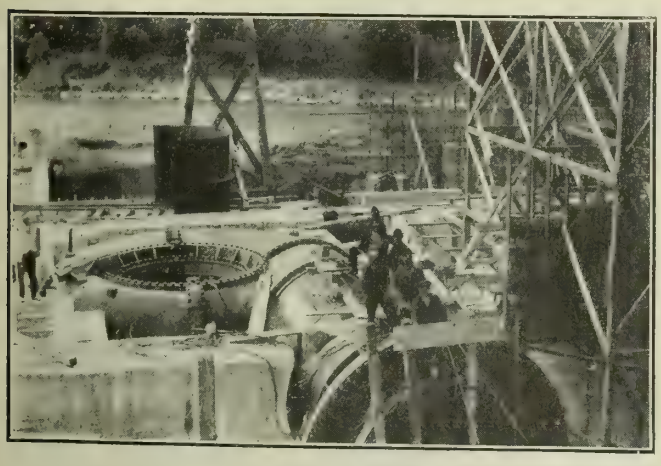


FIG. 1. TURBINE CASING AND STOP VALVE AT ONEIDA PLANT

occurred with regularity. After a time the pipe was filled and the action ceased. Upon examination no damage to the penstock or valve was found to have been done. Inquisitiveness led the foreman to empty the penstock and repeat the operation of filling it. As a rough means of judging of the force of water spouting from the vent pipe, he placed a barrel over the top of the opening. Under the first impulse this barrel was carried fully 50 ft. into the air and fell back over the concrete spillway into the ravine below. The regular series of explosions and spouts was repeated.

Although it may now be seen that the surges were caused by opening the headgate, this result could hardly have been predicted. The incident affords an excellent physical simile of the action of heavy surges in long electric transmission lines.

*606 Citizens Building, Cleveland, Ohio.

Two New Large Johnson Valves

Two 12-ft. Johnson cylindrical stop valves have been installed recently at the Oneida plant of the Utah Power & Light Co., near Phoenix, Utah, to control the admission of water to two 10,000-hp. turbines running under 140-ft. head. These are the largest valves of this type yet made.[1] The Oneida valves are set outside the foundations of the turbine casings to secure minimum size of building. Otherwise the valves would have been connected

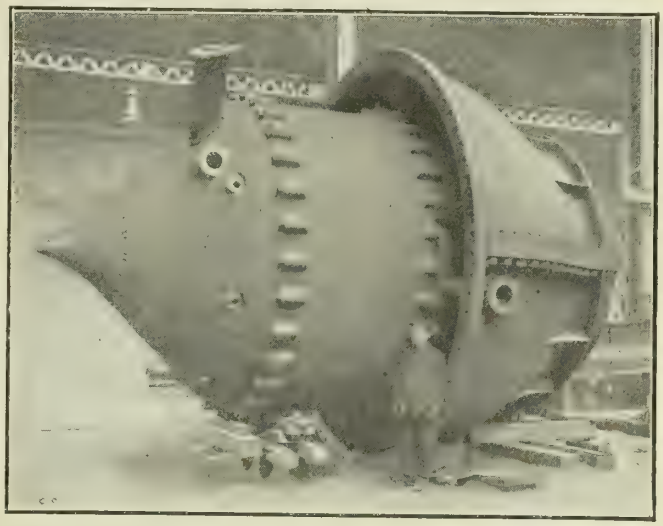


FIG. 2. CAST-STEEL CASINGS FOR 12-FT. JOHNSON VALVE

directly to the turbines. The rear part of the valve casing is of steel plate for economy; the rest is of cast steel, except for the bronze seat and ring.

When the valves are partly open the plungers may become unbalanced by débris and a transverse thrust be set up. Runways with monel-metal faces are provided to guide the plunger and prevent damage from this side thrust. A reach rod attached to the plunger works an outside indicator through a bell-crank shaft in a gland. Besides the indicator pointer, small incandescent lamps show ¼-, ½-, ¾-, and full-closed positions.

After the valve is calibrated it may be used as a venturi meter. The approach and throat ratio is 2:1 compared with 4:1 in the ordinary venturi tubes.

These valves were made by the Wellman-Seaver-Morgan Co., of Cleveland, Ohio.

[1]The design of this type was described in "Engineering News," Dec. 3, 1914. It consists essentially of a cylindrical body, forming an enlargement of the pipe line, with an internal cylindrical chamber containing a plunger of nearly the same diameter. The closed end of the inner chamber and the nose of the plunger are shaped to guide the water smoothly. The plunger seats against a ring in the outer casing.

Enlarging an Old Concrete Retaining-Wall

By George Paaswell*

In rebuilding an old embankment along the White Plains Road extension of the present Bronx subway, it became necessary to utilize the full width of the parcel for trackage on the road. This necessitated increasing the height of the original retaining-wall by about 11 ft. (see Fig. 1). For most of its length the present wall is on piles of which there are three rows, the spacing of the rows (longitudinally) being 3 ft. It was computed that the new wall with backfill would not overstress the piles, but that pending the placing of the earth backing the weight of the wall itself would seriously overload the inner rows of piles. Hence it was deemed advisable to drive another row (shown full in Fig. 1).

The derrick that was used for handling the spoil from the trench for the wall was also used for driving the piles, by a steam hammer working in leads suspended from the derrick boom.

The old wall consisted of 50-ft. sections, and the new wall of course merely extended these sections. The work was prepared for by excavating back of the wall, two sections or 100 ft. at a time. As the embankment was new it required heavy sheeting and timbering. Then the piles were driven.

There was one expansion lock in the old wall, and this lock was carried up through the new wall. The old lock stopped 2 ft. below the top of the old wall and it was necessary to cut out the concrete to reach it and make the pitch filler continuous at the joint. The old coping was removed to about 6 in. from the face of the wall, for architectural reasons and also to insure a better bond. Stonemasons trimmed off the broken part of the coping to obtain a straight line at the junction of the old and new wall.

The footing concrete was poured up to the batter point of the wall and large bond stones were inserted as keys. The forms were then built (see Fig. 2). A platform was built over the middle of the section and a mixer placed at each side. Closed chutes hung from the mouths of the mixers, and sections were added as required in the pouring.

The mixers were of the one-bag-batch type run by gasoline. This wall above the footing contained about 230 cu.yd. per 50-ft. section, and when light permitted we always attempted to pour it in one pour, running from 4 a.m. to 8 p.m. in two shifts. Only in one instance, however, were we successful in doing this. Usually the weather interfered or the mixers broke down. When there was doubt of completing the pour the lift was stopped 1 ft. below the top of the old wall (Fig. 1), a longitudinal timber form being inserted to constitute a key for the upper lift.

*Section Engineer, Public Service Commission for the First District, New York City.

The disadvantage of using small-unit mixers lay in the fact that the consistency of the batches varied considerably and the mixer required constant watching to prevent too wet a mix.

The face forms were stripped in 48 hr. and rubbed down. The back forms were left on longer as the sun shone directly on the back of the wall for a large part of the day and the concrete would have dried out too quickly. Although the original part of the wall is over five years old and a different brand of cement was used the wall appears monolithic at a comparatively short distance away.

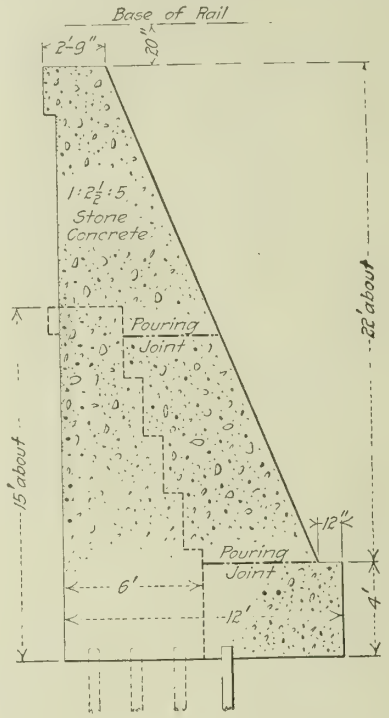


FIG. 1. OLD AND ENLARGED RETAINING-WALL

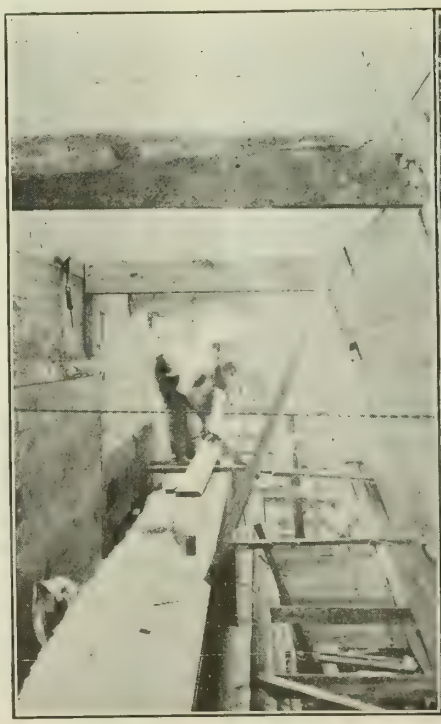


FIG. 2. INSIDE OF WALL FORMS

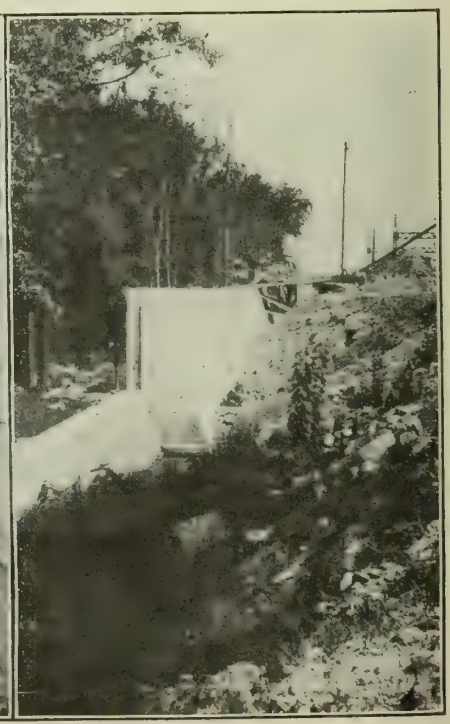


FIG. 3. COMPLETED SECTION OF WALL

The entire section of the wall that required enlargement was about 400 ft. long and contained a little over 1100 cu.yd.

The wall was built by the J. B. Malatesta Co., subcontractors for the Oscar Daniels Co., under the supervi-

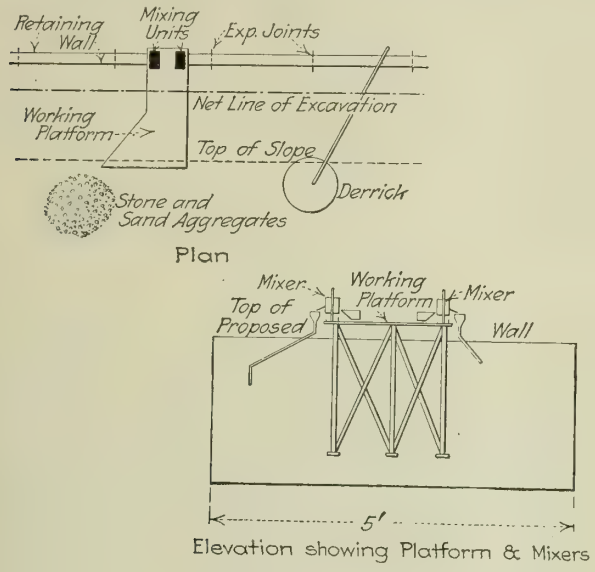


FIG. 4. LOCATION OF TWO-MIXER PLATFORM

sion of the Public Service Commission of the First District. C. V. V. Powers is Division Engineer, A. E. Clark Assistant Division Engineer in charge of all Bronx work, and the writer is section engineer.

Measuring Cement and Water in a Mixing Plant

The troubles that may arise from putting the wrong quantity of cement or water in a concrete batch are avoided by a pair of ingenious devices arranged by Harold E. Ketchum, contractor's superintendent, in the concrete-mixing plant used by the Hunkin-Conkey Construction Co. in building the east half of the Detroit-Superior viaduct, Cleveland.

Tipping Pan for Cement

The concrete is mixed in six-bag batches. Bags of cement are brought by a cable-hauled self-dumping car from the storehouse to the charging platform of the mixer house. The operation of emptying six bags into each charge involves delay, which is important whenever the concrete is being called for at maximum rates—and there is always the chance of the workmen making a mistake in the count, putting too many or too few bags in.

The charging hopper is double, one hopper under the stone gate and one under the sand gate of the bins above. A tipping pan has been set just alongside the sand hopper. The pan holds exactly six bags of loose cement. The cement handlers, therefore, need not count the bags, but simply fill the pan level full, which eliminates the chance of mistake. The pan being filled while the hoppers are discharging into the mixer and being refilled from the bins, it is ready to tip the cement charge into the sand hopper without loss of time.

The arrangement works well. It largely eliminates the necessity of an engineer's inspector on the charging platform.

On the opposite side of the charging hopper is a water barrel with a capacity equal to the water required for a batch. The 2-in. water pipe over the top of this barrel fills it up to a gage mark which defines the quantity needed for a batch. The barrel is tipped into the charging hopper while the stone is going down through into the mixer below.

As compared with the plan of running water by a pipe direct into the mixer, under control of the judgment of the mixerman, this arrangement is obviously superior. It goes a long way toward making successive batches of concrete uniform.

Diagram for Determining Pavement Crowns

By Charles W. Barber*

In determining the proper crown for asphalt- and concrete-paved streets of widths less than 50 ft., the formula, $C = \frac{W\ (100\ -\ 4\ P)}{6300\ +\ 50\ P^2}$ (T. J. Powell, *Trans.* Am. Soc. C.E., Vol. LXXIII, 1911, p. 225) is used by the Engineering Department of the District of Columbia. By combining this formula and the one for rate of transverse grade, $d = \frac{8\ C}{3\ W}$, I obtained $d = \frac{8\ (100\ -\ 4\ P)}{3\ (6300\ +\ 50\ P^2)}$. For this last formula the accompanying diagram, Fig. 1, is plotted.

It will be noted that the formula shows that the transverse grade is dependent upon the longitudinal,

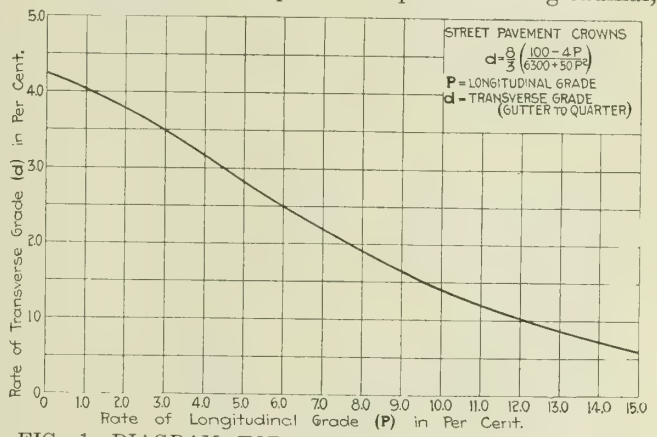


FIG. 1. DIAGRAM FOR DETERMINING CROWNS OF STREET PAVEMENTS

or curb, grade only, and does not include the width of roadway as do other formulas for determining crowns. Consequently the formula is readily adapted to diagram form. The basis of the formula, as mentioned by Mr. Powell in the reference given, is that a vehicle traveling upgrade along a line making an angle of 45 deg. to the curb line, in reality is very nearly on a level plane during the interval between the "quarter"[1] and the curb.

The method by which the transverse grade and crown cross-section are determined will now be shown.

C = Crown, or elevation of center of roadway above gutters;
d = Rate of transeverse grade, gutter to "quarter";
h = Difference in elevation of gutters;
P = Rate of longtitudinal grade (curb grade);
W = Width of roadway;
X = Eccentricity of high point of crown.

*Transitman, Engineer Department, District of Columbia, Washington, D. C.

[1]"Quarter" signifies the points midway between the high point of the crown and the gutters.

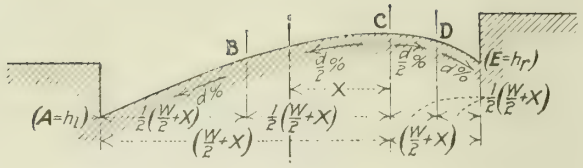


FIG. 2. METHOD OF DETERMINING PAVEMENT CROWNS

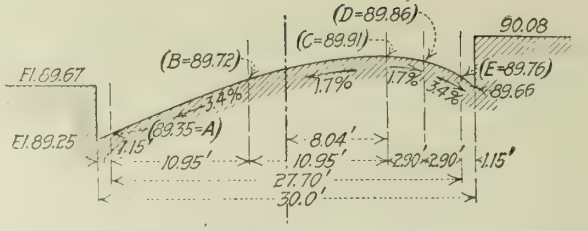


FIG. 3. ILLUSTRATING APPLICATION OF FORMULA AND DIAGRAM

$X = \frac{h}{\frac{3}{2} - d}$. Elevations are:

$A = h_1$ $\qquad$ $E = h_r$

$B = \frac{1}{2}\left(\frac{W}{2} + X\right)d + h_1$ $\qquad$ $D = h_r + \frac{1}{2}\left(\frac{W}{2} - X\right)d$

$C = B + \frac{1}{2}\left(\frac{W}{2} + X\right)\frac{d}{2}$ $\qquad$ $C = D + \frac{1}{2}\left(\frac{W}{2} - X\right)\frac{d}{2}$

To Use the Diagram—We begin by knowing the rate of longitudinal grade and then trace this ordinate vertically to its intersection with the curve, which point we then trace horizontally to the left, where we read the rate of tranverse grade d.

Crown Cross-Section—The accompanying Fig. 2 and equations indicate the general method in which the crown cross-section is obtained. It should be noticed that when the curbs are level $X = O$, and the high point of the crown is on the center line of the roadway.

Width of roadway (W)	=	30.00 ft.
Width of gutters	=	1.15 ft.
Elevation of left curb	=	86.67 ft.
Elevation of right curb	=	90.08 ft.
Rate of longtitudinal grade (P)	=	3.25 per cent.
Rise of gutter	=	0.10 ft.
Height of curb	=	0.52 ft.

Starting on the chart at $P = 3.25$, we find that this ordinate intersects the curve at $d = 3.40$ per cent. Our computations will be as follows (Fig. 3):

$$h = (90.08 - 89.67) = 0.41$$

$$X = \frac{0.41}{\frac{3}{2} \times 3.40} = 8.04$$

Subtracting the width of the gutter, W becomes $(30.00 - 2\text{x}1.15) = 27.70$

Then

$$\frac{W}{2} = 13.85$$

$$X = 8.04$$

$$\frac{W}{2} - X = 5.81$$

$$\frac{W}{2} + X = 21.91$$

$\frac{1}{2}\left(\frac{W}{2} + X\right)$		$\frac{1}{2}\left(\frac{W}{2} - X\right)$	
10.95	10.95	2.90	2.90
0.0340	0.0170	0.034	0.017
0.3723	0.1862	0.0986	0.0493

Elevations:

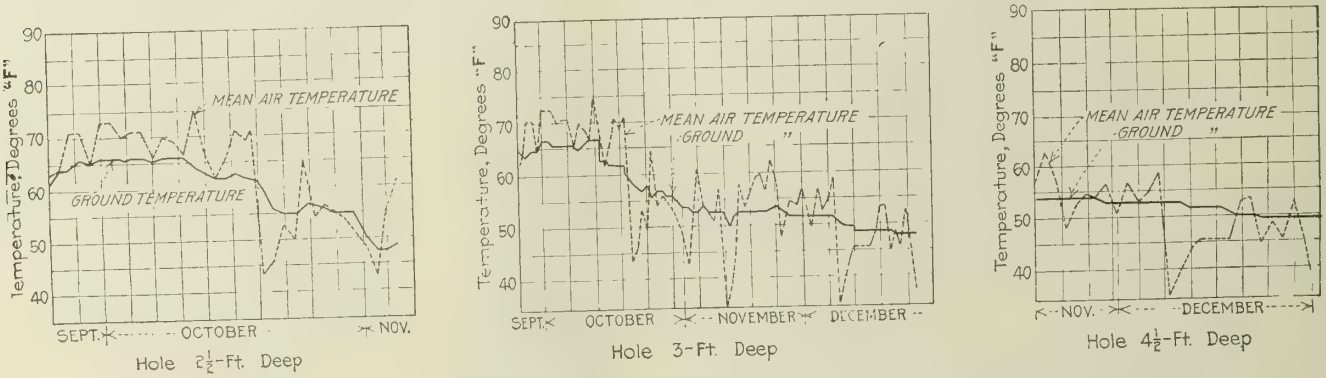
$A = 89.35$	$E = 89.76$
0.37	0.10
$B = 89.72$	$D = 89.86$
0.19	0.05
$C = 89.91$	$C = 89.91$

Ground Temperature Variations Decrease with Depth

By E. Lauchli*

In the notes on the design and construction of a reinforced-concrete dike dam at Mathis, Ga., in *Engineering News*, Sept. 2, 1915, was described the use of extra reinforcing steel in the cutoff wall made advisable to care for local stresses set up by the temperature changes at different depths.

The accompanying curves show the result of the studies, undertaken in connection with this work, to



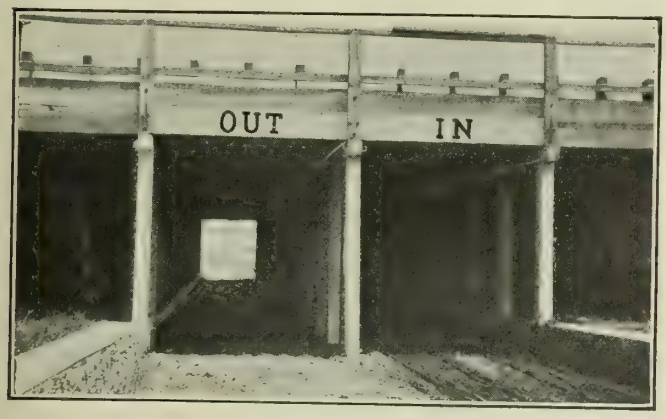
COMPARISON OF GROUND AND AIR TEMPERATURES IN BORE HOLES AT MATHIS, GA.

*2 Wall St., New York City.

ascertain the variation between ground and air temperature in various bore-holes of 2½ to 45 ft. depth. The curves require no explanation except perhaps to note that the ground temperature in the 45-ft. hole was the same throughout the year.

NOTES

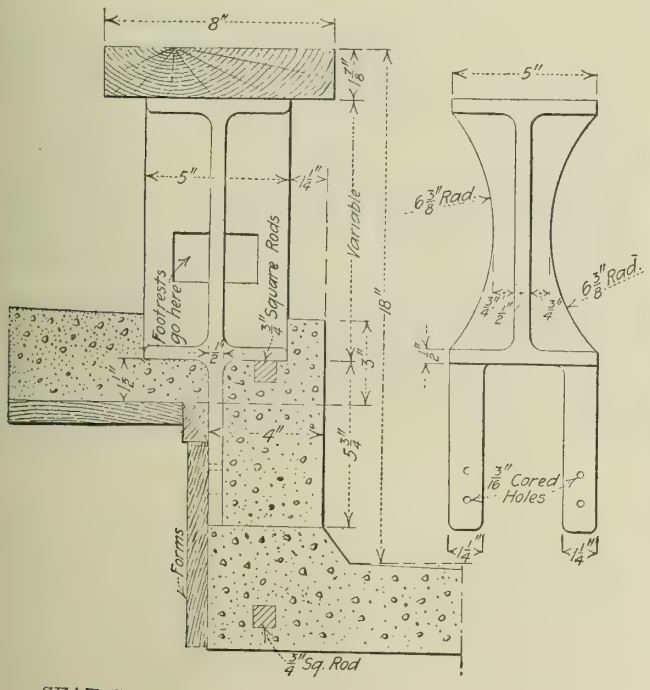
A Durable Timber Bridge is shown in the accompanying illustration. In spite of the fact that it carries an earth fill from 12 to 18 in. deep, it is sound and watertight. It was built in 1892 to form a subway under the Narragansett Park racetrack, near Providence, R. I. For many years this was a famous horse-racing track. It has been converted into an automobile speedway. The bridge is in 4 spans of about 8 ft. each.



A 23-YR.-OLD TIMBER BRIDGE WITH AN EARTH FILL AND A WATERTIGHT FLOOR

The 4x10-in. floor joists, spaced 2 ft. apart, are carried on 6x8-in. timber caps on rows of 6x8 in. posts. The floor is 3x10-in. planks, over which are four thicknesses of tar paper plastered on with hot tar. On top of this floor is the earth fill of the racetrack. The timbers are genuine long-leaf yellow pine and are as sound today as they were 23 yr. ago, and the floor is water-tight. Frederick E. Perkins in president of the Narragansett Park speedway.

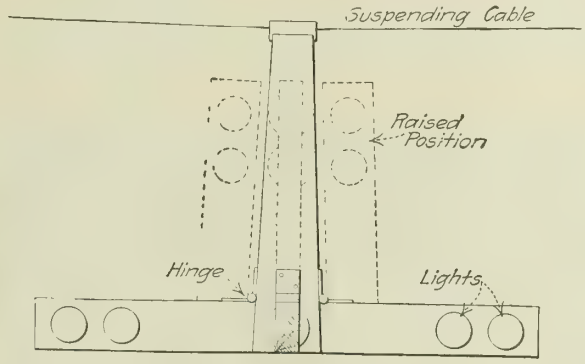
Cast-Iron Standards for Ball-Park Seats are being installed in the open stands and the bleachers of the new National League park on Commonwealth Ave. in Boston, Mass.



SEAT STANDARDS IN NEW BOSTON BALL PARK

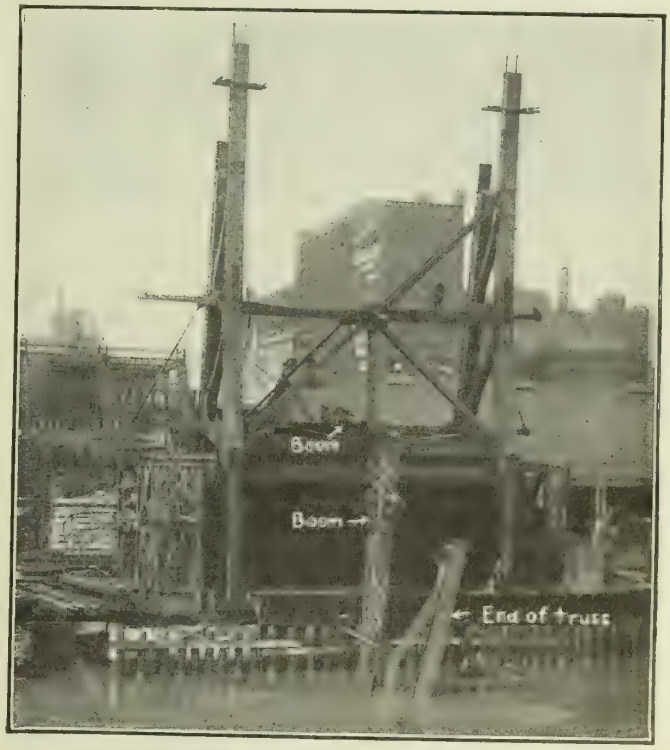
The stands in this park are of reinforced concrete, and in all of the open stands the seats are 2x8-in. plank screwed onto malleable cost-iron standards spaced every 3 ft. and embedded in the concrete of the steps during construction. About 12,000 of these standards are being used. The park structures were designed by the Osborn Engineering Co., of Cleveland, Ohio, and are being built by the James E. Gaffney Co., of Boston.

A Semaphore Type of Street Signal invented by a Cleveland policeman named Ketchum is being tried out in that city at the intersection of Euclid Ave. and East 9th St. Two cables are stretched from poles in diagonally opposite corners of the sidewalks. Hung from the wire cables at their intersections is a post about 3 ft. long, with arms



about 2 ft. long hinged near the bottom of the mast, as shown in the accompanying sketch. The signal is manually controlled by a policeman in a sidewalk booth. From levers here wires run to the signal, one for each blade or arm. The arms may be operated separately for left-hand turns, or in pairs for traffic moving along one street across the other and for right-hand turns. In addition to the position indication, in each arm is a red and a white light.

Failure of a Derrick on Bridge Erection—The fracture of a derrick iron caused the fall of a derrick, Aug. 25, while erecting the west leaf of the bascule bridge over the Chicago River at Jackson St., Chicago, Ill. The erection was illustrated

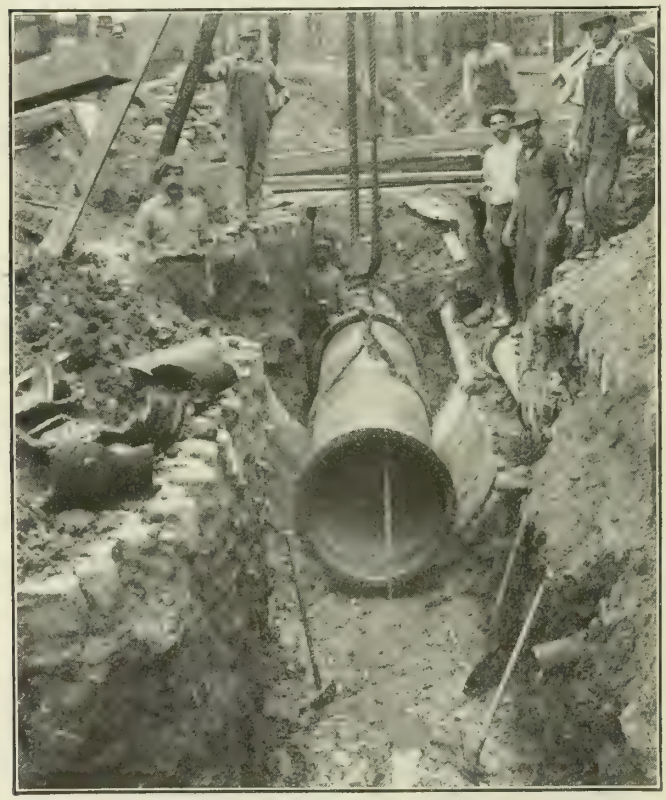


FALL OF A DERRICK WHILE ERECTING THE JACKSON ST. BRIDGE AT CHICAGO

in "Engineering News," July 22, 1915, but since that view was taken the leaf had been raised to a more nearly vertical position to keep its end clear of the channel. The derrick was placing a 22-ton section comprising the end panel of one truss

and a heavy transverse plate girder. The derrick iron holding the head of the mast to the stiff-legs broke, allowing the weight to pull the mast over. The steel boom fell across the completed work and doubled up, its main portion standing vertically with its head in the river. This is shown in the accompanying view, taken after the boom had been cut apart. The end of the truss panel is projecting above the water. The plate-girder was badly bent when recovered, being hauled up by means of tackle attached to the bridge.

Laying a Water Main Through a Storm Sewer—In the construction of an extension to the high-service fire-protection system of Boston, Mass., it was necessary to lay a 30-in. cast-iron pipe at right angles to a storm-water sewer having an internal diameter of 8 ft. As the top of this sewer was only 4 ft. from the surface of the street, which would allow insufficient cover for the water main, the sewer top was broken into and the main carried through the top of the sewer. To make a neat job and to create as little resistance as possible to the flow through the storm-water sewer, a



LAYING WATER MAIN THROUGH TOP OF SEWER

cast-iron cradle was designed to fit the diameter of the water main. This cradle rested upon the arch ring of the sewer where the latter was broken into. The accompanying view shows the main resting in the cradle. By the means described 28 in. of cover were secured over the water main. The bottom of the cast-iron saddle reached into the storm-water sewer a distance of 15 in. below the highest point of the crown of the arch.—F. I. Winslow, Engineer of Extension, Boston Water-Works.

The Great Northern Ry. Tunnel, 1733 ft. long, near Paola, Mont., with the exception of 500 ft. at the west end, was driven by the use of pneumatic-hammer drills of the "Jackhamer" type. The tunnel is 36 ft. wide and 32 ft. high, having a cross-section of 38 cu.yd. per lin.ft. The material is a sedimentary rock similar to soapstone in texture, but considerably harder. This rock is in strata inclined at 20 deg. to the horizontal and is very seamy and full of mud pockets. Water was frequently encountered. In the wall-plate drifts two 5-ft. rounds per 10-hr. shift could be driven, 14 holes 6 ft. deep to the round. This was possible because drilling could be resumed immediately after shooting, without loss of time in setting up bars and "mucking back." The rock remaining in the heading above the drifts was shot down upon traps erected in the drifts. A round here consisted of from 18 to 22 holes 10 ft. deep, which were drilled in from 3 to 4 hr. with two "Jackhamers." Ordinarily, drilling and mucking were completed in a half-shift. The most remarkable performance of the drills was shooting the bench ahead of the shovel. The "old timers" laughed at the idea and prophesied that tripod drills would have to be used. The bench contained 30 cu.yd. per lin.ft., and was excavated and timbered at an average rate of 20 lin.ft. per day. In order to break up this material, 60 to 70 holes 11 ft. deep were necessary. These were drilled with three or four "Jackhamers" regularly in 7 hr. An 11-ft. hole was frequently drilled in 10 min. The bench holes were drilled from the face because of insufficient overhead room to drill down holes. This prevented the drilling and the shovel excavation being carried on simultaneously.—H. King, of the Guthrie, McDougall Co., Paola, Mont.

Short Cuts in Surveying Computations—In examining the table on p. 363 of "Engineering News" of Aug. 19, 1915, I have been impressed with the conviction that a division by 43,560 can more easily be effected by the use of its reciprocal as a multiplier. If a given number of square feet is multiplied by 0.0000229568 the result will give acres and decimals. More conveniently this rule can be applied: Multiply square feet by 23 and point off 6 places, and multiply square feet by 43 and point off 9 places. Subtract the second product from the first and the result will give area in acres to a degree of precision within 0.001 acre in 100 acres. As an example:

4,356,000 sq. ft.		
× 23 and point off 6 places	=	100.188000
× 43 and point off 9 places	=	0.186908000
		100.001 acres

If greater precision is desired, instead of 43 use 432 as a multiplier for the subtractive quantity, pointing off in that case 10 places. Evidently, areas less than 10 acres may be obtained within a precision of 0.001 acre by using 4 as a multiplier instead of 43 and then pointing off only 8 places. Such a rule may be easily memorized or written in a notebook.—Horace Andrews, Albany, N. Y.

Conveying Automobile Parts by Wire-Rope Tramway between departments 780 ft. distant is now accomplished at Plant No. 3 of the Studebaker Corporation, Detroit, Mich. The carrier cable is 1¼ in. in diameter, the longest span being 178 ft. The traction cable is operated by a 10-hp. electric motor. The system is shown in operation in the accompanying view. By this means automobile bodies and wheels are sent to the



CABLE SYSTEM FOR TRANSPORTING AUTOMOBILE PARTS

assembling department. Formerly, these parts were taken down an elevator from the third floor of the finishing department, trucked through a tunnel to the assembling building, and there elevated to the fourth floor. By the old method 12 min. was required for delivery of a body, with four men to handle it en route. By the new method two men at each terminal tend the conveyor, and as many as 41 bodies have been delivered in 42 min. Steel trestles support the cables; at the buildings it was found necessary to erect steelwork from the ground to the proper height, to take the pull.

Editorials

Examinations for Commissions, Corps of Engineers

It was announced in *Engineering News* of Aug. 12 that a very, very narrow door had been again opened through which engineers who had graduated from other engineering schools than West Point might obtain positions in the Corps of Engineers, U. S. A. The official announcement of the examinations for such appointment, which will be held about Oct. 25, confirms the opinion then expressed that the door opened is so narrow that only an engineering graduate of very unusual ability will be at all likely to succeed in forcing his way through it.

In the first place, as already noted, candidates had first to take the examination for "Junior Engineer," in the engineer department at large. Those taking these examinations, which were held on Aug. 25 and 26, were required to have had "at least four years good civil, mechanical or electrical engineering experience," or to have graduated in engineering from an approved school. This examination for Junior Engineer occupied two days and it was announced that it would include nothing which was not covered by the courses in engineering given by reputable technical schools.

Those passing this examination who are graduates from an approved technical school, are between 21 and 29 years of age and are unmarried will be eligible to take the examination to be held by the War Department on Oct. 25 for a probational appointment as second lieutenant in the Corps of Engineers. The subjects covered in this examination are as follows: (1) English grammar and orthography; (2) elementary French, German or Spanish; (3) an optional subject to be selected by the candidate from a list submitted; (4) physics, including electricity and magnetism, sound and light; (5) chemistry, geology and mineralogy; (6) topographic, hydrographic and geodetic surveying, including the elements of practical astronomy; (7) descriptive geometry and drawing; (8) theoretical and applied mechanics; (9) theory and practice of engineering construction. It is noteworthy that subject 8 is given a relative rating of 18 and subject 9 of 30, while the first three points have relative ratings of only 4.

A candidate must pass a physical examination prior to the written examination, and also submit testimonials as to his moral character and fitness to hold a position as a commissioned officer.

According to the circular issued by the War Department prior to the examination a year ago, an average of at least 80% must be obtained by the candidate on the examination or he will be marked as failing. He will also fail if he does not receive a mark of 67% in any of the subjects listed. The probational appointment as second lieutenant is for one year only. At the end of the year a final examination is required on a dozen subjects of military engineering, including the candidate's military record and aptitude as certified to by the company, post and battalion commanders under which he has been. Candidates are required to obtain a mark of at least 75% in each subject included in this last examination.

As some of the readers of *Engineering News* may be interested in seeing what sort of questions are asked in the examination for a probational appointment, the examination questions used a year ago in the subject of theoretical and applied mechanics are given here:

THEORETICAL AND APPLIED MECHANICS

Part 1 (time, 3 hours).

I. Value, 7. 3 (a) Define stress; elastic limit; modulus of elasticity.

4 (b) A steel wire whose cross-sectional area is 0.01 sq.in. is to support a weight of 200 lb. as a pendulum. It has upon it two marks which are 200 ft. apart. What is the distance between the marks after the weight is added, the modulus of elasticity of the wire material being 30,000,000?

II. Value, 8. A flywheel whose mean diameter is 24 ft. is built up of four equal segments which are bolted together with two bolts at each joint. The rim is 4 in. thick and 18 in. wide and the material weighs 490 lb. per cu.ft. The wheel is designed for a normal speed of 75 r.p.m., and as a factor of safety the influence of the spokes was disregarded in designing the bolts. The safe stress on the bolts was assumed as 14,000 lb. per sq.in. What is the diameter of the bolts?

III. Value, 11. 6 (a) The coefficient of expansion for steel is 0.0000030; that for brass is 0.0000065. A steel column whose cross-sectional area is 5 sq.in. is 50 ft. long and is surmounted by a rigid crosspiece from the bottom side of each end of which hangs a brass rod whose cross-sectional area is 2 sq.in. Compute the length of the rods so that, regardless of temperature changes, their lower ends shall remain at the same elevation.

5 (b) If the rods are assumed to be 35 ft. long and have their lower ends immovably fixed, what total stress will be induced in the anchorage by a fall in temperature of 150°? Modulus of elasticity of brass is 10,000,000.

IV. Value, 13. 7 (a) Given the following beam without weight: Starting from the left-hand side there is a cantilever 5 ft. long to the support A. This cantilever is loaded uniformly with 1 ton per foot of length. From the support A to the support B the distance is 20 ft. Beyond B there is another cantilever 9 ft. long loaded with a concentrated load of 2 tons at its outer end.

Determine the amount and position of a concentrated load such that the beam may be cut through beneath it without disturbing the equilibrium of the system.

6 (b) Construct the shear and moment diagrams of the above beam with the unknown load added. Shear scale, ¼ in. per ton; bending-moment scale, ⅛ in. per ton-foot.

V. Value 11. 6 (a) A bar of steel whose modulus of elasticity is 30,000,000 is placed in a testing machine and subjected to tension. The cross-sectional area of the bar is 4 sq.in., its length is 20 ft., and its elastic limit of 60,000 lb. per sq.in. is reached in 15 seconds. What horsepower must be supplied the driving motor, assuming its efficiency to be 85% and that there is 10% loss of power in the testing machine?

5 (b) If the machine is provided with suitable reducing gears and with an automatic clutch designed to slip when the pull on the motor pinion (2 in. in pitch diameter) exceeds 40 lb., what must be the least speed of the motor at its maximum delivery during the above test?

Part 2 (time, 3 hours).

VI. Value, 10. 3 (a) In making compression tests of cast-iron columns 15 ft. long and 48 sq.in. in cross-sectional area the elastic limit of the material was reached at a unit pressure of 15,000 lb. per sq.in., the material having a modulus of elasticity of 15,000,000. Determine the resilience of the columns.

3 (b) Determine the modulus of resilience of the material.

4 (c) What load falling from a height of 4 ft. above the column will also strain the column to its elastic limit?

VII. Value, 7. A shaft in two parts is coupled with a coupling having in it 8 bolts, the bolt circle diameter being 18 in. The shaft transmits 1000 hp. at 500 r.p.m. If the safe load on the bolt material is 6000 lb. per sq.in., what is the diameter of the bolts?

VIII. Value, 8. 4 (a) Find the thickness of a spherical shell 6 ft. in diameter which is used as a receiver for compressed air at a pressure of 240 lb. per sq.in. above the atmosphere, the allowable unit stress of the material being 8000 lb. per sq.in.

4 (b) How great may be the diameter of the copper delivery pipe whose walls are $\frac{3}{8}$ in. thick and whose safe load is 3000 lb. per sq.in.?

IX. Value, 13. 5 (a) An open caisson 50 ft. long and 10 ft. wide (inside dimensions) has been sunk in still water which has risen to a height of 36 ft. above the bottom of the caisson. The sides and ends simply rest on the bottom and the sides are supported by the ends. The ends are protected against collapse by longitudinal braces. Two cross-members are placed across the ends with their centers at heights of 5 ft. and 24 ft., respectively, above the bottom. Against these butt the longitudinals, being centered vertically on the cross-members, but horizontally their centers are 1 ft. in from the sides; they are 8 in. by 8 in. in cross-section, and there are four of these longitudinals in all. Neglecting friction, what is the unit pressure on the ends of the longitudinals?

4 (b) The pier within the caisson weighs 165 lb. per cu.ft. and is 45 ft. long and 5 ft. wide, and at the present stage of water it just prevents movement of the caisson. The caisson itself is neutral as to buoyancy. How high is the pier?

4 (c) As a matter of safety the caisson is allowed to flood to a depth of 25 ft. At what stage of the water will the previous condition of instability obtain?

X. Value, 12. 6 (a) A dam having a vertical face on the reservoir side is 175 ft. high and the water behind it stands at 160 ft. At a depth of 150 ft. below the crest is the top of the rectangular opening delivering water to the penstock supplying a turbine. The opening is 4 ft. wide and 8 ft. high and is closed by a sliding valve, the valve being operated by a vertical rod from above. The penstock has a cross-sectional area equal to that of the opening, and the water flowing through it supplies a turbine which is direct-connected to an electric generator; the efficiency of the turbine is 75% and that of the generator is 92%. What must be the size of the valve rod when safely loaded to 16,000 lb. per sq.in., the coefficient of friction of the gate under pressure being 0.3?

6 (b) If the velocity of flow in the pipe is 47 ft. per second, what kilowatt energy is being delivered by the generator?

Breadth vs. Specialization in Engineering Study

The ruin of a vessel within three months of its launching described elsewhere in this issue, may serve a useful purpose in calling attention to the value to an engineer of information on a wide range of engineering work. Nothing is more common than to hear engineers and especially young engineers declare that they have no interest in engineering literature outside their own field of work. That contains, they say, all that they can possibly find time to read about. They propose to keep up to date in that and to let the rest go.

Such narrow specialization as this is responsible for many failures in engineering work. A man accustomed to civil-engineering work, for example, finds it necessary to design a special machine for use upon some work, and because of his limited knowledge of mechanical engineering he does not make sufficient provision for lubrication.

The hull of the "Sea Call" was ruined because the steel surfaces exposed under water formed a galvanic couple with the monel-metal plating of the hull and the corrosion of the steel naturally followed. Previous examples of such corrosion from galvanic action of dissimilar metals immersed in sea water are on record in engineering literature. Less than a dozen miles away from the yard where the "Sea Call" was built is the Charles River Dam. Before that dam was built a series of experiments was made, to determine whether galvanic corrosion would result from the use of manganese-bronze truck axles on the steel gates. As a result of these experiments, zinc plates were attached to the bronze axles to protect the steel from corrosion. The use of zinc plates on naval vessels that have steel hulls and manganese-bronze propellers is well-known. The fact that nickel and iron form an active galvanic battery when immersed in a corrosive solution is illustrated by the well-known Edison storage battery.

Attention is called to these matters simply to impress upon engineers, and especially upon younger readers, the value of broad knowledge as well as specialized knowledge. It has been often remarked that many important inventions have been made by men who were unfamiliar with the technical details of the industry to which their invention applied. Their experience in other fields of work, however, enabled them to bring to the problem a range of knowledge that too often is not possessed by the specialist in the industry.

Orderly City Development

The zone, or district, system of controlling the character and use of buildings is an essential feature of modern city planning and replanning. The system is common abroad, but has scarcely gained a foothold here. It cannot make much progress in the United States without the general adoption of constitutional amendments. Such an amendment was before the New York Constitutional Convention. It read:

> The Legislature may delegate to municipalities the right to create, fix and regulate areas or districts for private residences, for the location of trades and industries, and for the protection or improvement of particular localities, and to limit and regulate the height, dimensions, kinds and uses of buildings, by districts or otherwise.

It was to be hoped that this, or some equally adequate means to the same desirable end, should have been adopted by the convention at Albany, to be approved by the voters in November and put into effect by the Legislature of 1916. Haphazard city growth is for the temporary benefit of a few property owners. Well-ordered city growth benefits all the people for all time.

Big Steamships and Economic Ocean Transportation

A dozen years or more ago there was a great deal of discussion as to the rapid increase in the size of ships and its influence on economic freight carriage at sea. About that time James J. Hill, President of the Great Northern R.R., gave a contract for the construction of two of the largest vessels ever built for freight carrying to run in Transpacific service in connection with that railroad. The end of that experiment has just been announced. One of those two huge vessels, the "Dakota," was stranded after she was put into service, and became a wreck before she could be hauled off. The other big vessel, the "Minnesota," after experiencing various vicissitudes, was continued in service and only recently was said to have transported across the Pacific the largest cargo of freight ever transported by a single ocean vessel. Notwithstanding this and the high rates for ocean freight now prevailing, it has been recently announced that the railway company has decided to retire her from service and offer her for sale.

While it is quite possible that the impending changes in the United States navigation laws may have something

to do with this decision, it is also stated that the vessel has not proved the profitable carrier that was expected. As has been frequently pointed out in these columns, the experienced ship owners of Great Britain and Germany, who doubtless understand the ocean-transportation business better than the business men of any other nation, continue to build freight vessels of moderate size in order to earn profits. It is only on the route between New York and Europe, where high-class passenger traffic is under competition, that vessels larger than 20,000 tons have ever been put in profitable service, and very few ships operated on any other route exceed 10,000 tons.

Public-Health Instruction at Ohio State University

The establishment of a department of public health and sanitation at Ohio State University is significant both in aim and in the method proposed to accomplsh the aim. The University announcement states:

> The principal object of this course is to prepare young men and women for public-health work in Ohio and elsewhere and to fit them to occupy administrative and executive positions as health officers or members of boards of health or secretaries, agents or inspectors of health organizations. It is planned to provide the scientific groundwork of sanitary knowledge which underlies efficient health administration.

The degree of master of science in public health will be given after one year's study, but candidates must hold the degree of doctor of medicine or of bachelor of arts or its equivalent, and candidates with the master's degree must have had a year of preliminary collegiate training in chemistry, physics, zoölogy, comparative anatomy and pathogenic bacteriology. Most of the courses offered will be given in the Graduate School of the University. A number of the instructors appointed are members of the staff of the Ohio State Board of Health. The instructor in public health engineering is the chief engineer of that board.

The whole plan is commendable because, on the basis of either one of the required preliminary degrees mentioned, it offers specific training in the fundamental knowledge required by the modern public-health officer without adding a long course of study to that already pursued. The idea is not to turn out sanitary engineers, chemists, bacteriologists or pathologists, but rather, administrative health officers, competent to direct these and other employees of a health department. For those who wish to specialize, however, facilities are offered.

Good Bridge Paint

In 1878 a wrought-iron highway bridge was built over the Little Wabash River at Carmi, Ill., and the bridge stood until a few months ago, 37 years in all. Describing how a flood washout wrecked the bridge, G. H. Brown, the county superintendent of highways, closes his account[1] with the following laconic statement: "The iron in this structure was treated with a good coat of paint when it was erected and had another about twenty years ago."

Here is a remarkable record of paint endurance: A coat of paint lasted about twenty years. This is not a single result, but twice in succession the same experience was had—the second coat seems to have endured at least as well as the first. In view of the fact that a life of ten years is considered very good for bridge paint (the eight-year endurance of the paints in the Havre de Grace test was considered highly creditable), there ought to be no doubt that the performance of the Carmi paint is phenomenal.

A point of doubt remains, however. The first coat of paint, we know, had an ultimate life of about 17 years, but we do not know the ultimate life of the second coat. Mr. Brown does not say that it was gone. Had the bridge not been washed out, perhaps the paint would have lasted many more years—ten, or possibly even another twenty. Though the record made is so excellent, yet it may be that the flood deprived us of an even more notable record.

[1] In "Illinois Highways," the bulletin of the State Highway Department.

The work on the Brooklyn-Brighton viaduct in Cleveland (see the first page of this issue) is a typical illustration of the present high state of the art in concrete construction. Strictly speaking it is rather better than typical or average, for it has proceeded with exceptional smoothness and freedom from interruptions or complicating occurrences. It was unusually rapid and systematic. But with all due credit to the Bates & Rogers work, it can still be taken as a fair illustration of the fact that fast work in concreting is now the regular thing. We refer to a speed which not many years ago would have been out of the question. In the present case, we must remember, two bridges of 1,700 ft. are built successively, in a single season, or a total of 3,400 ft. of arch viaduct. That this is regarded as a practical or regular rate of working is indicated by the fact that at Harrisburg, Penn., the Grace contract for the Susquehanna bridge of the Cumberland Valley R.R. calls for the construction of 4,000 ft. of arch viaduct in a season.

In *Engineering News* of July 1 comment was made on an advertising leaflet issued by the University of Pittsburgh, in which a statement was made as to the average compensation of engineering graduates of twenty years' experience. Since this publication we have been informed by authorities of the University that the leaflet in question was prepared some four years ago. The figures used in its preparation were obtained from the publication of another institution and were at that time deemed to be reliable, and the statements made in the circular as to the demand from employers for graduates from the engineering course corresponded to the conditions prevailing at that time.

A number of copies of the circular were distributed through the mails at that time, in answer to requests for information, but none have been distributed since then so far as the University authorities were aware, and the recent appearance of one of the circulars, which were supposed to have been destroyed, they are at present unable to explain. Official representatives of the trustees and faculty of the University have expressed to us most emphatically their agreement with the position that misleading advertisements should not be published by any organization, least of all by an institution of learning, and assure us that the recent appearance of this circular was not authorized by the University authorities. We are glad to make this statement in justice to the University and its School of Engineering.

Letters to the Editor

The "Eastland" Disaster and Vessel Stability

Sir—The capsizing of the steamer "Eastland" in the Chicago River on July 24 has opened for discussion a technical subject about which people in general know less than nothing and about which the average engineer, unfortunately, knows but little more.

It seems to be generally supposed that a floating body rolls about its center of buoyancy, and that if the center of gravity of the body rise above the center of buoyancy,

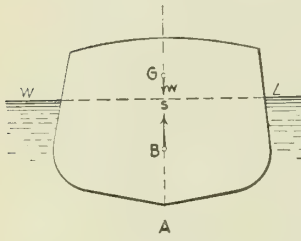


Fig. 1

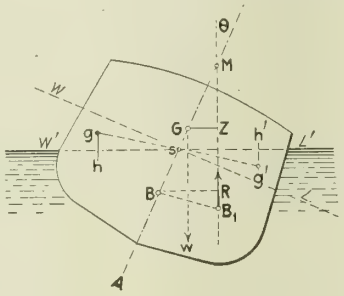


Fig. 2

the body would capsize. In *Engineering News* of July 29, 1915, you state that it is an elementary principle of vessel construction that the center of gravity of the vessel as a whole must be lower than the center of buoyancy in order that the vessel may remain upright. This statement is misleading, as that condition rarely if ever exists in ships. Such a condition would produce a ship so stiff that it would be very uncomfortable to ride on and would be easily swamped in a beam sea. In fact, about the only vessel approaching this condition is the fast sailing yacht.

A floating body does not roll about its center of buoyancy nor its center of gravity. It rolls about a center known to the marine engineer as a metacenter, which is located on the axis of the ship's section at the intersection of the vertical through the center of buoyancy in an inclined position.

Referring to the accompanying sketches, Fig. 1 represents a section through a ship floating at a water line indicated by WL. The center of gravity of the ship is located at the point marked G, through which the weight of the ship W acts downward. The center of buoyant forces is at B. To satisfy conditions of equilibrium the buoyant forces must equal W and act vertically through B and G. The ship is thus in a state of rest.

Now if we consider this condition of rest to be disturbed and the ship heels over to an angle, then the condition of equilibrium no longer exists. Referring to Fig. 2, we find a new water line indicated by $W'L'$. We have taken away from the left side a buoyant wedge WSW' and added it to the right side. Indicating the volume of this wedge by v, its center of gravity by G, the total displacement of the ship by V, and the horizontal shift of the center of gravity G by hh', then the horizontal shift of the center of buoyancy from B to R would equal the volume of the wedge multiplied by the distance hh' and divided by the total displacement V; that is $BR = \frac{v \times hh'}{V}$.

The new position of the center of buoyancy is on a vertical line through R and located from B parallel to gg'. Extend the vertical through R and it will intersect the axis AS at the point M, which is the metacenter, or the center about which this ship will heel.

It will be observed that the buoyant forces acting through B no longer act through the center of gravity G and the state of equilibrium has been destroyed. The buoyant forces act to the right of G a distance indicated by GZ, known as the righting arm or lever arm, the length of which is

$$\frac{v \times hh'}{V} - BG \sin \theta$$

hence the moment of stability

$$= GZ \times W$$

$$= W\left(\frac{v \times hh'}{V} - BG \sin \theta\right)$$

It will be observed that if M is above G, a positive lever arm exists and the action of the buoyant forces is toward righting the vessel; but if G is raised to a point above M, then a negative level arm exists and the vessel will capsize.

If the stability moments are calculated for various values of θ and for various conditions of loading, curves

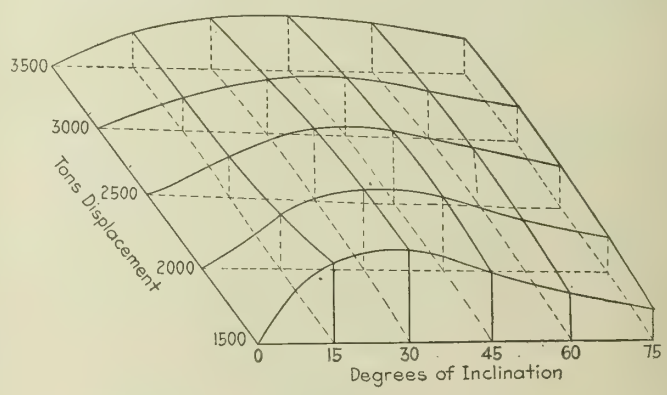


Fig. 3

may be made which will absolutely tell the story of any particular hull, such as are shown in Fig. 3.

Unfortunately the calculations involved in determining the statical stability of a ship are long and tedious and are rarely made. If the United States Government had required a complete set of such curves to be on file before the issuance of inspection papers, it is my belief that the "Eastland" would never have been placed in the excursion trade.

This ship was built for the fruit trade across Lake Michigan and for this purpose she was well fitted, her cargo being light and carried low and her speed high, as is required for the transportation of perishable cargoes.

The United States Government should not permit the reconstruction of any vessel without requiring a new set of stability calculations to be made and filed before issuing new inspection papers.

The "Eastland" was reconstructed for service that she was not fitted for at all. She was reconstructed for excursion service; some of her upper works were removed to make room for dancing. Such a cargo is necessarily carried higher, thus raising the center of gravity. This condition may be met by using water ballast, which is generally accomplished by constructing an inner bottom, the space between this and the outer shell being divided into compartments which may be filled with water. The "Eastland" was built this way. If all these compartments are only partly filled with water at the same time, then a condition of "free water in the hold" exists, and in this condition the center of buoyancy does not shift as far as it would if the compartments were full or empty. If under these conditions *B*, Fig. 2, should fall to the left of a vertical line through *G*, then a condition of negative stability would exist and the ship would capsize.

It has been suggested that the cause of the "Eastland" disaster was due to the ship being constructed without a keel. Keels do not prevent ships from capsizing. In single-bottom vessels they are used for structural purposes and in double-bottom vessels they do not exist except in the form of keelsons, which act to make the ship roll with the sea, thus making them more comfortable for passengers.

Too much emphasis cannot be placed upon the statement in your issue of July 29 that the primary cause of the "Eastland" disaster must be sought in the condition of her water-ballast tanks.

Reginald A. Towler.
33 Casgrain Ave., Detroit, Mich., Aug. 2, 1915.

Mortar Beds; Brick and Granite Block Pavements

Sir—In the editorial in *Engineering News* of Aug. 5, 1915, on "Mortar Beds for Brick and Stone Pavements," you speak of the resiliency of sand cushions. Granting that a sand cushion has some resiliency, the beneficial effects, if there are any, of this resiliency are nullified by its variability and by other factors incident to proper block-pavement construction. The variability is caused by natural variation in moisture content of sand, variation in depth of cushion, in grading of sand, in depth of blocks, and in amount of compression by roller or rammer. The wedging effect of the blocks, the binding of the grout, and the crowning action of the pavement also affect the resiliency.

The fact of the matter is that no two spots on a well-constructed sand-cushion brick pavement seem to have the same degree of resiliency. The deflection of various pavements in Kansas City under a wagon-wheel load of 1500 lb. was measured by James E. Howard, formerly of the United States Bureau of Standards, with a delicate level spanning 12 in. Briefly, it was found that one-course plain concrete pavement 6 in. thick deflected 0.0002 to 0.0006 in. when tested as noted. Cement-grouted brick pavements on a 6-in. concrete foundation deflected from 0.0003 to 0.01 in., and stone blocks from 0.0003 to 0.0019 in. These limits were determined by a large number of trials in each case on a number of pavements of different ages in various parts of the city and are exclusive of trials made near manholes, cracks, expansion joints, etc. The older sand-filled brick pavements showed a much greater variation.

The point I wish to bring out is that while concrete pavement showed a very uniform deflection, the brick varied from a deflection that would indicate a support as rigid as the concrete foundation it rested on to one suspiciously like what might be expected from brick depending for support entirely on arch or wedge action.

Without repeating the many arguments for or against the plain sand cushion, it seems to me that with a properly built brick or stone pavement the term cushion is a misnomer. It is rather the *sand bed* which levels up inequalities in the base, allows slightly misshapen brick to be rolled down to a smooth surface and beds each brick uniformly. The sand bed for block pavements has performed its function with credit to itself, but engineers are beginning to recognize that its vagaries are detrimental to the pavement that must stand the severity of traffic in the present-day large city. A more perfect bedding material is obtained when cement enough to hold the sand grains in the bedding course is used. This may be placed in the same manner as the sand cushion and the blocks rolled or rammed into it before the water is added to set the cement. Such a construction will insure the maintaining of a uniform bearing for the wearing surface.

City pavements must be so constructed, in order to withstand modern traffic, that they will retain a smooth, even surface and wear uniformly. Traffic soon searches out any variation or weakness in structure. The sand-cement bedding course is an improvement over the plain sand cushion, and maintains the blocks to uniform grade with less variation. The sand-cement mixture is as resilient as the portions of a plain sand cushion that have been properly compressed and that properly bed the blocks.

Clark R. Mandigo,
Assistant City Engineer.
Kansas City, Mo., Aug. 28, 1915.

Sir—The editorial comment in *Engineering News* of Aug. 5 in regard to the substitution of mortar beds for sand cushions in constructing stone-block pavements expresses very fully and clearly my opinion on this subject, to which I have had occasion to refer in previous contributions on city pavements.

It is my belief, based both on experience in construction and on a study of the settled practice in the most important of the world's cities, that the modern street pavement is most successful when consisting of two elements—a solid, rigid foundation and a more or less elastic renewable wearing surface.

For the foundation, concrete is now almost universal. The wearing surface is usually one of two classes, composed either of solid rectangular blocks laid in close contact, or of a layer of mineral aggregate filled with bituminous cement.

In asphalt pavements, elasticity is provided for by an asphaltic-cement binder, and the wearing surface is laid directly on the foundation. Where there is some inherent elasticity in the blocks as in the case of wood, the pavement surface has been most successfully constructed when laid in close contact with the foundation.

That there must be some similar provision for elasticity in the case of stone-block pavements was recognized not only in Paris (as shown by your quotation) over 40 years ago, but also, to take a single other instance, in the city of Liverpool, where the first of its modern stone-block pavements was laid about 40 years ago. The method used then has been followed very closely ever since. The practice of other foreign cities, such as Hamburg, can also be cited to substantiate the statement that the general principles for successful stone-block pavements were worked out very nearly half a century ago, and that there remains very little scope within which the exploiter of new specifications can exercise his ingenuity.

In many years' experience with brick and granite-block pavements I have known of but one case where surface settlement was caused by running of the sand cushion. This was at Panama, after the fire department in an excess of zeal had spent one Sunday morning trying out the new fire hydrants, unfortunately selecting for this experiment a street in the process of paving. The result was that much of the new sand cushion found its way into the equally new sewer.

Laying granite blocks directly on a rigid foundation will not prevent such pavement depressions as are found in some of our granite-block streets, where investigation always shows an equal depression in the foundation. I know of no granite-block pavement in this country carrying denser or heavier traffic than Lafayette St., New York City, yet the condition of its surface today shows nothing upon which to base criticism of the fact that it was laid on a sand cushion.

The almost perfect surface of the stone pavements of Hamburg and the very uniform condition of those of Liverpool show success over comparatively long periods of time of the generally accepted method of stone-block pavement construction. Where the rigid foundation method has been adopted, as in the Borough of St. Pancras, London, and on certain streets in Birmingham, the method has been followed to its logical conclusion by filling the joints with cement grout, making in effect a monolithic pavement subject to the disadvantages of that type for city street surfaces. An attempt to combine the two methods by using a rigid base and an elastic joint filler would seem to give none of the advantages of either method.

One great fault of our paving construction as compared with that abroad is our tendency to spend more time on specifications than on inspection and results. In great cities abroad, specifications have only minor changes from year to year. In this country it is the ambition of each administration to adopt specifications differing from those of its predecessor, resulting in much literature but no improvement in actual conditions. Greater improvement could be obtained in our city streets by careful attention to the inspection of construction and subsequent maintenance than by any variation of the many excellent specifications which have been successfully tried out in the past dozen years.

HENRY WELLES DURHAM,
Consulting Engineer.

New York City, Aug. 20, 1915.

Sir—In connection with the Committee on Specifications under the Board of Public Service of St. Louis, I have made some study of the conditions and character of failure of vitrified brick pavements. I have also just had an opportunity of making observations on brick pavements in a number of Eastern cities and of comparing notes with other engineers, and recently I made an inspection of the brick laid on the green concrete foundation in Paris, Ill.

In the editorial on the use of mortar beds for brick and granite-block pavements, in *Engineering News* of Aug. 5, 1915, it is claimed that the sand cushion has been retained because it gives to the pavement surface a certain amount of resiliency. Now it has always seemed to me that in grouted brick and granite-block pavements this is exactly what it is impossible for the sand to do. A grouted-brick pavement is a good pavement only so long as the grouted joints are intact. If the whole paving surface acts as a sheet, it is impossible to see how the individual blocks can receive any resilient aid from the sand bed. After the grouted joints have been broken, and I believe this usually is caused by defective support from the sand cushion, the resilient action may come into play, but at the same time the pavement is practically ruined.

A close study of the vitrified-brick pavements in St. Louis has led to the conclusion that the initial failure of the pavement was caused by the varying percentages of moisture in the sand cushion as laid, resulting, on drying out, in a condition where the wearing surface is supported only at intervals. The pavement in the unsupported sections apparently breaks down, fracturing the grouted joints. The opening of the grouted joints naturally permits water to get into the sand cushion, and with the sand fairly saturated it is quite possible to imagine that the pounding of heavy loads causes a shifting of the bed, resulting in high and low spots. Every evidence of this type of failure has been found in St. Louis pavements, and the writer has observed identical conditions in Eastern cities.

From interviews with paving engineers of other cities, it is further believed that some appreciation of the action described has been the reason for the gradual reduction in many communities of the depth of sand cushion used.

During the past winter, a committee of engineers recommended, and the Board of Public Service of St. Louis adopted, a type of construction which eliminates the sand cushion entirely. Two kinds of cushions are now being tried. In one of these, limestone screenings are substituted for the sand. This material is subject to ready compacting and has high internal friction. Its use will certainly result in the improvement of brick pavements.

In the second type of construction, a 1-in. bed of 1:4 mortar is substituted for the sand cushion, and we have every reason to believe that this will entirely cure the troubles enumerated. This latter type, or something nearer the Paris, Ill., method of construction, will be used exclusively in St. Louis next year.

After visiting the work in Baltimore, Md., referred to in *Engineering News* of Aug. 5, 1915, p. 276, and inspecting actual construction, I am more convinced than ever that the mortar-bed type of construction is a long step toward the realization of efficient brick pavements. The construction of brick pavements as exemplified in Baltimore and St. Louis is simpler, and if anything involves fewer contingencies than the old class of work with the sand beds. While the ultimate results are still a matter of speculation, it seems reasonable to believe that this construction will add ten years or more to the life of brick pavements.

The laying of the brick on the green concrete foundation as exemplified in Paris, Ill., appeals to me as an ideal pavement. I was very much impressed with the smooth surface obtained by the use of a hand-roller, with the efficiency of construction, the cheapness of the pavement, and with the solid monolithic character of the finished work. If this pavement is undisturbed, its life would seem to be limited only by the wearing qualities of the brick. In large cities, however, there is one objection to this construction; that is the great difficulty in satisfactorily repairing cuts in the pavement. If this can be worked out, the Paris type of pavement is ideal.

This method of construction will also remove to a very great extent the objection to brick pavements on account of noise; for it is clearly demonstrated in the Paris pavements that, although there is a rumble from steel tires passing over brick laid on a sand cushion, there is only a slight rattle from the same vehicle on the new monolithic work.

W. W. Horner,
Engineer in Charge of Design
of Sewerage and Paving.

St. Louis, Mo., Aug. 18, 1915.

Should Ferry Service Be Free?

Sir—In *Engineering News* of Aug. 5, 1915, Gen. H. M. Chittenden says:

> The freedom of the public highway is a freedom of use. If anyone wishes to walk or drive along it or transport goods, the public makes no charge. But the public does not undertake to transport him or his goods, except in special cases, one of which is the ferry. . . . [On the ferry] it carries the passenger and goods. The user is thus saved the expenditure of physical energy of himself and animals, wear and tear of equipment, expenditure of fuel oil, etc., in motor conveyance, over the route of the ferry. For this service, which is entirely special and in addition to that afforded by a bridge, it is right that the user should pay. He is simply paying for a service which, in the case of a bridge, he performs himself.

I submit that the distinction here set up between the road and the bridge (on the one hand) and the ferry (on the other) is wholly artificial and inconsequential and quite inadequate to justify any difference of practice as to tolls.

By building the road or the bridge or the ferry, the public spares to the user a far greater "expenditure of physical energy of himself and animals, wear and tear of equipment," etc., than by merely moving him and his goods over a small part of the line. When we have swallowed the camel by constructing the line, why strain at the gnat of merely moving persons and chattels over an insignificant portion of it?

Gen. Chittenden finds also that "ferries are special and exceptional facilities, affecting, as a rule, only limited portions of the community," and that "to make them free would thus be taxing a whole community for a special benefit to a limited portion."

But the users of the ferry (like the users of a bridge—also "a special and exceptional facility") are 100 per cent. of the users of the entire line. And probably there are members of the community who seldom or never use any part of the particular highway in question. By the same token, it would be unfair to tax these members for the benefit of those who use the highway extensively, or to tax the bachelor for the maintenance of public schools; but the bachelor (permitted to reside in a community uplifted by a public-school system) receives (cannot help receiving) in return for his taxes a value infinitely transcending the mere cost of tuition of a family of children; and since each of us is really a public servant, it is to the public's interest to facilitate our operations.

John C. Trautwine, Jr.

257 S. 4th St., Philadelphia, Aug. 20, 1915.

Military Engineer Reservists

Sir—It is probable that every engineer is anxious to render himself serviceable to his country in assuring her integrity and safety, but this same engineer, with his deep-seated sense of economy and efficiency, cannot bring himself to see the immediate necessity of giving up an appreciable portion of his time at the most efficient period of his life to join a reserve corps and learn how to be an engineer from the viewpoint of an army officer. Or, to put it in another form, he fails to see why he is not as good an engineer without a military training as he would be were he imbued with the more or less deplorable spirit of the military caste.

Why not let the Secretary of War organize a civilian board of engineers who, acting in conjunction with the army engineers, can work out and codify the problems to be met and their solutions? The results of these researches could be recorded in suitable handbooks and thus rendered available to every engineer. The problems under war conditions should not be so much greater than under peace that the fundamentals could not be mastered in a similar manner to the standardized problems of any engineering work. With this manual available, any engineer who has had a reasonable amount of practical experience could easily master the standardized details and become a "military engineer reservist" without any trouble. Then let him signify to the proper authority his willingness to dedicate his service to the cause of his country if needed, have his name recorded with the usual formalities, and he becomes available without further trouble or expense in case of war. In this way each reservist engineer could become a nucleus about which could be gathered unlimited assistants in emergencies, and the country would have a reserve engineer corps of unparalleled magnitude.

The idea is presented for consideration with the hope that it may lead to some result that will render available to the country the brains of the combined engineering profession without the economic waste of actual military service during times of peace.

Herbert D. Mendenhall,
Consulting Engineer.

Jacksonville, Fla., Aug. 14, 1915.

NOTES AND QUERIES

The Paddle Wheel as a Pump is the subject of inquiry by an engineer in Fresno, Calif. He asks whether any engineer in the United States has ever constructed and utilized for raising water a scoop wheel of the type extensively used in Holland and illustrated in "Engineering News" of May 19, 1910, p. 582.

Cleaning Machines are the subject of an inquiry just received from the chief engineer of a Western railway. A machine is wanted which can be used to clean dirt, rubbish, etc., from stone-ballasted track as well as from track at stations where the ties are embedded in concrete. It is thought that some manufacturer may possibly have developed a vacuum cleaner for this special work.

New Toledo Coal Dock Built in Record Time

At the opening of navigation on the Great Lakes this spring, the Cincinnati, Hamilton & Dayton Ry. surprised its patrons with a new coal-handling plant, dock and yard at Toledo, the road's principal port on Lake Erie. While transportation was closed the old facilities in the Rossford district on the Maumee River were replaced. There is here now one of the three largest car dumpers in the country.

Yards and Dock

The work for the new coal terminal involved the construction of 802 ft. of concrete dock, concrete foundations for the unloader, approach and run-off trestles, the relaying of the load and empty yards, and the erection of the unloader frame and machinery. The new load yard has a capacity for 140 cars and the empty yard for 96 cars. South of the dock is a classification yard with a capacity for 3000 cars.

The dock, except at the unloaders, is of reinforced concrete on piles cut off 18 in. below the water line. The front line is of tongue-and-groove sheet piling. Tie rods run back from the concrete to inshore deadmen. The section at the unloader is of the same general construction except that a line of battered piles is omitted and the concrete is anchored to the machine-foundation slab.

Design of Car Dumper

Machines for picking up and dumping coal cars are ot new, but there are few the size of this one, which shows the latest practice. When the Pennsylvania, Norfolk & Western and Baltimore & Ohio roads, and other large coal shippers, proposed to increase the capacity of their cars from 50 and 75 tons to 90, it became necessary to increase the strength of the car dumpers. This machine and its two immediate predecessors were therefore built to lift a total load of 140 tons—leaving leeway to care for possible 100-ton cars with 10-per cent. overload. It is designed to dump 40 cars per hour; but up to 49 have been handled.

The cradle rail is 30 ft. above the lake level, which is higher than normally seen; this change is made to reduce to a minimum the amount of lift of cars in the machine.

The chief new feature on this machine is a disappearing mule for pushing the cars up to the dumper platform (Fig. 2). This necessitates a trough in the approach track deep enough to let the mule pass down under incoming railway cars, and a track on the bottom as well as the top. Formerly it was necessary to wait for the mule to get back into its pit before bringing in a fresh car; with this scheme cars are fed into the foot of the incline while the mule is coming down underneath them.

There are two switch gates operated by steam cylinders controlled by the reversing haulage engines so that when the engines are started hauling the mule is shifted to the upper track, and when the mule is lowered the gates on the incline are set to drop the mule upon the under track.

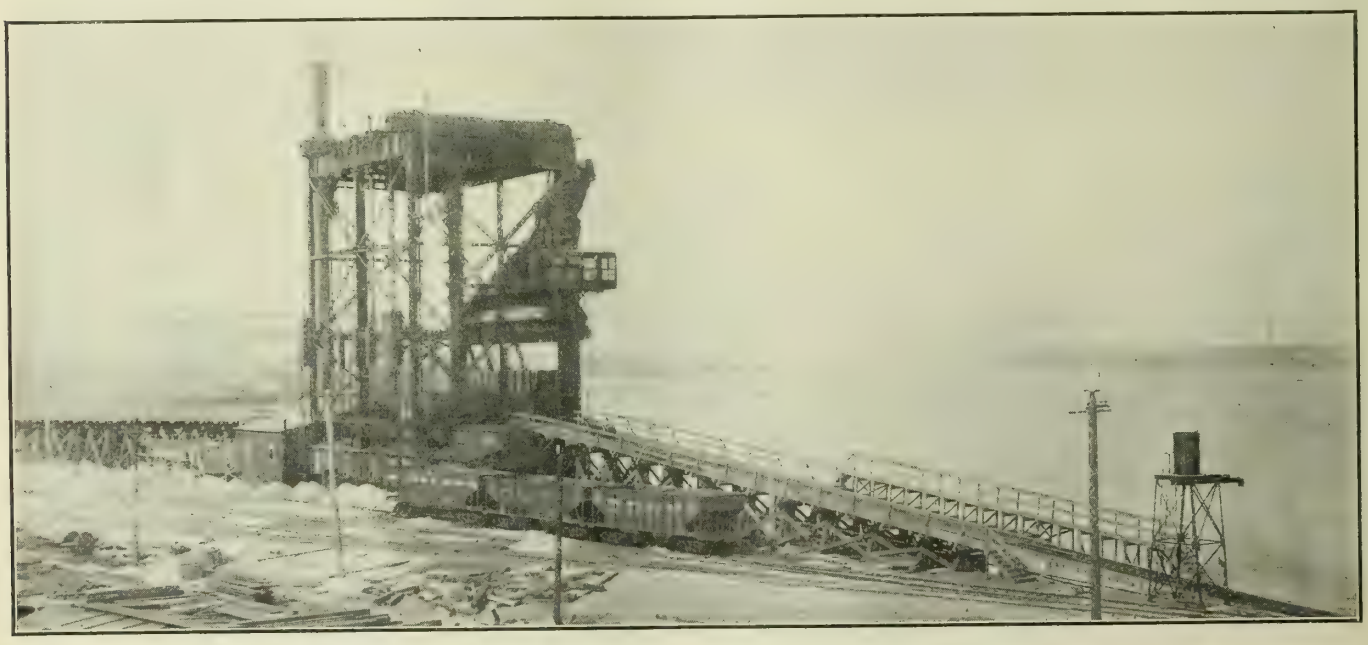


FIG. 1. THE TOLEDO COAL-CAR DUMPER OF THE CINCINNATI, HAMILTON & DAYTON RY.

To reduce the work required of the dumper boilers and engines, counterweights have been added to balance the dead-weight of the machine. There are two 50-ton boxes of iron punchings traveling up and down on the back of the dumper.

Large (22x24-in.) slow-speed engines are used on both haulage and tipple hoist. Two other engines serve the coal pan and distributing chute. Two 250-hp. internally fired Scotch marine boilers furnish steam. The machine has a revolving trimmer operated by an electric motor; otherwise all the motions are made by steam.

Operation of Dumper

The cars come down grade from a feed yard and go over the mule pit to the dumper incline, whereupon the mule rises out of the pit, comes up back of the car and pushes it up on the tipple. The platform and car are tilted sideways, the car being automatically gripped by four large clamps. The maximum inclination is 70 deg.

The coal is received on a pan which is lifted by screws to follow the car. The pan discharges into a chute and an operator on the pan directs the travel of coal to different parts of the boat. When the car is empty the cradle is returned to its original position and the upcoming loaded car pushes the empty off the platform and it runs down grade to the storage yard.

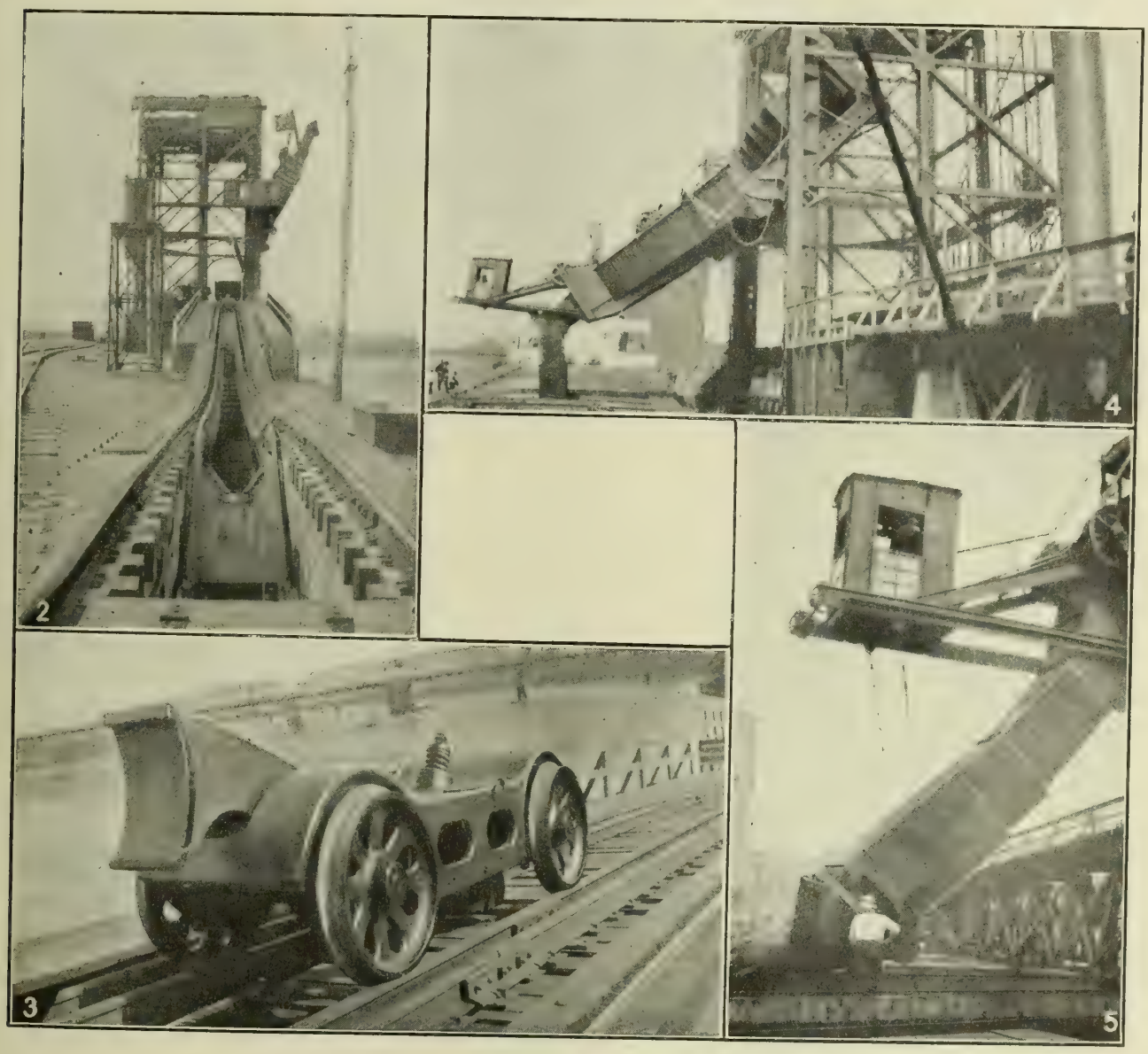
Construction and Erection

Contracts for the foundations and dock were let about Nov. 1, 1914, and preparations were rushed. The old plant was abandoned on Dec. 2 and work started the next day.

Piles in front of the old dock were driven by floating equipment, using steam hammers. Land drivers were used back of the old dock. A tug kept the river ice broken up and clear of the work. The unloader foundation was first laid and then the dock piles nearby were driven. The fill between docks was started and the pile driving pushed further along, then fill was made to the level of the concrete.

Stone and cement were brought in by rail, and sand by boat. The mixing plant was about 1000 ft. south of the car dumper and here was equipment for heating all the material. Concrete was hauled in bottom-dump buckets on narrow-gage flat cars. A boiler plant at the unloader foundations kept the concrete warm after placing, so that the weather never interrupted work. Some of the concrete was placed while the outside temperature was as low as 12 deg. below zero.

The machine foundations were completed Feb. 8, 1915. The mule-pit concrete was finished Mar. 7.



FIGS. 2 TO 5. DETAILS OF TOLEDO CAR DUMPER

Fig. 2—Mule pit and approach incline. Fig. 3—Mule. Fig. 4—Tilted car, pan and chute. Fig. 5—Chute discharging

The first structural member was set Feb 15, and the erectors worked for a time in two shifts—early morning to noon and noon to night. In 65 working hours the main frame was ready for the riveters, who worked in four gangs in the midst of erection of other structural material. By this time the machinery began to arrive, and its installation was started along with the piping work, sheeting, glazing, etc.

The rapid erection was largely due to the way in which the material was handled. The parts were made up from

the drawings of the Cleveland and Sandusky machines, which course saved time. A schedule was in force giving the time allowed for starting each part of the construction, the time for riveting, installing machinery parts, etc. There are about 400 tons of structural material in the dumper and 350 tons of machinery.

The reconstruction of the railroad yards started Dec. 6, 1914, and was completed April 12 when the machine was ready. The new elevation was about 9 ft. above the old and the filling material was waste cinder and slag hauled to the site in standard-gage cars.

The approach and run-off trestles were erected by the substructure contractor, the material being formed nearby and handled with a locomotive crane.

The design and construction of this terminal were under the direction of F. L. Stuart, Chief Engineer, B. & O. R.R., and the work was prosecuted under the supervision of A. M. Kinsman, Engineer of Construction, W. S. Bouton, Engineer of Bridges, A. H. Griffith, Assistant Engineer, and P. Callahan, Resident Engineer.

The Smith-McCormick Co., of Easton, Penn., were the contractors for substructures and trestles. The dumper was designed, built and erected by the Wellman-Seaver-Morgan Co., of Cleveland.

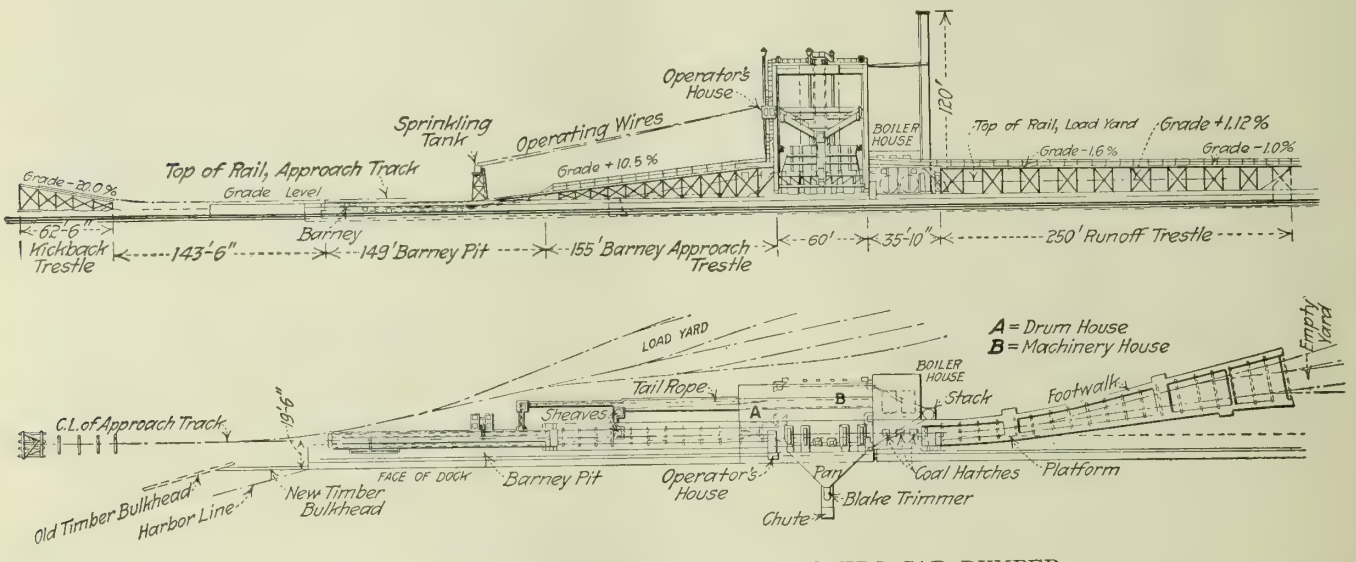


FIG. 6. PLAN AND ELEVATION OF NEW TOLEDO CAR DUMPER

Galvanic Corrosion Damages Hull of Yacht

A very large new sailing yacht, the "Sea Call," built for Alexander Smith Cochrane, of Yonkers, N. Y., at a cost said to have been in the neighborhood of half a million dollars, has been so injured by corrosion, within three months after her launching, that she has been dismantled and scrapped. The case is of especial interest to engineers, as it is one of the most remarkable instances on record of serious damage resulting from the galvanic action of dissimilar metals in a structure exposed to sea water.

The yacht was intended by its owner for ocean cruising. He desired to visit out-of-the-way corners of the world where no facilities exist for dry-docking or hauling vessels out of the water to remove marine growths from the hull. It was therefore decided to build the portion of the hull under water of monel-metal plates, using steel plates, however, above the water line. Monel metal is an alloy produced and marketed by the International Nickel Co. and named in honor of Ambrose Monell, its President. It is an alloy containing about 67% nickel and 27% copper. As might be expected from these chief constituents, the metal is highly resistant to corrosion. It has a strength about equal to that of mild steel.

According to the statement of the builders, it was the original intention of the vessel's designer, William Gardner, to use monel metal for the stem of the vessel, the rudder frame and the propeller frame, as well as for the under-water plating. Some difficulty was found in producing these parts in monel metal with the necessary accuracy and freedom from warping, and it was finally determined to use steel for these pieces instead.

The framing of the hull was of steel bulb angles. Monel-metal rivets were intended to be used in all monel-metal plates. In a very few cases, however, steel rivets were used by mistake in the monel-metal under-water plating. Attention was first attracted to the serious corrosion that was going on by the failure or total disappearance of one of these steel rivets. A stream of water entering through the open rivet hole was temporarily stopped by a pine plug and later by sending down a diver who put in a steel bolt as a permanent repair. In a very few weeks, however, this bolt was also eaten away. About this time it was decided to haul the yacht out of the water to remove the marine growths that had accumulated on the hull, for it was found, contrary to the expectation of the designers, that the salt water had so little effect on the monel-metal plates that the hull rapidly accumulated enough "grass" to check the vessel's progress. The serious corrosion which had taken place on the steel parts under water was discovered when the hull was exposed to view.

The most severe corrosion took place on the thin steel rib which forms the outer frame of the rudder (the rudder itself being covered with monel-metal plates). The reason why the corrosion was so severe here was very likely because of the rapid flow of water across the rudder edge, removing the corrosion as fast as it took place and thus presenting clean metal to the action of the elec-

tric current. A similar effect, almost as severe, took place on the steel stem of the vessel. Deep pits were eaten into the steel. There was heavy corrosion also on the steel propeller-frame casting and rudder shank.

The monel metal itself, as would be expected, showed not the slightest evidence of corrosion anywhere; and had the corrosion been confined to these outer steel pieces described, they could probably have been replaced at no serious expense by similar parts of monel metal and the galvanic action thus terminated. A more serious situation, however, was presented by the interior of the vessel. It was clearly evident, from the action on these exterior steel parts, that as the interior steel framing was connected to the monel-metal plates, corrosion would be inevitable there under the action of the bilge water. The probability that this might proceed unnoticed until the vessel's structure would be seriously weakened was doubtless the consideration that led to the decision to cut up for scrap a vessel which had been launched no longer ago than last March.

The "Sea Call" was 150 ft. long on the load water line, with a length over all of 214 ft., her bow having an enormous overhang. The beam of the vessel was 33 ft. 6 in. and the draft was 18 ft. The vessel had a heavy lead keel covered with monel plates and in addition a large centerboard. It was to be equipped with a 400-hp. internal-combustion engine as auxiliary power, but the engine was never installed.

The yacht was dismantled at the yards of her builders, Geo. Lawley & Sons, at Neponset, Mass. On Tuesday, Aug. 24, the hull was hauled out of the water on the marine railway at the Lawley yards, where it was inspected by one of the editors of *Engineering News*.

The possibility of galvanic corrosion occurring had evidently suggested itself to the designers of the vessel, for we are informed that experiments extending over several months were made at the Lawley yards on plates of monel metal and steel electrically connected and immersed in sea water. These experiments, we are informed, showed no appreciable corrosion of the steel and no measurable current in the wire connecting the plates, and it was therefore deemed safe to proceed with the construction of the "Sea Call" on the lines described. The present condition of the vessel, however, is indisputable evidence that the conditions in the boat itself were entirely different from those which existed in making the experiments referred to. It is doubtless true that the area of monel metal exposed to the sea water being very large in comparison with the area of steel exposed, the corrosion of the steel was concentrated.

It seems indeed strange that some such action should not have been foreseen in view of the large amount of experience on record as to the effect of galvanic action between steel and some of the copper alloys when immersed in sea water. Monel metal, we are informed, is almost identical with manganese bronze in its electrical relation to steel when connected as a galvanic couple. In ships which use manganese-bronze propellers it has become common practice to attach plates of zinc to the hull. As the zinc is more electro-positive than the steel, the corrosion due to the galvanic action with the manganese-bronze propeller is concentrated upon the zinc and the steel is protected.

Only a few miles distant from the Neponset shipyard is the Charles River dam. On the lock gates of this dam truck axles of manganese bronze were used. In *Engineering News* of Mar. 18, 1909, Edward C. Sherman described the extensive tests which were carried on to ascertain the amount of galvanic action that would take place on steel and manganese bronze joined electrically and immersed in sea water. As a result of these tests the steel portions of the dam were protected from corrosion by wrapping zinc sheets around the bronze axles.

Minneapolis Filter Patent-Case Decision

The Jewell water-filter patent-infringement suit (Ira H. Jewell vs. City of Minneapolis) was decided for the most part against the city early in August, 1915, by the United States District Court for Minnesota, Fourth Division. The original petition alleged infringement of three patents, but was narrowed before the case came to decision by striking out one patent entirely and some of the claims of the others.

The patent stricken out of consideration was No. 649,409. This was on the combination with a filter bed of a filtered water chamber beneath the bed, with columns supporting the bed from the bottom of the chamber and means for forcing the water up from the chamber through the bed.

Patent No. 649,410, on central control of filter operation, was finally contested on claims 1, 2, 6, 7, 8 and 9. Claim 1, which was the only one allowed, read as follows:

> A filter provided with a system of controlling valves which are provided with actuating devices located so as to be accessible for control from a single position of an operator.

The city contested this claim on the ground of anticipation, alleging that the use of power-operated in place of hand-operated valves did not constitute novelty and invention, but the judge, although admitting doubt, gave the benefit of the doubt to the plaintiff. The claims denied were on a whole filter system controlled "from a single position of an operator."

The third patent at issue, No. 649,411, was pressed only as regards claim 14, as follows:

> A filter comprising a tank having a tapered lower end and an opening at the bottom of the same, a screen at the lower end of the tank in line with said opening, a granular filter-bed within said tank, the part of said bed contained within the tapered portion of the tank being made of relatively large granules whereby water passing upwardly there-through in washing the filter is laterally deflected so as to be distributed throughout all parts of the bed and a screen interposed between said larger granules and the part of the bed above the same.

This claim the court sustained, regardless of the city's claims of anticipations by Hyatt and others. Although not asserting that Jewell invented high-velocity filter washing, the judge declared that the arrangement described in the claim made such washing "a practical and efficient process."

Engineering News is informed that the screens between the gravel and sand for holding the gravel in position during the washing operation were discarded in the 12 filters of the Minneapolis plant about a year ago and that neither screens nor substitutes therefor were used in the four new filters built since the beginning of the suit.

The city will appeal from the decision on both patents.

News of the Engineering World

Old Storm Sewer Bursts

A heavy rainfall at Baltimore, Md., on Aug. 12 surcharged and burst an old storm sewer in Patterson Park, flooding a swimming pool and adjacent land. The sewer was 7 ft. in diameter, with a two-ring brick arch, and with only 12 to 18 in. of cover where the fracture occurred. The arch split and lifted along the crown for 50 ft., then settled back in place without entirely collapsing. Had the cover been deeper it is believed that the sewer would have withstood the pressure. The swimming pool was drained and closed for several days, thoroughly cleaned and again put in use.

The burst sewer was built in 1889 and, like other old storm sewers in Baltimore, was maintained by the city engineer's department. It was a branch of what is known locally as the Harris Creek drain and carried the flow of Ogiers Run. The Linwood Avenue relief drain, of 12¼x12¼-ft. horseshoe section, now nearly completed by the Baltimore Sewerage Commission, will serve this district. For the foregoing information credit is due to Calvin W. Hendrick, Chief Engineer, Baltimore Sewerage Commission.

Erie Flood Investigation

The city of Erie, Penn., has employed the engineering firm Gannett & Seelye, of Harrisburg, Penn., to investigate and report on methods of preventing serious floods in Mill Creek (see report of flood in *Engineering News*, Aug. 12, 1915, p. 326). A force of 24 engineers and surveyors is already at work making a complete topographic survey of the creek and investigating possible reservoir sites and deflection schemes in the upper watershed. At present there is every prospect that the city will go ahead with construction when the proper solution is determined upon.

New Contract for the Automatic Handling of Railway Mail

The Chicago & Alton R.R. has placed a contract for the exchange of mail between trains and stations by the automatic system of the Hupp Automatic Mail Exchange Co. This contract applies to the Chicago and St. Louis line, 284 miles, with 25 mail stations, and the equipment is expected to be ready for service within a few months.

Various automatic systems have been devised and tried at different times, with the purpose of replacing the hand-operated catcher on the mail cars and the practice of throwing mail bags from the cars by hand, but this is believed to be the first case of the use of such a system in regular service on a long stretch of line.

Mechanism on the car automatically opens and closes the door, swings out and returns the catcher, and operates the mail-delivery chute. The mechanism is put into action by a track device, or trip, as the train approaches the exchange point. The bags to be taken are hung to mail cranes in the usual manner, but any number of bags can be taken at each station. The bags delivered fall into a trough alongside the track, thus reducing the liability of damage to the mail. Both ordinary and parcel mail will be handled. An experimental plant was installed on this railway about a year ago.

Seven Hydraulic Elevators Quit

The entire passenger-elevator equipment of the Bowling Green Building, New York City, was shut down because of a pipe breakage, at noon on Sept. 3. The seven elevators were of the hydraulic type manufactured by the Otis Elevator Co., and were installed when the building was erected, about 12 years ago. The accident was caused by the breaking of a supply pipe between the storage tank and an operating valve. No one was injured.

A Wreck in Pinnacle Tunnel, Va., occurred recently, as the result of a broken rail on the outside of an 8-deg. curve, according to F. I. Cabell, Chief Engineer of the Chesapeake & Ohio Ry. The Coal River Ry., on which the tunnel is located, is a branch line of the C. & O., which connects with the main line of the latter at St. Albans, W. Va. The tunnel is 360 ft. long and except for a small portion of its length at each end is lined with timber. The alignment through it is an 8-deg. curve. A train consisting of locomotive, express car, mail-and-baggage car and three coaches was moving eastward when it struck the broken rail 90 ft. from the west portal. The rail was piped through the center of the head in such a way that it could not be detected by ordinary inspection. Fifty feet east of the point of derailment the derailed coaches knocked down 23 lin.ft. of timber lining, which allowed the timber arch and packing above to fall and crush one end of one of the coaches, resulting in serious injury to six persons.

Timber-Preserving Plants in the United States numbered 122 in 1914, according to a report just issued by the Forest Service Bureau of the Department of Agriculture. Of these plants, 100 were of the pressure-cylinder type. The returns received from three-fourths of the plants show a consumption by them last year of over 79,000,000 gal. of creosote oil and of more than 27,000,00 lb. of zinc chloride, besides 2,500,000 gal. of other preservatives, such as coal tar and crude oil. Nearly 160,000,000 cu.ft. of timber was treated, an increase of about 7,000,000 cu.ft. over 1913 and 35,000,000 cu.ft. over 1912. The rapid growth of the industry is also shown by the fact that in 1895 there were only 15 timber-preserving plants in the United States. While the largest use of timber preservation is for railway ties, the room for further growth in the industry is indicated by the fact that as yet only about 30% of the railway ties used are treated with preservative.

The Outstanding Contracts on the extensions to the New York Rapid Transit system on Aug. 1, 1915, amounted in round numbers to $160,000,000, and about 20,000 workmen are engaged. Over 60 sections are now under contract, and the remaining sections, about 20 in number, will probably be put under contract before the end of the year.

Bids for 58 Mi. of Construction Railway, in connection with the Hetch Hetchy water-supply for San Francisco, will be asked within the next two months by M. M. O'Shaughnessy, city engineer of San Francisco. The railway will extend from the Hetch Hetchy dam site to Rosasco. The estimated cost of the work is $1,800,000, and the contractor will be expected to purchase 4½ per cent. municipal bonds to cover the amount of the contract.

The Illinois Structural Engineers Licensing Law has gone into effect, and Governor Dunne on Aug. 18 appointed the Board of Examiners for Licensing Structural Engineers, as

follows: President, E. N. Layfield, 1735 Monadnock Block, Chicago; secretary, James T. Hanley, Chicago; Prof. Ira O. Baker, Urbana, Ill.; John T. Musham, Chicago; C. C. Stowell, Rockford, Ill. The regulations governing the examinations will be made public as soon as they have been formulated.

Traffic Through the Panama Canal—During its first year of operation, ending Aug. 14, 1915, the Canal passed a total of 1317 ocean-going vessels with an aggregate net tonnage, Panama Canal measurement, of 4,596,644, an average of 3490 net tons per vessel. The tolls earned were $5,216,149. In comparison the traffic through the Suez Canal for the calendar year 1914 was 4802 vessels of 19,409,495 net tons. The total receipts were 125,121,237 francs, equivalent at 19.3c. per franc to $24,148,389. There was a considerable falling off in the Suez Canal traffic in 1914 on account of the war. The traffic was, however, about 4½ times as great as that through the Panama Canal.

State-Road Maintenance in Virginia is something of a problem at this time as there has been no appropriation for this purpose for the many miles of state highways in use and under construction. State Highway Commissioner G. P. Coleman is concerned over the situation. He intends to present certain bills to the next general assembly. He recommends:

(1) That the present practice in regard to jail prisoners be corrected. The law contemplates that these prisoners shall be put on the roads, but the present tendency is to keep them in jail where they are of use only in increasing the fees of sergeants and jailors. (2) That the automobile tax be set aside for the upkeep of roads, instead of for new construction.

The Production of Explosives in the United States for 1914, exclusive of exports, according to Albert H. Fay, of the Bureau of Mines, was 450,251,489 lb., as compared with a trifle over 500,000,000 lb. for 1913. This total comprises about 206,000,000 lb. of black powder, 218,000,000 lb. of high explosives other than permissible explosives, and 25,700,000 lb. of permissible explosives. This report is the third issued by the bureau relating to the production and distribution of explosives. In 1902 only 11,300 lb. of permissible explosives was used in coal mining, whereas in the last year 19,593,892 lb. were used. The total amount of explosives used for the production of coal in 1914 was 220,622,487 lb., of which about 8.9% was of the permissible class.

To Reduce Cost of City Telephone Service—With a view to determining whether any reduction in the cost of telephone service in New York City—now amounting to $300,000 annually—can be effected without detriment to the public interest, Mayor Mitchel and Comptroller Prendergast have directed that a comprehensive study of the situation be made. The investigation will be in charge of the following committee: Putnam A. Bates, electrical engineer of the Fire Department and chief engineer of the Bureau of Fire-Alarm Telegraph, chairman; Michael R. Brennan, superintendent of telegraph of the Police Department; Robert J. McIntyre, supervising statistician and examiner, and Chester M. Gould, assistant engineer of the Department of Finance.

A Large Irrigation System in Hawaii, intended to supply fresh mountain water to the Koloa Sugar Co. on the Kauai, is nearly completed, according to an announcement by A. P. Taylor, Honolulu, dated July 30. Over 10,000 ft. of tunnel and several miles of ditches are practically finished. The Waiahole tunnel, 7 mi. long, which extends through the Koolau Range near Honolulu from the windward side of the Island of Oahu to the leeward side, is rapidly approaching completion. This tunnel was projected to carry water from the Waiahole Valley to the land of the sugar company, on the leeward side of the island. The tunnel construction is in charge of Jorgen Jorgensen, a Danish engineer, who has built large irrigation systems on the Island of Hawaii, one of which is known as the Hamakua Ditch.

The Buffalo & Susquehanna Ry., 90 miles long in western New York, was ordered to discontinue its operations by the New York Supreme Court a year ago, as noted in "Engineering News," Nov. 5, 1914, p. 945. The protest of residents along the line of the road to the State Public Service Commission caused the abandonment of the road to be delayed while various plans were canvassed for continuing its operation. It is now announced that the sale of the road will take place under foreclosure proceedings on Sept. 13, and that on that date the property will be purchased by the Western New York & Pennsylvania Traction Co., which operates a system of trolley lines in the region south of Buffalo. The new company will electrify the line and will operate passenger trains by a gasoline-motor locomotive until the electrification is completed.

Recovery of Secondary Metals in 1914, exclusive of iron and steel, was valued at $57,039,706, according to statistics compiled by J. P. Dunlop, United States Geological Survey. Secondary metals are those recovered from scrap metals, sweepings, skimmings, drosses, etc., and are so called to distinguish them from the metals derived directly from ore. The reports of the Survey do not include the large quantity of iron and steel remelted, nor do they include nickel, gold, silver and platinum. The value of the re-used iron and steel amounts to many millions of dollars annually. The recoveries of lead, zinc, copper, tin, antimony and aluminum in 1914 aggregated about 287,000 short tons. As these secondary metals sell at prices only slightly lower than those of new metals and replace an equivalent quantity of primary metals, they must be considered in any estimate of stock available for consumption in any year. Where a special purity of a metal is necessary, primary or virgin pig metal must be employed; but secondary metals are used extensively in foundries, which find this practice necessary in order to compete for business.

The Two Public Service Commissions of New York recently issued a joint order for the first time since the commissions were established. The jurisdiction of the Public Service Commission of the First District is over public utilities within the boundaries of Greater New York; that of the Commission of the Second District is over public utilities in all the rest of the state. The joint order was issued as the result of a joint meeting of the two commissions to consider the removal of grade crossings on the lines of the Harlem and the New York, New Haven & Hartford railways just south of the New York City boundary line. Improvements just north of the city limits were ordered some time ago by the Commission of the Second District. The joint order extends these improvements southward inside of the city limits. The work involves the construction of a viaduct to carry a street over the tracks, the cost of which will be apportioned according to the law, while the cost of the remainder of the work, including a new station for the Harlem company at 241st St., will be borne by the railway companies.

The Railway System of India has its most eastern extension in the new Southern Shan States Ry., lying north of Burma and Siam. This is being built to develop a rich agricultural section and to form a link in the future connection with the railway system of China. The new line opened in 1915 extends eastward from Thazi, on the Burma Railways (306 miles north of Rangoon), to Aunghban, 70 miles, and is to be carried 33 miles further to Yawnghwe. Beyond this surveys have been made as far as Feng Tung, about 270 miles further. At Thazi the elevation is 525 ft. above sea level, rising to 1546 ft. at Lebyin (38 mi.), where commences a 4 per cent. grade 17 miles long, with two switchbacks. The summit elevation is 4603 ft. and then there is a slight fall, Aunghban being at 4214 ft. Steep grades will be required to bring the line down to Yawnghwe at an elevation of 2903 ft. The railway is of meter gage. The sharpest curves are 17 deg., with transition spirals, and the heavy grades (4 and 2½ per cent.) are compensated for curvature. Locomotives of the Mallet type (0:6:6:0) are used on the heavy grades. For about 30 mi. the line is in a very unhealthy district, and a special medical force was organized. Dispensaries and hospitals were established along the work, the construction camps were visited daily, and during the fever season the doctors administered quinine regularly to all the workmen. At some points water had to be piped for several miles or brought long distances by mules. The railway was built for the Government of India by the Burma Railways Co., under the direction of F. D. Couchman, Chief Engineer, and is operated by that company.

ENGINEERING SCHOOLS

Massachusetts Institute of Technology

The contract between Harvard University and the Massachusetts Institute of Technology, under which the Harvard Engineering School was consolidated with the Institute, has been submitted to the Massachusetts Supreme Court in order that the legality of the contract may be authoritatively determined by that body. As will be remembered, an important feature of this contract is that Harvard turns over to the Institute three-fifths of the income from the Gordon McKay endowment. The trustees of the endowment, however, have filed with the court a protest alleging that under the terms of Gordon McKay's will this transfer to the Institute which Harvard Univer-

sity has agreed to make will be illegal and void. Under the terms of McKay's will, the income from the fund that he bequeathed to Harvard University will greatly increase in future years. The trustees under the will have already paid over to the University about $2,000,000, and more than $5,500,000 additional is now in the trustees' hands. The final amount of the endowment, after life interests established under the will have ceased, will exceed $22,000,000, even if all the income from the endowment is spent by the University and none is reserved for accumulation. The amount at stake therefore is very large.

The principal ground on which the trustees attack the transfer as illegal is that it is contrary to the intentions of the testator. The trustees declare that Gordon McKay during his lifetime was entirely familiar with the work of the Institute of Technology and was repeatedly solicited by persons connected with it to intrust to the Institute the management of the educational endowment he proposed to create. He, however, deliberately and intentionally selected Harvard University instead.

It is further stated that Mr. McKay was on terms of close intimacy and friendship with the late Prof. N. S. Shaler during the years from 1891 to 1906, when the latter was the head of the Lawrence Scientific School, and it was largely through Shaler's influence that McKay finally determined to make Harvard the beneficiary under his will. The trustees further declare that it was McKay's intention to have his benefaction used in promoting a wide range of scientific subjects and not be restricted to engineering and its applications, and that the Harvard University authorities cannot legally relinquish their jurisdiction over a definite proportion of this fund to the authorities of another institution.

Colorado School of Mines

The Joseph A. Holmes Chair of Safety and Efficiency Engineering has been established in this school as a memorial to the late Dr. Joseph A. Holmes, Director of the United States Bureau of Mines.

PERSONALS

Mr. O. H. Lang has been appointed Engineer of Highways of Thomas County, Georgia, with headquarters at Thomasville.

Mr. William B. Bamdford, M. Am. Soc. C. E., Architect and Consulting Engineer, of Belmar, N. J., has been elected a member of the City Council of Belmar.

Mr. N. Everett Waddell, Assoc. M. Am. Soc. C. E., will hereafter be associated with his father, Mr. J. A. L. Waddell, M. Am. Soc C. E., in partnership under the firm name of Waddell & Son, Consulting Engineers, 800 Graphic Arts Building, Kansas City, Mo.

Mr. R. T. Childs has resigned as Editor of the construction news department of "Engineering News," to take charge of an important real-estate development at Mineola, Long Island. His New York office address is 358 Fifth Ave., Shawmut Realty Co. He is a civil-engineering graduate of Rensselaer Polytechnic Institute, class of 1903, and was formerly a member of the editorial staff of "Iron Age." He has been with "Engineering News" since December, 1909, and he originally established the department of market prices of engineering materials, appearing in the first issue of each month. Mr. L. V. Fletcher, as head of the business news department of the Hill Publishing Co., has assumed Mr. Childs' work. He has been with the F. W. Dodge Co. construction report agency for 10 years, for five years being in charge of the news-gathering service of the eastern office.

OBITUARY

Samuel Todd Davis, Jr., President of the Locomobile Co., of Bridgeport, Conn., died at Fairfield, Conn., on Sept. 1, in his 43rd year.

William John Noonan, for 20 years a member of the Ottawa River Works Department, and later engineer for the City of Ottawa, Ont., died recently at his home in that city from pneumonia.

Thomas W. Burrows, formerly General Superintendent of the old Chicago & Erie R.R., died at his home in Lima, Ohio, on Aug. 30, at 63 years of age. He was engaged in railway work most of his lifetime.

Alexander Wilson, formerly Superintendent of the Railroad Department of the Cambria Steel Co., died at Johnstown, Penn., on Aug. 30. He had served as Mayor and Comptroller of Johnstown. He was 75 years old.

E. F. McCrea, Division Engineer of the Cleveland & Pittsburgh division of the Pennsylvania Lines, died on Aug. 28 at his father's home near Logansport, Ind. Mr. McCrea had been in the Pennsylvania's service since 1899.

James W. Cain, formerly Superintendent of Highways of the Borough of Queens, Long Island, died at his home in Bayside, L. I., on Aug. 27, at 70 years of age. Mr. Cain was a resident of Bayside nearly all of his life and was widely known in political circles in Queens.

Griffith W. Lewis, State Director of Railroads of New Jersey, died suddenly from heart trouble at his home in Burlington, N. J., on Aug. 28, at 51 years of age. He served in the State Senate in 1910 and for many years was identified with Republican affairs in Burlington County.

I. N. Robinson, Road Overseer of Ouray County, Colorado, was instantly killed in an automobile accident on Aug. 24. He was on his way to Portland to inspect a bridge which was being constructed there across the Uncompahgre River. His son, who accompanied him, was seriously injured.

J. W. Harry James, a civil and mechanical engineer, of the American Bridge Co., of Wilmington, Del., died at his home in Chester, Penn., on Aug. 28. He was born in England, and prior to his residence in this country had charge of various engineering works in England, France and Russia. He was at one time Consulting Engineer of the Department of Public Works of India.

John R. Graham, President of the Bangor (Me.) Railway & Electric Co., died on Aug. 24 at Intervale, N. H., while on vacation. For many years Mr. Graham was a resident of Quincy, Mass., until about 10 years ago, when he moved to Bangor, and was well known in railway affairs in both cities. At one time he was President of the old Boston & Quincy Railway Co. He was 68 years of age and 10 children survive him.

Gen. John H. Albin, of New Hampshire, President of the Connecticut River R.R., died recently. He was a graduate of Dartmouth College and practiced law in the State of New Hampshire the greater part of his lifetime. For many years General Albin was a Director and President of the Sullivan County R.R., in the Connecticut Valley, and was also a Director of the Vermont Valley R.R., and a Director and President of the Concord Street Ry. He was a Director of the Connecticut River R.R. and in 1914 was elected President, to succeed the late Lucius Tuttle.

John Haines Warder, Assoc. Am. Soc. C. E., Secretary of the Western Society of Engineers, died at his home in Chicago on Aug. 30, at 70 years of age. Mr. Warder was a graduate in mechanical engineering of the Polytechnic College of Philadelphia, and was engaged in engineering work the most of his lifetime. At one time he was connected with the Cincinnati Southern Railway System and was engaged in bridge inspection at various times at the Phœnix Iron Works and in the cites of Detroit, Pittsburgh, Edgemoore, Minn., Athens, Penn., Elmira, Rochester and Chicago. He also had much to do with planning the power and electric plants of Chicago. At the time of his death he was Assistant Engineer of the Bureau of Sewers of that city. He had been Secretary of the Western Society since January, 1901.

William L. Ziegler, Engineer of Construction of the Pennsylvania R.R., died Aug. 6. He was born in Harrisburg, Penn., Aug. 15, 1847, and graduated from the Central High School, Philadelphia, in 1865. He joined the engineering corps of the

Pennsylvania R.R. two years later as a chainman. Having served as rodman, levelman and transitman, he was promoted to be Assistant Engineer in 1873. In 1875 he was appointed Assistant Engineer of Maintenance-of-Way, in charge of the construction of the tracks and station in Fairmount Park to take care of the Centennial traffic in 1876. Afterward he became Engineer of Construction in charge of the union station and carsheds at Pittsburgh. In recent years he had charge of the construction of some of the most important improvements made by the railway company in Philadelphia.

J. G. Metcalfe, formerly President of the Mexican International Ry., and recently consulting railway expert for Speyer & Co., bankers, of New York City, died at Pocono Summit, Penn., on Aug. 31, in his 67th year. Mr. Metcalfe was born in Cambridge, Ohio, and started his railway career as a telegraph operator. In 1900 he was made General Manager of the Denver & Rio Grande R.R., and later held the same position on the Evansville & Terre Haute R.R. In 1902 he was appointed President of the Mexico International Ry., and for a year, starting in 1904, was Vice-President of the National Lines of Mexico. In 1905 he became Vice-President of the Manila Railway Co., and retained that position until his death, at which time he was also Vice-President of the Bolivia Railway Co. and a Director of the Missouri Pacific R.R. He took an active part in solving transportation problems in South America, and some years ago was called to London to give expert advice on the London Underground Railway Co.'s problems.

ENGINEERING SOCIETIES

COMING MEETINGS

NEW ENGLAND WATER WORKS ASSOCIATION.
Sept. 7-9. Convention in New York City. Secy., Willard Kent, Narragansett Pier, R. I.

TRAVELING ENGINEERS' ASSOCIATION.
Sept. 7-10. Annual meeting in Chicago. Secy., W. O. Thompson, N. Y. C. R.R., East Buffalo, N. Y.

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Oct. 11-12. Secy., Will P. Blair, Engineers Bldg., Cleveland, Ohio.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 12-14. Annual convention at Dayton, Ohio. Secy., Charles Carroll Brown, 702 Wulsin Bldg., Indianapolis, Ind.

SAN FRANCISCO MEETINGS

INSTITUTE OF RADIO ENGINEERS.
Sept. 13-18. Secy., David Sarnoff, 71 Broadway, New York.

PAN-AMERICAN ROAD CONGRESS.
Sept. 13-18. Secy., E. L. Powers, Road Builders Association, 150 Nassau St., New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 16-18. Secy., Charles Warren Hunt, 220 West 57th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Sept. 16-18. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 16-18. Secy., Bradley Stoughton, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 16-18. Secy., F. L. Hutchinson, 29 West 39th St., New York City.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Sept. 16-18. Secy., J. J. Blackmore, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Sept. 16-18. Secy., J. W. Richards, Lehigh University, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Sept. 17-21,

INTERNATIONAL IRRIGATION CONGRESS.
Sept. 20. Secy., Arthur Hooker, Sacramento, Calif.

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Sept. 20. Secy., F. F. Sharpless, 52 Broadway, New York City.

PACIFIC COAST ASSOCIATION OF PORT AUTHORITIES.
Sept. 20 and 21. Secy., Leo V. Merle, Ferry Bldg., San Francisco, Calif.

AMERICAN MINING CONGRESS.
Sept. 20-22. Secy., J. F. Callbreath, Washington, D. C.

INTERNATIONAL ENGINEERING CONGRESS.
Sept. 20-25. W. A. Cattell. Secy., Comm. of Management, Foxcroft Bldg., San Francisco.

INTERNATIONAL ASSOCIATION OF BRIDGE AND STRUCTURAL IRON WORKERS.
Sept. 20-30. Secy., Harry Jones, American Central Life Bldg., Indianapolis, Ind.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Sept. 21 and 22. Secy., F. M. White, Madison, Wis.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Sept. 23 and 24. Secy., W. H Ross, 154 Nassau St., New York City.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 23 and 24. Secy., H. M. Wilson, Bureau of Mines. Pittsburgh, Penn.

AMERICAN ASSOCIATION OF REFRIGERATION.
Sept. 23 and 24. Secy., J. F. Nickerson, 431 South Dearborn St., Chicago, Ill

ILLINOIS GAS ASSOCIATION.
Sept. 27. Adjourned meeting. Secy., H. H. Clark, 72 West Adams St., Chicago, Ill.

SAFETY CONFERENCE.
Sept. 27-30. A. C. Carruthers, Vice-Pres., Collective Insurance & Universal Safety Exhibit, Mines and Metallurgy Bldg., San Francisco.

INTERNATIONAL GAS CONGRESS.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

County Highway Engineers' Association—The ninth annual session will be held at Hannibal, Mo., Sept. 13-15. The secretary is E. W. Sheets.

Pennsylvania Welfare and Efficiency Congress—The third annual conference will be held in Harrisburg, Penn., Nov. 16 to 18, and the annual exhibit Nov. 15 to 19.

Engineers Club of St. Louis—A reunion meeting was held at the club on Sept. 8, at which several of the members gave their impressions of the Panama-Pacific Exposition.

American Institute of Consulting Engineers—The Institute has recently joined the Chamber of Commerce of the United States and claims that it is the only engineering organization which has membership in that body.

Youngstown Engineers' Society—The Youngstown (Ohio) engineers will hold a picnic at Milton Dam on Saturday, Sept. 11. The trip to the dam will be made in automobiles. The Milton reservoir is situated 17 mi. west of Youngstown. Its capacity is 10 billion gallons, length 6 mi., greatest width 1½ mi., depth of water at spillway 46 ft. The earth-fill dam contains 200,000 cu.yd. The secretary is L. P. Fawcett.

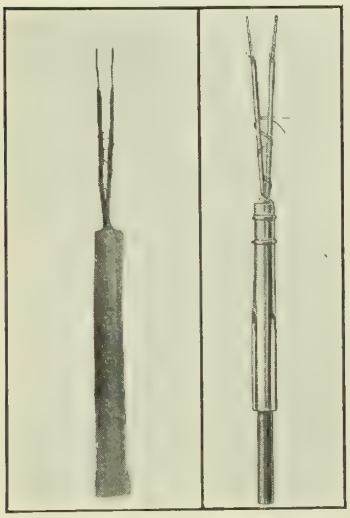
Canadian Engineers representing the British Columbia and Alberta members of the British Institution of Civil Engineers, the Canadian Society of Civil Engineers and the American Society of Civil Engineers have made arrangements with the Southern Pacific and the Canadian Pacific Ry. companies for special train and steamer facilities from San Francisco via Victoria and Vancouver and Calgary to Chicago in order that the members of the International Engineering Congress may have an opportunity to view the Canadian Rockies and to visit some of the engineering works along this route. C. W. Allen, engineer of the Dominion Water-Power Branch, in charge of the water-power exhibit in the Canadian pavilon at the Panama-Pacific International Exposition, has arranged to make the final preparations for the trip, and requests for information should be addressed to him.

National Conference on Concrete Roadbuilding—The second national conference will be held in Chicago, Sept. 15 to 18, at the Auditorium Hotel. The following subcommittees will report: Drainage and Preparation of Subgrade, Hector J. Hughes; Economical Widths of Pavement and Shoulders, J. J. Cox; Problems of Design, Thickness, Crown and Grade, Ira O. Baker; Aggregates, D. A. Abrams; Handling and Hauling Materials and Water-Supply, T. R. Agg; Organization of Concreting Crew, H. P. Gillette; Proportions of Materials and Consistency of Concrete, W. S. Gearhart; Mixing and Placing Concrete, Ernest McCullough; Reinforcement, Richard L. Humphrey; Joint Location and Construction, George A. Ricker; Expansion and Contraction, F. E. Turneaure; Finishing and Curbing, Charles Whiting Baker; Construction of Shoulders and Curbs, A. N. Johnson; Methods and Cost of Maintenance, A. H. Hinkle. Form of Specifications, A. R. Hirst; Cost of Construction, C. J. Benett; Estimating and Inspection Problems, A. Marston. The office of the secretary is at 208 South La Salle St., Chicago.

Appliances and Materials

Delay Electric Detonators

Two detonators for use in tunnel driving, shaft sinking, etc., which will set off the various charges of explosives as desired by one operation of a blasting machine or one application of electric current, are now manufactured by the E. I. du Pont de Nemours Powder Co. One is called the "du Pont Delay Electric Blasting Cap" and the other the "Delay Electric Igniter." They differ in construction, but have the same purpose. The caps are made with two delays, and are similar in outward appearance to the ordinary electric blasting caps, except that the copper shells are slightly longer and are covered with a rubber tube. The delay is accomplished by the use of a slow-burning material inside the shell, which is ignited by the electric current passing through the bridge wires. When this material has burned to the fulminate charge in the shell, the latter explodes and in turn detonates the explosive. In use the instantaneous electric blasting caps are placed in the hole or set of holes which should be detonated first and simultaneously; the first delays are placed in the hole which should be detonated second; the second delays are placed in the holes to be detonated third. Ordinary electric blasting caps can be used in dry work, but in wet work the waterproof electric blasting caps should be used in connection with the delay electric blasting caps, the latter being made on the waterproof type.



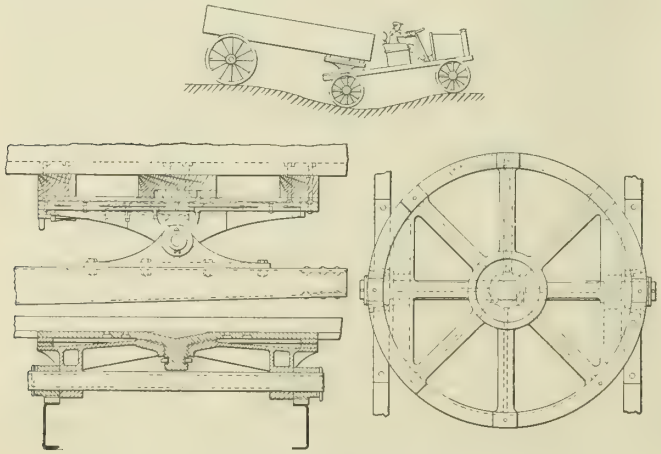
DELAY ELECTRIC BLASTING CAP AND DELAY ELECTRIC IGNITER

The delay electric igniter is made with a number of delays. It consists of a small brass tube, into one end of which the igniting material, composition plugs and wires, are inserted and fastened. These extend about half the length of the tube. Into the other end is inserted a piece of fuse, which touches the igniting material and which is clinched securely in the brass tube. The delay is brought about by using different lengths of fuse, the first delay having 2 in. of fuse, the second 4 in., etc., the fuse length increasing 2 in. for each delay. The wire lengths are the same as for the regular electric blasting caps.

* * *

Flexible Fifth-Wheel for Tractor-Trailer

A fifth-wheel attachment with unusual features, an appliance designed to convert any motor truck into a tractor for handling a two-wheel trailer, has been put on the market by C. H. Martin, 293 Bridge St., Springfield, Mass. This fifth-wheel connection, as the accompanying sketch shows, has a crosswise hinge which gives longitudinal flexibility, thus permitting the vehicle as a whole to conform to the unevenness of the road. No longitudinal hinge is provided, for the reason, it is claimed, that this would permit sidewise tipping of the load on curves or on a crowned road, and thus interfere with the stability of the vehicle. The Martin patent fifth-wheel is made of steel in several sizes from an 18-in. circle for Ford cars or light runabouts ($25) to a 36-in. circle for 5-ton trucks ($90). The top member may be bolted to the cross-bolsters of any wagon and the lower member to the frame of any truck.

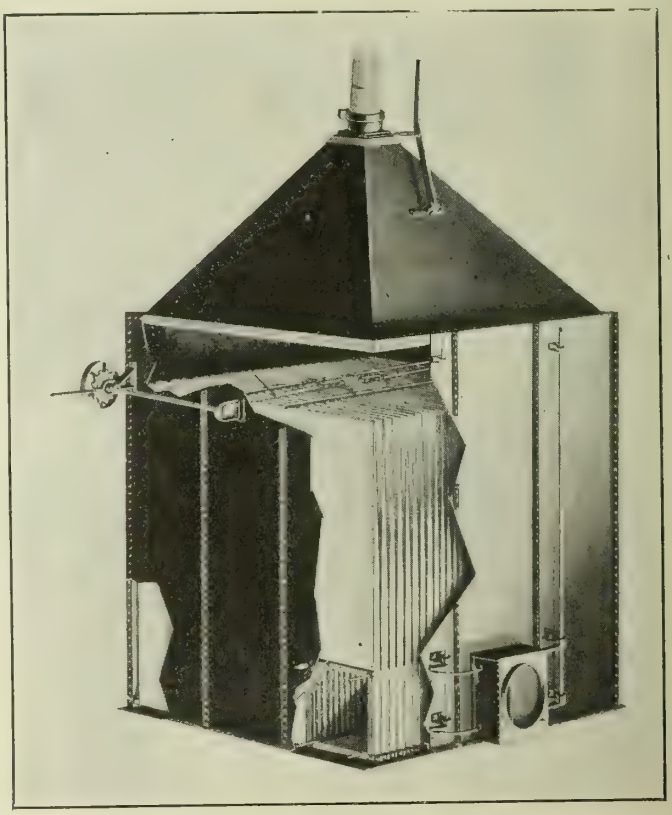


MARTIN PATENT FIFTH-WHEEL FOR TRACTOR-TRAILER CONNECTION

* * *

Cloth-Screen Dust Arrester

A device for collecting dust from tumbling mills, emery wheels, sand-blast equipment, etc., was recently placed on the market by the Whiting Foundry Equipment Co., Harvey, Ill.



CLOTH-SCREEN DUST ARRESTER

The makeup of the arrester is shown in the accompanying view. It consists of an outside case or house of heavy sheet steel in which is located a series of cloth screens that permit free air passage. Air which has passed through this arrester is claimed to be entirely satisfactory to breathe.

* * *

Automatic Gas Street Lamps

An automatic gas lighter has been devised by the Automatic Gas Lighting Equipment Co., of Boston, Mass. This is intended to take the place of the men and boys who are universally employed for lighting and extinguishing gas street lamps. A clock box is attached to the Welsbach lamp standard and the clock mechanism in it operates a tripping lever controlling a double-acting valve. When the gas supply is open the pilot supply is closed, and vice versa. The pilot comes up through a small hole in the center of the gas cap and the flame may be adjusted to use 0.1 or 0.2 cu.ft. per hr. The lighting and extinguishing times are regulated by a control dial inside the clock box.

This device has been used in Newton, Fall River, Gardner and Quincy, Mass., and other cities in from 100 to 1000 units. It is claimed that one man can easily look after 250 to 300 of these machines and lamps, doing all the inspection, cleaning, winding, replacing of mantles, etc. It is claimed that the cost of running a lamp so equipped, including labor, mantles, chimneys, globes, domes, clock repairs, depreciation and interest at 10 per cent., totals about $6 per annum, which is to be added to the local cost of gas, which may vary from $9 to $12. The cost of street lighting where hand extinguishment and lighting is employed is in the vicinity of from $24 to $30 per annum.

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Building the Mathis Dams--I

By E. Lauchli*

SYNOPSIS—First of two articles on the storage reservoir and dams of the Georgia Ry. & Power Co., supplementing earlier notes on the Tallulah Falls high-head hydro-electric development. Design of a reinforced-concrete dam with bulkhead, spillway and power-house sections. Unusual grouting of deep-lying fissured rock to prevent leakage.

The two reinforced-concrete dams at the Mathis storage reservoir of the Georgia Ry. & Power Co.'s Tallulah Falls development[1] are of unusual interest because of their features of design and methods of construction. A few brief notes on both aspects of the work are given herewith.

The Mathis reservoir is 10 mi. long and has a storage capacity of 1,335,000 cu.ft. It is located at Lakemont, Ga., some 6 mi. above the intake works of the Tallulah Falls plant. In order to dam the Tallulah River, it was necessary to throw across it a reinforced dam, 660 ft. long and 90 ft. high; and to close a depression leading out of the basin, a reinforced-concrete dam, 325 ft. long and 45 ft. high, was built a quarter of a mile downstream from the main dam. The location of both these structures is shown in Fig. 2.

The main dam comprises a short bulkhead section (east end), followed by a 290-ft. spillway section, then by a 60-ft. intake or power-house section, and finally by

*2 Wall St., New York City.

[1]For the design of the Tallulah Falls hydro-electric plant see "Engineering News," Jan. 29, 1914; for notes on construction difficulties see the issue of Apr. 16, 1914.

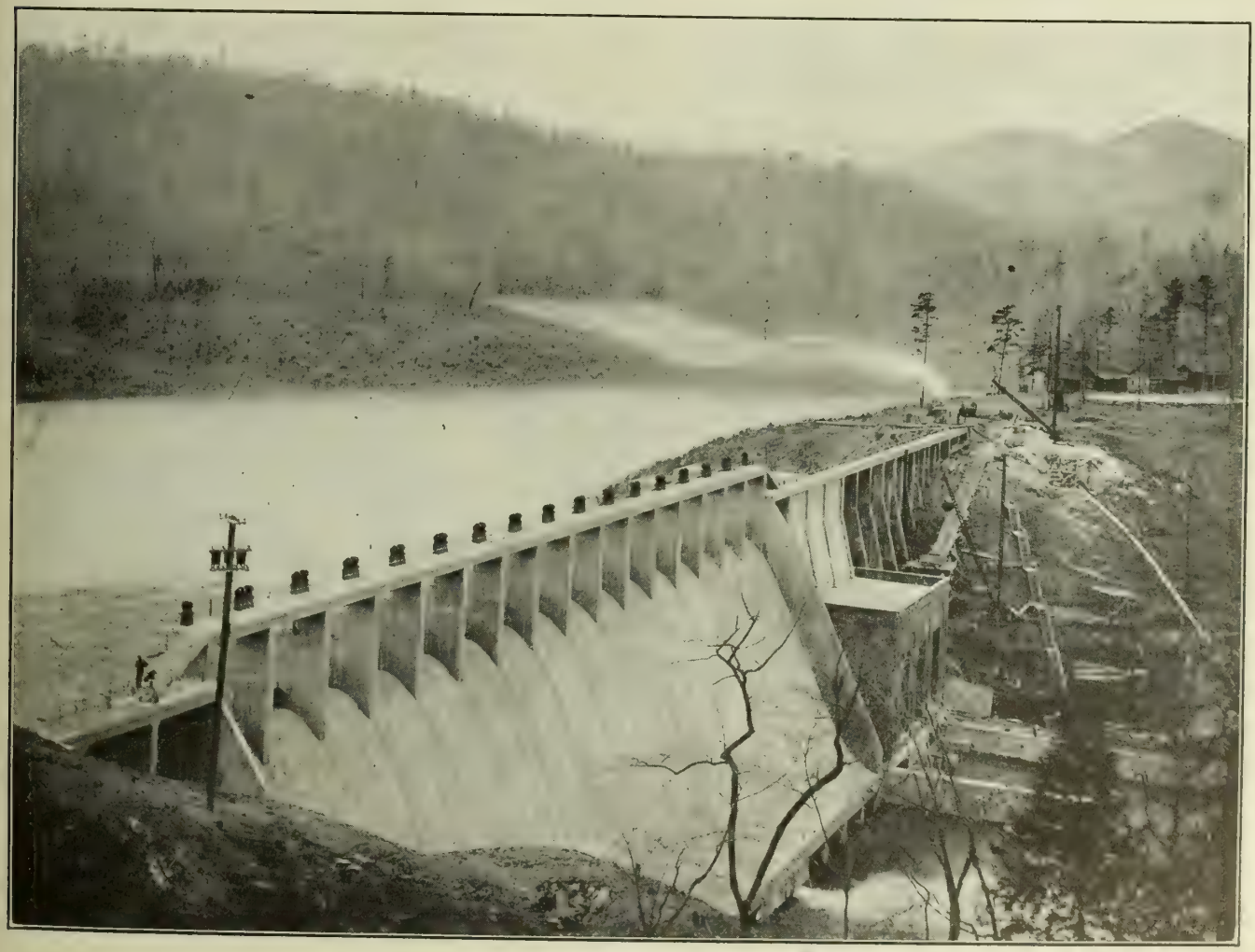


FIG. 1. REINFORCED-CONCRETE DAM AT MATHIS RESERVOIR

a second bulkhead section ending in a corewall carried into the hillside.

The spillway section consists of reinforced-concrete buttresses, 18 ft. c. to c., carrying upstream arched decks on a slope of 45 deg. with the horizontal, and aprons

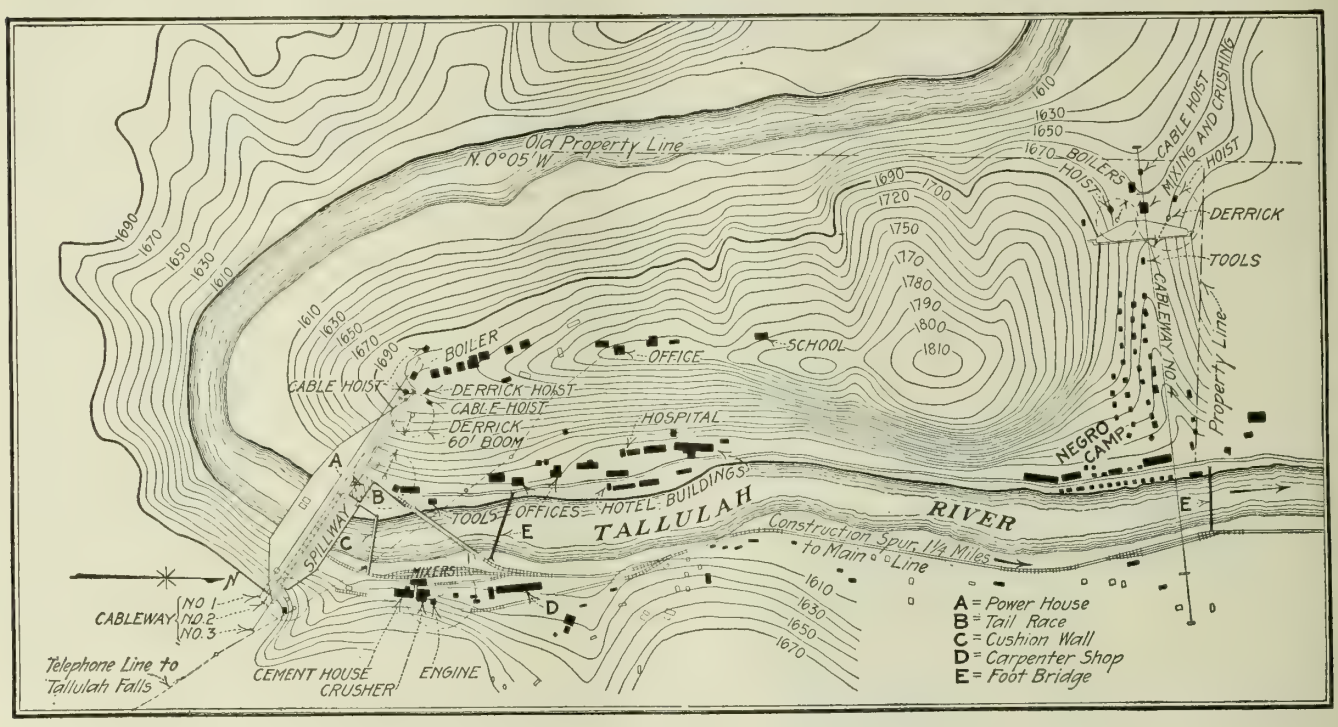


FIG. 2. CONSTRUCTION LAYOUT FOR THE MATHIS DAMS

on the downstream side, as shown in Fig. 3. The buttresses, to save material, were built in 12-ft. lifts, and decrease in thickness from bottom to top, and from the upstream to the downstream end. For instance, the lower lift of a buttress tapers from 40 to 32 in. and the upper lift from 24 to 20 in.

The spillway buttresses are reinforced horizontally at lift elevation and vertically at cross-strut points. Two walkways are provided through the buttresses, one near

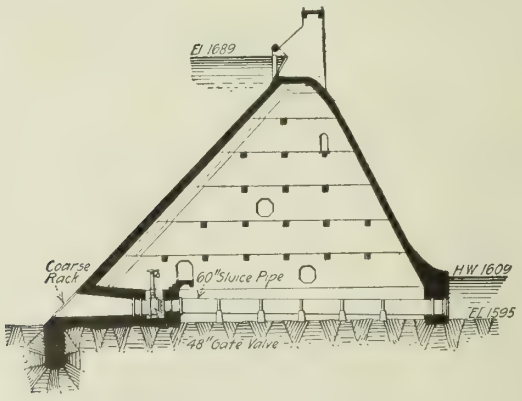


FIG. 3. SLUICEWAY SECTION, MATHIS DAMS

El. 1610, leading from the power house to the gate valves of the sluiceways, and one at El. 1655.

Decks, Aprons, Crest and Sluice

The decks consist of reinforced-concrete arched slabs, free to expand or contract horizontally. They have a rise of 18 in. at the crown and a crown thickness varying from 18 in. near the crest to 39 in. at the bottom, near the cutoff wall. The reinforcement is of 1⅛-in. corrugated bars placed 4 in. c. to c. at the bottom, the spacing varying at higher elevations according to the load carried. Near the crest the reinforcement is of 1-in. rods. Equalizing rods of ⅝-in. diameter are laid longitudinally, 24 in. c. to c. The decks were built in lifts corresponding to the buttress lifts, and keys were provided at the joints. Each deck rests on reinforced haunches cast with the buttress. To allow expansion and to insure imperviousness $\frac{3}{16}$x6-in. hair-felt strips were laid in hot asphalt at the seat, between the decks and the haunches.

The aprons on the downstream side are 18 in. thick from top to bottom, reinforced with 1-in. rods, spaced 7 in. c. to c., with equalizing rods running longitudinally. No waterproofing was provided between the apron slabs and the buttresses, but the abutting surfaces of each slab were tongued and grooved to permit horizontal and vertical expansion.

The crest is equipped with flashboards located between reinforced-concrete piers 26 in. thick, carrying a walkway or operating bridge 8 ft. wide, as shown in Fig. 5. There are seven Stauwerke-type automatic flashboards, capable of discharging 6000 sec.ft. (50 per cent. of the maximum recorded discharge) and nine hand-operated flashboards. All consist of leaves 16 ft. long and 7 ft. high, hinged at the crest of the dam.

There are three sluiceways, two at El. 1601, as shown in Fig. 4, and one at El. 1643, having a total capacity of 3500 sec.ft. with the pond at maximum elevation. Each sluiceway consists of (1) a tapered reinforced-concrete intake, protected by a coarse rack made of 35-lb. rails, 14 in. c. to c.; (2) a 48-in. gate valve operated by a 7-hp. electric motor, controlled from the power house; and (3) a 60-in. steel pipe ⅜ in. thick, carried on concrete piers.

The gate valves are of heavy design, with square bottom disks and heavy bronze guides. Heavy flaring cast-

ings, embedded in heavy concrete blocks, are provided on either side of the gate valve.

In order to protect the river bed from erosion, on the downstream side of the dam, a concrete submerged weir has been provided 100 ft. downstream from the spillway section, so as to form a water cushion, 14 ft. deep, in times of heavy floods. The weir wall, 3 ft. wide at the top, 7 ft. at the base, and 3.5-ft. high, is designed to

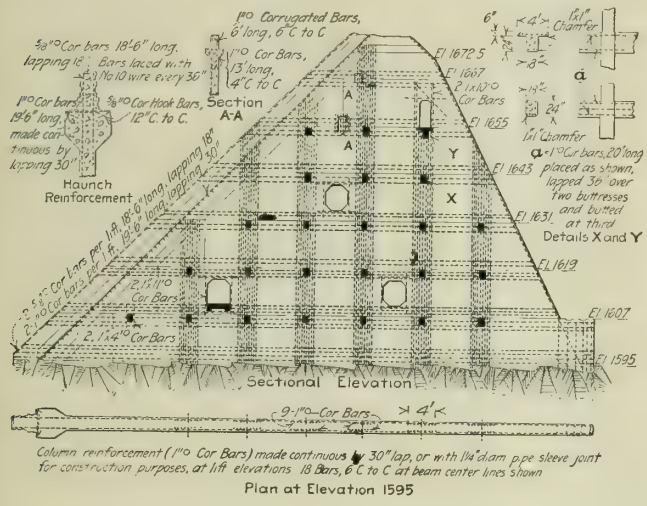


FIG. 4. SPILLWAY BUTTRESS DESIGN

have a low discharge coefficient. It is built on rock foundation throughout, and anchored every 18 in. with 1-in. rods.

Power-House Section

The power-house section of the dam is shown in Fig. 6. It consists of three bays, between buttresses spaced 20 ft. c. to c. Provision has been made for two 3000-kw. units. The power house is a brick building with steel columns on the downstream side, carrying the roof beams and the crane girders, the latter being carried at the upstream side of the power house on concrete brackets. The foundations and wheel-pits are of mass concrete.

There are two intake bays, each provided with stop-logs, fine-trash racks and 14x14-ft. steel headgates, with bronze guides, operated from a concrete platform at El. 1692. An 18-in. bypass has also been provided on each penstock to balance the pressure before hoisting the gate.

The bulkhead section consists of buttresses, of uniform thickness throughout a lift, placed 18 ft. c. to c. and without aprons on the downstream side, as shown in Fig. 1. The buttress footings were carried down to rock, with the exception of a few buttresses at the west end, which, on account of the extreme depth of bedrock, were given spread footings.

Throughout the dam a concrete cutoff wall was carried down to rock at the upstream side. Before laying concrete in the cutoff trench, drill-holes were put down

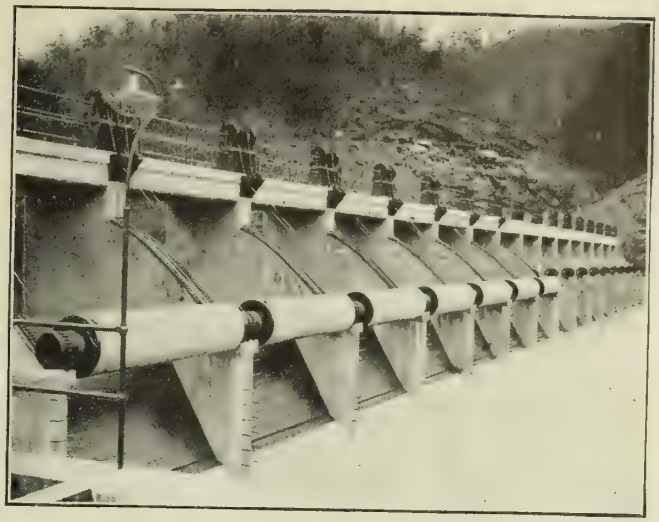


FIG. 5. AUTOMATIC FLASHBOARDS AT MATHIS DAM

at the bottom of the trench and then grouted under pressure.

In general these holes took little grout, except at the west end of the dam, where some trouble was experienced on account of the geological formation of the hill. Here the cutoff wall was carried down as far as 30 ft. below the original ground surface (see Fig. 7). From there on, to and beyond the dam, Lackawanna steel sheet piling 30 ft. long was driven through the material overlying the rock.

Grouting Fissured Rock

The location of the rock had been ascertained by driving 4-in. steel pipes (with water jet and by churning). In general it was found that the underlying rock was badly fissured and weathered. As there was some possibility that leaks would develop, about 3300 ft. of holes, 10 to 30 ft. deep, were put down with steam and air

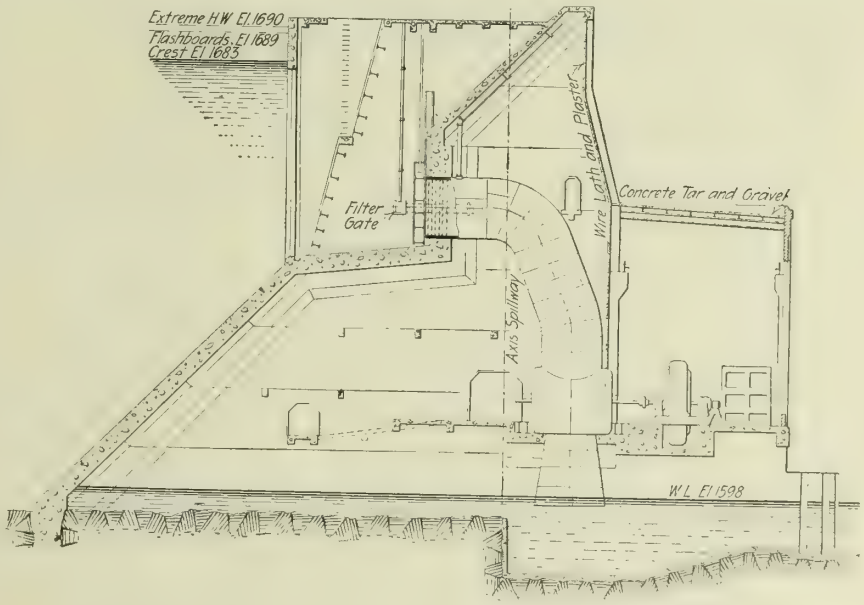


FIG. 6. SECTION THROUGH MATHIS DAM AT POWER HOUSE

drills and then grouted under 60- to 90-lb. pressure. About 2300 sacks of cement were thus used with a little sand added when the grout was absorbed too freely.

This, however, was not considered sufficient, as there was always the chance that a vertical hole would miss vertical seams. Therefore a shaft 50 ft. deep was sunk

at the west end of the dam, on the downstream side. As it was anticipated that drilling and grouting would be carried on while the reservoir was filling up, the bracing and sheeting was made strong enough to resist the full hydrostatic pressure. The shaft was driven through soft material easily picked for the first 40 ft. Below this elevation blasting had to be resorted to in order to excavate a working chamber 8x17x8 ft. The shaft was made 6x8 ft. in the clear and timbered with 10x10-in. posts and caps and 3-in. sheeting. The voids beyond the lagging were grouted. Diamond-drill holes varying in length from 50 to 290 ft. were put down at various angles, as shown in Fig. 7.

Some 1400 ft. of 4-in. holes were drilled, the bits giving a 3-in. core. Progress varied from 10 to 30 ft. per 24 hr. (two shifts), according to the hardness of the material penetrated. Frequently during drilling a flow of 3 or 4 gal. per min. would spout out of the collar of a hole, but no serious inrush of water ever occurred.

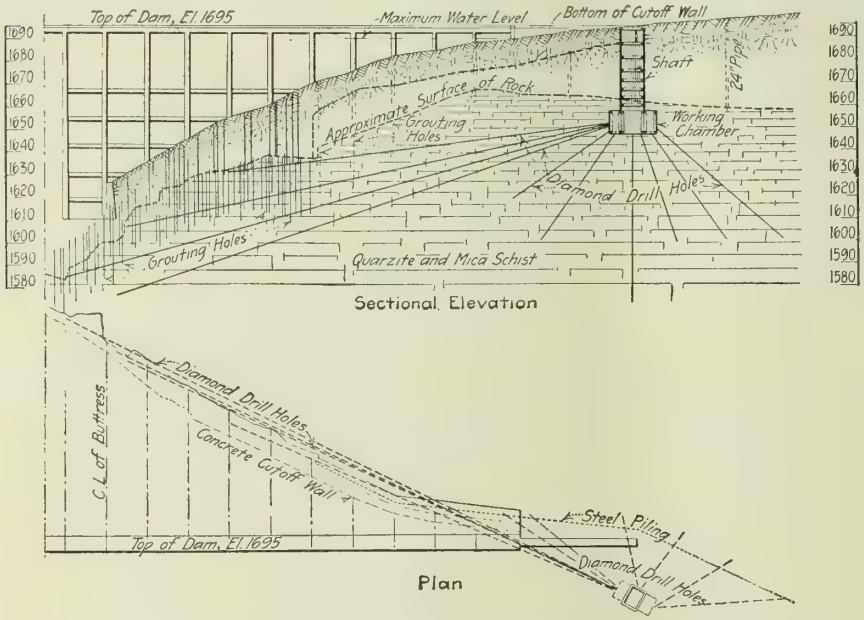


FIG. 7. DIAMOND DRILL HOLES FOR GROUTING FISSURED ROCK

With the reservoir at maximum elevation the total leakage into the shaft never exceeded 10 gal. per min. No bits or diamonds were lost. This work was done at a cost of about $4.50 per lin.ft. for drilling.

The holes were grouted under a pressure of from 60 to 80 lb. per sq.in. with neat cement grout mostly. Usually a hole would be drilled a short distance, and then grouted, then cleaned out and redrilled. A cement core could be recovered after 20 hr. when the hole was not cleaned out. About 29,000 gal. of grout was forced into the holes, the upper part of these absorbing more than the lower.

The total leakage at the west end of the dam never exceeded 200 gal. per min. with the reservoir at maximum elevation; it was finally reduced to a negligible amount.

Concrete Proportions and Stresses

The buttresses, piers and abutments were made of 1:3:6 concrete, the stone passing through 2½-in. mesh. The decks, crest, apron, beams and bridges were made of 1:2:4 mix, the stone passing a 2-in. mesh. The steel for the reinforcement had an ultimate strength of not less than 80,000 lb. per sq.in.

The following unit stresses were allowed:

	Tons per Sq.Ft.
Bearing power of rock for buttress footings	15
Bearing power of hardpan	3
	Lb. per Sq.In.
Buttresses, compression	300
Buttresses, direct shear	100
Deck and apron, compression	600
Deck and apron, tension	0
Deck and apron, shear	75
Steel reinforcement, tension	14,000

The structure required 23,700 cu.yd. of excavation; 33,600 cu.yd. of concrete and 1,908,200 lb. of steel reinforcement—about 56 lb. of steel per cubic yard—were used. The largest amount of concrete laid per week was 1073 cu.yd., and the largest weight of steel 87,400 lb.

Engineers and Contractors

The writer was in charge of the design of this dam and supervised its construction. C. G. Adsit was in general charge of construction work at the Mathis reservoir; with H. T. Hartwell as resident engineer. The late John Birkinbine was retained as consulting engineer. The whole Tallulah River development of the Georgia Ry. & Power Co. was designed by C. O. Lenz, Chief Engineer.

Gasoline Made by New Process

Much has been heard in recent months of processes for the production of gasoline fuel for internal-combustion engines out of heavier petroleum oils. Most of these processes seem to be modifications of the fundamental scheme to "crack" the heavier oils into the more volatile hydrocarbons with the deposition of excess carbon in the treating retorts. One process (described by the inventor, A. M. McAfee, before the American Institute of Chemical Engineers in San Francisco, Aug. 25, 1915) differs radically from these others in that high pressure is not employed on the stills and high-boiling oils are broken down into lower-boiling oils, which are sweet-smelling, water-white and saturated for hydrogen. Valuable heavy oils are produced as desired, and the carbon is deposited in a granular mass easily handled. The process has been tried out with success by the Gulf Refining Co., of Bayonne, N. J.

In practical operation, any kind of crude petroleum is distilled to remove gasoline and kerosene or to free it of moisture. Anhydrous aluminum chloride is added, and the mixture is brought up to boiling in a still with stirrer. The distilling vapors are held to 350° F. or under, to prevent the aluminum chloride passing over to the condenser. The distillate is a mixture of gasoline, solvent oil and kerosene which are later separated by fractionation. No treatment is given them except washing with alkali.

The results with a Texas crude oil show 17.8% gasoline, 13% gas naphtha, 8.7% kerosene, 17.1% gas oil, 25.6% lubricating oil, no asphaltic residue and a loss of 17.8%. The usual process yields 4.3% kerosene, 52% gas oil, 25.5% lubricating oil, and 12½% asphaltic residue.

Track Elevation at Lynn, Mass.

By Charles B. Breed*

SYNOPSIS—Projects for the elimination of grade crossings of the Boston & Maine R.R., at Lynn, Mass., included both track elevation and track depression. The former was adopted, at first for two tracks and later for four tracks. A feature of the work was the crossing of a public square in the center of the city. The bridges are of steel, with concrete decks, and have the columns and exterior girders masked with concrete. A concrete-arch viaduct runs through the station grounds. Some open-deck bridges have been given a solid floor of plank and roofing paper. The history and development of the project as now carried out are described, as are also the methods of carrying on the construction.

The city of Lynn, Mass., 11 mi. north of Boston, has a population (1915) of about 100,000, and an assessed value of real and personal property of $90,000,000. The Boston & Maine R.R. line through Lynn before its elevation was from 5 to 20 ft. above mean high tide. It was proposed to abolish eight crossings on the main line and seven on the Saugus branch, both double-track roads, with respectively about 150 and 40 regular trains daily. All of the crossings on the Saugus branch were grade crossings. On the main line, those in West Lynn were grade crossings, while all of the crossings from Central Square to the east had already been provided with highway overpasses, except at Chatham St. The situation is shown by the plan and profile, Fig. 1.

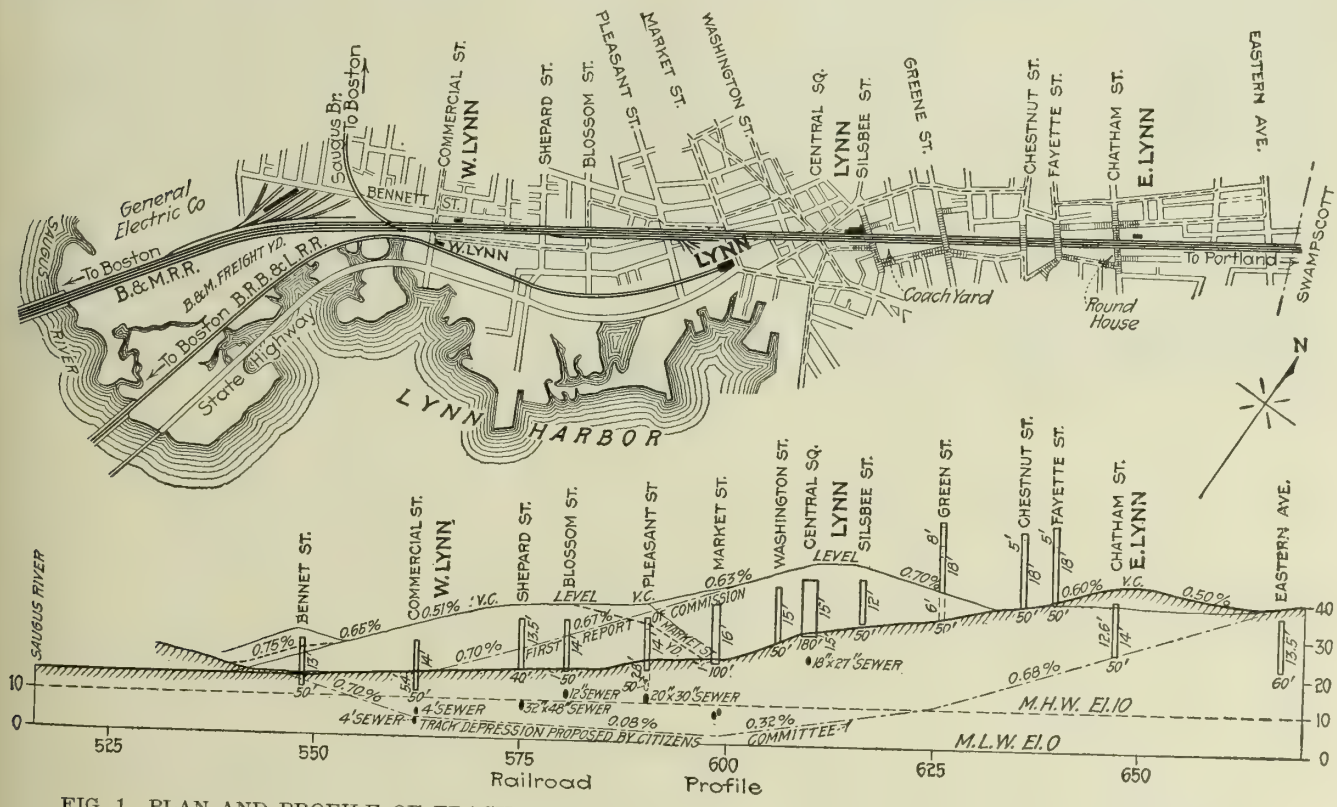


FIG. 1. PLAN AND PROFILE OF TRACK ELEVATION ON THE BOSTON & MAINE R.R. AT LYNN, MASS.

History of the Project

In July, 1901, the city engineer (the late George I. Leland) was instructed to prepare alternative plans for the abolition of grade crossings by depression and by elevation of tracks. His report showed that in 1901 at Central Square about 30,000 people and 2500 vehicles crossed the tracks daily, and that the gates were down about 3½ hr. between 6 a.m. and 11 p.m. At Washington St. about 7000 people passed, at Market St. 13,000, and at Pleasant St. about 5000. The gates were down at this last crossing for 7 hr. out of 17, and between 2 and 3 p.m. they were down 45 min. in the hour. In general this street was closed to traffic about half of the time, as it was located at the throat of the Market St. freight yard.

Five studies were made and estimated as follows: Main line elevation, $1,144,700; main line depression, $2,905,777; Saugus branch elevation, $418,320; Saugus branch depression, $635,875; Saugus branch relocation, $304,942. The city adopted the main line track-elevation plan. The railway also advocated track elevation; but its plan called for lower headroom and steeper approach grades on the streets, and for open-floor bridges throughout. Central Square is the industrial center of Lynn, the transfer point of all street-car lines, and contains the best business buildings. To have an open-floor railway viaduct 200 ft. long across Central Square was by no means desirable.

It was inadvisable to change the street grade to any extent at Central Square, on account of the value of the

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land and buildings. This resulted in an elevation of 18 ft. for the railway, bringing it to the grade of the Silsbee St. bridge over the tracks. The railway proposed to close this street and provide only a foot subway; but the city objected to this, as 14,000 people daily passed through Silsbee St. The city petitioned the Superior Court to appoint a special grade crossing commission, which made its report in 1906. It held that Silsbee St. should be closed, that public security and convenience did not require the immediate elimination of any crossings on the Saugus branch, and that two crossings on the main line could be left to a later time.

This report was opposed so strongly by the city that the Massachusetts Railroad Commission returned it for further consideration. The next report was made in 1909 and was the same as the first, except that it recommended the two extra crossings on the main line. In the meantime, however, the railway had agreed that a street in substitution for Silsbee St. should be built when necessity arose for it, the railway to pay 65% and the city

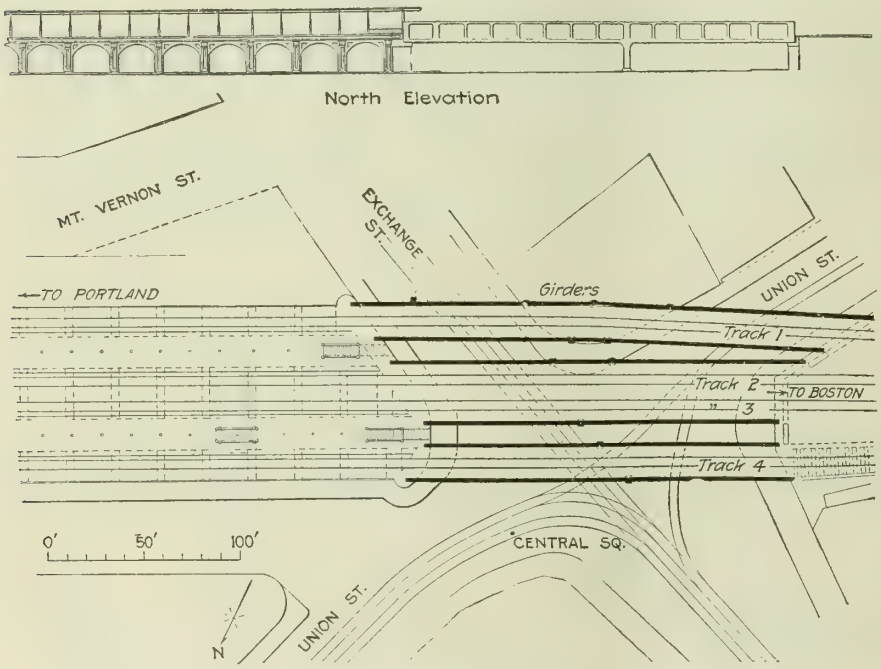


FIG. 2. CENTRAL SQUARE BRIDGE AND VIADUCT THROUGH STATION GROUNDS, LYNN, MASS.

35% of the cost. The Railroad Commission approved the report and the Superior Court made it a decree. Construction was started in September, 1909, at Commercial St. in the west end and at Chatham St. in the east end of the city.

About this time the New York, New Haven & Hartford R.R. obtained control of the Boston & Maine R.R. and proposed to four-track the line through Lynn, purchasing land for this purpose at a cost of nearly $1,000,000. To a committee of citizens Mr. Mellen, president of the railway, expressed himself in favor of track depression, were it not for the expense already incurred for track elevation. This was early in 1911. The municipal council then voted to assume the entire cost up to that date (about $624,000), and introduced a bill in the Legislature for a four-track depression project.

The railway company at that time estimated the cost at $4,495,000 for double-track depression and $1,412,000 for double-track elevation. The writer, representing the city, estimated the cost at $3,500,000 and $1,500,000 respectively. The railway alone was to pay the cost incidental to the two additional tracks.

The city's bill was not passed. The railway having purchased land for additional width of its location, as already noted, then proposed a bill modifying the two-track plans provided for by the court decree so as to allow for four tracks. The city took this opportunity to require that the construction, headroom, street approaches and bridges should be satisfactory to the city. The new act was drawn up jointly by representatives of the railway and of the city, and was passed by the Legislature in 1912.

This act provided, briefly, as follows: (1) A four-track elevation, with grade practically in accordance with the report of 1909; (2) Silsbee St. to have a subway the full width of street; (3) solid-floor bridges to be used, except at five streets where the bridges already had been fabricated or erected; (4) new highway bridges to be built at Green, Fayette and Chestnut St., with brick paving instead of plank floors, and to be maintained forever by the railway; (5) the bridges at Market, Washington, and Silsbee St., and Central Square, and the steel viaduct through the station grounds to have the girders and columns masked with concrete.

The Central Square bridge and the viaduct through the station grounds were required to be in accordance with a new plan which was presented with the act. This plan gave a minimum of columns in the square and a more attractive viaduct. It will be seen from Fig. 2 that the four tracks across Central Square are crossed by one double-track bridge flanked on each side by a single-track bridge, the lengths of span and positions of girders being accommodated to the street plan and street-railway track layout. Beyond this, a viaduct with arched spans extends to the station.

The act provided also that the railway should pay for all changes in overhead bridges and approaches east of the station, and that the cost of a two-track elevation should be divided among the railway, the city, the Commonwealth and the street railway company. All additional cost incidental to two extra tracks to be paid by the railway.

The Present Work and Its Cost

The work is now practically completed as a two-track elevation, but its expansion into a four-track line has not been fully accomplished owing to the financial condition of the railway. The total cost to date is about $3,000,000 (exclusive of the railway's additional right-of-way). About half of this is chargeable to the two-track system, and has been paid for as follows: The Boston & Maine R.R., 65%; the city, 10%; the Commonwealth, 17½%; and the Bay State St. Ry. Co., 7½%.

The expense to the railway, including its extra land for widening, will probably reach $3,500,000, which is a large outlay in view of the company's financial difficulties.

And unfortunately its benefits cannot be realized without additional expense. At Salem, 5 mi. east, is a single-track tunnel in the heart of the city. At Chelsea, between Lynn and Boston, the road has a double-track line with several dangerous grade crossings. It will cost about $6,000,000 to complete a four-track system from Boston to beyond Salem, where two important branches leave this division.

Fig. 1 shows a plan and profile of the work. The railway approached originally from Boston on the level and at 5 ft. above mean high water. From Commercial St. to Market St. it rose on a grade of 0.20%, and thence at 1% to Central Square. The latter grade was the maximum for the division and seriously affected freight traffic. It often caused very slow movements across the square, involving serious delays to street traffic (including fire-department delays). From the station eastward there was a rising grade of 0.32% for 2000 ft., followed by a level stretch. The other 1% grades can be eliminated at no great cost, and 0.7% is assumed as the maximum future grade for this division. The old alignment was followed.

The profile shows also the track-elevation project of the special grade-crossing commission (which was rejected) and the track-depression project of the city. The latter would have affected all the large sewers and lowered the railway nearly to low-tide level, requiring waterproof construction.

Methods of Construction

The general method of handling the work was as follows: At Chatham St. the two main-line tracks were first raised 6 ft. under traffic. Piles for two tracks were then driven and the tracks supported on the trestle. The street was closed to team traffic and the excavation was done by hand shoveling and teams. Many of the dwellings were so near the street line that they had to be shored, which was accomplished without settlement. When the two additional tracks were constructed in 1914, one on each side of the old double-track system, temporary trestles were first constructed across the street, and later replaced by permanent bridges. Typical views of the construction work within the city are shown in Fig. 3 with explanatory notes appended.

In the work at Commercial St., the tracks were first thrown far enough to the south to admit of constructing a two-track abutment. Then the street was excavated, and as this proceeded the tracks were also depressed to the grade of the new underpass, pedestrian traffic only being maintained on the streets. When the northerly half of the abutments was completed the traffic was turned onto the new elevation. A temporary runoff east of Commercial St. brought the elevated tracks to the old grade again at Shepard St. The next season the main-line tracks from Commercial St. to Market St. were thrown to the south far enough to permit the building of the retaining walls on the north side throughout this district.

These walls were partly constructed when work was held up on account of the introduction into the Legislature of an act which seemed destined to change the type of construction since it called for track depression. During this time the railway purchased a large amount of property between Commercial St. and Central Square, so that before work was resumed it was possible to demolish several buildings and to throw the tracks from West Lynn to Central Square still further to the south. This allowed not only the construction of the northerly wall but also the placing of filling adjacent to this wall sufficiently wide for two tracks.

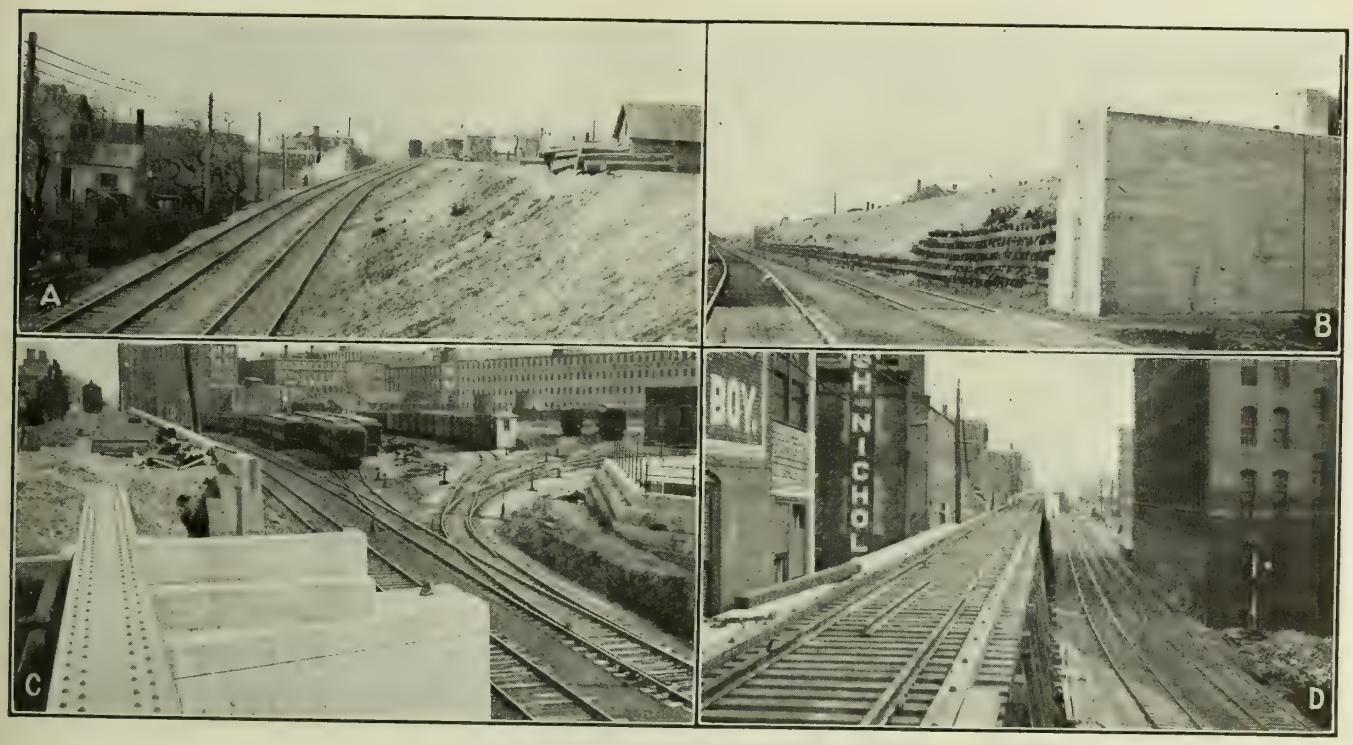


FIG. 3. TYPICAL VIEWS OF CONSTRUCTION WORK, BOSTON & MAINE R.R. TRACK ELEVATION AT LYNN

A—Looking west from Shepard St.; temporary low-level tracks at the left and elevation at the right. B—Looking west from Blossom St.; elevation completed for two high-level tracks. C—East from Pleasant St. bridge; two low-level tracks passing through the Market St. yard. The wall parallel with the track was part of the two-track elevation system (at the left) and was buried when this was widened to a four-track system. D—East from Market St.; two temporary low-level tracks and one track of the two-track elevated trestle. Top of retaining wall at the left.

The traffic tracks were moved south far enough between Market St. and Central Square to admit of constructing, not only the northerly wall, but also a two-track trestle (one track at a time) through this narrow district (Fig. 3). At Central Square the traffic tracks were thrown toward the south a considerable distance, which permitted the construction of a permanent viaduct

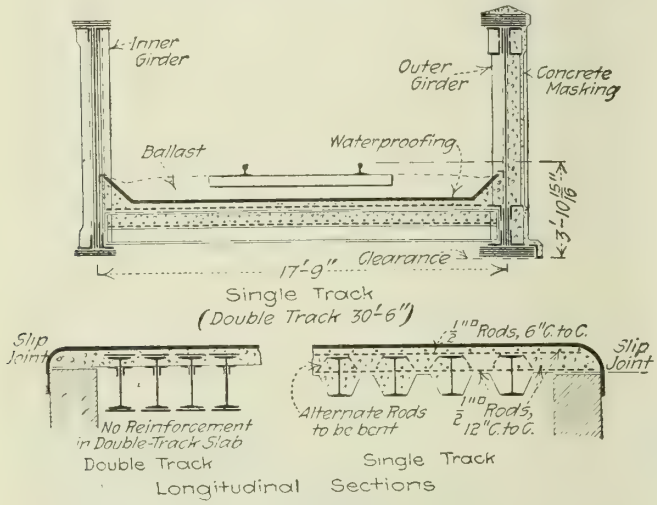


FIG. 4. SOLID FLOOR CONSTRUCTION; CENTRAL SQUARE BRIDGE SPANS

for three tracks from the Square through the station grounds to Silsbee St., and the runoff thence toward Green St.

By Aug. 9, 1913, all westbound traffic was carried on the elevated structure supported on permanent bridges or earth fill, except from Central Square to Market St. Then the trestle for east-bound traffic was constructed between Market St. and Central Square on the site of the old low-level temporary westbound track, and traffic was thrown onto the new elevated track. The temporary low-level tracks were then taken up, and the abutments at the various streets were extended to four-track width and the walls on the south side were constructed.

The widening out of the embankment was done from the eastbound traffic track. The fill between Market St. and Central Square was made from the trestle, principally at night and on Sundays on account of the large amount of regular traffic. The caps and stringers of the trestle only were reclaimed. The bridges on the main line were erected for two tracks before the traffic was turned onto the high level.

The runoff of the Saugus branch was raised entirely under traffic, both tracks being in operation during the construction. After the tracks had been raised to their full height, piling was driven at Bennett St., the excavation made and abutments constructed, while the railway traffic was carried on the two-track pile trestle.

Details of Bridges

All bridges were of the plate-girder type. The floor systems were field riveted. Seven of the spans in the Central Square bridge were 100 to 115 ft. in length; and the steel in this bridge weighed 1483 tons. Special derrick cars were used for handling these girders, the larger ones being placed at night.

Fig. 4 illustrates the type of floor for the solid-floor railway bridges. The concrete masking put on the outside girders is shown in Fig. 5. Much of this work was done during the winter time; steam coils were introduced into the forms, which were packed with straw to keep the concrete from freezing. The Central Square bridge floor had 674 cu.yd. of concrete and 1806 sq.yd. of waterproofing. The masking of the outer girders required 738 sq.yd. at the contract price of $4.25 per sq.yd. That on the Market St. bridge (Fig. 5) cost $935; Washington St. bridge, $493; and on the station viaduct and Silsbee St. bridge, $3638.

None of the bridges, except at Silsbee St. and Bennett St., had curb columns. In the former case they could not be avoided because the station platform extended across the street, so that the girders had to be shallow and therefore of short span. Bennett St. is in the outskirts of the city, near the new freight yard, and the city agreed to the cheaper construction in this place.

The remaining railway bridges were of open-floor construction, and under the act it was necessary to provide these with watertight decks. To meet this condition the railway constructed a watertight wood deck of special design on the steel flooring. The construction is shown in Fig. 6, but the floors have not been in use long enough to give conclusive evidence as to their success.

The ties are 7x10 in., 12 ft. long, with 4-in. oak blocks, carrying the track rails and guard rails. The open spaces are covered with two layers of tongued and grooved planking, secured by iron straps and screws. Between the two courses of planks are layers of felt, each mopped with coal-tar pitch. The openings at each side between the floor and the girders are closed by inclined sheathing in the plane of the gusset plates. This consists of two layers of 7/8-in. matched boards with a layer of roofing between them.

The highway bridges had steel floor-beams and wood stringers, carrying 4-in. hard-pine plank covered with

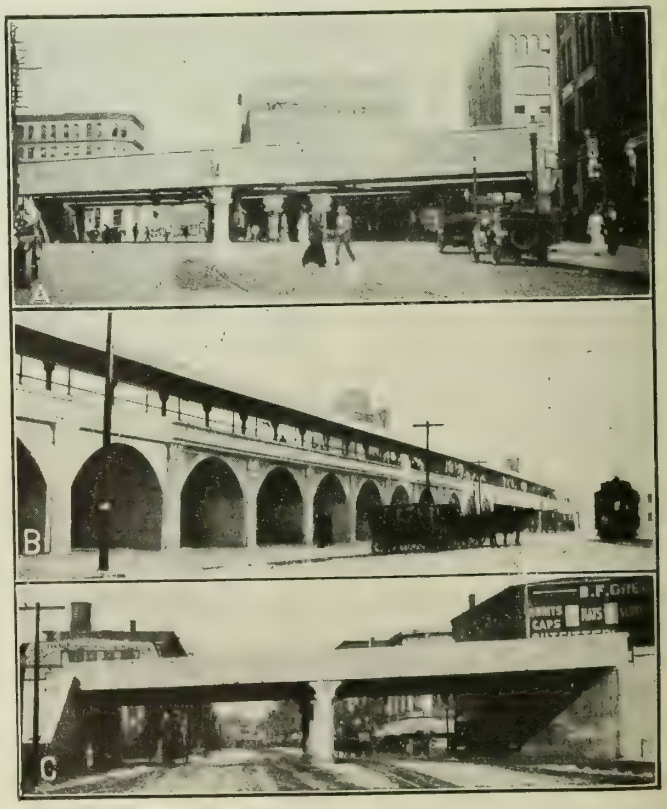


FIG. 5. TRACK ELEVATION STRUCTURES AT LYNN, MASS.

A—Steel bridge over Central Square. B—Concrete viaduct through station grounds. C—Steel bridge over Market St.

1½ in. of coal-tar pavement and waterproofing. On this was a 1-in. sand cushion for the brick pavement which was grouted with cement.

The bridges were constructed by the New England Bridge Co., Shoemaker Bridge Co., Boston Bridge Co., Phœnix Bridge Co., Pennsylvania Bridge Co. and American Bridge Co. The price for this steel work erected averaged 3.264c. per lb.

Concrete Work, Filling and Stations

The retaining walls and abutments were of gravity section, made with 1 : 3 : 6 concrete. No permanent piles were used on the project. The filling was principally sand and gravel, obtained from Peabody and Newburyport with hauls of 9 mi. and 27 mi. respectively. The gravel trains were equipped with air-operated dump cars, the spreading being done entirely by hand. There were practically no delays to regular train traffic throughout the entire period of construction.

The freight yards have been ballasted with gravel. The main-line tracks have stone ballast, hard-pine ties, Wolhaupter tie-plates, continuous rail joints and 85-lb. rails. There were only six private industry tracks leading from the main track. All of these were retained, some by building trestles on the owners' property and others by sidetracks on the railway right-of-way.

The filling was done by the railway company. The walls, abutments, station extension and viaduct arches were built and most of the street work was done under contract by T. Stuart & Son Co., of Newton, Mass. The Chatham St. project was carried through under a separate contract by the Farnum-Hanscom Co., of Boston. A few special contracts were let for remodeling the Lynn station and for special street pavement improvements. The unit prices paid T. Stuart & Son Co. on this work were as follows:

Excavation, earth, per cu.yd.	$0.50
Excavation, rock, per cu.yd.	2.50
Concrete masonry, plain 1 : 3 : 6, per cu.yd.	5.75
Concrete masonry, reinforced, per cu.yd.	7.25
Bar reinforcement in place, per lb.	.05
Waterproofing for arches (5-ply felt and 2-in. tar concrete), per sq.yd.	.85
Masking of bridges, per sq.yd.	4.25
Granolithic sidewalks, per sq.yd.	1.65
Furnishing and laying brick sidewalks, per sq.yd.	1.20
6-in. trap-rock macadam roadways, per sq.yd.	.60
Laying stone block paving, with sand joints, per sq.yd.	1.00
Grouting joints of stone block pavements, per sq.yd.	.20
Furnishing and laying first-class stone block pavement, per sq.yd.	2.85
6-in. concrete foundation for pavement, per sq.ft.	1.05
Manholes and catch basins, each	75.00
New curbstones in place, per lin.ft.	.90
Resetting curbstones, per lin.ft.	.20
6-in. sewer pipe furnished and laid, per lin.ft.	.90
8-in. sewer pipe furnished and laid, per lin.ft.	1.40
10-in. sewer pipe furnished and laid, per lin.ft.	1.60

The West Lynn and the East Lynn stations are small buildings built at the level of the elevated tracks and approached by stairs and inclined driveways. The Lynn station had originally two buildings, but the eastbound building was torn down and moved to another city. The westbound building was left at its original grade, and its main waiting-room was extended so as to pass under the elevated tracks, with stairway approaches to the island platforms. The extension of the waiting-room alone in this action cost about $51,000, whereas the total cost of station-building alterations, including new platforms, awnings, etc., was $106,000. This work was all done on a cost plus 10% basis, figured on the labor and materials, with no charge for plant or superintendence.

Parallel to and on the south side of the railway, between Central Square and Silsbee St., is Mt. Vernon St. (Fig. 2). This originally had an up grade of about 3½% from Central Square to the overpass at Silsbee St. The depression of Silsbee St. so as to pass under the railway introduced a hill with its summit midway along Mt. Vernon St. with a 3½% grade on each side. This hill was cut down, and a practically level street made, 50 ft. in width, which with the 20-ft. driveway in the station grounds resulted in a way 70 ft. wide. The city entered into a special contract with the railway in connection with this project, which included improved street pavements and some improvements in the station grounds. The city agree to pay 35% of the cost of that portion of the additional work which was done upon the street alone, including grade damages, and the railway agreed to pay the remaining 65%. The total additional cost of this project was $16,400.

Another special agreement was made between the railway and the city with respect to Bennett St. Originally this did not cross the Saugus branch, but the railway was raised to permit of extending the street. The railway agreed to pay for this additional raise and bridge construction, the city to pave Bennett St. from Commercial St. to the new freight yard.

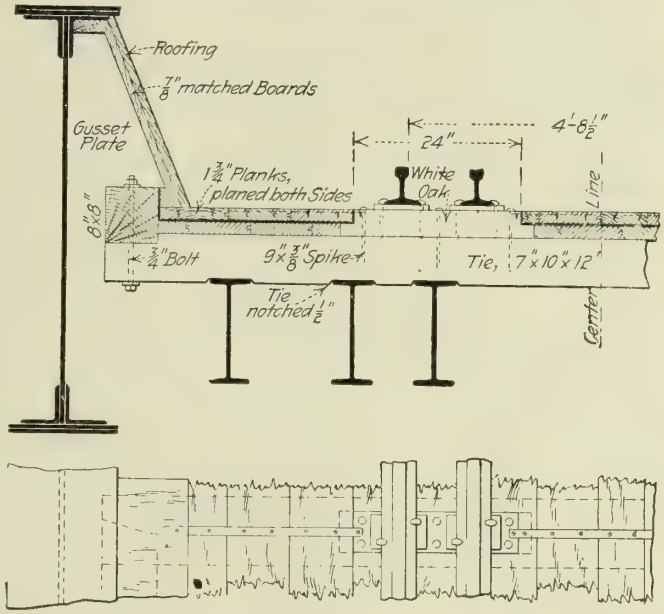


FIG. 6. WATER-TIGHT DECK FOR OLD OPEN-DECK BRIDGES IN LYNN, MASS.

Engineers

The work was done under three successive chief engineers of the Boston & Maine R.R.: H. Bissell, J. P. Snow and A. B. Corthell, the present Chief Engineer. The construction work was successively in charge of L. C. Lawton (now City Engineer of Haverhill, Mass.), F. C. Shepherd, Engineer of Construction of the Boston & Maine R.R., and G. L. Huckins, Division Engineer of Construction. The Resident Engineer for the railway was J. A. Parant. The bridges were designed by B. W. Guppy, Bridge Engineer of the Boston & Maine R.R. The Commonwealth was represented by H. W. Hayes, Chief Engineer of the Massachusetts Public-Service Commission. The Bay State Street Ry. was represented by David Curtin, Engineer of Maintenance of Way, and L. B. Reilly and F. B. Walker, Assistant Engineers. The municipality was represented by Wm. L. Vennard, City Engineer, and the writer, acting as consulting engineer.

Three Years' Growth of Street Traffic in Newark, N. J.

By Harland Bartholomew*

SYNOPSIS—Some interesting comparisons of traffic censuses made in 1912 and in 1915, showing the growth in vehicular traffic and the decreases in pedestrian and trolley traffic at Broad and Market St. accomplished by rerouting trolley cars.

Three years ago a traffic census was taken in Newark, N. J., chiefly with the end in view of effecting some relief to the traffic congestion at the corner of Broad and Market St., the city's main thoroughfares. A second similar census has just been completed, which offers many interesting comparisons and shows some of the relief effected. For an account of the 1912 census the reader is referred to the article by F. Van Z. Lane, in *Engineering News*, Sept. 12, 1912.

The police department has used and is using these censuses to regulate traffic and to determine points where traffic policemen are needed. The engineering department is using the figures in some instances as a basis for determining the type of pavement. The board of assessment and revision of taxes is using the data in making tax assessments. These uses of the traffic censuses are of course additional to those of the City Plan Commission, which made the counts with an aim to devising proper means for traffic distribution in the business section.

The completed count took approximately two weeks to accomplish with 30 special employees, although inclement weather conditions and torn-up pavements extended the time on a few counts one or two weeks longer. There were 107 places throughout the city where observations were taken for a period of 10 hr.—8 a.m. to 6 p.m. The observation points were upon thoroughfares where the greatest proportion of travel occurs. Counts were made always in the middle of the block to avoid confusion at street intersections and to observe accurately the total traffic passing through the street.

At each point note was made of the volume, character and direction of pedestrian and vehicular traffic. Vehicular traffic was classified according to character and weight, that is, whether the vehicle was drawn by one, two, three or four horses, with iron tires or rubber tires; whether it was a pleasure automobile or a small or large motor truck. Weights were determined according to whether the vehicle was empty, half full, or loaded.

*Secretary of the City Plan Commission, Newark, N. J.

Forms were provided for the enumerators so that all of these data were easily recorded. The field notes were tabulated upon daily sheets by the amounts of traffic in 15-min. intervals, so that it is possible to tell specifically the character and amount of traffic at any or all points during any period of the day.

Observations were not made on Saturdays, Sundays, holidays or on rainy days, thus avoiding abnormal conditions. The counts were also made at the same time of year as those of 1912 for equitable comparison.

An attempt was made to count for an entire week at one point in order to determine the daily traffic variation. Owing to extremely inclement weather conditions which prevailed last spring this was impossible. However, counts were made on seven different clear days at one point, and the results obtained are shown in Table I.

It will be noticed in this count that no great difference occurs in traffic on the different days, a maximum difference of 30% being noted in pedestrian travel on Monday and Tuesday. The counts for Saturday and Sunday do not compare favorably with those of the other days of the week. Monday is the heaviest day of the week in pedestrian travel.

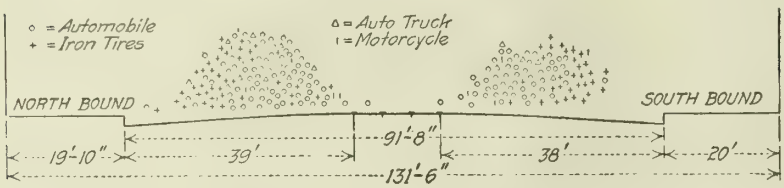


FIG. 1. TRAFFIC FOR ONE HOUR ON BROAD ST., NEWARK, N. J., BETWEEN COURT AND FRANKLIN ST.

Showing approximate distribution of traffic on the cross-section of the street—a new wood-block pavement

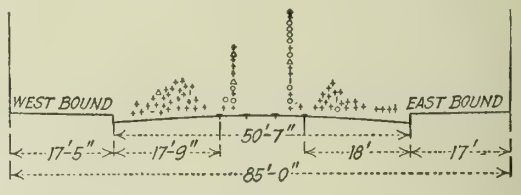


FIG. 2. TRAFFIC FOR ONE HOUR ON SPRINGFIELD AVE., NEWARK, N. J.

Showing distribution over cross-section with old granite blocks in poor condition

TABLE I. VARIATION IN DAILY TRAFFIC

Day	Date	Time Hr.	Roadway Traffic: Number Vehicles, Total	Roadway Traffic: Total Wt. of Vehicles, Tons	Sidewalk Traffic: West Side	Sidewalk Traffic: East Side	Total Pedestrians
Sunday	4-18-15	10	1529	2614.50	872	562	1434
Monday	4-19-15	10	2402	4724.00	1241	571	1812
Tuesday	4-27-15	10	2402	4970.00	868	529	1397
Wednesday	4- 7-15	10	2061	4110.75	1164	598	1762
Thursday	4-29-15	10	2462	4036.25	1085	559	1644
Friday	4-30-15	10	1951	4053.75	1009	443	1452
Saturday	5- 1-15	10	2550	5031.75	810	569	1379

A chart was made showing the totals of each kind of traffic at the several observation points for 1912 and 1915, also the total increase or decrease and percentages of increase or decrease. While pedestrian traffic throughout the city increased 9.16 per cent., vehicular travel increased 23.84 per cent. These figures are an indication of increased activity despite the present business depression. According to the recent state census the population increased only slightly over 3 per cent. during this period.

Observation points showing an increase or decrease in excess of 30% in either vehicular or pedestrian traffic were plotted on a map to indicate their comparative locations. Of these, there were five points where pedestrian traffic decreased and 49 points where it increased. There were four points where vehicular traffic decreased and 35 points where it increased.

The points of excessive decrease in pedestrian traffic are explained by the rerouting of the trolley cars and interruptions to traffic because of construction work. The points of excessive decrease in vehicular traffic are all explained by increases on parallel thoroughfares because of new pavements or because of construction work. The many points of excessive increase in pedestrian traffic are the result both of rerouting trolley cars and of the normal increase of population. The points of excessive increase in vehicular travel are in consequence of new and better pavements and of the large total increase in vehicular traffic.

Table 2 shows the comparative counts of traffic at the intersection of Broad and Market St. in 1912 and 1915.

TABLE 2. TRAFFIC AT BROAD AND MARKET ST., 1912 AND 1915

Between	Vehicles		Cars		Pedestrians	
	1912	1915	1912	1915	1912	1915
Market St. (E.) Beaver and Broad St.	2,277	3,636	1,955	1,697	68,253	41,550
Market St. (W.) Halsey and Broad St.	2,252	3,261	1,517	1,664	77,036	72,556
Broad St. (S.) Mechanic and Market St.	4,052	6,052	1,097	1,245	52,109	53,547
Broad St. (N.) Bank and Market St.	4,210	5,974	1,535	1,255	82,493	72,071
Total	12,791	18,923	6,104	5,861	279,891	246,724
Percentage of increase or decrease		+47.99%		−3.98%		−11.85%

These results are doubly interesting since this is the busiest point in Newark and reputed to be one of the busiest corners in the country. The decrease in pedestrian traffic resulted from the recent rerouting of the trolley cars, while the increase in vehicular traffic was caused by the new wood-block pavement on Broad St. as well as by the normal increase of the city. The recent rerouting of the trolley cars was designed especially to relieve congestion at this intersection.

The actual decrease in pedestrian traffic at this point is not to be deprecated, since this corner long ago reached the saturation point, and the rerouting of the trolley cars has helped to spread the surplus traffic. Vehicular traffic at this point will undoubtedly continue to increase until other channels are provided for it.

The increases in all kinds of traffic verify the previous assertions of the City Plan Commission that the growth of the city is taking place chiefly to the south and west.

A comparative analysis of the total vehicular traffic in 1912 and 1915 is shown in Table 3, which also shows the actual number of each type of vehicle counted and the percentage of increase or decrease.

TABLE 3. TOTAL VEHICULAR TRAFFIC; 1912 AND 1915

	Iron Tires	Motor Trucks	Automobiles	Rubber Tires	Street Cars	Total
1915	69,471	15,322	72,463	7,342	43,483	208,081
1912	79,823	5,065	34,016	10,338	38,755	167,997
Inc. or dec.	−10,352	+10,257	−38,447	−2,996	+4,728	+40,084
Percentage	12.97%	202.51%	113.03%	28.98%	12.20%	23.840%

While the decrease in the number of horse-drawn iron-tired vehicles is at first rather surprising, it will be noticed that the increase in the number of motor trucks corresponds closely to this decrease, which is an indication that business is really on the increase, since a motor truck carries considerably more than the horse-drawn vehicle. The average weight of motor-truck traffic is 3.66 tons per vehicle as against 2.22 tons per vehicle of the horse-drawn type. Table 4 gives the total number and weights of motor trucks and iron-tired vehicles.

TABLE 4. COMMERCIAL VEHICLES AND WEIGHTS; 1912 AND 1915

	Iron Tires	Weights	Auto Trucks	Weights
1912	79,823	183,273.75	5,065	22,752.00
1915	69,471	154,428.75	15,322	56,128.25
Inc. or dec.	−10,352	−28,845.00	+10,257	+33,366.25
Percentage	12.97%	18.68%	202.51%	146.59%

Table 5 shows that a larger number of small motor trucks are evidently being used than formerly, since the average weight is decreasing.

TABLE 5. AVERAGE WEIGHT PER VEHICLE

	1912	1915	Difference
Iron tires	2.28 tons	2.22 tons	0.06 tons
Motor trucks	4.49 tons	3.66 tons	0.83 tons

The decrease in horse-drawn rubber-tire traffic, which is usually of the pleasure-vehicle type, is greatly offset by the enormous increase—113%—in automobile traffic, which includes runabouts, touring cars and limousines only. The count was completed before the advent of the so-called "jitney bus," some 200 of these having subsequently appeared in the city.

The increase in street-car traffic is a clear indication of added service (12%), which corresponds favorably with the total increase in pedestrian travel (9%).

The proportions of different kinds of vehicular traffic in the city in 1912 and 1915 is shown in Table 6.

TABLE 6. CHARACTER OF VEHICULAR TRAVEL; 1912 AND 1915

	1912		1915	
	Total	Per Cent.	Total	Per Cent.
Iron-tire	79,823	47.5	69,471	33 4
Motor trucks	5,065	3.0	15,322	7.4
Automobiles	34,016	20.2	72,463	34 8
Rubber tires	10,338	6.1	7,342	3 5
Street cars	38,755	23.2	43,483	20 9
	167,997	100.0	208,081	100 0

Innumerable conclusions could be drawn from a study of the figures at hand. A statement of general conditions and conclusions concisely stated follows:

Vehicular traffic in the city increased 23.84%.

Pedestrian traffic in the city increased 9.16%.

Trolley traffic in the city increased 12.20%.

Horse-drawn traffic, which decreased 12.97%, is being supplanted by motor trucks, which increased 202.51%.

Automobile traffic increased 113.03%.

Rerouting of trolley cars decreased pedestrian traffic at Broad and Market Sts. 11.85 per cent., while there were corresponding increases on Broad St. and Park Place in the vicinity of Central Ave., also at Market and Mulberry Sts. New pavement on Broad St. caused an increase of slightly over 50% in vehicular traffic on that thoroughfare.

Figs. 1 and 2 illustrate the approximate position taken by vehicles in two wide thoroughfares, one with a good pavement and one with a poor pavement. The designations indicate the center of the vehicle. Standing vehicles it will be noticed are responsible for lack of travel close to curbs. The illustrations are a clear indication of where the wear of pavement is to be expected.

E. P. Goodrich, of New York City, is consulting engineer of the commission; under his general supervision, the traffic work was in charge of A. B. Cozzens, assistant engineer, and the writer.

Material Rejected Under Test by the Pennsylvania R.R System is reported for certain classes in a recent bulletin The following table gives the acceptances and rejections in one year in six of the more important classes:

	Quantity Tested	Quantity Rejected
Steel castings (pounds)	77,700,000	500,000
Steel wheels (number)	128,000	4,000
Axles (number)	165,000	8,000
Bar iron (pounds)	150,000,000	6,000,000
Air brake hoses (number)	635,000	85,000
Cotton waste (pounds)	3,800,000	400,000

The total value of supplies, materials and purchased equipment tested and inspected in a representative year exceeds $80,000,000, and the cost of making these tests is a little more than one-half of 1% of that value.

Dominguez Central-Station Irrigation System

By Chester B. Loomis*

The irrigation system of the Dominguez Water Co. in southern California is an interesting example of central pumping-station development. The Dominguez Rancho, one of the old Spanish grants, about 14 mi. south of Los Angeles, contains approximately 20,000 acres of highly productive land. One part (*A* on accompanying map) was irrigated by individual electric motor- or gas engine-driven centrifugal pumps with a lift of not more than 25 ft. Another part (*B*) was partly irrigated by vertical gas-engine centrifugal pumps with a lift of from 75 to 125 ft. to the surface. Under some land (*C*) there are no water-bearing gravels at a depth that would allow of economical irrigation.

Considering the low lift and the long pipe lines necessary, it was found more economical to continue irrigation on the *"A"* lands as before and to install a system for the *"B"* and *"C"* lands only. During the preliminary work 4000 acres were sold for the industrial city of Torrance.[1] A stipulation was made that water should be supplied to the city by the Dominguez pumping station. No changes in the plans, beyond the design of the piping system, were required, as it is a well-known fact that when an agricultural district becomes a residential and manufacturing district, in general the same amount of water (say one miner's inch to 7½ acres) is required.

Wells and Canal

The water supply is taken entirely from wells and raised to the surface by air lifts. Steam-pumping engines serve the irrigation lines. Six wells (see map) lie east

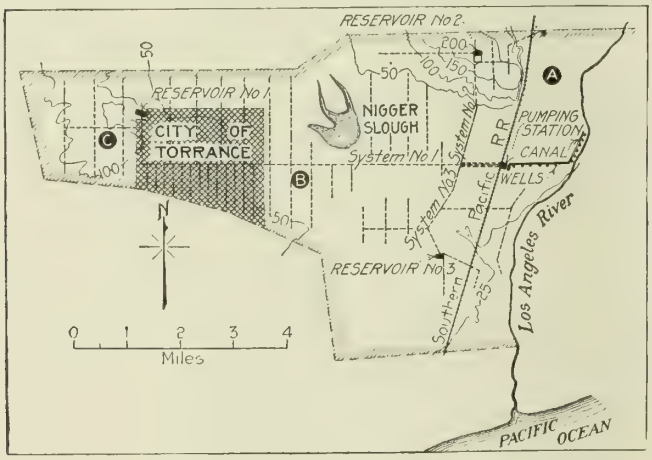


FIG. 1. IRRIGATION LINES ON DOMINGUEZ RANCHO

of the pumping-station site and a second line of six wells was drilled in a northerly direction along the bed of the Los Angeles river. The six wells on the east and west line from the station are shallow, being approximately 100 ft. deep with the water level standing from 10 to 40 ft. below the surface, depending on the season and pumpage. These wells were drilled 500 ft. apart, so that the cones of depression during pumping would not intersect except in case of excessive draft. The deep wells along the river bed average about 500 ft. in depth and flow approximately 200 gal. per min. each; but during pumping the level is lowered to approximately 30 ft. below surface. When pumping is stopped for about 36 hr. they again commence to flow. These six wells are also placed 500 ft. apart. All wells are 12 inches in diameter, cased with double No. 12 gage, red-iron stovepipe casing and were drilled with a standard California rig. The shallow-well casings, being in fine gravel and coarse sand, were given six rows of very narrow perforations equally spaced around the circumference. The deep-well casings are in coarse gravel and were given six rows of cuts ¼ in. wide. Each well was thoroughly sand pumped.

Over each well is a concrete box 3 ft. square by 5 ft. high (inside), the well casing projecting 18 in. above the concrete floor. From these boxes short pieces of 10-inch riveted steel pipe deliver the water into a concrete-lined canal, which extends from the farthest well to the pumping station sump. This canal has a fall of 2 ft. per mi. and increases in capacity from 10 sec.-ft. at the farthest well to 35 sec.-ft. at the pumping station.

This canal discharges through screens into a 250,000-gal. concrete sump, which acts both as a settling basin and a regulator for the pump supply. The sump is connected to the pumping station by a large concrete-lined tunnel.

Pumping Station

The pumping station is a reinforced-concrete structure 110 ft. long by 50 ft. wide and 23 ft. high to the bottom chord of the roof trusses. As there is no snow load and the roof has a pitch of 5 to 1, the trusses are of extremely light steel on 10 ft. centers. The roof is of galvanized corrugated iron. The exterior walls are paneled and finished in splatter-dash, making the building very attractive.

A right-angle extension of the sump tunnel, 4x6 ft. in section, runs along the wall nearest the sump. Short chambers open from it for the suction pipes of Pumps 1 and 2. This avoids blocking the tunnel with large suction pipes and keeps it out from under the pump foundations. All suction lines in the station, including those of the auxiliaries, take their water from this tunnel.

Boilers

There was no attempt at separate engine and boiler rooms, since with crude-oil fuel there is no dust or dirt. The boilers are installed across one end of the engine room. This leads to better attention, as they are always under the eye of the operating engineer. It also does away with the fireman, for the oiler can easily handle the fires in addition to his regular duties. The load is practically constant, and often the fires do not need attention for several hours at a time.

There are two water-tube boilers (standard Stirling type for 150-lb. working pressure) set in a single battery, with room for a single third boiler. This space is temporarily occupied by the machine shop. The settings are raised 1 ft. higher than standard to increase the volume of the combustion chamber.

The boilers are fired with crude oil under 40- to 50-lb. burner pressure. Each boiler has two front-fired burners (Wilgus type), set just inside the fire doors and throwing a fish-tail flame horizontally toward the bridge wall.

At first one boiler had two center-fired burners, designed by the writer, set in the center of the brick-covered grates. After careful tests the efficiency of the two types was found practically the same, except under very heavy

*Consulting Engineer, 419 Wilcox Building, Los Angeles, Calif.

[1]Described in "Engineering News," Oct. 30, 1913.

overloads, when the center burners showed up about 1½ per cent. better. The stack-gas analyses showed from 13.5 to 14 per cent. CO_2 under normal running conditions for long periods. As the plant load is practically uniform, the front-fired type was used on both boilers because of easier removal for repair and cleaning.

Fuel oil is delivered at the plant in tank cars; the tracks being high enough for gravity unloading. A permanent 7⅝-in. line is laid underground from the railroad to the station tank, which is of reinforced concrete, 25 ft. in diameter by 10 ft. deep. All that is necessary to unload a car is to screw a large funnel into the delivery line, spot the car discharge over the funnel and open the valve. The station fuel pumps take their supply directly from the storage tank. In case the oil in the station tank is too cold to be handled by the fuel-oil pumps, it may be heated around the pump suction pipes by steam coils.

Air Compressors and Pumping Engines

Two single-stage air compressors (14- and 27x19x24-in. cross-compound condensing) supply the well air lifts. Cooling water for the condensers is drawn from the suction tunnel and discharged into the sump outside. The compressors have mechanically operated inlet and automatic exhaust valves, automatic lubrication, pressure governors, safety stops, reheating receivers, etc. The air inlet pipes lead vertically upward through the roof.

There are three pumping engines, each being normally operated under a different head; but the designs allow two pumps to serve each one of the three irrigation systems, thus preventing water shortage due to the breakdown of any unit.

Pump 1 is a 16- and 34x16x36-in. cross-compound condensing Corliss-type crank-and-flywheel high-duty engine, with outside center-packed water ends. It is equipped with a combined speed and pressure governor, suction condenser, direct-connected suction valveless air pump, automatic lubrication, etc. This pump normally operates against a head of 139 ft., but is capable of delivering water into Line 2 against a head of 250 ft.

Pump 2 is similar to Pump 1, except in the water end, though this is also outside center packed. This pump is 16- and 34x12x36-in. and operates normally against a 250-ft. head.

Pump 3 consists of an impulse steam turbine driving two 8-in. centrifugals through reduction gearing (all De Laval machines). These pumps work against a 60-ft. head at 1500 r.p.m. The turbine exhausts into a jet condenser which takes cooling water from the suction tunnel and discharges back into it. By this scheme a long and complicated condenser discharge pipe is avoided, and by proper position of the condenser discharge lines the water in the tunnel is not raised perceptibly in temperature.

Auxiliaries

The auxiliaries consist of two 7x4½x10-in. boiler-feed pumps, a 500-hp. open feed-water heater, a fuel-oil pumping set (comprising two 4x3x4-in. duplex pumps mounted on a stand together with an oil heater and pressure regulator), a 10-kw. 110-volt direct-current generator, direct connected to a vertical high-speed engine taking steam either from the main boilers or from a 15-hp. vertical-boiler outfit which is complete with feed pump and injector. The little boiler can be fired either with wood or oil and is used particularly to furnish steam for atomizing the fuel oil when starting up the main boilers and to operate the 10-kw. generator when the main boilers are shut down and night work is to be done.

The machine shop contains an 18-in. swing lathe and a 48-in. drill press, driven by a gasoline engine. When the third boiler is installed the machine shop will be removed to the building now occupied by the blacksmith shop and storeroom; but it is at present more convenient to have the shop where the engineer can attend to the work while the plant is in operation.

Irrigation Lines

Irrigation Line 1 is served by Pump 1 and consists of a 33-in. riveted steel force main approximately 8 mi. long discharging into a 20,000,000-gal. reservoir. The reservoirs on all three lines are in earth and are lined with crude oil well worked into the dirt. This makes a very satisfactory and completely water-tight lining. From the force main laterals are run out at right angles every 2000 ft., so as to cover all the lands served by this particular line. These laterals vary in size according to the hydraulic head, so that each one has the same discharge. The outlets on this line and also on Line 2 all have standard 4-in. iron-body brass-mounted gate valves.

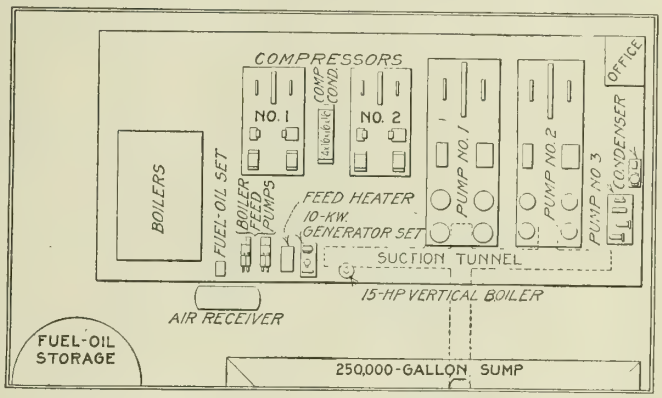


FIG. 2. LAYOUT OF DOMINGUEZ PUMPING STATION

Line 2 is served by Pump 2 and consists of a 20-in. riveted steel force main delivering into a 7,500,000-gal. reservoir. Owing to the topography of the land served by this line it was not possible to run laterals from the force main, so trunks were run from the reservoir and laterals from these trunks. Line 3 is served by Pump 3 and consists of a 20-in. riveted steel line delivering into a 7,500,000-gal. reservoir. Laterals are run from the force main and from trunk lines out of the reservoir. On account of the elevation of certain portions of the land served by this line the reservoir is so piped that it may be bypassed and the irrigation water pumped directly on the land.

All water consumers on the various systems purchase their water through meters, these meters being checked by Venturi meters at the pumping station.

This plant was designed and installed by the writer and has been in operation now for two years. It has proved very efficient and reliable.

Inexpensive Electric Service for unwired dwellings is being promoted by the Louisville (Ky.) Gas & Electric Co., by offering a low-priced panel board for service in one room. A steel panel carries a meter and a two-socket receptacle. A 12-ft. cord and a 60-watt tungsten lamp is included in each outfit. A light and a fan or a flatiron, or any two current-drawing devices, can be used at one time. The rest of the house may be wired starting with this panel as a base, and it is expected that many installations will grow in this way.

A Generalized Form of Hooke's Law

By E. R. Hedrick*

It has been known for a long time that many materials fail to satisfy Hooke's law exactly, even within the range usually described as below the elastic limit. Even such substances as steel and wood have measurable variations from this law that have long been recognized by physicists and engineers.[1] Other substances, such as cast iron, concrete, bronze, copper, stone, rope and so on, depart from the law very widely indeed.

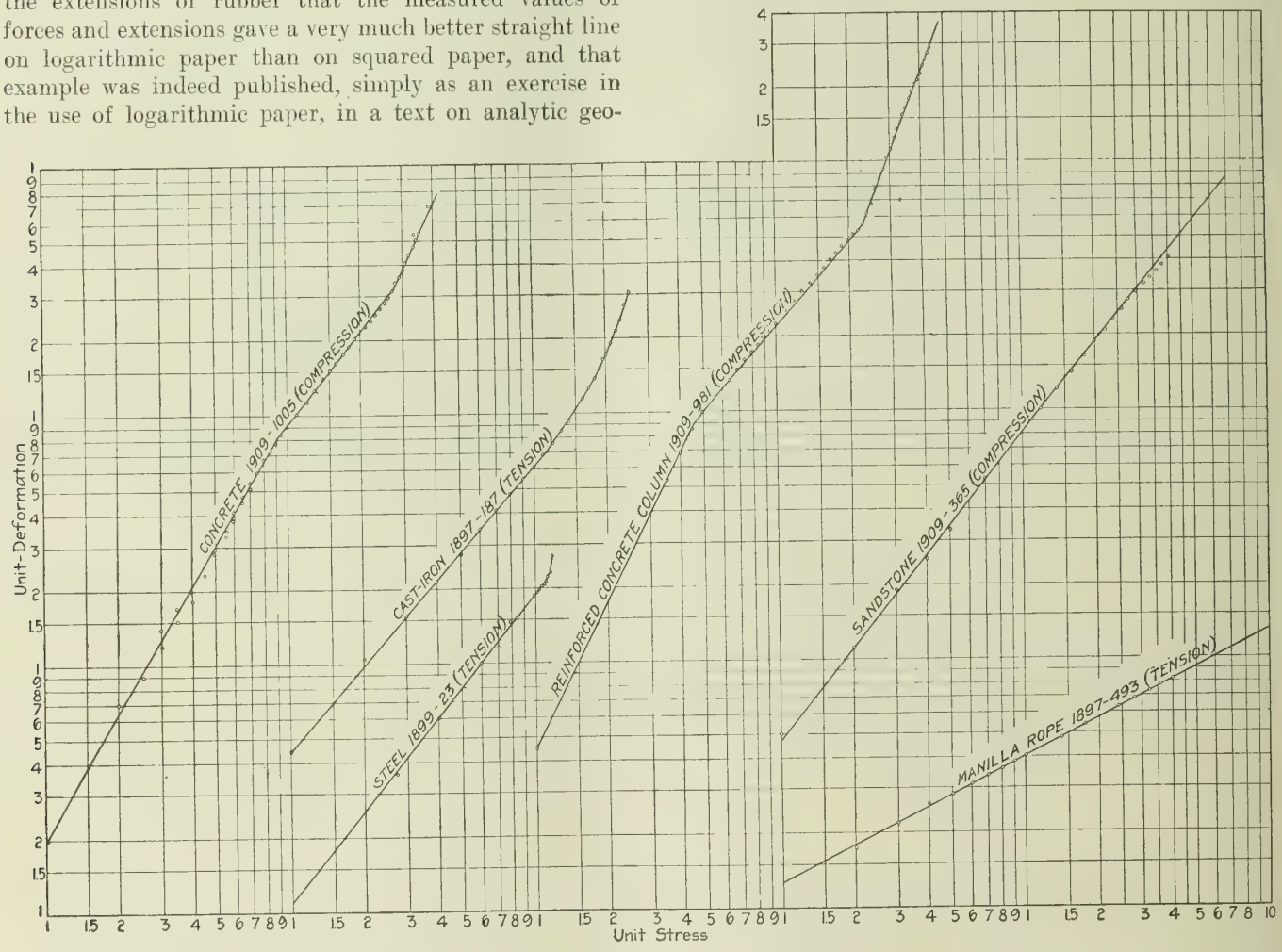
The writer discovered originally for a set of data on the extensions of rubber that the measured values of forces and extensions gave a very much better straight line on logarithmic paper than on squared paper, and that example was indeed published, simply as an exercise in the use of logarithmic paper, in a text on analytic geometry with which the writer was connected.[2] This means, of course, that the relation between the force p and the extension e is in that example much better expressed by a relation of the form

$$p = ke^n \qquad \text{or} \qquad e = cp^{\frac{1}{n}} \tag{1}$$

if n is taken *different from unity*. In the example just mentioned the value of n was found to be approximately 0.625.

It seemed less likely that other substances would show any similar behavior; but it at least suggested itself that a comparison would be illuminating, if for no other purpose than to bring out the contrast between rubber and other substances. For this purpose I have been working over the data contained in the Reports of the Watertown Arsenal, in which the numerical results of the actual tests of a large number of substances are given. Contrary to my original expectation, I soon began to suspect that the effect noticed in the example mentioned is not peculiar to rubber, but occurs also with many other substances.

I have now worked over a substantial part of the tests in several of the volumes of the Watertown Reports, and I think it is safe to announce that these results follow a straight line on logarithmic paper[3] better than they follow a straight line on squared paper, in a very large number of cases.



LOGARITHMIC PLOTTINGS OF SOME STRENGTH TESTS OF VARIOUS MATERIALS
References are to "Tests of Metals," Watertown Reports

For steel, of which the tests are most numerous, the value of n is quite close to unity, but it is in most instances very definitely different from unity, and there are specimens[4] that give values as low as 0.69. The majority of specimens of steel give values of n over 0.85, but many specimens give values less than 0.9.[5]

Some other substances give values of n near to unity. Thus, an excellent specimen of long-leaf yellow pine, under compression, follows a straight line on logarithmic paper with remarkable fidelity, and gives a value not far from

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[1]See, e.g., Thurston, "Materials of Construction," pp. 346-347; U. S. Board, 1881, pp. 217-221; Poynting and Thompson, "Properties of Materials," p. 53; etc.

[2]Ziwet and Hopkins, "Analytic Geometry," p. 275.

[3]The proper initial extension for the initial load must be determined by trial of several logarithmic plottings.

[4]"Watertown Arsenal Reports," 1897, p. 317.

[5]Watertown, 1899, pp. 23 to 47 and p. 163.

0.95.[6] Other specimens of wood show greater divergence; thus, a piece of fir, across the grain,[7] gave $n = 0.85$, approximately.

Other substances show still great divergences. Thus, a specimen of cast steel (Watertown Reports, 1899, p. 351) gives $n = 0.74$. Two specimens of cast iron (1910, pp. 161-2) give 0.69. Several specimens of copper (1907, pp. 78-81) give a set of remarkably parallel lines that correspond to 0.56. A specimen of sandstone (1907, p. 365) gives 0.80.

A case that is worthy of mention is that of rope. A piece of manila rope (1897, p. 493) gives a very good line for $n = 1.94$. Confirmatory evidence that this case is not accidental is to be found in the same volume.

The behavior of concrete, both plain and reinforced, is very remarkable. Evidently, a further study of this important substance is desirable, as will be seen if an attempt is made to draw the corresponding lines. Throughout long ranges of values the pressures and compressions follow a straight line on logarithmic paper. These lines take suddenly a different direction, as will be seen in a most pronounced fashion if even a hasty sketch is made of the test in Watertown Report 1909, pp. 981-982, in the range from 1000 lb. to 4400 lb. per sq.in.,

An interesting confirmation is afforded by the tests on the strength of iron girders conducted by the United States Board and reported in detail on pages 217-259 (Report, 1881). The variation from theory noticed by the board (pp. 217-220), which appears prominently in the numerical data and in the large graph inserted near page 281, seems to check with what would be expected from the theory proposed in the present paper. The numerical data plot as straight lines on logarithmic paper up to the elastic limit in the case of every beam measured by the board. The elastic limit itself shows very strongly on the logarithmic graphs, and it would appear from certain remarks appended to the report that uncertainty remained in the minds of the board in several instances which are perfectly determinate on the logarithmic graphs. The formulas for the deflection d produced by a center-load w are

$$d = Kw^n \quad \text{or} \quad w = Cd^{\frac{1}{n}} \qquad (2)$$

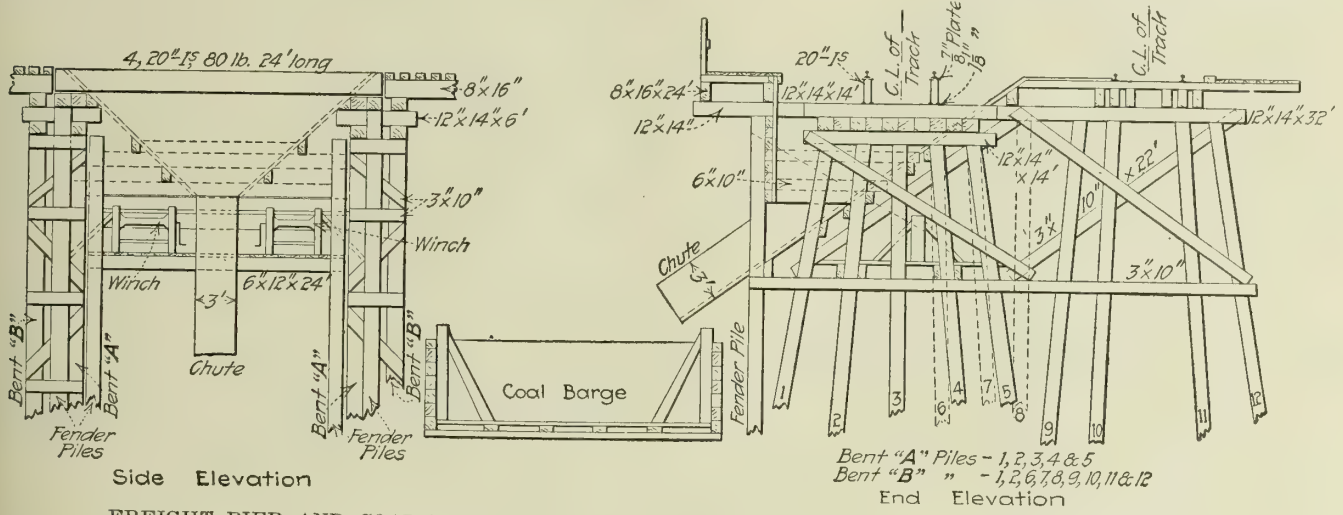
where n varies from a trifle less than 1 to a minimum of 0.74 (see page 240) for this set of tests. It will be remarked that this range of values is practically the same as that found for direct-tension experiments. These formulas agree with beam formulas which I have deduced on assuming that eq. (1) holds for direct tension and compression.

[6] Watertown, 1897, p. 420.
[7] Watertown, 1896, p. 386.

River Terminal at East St. Louis

The Alton & Southern Ry. is a new 15-mi. belt line which serves a large portion of the industrial district at East St. Louis, Ill. It connects with nearly all the railways entering this district and has a water terminal (known as the Fox Terminal) on the Mississippi River just south of the city, near Carondelet. This was mentioned in an article on "Port Improvements Along the Mississippi River" in *Engineering News*, June 3, 1915.

The terminal has a double-track timber trestle 1400 ft. long, with an average height of 20 ft. above the water. This can accommodate barges on both sides. Lumber and heavy freight are handled between barges and cars by a 50-ton locomotive crane, having a hoisting capacity of 20 tons. Package freight is delivered from pier to barge by spiral chutes, and is handled from the barges by the crane, the freight being placed in slings.



FREIGHT PIER AND COAL HOPPER OF THE ALTON & SOUTHERN RY., AT EAST ST. LOUIS, ILL.

Special facilities are provided for shipping coal, and it is expected that a large traffic in Illinois coal will be handled in this way. The coal is delivered at the pier in railway dump cars and discharged into a track hopper, from which a hinged spout delivers it into the barge. At high water, when there is not enough fall for this gravity chute, the coal is carried from the hopper by a conveyor on a boom. During the first month's operation about 3000 tons of coal and 10,000 tons of bauxite were shipped from this pier.

The terminal has about 3400 ft. of track, with accommodation for 10 cars on the pier and storage room for 50 cars, so that freight can be handled promptly. The facilities provided are in excess of present needs, and are so arranged as to allow for enlargement with the expected increase in the water-borne freight traffic. The cost was about $50,000. E. S. Fickes is Chief Engineer of the Alton & Southern Ry., and for information and plans we are indebted to him and to W. N. Aubuchon, Jr., manager of the East St. Louis Association of Commerce.

5000-Hp. Chain Drive for a Hydro-Electric Plant

The Ox-Bow hydro-electric plant on the Snake River, in Oregon, has the distinction of possessing the most powerful chain-drive gear in the world. This feature was not intended in the original design, but was introduced to adapt existing machinery to modified conditions and plans. The plant is owned by the Idaho-Oregon Light & Power Co., and is located about 50 miles north of Huntington, Ore. It has been in operation for some months.

The location is at the downstream end of a sharp bend or loop in the river. The original project provided for a tunnel across the neck of land, the tunnel being about 1160 ft. long and 26 ft. diameter. The floor was 10 ft.

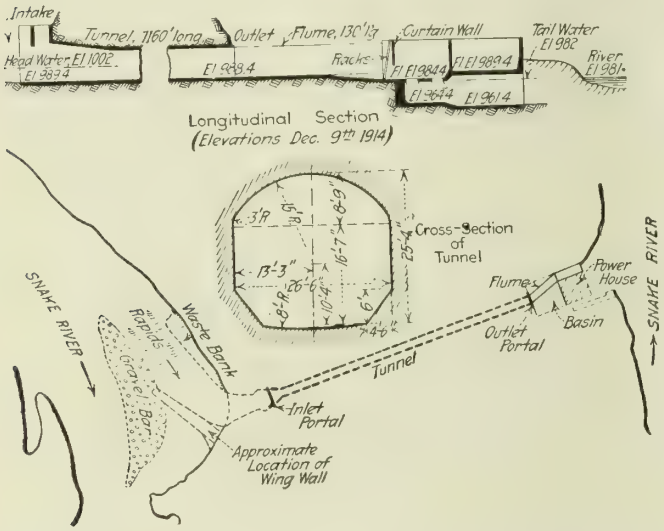


FIG. 1. PLAN AND LONGITUDINAL SECTION OF THE OX-BOW HYDRO-ELECTRIC PLANT ON THE SNAKE RIVER, OREGON

below low water at the intake end, and had a fall of 1:1000. This gave a natural head of from 20 to 22 ft., depending on the stage of the river, and was little affected by flood- or low-water conditions. This is shown in Fig. 1. In addition, a diversion dam was to be constructed about 1000 ft. below the tunnel intake, raising the head-water level 30 ft., and thus affording about 50 to 52 ft. head.

The power plant, at the lower end of the tunnel, was designed for the installation of six units, each consisting of two pair of 48-in. waterwheels operating in open flume through center-discharge shaft tubes and direct-connected by flange couplings to a 3600-kw. alternating-current three-phase 60-cycle generator running at 225 r.p.m. The plant was also to contain two 250-kw. direct-connected exciters operated by independent waterwheel units.

Financial difficulties necessitated the stopping of construction when the tunnel had been finished, except for the openings from the headgates in the river. The power-plant foundations had been completed to the floor level in two units and to the spring line of the arches which were to support the floor in the remainder of the plant. Machinery had been purchased and the waterwheel apparatus delivered for three units, as was also the structural steel for the entire power plant. The dam to give the intended head had not been built. This condition continued for several years until the appointment of a receiver in December, 1913.

The receiver and the bondholders of the company employed Prof. John R. Allen, of Ann Arbor, Mich., and W. H. Rosecrans, consulting engineer, of Chicago, to examine the condition of the property and suggest some means of developing power.

With the low head available (20 ft. instead of 50 ft.), and the consequent reduction in power, the turbines could not be run at the speed required for the generators. But as the machinery had been delivered it was desirable to utilize it rather than order new equipment. Direct connection being out of the question, some form of gear transmission was considered, and the engineers recommended the installation of a single unit composed of two waterwheels and one generator, with a chain-drive transmission. This plan made it possible, with comparatively slight changes, to use the machinery already purchased. The expense was much lower than by another system of development, and only a small proportion of this expense would be lost if the plant should be altered later in accordance with the original plans.

The arrangement of the connections of this generating unit to provide for the necessary difference in speed of the waterwheels and generator is shown in Fig. 2. The waterwheels are placed parallel instead of in line, and the generator is slightly above them. Shaft extensions were introduced to carry the chain drive.

Each of the two waterwheel shafts carries a 71-tooth sprocket wheel 45.49 in. diameter, while the generator shaft carries two corresponding 47-tooth sprockets, 30.31 in diameter. Each pair of sprockets carries four Morse silent driving chains 31.67 ft. long and 21 in. wide, weighing about 2800 lb. each. The pitch is 2 in. throughout. The sprockets are made in halves and bolted on the shafts, which are 129 in. c. to c. The speeds are 149 r.p.m. for the waterwheel shafts and 225 r.p.m. for the generator shaft.

The chains have been tested to a strain of 40,000 lb. per sq.in., but the maximum tensile strain under ordinary

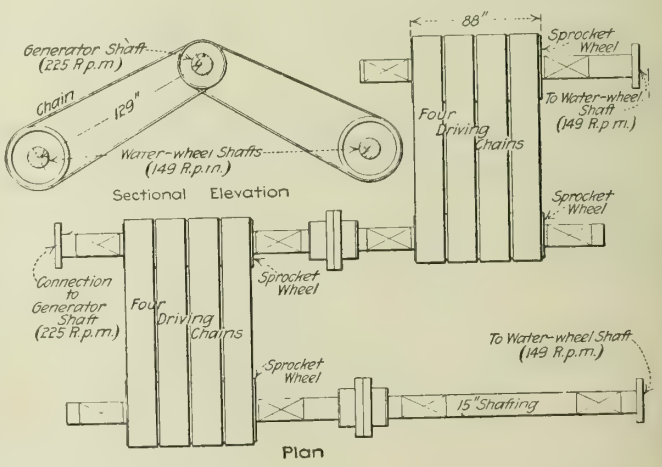


FIG. 2. 5000-HP. CHAIN DRIVE FROM TWO WATER-WHEEL SHAFTS TO A SINGLE GENERATOR SHAFT: OX-BOW HYDRO-ELECTRIC PLANT

operating conditions will be 600 lb. per sq.in. It is stated that the largest chain drive previous to this was of 1500 hp., so that this 5000-hp. drive is by far the largest yet installed.

The designs were made in the office of the W. H. Rosecrans Engineering Co., of Chicago, and the installation was made under the direct supervision of Mr. Rosecrans.

John R. Allen, Professor of Mechanical Engineering at the University of Michigan, acted as consulting mechanical engineer.

The New Sewerage System of Cairo, Egypt

The ancient city of Cairo, Egypt, is situated on the delta of the Nile. Its site is so nearly level that it was difficult to lay out a system of sewerage for the city in the ordinary way, with gravity discharge. In laying out the new sewerage system for the city which has been recently put in operation, therefore, the city has been divided into small areas and the sewage from each of these areas, after flowing by gravity to a central sump is forced by compressed air through closed pipes leading to a main outfall sewer.

So far as we are aware, this is the most extensive installation of compressed air apparatus for the forcing of sewage from district collecting stations that has ever been made. It is of course not novel as the Shone compressed-air ejector for forcing sewage has long been used in England.

A brief description of the Cairo system was given by Dr. E. L. Corthell in a paper published in "Professional Memoirs," Corps of Engineers, for May-June, 1915, following his visit to Cairo while the works were under construction. From this and from additional information furnished to Mr. Corthell recently by C. Carkeet James, M. Inst. C. E., under whose direction the works were constructed, the following description has been prepared.

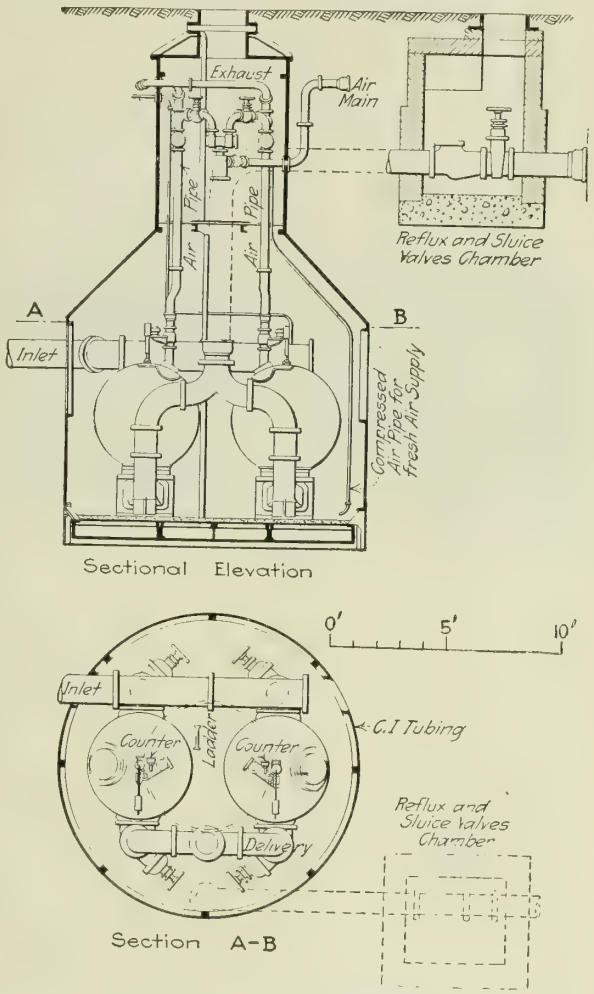
The total area in Cairo to be drained with the aid of compressed air is a strip 3 to 4 km. broad extending along the Nile for nearly 12 km. This tract has been divided into 63 small areas. In each of these the sewage flows by gravity to an underground compressed-air discharging station. From each of the stations the sewage is forced by compressed air through closed cast-iron pipes into a gravity outfall conduit, 1.6 m. in diameter, which starts at Pont Ghamra.

The accompanying drawing shows a section of a compressed-air discharging station. Each station contains two spherical cast-iron sewage receivers. The sewage from the district draining to the station flows into the receiver by gravity until the receiver is filled. A float in the receiver then opens a valve admitting compressed air and at the same time closes another valve, which shuts off the inflow of sewage. The compressed air forces the sewage contained in the receiver out through a discharge pipe leading from the bottom of the receiver. When the receiver is empty the compressed air is cut off and the inlet valve is again opened. The process is entirely automatic, and the apparatus is claimed to have been so designed as to require little supervision to keep it in working order.

The compressed air used to operate the sewage-discharging stations is furnished by a central station, where there are four air compressors driven by triple-expansion engines delivering air at a pressure of from 22 to 25 lb. per sq.in. To insure continuous service, the compressed-air mains from the central compressing station to the sewage-discharging stations are laid on the loop plan.

In the main outfall sewer the sewage flows by gravity to a pumping station at Kafr-el-Gamus, a distance of 13½ km., receiving the discharge from various suburban gravity sewerage systems on the way. At the pumping station the sewage is screened and then forced by plunger pumping engines through a cast-iron delivery main, 0.92 m. diameter, to a sewage farm at Gebel-el-Asfar, a further distance of 11½ km.

The sewage farm (on which the sewage will be used for irrigation) is a tract in the desert about 4 km. square. The sewage delivered from the force main will pass through sedimentation tanks, and a portion of it may be further purified on gravel filter beds. It is expected that about 3000 feddans of land (3300 acres) will eventually be irrigated by sewage. About 350 feddans have been graded to receive irrigation water, and 170 feddans have been planted with 35,000 fruit trees, while 80 feddans of cereals are under cultivation. About 80 km. of compressed-air mains and sewage force mains from the



SECTIONAL VIEWS OF COMPRESSED-AIR DISCHARGE STATION, CAIRO SEWERAGE SYSTEM

compressed-air stations have been laid. Only a small part of the gravity sewers discharging to the compressed-air stations, however, has as yet been constructed. The area around the principal hotels and that near the military barracks, as well as some of the important suburbs, have been sewered. Further work on the laying of sewers was interrupted by the outbreak of war. The expenditure on the works thus far completed under Mr. James' direction is about £1,500,000 Egyptian. Approximately £500,000 Egyptian more will be required for laying the small sewers to the compressed-air discharge stations. The system has been planned for the needs of a population of about 1,000,000.

Flood Wrecks Masonry Bridges*

In a heavy rain on July 28 in the northern part of Chautauqua County, New York, a number of bridges and culverts were washed out. Particular interest attaches to the failure of three masonry bridges of different types.

The Mason bridge at Dewittville on State Road No. 5263A was a 24-ft. span consisting of a 20-in. slab of gravel concrete, reinforced with 7/8-in. bars spaced 4 5/8 in. c. to c. and 1/2-in. bars spaced 12 in. c. to c. across the road. It was built in 1912. Failure was due to undermining of both abutments, the water washing out the bed of the stream from a normal depth of about 18 in. to a depth of 12 ft. The roller seen standing on the bridge in the view belonged to the Ontario Roads Co., contractors for the state road at this place. It happened to be standing on the bridge at the time for the purpose of blocking the road, which was closed on account of other construction work. The high-water mark was about 18 in.



REINFORCED-CONCRETE SLAB BRIDGE WRECKED BY ABUTMENT UNDERMINING

over the roadway. The flood carried away about 600 cu.yd. of earthwork and the total damage is estimated at $2500.

The second bridge to fail was the Lefingwell bridge, an 8-ft. stone-arch culvert under the Buffalo-Erie highway. This was a structure of long standing. Practically all of the culvert was carried away, only a small length of the barrel remaining. How this stood up while the earth and masonry from above were carried through it is hard to explain. About 1000 cu.yd. of earth was taken away with the bridge. The total damage is estimated at about $2000.

The southeast wing wall of the Glenn Mill bridge, a 30-ft.-span concrete arch near Westfield was overturned, allowing the stream to carry away about 1500 cu.yd. of earth from the uncompleted fill. This failure was illustrated in *Engineering News*, Aug. 19, 1915, p. 379. The wing was previously cracked and the high water softened the toe of the slope, allowing the earth back of the wall to push it over. High-water marks indicated that the water reached a depth of about 10 ft. above normal. During the dry season of the previous year, while the bridge was under construction, all the water was carried through a 12-in. pipe. The damage is estimated at $2500.

In accordance with New York State Highway Law bridges of over 5-ft. span are town charges whether located on state and county highways or not, and steps have already been taken by the town officials for the replacement or repair of all these bridges.

*Information furnished by W. M. Acheson, Division Engineer, New York State Commission of Highways, Buffalo, N. Y.

State Supervision of Public Water-Supplies in Kansas

By Fred R. Hesser*

An effective plan for state supervision of water-supplies has been used for the past two years by the Kansas State Board of Health. Some of its details may be of interest to others connected with public-health work.

The water and sewage law passed in 1907 provides for the appointment of an engineer for the State Board of Health from the faculty of the Engineering School of the State University. The head of the Sanitary Engineering Department has always held this appointment as head of the Water and Sewage Division of the State Board of Health. The work of this division has increased in volume till at the present time two assistant engineers and a stenographer-clerk are employed. A laboratory is also maintained by this division at the University. It employs a force consisting of the director, chemist, bacteriologist, three laboratory assistants and two stenographers.

The provisions of the water and sewage law are as follows:

> That no person, company, corporation, institution or municipality shall supply water for domestic purposes to the public within the state from or by means of any water-works without a written permit from the State Board of Health for the supplying of such water. The application for such permit shall be accompanied by a certified copy of the maps, plans and specifications for the construction of such water-works or extension, and of a description of the source from which it is proposed to derive the supply and of the manner of storage, purification or treatment proposed for the supply previous to its delivery to consumers, together with such other data and information as may be required by the State Board of Health; and no other or additional source of supply shall subsequently be used, nor any change in the method of treatment be made without an additional permit. The supplying of water without a permit shall be deemed a misdemeanor, punishable by a fine of not less than $25 nor more than $50 for each offense. Each day shall constitute a separate offense.

The board is empowered to make any investigations of water-supplies upon complaint of municipal or public-health officers or to act upon its own motion, and to order such changes in the source of supply or method of treatment as may be necessary to safeguard the public health. Permission to discharge sewage into streams or other bodies of water must also be obtained from the board under practically the same conditions as to treatment as those described. The engineer and secretary of the board are empowered to act when the board is not in session.

The consulting engineers practicing in the state have come to realize that the provisions of this law do not work a hardship upon them but, on the contrary, serve to maintain a standard under which competition is more nearly fair and open. Consequently they are, with few exceptions, glad to coöperate with the engineers for the board in their requirements. Upon being advised that a town or corporation contemplates the construction of a water-works or a change in an old system, one of our engineers visits the town and makes a thorough inspec-

*Assistant Engineer, Kansas State Board of Health, Lawrence, Kan.

tion of the plant and discusses conditions with those in charge and with the engineers for the work.

The plans and information, when completed, are sent to the office of this division at Lawrence and must include the following items: General plans, detail plans, engineer's report, specifications, application. These are examined not only from the viewpoint of quality of supply but also that of adequacy for future growth, fire protection and mechanical efficiency. If necessary they are returned with a request that corrections be made and when satisfactory the blueprints are stamped "Approved" and signed by the engineer for the board. One copy of the plans is filed in the office of the secretary at the State House in Topeka and another in the engineer's office at the University. Arrangements have just been made to furnish blank progress-report cards to engineers in charge of such work. These will be returned to the office each month.

There are 197 plants in the state supplying water to municipalities. Of these, 16 are privately owned, 27 use surface water and rapid sand filters and 14 use surface water with no further treatment than coagulation and sedimentation.

Analyses of samples from each supply have been made at frequent intervals during the past three years, the surface water-supplies being watched very carefully. When sufficient evidence of poor quality of any water has been collected the city authorities or owners of the plant are approached and the improvement can usually be brought about without recourse to a formal order from the board. Occasionally, however, it has been necessary for the board to order improvements recommended by its engineer. Within the past year seven modern rapid sand filter plants have been installed by this method, and work is in progress on four more.

Acceptance of purification plants by the city or owner is made contingent upon approval by the State Board of Health. When ready for operation an engineer from this division, usually accompanied by the laboratory director, takes charge of the plant and operates it for two or more days. Alkalinity and turbidity determinations are made on the raw, coagulated, and filtered water at frequent intervals and bacteriological samples are plated on agar at hourly intervals. Bacteriological samples are also collected at two- or four-hour intervals and expressed to the laboratory in refrigerating shipping containers for check counts and B. coli fermentations. The test also includes calibration of orifice boxes, rate regulators and loss-of-head gages, quantity of wash water used and rate of application of wash water and air, clarifying effect obtained in the basins by the use of varying chemical doses applied at various points. The bacteriological standard heretofore required has been "a removal of 98% when the raw water count exceeds 3500 per c.c. or a count of less than 100 per c.c. in filtered water when the raw-water count is less than 3500 c.c., with complete removal of turbidity." The operators of these plants are instructed in making alkalinity titrations with erythrosene and turbidity readings with a candle turbidimeter. Compact kits containing the required apparatus and reagents are furnished at cost by the laboratory. The operators are also furnished a pad of blank-form operating reports. A duplicate copy of each is sent to the engineer's office each month. Since these plants are rarely large enough to employ a chemist this method enables us to check their operation. Usually the plant purchases a shipping container and weekly bacterial examinations of their samples are made free.

The refrigerating containers are manufactured in Lawrence for the laboratory of this division.[1] They consist of an insulated outer case and tightly fitting top from which is hung a copper box with divisions for 4 or 6 bacteriological sample bottles. Cracked ice is placed in the bottom and low temperature held for 48 hours.

Rules recently adopted by the Board provide for annual inspections of all water-works and sewage-disposal plants in the state by the engineers of this division. Standard information blanks will be used for recording the results of these inspections. Mineral, sanitary chemical, and bacteriological examinations of all ground water-supplies will be made twice each year and surface water-supplies will be examined bacteriologically, chemically, and microscopically each week. Each plant is charged a fee, graduated, according to the population supplied, from $12.50 to $150 per year. These fees are used to maintain the laboratory.

Sources from which common carriers supply drinking water are to be inspected and sampled twice a year. Springs, wells and other sources from which water is bottled and sold for domestic or public use will also be under the direct supervision of the State Board of Health.

Sulphur Causes Garbage-Reduction Odors

Study of the cause and prevention of odors and dust from garbage-reduction works in New York City has been made by the Central Testing Laboratory of the City of New York and a detailed report is given in the *Journal of Industrial and Engineering Chemistry* of the American Chemical Society, September, 1915. At the plant studied the garbage arrives at the docks in open scows and is conveyed to large lined iron tanks or digesters. These are vented and the gases have considerable odor. The cooked garbage and liquor are run into vented receiving tanks before being pressed. Liquids are run to open settling tanks where the grease is skimmed off and the liquor discarded. The pressed garbage goes to direct-heat driers which give off odor and dust perceptible for miles around. The dried garbage is conveyed to a naphtha-extraction plant, and the tankage is dried in a second set of direct-heat driers with more odor and dust.

The odors from handling raw garbage, from the grease-separating tanks, from pressing and from conveying garbage under treatment are of only local importance. None of the substances (principally mineral matter and fats) carried over mechanically with the digester vent gases were found important. The condensable volatiles included essential oils and sulphur compounds. The extremely nauseating odor of uncondensable vent gases was found due largely to sulphur compounds. Simple heating of vent gases was useless, but washing with a solution of calcium hypochlorite prevented odors.

The scrubber installed removed 91% of the total dust from drier gases and 70% of the odorous substances. Leading the gas across pine-tar oil substituted the odor of the latter for the objectionable smell. No reasonable amount of a dilution with air was effective.

[1] See illustrated description, "Engineering News," Oct. 23, 1913, p. 819.—Editor.

Engineering Literature

Faults of Technical Literature

By R. Fleming*

Technical literature may be divided into two classes: That which finds its way to the public through periodicals, and that which appears in book form. This article has in mind the latter class, though much of what is written will apply to both divisions.

A glance through the catalogs of publishers of technical books will show what a bewildering number has been written on certain subjects. New books on Applied Mechanics are continually being brought out. Three books on Foundations closely followed each other in 1914. Books on Structural Engineering are being multiplied. Are all these books needed? A university lecturer in an article[1] entitled "Books for Engineers—A Criticism," in the Engineering Supplement of the London *Times*, of Jan. 31, 1912, writes thus of a search he had made:

> Two or three impressions were gained by this search. One was that a flood of technical books is emanating from America. . . . To come to the faults of the technical books which are now appearing so rapidly, many of them are badly written, badly arranged and badly priced. . . . Many authors do not appear to have in mind any definite purpose for their books. They do not seem to take the trouble to ascertain if such a book is really needed. They do not ascertain before beginning their task how far the field is really covered.

Books describing industrial processes are hardly out of the hands of the printer before the processes have been modified and new books are needed. But about those on Mechanics dealing with unchanging principles it is well to ask whether the new are better than the old. Of course, the best book on any subject is yet to be written. Not every writer has the confidence expressed in the preface of a textbook on Applied Mechanics: "The author claims that the chapters on Moment of Inertia, Center of Gravity, Work and Energy, Friction and Impact are more complete in theory and application than those of any other American textbook."

Most technical books are written by teachers in technical schools and colleges. There are several reasons for this. The teacher has access to libraries, is able or should be able to express himself clearly, and from his teaching experience knows the difficulties in grasping new subjects. Moreover, he has time at his disposal to which the professional man is a stranger. The college year seldom lasts over forty weeks and recitations and lectures are confined to comparatively few hours per week. Knowing that he may be rated according to the number of books he has written, he embodies his notes and lectures in a book, thus adding another to a field that may be well covered. The responsibility for overproduction rests largely upon the boards of trustees of our various institutions of learning, who in choosing a faculty generally put more stress upon authorship than upon teaching ability.

One cause of lack of accuracy is the acceptance without discrimination of what has already been written. An erroneous statement once fairly started has a surprising tenacity of life. Hutton's formula for wind pressure on inclined surfaces, although discredited, is constantly met with in textbooks, and handbooks. The Carnegie "Pocket Companion," edition of 1913, gives it, the Cambria Steel Co.'s Handbook, 1914, quotes it without a name attached, and the Handbook of the Lackawanna Steel Co., 1915, quotes it as Unwin's formula. Dates are often given wrongly, especially in footnotes. Euler's column formula is found dated both 1757 and 1759. In this case there is an explanation. The paper "Sur la Force des Colonnes, Par M. Euler" appeared in the "Histoire de l'Academie Royale" for the year 1757 but the volume bears the imprint, Berlin, 1759.

First editions are often lessened in value because of the number of errors resulting either from careless preparation of the manuscript or careless proofreading. One book before the writer has twenty-seven errors in twenty-two consecutive pages. Some are trifling but others are serious. A student has the help of his instructor in detecting errors, the "constant reader" will probably find them from the context, but the busy man who regards his library as his dictionary is liable to be led astray. The engineer who passes a problem with a given book to an assistant may receive an absurd answer or none.

From a large number of errors which have caused annoyance, three will be cited from books of recognized merit:

1. The "American Civil Engineers' Pocket Book," second edition, page 297, gives as the formula for bending moment of a cantilever beam uniformly loaded, $M = \frac{Wx^2}{2}\left(\frac{3}{4} - \frac{x}{l}\right)$. This should be $\frac{Wlx}{2}\left(\frac{3}{4} - \frac{x}{l}\right)$.

2. Johnson, Bryan and Turneaure in their analytical treatment of wind loading in "Modern Framed Structures," eighth edition, page 512, write: "and substitute the values of M and S_2 in (11b)." In this edition equation (11b) is not given and it is necessary to consult earlier editions.

3. Ketchum in "Steel Mill Buildings," third edition, page 119, in the figure of a double portal, gives a stress of 4242 lb. in the member c — 7 and the same in member c — 8. In each case it should be 2121 lb. The stress diagram is correctly drawn but the reader does not stop to scale a diagram. He looks at the stresses given on the figure. From this figure he would infer that for a double portal the stresses in certain members are equal to the stresses in certain other members when they are but one-half as much.

Lack of clearness occurs when an author leaves too much to be understood by the reader. In one standard treatise on Mechanics the reader must at times determine from his previous knowledge of the subject the meaning of + and —. A single sentence would clarify the whole matter. Another book that has passed through several editions contains an article of five pages on "The Flexure of Long

*American Bridge Co., 30 Church St., New York City.

[1]Reprinted in part in "Engineering News," of April 18, 1912.

Columns." Near the close of the section is a paragraph commencing: "Euler's formula, therefore, is strictly applicable only to . . . ". While the student may infer that the formula deduced is the well-known Euler formula, it is not so expressed and the paragraph does scant justice to Euler.

Flexure in beams is almost invariably treated without any mention that the beam is considered as stayed laterally. One textbook, "Stresses in Structures," in showing how to use the tables in the rolling-mill handbooks quotes the full tabular load as the strength of a 9-in. beam with span of 20 ft. No mention is made of the proviso so explicitly stated in the handbook that the tabular loads apply only to beams stayed sideways. A note like the following, used in another book, would have left no room for doubt: "Due attention in selecting the beam must be given to lateral and vertical deflection as previously noted, or to a proper reduction of the specified fiber stress to allow for these reductions." In this connection it is noted that reports of beam tests lose their value when they do not state how the beam is stayed sideways.

It is conducive to clearness to find in all the pages of a book the same symbol denoting the same thing. Greene's "Structural Mechanics" is an illustration. In the introduction the author says: "The notation is practically uniform throughout the book and is that used by several standard authors." It is also a great help to find an introductory page or an appendix tabulating in alphabetical order all the symbols used. A few books give this. May their number be increased! A step farther would be a more general agreement among authors to use the same notation.

Plagiarism is an ugly word to use and happily the fault is not common. Yet occasionally when two books are compared it may be inferred that one copied from the other or that both borrowed from a common source. Some again quote a great deal and give credit for little. More prevalent still is the use of the work of thinkers and scholars without any mention of their names. Goodman's "Mechanics Applied to Engineering" is a model in the giving of credit. Instances are: Young's Modulus of Elasticity, Bow's Notation, Barlow's Theory, "the method is due to Professor Dalby," "the author and Mr. R. H. Thorpe of New York." Molitor is also to be commended. In the preface of his "Kinetic Theory of Engineering Structures" he states: "Each subject is prefaced by a few brief historical remarks and all important theorems bear the name of their originators, a practice which has been shamefully neglected by many modern writers." This is quite in contrast to the practice of some others to whom the lines of Kipling might apply:

When 'Omer smote 'is bloomin' lyre,
He'd 'eard men sing by land an' sea;
An' what he thought 'e might require,
'E went an' took—the same as me!

The market-girls an' fishermen,
The shepherds an' the sailors, too,
They 'eard old songs turn up again,
But kep' it quiet—same as you!

They knew 'e stole; 'e knew they knowed.
They didn't tell, nor make a fuss,
But winked at 'Omer down the road,
An' 'e winked back—the same as us!

In closing let it be said that despite its faults technical literature was never better than it is today.

Transition or Spiral Curves

REVIEWED BY HENRY J. SAUNDERS*

THE RAILROAD TAPER: The Theory and Application of a Compound Transition Curve Based upon Thirty-Foot Chords—By Lee Perkins, Formerly Assistant Engineer Southern Pacific Lines in Arizona and Mexico. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Flexible leather; 4x7 in.; pp. x + 356; 41 text illustrations; 42 tables. $2.50, net.

In the "Railroad Taper," Mr. Perkins has presented the subject of transition or spiral curves as developed by William Hood, chief engineer of the Southern Pacific Co. The curve used is a series of compound curves developed from a basic chord length of 30 ft. A set of tables is also given based on the 10-meter chord for use in Mexico and South America.

Mr. Perkins' work as a whole, although it cannot be said to be the last word in spiral curves, still seems to be such an improvement over other books and tables on the subject that it deserves little criticism and much praise. The writer has taken the trouble to compare this work with some ten or more others on the same subject and can say that with one or two exceptions this is the only work which can be used easily and universally by the man in the field under nearly all conditions.

The writer believes that a better understood title for the book should have been selected or at least that the word "curve" should have immediately followed the word "taper." Of some ten books examined no one of them used the word taper, three using "spiral," four "transition curve," two "transition spiral" and one "parabolic curve." Webster defines the noun "taper" as "a gradual diminution of thickness in an elongated object," referring more to volume than to surface.

The writer believes that Mr. Hood had some well-defined reason for the selection of the 30-ft. basic chord length and believes that should be brought out in this work, owing to the fact that a great many engineers look with disfavor on any unit of measurement which will not go into 100 an even number of times.

The location and track problems selected are good and cover the usual run of problems encountered in the field. The tables are ample, although the writer believes that a more definite nomenclature should be selected for the different types of taper in order that the necessary table could be selected at a glance without having to study out the system of numbering.

The author explains fully the relation of the speed of the train to the length and number of the taper selected. This is a point which cannot be too fully impressed upon the field engineer.

The slight changes which have been suggested would make the book of general value to engineers, although as it stands it can certainly be used as well or better than any other work on this subject.

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A summary of the operating results of the water-softening and filtration plant of McKeesport, Penn., occupies a large part of the annual report for 1914 of the water and lighting commissioners of that city. A folding table giving data by months and by yearly averages for six years is included. There is also a description of the plant. The summary was written by Edward C. Trax, chemical engineer, who is in charge of the filtration plant.

The Theory of Direct-Acting Steam Pumps

REVIEWED BY H. E. LONGWELL*

DIRECT-ACTING STEAM PUMPS—By Frank F. Nickel, Associate in Mechanical Engineering, Columbia University. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. x + 258; 218 illustrations. $3, net.

The author has set himself a rather thankless task, for the reason that his subject is one that has ceased to be of much general interest from an engineering standpoint. He has developed a somewhat elaborate theoretical treatment of the direct-acting steam pump, which it is hardly probable ever existed in the minds of the pioneer designers of this type of machine, whose lead apparently has been blindly followed by their successors.

Table 17 (page 181), giving a list of standard sizes of boiler feed pumps, furnishes sufficiently convincing evidence that to a large extent designs for this type of pumps have been based on "rule-of-thumb" methods rather than on exact calculations. If the design were based on logical principles it is evident that the ratio of diameter of water cylinder to steam cylinder should be fairly uniform throughout the list. If, as the author states, the mechanical efficiency increases materially with the length of the stroke, it is obvious that any departure from uniformity should be in the line of an increasing ratio in the larger sizes.

If a 4-in. water cylinder is correct for a 6-in. steam cylinder with 6-in. stroke and 65 per cent. mechanical efficiency, there can hardly be any good reason for making a water cylinder so small as 5¼ in. in connection with a 9-in. steam cylinder of a 10-in. stroke pump, having an alleged mechanical efficiency of 75 per cent., or a water cylinder only 7 in. diameter for a 12-in. steam cylinder of a 12-in. stroke pump of 77.5 per cent. mechanical efficiency.

Inasmuch as substantially the same list has been "standard" for over thirty years, it is apparent that the matter of proportions of water cylinder to steam cylinder has never been given any serious engineering consideration. Furthermore, there is no evidence that the proportions of any of the so-called "standard" sizes are really logical.

The book opens with a short chapter on the development of the direct-acting steam pump. This is followed by a chapter on performance factors, which is largely theoretical and applies to any type of reciprocating pump.

Chapter III (about 100 pages) is entitled "Classification and Types." It undertakes to explain the numerous ingenious designs of single-cylinder steam ends that were devised to evade detail patents rather than because they possessed any marked inherent merits either practical or theoretical. The descriptions are too meager and the illustrations too incomplete to make the matter clear to a novice. For example, Fig. 28 (page 45) shows a piston in a position where it shuts off the steam port completely, and the means for getting steam into the cylinder to propel the piston is left to the imagination of the reader. The operation of the valve gear of duplex pumps is explained at length, and considerable space is devoted to a discussion of various designs of water cylinders.

The action of the cross-exhaust which makes the expansive use of steam possible in a direct-acting compound pump without compensating devices is described in a clear and interesting manner, and practical formulas are evolved for calculating the cylinder ratios of such pumps. There are also a number of elaborate tables of doubtful value, which purport to give the mean effective pressure referred to the high-pressure cylinder, and the steam force in pounds in multiple-expansion pumps of many sizes working under various boiler pressures, both condensing and noncondensing.

Two chapters are devoted to the mechanical design of water and steam ends, giving formulas—more or less empirical—for the strength and proportion of parts.

Chapter VI discusses sundry types of pumps from the standpoint of their suitability for different kinds of service. Chapter VII deals with the economic performance, or "duty" of pumps. It includes seven pages of tables, which claim to give the actual duty in millions of foot-pounds per 1000 lb. of steam over the whole range of sizes, from the tiny simple pump of 4-in. stroke working with 50-lb. boiler pressure to a triple-expansion condensing pump of 48-in. stroke working under a boiler pressure of 200 lb. Except in the case of a large water-works pump, carefully designed to meet conditions that can be predicted with accuracy, the duty of a direct-acting steam pump is pretty much of a joke, and this chapter should not be taken too seriously. Engineering literature is singularly free from reports of actual tests of ordinary direct-acting pumps, and the author does not undertake to supply this deficiency. The duties given in the tables are most probably calculated, and no evidence is offered to the effect that they are in close agreement with the results of actual experiment.

The book closes with a very brief chapter on the operation and adjustment of direct-acting pumps and with an appendix consisting of tables giving the frictional resistance of Pennsylvania and California oils in pipe lines of sundry lengths and diameters at various rates of flow.

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Essays on Promoting Efficiency

EXPERIENCES IN EFFICIENCY—By Benj. A. Franklin. [Works Management Library.] New York: The Engineering Magazine Co. Cloth; 5x8 in.; pp. xi + 167. $1.

HINTS CONCERNING THE ORGANIZATION OF WORK-SHOPS AND FACTORIES—By Robert Grimshaw, Consulting Engineer; Lecturer, New York University School of Commerce, Accounts and Finance, Pratt Institute, etc.; author of "Catechisms of Locomotive and Stationary Steam Engines, Boilers and Pumps"; "Shop Kinks"; "Workshop Practice"; "Werkstatt Betrieb und Organization"; "System und Organization in kaufmaennischen Betrieben," and other practical works in English, French and German. New York: New York University Book Store, University Building, 32 Waverly Place. 4x6 in.; pp. 104. 50c.

Mr. Franklin's little book contains some articles, reprinted from *Engineering Magazine,* relating in conversational style a few cases of decreasing manufacturing costs and increasing workmen's rewards for labor. The author's particular contribution to the field seems to be a quality-piece-work scheme of payment for labor, by which the total wage secured depends both on quantity of output and reduction of waste. Some experience is cited with "gang piece-work" pay. Where a number of men were involved in a multitude of operations, the cost of the finished product was determined and used as the basis of a gang payment, which was divided among the various workmen in some proportion judged to be fair. The result was greater coöperation, increased and cheapened output, improved quality and larger wages per man.

Applying efficiency methods to the efficiency men themselves is an unusual theme taken up. The statistical clerks were induced to record the times of their own operations and this furnished the handle for scheduling progress of shop records. The men saw chances of improving their own work, and seven took on extra tasks that before would have required two more men.

There are also some interesting comments on building up a real cost-accounting system. Throughout the author displays a sensible moderation in scrapping old methods which may give good results—straight piece-work wages in some plants, for instance.

The Grimshaw pamphlet appears to be a condensation of lectures given at the New York University and the Pratt Institute. The text consists of tabular or skeleton arrangements of abbreviated expressions defining the aims and methods of organized business, the functions of manufacturing plants and productive departments. Handling stock and labor, reducing costs, increasing production, etc., are similarly taken up "in breathless style."

Descriptive Geometry for Draftsmen

Reviewed By Alton L. Smith*

THE ESSENTIALS OF DESCRIPTIVE GEOMETRY—By F. G. Higbee, M. E., Professor and Head of Department of Descriptive Geometry and Drawing, State University of Iowa. New York and London: John Wiley & Sons. Cloth; 6x9 in.; pp. vi. + 204. $1.80, net.

The author aims to present the subject from the viewpoint of the draftsman. The first fifth of the text explains the general principles of projection and discusses the elementary operations employed in the solution of space problems. The next fifth takes up 17 simple propositions relating to the point, line and plane, the statement in each case being followed by a discussion of the space solution and explanation of the geometric constructions used. The remainder of the book is devoted to the subject of surfaces. Each chapter is followed by a set of practice problems, the whole totaling nearly 300. One entire chapter deals with making paper models of sheet-metal work. The book concludes with an appendix giving useful geometric constructions.

To help the student visualize and vitalize his problem, the author makes use of solids instead of dealing with the geometric point, line and plane. Thus, finding the actual length of a line when its projections are given is presented as a problem of finding the overall length of the inclined brace of a wooden bracket. This method is supposed to overcome two difficulties. First, it is thought that a student can imagine a block of wood much easier than he can conceive of a wire or sheet of cardboard. Second, it is believed that the student can more quickly apply his principles to engineering problems if he has worked out his elementary problems in magnitudes of commercial shape and dimensions instead of the usual ones employed by the mathematician. The problems presented cover a fair range and in most cases have a "practical flavor" rather than real commercial application.

The large amount of space given to sheet-metal pattern work and the total exclusion of some other useful topics will impair the value of the book for those who desire the treatment to be comprehensive, even though brief. However, the matter on surfaces probably constitutes the most valuable feature of the book.

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Fundamentals of Hydraulics

ELEMENTS OF HYDRAULICS—By S. E. Slocum, Professor of Applied Mathematics in the University of Cincinnati. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xi+294; 210 illustrations. $2.50, net.

Professor Slocum evidently has aimed to instruct the student in the fundamentals of hydraulics and simultaneously to impress him on certain important practical applications of theory which should be well known. The book is another evidence of the tendency to break away from academic presentations of pure theory to secure the interest of the student and to visualize the abstractions which once were all too exclusively dealt with.

The book starts off with a brief review of the old academic "hydrostatics"—properties of water, pressure phenomena, properties of floating bodies, etc.—but into this is injected a consideration of presses, accumulators, jacks, elevators, dams, locks, barges, etc. This is done partly by inserted discussions and partly by a group of real and hypothetical engineering problems. The Kensico dam and Keokuk lock are among the actual structures considered.

The convenient term "hydrokinetics" appears here, as in the more academic treatises; but the treatment follows the lines indicated for the preceding section. "Hydrodynamics" is a term also retained to make the subject of hydraulic machinery sound formidable. The division of the book among these parts is 17, 40, and 43 per cent.

In taking up hydrokinetics the formula for flow out of orifices, over weirs and through pipes and nozzles is developed. The author introduces early the idea of stream lines and liquid veins to facilitate the later discussions of kinetic pressure and stream gaging. Venturi meters and siphon spillways are also treated.

Flow in open channels follows, the Kutter, Bazin and Chezy formulas being briefly presented as experimental deductions. Stream gaging by current meters is mentioned, and the use of pitot tubes is discussed at some length. Six pages are devoted to backwater curves in channels—not too much space considering the immediate importance of backwater from stream obstructions. Waterworks problems figure in the appendix to hydrokinetics.

Hydrodynamics is attacked by studying impact on various stationary and moving surfaces, as an introduction to impulse wheels. The reaction of jets serves to open up the subject of reaction turbines. Both classes of machines are presented in their practical details as well as in their underlying theories.

One of the most interesting and useful parts of the book is the review of design characteristics as developed in this country by Zowski and Baashuus (*Engineering News* of Jan. 28, 1909, and Mar. 2, 1911). Of course this is not gone into far enough so that designing can proceed with this text as a guide, but enough is given to be of great aid in understanding the proper selection of wheels. The scope of the section on centrifugal pumps may be similarly described.

Not all the minor matters have been here noted—such as water hammer and displacement pumps; their treatment is in keeping with their importance compared with the other sections noted herein.

Linear Perspective

REVIEWED BY CHARLES W. REINHARDT*

THE PRINCIPLES AND PRACTICE OF LINEAR PERSPECTIVE, Developed Along Original Lines: Being a Practical Handbook for Architects, Civil and Mechanical Engineers, Art Designers, Engravers, and for Draftsmen Engaged in All the Industrial Arts, Including a Self-Explanatory Linear Perspective Chart in Simplified Form—By Herman T. C. Kraus, C. E. Second Edition, Revised and Enlarged. New York: Norman W. Henley Publishing Co., 132 Nassau St. Cloth; 10x13 in.; pp. 53; 15 plates of practical examples. $2.50.

The present edition of this book does not seem to differ from the first edition, except for the addition of a "Self-Explanatory Linear Perspective Chart." This chart is said to be the "only complete nontechnical one ever issued," and it is also stated that "by its careful study the student and layman can obtain a complete knowledge of perspective." The least that could be said about this chart is that it would have gained greatly in appearance if reduced to about one-half size.

The fifteen plates of practical examples accompanying the text are all made by the "wax-process," and while appearing clean-cut and well executed, exhibit a questionable system of outline shading (see Figs. 1, 2, 6, 7 on Plate I, Fig. 6 on Plate XI and similar ones). The subjects represented seem, however, to be well chosen; the text likewise is lucidly written and directly applied. Paper and printing are excellent, as well as the binding.

THE A B C OF IRON AND STEEL, With a Directory of the Iron and Steel Works and Their Products of the United States and Canada—Edited by A. O. Backett. Cleveland, Ohio: The Penton Publishing Co. Cloth; 8x11 in.; pp. xv + 338; 222 illustrations. $5, postpaid.

An interesting and attractive treatise on American iron and steel making, written in a somewhat popular style, has here been secured with the coöperation of sixteen men well known in the industry. There are chapters on ore and mining, the preliminary treatment, or "beneficiation," of ores, valuation of ore, transportation and handling, beehive and byproduct oven coke, blast furnaces, puddling processes, crucible, bessemer and open-hearth steel, rolling and wire-drawing mills, malleable castings, steel foundries, and electric steel furnaces. Appended to this descriptive matter are numerous statistical tables relating to the American industry and a directory of concerns in this country and Canada making pig and wrought iron, steel and mill products.

In the notice of Dr. H. B. Hemingway's "Legal Principles of Public Health Administration" (*Engineering News* of July 15, p. 120), a word was accidentally omitted from the brief quotation from the book in the third paragraph of the review. We repeat the paragraph, giving the quotation correctly, with the omitted word in roman:

"In view of several flattering tributes paid by the author to the engineering profession, including a statement that it might be better to choose a health officer from sanitary engineers than from physicians, it may seem ungracious on our part to point out that in discussing sewage treatment he says that the Imhoff tank 'takes the crude sewage and pours out water much clearer than that found in many streams, and practically devoid of *harmful* bacteria.' This is clearly a misconception of the object and the effect of the Imhoff tank, but it may not do much harm in this book."

The omission of the word "harmful" misrepresents the author in a way which was wholly unintentional and is regretted. It did not affect the criticism, which was addressed to the correct and not to the incorrect quotation.

SHAPE BOOK, Containing Profiles, Tables and Data Appertaining to the Shapes, Plates, Bars, Rails and Track Accessories Manufactured by Carnegie Steel Company, Pittsburgh, Penn. Fifth Edition, 1915. Flexible leather; 5x8 in.; pp. 312; illustrated.

It is four years since the last previous edition of this book was issued, and the new volume just printed shows a remarkable development in many lines of special manufacture. It is now possible for the designing engineer to command a far greater variety of forms in standard rolled sections than existed only a few years ago. For many of these new sections the automobile industry is responsible. Another development has been in small sections used in the construction of metal window frames, skylights, etc. A variety of types of deformed bars for concrete reinforcement is shown. A considerable number of the sections have been rolled for special customers and are obtainable only by special arrangement. Their inclusion in the book is of value, however, as there would doubtless be no difficulty in obtaining these special sections by any engineer who desired to use them for purposes not competitive with the company for which the section was originally rolled.

HUMAN NATURE AND RAILROADS—By Ivy L. Lee. Philadelphia: E. S. Nash & Co. Cloth; 5x8 in.; pp. 129. $1, net.

The series of addresses which are printed in this book were delivered by Mr. Lee before various public bodies during the past year. Their general purport is to impress upon the public the need of a square deal in the treatment of the railways by the public and the public's representatives—the legislatures, commissions and courts. In an address entitled "Training the Railroad Man," delivered before the Society for the Promotion of Engineering Education, Mr. Lee deals with the problem of the best training for students in technical and other schools.

Especial interest attaches to this book because its author was the active agent in carrying out the policy of publicity adopted by the Pennsylvania Railroad a few years ago. In "Telling the Railroad Story," Mr. Lee explains how that policy has been carried out.

A three-plane (isometric projection) horsepower chart for gears and pulleys is published by the Mesta Machine Co., of Pittsburgh, as Bulletin Ka. Curves show pitch-circle velocity, pitch-circle load and horsepower for various revolutions per minute, torques and pitch diameters.

A handbook of India has been issued by the United States Department of Commerce, in an effort to stimulate interest in the Indian market on the part of American manufacturers. This is a book of 640 pages and deals with the resources, industries and commerce of India. It contains many illustrations, a large detailed map and facts concerning a multitude of Indian activities and conditions, with interesting accounts of the native states and of Ceylon, Afghanistan and Tibet. E. E. Pratt, chief of the bureau, states that this work is regarded as one of the most valuable publications ever produced by his

*Of Reinhardt-Winters-Cahill Co., technical illustrators, Times Building, New York City.

bureau. It is known as No. 72 in the series of special consular reports, and may be obtained for $1 from the Superintendent of Documents, Washington, D. C.

NEW PUBLICATIONS

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor, the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS—Proceedings of Annual Meeting Held at Rochester, N. Y., June 22-25, 1915. Chicago, Ill. (c/o M., St. P. & S. S. M. Ry.): P. W. Drew, Secretary Paper; 6x9 in; pp. 270.

A BIBLIOGRAPHY OF MUNICIPAL GOVERNMENT IN THE UNITED STATES—By William Bennett Munro, Professor of Municipal Government, Harvard University. Cambridge, Mass.: Harvard University Press. Cloth; 6x9 in.; pp. xiii + 472. $2.50, net.

THE BOOK OF WIRELESS: Being a Clear Description of Wireless Telegraph Sets and How to Make and Operate Them, Together with a Simple Explanation of How Wireless Works—By A. Frederick Collins, Author of "Wireless Telegraphy, Its History, Theory and Practice," "The Book of Stars," "The Book of Magic," etc. New York and London: D. Appleton & Co. Cloth; 5x8 in.; pp. xv + 222; 219 illustrations. $1, net.

CANADIAN RAILWAY AND CANAL STATISTICS: Annual Report of the Department of Railways and Canals for 1913-14; Railway Statistics for 1914; Canal Statistics for the Season of Navigation, 1914—Ottawa, Ont.: Department of Railways and Canals. Paper; 7x10 in.; pp. 472; 109; 191; illustrated.

COMPASS SURVEYING AND THE SIMPLIFIED CALCULATION OF FARM AREAS—By Charles Mitchell Thomas, Civil Engineer and Surveyor. Wytheville, Va.: The Author. Cloth; 6x8 in.; pp. vi + 92; charts. $2.

ELECTRIC WIRING SPECIFICATIONS—By J. H. Montgomery, Professor of Physics and Electrical Engineering, University of Southern California. New York: D. Van Nostrand Co. Cloth; 4x7 in.; pp. 139. $1, net.

ELECTRICAL MEASUREMENTS AND METER TESTING: A Book in Plain English for the Student and Practical Man; Fundamental Theory, Practical Applications and Examples—By David Penn Moreton, Associate Professor of Electrical Engineering, Armour Institute of Technology. Chicago, Ill.: Frederick J. Drake & Co. Linen; 4x7 in.; pp. 328; 191 illustrations. $1.

HANDBOOK OF THERMODYNAMIC TABLES AND DIAGRAMS: A Selection of Tables and Diagrams from "Engineering Thermodynamics" by Charles Edward Lucke, Professor of Mechanical Engineering, Columbia University —Arranged and Amplified by John J. Flather, Professor of Mechanical Engineering, University of Minnesota. Cloth; 6x9 in.; pp. xvi + 238; 82 charts. $1.50, net.

IDIOSYNCRASIES OF UNDERGROUND WATER—By Robert E. Horton, Consulting Hydraulic Engineer, 57 No. Pine Ave., Albany, N. Y. [Reprinted from Proceedings of the Connecticut Society of Civil Engineers for 1915.] Paper; 6x9 in.; pp. 56; illustrated.

INTERNAL COMBUSTION ENGINES, Theory and Design: A Textbook on Gas and Oil Engines for Engineers and Students in Engineering—By Robert L. Streeter, Assistant Professor of Mechanical Engineering, Russell Sage Foundation, Rensselaer Polytechnic Institute. New York and London: McGraw-Hill Book Co., Inc. Cloth; 7x10 in.; pp. xi + 418; 240 text illustrations and drawings. $4, net.

AN INVESTIGATION OF IOWA FIRE CLAYS—By Milton F. Beecher. Bulletin 40, Engineering Experiment Station. Ames, Iowa: Iowa State College of Agriculture and Mechanic Arts. Paper; 6x9 in.; pp. 117; illustrated.

IRRIGATION AND SETTLEMENT IN AMERICA—By A. D. Lewis, Circle Engineer, Irrigation Department, Union of South Africa; late of the Public Works Department of Punjab, India. Pretoria, South Africa: Government Printing and Stationery Office. Cloth; 8x11 in.; pp. 258; illustrated. 10/6 post free.

IRRIGATION PRACTICE AND ENGINEERING: Vol. I, Use of Irrigation Water and Irrigation Practice—By B. A. Etcheverry, Head of the Department of Irrigation, University of California. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xiii + 213; 77 illustrations. $2, net.

A MANUAL FOR HEALTH OFFICERS—By J. Scott MacNutt, Sometime Health Officer of Orange, N. J., and Member of the Board of Examiners of Health Officers and Sanitary Inspectors of New Jersey; Lecturer on Public Health Service in the Massachusetts Institute of Technology: With a Foreword by William T. Sedgwick, Professor of Biology and Public Health, Massachusetts Institute of Technology. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. x + 650: $3, net.

MASTER BOILER MAKERS' ASSOCIATION—Proceedings of Annual Convention held at Chicago, May 25-28, 1915. New York (95 Liberty St.): Harry D. Vought, Secretary. Cloth; 6x9 in.; pp. 230; illustrated. $1.

THE MINERAL RESOURCES OF TEXAS—By William B. Phillips. Bulletin No. 365. Austin, Tex.: University of Texas. Paper; 6x9 in.; pp. 362; illustrated.

THE NAVAL STORES INDUSTRY—By A. W. Schorger, Chemist, and H. S. Betts, Engineer, Forest Products Laboratory. Washington, D. C.: United States Department of Agriculture. Bulletin No. 229. Paper; 6x9 in.; pp. 58; illustrated.

NEW JERSEY STATE BOARD OF PUBLIC UTILITY COMMISSIONERS (Trenton, N. J.)—Report for 1914. Cloth; 6x9 in.; pp. 307.

NEW YORK STATE COMMISSIONER OF HIGHWAYS (Albany, N. Y.)—Report for 1914. Cloth; 6x9 in.; pp. 892.

OIL ENGINES FOR PUMP IRRIGATION AND THE COST OF PUMPING—By George E. P. Smith. Bulletin 74, Agricultural Experiment Station. Tucson, Ariz.: University of Arizona. Paper; 6x9 in.; pp. 72; illustrated.

PRACTICAL SURVEYING for Surveyors' Assistants, Vocational, and High Schools—By Ernest McCullough, M. Am. Soc. C. E., author of "Engineering Work in Towns and Cities"; "The Business of Contracting"; "Engineering as a Vocation." New York: D. Van Nostrand Co. Cloth; 5x8 in.; pp. ix + 42; 229 illustrations. $2, net.

PROPERTIES OF STEAM AND AMMONIA—By G. A. Goodenough, Professor of Thermodynamics, University of Illinois. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 7x10 in.; pp. vii + 108; illustrated. $1.25, net.

THE RAILWAY LIBRARY, 1914: A Collection of Addresses and Papers on Railway Subjects, Mostly Delivered or Published During the Year Named, Also Statistics for 1914—Compiled and Edited by Slason Thompson, Director of Bureau of Railway News and Statistics. Chicago, Ill. (1529 Railway Exchange Bldg.): The Bureau. Cloth; 6x9 in.; pp. 470. $1.

THE SAMPLING AND CHEMICAL ANALYSIS OF IRON AND STEEL—By O. Bauer and E. Deiss of the Royal Testing Bureau at Gross-Lichterfelde, Germany. Authorized translation from the German by William T. Hall and Robert S. Williams, Massachusetts Institute of Technology. [International Chemical Series.] New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xiv + 373; 173 illustrations. $3, net.

STANDARDS FOR RUBBER COVERED WIRES AND CABLES, Including Label Service Manual, "National Electrical Code" Specifications and Underwriters' Laboratories' Standards for Physical and Chemical Tests of Rubber Compounds Used for Electrical Insulation—Underwriters' Laboratories, Inc., 207 East Ohio St., Chicago, Ill. Paper; 6x9 in.; pp. 126; illustrated.

STRUCTURAL STEEL: Handbook No. 16—Compiled and Published by R. A. Skelton & Co., Moorgate Station Chambers, London, E. C., England. Cloth; 7x9 in.; pp. 319; illustrated.

SURVEYING AND FIELD WORK: A Practical Textbook on Surveying, Leveling and Setting-Out, Intended for the Use of Students in Technical Schools and Colleges and as a Work of Reference for Surveyors, Engineers and Architects—By James Williamson, Assoc. M. Inst. C. E. [The Glasgow Textbooks.] New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. xxii + 363; 271 illustrations. $3, net.

SURVEYING MANUAL: A Manual of Field and Office Methods for the Use of Students in Surveying—By William D. Pence, M. Am. Soc. C. E., Professor of Railway Engineering, University of Wisconsin, and Milo S. Ketchum, M. Am. Soc. C. E., Dean, College of Engineering and Professor of Civil Engineering, University of Colorado. Fourth Edition. New York and London: McGraw-Hill Book Co., Inc. Flexible leather; 4x7 in.; pp. xiv + 388; illustrated. $2, net.

TESTS OF SUBMERGED ORIFICE HEADGATES FOR THE MEASUREMENT OF IRRIGATION WATER—By F. L. Bixby, Irrigation Engineer. Bulletin 97, Agricultural Experiment Station. State College, N. M.: New Mexico College of Agriculture and Mechanic Arts. Paper; 6x9 in.; pp. 55; illustrated.

A TEXTBOOK OF ENGINEERING THERMODYNAMICS—By Charles Edward Lucke, Professor of Mechanical Engineering, Columbia University, and John J. Flather, Professor of Mechanical Engineering, University of Minnesota: An Abridgment of "Engineering Thermodynamics," by Charles Edward Lucke. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xxiv + 688; 189 illustrations. $5, net.

VALVES AND VALVE GEARS: Vol. II, Gasoline, Gas and Oil Engines—By Franklin DeRonde Furman, M. Am. Soc. M. E., Professor of Mechanism and Machine Design, Stevens Institute of Technology. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xi + 190; 216 illustrations. $2, net.

WATER-SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY—Washington, D. C. Paper; 6x9 in.; illustrated.

No. 356: Surface Water Supply of the United States, 1913; Part VI, Missouri River Basin. Pp. 291.

No. 375-B: Ground Water in Paradise Valley, Arizona —By O. E. Meinzer and A. J. Ellis. Pp. 26.

No. 375-C: The Relation of Stream Gaging to the Science of Hydraulics—By C. H. Pierce and R. W. Davenport. Pp. 10.

No. 375-D: Ground Water in Big Smoky Valley, Nevada —By O. E. Meinzer. Pp. 31.

No. 375-E: A Method of Correcting River Discharge for a Changing Stage—By Benjamin E. Jones. Pp. 10.

Field and Office

Baby Mixer Proves Economical

Unusually efficient work was observed recently in concreting with a baby batch mixer. Rapid mixing and placing of concrete, great adaptability to conditions of ground, etc., and, to all appearances, very low cost were features of the performance. The case was the concreting of column footings for the Delco Building, a large reinforced-concrete structure now under erection at Dayton, Ohio.

The 93 footings of the building, 2 ft. to 14 ft. below ground floor and from 1 yd. to 7 yd. in contents of concrete, were ready for concreting long before the mixing plant and towers were assembled and erected. As the footing pits tended to cave, it was desired to concrete them as soon as excavated to save extra work in holding the walls or clearing the pits.

Work was begun by hand mixing, but this proved too expensive on account of rehandling sand and stone, as well as too slow—the excavation got too far ahead of the concrete.

Half-Bag Batch Mixer for Direct Depositing

A self-propelling half-bag mixer (Foote) was then brought on the job. It proved successful from the start.

The mixer was run under its own power to a point near enough to the footing so that the concrete could be chuted from the mixer to place. In many instances the gravel aggregate was taken direct from the excavation in which case only the cement had to be wheeled.

The full day's capacity of the mixer (said to be 80 cu.yd. in 10 hr.) was never used, but some very good short-time performances were made. The best was 7 yd. in 28 min., with a force consisting of one foreman, one operator, two shovelers, one material wheeler, one batch tender and one puddler. In this particular case the material was specially convenient and the mixer was placed more advantageously than usual. In numerous other cases, however, 45 yd. in 8 hr. was turned out, with two wheelers added to the gang.

Wheeling Concrete for Wall Work

For forming the walls (2 ft. to 10 ft. high) of the ground-floor sill and of the interior tunnel, a directly opposite method of using the portable mixer was employed—keeping the mixer stationary and wheeling the concrete from it to the wall. This was on account of the small yardage of concrete per foot of wall. Actually, it was found that wheeling concrete as far as 150 ft. was cheaper than moving the mixer, rehandling material and rebuilding runways.

The labor cost per yard of concrete was higher under this method than under that used for the footings because three more men were required in wheeling.

Factors of the Machine's Success

The fact that the mixer was self-propelled turned out to be very valuable. Often the machine crawled over piles of excavated dirt like a snail, but it always got there and it was mired only once.

The simplicity of the mechanism was another important element. A second-class engineer was hired and he operated it successfully. In turning out about 1000 yd. of concrete the mixer held work up only twice, and only one of these cases is chargeable to the machine.

More Use of Motor Trucks for Hauling Structural Steel

By D. P. N. Little*

I was very much interested in the article in *Engineering News* of July 22, 1915, by William Collins, Jr., describing the hauling of heavy girders for the Jerome Ave. elevated-railway structure in New York City. The article was of particular interest, for we have these hauling problems confronting us on the Pacific Coast, as well as our brothers in the East; and just at this time the Union Iron Works, of Los Angeles, had to consider the problem of

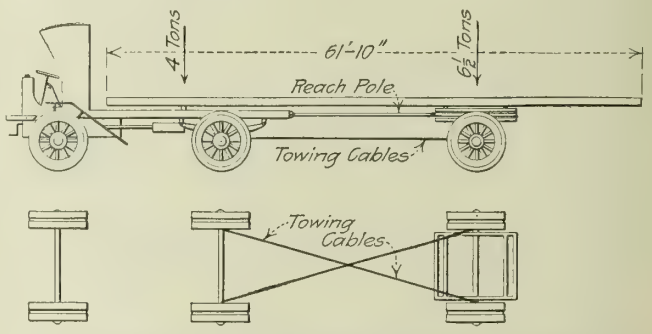


FIG. 1. SKETCH PLAN OF METHOD OF CONNECTING TRUCK AND TRAILER FOR HAULING STRUCTURAL STEEL

transporting two girders, 72 in. deep by 61 ft. 10 in. long, weighing about 11 tons each, which were designed for a bridge on Cypress Ave., between Los Angeles and Orange Counties, 24 mi. distant from the shops.

As the location was not convenient for shipping by rail, it was decided to use a 3½-ton motor truck with a two-wheeled rubber-tired trailer. The roads for most of the way are thoroughly improved, although there are quite a number of very short turns.

The accompanying sketch, Fig. 1, shows the method of loading, about 6½ tons being put on the trailer and about 4 tons on the truck.

The trailer frame has swivels at two points, and the tow-line connection of crossed wire cables from axle to axle compels the trailer to take the same circle as the rear wheels of the truck. The second swivel frame carries the reach pole, which is connected to the rear end of the truck body by a toggle joint, but it does not carry any strain. The upper swivel frame acts as a bolster and is provided with rollers. The girder was securely chained to the swivel frame of the trailer as well as to a swivel bolster on the body of the truck. Both girders were safely

*President of the Union Iron Works, Los Angeles, Calif.



FIG. 2. LOADING AND HAULING 11-TON STEEL GIRDERS BY MOTOR TRUCK AND TRAILER

transported to their destination without incident, the time consumed from start to finish being 10 hr. for each girder. This would have been cut to 8 hr., but the weather was unusually warm and the oil-macadam roads were rather soft.

We have estimated (taking the period of the year as a basis) that the operation of our truck, including depreciation, labor, upkeep and fuel expenses, averages about $1 per hr. of operating time, and if this assumption is correct we transported these girders 24 mi. for a little less than $1 per ton. However, taking Mr. Collins' estimate of $20 per day it would make our hauling cost about $1.90 per ton, or 7.91c. per ton-mile as against Mr. Collins' 16½c.

With this same truck we have hauled steel beams 57 ft. long 66 mi. to Riverside without the use of a trailer. We find this cheaper than loading on two flat-cars.

Lifting Bridge Trusses to Adjust Rollers

By H. T. Welty*

The Ottawa & New York R.R. and the Ottawa Division of the New York Central R.R. are carried over the south channel of the St. Lawrence River near Cornwall, Ont., by a bridge consisting of three 368-ft. single-track truss spans. A recent inspection disclosed the fact that the expansion rollers (of which there are six, 12 in. high, at each expansion point) were inclined considerably more than they should be at the temperature obtaining when the inspection was made, and at two points the inclination had progressed so far that a further movement of ½ in. only was possible. It therefore became necessary to jack up the trusses and adjust the rollers.

The elevation of the bridge above the river, about 40 ft., and the swift current which prevails at this point made the use of any falsework difficult and expensive; the dimensions of the piers, which extend beyond the truss bearings only 4 ft. transverse to the axis of the bridge, and 1 ft. in the other direction, necessitated a compact device for jacking.

The device adopted consisted of a pair of U-shaped lifting rods engaging threaded cast-steel collars which replaced the nuts on the end pins. The rods were threaded at the tops for nuts which rested on loading beams, these beams being in turn supported on lifting beams against the lower flanges of which, through timber blocks, the jacks operated.

The collars were threaded from field measurements of the threads on the pins, and each was provided with a ¼-in. rim at the outer end to hold the lifting rods in position. The latter were made of 1¾-in. square rods to give a good bearing on the collars, and the inside rod was made in two parts with a turnbuckle connection to permit inserting it around the end floorbeam without disturbing the latter. The loading beams were made of two 12-in. channels bolted together through a 4-in. wood-block separator, the bearing of the lifting-rod nuts being taken

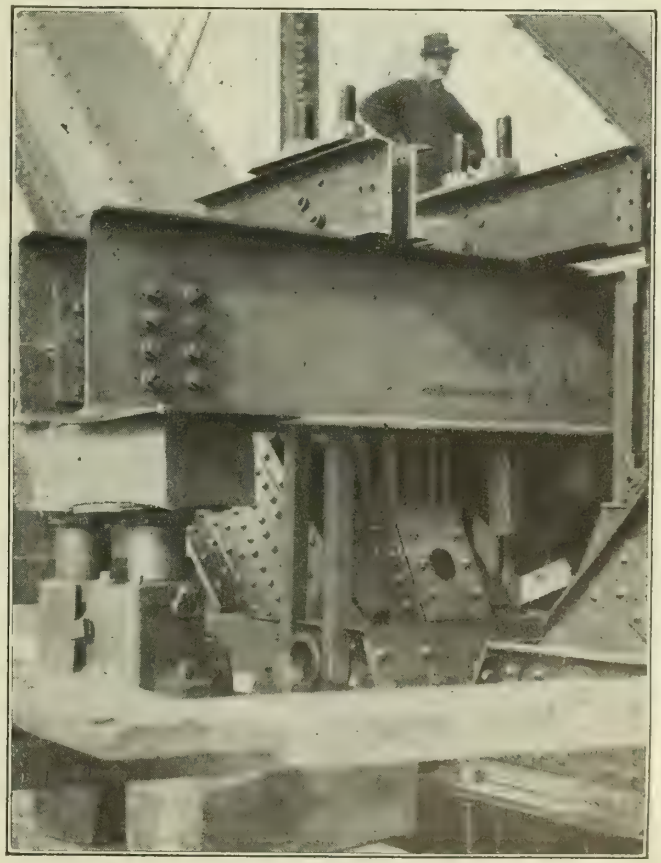


FIG. 1. VIEW OF LIFTING-DEVICE IN POSITION

*Engineer of Structures, New York Central R.R. east of Buffalo, Grand Central Terminal, New York City.

by a ¾-in. plate resting on their top flanges. These beams rested on the top flanges of the lifting beam composed of two 24-in. 80-lb. I-beams 9 ft. 3 in. long which spanned the truss shoe, one on each side of the end floorbeam. At the outer end these beams were connected over the jacking point by a 20-in. I-beam diaphragm, but at the inner end, where the floorbeam interfered, dependence was placed on bolts extending through the webs and clamping the parts together through wooden blocks.

Due to interference from the end-post, the lifting beam could not be placed nearer the top of the pier than about 5 ft., which necessitated the use of blocking. The blocking, because of the restricted area of the pier, could not be arranged to give a very ample bearing area, a high bearing pressure on the blocks resulting (see Fig. 1).

The weight to be lifted was calculated as 280,000 lb., and in order that ample jacking capacity would be available four 60-ton jacks were used.

A force of six men was employed in the work. After the preliminary details—such as drilling holes in the old material and making cuts to permit the placing of the lifting rods and beams—had been completed at all points, the lifting parts and blocking were placed at one bearing, the truss raised about one inch and the rollers adjusted, after which the lifting parts and jacks were removed to the next bearing and the same procedure repeated, and so on until all six expansion bearings were adjusted. Two bearings were adjusted each day. In some cases the roller nest was not exactly square on the bedplate and in addition to adjusting the inclination of the rollers it was necessary to adjust the position of the nest. This was done by means of a small track jack.

During the adjustment of the rollers no traffic was permitted on the bridge, and the work proceeded to completion without interruption or difficulty.

The device was designed in the office of Engineer of Structures, of the Construction Department of the N. Y. C. R.R., and the work was carried out by the Maintenance of Way Department forces under the supervision of the Assistant Engineer, Adirondack Division.

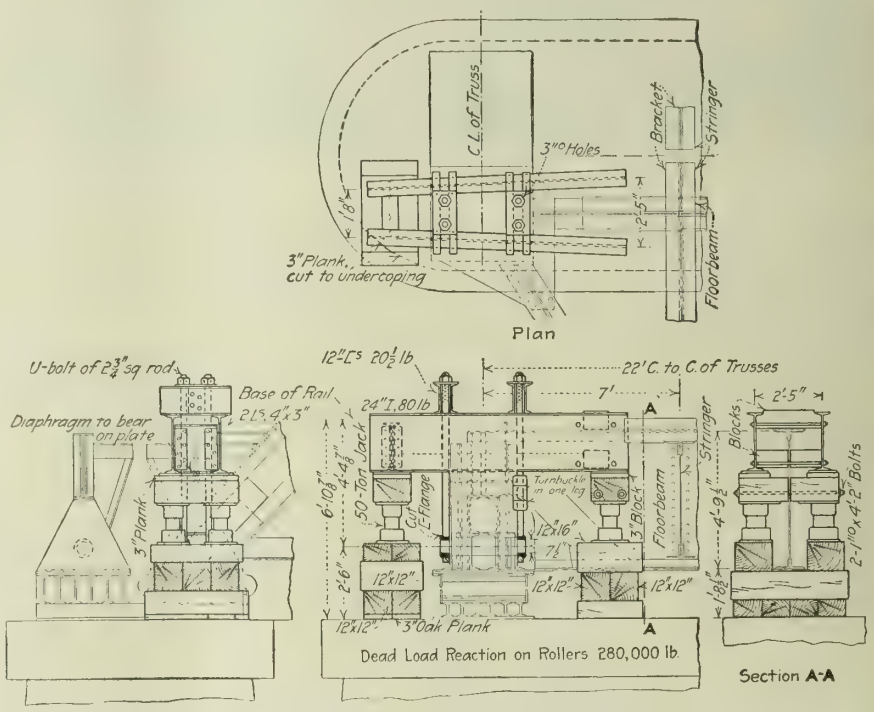


FIG. 2. ARRANGEMENT FOR LIFTING TRUSS TO ADJUST ROLLERS, CORNWALL BRIDGE

Tar Paint on Penstocks and Draft Tubes has been used successfully at the water-power plant on the Minidoka, Idaho, reclamation project, according to a report in the "Reclamation Record for September." The use of this material appears to have been due to the article on the Fernando siphon of the Los Angeles water supply, published in "Engineering News," May 21, 1914. Barry Dibble, engineer in charge of the Minidoka power plant, found that the steel draft tubes and penstocks under water were not protected from corrosion by the red-lead paints that had been applied. During the fall of 1914 the parts exposed to water on all the draft tubes were scraped clean and repainted with water-gas and coal-gas tar, the former being used for the first coat and the latter for the second and third coats. The steel was first cleaned with steel scrapers and brushes. The cost of the water-gas tar was about 15c. per gallon delivered. One gallon covered about 30 sq.yd. In cool weather, one quart of gasoline was mixed with three to five gallons of tar. The tar was applied with a brush in the same manner as ordinary oil paints. At a cost of labor for painting only of $110, and for material of $10.39, 750 sq.yd. were cleaned and painted.

Load Tests of Concrete Pipe

By E. R. Conant*

In preparation for the construction of 12 mi. of sanitary and storm-water sewers in Savannah, I made a series of load tests on the circular concrete pipe of the Meriwether type, made by the Lock Joint Pipe Co., which type is being used in about 40% of the work. These tests were made under the following specifications:

When supported upon a saddle which extends the full length of the pipe, exclusive of the bell, and whose outer surface fits accurately the outer curve surface of the pipe, and whose width is equal to an arc of 15 deg., in such a manner that an even bearing is provided throughout the whole length, and pressure is applied at the crown uniformly through a knife-edge 1 in. in width, the various sizes of pipe with diameters greater than 42 in. shall withstand the following pressures:

Diameter, In.	Pressure, Lb. per Lin.Ft.	Diameter, In.	Pressure, Lb. per Lin.Ft.
24	2,150	54	5,000
30	2,700	60	5,500
36	3,300	66	6,000
42	3,800	72	6,500
48	4,400		

Bending tests were made on one section each of the 48-in. and 66-in. diameter pipe and on two jointed sections of 36-in. pipe. All concrete was a 1:2:4 mix using river sand and a fine crushed granite for aggregate. The reinforcement was of the standard size and disposition for this type of pipe.

The test on the 48-in. pipe is shown in Fig. 1. In this a load was placed on a 42-in. wide platform carried on a 1-in. knife-edge which rested on the top element of the pipe, the pipe itself being bedded on saddles made by laying two 1x4-in. boards on the ground. The direct load was applied by loading the platform with cement in sacks over a space 4 ft. each side of the knife-edge.

The 48-in. pipe, 48 in. long and 16 days old, showed a hair crack at the invert and crown at 4½ tons load; the deflection was inappreciable. The load was left in place

*Chief Engineer, Savannah, Ga.



FIG. 1. LOAD TEST ON 48-IN. REINFORCED CONCRETE PIPE

unchanged for 24 hr., but no change in the pipe took place. Loading was resumed until 7.35 tons, or 2.08 tons per lin.ft., had been placed. At this load the deflection was $\frac{3}{8}$ in. and the cracks in the invert and crown opened up slightly, but no crack extended outside of the inner line of reinforcement. In this pipe American Steel & Wire Co.'s triangular mesh No. 34 was used for reinforcing, two hoops being used—the first one $\frac{3}{4}$-in. from the outside face and the second $1\frac{3}{4}$ in. from the inside face of the pipe.

Similiar load test was made on a 66-in. pipe after the pipe had aged 14 days. The loading of $11\frac{1}{2}$ tons was applied on a 1-in. knife-edge, producing a deflection of only $\frac{1}{16}$ in. at the crown. A few hair-cracks occurred on the inside of the pipe at the top and bottom.

Another test was made to determine the strength of the joints (Fig. 2). Two 36-in. diameter pipes were jointed with grout in the customary manner, and the pipe was then supported at its ends and load was placed upon a 16-in. saddle centered over the joint. In this test $8\frac{1}{2}$ tons was placed on the loading platform, with the result that no deflection could be noticed and no cracks occurred. The joints thus resisted a bending load greater than the required strength of the pipe.



FIG. 2. TESTING THE JOINT IN LOCK-JOINT PIPE

Subdrainage of Brick-Paved Streets, Lakewood, Ohio

By E. A. Fisher*

I agree with the suggestion of the National Paving Brick Manufacturers' Association that too little attention has been paid to the question of drainage and the action of frost in water-impregnated soils. All the real reasons for the cracking of brick pavements are not fully understood, nor is it to be doubted that the expansive action of freezing water in the subsoil is responsible for some of the trouble. It would therefore seem reasonable to provide, as far as possible, against this cause.

In brick pavements recently constructed in Lakewood, Ohio, I have endeavored to provide subdrainage by placing a 3-in. tile drain behind the curb, laid in cinders as shown in Fig. 1. We used this method of construction last season in all streets with the exception of one. Of those streets in which a tile drain was placed, none has shown any signs of cracking. The one in which no tile was laid has already cracked. Subsoil conditions in the several streets are almost identical.

A condition which exists for about 2000 ft. on one side-hill street which we paved this season is shown in Fig. 2.

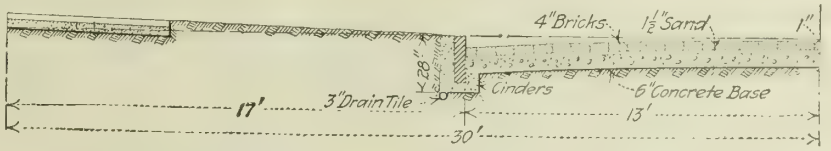


FIG. 1. HALF CROSS-SECTION OF BRICK-PAVED STREET WITH TILE DRAINS BEHIND CURBS

During a hard rainstorm and at intervals afterward, I visited this street to see what effect the tile drain was having. I found the 3-in. tile on the high side of the street, which discharged into the nearest catchbasin, running nearly full. The tile on the low side of the street was running nearly a quarter full.

*City Engineer of Lakewood, Ohio.

In this particular case one can very easily imagine what might happen with the ground saturated by fall rains, followed by a sharp freeze, if there were no tile drain to intercept the water from the slope.

Admitting the theory of capillarity in soils, there may be some question as to where to place the drain. I have worked on the presumption that the presence of 13 in. of

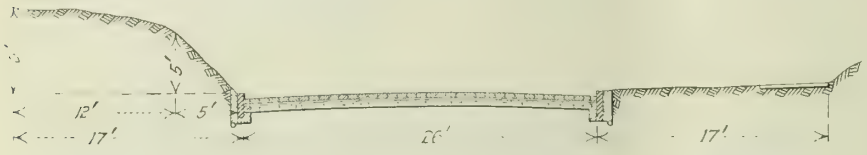
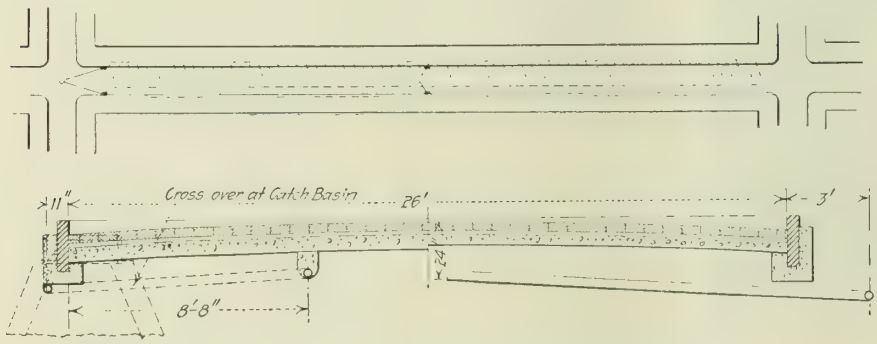


FIG. 2. CROSS-SECTION OF SIDEHILL STREET IN LAKEWOOD, OHIO

porous cinder between the tile and the nearest point of the subgrade would break down any capillarity that might exist.

The N. P. B. M. A. specifications suggest that the drain be placed 3 ft. back of the curb and that lateral drains be run from this tile drain to the center of the street. In Fig. 3 is shown a 600-ft. block with one side of the street drained with lateral tile drains 8 ft. 8 in. center to center and the other side drained longitudinally of the



FIGS. 3 AND 4. PLAN AND CROSS-SECTION OF STREET WITH TWO PROPOSED SYSTEMS OF SUBDRAINAGE

street by two tiles with the same spacing apart. In each case the drain is led to the nearest catchbasin. The saving in lineal feet of tile in the longitudinal drainage over the lateral system is about 30% for the same spacing. Fig. 4 is a cross-section of the street in Fig. 3.

I am firmly of the opinion that there is virtue in the use of a tile drain under the curb, and there may be additional virtue in the lateral drainage suggested. I shall try to find out at the first opportunity.

Explosives for Driving Concrete Piles*

In driving reinforced-concrete piles for the Cabugao Bridge, Ilicos Sur, Philippine Islands, compacted gravel sand, clay and bowlders up to 10 in. diameter were encountered, and it was decided to loosen up the material ahead of the piles by the use of explosives. It was desired to obtain a penetration to El. —6.8 m., the ground level being at approximately El. +0.2 m.

The plan was to explode the charges at El. —6.0 m., leaving 80 cm. of penetration to be obtained by driving the tapered points of the piles into the undisturbed material. Judson powder R.R.P. was used because it was decided this would exert its action through a greater range horizontally and with probably more force upward than other available explosives.

The piledriver was moved into place for driving the pile and a 6-m. length of 3-in. galvanized-iron pipe was hoisted in the leads. A pipe coupling was screwed on to the hammering end of the pipe to protect the threads in driving, and on the driving end was attached a steel cap made of old plate ½ in. thick, 7 in. square, notched on the four sides about 2 in. The corners of the plate were bent up at right angles forming a circle practically the diameter of the outside of the pipe. Into a hole punched in the center of the plate a piece of ¾-in. steel 2 in. long was driven while hot and made snug. The cap was fitted over the end of the pipe at just ground level, and the protruding point served as a guide to keep the cap and pipe going straight. The cap, while it did not keep water out of the pipe, prevented the earth from entering and filling it. While the driver was being moved into place and the pipe was being prepared for driving, the charge of explosives was simultaneously prepared. With light blows of the hammer, the pipe was driven into the ground 6 m.

The charge, really a long cartridge, was lowered into the pipe. The cartridge was a tin tube of 2½ in. diameter and 1 m. long containing Judson powder R.R.P., tamped to a depth of 75 cm. Two sticks of dynamite, with a 6-m. fuse and cap in each, were placed on top of the powder. Another stick of dynamite was broken into four pieces and tamped in around the exploder sticks along with more Judson powder R.R.P. up to within about 4 cm. of the top of the tube. On top of this was rammed some of the thin paper in which fuses are packed, and the tube was sealed with asphalt or white lead, crimping the end of the tube slightly.

When the bottom of the tube was down to the bottom of the pipe and resting on the cap, a 6-m. length of 1-in. pipe was run down on to the top of the cartridge and held there by two laborers on the piledriver. The cable was then hitched to a rope fastened around the top of the 3-in. pipe and with the engine the pipe was gradually withdrawn, leaving the cap and tube down in the ground. The 1-in. pipe was withdrawn after the 3-in. pipe had been lifted about 2 m.

As soon as the two pipes were out of the ground, the fuses were lighted and the charge exploded. The piledriver was then moved into place for the next pile but one and the operation repeated, and then to the second pile beyond that. This gave three explosions for the bent of five piles, which were spaced about 1 m. apart. The concrete piles were then driven with very satisfactory results as to grade, the bearing being much more than required. These facts should be noted:

1. There must be a steel cap on the penetrating end of the pipe as a wooden plug splinters and forces itself up into the pipe.

2. There must be a coupling on the driving end of the pipe as the metal at the base of the threads is too thin to permit of

*Abstract from an article by Frank T. James, in the "Quarterly Bulletin," Bureau of Public Works, Philippine Islands.

hammering without crimping the edges. The coupling also serves as a collar with which to grip the pipe with a rope when withdrawing it from the ground.

3. A block, preferably of hardwood, should be used on top of the coupling as a further protection for the end of the pipe.

4. The 3-in. pipe should not be driven until the cartridge is all ready, because once in awhile the cap slides off the end of the pipe when down at a considerable depth, and the charge must be put in immediately before the earth works itself into the pipe.

5. Dynamite is absolutely necessary to explode Judson powder R. R. P. The manufacturer's handbook states the size and number of sticks to be used for different sized charges. The charge used was about 6 lb. and required two ⅞-in. sticks.

6. In every charge of dynamite there should be two fuses and two caps as a minimum. One fuse and one cap are not enough as oftentimes a fuse that burns well for half its length or more dies before reaching the cap, if the latter has been crimped too much or improperly. Using two fuses and two caps lessens the chances of failure to explode. One of the fuses should be a foot or more longer than the other, and the longer one be lighted first, to insure reasonable safety to the man doing the igniting. This must be done quickly; hence a torch or other large flame is best.

Jacking Tests on Piles

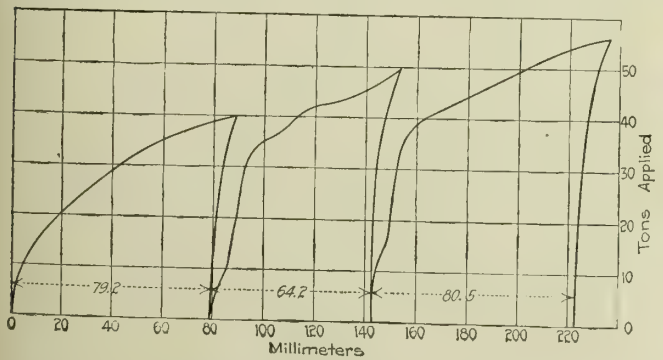
Interesting pile tests were made last spring at the Potter Building, New York City, by Maurice Deutsch, consulting engineer. The piers along the Beekman St. front of the building, on the line of the new subway, were underpinned to a depth of from 56 to 59 ft. below curb, by carrying a series of open pits under the main piers down to water level (about 44 ft. below curb) with five tubular steel-and-concrete piles, of 14 in. diameter, jacked down below the pit bottom to about 15 ft. below water level. Each of these piles was tested to a load of 56 tons by means of a hydraulic jack. Readings were taken on a dial deflectometer. The results of three tests on one of these piles, penetrating 15 ft. in medium fine sand, are shown by the accompanying curves.

SETTLEMENT AND RECOVERY OF PILES UNDER LOAD

First Test		Second Test		Third Test	
Tons	Movement mm.	Tons	Movement mm.	Tons	Movement mm.
10	4	10	5	10	1
35	60	20	10	16	5.5
40	89.3	30	13	31	9.5
E		35	20	40	20
Recovery.....10.1		38	30	45	40
		42	40	50	60
Net movement....79.2		43	50	54	80
		45	60	56	93.9
		48	70		
		50	75.3	Recovery.....13.4	
		Recovery.....11.1		Net movement.....80.5	
		Net movement..64.2			

Total net movement 223.9 mm.

It is to be noted that the greatest movement was on the last test, the pile settling at a steady and fairly uniform rate as the load was increased. The recovery on the three tests seems to have been progressively greater as the tests continued and the soil became more compressed. On the third test the application of 10 tons seems to have caused practically no movement, 16 tons being required to obtain approximately the same small movement that resulted from 10 tons in the other two tests.



CURVES SHOWING MOVEMENT OF A PILE UNDER THREE SEPARATE LOADINGS

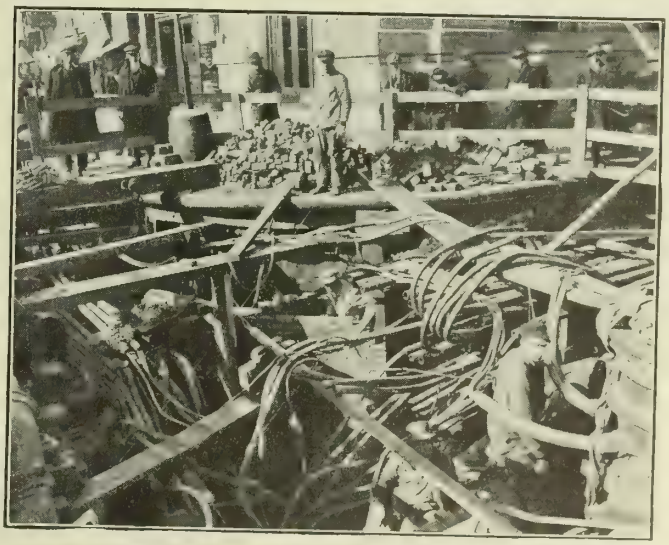
On the second application of load it took 20 tons to settle the pile the distance it had recovered on the first application, and on the third test 32 tons was applied before the pile settled the distance it had recovered after the removal of the load in the second test. In the third test, after the application of 40 tons, the settlement was more uniform with equal increments of load, than in the previous tests. Commenting upon this particular feature, Mr. Deutsch says:

> This [uniform settlement] would seem to indicate that the soil had reached its maximum resistance to compression, and that the frictional resistance between the pile and the soil having been overcome the settlement of the pile continued uniformly and was subject only to the load increase. The behavior of the soil at this point corresponds to the action of a vibratory force or hammer action applied to a pile or pier penetrating a dense material. The pile that is subjected to a vibratory force will continue to settle so long as this force is applied, and the amount of settlement will increase with the frequency of vibration, assuming the load to be constant, or assuming the frequency to be constant with the increase of the loading.

NOTES

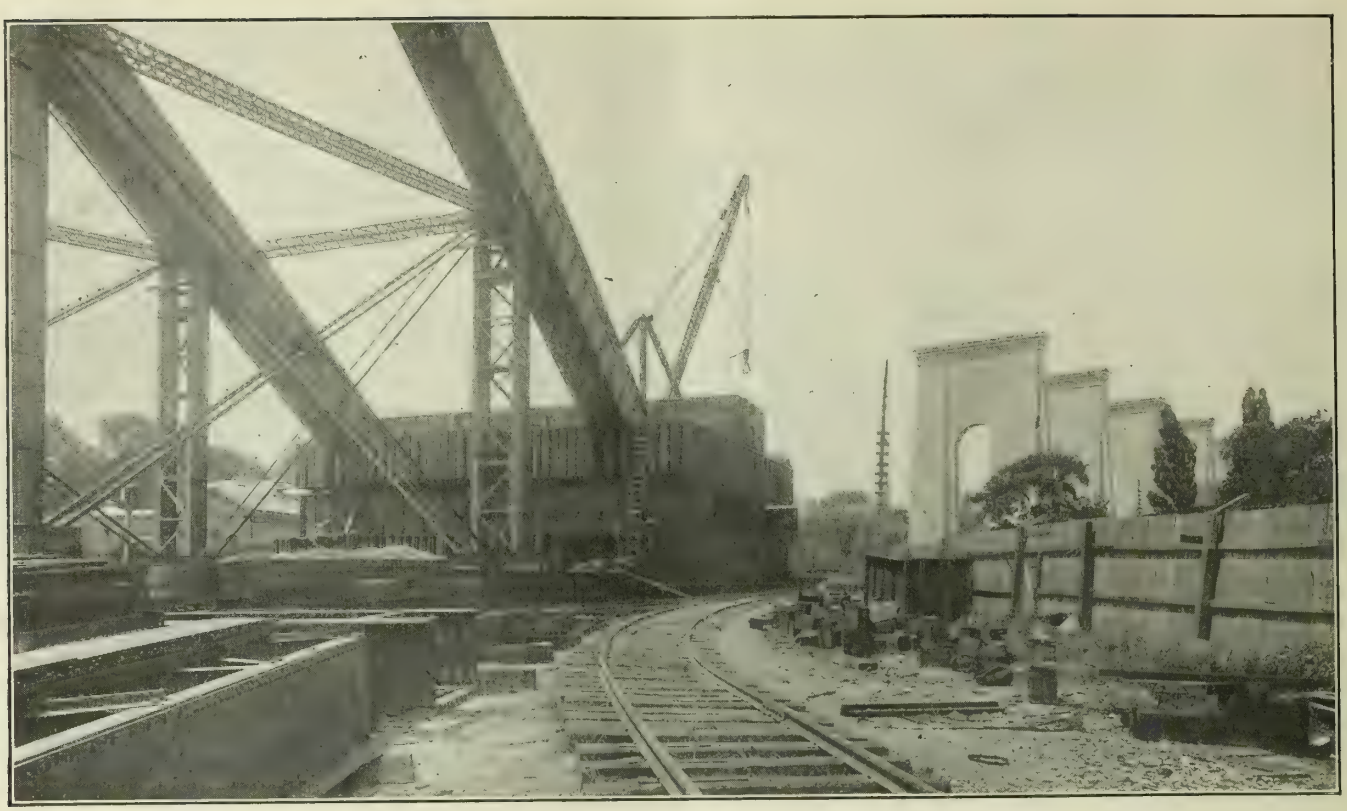
Puddled Concrete for Water-tightness was used for the basement wall of the Circle Building, recently erected in New York City. Several kinds of concrete waterproofing were tested by the contractor—the Columbus Circle Construction Corporation—but puddled gravel concrete of 1:2:5 mix was finally adopted, having stood up very satisfactorily under test. The test in question consisted of placing a 2-ft. 6-in. cube of concrete, having a hollow or core which gave 12-in. walls all around, in a trench containing water. After remaining in the water for two weeks no water was found in the core hole in the block. The concrete was puddled with scrapers such as are used to remove ice from sidewalks.

Broadway With the Cover Off is shown in the accompanying illustration. This picture shows the southwest corner of Murray St. and Broadway during the reconstruction of the various subsurface conduits, which carry the means of life



CORNER OF BROADWAY AND MURRAY ST., NEW YORK, SHOWING SUBSURFACE CONDUITS

to the city's many industries. Inquiry is sometimes made why New York City granite-block pavements are constructed with asphalt- or tar-filled joints. The accompanying picture shows the reason why. Grouted joints make a pavement too difficult to open for access to these many conduits.



WARD'S ISLAND BACKSTAY ANCHORAGE OF THE HELL GATE STEEL-ARCH BRIDGE OF THE NEW YORK CONNECTING R.R.

The Ward's Island Backstay Anchorage of the Hell Gate steel-arch bridge of the New York Connecting R.R. is shown in the accompanying view. This backstay is about 2 ft. farther from the west abutment than the east backstay is from the east abutment, but because of a slight bend in the top tie, it requires a heavier anchorage. The picture shown is from a photograph taken July 23, when the anchorage consisted of 3670 tons of steel girders, which will later be incorporated in the east viaduct approach. Before the arch is extended to the center of the span 1500 tons more will be required in this anchorage.

Another Form of Contracted Multiplication—I desire to call attention to a contracted method of multiplication I have used for some time and which I find quite valuable. In order to avoid carrying figures in the multiplication beyond the required precision, I write the multiplier under the multiplicand in the inverted order and proceed to multiply in the usual manner by using only the figures above and to the left of each figure of the multiplier. The position of the unit in the multiplier determines the number of decimal points that will be preserved in the product. In order to gain a precision to any number of decimals, the unit figure of the multiplier should be placed one point to the right of that decimal, thus preserving one figure more than necessary, which figure is used to determine the nearest number required. To illustrate, take 623.85 to be multiplied by 0.71721. In this case two decimal points are to be preserved, so that zero in the multiplier is placed under the third decimal point of the multiplicand, and the sine is written in the reversed order, thus:

```
623.850
12717.0
--------
436.695
  6.238
  4.368
    124
      6
--------
447.431
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Correct value = 447.43
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This accomplishes the same purpose as that sought by E. E. Thum in "Engineering News," July 15, 1915, p. 124, but in a more positive manner. I claim no originality in this matter. The person who explained this to me remarked that this was the only really valuable thing he learned while attending a university.—C. E. Day, Southern Pacific Co., San Francisco, Calif.

Producer-Gas Engine Starts on Gasoline—A producer-gas engine in the pumping station of the water-works of Riverhead, L. I., is arranged to start on gasoline when fire service puts a suddenly increased demand on the station. The engine operates successfully with both fuels, special arrangement being made to suit the gasoline charge to the compression as proportioned for producer gas. The station contains two engines rated at 50 hp. on producer gas or 70 hp. on gasoline. There is a producer for each engine. One of the units is in service for regular operations, but on fire calls it is necessary to start the second. As the producer cannot respond very promptly, the arrangement was made to start this engine on gasoline. A pump-feed carburetor was fitted with a throttle valve in the supply line to the cylinder, so that the charge can be throttled down and a mixture supplied that is not only weak in quality but low in quantity in order to avoid excessive compression and the consequent danger of preignition, etc. By throwing a valve the engine feed is changed from producer to carburetor or the reverse. The engines are Nash engines of the National Meter Co., which also put in the carburetor.

Recording Stream-Flow Gages are discussed by C. H. Pierce in "Water Supply Paper 375-F," issued by the United States Geological Survey. The author favors the use of automatic gages and cites many instances where the records they furnish are far more valuable than would be the record of a gage read by observers at occasional intervals. He further advises a preliminary study of the stream and in many cases the obtaining of preliminary records by portable recording gages before establishing a permanent gaging station.

The Cost of Aërial Tramways is given by a writer in "The Engineer" (London) for July 23, the figures being compiled from actual experience and representing plants which involve no special complications. For lines one mile long, the cost ranges from $11,500 per mile for a capacity of 10 tons per hour to $14,350 for 40 tons and $17,500 for 80 tons per hour. For lines five miles in length, of similar capacities, the cost per mile is $37,000, $52,500 and $65,500 respectively. The estimates are for the total cost of the line erected, and are based on the use of spiral-wound ropes for lines up to 20 tons capacity and locked-coil ropes for from 40 to 80 tons capacity. The operating expense per day is estimated as follows: One-mile tramway, $6 for 100 tons per day, $9 for 400 tons, and $14.50 for 1000 tons. Five-mile line, $12.75, $21 and $39.50 respectively. The operating expenses include depreciation, but not the cost of driving. This latter varies so widely with difference in elevation between terminals, etc., that it cannot be standardized and must be estimated for each plant.

Editorials

Missouri River Navigation

In *Engineering News* of Aug. 26 was noted the official recommendation of Colonel Deakyne, in charge of the United States Engineer Office at Kansas City, that the Government should expend no more money upon the improvement for navigation of the Missouri River below Kansas City. As was to be expected, this report by Colonel Deakyne has aroused great local hostility. A meeting was recently held at Kansas City, attended by 260 delegates from the states in the Missouri and Mississippi valleys, and a committee was appointed to draft a protest to the Board of Engineers for Rivers and Harbors. It was declared that the fight against the abandonment of the Missouri River would be carried into Congress, and the following resolution was adopted:

> Whereas, it is recognized that expenditure by the Federal Government on the Missouri River will greatly deepen the channel thereof and develop it into a great highway of commerce, we do here further call attention to the fact that when the river has been controlled and made navigable it will be kept within bounds and it will incidentally preserve and protect 500,000 acres of land worth $50,000,000 along its banks, now liable to overflow. The value of the land thus restored to the use of the people will be greater than the amount expended by the Government in making the river thoroughly navigable.

One wonders how many of the delegates who took part in this protest seriously believe that steamboat traffic on the Missouri River will ever become important in amount, no matter how much money the Government may spend on the improvement of the stream.

The language of the resolution quoted unconsciously reveals that the real reason why the residents of the Mississippi valley are vociferous in demanding Federal appropriations for navigation is because they wish the Government to pay the cost of reclaiming the lands along the rivers.

The present situation in regard to inland-river navigation in the Middle West may be briefly summarized as follows: The Government has spent an enormous sum, amounting to probably over $200,000,000, on the improvement for navigation of the Mississippi River and its tributaries, but the traffic on these rivers has in many cases entirely disappeared and on hardly a single one is there traffic enough at the present time to justify the expenditure that the Government has made on its improvement. Further, there are no signs whatever that river traffic is to increase in the future. On the contrary, there is a steady falling off year by year. It is admitted by the more intelligent advocates of river improvement that the chief cause of the falling off of river traffic on the inland waterways of the West is not the inadequacy of the channels that the Government has improved, but other causes with which the Government has nothing to do.

There is room for fair difference of opinion as to whether certain inland rivers most favorably situated may not in time, through changes in conditions, become of some value for navigation; but as to the Missouri River below Kansas City there can be no question in the engineering profession but that Colonel Deakyne's opinion is sound.

It may be of interest to briefly summarize a few important facts regarding this stream. The length of the river from Kansas City to its mouth is 392 miles, and in that distance the river falls 325 ft. The river winds through alluvial bottoms for nearly the whole distance and frequently changes its channel. One such change was noted in these columns only a few weeks ago. Including the distance from the mouth of the river to St. Louis, the steamboat route between Kansas City and St. Louis is nearly 420 miles long, whereas the rail distance between the same points is only about 290 miles. The Government has expended over $11,600,000 on this stretch of the river, of which about $5,000,000 has been spent in the last five years. Although numerous steamboats navigated the river in the pioneer days before the advent of railways, steamboat traffic on the river was abandoned many years ago, and the Government, after systematic work to improve the river from 1884 to 1902, abandoned the work. In the River and Harbor Act of 1912, however, Congress adopted a project for improvement of the river below Kansas City at an estimated cost of $20,000,000 to be completed in ten years. This appropriation was due to the energetic campaign which was engineered about that time for Government appropriations for inland rivers.

In order to back up this appropriation with at least a semblance of business on the river, a company was organized in Kansas City to run steamers between that place and St. Louis and great claims were made as to the enormous business which the company would carry on and the great saving which would accrue to commerce by reason of the revival of river navigation. It is of interest to compare this promised performance with the actual result as stated by Colonel Deakyne in his report published in the issue of Aug. 26. He states that the total river traffic on the lower Missouri in the last fiscal year was 37,551 tons carried distances of 8 to 290 miles at a total freight charge of $41,000. If there were any sound basis for the claims of economic advantage in river transportation, certainly the steamers that have been in service on the Missouri River ought to have made a far better showing in the last two years.

The river advocates, of course, will claim that the reason why traffic does not seek the river is that the present channel is inadequate. It is not possible, however, within the limits of any reasonable expenditure to make of the lower Missouri River a navigable channel that will be safe and commodious for vessels at all seasons. The $20,000,000 which the Government proposed to spend on the present project would not secure such a channel. With that amount spent, the river channel would still be far inferior for navigation to that of the Mississippi River, where, as is well known, the river traffic dwindles rapidly year by year.

It is altogether probable that the time has come when the Government will have to abandon its long-established policy of spending money ostensibly to improve navigation

on inland rivers, but actually to enable the local congressman to go home with a story of the appropriations he has secured to be spent within his own district. In the immediate future the Federal Government will have no money to spare for pork-barrel river and harbor appopriations. Expenditures are now running far ahead of revenue. At the coming session of Congress there will doubtless be largely increased appropriations for national defense. Increased Federal taxation will probably be necessary anyway, and with this will come a general public demand that expenditure by the Government on unprofitable enterprises shall be stopped.

Excess Condemnation Proposed in New Jersey

Excess condemnation, or taking more land than is to be used for a public improvement and selling the excess after the improvement is completed, facilitates many classes of work with which the engineer has to do. The practice is rare in the United States, because without specific state constitutional authorization it is generally held that excess land purchases for resale are not purchases for public use. A few states have recently adopted excess-condemnation amendments to their constitution, and on Nov. 2 one already passed by the New Jersey legislature will go before the people of that state. It reads as follows:

> The Legislature may authorize the state, or counties, cities, towns, boroughs or other municipalities, or any board, governing body or commission of the same, to take more land and property than is needed for actual construction in the laying out, widening, extending or relocating the parks, public places, highways or streets; provided, however, that the additional lands and properties so authorized to be taken shall be no more than sufficient to form suitable building sites abutting on such park, public place, highway or street. After so much of the land or property taken has been appropriated for such park, public place, highway or street as is needed therefor, the remainder may be sold or leased and reasonable restrictions imposed.

The aim and effect of this and similar constitutional amendments is to save a city or other governing body from paying the full value of an entire lot for a fraction of it, and perhaps a small fraction at that. Excess condemnation also enables the public buyer to recombine and sell fractional lots resulting from a land taking, gaining for itself a part of the enhanced value due to the improvement for which land is primarily being condemned and thus reducing the cost of the improvement. In conclusion, excess condemnation gives the public purchaser more or less control of the character of the improvements abutting on a boulevard, public square or park.

Concrete Pressure in Forms

The question of the pressure of concrete in forms is by no means as fully explored as desirable. Practice is well ahead of the range of experiment or well-founded formula. Pouring concrete in massive structures to about 30 ft. depth in a day's run has been done on both the Brooklyn-Brighton and the Detroit-Superior viaducts, the former case being noted in last week's issue. But measurements of pressure do not go to such depths, and no one knows reasonably closely what the pressures on the forms are in such cases. The depth of pour at which transmission of pressure begins to be interfered with is estimated variously by different persons, from 2 hr. pouring depth to 5 hr.

Usually it is assumed that concrete pressure is exactly the same in character as hydrostatic pressure. If so, then an arch ring of 50 ft. rise should, if concreted within a shorter time than that required for a set sufficient to destroy the hydrostatic character, exert an outward pressure upon the forms at the skewbacks corresponding to 50 ft. head, or 5,000 to 6,000 lb. per sq.ft. This is so great a pressure that it would be hard to hold with anything in the way of form ties now in use. Arch rings of nearly this rise have been concreted—most of the rise in half a day—without the use of forms having such enormous strength. Was the pressure reduced not only by set but also by friction in the forms? Is "liquid" concrete really semigranular material rather than a fluid?

Arch work in concrete has developed with the general progress of the concrete industry. Not very long ago the construction of a 150-ft. concrete arch gave rise to elaborate planning and preparation of drawings to guide the contractor in sectionalizing the concreting of the arch ring. The concreting extended over many days; the several ring sections were bulkheaded off and keyed, the reinforcement was spliced at the key blocks, and a very complex job was made of the whole. Nowadays such a ring is likely to be concreted in one day's run, and the elaborate sectionalizing is unnecessary. The resulting advantages are such as to invite consideration of the same procedure for much larger arches. The cost of installing the extra plant for mixing and placing would doubtless be well repaid by the saving in labor, expense and delay.

The question of liquid concrete pressure in an arch ring may therefore become an immediate practical question in the near future. Present experimental study does not furnish an answer. Further research is needed, based on a well-devised plan of experiment and carried out by able investigators. Possibly such a body as the American Concrete Institute might initiate the work and provide the means.

The Delayed Bidder's Case

An intending bidder who fails to get his bid in on time is not entitled to submit a late bid, even though his delay was due to an act of God. The question came up a few weeks ago in connection with a rapid-transit contract in New York City.

The Public Service Commission received bids closing Aug. 4 at 12:15 p.m. for certain station finish. The preceding night had been one of remarkably heavy rain. After the bids closed a representative of the Marble Arch Co. appeared and offered to submit a bid, stating that he had been held up by the rainstorm and by a block on the subway. The offer was refused. On opening the bids the lowest bid was computed at $268,102.50. Later the Marble Arch Co. served notice to show cause why a writ of mandamus should not issue, directing the commission to accept his bid, stating that it was lower than the lowest of the bids opened. The subsequent decision of the court on this question was to uphold the action of the commission in rejecting the offer to submit a late bid, in spite of the fact that the applicant set forth a detailed account of his difficulties in reaching the office of the commission.

The decision of the court is in accord with the dictates of common sense; had the outcome been different all sorts of peculiar situations might arise in the future to harass the commission and delay construction.

An opinion of the United States Supreme Court on the once hotly debated question of enhanced value of water or gas mains because of improved paving over them is sure to arouse interest. In the recently announced Des Moines 90c. gas case is a finding in this matter which will meet the hearty approval of many, and perhaps of most, engineers. The court makes no comments of its own, but accepts and promulgates the statement of a master-in-chancery for the court below. The master decided that the life of mains was not increased by the need for removing new paving when the mains had to be taken up, that the owners of the mains had acquired no property right in the paving, and that there was no justice or equity in increasing the price of gas because the company might have the replace the pavement.

This same case is of timely interest, as it gives a forecast of the court's decision in the Passaic 90c. gas case, which has attracted great attention for two years. From what has been published in these columns (Jan. 21, June 17, and July 1, 1915) it will be recalled that the New Jersey Public Utility Commissioners in appraising the property of the Public Service Gas Co. refused any substantial value for franchises and the State Supreme Court upheld them. The Court of Errors and Appeals first reversed the Supreme Court (taking the ground that franchises were company property and that the value was indicated by the market value of the company's securities) and later reversed itself (one judge explaining that franchises were property, but not "property used and useful in the public service"). The case is now before the United States Supreme Court on appeal. The Des Moines decision does not touch upon franchise value specifically, but it dismisses value for good will, past earnings and paving over old mains. The next consistent step will be a general denial of franchise value—beyond that due to cost and burden. Such an authoritative pronouncement on what to include in the basis of rates will clear away the haze that now involves this matter.

Word comes from Philadelphia that the "voluntary installation of [water] meters is proceeding at an unexpected rate." Moreover, incentive being offered by the water bureau led the *Bulletin* to declare that "the 2 per cent. of the service which is now metered ought to show considerable expansion" in September. Evidently the "unexpected rate" has not been maintained long or would be "unexpected" only in Philadelphia. Seriously, any noticeable acceleration in the installation of water meters in Philadelphia is encouraging.

Letters to the Editor

Should Another Course Be Added to the Engineering Schools' Curriculum

Sir—The latest progress report of the special committee of the American Society of Civil Engineers appointed to investigate the conditions of employment and compensation of civil engineers shows among other things that the average compensation of nongraduates with from two to fifteen years' experience exceeds that of graduates with the same amount of experience. A still greater discrepancy in favor of the nongraduates would undoubtedly be found if engineers outside the membership of the society were studied, as then more of the younger graduates would be included.

This is owing, no doubt, to the lack of field experience in the young graduate and to the results which the nongraduate can secure with his practical knowledge. The condition disclosed by the committee's report is due, in a large measure, to the technical school. The curriculum rightly embraces theories and underlying principles, but it does not include in any adequate measure the art of applying these principles and theories to practical use.

The engineering student devotes hours to descriptive geometry and calculus, but can he cut out a pattern by which an elliptical sheet-metal pipe can be made which will fit a hypocycloid of revolution at any given angle, if such should be required on his first job? He can draw detailed plans for a timber roof on an ordinary dwelling house, but can he show the carpenter how to cut a jack rafter to fit the hip rafter? He can design a 100-ft. plate girder down to the last rivet, but does he know the first thing about how to place it upon its abutments, or how to build them? In most cases, No.

It will be argued that designing and constructing are in entirely different fields. That is true, but a man is a better designer if he knows the erecting end. His detailing of connections, etc., will be better if he is able to view them from the standpoint of the man in the field who has to erect. *Vice versa,* the construction man will do better work if he is conversant with designing methods and principles. Every construction engineer has repeatedly come across details in plans which have either been impossible or expensive. Most of them would have been obviated had practical experience been combined with theoretical instruction.

About a year ago the writer was asked to address a student engineering society, and in conversation with one of the young men interested, intimated a desire to speak upon "What do you know at graduation." When an explanation was sought, the reply took the form of a hypothetical question: "Suppose you had to erect a 100-ft. steel flagpole, lay the necessary foundation and place the guys and guy anchors. You could, no doubt, compute the size of the pole necessary to take care of all possible wind stresses and to meet all other conditions. You could calculate the sizes of the guys and the weight of anchorage necessary and the number of yards of con-

crete to form the anchorages and foundation. But how would you put the pole up in the air? Could you say how many barrels of cement, how many cubic yards of sand and of gravel would be necessary to make the concrete?" The young man saw the point, for he did not know the first thing about the raising of the pole. Yet a man with two years of experience (the equivalent to a degree in the American Society requirements for admission) on construction work would probably have answered at once.

Technical colleges, of course, are not intended to turn out finished and thoroughly competent engineers. But they should not graduate men, as they do, who know nothing whatever of the tools, equipment and methods of construction. Graduates are put forth upon an unsuspecting world who do not even know the names of many of the tools and much of the equipment with which they have to deal; they have only a hazy idea of the way work is done and practically nothing of the unit costs of such work.

The direct cause of this condition is perhaps the fact that instructors and professors, in general, are men with very limited construction experience. Many have devoted practically all their time since graduation to the classroom; they are well-grounded in theory and quite naturally deficient in its application, so that they fail to see the importance of the construction side of engineering.

It seems to the writer that, as a remedy, a course in engineering construction might be a very desirable adjunct to the curriculum of the technical college. A chair of this sort should be filled by a man who is well-grounded in theory and who has had a fairly extensive experience in actual construction of engineering works of the class which the graduate would be most likely to encounter early in his career.

The course should embrace the ordinary construction which the young engineer might be called upon to plan and supervise—such as all classes of concrete work, excavation, foundations, sewers, water-works, pavements, buildings and bridges. It should also include falsework, rigging, etc. The student should be acquainted with the field for various kinds of tools from pick and shovel up and should be given instruction as to when and how to use them. Next should come the kinds and uses of the various power equipment. He should be taught how to tie knots and to rig derricks, hoists and such equipment.

Methods of doing various classes of work might be taken up in the classroom. Instruction would probably be given as to what equipment to use in specific cases, such as, for example, dry-earth excavation under various conditions, excavations in wet earth, in rock, under water, in quicksand. The temporary works necessary, such as sheetpiling, falsework, coffer-dams, forms and underpinning, would also be studied. Quantity surveying should also be included, both for the finished structure and for all temporary works. Unit costs of the more common elements under varying conditions might well be added; this should also include cost accounting and distribution. The instructor, from time to time, could introduce new features, such as floods, storms, etc., which would correspond with actual unforeseen contingencies.

As a summation, problems should be given which would combine all these; for example, a concrete-arch bridge is to be constructed from plans furnished. The foundations at one end are 10 ft. below the water level and in treacherous soil requiring piling; at the other end solid rock is encountered. The student should work out the problem from the knowledge he may have previously gained. He should first, perhaps, outline the methods by which he would do the work. In other words, he should design his construction plant. This would include making a list of all the tools and equipment that he would deem necessary, as well as of all material for the construction and assembling of the plant. Next would come a bill of material for the entire job from inception to completion, An outline of the various steps in the progress of the work would be in order, together with the methods to be used in each case. In short, the student should plan the work just as an experienced man would do if he had to do the work in the heart of Africa—with no convenient base from which deficiencies might be supplied. Of course, the student could not do this as well as an experienced man could, but he would do better than he could if he had had no previous instruction. As a finality, an estimate of cost and time should be prepared.

Work of this nature could probably best be given by lecture courses, supplemented by visits whenever possible to scenes of work in progress. Students should be urged to secure positions—or merely "jobs"—on construction works during the summer vacations, for which credits should be given. A young man with pick and shovel, if he keeps his eyes open, can learn a great deal in one summer.

A course of this nature, as roughly outlined, would undoubtedly prove to be one of the most interesting and popular, as well as beneficial, in the entire curriculum, and deservedly so. It would also do much toward securing better initial salaries for the graduate.

The writer is not attempting to disparage the teaching of theory, nor advocating the transformation of our technical schools into mere trade schools. He is appealing for a happy medium in combining theory and application, believing that such a combination would benefit both school and graduate, and eliminate much of the criticism of the product now placed upon the market.

R. C. Hardman.

Colorado Springs, Colo.

[We give space to Mr. Hardman's letter because it represents a type of criticism of the technical school which one frequently hears, but for which there is perhaps less justification than many suppose. A number of the technical schools are attempting to give just such practical instruction as our correspondent proposes, and have long done so. One member of the editorial staff of this journal, for example, recalls being given as a freshman in Cornell, fifteen years ago, the identical problem as to the practical method of erecting a flagpole which our correspondent suggests. The real trouble with our technical schools, as we see it, is that through a misinterpretation of such criticisms as that of our correspondent they have loaded up their courses with a mass of technical detail and have multiplied courses and specialized instruction, so that the tendency is toward the production of specialists rather than all-around engineers. But in imparting fundamental knowledge and giving rudimentary training the practical side can be emphasized more successfully than now is generally done.

There is a limit to the amount of information one can cram into a youth in four years; and he ought to get out of his college course a development of character and personality that he may miss if he has to grind on purely technical studies all the time.

It is obvious, however, that detail instruction on field and shop and office methods in all the various branches is attempting the impossible. How many engineers of ten years' experience have any practical knowledge of construction work and methods outside the fields in which they have been directly engaged? Suppose it were attempted to make students in their four-year course familiar with the construction methods now in use "in all classes of concrete work, excavation, foundations, sewers, water-works, pavements, buildings, bridges, etc."—we quote the list from our correspondent's letter. There is enough in this list alone to consume all the time of a four-year course, and this of course is only a beginning in enumerating the different fields of work in which a civil engineer may engage.

The real trouble, it seems to us, lies in the fact that the engineering schools are expected to turn out *engineers* at graduation, whereas their aim should be to turn out men so well-grounded in the fundamental principles and methods applicable to all sorts of engineering work that they will have this knowledge and ability as an aid in whatever sort of engineering work chance directs them toward—for in nine cases out of ten, it is chance, and not specialization in college studies, that determines in what sort of engineering work a graduate will find employment.

We would not be understood, however, as urging that engineering instruction should be purely theoretical. All the subjects in an engineering school should be taught as *applied* science; and the ability to apply it is as important as the science.

What does seem to us objectionable is attempting to teach in an engineering school a lot of detail relating to special fields of engineering work, which the student will never use unless he chances to fall into that particular field. It is said of course that such instruction is useful mental training, but it should not be forgotten that there is an elastic limit to the mental machinery of the students. The world is afflicted nowadays with societies devoted to almost every subject under the sun, but there may yet be room for a society for the Prevention of Cruelty to Engineering Students.—Editor.]

Engineering-Society Publicity

Sir—I read with much interest F. H. Newell's letter on "Public Speaking for Engineers," in *Engineering News* of Aug. 5, 1915. Mr. Newell rightly places much emphasis on the importance of engineering publicity, which has been woefully neglected by the profession. Not only has the young graduate engineer a marked lack of self-expression; the older engineers are guilty to a large extent of the same disability.

It is my opinion that the self-centered aloofness of the engineer and his hesitancy to discuss matters of public interest and welfare without remuneration has been one of the causes of failure on the part of the public to appreciate the importance of the engineer and to make proper recognition of the profession.

A rough outline of a scheme of publicity for local or sectional engineering societies which would lead to very desirable results in elevating the plane of the engineer as a professional man and in benefiting the individual members of the society is here suggested.

Publicity committees composed of men proficient in their respective branches of engineering would be elected or appointed for a term of three to six months (depending on the number of members, the idea being to give all members a chance to serve on such work). The duties of these committees would be to keep in touch, through the aid of the secretary, with questions of public interest and to prepare and submit articles on these questions to the various newspapers in the city and vicinity; also to report on disasters or accidents related to engineering. Of course such matter should be written in language readily understood by the average reader.

The various engineering societies should become active in publicity work in order that we may be freed from the sensational, untruthful and harmful reports on accidents to engineering works so common in the daily press.

ALBERT M. WOLF.

Chicago, Sept. 4, 1915.

The Flat-Slab Patent Suit

Sir—I note in your issue of Aug. 19, 1915, p. 379, you publish a statement relative to the contempt proceedings in Minneapolis, in the case of the alleged infringement of the Norcross patent for concrete flat slabs. That statement was not complete.

Judge Morris, who decided the matter, said that he considered it was up to the Court of Appeals to decide the scope of the Norcross claims and he did not understand clearly how the ruling which he was bound by was consistent with the state of the art. For that reason he decided to fine me nominally $200, not to be paid until after the matter was passed upon by the Court of Appeals, and that this fine was made payable into the United States Treasury in order that an appeal to the Court of Appeals would lie and the matter could be more fully threshed out by it.

C. A. P. TURNER.

Minneapolis, Minn., Aug. 27, 1915.

NOTES AND QUERIES

Errata—W. G. Peters, Deputy County Engineer, Chehalis, Lewis County, Wash., sends the following corrections to the "Table of Square Feet Reduced to Decimals of an Acre," p. 363, "Engineering News," Aug. 19, 1915:

510 sq.ft.	reading 0.0171	should read 0.01171
27,200 sq.ft.	reading 0.62242	should read 0.62442
35,700 sq.ft.	reading 0.81596	should read 0.81956
42,700 sq.ft.	reading 0.98206	should read 0.98026

The Paddle Wheel as a Pump—In response to the inquiry, in this column of the issue of Sept. 9, about scoop wheels built and used in this country, John H. Cook, Hydraulic Engineer, 158 Ellison St., Paterson, N. J., writes that there is a paddle wheel that is used as a pump at the Morris Canal and Banking Co.'s station on the Hackensack River, not far from the Newark Plank Road in Jersey City. This wheel is about 12 ft. across the breast and is operated by an old walking-beam engine that was built about the year 1856. The water is lifted about 5 ft.

Water-Pocketing in Two-Angle Members—This is urged by A. R. Astbury, Provincial Executive Engineer, Winterfield, Simla, against such a design of member. In light pony-truss highway bridges, where extreme lightness and compactness are necessary on account of pack transportation (weight limit 150 lb., length limit 12 ft.), the two-angle member with angles spread enough to take the gusset-plate is economical, but rapid rusting is feared from water-pocketing between angles. Suitable designs would be appreciated.

Measuring Drainability of Imhoff Tank Sludge*

The thorough digestion of organic matter in the sludge compartment of a mature Emscher tank results in a destruction of the sticky colloidal matters, a breaking down of organized bodies into finely divided particles, and a material reduction both in the volume of the sludge and in its percentage of moisture. It also causes the presence of gas, which is compressed when the sludge is in the bottom of the tank, but which expands when reduced to normal pressure as the sludge is withdrawn.

This expansion causes the solid portion of the sludge to float upon the water, which, owing to the conditions described, very rapidly separates at the bottom. For these reasons such sludge, applied to underdrained sand beds, will dry sufficiently to be removed in a few days instead of probably weeks or months with other kinds of sludge.

The methods of sludge analysis in most common use consist in determining the percentage moisture and specific gravity of the wet mass and the percentage of the dry residue that is fixed and that which is fat or soluble in ether. These tests are principally of value to show, in an indirect way, the good or bad qualities of the sludge, and it seems that an additional test is required to measure drainability.

The real and essential properties of sludge, when it must be disposed of on land adjacent to habitations, are odor, volume and drainability. I am not acquainted with any better apparatus than the nose for determining the first, a foot-rule for the second, and for the third the results of a few experiments are here offered in the hope that from them a simple test may be devised.

Since April of this year a composite sample of each batch of sludge placed on the drying beds at the Pennypack Creek sewage-disposal works (Philadelphia) has been submitted to the two following procedures:

A portion amounting to 700 c.c. is placed in a 1,000-c.c. measuring cylinder and the amount of clear water separated at the bottom observed and recorded at hourly intervals. This is continued until the sludge begins to settle down into the water again.

Another 700-c.c. portion is placed in a vertical piece of glass tubing of the same internal diameter as the measuring cylinder. Over the lower end of the tube is secured a piece of wire screen which supports a ½-in. layer of small pebbles, a ½-in. layer of clean Jersey gravel, and a 2-in. layer of fine sand. (The thickness of these layers could probably be reduced and thereby decrease the amount of entrained drain water.)

The tube is held in a retort stand over a funnel resting in a measuring cylinder to collect the water draining out of the sludge, and the accumulated amount of water is read at hourly intervals until the sludge ceases to drain. The results of these measurements are plotted in terms of c.c. of separated water and time.

In several instances the sludge placed in the measuring cylinder has begun to float on the water, after a few hours settled down, then separated and floated again. Such action prevents obtaining a useful curve of drainability, and it appears that the tube with filtering media is the better method.

*Condensed from a paper presented to the Sanitary Engineering Section of the American Public Health Association, Rochester, N. Y., September, 1914, by W. L. Stevenson, Assistant Engineer, Sewage Disposal, Philadelphia.

An examination of the curves [not here reproduced—Editor] indicates that the factors which should be combined to obtain a number to represent the drainability of the sludge are:

a. The rate of drainage represented by the slope of the first part of the curve.

b. The ratio between the amount of water drained from a liter of sludge and the amount of moisture therein as determined by the usual evaporation method.

c. The time required for the water to begin to drain out.

Good sludge will be indicated by (a) having a steep slope, (b) showing a large number for the ratio, and (c) showing a short time; bad sludge the reverse.

No attempts have been made to combine these three factors to form a number similar to the relative-stability figure for filter effluents, because the data are too meager and only sludge from one works treating a sewage which is two-thirds institutional has been used in the experiments. But I believe that more extended study in some of the sewage-works or testing-station laboratories might develop a simple field test capable of being made by the type of operator usually found in the smaller works and that its use would serve to indicate a very important characteristic of Emscher tank sludge.

Convention of the New England Water-Works Association

The 34th annual convention of the New England Water-Works Association was held in New York City, Sept. 7-9. The registration was well over 600, and all the meetings were fairly well attended considering the many other attractions in the city and the extreme heat of the weather. Following the usual addresses of welcome and other preliminaries, the following subjects were discussed:

New York City Water-Works

The water-supply and water-works of New York City were naturally subjects of much interest. The present status of the new Catskill water-supply was described by J. Waldo Smith, Chief Engineer of the Board of Water-Supply. This work is rapidly nearing completion and another spring will see its real test in service. Mr. Smith frankly stated that because of the much new and unprecedented construction he expected to find that details would have to be revised and changes made before reaching an entirely satisfactory conclusion of the work.

The sanitation of the Catskill watershed was described by George H. Honness, Department Engineer of the Board of Water-Supply, and the forestation of the watershed was described by Sidney K. Clapp, Assistant Engineer of the Board of Water-Supply. Mr. Clapp's paper was unusual in the wealth of detail given; it covered the gathering of the seeds, planting, keeping off birds and mice, preventing mildew, exterminating grubs and field mice, and precautions against winter killing of the young trees. The forestation work of the Board of Water-Supply is more for landscape work than in expectation of utilizing the trees later for commercial purposes.

The forestation of the Croton watershed was the subject of a paper by T. C. Culyer, Assistant Engineer, Department of Water-Supply, Gas and Electricity. The concrete wire-fence posts used in the Catskill drainage areas were described by Ralph N. Wheeler, Department Engineer, Board of Water-Supply.

The Kensico dam and reservoir were described by Wilson Fitch Smith, Division Engineer, Board of Water-

Supply, and a very enjoyable excursion was made to the dam Sept. 9. Although the temperature on that day was around 90 deg., a large party took the special train to Valhalla and toiled up the hill to the top of the dam. Very few, however, could be induced to visit the quarry, which is about a mile from the dam.

The water-supplies of some Long Island sections of the city were described in considerable detail by W. F. Laase, Assistant Engineer, Department of Water-Supply, Gas and Electricity, in a paper, "Infiltration Galleries as a Source of Water-Supply on Long Island."

The laying of water pipe in the congested streets of the city was the subject of a paper by M. Blatt, Assistant Engineer, Department of Water-Supply, Gas and Electricity. As a typical instance Mr. Blatt described the installation of the downtown high pressure fire-protection mains. No records of subsurface structures were available when the work was started, and it was first attempted to obtain a plan of these pipes and conduits by digging test pits at intervals. Subsequent experience proved this was not feasible, and the work was carried on without knowledge of the subsurface conditions to be met, except such as could be obtained from test pits immediately in advance of the trenching. Much reconstruction of existing structures was required before room could be found for the new mains.

The electric operation of valves on the high-pressure fire-protection system was described by Alfred Williamson, Mechanical Engineer, Department of Water-Supply, Gas and Electricity.

The locating of a leak in a 12-in. submarine main crossing to Riker's and North Brother Islands was described in a paper by E. G. Hooper, Assistant Engineer, Department of Water-Supply, Gas and Electricity. The chief feature in the method used was the determination of the hydraulic gradients on different parts of the line by means of pressure gages; the point where the gradient shifted, being the place where the velocity changed, denoted the vicinity of the leak.

Water-Supplies of Other Cities

The double sand filtration plant for the purification of the water-supply of South Norwalk, Conn., built about 7 yr. ago, was described by H. W. Clark, Chemist, Massachusetts State Board of Health. This plant, according to Allen Hazen, is the most complete in this country for the removal of tastes and odors. Portions of the water treated, Mr. Clark said, are sometimes about the color and consistency of thick pea soup. No difficulties have developed in its operation. The interest on the $100,000 investment and the cost of operation amount to about $10,500 per annum.

A joint additional water-supply for the cities of Salem and Beverly, Mass., was the subject of a paper by F. F. Longley, New York City. The most interesting features of this work were the survey of a 9,000-acre swamp and the building of a canal through this swamp from the Ipswich River to a pumping station near the present reservoir. The canal was so feasible that it was built instead of a pipe line as first proposed.

Recent improvements to the water-supply of Fall River, Mass., were described in great detail by H. K. Barrows, Boston, Mass. Here water is taken from a natural pond close to the city, which contains only a limited supply. The pumping plant is an old one and as not sufficient storage is provided for a single day's supply (5,600,000 gal.), the city has not much margin of safety. The improvements noted were the establishment of an independent electrically operated pumping station for emergency use and the improvement of the water-supply itself by the gradual acquirement of the watershed by the city. The greater part of the paper was a detail description of the construction of a covered reinforced-concrete drain.

Water-Main Joints—Use of Leadite

The use of leadite for water-main joints was the subject of two papers—one by Henry A. Symonds, Consulting Engineer, Hanscom Construction Co., Boston, Mass., and the other by W. C. Hawley, Chief Engineer and Superintendent, Pennsylvania Water Co., Wilkinsburg, Penn. Both were in favor of the use of leadite. Mr. Symonds emphasized the necessity of skilled labor. Practically the only unsatisfactory experience he had had was on sharp curves, where the thin wedge of leadite broke out in some instances. However, he stated that he believed satisfactory results could be obtained with proper care under any and all conditions. Mr. Hawley said his earliest experience with leadite was unsatisfactory, but that now after nine years' trial he had come to use it exclusively; some failures he believed were caused by improper manipulation of the material and some by collusion among the calkers, who would be thrown out of employment if leadite was adopted. He laid considerable stress on the effect of leadite in preventing electrolysis. A. E. Martin, Superintendent of Water-Works of Springfield, Mass., and other speakers gave their experiences, in which it was brought out that although leadite joints sometimes show leakage at first, generally within 24 hr. they become watertight.

Leakage from lead-jointed mains was discussed by Arthur H. Smith, Engineer of the Associated Factory Mutual Fire Insurance Companies, Boston, Mass. This paper contained a valuable compilation of data from a variety of sources, from which the author drew the conclusion that water-tightness was an impossibility and that a leakage of 1 gal. per day per lin.-ft. of joint was to be expected in good and acceptable work. Many instances were quoted where existing mains show a much larger leakage. It was generally agreed that all mains should be fully tested for water-tightness of the joints before acceptance, but that in few cases was this feasible before the pipe trench was backfilled, although this was preferable. Deferring the backfilling to know if the joints were water-tight does not seem to be general practice except where the work is in outlying districts. It was also questioned whether it was good policy to leave the pipe uncovered any length of time, as the increased effects of temperature changes led to expansion and contraction and the opening of joints.

The need of a standard to determine just what leakage should be allowed was keenly felt and upon the motion of William F. Sullivan, Engineer and Superintendent, Pennichuck Water-Works, Nashua, N. H., a motion was passed to have the president appoint a committee to investigate this subject.

Experience with Water-Main Gate Valves

An interesting discussion of gate valves was started by two papers—one by Geo. H. Finneran, Assistant Superintendent of Water Service, Boston, Mass., on the reasons for adopting the solid-wedge type of valve in Boston,

and the other by John M. Diven, Superintendent of Water-Works, Troy, N. Y., on the reasons for using the double-disk valve. In Boston solid-wedge valves have been used since 1848, when the present water-works were begun. The city has its own shops, where all these valves under 12 in. in size are made. Mr. Sullivan believed the governing consideration was mechanical simplicity, and as the solid-wedge valves possessed this virtue and had always given satisfactory service, there was no reason for abandoning their use. Mr. Diven based his arguments in favor of double-disk valves chiefly on the fact that manufacturers have practically abandoned the manufacture of any but this type and that the most popular type must be *per se* the best type. Much interesting information in regard to the actual wear of valves was brought out in the discussion. The manufacturers of valves were given the privilege of the floor, but none availed himself of it.

Miscellaneous Subjects—Meter Testing, Etc.

The work of the New York City Department of Water-Supply, Gas and Electricity in developing tests for meters was described by F. B. Nelson, Assistant Engineer of the Department. The city of New York does not own water meters, but any water consumer may purchase a meter and pay for his water in that way if he so desires. The point emphasized in Mr. Nelson's paper was that meters of different makes for the same-sized service vary a great deal in capacity (64%) and an attempt is being made to rate them by taking this into account.

The control of public water-supplies by the Conservation Commission of New York State was the subject of a paper by Russell Suter, Assistant Civil Engineer of the Commission, Albany, N. Y.

The results of a study of data collected chiefly in connection with the Metropolitan Water-Works of Massachusetts on the decolorization of water by storage were given by Ralph H. Stearns, Boston, Mass. Although Mr. Stearns had a well-developed theory, this was questioned by several speakers. Allen Hazen pointed out that there were so many uncertain elements entering into the problem that it was difficult to arrive at any general conclusions.

The use of wood pipe generally, and in New Hampshire in particular, was described in a paper by A. W. Dudley, Consulting Engineer, Manchester, N. H.

Association Business Transacted

The most important business transacted was the appointment by the president of a committee to investigate and tabulate leakage of water-main joints, with the end in view of establishing some standard of water-tightness for both old and new mains. The committee appointed is F. A. Barbour, Consulting Engineer, Boston, Mass.; Carleton E. Davis, Chief of the Bureau of Water of Philadelphia; Samuel E. Killam, Superintendent of Pipe Lines and Reservoirs, Metropolitan Water-Works, Boston, Mass.; Caleb Mills Saville, Chief Engineer of the Board of Water Commissioners of Hartford, Conn.; Henry B. Machen, Borough Engineer, Department of Water Supply, Gas and Electricity, New York City, and Arthur H. Smith, Engineer, Associated Factory Mutual Fire Insurance Companies, Boston, Mass.

Three past-presidents of the association were elected to honorary membership. They are Edwin C. Brooks, of Melrose, Mass., former Superintendent of Water-Works of Cambridge, Mass.; George A. Stacy, Superintendent of Water-Works of Marlboro, Mass.; and Robert J. Thomas, Superintendent of Water-Works of Lowell, Mass.

This nominating committee to choose the officers for 1916 was appointed: F. A. McInness, Boston, Mass.; E. W. Kent, Newport, R. I.; J. Waldo Smith, New York City; E. E. Lochridge, Springfield, Mass.; A. E. Blackmer, Beverly, Mass.

It was proposed by Charles W. Sherman, Consulting Engineer, Boston, Mass., to honor the late Dexter Brackett, past-president of the association, by establishing a fund to be raised by subscription, the income of which might be used as a prize for papers, for research work, or any other purpose that the executive committee might decide upon.

Awakening of the Engineer*

By F. H. Newell†

Now is the day of awakening of the engineer as a man and as a citizen to a larger realization of his duty to society in general, to his profession, and to himself in particular. He is not alone in this. A world-wide war has shocked into new life many dormant conceptions and has opened the eyes of mankind to the larger claims of brotherhood.

The quality that distinguishes the engineer as a professional man from his brother the mechanic is education. The engineer is undoubtedly benefited if at the same time he is a good mechanic, although he may be a success even if he has little or no mechanical ability. To be an engineer in the true sense, he must have, however, that education which enables him to understand the true perspective of things, to know the big from the little, to obtain facts and judge correctly from these.

What is the service which all engineers should be eager to render and which is the fruition of years of training? What do we mean when we claim that the highest function of the engineer and his greatest reward are found in effective service? The word conveys the idea of help rendered to another, not as a favor involving an obligation, nor on the other hand as a matter of self-sacrifice. It is something that may be expected though it cannot be demanded, and may be performed among equals. Service consists of those acts that tend to lessen trouble or increase the health, prosperity and convenience of others.

Engineers in performing service are by this very fact entitled to full recognition. Service implies a suitable reward, and while the effort may be altruistic, it does not involve unnecessary self-denial. A proper remuneration—one assuring a good living—is due to the engineer. He that performs service rightfully does it with full expectation of reward, directly or indirectly, in the satisfaction of duty well done.

Engineer's Service to the Public

Among all the various occupations there is none more capable of leading in service to mankind and in realizing higher ideals than engineering. The engineer should be a man of vision—a missionary of light and progress. His life is devoted to careful, impartial measurement and

*Extracts from an address before the American Association of Engineers, Chicago, Sept. 14, 1915.

†Professor of Civil Engineering, University of Illinois Urbana.

weighing of facts. He cannot afford to be deceived or to mislead others on these facts; having ascertained them in their true proportion, it is then his business to idealize, to plan, and to use his ingenuity in devising methods for adding to the comfort and convenience of mankind—such for example, as through better conditions of transportation, of communication, of heating, lighting, water-supply and of the things which tend to produce better health and longer life in the community.

In this work the engineer is far ahead of the public. The latter in many ways has not yet caught up with the growth of knowledge and does not appreciate the possibilities that are awaiting realization under the magic touch of the skilled engineer. The public is not wholly to blame. The engineer is to a certain extent culpable. He has not fully felt the need of diffusion of information, except among his professional brothers. He has not taken the public into his confidence and explained in simple terms, in ways that would attract the public, the results already achieved; nor has he given these a setting or application such that the ordinary citizen and taxpayer can comprehend how this work affects him or how his condition may be improved.

Engineers in North America Number 100,000

It is safe to assume that there are in North America over 100,000 men whom we would class as "engineers" outside of the purely mechanical occupations. Of these over 40,000 are members of approximately 100 organizations,[1] leaving over 60,000 men not enrolled in any engineering society.

In the great group of 60,000 are many men of ability and standing in the profession, but who have never seen the necessity of joining with their fellows in organized efforts. By far the greater part, however, are the younger or less prosperous men, who are performing routine work in engineering offices or engaged in the details of the country surveyor and engineer. As a whole, they include the more poorly paid professional men whose compensation averages less probably than that of the high-grade mechanics. We do not have any definite data on this point, but those who have employed engineers and graduates of engineering schools are aware of the fact that under present conditions at least, we can obtain the service of highly educated skilled engineers as computers, draftsmen, office or field assistants at a nominal wage.

It is not the "submerged tenth" but the six-tenths for whom special appeal should be made to ascertain whether their condition may not be improved by applying to it the same painstaking study to ascertain the facts and to provide a remedy, as should be done by the engineer to meet and overcome physical obstacles.

Widening the Field for Engineers' Work

To this large body of engineers there is being added each year about 5,000 recruits, mainly from the engineering colleges, more or less well-trained in the fundamentals of engineering. One of the problems that is now confronting us is the fact that each year this large group of graduates, as well as the thousands of young men employed in engineering offices, is coming into a profession apparently overcrowded. This overcrowding, however, is more apparent than real. A relief is to be obtained not by limiting the influx of men, but rather by widening the field of service.

The field is practically unlimited, the bounds extending with every improvement in the conditions favorable to human health, comfort and industry. Artificial limits, the cramping efforts of which we now appreciate, are set solely by ignorance. They exist only in the mind and arise because of lack of knowledge by the public in general and of individuals in particular. To put it in another way, if every taxpayer and voter in the country, every town, city, county and state officer, were fully aware of the conditions which surround him and the extent to which the engineer could remedy or improve these conditions, there would be an immediate demand for all the engineers that could be found.

To seize properly the opportunity the engineer who rises to the occasion must cultivate some of the qualities summed up in the term *salesmanship*. We recognize that the success of many a merchant is due to a peculiar art that he has acquired and one that enables him to sell goods at a profit. We have more slowly come to recognize the fact that his success is due not to the fact that he personally makes a profit, but that the other party, the world to whom he sells, is benefited. For a time a merchant may sell inferior goods and make money, but an established business can rest secure only on honest advertising and on the realization by the public that he is performing a real service to mankind.

In the same way, the engineer, to succeed, must acquire the art of salesmanship. He may not recognize or label the quality and may even deny its existence. He may point to a code of ethics rigidly observed against advertising or self-exploitation, and yet he may possess to a high degree the real art of presenting his ware in such a way as to convince the world that its general welfare is promoted by purchasing from him.

There is perhaps nothing more instructive to the young engineer than to try to ascertain the methods of salesmanship which have led to the recognition of certain well-known and respected engineers. Some have succeeded through or in spite of extreme modesty; but in each case there has been not only true value of the goods to be delivered, but some quality of mind or action that has impressed upon others the fact that the goods are of superior value.

Line of Action for Awakened Engineers

In the present awakening of engineers innumerable schemes have been suggested for action, but most of these fall under one or the other of two principal lines: (1) Coördination and coöperation of existing engineering societies and organizations; (2) formation of one or more new associations devoted almost exclusively to the material welfare of engineers. These movements are the natural outgrowth of the discussion and unrest which have prevailed. They are not antagonistic and may be mutually helpful. Not all men think alike, and the path which will be attractive to one group is not to another.

[1]The larger part of this 40,000 is included in four great national societies, the membership of which in round numbers is as follows: Civil, 7,700; Mechanical, 6,100; Mining, 5,000; Electrical, 7,750. The total of 26,550 includes many duplications, but it is safe to assume that at least 20,000 engineers, embracing most of the men who have become leaders in the profession, are included in the membership noted. The organizations next in point of size are the Engineers' Society of Western Pennsylvania, with headquarters at Pittsburgh, 1,150 members; and the Western Society of Engineers, with office in Chicago, 1,200 members; next the Associated Engineering Society of St. Louis, with 800. The hundred or more local engineering societies organized at the principal centers of population have a membership each of from 100 or less up to 500 or more, averaging about 200.

In establishing a new movement or society the burden of proof of the need of such organization is upon the promoters. If it is proposed to assume new costs and create new obligations, it must be clearly shown that there exists not only real need for this additional machinery, but that the public will be the gainer thereby.

If we go deeply, we find that in a free country no volunteer organization can long exist if it be founded on purely selfish motives. The public does not long deal with the merchant that does not give fair bargains, and it does not look with favor upon any body of men brought together for confessedly selfish ends. If, therefore, any movement should be so unfortunate as to start with the handicap of popular misconception that it is devoted solely to the financial gain of its members, its future history would likely be short and stormy. For this reason the benefits kept prominently in view should be those, not of individuals, but of society as a whole.

Summing up the needs and opportunities, it appears that a great part of the main body of engineers is not fully employed to the best advantages to society and to themselves, with corresponding loss to all. Nearly two-thirds of those who may properly call themselves engineers, or perhaps 60,000 men, are not members of any well-recognized organization, and are not utilizing their potential strength to help themselves or one another. There is need of enlightenment, of raising ideals and of united effort toward better things. The existing engineering organizations, which include perhaps 40,000 men, are devoted almost exclusively to technical questions as distinct from those things that concern the engineer as an individual and a citizen. Few of the older societies attempt to bring in the rank and file of the profession, or attempt to cover the field of the new American Association of Engineers in its efforts to help and reach the masses of the profession.

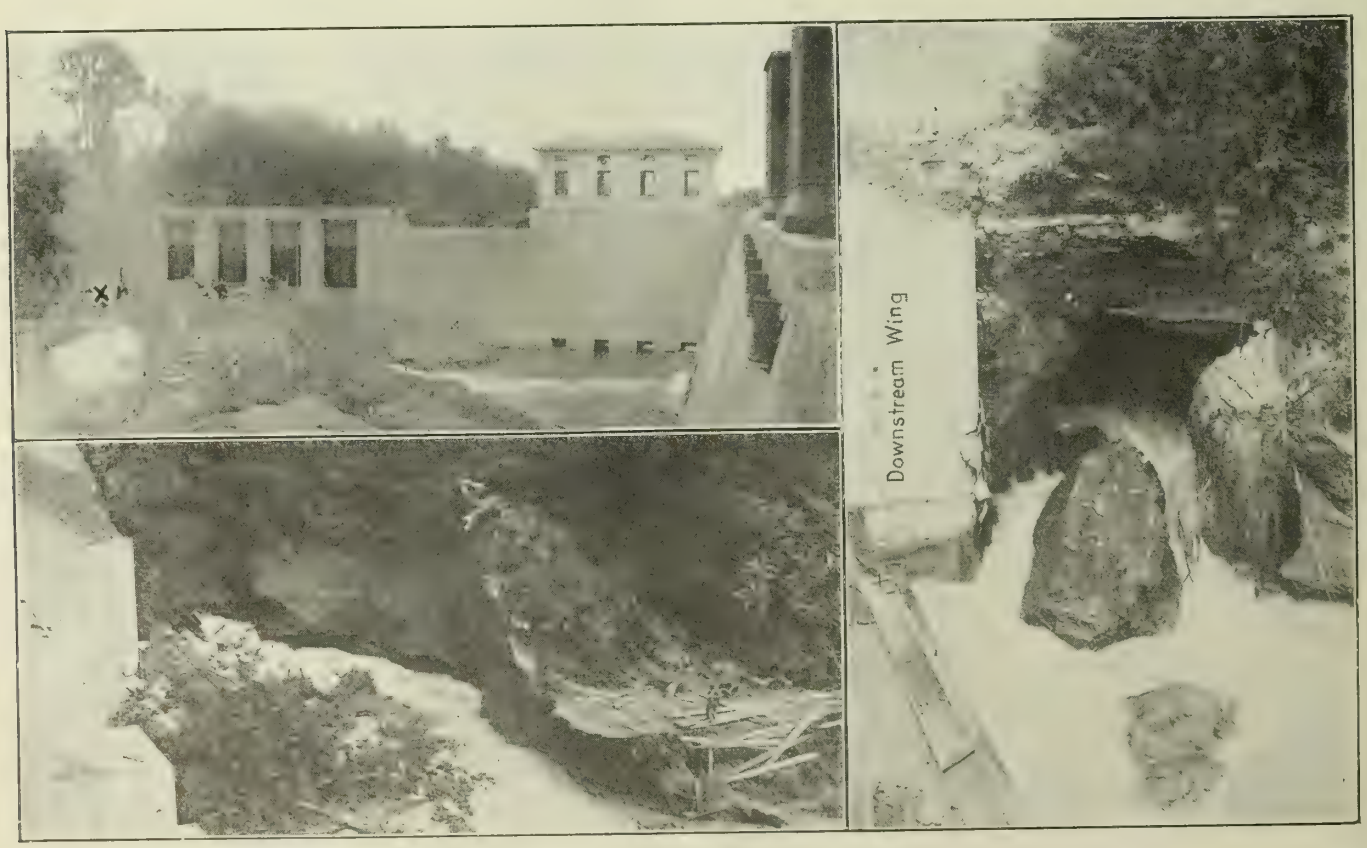
News of the Engineering World

Blowout at End of Concrete Dam, Seneca Falls, N. Y.*

A partial failure of dam No. 2 on the Cayuga & Seneca Canal, about a mile below the village of Seneca Falls, N. Y., occurred Sept. 3. The failure was caused by leakage around the end of one abutment and cutoff wall. This dam is part of the New York State Barge Canal system, and was built to mantain a 4-mi. level to Waterloo.

The dam is about 475 ft. long and is made up of an earth-filled section on the south end, a pair of twin locks in the center and a solid concrete section on the north end. The part of the canal immediately above the dam spreads out and forms an artificial lake 1,500 ft. wide.

*Information furnished by Reed W. Cady, Civil Engineer, Seneca Falls, N. Y.



BLOWOUT AT END OF CONCRETE DAM, CAYUGA & SENECA CANAL, SENECA FALLS, N. Y.
Cross in upper left-hand view shows upstream end of blowout; other views show downstream end

The break occurred at the north end of the concrete part of the dam, where the original surface was an abrupt outcrop of soft shale with occasional strata of a harder, somewhat porous rock. A cutoff wall was carried into this bank 50 ft. from the original surface, which at the time was thought sufficient, although the porous nature of the material was known.

The dam was completed and the canal level filled on Aug. 19 and 20 of this year. Seepage was noticed at once on the downstream side of the slope, but the water that came through was clear. The flow was equivalent to that from a 4-in. orifice, and apparently did not increase during the first ten days.

On Sept. 2 it was noticed that the rocks were wet for over 100 ft. downstream and that the leakage was slightly more. At 7 a.m. on the 3rd a big stream was noticed rushing from the hole just below the abutment. Responsible people were notified at once, and the boats on the canal level above were warned.

To facilitate drawing off the water the valves of the lock were opened, and by 6 p.m. of that day the head was reduced 12 ft. Some 36 hr. after the break the hole was exposed. The water had eroded a tunnel 120 ft. long around the end of the cutoff wall. This blowout varied in size from 6x8 ft. near the inlet to 12x20 ft. at the outlet. The opening on the upstream side was 30 ft. and at the outlet was 45 ft. below the original pool level. No injury was done to the dam masonry, for all the water found its way around the end and not under the concrete. Large quantities of earth and soft rock were washed from below and behind the abutment.

Plans for repairs have not been decided upon, but they will probably include building the cutoff wall farther into the hill, blanketing the upstream slope with a clay embankment or grouting the porous strata.

San Francisco Shore Protection

The design for the protection of the ocean beach alongside the new esplanade in San Francisco has just been completed, and it is announced that bids for one unit will be called for in a few weeks. As described on page 499 (Sept. 9, 1915) the esplanade is a new boulevard on the Pacific-coast side of San Francisco. In its preparation it is necessary to protect the beach against the inroads of the sea, and the wall and paving shown in the accompanying drawings are intended for that purpose.

The beach protection consists of a series of steps six in number, which will be erected from beneath the surface of the sands to a position well above the influence of ordinary breakers. Backing the steps is a seawall of reinforced concrete with a front molded to a curve that will throw the breakers back upon themselves and thus counteract their destructive force. Every 150 ft. along the breakwater a concrete stairway will lead from the beach to the scenic boulevard, or esplanade, which will parallel the steps on the east. In front of the steps reinforced-concrete interlocking sheetpiles will be driven 15 ft. below mean tide, as a protection against the underscour of the seas, and as a foundation for the reinforced-concrete seawall, pedestral piles with mushroom bottoms will be driven at intervals of 10 ft.

Between the coping and the Great Highway, or esplanade proper, will be a promenade 25 ft. in width, of artificial stone. This will be built on a slight slope draining toward the parapet wall, through which will be scupper holes to release any water from wave crests which may top the parapet.

The price estimated for the construction of the first section, to be constructed along the beach for a distance of 650 ft. southward from a point near the terminus of Cabrillo St., is about $48,500. The design and construction are under the direction of M. M. O'Shaughnessy, City Engineer of San Francisco.

Activated-Sludge Progress at Cleveland, Ohio

Plans for a 1,000,000-gal. unit of activated-sludge tanks have been completed for Cleveland, Ohio, under the direction of R. Winthrop Pratt, consulting engineer. The plans have been so drawn that this unit could, with moderate changes, be made a part of the Imhoff sewage-treatment scheme already tentatively adopted for the east-side disposal works at Cleveland. Bids for the work were to be received on Sept. 15.

The small experimental activated-sludge tank at Cleveland, described in the review of activated-sludge experiments in *Engineering News* for July 15, 1915, is giving good results. The effluent from this tank after three hours aëration and ten or fifteen minutes sedimentation is bright and clear; in fact, it compares very favorably in appearance with the city water-supply.

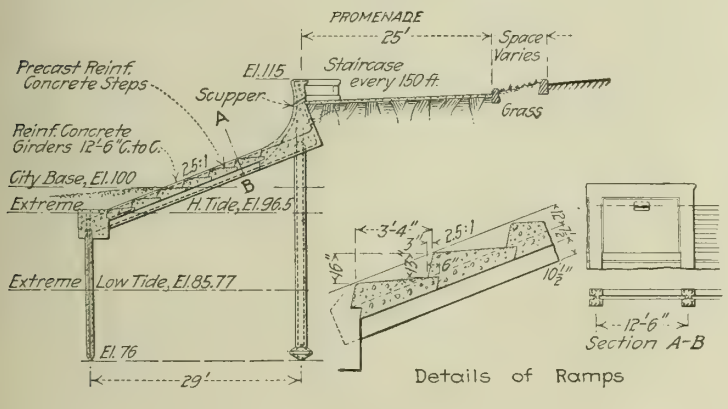


FIG. 1. DETAILS OF SEAWALL AT ESPLANADE

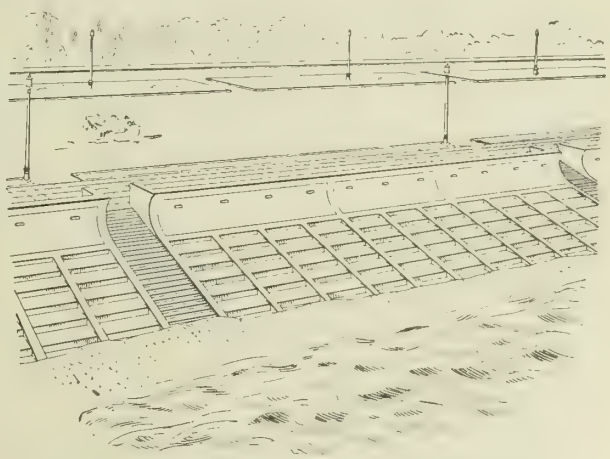


FIG. 2. PERSPECTIVE OF SHORE PROTECTION

Status of the Bronze Troubles on the Catskill Aqueduct

Rumors about new and greater troubles with cracking of bronze on the Catskill Aqueduct, New York City, are answered by Alfred D. Flinn, Deputy Chief Engineer, as follows:

Information on the subject up to about six months ago has already appeared.[1] For certain bolts, ladders, pipe fittings, valves and similar parts which would be exposed to moisture and difficult of replacement, the engineers of the Board of Water Supply sought a material highly resistant to corrosion and of sufficient strength to replace cast iron and steel, commonly used for such purposes. After careful inquiry, manganese bronze, Tobin bronze and naval brass were adopted. In the course of time some bolts were found cracked, and as time progressed this trouble with rolled and drawn material proved to be so extensive as to require replacement in a great many instances. The large forgings, principally for valve and sluice-gate stems, have developed no defects. Most of the castings have continued to be sound.

Recently, however, a number of castings, especially parts of large bronze gate valves, have developed fine cracks. Apparently these cracks result from repairs of foundry defects made by the process of "burning in," or welding, which has long been practiced in most if not all brass foundries. These valves are in chambers near the surface of the ground, where they are accessible for removal, for replacement or for such repairs as may be decided upon. The trouble mentioned is annoying, but will not delay the introduction of Catskill water beyond the time expected, the fall of 1916.

N. Y. Fire Department Reports on Subway Dangers

As a result of the serious fire in the New York subway on Jan. 6, 1915 (noted in *Engineering News,* Jan. 14, 1915), and at the request of the mayor, a study of the New York subway from the standpoint of the fire department was made by John Kenlon, Putnam A. Bates and Joseph O. Hammitt, all of the department. After an extended investigation they have recommended the following measures, as needed fire-prevention work: The substitution of steel cars for wood; isolation of buildings and show windows from the subway by fire walls; installation of electric wiring in fireproof conduits; use of slow-burning wood for third-rail guards; use of metal news-stands, doors, lockers, etc., in the stations; improvement of general house-keeping conditions in workshops and locker rooms; reduction and safeguarding of the storage and use of inflammable liquids; complete isolation of the various electric-wiring systems from one another to prevent communication of a breakdown; installation of emergency lights along the subway; duplication of current supply for lighting; installation of a complete fire-alarm system of approved construction, connecting with fire headquarters; installation of a complete additional telephone system connecting the power plant and executive offices of the operating company with stations every 500 ft. throughout the subway; reconstruction of splicing chambers to segregate wiring systems and to prevent escape of smoke or gases into the subway; better upkeep of emergency battery lamps in cars and equipment of each car with portable electric lamps; division of the subway by longitudinal walls between tracks, with protected openings at 500-ft. intervals; additional and improved emergency exits to the street; training of operating employees in regard to procedure in case of fire.

City of Philadelphia Starts Rapid-Transit Work

Extension of Philadelphia's one subway line (Market St.) into a large municipal rapid-transit network began last week with the start of work on subway and elevated contracts awarded in August. Bids are also asked for another section of elevated, to be opened Oct. 19. Henry H. Quimby, Chief Engineer of the Department of City Transit,[1] gives the following statement:

The subway contract covers the City Hall Station section of the Broad St. line, extending from Filbert St. to South Penn Sq., about 750 ft. long, passing under the present subway line in Filbert St. and in South Penn Sq., and passing also under City Hall diagonally, with four tracks and two island platforms, and including galleries, entrance stairs, escalator wells, ventilation, drainage, etc.

The elevated contract covers the column foundations and piers for about 5 mi. of line from Front and Callowhill St. to Frankford Ave. and Unity St.

The work embraced in these contracts and in the ones that will follow shortly to complete the construction of the first five miles of the Frankford Elevated was authorized by ordinance of Councils July 2, 1915, to be paid for out of an initial loan of $6,000,000, approved for the purpose by the voters of the city at a special election held Apr. 29, 1915, and apportioned by Councils equally between the subway and the elevated.

The initial loan was limited to this amount because of the expectation of the adoption by the electors of the state at the November election of a constitutional amendment, which has already been passed by the Legislature and now requires only the approval of the voters, and which, if so approved, will not only extend the borrowing capacity of the city, but will permit the borrowing to be done upon longer-term bonds, and the funding of interest and sinking-fund charges during construction, and the grading of the sinking-fund payments so that in the early years of operation they will be light and in the later years of their term they will be heavier to make up the amortizing amount.

As soon as the municipal legislation authorizing the work was enacted, the construction plans were submitted to the Public Service Commission of Pennsylvania for approval and for a certificate of public convenience, which is by law required to be obtained from the commission before any new lines or extensions of lines are constructed. The certificate was granted and the plans approved Aug. 14. A taxpayer's suit was brought July 10, to restrain the department from proceeding with the work, but after the decision of the Public Service Commission the suit was

[1] See "Engineering News," Nov. 26, 1914, p. 1092, "Unsatisfactory Performance of Brass and Bronze on the Catskill Aqueduct," stating the nature and extent of the cracking; and July 8, 1915, p. 69, "Cracking of Copper Alloys," which discusses the vital relation of corrosion to the phenomenon.

[1] 1754 Bourse Building, Philadelphia, Penn.

withdrawn. The contracts were then immediately awarded.

Bids are now being invited, to be opened Oct. 19, for the steel superstructure of the 5-mi. stretch of the Frankford Elevated, and contracts will follow for the concrete floor and for the station platforms, buildings and stairs.

Additional sections of subway will be advertised soon. The one now under way was made the first because it involves the most difficult and tedious work and will require the longest time to complete, there being about 3,000 ft. of heavy and thick walls to underpin besides the two lines of existing subway structure.

Additional sections of elevated will be advertised as soon as the south terminus of the line is determined, this portion of the route being dependent upon the outcome of negotiations for the operation of the lines. If a satisfactory contract shall be made with the trolley company, which also owns the Market St. rapid-transit line, the Frankford Elevated will be connected to the Market St. line at Front and Arch St. Construction plans for this route are complete, and it is expected that if there shall be no delay in the program the Frankford line can be completed for operation early in 1917.

Preliminary construction work on the subway system has been in progress since Mar. 20, 1915, when the relocation and reconstruction of sewers were commenced. Six contracts were placed for this advance work, involving about $450,000, and three of them have been completed.

The plans of the Department of City Transit, which was organized under authority of special state legislation to have supervision and control of the transit facilities of the city and is presided over by Director A. Merritt Taylor, contemplate the immediate construction of about 11 mi. of subway north and south in Broad St. (half four-track and half two-track), with elevated spurs to the east and the west at the north, together with a double-track elevated railway 7 mi. long to the Frankford district of the city, nearly paralleling the Delaware River, and probably making a connection with the present Market St. subway for operation through the central business district; estimated cost of structure $34,000,000.

The plans cover also a 6-mi. double-track elevated railway southwestward to the Darby district, to be built immediately after the completion of the Frankford line and to connect provisionally with the Market St. line at 30th St.; estimated cost of construction $4,500,000. Also, later, a double-track subway under the Parkway connecting with the Broad St. subway at City Hall, emerging in Fairmont Park and extending as an elevated along 29th St. and Henry Ave. to the Roxborough district, 8 mi. Also, as traffic will make necessary, a 1½-mi. delivery loop for the Broad St. subway in the central business district.

Studies and tentative plans have been made for a subway under Chestnut St. through the central business district and connecting the Frankford and Darby lines when traffic in the Market St. subway shall have reached the limit of the capacity of that line.

U. S. Naval Advisory Board

The personnel of the Naval Advisory Board of Inventions appointed by Josephus Daniels, Secretary of the Navy, has been already announced piecemeal in the personal columns of *Engineering News*. The complete board consists of 23 members; the chairman and original appointee is Thomas A. Edison. The other 22 members were chosen (in most cases by the governing boards) by the eleven principal engineering and scientific societies, and their formal appointment by Secretary Daniels has just been announced. These appointees are listed below according to the society they represent:

American Society of Civil Engineers—Andrew Murray Hunt, Consulting Engineer, of San Francisco, Calif., is a native of Sioux City, Iowa, and a graduate (1875) of the United States Naval Academy. His engineering activities include hydro-electric and irrigation developments, steam-power and gas plants, oil refineries, cement-manufacturing plants and other industrial works. Alfred Craven, Chief Engineer of the Public Service Commission, First District, New York, is a native of New Jersey and was graduated from the United States Naval Academy in 1867. A biographical sketch of Mr. Craven was published in *Engineering News* Oct. 8, 1914.

American Society of Mechanical Engineers—William Le Roy Emmet was born in New York State and is a graduate (1881) of the United States Naval Academy. He designed and directed the development of the Curtis steam turbine by the General Electric Co. and has done much in the field of electric power for ship propulsion, as well as other electrical engineering work. Spencer Miller was born in Illinois and was graduated from Worcester Polytechnic Institute in 1879. He is Chief Engineer of the Lidgerwood Manufacturing Co., New York City, and is noted for his cableway inventions, particularly the adaptation of this device to coaling ships at sea.

American Institute of Electrical Engineers—Frank Julian Sprague, a native of Connecticut and a graduate of the United States Naval Academy (1878), is the founder of the Sprague Electric Co. and an electrical engineer of international reputation. B. G. Lamme was born in Springfield, Ohio, and was graduated from Ohio State University in 1888. He has designed much electrical machinery and is now Chief Engineer of the Westinghouse Electric and Manufacturing Co.

American Institute of Mining Engineers—William Lawrence Sanders was graduated from Pennsylvania University in 1876. He is Chairman of the Board of Directors of the Ingersoll-Rand Co. and the inventor of many improvements to drilling machinery. Benjamin Bowditch Thayer was born in San Francisco and was graduated from Harvard University in 1885. He is a noted mining engineer and is President of the Anaconda Copper Mining Co.

The Inventors' Guild—Peter Cooper Hewitt, of New York, and Thomas Robins, President of the Robins Conveying Belt Co., Passaic, N. J.

American Society of Automobile Engineers—Andrew L. Riker, of Detroit, and Howard E. Coffin, Vice-President of the Hudson Motor Car Co., Detroit, who was educated at the University of Michigan.

American Society of Aeronautic Engineers—Henry A. W. Wood, New York City, and Elmer Ambrose Sperry, New York City, a graduate of Cornell University.

American Electro-Chemical Society—Joseph William Richards, South Bethlehem, Penn., a graduate of Lehigh University, and Lawrence Addicks, who was graduated from the Massachusetts Institute of Technology in 1889, Consulting Engineer of Phelps, Dodge & Co., New York City.

American Chemical Society—W. R. Whitney, Director of the Research Laboratory of the General Electric Co., Schenectady, N. Y., is a graduate of Massachusetts Institute of Technology (1890). L. H. Backeland is a Belgian and a graduate of the University of Ghent and is famous as the inventor of "Velox" photographic paper and of "Bakelite," an insulating material.

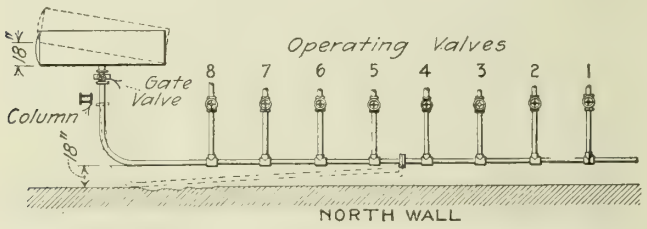
American Aeronautical Society—Matthew Bacon Sellers, Baltimore, Md., a graduate of Harvard University, and Hudson Maxim, of Brooklyn, N. Y.

American Mathematical Society—Robert Simpson Woodward, Washington, D. C., a graduate of Michigan University, President of the Carnegie Institution, and Arthur Gordon Webster, a Harvard graduate, Professor of Physics at Clark University, Worcester, Mass.

Hydraulic Elevators Shut Down by Broken Gate Valve*

Seven of the eight hydraulic elevators in the Bowling Green Building, New York City, sank to the bottom when a 14-in. gate valve in the main line from the high-pressure water-storage tanks to the elevator-machine cylinders broke, at noon on Sept. 3. The other elevator was at the bottom already and therefore did not participate in the accident.

The accompanying diagram indicates what took place when the valve casing broke. The high-pressure water was contained in two cylindrical tanks, one above the other



SUPPLY LINES FOR BOWLING GREEN ELEVATORS

and connected by a pipe. The lower tank was kept full, the upper nearly so except for the air at the top, under 180 lb. pressure. The storage water was of course released. The tanks were thrown out of place horizontally about 18 in., and the pipe line was thrown out in the opposite direction about the same distance, being stopped by the north wall of the building. The valve was further damaged by striking the column shown in the diagram.

When the valve broke, the operating valves in the elevator cars closed immediately, allowing the escape of only a gallon or two of water from each of the vertical cylinders in the shaft. All the cars descended at not more than normal speed until they were within a few inches of the bottom, when the effect of the slight leakage was felt and the cars dropped with a bump. None of the 30 passengers was injured.

About half the main pipe line was practically undamaged, as indicated in the diagram. The four elevators on this portion of the line were speedily put in operation, power being furnished by the low-pressure (120 lb.) supply.

Levee Flood Gates Were Carried Out in East St. Louis last week during a fall of the Mississippi River. These backwater gates (on Cahokia Creek) are reported to have been built for temporary use by the East Side Levee and Sanitary District in 1912, and this outlet would eventually have been abandoned. The old creek channel stood full and the gates were clogged.

*Noted in "Engineering News," Sept. 9.

The Retaining Walls for the Levee of the Kaw River Drainage District, Kansas City, Kan. (see "Engineering News," Aug. 26, 1915, p. 430), are to be redesigned before construction.

The Injunction in the Minneapolis Water-Filter-Patent Suit (Ira H. Jewell vs. City of Minneapolis; see "Engineering News," Sept. 9, 1915, p. 523) has been suspended until a decision is reached in an appeal to the United States Circuit Court of Appeals.

PERSONALS

Capt. Harold C. Fiske, Corps of Engineers, U. S. A., has been relieved from duty at Pittsburgh, Penn., and will be stationed at Vicksburg, Miss.

Maj. Elliott J. Dent, Assoc. M. Am. Soc. C. E., Corps of Engineers, U. S. A., has been relieved from duty in New York City and will be stationed at Little Rock, Ark.

Mr. James P. Nelson, a member of the Valuation Committee of the Chesapeake & Ohio Ry. Co., has been placed in charge of the engineering work of the committee.

Mr. Fred W. Cummings, Superintendent of the municipal garbage-reduction plant of Cleveland, Ohio, resigned on Aug. 31 to accept a position with a similar plant operated by a private company at Detroit, Mich.

Mr. E. S. Mudge, Division Engineer of the Atchison, Topeka & Santa Fé Ry. at Wellington, Kan., has been made Assistant Engineer in Charge of Valuation for the Western lines of the road, wtih headquarters at Amarillo, Texas.

Mr. W. P. Danford, formerly City Engineer of Durant, Okla., has been appointed Assistant State Engineer of the State Highway Department, with headquarters at Oklahoma City. He will act as State Engineer until Oct. 1.

Mr. P. J. Flynn, Manager of the Winnipeg Union Terminals, has been appointed Superintendent of the Canadian Northern Ry., with headquarters at Winnipeg, Man. He succeeds Mr. M. B. Murphy, who has been transferred to Calgary, Alta.

Mr. W. D. Pearce, Assistant Engineer of the Northern Pacific Ry., has been appointed Supervisor of Bridges and Buildings on the Yellowstone division, with headquarters at Glendive, Mont. He succeeds Mr. W. C. Sloan, who has been promoted.

Mr. Frank C. French, M. Am. Soc. C. E., who for several years past has been connected with the Butte & Superior Copper Co. and other copper properties in the Butte district, will reopen offices in Salt Lake City for the practice of civil and mining engineering.

Mr. R. D. Starbuck, Special Engineer on the staff of Mr. J. J. Bernet, Vice-President of the New York Central & Hudson River R.R., at Chicago, has been transferred as Special Engineer on the staff of Mr. A. T. Hardin, Assoc. M. Am. Soc. C. E., Vice-President in Charge of Operation, at New York City.

Mr. Julius Edgar Willoughby, M. Am. Soc. C. E., Assistant Chief Engineer of the Atlantic Coast Line, has been made Chief Engineer, with headquarters at Wilmington, N. C., to succeed the late E. B. Pleasants. Mr. Willoughby entered the service of the Atlantic Coast Line as Assistant Chief Engineer in 1913, which position he has held until his present appointment.

Mr. John G. D. Mack, M. Am. Soc. M. E., Professor of Machine Design in the College of Engineering, University of Wisconsin, has been appointed State Chief Engineer by the Railroad Commission of Wisconsin, with a salary of $6,000 a year. Professor Mack will have charge of and supervision over all engineering work for the state, including the engineering work of the Railroad, Highway and Tax Commissions. He has been a member of the University Faculty for nearly 25 years.

OBITUARY

William F. Endress, Captain, Corps of Engineers, U. S. A., died Sept. 7 from pneumonia while on board the steamer "Allianca" en route from Colon to New York.

John Haines Warder, Assoc. Am. Soc. C. E., whose death was noted in "Engineering News" of Sept. 9, became Secretary of the Western Society of Engineers in January, 1901,

which position he held until his death. He resigned as Assistant Engineer of the Bureau of Sewers of Chicago to accept the position of Secretary of the society.

Edward B. Moore, ex-United States Commissioner of Patents, died Sept. 7 at his home in Washington, D. C. Mr. Moore was born at North Anson, Me., in 1851. After receiving a high-school education he became a page in the United States Senate. In 1881 he was admitted to the bar and in 1883 became an assistant examiner in the Patent Office, with which he was connected for 30 years. He was Commissioner from 1907 to 1913, at which time he left the Patent Office to become a member of the law firm of Moore & Clark in Washington.

Dr. Karl E. Guthe, Dean of the Graduate Department, University of Michigan, died at Ashland, Ore., on Sept. 11. Dr. Guthe was born in Hanover, Germany, in 1866, and received his education in the Hanover Technical School and the Universities of Marburg, Strassburg and Berlin. He came to the United States in 1892 and entered the University of Michigan as an instructor in physics, being made Assistant Professor in 1900. In 1903 he was appointed Associate Physicist in the United States Bureau of Standards, and in 1905 was Professor of Physics in the Iowa State University. The same year he was made Professor of Physics at the University of Michigan. In 1909 he became Dean. Dr. Guthe was the author of several books on physics and a member of the Bureau of Awards of the St. Louis Exposition.

Sir William C. Van Horne, K. C. M. G., Assoc. Can. Soc. C. E., a noted railroad builder and financier of Canada, died at the Royal Victoria Hospital in Montreal, Sept. 11. Sir William was born in Will County, Ill., in 1843, and at the age of 13 was left upon his own resources. He worked in the railroad yards and afterward as a telegraph operator with the Illinois Central R.R., after rapid strides becoming General Superintendent of the St. Louis, Kansas City & Northern Ry. Later he was connected with the Southern Minnesota Ry. as General Manager and the Chicago & Alton R.R. and the Chicago, Milwaukee & St. Paul Ry. as General Superintendent. In 1882 he moved to Canada and became General Manager of the Canadian Pacific Ry. and superintended its extension to the Pacific Coast. Sir William was Vice-President of the road from 1884 to 1888, President from 1888 to 1899 and was made Chairman of the Board of Directors the following year. He was knighted by Queen Victoria in 1894 in recognition of his railway work in Canada and for his interest and services in public affairs.

Dr. John E. Sinclair, Professor Emeritus of Mathematics at the Worcester Polytechnic Institute, died Sept. 12 at his home in Worcester, Mass. He was born at Brentwood, N. H., Mar. 28, 1838, and was graduated from Dartmouth College in 1858. He began teaching at Adrian, Mich., the same year, and from 1859 to 1863 he was an instructor at Washington University, St. Louis, Mo., where the honorary degree of A.M. was conferred upon him in 1862. From 1863 to 1869 he was Assistant Professor and Professor of Mathematics at Dartmouth. He was made Professor of Mathematics at Worcester Polytechnic Institute at the inception of the school in 1869 and was head of the mathematics department until 1908. Practically every graduate of the Institute up to that year passed through his hands in "calc. and analyt.," and no professor was ever more original in his methods of instruction or more dearly loved than "Johnny Sin²," as he was affectionately called by generations of Worcester men. Dr. Sinclair was retired on a well-earned pension in 1907. At the recent semi-centennial anniversary of the Institute he was an honored guest.

ENGINEERING SOCIETIES

COMING MEETINGS

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Oct. 11-12. Secy., Will P. Blair, Engineers Bldg., Cleveland, Ohio.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 12-14. Annual convention at Dayton, Ohio. Secy., Charles Carroll Brown, 702 Wulsin Bldg., Indianapolis, Ind.

SAN FRANCISCO MEETINGS

INTERNATIONAL ENGINEERING CONGRESS.
Sept. 20-25. W. A. Cattell, Secy., Comm. of Management, Foxcroft Bldg., San Francisco.

INTERNATIONAL IRRIGATION CONGRESS.
Sept. 20. Secy., Arthur Hooker, Sacramento, Calif.

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Sept. 20. Secy., F. F. Sharpless, 52 Broadway, New York City.

PACIFIC COAST ASSOCIATION OF PORT AUTHORITIES.
Sept. 20 and 21. Secy., Leo V. Merle, Ferry Bldg., San Francisco, Calif.

AMERICAN MINING CONGRESS.
Sept. 20-22. Secy., J. F. Callbreath, Washington, D. C.

INTERNATIONAL ASSOCIATION OF BRIDGE AND STRUCTURAL IRON WORKERS.
Sept. 20-30. Secy., Harry Jones, American Central Life Bldg., Indianapolis, Ind.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Sept. 21 and 22. Secy., F. M. White, Madison, Wis.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Sept. 23 and 24. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 23 and 24. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN ASSOCIATION OF REFRIGERATION.
Sept. 23 and 24. Secy., J. F. Nickerson, 431 South Dearborn St., Chicago, Ill.

ILLINOIS GAS ASSOCIATION.
Sept. 27. Adjourned meeting. Secy., H. H. Clark, 72 West Adams St., Chicago, Ill.

SAFETY CONFERENCE.
Sept. 27-30. A. C. Carruthers, Vice-Pres., Collective Insurance & Universal Safety Exhibit, Mines and Metallurgy Bldg., San Francisco.

INTERNATIONAL GAS CONGRESS.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

Pan-American Road Congress—The Pan-American Road Congress is scheduled to be held all next week in Oakland, under the joint auspices of the American Road Builders' Association and the American Highway Association. Other road associations holding their conventions on the same dates are the Tri-State Good Roads Association and the Pacific Highway Association.

Engineers' Society of Pennsylvania—On Sept. 17-18, members of the society intend to make an inspection trip to Torresdale, where a filtration plant and experimental sewage-disposal plant are situated. The party will then go by special boat down the Delaware River, viewing the harbor improvements and visiting League Island Navy Yard and the New York Shipbuilding plant. Theater parties are planned for the evening of the 17th. The next morning the party will go by automobile to the Baldwin Locomotive Works and in the afternoon to a ball game. The Secretary is E. R. Dasher, 31 South Front St., Harrisburg, Penn.

American Society for Municipal Improvement—The 22nd annual convention will be held in Dayton, Ohio, Oct. 12-15, at the Hotel Miami. Proof sheets of the program have just been received in this office, indicating that the program of the convention will soon be issued to the membership. A banquet will be tendered by the National Paving Brick Manufacturers' Association on Oct. 12. The entertainment of the ladies is in charge of the Dayton Engineers' Club, and the program for the week has been arranged. The secretary of the Municipal Improvement Society is Charles Carroll Brown, 702 Wulsin Bldg., Indianapolis, Ind.

"The Smoke Prevention Association"—At the tenth annual convention of the International Association for the Prevention of Smoke, held in Cincinnati, Sept. 8 to 10, the name of the society was changed to the Smoke Prevention Association. The 1916 convention will be held in St. Louis. Prof. J. J. O'Connor, of the Mellon Institute of Industrial Research, University of Pittsburgh, stated that Pittsburgh intends to hold a large exhibition of smoke-prevention appliances in 1917 and wants the convention there that year. Officers were elected as follows: President, William A. Hoffman, St. Louis; Vice-President, Charles W. Heath, Cincinnati; Secretary-Treasurer, Frank Chambers, Chicago.

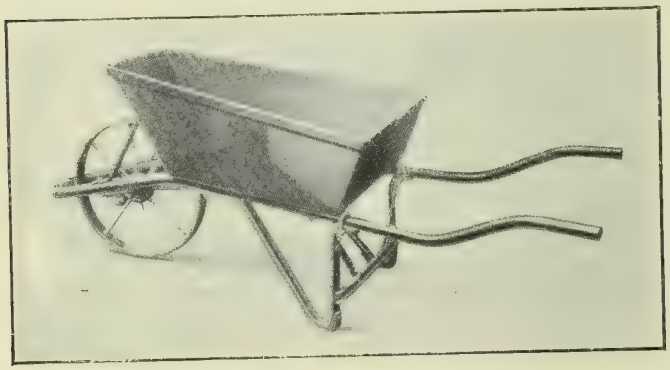
American Public Health Association—The annual convention held at Rochester, N. Y., Sept. 7-10, was one of the largest and most successful in the history of the association. Many papers were presented before the association as a whole and before the half-dozen sections. Dr. John F. Anderson, Di-

rector Hygienic Laboratory, United States Public Health Service, was elected President, to succeed Prof. William T. Sedgwick, of the Massachusetts Institute of Technology, and Prof. Selskar M. Gunn, 755 Boylston St., Boston, Mass., was reëlected as Secretary. Prof. George C. Whipple, of Harvard University, was elected Chairman, and Theodore Horton, Chief Engineer of the New York State Department of Health, was made Vice-Chairman of the Sanitary Engineering Section. The 1916 convention will be held at Cincinnati.

Appliances and Materials

Contractor's Measuring Wheelbarrow

The barrow shown in the accompanying illustration has been developed by the Sterling Wheelbarrow Co., of West Allis, Wis., in response to the demands of contractors laying concrete sidewalks, bases for asphalt and wood-block pavements, etc. The demands of most municipalities where such



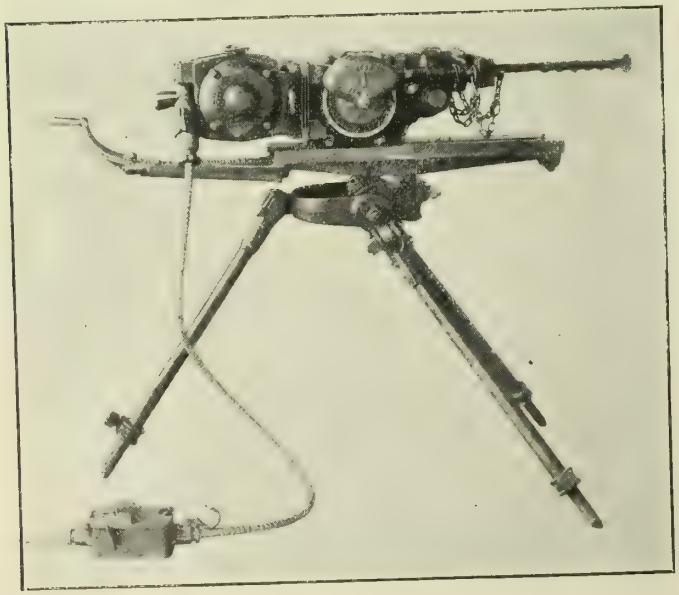
CONTRACTOR'S MEASURING BARROW

work is being done are for careful measuring of ingredients and material placed, and on the majority of these jobs a barrow of known capacity is the most convenient measure. This wheelbarrow is regularly furnished in 2- and 3-cu.ft. sizes.

* * *

Electric Percussion Rock Drills

After making trial installations of an electric rock drill for several years, the Fort Wayne (Ind.) Electric Works have standardized their line for regular production. The drill, as shown in the accompanying views, is of a rotary-hammer type



SIDE AND PHANTOM VIEWS OF FORT WAYNE ELECTRIC PERCUSSION ROCK DRILL

for mounting on tripod, column or bar. A rotating helve carries two hammers and is belt-driven (850 r.p.m.) by the driving motor, using a tightening idler pulley to give speed variation. A round-headed hammer strikes a round-headed cap or tappet block against which the drill steel is set. On the recoil the hammers are cushioned by the air trapped in the hammer chambers. Normally, the drill gets 1700 blows per min. Around the steel is also a sleeve gripping it and itself rotated by a worm gear on the helve shaft. Spring-steel plates hold the drill steel in the chuck and absorb the energy of the blows when the steel is not in rock. Special drills are used with a helical rib, or wing, going around from point to grip and serving to convey the rock punchings out of the drill hole. The motor has ball bearings; the other rotating parts are mounted in roller bearings. All are packed in grease and require attention only about once in 30 days. The motors are fully inclosed and designed for use in wet places; they are furnished for 115, 230 and 550 volts, direct current, and 110 and 220 volts, single- or two-phase alternating current. From 1.5 to 2.5 hp. generator capacity is needed per drill.

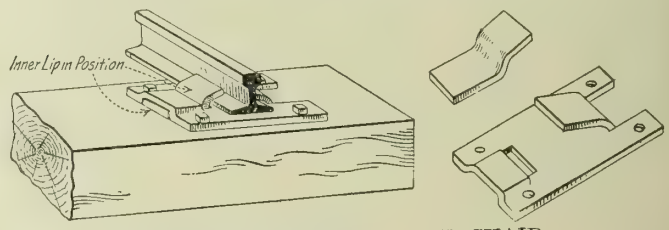
The machines now put out (A 10) are medium-capacity drills making holes up to about 12 ft. deep and finishing at 1½-in. bottom diameter. The body and shell weigh 275 lb., the motor 130 to 175 lb., the tripod 175 lb. This drill has a capacity equal to a 2½- or 3-in. piston drill which may require 12 to 18 hp. in compressors.

Electric drills are finding increasing use owing to their greater convenience and the saved investment in compressor, engine or motor, and piping—besides showing decreased maintenance and operating labor. Among the notable uses of these drills should be mentioned the Sun River irrigation project of the United States Reclamation Service (all machinery here driven by electricity as noted in "Engineering News," Oct. 29, 1914), and the Canadian Northern tunnel, near Duluth, Minn. The Rochester (N. Y.) Railway and Light Co. during the past three years has purchased several electric rock drills, which are rented to contractors doing work near the power lines.

* * *

Improved Two-Piece Rail Chair

An improved design of two-piece rail chair, to be used with driven or screwed spikes or bolt fasteners, is shown in



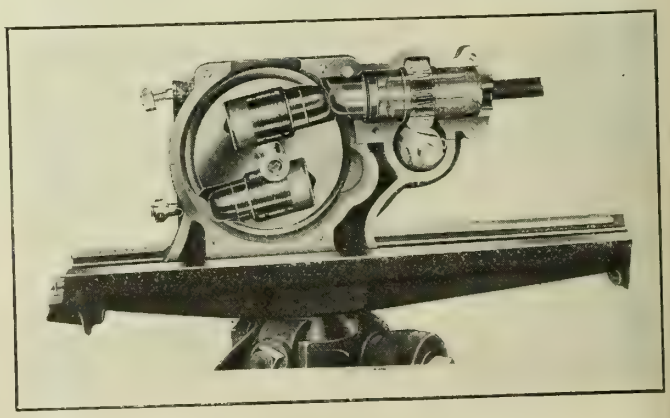
TWO-PIECE GRIPPING RAIL CHAIR

the accompanying sketch. The inner lip gives a strong grip on the rail base. The device is made by the American Rail Chair Co., Ewing Building, Findlay, Ohio.

* * *

One-Bag Low-Level Concrete Mixer

A new mixer (Rex No. 10) has been added to the line of the Chain Belt Co., of Milwaukee, Wis. This has a capacity of 10 cu.ft. and is assembled on a low truck for ease in charging, the platform (when used in place of a charging hopper) being 22 in. above the ground. The construction is all of steel and iron. The drum is cast in two sections and



bolted together. A sprocket for chain drive is bolted on sections around the middle of the drum. The frame is of steel channels and has 6x28-in. wheels. Steam engine and boiler, gasoline engine or electric motor can be furnished. The price is $450 without power loader and automatic tank.

Engineering News

VOLUME 74 SEPTEMBER 23, 1915 NUMBER 13

San Diego's Municipal Stadium

By F. A. Rhodes*

During the past spring there was completed in the city of San Diego, Calif., a large stadium, the cost of which was defrayed by the city. The structure will comfortably seat 28,000 people. The field has a ¼-mi. cinder track next the railing, inside of which are the football gridiron and the baseball diamond. The athletic building is divided into four compartments (for men, boys, women and girls), each with dressing room, lockers and showers. The building incloses a patio large enough for a handball or basketball court. The location of the stadium in proximity to the high school makes it a valuable adjunct to that institution.



FIG. 1. ENTRANCE TO MUNICIPAL STADIUM AT SAN DIEGO, CALIF.

The sum of $150,000 was voted by the people of San Diego to provide a stadium for Balboa Park. Elaborate plans for a combination stadium and Greek theater were prepared by Quayle Bros. & Cressey, architects, the understanding with the stadium committee being that should their plans exceed the bond issue the difference would be raised by private subscription. When the bids were opened before the Board of Park Commissioners, it was found that the lowest was $325,000. The park board refused to award the contract unless the committee raised $175,000. Meanwhile the board called in the writer and requested that some method be worked out to save $30,000 or $40,000 in the grading of the site.

The site of the work was the southern end of the park where Fifteenth St. ended at the south park line. Fifteenth St. was a graded and improved street in a built-up district, but it was so graded that at A St. (the first street south and parallel with the park line) the drainage from all directions went to this intersection. The proposition to raise the grades of Fifteenth St. from B St. to the park line and of A St. on each side of Fifteenth as far as necessary and to fill in the adjoining property, raise the houses, etc., was put before the property owners. This change of grade was to provide a short haul for waste excavation from the stadium and give a continuous surface drainage from the stadium south on Fifteenth St. The property owners accepted $3000 to cover the cost of replacing sidewalks and curbs and raising their houses, which they preferred to do individually, the park board to furnish the dirt to fill the streets and property to the new elevations. The property owners lost about $4000 by not accepting the board's offer to do this work for them.

As a short haul on the excavation was the solution of the money-saving problem, so far as the earthwork was concerned, it was necessary to make the excavation and embankment quantities balance. This was done by building up the embankments on each side of the field to carry the concrete seats. The slopes on the inside were finished 30 to 17 and on the outside 2 to 1. The cut was trimmed 30 to 17 and in the north end was conical. The grading specifications provided that these fills be in 6-in. layers thoroughly wet and tamped. The dirt was dumped from the wagons, spread by a mormon scraper, rolled with a

*Consulting Engineer, 513 Union Building, San Diego, Calif.

petrolithic roller, thoroughly wet and then rolled again. The contours of the site are shown in light lines in the plan in Fig. 2. The excavation consisted of about 18 in. of topsoil, below which was a layer of hardpan about 18 in. thick. Below the hardpan a soft sandstone was encountered. In this sandstone were pockets of white sand and at a depth of 40 ft. was a layer of sea shells cemented in sand. The sandstone required loosening for the 60-ton 1½-yd. shovel, but by the time it had received the final rolling it had all dissolved to sand, containing just enough clay to bind it.

Two tests were made before the commencement of the work to determine if possible the percentage of volume of fill over cut. The first test was made by carefully cutting out a cubic yard in place and putting it in a yard box and thoroughly tamping it dry as the box was filled up. The fill swelled 20 per cent. over the cut. In the next sample, water was used in tamping, and the fill swelled but 10 per cent. over the cut. It was not thought advisable, however, to depend on the 10 per cent. swell of the fill and possibly be short of material on the wind-up. The estimated quantities adopted were 119,842 cu.yd. excavation and 118,175 cu.yd. embankment, an excess excavation of 1,667 cu.yd. The final quantities worked out remarkably close to this estimate. It was arranged to take care of any further excess or a shortage by raising or lowering the elevation of the stadium field without affecting any of the other work.

In finishing no changes were made in the field elevation, which was at El. 125 (Fig. 2), as the contractor disposed of the excess material. The test for swellage showed about 60 per cent. hardpan and 40 per cent. sandstone, whereas the total yardage contained about 95 per cent. sandstone and 5 per cent. hardpan. The sandstone dissolved to a sand containing a slight amount of clay and resumed the same volume in embankment as in place.

The topsoil was first stripped from the entire site and put into three piles, two at the upper end and one in the center of the field, at approximately the finished grade elevation. This top soil was afterward spread over the field and the outer exposed surfaces that are to be covered with verdure.

The bulk of the dirt was handled by one 1½-yd. railroad shovel and one ⅝-yd. revolving shovel, delivering into 2-yd. wagons. The average haul was about 500 ft. and the work was so arranged that all except about 30,000 yd. was on a downhill haul. When the west fill reached the point where the grade was too steep for the teams to pull up the loads, a cable was installed that enabled the

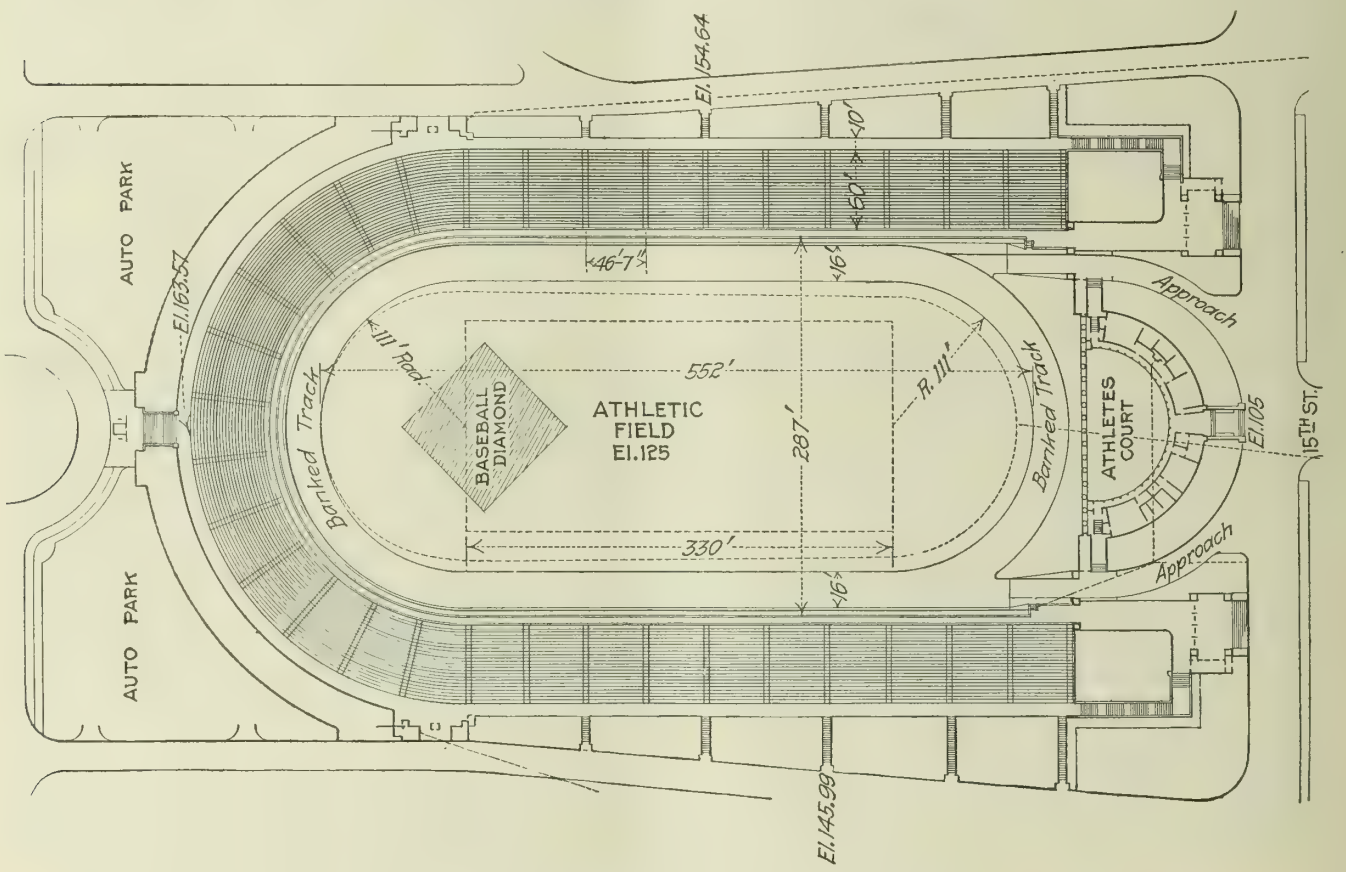


FIG. 2. PLAN OF THE SAN DIEGO MUNICIPAL STADIUM

empties returning to the shovel to assist the loaded teams to the top of the embankment. The slopes were trimmed to grade with a fresno scraper attached to the center of a cable, which passed through a block at both the toe and the heel of the slope. A team was hooked to each end of the cable and the scraper hauled up empty and loaded on downward trips. A portion of the slopes was also plowed in this manner.

The general layout of the stadium with its structures is shown in Fig. 4. The original design was revised to the extent of eliminating the Greek theater and the reinforced-concrete seats, but otherwise was not changed. The structures comprise a horseshoe-shaped series of seats—25 steps in all—made of concrete laid directly on the ground, step approaches at intervals along the outside slope, a rear entrance, a side entrance with toilet rooms attached and an elaborate front entrance of reinforced concrete (see Fig. 1) containing locker rooms, etc., and an imposing colonnade.



FIG. 3. EXCAVATING WORK IN PROGRESS ON THE SAN DIEGO MUNICIPAL STADIUM

The seats were cut out of the slopes (Fig. 6), commencing at the toe, and the concrete run six steps at a pouring. This method required one form for the face of the riser. The vertical joints were made by inserting sheet-iron strips dipped in oil in the wet concrete and pulling them when the concrete had set (Fig. 4). The horizontal joints were made by placing a strip of tarred paper on top of the riser, which was left in the concrete. The joints were put in to provide for a possible settlement in the embankment, to prevent bridging and irregular cracks and to facilitate any possible repair work. Each block can be removed and repoured if damaged. Some of the seats and risers have been in place eleven months; but they show no distortion nor cracks, other than the paper or cut joints.

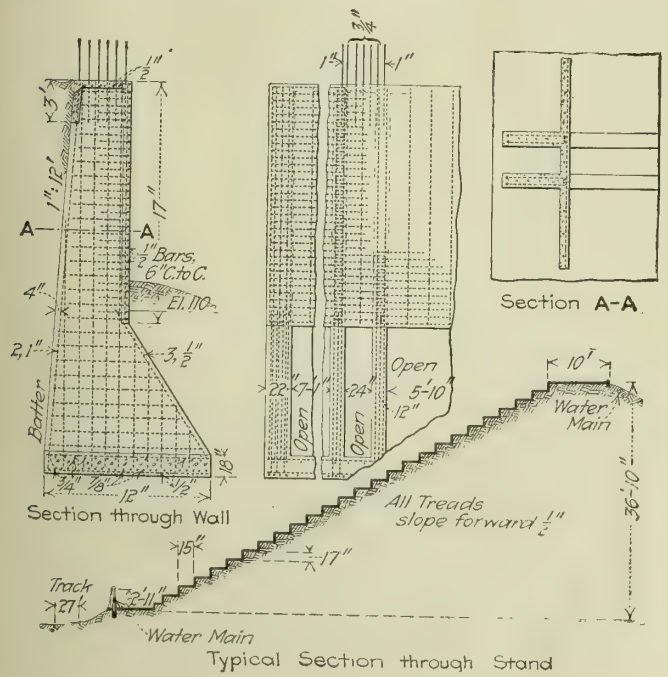


FIG. 4. DETAILS OF STEPS AND OF RETAINING WALL UNDER ENTRANCE COLONNADE

The concrete walk at the top of the steps drains to the seats; each row of seats has a ½-in. fall toward the field and drains to the lower concrete walk. This lower walk carries the water south, out over the two main entrance steps, where it empties into storm drains. The top walk and all the seats are laid on the same rate of grade as the lower walk. All drain to the south end of the stadium as well as toward the lower walk.

The field drains to a catch basin in the south end, and water is led out under the wall and athletic building to the main storm drain, which catches the storm waters from all the stadium roads.

The railing around the field carries a 2-in. water-main equipped with hydrants for washing down the seats. There is also a water line outside the top walk for the same purpose.

Retaining Wall Under Colonnade

The concrete wall at the south end of the field was designed to carry 16 columns, 25 ft. high, supporting a continuous cornice 8 ft. high and at the same time to retain a 16-ft. fill on its north side; the south side is used for playing handball. Fig. 4 shows the design and Fig. 5 the early part of this construction. The wall was made in one

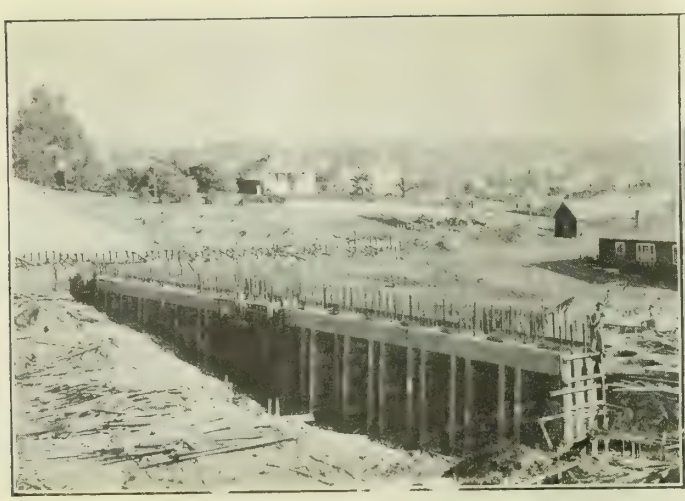


FIG. 5. RETAINING WALL UNDER CONSTRUCTION

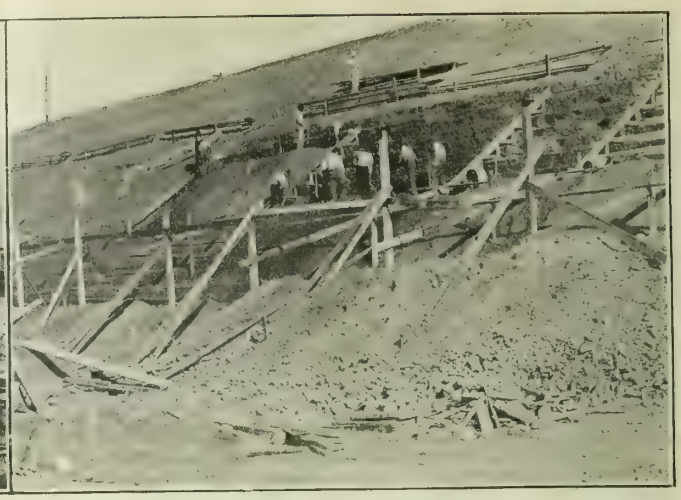


FIG. 6. LAYING STEPS FOR SAN DIEGO STADIUM

continuous pouring and has no joints. The face of the wall extends down from the top 17.25 ft., being 1 ft. below the finished grades on the south side of the wall, the foundation for the buttresses going from 1 to 12 ft. deeper.

The concrete mix used was one part cement, two parts washed river sand and four parts river gravel, crushed to ¾-in. size and washed. When the forms were stripped the wall presented smooth surfaces without pockets. This same mix was specified for the concrete seats and risers.

Bids were called for on the entire work, but in two parts—(1) grading and (2) general construction—with the provision that the park board reserved the right to do the grading work itself or let the contracts separately. The contract was let in two parts for $11,050 less than the lowest bid for the entire job. The basis for the earthwork bids was 110,000 cu.yd. excavation and 7,000 cu.yd. topsoil, and the two lowest bids were as follows:

F. O. Engstrum Co.:	
110,000 cu.yd. excavation at 35c	$38,500
7,000 cu.yd. topsoil at 35c	2,450
All other work	72,694
Total bid	$113,644
C. L. Hyde Construction Co.:	
110,000 cu.yd. excavation at 24c	$26,400
7,000 cu.yd. topsoil at 50c	3,500
All other work	93,000
Total bid	$122,900
Contracts as let:	
To C. L. Hyde Construction Co., for grading	$29,900
To F. O. Engstrum Co., all other work	72,694
Total contract	$102,594

The actual amount paid the contractors was $9,044.68 more than these figures, because of excess yardage over the basis of the bid, force account work, and extras on general construction.

In addition the cost of engineering, superintendence, architects, damages, inspection, advertising, blueprints, stationery, photographs, hardware, water meter, planting and other improvements was not covered by the contracts.

Quayle Bros. & Cressey did all the architectural designing and to them should be given the credit for all the utility, conveniences and beauty of the entire structure. H. S. Ervay and the writer worked out all the engineering problems, including the grades, seats, retaining wall, drainage and estimated costs. It was necessary, of course, to work in conjunction with the architects to keep the costs within the appropriation. The estimate of cost was $140,000. The park commissioners retained the writer as Engineer and Superintendent of Construction until the completion of the work. It was dedicated to the public, May 31, 1915, at which time about 20,000 people were seated in it.

The Average Discharge of the Tennessee River at points in North Carolina and Virginia where the river joins the Ohio has been investigated by the United States Geological Survey during the past year, and the findings were recently reported. The average flow of the river at its mouth is 63,000 cu.ft. per sec. This figure was determined by averaging the figures of a 39-yr. period (1875 to 1913). The report gives the daily flow at Chattanooga since 1874; at Florence, Ala., since 1895, and at Johnsonville, Tenn., since 1890. The average discharge at Chattanooga is 33,400 sec.-ft.; at Florence, 38,400; at Johnsonville, 42,000. The Geological Survey has also reported on the areas drained by important rivers in the neighborhood of the Tennessee. The Cumberland River drains an area of 17,900 sq.mi.; the Tennessee, 40,700; the Kanawha, 12,200; the Miami, 5410; the Wabash, 32,900, and the Allegheny, 11,700.



FIG. 7. THE COMPLETED SAN DIEGO MUNICIPAL STADIUM WITH ITS OPENING-DAY CROWD

Drainage Pumping Plant with Variable-Speed Drive

The Hartwell Drainage and Levee District has an area of about 10,000 acres in the northwestern part of Greene County, Illinois. The elevation of the bottom land varies from 426 ft. to 440 ft. (Memphis datum) and that of the river varies from 423 ft. to 440.5 ft. Under these conditions it was necessary to levee the district, and as the river is at flood stage during the crop season it is necessary to pump the run-off at these times.

Rainfall and Run-Off in Levee District

The levee extends along three sides of the district, and has a total length of 13 mi. It is 4 ft. above the highest known water, and has a slope of 1 on 3 for the river side and 1 on 2 for the land side, with a crown of 6 ft. Its only break is at the gravity outlet at the southwest corner of the district. This is a concrete structure with wing walls to hold back the fill and three 42-in. riveted steel pipes provided with hand-operated sluice gates. The elevation of the bottom of these pipes is 421.3 ft. and the top of the concrete wall is level with the levee top.

The rainfall in this section averages about 35 in. per year. The run-off is about 31%, but as there is considerable seepage from the river, 36% was used in estimating the pumpage. The pumping plant was designed to remove ¼ in. of rainfall from the entire watershed in 24 hr.

The run-off is conveyed by open ditches and tile drains. The main ditch leading direct to the pumping plant and gravity outlet is 11,284 ft. long. It has a bottom width of from 35 to 22 ft. and a depth of from 13 to 8 ft. Lateral No. 1, which empties into the main ditch, is 16,632 ft. long and from 12 to 24 ft. wide on the bottom, with an almost constant depth of 9 ft. Lateral No. 2, a continuation of the main ditch, is 13,130 ft. long, from 22 to 18 ft. bottom width, and averages 8 ft. deep. Lateral No. 3, another branch of the main ditch, is 11,150 ft. long, with other dimensions similar to No. 2. The bank slope of all the ditches is 1 on 1, and the fall varies from 0.5 to 1.2 per mile. The main ditch proper terminates at the suction bay, a branch leading off to the gravity outlet about 300 ft. south of the pumping station.

A general cross-section of the pumping station is shown in Fig. 1. The suction bay is built of 1:3:5 concrete, reinforced in both the floor and walls with triangular-mesh expanded metal. The floor is 12 in. thick, and the back and end walls are 4.5 ft. at the base.

The trash-rack (which has not yet been built owing to the immediate need of pumping) will extend across the main ditch 75 ft. east of the suction bay. It will consist of a concrete foundation and cutoff wall and concrete piers carrying steel I-beams to hold the tops of steel bars, $\frac{5}{16}$x1¾ in., spaced 2 in. c. to c. The lower ends of these will rest on the concrete foundation.

The back wall of the suction bay forms part of the building foundation. The remainder of the foundation is 1:2:5 concrete. The 6-in. floor of the building is of 1:2½:5 concrete, reinforced with woven wire netting. Level with the top of the floor and extending 7 ft. below it are the foundations for the pumps and motors. The building is 65x30 ft. in plan with brick walls and a slate roof. A 5-ton traveling crane runs on 10-in. I-beams carried by pilasters along the west wall and 12-in. I-beams on steel columns along the center of the building.

The three pumps, made by the Alberger Pump & Condenser Co., are of the double-suction, centrifugal, horizontal-shaft, volute type, with 30-in. discharge. These are shown in Fig. 2. The impellers are of bronze. The 24-in. suction pipes are of ¼-in. steel plates. They extend through the floor and back wall of the suction bay, and have bell ends 12 in. from the floor of the bay. The 30-in. discharge pipes are of similar construction. They extend through the west wall of the building (Fig. 3)

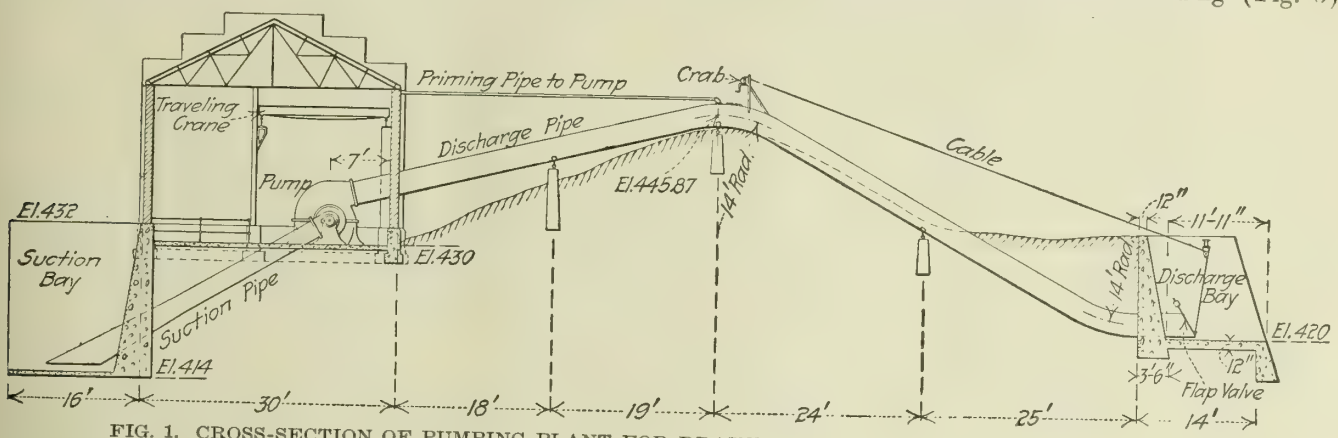


FIG. 1. CROSS-SECTION OF PUMPING PLANT FOR DRAINING THE HARTWELL LEVEE DRAINAGE DISTRICT, ILLINOIS

and converge on curves of 21 ft. from 20 ft. to 5 ft. c. to c. at the top of the levee, and then run parallel with each other down the levee and through the back wall of the discharge bay. The ends are provided with flap valves (Fig. 1).

The pumps have 2-in. drain pipes running from the bottom of the volute under the floor to a common valve box built in the floor, and are drained into the suction bay. The pumps are guaranteed for a capacity of 22,500 gal. per min., an efficiency of 75% at 21-ft. total dynamic head and 300 r.p.m.; 68% at 12 ft. head, 251 r.p.m., and 58% at 8 ft. head, 251 r.p.m.

Pump Drive and Speed-Change Device

Each pump is driven by a 150-hp. 12-pole motor of the slip-ring type for 2,200-volt three-phase 60-cycle alternating current. They run at 600 r.p.m. with no load. They are guaranteed to withstand a voltage of 5,000 volts for one minute and to have a full-load efficiency of 90%, with an 89% power factor. They are connected to the pumps by 44-in. Morse silent chains of 2-in. pitch, which are guaranteed to give an efficiency of

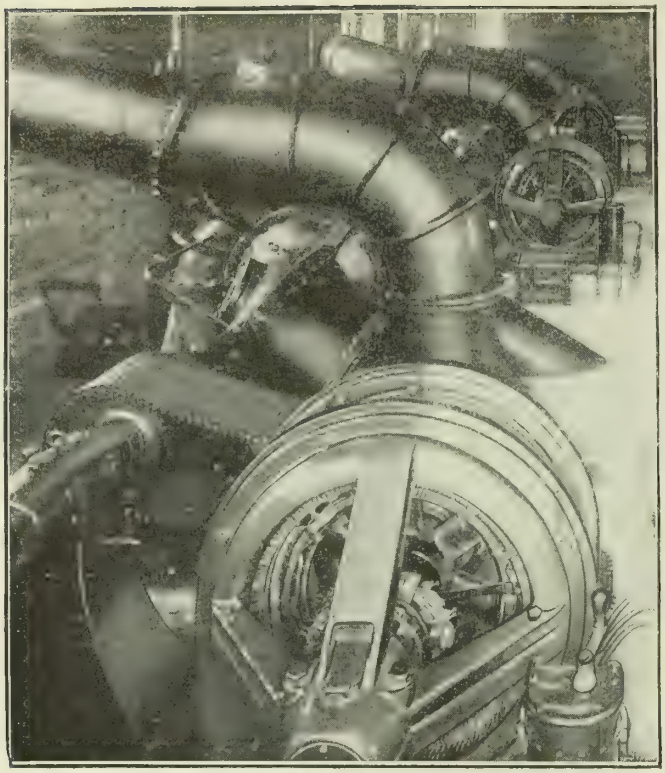


FIG. 2. DRAINAGE PUMPING PLANT WITH CHAIN DRIVE FROM ELECTRIC MOTORS TO CENTRIFUGAL PUMPS

98%. Each motor is equipped with pulleys of three sizes to give the pumps the speed required at the various heads. Power is supplied by the Northwestern Power Co., of Keokuk, Iowa, and is transmitted to Hull, Ill., at 110,000 volts, two-phase. There it is transformed and goes through a frequency changer and is transmitted from there at 33,000 volts, three-phase. The total distance of transmission is about 120 mi. The substation is in the northeast corner of the pumping station.

The pipes for priming the pumps are taken from the discharge pipes on top of the levee, 3-in. air lines being brought into the building overhead and through a safety tank 10 ft. long and 36 in. diameter to a compressor run by a 10-hp. motor. The purpose of the tank is to catch the entrained water. The pipe from the vacuum pump is taken out at the top of the tank. This method has proved superior to the barometric column method.

This is said to be the largest drainage pumping plant on the Illinois River, and probably the largest electrically operated drainage pumping plant in the country.

Method of Varying Pump Speed

The speed of the pumps is varied to suit the conditions of water level by changing the chain sprocket on the motor shaft. Three pulleys are employed, with diameters of 8.11, 9.06 and 11.27 in., made with a slip fit on the shaft. The apparatus used in making the change is shown in Fig. 4. The sag of the chain is taken out by placing a pair of rigid frames beneath it. The frame for the upper run of the chain is bolted to it at one end, and its other end is raised by the hoisting chain of the traveling crane. The frame of the lower run of the chain is raised by a jack.

The motor is then shifted inward by means of its take-up screws until the pulley is clear of the lugs on the chain. A screwjack device placed on the end of the shaft and hooked over the pulley is used to pull off the latter. The new pulley is lowered into place by a sling from the traveling crane, and another jacking device, which is hooked to the arms of the motor frame, is then used to pull this pulley upon the shaft. The one man in charge of the plant can change the pulleys on all three motors and have the pumps running again in 30 min.

The largest pulleys will seldom be used, probably once in three or four years. The smallest and intermediate pulleys will be interchanged probably three or four times a year. The pumps (with small pulleys in place) were started March 20, and ran for 60 days before it was necessary to apply the intermediate pulleys on account of high water. These remained in use during the exceedingly rainy period and consequent high-water stage of the river. At the beginning of the dry season in the fall the small pulleys will be replaced and will probably continue in service until next spring.

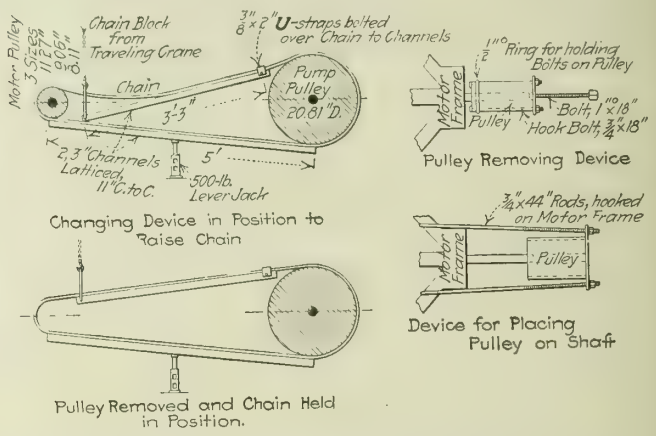


FIG. 4. APPARATUS USED IN CHANGING THE CHAIN SPROCKET PULLEYS ON THE MOTOR SHAFT TO VARY THE SPEED OF THE PUMPS

The tests so far made have been insufficient to determine exactly the friction head. The present instructions

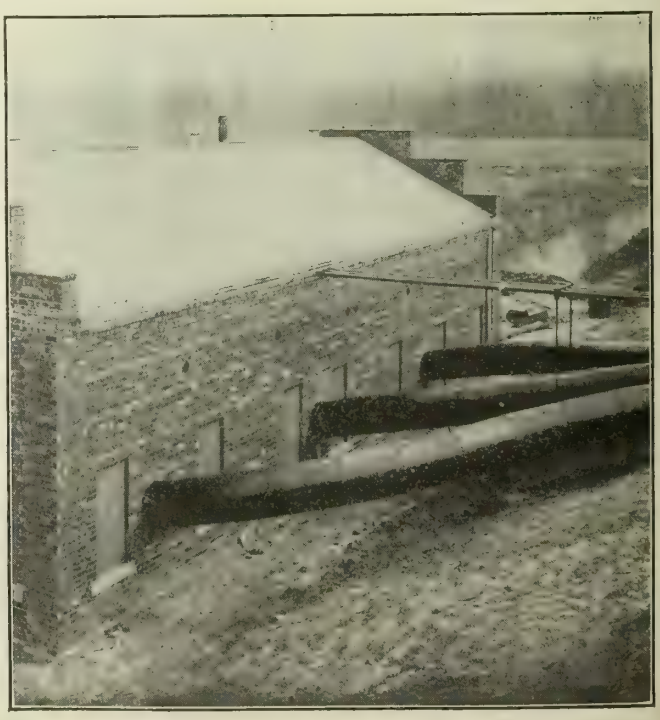


FIG. 3. DISCHARGE PIPES OF DRAINAGE STATION AND OVERHEAD LINES FOR PRIMING PUMPS

to the operator are to use the small pulleys for heads of from 0 to 4 ft., the intermediates for from 4 to 10½ ft., and the large pulleys for heads above 10½ ft. These are static heads only.

Operation and Engineering

There is a brick dwelling, about 300 ft. from the pumping station, for the use of the operator, who is also supplied with a motor boat. He is employed 12 months in the year and is required to send daily reports to the district engineer on the form (7¼x5½ in.) shown in Fig. 5.

Hartwell Drainage and Levee District
Greene County, Illinois

PUMPING RECORD

Weather ..... Month ..... Day ..... Year .....
Rainfall ..... Inches 191

	Hours Run	Time of Running	Pulley No.	R. P. M	Approximate Amperage
Pump No. I					
Pump No. II					
Pump No. III					

Total Meter Reading 6:00 P. M. .....
K. W. H. used .....

River Gauge Reading 7:00 A. M. ..... Ft.
Ditch " " 7:00 A. M. ..... Ft.
River " " 6:00 P. M. ..... Ft.
Ditch " " 6:00 P. M. ..... Ft.
Average head - - ..... Ft.

Caldwell Engineering Co.
Engineers
Jacksonville, Illinois

Operator

FIG. 5. DAILY-REPORT FORM, HARTWELL STATION

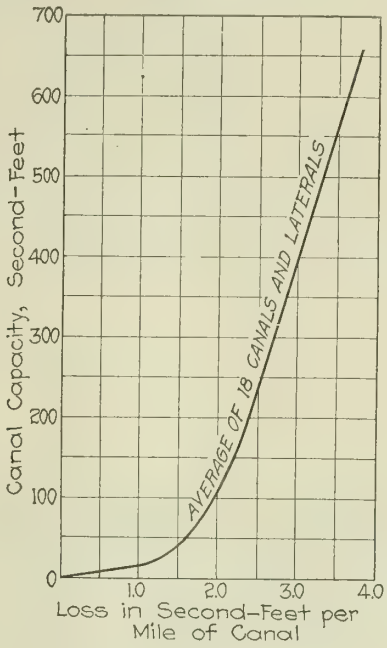
These works were designed by H. L. Caldwell, Chief Engineer of the Caldwell Engineering Co., Jacksonville, Ill., and were built under the supervision of S. J. Dalton, Jr., Field Engineer. The contractors were as follows: Levee reinforcing, Barston & Millard, Peoria, Ill.; pumping station, Arrow Engineering Co., St. Louis, Mo.; gravity outlet, J. D. Weaver, Jacksonville, Ill.; ditches, R. H. & G. A. McWilliams, Chicago, Ill.

Transmission Losses in Modesto Irrigation Canals

By Kenneth A. Heron*

Where open unlined earth canals are used for the distribution of water in an irrigation system a large part of the water appropriated is lost in transmission between the source of supply and the farms. To determine just what this loss amounts to in the Modesto Irrigation District, in California, a series of measurements was made by me during the irrigation season of 1914.

Owing to the warm summer temperature and the sandy formations and soils of the district, the transmission losses were found somewhat higher than is ordinarily the case. These losses are divided into those from seepage, evaporation and leakage. The evaporation loss is such a small part of the seepage loss that no effort was made to distinguish between the two, which were combined and called seepage. The following general methods were pursued in determining the seepage losses. A time was selected when the flow of a lateral or canal had been constant for some hours. It was then measured with an A. Lietz current meter at the head, or at the high end of the portion of the lateral or canal section under observation. Measurements were made at points lower down after such periods of time as it was computed would be required by the same water that was last measured to reach the new measuring point. As some of the canal sections under observation were as much as nine miles in length an entire day was frequently required to obtain the measurements on one lateral. All visible losses from the canal, such as leaks through boxes, water turned out of the canal into another canal and leaks through banks, were carefully measured. Large irrigation heads (average 20 sec.-ft.) are used in this district, and consequently the flow in laterals is not subject to as many variations as is the case where a large number of small heads are drawn from a lateral. After the last measurement was made on the low end of the section under observation, it was ascertained if the intake discharge at the high end of the section had remained constant. Where any material change happened the measurements were repeated.



TRANSMISSION LOSSES BY SEEPAGE AND EVAPORATION

All the most important canal and main lateral transmission losses were checked by a system of daily gage readings and measurements, which were carried on throughout the season. As a result of all the measurements made, the accompanying curve has been drawn to show the average loss per mile in canals and laterals of various capacities. In a number of instances the results were quite different from what the curve would indicate, but cases of this kind were explained by local conditions.

It is thought that this curve represents average conditions in generally sandy areas such as exist in the San Joaquin and Sacramento Valleys in California.

*Irrigation Engineer, Modesto, Calif.

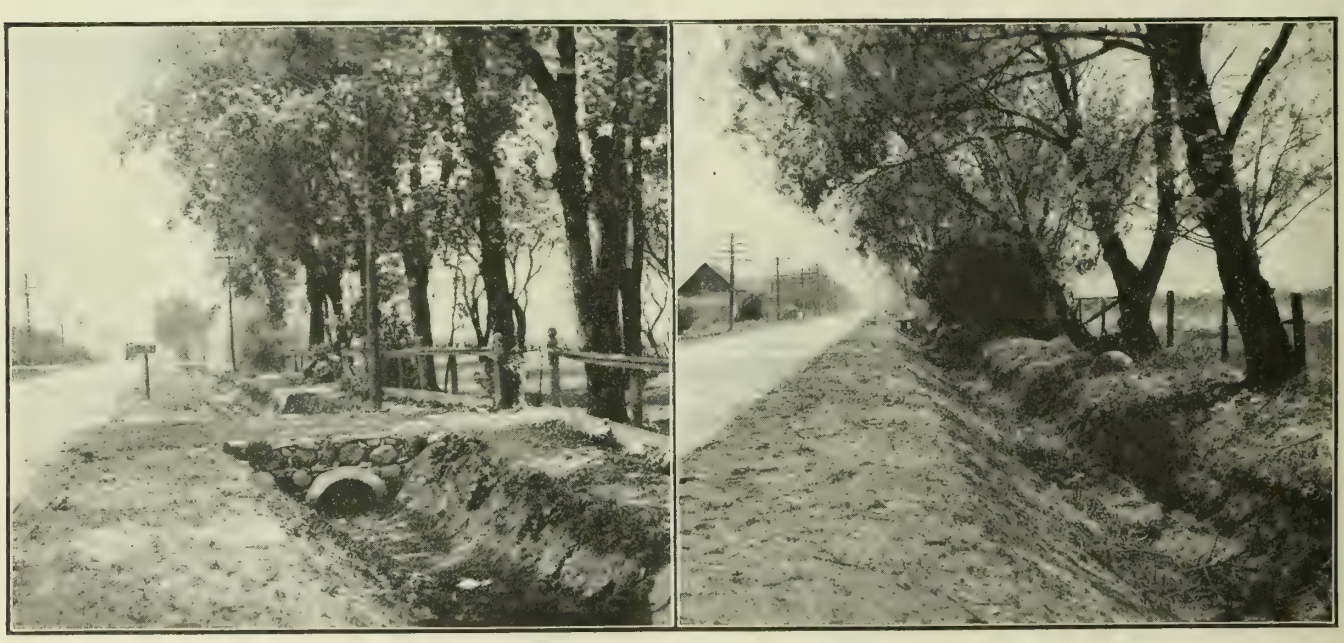
Industrial Accident Statistics—The industries which contribute the greater number of fatal accidents are railway employments and agricultural pursuits, each group being responsible for approximately 4,200 fatalities a year. Coal mining contributes more than 2,600, and building and construction work nearly 1,900. General manufacturing, while employing large numbers, produces only 1,800 fatal accidents. When the fatality rates are considered, metal mining ranks as most hazardous, with a rate of 4 per 1,000; coal mining coming next, with 3.5, and fisheries and navigation following with a rate of 3 per 1,000. Manufacturing industries as a whole rank lowest, with a rate of 0.25. The United States Bureau of Labor Statistics of the Department of Labor has just issued, as Bulletin 157, a report on this subject by Frederick L. Hoffman. The conclusion reached is that the number of fatal industrial accidents among American wage-earners, including both sexes, may be conservatively estimated at 25,000, and the number of injuries involving a disability of more than four weeks at approximately 700,000.

Revised Cross-Sections for Illinois Roads

By H. E. Bilger*

SYNOPSIS—An analysis of the highway problem of Illinois and the Middle West, where good local material for roadbuilding is scarce. Discusses how an attempt has been made to solve these problems as economically as possible by devising types of brick and concrete roads to fit rural conditions.

The proposed system of state-aid roads in Illinois comprises some 15,000 mi. and includes the main rural highways in each of the 102 counties of the state. With a construction problem of this magnitude and rapidly changing traffic conditions the important matter is not to complete the entire system within a specified time, but to construct in each locality roads of such types and dimensions as economically to satisfy present traffic requirements, and in addition be susceptible of reasonable modification to meet the requirements of the future.



SIX-FOOT EARTH SHOULDERS AND LARGE SIDE DITCHES FOR SURFACE DRAINAGE, 18-FT. CONCRETE ROAD, ILLINOIS HIGHWAY COMMISSION

In a state having a gross area of 55,000 sq.mi. there is such a wide variety of conditions as to admit the economical construction of very many different types of highway. Therefore it is not practicable, nor even desirable, to attempt the design of standard cross-sections to cover all the conditions encountered. Nevertheless, a certain number of these cross-sections constitute the group most frequently used, and which are termed "standard."

The necessary width of right-of-way is governed largely by the topographic conditions, but also by the type of the proposed improvements. On rural highways paved with brick or concrete there can be found no condition in the proposed Illinois state-aid system that will properly admit of a right-of-way narrower than 40 ft. It is highly desirable that the minimum width of right-of-way for all main traveled county roads be 50 ft. Cuts and fills will in many cases require a width of 60 or 70 ft., or even more.

Where a highway crosses a valley it is particularly desirable that the width of right-of-way be ample to afford space for borrow-pits, in order that the necessary material may be provided economically for the construction of the embankment. For this additional width the cost of farm land, even at $300 or $400 an acre, is almost negligible when compared with the expense necessarily incurred where filling material must be moved for a distance of over 300 ft.

Since the true function of a highway is not the transportation of freight at a minimum cost, it is evident that great expense in making grades easier than about 3 per cent. is not warranted by traffic considerations alone. Excessive cuts in order to provide an easy gradient through ordinary ridges merely add difficulties to the drainage problem.

Except for comparatively short lengths over ridges, it is particularly desirable that the width of graded roadway be not less than 28 ft. in order to provide for the maintenance of an earth road on each side of the pavement, where this has only a 10-ft. width. For probably at least nine months of the year weather conditions in Illinois admit of the economical maintenance of an earth road to a degree of perfection that induces the greater portion of the traveling public to abandon the pavement.

If the graded roadway is less than 28 ft. in width it becomes necessary to construct the pavement off the center line of the highway and have the entire earth roadway on one side. One objection to this is that in going in a certain direction the loaded vehicle on the pavement is

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BUILDING 3-FT. CONCRETE SHOULDERS AT CROSS-ROADS



WIDENING CONCRETE SHOULDERS TO 3 FT. AT CROSS-ROADS

required to take to the earth road almost entirely, for the vehicle coming in the opposite direction has practically no opportunity to turn out, even though it be empty. A counteracting objection to a pavement on the center line is the necessity for maintaining two parallel earth roads.

It yet remains to be proved whether it is more economical to maintain an earth road 15 ft. wide, and accommodating traffic in both directions, than to maintain two earth roads each 9 ft. wide. Considering the possibilities of future development, it would seem that the pavement should be at least approximately in the center of the highway.

Wherever practicable the side ditches are constructed with a 2-ft. horizontal base 2 ft. lower than the crown of the finished pavement. The horizontal base is not always economically practicable, but is dependent largely upon the character of the soil and also upon the contractor's facilities for doing the work. A V-ditch is about 6 in. deeper than the flat-bottom ditch. Its additional capacity is practically negligible, but under certain soil and other conditions it can be more economically built by machine work than the flat-bottom ditch.

For short stretches over ridges the width of the graded roadway may economically be narrowed to about 18 ft. as a minimum, if provision is to be made for two lines of traffic. The practicability of this construction depends largely on the omission of deep ditches on the ridges, where but a very small amount of water needs to be taken care of by the surface drains.

Discussion of New Cross-Sections

Cross-Section 1—The 10-ft. concrete pavement is particularly applicable for light or medium horse-drawn traffic, where the loaded vehicles move largely in one direction and the pleasure vehicles are more or less equally divided with respect to their direction of travel. Except for a small amount of slow-moving traffic, 10 ft. is the narrowest width a concrete pavement should ever have in Illinois, even on a level tangent.

Concrete pavements which are only about 8 ft. wide, where the coarse aggregate used is of sedimentary origin, readily yield along the wheel tracks under moderate steel-tired traffic. The 10-ft. width affords more or less opportunity for distribution of the wear, and consequently this width of pavement is more durable. The combination of conditions that make the adoption of a 10-ft. cross-section advisable is not so common in Illinois as might be inferred from the general preference given it by officials in many of the counties.

Durability and Width of Pavement

Inasmuch as the durability of a concrete pavement is measured largely by the wearing qualities of the coarse aggregate used, it is evident that under Illinois conditions, where practically the only coarse aggregate available is limestone or dolomite, there are no very strong arguments for a 10-ft. concrete pavement where horse-drawn traffic is heavy. Were diabase or other forms of good igneous rock available, the situation would be somewhat modified. A sandy clay soil for the shoulders favors a 10-ft. width, while gumbo and buckshot soils discourage its adoption.

Cross-Section 2—This is identical with cross-section 1, except that the roadway is on a fill and is only 28 ft. wide. The reason for the reduction of the width is to meet the many cases that arise where funds are not available for more expensive first-cost construction, and also to keep the embankment within the limits of the highway.

Cross-Section 3—The use of this cross-section is intended to be confined to short lengths of road over ridges. Excessive expense due to excavation is avoided by providing a graded roadway only 18 ft. in width, and by meeting the drainage requirements with concrete gutters. This cross-section virtually provides an 18-ft. roadway,



CONCRETE GUTTERS OF 16-FT. BRICK ROAD

since the shallow concrete gutters take the traffic as well as the pavement proper. This construction is adopted only where little water is to be cared for.

Heretofore this cross-section was designed with grouted macadam gutters, but the impracticability of constructing gutters of a type other than that of the pavement was soon demonstrated. While the 15-ft. concrete pavement is being laid there is but little additional labor expense incurred in laying the concrete gutters as a part of the pavement.

During construction the placing of the concrete in the pavement proper is always just a few feet in advance of the gutter. The thin forms along the line of the pavement proper are removed as soon as the concrete for the gutters has been placed; consequently they become part of the pavement. The economy of this cross-section is not at once appreciated from the office point of view, but becomes established when considered from the contractor's viewpoint.

The grouted macadam gutters cannot be constructed simultaneously with the pavement because time has to be given for the concrete to season. This delay, in addition to the new labor operations, equipment, etc., to be employed in constructing the grouted macadam gutters, practically demands the substitution of concrete.

This cross-section is applicable for all motor-traffic conditions and for all reasonably heavy horse-drawn traffic conditions where there are two lines of traffic.

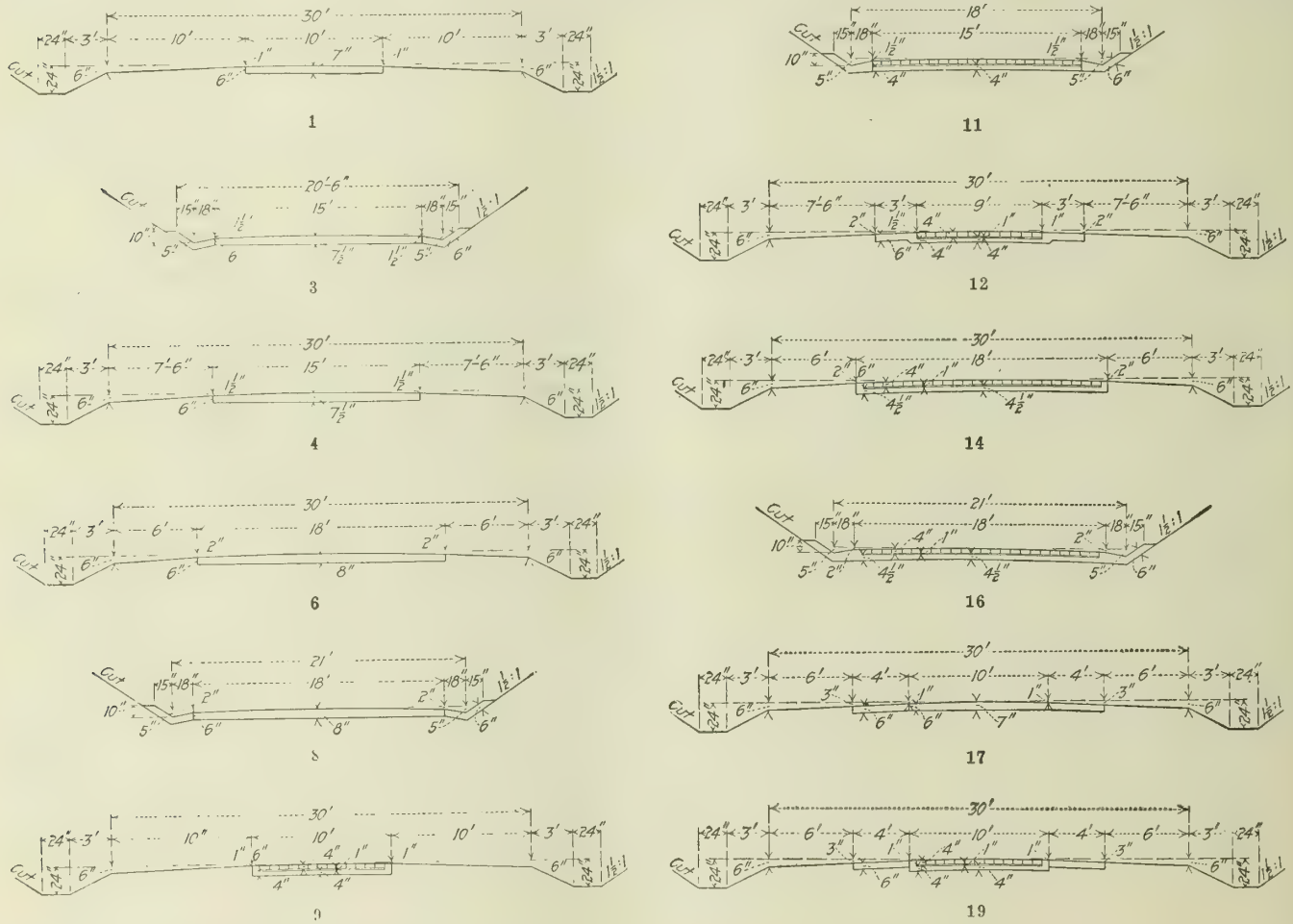
Cross-Section 4—The 15-ft. width of concrete pavement is rapidly growing in favor in Illinois. This width satisfactorily admits of two lines of horse-drawn traffic, and answers with more or less satisfaction the requirements of two lines of motor traffic at normal speeds when such traffic is not very dense.

Cross-Section 5—This is practically identical with cross-section 4, except that it is for a roadway on an embankment 32 ft. in width. The most developed areas of Illinois require a graded roadway, even on comparatively high embankments, of not less than 32 ft. in width. These cross-sections are not strictly consistent, but are designed to meet local requirements and preferences.

Cross-Section 6—Except under extremely dense traffic conditions, cross-section 6 owes its existence entirely to the motor vehicle. For two fast-moving lines of motor traffic safety requires that the width of the pavement be not less than 18 ft. An 18-ft. concrete or brick pavement constructed on a highway upon which there has never been a pavement of any kind can only mean a sudden revolution of traffic conditions. Logically this type would be reached by successive developments of less expensive construction and of narrower widths.

Cross-Section 7—This is identical with cross-section 6, except that the roadway is on an embankment and is 32 ft. in width.

Cross-Section 8—Like cross-section 3, this is especially applicable for short lengths over ridges. The virtual roadway is 21 ft. It would seem that conditions are not frequently encountered that would warrant the adoption of this cross-section, because of the additional width provided.



NEW ROAD CROSS-SECTIONS NOS. 1 TO 19, ILLINOIS HIGHWAY COMMISSION

Cross-Section 9—It will be noted that, beginning with cross-section 9, the variation from the preceding cross-sections is confined almost entirely to the character of the pavement. In addition to being applicable under all conditions noted under cross-section 1, it is also suitable for the most severe horse-drawn traffic to be found in any rural community in Illinois.

As a rough average it has been found that the contract price of the pavement proper (cross-section 9) over and above that of the concrete cross-section 1 is about 70c. per sq.yd. Cross-section 9 makes use of local aggregates for the concrete, which as a rule are less expensive than the imported. Local sand, gravel and stone in Illinois are not always acceptable for concrete pavements, but with judgment they can usually be employed with safety and economy in the construction of concrete bases for brick.

A probable additional point in favor of cross-section 9 is that its width may be readily increased at any time future conditions demand. The probable life of a brick pavement is such that while only a 10-ft. width is originally warranted, its future widening may be accomplished while the pavement is still far from worn out.

Cross-Section 10—This is identical with cross-section 9, except that the roadway is on an embankment and is only 28 ft. in width.

Cross-Section 11—This corresponds with cross-section 3. The virtual roadway provided is 18 ft. in width. The remarks relating to the concrete gutters of cross-section 3 apply also to this type. The concrete gutters are constructed as a part of the concrete base and are of the same materials and mixture. Considering the small amount of traffic that comes upon these gutters, and also the fact that much of this is motor traffic having rubber tires, it is quite probable that the length of life of the gutters approaches that of the brick pavement.

Cross-Section 12—This is a development of the narrow brick pavement with macadam shoulders. As in the construction of grouted macadam gutters, it was found in practice that gravel or macadam shoulders are not often economical or advisable in conjunction with a brick or concrete pavement. All materials employed and all operations of construction throughout the entire width of pavement should be identical so far as practicable.

The 3-ft. concrete shoulders are constructed as a part of the base. The mixture for the concrete base is 1 : 3½ : 6, whereas the mixture for the shoulder is 1 : 1¾ : 3. By adopting this mixture for the shoulders the ratio of fine to coarse aggregate remains constant, while exactly twice the amount of cement is required in one batch for the shoulders as in one batch for the base. This simplifies construction operations.

It is anticipated that cross-section 12 will provide the substantial equivalent for the 15-ft. brick pavement and at somewhat less expense. Probably more than 80 per cent. of the horse-drawn traffic will naturally be confined to the 9-ft. width of brick, and the use of the concrete shoulders will be largely for passing.

Cross-Section 13—This cross-section is identical with cross-section 12, except that the roadway is on an embankment and is 32 ft. in width.

Cross-sections 14 and 15—These are types which are demanded by actual necessity in extremely few rural communities in Illinois. Cross-section 15 is identical with cross-section 14, except that it is on a fill and is consequently 32 ft. wide.

Cross-Section 16—With cross-sections 14 and 15, this is representative of as durable a type of rural highway improvement as is commercially possible in Illinois.

Cross-Section 17—Except for rare occasions, this cross-section is destined soon to become obsolete. Cross-section 18 is identical with cross-section 17, except the width of roadway, which is 32 ft.

Cross-Section 19—The macadam shoulders are destined soon to be entirely abandoned, as also in cross-section 20, which is identical with cross-section 19, except the width of roadway, which is 32 ft.

Conclusions—A road cross-section can be designed intelligently only in the light of all the conditions peculiar to the locality in which the road is to be built. Economic procedure in rural highway improvement is measured by the degree of thoroughness of the analysis of the local conditions, and in strict compliance with those conditions.

The work of the Illinois State Highway Department is carried on under the direction of William W. Marr, Chief State Highway Engineer, with whose approval the foregoing is published.

Longitude Determinations of Great Accuracy

By Owen B. French*

During the summer of 1914 the United States Coast and Geodetic Survey determined three differences of longitude with a higher order of accuracy than had been obtained previously. The work was done in coöperation with the Royal Prussian Geodetic Institute of Potsdam, Germany, for the purpose of furnishing a more accurate connection between the longitude nets of America and Europe, and also to secure data sufficiently accurate to show any possible change in the relative positions of the two continents.

When this work was first considered in March, 1912, it was proposed to make the new determination by wireless telegraphy. The observers were to determine the difference of longitude between Cambridge, Mass., and the Azores Islands, using signals sent from Glace Bay, Canada; while German observers were to make the determination between the Azores and Potsdam, Germany, using signals sent from the wireless station at Clifden, Ireland. The distances between the sending stations and their receiving stations are practically equal, so that the time of transmission would be eliminated.

The difficulty in securing suitable recording apparatus for wireless signals and several other considerations caused the abandonment of this plan and the substitution of the method by cable between Far Rockaway, Long Island, N. Y., and Borkum, Germany, including an accurate connection with the longitude net at each end of the cable.

The connection of the cable station at Far Rockaway, N. Y., with the longitude net of the United States was accomplished by Fremont Morse and Owen B. French, of the United States Coast and Geodetic Survey. Two old stations, Harvard College Observatory, Cambridge, Mass., and New Naval Observatory, Washington, D. C., were used for this connection, with a new direct determination also between the old stations, the old work having been done before the transit micrometer came into use in the Coast and Geodetic Survey. Harvard Observa-

*Assistant, Coast and Geodetic Survey, Washington, D. C.

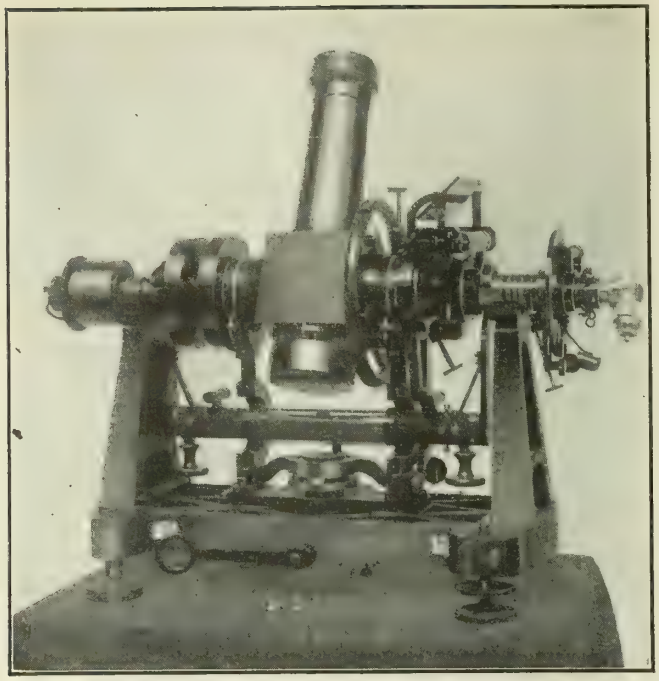


FIG. 1. MOST RECENT TYPE OF TRANSIT INSTRUMENT FOR LONGITUDE DETERMINATION

tory is considered as the initial station for all United States longitudes, as all the old transatlantic longitudes have been connected with it.

New instruments, made by Bamberg, of Berlin, Germany, were received by the Coast and Geodetic Survey just before this work was begun and were used here for the first time. The transits are of the broken-telescope type, with the eyepiece and transit micrometer at one end of the axis (Fig. 1). The frame supporting the telescope axis is low and very rigid, having two supporting screws at either end of one side and a third screw in the middle of the other long side. Although this method of supporting an instrument causes a disturbance of the azimuth whenever the axis is leveled, the instruments proved very stable. The field of the telescope being sufficiently large, the telescope was reversed in the middle of the observation on each star, thus eliminating the necessity for considering collimation and pivot inequality.

The chronographs for receiving the records, made by Fuess, of Berlin, Germany (Fig. 2), are of the fillet type, with electric control for starting and stopping. The whole apparatus was so arranged and wired that the observer could control all the electric circuits while sitting at the telescope without touching the instrument or pier. The electricity for operating the various relays and illuminating the field of the telescope was furnished by dry cells.

At Cambridge and Washington the standard observatory clocks were used. At Far Rockaway the German clock was used for the United States work as well as for the cable work. All the clocks were kept at practically a constant temperature.

The differences of time resulting from this work are:

	Min.	Sec.	Sec.
Cambridge to Far Rockaway.....	10	29.031	±0.0031
Far Rockaway to Washington.....	13	15.704	±0.0028
Cambridge to Washington.....	23	44.738	±0.0024

The error of closure is 0.003, which is smaller than might be expected from the probable errors shown in the last column. These probable errors are not inferior to those obtained in any foreign country and are about half as large as the best previously obtained by the United States Coast and Geodetic Survey, which has charge of all primary longitude work in the United States.

The foregoing results depend upon observations made on eight to ten nights for each line. Errors of star-place were eliminated by observing the same stars at both stations of each line. Three time sets, each consisting of five or six time stars and an azimuth star, were observed each night with two exchanges of signals between stations. The observers exchanged stations near the middle of the observations on each line, each taking his instruments with him every time, thus making the final results practically free from personal equation.

The personal equations on the three lines are: +0.020, —0.001 and +0.004 sec. The first may be considered as due partly to the instruments being new and not in perfectly smooth working condition and slightly to inexperience of the observers with this style of instrument. These observations, therefore, confirm previous statements that observations made with the transit micrometer practically eliminate the need for considering personal equation between the observers.

The old value for the difference of longitude between Cambridge and Washington agrees exactly with the value given. This must be classed as accidental when we consider that the old value was based upon two lines, one of which received a correction of 0.031 sec. and the other of 0.010 sec. in the adjustment of that work. However, the old longitude determinations are of a high order of accuracy, where there was an exchange of observers, as has been shown by several comparisons with work by modern instruments.

In view of the statement that this work was undertaken partly for the purpose of showing a possible change in the relative positions of the two continents, it may be interesting to note that the results recently obtained by observers of the United States Naval Observatory for the difference of longitude between Washington and Paris, using wireless telegraphy, agree more closely with the old transatlantic longitudes than might be expected from the probable errors of the old results, and do not differ enough to furnish proof regarding any change in position of the continents.

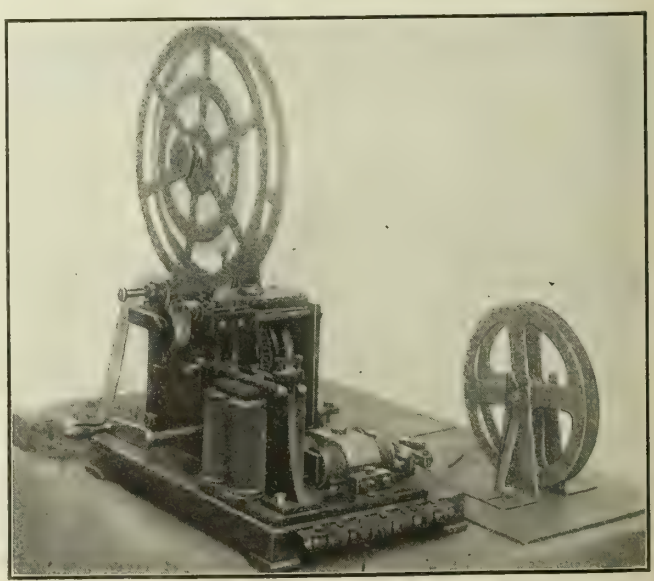


FIG. 2. RECORDING INSTRUMENT FOR LONGITUDE DETERMINATION

Building the Mathis Dams--II

By E. Lauchli*

SYNOPSIS—Notes on the design and construction of a dike dam built upon a reinforced-concrete mattress and having a very deep reinforced cutoff wall. Effect of ground-temperature differences on cutoff-wall stresses.

In creating the Mathis reservoir a small dike dam across a depression leading from the basis was required in addition to the main dam across the Tallulah River. Various structures were considered for closing the gap. One was an earth fill with reinforced-concrete core wall; but this was abandoned for lack of proper material. The soil at and near the site consisted of sand mixed with a very little clay and decomposed mica schist. A masonry dam of the gravity type was out of the question owing to lack of adequate foundations. The design of a reinforced-concrete structure was then prepared, with a cutoff wall 10 to 15 ft. deep and buttresses resting on spread footings.

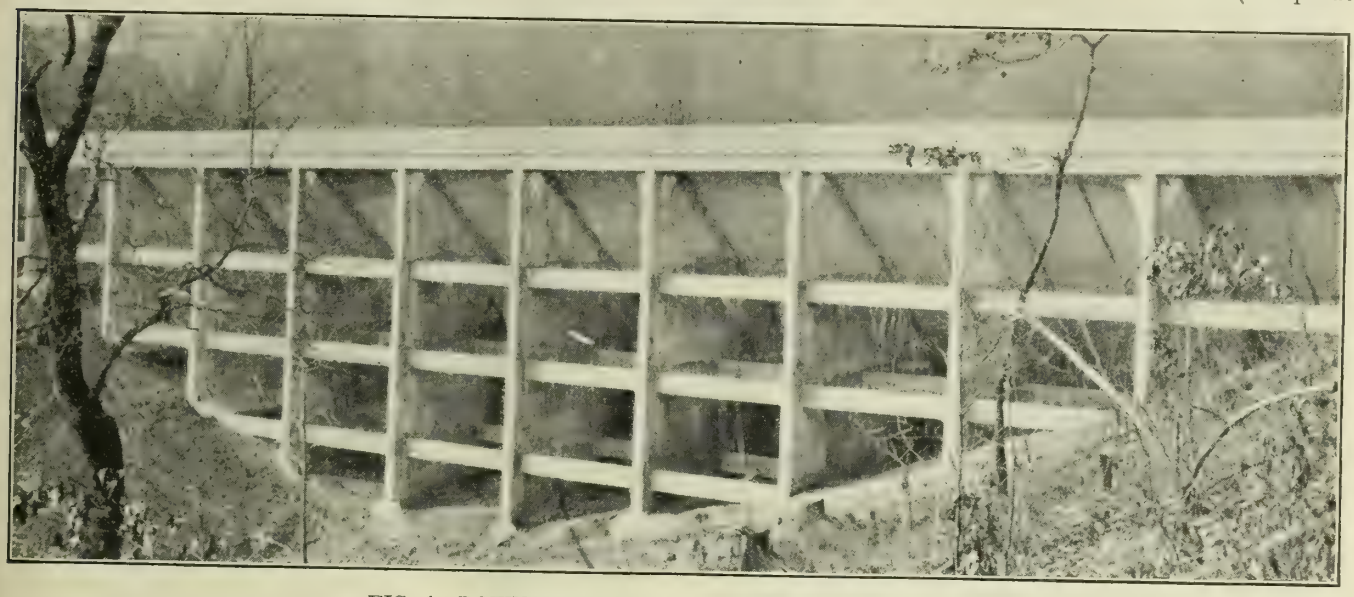


FIG. 1. DOWNSTREAM VIEW OF MATHIS DIKE DAM

Reinforced-Concrete Dam Selected

While this design was being elaborated test pits sunk at various points of the proposed cutoff wall revealed the fact that rock was not available except at great depth, and that the material penetrated was chiefly of the kind referred to before, together with loose rock which weathered rapidly on exposure.

The design was therefore modified to suit these new conditions. The buttresses were spaced 18 ft. c. to c., and instead of spreading their footings, a heavily reinforced concrete mattress was provided (1) to reduce the pressure on the subsoil, (2) to avoid unequal settlements, (3) to prevent the buttresses on the side slopes from moving sideways, and (4) to increase the stability of the structure against sliding.

The pressure on the foundation is uniform with the reservoir empty. With water at El. 1692 (3 ft. allowance being made above maximum level for wave action) the pressure at the heel and toe of the dam is 920 and 1,370 lb. per sq.ft. respectively. The friction coefficient against sliding is 0.47. However, in order to further increase the stability of the structure against sliding, a longitudinal reinforced-concrete rib was provided at the toe and another at the center of the lower side of the mattress. The latter is reinforced with 1-in. corrugated steel bars, placed so as to take care of positive and negative moments. Near the buttresses the depth of the mattress is increased to take care of shearing stresses.

Care was taken to exclude the possibility of water pressure under the mattress. To this end, the cutoff wall was carried down to rock 30 to 57 ft. (except at one end) and its junction with the mattress and deck was amply reinforced. Weep holes were left through the mattress.

Design of the Buttresses and Decks

The buttresses were made of 1:3:6 concrete (the design allowed 300 lb. per sq.in. for concrete in compression and 100 lb. for shear). From the mattresses up to El. 1670 the buttresses are 16 in. thick. and 14 in. above that elevation. Although 10 in. would have been ample to resist the stresses, it was found advisable to increase the thickness to provide ample working room.

When pouring one of the last buttresses, a mixture of 1:2:4 concrete was used. This showed that economy in labor would result by using a rich mixture for work of this kind, as much spading and finishing could thereby be avoided.

The decks were made of 1:2:4 concrete (unit stresses of 600 lb., 60 lb. and 14,000 lb. per sq.in. being allowed for concrete in compression and shear and for tension in steel respectively). As little information was available on the corrosion of steel reinforcement embedded in thin concrete slabs subjected to hydrostatic pressure, it was decided to curve the lower side of the deck, thus making each slab an arch capable of bearing the hydro-

*2 Wall St., New York City.

static pressure, in case of any depreciation of the steel reinforcement which might take place in course of time.

The decks are free to expand or contract horizontally, and strips of asphalted felt are provided between the deck and the haunches so as to insure watertightness. The abutting surfaces of the buttress tongues and of the decks are painted with asphaltum.

Ground Temperature Variations

During construction the question arose as to the possibility of vertical temperature cracks developing in the

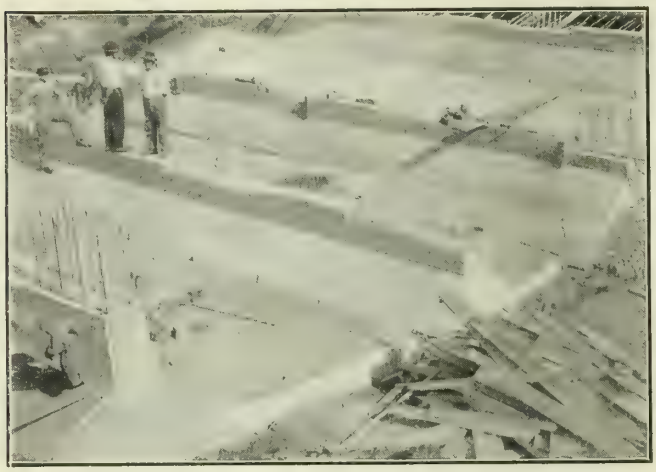


FIG. 2. FOUNDATION MATTRESS FOR DIKE DAM

cutoff wall, which cracks might enable water to find its way under the mattress. The writer carried on a series of observations in bore holes 2.5 to 45 ft. deep to ascertain the variation between ground and air temperature in the vicinity of the structure.

The ground temperature, even in December, at the bottom of the 45-ft. hole was found to be constant at 61.5 deg. F., which is 2.5 deg. higher than the average yearly air temperature here. The temperature recorded at the bottom of the 16-ft. hole ran from 53 to 56 deg. F. It was anticipated that the upper part of the cutoff wall would be subjected to nearly the same temperature variations as water in the reservoir—that is, from about 34 to 60 deg. F. Therefore the upper 15 to 20 ft. was reinforced with $\frac{5}{8}$-in. vertical rods spaced about 2 ft. c. to c. and with 1-in. horizontal rods spaced 12 in. c. to c. At 2.5 to 3 ft. the ground was subjected to practically daily temperature variations; therefore the concrete mattress, in spite of its heavy steel reinforcement, was covered with 3 ft. of earth, so as to minimize the effect of temperature changes.

The decks are of course fully exposed to temperature variations, but are free to expand or contract horizontally. In certain instances, with the reservoir empty, the joints opened from $\frac{1}{16}$ to $\frac{3}{16}$ in. per panel. The beams between buttresses were poured during the summer of 1913. The maximum air temperature was about 110 deg. F. in the sun. During the winter of 1913-14 the minimum air temperatures were from 12 to 15 deg. F., yet only hair cracks were apparent in a few beams.

Methods of Construction

One wooden derrick with a 60-ft. boom and one steel derrick with a 100-ft. boom handled the material excavated from the cutoff trench. The excavation was made with picks and shovels, no blasting being required. The sides of the trench stood well, requiring no bracing or sheeting, even when 57 ft. deep. However, no chance was taken, and enough bracing was provided to protect the crews against a possible cave-in. After rock had been reached, drills were put to work in order to ascertain the nature of the underlying rock. Except in a few instances, a soft solid rock was encountered which disintegrated rapidly when exposed. All bore-holes, except Nos. 8, 9, 10, 11 and 20 (Fig. 4) were carried down with machine drills, the others being churned.

After holes No. 7 and No. 8 had been put down, it was feared that no rock could be found except at great depth, thus necessitating much excavation and concrete, and an attempt was made to drive steel sheetpiling, as shown in Fig. 4. The result obtained can hardly be called successful, and only about 50 lin. ft. was used. It was then decided to provide all test holes with grout pipes, extending these to the surface of the ground, on the downstream side of the deck and to grout the holes under high pressure, should leaks develop with the reservoir full.[1]

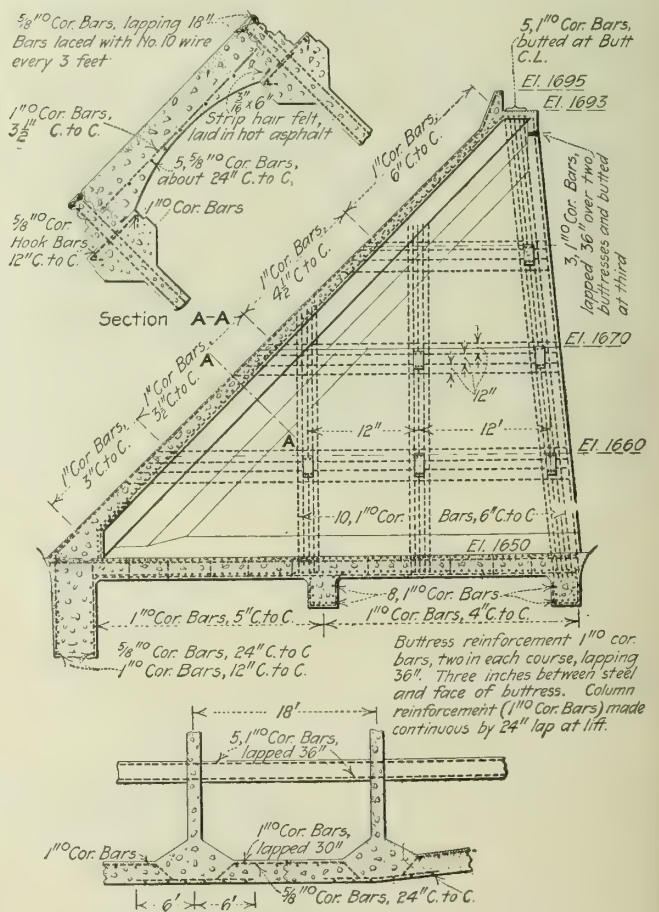


FIG. 3. DETAILS OF MATHIS DIKE DAM

The cutoff wall was concreted in sections, between wooden bulkheads, the abutting surfaces of the concrete sections being tongued and grooved. A 1:3:6 mixture was used, one-man stones being embedded in it.

The concrete plant (see Fig. 2 of Part I of this article) consisted of a ½-yd. cube mixer, located about 30 ft.

[1]After construction was completed and the reservoir filled to maximum level, the grout-pipe caps were removed and it was found that half of the pipes would discharge from 0.5 to 12 gal. per min. They were then grouted under a pressure of 70 to 85 lb. In general they took comparatively little grout—one to four sacks of cement each, although one or two pipes took from 12 to 16 sacks.

back of the cutoff wall, at the center of the structure. The concrete was handled with derricks, from the mixer to the forms, in special buckets on a car rolling back and forth over a track laid on the top of the buttresses. A 1500-ft. cableway conveyed crushed rock and sand from a construction railroad, 1¼ mi. long, connecting the Tallulah Falls R.R. with the crusher plant at the main dam, a quarter mile above.

About 180 cu.yd. of concrete was laid per week, the maximum being 478 cu.yd. The whole structure involved 4523 cu.yd. of concrete and 288,830 lb. of reinforcing steel—that is, 64 lb. of steel per cu.yd. of concrete. An average of 12,600 lb. of steel was laid per week (six days) and a maximum of 26,000 lb.

As negro labor was used almost exclusively, the inspection was made very rigid, no concrete being laid in the absence of inspectors. The mattress was concreted in sections 18 ft. wide between construction joints located half way between buttresses, beginning with the lowest section. The buttresses were concreted up to a height of 3 or 4 ft. together with the mattress; after that in 10-ft. lifts. The cross struts were poured usually a week or two after a buttress lift.

Timber forms were used throughout; but the arch forms for the lower side of the decks were lined with sheet iron. The decks were concreted in panels extending from buttress to buttress and in lifts of about 10 ft. A 1:2:4 concrete was used in the mattress, decks and cross-beams, and 1:3:6 in the balance of the structure. The specifications called for stones passing through a 2-in. and 2½-in. mesh for the respective mixtures.

The cost of this structure, involving 3100 cu.yd. of excavation and 4523 cu.yd. of concrete, was approximately $75,000, the cost of excavation and concrete being $3.40 and $14.45 per cu.yd. respectively. Cement cost $1.823 per bbl.

C. O. Lenz, Chief Engineer of the Georgia Railway and Power Co., was responsible for the engineering work on the entire Tallulah Falls power development. The late John Birkinbine was retained as consulting engineer on the reservoir project. C. G. Adsit was in charge of the construction work at the Mathis basin with H. T. Hartwell as resident engineer. The writer was in charge of the design of the two dams at Mathis and supervised their construction. The Hardaway Construction Co. was the subcontractor on the dams.

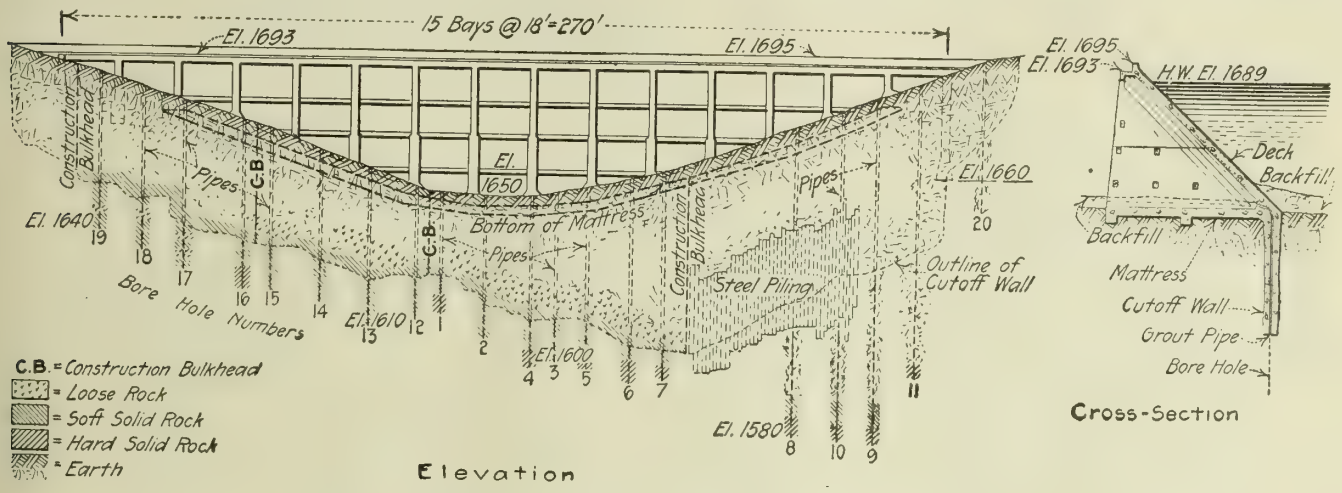


FIG. 4. ELEVATION OF MATHIS DIKE DAM AND FOUNDATIONS

State Control of Sewage-Treatment Works*

As the great majority of sewage-treatment works in America are small and frequently widely separated, it is apparent that the needed expert supervision cannot be obtained locally and that efficiency of operation can only be secured through some central authority. In several states the legislatures have empowered the state boards of health with authority to control the pollution of water-their approval is required before sewerage works can be constructed.

In municipalities where sewage treatment is intrusted to competent, expert employees and where this work has the strong moral and financial support of the citizens, the exercise of state authority and supervision is but little needed. But in such cases the coöperation of state and municipal officials is of mutual advantage.

For the state boards of health to act intelligently they should know the methods of operation and the results accomplished in all the sewage-treatment works in the state. They would then be able to act as clearing houses, supplying to one works the information obtained from several others operating under similar conditions. Such information must, of course, be applied to any particular works by one who is thoroughly conversant with local conditions and able to distinguish the peculiarities and differences involved. The operation of each works is a purely individual matter. Blindly copying, without due analysis of the local conditions, is generally fatal.

The state is interested in seeing that the existing works accomplish the best results possible, and the separate communities are naturally anxious that the works shall meet the requirements at the minimum expense for operation, additions and renewals. To this end, information is required on the following:

1. The purpose of the works; that is, are they primarily intended to protect sources of water-supplies or to prevent the creation of nuisance?
2. The construction of the works; that is, the details of each process that influences operating methods, rather than the stability of the structure.
3. The quantity and character of the sewage to be treated.
4. The methods of operation and the results accomplished.

*From a report of the Committee on Works Operation and Analytical Methods to the Sanitary Engineering Section of the American Public H alth Association, Rochester, September, 1915. The committee was composed of W. L. Stevenson, chairman, C. B. Hoover, F. E. Daniels and four others.

It is practically impossible to recommend a standard form of report blank to cover the many types of apparatus used in sewage treatment. If, however, the report form for each works in a state is prepared to meet the local needs, it can still contain essential data so recorded that reports of operation of similar types of apparatus in different works will be in identical form for comparison.

In preparing such forms it should be borne in mind that the small works are generally operated by employees lacking a technical education, and therefore clearness and simplicity should be obtained by having as much as possible printed, leaving only figures to be filled in.

It is again desired to call attention to the importance of recording essential data. In the majority of sewage-treatment works no provision is made to obtain a record of the rate of flow to the plant, even though such information is vital to proper operation. The committee strongly recommends that engineers in designing new works provide means for easy measurement of the flow and that measuring devices be installed in existing works not now so equipped.

Railway Coal-Storage Plants

Two widely different types of coal storage and handling plants for railway coal supply are described below, and in both of these the coal is stored in open piles.

The deterioration of coal in open piles is not a serious consideration, according to a report to the International Railway Fuel Association by a committee of which Hiram J. Slifer, consulting engineer, Chicago, is chairman. But the coal should be carefully studied to determine the best methods of preventing spontaneous combustion, and it is advisable to store that from different fields in different piles. The report stated that various investigations have shown that with most coals there is very little difference in the heating value whether stored in the open or under cover, while objections to a covering are the increased cost of the plant and probable interference with the handling of the coal.

Louisville & Nashville Railroad Plant

The coal-storage plant designed for the new Radnor yard of the Louisville & Nashville R.R., at Nashville, Tenn., comprises a semicircular coal pile, which is divided by a semicircular track for a locomotive crane.[1] The coal can be filled in over the ends of the track, leaving only a pocket for the crane. The general arrangement is shown in Fig. 1. This plant will serve both the Louisville & Nashville and the Nashville, Chattanooga & St. Louis railroads. The storage pile will contain about 12,300 tons for the former and 8200 tons for the latter, while the coaling station for locomotives will have a 600- and a 400-ton bin for the two roads respectively.

The crane will travel on two tracks of 29¼-in. gage, spaced 18 ft. 11 in. c. to c., and will be mounted on four four-wheel trucks, thus having ample stability for swinging. It will have a long braced steel boom, carrying a 5-yd. grab bucket and having a maximum radius of 110 ft.

Coal will be received in hopper-bottom cars and dumped into a track pit, from which it may be fed directly to the vertical bucket hoist of the coaling station, or it may be picked up by the locomotive crane and deposited on the storage pile. To supply the coaling station the crane takes coal from the pile and drops it into the pit, filling it to such height that the coal will flow by gravity into the automatic feeders of the bucket hoist.

The coaling station will be of reinforced-concrete, with a hoist tower of structural steel. It will serve three engine tracks. In addition to the coal bins, it will have storage for 75 tons of green sand and 10 tons of dry sand. The coal and sand will be raised by duplicate balanced buckets at the rate of 125 tons per hour for both buckets. It will be provided also with four steel weighing hoppers of 15 tons' capacity. The crane will be operated by steam and the hoists by electricity.

A coal-storage and coaling plant of the same type is in operation at Paris, Ky. This has a crane of 80-ft. radius (with 3-yd. bucket) and travels on a single track

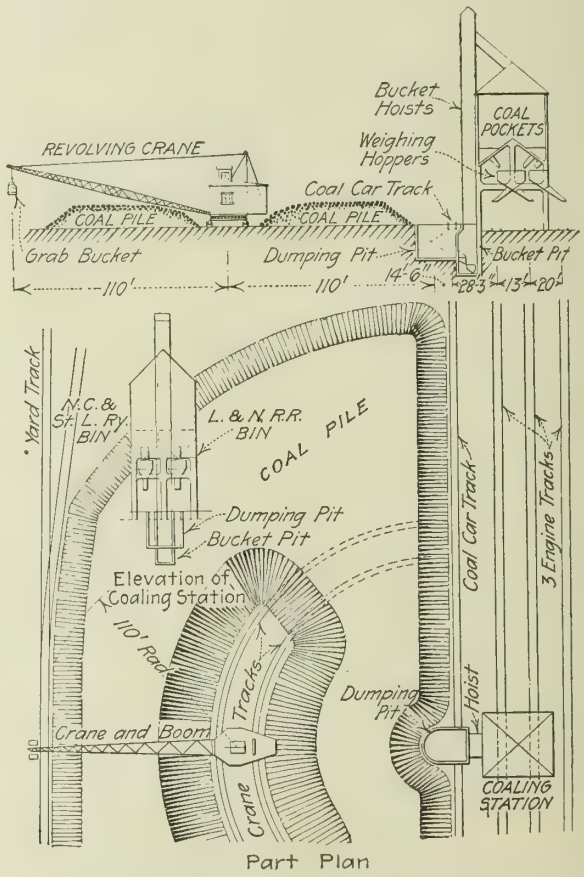


FIG. 1. COAL-STORAGE AND COAL-HANDLING PLANT WITH 110-FT. REVOLVING CRANE AT THE RADNOR YARD, LOUISVILLE & NASHVILLE R.R.

of 15-ft. gage. The coaling station has only a single bin of 400 tons' capacity, and has no weighing hoppers or sand-handling equipment. A similar plant with 110-ft. crane and 600-ton bin is being installed at Lebanon Junction, Ky. The plant at Paris has not been in use long enough (and has not handled enough coal) thoroughly to test the operation and advantages of the scheme, but it is satisfactory as to its mechanical operation. The only special features of the coaling stations used in connection with these storage plants are the open-back dumping pit

[1]This system, with a long-radius locomotive crane running on circular (or segmental) tracks, is patented by the Link-Belt Co., which supplied the cranes for the Louisville & Nashville R.R. here described.

and the unusual depth of the feeder and bucket-hoist pit. The cranes were built by the Link-Belt Co., and the coaling-station machinery by the Ogle Construction Co., of Chicago. The plants were designed and built under the direction of W. H. Courtenay, Chief Engineer of the Louisville & Nashville.

Southern Railway Coal Storage

Several reinforced-concrete coaling stations have been built recently by the Southern Ry., and at three of these provision is made for storing a supply of coal on the ground and handling this by means of drag-line buckets. The storage piles contain from 3000 to 10,000 tons each, with a depth of not more than 10 ft. The general arrangement of the plant is shown in Fig. 2.

The methods of delivering the coal to the storage pile and returning it to the coaling station are quite different from those at the Nashville plant already described. The railway cars dump the coal into a track hopper, from which it is fed by a loading device to an elevating conveyor of the bucket type. This delivers the coal either to the storage bin of the coaling station or to a gravity chute which discharges it at about the center of the storage pile. From this point it is distributed over the area of the pile by the drag scraper, which also delivers coal from the pile to the track hopper and elevator for the supply of the elevated coaling bin.

The storage pile is of irregular form and is surrounded by poles about 20 ft. apart for the attachment of the bucket lines. At the first plant these poles (termed pulling poles) were 20 ft. high, but it was found that poles of such height were not practicable without the use of outside guy lines, which would be undesirable. The height was reduced, therefore, to 12 ft. The poles are made of steel H-beams, each set in a concrete base. They are connected at the top by a row of 7/8-in. rods.

The operation of the scraper bucket is effected by means of a double-drum friction hoist driven by a 25-hp. motor geared directly to the countershaft. The hoist and motor are mounted in a housing in the coaling station or on a steel platform over the coal-receiving track. From the drum a steel hauling cable extends to the bail on the mouth of the bucket. The backhaul cable extends to a block hitched to one of the posts and thence to its attachment to the back of the bucket, as shown.

With this equipment the operator can take the coal delivered from the chute and distribute it between this point and the post to which the snatch-block is attached. To reach the space between two posts, lines may be fastened to them and the snatch-block attached to the lines, as shown in Fig. 2. By shifting the block from pole to pole any point within the coal-storage area can be reached.

When it is necessary to supply the bin of the coaling station, the position of the bucket or scoop is reversed, its mouth (or open end) being turned toward the coaling station, as in Fig. 2, the backhaul cable then becoming the hauling line. In this way coal is carried from the storage pile to the receiving hopper, from which it is fed to the bucket conveyor and elevated to the bin. Each plant is equipped with at least two of these scraper buckets, thus minimizing the work of changing the blocks and tackle.

The coaling station shown in the drawing serves three engine tracks. The main bin has a capacity of 955 tons, and there are three scale pockets of 15 tons each, making a total of 1000 tons. It has also a sand-storage bin, with delivery spouts, so that engines can take coal and sand at the same time. The design of these coaling plants is under the direction of the maintenance-of-way department, and for information and plans thanks are due to H. W. Miller, Vice-President of the Southern Ry.

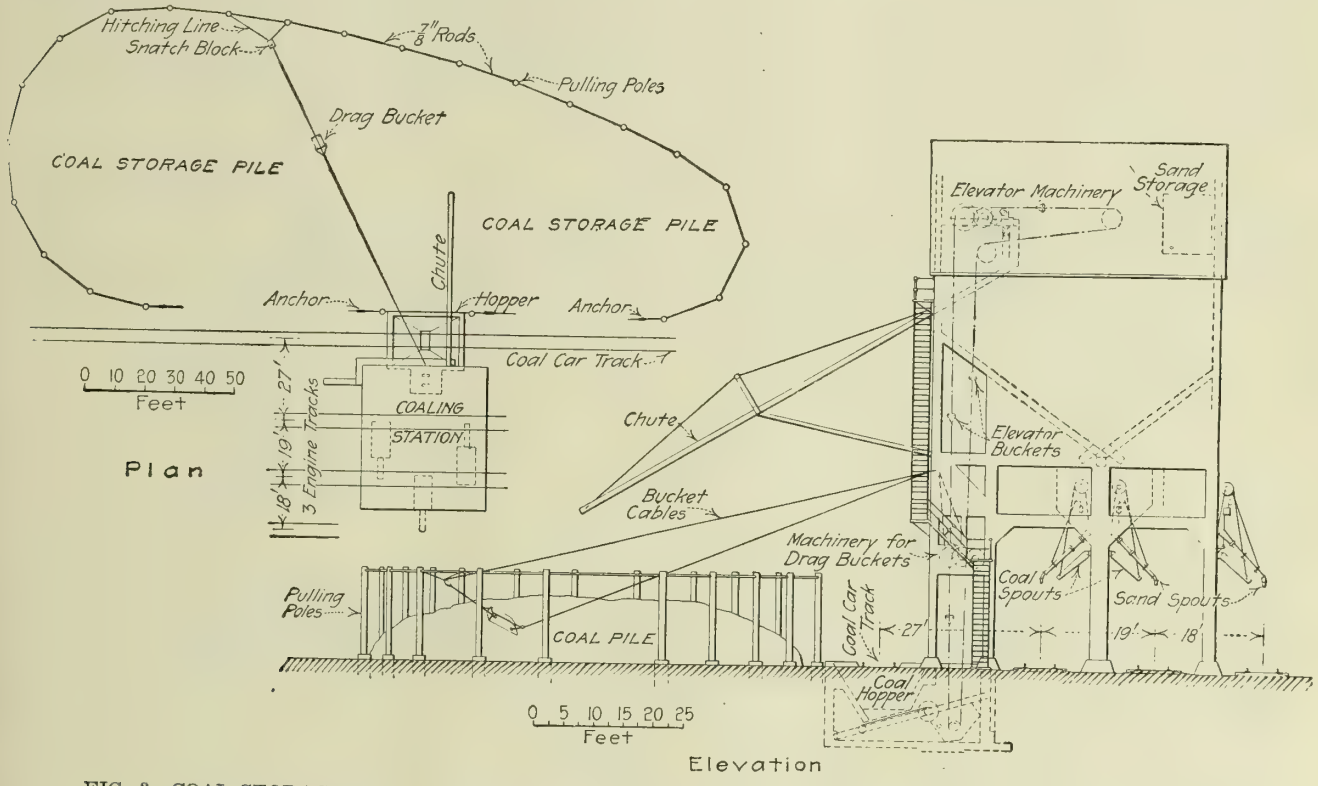


FIG. 2. COAL-STORAGE AND COAL-HANDLING PLANT WITH DRAG-LINE BUCKETS, SOUTHERN RY.

Laying Street-Railway Track Without Ties

By E. R. Horton, Jr.*

SYNOPSIS—The system of construction here described dispenses entirely with the use of ties. The rails are supported by reinforced-concrete girders, to which they are anchored at frequent intervals. Special features are the anchors, the use of continuous bed-plates under the rails, and the use of channel base plates to support the rail joints. The concrete is carried up to form the street paving along the tracks. The general purpose of the design is described and details of cost are given.

The type of track construction for paved streets which is here described, and shown in the accompanying drawings (Figs. 1 and 2), has been designed by the writer as the result of study and experience with low T-rails in concrete track paving on the lines of the Southern Public Utilities Co., of Charlotte, N. C. Acknowledgment is made to Edwin F. Taylor, general superintendent, whose coöperation has resulted in the adoption of this as the company's standard construction.

For the past five years the writer has been engaged in extending, reconstructing and paving the track systems of this company. The types of construction have been varied, but about 15 mi. has been concrete paving with 60- and 70-lb. T-rails. The ballasted cross-tie construction, with two-course concrete, has not been entirely satisfactory except in certain cases where conditions were favorable. Conclusions based upon both the successful and unsuccessful portions of the lines have resulted in the development of the present type. The most important of these conclusions may be stated as follows:

Concrete is satisfactory as track pavement when the track structure is not too flexible, and when very fine dust is excluded from the mixture. One of the most common causes of failure of track pavements is deflection of the rail; low T-rail will deflect on any yielding substructure to such an extent that the paving will be destroyed. Ballast when newly laid (and however thoroughly tamped and rolled) will shake down under traffic, and set up a wave motion in the rail. Therefore, where low T-rail is used, it must be so supported from beneath that the deflection will not be sufficient to injure the pavement. Reinforced concrete is most suitable for this purpose because it is permanent and will not settle.

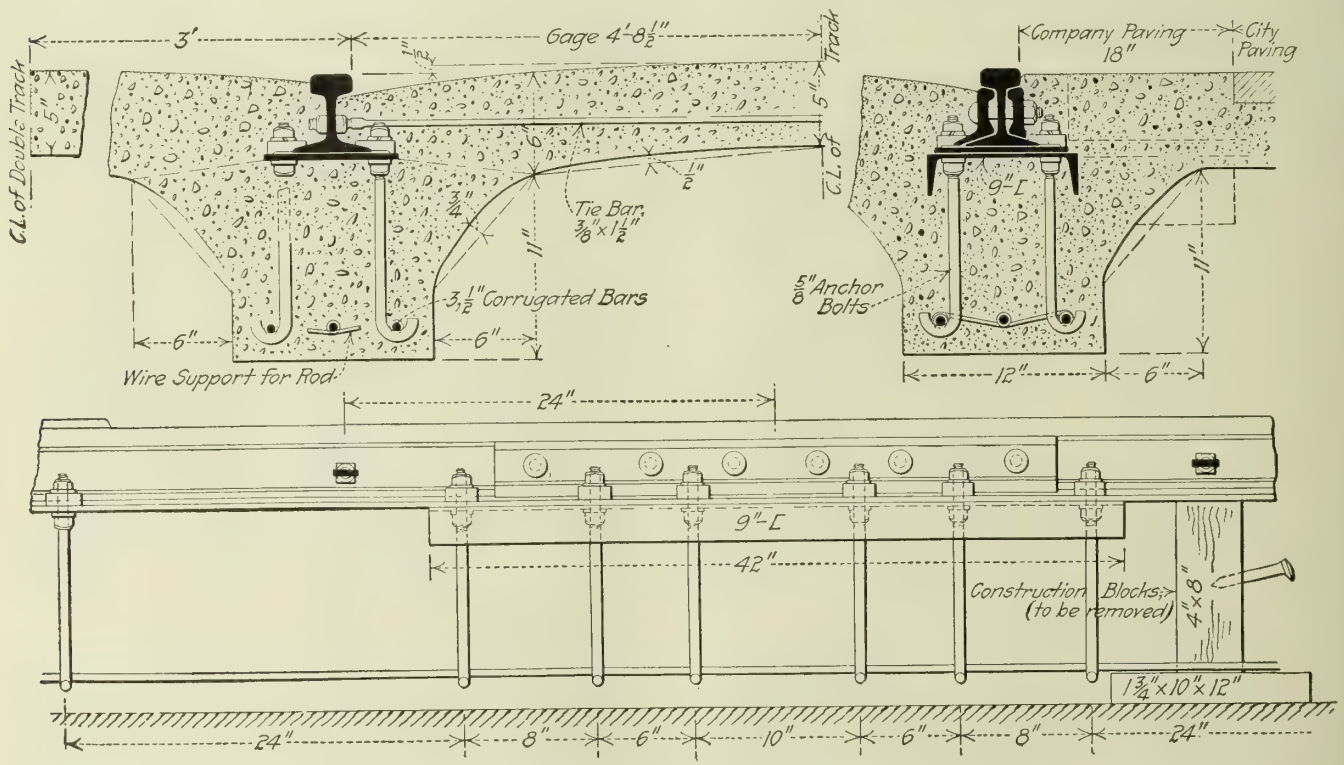


FIG. 1. CROSS-SECTION OF STREET-RAILWAY TRACK CONSTRUCTION WITH T-RAILS AND CONCRETE PAVING AT ANDERSON, N. C.

Another very common cause of failure of track pavement is impact at the joints. This may result from any or all of several causes, and when once it develops it is generally fatal to the pavement around it. We believe we can make a simple base-supporting splice which will overcome the causes of impact very largely and on the other hand will so distribute any possible impact as to render it harmless. Even patented joints in use now are dependent upon a number of factors for successful use, and all of them will fail if impact sets in.

The construction illustrated will be used immediately on about 6 mi. of track in Anderson and Greenville, S. C., and elsewhere, as may be necessary. Accurate

*Engineer, Southern Public Utilities Co., Charlotte, N. C.

cost records will be kept. It is believed that this type will be of special interest in view of the fact that whereas a few years ago paving was not required except in the centers of the larger towns, now railway companies are forced to pave tracks even in smaller towns and in all classes of streets, where falling revenues with light traffic do not justify high rails and expensive construction.

No patents have yet been granted, but an application is being prepared which will cover the principal features. We do not claim that this construction is new throughout, for we have gleaned several ideas. Many features, however, are entirely new and the arrangement as a whole is new.

Features of the Design

The special features of this type of construction may be stated as follows:

1. Use of low T-rail instead of high T-rail. With the latter rail (a) it is necessary often to buy more metal than is required to carry the traffic, in order to get paving depth; (b) the same tonnage costs about 30 per cent. more than standard rail because it is special; (c) the same tonnage gives less wear than the standard rail, because of the smaller amount of metal in the head of the high rail.

2. Continuous rolled-steel bearing plate. This plate, 3/8x8 in., affords great resistance to overturning, and distributes the stress over a width much greater than that of the rail base.

3. Strong and frequent anchorage of rail to plates embedded in the concrete. This is afforded by the long hook bolts, which also serve to hold the longitudinal reinforcing rods in the bottom of the beam during construction.

4. Continuous, reinforced-concrete girder under each rail. This girder is made of strong, rich concrete and is capable of taking our heaviest cars over short spans where wide trenches have sunk, or over longer stretches of poor soil, without destroying the structure.

5. Provision for shrinkage of the concrete. This is made by the use of jam nuts and wood washers under the base plates and high-tension split washers on top of the rail clips. The top nut will be drawn down until the lock washer is flat. If there be any shrinkage, the weight of the cars will cause the plate to sink down until the wooden washer is compressed and the load bears evenly on the concrete, when the lock washer above will open slightly and prevent any lost motion.

It is hard to see how any considerable amount of shrinkage can take place under the plates. If the center of the shrinkage be assumed as at the center of the 12-in. beam, therefore 6 in. under the plate, and the shrinkage as 0.08% (a liberal allowance), theoretically the relative motion between the plate and the rail will be only 0.0096 in. or less than 1-100 in. The washer used will take up 1/8 in. easily, and although we do not expect as much shrinkage as that, we can hardly believe it to be as computed, less than 1-100 in.

6. Elaborate treatment of the rail joints. The intention is to secure a perfect fit of the rail ends, so that there will be no initial pounding, and to make a structure so strong and stiff that it will not allow relative motion of the parts. The rail ends will ordinarily be finished by grinding; but in some cases where the track is laid in earth the rails have never closed the expansion joints, and the interurban cars have badly pounded the rail ends. In these cases the ends will be cut off with a power saw.

The rails will be laid close, no allowance being made for expansion, since the area of metal exposed to the sun will be small, and the concrete surrounding the rail will rapidly conduct the heat away. The holes in the rail are 1 in. in diameter. The bolts used will be 7/8 in. in diameter, of Mayari heat-treated chrome steel, with a very high elastic limit. The bolts are a very important part of the structure. The object in using these large bolts in the 70-lb. rails is to get great strength as well as to fill the holes in the rails to get a continuous structure. The splice bars are of standard angle section, with notches cut in the flange for the same kind of rail clips as are used elsewhere.

7. Increase of available conductor area. This may be secured by bonding the ends of the 3/8x8-in. base plates together, with occasional bonding to the rails. The rails, if well bonded, afford ample area for the current, but the bonding of the base plates would protect the structure against any electrolytic action (however unlikely). Although with good rail bonding this plate bonding would be superfluous, it would be a good investment as a protection against defective bonding if it prevented the loss of only about 1000 kw.-hr. annually per mile. We intend to experiment with this feature.

Advantages of This Construction

The advantages are nearly obvious and may be summed up under four heads:

1. Complete adaptability. The only articles not on the market as stock are the hook bolts and the wood washers. The construction is adaptable to any density or weight of traffic, conditions of soil, size of rail, etc., by modifications of beam, anchors, etc.

Where the rolling stock is exceedingly heavy and the schedules close and fast, we would use a deeper beam, properly reinforced, with larger anchor bolts and a 2x8-in. creosoted pine stringer with field notches in the sides for the anchor bolts to pass through. In such a case, we contemplate special provisions for the renewal of rails and stringers—matters which need not be entered into here. In general, we believe that a proper modification in the steel structure would be sufficient.

2. Permanence. This construction is believed to be as nearly permanent as a track structure can be built.

3. Comparatively low cost, $15,079 per mile of single track. This averages about $3000 per mile cheaper than ballasted high T-rail construction, which involves an excavation 18 in. deep, 9 ft. wide; 5-in. rolled ballast under ties and to tops of ties 2 ft. in middle of track; oak ties 6x8 in. by 8 ft., 30 in. c. to c.; 7-in. 80-lb. T-rail 60 feet

ESTIMATE OF COST PER MILE OF SINGLE TRACK (EXCLUSIVE OF BONDING) *

Excavation, 1160 cu.yd. at 50c	$580
Rails, 110 tons at $38	4,180
Splices, 9969 lb. at $2.10	209
Bolts, 1320 lb. at $0.0435	57
Lock washers, 1056 lb. at $0.01	11
Clips, 7300 lb. at $0.0235	171
Machine bolts, 3000 lb. at $0.012	36
Hook bolts, 4800 lb. at $0.035	168
Split washers, 7800 lb. at $2.65 per M	20
Base plates, 107,000 lb. at $1.68 per 100 lb	1,797
Corrugated bars*, 56,000 lb. at $1.665 per 100 lb	933
Channels, 8500 lb. at $1.68 per 100 lb	143
Tie-rods, 700 lb. at $0.16	112
Hauling steel on work car, 190 tons approximately at 50c	95
Assembling track, no tamping	500
Concrete, 1160 cu.yd., at $5.23	6,067
Total cost of materials and placing	$15,079

* Four bars in each girder, instead of three as shown by the drawing. Due to foundationd conitions.

long; concrete, 1 : 1½ : 3, from bottom of ties under rails to tops of paving.

4. Minimum maintenance and depreciation charges.

Concrete Paving and Foundation

Concrete Surface—Concrete was adopted because (a) the experience of ourselves and others has shown it to be a satisfactory wearing surface when the foundation is not broken up; (b) a concrete surface can be laid more cheaply with respect to material, and if monolithic with the base, more cheaply also with respect to labor, than almost any other suitable surface; (c) concrete is best adapted for use with low T-rail.

The wearing surface used heretofore has been a 2-in. course of cement and granite screenings mixed 1 : 1½, with screenings ranging from ⅜ in. to $\frac{1}{32}$ in. This is very satisfactory, but the screenings become expensive at times on account of the fact that no dust is allowed in them. We have not had many of the troubles supposed to be inherent in two-course pavement, but we have here adopted a coarse concrete top because it will be cheaper, and will wear as well if properly put down.

A mix of 1 : 1½ : 3 was chosen at first to make proportion of cement and sand the same as proportions of cement and screenings in our former top, and then because this mix seemed largely used elsewhere. But it is probable that we shall use 1 : 2 : 4 or even 1 : 2 : 4½ in case we get as low a percentage of voids in the stone as we expect. The sand will be, as nearly as possible, about half coarse and half fine, as this has been found to be the strongest mixture of sizes. The stone will be blue granite, from ¼ to 1 in., and we expect to get a low percentage of voids.

Method of Rolling the Concrete Surface

We expect to use hydrated lime to the extent of about 8% of cement used (proportioned by weight) to secure density and waterproofness. We plan to roll with a small cast hand-roller of sufficient weight, rather than to tamp; then to wood-float it, trowel it and score it into blocks 5x10 in. with staggered joints. We have two alternate treatments of the surface in mind; one is to scatter on the concrete a light course of screenings, trowel and score as before; the other is to scatter on the top a course of 2-in. stone after tamping or rolling with a gridiron surface, the stone being lightly rolled so as to bring flat faces up and make them flush with the mortar.

If the roller is made with blades 1¼ in. deep, 1 in. apart, it is believed that only ½- and ¼-in. stone will remain on top, with an excess of mortar in which the 2-in. stone will be bedded. This will be rolled with a plain roller to bring the flat sides up, and together with the small stone form a good wearing surface. These alternative methods will be tried, and perhaps adopted if found better than the plain concrete. Of course if 2-in. stone is put on the surface it cannot be blocked off.

Paving Base—This will be the same mix as the top, will be monolithic with it and also with the track foundation.

Track Foundation—This will consist of large reinforced-concrete girders under the rails, of the same mix as the top and paving base, reinforced with three or more corrugated bars lapped so as to be continuous.

Cross-Section—The track foundation and pavement, which are monolithic, take the form of an arch, the pavement in the middle of the track forming the flat crown and the girders under the rails forming the abutments. It was desired to make the entire structure effective; the girders, carrying the track loads, and the crown, upon which there is street traffic only, being proportioned for those loads.

The shape of the surface, which is crowned from beneath the rail heads and has no distinct groove, has been our standard for several years, both with concrete and brick pavements. It has been satisfactory both to us and to the citizens.

At 50-ft. intervals will be expansion joints not over ½ in. wide, 5 in. deep, filled with asphalt and stone dust. Midway between these will be contraction joints made by using a thin steel plate (greased), which is removed after the concrete has set. The joints are filled by pouring in hot asphalt.

Design of the Track Structure

Rail—We use the Am. S. C. E. 70-lb. T-rail section because it gives maximum wear on account of the center bearing and distribution of the metal; and further because it is the cheapest rail since it is a standard section and rolled by all mills.

Bearing Plate—A width of 8 in. was selected as about the maximum which might be used without isolating a cake of concrete above it; and because this width afforded about the right projection from the rail base for the bolts and clips. The thickness of the plate is greater than that found by static computations, but not too great when the shocks of our heaviest cars are considered.

Anchorage—It is contrary to facts to assume that the rail will lie flat on the girder, and therefore anchors spaced from 5 to 10 ft. apart are insufficient. The rail should have a uniform bearing and should be held uniformly on that bearing. This calls for anchors much closer together than is customary in this class of construction. We have generally anchored the rail every 2 ft., and closer at joints.

Tie Rods—We have adopted a ⅜x1½-in. flat tie rod, but have placed it only 1½ in. from the base of the rail, so as to have it as low in the paving as possible, to prevent cracking. Should cracking develop, we will use a strip of light wire mesh over the rods. We have held to tie rods, although with similar construction (Rinehardt system) in Berlin and elsewhere they have been found unnecessary.

Rail-Joint Reinforcing—Impact is responsible for the failure of joints in paved streets. It may be developed from the first because of uneven surfaces of the rail heads, or it may be developed later by pounding in consequence of broken wave motion. Where the support is yielding, there will be a concavity under the wheel, and where the anchorage of the rail is not frequent and powerful, there will be a convexity ahead of the wheel. The conditions necessary for transmission of wave motion (and load, of course) are that the splice bars shall be long enough, strong enough, not worn badly and tight-fitting. The wear usually takes place on the top of the bars.

The conditions favorable to failure resulting from improper fit of the bars are: Bolts overstrained when first put on; poor mechanical fit; movements of the rails because of expansion and contraction (allowed by the long holes in bars and large round holes in the rail); and badly worn condition of bars.

We will guard against overstraining the bolts by using large heat-treated steel bolts with strong washers; but we must depend upon the manufacturers for good initial fit. We will provide against temperature movements by having bolts fitting the holes in the rail tightly and butting the rail ends close together. We wished also to have the holes in half the bars made round, so that by putting all the nuts on one side of the rail we could have close-fitting bolts in the splices also; but the bars were punched before we decided on this. We do not know how better to prevent wear of the tops of the bars than to use higher carbon metal; this wear is a combination of compression of fibers and flow of metal. We planned to use the splice bars without the nearly horizontal leg, but the cost of rolling or of shearing after rolling was prohibitive.

We have met the requirements for an efficient joint as follows: (1) Rail heads will be ground, and in rails already battered the ends will be sawed off. (2) Looseness will be prevented by the use of closed joints, large high-tension tight-fitting splice bolts and strong anchorage of the track by means of anchor bolts. (3) A steel channel

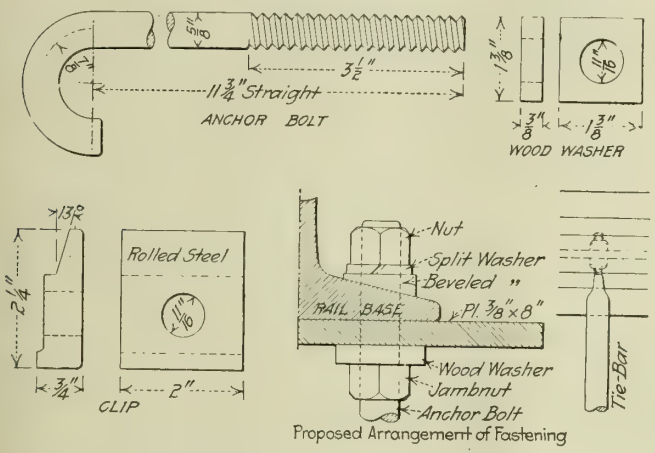


FIG. 2. DETAILS OF T-RAIL TRACK FOR STREET RAILWAY AT ANDERSON, N. C.

is provided to transmit flexure, this being anchored to the rail and plate over a considerable length so as to maintain the rail ends in the same plane. (4) The base plate and channel will distribute load and impact.

Reinforced-Concrete Track Girders

The ultimate support of the wheel loads is the earth, the bearing value of which is limited, variable and uncertain. Therefore pressure should be distributed over as large an area as possible. Under any circumstances there will be some deflection and some settlement. The former should be as small as possible and the latter should be even, so as not to disturb the pavement. Both these considerations point to the necessity for having beneath the rail a member capable of taking the entire wheel load and distributing it over the requisite area of earth. For this purpose we have adopted the reinforced-concrete girders.

There are two general methods which may be used in the design of the girder: One is to assume that the rail and the reinforcing rods form the chords of a built-up beam, and that the concrete and anchors transmit the shear only, the rail taking the compression instead of the concrete. This assumption involves another—namely, that the longitudinal shear will be transmitted from rail to plate, and thence to concrete, and there will be no slipping there. In order to be sure of securing this condition, it would be necessary to have bolts through the rail base (as shown in Fig. 2). With this construction a low T-rail can be used under all traffic, the minimum requirement being to use enough reinforcement to throw the neutral axis at or near the base of the rail, so that there will be no cracking of the concrete. The depth and reinforcement will vary with the loads.

The other method of design is to assume the load on the concrete beam as practically concentrated, and to place sufficient reinforcing in the bottom of the beam to distribute it over an ample area of earth.

Of the two schemes, the first is perhaps the better from a cost standpoint, generally speaking. But in our case we are using rails already on hand, and will use them with clips and reinforce for almost the entire load (with shock) concentrated. We believe that when rails are ordered from the mills, the cost of punching holes in the base of rail plus the cost of beveled washers would be less than the cost of the clips used on the edge of the rail, and the reinforcing would be more efficient and cheaper. We have just ordered a hydraulic punch, which should enable us to punch holes in the field rather cheaply, and we will see what can be done in this way. The base plates under the rails are counted on only to widen the bearing area on the concrete.

Answers to Criticisms of the Design

The criticisms which have been made of the above system of track construction may be considered as follows:

1. The track will be too rigid. We believe a really rigid track can be built and be successful, the vibration being taken up in the cars. We know of tracks in this country and abroad which are similar to this and give no trouble due to rigidity.

2. Concrete is not suitable for a wearing surface. Our whole experience has been a contradiction of this, even though some of our own work is not satisfactory.

3. The expansion joints in the concrete will spall and disintegrate. We have never had trouble from our expansion joints. We originally used for edge protection a set of plates, which were anchored into the concrete by bolts; but this was very troublesome and somewhat expensive, so we have since been using the joint described in the specifications. The most important things about expansion joints are to get them narrow and to thoroughly compact the sides with an edger.

We also use an edger against forms for the edge of our pavement next to the city pavement, and have no trouble here either; although we formerly had this edge sloping outward upon the theory that that would prevent spalling, the most noticeable effect of this slope was to allow the asphalt to crawl up it under the ironing effect of vehicular traffic, ultimately causing a rut there, so we have since made the edge vertical. The contraction joint we have adopted because we have found that where the expansion sections were laid 50 ft. apart a contraction crack nearly always formed exactly midway.

4. Underdrainage. We have no provision for underdrainage and do not believe it necessary in our conditions.

5. Electrolysis. The possibility of electrolytic action upon the steel below the rail is very remote, and may be obviated at little cost.

6. Regaging or changing rail or grades. When the rail needs regaging or renewing probably we will wish to

double-track the line. The grades are set by the city, and there is only the remotest possibility of having to change them. Provision could be made for regaging or renewing rail by using long holes in the plates (for adjustment), by separating the foundations and top slab by a layer of heavy paper, and by tipping the tops of the anchor bolts with tar, so that they would not rust.

7. Shattering of concrete. It has been suggested that the concrete around the rail may be shattered by vibration or by ice under the rail and plate. The vibration of the rail will be so limited with anchorages 2 ft. apart that it will be incapable of causing impact. Little or no water can find its way under the rail, but in a colder climate tar or asphalt might be poured along the edge of the rail.

8. Special work and curves. Our special work will be laid on steel or wood ties on a concrete base. For curves, the plates will bend the same as the rail. Steel-weld compromise rails will be used instead of compromise joints.

Construction Methods

The water is taken from hydrants along the curb, and no charge made against the contractor for it, as the company owns the water-works system.

The cement is furnished by the company in warehouse or in cars in railway yards, and is hauled to the job by the contractor and protected by him. As the inspector on the job receipts for the cement delivered on the job and shows on his report the disposal of it, we know just what mixture we are getting. By thorough experiment we will find the length of track which should be built with a certain amount of cement, so that we will have both a check on the grading and on the use of the cement.

The stone is delivered by the company on the streets to be paved, at the intersections. We have several cars built for this purpose having an A-shaped bottom and slide doors which trip by a hand lever operated from the cab. The load can be dumped in six parts, as the length of the car is divided into three compartments, and each compartment dumps half on either side. The load dumps well clear of the rails.

The rails are in general those at present in service; and they are removed by the combined forces of the company and the contractor. This is done by jacking up the rails every 15 ft. and knocking off the old ties with sledges. The specifications state that we will take up the rail and the contractor will take up the ties. Contractors generally are loath to participate in this method, as they seem to feel that advantage is being taken of them, although it is more to their advantage than to ours.

The excavation is done mostly by pick and shovel, and the hauling by wagons. Tamping is used, as rolling is not practicable here. When the excavation is ready the company assembles the track and puts it to line and grade. No attempt is made to have the track to final line and grade for more than a block ahead of the concrete, as temperature changes and other disturbances would destroy it. Of course, the track will be fixed longitudinally, as one end will be completed and fast. The track is supported vertically during construction by bearing blocks under the anchor bolts (which are rigid on account of the jam nut under the bearing plate). The track is lined by staking from the sides.

The concreting was intended originally to be done entirely from set-ups at the intersections, using plank runways in center of the track and 6-ft. hand carts for hauling the concrete. The placing of the concrete was to begin at the middle of the block, and back up toward the mixer as the work proceeded, the carts returning on the roadway beside the track. It was believed that these carts would be very economical for this work. It was afterward decided to spout the concrete into place, which was done with very good results. A 2½-in. top surface is made with concrete 1 : 1¾ : 3½, using ⅛- to ⅝-in. stone, which gives a surface that can be finished as smooth as a sidewalk. This is quite satisfactory, and although the concrete is put on in two courses it forms in effect one solid mass.

The concrete is placed and finished as specified elsewhere. The scoring board used to block off the surface is made of heavy timbers, having a crown slightly flatter than the finished pavement. This crown is sawed out of the thickness of the timbers. On the bottom or working side there are V-shaped oak strips put on in a staggered arrangement to follow the lines of 5x10-in. joint blocks. This board has a length equal to the width between rails and a width of 20 in. or four courses of blocks.

The strip is left off from the last block edge on the front side and when the board is moved forward the last strip on the rear side is set across the ends of the short joints of the last course scored. This is done because it was found that when the outer edge of the last course was printed, and the men attempted to set the board for the next width, they lost time getting the oak strips to register in the last one of the last width, and often made a double joint there, whereas when the short joints of that course only are printed before taking up the board, the rear strip can be set across their ends at the next setting without trouble.

These boards have scored over 100,000 sq.yd. of paving for us and have been perfectly satisfactory. They cost about $5 each, will print about 10,000 sq.yd. (with frequently renewed oak strips), and would last indefinitely except that the men in using them tamp on them with a pick or other heavy object. Two or three light blows suffice. They are operated by the finisher and water-boy or one of the common laborers, and this scoring really adds practically nothing to finishing cost, because it goes very rapidly and the finisher has ample time from his floating to do it.

Separate boards with no crown can be used for the flat paving outside the tracks, and this method is better than having that part done by a long single board. We have used for the space between double tracks a longer board similar to the one used in the tracks, but with the end bearings arranged to allow the printing to be done ¼ in. below the rail instead of 1¼ in. These boards are kept greased. They have handles made of old rubber hose.

Specifications for Construction Work

The specifications include the following sections governing the construction work:

Outline of Work—(a) The company will remove the old rail. (b) The contractor will remove the old ties to the edge of the street; they are not to be sold. (c) The contractor will excavate to cross-section shown on plan and to grade set by the city engineer or the engineer of the company, and will tamp the subgrade to the satisfaction of the engineer. (d) The company will build track ready for the concreting. (e) The contractor will place concrete and protect it until acceptance.

Excavation—Earth must not be disturbed below subgrade. Where filling is necessary it shall be done with approved material in 5-in. layers and thoroughly tamped. Waste excavated material shall be the property of the company, to be

hauled by the contractor to any point designated, not over 2000 ft. on good roads.

Concrete—To be composed of 1 part cement, 2 parts sand or screenings and 4 parts crushed stone (size passing 1-in. ring and retained on ¼-in. ring), and hydrated lime 5% of weight of cement. To be laid of a consistency satisfactory to the engineer, thoroughly tamped and floated with wooden float, troweled if required, and blocked off if required by the city. The scoring to be shallow grooves made with a scoring board.

Joints in Paving—Contraction joints to be provided every 50 ft., to be not over ½ in. wide, 5 in. deep, filled with asphalt and stone dust. These are to be made by using weather-boarding, dressed on both sides and greased, and withdrawing the board after concrete sets and filling as noted before. Midway between these joints shall be contraction joints made by using a thin steel plate (greased) withdrawing after concrete sets, and pouring with asphalt. Both these joints must be thoroughly compacted along their edges by using edgers of small radius.

Protection of Work—In hot weather the pavement shall be kept wet for at least three days (sometimes longer) by the liberal use of water sprinkled upon it. The company furnishes the water. When required by the engineer 3 in. of sand shall be sprinkled upon the pavement for the purpose of holding the moisture, and keeping the pavement cool. In cold weather, if the thermometer is below 40° at 4:30 p.m., and is going down, all placing of concrete must be stopped and that part which is already laid must be finished as soon as possible. If the thermometer is going up at 4:30 p.m., work may be continued until 6 p.m. When required by the engineer the work must be covered with tar-paper and 2 in. of horse manure. Other means may be used if preferred by the contractor.

Car-Transfer Ferry on the Ohio; C., B. & Q. R.R.

In order to develop a new rail route from the Northwestern States to the Gulf, the Chicago, Burlington & Quincy R.R. is building a line 13 mi. in length from its present terminal at Metropolis, Ill., to connect with the Nashville, Chattanooga & St. Louis Ry. at Paducah, Ky. The principal engineering feature of this line will be the great double-track bridge across the Ohio River, but this will not be completed for some time.

To provide immediate communication across the river, the new railway has been extended down the bank on each side of the river, and cars will be ferried across on transfer boats. These are double-track deck scows, accommodating ten freight cars on each track. They will be handled by tow-boats. The distance between landings is about one mile.

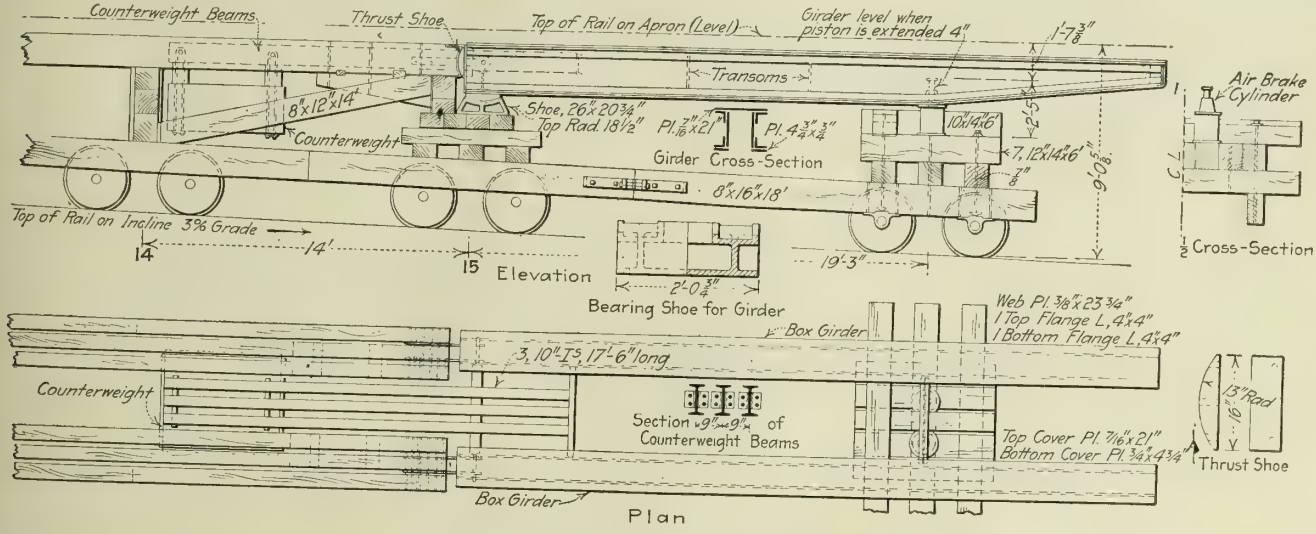


FIG. 1. ADJUSTABLE APRON CONNECTION BETWEEN CRADLE AND CAR-TRANSFER BOAT

At each landing an incline is laid to about low-water line, and on this rides a cradle, which is moved up or down the incline to keep its rails at the same height above the varying level of the water. The cradle is shifted as required by a cable attached to a locomotive and passed around a hitching pulley on the cradle frame. The incline has a descending grade of 3 per cent. for a length of about 2000 ft. The track on the cradle is level, with a short 4 per cent. grade rising from the incline track to the cradle track.

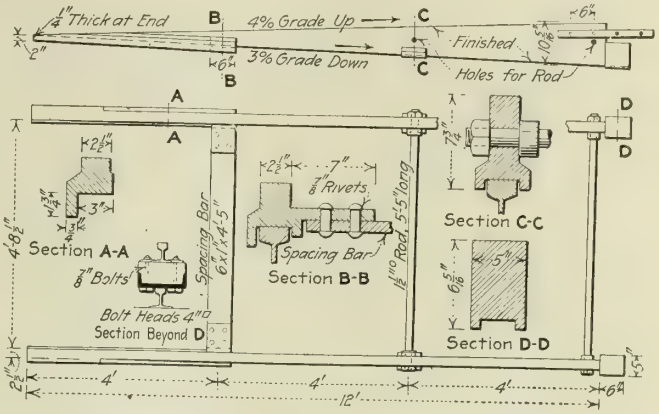
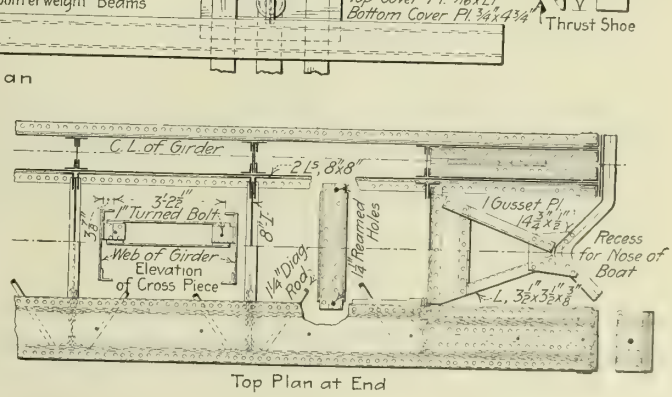


FIG. 2. FEATHER-RAIL CONNECTION BETWEEN TRACK ON INCLINE AND TRACK ON CRADLE

The incline is double-track, with two cradles, one for each track on the boat, but the cradles are separate and are operated independently. The river end of the incline is a double-track timber trestle, with five-pile bents 13 ft. c. to c. under each track and two lines of 8x16-in. stringers under each end of the 10-ft. ties. Fender timbers are laid upon the outer ends of the caps. The tracks are 12 ft. c. to c.



The general construction of the cradle is shown in Fig. 3. It is 240 ft. long. Its deck consists of two pairs

of 8x16-in. stringers upon which are laid the 10-ft. ties. At the land end, where the height is low, the stringers rest directly upon axles arranged in pairs. As the height above the incline increases they are supported by blocking or cross-timbers on two lines of substringers, which are mounted on the axles, as shown. The wheels are mainly 33-in. car wheels. As the joints of the stringers are in tension when the cradle is hauled up the incline, they are spliced by horizontal bolts passed through the outstanding flanges of L-shaped straps spiked to the sides of the timbers. These connections also give vertical flexibility to allow for irregularities in track surface.

Land and River Connections of Cradle

At the land end of the cradle is a pair of 12-ft. feather rails to connect the track on the incline with that on the cradle. This connection is shown in Fig. 2. The feather rails are steel castings 12 ft. long, grooved on the under side to ride on the incline rail, while the upper surface forms a running head for the wheels. At the toe, where the wheels are engaged, the thickness of the feather rail is only ¼ in. At the heel there is a splice connection to the track rail on the cradle.

The river end of the upper deck of the cradle is an adjustable apron 30 ft. long, supported by cross-timbers on the substringers. This is shown in Fig. 1. It consists of a pair of heavy box-girders, connected by crosspieces and diagonal lateral rods. The I-beam crosspieces are not connected rigidly to the girder webs, but are secured by horizontal pins through angle brackets on the webs. This allows for variations in level of the opposite rails of the incline track, the girders being free to rise and fall independently in a vertical plane, while with rigid riveted connections severe twisting stresses would be set up.

The apron is supported at the heel and one intermediate point, and its outer end is cantilevered beyond the latter. The outer end is raised and lowered as required to compensate for slight changes in level of the tracks on the cradle and the boat and to bring these rails into exact position. For this purpose its outer support carries a pair of air-brake cylinders, with piping led along the cradle and fitted with hose so that it can be connected to the brake system of the engine handling the train. To balance the apron it is fitted with an extension arm consisting of three 10-in. I-beams having a counterweight box suspended from their ends.

Vertical and lateral movements of the apron are provided for by a hemispherical bearing under the heel of each girder, and a similar bearing or thrust shoe at its end, butting against the end frame of the cradle. The outer end of the apron is heavily built and braced to withstand blows and has a recessed end frame to receive the V-shaped nose on the end of the boat, thus automatically centering the tracks. Portable rail stops which slide on the rails are used to hold the cradle in position on the incline track, and also to hold the train on the cradle while making the rail-end adjustments of apron to boat.

The new railway is being built under the name of the Paducah & Illinois R.R. The incline on the Illinois side of the river was built and is owned by the Chicago, Burlington & Quincy, and that on the Kentucky side by the Nashville, Chattanooga & St. Louis, of which Hunter McDonald is Chief Engineer. The Chief Engineer of the Paducah & Illinois is C. H. Cartlidge, Bridge Engineer of the Chicago, Burlington & Quincy.

Federal and State Co-operation in Water-Power Control

By Leonard Lundgren*

Much has been said and written along theoretical lines about the dual control of water powers in the United States by the Federal Government and the Sovereign States, control by the former arising from the ownership of public lands and by the latter from state laws on the appropriation of water. Many writers have attempted to

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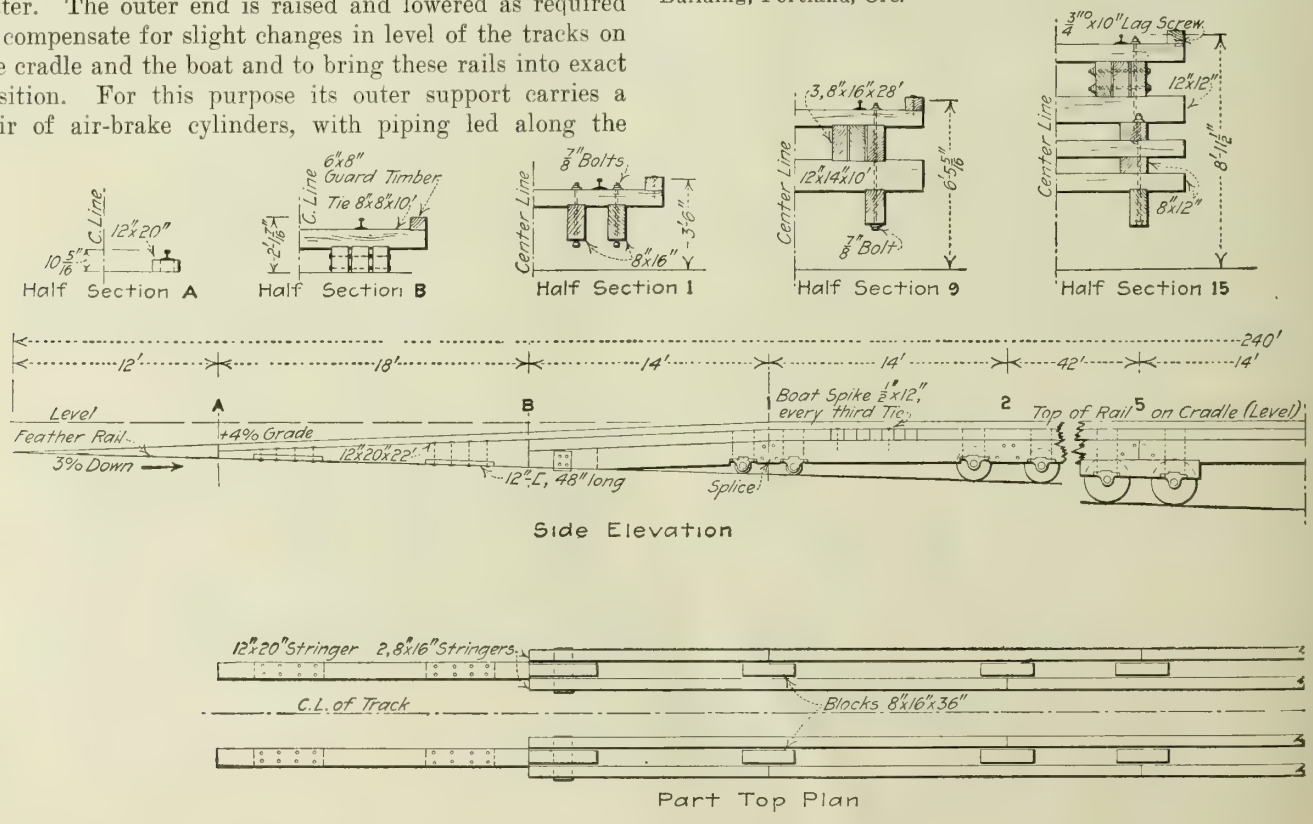


FIG. 3. CRADLE ON INCLINE OF CAR-TRANSFER FERRY ON

point out that such dual control is incompatible with the industrial development of the country and actually hinders its growth. In practice, however, the Federal Government works in the closest harmony with the State. The regulations of the Secretary of Agriculture, effective Feb. 1, 1915, contain the following:

> Wherever the approval of a state administrative official, board or commission is a condition precedent to the right either to take and use water for power purposes or to engage in the business of the generation, transmission or distribution of power, certified evidence of such approval must be filed . . . before a final permit will be issued. Formal notification by such official, board or commission that the water right has been canceled or that the permission to engage in the power business withdrawn, will be deemed sufficient grounds for the revocation of the permit.

These or similar requirements have been in force in the regulations of the Departments of the Interior and of Agriculture for the last five years. During this period no person has secured a permit to construct a water-power plant on public lands without first securing a water right from the state.

Coöperation with State of California

A year ago, in order to facilitate the approval of applications for water power both by the state and by the Federal Government, a coöperative agreement was made between the Secretary of Agriculture, Hon. G. F. Houston, and the State Water Commission of California, of which Prof. Charles D. Marx, President of the American Society of Civil Engineers, is Chairman.

This agreement provides that whenever an application for a permit for a water-power site is filed with the District Forester of San Francisco, notice of the application will be sent to the State Water Commission. Whenever an application is made to the State Water Commission for a permit to appropriate water, if the use of such water will in any way make necessary the occupancy of any national forest land, the State Water Commission will give immediate notice to the District Forester at San Francisco. Further clauses of the agreement provide in substance that neither the State Water Commission nor the representatives of the Federal Forest Department will issue permits to water users until both authorities have given final approval to the application.

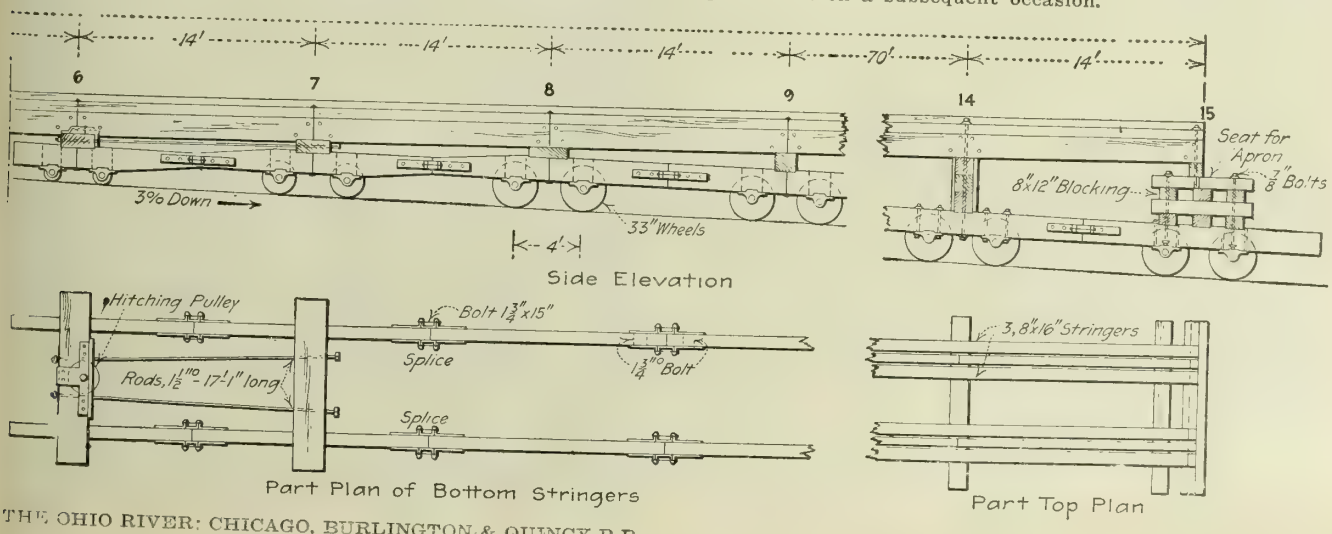
In accordance with this agreement the Secretary of Agriculture a few months ago refused certain rights-of-way in the Inyo National Forest to a company, as its previous application for the privilege of using the water of certain creeks had been rejected by the State Water Supply Commission on the ground that the public interest so demanded. The company argued against this decision on the ground that the streams proposed to be appropriated were located entirely within the National Forest reserves and that the state authorities, therefore, had no voice in the matter. The Secretary of Agriculture in refusing to reconsider his decision said:

> It is believed that better results can be secured under existing conditions by coöperative action between the state and Federal authorities than by any insistence upon strict legal rights on behalf of either.

Another coöperative agreement has been made between the Department of Agriculture and the State of Oregon, represented by the State Engineer. This is framed on lines similar to those of the agreement with the State of California, and provides that the District Forester at Portland and the State Engineer will each furnish the other with data and coöperate while acting upon applications for power permits on National Forest lands. This agreement was consummated in May, 1915.

It is anticipated that other states having laws which permit coöperation as outlined above will see the advantages that accrue and will accordingly enter into similar agreements.

Lump-Sum Allowances for Extra Work were recently the subject of a dispute among the public authorities of New York City. Contracts let by the Public Service Commission for subway or other rapid-transit work require to be consented to by the Board of Estimate, which makes the appropriation to pay for the contract. Recently when several contracts awarded by the commission came before the board for appropriations, the board made the appropriation conditional on the elimination of a clause in the contract authorizing the chief engineer of the commission to fix either unit prices or a lump sum for incidental or extra work as it arose. The prior arrangement for extra work had been cost plus 10 per cent. This arrangement led to excessive supervision and accounting, which is avoided by using the lump-sum or the unit-price method of payment. For some time past the commission's contracts have included a clause making the latter methods optional as alternatives to the percentage method, and the board has hitherto approved such contracts. The board's conditional appropriation formed the subject of a court action by the bidder to whom a contract had been awarded for mandamus to require the board to give its consent and make the appropriation without qualification. The mandamus was issued by the court, and the board then consented to the contract and made the appropriation without condition. No appeal to a higher court was taken, because the board did not want to delay subway construction work; but it has made the statement that it does not accept the view taken by the judge who issued the mandamus and will carry the matter before a higher court on a subsequent occasion.



THE OHIO RIVER: CHICAGO, BURLINGTON & QUINCY R.R.

Field and Office

Lap-Bolted Crossbracing in Wide and Deep Cut

Bolted continuous crossbracing of subway excavation is employed by the Cranford Co. on sections 1 and 1A of the Flatbush Ave. subway, in Brooklyn, New York City. Each crossbrace is built up of 6x12's, 16 ft. long, lapped 8 ft. and bolted together, forming a continuous 12x12. The bolt holes are located by templet, so that they will coincide, no matter which ends are lapped. This means rapid timbering and avoidance of waste. The crossbraces are posted and spread as shown in Fig. 2.

The illustrations show the timbering at Prospect Park Plaza, where the excavation reaches a maximum width of 100 ft. and a greatest depth of 82 ft., providing room for diverging subway tracks on three double-track levels. In the upper part the bents are spaced 10 ft., in the lower part 5 ft. c. to c. The bents of the lower portion of this cut are not in the same vertical plane as the upper bents because of interference of steelwork; longitudinal timbers of the same lapped construction as the cross-struts are used at the top of the offsetting to bridge. Elsewhere on the line the bent spacing is 10 ft.

John C. Sheridan, Chief Engineer for the contractor, devised the bolted timbering.



FIG. 1. GENERAL VIEW OF TOP OF DEEP OPEN CUT AT PROSPECT PARK PLAZA, BROOKLYN

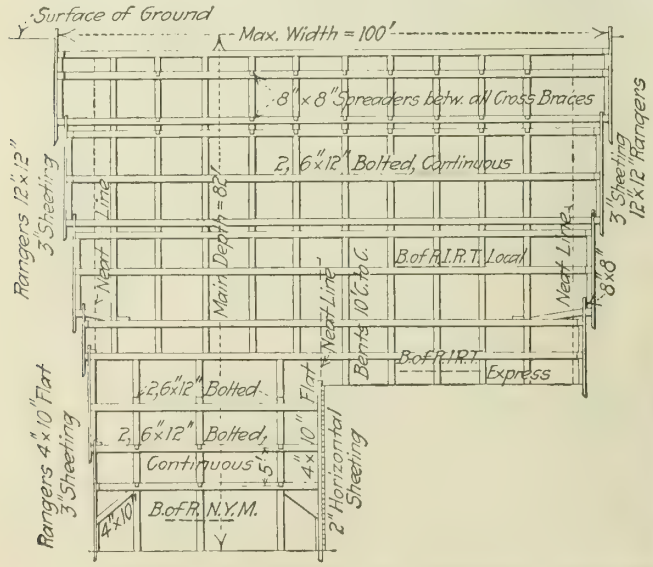


FIG. 2. SHERIDAN'S SCHEME OF TIMBERING; BOTTOM OF 80-FT. CUT

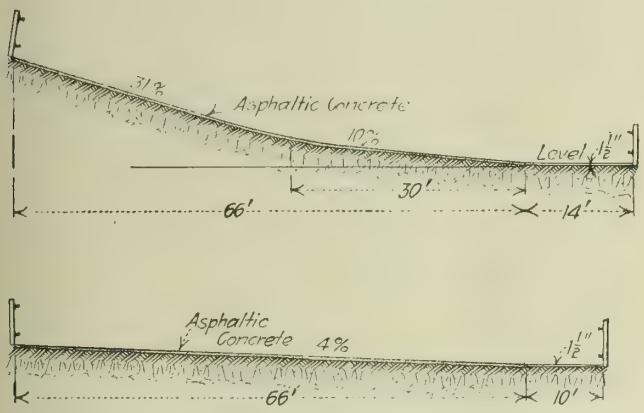


FIG. 3. TIMBERING FOR THE DEEP OPEN CUT

Adapting an Old Racetrack to Automobile Racing

A one-time famous horse-racing track at Narragansett Park, Cranston, near Providence, R. I., has recently been converted into an automobile racetrack by banking the curves and covering the trackway with an asphaltic-concrete pavement. The track is owned by Frederick E. Perkins, President of the Narragansett Park Speedway, Inc., who has personally planned and supervised all the construction work—with no little pride that he has done so without the assistance of an engineer.

The old horse-racing track was the usual one-mile oval consisting of two quarter-mile straightaways and two quarter-mile half-circle arcs of 420 ft. radius. The track surface was hard-packed loam overlying gravel, which is only one or two feet below surface over the whole meadow containing the track. This gives good natural subdrainage, so that the only additional provision for drainage considered necessary was the sinking of shallow pits, or sumps, at intervals around the inner edge of the



FIGS. 1 AND 2. CROSS-SECTIONS OF RACETRACK ON CURVE AND ON TANGENT

track. These are lined with dry stone walls and drain into the subsoil gravel. They are covered with substantial timbers.

The surface of the old track was thoroughly rolled with a 10-ton steam roller. On the curves the roadbed had previously been banked to a maximum of about 10 ft., the earth being placed in thin layers and allowed to settle for two or three years before the pavement was constructed. On top of the compacted surface of the old track a 4½-in. asphaltic-concrete pavement was laid in two courses, the bottom course of 3 in. being mixed to conform approximately to the well-known Topeka specifications, while the top course is practically a sheet-



FIG. 3. NARRAGANSETT ASPHALT MOTOR RACETRACK



FIG. 4. TANGENT ON MOTOR RACETRACK

asphalt mixture. The pavement is 66 ft. wide, not including the 10-ft. to 14-ft. apron inside the racing line; the total paved width thus is 76 to 80 ft.

The alignment of the old track was not materially changed. The measured one-mile racing line is from 10 (on tangents) to 14 ft. (center of curve) inside the inner edge of the pavement aprons. There are no easement curves between the tangents and the curves, as this would have required a redesign of the old track. An approximate cross-section of the curves is shown in Fig. 1. To attain the maximum superelevation of about 10 ft., the P.C. of the curve of the outside edge of



FIG. 5. CONSTRUCTION PLANT, NARRAGANSETT PARK AUTOMOBILE RACETRACK, CRANSTON, R. I.



FIG. 6. ROLLING ACROSS THE TRACK ON A 31% GRADE WITH SPECIAL STEAM ROLLERS

the track is placed at half the full superelevation, which is attained at a point 100 ft. beyond the P.C. From the P.C. to the level of the straightaway 150 ft. intervenes. Fig. 2 is a cross-section on the straightaway. The dished surface on the curves was obtained by eye, no templets being used.

For use in building the pavement, Mr. Perkins purchased one of the largest-size Cummer portable asphalt plants, a 10-ton 3-wheel steam roller, two 6½-ton tandem steam rollers, crushers, screens and bins and all other necessary paving equipment. He hired his own employees and personally superintended the work. Local stone and gravel were largely used, although imported sand and traprock were used to some extent. Work was begun in April and the pavement was completed in July at an approximate cost of $200,000. The tandem rollers had to be especially designed and built (Buffalo Steam Roller Co.) to permit their rolling the track banking, the upper half of which is on about a 31 per cent. grade. The difference between these rollers and the standard Buffalo-Pitts tandem rollers is said to be not only in the gear ratios, but in the boiler, which is designed for a higher pressure than standard.

Both edges of the track are lined with substantial posts spaced 3 ft. c. to c., to which are spiked two rows of 25-lb. steel railway rails. This railing is intended to be strong enough to deflect a runaway car back upon the track.

Inspection and Maintenance of Highway Bridges

In 1912 the state legislature of Rhode Island passed a law which put all bridges and culverts on roads which had in any way been improved by the state in the hands of the state highway department for maintenance and repair. In this way the perpetual care of about 156 bridges of various types was suddenly thrust upon a small engineering staff already with plenty of work to do. The bridges had been built at various times by the different county, town and city authorities and in many cases no record plans were available for filing with the state highway department.

To become better acquainted with the details of their legacy the following scheme was devised by the highway department engineers. Each bridge was inspected and measured by an engineer, and notes were made under the following heads: Name, location, type, causeway, substructure; abutments, piers, piling, wing walls, superstructure; trusses, lateral systems, bearing on abutments, floor-beams, stringers, roadway, sidewalks, railing, paint; general remarks; recommendations; notes. Two photographs, side and end elevations, were taken of each bridge with a 3A Kodak. All this was accomplished by one man in about 30 days.

From the inspection report, index cards 4x6 in. (Fig. 1) were compiled giving all the essential descriptive data on each bridge. In the filing number the first letter of the name of the county in which the bridge is located is used, together with the numerals of a serial number which runs from 1 to 156 for the entire state. A road map with the numbers of the bridges lettered on at the bridge site furnishes a ready means of locating any bridge. With the first a second 4x6 card is kept, carrying a record of the

B-11

HAMILTON AVE. BRIDGE

Location ..... Wickford (Boston Neck Road)
Type ..... Pratt Steel Truss—pin-connected
No. of Spans 1
Date Built ..... Built by ..... Town
Overall Length ..... 104 ft. Width .... 33 ft. T. W. .... 20 ft.
Clear Span ..... 101 ft. Causeways .....
Headroom ..... 2½ ft. Headwalls .....
Bridges ... Fieldbook No. 213 Plans P11
Reports and Data
Road F. B. No. 417 Sta. 950 N. K. 1908, Sec. 1
Plans

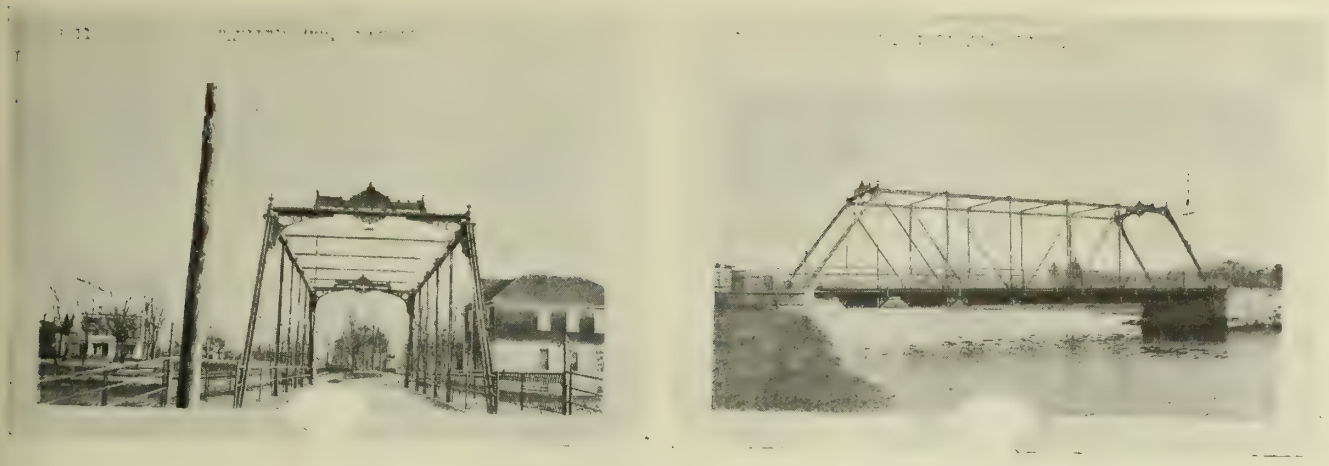
FIG. 1. RECORD CARD OF BRIDGE DATA; RHODE ISLAND STATE HIGHWAY DEPARTMENT

B-11

HAMILTON AVE. BRIDGE—MAINTENANCE

1912 Lumber and repairs	$126.95	
Painting	273.74	$400.69
1914 General repairs to sidewalk	11.82	$412.51

FIG. 2. RECORD CARD OF BRIDGE MAINTENANCE; RHODE ISLAND STATE HIGHWAY DEPARTMENT



FIGS. 3 AND 4. PHOTOGRAPHIC RECORD OF STATE HIGHWAY BRIDGES, RHODE ISLAND

repairs to each bridge (Fig. 2). The two 3¼x5½-in. photographs are mounted on 4x6-in. index cards (Figs. 4 and 5) and filed with the cards shown in Figs. 1 and 2.

As fast as they can be prepared, record plans of all the bridges are made from the field measurements. However, it is stated that the index cards and photographs afford a quick acquaintance with all the essential details of each bridge and its surroundings and have greatly facilitated the scheme for maintenance and repairs.

When repairs are made the foreman or assistant engineer in charge fills out weekly reports, 8½x11 in., which give the cost of labor and materials (differentiated). These are filed in the highway department office in a loose-leaf binder, under the bridge number, and the annual summaries only are transferred to the index card. In the same binder are kept the originals of the inspection reports.

Besides the file of cards of bridge descriptions and repairs, which are arranged consecutively by number, a separate card file is kept, arranged by names of towns alphabetically, under the name of each town being a list of the bridges in the town and their numbers. Another card file is kept of the bridge material on hand at different points.

The Chief Engineer of the Rhode Island State Board of Public Roads is Irving W. Patterson and the Assistant Engineer in charge of bridge inspection is J. V. Keily.

Organization for Bridge Work by Day Labor, St. Louis

The adoption of the day-labor system for the construction of the east, or Illinois, approach to the new Municipal Bridge over the Mississippi River at St. Louis, Mo., was noted in our issue of May 13, 1915, and the organization under this system is shown by the accompanying drawing. Clinton H. Fisk is Chief Engineer.

The railway approach will be 2.3 mi. long, and the highway approach 0.7 mi. The structure will include 24,000 tons of steel and 35,000 cu.yd. of concrete. Boller, Hodge & Baird, of New York, are the consulting engineers; Brenneke & Fay, of St. Louis, act as the resident engineers.

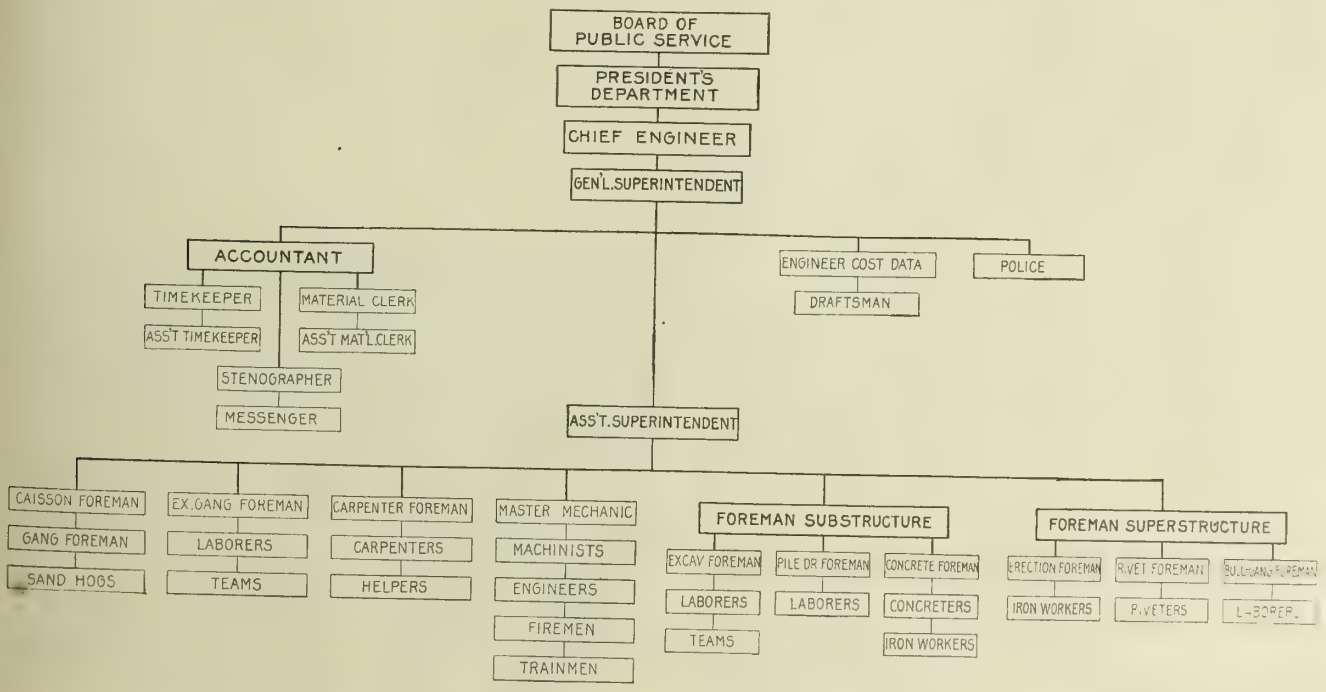


CHART OF ORGANIZATION FOR BUILDING EAST APPROACH OF ST. LOUIS MUNICIPAL BRIDGE

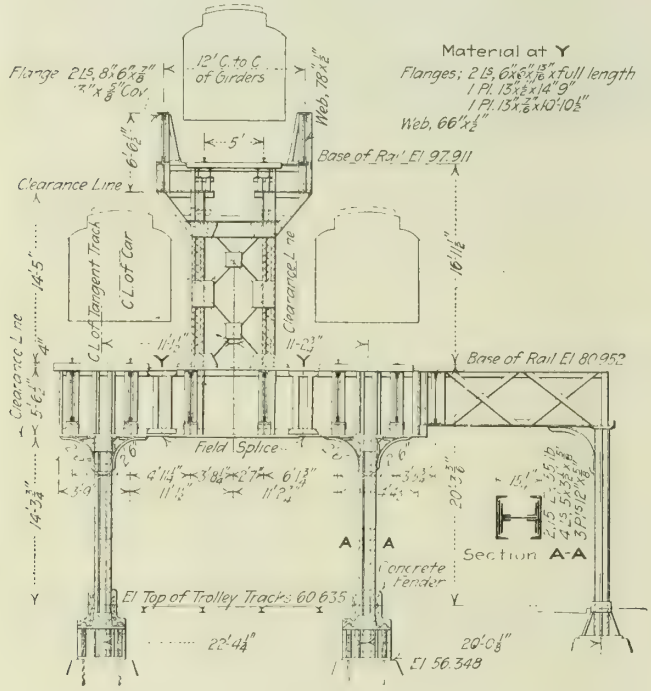
Rivets in Tension

Continuing the previous discussion in *Engineering News* concerning the admissibility of rivets for service in tension, V. H. Poss[1] describes how rivets showed their superiority over bolts in the San Francisco earthquake and fire of 1906. In those steel-frame buildings that collapsed in whole or in part, he observed that bolted field-connections had almost invariably given way by the bolts breaking off; in all-riveted work, on the other hand, the connection angles tore apart at the root, leaving each leg fast to the member to which it was riveted. This occurrence furnishes good testimony in favor of rivets in tension.

Using rivets in tension for wind-bracing connections is sound practice, Mr. Poss believes; but where load is carried directly, whether dead- or live-load, and failure would result in serious damage, neither rivets nor bolts in tension can be considered reliable.

As to the harmful effect of initial tension in rivets, he shows by an example that its influence is usually small. If the compressed area of plate under the rivet is four times the sectional area of the rivet shank [this seems a conservative assumption—Editor], then an initial stress of 12,000 lb. per sq.in. in the rivet gives a compression of 3,000 lb. per sq.in. in the plate. When tensile load comes on the rivet, it is resisted partly by further stretch of the rivet, but more by the relief of compression in the plate. The plate compression is entirely relieved by the time the rivet tension has increased to 15,000 lb. per sq.in., at which stage, therefore, the initial stress loses all its influence. Tension in rivets is actually utilized in nearly all riveted work, but especially in the cover-plate riveting of girder flanges, William Vetter[2] points out. The shear between plates is resisted by friction and not by rivet bending, and this plate friction is produced wholly by the tension in the rivet. If it is not good practice to depend on this tension, a new design for girder flanges is necessary, in which no rivet shall pass through more than two thicknesses of metal.

[1]Consulting Engineer, 57 Post St., San Francisco, Calif.



A Special Hoisting Job

Two plate-girders 100 ft. long had to be set for track elevation over the elevated-railway structure at 53d St. on the Ninth Ave. line, New York City, a short time ago. Inasmuch as the operation was bound to interrupt traffic, it had to be done in the shortest possible time. The contractors, Terry & Tench, Inc., laid out their plant with this end in view.

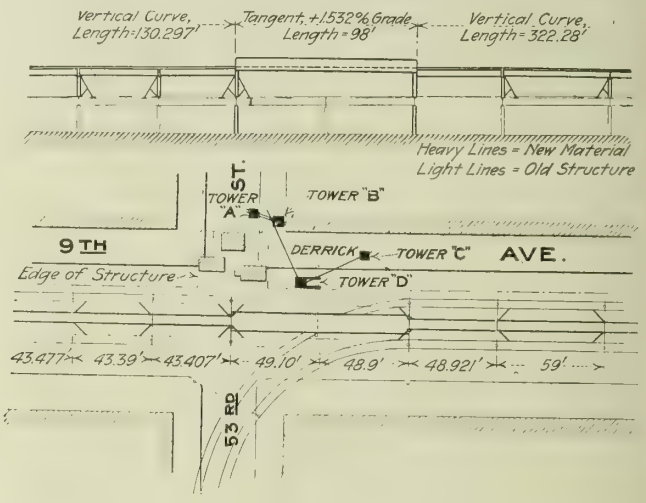


FIG. 1. "HUMP" TRACK AT 53RD ST. TURNOUT, NINTH AVE. ELEVATED, NEW YORK CITY

A 75-ton steel derrick was used to do the lifting. A signal-tower projection of the elevated structure limited the location in a rather awkward way, as the plan in Fig. 1 shows. To reach the final position of the girders the derrick had to be placed practically at the level of the elevated structure, about 20 ft. above street. This meant supporting the mast and stiff-legs on towers.

[2]Civil Engineer, 2463 Marion Rd., Fordham, New York City.

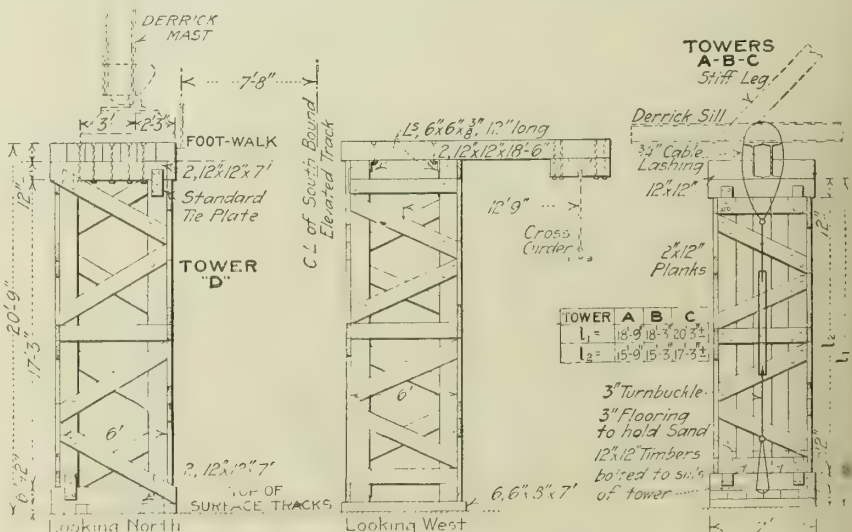


FIG. 2. DERRICK TOWERS

Fig. 2 shows in sketch form the construction of the towers. For taking the uplift on the stiff-legs these towers were filled with sand, the weight of which was taken by an anchor rope carried down from the two I-beams capping the tower to a platform in the bottom.

The long girders make a crossing of the raised middle express track over a turnout of the local track (to the Sixth Ave. line); they are located as shown in Fig. 1. Each girder weighs 27 tons. They were brought by team to the site and stored in the street just north of the derrick. In this position the derrick had to reach some 65 ft. in making the lift, but in a position where the uplift on the west stiff-leg was very slight. The girder was hoisted and the boom topped in, swinging out only enough to allow the girder to clear the mast. After getting above the level of the elevated structure, it was moved directly south by a combination of topping and swinging movements and set in place on the permanent supporting bents already erected. As soon as it was held by a few bolts, the operation of trains past the point of working could be resumed.

In setting the first of the two girders, train operation was stopped only 12 min. The second girder required 22 min. interruption.

The derrick had 36-ft. mast and 70-ft. boom, of structural steel with steel fittings. This derrick, if properly anchored, is capable of lifting its capacity at a reach of 40 ft. It has no bullwheel, but was swung by side lines from the end of the boom, going to the engine by way of lead-blocks. Tag-line tackle was also used.

While the hoist was not very heavy, the awkwardness of the location and the necessity of doing the job rapidly and with certainty made it an unusual and rather anxious piece of work. All persons concerned were gratified at the speed of working realized. Holton D. Robinson was engineer for the contractors and W. R. Coppage was superintendent. The work was done for the Interborough Rapid Transit Co., George H. Pegram, Chief Engineer.



FIG. 3. HOISTING SECOND 100-FT. GIRDER AT 53RD ST.



WEIR AND SURVEYING PARTY IN BURMA

Stream-Gaging in Burma

Engineering, wherever it may be, employs much the same methods. The accompanying view will present a familiar appearance to many civil engineers. Take away the banana trees and the bamboo, and it could well serve for similar operation of stream measurement in most any temperate country. Yet the original photograph was taken far in the interior of Burma, where few engineers have penetrated before.

The weir shown is the standard contracted weir, and the water quantities were computed by the Francis formula.

The lumber used in the weir was teakwood, freshly cut. Teakwood, when freshly cut, has a strong, not unpleasant, pungent odor which rather effectually drives away mosquitoes and gnats—a welcome relief to the European.

The young man by the level is not the engineer, but the engineer's muscles, his duty being to carry the instrument and set it up, leaving only the centering and final leveling up (and of course the reading of angles) to be done by the engineer.

The rodman, a dignified, turbaned Hindu, in his slow way was rather an efficient workman and performed his duties creditably.

It has been my observation that an unskilled laborer is the same as any other form of engine, and like any other heat engine can only perform as much work as the fuel it consumes. The Hindu is a notoriously light feeder, and most of his foods are low in calorific value; consequently he is not strong in energy.—J. D. Swaren, Hayward, Calif.

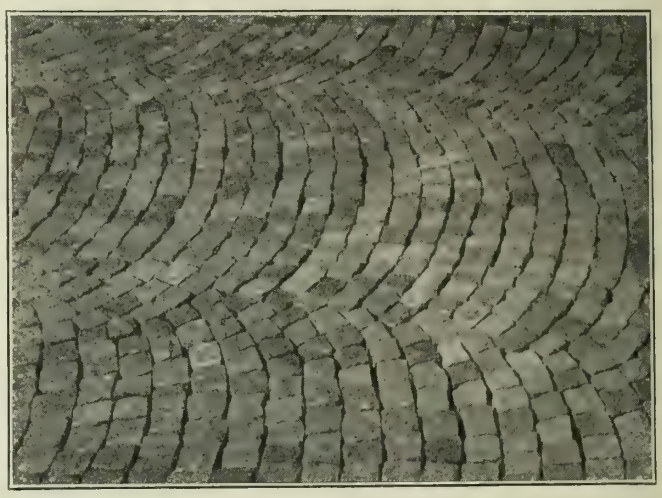
NOTES

Smooth-Break Blasting of underwater concrete pillars was recently accomplished by one Bolger, a South Carolina blaster, according to the October issue of the "Du Pont Magazine" (house organ of the Du Pont powder company). Some 3-ft. iron-incased concrete pillars, 24 ft. long, 8 ft. under water and 8 ft. in mud and sand, were to be cut down level with the mud bottom. The first attempt was by shooting holes drilled in three sides, but this gave a jagged surface. Then a cloth pocket about 2 in. wide was filled with dynamite and wrapped around the column at the proper level. After the charge was fired the break was found as clean as though the concrete had been sawn.

Long Lines in Triangulation—The longest line in the United States Coast and Geodetic Survey triangulation is that from Toiyabe Dome, Nev., to Ragged Peak, Nev., about 227 mi. This was observed only in one direction. The line from Mount Shasta, Calif., to Mount Helena, Calif., is 192 mi. in length, and that from Mount Ellen, Utah, to Mount Uncompahgre, Colo., is 183 mi. The triangle formed by Wheeler Peak, Nev., Mount Nebo, Utah, and Pilot Peak, Nev., has sides of 148, 148, and 141 mi., respectively.—August "Bulletin" of the U. S. Coast and Geodetic Survey.

A Locomotive Crane for Ditch Excavation, mounted on a steel scow instead of on wheels, is proving economical in cleaning out the ditches which take care of waste water from the higher levels on the Minidoka irrigation project in Idaho. The Brownhoist crane is operated by a 40-hp. White gasoline engine, with an electric self-starter. It is equipped with a 33-ft. variable-radius boom and ½-cu.yd. Brownhoist bucket. The barge is constructed of steel plates and angles, and so built that it can easily be knocked down for removal to other points. A hand-operated pump is carried for emergencies. An electric-lighting system with two large lamps and reflectors has been installed to provide light for night operation. The barge and crane are designed to operate in 3 ft. or more of water, without spuds. The center of gravity is very low and the rotating parts are balanced. The crane has been in operation several months and it has been proved that it will work in less than 3 ft. of water. It is propelled along the ditch by means of hand crabs, one in each end of the barge. The rope leading from the crab is fastened at some convenient place along the bank and the barge is pulled ahead a few feet to the next digging. It requires three men for the two shifts, one operator for the day and one for the night, and a helper during the day. The silt is dug from the bottom of the ditch and deposited on the bank. F. N. Cronholn, Rupert, Idaho, is superintendent of construction for the United States Reclamation Service.

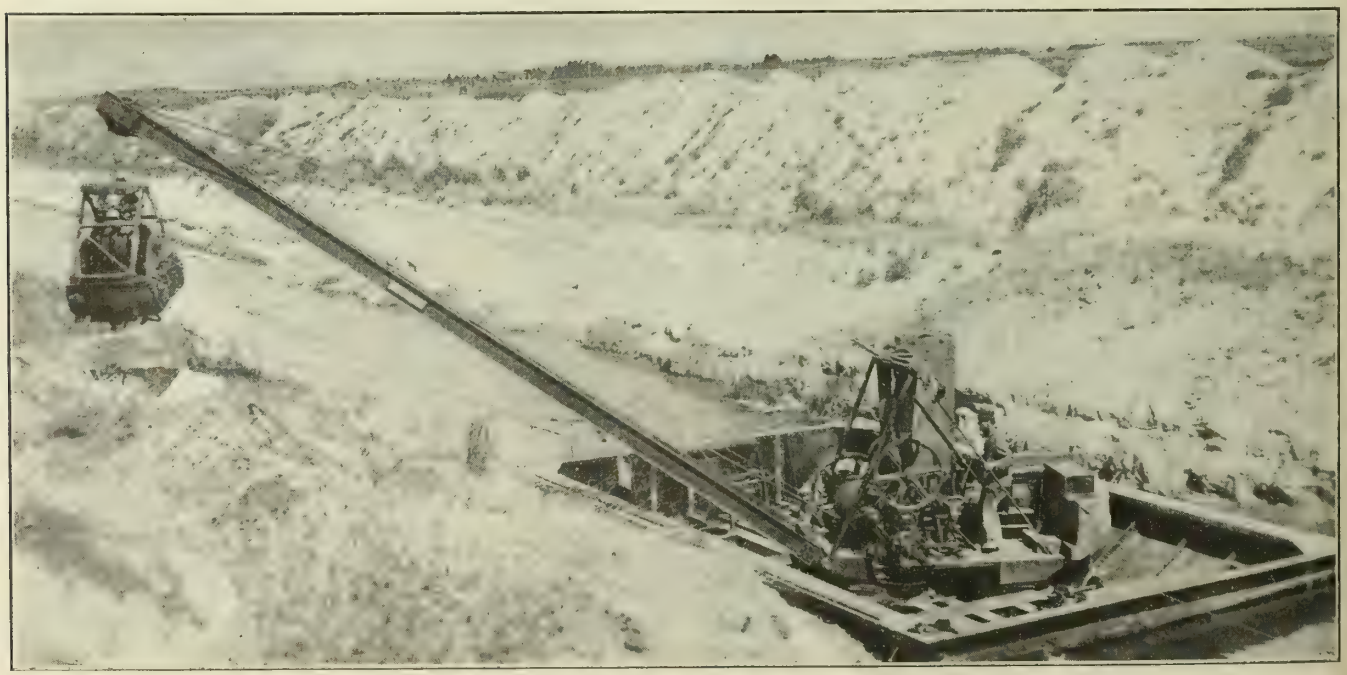
Cube Granite-Blocks for Driveway Floors are being tried in the new American Express Co. and Mail Service buildings of the Grand Central Terminal improvement, at 45th St., 46th St. and Lexington Ave., New York City. Owing to the lack of available depth, full-size granite paving blocks were out of the question, yet on account of the concentrated traffic of heavy mail and express trucks a granite wearing surface was deemed essential. The blocks used are 3-in. cubes of



"DURAX" GRANITE-BLOCK PAVEMENT; DRIVEWAY OF MAIL SERVICE BUILDING, GRAND CENTRAL TERMINAL, NEW YORK CITY

Salisbury, N. C., granite known by the trade name of Durax. Under the blocks is a 12-in. concrete floor, on which the blocks are bedded in a 1:2 mortar bed from ½ to 1 in. thick. After laying, the blocks were rolled with a 7-ton tandem roller. The joints were swept half full of pea stone and poured full with asphaltic cement. Although the driveways are only 144x40 ft. these pavements are notable experiments in testing the durability of small-cube granite-block pavements under heavy and dense traffic conditions. They will also be interesting in throwing light on the question of the durability of mortar beds for granite block pavements under such traffic conditions—a point now being much discussed. The pavements were laid by the Metropolitan Paving Co., New York City, which has secured the rights to manufacture and lay Durax pavements in this country.

Accumulation of Silt in Lake McMillan on the United States Reclamation project at Carlsbad, N. M., has reduced the capacity of the lake about 26% in a period of 11½ years, according to measurements recently made.



USING A FLOATING LOCOMOTIVE CRANE FOR DITCH EXCAVATION

Editorials

Color in Hydraulic Tests

New advances in hydraulic engineering having the interest and service possessed by one shown in this issue are so infrequent that they compel unusual attention. The use of dissolved coloring matter in determining flow through long penstocks and hydraulic turbines is distinctly an addition to the methods previously available, though it is perhaps essentially a development of the old float scheme of gaging stream flow.

No little credit is due Mr. Johnson and his associates for developing this test into one of accuracy and simplicity. With this development disclosed so fully as in Mr. Taylor's article, little more than some accumulated experience is needed by any engineer who desires to use this novel plan.

The color test as so far worked out is of greatest application with fairly long pipe lines where any slight errors of introduction of and observation at exit are swallowed up by a long elapsed time of transit. Future use of the method will show how far Mr. Johnson's empirical rule holds for relation between initial, final and mean time of transit; then we may see if the true mean velocity is ever less than that observed in color runs—as might possibly be the case with a very large conduit of limited length and using a single midstream injection point. This test holds out interesting possibilities for determining flow in canals and possibly in some rivers, though a vast amount of development work is essential in securing proper injection of the color and in determining what constitutes the indication of mean velocity.

Kicking Engineers Around in New York Departments

The huge sums of money that are being "saved" for New York City every day by proposed wholesale discharges of engineers in the city service and by the reductions of the salaries of such engineers as would be left is more creditable to the imagination than to the intelligence of the proponents. Here is an example—both of the "saving" and raving:

> New York City is being bankrupted by its engineers. It has just been brought out that the salaries of the engineers of the Public Service Commission amount to $2,300,000 annually. There are so many useless engineers on the payrolls in other departments that they are constantly devising means of spending the city's money in order to show some excuse for their jobs. The result is an unending series of sewer repairs, new sewers, changes of grades and widths of streets, new streets, and new improvements of all kinds. It is rumored that the engineers of the Water Board are now busy making surveys and borings for a $50,000,000 addition to the Catskill aqueduct. If two-thirds of the engineers on the payroll were discharged, the saving to the city and the taxpayers would immediately amount to millions of dollars.

Such talk almost answers itself. Some people, however, may not know that New York is building a vast rapid-transit subway system, the cost of which will run into the hundreds of millions, and those who do know it may not realize the number and complexity of the engineering problems that arise from such an immense task carried on in and beneath the streets of a great city. The subway, the new Catskill water-supply and many lesser works of large importance in the aggregate demand a good-sized army of competent engineers, many of whom must be paid large salaries.

If events prove that the present and earlier city administrations have entered upon more extensive public improvements than the taxpayers are willing to stand for, after real extravagance and waste have been cut down, then of course the engineers in the employ of New York City will stand up like men, as engineers always do, and take their fair share of the burden of readjustment. When it comes to being treated like old-time Harlem goats or "houn' dogs," that will be another matter, but until those in authority join in such irresponsible clamor as is now going on, the municipal engineers of New York will do best to continue to maintain a dignified silence.

Contractors' Bids on Their Own Plans Declared Illegal

Asking contractors to furnish and bid on their plans is far too common. What appears to be a flagrant case of this kind has occurred at Seattle, Wash., but thanks to a clear-headed and courageous corporation counsel, a farcical proceeding that might have added difficulty to difficulty has probably been averted.

The Seattle incident is connected with proposed measures to stop leakage from the Cedar Lake reservoir. (See *Engineering News*, Jan. 21, 1915.) James E. Bradford, Corporation Counsel of Seattle, was asked to pass upon the legality of the following provisions from an invitation for bids:

> The method of treating the reservoir basin to reduce loss of water by percolation therefrom will not be specified by the City of Seattle. Contractors are invited to examine the site of the reservoir and submit their own proposals for reducing the loss of water.

Mr. Bradford first points out that the city charter (Art. VIII, Sec. 14) distinctly provides that all contracts for public improvements must be let "to the lowest bidder" after public advertisement for at least ten days, during which time "plans and specifications" for the proposed work must "be on file" and subject to inspection. This language, the corporation counsel rightly says, is so plain as not to be "even open to construction."

To remove any lingering doubts as to whether the charter provision is legally sound Mr. Bradford cites some telling sentences from Coshert vs. Seattle (57 Wash., p. 649-51), in which the court declared that this very provision of the Seattle charter was designed to prevent "favoritism, fraud and extravagance" by making "intelligent competition" possible and by affording a basis "for ascertaining who in fact was the lowest bidder." That the Washington court was not alone in this opin-

ion was shown by citing People vs. Commissioners of Buffalo County (4 Neb., 150), in which the court ruled that county commissioners could not contract for a bridge "when the only competitive bidding was upon plans furnished by the respective bidders." In line with both these decisions is Dillon's "Municipal Corporations" (Sec. 807).

The case against inviting contractors to bid on their own plan is made all the stronger at Seattle by the charter provision that the board of public works cannot pass upon who submits the *best* but only upon who submits the *lowest* bid. Where each contractor submits his own plan there might be as many plans as bids, no two upon the same basis, making it impossible to say which bid was the lowest.

To drive the argument home Mr. Bradford passes from charter provisions, court decisions and expert legal opinion to a common-sense statement of the case, the gist of which is that since sooner or later the city authorities must decide upon some plan for stopping the leaks they might as well do so at once, "without fear or favor."

As nearly as can be judged from across the continent, but in the light of evidence from other and apparently similar cases, the Seattle authorities sadly confused two things that should have been kept separate—the selection of a method of stopping the leaks and of a contractor to execute the plan selected.

If the authorities desired a competition on plans, why did they not confine their request for bids to plans alone? A plan selected, real competition could then be secured for its execution and all the bids would have been on a strictly competitive basis. But even this course would not warrant placing elsewhere than upon an engineer the main reliance for selecting a plan and awarding a contract for stopping the leaks from the reservoir. There are strong indications that Seattle and some other Pacific Coast cities have been governed too much of late by laymen who put a higher estimate on their own opinions in engineering matters than upon the judgment of engineers.

Leaves and Storm-Sewer Inlets

Unless storm-sewer inlets in tree-lined streets are properly designed, leaves may be thrown down by a heavy storm and the street drainage system go out of commission under the influence of a narcotic of leaves, sticks and mud. Just such a condition as this occurred during and just subsequent to a rain and hailstorm in Jackson, Mich., in August. This was the third storm of the sort to occur there this summer, and each time the same street was flooded by the stopping-up of sewer-inlet gratings. H. K. Higgins, of Jackson, Mich., writes as follows:

> These three storms show a marked phenomenon which the writer has frequently observed elsewhere—it is not the precipitation per se that causes flooding or measures its damage, but rather the uncleanliness of streets and water courses. In the third storm there was, nearly at the time of maximum precipitation (0.8 in. in 15 min.), a heavy hail with stones measuring 1½x1½x1 in. The hail cut the foliage from trees and the leaves clogged the catch-basin inlets, which have holes 2½ in. square and a slot about 21x4 in. (the Hall inlet). The water rose after the rain had practically ceased, flooding the street, which was being paved.

There are many designs of sewer-inlet protection. Which to choose depends upon a variety of local conditions, all of which should be given careful study. The Jackson incident shows what may happen with closely grated openings in tree-lined streets. But if the openings had not been closely grated it is conceivable that the sewers, at the time of this or a subsequent storm, would have been clogged by leaves and associated material and the streets flooded just as badly. It is the duty of the engineer to guard against either contingency as fully as is possible within the funds at his command. Beyond that, he must try to select the lesser of two evils.

Small Street Cars To Compete with Jitney Busses

The competition of the jitney bus continues to be the most actively discussed subject in street-railway circles from ocean to ocean. It may well be so, for the alarming decrease reported in the earnings of some roads means either a remedy or a receivership. In the last six months many investigations of the situation all over the country have been made and the results generally agree on three points: (1) The jitney movement has popular approval in most cases—in spite of broken-down and overcrowded vehicles—and severe restrictive ordinances do not have universal approval; (2) the business tends to limit itself through the narrow margin of profit secured even by free-lance owner-drivers who do their own repairing; (3) the impossibility of running nickel busses where licenses, liability bonds and police oversight are imposed to protect the public as fully as is done against the hazards of street-railway transportation.

The small net earnings won by jitney owners constantly eliminate many vehicles, but so far there has seemed to be a good supply of venturesome spirits each with his necessary one or two hundred dollars. Evidently the street railways cannot safely rely on the movement's dying by starvation. The popularity of the jitneys and frequent public disapproval of severe ordinance restrictions make the hope of legislating the movement out of existence a precarious one.

Naturally, then, the street railways are looking for ways of meeting their new competitor with more popular and cheaper service. The scheme most talked of now is that of replacing the very heavy cars which have come into vogue with very light and small one-man types. This would give the more frequent service, fewer stops and quicker runs which seem to keep the jitneys patronized; the railway would apparently gain through decreased motive-power, track-repair and platform-labor costs per passenger. In the course of time perhaps the unit overhead charges could be decreased through smaller investment in rolling stock and track construction, for the weight of cars and trackwork has gone up as the square of the capacity of the cars, or as some higher power.

Five years ago there was a strong reaction against the heavy street cars that were being run. Street-railway engineers were discussing the details that could be lightened without sacrificing carrying capacity and necessary strength. There was pressure from the administrative officials to cut down the maintenance and power costs, but the public had not shown its preference for a light fly-away service. Neither engineers nor administrators had the nerve to plunge into such a revolution of service as is now proposed, even if they realized the pe-

culiar relation between car capacity and total expenses. A few of the small one-man cars have been put into use, but it is too early to know how successful they really are. In crowded city streets two men have been found indispensable on a car, and where the new type has appeared an extra motorman has been put on to carry the car through the congested zone. Some need of educating the public and overcoming labor-union opposition seems to be called for, but there is a field for the service, at least in the smaller cities and on outlying lines, so that if this scheme is really the preventive of impending bankruptcy, as some think, such possible obstacles will be swept away.

Embedding Street Railway Rails in Concrete

Every engineer responsible for railway-track construction or maintenance will be interested in the new type of street-railway track which is to be laid in Charlotte, N. C., and is described elsewhere in this issue by E. R. Horton, the engineer who has worked out the details of the design.

In *Engineering News* of Aug. 6, 1908, was described the design for street-railway track developed for use in Charlotte by James N. Hazlehurst, then chief engineer. In that design wooden ties were used at the rail joints and at intervals of 12½ ft. between. The main supports of the rails, however, were the concrete longitudinals, to which the rails were held by U-shaped anchor stirrups.

The most noticeable feature of this track is the lack of ties. The rails are laid upon flat steel plates which are bedded on heavy concrete stringers. It is not such prominent features, however, which will be of the greatest interest to maintenance-of-way engineers, for superficially similar designs have been employed before—and without any phenomenal success. (A recent investigation of track construction in the larger cities of this country disclosed the existence of nearly 150 mi. of the tieless concrete type—about 2% of the total.)

What track engineers will look at will be the provisions for maintaining rigidity of the running rails, especially at the joints. Play would develop at the joints from the impact of car wheels and elsewhere along the track as the result of shrinkage of the concrete. Mr. Horton seems to have forestalled trouble at both points by ingenious and well-planned construction, particularly the use of wood inserts and spring washers at anchors.

No doubt the design will receive severe criticism from those who contend that a certain amount of elasticity is a necessary feature of railway track. The earliest track was laid with cast-iron rails on stone blocks, and it promptly proved a failure. Ever since, it has been argued that it is impossible to carry the rails on unyielding supports. On a cross-country stretch of railway track some elasticity is essential; a rigid roadbed all of whose parts possess equal resistance to compression, is a financial impossibility. Compression of the wooden ties and slight bending of the rails is necessary to take up the inevitable inequalities of the surface. But when rails are laid in paved streets, rigidity is essential to long life of the adjoining pavement and the expense of maintaining an embedded elastic track makes a rigid construction feasible.

The concrete stringers supporting the rails in Mr. Horton's design are made monolithic with the concrete street paving, which is carried to the top of the rail head. The rapidly increasing use of concrete for paving makes this design of special interest from this point of view also.

To Make the Home Safer

There is great promise in a piece of work recently started by the National Board of Fire Underwriters. Experts retained by the board are studying how the house—the ordinary separate "cottage" dwelling-house—can be made more safe against fire.

Many volumes have been written on fireproof construction, and inventors and manufacturers crowd the market with materials for building fireproof floors, walls and other parts in the cheapest and most effective style. There is also a fair amount of written knowledge on fire-retardant construction and on mill construction and the like. All this is for the office, the warehouse and the factory—but not for the home.

Dwelling-houses are not built fireproof (or if they are we call them mansions), nor are they built of mill-construction type. They are wooden structures, with the wood so subdivided as to present favorable conditions for rapid spread of fire. Their frames and walls form a multitude of interconnected cells, concealed hollow spaces communicating by way of cracks and by holes cut for plumbing and heating pipes and electric wires that are threaded through these spaces. Their construction does not meet the chief requirements of fire prevention. Baldly stated, a dwelling is a firetrap.

The insurance interests have for some years made a persistent campaign against the shingle roof; so persistent, in fact, that one might have thought all other elements of the dwelling-house to be acceptable. But the fact is that the fire dangers within the house are many and varied, and the roof danger singly may be by no means the most important point of improvement. Regardless of the relative magnitude of the interior and the roof hazards, however, the following is true: That if a campaign against interior fire dangers promises to yield large results and the campaign against shingles only a small result, it is high time to take up a study of the interior risks and get the campaign started.

Thousands of home builders throughout the country will be glad to have the results of this study. Today they lack instruction or advice on the subject. They know nothing of fire prevention in either the construction or the operation of the house, and as for fire-fighting provision they know even less. Perhaps it is advisable for every house to maintain an extinguisher on each floor. It so, let the underwriters determine this fact and publish it.

A 2% to 5% increase in the cost of a house can accomplish a surprising improvement from the fire-protection standpoint. There will be no great difficulty in inducing home builders to invest this additional amount, provided they are informed in detail how to reduce the fire risk. The underwriters have undertaken to show them how.

The underwriters might well go a step farther than merely preparing advice. They might adjust the rates accordingly. In business buildings the possibility of reduced insurance rates stimulates extra precautions. Should that be neglected among the householders?

Letters to the Editor

Improved Chuting of Concrete

Sir—The editorial note entitled "Concrete Chuting Predominant," in *Engineering News* of Aug. 12, was read with much interest. It appears, however, that *the one* very important factor that has silenced much of the objection to spouting concrete was omitted. The same is true of Mr. McCullough's letter in the issue of Sept. 2.

In the days when the gravity chute was more or less of an experiment many contractors saw therein a means of placing concrete very economically, and in order to make "records" with the rather crude apparatus then available (compared with the uptodate spouting plant), the concrete quite naturally was mixed very wet to insure its "flowing" in the chute. Then, also, there was a tendency to cut down the time of mixing, since no difficulty was experienced in getting the concrete away from the mixer, as had been the case with other methods. These two conditions naturally produced results which raised a storm of adverse criticism from engineers, for the great amount of laitance (decomposed cement formed in the presence of an excess of water) present did, without question, weaken the concrete. In one case with which I am acquainted a great number of laitance spots were found in a slab placed by chute. These never did harden and could be dug up easily with a knife to a depth of an inch or so. This without question was due to the excess of water used. The basis for the widespread criticism of gravity spouting of concrete was well-founded, and contractors and manufacturers were quick to realize that unless something were done to remedy the apparent faults, this type of apparatus would be barred by engineers and owners.

Accordingly, careful study was made of the proper angle of chutes and the consistency of concrete required to enable placing the concrete without the excessive use of water. It was soon found that, with a certain minimum angle of chutes, concrete mixed to the consistency of a thick gravy and having no excess of water would flow readily—such a mixture being surprisingly slippery and possessing a sort of oily smoothness. The addition of a small amount of hydrate of lime (up to 10% by volume of the cement) was also found to make the concrete flow more readily. To produce a mixture wherein the stone is held in suspension and the entire mass clings together requires more thorough mixing than is usually done, and herein lies the whole secret of chuting; excess water is not required.

With a little experience the man at the mixer can tell, by the following indications, whether the concrete is of the proper consistency to flow well in the chutes: If, when dumped into the skip or hoisting bucket, the concrete stands up in a pile, it is too dry and requires additional water and more mixing. If it levels off and shows a covering of water, it is too wet to hold the aggregate.

Not only must the mixture be right to insure successful operation, but the flow of concrete should be steady and continuous by proper regulation at the distributing hopper at the top of the tower. Increasing the time of mixing may make this last condition difficult of fulfillment, but this can be accomplished easily by having two mixers at each plant instead of the one usually seen.

Concrete chuting has come to stay because of the great economy of operation; it is the duty of the engineer to aid in obtaining the best results, rather than to forbid its use. Given a well-designed plant, all that the engineer needs to do, as his share, is to see that the concrete is properly mixed before being discharged into the chutes. This will remove the one great objection and actually result in stronger concrete than we now obtain with rapid mixing, even if there is no excess of water present. A paper read by H. H. Scofield before the Indiana Engineering Society gave the results of tests to ascertain the effect of mixing on the compressive strength of concrete. These tests showed that the strength was increased by from 27% to over 50% by lengthening the mixing periods from 10 to 18 min. over that of the usual ½ to 1 min. It would be impossible, of course, to increase the time of mixing quite so much, but with the aid of the mixer manufacturers, by building machines of higher speed, beneficial results can be secured.

Summing up the situation, the popularity of the gravity spouting system of concrete distribution can be increased still more by the use of high-speed mixers, a slightly increased time of mixing and careful supervision.

Albert M. Wolf,
Principal Assistant Engineer,
Condron Co., Structural Engineers.
Chicago, Ill, Sept. 8, 1915.

Lake Okeechobee Water Level

Sir—In the editorial columns of *Engineering News* of Sept. 2, 1915, under "Everglades Drainage Problems and Florida Rainfall," comment was made concerning the water level of Lake Okeechobee, the effect thereon of recent heavy rains and the condition of the surrounding territory. It was stated that last spring the lake was at its lowest stage and that as a result of recent heavy rains it was reported that the lake was at its highest stage.

It is clear that that part of the editorial relating to conditions on and about Lake Okeechobee was founded on incorrect information. The rainstorm of Aug. 1, 2 and 3, referred to in the editorial mentioned, extended in a more or less well-defined zone 40 to 50 mi. wide across the peninsular part of Florida, with St. Petersburg the center on the Gulf and Jupiter the center on the Atlantic side. During the three days, from 8 to 15 in. of rain fell, generally within the heavier storm area. The southern edge of the storm zone passed north of the middle of Lake Okeechobee.

The level of the lake as recorded for the week ending July 31 was 16.09 ft. above sea level; on Tuesday, Aug. 3, the level was 16.42 ft.; for the week ending Aug. 7, 16.63 ft.; for the week ending Aug. 14, 16.80 ft. The rise attributable to this storm was about 0.70 ft. The lowest level reached by the lake was 15.8 ft. during the autumn

of 1914. The lake overflows its banks on the south at El. 21.5 ft. The highest water ever recorded, not due to wind tide, is 21.8 ft. Okeechobee cannot rise above this level owing to the fact that at this elevation the lake spills over its entire southern rim for a distance of more than twenty miles, faster than there is any possibility of water being supplied to it.

The effect of the storm on Lake Okeechobee appears almost insignificant in consideration of the heavy rainfall. This is due chiefly to two causes—the storm was not sufficiently broad in extent to cause general extreme floods and followed a period of rain deficiency that had prepared the lakes and ponds in the Okeechobee drainage area and the ground itself for the reception of a large amount of water, without flooding. This flood cannot be used as a criterion by which to judge of what Lake Okeechobee can do when the opportunity is really offered.

At El. 16 ft. the navigability of the lake is but slightly impaired and this over shoals bordering the south and west shores. The lake is regularly navigated in and out of the canals on the south and east and Taylor's Creek by boats of 4-ft. draft, and there are more boats on Lake Okeechobee today than ever before. Three-fourths of the lake has a depth in excess of 8 ft. when the lake level is at 16 ft.

The remarks relative to the recommendations of engineers brought out in the editorial mentioned are concurred in by myself. The foregoing is offered, therefore, not in regard to the comment on the recommendations, but in correction of the erroneous information that must have been supplied you relative to Lake Okeechobee.

Work on the canals and regulating works for controlling Lake Okeechobee is progressing.

F. C. Elliot,
Chief Drainage Engineer,
Everglades Drainage District.

Tallahassee, Fla., Sept. 8, 1915.

Does Good Iron Preserve Paint?

Sir—"Good Bridge Paint" in your issue of Sept. 9 refers to endurance of paint on a wrought-iron highway bridge for 37 years. You point out that "here is a remarkable record of paint endurance." I believe that your emphasis should be placed on the good quality of the iron rather than that of the paint. This wrought iron it would seem to me was of such purity that paint in the first case lasted 17 years and in the second case at least 20 years. With inferior quality of iron or steel, how long would either coat of paint have lasted?

I have been told that wrought-iron links which were underground at the well-known Chain Bridge at Newburyport, Mass., were intact and free of rust after 100 years of service. From personal observation I can say that the iron of this bridge was remarkably free of rust 75 years after it was built, and I attribute this endurance to the quality of the wrought-iron rather than to a protective coating.

From experiments that I have been making toward rustproofing of steel and iron I have concluded that paint or other protective coating depends for its endurance upon one important factor that must be emphasized; namely, the quality of the underlying surface of iron or steel. If the surface is rusty, scaly, granular, wet or greasy, trouble is very apt to occur; and if the surface is smoothed off, even by sandblasting, impurities in the metal itself reacting with the paint or other coating will often start disintegration. But with pure wrought iron "such as they used to have," rust does not readily occur and paint easily endures.

The subjects of rust, bridge paints, and protective coatings that will withstand atmospheric and gaseous conditions without costing too much are worthy of more discussion by engineers. It should be practicable to obtain better results than we are getting.

F. B. Sanborn,
Consulting Engineer.

Tufts College, Mass., Sept. 12, 1915.

Earnings of Graduate and Nongraduate Engineers

Sir—Referring to my letter under the above title published in *Engineering News* of Aug. 12, p. 325, and your editorial comment thereon, I have gone to the pains of making a tabular comparison on the basis which you suggest, that is counting the experience in engineering to begin when a student enters college and not when he graduates. On this basis the comparison is as follows:

Years' Experience	Monthly Salary College Men	Monthly Salary Non-College Men
1	$00	$67
2	00	78
3	00	95
4	00	105
5	67	107
6	85	115
7	110	120
8	122	130
9	133	137
10	145	145
11	160	150
12	175	160
13	190	170
14	200	180
15	210	190
16	225	200
17	240	210
18	250	220
19	275	225
20	275	225
21	285	225
22	285	225
23	290	225
24	300	225

Assume that the college course lasts four years and costs $1000 a year. That is $4000 invested, noncompound interest on which at 5% for the first five years after graduation (when the graduate's earnings become equal to the nongraduate) is $1000; and during the same time the shortage in his pay compared to the other man's amounts to $1104. At the end of six years, then, he is $6104 behind. The interest on this during the next nine years is $2745, and his extra earnings amount to $2640, about balancing that. Then his extra pay begins to wipe out the principal and in six years extinguishes it. It is now 21 years since graduation, and from this time on the graduate gets $900 a year more than the nongraduate. But by this time half of the graduates have dropped out. So that the conclusion is that in, say, 20 years the college education will pay for itself, and as only half stay the 20 years out we may say that for half of those who graduate college pays.

The figures used above are supported by data at the beginning and end of the term; intermediate ones are interpolated. The figures for the end of the term are taken from the diagram in your issue of Jan. 7, 1915, the line for graduates being shifted four years to the right so as to make their experience date from college entrance.

Civil Engineer.

Nashville, Tenn., Aug. 17, 1915.

Automatic Cab-Signal and Train-Stop System

SYNOPSIS—This railway signaling system gives both visible and audible signals in the engine cab, and supplements these by a service application of the train-brakes if a "stop" signal is disregarded. A special feature is that the connection between the track and engine equipment is by magnetic influence only, so that no contact is required.

An interesting example of the development of cab signals and automatic train stops is found in a system placed, on Sept. 22, in service on the main line of the Western Pacific Ry. This installation comprises five miles of track at the district terminal at Oroville, Calif., and 20 locomotives used at this terminal are equipped with the necessary apparatus. The distance is divided into four block sections. There are 9 fixed-signal locations, at which 20 track devices are arranged for giving 15 cab-signal indications and 7 automatic-stop operations. The system has proved satisfactory under unfavorable conditions caused by snow and bad weather.

Both visible and audible signals are given in the engine cab for three indications—"proceed," "proceed under control" and "stop." Electric lights (green, yellow and red) form the visible signals. The others are whistles of three distinct tones, which continue to operate until the connections are restored to normal position by the engineman. If signals are not obeyed, the automatic train stop gives a service application of the brakes. This cannot be released until the train has been stopped, but it does not prevent the further application of the brakes by the engineman. Provision can be made for rendering the train-stop device inoperative when the speed is below a given rate.

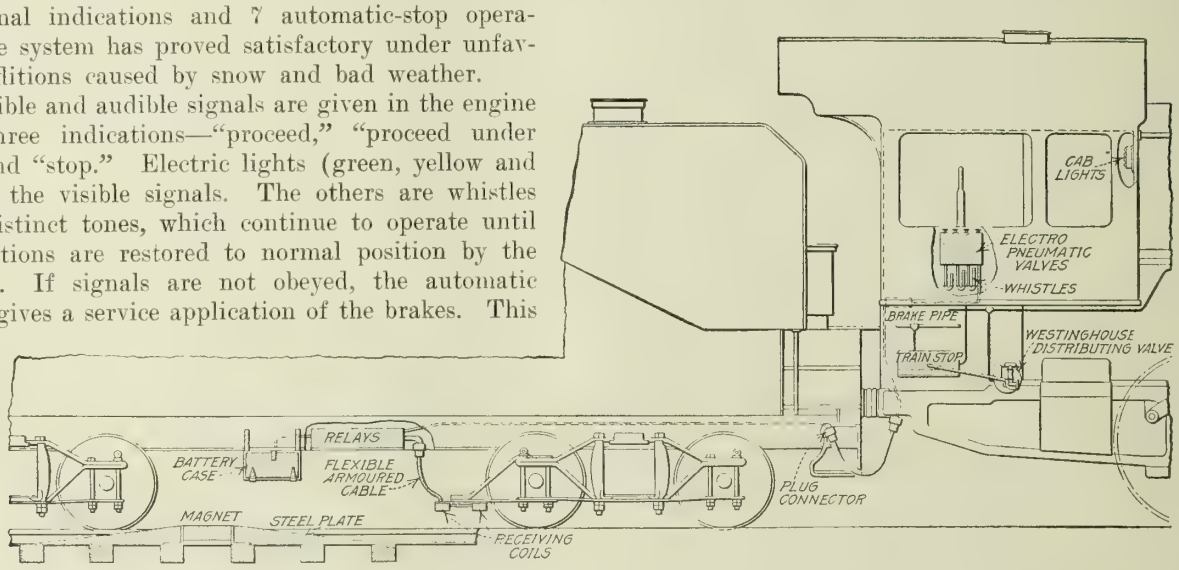


FIG. 1. TRACK AND ENGINE EQUIPMENT, BOSTWICK CAB-SIGNAL AND TRAIN-STOP SYSTEM

The transmission of signals from the track to the engine is effected by magnetic impulse only, and there is no electrical or mechanical contact between the parts on the track and those on the engine. The general arrangement is shown in Fig. 1. The track magnets are located between the rails, there being one for each of the three signal indications and a fourth for the train stop. Each track magnet, when energized, transmits signals for traffic in either direction.

The magnet is inclosed in a waterproof case 15⅞ in. long, resting on the ties and having its upper surface 1¾ in. above the rails. It requires an energizing circuit of 5 amp. at 10 volts, and normal operation takes current for 15 sec. only. The magnets are protected from hanging brake rods, etc., by 48-in. ramps or inclined blocks faced with steel plate.

Beneath the tender is a cross bar carrying the receiving coils, one for each signal and a fourth for the train stop. Each coil receives and transmits magnetic-impulse signals for traffic in either direction. This is shown in Fig. 2.

Each track magnet is so located that the corresponding receiving coil on the tender will pass directly over it. The cross bar carrying the coils is so placed as to provide a clearance of 3 in. between the magnets and coils. The extreme lateral or vertical movements of the engine cannot carry the receiving coils out of the magnetic fields of their respective track magnets or cause wrong signals to be given. Each magnet is entirely inclosed by a substantial, water-tight metal box, amply protected from injury. There are no moving parts in or about either the track magnets or the receiving coils.

Each fixed signal location has a standard railway battery set of 10 volts, with the necessary controlling and protective relays, wiring and trunking, and one or more track magnet boxes, according to signal needs. By means of a local track circuit, the track magnets are energized when an engine is 66 ft. distant and remain energized until after the tender has passed over the track magnet boxes at that location.

The apparatus on the engine consists of 4 receiving coils, 4 relays, a storage battery of 2.5 volts, 4 electromagnetic-control air valves, 3 electric lights, 4 whistles and the train-stop appliance. A receiving coil, actuated by its energized track magnet, transmits the signal impulse through its relay, electric connections and air valve to its cab light and whistle. The train-stop apparatus is similarly controlled and actuated, except that its valve is vented. Each operation of the train stop is automatically registered and the engineman held accountable therefor.

A visual signal at each train-stop location is the only roadside signal used. This consists of a simple, hooded, two-light marker for proceed indications, operated from the battery at that location. Closed circuits are used

with electric control. Wherever air control is used, any leak or break will cause warning signals to be set against approaching trains. Fig. 3 shows one of the fixed-signal installations at the end of a block, with the relay cabinet and the track magnets.

The receiving and relay coils are of relatively high resistance. The relay magnets are powerful enough to

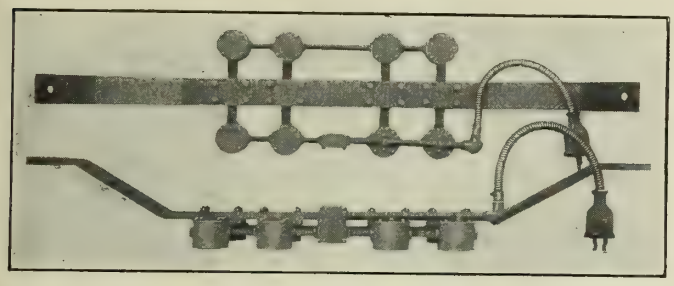


FIG. 2. GROUP OF RECEIVING COILS ON LOCOMOTIVE TENDER TRUCK FRAME

prevent contact from being opened through any engine vibration or shock, and the battery current is not essential to perfect relay operation, but is used to give protection against the breaking or loosening of any wire or connection.

The operation of the signal device is shown in Fig. 4. As the receiving coil passes through the field of the energized track magnet, a current is generated in it which is more powerful than, and flows in the direction opposite to, the battery current normally circulating in the receiving coil and relay. The action of this induced current momentarily reverses the magnetism of the relay, permitting its armature to drop and open the circuit to the cab apparatus. The armature is immediately reattracted to normal position. This interruption of the circuit deënergizes momentarily the iron-clad magnet *A*, causing the release of its armature *B*, which normally is tightly held to the poles of the magnet.

The lever *C* rises with the armature, and the air in the air supply pipe (connected with the engine main air reservoir) is thus permitted to unseat the valve and flow to the whistle. At the same time, the disk *D*, rising

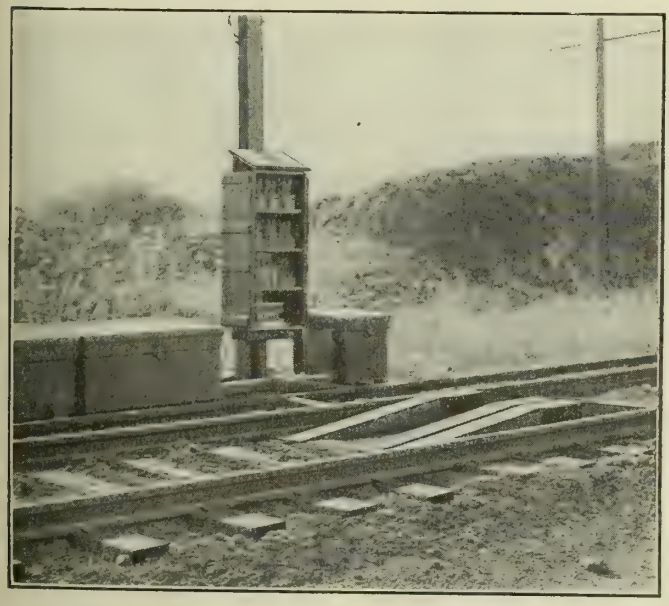


FIG. 3. FIXED SIGNAL INSTALLATION AND TRACK MAGNETS AT A BLOCK SECTION

with the armature stem, closes the contact springs *E* and lights the lamp. The armature is restored to normal position only when the knob *F* is depressed, which opens the contact springs, thus cutting out the signal light and closing the air valve. Fig. 5 shows the whistles and their control valves.

The foregoing description applies to each of the three sets of apparatus for signal indications. A fourth set of the same apparatus, omitting the lamp, is provided for the operation of the automatic stop. This is operated in the same manner as described except that the valve connecting with the automatic stop (outside and below the cab) is a vent instead of a supply valve. The alarm whistle of the automatic stop is located in the base of the automatic-stop valve apparatus. When the automatic stop has been operated, pressure on the knob *F* restores the vent valve to normal position, but the ser-

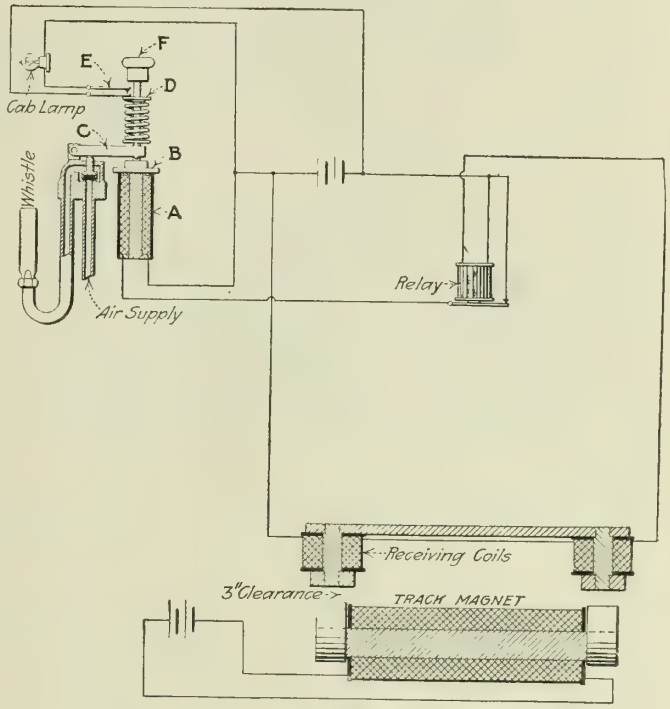


FIG. 4. DIAGRAM OF TRACK AND ENGINE EQUIPMENT

vice application of the brakes given cannot be released until the train is stopped, when the engineman must restore it from the ground. The necessary reversal of the operation of the receiving coils when an engine has been turned is provided for by a reversing switch.

The train-stop device (Fig. 5), is connected to the brake pipe, and is pneumatically operated and electrically controlled. When it has applied the brakes they cannot be released until the device is restored to its normal position (although an emergency application can be made). This requires first pushing the knob of the electric vent valve in the cab, and then pushing the release button of the tandem valve, which can be reached only from the ground. When this is done, the engineman can release the brakes and proceed, subject to the indication of the roadside signal or marker. When two locomotives are attached to a train, the automatic stop is operative only on the head engine.

The circuits are shown in Fig. 6, but only as controlling the train stop. The block sections are insulated in the usual manner, and failure of any part of the appar-

atus will cause the signals to be displayed in the same way as if the block were occupied by a train.

Block No. 1 is supplied with current at *A* by the track battery *B*, the current being carried by the rails to *C* and thence to the relay *D*. In normal position, with no trains in the block, this relay attracts its armature

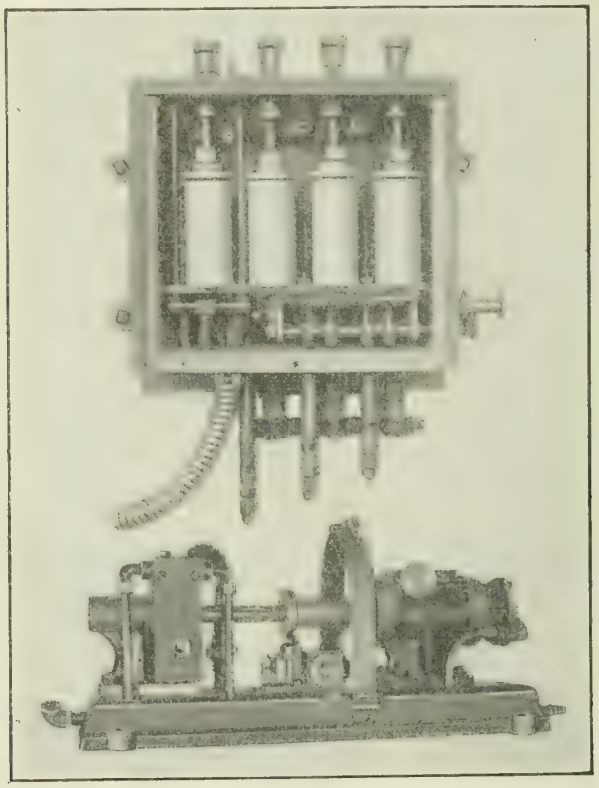


FIG. 5. AUDIBLE SIGNALS AND TRAIN-STOP

The upper view shows the signal whistles, with their electro-magnetically controlled air valves. The lower view shows the train-stop device in its open position

and connects battery *E* with the line relay at the far end of block No. 2. This latter block is supplied with current in the same way (at its far end), and the relay *F* connects its battery *G* with the line relay *H* of block No. 1.

Should opposing trains enter the two blocks simultaneously, the current supplying relays *D* and *F* would be cut off. These relays and the line relays would then drop their armatures, thus giving the signal indications in the engine cabs. The spacing of the signals is sufficient to enable the engineman to stop the train before coming to a "stop" signal, but the train-stop connection is set far enough in advance to bring a train to a stop before it can enter the danger zone.

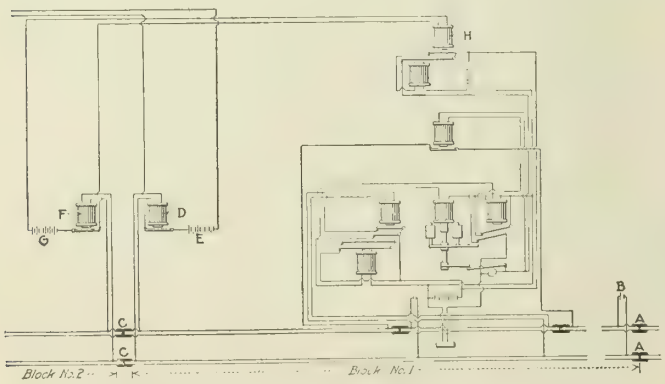


FIG. 6. DIAGRAM OF SIGNAL CIRCUITS

The automatic cab-signal and train-stop system here described is the invention of F. F. Bostwick, who is President of the National Safety Appliance Co., Mechanics Institute Building, San Francisco, Calif. The equipment described has been developed by W. S. Levin, chief engineer of the company, who has been in sole charge of design and construction, and to whose practical inventive ability is credited the successful completion of the system. It is applicable to single and double track, and for steam and electric traction. It may be used with or without the train stop. It can be applied also in connection with existing signaling and interlocking plants.

New Process Recovers Potash

New schemes for winning potash from American sources of supply continue to show the ingenuity of engineering chemists. The latest announced process was described by Edward Hart, of Lafayette College, Easton, Penn., in the August issue of the *Journal of Industrial and Engineering Chemistry* of the American Chemical Society. A plant has been erected by the Clinchfield Products Co., at Erwin, Tenn., in close proximity to supplies of cheap coal and barytes, both of which are needed. The potash to be recovered is contained in large quantities of refuse from feldspar mines, running as high as 9% in potash and 15% alumina.

Briefly, the process consists in heating a mixture of feldspar refuse and barytes in proper proportion in a reducing atmosphere where a barium-aluminum-potassium silicate results containing about 36% silica. This is run into water while molten, and the granulated material is ground and floated. The settled material is then treated as a paste with the proper quantity of sulphuric acid, which decomposes it perfectly, giving a solution of alum and aluminum sulphate and a solid residue consisting of nearly equal parts of very finely divided barium sulphate and silica.

It might be supposed that the silica would be so gelatinous as to be unwashable, but this has not been found true. On the contrary, where properly manipulated, the precipitate is somewhat granular, but entirely free from grit, and forms an excellent material, after ignition, for use as a pigment in printing ink, rubber incorporation and as a coating for paper.

The solution, when evaporated, yields the potash as potash alum, and if the little iron present be kept in the ferrous condition, this alum, after washing with a little water and whizzing, is entirely free from iron and well suited for the preparation of pure potassium sulphate and iron-free alumina or aluminum sulphate, as desired. It is intended to sell the alum as such so far as the market will take it and to decompose only so much of it as may be necessary. This process may therefore furnish no potash at all. But inasmuch as potash for alum production now comes from overseas, this method is an indirect contribution to the supply.

The solution never contains enough potash to precipitate all the aluminum as alum. An excess of aluminum sulphate remains in the mother liquor together with the sodium and a little iron. This is allowed to cool and is broken up, furnishing a material equal in value to that now made from bauxite.

Color Used in Hydraulic Tests of Power Plants

By Roy Taylor*

SYNOPSIS—The injection of coloring matter has been employed in the roughest class of hydraulic-flow measurements, but very little has been reported of the possibilities of this test for accurate determinations. Details are presented of the method and apparatus developed by R. D. Johnson and associates for color tests at the Niagara Falls and Salmon River plants of the Ontario Power Co. Use of potassium permanganate and aniline dyes.

The use of coloring matter in water for rough measurements of sewer velocities, river currents and to detect leakage through dams is not unknown; but engineers in general fail to realize the practicability of this scheme in the measurement of water consumption at hydro-electric works and similar hydraulic developments where there are long pipe lines. This is no doubt because of the slight information of a practical nature published on the more refined color tests. The writer contributes these notes on two specific cases in the hope of helping to fill the gap.

It is hardly necessary to discuss the fundamental idea of the color tests beyond stating that the coloring matter is injected into the pipe system at a known point and at an observed time, the interval being recorded before it appears at the outlet of the pipe line or power plant. The computation of quantity of water flowing is extremely simple; it merely requires dividing the total volume of the system, between points of introduction and observation, by the time. The actual practice required for accurate color tests is not so simple as the preceding statement, as will be evident from the descriptions of trials at the Niagara Falls and Salmon River plants.

Color Tests Made at Niagara Falls

Several years ago color was used in a series of tests conducted at the plant of the Ontario Power Co., Niagara Falls, to determine the relation between quantity flowing and loss of head in its two 18-ft. conduits. These are each about 6,300 ft. in length, one round in section and built of steel, the other slightly oblate in section and constructed of reinforced concrete. These first tests were not extensive, but served to bring out the possibilities of the use of coloring matter in the measurement of water, so that during the summers of 1913 and 1914 a complete calibration of the plant was made and valuable information as to head losses, water consumption, velocities and efficiency of each of the 14 units was obtained.

It was decided to use color for these tests for several reasons: It had proved satisfactory in the first instance; to construct any form of weir in the tailrace was almost impossible, and, finally, as it was dangerous to approach and work near the tailrace, it was impracticable to use any method involving the percentage of solution and requiring constant taking of samples. The color method was therefore adopted for all measurements of water. When a few difficutlies had been surmounted and the methods of running the tests had been systematized, results were obtained which are believed to be as accurate, if not more so, than could have been obtained by the use of any other method, not excluding that of weir measurement in this case.

Prior to testing the efficiency of each separate unit, a series of color runs was made on the two conduits to obtain an accurate relation between the flow in the pipe and the corresponding quiescent gradient level existing in the spillway on conduit No. 1 and in the surge tank in the case of conduit No. 2. These water levels were very sensitive to changes in conduit velocity, so that once the relation was established it became an easy matter to compute the flow in the conduit at any time by referring to the water-level chart of a recording graphic meter.

Introduction of Potassium Permanganate

The Niagara water is always comparatively clear, and the color runs in general occupied less than 12 min., so that potassium permanganate proved to be the most satisfactory, and at the same time the most inexpensive, substance with which to color the water. It is a very powerful stain turning the water a dark purple color, and the commercial product is easily obtainable at a price of less than 20c. lb. (with an ordinary market). It comes in the form of small crystals and can be introduced into the water without further preparation as it dissolves very quickly.

In the present instance, to introduce the color properly at the forebay entrance to the pipe lines presented a considerable problem, as the center of the pipe was 15 ft. or so below the floor and the velocity was over 18 ft. per sec. After failures with several rigs a device made up of iron pipe was constructed (see Fig. 1) which proved definite in action and simple in operation. The rod running through the handle was first drawn up and fastened with a pin so that the cover or piston on the end of the rod acted as a cork in the 4-in. cylinder; then the dry crystals were poured into the cylinder through a hole in the side, having a removable plug. The pipe was lowered into the water and at a definite time the pin removed and the handle rammed down, the end piston uncorking the cylinder and the upper piston ejecting the entire contents into the current almost instantaneously, at a point very close to the center of the pipe.

An observer stationed on the power-house roof noted the time to the nearest second, when the first trace of color appeared, the time of maximum color density and the time of the last trace. The mean time between the first and last trace, which usually corresponded to the time of maximum density, was used in computing the total elapsed time. (The reason for this will be discussed later.) Watches held by the man introducing the color and by the distant color observer were carefully checked by telephone after each run. The amount of color injected for one shot depended somewhat upon the conduit velocity

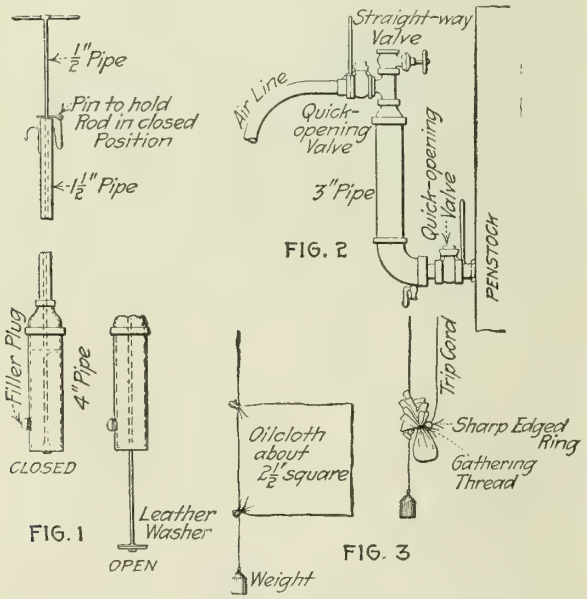
*Hydraulic Engineer, R. D. Johnson & P. Wahlman, 60 Wall St., New York City.

and the load conditions existing at the time, but it never exceeded one cupful of crystals. The amount was constantly varied, the aim being to use sufficient to make the color clearly and sharply visible to the observer and yet not enough to drag out the persistence of color unnecessarily and make the readings indefinite. An observer at first will experience some difficulty in catching the time of maximum density, but with a little practice it becomes comparatively simple.

Over 60 runs were made by this method on the two Niagara conduits, embracing flows as low as 2,000 cu.ft. per sec., or a conduit velocity of 8 ft. per sec., and a maximum flow in the concrete conduit of about 6,600 cu.ft. per sec., corresponding to a conduit velocity of 26 ft. per sec.

Testing Power Units by Color Runs

To test each unit separately the color had to be forced into the penstock, at a convenient point near its upper end, with compressed air in order to overcome the pressure head of 50 ft. existing at that point. The apparatus shown in Fig. 2 was devised to accomplish this and could be easily attached to any penstock and connected up to



COLOR INJECTORS FOR HYDRAULIC TESTS

Fig. 1—Dry potassium permanganate injector. Fig. 2—Compressed-air permanganate-solution injector. Fig. 3—Dye bag and release

an air line near-by. The permanganate crystals were dissolved in water (saturated solution) and about a pint of this liquid was sufficient to give a good color. A charge of this size could be poured into the cylinder and by means of the compressed air could almost instantaneously be injected into the penstock with a force sufficient to carry it well into the stream. In filling, the quick-opening valves were closed and the cylinder drained through the pet cock; then the straight-way valve was opened and the stain poured in. In discharging, the filling valve was closed and the air-line connection opened. At a definite time the valve at the penstock was opened and a bell signal given the discharge observer. In refilling, the penstock valve was shut and air pressure cut off; then the air pressure was released and the cylinder drained through the pet cock.

The schedule adopted was to hold the machine under test at a certain constant gate opening and, when all disturbances of the water had quieted down, to introduce six injections of color at about 1½-min. intervals. The observer was stationed on the power-house roof with a stop-watch and an electric buzzer beside him. The latter was connected to a push-button in the valve chamber where the color was put in. Two rings were given the observer as a warning 10 sec. before the introduction of color, followed by a signal-ring simultaneous with the opening of the valve and injecting the color. At the signal bell, the observer started his stop watch and later recorded the color appearance (to ⅕ sec.), as previously described, in this way eliminating all errors due to watch corrections by having all times recorded to a single watch. The elapsed time before the color passed completely through to the tailrace on full-load runs was only about 31 sec., so that accuracy in time recording was of great importance. In computing the results, to eliminate small discrepancies, the six runs were averaged and considered as one point on the efficiency curve. The gate opening on the machine was then changed and another set of runs taken.

Slight errors in time resulted from the various lengths of paths followed by the particles of water in getting through the turbine casings. On conduit runs any error thus caused was so small a part of the total elapsed time as to be inappreciable; but in the runs on separate units where the total elapsed time was in some cases as low as 31 sec. it affected the results to the extent of from 1 to 2 per cent. As this error was practically the same on all machines, it could be corrected in the final results by arbitrarily revising the computed drafts of each turbine proportionately, until their total checked with the accurate measurement of flow in the conduit as determined from the gradient level in the tank and spillway. By this process the true efficiencies of the different wheels at all gates were obtained.

Tests at Salmon River Plant

The results of these Niagara tests were so uniformly satisfactory that upon the completion of the Salmon River Power Co.'s plant at Altmar, N. Y., it was decided to conduct similar tests to determine the best ways and best gates at which to operate the four 7,500-kw. units, their efficiencies, the frictional losses in the pipe line, and to calibrate the tailrace weir so that the records from it could later be used to keep track of water consumption. This work was carried out during October and November, 1914, under the direction of R. D. Johnson, who had previously supervised the tests made at Niagara. The color method was adopted in this instance because sufficiently accurate and at the same time less expensive to carry out than any other.

As this Salmon River plant is typical of a large majority of long-pipe-line hydro-electric developments, the methods used and the results obtained will be discussed in some detail.

The general features of this plant are as follows: The water is carried from a large reservoir by means of 600 ft. of rock tunnel, 7,800 ft. of 12-ft. wood-stave pipe and 1,200 ft. of 11.5-ft. steel pipe, making in all nearly 10,000 ft. of conduit. This leads to the top of a high bank just above the power house. From here it is dropped down the hill in four 8-ft. steel penstocks each connecting with a 7,500-kw. unit in the power house. On leaving the draft tubes the water flows out under a curtain wall at the end of the power house, through a rock cut to a

concrete weir wall several hundred feet downstream, thence through a rough artificial channel into the river some distance below.

Use of Aniline Dye

The same substance that had been so successfully used in the clear waters of Niagara River proved to be absolutely invisible in the dark brown waters of this river, even when introduced in large quantities. The reservoir had been filled but shortly before, leaving a large quantity of vegetable matter in the water. Upon this the strong oxidizing properties of the permanganate acted and during the 2-mi. journey, changed from its natural deep purple color to a muddy brown very similar in shade to the vegetable-stained river water.

It therefore became necessary to procure a brilliant red aniline dye which would be unaffected by the character of the water. Before diluting this dye in water it is a bright red, but when a small amount of it is put into a considerable quantity of water it gives the solution a light green opaque color (by transmitted light). To the observer this color is very clearly distinguishable against the dark brown of the water. Observations of the color were taken at the point where the tail water emerged from the power house and noted the usual three times. On some of the long runs, occupying over an hour, the presence of the color could first be detected by the flecks of foam taking on a pink shade (from reflected light), and in all cases this coloring of the foam seemed to be a very sensitive indication of the first trace of color reaching the tailrace. It is a good idea to purchase the dye in what is called a paste, but which really is a semi-liquid, for the powdered form cakes when put in water and has to be thoroughly dissolved in hot water before it is fit to use.

Importance of Quick Injection

Too much emphasis cannot be placed upon the importance of introducing the coloring matter in the proper way. Any failure of the injecting apparatus to work, premature dumping of the color, leakage, or fouling of the operating apparatus causing the color to dribble out slowly—all are invisible to the man operating it, so that under any of these conditions the time of introduction is at best very vague, if not altogether unknown, producing results of no value. Any apparatus that is uncertain of operation cannot fail to cause a lack of confidence in all results obtained. The color should always be injected suddenly; it should be in a form which will quickly dissolve or dilute and it should also be released where it will be sure to be caught by the current and whirled immediately into the main flow.

The case in question presented particular difficulties, as the only place where the color could be introduced was through an opening in the gate-house floor just behind the screens. The water surface stood 30 ft. below this floor and the pipe entrance 15 ft. below that. Fig. 3 shows a form of device that proved to be very definite of action and satisfactory in every way. A pint or more of the color could be held in the bag formed from the square piece of oilcloth. The bag was closed by gathering at the top and bound around with a thread. On the trip cord was fastened a sharp jagged wire ring through which this gathering thread passed, so that when the color had been lowered to the desired point, the trip cord could be jerked at a definite time, cutting the thread and releasing the color in one compact dose with no chance of its being strung out.

The time taken by the color to make its way down the pipe through the penstocks and units, into the tail race varied from 12 min. with all four machines running at full gate, to 1 hr. 23 min. with only one wheel running at 0.4 gate.

During all the tests the electrical load carried by the plant was tied in with that of the Ontario Power Co. at Niagara Falls so that any fluctuations of commercial load were carried by that plant and it was possible to put the Salmon River units under hand control during the entire runs thereby holding the gate openings constant.

Checks on Color Tests

Weir readings in the tailrace were taken every ½ min., and the quantity figured from a discharge curve previously made up. This was used as a check on the color runs. Two other rough checks were possible by figuring the quantity from the turbine gate openings considered as submerged orifices, and from the electric load and estimated efficiency characteristics. Readings of the water level in the surge tank at the top of the penstock and pressure gage readings at the bottom of the penstock were taken so that pipe-line losses, penstock losses and net operating head could be determined. The surge tank level, especially for large flows, became very sensitive, and when a loss curve was established this level became an accurate way of checking the results of any single color run.

The total volume was carefully figured and as the different units were taken up small corrections were made for the different tailrace lengths and short sections of pipe line between penstock entrances.

When two or more wheels are tested together the gate openings should be kept about equal, especially in the case of long penstocks, as otherwise the color will be strung out, moving faster through one penstock and wheel—that is, the larger gate opening—than through the other. In figuring the volume all penstocks, wheel casings and draft-tubes must be included. Errors are easy to make and should be guarded against wherever a division in the channel, pipe, or water course takes place.

Eliminating Discrepancies in Results

With all these various factors dependent upon one another it is apparent that any error resulting from incorrect readings, poor observations, wrong times, or freaks of eddy currents and waterwheel runners, invariably can be picked up and investigated. Unavoidable discrepancies, by weighing the causes of error, can be smoothed out and adjusted until the final results have a higher degree of accuracy than it is possible to attain from any one system of measurements. Provided no freak is found, the friction-loss curve, the weir-discharge curve, the curve between gate openings and quantity and the wheel efficiency curves, should all be relatively smooth and the results of any one run should fall on them all or be investigated.

As an example of the value of this checking one case may be cited. The tests on one unit disclosed the fact that the relation between gate opening and draft was not like that on the other units, and that the efficiency had fallen off. The wheel was shut down and upon

examination several large blocks of wood were discovered jammed between the runner vanes.

About 40 color runs in all were made in the tests at Salmon River, and two facts of special interest were brought out—the time between the first and last trace was invariably equal to about one-tenth the total elapsed time, and the maximum density of color occurred at about the mean time between the first and last trace.

Injected Color Strings Out

The first phenomenon is interesting since according to the supposed theory of flow in pipes a great deal more stringing out of the color should have occurred, owing to the difference in velocity at the center and along the surface of the pipe. This may be accounted for by the fact that the separate particles do not flow along in a straight longitudinal direction, but twist and turn in eddies and at bends, so as to flow partly with the fast moving center and partly with the dragging water along the sides, the resultant being an evening-up to the average rate of travel. The results show that the last particles of color visible must have flowed at a rate of about nine-tenths that of the fastest, and this difference is intensified by the right-angled bend into the penstocks and the difference in length of path of the various particles in going through the turbines.

The fact that the point of maximum color occurs at the mean time between the first and last trace indicates that the greater proportion of particles have traveled at the mean rate. As the grading off of color was uniform and similar in both directions, it would appear that the time at which this maximum density occurs is the proper time to be used for computing the average rate of flow through the pipe. No proof of this is possible, without calibration by some more accurate method, if such exists; yet it is firmly believed to be near the truth.

At every opportunity this theory has been checked in one way or another, and no reason to doubt its correctness has as yet been found. On several of the slowest runs, rod floats were allowed to drift down the tailrace, and from the known volume the quantity was figured and found to check with that computed from the color. Again, the weir, which was a rather rough-topped concrete wall with an unknown coefficient, was calibrated by means of the color runs and the resulting discharge curve proved to be a true three-halves-power curve with a definite coefficient, in a general way showing the color method to be consistent within its range. As further checking by means of pipe losses and computed flow for different gate openings disclosed no error, it seems certain that very little error will result if this theory is adopted. In cases where a slight difference occurred between the mean of first and last traces and the time of maximum density, they were corrected according to the weighted probable degree of accuracy of observation, and averaged.

Proper Status of Color Tests

Substances other than aniline dye and permanganate have been tried out at various times but none has proved satisfactory. Shavings, sawdust, confetti and oil were experimented with at the Salmon River plant; but all are open to the same objection, that of dragging out the final traces to such a degree that all accuracy in the observation is lost and any recorded times are at least uncertain and indefinite. Where the water to be measured is clear and free from vegetable stain and the time of color-runs is not too great, potassium permanganate probably will prove the cheapest and most satisfactory substance to use, while in muddy streams or with long pipe lines affording sufficient time of transit for oxidation to take place, either a brilliant green or red aniline dye will be necessary.

In conclusion it may be said that if ordinary care is used to avoid unnecessary errors, if the color is introduced in the proper way and just enough is injected at a time to be clearly visible to the observer, the results obtained from color-run tests should have a higher degree of accuracy than those from the common methods of water measurement now in use, such as current meters, pitot tubes, rod floats, or even by the method of chemical solution; and will compare very favorably with results obtained from the standard test weir. Without doubt a carefully constructed sharp-edged test weir is the most accurate device for flow measurements; but in most cases it is impracticable to build one—either on account of the expense or the lack of a suitable location or because the quantity of water is too great to come within known experimental calibrations.

Color Test an Aid to Operation

With color, tests can be made conveniently at widely separated dates to determine the falling off of plant efficiency, the effect of any alteration or wearing of the waterwheel runners, etc.; whereas it is often most inconvenient to reconstruct a special weir during normal operation. For all such reasons it seems strange that this method is not more frequently used in connection with hydro-electric tests. It is applicable to any plant having a pipe line or long penstock, can be used without interruption to the commercial load, is inexpensive and with a moderate amount of care will give results that are sufficiently accurate for all practical purposes.

Roofs and Floors in Africa—Corrugated iron would seem on casual inspection to be the favorite roofing medium in Portuguese East Africa, but a tendency is manifest to replace it by materials more easily handled and at the same time less conductive of heat. United States Consul George A. Chamberlain, Lourenco Marques, believes that there is a promising market in his vicinity for modern roofings and floor coverings. Local builders state that pitch or asphalt or patented roofings are rapidly replacing old roofs. The floors in Lourenco Marques are of two kinds—in the cheaper houses of wood, and in the more expensive of parquet, tile or mosaic. The idea of the tile and mosaic floors is that they are cool; but at the same time they are tiring to the feet. Board floors, unless very carefully laid, give easy ingress to insects and vermin, which are very prevalent. Modern types of roofs have been introduced into Tripoli, Libya, since coming under Italian influence. Of the 1,050,000 inhabitants of Libya 95 per cent. are Arabs, and the largest portion of these are nomadic. Natives who live in the Oases haxe fixed habitations, with simple houses of stone ,sun-dried brick or packed earth, with roofs of date-wood rafters overlaid with palm leaves and straw and the whole covered with a coating of lime plaster. In coast towns the principal building materials are stone and brick, with flat roofs covered with lime concrete. Sloping roofs have now been introduced. A roofing that seems to have been favorably received is known as "Eternit" and is an artificial stone composed of asbestos, other mineral substances and chalk, mixed and hardened with acid. It is produced in sheets by an Italian firm at Casale Monferrato and costs about 5c. per sq.ft. This material can be cut without cracking, and nails can be driven through it. It is estimated that fully 75 per cent. of the $40,000 imports of roofing materials in Tripoli in 1913 were of "Eternit."

News of the Engineering World

New Carnegie I-Beams Rolled

An important change in its I-beam rolling is announced by the Carnegie Steel Co.—the production of a new line characterized by wide and thin flanges and flange bevel flattened to 1 in 11, the previous standard being 1 in 6. The sizes of I-beam to which this applies are 27, 24, 21, 18, 15, 12, 10 and 8 in. deep.

These beams are a development from the high-efficiency (thin-web) beams brought out a year or two ago. The introduction of the 27-in. size, and of the 21-in. size to replace the 20-in., was a feature of that line, as was also a tapered thickening of the web at its junction with the flanges. The new wide-flange line also has the 27-in. and 21-in. sizes, thus giving a 3-in. gradation down to the 12-in. depth and a 2-in. gradation thence to 8 in. In other respects, however, the new beams differ radically from the high-efficiency beams.

The webs are thicker, the flanges wider and much thinner, the flange bevel flatter, and the web-enlargement at the flanges reduced in size. The beams are all a pound or two heavier than the high-efficiency beams, and their carrying capacity per pound is lower (though equal to that of the "standard-weight" I-beams). The 24-in. I-beam, for instance, has 7-in. flange and ½-in. web in the old "standard-weight" section weighing 80 lb. per ft.; 7-in. flange and $^{25}/_{64}$-in. web in the high-efficiency section weighing 69½ lb.; 9-in. flange and $\frac{17}{32}$-in. web in the new section weighing 74 lb.

A pamphlet "Structural Beams," describing the new sections, has just been issued by the Carnegie Steel Co., Carnegie Building, Pittsburgh, Penn.

Organization of Pan-American Scientific Congress

A second Pan-American Scientific Congress will be held in Washington, D. C., Dec. 27, 1915, to Jan. 8, 1916. The program is divided into nine main sections, of which the fifth is Engineering and is in charge of Gen. W. H. Bixby. (The others cover anthropology, astronomy, natural resources, education, law, mining, public health and transportation.)

The secretary of the engineering section is Elmer L. Corthell. The section will concern itself in particular with discussion of various engineering subjects that commanded the attention of the delegates to the Santiago Congress of 1908. Among these is "a common Pan-American body of engineering nomenclature and laws regulating the use of water." Another subject to be discussed is the desirability and practicability of establishing a uniform railroad gage in Pan-America, especially in Central and South America. The five principal engineering societies of the United States have delegated their secretaries to represent them.—By G. L. Swigett, Assistant Secretary General, Second Pan-American Scientific Congress.

On the Pacific Coast Special

[*Editorial Correspondence*]

Members of the four national societies of civil, mechanical, mining and electrical engineers left New York City for San Francisco on Thursday, Sept. 9, on a special through train of 13 steel cars over the New York Central lines and Santa Fé system. The entire party, with those who joined at Albany, Buffalo, Cleveland and other points, numbered over 150.

Among the prominent members of the party were: Dr. John A. Brashear, President of the Mechanical Engineers, and William L. Saunders, President of the Mining Engineers; Gano Dunn, President of the United Engineering Society; H. J. E. Wenckebach and Robert Snellen, delegates from Holland to the International Engineering Congress; Major Jean de Pulligny, delegate of the French Government; Prof. A. E. Rohn, of the Zurich Polytechnic Institute, delegate from Switzerland; Roger Tappan, from Finland; W. Charnley, from Brazil, and José R. Villalon, from Cuba; Prof. Ira H. Woolson, S. L. F. Deyo, D. H. Grimm, C. F. Rand, Lazarus White, W. N. Best, Mansfield Merriman and J. J. Carty, of New York; Worcester R. Warner, of Tarrytown; H. G. Reist, of Schenectady; J. A. Seymour, of Auburn; Gardner Williams and C. F. Loweth, of Chicago.

Friday forenoon was spent at Niagara Falls, with a trip over the Niagara Gorge Ry. to Lewiston. Very hot weather prevailed the first two days, but heavy rains Friday night cooled the air and gave the travelers an opportunity to see the streams of northern Missouri and eastern Kansas in high flood.

Colorado Springs was reached on Sunday morning, Sept. 10. Most of the party spent the morning in an excursion by automobiles to Crystal Park, a mountain valley 2,750 ft. above the city plain. The park is reached by a new automobile road with 8% maximum grades. The road zigzags back and forth, and at three places, where the slope was too steep for grading wide enough to make a hairpin turn, a Y has been made. The company which built the road runs 20-passenger automobiles over it.

An excursion up Pike's Peak was attempted by most of the party in the afternoon, but the breakdown of the rack locomotive after the first half mile compelled a return. A number, by invitation of the Portland Mining Co., motored to Cripple Creek. Several others went over the new automobile road which is under construction to the top of Pike's Peak, and of which about 30 mi. has been completed.

Monday was spent crossing New Mexico, where remarkable sandstone cliffs were a source of great interest. The train arrived early Tuesday morning at the Grand Cañon of the Colorado River, and the visitors had the entire day to view this indescribable wonder.

Tuesday night and Wednesday were spent between the Grand Cañon and San Francisco, the most interesting

engineering feature being the famous Tehachapi Pass over the Sierra Nevada range. From the summit of the pass to Bakersfield, a distance of 50 mi., the railway descends 3,550 ft. The location is along steep hillsides where numerous tunnels and horseshoe curves and one complete loop were necessary.

At Albuquerque the travelers were greeted by a local committee representing the engineers of New Mexico; and as the train approached San Francisco on Wednesday afternoon, members of the local reception committee came out to extend a welcome. The remaining days of the week after arrival at San Francisco were occupied by the meetings of the several national societies, and the week following to the International Engineering Congress.

The Worst Slide at Gaillard Cut, Panama Canal, occurred on the east bank, just north of Gold Hill and directly opposite the village of Culebra, on Sept. 18. An upheaval of the bottom of the canal is alleged to have taken place at the same time, forming an island in the middle of the channel, closing the latter to navigation.

Reduction in Number of Accidents has been secured by the Baltimore Gas and Electric Co. as a result of the work of its safety committees. There were no accidents fatal to the public in the year ending June 30, 1915, and the total number of nonemployees injured was reduced from 102 to 25. However, four men were killed compared with one the year before. The total number of accidents was 330, a reduction of 30%; the number of employees injured was 301, or 17% reduction.

An Explosion Wrecked the sewage-pumping station of Batavia, N. Y., on Aug. 18, fatally injuring an employee and putting out of commission the pumps which lift the sewage of the city to sewage-treatment works. It is supposed that the explosion was caused by either natural gas or gasoline that gained access to the pump-well through the sewers. Thomas Fleming, Jr., of Chester & Fleming, Pittsburgh, was called in to advise the city immediately after the explosion. H. J. Burkhart is Mayor of Batavia.

A Large Contract for Stone Ballast for a portion of the new subway system for New York City has been awarded by the Public Service Commission for the First District. About 243,000 cu.yd. of hard-limestone ballast will be supplied by the Upper Hudson Stone Co. for $228,010, or about $0.94 per yd.

Grinding the Rails of Street Railways by means of the track brakes used on steep grades is being practised at San Francisco. The ordinary wood blocks or shoes of the track brakes are replaced by carborundum blocks and the cars are run at regular speed with the brakes set sufficiently to cause the blocks to grind the rail heads.

Railway Scale-Testing Cars of large and short wheelbase were discussed by C. A. Briggs, of the United States Bureau of Standards in a paper read at the Chicago meeting of the National Association of Scale Experts. His conclusions were unfavorable to the longer double-truck cars and in favor of four-wheeled cars. The wheelbase preferably should be 5 or 5½ ft., with 7 ft. as a maximum.

The First Cargo of American Coal for Greece was shipped from Norfolk, Va., in July. The collier proceeded to Patras where 3400 tons was discharged, then to Paræus, where the remaining 2600 tons was discharged. The price of the coal is stated to have been $15.07 per ton c.i.f. Patras, of which $11.42 was for ocean freight and $3.65 for the coal itself. The annual consumption of coal for the Patras district is 60,000 to 80,000 tons, practically all bituminous.

A Weather Bureau Station has just been established on a farm near Omaha, Neb., for the purpose of making systematic observations of the upper air, by means of kites carrying self-recording instruments. It was not necessary to erect new buildings, excepting a small shelter for the kite reel, as the buildings on the farm were sufficient for the needs of the work. This work was formerly carried on at Mount Weather, Va., and the apparatus was moved from that station to the present one. This station will be known as the Drexel Aërological Station, and the observations obtained here will be sent to the Central Office of the Weather Bureau at Washington, D. C., for computation and study. Kite flights were begun at this station Sept. 1.—B. J. Sherry, Drexel, Neb.

The Largest Municipal Office Building in the world is the new Municipal Building of New York City. According to the report of Borough President M. M. Marks, the building contains about 1,000 offices, which are occupied by over 4,200 city officers and employees. The force employed for cleaning, maintaining and operating the building is under the 8-hr. law and other restrictions, which make it difficult to secure economy. Nevertheless, the estimated annual cost for daily cleaning, watching and attendance for 1915 is only 11.9c. per sq.ft. There is in the entire building 830,000 sq.ft. of floor area. The estimated total cost of operation and maintenance for 1915, including heating, lighting and elevator service, is 29¾c. per sq.ft. of floor area and 49c. per sq.ft. of office area.

Shipbuilding in Nagasaki, Japan, has become an industry of great importance since the opening of the Panama Canal and the withdrawal of many European vessels from active service. Atlhough Oregon pine costs 70 to 75 per cent. more than the native pine, it is preferred for shipbuilding purposes because of its fewer knots and more regular grain. These characteristics result in a reduction of labor cost, which is an important factor in Japan, where the cost of labor is high compared with other places in the Far East. The Japanese ship's carpenter receives the equivalent of 30c. to $2 per day, according to his degree of skill, while in certain parts of China an expert carpenter receives less than 10c., United States currency. The largest single shipment of Oregon pine to Nagasaki is now on its way and consists of 2000 tons of timber.

A Large Coal-Loading Wharf is under construction in New Castle Harbor, New South Wales. It will be one-third mile long, with water 30 ft. deep along the face line. A system of heavy diagonal bracing is employed between the superstructure and the high-water mark, for the purpose of preventing the traverse rail from being knocked out of alignment by heavy vessels. The dock will carry six 15-ton coal-loading high-speed electric traveling cranes, each weighing 200 tons, of English manufacture. Two have been delivered, and a third is on the way. The following data are from a report on the test of these machines:

Hoisting with two motors: Load, 15 tons; speed, 97 ft. per min.; 480 volts, 240 amperes. Hoisting with one motor: Load, 15 tons; speed, 47.6 ft. per min.; 270 volts, 110 amperes. Traveling: Speed, 97 ft. per min.; 488 volts; 48 amperes.

For hoisting, 154 hp. was required; 7¾ hp. for slewing, and 31½ hp. for traversing. Each of the cranes will lift 15 tons at 55-ft. radius a vertical distance of 39 ft. It is estimated that the six cranes will be able to load over 2,500,000 tons of coal per annum.

PERSONALS

Mr. R. S. Bryant, Consulting Engineer of the Standard Welding Co., of Cleveland, Ohio, has become Factory Manager of the company.

Mr. Joachim G. Giaver has opened an office in the Railway Exchange Building, Chicago, Ill., where he will engage in structural engineering.

Mr. Charles L. Wood, formerly with the United States Coast and Geodetic Survey, has been appointed Highway and Bridge Engineer of Lowndes County, Mississippi.

Mr. Thomas B. Smith, formerly Postmaster of Philadelphia, has been appointed a member of the Public Service Commission of Pennsylvania by Governor Brumbaugh.

Mr. F. K. Bennett, Supervisor of the Minneapolis & St. Louis R.R., at Monmouth, Ill., has been made Valuation Engineer, with headquarters at Minneapolis, Minn.

Mr. Gus E. Hauser, Jr., of Columbus, Miss., has been appointed consulting engineer for the $100,000 bond issue for highway construction in Lowndes County, Mississippi.

Mr. Charles A. Russell, of Gloucester, Mass., has been appointed a member of the Massachusetts Public Service Commission, to fill the vacancy caused by the retirement of Mr. Clinton White.

Dr. Otto Kress will hereafter have charge of the pulp and paper investigations at the United States Forest Products Laboratory at Madison, Wis. He succeeds Mr. O. L. E. Webber, who recently resigned.

Mr. Herman L. Wittstein, Jun. Am. Soc. C. E., Efficiency Engineer of the Knox Motors Co., Springfield, Mass., has become Assistant to the Manager of the Standard Fuse Corporation at Paulsboro, N. J.

Dr. Robert P. Calvert, Instructor of Chemistry at Columbia University, has been appointed Director of the Laboratory of

General Chemistry at the Experiment Station of the E. I. du Pont de Nemours Powder Co., of Wilmington, Del.

Mr. Charles B. Buerger, M. Am. Soc. C. E., Principal Assistant Engineer with Mr. George W. Fuller, New York City, has resigned to accept an appointment as Consulting Engineer of the Atlantic Refining Co., of Philadelphia, Penn.

Mr. J. P. Walker, Assistant Engineer of the Valuation Department of the Atlantic Coast Line at Petersburg, Va., has been made Assistant Superintendent of the Charleston district of that road, with headquarters at Charleston, S. C.

Mr. Nelson Ogden, Assoc. M. Am. Soc. M. E., who was engaged for a number of years with the New London Ship and Engine Co. on the design of Diesel oil engines, has accepted a position with the McIntosh & Seymour Corporation, of Auburn, N. Y.

Mr. William C. Coffin, M. Am. Soc. M. E., recently Structural Engineer of the Jones & Laughlin Steel Co., Pittsburgh, Penn., has been elected Vice-President of the Knox Pressed & Welded Steel Co., Pittsburgh. From 1898 to 1908 he was Vice-President of the Riter-Conley Manufacturing Co.

Mr. Edward Anderberg, Assoc. M. Am. Soc. C. E., Assistant Engineer, New York State Barge Canal, in charge of bridge and lock work, at Lockport, N. Y., has been appointed Resident Engineer at New York City, in charge of terminal construction. He succeeds Mr. Earl Talbot, who recently resigned.

Prof. Frederick H. Newell, M. Am. Soc. C. E., the new head of the civil engineering department of the University of Illinois, and formerly Director of the United States Reclamation Service, has been appointed a member of the Illinois State Board of Examiners of Structural Engineers, by Governor Dunne.

Prof. Alexander Miller Gray, Assistant Professor of Electrical Engineering at McGill University, Montreal, has been appointed Professor of Electrical Engineering in Sibley College, Cornell University. He will also be the head of the electrical department, filling the vacancy caused by the resignation of Prof. H. H. Norris.

Dr. M. X. Sullivan, who has been connected with the Division of Soil Fertility of the United States Department of Agriculture, at Washington, D. C., has accepted the position of biological chemist of the United States Public Health Service. He will be engaged in the biochemical study of pellagra at the pellagra hospital in Spartanburg, S. C.

Mr. William E. Keily, Assoc. Am. Inst. E. E., until recently Associate Editor of the "Electrical World," at Chicago, has opened an office in the Edison Building, 72 West Adams St., that city, where he will engage in consulting work in public-utility development. From 1910 to 1914 Mr. Keily was Editor of the "Convention Daily," published at the annual conventions of the National Electric Light Association held at St. Louis, New York, Seattle, Chicago and Philadelphia. Previous to his connection with the "Electrical World," he was Managing Editor of the "Western Electrician" of Chicago.

OBITUARY

Sereno S. Pratt, of Brooklyn, N. Y., for the last five years Secretary of the Chamber of Commerce of New York City, died recently at his summer home at Dorset, Vt.

Charles Hawlett Wing, Professor and head of the Department of Chemistry of the Massachusetts Institute of Technology from 1874 to 1884, died in Boston on Sept. 14, at 80 years of age. He was Professor of Chemistry at Cornell University previous to his connection with the Technology.

Gen. Edward H. Ripley, founder and Director of the United States and Brazil Steamship Line, died at Rutland, Vt., on Sept. 14, after a long illness. He was the builder of the Raritan River R.R. and various structures in New York City. He left Union College to enter the Union army as captain of volunteers and was rapidly promoted to the rank of brigadier-general.

William F. Fitch, formerly President of the Duluth, South Shore & Atlantic R.R., died at his home in Marquette, Mich., on Sept. 16, at 76 years of age. Mr. Fitch was born in Circleville, Ohio, and in 1871 began his railroad career as a clerk in the employ of the Chicago & Northwestern Ry. In 1888 he entered the service of the Duluth, South Shore & Atlantic. At various times he was also President of the Mineral Range R.R., General Manager of the Calumet & Hancock R.R., and President of the Lake Shore Terminal & Transfer Ry. In 1902 he became Vice-President of the Wisconsin Central Ry.

John Howard Van Amringe, Dean Emeritus of Columbia College, died at the age of 79 years at the Keeler House, Morristown, N. J., on Sept. 10, from a stroke of apoplexy. He was born at Philadelphia, and received his education at the Montgomery Academy, in Orange County, N. Y., Yale and Columbia colleges. He devoted almost his entire time for fifty years to the interests of Columbia, and retired only five years ago. He was the author of a "History of Columbia College" and contributed the Columbia section to the volume known as "Universities and Their Sons." Some years ago he edited a series of Davies' mathematical works; at one time he was president of the New York Mathematical Society.

ENGINEERING SOCIETIES

COMING MEETINGS

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Oct. 11-12. Secy., Will P. Blair, Engineers Bldg., Cleveland, Ohio.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 12-14. Annual convention at Dayton, Ohio. Secy., Charles Carroll Brown, 702 Wulsin Bldg., Indianapolis, Ind.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. 19-21. Annual meeting, at Detroit, Mich. Secy., C. A. Lichty, 319 N. Waller Ave., Chicago.

SAN FRANCISCO MEETINGS

ILLINOIS GAS ASSOCIATION.
Sept. 27. Adjourned meeting. Secy., H. H. Clark, 72 West Adams St., Chicago, Ill.

SAFETY CONFERENCE.
Sept. 27-30. A. C. Carruthers, Vice-Pres., Collective Insurance & Universal Safety Exhibit, Mines and Metallurgy Bldg., San Francisco.

INTERNATIONAL GAS CONGRESS.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Sept. 27 to Oct. 1. Secy., George C. Ramsdell, 29 West 39th St., New York City.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

National Conference on Concrete-Road Building—This meeting will be held in Chicago, Feb. 15-18, 1916. The notice in the issue of Sept. 9 gave the date as Sept. 15-18.

The Society to Promote the Science of Management will hold a special memorial meeting in honor of Frederick W. Taylor on Oct. 22, at 8:15 p.m., in Houston Hall, University of Pennsylvania, Philadelphia. There will be several speakers who have been closely associated with Mr. Taylor at different periods of his career. The secretary is Prof. Henry W. Shelton, Hanover, N. H.

Electrical Dealers' and Contractors' Association of Ontario—The annual convention was held in Toronto, Can., Sept. 6-9. The following officers were elected: President, J. W. Commeford, Toronto; First Vice-President, William Greenleaf, Belleville; Second Vice-President, J. R. Zenorble, Windsor; Secretary, Rufus Earle, Toronto; Treasurer, J. C. Soules, Toronto. The place of meeting for next year was left to the decision of the Executive Committee.

Northwestern Branch of the American Society of Civil Engineers—The Northwestern Branch held its annual meeting on Sept. 17 in St. Paul, Minn. After a dinner the following officers were elected: President, W. L. Darling, Chief Engineer of the Northern Pacific Ry., St. Paul; First Vice-President, George L. Wilson, Chief Engineer of the Twin City Rapid Transit Co., Minneapolis; Second Vice-President, L. W. Rundlett, St. Paul; Secretary, R. D. Thomas, Minneapolis; Treasurer, A. F. Meyer.

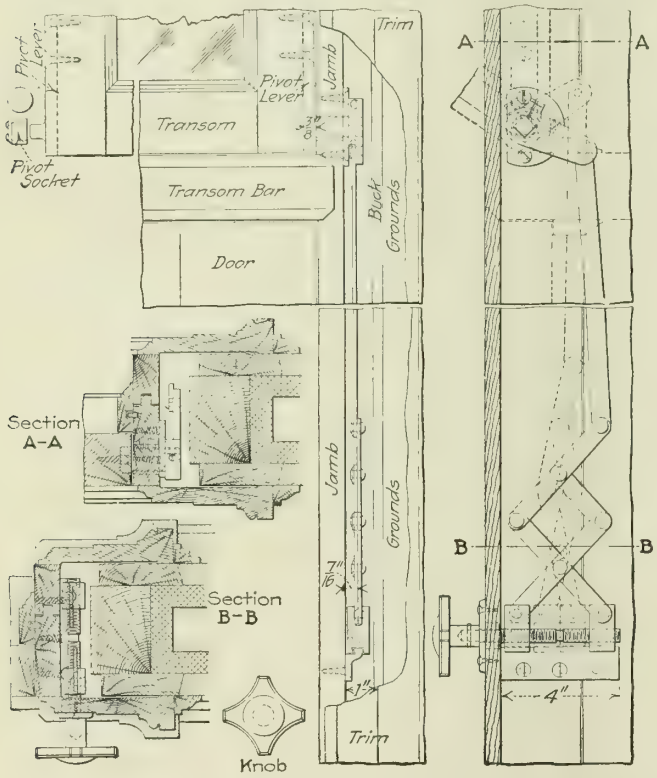
Institute of Paving Brick Manufacturers—This society was recently organized with the following officers: President, F. R. Kanengeiser; Vice-President, D. E. Humphrey; Secretary, Robert Keplinger, Metropolitan Paving Brick Co., Canton, Ohio; Treasurer, Spencer M. Duty. A meeting was held at Alton, Ill., on Sept. 22. This society was organized for the benefit of brick makers, men and companies of allied occupations being admitted only to associate membership. Only active members constitute the board of directors. Officers must be active members and no two of them can be identified with the same concern. The dues of an active member are $20 per year, while an associate member pays $5 per meeting.

The American Institute of Consulting Engineers is the first engineering organization to join the Chamber of Commerce of the United States. The Institute will coöperate with the Chamber in its activities for the development of industry and commerce. The Institute is the only engineering organization that has membership in the Chamber.

Appliances and Materials

Concealed Transom Operator

A new type of concealed transom operator involving no gears, bolts or exterior rods is being installed in some of the newer buildings. The design comprises lazy tongs, a reach rod and a bell crank as shown in the accompanying sketch. The first complete turn of the operating knob noiselessly opens the transom to an angle of 20 deg. This operator is for bottom-, center- or top-hung transoms and is adjustable to every style and size. The maker, the Tabor Sash &



NEWBERTH CONCEALED TRANSOM-OPERATOR

Fixture Co., 61 Polk St., Newark, N. J., claims that the device requires no oiling or attention after installation and that the working parts are rust-proof. The entire device can be removed by loosening the screw on the top clamping level after the trim is removed.

* * *

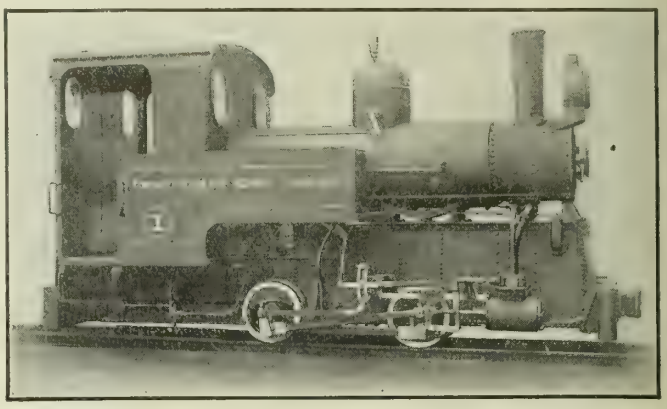
An Electric Harbor Range Light, made by the Esterline Co., of Indianapolis, and known as the "Golden Glow" light, has been installed by the United States Lighthouse Bureau at Vidal Shoals, at Two Harbors and at other points on the Great Lakes, and is shortly to be installed in the Philadelphia harbor. In this light a deep parabolic reflector is used, made of glass of a yellowish green color. The silvering is done on the outer surface of the reflector. The light from the lamp passes through the glass and is reflected back again from the silvered surface; the blue and violet rays are absorbed, and the yellow rays which are reflected are claimed to have special power to penetrate fog. Similar reflectors are made for locomotives, electric-railway cars, searchlights, etc. In the harbor range lights 94- to 151-watt incandescent tungsten lamps are used.

* * *

Dinkey Locomotive with Underhung Tank

The interesting type of dinkey locomotive shown herewith is one of three built by the H. K. Porter Co., of Pittsburgh, Penn., for the Toronto-Hamilton Highway Commission for use on road construction. The special features are the use of plate frames and the utilization of these frames to form the sides of an underhung water tank, forward of the firebox. This gives a lower center of gravity than can be obtained with a saddle tank over the boiler, and results in greater steadiness on rough tracks.

The engine is for track of 24-in. gage. While it weighs only 7½ tons, it has a tractive effort as high as 3435 lb. It



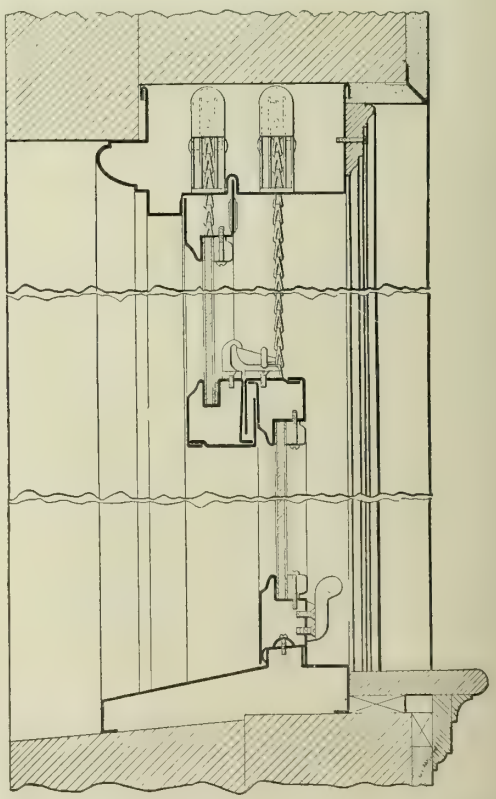
DINKEY LOCOMOTIVE WITH PLATE FRAMES AND UNDERHUNG TANK

is 14½ ft. long, 8 ft. wide, and 8½ ft. high overall. The cylinders are 7x10 in., with slide valves and the Walschaerts valve gear. The driving wheels are 20 in. diameter, with a wheelbase of 4 ft. The boiler is 25 in. diameter, and carries a pressure of 165 lb. A coal bunker of about 500-lb. capacity is placed at one side of the boiler.

* * *

Heavy Double-Hung Window

A new steel street-front window is manufactured by the S. H. Pomeroy Co., Inc., New York City, which is three times as heavy as the usual fire-retardant windows produced by this company. It can be supplied with either single- or multi-light sash, with or without glass in place. Wearing parts are



FIREPROOF WINDOW FOR STREET FRONTS

replaceable. The details of the double-hung window are shown in the accompanying cross-section drawing. The window is applicable to office buildings, loft buildings, hotels and apartment houses.

Engineering News

VOLUME 74 SEPTEMBER 30, 1915 NUMBER 14

Rebuilding Elevated Railways in New York City—I

SYNOPSIS—Adding a third track for express service on the elevated railways of Manhattan and Bronx boroughs, New York, made extensive rebuilding of the structure necessary. The work involves about 50,000 tons of steel, and had to be done under traffic. Different station types are used, the principal ones being the mezzanine and hump type.

Most of the 37-mi. network of rapid-transit elevated railway in the Boroughs of Manhattan and Bronx, New York City, all originally built double-track, is being reconstructed by adding a third track for express-train service. Some lines were equipped with a third track a number of years ago, notably the Ninth Ave. line, on which expresses have been operated since that time in a no-stop run from 14th St. to 116th St., about five miles. This early third-tracking, however, has little effect in reducing the magnitude of the present enterprise, because the work, while primarily consisting of adding a track to the elevated structure, involves a great deal more:

Complete or nearly complete replacement of present two-track structure at certain locations by new structure carrying from three to five tracks; removal of all present center platforms, so as to permit the carrying through of the center track; remodeling a large number of stations to serve the express traffic, which generally includes reconstruction of structure for a distance of about 1700 ft.; replacement of a two-track swing span and two end spans with a double-deck four-track bridge; and rearrangement of running tracks, at one point even raising the running tracks 7 ft. and at another shifting the track with its supporting girders 13 ft. sidewise; all the work be-

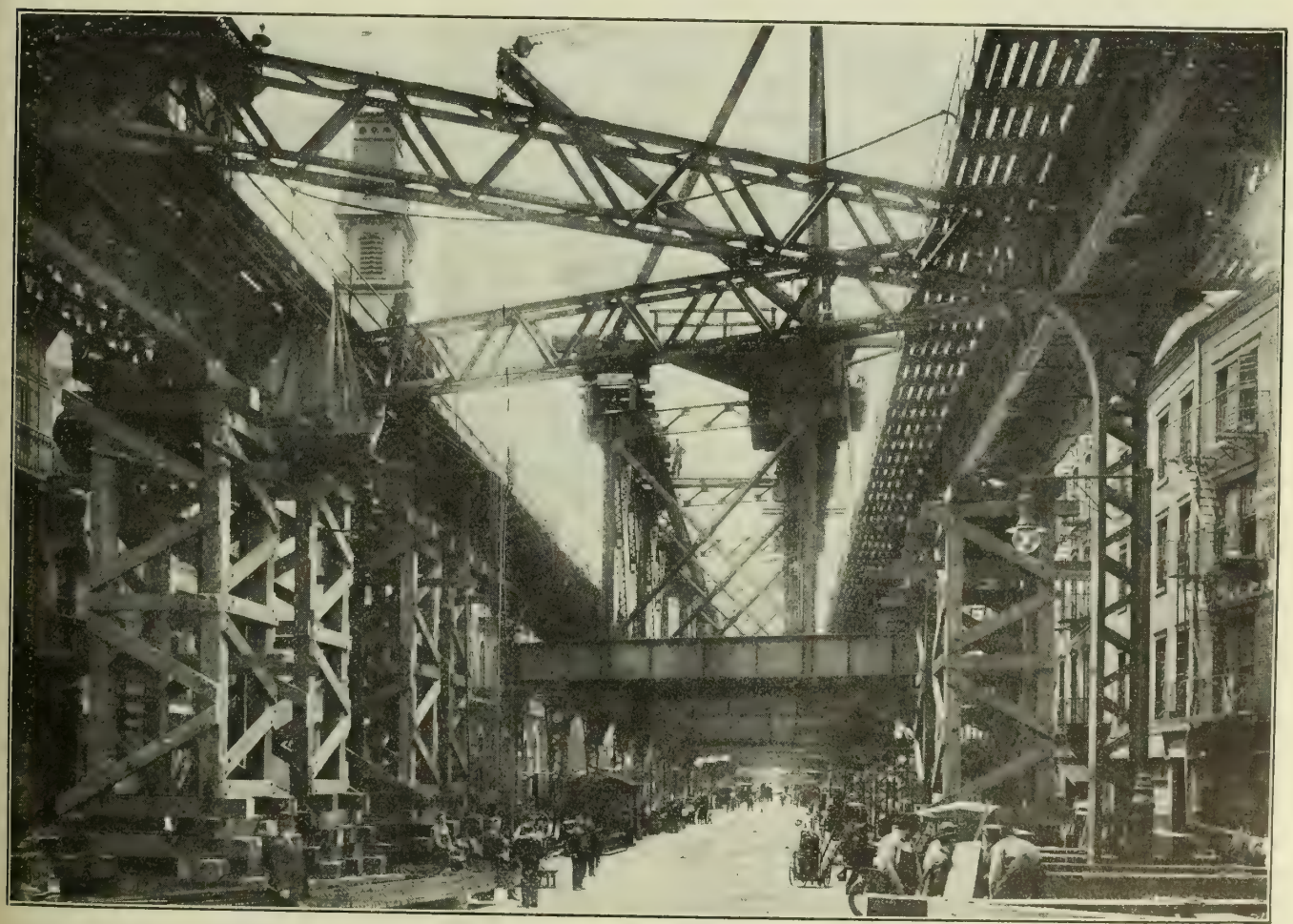


FIG. 1. DOUBLE-DECKING THE SOUTH FERRY LINE IN NEW BOWERY, MANHATTAN BOROUGH, NEW YORK CITY

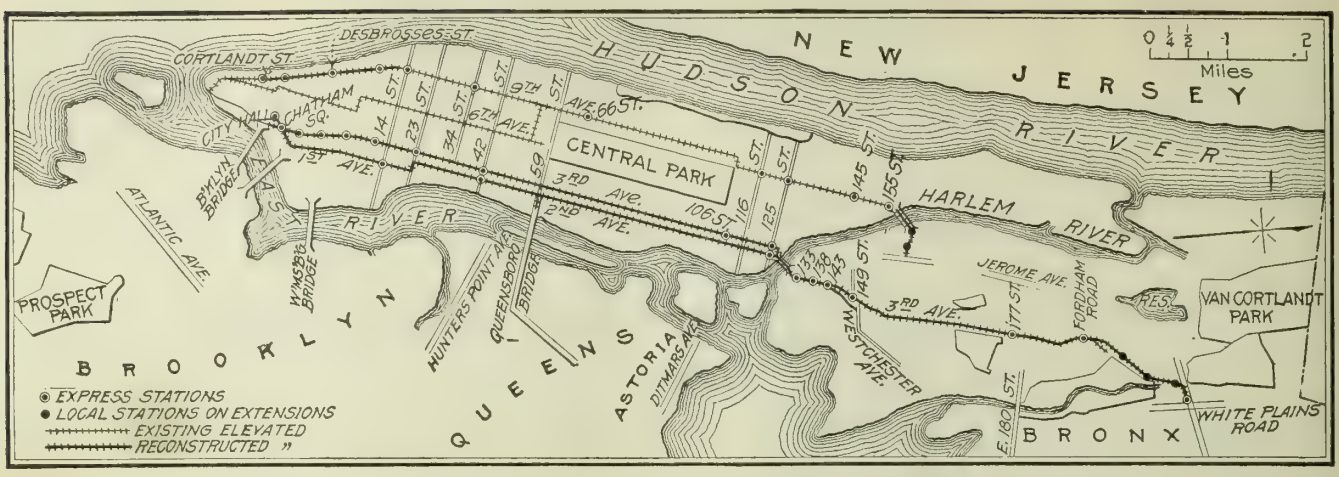


FIG. 2. ELEVATED-RAILWAY SYSTEM OF THE BOROUGHS OF MANHATTAN AND BRONX, NEW YORK CITY

ing accomplished without interfering with the proper running of the trains, which carry over one million passengers a day.

Complicating the whole problem, three important grade crossings or track junctions are being rebuilt with separation of grade and routes, involving much new structure, double-decking, revision of trackage, etc.

The undertaking is of such magnitude that it may be considered virtually a reconstruction of the entire elevated system of the Manhattan Railway Co. The work is described in a summary way in the present article. The reconstruction is being carried out by T. A. Gillespie Co., Terry & Tench, and Snare & Triest, contractors, under the supervision of the Interborough Rapid Transit Co., lessee of the Manhattan Railway Co. lines under a 999-year lease. The plans for the work received the formal approval of the Public Service Commission, but were developed wholly in the Interborough engineering department.

Planned Fifteen Years Ago

A dozen or more years ago the Manhattan Railway Co. entertained the idea of fitting all its lines with third track for express-train operation—southward in the morning rush hours, northward in the evening rush hours, express trains in both cases to return over the local tracks. The feasibility of the project was investigated at that time, the old structure and its possibilities in the way of carrying additional loads and suitability for reinforcng were thoroughly canvassed, and designs were developed for a considerable part of the work. However, for various reasons the work was not carried any farther then.

Five years ago, when the city authorities in negotiating for new rapid-transit construction asked for inclusion of third-tracking proposals, the plan was taken up anew. The agreement between the city and the Interborough, reached in March, 1913, included the third-tracking of the elevated lines as an essential feature. Not long afterward the Public Service Commission issued formal authorization for the work, which has been carried forward actively since then to the point where erection is in progress on practically every section of the undertaking.

Work Done Under Traffic

The most important condition of the work was that the dense traffic—averaging about 300 trains per day per track—must be maintained at all times, without interruption or risk, and with the minimum inconvenience to passengers and disarrangement of schedules. This meant piecemeal work, the adoption of cutting and fitting methods in place of complete reconstruction in many instances, and sometimes the adoption of radically unusual designs or procedures.

On the map, Fig. 2, the four lines in Manhattan, one of them extending into Bronx Borough, are indicated. Each of the four lines was double-track, except for three tracks on the Ninth Ave. line from 12th St. to 159th St. (between 114th and 127th St. there were only two tracks), and on a portion of the Third Ave. line. As reconstructed, the system will have three tracks everywhere except on the Sixth Ave. line, and four or five tracks in the vicinity of the Chatham Square junction and between 125th and 145th St. on the Second Ave. and Third Ave. lines.

Other prominent elements of the system as rebuilt are: Station reconstruction on the remainder of the Ninth Ave. line north of Christopher St. to suit the new express-operating system; double-decking along Park Row on the Third Ave. line to provide four tracks entering City Hall station from Chatham Square station, and similar double-decking on the Second Ave. line from Franklin Square to Chatham Square station to correspond with the



FIG. 3. TRACK INCLINE TO "HUMP" EXPRESS STATION, NINTH ST. STATION OF THIRD AVE. LINE

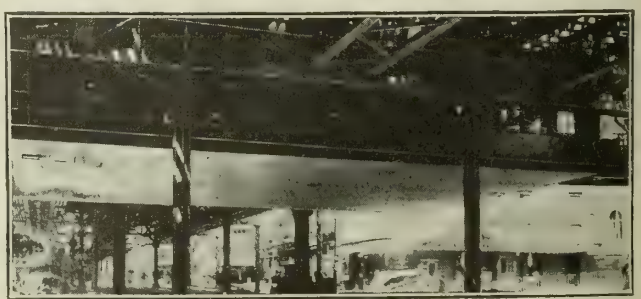


FIG. 4. MEZZANINE CONCOURSE OF ISLAND-PLATFORM STATION, 42ND ST. STATION OF SECOND AVE. LINE

elimination of grade crossing at Chatham Square; complete rebuilding and double-decking of Chatham Square station to separate crossing tracks; rebuilding the entire structure for five tracks to near Canal St. and for three tracks north of this point; third-tracking and station revision northward on Third Ave. to the Harlem River bridge; third-tracking and provision of express stations on the Second Ave. line from Chatham Square to 125th St., and removal of the 127th St. station to 125th St.; revision of track and double-decking thence north to Harlem River bridge; replacement of the entire Harlem River bridge by a double-deck structure, giving four tracks total; four-tracking and station revision to 145th St. in the Bronx, and third-tracking thence north to the end of the line at Bronx Park.

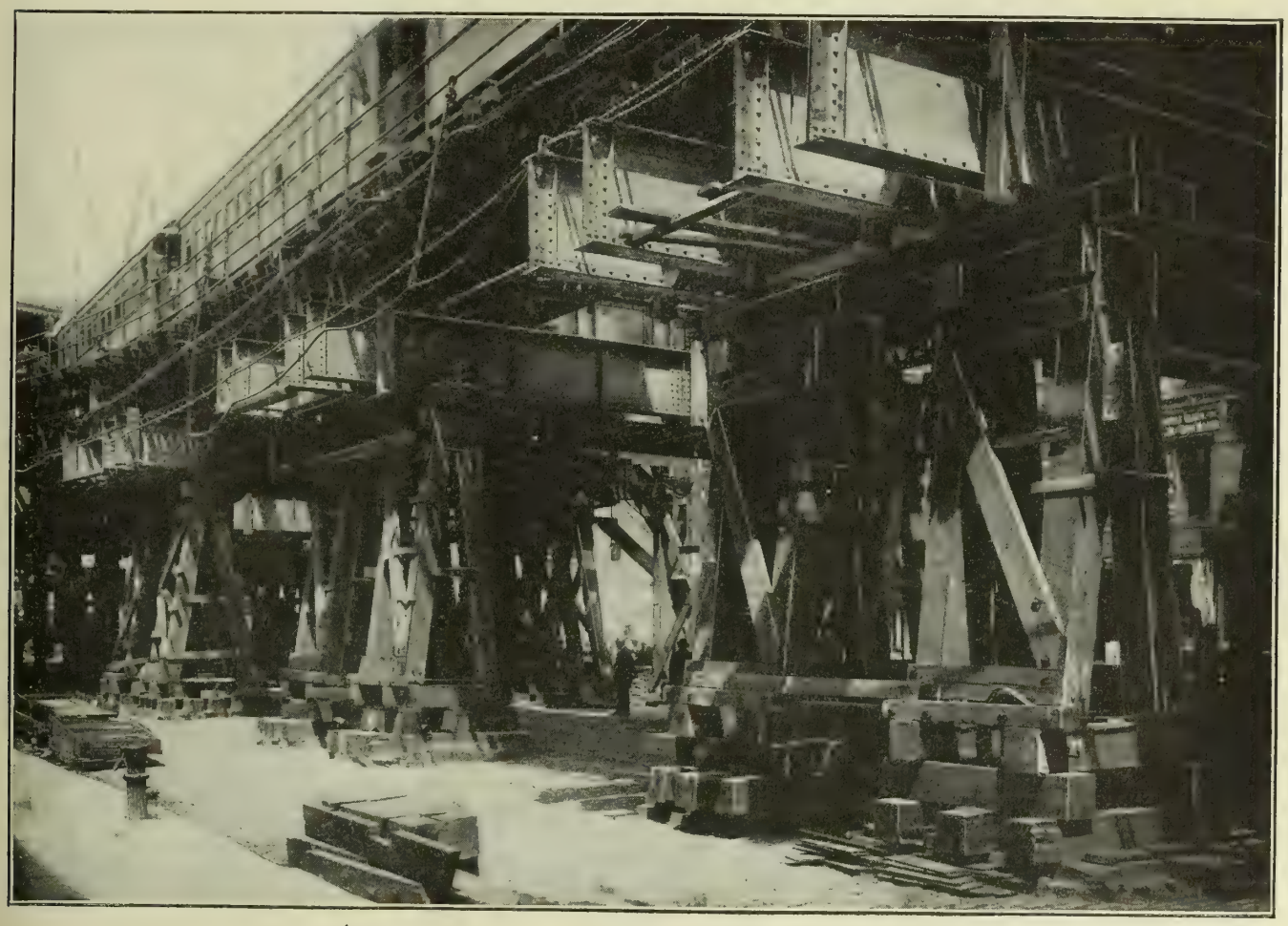


FIG. 5. TYPICAL SHORING WITH NEEDLE BEAMS; ELEVATED-RAILWAY RECONSTRUCTION
Needle beams required here for supporting center-track girders

General Conditions of Reconstruction

Most of the old elevated structure consists of transverse bents comprising two columns and a plate-girder or truss, spaced generally 42 to 45 ft. apart along the line, carrying longitudinal girders—one per rail—on which the track ties are laid. At individual points where the structure is high above the street successive pairs of bents are braced together by longitudinal portal bracing to form four-column towers.

Most of this two-column construction had been built originally with tracks spread sufficiently to admit a future center track. In some places the cross-girders of the bents had even been punched for the connection of the future track girders. However, on parts of the line the cross-girders were not strong enough to carry the additional track with modern loading—the present-day electric elevated trains, as compared with the much smaller and lighter cars and light steam locomotives of twenty years ago. It was necessary to remove these girders and replace them by stronger ones, and in many cases also to renew the columns.

Single-Track and One-Column Construction

Single-track or one-column construction (see sketches E and J, Fig. 6) existed on a few lines, notably on the Bowery and New Bowery (Third Ave. line) and on Greenwich St. (Ninth Ave. line). The columns, set just inside the curb line, on the sidewalk were built with a spread cap carrying a pair of track girders of suitable spacing for one track. In some instances the two single-track structures, one on each side of the street, were braced together by transverse struts, but in the main they relied for lateral stiffness upon the fixity of the columns on their brick foundation piers.

The treatment suitable for the several cases of single-track construction depended upon the layout of the new work. Throughout the length of the Bowery it has been necessary to build an entirely new structure occupying the middle of the street and to abandon the old structure completely with only local exceptions, where the original column locations could be used. On Greenwich St., however, the old column locations and in fact many of the

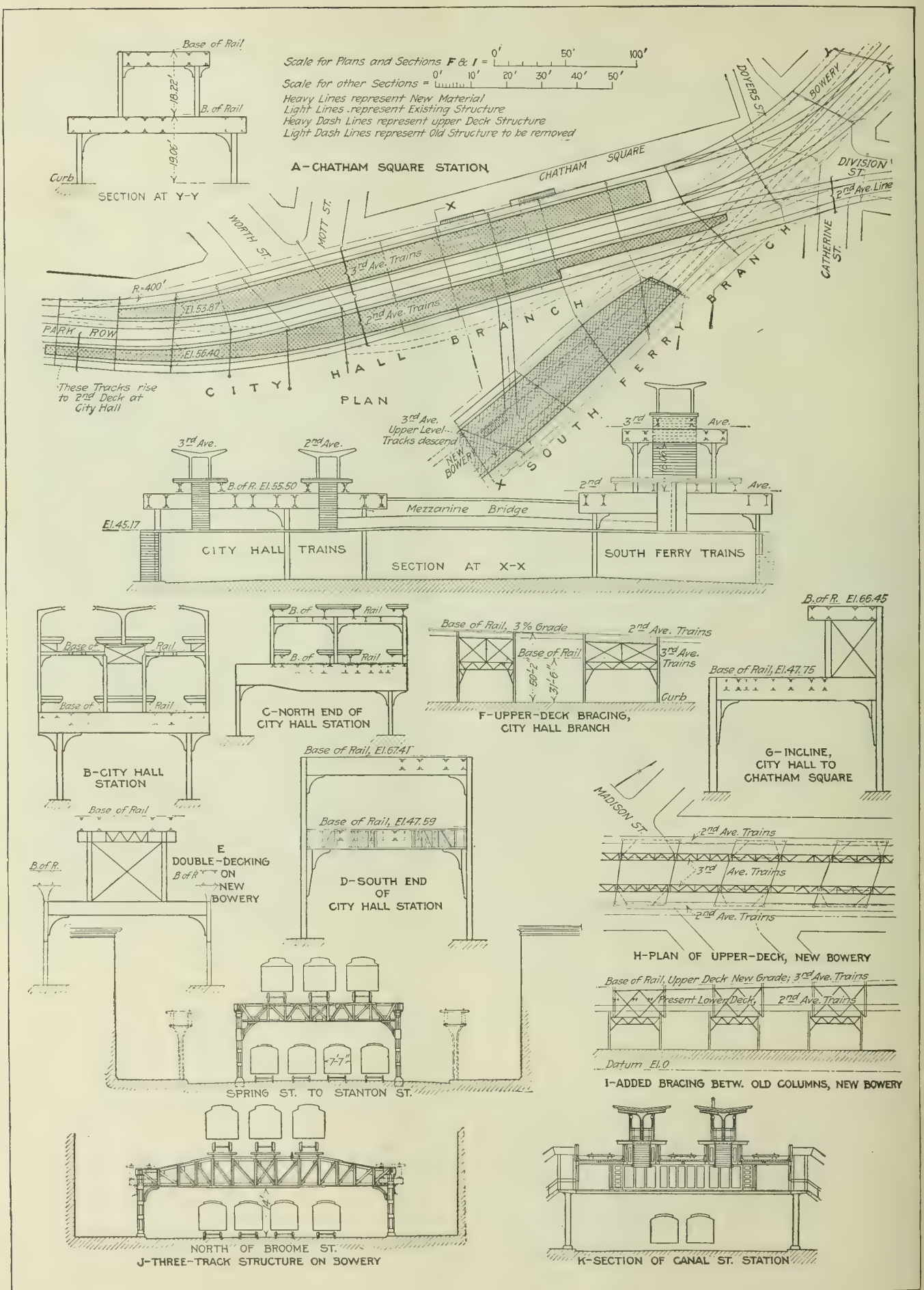


FIG. 6. TYPICAL SKETCHES OF NEW YORK ELEVATED-RAILWAY RECONSTRUCTION, SOUTH PORTION

old columns themselves are retained throughout and cross-girders are slipped in between the old track stringers, carrying them as well as the new set of middle track girders. When the new work is completed there will be none of the single-column structure remaining in service.

Express Stations: Mezzanine and Hump Types

How to reach the new center track with station platforms (at express stations) was one of the essential problems of the enterprise.

Two main types of station were worked out as solutions of this problem—(1) the island-platform or mezzanine station type, and (2) the double-deck station or "hump" type.

(1) The island-platform stations, in which the platforms are between the tracks and are reached by stairs, have the station booths and concourse on a mezzanine floor between street and track level. Sketch A in Fig. 6 and the view, Fig. 4, show such stations.

This type was used where the tracks were far enough apart or could be spread to admit the island platforms. The structure was high enough, at most of the stations, to admit of building the mezzanine floor and yet leave sufficient street clearance; but at several stations the structure had to be raised to make room for the mezzanine, by amounts ranging up to 7 ft.

(2) The "hump" type of station, produced by raising the center track about 11 ft. at and near the station, with express platforms located directly over the local tracks, and local platforms outside the local tracks, has an important advantage in not requiring more width of ground area than the previously existing local station. Also, it is the cheapest solution where the center track already exists or where the existing structure is wide enough only for third track without island platforms. The circumstances of the old elevated structure were such that the hump type proved best for a number of locations—see for example the view, Fig. 3.

A determining factor in deciding between mezzanine and hump station was the matter of easement damages to abutting property. Where there was reason to apprehend large claims for damages if the elevated structure were widened for island platforms, the hump type was adopted, as involving least disturbance of the property status.

The principal station type other than the two above noted is that employed at Greenwich St., on the Ninth Ave. line. Here the old tracks were spaced far enough to admit a third track and a single island platform—the old outside platforms being continued in service. However, the structure was not high enough to admit a mezzanine for reaching the express (island) platform. Therefore a bridge over the tracks was constructed, with stairs to all three platforms, allowing access to the island platform from either local platform.

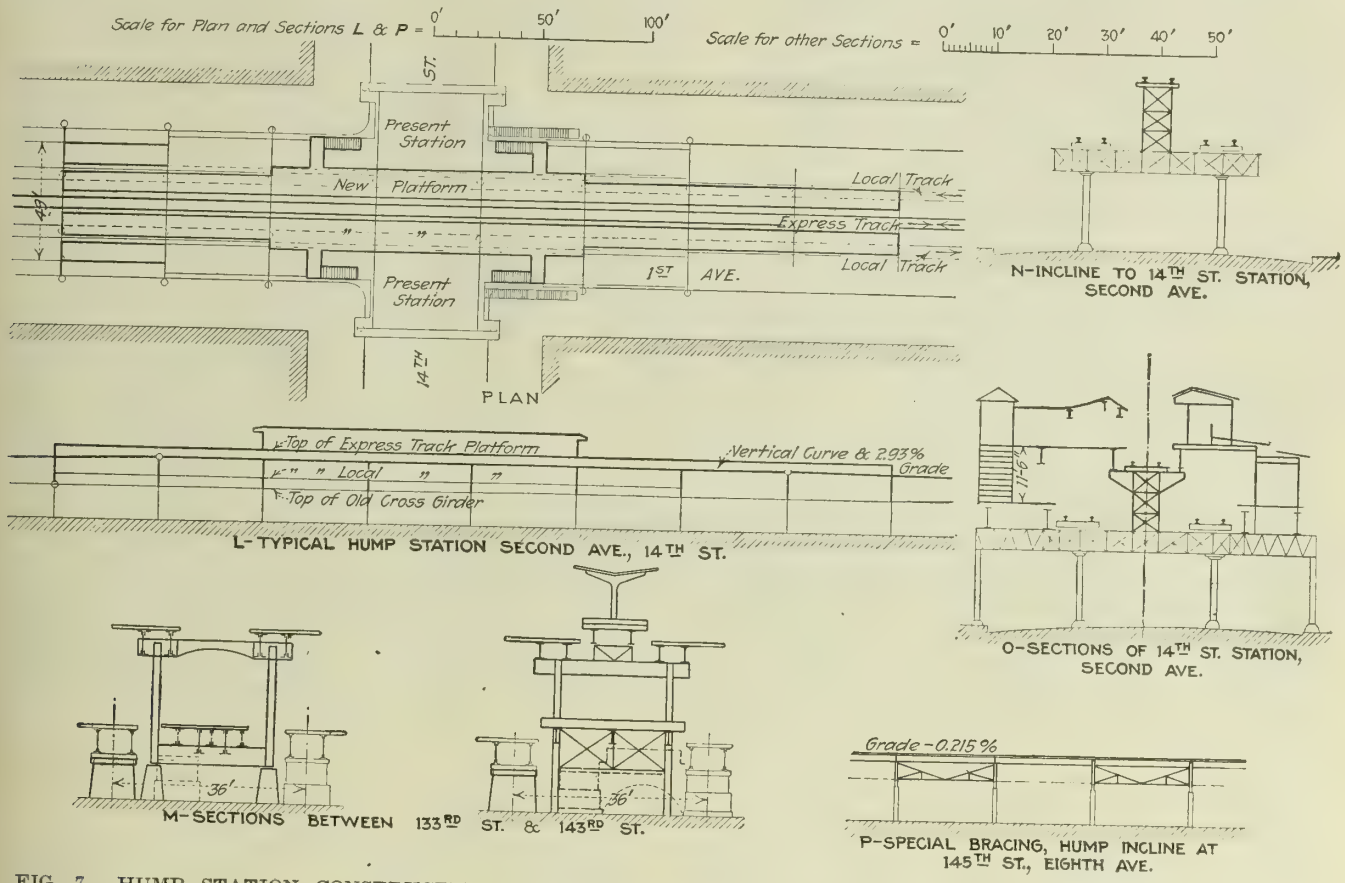


FIG. 7. HUMP STATION CONSTRUCTION AND DOUBLE-DECK WORK ON BRONX BOROUGH ELEVATED LINES

An Ingenious Station Arrangement

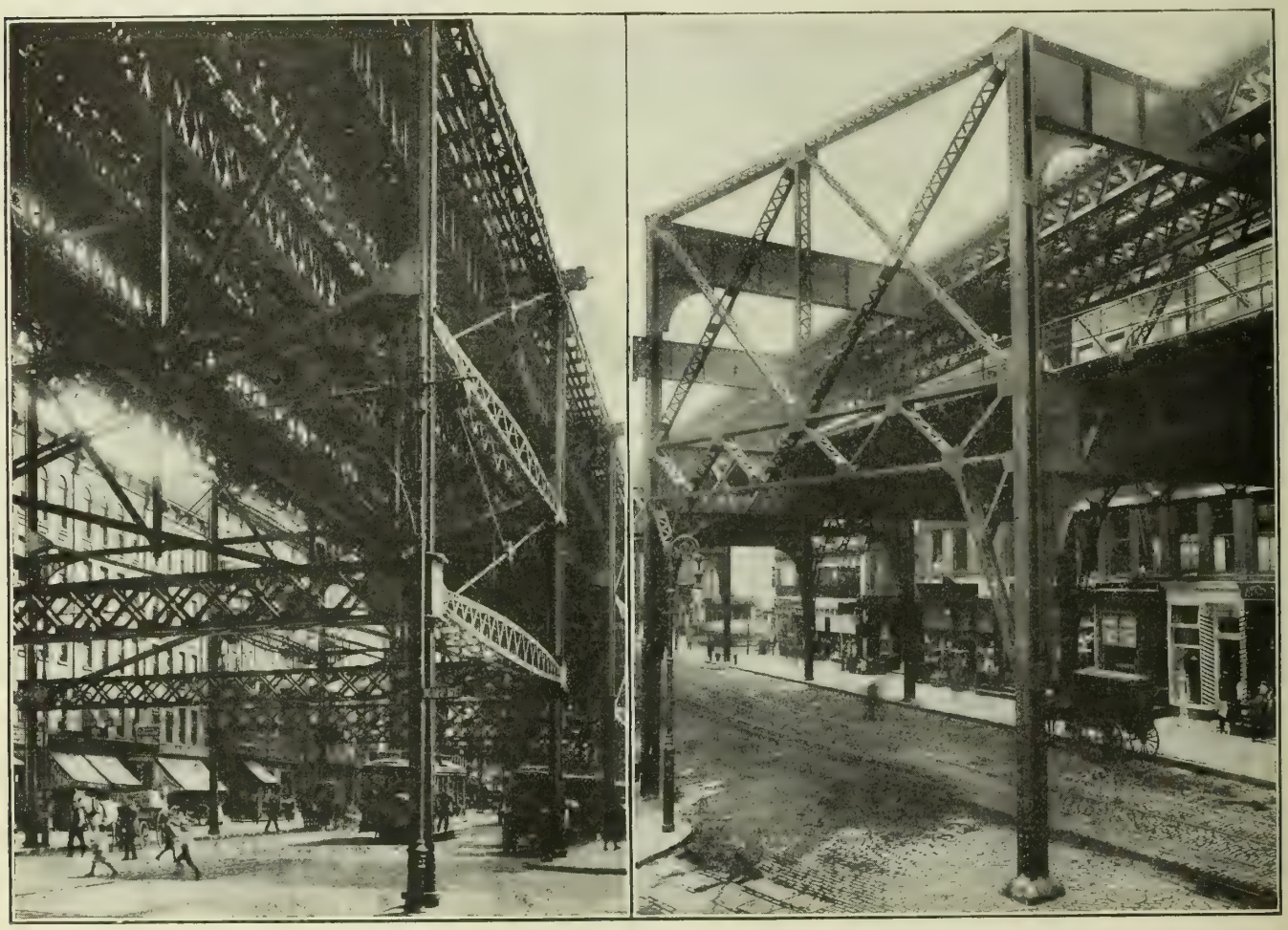
An ingenious special arrangement of station platforms was used in rebuilding the 116th St. station of the Ninth Ave. line. Here also only one island platform could be placed between tracks, but there were no outside platforms and no possibility of placing them. An island platform was therefore arranged between the southbound track and the express track, here shifted close over toward the northbound track; just north of this platform the express track was swung over to a position alongside the southbound track, and beyond this point a second island platform built

between the express and northbound track. The mezzanine station communicates with both platforms and connects them.

Shoring the Structure for Rebuilding

The simple hoisting and setting of new center track girders is carried on entirely from above by a derrick traveler sliding on the finished track and with sufficient reach to erect the span ahead and (in cases where there is an upper-deck structure) the next succeeding bent, and of sufficient capacity to lift from the street or from a construction car on one of the running tracks and set to place in the span ahead one of the new track stringers. However, as there is such a large amount of work involving changes in or replacement of old structure, the general condition is that shoring from the street surface is required as a preliminary to the center-track work.

Difficulties in the way of shoring are the presence of double-track street-car lines in all the streets on which elevated structure exists, and the fact that the clearance height of the old structure is so low that the depth available for needling girders is quite limited. The type of shoring most commonly employed, illustrated by Fig. 5 (Third Ave. near 42nd St.), comprises square towers made up of four 12x12's set in a 5-ft. square, adapted to be set directly on the street pavement and form a seat for blocking and jacks about 3 ft. below the bottoms of the track girders. At each column where shoring support is required two such towers are used, one being set just forward and the other just back of the column, directly under the outer pair of track girders, and so as to clear the street-car tracks. With towers thus placed at two columns of the bent, blocking placed on the four towers supports the four girder-span ends and enables the track girders to be jacked up, the cross-girders to be removed and replaced, and the columns to be renewed. Where towers could not be placed to give direct support, or where a center track also had to be supported, transverse I-beams bearing on a pair of towers were placed under the track girders.



FIGS. 8 AND 9. SPECIAL BRACING OF RECONSTRUCTED ELEVATED-RAILWAY STRUCTURES IN MANHATTAN

Fig. 8—Additional bracing of high structure on the Ninth Ave. line at Eighth Ave. and 117th St. On both transverse and longitudinal bracing of the towers, the lower panel has been added. Note gusset-plate connections to Phœnix columns. Fig. 9—Tower bracing of double-deck structure on Park Row

Removing and Resetting Cross-Girders

At some locations the cross-girders after being cut loose from their connecting track-girders can be slipped out endways and removed, all interfering stiffeners being cut away to make this possible. In many cases, however, the cross-girder has to be cut into three pieces—cutting loose the center section and lowering it into the street, and then slipping out the two end sections. The cutting is in nearly all cases done by oxyacetylene burners.

Erection of the new cross-girders is done either by slipping in the two ends from the sides and lifting up the center section from the street and splicing, or by lifting the girder up straight in one piece, its top flange being left off to be put in place after the girder is set.

(*Concluded in next week's issue*)

Water-Typhoid Suit Lost

A suit to recover $15,000 damage for a death from typhoid fever alleged to have been caused by polluted water due to a faulty check valve between a mill supply and the supply furnished by the Circleville Water-Supply Co., of Circleville, Ohio, was decided in favor of the company early last May. Although the decision was in a petty court and can in no sense be regarded as laying down the law in Ohio or elsewhere, the alleged facts in the case and some of the instructions given to the jury by the presiding judge seem worthy of record.[1] The following notes have been taken from a summary of the testimony prepared by Barton Walters, of Circleville, Ohio, counsel for the water company.

According to the testimony, there was only one death from typhoid fever in Circleville during the 3¾ yr. ending with September, 1913. Changing now from deaths to cases, the testimony indicated one case in October, one in November, two in December, 1913, 14 in January, 1914, 20 in February of the same year, and after that scattering cases which brought up the total to 54 cases. There were five deaths. An investigation of 43 cases by the Ohio State Board of Health showed that these were distributed among 40 families containing 178 persons; two cases were probably due to contact, and one case was contracted outside of the city. There seemed to be no connection between the outbreak and the milk supply, the State Board of Health concluded. It appeared that 70% of the families affected used unsanitary privies [it should be noted, however, that the outbreak was in the winter], but the company's water-supply was in general use, and while wells and cisterns were common, water from these was not used for drinking purposes.

The husband of the deceased brought suit for damages, alleging that it was the duty of the Circleville Water-Supply Co. to furnish pure and wholesome water, and that the company had disregarded this duty, negligently permitted the water-supply to become contaminated and thus caused the death of his wife. The alleged cause of this pollution was not the regular supply of the Circleville Water-Supply Co., but water from the Scioto River, which, it was claimed, gained access to the mains of the water company through an emergency connection between the fire-protection water-supply system of a large paper mill of Circleville and an emergency connection between this supply main and the water main of the Circleville Water-Supply Co. According to the summary of the testimony prepared by Mr. Walters:

> This connection was made between the sprinkler system of the mill and the mains of the Circleville Water-Supply Co. by installing an 8-in. Pratt & Cady check valve with an automatic swinging gage. This valve was installed, it was claimed, eight or ten years ago, and was so arranged that the water could pass from the mains of the public utility to the mains of the industrial plants whenever the pressure in the industrial plant was lower than that in the city mains.

The defendant company tested the valve from time to time by means of a water meter set in a rubber-hose bypass, relying upon the meter to show water passing in either direction after closing the manually operated gage set at the connection. Quoting again from Mr. Walters' summary of the testimony:

> It was claimed that in January, 1914, this test as described was made and that it was discovered that a considerable quantity of water from the mains of the paper mill was passing back through the check valve into the mains of the water company. A trench was opened in the street and the valve uncovered, and upon removing the bonnet it was found that the wing or swinging gate of the valve was worn and it dropped down far enough to allow it to "cock," that it was off its seat and in such a position as to allow a quantity of water to pass from the paper mill into the mains of the water company whenever the paper mill's pressure was greater than the water company's pressure, which occurred frequently, and the plaintiff claimed that it was in this manner that the water-supply became polluted. It was pointed out that all of the cases of typhoid, with but two or three exceptions, occurred in a section of the town embracing six or eight blocks adjacent to the American Strawboard Co.'s paper mill.

Mr. Walters' summary of the testimony did not disclose any denial by the company that the check valve leaked at the time of this test, but the water company introduced evidence to show that for a year previous it had tested the valve at least once a month and had always found it in proper working order.

Evidence was introduced (by which side is not stated in the summary sent by Mr. Walters) showing that Circleville is located on the Scioto River 30 mi. below the outfall of the Columbus sewage-treatment plant and "tending to show the presence of B. coli in large numbers in the water of the Scioto River at Columbus and also at Circleville," the latter in the vicinity of the strawboard mill in January, 1914. Evidence was also introduced that claimed to show that "for some time prior to the outbreak of typhoid the water in a portion of the mains of the water company was milky and evil smelling."

The defense of the company as summarized by Mr. Walters was as follows:

> The defendant denied that it had furnished impure water and denied that the plaintiff's intestate contracted typhoid fever by drinking water supplied by the defendant; denied that it had been negligent in any particular, and set up the defense of contributory negligence and contended that inasmuch as the citizens of Circleville had been cautioned and advised by the newspapers of the city almost daily to boil the water for safety, and the fact that it was notoriously well known and discussed by the citizens of the city that the public water might be polluted and might be the source for the numerous cases of typhoid, that the drinking of the unboiled water by the said Iva Grant, deceased, was such negligence upon her part as would preclude recovery by her administrator for her death.

The judge issued a long series of instructions to the jury which may be summed up as follows: The defendant company could not be held as a guarantor or insurer that the water furnished by it to its consumers did not contain pollution; the company could only be held "to exercise ordinary care in the operation of its plant," including a workmanlike installation of a standard check valve in the mill connection and ordinary care in testing the check valve; the company could not be held liable for an accident to the check valve. The judge declared further:

> Although you find that the defendant failed to exercise ordinary care in the operation of its plant, and that on account thereof said Iva Grant contracted typhoid fever from water supplied by the defendant and died as a result, I charge you that if you further find that Iva Grant had knowledge or reasonable means of knowledge that said water was polluted before and at the time she drank the same, then she took upon herself the risk of drinking such water and you must return a verdict in favor of the defendant.

The judge declared that "reasonable knowledge" that the water was polluted would be afforded by proof of warnings to that effect published in the newspapers and by open discussion of the alleged water pollution by neighbors and their caution to one another to boil the water.

[1] The case was brought by Samuel C. Grant, administrator of the estate of Iva Grant, deceased, in a petition to the Court of Common Pleas of Pickaway County, Ohio, dated May 28, 1914. The decision was rendered by the jury on May 4 or 5, 1915.

The defense in the case was made by Barton Walters, of Circleville, Ohio, the attorney already mentioned, assisted by William Miller, an attorney of Columbus, Ohio, and by George A. Johnson, of New York City, and A. Elliott Kimberly, of Columbus, Ohio, sanitary engineers. The general supervision of the case was directed by A. W. Cuddeback, superintendent and engineer of the Passaic Water Co., of Paterson, N. J., in behalf of the Circleville Water-Supply Co.

Pier and Pile Foundations on Earth and Rock

Work on the Circle Building, a new and in some respects remarkable structure, is rapidly nearing completion. The building is located on an irregularly shaped plot on the north side of Columbus Circle, New York City. It fronts 261 ft. on Central Park West, 316 ft. on Broadway, 195 ft. on 61st St., and 38 ft. on the Circle end. The first floor of the building contains stores and display rooms, the second floor being devoted to office purposes. The original layout contemplated a five-story structure with a tower extending 25 stories above the roof. This plan is being held in abeyance and the building has been carried up only two stories. The idea of constructing a high tower, however, is still alive and the footings and columns in the central portion of the building were designed and constructed to take ultimately the load of such a tower.

Rock at the site varied considerably as to depth. Fortunately the low height of the building made it unnecessary to sink the piers to rock, except those designed to carry the proposed tower. These piers were in all cases sunk to rock by open excavation, rock being struck at a maximum depth of about 48 ft. At one point south of the center of the plot, along Broadway, rock showed about 6 in. below curb. The elevation of the grillage beams was 4 ft. below the cellar floor.

Where possible, the piers were excavated with buckets operated by A-frame bull-wheel derricks, but the smaller

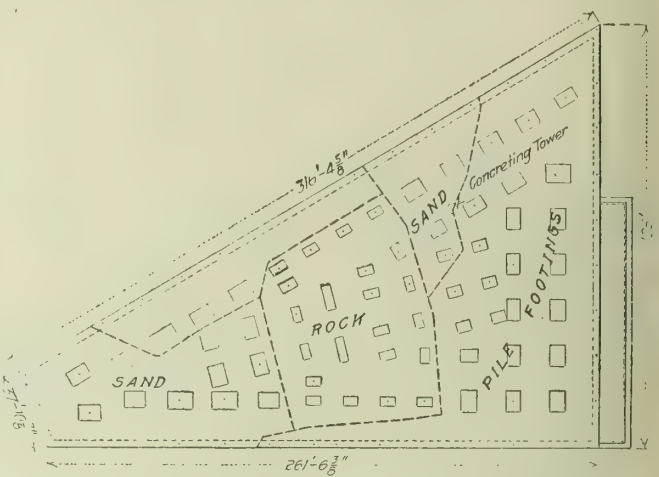


FIG. 2. FOUNDATION PLAN OF CIRCLE BUILDING

piers had to be dug by hand. Those of medium size were dug out in stages (benched out). In the smallest holes pails were filled with earth and hoisted out by hand. The pier pits were sheetpiled with tongued-and-grooved yellow-pine piles 16 to 20 ft. in length. At the deep piers followers were used in driving the sheeting.

Fig. 2 is a foundation plan. The piers for the two-story part of the building rest on sand or on blue clay, and most of them have direct soil footings. At one corner several piers have Raymond concrete pile foundations. These consist of two to six piles per pier and a reinforced-concrete cap plate 3 ft. thick.

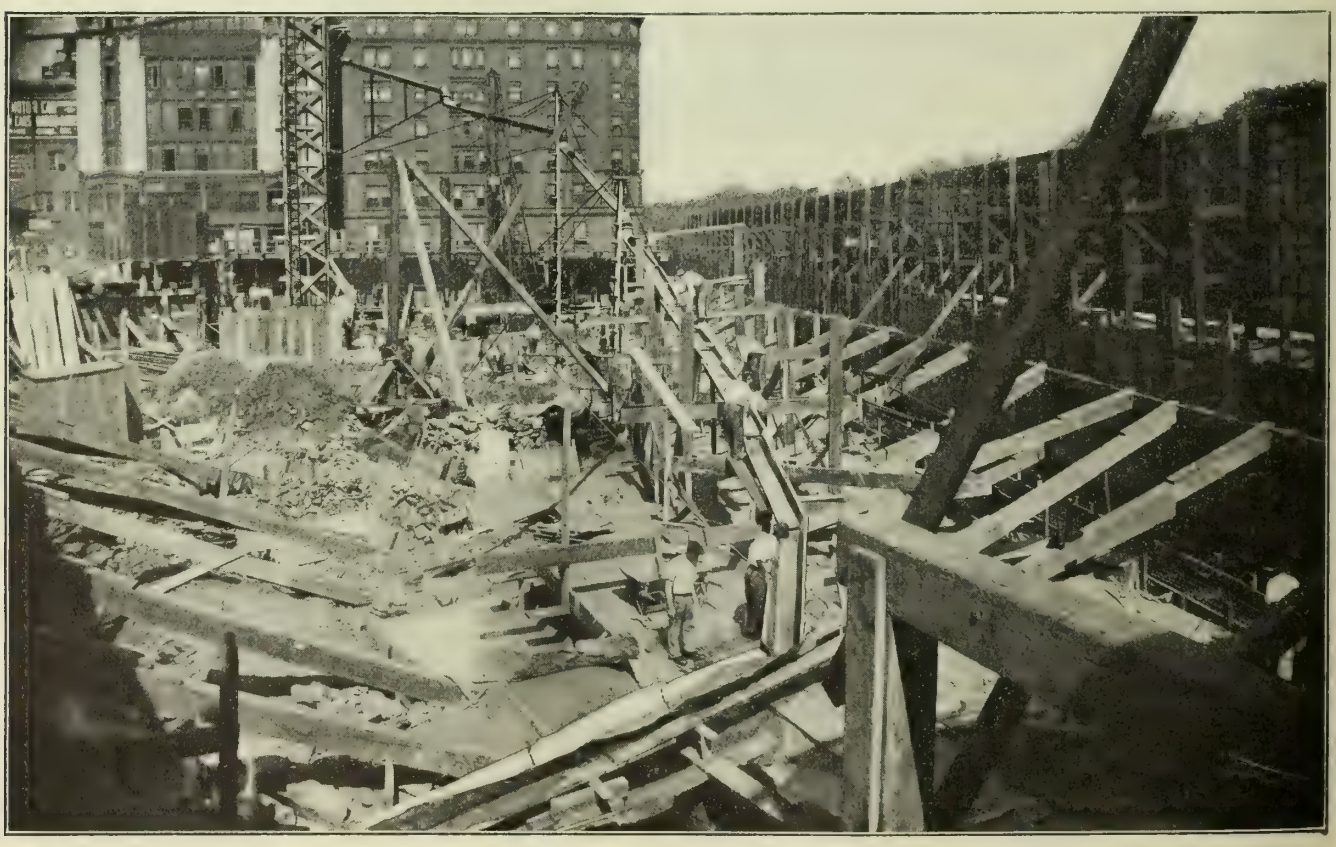


FIG. 1. GENERAL VIEW OF WORK ON CIRCLE BUILDING, SHOWING CHUTING SYSTEM IN OPERATION



FIG. 3. VIEW OF THE CIRCLE BUILDING SITE TAKEN TWO MONTHS AFTER FIG. 1
Grillage beams on piers in foreground. Recesses left in wall at right for later placing of columns

The cellar was excavated by a steam shovel, which started at one end of the site and worked in to the other end, where it turned around and dug its way out. The spoil was loaded on 3-ton motor trucks, which were loaded with 4 yd. Twenty trucks were employed, each hauling seven loads per day. The trucks were drawn out of the excavation by a cable operated by a hoisting engine.

Difficulties from Ground Water

A spring in the north end of the excavation caused very mucky soil in the vicinity. The water had to be pumped out of the pier excavation continuously. Double-diaphragm gasoline pumps were used in some cases, but these were only satisfactory on lifts of from 18 to 20 ft. For the most part high-pressure steam pumps were employed to jet out the water. Steam pressure as high as 110 lb. was used. Water from pier excavations was pumped into a receiving tank to allow the sand in suspension to settle. A pipe led from the tank to the sewer, though the sewers in the vicinity of Columbus Circle are very small for the duty they have to perform.

Puddled-Concrete Building Wall

A part of the building wall is carried on 238 concrete piles driven 2 to 2½ ft. c. to c., the spacing of the piles being less at column locations. The average penetration was 12 ft. It was necessary to proceed with the concreting before the steelwork was received. The grillage beams were secured and placed before the walls were poured, recesses being left in the walls at column locations to provide for the future placing of the wall columns. When the columns were received they were erected and forms placed in front of them and the recesses filled with concrete. Some of these recesses are visible at the right in Fig. 3.

The wheelbarrow method of distributing concrete from mixer to the required location was tried and quickly abandoned as being excessively costly. A 75-ft. tower[1] was then erected at the point indicated in Fig. 2 and the concrete chuted from a point 65 ft. above ground to all parts of the wall. The chuting run varied up to 200 ft. At the forms two men hoed the concrete, which was of soupy consistency, from the chutes into the forms and puddled the concrete thoroughly with scrapers similar to those used to remove ice from sidewalks.

An interesting point in connection with the excavation developed after the foundations had been built. It was determined that the boiler room was not as high as it should be. The column footings at this location were therefore underpinned and the floor of the boiler room was lowered 7 ft. by hand excavation. The soil was mucky, so that it was necessary to keep gasoline pumps operating while work was in progress.



FIG. 4. TIMBERED DEEP-PIER EXCAVATIONS
Looking down into Nos. 57 and 58 of Fig. 1

The general contractor is the Columbus Circle Construction Corporation, of which H. Mandel is president. The superintendent of construction for the contractor is F. L. Shea. R. E. Moss is engineer and James C. Green, architect. The building is owned by the Hearst interests.

[1] F. L. Shea, Superintendent of Construction for the Columbus Circle Construction Corporation, described the concreting plant used on this job in "Engineering News" of Sept. 2, 1915.

Development of Ultra-Violet Water Disinfection

SYNOPSIS—The adaptation of the ultra-violet water-treatment method to American conditions is outlined and some installations are described.

The gradual technical development of the use of ultra-violet light in sterilizing water has been variously noted in *Engineering News*[1]. During the past two years an American concern, the R. U. V. Co., of New York City, has been developing the ultra-violet process for American conditions. Some of the results secured are here given.

The theory of the ultra-violet process may be briefly summarized: Ultra-violet rays are given out in profusion by the electric arc between metal electrodes and especially by the mercury arc. But where glass walls inclose the arc stream, as in the case of the ordinary mercury lamp, the walls absorb a large part of the ultra-violet light. By putting the mercury arc in a quartz tube and working it at high intensity, the absorption is prevented and a possible source of intense radiations is provided.

The bactericidal effect of ultra-violet light is well known. The ordinary pathogenic organisms are easily and quickly disintegrated under its influence, but as the ultra-violet rays have no great penetrating power for opaque objects, it is advisable to remove the suspended matter from the water by filtration and then to run the water in thin streams past the source of light. To guard against the effect of microscopic suspended matter, a single passage of the water is not relied on, baffles and tortuous passages being arranged to give several exposures of a given quantity of water, which has been thoroughly stirred up.

[1]The sterilization of water by ultra-violet rays was noted in the following articles: "Sterilization of Polluted Water by Ultra-Violet Rays," Sept. 15, 1910; "Sterilization of Polluted Water by Ultra-Violet Rays at Marseilles, France," Dec. 8, 1910, and Dec. 7, 1911; "Water Purification by Ozone, Ultra-Violet Rays, and Chlorine," Aug. 24, 1911, Oct. 17 and Dec. 19, 1912; "The Application of Ultra-Violet Rays for Purifying Large Quantities of Water," Aug. 21, 1913.

Early Work and American Conditions

The early work was done with water not under pressure or in a closed system. The most of the potable American water-supplies that might be treated by ultra-violet rays, where electricity can be supplied and good supervision secured, require that the process be carried on while the water is passing through a pressure system. Therefore only the principles of the process as worked out abroad are of particular service in this country; quite new apparatus has had to be developed. The cases where the water being treated flows in open channels are the small supplies in which the water is drawn off slowly into storage bottles, etc., or circulating systems for swimming pools.

Of some 320 plants installed or approaching completion in this country, 20 are for swimming pools, about 200 are of the small gravity-flow units of 60 to 120 gal. per hr. capacity, and about 100 are of the larger pressure-type sterilizers of 200 to 3000 gal. capacity. The first cost is about $750 per 1,000 gal. per hr. capacity for the larger machines, rising to about $900 for the smallest.

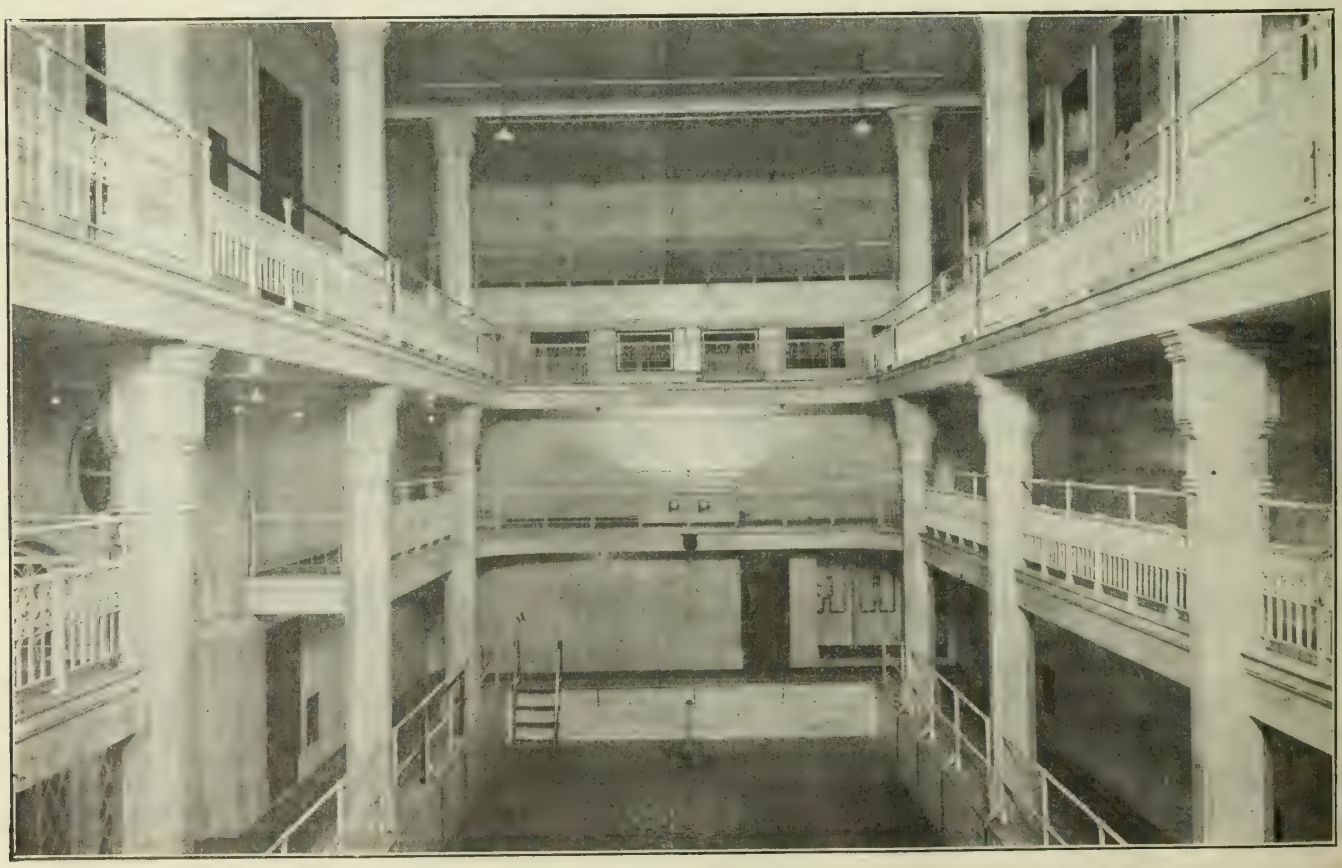


FIG. 1. SWIMMING POOL AND ULTRA-VIOLET RAY STERILIZER, NEW YORK ATHLETIC CLUB

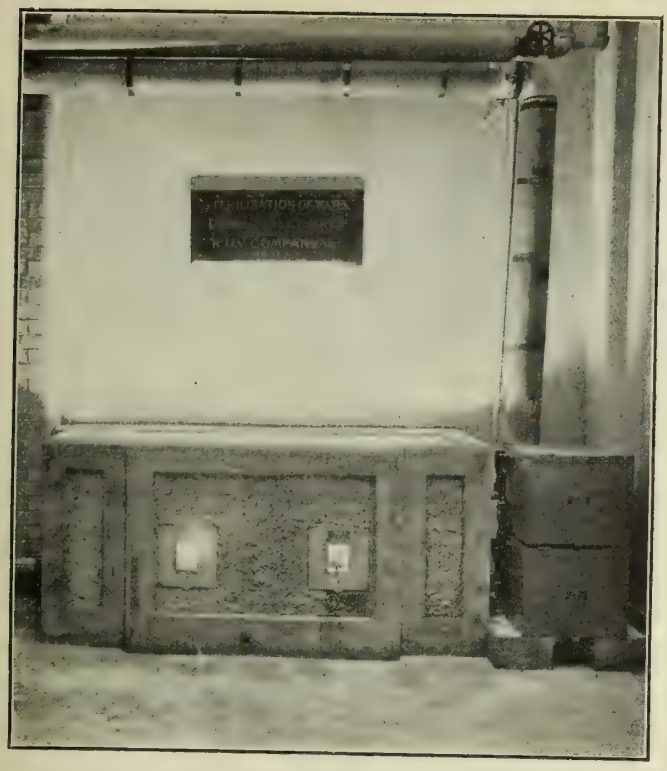


FIG. 2. STERILIZING TANK AT WEST SIDE Y. M. C. A., NEW YORK CITY

Direct current is required for the lamps in all cases. For the smallest machines the supply is at 110 volts, for the larger ones it is at 220 volts, while the largest require 500. Where direct-current at proper voltage is not available, rectifiers or motor-generator sets are used.

Disinfection Tanks for Swimming Pools

When ultra-violet light is used in purifying the contents of swimming tanks, the water is circulated, filtered and sterilized. It is led off, as usual, by the drain at the lowest point of the swimming tank, and forced by a small motor-driven centrifugal pump through filters to the sterilizer tank, which is usually elevated so that the water may run through and discharge by gravity. Fig. 1 shows such an installation at the New York Athletic Club and Fig. 2 that at the West Side Y. M. C. A. in New York City.[2] In each of these places two mercury-arc lamps are used, the sterilizing tanks being provided with baffles so that the water passes repeatedly under the rays.

Tests of the water at the New York Athletic Club showed a count of 280 bacteria per c.c. (agar plates at 40° C. for 24 hr.) in a sample taken over the drain pipe, with B. coli present in 75% of the 1-c.c. inoculations. The count at tank outlet was 2 per c.c., with no B. coli in 10-c.c. inoculations. At the West Side Y. M. C. A. the count before installation of the ultra-violet sterilizer was 2,200 to 5,100 per c.c., with B. coli present. This quickly dropped to 400 to 600, with no B. coli; and eventually ran from 10 to 70 in the pool, with no B. coli found.

Further development of the swimming-pool sterilizer is being made to evolve a standardized line that can be installed without the special work now often involved.

[2]Besides the two swimming-pool installations shown in Figs. 1 and 2, notable examples of these sterilizers are to be found at such places as the West Side Y. W. C. A. in New York, the Germantown Y. W. C. A., the Detroit and Dayton Y. M. C. A. buildings, the Minneapolis Athletic Club, the Forest Home School in Milwaukee, and the Forest Park Highlands, St. Louis, Mo., the last for a large open-air pool.

The design of sterilizer shown in Figs. 3, 4 and 5 has been developed for treating water under pressure. The water flows in a circuitous path through an iron casing in the center of which is packed a quartz tube whose interior is open to the air for the insertion of the mercury-arc lamp. The flow is divided, and on each side the baffles are arranged so that the water passes back and forth radially, coming close to the lamp twice. These types are made in two sizes—one for 600 to 1,000 gal. per hr. and the other for 1,000 to 3,000 gal. The smaller one requires 0.55 kw. power and the larger 1.25 kw. The lamps used are shown in Fig. 5. The only labor required is the tilting of these lamps to start and an occasional cleaning of the casing.

Where the water to be treated is not perfectly clear, the supply has to be prefiltered, the type usually employed being a vertical pressure cylinder packed with sand, charcoal or bone black—depending on the quality of the raw water. The loss of head through the filters is from 6 to 12 ft., while that through the sterilizer is 2½ ft. for one size and 3 ft. for the other. Where the pressure head of the supply system is not large enough to pass the water through the sterilizers and deliver properly, booster pumps are employed. Where it is desired to treat supplies greater than the capacity of a single unit, two or more are used in parallel; it is not unusual to install a duplicate sterilizer as a spare unit for use in contingencies.

Automatic lamp control for large sterilizers and full electric control of water flow are being developed. When these are perfected the entire sterilization process can be controlled from the switchboard.

Out of the earlier design of small gravity-flow sterilizer first furnished, the automatic type shown in Fig. 7 has been developed. Water flows into an enameled iron tank

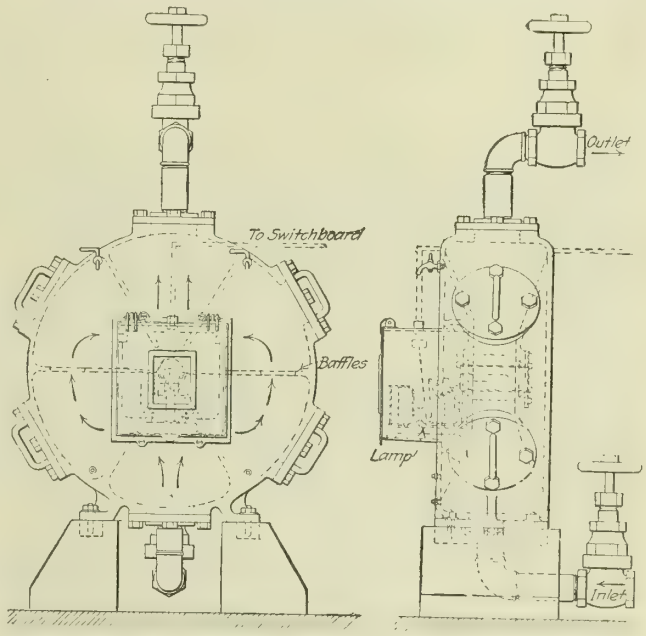


FIG. 3. PRESSURE TYPE OF STERILIZER

and around baffles so that it passes twice in thin streams close under the lamp. The lamp frame is fastened to the plunger of a solenoid through which the main current flows; closing the lamp circuit then lifts the lamp and starts the arc, while breaking the current causes the mercury tube to lower ready for starting again. Where the total daily consumption is small but there are occa-

sional heavy drafts of water, this sterilizer has been used, overflowing into a storage tank.

A small pressure sterilizer (200 gal. per hr.) has been built along the lines of the apparatus shown in Figs. 3, 4 and 5. A different type of lamp is used, however, such that automatic tipping of the lamp, as previously noted, is obtained.

Many Carbon-Free Metals and Alloys Now Available

In many metallurgical operations there is need of employing carbon-free metals and alloys in order to control fully the physical properties of the final metal, which may be a special steel or bronze, for instance. A large number of these have been developed by the Goldschmidt Thermit Co., of New York City, employing in their production the well-known aluminum-oxidation reactions by which a high temperature is produced in carbon-free surroundings. A brief review of the uses of most of these is given, from notes by H. De Courcy Browne, metallurgical engineer of the Thermit Co., in the paragraphs which follow. The approximate analyses are appended in a group.

Pure Manganese Products

Manganese, 97-98% pure, has been a commercial product for over 10 years. Its melting point is about 1260° C. It dissolves very readily and alloys can be easily made with chromium, aluminum, copper, zinc, tin, nickel, titanium, etc. It is not detrimental to some work where the usual 80% ferro-manganese with its combination of iron and carbon has been dropped. It is used in the manufacture of cupro-nickel, german-silver and aluminum sheets, where it has been found that a small addition increases the ductility in rolling. It is also used in the manufacture of manganese bronze and is especially advantageous where a high manganese and a low carbon content is desired. Manganese is generally added in the ratio of about ¼ to ½%, although in some resistance metals the content goes as high as 10%. This metal in powdered form is used by steel foundries to obtain a hardened surface on certain parts of steel castings; the "flour" is mixed with a binding material and swabbed on the mold where it is desired to harden the casting.

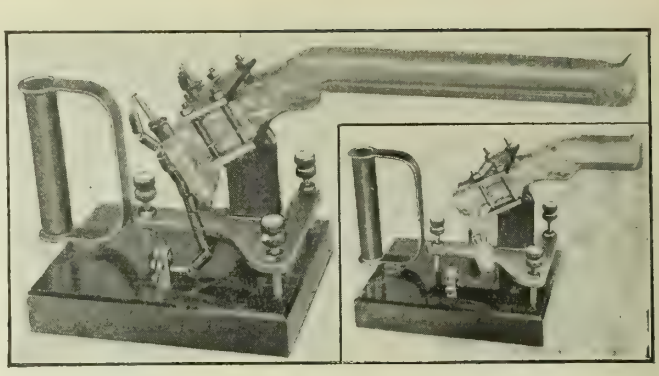


FIG. 5. PISTOL-TYPE MERCURY-ARC LAMPS

Chromium, Cobalt, Copper and Nickel

Pure chromium (98 to 99%) is generally used in resistance metals and mixtures where a high chromium content is desired; for example, in fine tool steels, projectiles, etc. The general addition of pure chromium is about ½ to 4%. In resistance metals the content often goes to 15% and even 30%.

Cobalt, made in 97% purity, has aroused great interest in the steel business since 1913. It is used in ordinary high-speed tool steel, where it is believed that the addition of about 5% improves the cutting qualities. The possible use of cobalt in brasses and bronzes is being studied.

Cobalt-copper: A small addition of cobalt, from 0.10 to 0.25%, increases the physical strength of brass and bronze castings and drawn wire, and of manganese-bronze, low brass and "88-10-2" or gun metal. In this nonferrous work, a 10% cobalt-copper alloy can be used to advantage.

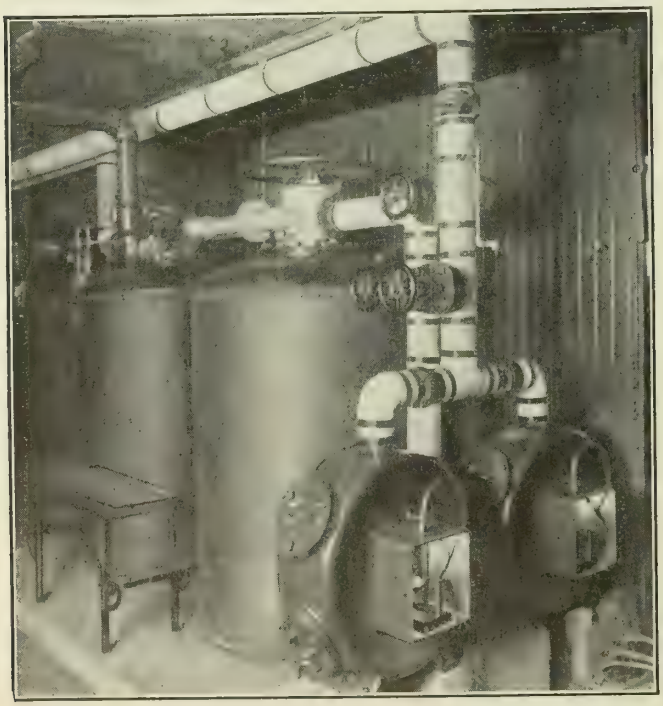


FIG. 4. STERILIZER INSTALLATIONS AT MARSHALL FIELD STORE, CHICAGO

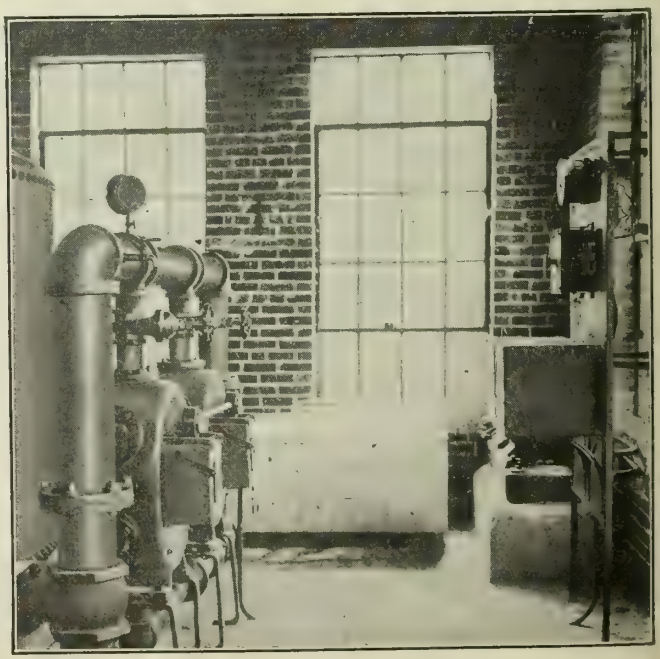


FIG. 6. INSTALLATION OF VALLEY PARK (MO.) WATER CO.

A 50-50 nickel-copper alloy is one of the new combinations. It is used in german-silver castings and where a small percentage of nickel is desired in bronzes of high physical strength. This alloy dissolves at a much lower temperature than pure nickel so that it is not necessary to raise the temperature of the treated metal above normal. Nickel is also thus introduced in a plastic lead or bearing alloy to prevent segregation of the lead. In all so-called red-metal alloys where nickel

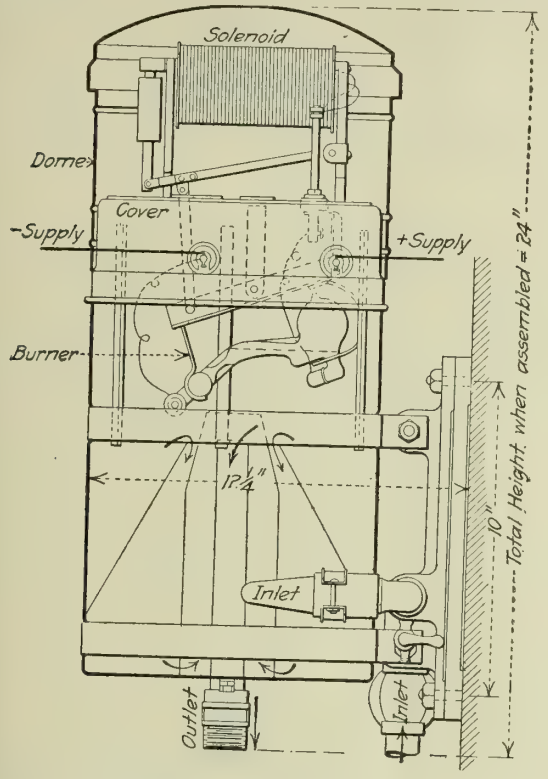


FIG. 7. ARRANGEMENT OF SMALL AUTOMATIC ULTRA-VIOLET STERILIZER

is introduced to promote fineness of grain and increase of tensile strength this combination is economical.

Carbon-Free Ferro-Alloys

Ferro-titanium, 25%, is used with both iron and steel; a small addition, generally about 1¼ lb. of the alloy per ton of metal treated, tends to cleanse the metal thoroughly, the titanium having an affinity for oxygen and nitrogen. With carbon-free alloy no carbides are formed and all the titanium is available to the steel or iron, resulting in an exceptionally dense and close-grained metal.

Ferro-chromium, 60%, has a very wide commercial use and many steel makers prefer it to the low-carbon electric-furnace product. The general addition of ferro-chromium would be about the same as for pure chromium.

Ferro-vanadium, either 25 or 40%, is used in practically all grades of tool steel, where it has been found that vanadium has a tendency to intensify the hardening and toughening effects of other alloys. Vanadium is also used in steel castings that are subjected to high static and dynamic loads. Probably in from 50 to 75% of the locomotive frames the metal is treated with about ¼% of vanadium. In locomotive cylinders it has been found that vanadium will close the grain of the iron and produce better castings. In steels for automobile parts, such as gears, axles, crankshafts, etc., this alloy is widely employed. The usual addition of vanadium is about 1%. For high-speed and crucible tool steels, for automobile steel and steel castings it is generally about ¼%. With cast iron the addition is usually about $\frac{1}{10}$%.

Ferro-boron, so far, has had only a very narrow commercial field, although lately considerable study has been given to the use of boron in various steels in the hope of ascertaining the field for this element.

Ferro-chrome-cobalt is used in chromium-cobalt steels and some melters prefer it to using cobalt and chromium metals separately. The addition of this alloy is the same as cobalt.

Carbon-Free Manganese Alloys

Manganese-titanium is generally used in high-class bronzes, where it has the advantage of the strong combination of manganese and titanium. It is a very stringent deoxidizer and will also increase the physical strength considerably. The addition of alloy is generally about ¼ to ¾%.

Manganese-boron is used for the same general work as the manganese-titanium alloy just mentioned, although boron is used considerably for high-conductivity copper castings. It is used under the same general conditions and in the same ratio approximately as manganese-titanium.

Chromium-manganese is advantageous for certain classes of work where otherwise chromium would have to be used separately. It dissolves at a considerably lower temperature.

Manganese-aluminum, 25 to 75%, is a new development. This is made from the 98% pure manganese and is technically free from iron and carbon, both of which are extremely detrimental in aluminum work. This alloy dissolves at a low temperature, and its usual effect on aluminum castings is to reduce shrinkage, close the grain and increase density. Considerable improvement in strength, without appreciable loss in ductility, can be obtained.

ANALYSES OF CARBON-FREE METALS AND ALLOYS (EXPRESSED IN PER CENTS)

	Pure Manganese	Cobalt-Copper	Pure Cobalt	Pure Chromium	Chromium-Manganese	Manganese-Boron Balance	Manganese-Titanium Balance	Ferro-Chrome Cobalt	Ferro-Boron	Ferro-Vanadium	Ferro-Chromium	Ferro-Titanium
Manganese	97–98	Trace			70	60.0–62.0	54.0–55.0					
Aluminum	0.25–0.50	0.10–0.25	0.25–0.50	0.25–0.50	0.10–0.25	1.0–1.5	5.0–6.0	0.25–0.50	1.00–1.50	0.25–0.75	0.50–	0.25–0.50
Silicon	0.50–0.75	Trace	0.25–0.50	0.10–0.25	0.25–0.50	0.5–1.0	3.0–4.0	0.50–0.75	0.25–0.50	0.25–0.75	0.50–0.75	1.0 or 6.0
Iron	0.50–1.00	Trace	1.00–2.00	0.25–0.50	0.25–0.50	0.5–1.0	1.0–1.5	20.0	Balance	Balance	Balance	0.50–0.75
Phosphorus	0.10–0.25	Trace	Trace	Trace	Trace				75.0–78.0	75.0 or 60.0	40.0	Balance
Sulphur	Trace	Trace	Trace	Trace	Trace					Trace	Trace	70 0
Cobalt		10.0	97.0							Trace	Trace	Trace
Copper		89.0						40.0				
Chromium				98.0–99.0	30.0						60.0–61.0	
Boron								40.0				
Titanium						35 0			20.0–25.0			25.0
Vanadium							35.0					
Arsenic			None							25.0 or 40 0		
Nickel		1.00										

City Planning in Queens Borough, New York—I

By Frank B. Tucker*

SYNOPSIS—A description of the methods employed in converting the largest and most rural of New York City's five boroughs into a real city; showing how a comprehensive city plan is being worked out so far as possible within legal limitations and complications.

The Borough of Queens, New York City, with an area of 117.4 sq.mi., is the largest of the city's five boroughs. It is part of Long Island and extends from the East River and Long Island Sound on the west and north to the Atlantic Ocean on the south.

Previous to its inclusion within the corporate limits of the City of New York (1898) the Borough of Queens, then a part of the County of Queens, comprehended Long Island City, the towns of Flushing, Jamaica and Newtown and part of Hempstead; eight incorporated villages—College Point, Flushing, Whitestone, Jamaica, Richmond Hill, Rockaway Beach, Arverne and Far Rockaway; and numerous unincorporated communities.

At the time of the consolidation, only one existing map, that of Long Island City, containing 4741 acres, was officially accepted; of the remaining 70,370 acres, there were no official surveys or maps. The work of making these surveys was begun under the old Board of Public Improvements of the city, in accordance with the general plan of making complete topographic surveys of all the boroughs.

Until 1903 the topographic survey work in Queens was almost wholly of a preliminary character. The triangulation on which the survey of the Borough of the Bronx is based was extended to Queens, and numerous triangulation and traverse stations were established there. A net of levels was also run, establishing benchmarks. The work of these years proved of inestimable value when the work was taken up in Queens as a problem separate and distinct from the other boroughs, following the abolishment of the Board of Public Improvements (1902), when topographical survey bureaus were established in all the boroughs.

Work of the Topographical Bureau

Following the establishment of the Queens Topographical Bureau, a comprehensive line of work was determined upon: (1) A topographic survey; (2) a tentative street system design based upon the topographic survey; (3) a detail property survey of existing streets and their demarkation upon the ground with monuments as well as the demarkation of new streets; (4) a final map laying down the lines of all streets, their widths and grades, and the linear and angular dimensions of all blocks as determined by the detail property survey and by computations.

The Bronx triangulation system has for its axes of coördinates, Tenth Ave., Borough of Manhattan, and 225th St., Borough of the Bronx. The Tenth Ave. axis is 28° 59′ 13.5″ east of true north; the 225th St. axis is, of course, normal to this. These axes were retained by the Topographical Bureau, and to them all its coördinates still refer. Eventually, however, they will be transformed to the triangulation system of Greater New York, established for the city in 1908 by an officer of the United States Coast and Geodetic Survey (see *Engineering News*, May 21, 1903, page 456).

Topographic Survey Methods

The nucleus of control for the topographic survey was the traverse and level net that the old Board of Public Improvements had spread over the borough. Most of the traversing was done with 50- and 100-ft. tape catenaries, provided with handles for adjustment to tension and temperature. At frequent intervals the tapes in service were compared with one standardized at Washington. All measurements were made twice and required to check within 0.02 ft. in 1000 ft. Angles were turned 24 times (angle 12, explement 12, each 6 times with the telescope erect and 6 times with the telescope inverted). The closures were within $\frac{4}{1}\frac{0}{2}$ sec.

Levels were run with common wye levels and ordinary target rods, reading to 0.001 ft., with foresights and backsights equalized, 225 ft. being taken as the criterion for a proper sight. Two rods were used and each was read separately on every turning point and benchmark. The operation was then repeated with a new setup of the level in approximately the same position. The mean of all the readings was taken as final, and in a given run the allowable error was 0.02 $\sqrt{\text{distance in miles}}$.

Nearly all topography was taken with planetables. This work is now complete, but at its height seven planetable parties were in the field, composed of six men each. All planetable work is to a scale of 1 in. = 80 ft.; each sheet covering a strip of country 2,000 ft. wide, and of variable lengths, depending on conditions. On each sheet were first drawn the range and traverse lines in blue and green respectively; the range lines were 500 ft. apart.

In the fieldwork there were few departures from conventional methods. The purpose of this survey was to gather data necessary for the design of a street system, so accuracy and speed were the prime requisites. Accuracy in the determination of existing street lines was of paramount importance; next, buildings and contours. The latter were of 5-ft. intervals, and were run out in the field. To do this a level was used in conjunction with the planetable and two or sometimes three rodmen were employed.

As soon as a planetable sheet was completed, it was turned into the office, where it was transferred *in toto* to mounted sheets, 31x53 in., representing an area of 2,000x4,000 ft., or 183.6 acres. For many purposes a scale of 80 ft. to the inch is too great, so these sheets were pantographed down to a scale of 1 in. = 200 ft., on mounted sheets of the same size as for the other scale.

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These sheets then included an area of 5000x10,000 ft., or 1148 acres.

Tracings are made of these 200-ft. topographic sheets and prints taken; these are matched and pasted together until they comprehend a large area. This assembled print serves as a study plat, wherewith to work out the design of a street and grade system.

Design of the Borough Street System

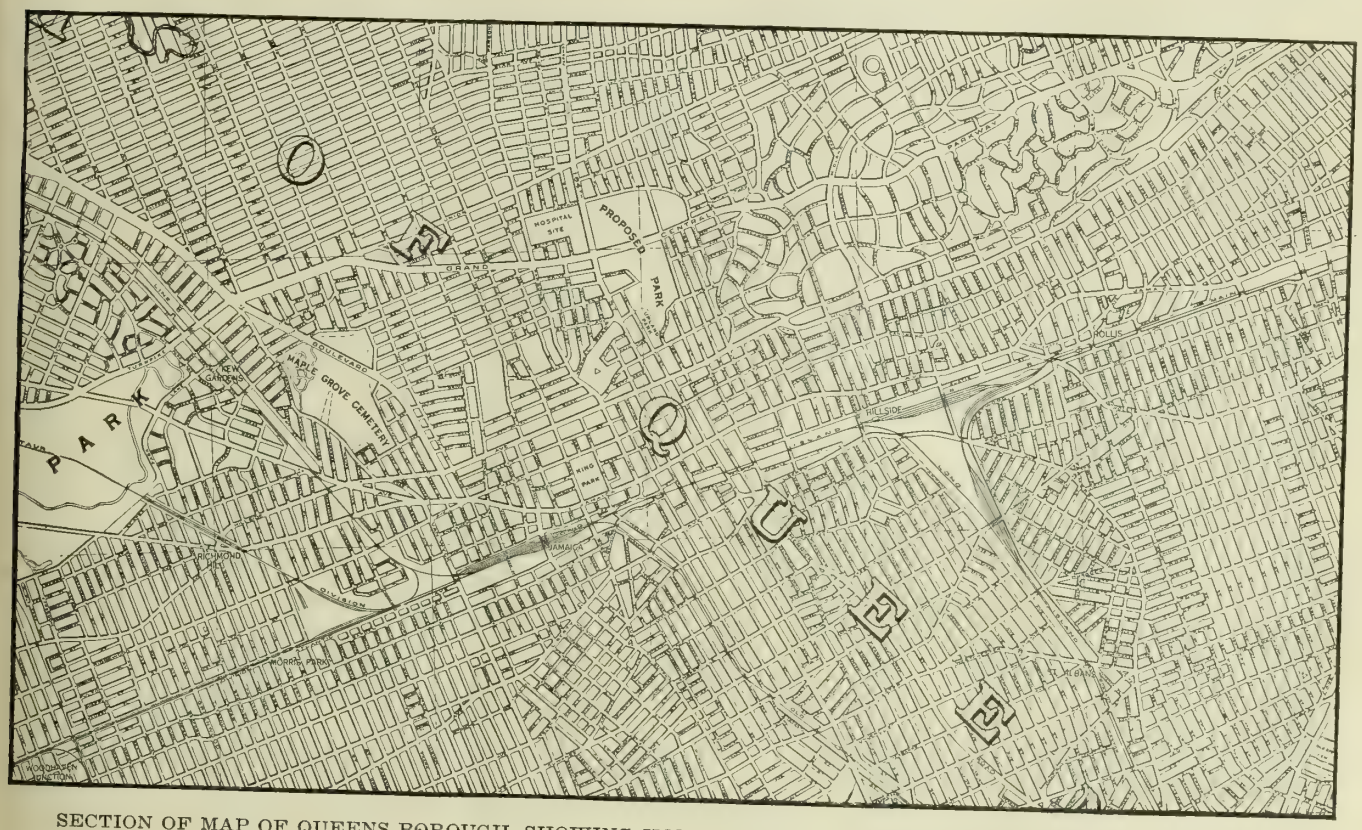
In designing the street system of Queens, the engineers of the Topographical Bureau have recognized from the first that a great influx of population would follow adequate transit connections with Manhattan and Brooklyn, and have attempted to design a street system that would weld together the multitudinous existing streets into a comprehensive and harmonious whole, in anticipation of such development. Queens has offered little leeway to apply idealistic principles of city planning.

On the assembled prints of the reduced planetable sheets careful study of the undeveloped areas is made to determine their proper street treatment, and of the developed areas to determine the streets that shall be widened and those that shall be discontinued.

For the undeveloped areas blocks 200x600 ft. are freely used, with the long dimension parallel to the trend of probable greatest traffic. This size of block gives 48 lots, 25x100 ft., or 60 lots, 20x100 ft., the lot dimensions common in New York. When conditions require blocks of other dimensions or of irregular shape, the aim is to obtain the greatest possible number of lots 100 ft. deep, for this depth of lot seems peculiarly adapted to New York's needs—a greater depth not appreciably increasing values, but a lesser depth materially decreasing them.

New York seems to have adapted itself to streets 60 ft. wide and avenues 100 ft. wide. These were the widths used when the street plan of old New York City was laid out in the first decade of the Nineteenth Century, and to these widths, especially the former, both public and private streets have been opened, although in a number of instances parsimonious real estate promoters used a lesser width.

In designing the street system for the Borough of Queens, 60 ft. and 100 ft. have been the widths commonly used, although intermediates have been freely admitted. Two marked exceptions, involving the use of greater widths, deserve special attention: Queen's Boulevard, extending from the Queensboro Bridge to Jamaica, a distance of nearly six miles, is to be the widest street in the Borough—200 ft. The city has already acquired title to the right-of-way; its physical treatment, however, due to its exceptional width, is as yet only partially determined. If present plans mature, Grand Central Parkway, 150 ft. wide, will extend from Queen's Boulevard near its Jamaica terminus, eastward (atop the "backbone" of Long Island, affording in places a view of both Long Island Sound and the Atlantic Ocean) to the boundary of the City of New York, a distance of about 7½ miles.



SECTION OF MAP OF QUEENS BOROUGH, SHOWING HOW EXISTING AND NEW STREETS ARE HARMONIZED

Adjusting Street Grades to Topography

The fixing of street grades has not been difficult from a topographic viewpoint. The topography of Queens is not rugged, and in only a few sections is it necessary to observe contours in locating streets. With new streets, drainage and a minimum of earthwork are the governing considerations.

With existing streets, difficulties are frequent, because of the economic necessity of recognizing improvements already installed. It is, of course, impossible always to hold present grades, but in most cases a careful study will reveal means whereby it may be done or at least close-

ly approximated. Crowns within the block will often accomplish the desired purpose.

In fixing grades those at curb and house lines should be officially established as well as those at center line; otherwise discrepancies will occur at these points by reason of surveyors using different methods of interpreting the center-line grades.

At the time of designing the street system, areas whose natural topography suggest their adaptability to park purposes are set aside. But the city's present policy of assessing the cost of its park purchases upon the limited area especially benefited is not propitious to the early acquisition of these lands for parks. There is nothing to prevent the owners of these areas proposed as parks by the Topographical Bureau from subdividing them into building lots or otherwise disposing of them; thereby augmenting their cost and the difficulty of their purchase when congestion of population will have made their acquisition still more desirable.

Widening the Existing Streets

The design of a practicable street system requires the widening of many existing streets and the discontinuance of others. The experience of the Topographical Bureau with such streets has not been very satisfactory. On the first designs prepared, the number of widened and discontinued streets shown was plentiful, but the accomplishment of these improvements was defeated in most cases by the property owners or by legal difficulties. The result was that for several sections the street design had to be entirely recast to incorporate some old road, or to hold existing streets to their present width.

The cost of widening a street in New York City is now a matter of local assessment; consequently property owners are bitterly opposed to all street widenings, although tacitly admitting the wisdom of such procedure. They view wide streets as a benefit to the whole community and clamor to have a large portion of the cost placed upon the city at large (a practice that obtained in past instances) or the scheme abandoned, a prerogative that a majority of those affected can exercise.

An arbitrary rule of the City Board of Estimate and Apportionment is that streets of a length greater than 1500 ft. shall be at least 60 ft. wide. This rule cannot be rigorously applied. Many streets of a lesser width, usually 50 ft., are of purely local importance and can never become important traffic streets. The widening of such streets is always protested by property owners.

In other cases, streets of lesser width have been extensively improved with buildings, and damage claims, were the streets widened, would be prohibitive; and as there is no law in New York making it obligatory for new buildings to observe widened lines, these streets must be continued at their present width.

The determination of what streets shall be widened, and whether the widening shall be on both sides or only one, are matters that require a thorough investigation in each instance. Where no buildings are affected it is usually best to divide the widening equally between both sides, otherwise the lots on the widened side may be so materially shortened as to seriously impair their value. Where buildings have to be moved or removed economy will generally require that the widening be all on one side, except in the widening and straightening of old roads, where, by shifting from side to side, it is often possible to avoid buildings.

Discontinuing Existing Streets

The discontinuance of an existing street is difficult. The statute law relating to the discontinuance of streets in New York City is most comprehensive in phraseology, but is applicable to only a few streets. In brief it vests in the proper local authorities full power to discontinue all streets necessary effectually to secure and preserve regularity and uniformity in a general and permanent street system. It states that upon the filing of an official map establishing a permanent street system for a section the streets shown thereon are the only lawful streets, and that the fee owner of a street not shown thereon may inclose, use and occupy the area as fully as if it had never been a street, if not then in use, or if in use, upon the day a permanent street is physically opened to take its place.

Seen from an engineer's viewpoint the leeway allowed by this law for the discontinuance of a street at variance with a proper street plan is all that could be desired; but from a legal viewpoint it is beset with many difficulties. Its weakness lies in its failure to provide a practicable disposition of the street upon its discontinuance. And what is true of this law is true probably of any law that can be evolved for the case.

Who Is the Fee Owner of a Street?

It is all very well to say that the fee owner may inclose, use and occupy the area as if it had never been a street; but who is the fee owner?

The reversion of a street upon its discontinuance to the fee owner thereof as provided by this law is possible and equitable only when the fee-ownership of the abutting property upon both sides is in the same person, or in persons in full sympathy and accord with one another, which is seldom the case.

To determine the fee ownership of a street is often impossible because the fee is lost either in the incompleteness or in the total absence of an official chronicle of its succession from the patents of Holland and England. To the streets that date from the Dutch occupation of New Amsterdam (New York) the fee title is acknowledged to be in the city. But to the streets that date to the sovereignty of England, the city claims only an easement title. In the case of streets that date from American Independence no generality is possible, fee or easement titles being acquired according to the idiosyncracy of each community or to individual whim if privately opened and tendered to the authorities.

Establishing Identity of Streets

To discontinue any street other than one whose fee is in the abutting owner is quite impossible—in the case of the old Dutch streets, because of the absence of all data conclusively establishing their identity and defining them by bearings, distances and widths; with the English streets there is the same absence of dimensions. Their identity, however, is possible as there is extant an excellent map of New York and Staten Island and a portion of Long Island, made in 1781 by General Sir Henry Clinton, Commander-in-Chief of His Majesty's Forces, then occupying New York. By eliminating from this map the few streets of possible Dutch origin, we have left those opened during the English colonial days.

From the close of the Revolution to about the end of the first half of the Nineteenth Century, street records are very meager and unsatisfactory. With the exception of the regularly incorporated turnpikes, proof of streets originating during this period is arrived at more by a process of elimination than by recorded evidence, land being of too small value to warrant any elaborate street opening procedure.

Beginning with about the latter half of the Nineteenth Century, land values began to rise rapidly, and where streets were opened by the authorities, the statutory legal requirements were observed. Consequently surveys and descriptions of a more or less satisfactory nature are matters of record for these streets, where the records have not been lost. Besides the streets regularly opened by the authorities, most of those privately opened by real-estate promoters, through the subdivision of acreage into building lots, also date from this period. The filed plots of these subdivisions in the county clerk's office are very complete, and the dimensions they give are dependable.

The discontinuance of any of these streets would of course work hardship to the abutting owners, though in the case of streets originally private there is no implied obligation on the part of the authorities as to their permanency; but there is on the part of the persons who privately opened them. While the city may officially discontinue a street, its fee owner cannot take physical possession of it, because he has parted with an easement in it to every person to whom he has sold property fronting upon it.

Some Guiding Principles

It must always be borne in mind that the cost of any change in the grade, width or alignment of an existing street will be a tax upon the community, usually levied directly upon property owners in the immediate vicinity; perhaps very poor people struggling to own a home and already heavily burdened with mortgages and general taxes. Unless of obvious necessity or palpable advantage the width and grades of existing streets should be held, for against the opposition of affected property owners the accomplishment of changes is impossible.

The exception to this statement is the old arterial highways. Their continuance as urban streets at their existing widths and grades is quite out of the question, and their discontinuance is precluded by the almost certain confusion of their fee title; so they must be developed and utilized to the best advantage. This will usually be found to be their continuance as arterial thoroughfares, for as originally laid out, they probably represent the line of least resistance between the several communities which they serve.

The experience of the Topographical Bureau has shown that the best mode of treating these old highways is to widen them, improving their alignment and grades, and use them as axes from which to extend rectangular street systems. In their widening, however, care must be taken to include the lines of the old highway entirely within those of the new, for otherwise there will be left a strip of the old street between the new and the abutting private property, the fee title to which may be impossible of adjudication.

A second article will describe the engineering work done in establishing the predetermined city plan, of which the accompanying illustration is typical.

Costs of 12- and 16-Ft. Lengths of Cast-Iron Pipe Laid

By F. C. Roberts*

When the manufacture of 16-ft. lengths of cast-iron pipe was undertaken by the American Cast Iron Pipe Co., of Birmingham, Ala., a year or more ago, it was apparently regarded by other manufacturers of this commodity as a more or less hazardous business innovation, and by users of cast-iron pipe as somewhat of an experiment. Both classes seem to have been unaware of the fact that the manufacture of 16-ft. lengths of cast-iron pipe has long since been successfully practiced on the Continent of Europe.

In the hope of stimulating argument on a subject that is of importance to users of cast-iron pipe, I subjoin the following cost figures, of laying both 12- and 16-ft. lengths of pipe. The figures given are complete as to all details of the work, except overhead charges (interest, depreciation of tools, superintendence, etc.). It should be remembered that all costs fluctate with the wages and efficiency of skilled and unskilled labor, the character of the work demanded, and other local conditions.

The wage scale was $4 for skilled labor, $3 for unskilled, and $5.50 for teams, all working 8 hr. per day. Lead cost $0.0445 and hemp cost $0.05 per lb. The trenches were 20 in. wide and had depths of 28 in. for the 4-in., and 30 in. for the 6-in. pipe, and bell holes at intervals of 12 and 16 ft., according to which length of pipe was being used. The soil was a sandy loam. Shoring was not required, and there was no macadam or pavement. The backfilling was done with a scraper and the water tamping and crowning by hand labor.

Table 1 gives general comparative data for the pipe alone, and Table 2 gives field costs for the pipe in place. The figures are for unbroken runs of pipe; that is, specials, hydrants and valves have been omitted, since these vary with almost every job.

TABLE 1. GENERAL DATA FOR 4- AND 6-IN. CAST-IRON PIPE IN 12- AND 16-FT. LENGTHS

Diam., In.	Length, Ft.	Approx. Weight per Length, Lb.	Total Lengths, Ft.	Total Weight, Tons	Cost of Pipe, F.o.b. At Shop	F.o.b. At Destination
4	12	260	40,000	434.0	$20.40	$33.40
4	16	340	40,000	425.0	21.40	34.40
6	12	400	4,000	66.6	18.40	31.40
6	16	520	4,000	65.0	19.40	32.40

TABLE 2. FIELD COSTS PER FOOT OF LAID PIPE

	4 in.x 12 ft.	4 in.x16 ft.	6 in.x 12 ft.	6 in.x 16 ft.
F.o.b. destination..	$0.3623	$0.3655	$0.5228	$0.5265
Distribution	.0054	.0053	.0083	.0081
Trenching	.0576	.0576	.0600	.0600
Laying and cutting	.0120	.0112	.0184	.0171
Yarn and lead....	.0316	.0237	.0431	.0324
Fuel	.0033	.0024	.0046	.0035
Yarning and leading	.0045	.0037	.0067	.0050
Bell holes.....	.0166	.0125	.0208	.0156
Calking*	.0062	.0046	.0091	.0070
Testing†	.0051	.0048	.0059	.0054
Backfilling‡	.0216	.0215	.0225	.0223
Totals	$0.5262	$0.5128	$0.7222	$0.7029

*All calking was done by hand. †Testing includes touching up or repouring defective joints. ‡Backfilling includes tamping.

COMPARATIVE SUMMARY OF COSTS

Diam., In.	Total Length, Ft.	Pipe Length, Ft.	Cost per Ft.	Total Cost
4	40,000	12	$0.5261	$21,048
4	40,000	16	.5128	20,512
Difference			$0.0133	$536
6	4,000	12	$0.7222	$2,888
6	4,000	16	.7029	2,811
Difference			$0.0193	$77

*Consulting Engineer, Marsh-Strong Bldg., Los Angeles, Calif.

Kansas City Maintains Open Asphalt Specifications

By Clark R. Mandigo*

SYNOPSIS—With the experience gained in building and maintaining 4,000,000 sq.yd. of asphalt pavement, the engineers of Kansas City, Mo., have developed specifications and tests for asphaltic cement which are simple and easily understood, and which are truly open specifications, in that they pass all asphaltic cements which service shows makes satisfactory pavements.

Within the past ten years a large number of asphaltic cements, including various natural bitumens, the blown oils and manufactured asphalts have been placed on the market. Municipal engineers have been confronted with the problem of selecting the good and discarding the bad. When the almost infinite variety of mixtures, fluxes and degrees of refinement are considered, the difficulty of making a proper selection is apparent.

Within recent years considerable progress has been made toward standardizing asphalt tests, but although the majority of cities use a so-called "open" specification, there is little agreement except on a few of the older tests. This condition is caused largely by those who sell asphalt. Unlike cement and brick manufacturers, who have been untiring in their efforts to standardize tests for their materials, the asphalt interests have been constantly fighting for advantage over one another.

The asphalt companies are responsible for the ten-year maintenance guarantee; they have argued that so long as they were to keep the pavement in repair for ten years the quality of the materials to be used should be left to them. Where intelligent supervision and care were exercised by the contractor, the early asphalt pavements, as a rule, were satisfactory, for they were all built on the results of experience with one kind of asphalt. When it became necessary or desirable to use other kinds of asphalt, it was found the former criteria did not always hold.

Kansas City Experience

Kansas City, Mo., has maintained open specifications on asphaltic cement for the past ten years. The original specifications as written by Dr. Walter M. Cross, city chemist, are quoted in full in the appendix of the 1908 edition of Richardson's "The Modern Asphalt Pavement." It will be noted that no requirements are imposed on the contractor as to the kind of "raw" asphalt or flux used, but that certain tests are prescribed for the asphaltic cement used in the paving mixture, and that any asphalt passing these tests may be used, provided it shall have been successfully used in the paving industry under similar conditions for four years prior to the letting of the contract.

This idea of dealing only with the finished product and fixing requirements for the asphaltic cement as it enters the wearing surface mixture has since been successfully maintained in the Kansas City specifications. With the addition of the ductility and viscosity tests, about 8 and 6 yr. ago respectively, the requirement as to prior use of the material was dropped and asphaltic cement is now accepted for paving purposes on the basis of a series of laboratory tests only.

Kansas City Specifications

The present specifications read as follows:

Asphaltic Cement—The asphaltic cement used in the wearing surface, when considered apart from the mineral matter which it may contain, shall have the following characteristics:

It shall be free from water or decomposition products.

The various hydrocarbons composing it shall be present in homogeneous solution, none of oily or granular character being present.

It must be of such consistency that at a temperature of 25 deg. C. a No. 2 needle, weighted with 100 grams, will not in 5 sec. penetrate more than 9 nor less than 4½ mm. The exact penetration shall not vary more than 0.4 mm. from that fixed by the city engineer within the limits specified. The No. 2 needle referred to is a common sewing needle about 1 mm. in diameter and tapering uniformly to a sharp point for 1 cm. of its length.

Twenty grams of it shall not lose more than 3 per cent. in weight upon being maintained at a uniform temperature of 165 deg. C. for 5 hr. in a cylindrical vessel 3 in. in diameter and 1 in. high.

Twenty grams of it shall not lose more than 6 per cent. in weight upon being maintained at a uniform temperature of 205 deg. C. for 5 hr. in a cylindrical vessel 3 in. in diameter and 1 in. high.

It shall be soluble in chemically pure carbon bisulphide (CS_2) at air temperature to the extent of at least 95 per cent.

It shall not contain more than 4½ per cent. of carbonaceous matter insoluble in chemically pure carbon bisulphide, at air temperature.

It shall be soluble in 85 deg. Bé. petroleum naphtha, air temperature, to the extent of not less than 65 per cent. and not more than 72½ per cent.

Its solubility in carbon tetrachloride shall not be more than 1½ per cent. less than its solubility in carbon bisulphide—both tests being made at air temperature.

It shall show of fixed carbon not more than 15 per cent.

It shall show a flashing point (New York State closed oil tester) of more than 175 deg. C.

Its viscosity at a temperature of 0 deg. C. shall not be less than 0.15 grams. Viscosity of asphaltic cement by the terms of this contract shall mean the number of grams of asphaltic cement that will, in 4 hr., be forced through a circular orifice 1.0 cm. in diameter by a pressure equal to that exerted by a column of mercury 150 cm. high. The asphaltic cement during this test shall be contained in an iron cylinder 42 mm. in diameter and 100 mm. high, and the thickness of the plate through which the orifice is made shall not be more than 2.0 mm.

Its ductility at a temperature of 25 deg. C. shall be not less than 15 cm. [The minimum until recently was 10 cm.] Ductility, by the terms of this contract, shall be understood to mean the distance in centimeters that a cylinder of the asphaltic cement, 1 cm. in diameter, can be drawn out at the rate of 1 cm. per min. The drawing out shall be accomplished by means of two similar cups cylindrical in form, of inside diameter of about 3 cm., open at one end and having a concentric orifice 1 cm. in diameter through a circular plate not more than 0.5 mm. thick, which covers the other end. To make a determination, one of the cups is placed on a smooth surface with the open end down. The other cup is then placed on top of the first, with the open end up, so that the 1-cm. orifices coincide. The hot asphaltic cement is poured into the top cup slowly, so as to fill both cups completely. The temperature of the asphaltic cement is then cooled to the temperature of 25 deg. C., and the cups are pulled apart at the rate of 1 c.m. per min.

The asphaltic cement used under this contract must not be changed as to the brand, kinds, proportions and qualities of the ingredients during the progress of the work.

*Assistant City Engineer, Kansas City, Mo.

All of the tests except the ductility and viscosity tests are familiar to paving engineers and chemists, are performed in accordance with the best practice of standard laboratories and require no further explanation.

Methods and Apparatus Described

The apparatus for making the ductility test is of an inexpensive design developed by Dr. Cross and has some rather striking features. Two brass cylindrical cups about 3 cm. in diameter and 6 cm. deep have a hole 1 cm. in diameter bored through the center of the bottom of each and reamed out at a wide angle from the inside so that the thickness of the plate bottom at the edge of the hole is ½ mm.

In making the test the open end of one cup is fitted over a short rubber cylinder which is embedded in a lead weight, the other cup is placed on top of the first so that the orifices exactly coincide and the two cups are filled by pouring the melted asphalt into the upper cup. After the asphalt has cooled, the cups are placed in water kept at a temperature of 25 deg. C. until the asphalt has adjusted itself to this temperature. The cups are then placed in the bottom of a glass jar filled with water at a temperature of 25 deg. C., the lead weight being used as a base.

Above the jar, on a rack, is set a metronome, such as musicians use, but from which the bottom has been removed, and which has been so adjusted that it will wind a wire on the wheel next to the spring drum at the rate of 1 cm. a min. A fine, flexible wire is attached to the upper cup, and the metronome is placed over the glass cylinder so that the pull will be vertical as tested by a plumb-bob. The metronome is started and the cups are pulled apart at the rate of 1 cm. per min. As soon as the fine thread of asphalt is seen to break and wave in the water, the metronome is stopped and the distance between faces of clips is measured.

A metronome with a strong spring should be selected, and even then it is sometimes necessary to help it along at first to get the cups started apart. The cups are carefully machined and polished so as to set tight against each other. The jar used is a heavy glass cylinder about 3 in. (4½ in. would be better) in diameter and 36 in. long placed in a round can. The bottom is sealed by pouring asphalt in the space between the can and the glass.

Advantages of the Ductility Test

The commendable thing about this test is the uniformity of results. It measures the elongation of a cylinder of asphalt 1 cm. in diameter and 1 mm. long and eliminates, as far as possible, all variable factors which might affect the results. Duplicate tests made on the same asphalt or by different observers check very closely. Although pulled at a slower rate, the elongation obtained by the Cross method is only about one-half to one-third of that obtained by the briquette method, but there is no fixed ratio between the two. The minimum limit set by the specifications is therefore more severe than that usually required. The ductility test is of course the determination of the adhesiveness of the asphaltic cement, and this is now recognized as important.

The viscosity test as first used was performed at a temperature of 25 deg. C., but on account of the difficulty in maintaining this temperature for a long period, and because it did not give all the information desired, the

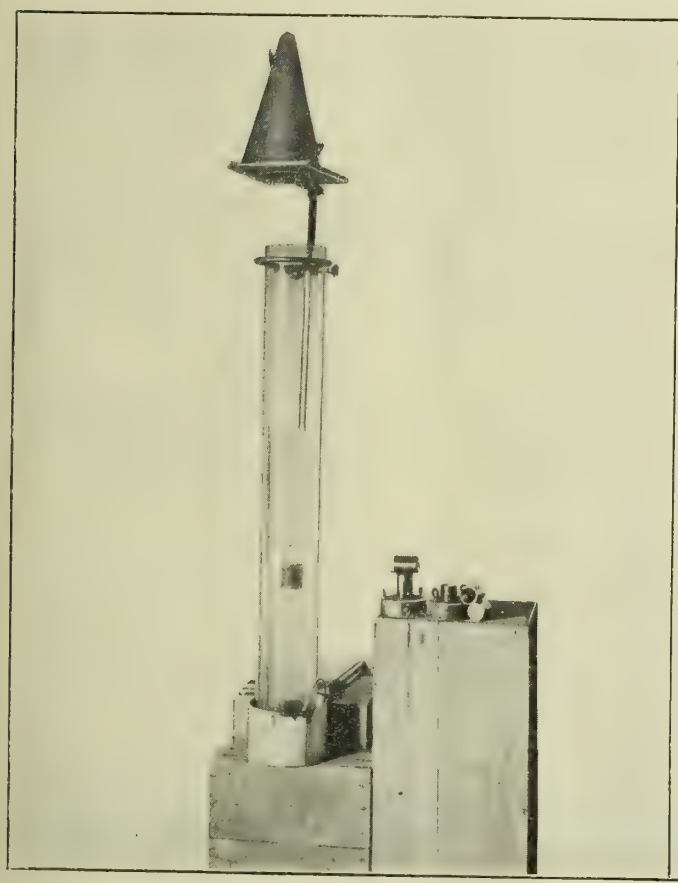


FIG. 1. APPARATUS FOR ASPHALT-DUCTILITY TEST

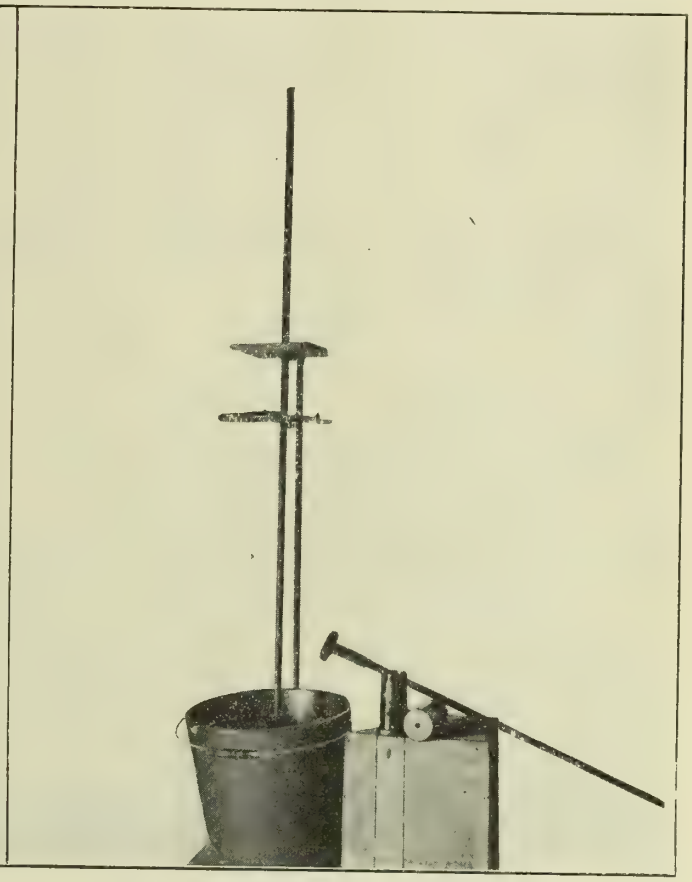


FIG. 2. APPARATUS FOR VISCOSITY TEST

0 deg. C. test was substituted. Zero temperature is easily maintained in the laboratory with melting ice.

Apparatus for the Viscosity Tests

The apparatus for this test is very simple and inexpensive. An iron cylinder of the size specified, threaded at both ends, has two threaded caps, one of which is 2 mm. in thickness with a 1 cm. hole drilled in the center; the other has a welded shank threaded for a ⅜-in. gas pipe about 145 cm. long. A glass tube is cemented into the top of the gas pipe and marked at a point 150 cm. above the bottom of the cap. In making the test the lower cap is screwed on, placed on a smooth surface and the cylinder filled full with asphalt; after this has cooled the upper cap is screwed on, the pipe is attached, and the whole is suspended in a pail of crushed ice by clamps on the iron pipe. The pipe and glass tube are then filled with mercury to the 150-cm. mark, and after about one-half hour such asphaltic cement as has been forced through the orifice is shaved off and the beginning time noted. At the end of four hours the cylinder is removed and the asphalt again shaved off, and the shavings weighed.

This viscosity test is a unique requirement for asphaltic cement and was invented by Dr. Cross to prevent cracked pavements. It has been found that asphaltic cement should have some flow even at low temperatures, so that it would adjust itself to contraction in order to avoid cracking of the asphaltic surface in winter. Since the adoption of the test no cracking has occurred where the asphaltic cement of the specified mixture showed the required zero viscosity. Most of the payments laid before the viscosity test was required did not crack, but many of them did without apparent cause.

The viscosity test makes possible the selection of an asphaltic cement which will not be in any way responsible for cracked asphaltic surfaces. It is in effect the means of testing the ductility or flow of asphaltic cement at low temperatures. A pavement built with an asphaltic cement which has some ductility at low temperatures will take up contraction by a stretching of the asphaltic film around each sand grain and will not become a brittle mass. The method of determining the viscosity, being a simple orifice test, is a true measure of the flow.

Efficiency of Ductility and Viscosity Tests

Most of the standard brands of asphaltic cement can be made to pass all requirements, except those for ductility and viscosity, with proper care in their preparation and with the use of a proper flux, although for protection against inferior grades the solubility and volatility requirements are more complete than customary. The majority of failures of asphalt submitted have been on the ductility test. The ductility test is usually made first on account of the shorter time consumed.

Of the asphalts submitted which pass all other requirements, including ductility, a number fail in the viscosity test. Some of the manufactured asphalts have been brought up to the requirements of both tests by the addition of varying percentages of natural bitumens having the properties they lack to a high degree. The fact of the matter is that no properly prepared high-grade asphaltic cement, whether natural or manufactured, which has proved itself suitable by long time usage in pavements has failed to pass the requirements. In other words, the specifications have admitted all cements which experience and good judgment show make good pavements.

The specifications have, however, passed some asphaltic cements which have been viewed with suspicion on account of their newness or origin; and while these are probably not so good as the best, they have been very satisfactory, and no failures because of the asphaltic cement have occurred in pavements laid. The specifications as outlined are made to fit the requirements of the Kansas City climate and are used for sheet asphalt and fine-graded asphaltic concrete. Where asphalt is desired for bituminous macadam, surface dressing or filler for blocks, these requirements are varied to suit conditions.

Kansas City has more than 4,000,000 sq.yd. of asphalt pavement in use on streets, exclusive of car tracks, some of which is 26 yr. old. This pavement is in all conditions, from good to bad, and has been laid under all sorts of traffic, in all sorts of manners and with a great variety of materials. Experience with these pavements forms a fair basis for present and future guidance. It has been the constant endeavor to improve the finished pavement to meet the increased severity of use, and the asphaltic cement requirements, together with mixtures and method of laying, have been modified from time to time with the idea of getting the best material and workmanship.

The testing methods outlined in the foregoing notes have proved very satisfactory over a long period of time and will undoubtedly be retained. They are presented for the consideration and discussion of those who are interested in obtaining some uniformity and certainty in testing asphaltic cement.

Municipal Research Work*

The question of research work in connection with the activities of a city is one which must be considered very carefully. Taking the country as a whole, the cities have undertaken, relatively speaking, no research work up to date. In view of the tremendous opportunity for such work and in face of the fact that at our universities and research institutions great fortunes are being spent, the isolated pieces of work carried on in our municipalities are almost negligible. My own feeling is that a part of the work now done by our cities could more properly be done elsewhere. At the present time our colleges and research institutions are the places for so-called "pure science." The net result of work of this kind carried on under existing municipal conditions is apt to be too small to warrant its being undertaken. The atmosphere in which the work of the average municipal laboratory is carried on is not especially encouraging to those types of work where results may be delayed or very definite results perhaps not even assured. On the other hand, there are varieties of work which can best be done by the cities in connection with construction.

Some day there will perhaps be instituted a generously endowed foundation for municipal research through which it may be possible to coördinate efforts of this kind in a number of different places. When this step is taken a new day will have dawned for American municipalities. Graft, inefficiency and political interference will disappear in proportion as we are able to establish definite scientific and engineering standards covering different municipal activities.

*From 1914 report of M. L. Cooke, Director of Public Works, Philadelphia.

Placing Masonry for the Elephant Butte Dam, New Mexico*

By E. H. Baldwin†

SYNOPSIS—Details of masonry work on a very large concrete dam. Masonry is rubble concrete, with smooth concrete face. Quarrying methods and grouting of cutoff wall described. (Mixing and placing of concrete and records of placing masonry will be described in a subsequent article.)

The Elephant Butte Dam is being constructed by the United States Reclamation Service across the Rio Grande at a point about 12 mi. west of Engle, N. M. It is of cyclopean concrete, will be 1200 ft. long, over 300 ft. high, and will contain in excess of 600,000 cu.yd. of masonry. It will impound 2,626,700 acre-feet of water and form a lake 40 mi. long with surface area of 40,080 acres.

The excavation for the dam was sufficiently advanced on June 3, 1913, to permit of commencing masonry work on that date, but as there was still a large amount of excavation to be done, only one cable was used on the masonry for some time.

The character of the foundation was such that it was deemed advisable to cover it with masonry as soon after exposure as possible; this was due to the stratification of the bedrock, which presented a sound and otherwise excellent appearance when first uncovered, but the great extremes of temperature in this climate would gradually open up seams that were at first imperceptible. For this reason it was considered expedient to carry on masonry operations coincident with the excavation. Whenever an area was prepared sufficiently large to make such work economical it was quickly covered with masonry. Other reasons for carrying on masonry work before the entire bottom was prepared were as follows:

A large amount of the material being excavated was sand and gravel taken from outside the neat lines of the dam. This was drawn to the outer cables by drag scrapers, picked up by grab buckets on these cables, transported to the upper railroad and carried to a storage pile for future use as concrete aggregate. This method of work rendered the middle cable useless for excavation purposes, but it was used to advantage in transporting concrete and plums to the dam and enabled a large amount of sand and gravel to be used direct from the excavation.

Using Construction Cableways for Masonry

After July 1 two shifts worked continuously on masonry, but with only one cable, until December, when one shift was transferred to excavation. In February, 1914, two shifts, but with only one cable, were used on this work, and on Mar. 1 masonry work became the main issue, with two shifts using two, and sometimes three, cables.

As will be seen in Fig. 2, a cutoff trench is excavated at the heel of the dam. This varies somewhat in section, according to the material encountered, but averages about 10 ft. wide in the bottom and 15 ft. deep below the remainder of the foundation. The bottom of this trench is in excellent sandstone, but to make sure of its solidity a number of test-holes were put down with churn drills to a depth of 25 ft. below the bottom of the trench.

*Previous articles on the Elephant Butte Dam in "Engineering News" are as follows: "Excavation for Foundation," Jan. 14, 1915; "Concrete-Mixing Plant," Aug. 6, 1914; "Construction Camp," Dec. 31, 1914.

†Assistant Chief of Construction, United States Reclamation Service, Denver, Colo.

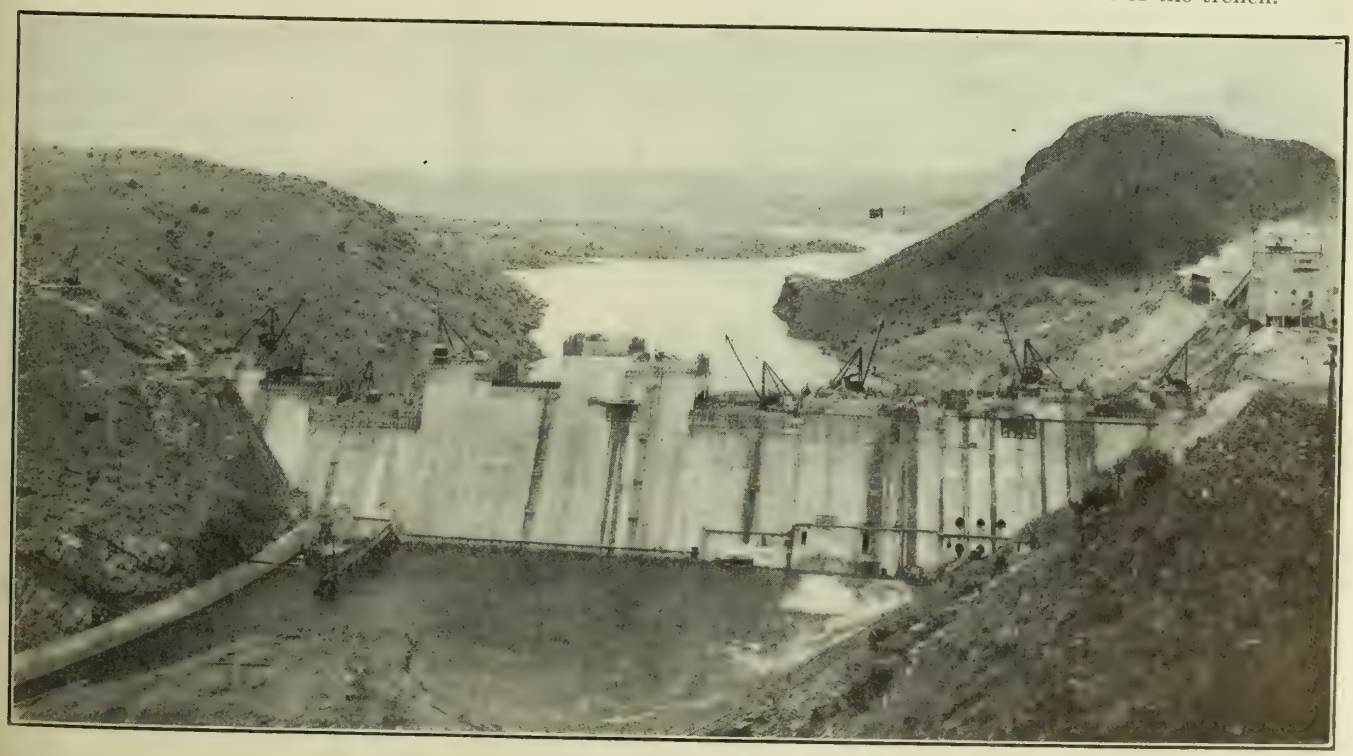
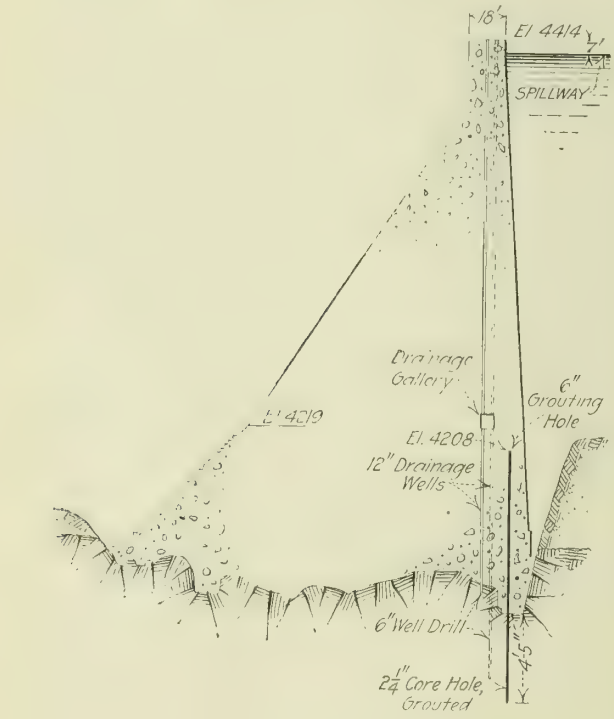


FIG. 1. ELEPHANT BUTTE DAM UNDER CONSTRUCTION

Every precaution possible was taken to prevent leakage beneath the dam or percolation through it; but in case such leakage or percolation did take place, means have been provided to lead the resulting water harmlessly away. The specifications called for a row of holes in the center of cutoff trench 10 ft. apart, parallel with the axis of the dam, to be drilled to a depth of 50 ft. below the bottom of the trench, and grouted under high pressure, to seal all accessible seams and prevent percolation under the dam. About 10 ft. downstream from the line of grouting holes a row of drainage wells, 12 in. in diameter and 8 ft. apart throughout the entire length of the axis of the dam, was provided for in the masonry to extend upward to the inspection tunnel located slightly above river bed, to discharge any water which rises to that elevation into a drainage conduit leading to the downstream face of the dam. The wells were to be drilled to a diameter of 6 in. and a depth of 45 ft. below the base of the dam. A distance of 5 ft. downstream from this line of drainage wells a similar row was provided, not extending into bedrock, but extending from the base of the dam to the inspection tunnel. These wells were staggered with reference to the wells in the upper row.

The cutoff trench was filled with 1:6 concrete, but before filling, seats were cut in the bedrock for 6-in. iron pipes, which were set up and concreted in on the location for the grouting holes. The drainage wells were carried up in similar manner, but were cast with collapsible iron forms 12 in. in diameter. When the concrete around them had set sufficiently to allow of their removal, the forms were collapsed, removed, cleaned, oiled and put back into place for further work.



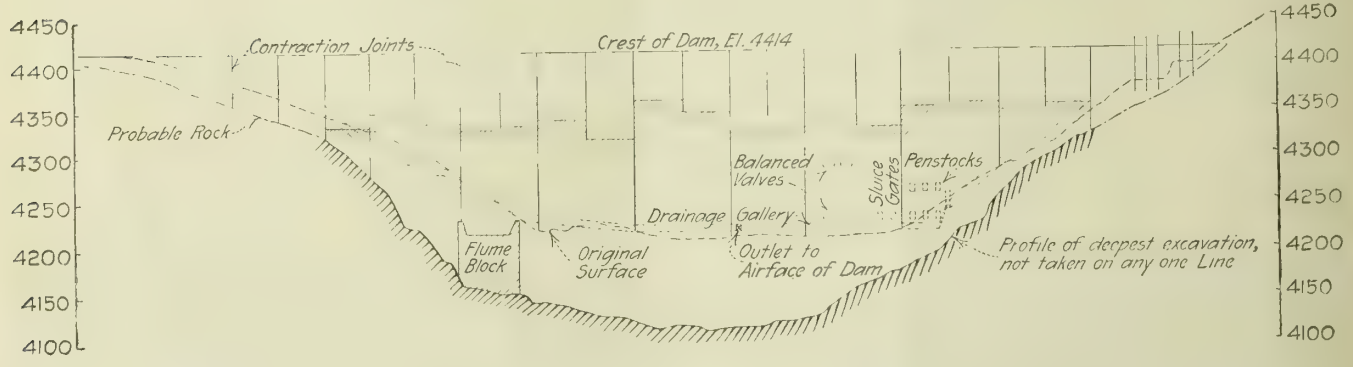


FIG. 2. ELEVATION AND SECTION OF ELEPHANT BUTTE DAM, UNITED STATES RECLAMATION SERVICE

Drilling the Grouting Holes

When the masonry covering was considered sufficient, or at a convenient time, the grouting holes were drilled with a Davis Calyx drill, the shot bit being used. The operation of the machine has been uniformly successful. Cores were retained from every fourth hole and stored for future reference. This machine has drilled 59 holes to a total depth of 3125 lin.ft. As the concrete was placed rapidly it frequently happened that the drill would start from 75 to 100 ft. above the hole; but this did not make any great difference, except that it caused more tubing to be handled than would otherwise have been the case. In January, 1915, a well-drill was rigged with a 3-in. string of tools and used in place of the shot drill. While this did not furnish a core, it gave just as good results and at from one-third to one-half the cost. With this drill 34 grouting holes were put down to a total depth of 1845 lin.ft. All drilling was carried on in three shifts.

The drilling of these holes was closely followed by the grouting machine. This was a No. 2 Canniff, and was operated from one to three shifts, depending on the condition of the hole or the urgency of the case. In addition to the regular grouting holes called for in the specifications, considerable other grouting was done. Wherever cracks were found in the foundation, 2-in. iron pipe was inserted and carried up until the rock was sufficiently covered with masonry to withstand the pressure, or more often until it was convenient to grout it. The grouting consisted of 83 regular holes along cutoff trench and 93 additional holes (see Fig. 3).

Neat portland cement was generally used; but whenever a water test indicated that the hole was very loose and would consequently take considerable grout, sand-cement was utilized. The 176 holes so far grouted have taken 341 bbl. of portland and 1250 bbl. of sand-cement. The largest quantity of cement forced into one hole was 85 bbl. of sand-cement.

Holes were cleaned before grouting by forcing a stream of water through them. Seepage tests under gravity and pressure heads were made before and after grouting. Seepage before grouting varied from 0.1 to 150 gal. per hr. under gravity and from 3 to 192 gal. per hr. under pressure of 100 lb. per sq.in. After grouting, an average of 0.015 gal. per hr. under gravity and 1.5 gal. per hr.

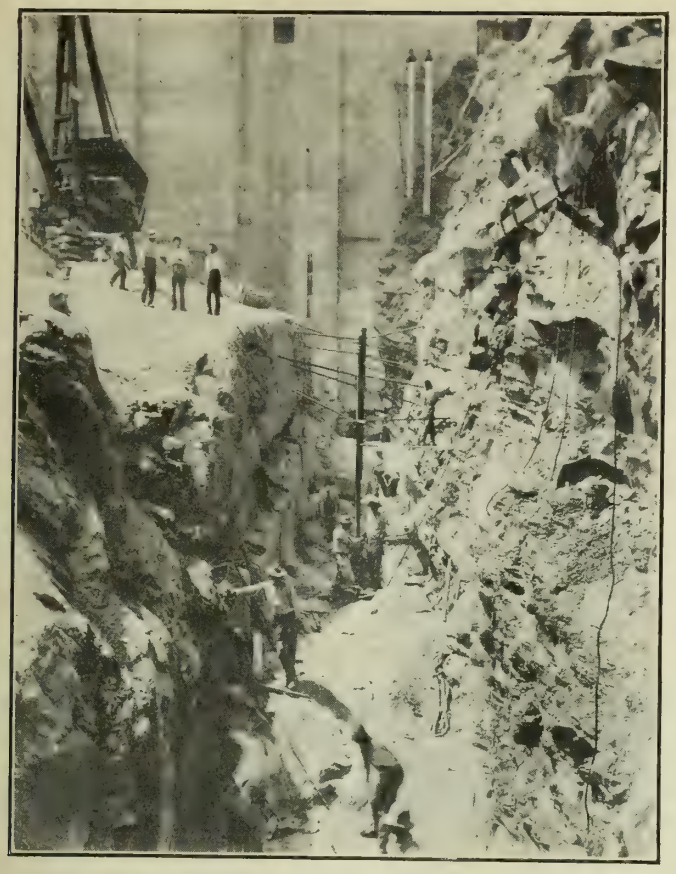


FIG. 3. PLACING GROUTING PIPES IN THE CUTOFF TRENCH AT THE HEEL OF THE DAM

under 100 lb. pressure was obtained. Three gallons per hour per 100 lb. pressure was adopted as the limit; if the seepage was in excess of this, grouting was continued until this limit was reached. Three densities of grout were used—1:7, 2:7 and 3:7 parts of cement to water, by volume. Operation was continuous with pressures from gravity to 100 lb.

Drilling Foundation-Drainage Wells

The upstream row of drainage wells was drilled with a 6-in. well-drill to a depth of about 45 ft. below the foundation. To date 165 of these holes have been drilled to a total depth of 7580 lin.ft. The purpose of this drilling was to intercept any percolation beneath the dam that might not have been cut off by the grouting, also to provide an opportunity in case percolation was considered too great, to grout this additional row of holes or as many of them as seemed necessary. As previously stated, these holes and the row 5 ft. downstream were carried up in the concrete to the floor of the inspection gallery, where any seepage water present was discharged into gutters at either side of the gallery floor and conducted to the downstream side of dam. This left a raised walk in the center of the gallery. These wells are continued from the roof of the gallery to the top of the dam, to intercept and carry off any water that enters the dam.

The effectiveness of the grouting operations has been clearly demonstrated. Careful measurements have been kept of the discharge from all drainage wells and the percolation around the abutments. On Aug. 13 this amounted to 59 gal. per min., or 0.13 cu.ft. per sec., with a head of 100 ft.

The section in Fig. 2 shows the drainage or inspection gallery and the relation of the grouting pipes and drainage wells to it. The elevation of the floor of the gallery is 4218, or about 4 ft. above the river bed, and supposed to be at all times above water level in the river below the dam. It is built the entire length of the dam, rising very slightly in grade from the low point at Station 7+30 until near the abutments, where it is carried up on a 10:8 slope.

Completed Drainage Gallery in Dam

In order to make the gallery more accessible, steps are provided on the slopes wherever steeper than 10:1. The steps are built in flights of about 25 ft. in height, with a landing; on a 10:1 slope, from 5 ft. to 10 ft. in length, according to the topography of the abutment. At one side a 1½-in. pipe handrail is provided. Conduits for electric wires were built in the concrete about 1 in. above the roof of all galleries, with openings every 20 ft. for lamps. The completed galleries and tunnels, of which there are in all about 2500 lin.ft., are well lighted and afford exceptional and convenient facilities for examining the interior of the dam and noting the percolation under and through the dam with the varying conditions of temperature and head.

It was intended to carry the drainage gallery from abutment to abutment, but near Station 9+40 the abutment was so precipitous that a vertical ladder or tunneling would have been necessary; so it was decided to end it at this point and start another about 22 ft. higher to be entered by one of the galleries provided in connection with the sluice-gate operating chambers. The drainage galleries are connected for drainage purposes by a 12-in. opening built in the concrete.

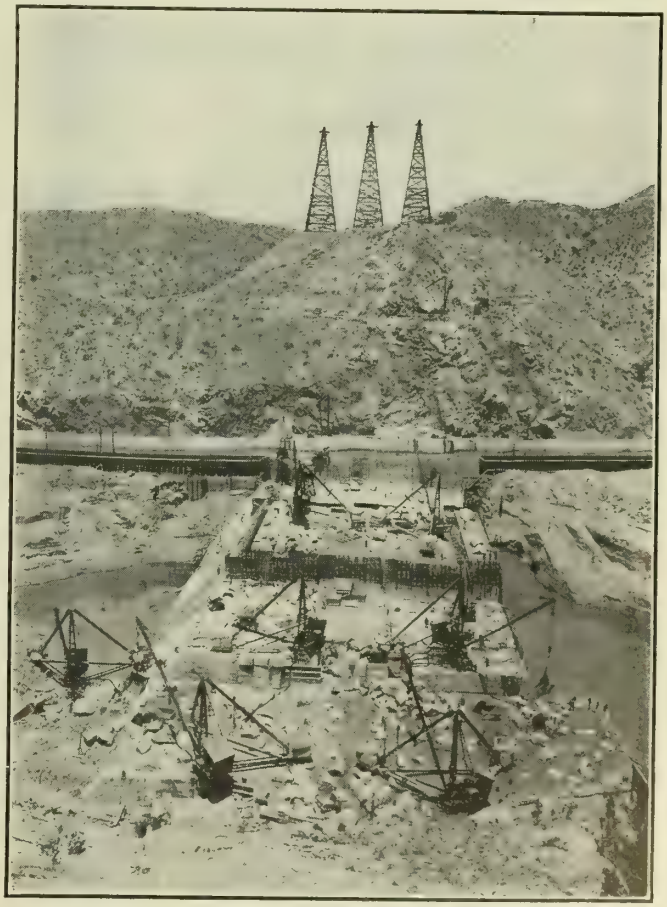


FIG. 4. FIRST STAGES OF ELEPHANT BUTTE MASONRY
Smooth surface in middle section left unroughened so that derrick pier blocks can be cast thereon

To increase the imperviousness of the upstream face special precautions are being taken. The portion of dam upstream from the upper row of drainage wells is made of a richer mix than the remainder of the dam. This is a 1:6 mix, while a 1:9 mix is generally used. There is no sharply defined line between the two grades of concrete; forms are not used to separate them, but they are blended together in a distance of from 1 to 3 ft.

Waterproofing the Upstream Face

To discourage further the entrance of water into the dam the upstream face is being coated with portland-cement mortar applied with a cement-gun. The mortar is mixed in the proportion of 1 part cement to 2 parts sand and applied in a layer about 1 in. thick. Advantage is taken of rising water in the reservoir to work from rafts specially constructed for the purpose. There are two of these, each 9x13 ft., made of planking on a framework laid on and attached to 16 oil barrels. One raft contains the machine, operator and helpers, small mixing box and a few sacks of cement and sand, while the other is loaded with cement and sand. The order of operation is to take a strip about 10 ft. high and the length of the dam at water level, and first clean it thoroughly with scrapers and wire brushes. It is then gone over with a sandblast, using coarse sand, passed through the machine to obtain the necessary pressure. This roughens the surface sufficiently to cause the mortar to adhere to it. The surface is then thoroughly moistened from a hose and immediately followed with the mortar. This is put on in four layers, each about ¼ in. in thickness. It was found that a thicker coat than this, applied on a vertical wall, without reinforcement, would, on account of its weight, slough off before setting; but by applying in thin coats this trouble was overcome. The layers follow each other before the preceding layer has attained its final set, and so far there is no indication of a parting of the layers.

Numerous samples taken from the face showed perfect adhesion to the concrete, it being impossible in every case to break mortar from the concrete at the line of contact. As indicated in the foregoing, the operation of the cement-gun is dependent on the rise of water in the reservoir; consequently its operation is somewhat intermittent. But as the small crew employed on this feature has other duties that can be worked in between, this is not objectionable, especially as it enables a great saving to be made by avoiding the necessity of scaffolding. The total area covered to date is about 96,500 sq.ft., at a cost of 8c. per sq.ft., which includes all charges.

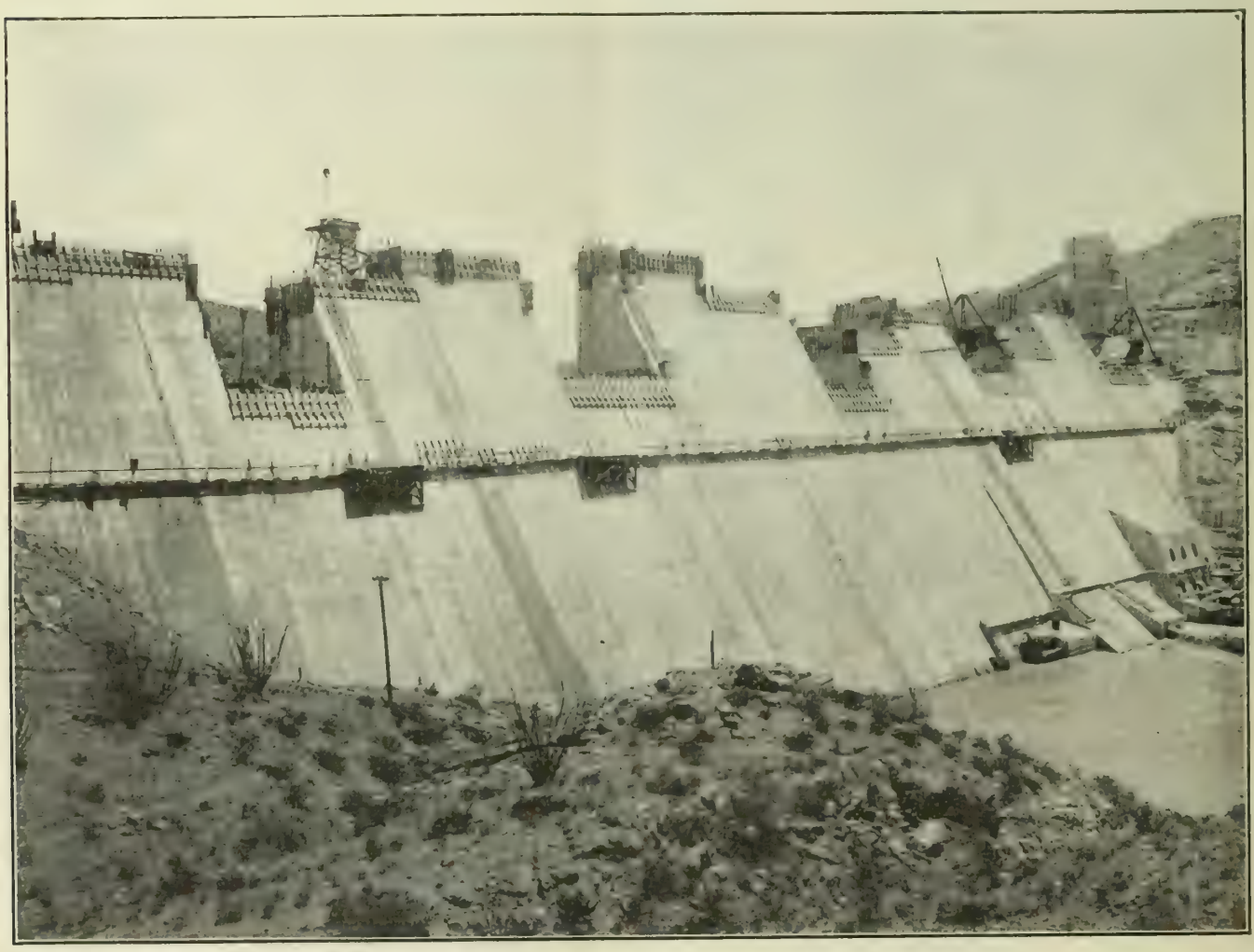


FIG. 5. DOWNSTREAM FACE OF ELEPHANT BUTTE DAM IN AUGUST, 1915

Water surface is 105 ft. above deepest part of foundation; walk is 200 ft. above foundation; completed top of dam will be 100 ft. above walk

Operation of Quarries

Three sandstone rock quarries, located from 2000 to 6000 ft. from the dam, are in use. These are known locally as No. 1, No. 2 and No. 5. First quarry 1 was

developed, but was so disappointing that No. 2 was opened up, and gave much better results. Later, in order to get more working face, No. 5 was developed, after unsatisfactory results from Nos. 3 and 4. Quarry 2 has furnished by far the greater amount of material. It contains streaks of shale, which, with the overburden of unsuitable material, gives from 15 to 20% of waste. The face as now developed is about 600 ft. long and 150 ft. high. The bulk of the rock taken from this quarry was loosened by shooting holes from 125 to 150 ft. deep, put down with a 6-in. well-drill, three or four being shot at a time. The largest single blast was in October, 1914, when four holes, loaded with 39,575 lb. of powder, were shot at once, loosening some 70,000 cu.yd. of rock.

This quarry is served by six guy derricks and a double-track standard-gage railroad. On account of the unsuitable material mixed in with the good rock, it has not been feasible to use steam shovels or other mechanical means for loading crusher rock. Rock for the crushers is broken by hand, the larger stones unsuitable for plums are plug-holed and shot and loaded into skips, which are emptied by derricks into waiting 6-cu.yd. dump cars. These are then drawn in trains of 10 or 12 cars by 16-ton locomotives to the crushers, dumped and returned for another load. Plum rock is loaded on flat cars, either in skips or chain slings, for transportation to the dam after cleaning and washing. The cleaning and washing is done on a special side track, alongside of which is a platform, built to the height of the cars, and equipped with water and air hose, pneumatic chipping tools, hammers, and numerous other tools necessary for this work. Quarries 1 and 5 are served by two derricks and one derrick respectively, and by convenient side tracks.

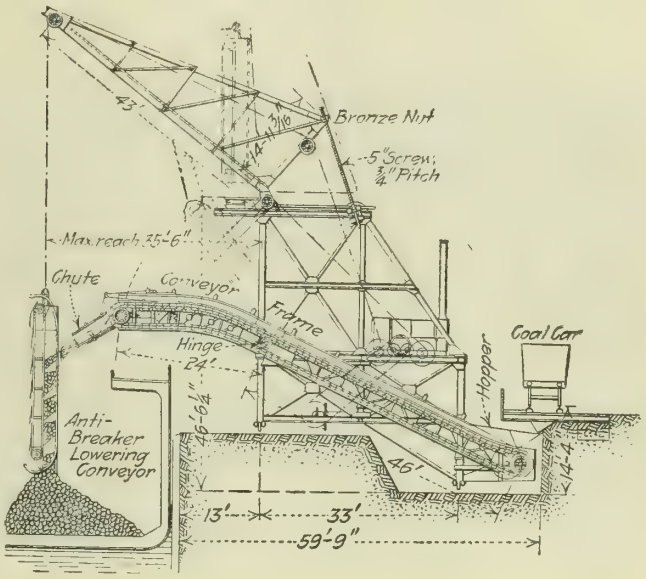
Blended-Cement Plant

With the exception of some thin reinforced work and around water outlets that will discharge under high velocity, all concrete is made with sand-cement. This is made on the work by blending the sandstone from the regular quarries with portland cement. The plant is modern and well suited to the work. It consists of rock crusher, drier, ball mill and four tube mills, with necessary conveyors, elevators and storage bins. The blend used is about 50%, but varies slightly from day to day. The product has a fineness of 90 to 93% passing the No. 200 sieve. Samples from the concrete used were at first taken daily, but are now taken semiweekly. A sufficient number are taken to provide for the following tests: 28 days, 3 months, 6 months, 1 yr. and 2 yr. A complete laboratory on the work enables these tests to be consistently carried out, and the results so far obtained from samples taken on the work bear out the previous laboratory tests that for massive work sand-cement is as satisfactory from the standpoint of strength and permanency as portland cement, and in many cases a great saving can be effected by its use. The plant has a continuous capacity of 1600 bbl. of sand-cement in a three-shift day of 24 hr.; but on account of repairs, changes, etc., from time to time it has never been run steadily on a three-shift basis. The maximum output for one month was in February, 1915, when 39,500 bbl. were produced. The operating force consists of a chemical expert, who has charge of the entire force in mill and laboratory. In the laboratory he is assisted by a chemist and a cement tester; in the mill he is represented by a general foreman, who has charge of the foremen, millers, weighers and general labor. Including the general foreman, from 7 to 10 men are required each shift.

English Ship-Coaling Machine

A coal-shipping plant installed at Workington, England, is designed specially to handle the coal with a minimum of breakage. The machine is carried by a tower traveling on a track 120 ft. long near the edge of the dock, the rails having a gage of 33 ft. In the rear of this track, and above it, is a track for the drop-bottom coal cars, the coal being discharged between the rails and delivered to a hopper on the end of a conveyor frame, which extends through the tower.

The conveyor consists of a traveling belt of steel plates 4 ft. wide, running at about 120 ft. per min. The



MACHINE FOR COALING SHIPS, WORKINGTON HARBOR

outer end of the conveyor frame is adjustable, having trunnion bearings in the front of the tower, so that it can be raised or lowered to clear deck fixtures and to give the coal as little drop as possible. The conveyor and the propelling machinery are driven from a 40-hp. engine.

A chute on the end of the conveyor frame delivers the coal to a Handcock antibreaker. This is a vertical tube suspended from a boom on the tower, and containing a series of trays attached to endless chains. The weight of the coal as it flows into the tube operates this vertical lowering conveyor. The loaded trays descend, free the coal at the bottom, and then ascend empty. An automatic brake controls the speed.

In coaling a ship, the tube is lowered till its open end is nearly on the floor of the hull, and as the coal is delivered the tube is gradually raised, keeping its end level with the top of the coal pile, so that the coal flows out without a direct drop. This machine (described in *The Engineer,* of London, July 2) is designed to deliver 400 tons of coal per hour, but can work at the rate of 600 tons per hour. It was built by F. Turnbull & Co., of Newcastle-on-Tyne, to the designs of Cecil Walton, Engineer for the Workington Harbor Board, and under the direction of Bowen Cooke, Chief Engineer of the London & Northwestern Ry.

Field and Office

Culverts Damaged by Extreme Freshet in Small Creek

By A. E. Steere*

Heavy rainfall in the Mohawk Valley and western New York State on Aug. 22, 1915, caused considerable damage to small culverts and highway bridges over small streams. One of the storm centers developed at Hoffmans; while lasting less than one hour, it caused the local streams to discharge unusual volumes of water for small watersheds. There was opportunity to get a fairly close estimate of the maximum discharge of a small stream entering the Mohawk from the north. This shows a phenomenal rate of flow per acre.



FIG. 1. CONCRETE CULVERT DAMAGED BY SETTLING OF WALLS



FIG. 2. OLD CULVERT PARTLY WASHED OUT WHEN FLOWING UNDER LARGE HEAD

The stream has a drainage area of about 1¼ sq.mi. The area is rectangular in plan and has steep slopes. On that account the run-off from the full area was delivered to the creek along its course at about the same time.

The creek is crossed by a double-track electric railway line, a state road, and the New York Central Railroad embankment carrying eight tracks. The electric crossing was a concrete culvert 10 ft. in span, the embankment being about 20 ft. high above the culvert. The New York Central crossing was a culvert of even smaller sectional area. At both culverts the water was dammed back so that they ran full under a head of 12 ft. in the case of the electric crossing and more in the case of the railway crossing.

The experience at the electric culvert was the more interesting. The foundation for the side walls of the structure was on heavy gravel, the bottom being the natural stream bed. The rush of water through this opening with the head of water caused scour to such an extent that the walls were undermined and sank two feet at a point about 30 ft. from the point of entrance. The spandrel walls at either end were broken at the center of the arch and separated from the barrel of the culvert along a transverse construction joint. The arch of the culvert for a distance of about 45 ft., where the greatest settlement occurred, is cracked laterally and transversely in many directions, while the edges of these lines of fracture have spalled considerably, indicating that the arch is under serious strain. A section of the side wall approximately 15 ft. long separated about 4 in. along a horizontal joint from the arch ring.

As this arch settled during the process of undermining, the water followed more readily through the soft material along the barrel of the culvert, causing the earth fill on the lower end of the culvert to flow through the large opening in the arch near the spandrel wall. The electric-railroad tracks showed a distinct sag, but were subsequently brought to grade by additional material, so that traffic could be resumed.

The cause of the failure was the undermining of the arch walls, caused by the absence of a concrete or masonry invert between the side walls. As an additional precaution where culverts may be subject to water pressure, an inexpensive cut-off wall should be placed around the arch ring within the limits of the embankment.

The culvert at the New York Central crossing was an old one which had been extended at different times, the last extension being of concrete, while the former construction was of the stone-arch type. The greater portion of this structure was washed out.

The embankment under the four main tracks and the crossover for traffic going to the West Shore tracks was washed away, leaving the rails and ties suspended across the gap. Track watchmen were on hand, which prevented accident. The railroad forces were on the site promptly with piledrivers, wrecking cranes and many cars of piles and heavy timbers making repairs (see Fig. 2).

An estimate of the maximum discharge of this creek, from observations taken after the storm subsided, would indicate an approximate flow of 1,500 cu.ft. per sec. As

*Resident Engineer, Mohawk River District, New York Barge Canal; Mark Building, Amsterdam, N. Y.

stated, the watershed covers about 800 acres. One of the old formulas used in designing small culverts is

Area of opening $= c \times$ *drainage area in acres*

where c is assumed to vary from 1 to 4, according to the slope conditions of the drainage area. By this formula the culvert was much too small.

Soil-Bearing Test with Confined Plunger

The Detroit-Superior viaduct, Cleveland, has most of its piers founded on piles driven in hard clay. Driving these piles was very difficult, and in redesigning the east abutment and one pier the engineers believed that the foundation piles should be eliminated. To verify this opinion a bearing pressure test of the soil was made, as shown by the view in Fig. 1.



FIG. 1. SOIL-BEARING TEST AT LOAD OF 8 TONS PER SQ.FT.

The test was carried up to a loading of 13½ tons per sq.ft., at which the settlement was about two inches. The settlement readings were very slight up to a load of 8 tons per sq.ft., which may be considered the equivalent of a yield point, and was so interpreted. The relation between settlement and load is shown by curve in Fig. 3. Each load was left on for a certain length of time before more load was added, and at most of the loads settlement occurred in this waiting period. Separate settlement-time curves for these intervals are shown in Fig. 4. The curves were plotted by A. W. Zesiger, bridge engineer, Cuyahoga County, who is in charge of the viaduct work. The testing arrangement, shown by the sketch Fig. 2, is interesting in the use of a confined plunger. A base-block 2 ft. square, set on the bottom of a square sheeted pit about 4 ft. on a side, is surrounded by a 6x12 curb fastened to the sheeting by a nailing strip. Clay packing is put between the sheeting and the back of the curb to prevent the rising up of the bottom soil in this space. The clearance between curb and plunger is ¼ in., the inside size of the opening of the curb being ½ in. larger than the plunger. The effect of this arrangement seems to have been complete prevention of any rising-up of the soil, so that the full bearing power of a buried foundation was presumably realized. The clay subsoil found at the site is particularly liable to lateral flow and heaving up at un-

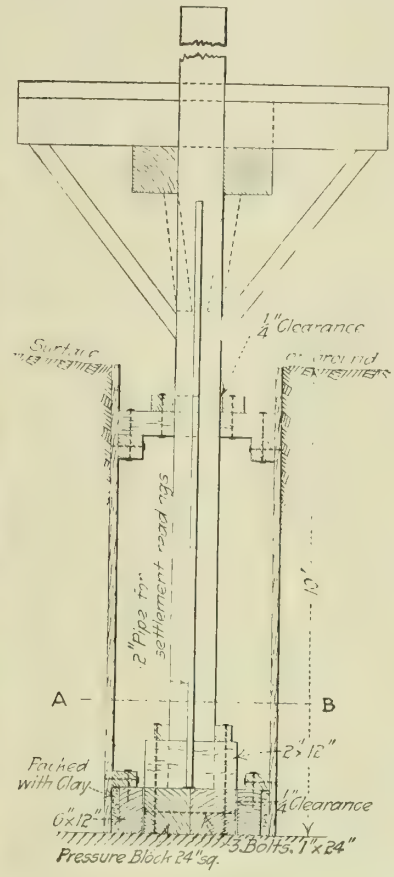


FIG. 2. SKETCH OF RIG FOR SOIL-BEARING TEST

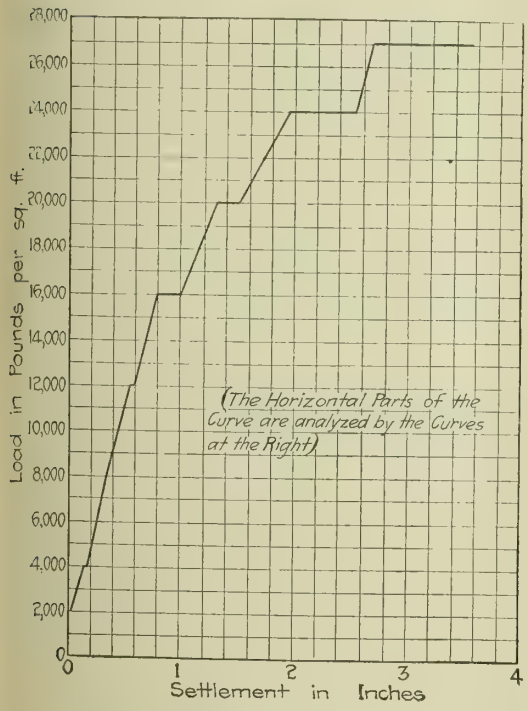


Fig. 3. Increase of Settlement with Load

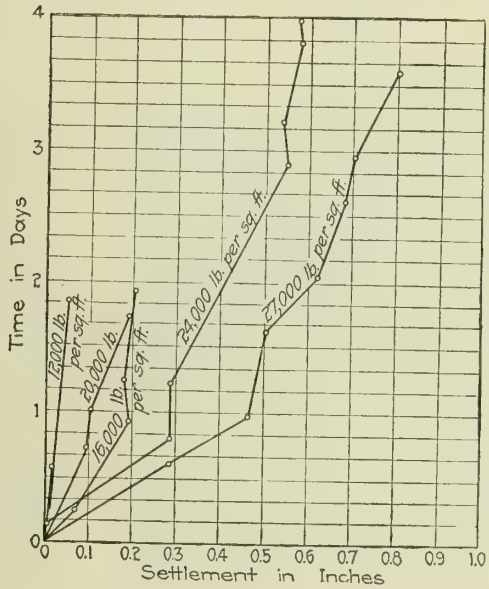


Fig. 4. Settlements at Constant Load

FIGS. 3 AND 4. ANALYSIS OF SOIL-BEARING TEST AT DETROIT-SUPERIOR VIADUCT

loaded points under the influence of a concentrated load, so that the precaution was particularly necessary in this case.

Load Test Under River Piers

The river piers of the same viaduct were founded by concreting under water direct on the clay bottom of an excavation inside a coffer-dam without piles. To verify their bearing capacity a load test of the bottom soil was made after a 16-ft. depth of the pier substructure concrete had been placed. A well 36 in. in diameter was cored in the concrete, and a 34-in. diameter plunger was set on the bottom soil in this hole. A load of 10 tons per sq.ft. on this plunger produced a settlement of 0.21 ft. The foundation was approved on the strength of this test.

New Sewer Inlets at St. Louis

By S. Chivvis*

The Division of Sewer Design of the Engineering Department of St. Louis has recently made some important changes in its standard types of street inlets and in its policy of trapping them.

Heretofore all inlets connected directly to the sewers have been built with catchbasins and have been trapped as shown in Fig. 1. This type (see also the view, Fig. 2) has been rather expensive on account of the massive brick neck and heavy stone. The corbels at either side of the opening, which were primarily intended to support the two front corners of the stone, are complicated by the necessity of molding into their upper surface inserts to admit the bar. The sill, which should be shaped to allow the water to drop suddenly and surely from the gutter into the inlet, has not accomplished this end, having a broad flat upper surface laid horizontally.

The result of the last-mentioned defects has been that a large amount of the water for which the sidehill or lateral sewers have been computed has rushed past the inlets it should have entered, and gorged those at the foot of the grade.

The difficulty has been met partly by a redesign of the inlet itself with a slightly greater length of steeply inclined spillway and partly by closer coördination between the sewer and street paving divisions in the matter of gutter depressions at the inlet face. In addition, the more sparing use of traps and catchbasins makes possible the placing of a greater number of inlets at a lower cost per unit.

*Office Engineer of Design, Sewers and Paving, Board of Public Service, St. Louis, Mo.

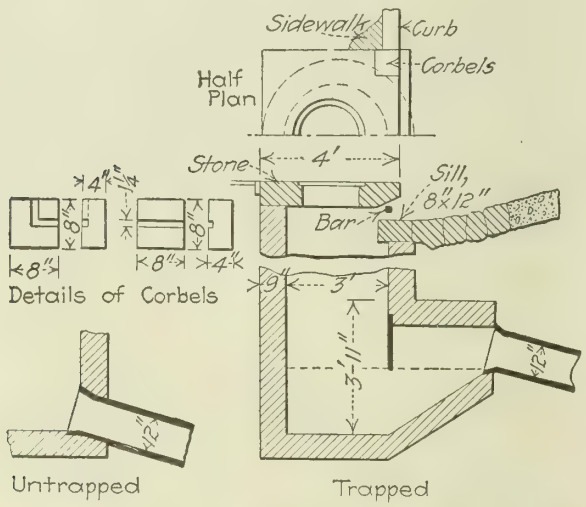


FIG. 1. OLD SEWER INLETS

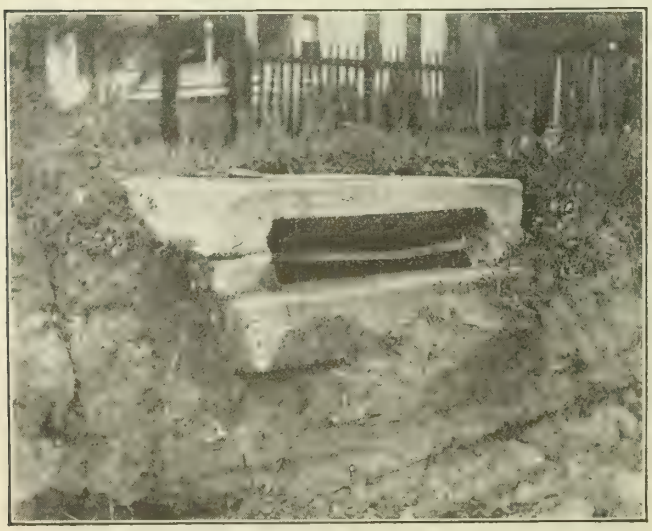


FIG. 2. EXTERIOR VIEW OF OLD SEWER INLET

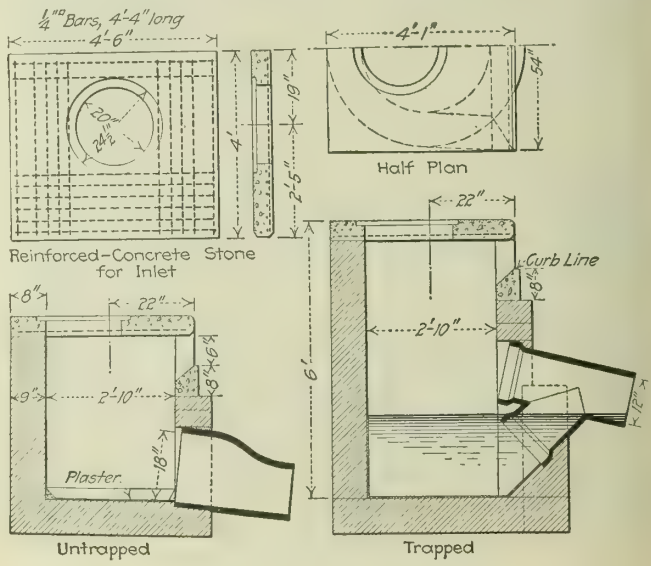


FIG. 3. NEW SEWER INLET

Fig. 3 shows the details for both the trapped and untrapped types of the new design. The use of the trapped type with catchbasin is contemplated on inlets connected to sewers of flat grade where, on account of the sluggish flow, septic action will have a chance to begin, and on inlets draining telford streets on grades steep enough to allow the gravel to wash into the gutters. This latter case could of course be met by the use of the catchbasin alone, but the standard trapped inlet is used to avoid a multiplicity of types. All inlets not falling into the two categories mentioned will be untrapped.

With regard to the stone or cap, the old St. Louis practice called for hewn limestone of a thickness of 8 in. With the advent of concrete this thickness was retained, no reinforcing being used; but the natural eagerness of contractors to push their work led to a great number of breakages caused by loading and unloading these stones when comparatively green.

The new cap design saves 45% in weight (967 lb. complete, compared with 1,740 lb.) while adding materially to the strength under live-loading. This strength

makes unnecessary the use of corbels to support the overhanging corners, and the absence of corbels allows a greater length of spillway with a smaller stone, the new dimensions being 4x4½ ft., while the old were 4x5 ft.

Cost of Motor-Truck Hauling Depends on Conditions

Engineering News of Sept. 16, 1915, published an article by D. P. N. Little in which he described how a motor truck and trailer hauled two 11-ton girders 61 ft. 10 in. long a distance of 24 mi. from the Los Angeles shops of the Union Iron Works. He compared the cost of transportation of these two girders with the costs submitted in my article on "Motor Trucks for Heavy Structural Steel" for the Jerome Ave. elevated railway structure in New York City, *Engineering News,* July 22, p. 174. Mr. Little succeeded in cutting his costs of hauling these girders to approximately one-half the cost of those hauled on Jerome Ave. I think it is only just to explain the differences in the costs of the two pieces of work.

The average length of haul on the Jerome Ave. section is two miles, a greater part through unpaved streets with barely room for a truck to pass between the storage piles of girders, which compelled slow and careful operation. In a 10-hr. day these trucks are in actual operation only half of the time; the other 5 hr. is consumed in loading and unloading, the unloading being done by hand. It is obvious that the trucks are making only half the ton-mileage in a 10-hr. day that they would make if they were in continuous operation, as in Mr. Little's case, where the distance between the shops and the girders' destination was 24 mi. "over thoroughly improved oil-macadam roads."

Again, the assumption of $20 per day per truck is liberal, but by no means in excess of the actual cost of maintenance, which runs high on account of the wear and tear on motor cars that have hauled as high as 25 tons on a load. The costs submitted by me have run over a period of nine months, during the most inclement months of the year, as compared to Mr. Little's assumptions for depreciation of motor cars and trailers, derived from a service period of two or three days.—William Collins, Jr., Inspector for Public Service Commission, New York City.

An Underrated Contributor to Steel Construction

By R. Fleming*

The history of bridge and building failures is mostly a story of faulty details. Seldom has a structure given way for lack of strength in the main members. But eccentric rivet connections bringing about large bending moments, connections that induce secondary stresses, insufficient lacing of compression members, have all invited disaster. In the final analysis the cause of failure has been that the importance of the detailer's work was underrated. The recent failure of the Panama crane "Ajax" might have been averted if there had been more knowledge shown in the detailing of a large compression member.

*American Bridge Co., 30 Church St., New York City.

The draftsman often does not realize that his opportunities are of enough importance to call forth his best energies and the use of all the knowledge he may possess. The graduate from a technical school is apt to regard the time spent in the drafting room merely as a stepping stone to something else. He does not think it worth while to make the occupation permanent. The highly standardized systems in use in the drafting rooms of the large structural-engineering offices prescribe so much that he thinks there is no call for initiative on his part. The practice of some firms of drawing their supply of draftsmen from evening and trade schools or from an apprentice system tends to lessen the value of a knowledge of mechanics and the laws of stresses.

Money Can Be Saved by a Detailer

Aside from averting failure, the draftsman can do much in lessening the cost of shopwork. Countersunk rivets are expensive, yet how often the base of a column is filled with them when half the number would answer. The writer once made designs and estimates for a series of roof trusses to be used as standards. About the time they were finished it was found that a truss detailed in the drafting room weighed less than the standard truss of the same span, loading and main members. The draftsman, by an ingenious arrangement of field splices and a careful study of details, had effected a saving of at least $200 on the estimated cost of the roof. A careful scrutiny of his work showed no lack of strength or nonconformity to rules or instructions. Of course he could have made no such saving on every roof. It would not have been made on the roof in question if the span had been 2 ft. more or 3 ft. less.

Structures are sometimes detailed with but little regard to transportation, making freight rates excessively high because of space occupied. This is particularly true of export work. The cost of field riveting and the rates for transportation should be carefully compared and studied.

A Thousand Dollars Lost in Erection

Another opportunity of the detailer is to bring about ease of erection, thus saving field costs. One large structural firm makes a specialty of a final examination of all working drawings in order to eliminate every possible field rivet. The erector of an office building in Philadelphia was put to an expense of $1,200 for cutting out and replacing rivets in columns. The columns were made of 8- and 10-in. web plates, four angles and two cover plates. Without giving the subject much thought or making inquiries, the detailer assumed that the erector could spread the columns and drop the connecting girders between them. At the site this proved so difficult that it was found cheaper to cut out rivets, swing in the girders, and then drive new rivets. If the connections had been properly detailed, $900 of the $1,200 could have been saved. Insufficient clearances are also fruitful causes of trouble and expense. These can usually be avoided by previous study in the drafting room.

The remedy for poor and expensive detailing lies partly with the draftsman and partly with the firm that employs him. Greater inducements should be held out by firms than are offered at present. The ideal draftsman is a designer—a designer of details.[1] Estimating his value

[1]"The Designing of Details," "Engineering and Contracting," Feb. 10, 1915.

from the cost per sheet of his drawings or the cost per ton of material detailed may be misleading. A few years ago the contract for a complicated steel structure in the Pennsylvania coal regions was awarded to a firm of limited experience that had considerably underbid all competitors. One cause for the low bid was that the assumed cost of drawings was about half that of other bidders. However, by hiring students at nominal wages from a near-by technical institution, the firm succeeded in having the drawings made within the estimated cost. But the cost of erection! Every dollar saved in the drafting room cost two in the field.

What is usually considered the designing of a structure may be comparatively easy, but the detailing may be difficult. The rewards for good detailing should be commensurate with the service rendered. This does not mean that the designer should receive less salary, but that the detailer should receive more. And as previously mentioned, he should be a designer of details and recognized as such.

Testing Large Water Meters

A new equipment for testing water meters of 3-, 4- and 5-in. sizes was installed at the testing laboratory of the St. Louis, Mo., water-works in 1914. The special features of this equipment are an air cushion for water hammer, a quick-opening valve, a sliding joint to accommodate meters of various lengths, clamps instead of bolts for holding the meters between the flanges of the machine, pressure gages at inlet and outlet ends of the meter, various sizes of orifices, and an overhead trolley.

All fittings, except where otherwise specified, are wrought iron; the air cushion is a section of 12-in. cast-iron pipe about 4 ft. long; the 50-cu.ft. measuring tank is a 12-ft. section of 30-in. cast-iron pipe set on a concrete base. There is a drain from the dished concrete foundation under the meter connection to the sewer.

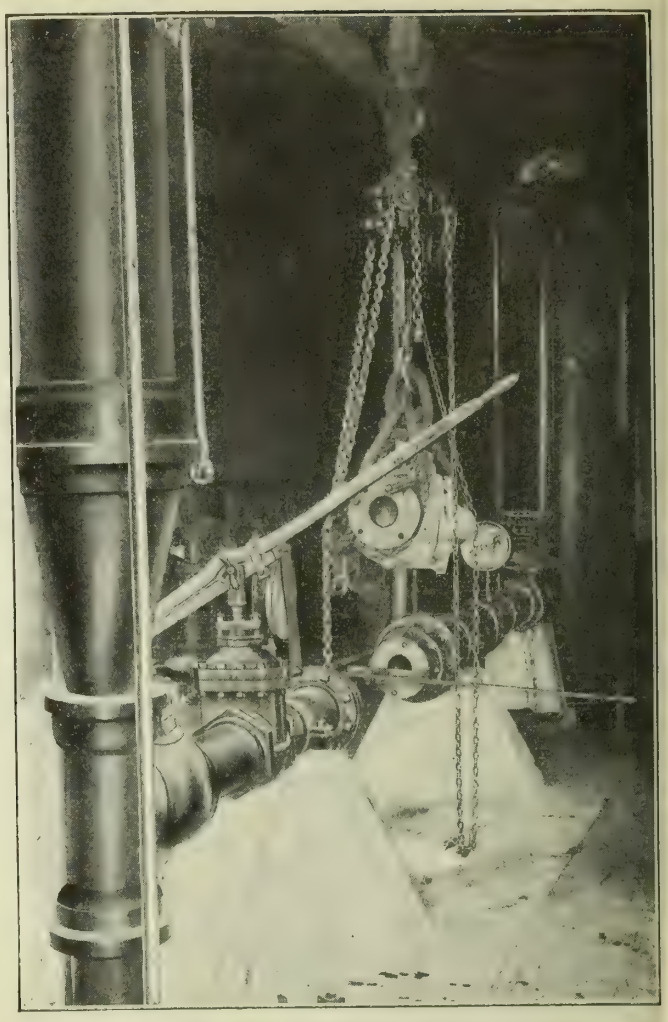


FIG. 2. VIEW OF ST. LOUIS TESTING PLANT FOR LARGE WATER METERS

The ends of the 6-in. wrought-iron pipe to which the flanges of the meter connection are attached are held on their concrete piers by wrought-iron bands riveted to ½x2½-in. iron straps bent to conform to the outline of the pier and bedded in the concrete. The concrete foundation under the testing pit is reinforced with four ½-in. round bars, as shown in Fig. 1.

The illustration, Fig. 2, shows the lever for moving the sliding connection in or out and also two of the clamps for fastening on the meters.

The Water Commissioner of St. Louis, Mo., is Edward E. Wall, to whom credit is due for the drawings and information given.

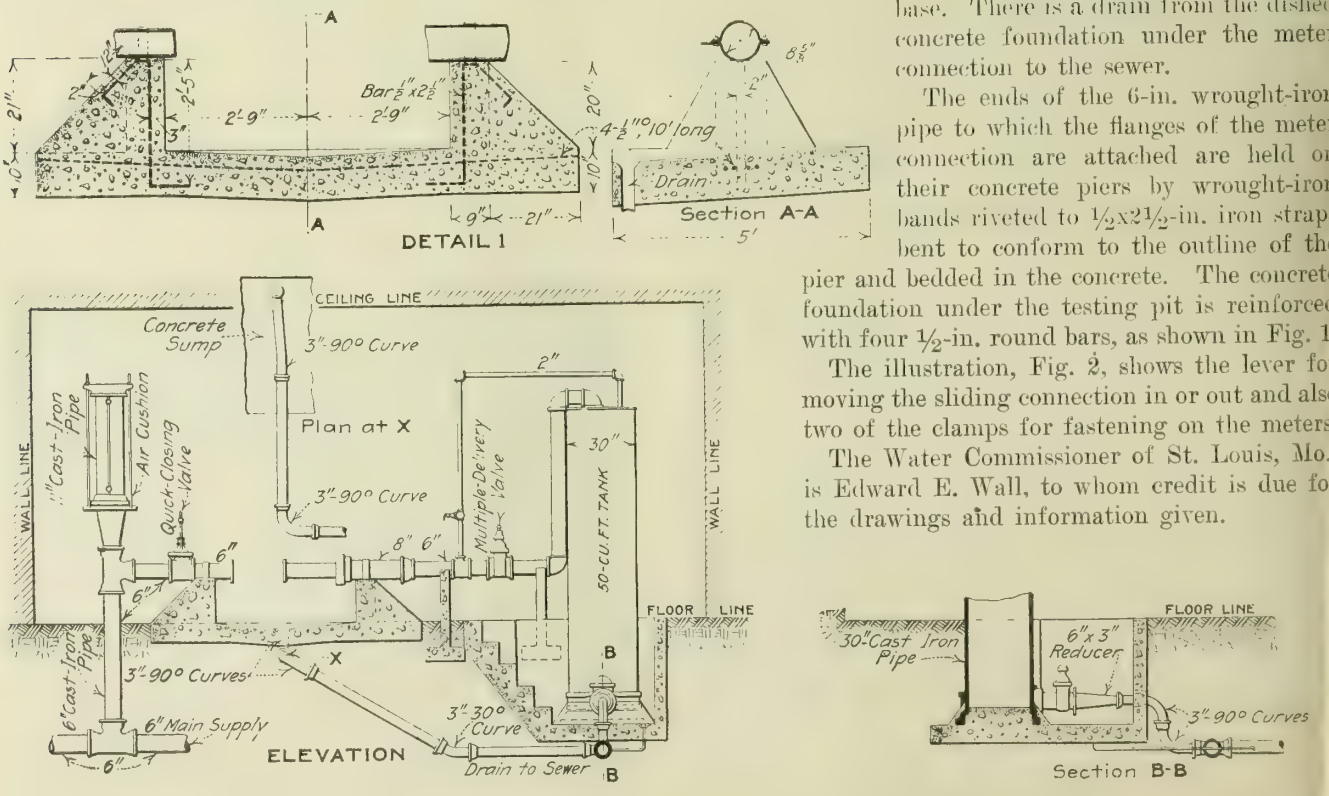


FIG. 1. EQUIPMENT FOR TESTING LARGE WATER METERS, ST. LOUIS, MO.

Large Steel Grandstand for Automobile Racetrack

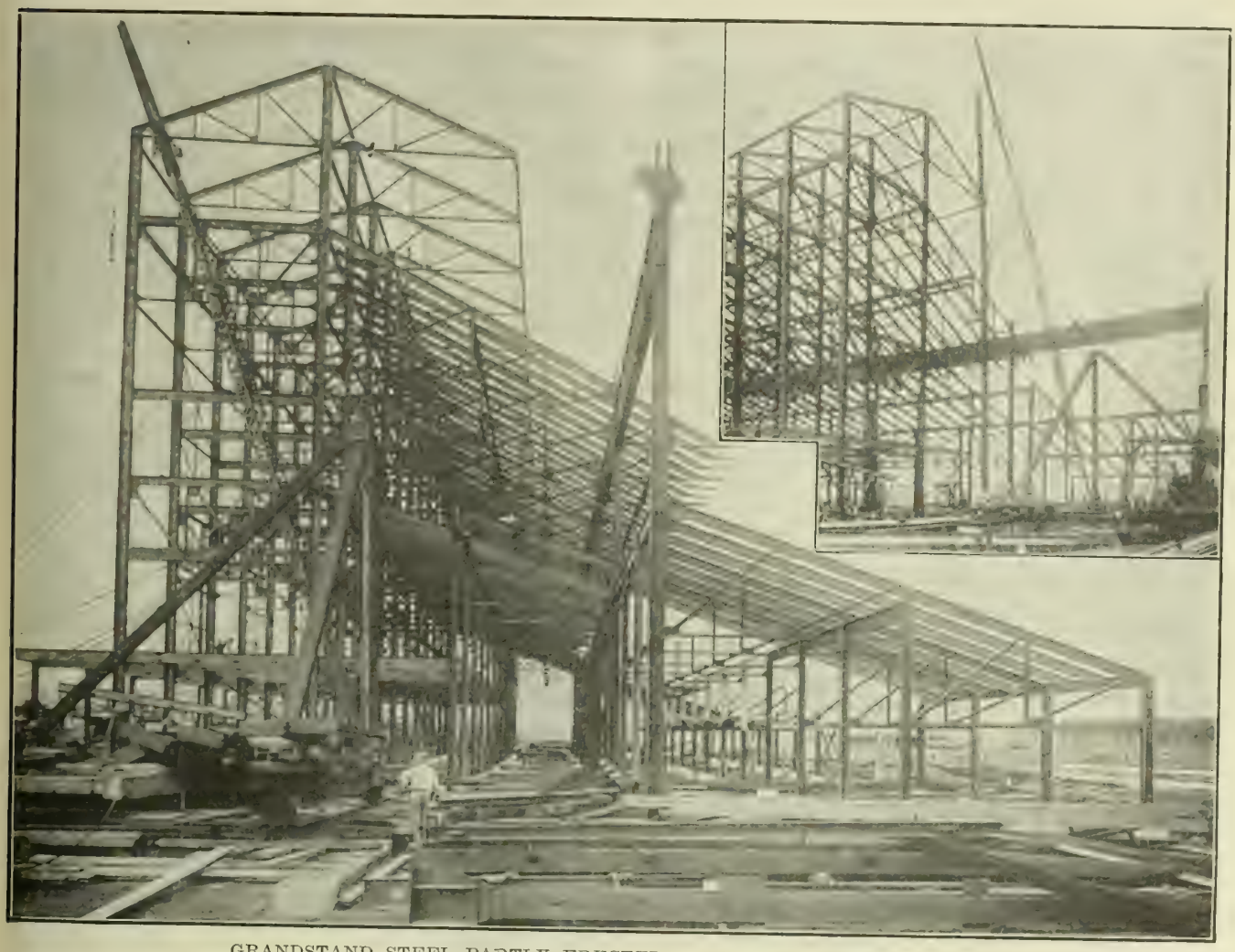
The costly two-mile racetrack for automobiles at Sheepshead Bay, N. Y., nearly completed, has a grandstand ranking among the grandest in the world. It is 1,200 ft. long by 110 ft. deep in plan, has two seat-banks and in front of the lower one a four-tier line of boxes, and contains some 2,700 tons of steel. The boxes are framed in wood. The two views herewith, showing the framework during erection, exhibit the arrangement clearly.

Fore-and-aft bents of six columns carry the trusses of the seat-banks and roof. The bents are spaced 16 ft. 4 in. apart, but the front line of columns under the balcony is spaced 49 ft. (that is, there is a column at every third bent only) to reduce the obstruction of view from the upper half of the main seat-bank. Longitudinal bracing between bents occurs in alternate bays of the three main column lines, and in every fourth bay of the other three lines. The fore-and-aft bracing consists of portal trusses under the seat-banks. Field-connections are riveted.

The five bays of the bent are 17 ft. 5 in. to 21 ft. 6 in. long, giving a depth of 93 ft. for the main part of the stand. Back of this is a three-story extension one bay in depth, containing longitudinal corridors and toilet-rooms.

The steelwork is of normal design and detailing throughout. The seat-bank stepping is carried by fore-and-aft I-beam joists, which divide the bays of the frame into three spaces. The stepping is built up of 2x6 studs supporting risers and treads (or seats), all built up on spiking strips bolted on top of the I-beam joists. The seat proportions are 10½-in. rise to 32-in. tread in the main bank, and 16½-in. rise to 32-in. tread in the balcony, or slope-ratios of about 1:3 and 1:2 respectively. The roof consists of asbestos shingles on sheathing on wooden purlins, with wooden outlookers to carry the eaves.

The height from ground to top of main seat-bank is 35 ft., to top of balcony 65 ft., and to peak of roof 84 ft. This required using a boom spliced out to 90 ft. long, on the derrick traveler (see views) which erected the main members of the framing. This traveler was carried by four two-wheel trucks running on a two-rail track laid longitudinal to the grandstand near the middle of the depth. It could reach all parts of the bent.



GRANDSTAND STEEL PARTLY ERECTED; DERRICK IN FOREGROUND

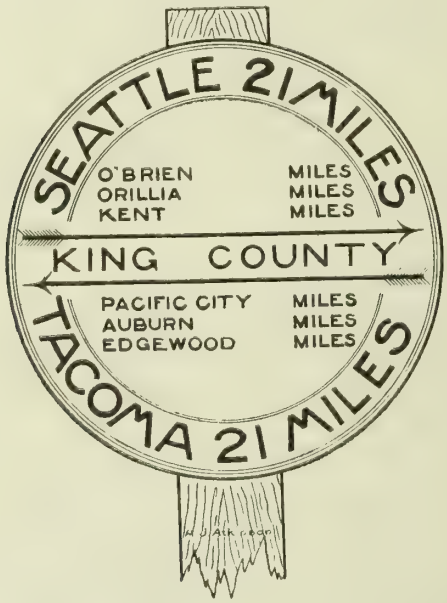
Blaine H. Miller, Chief Engineer of the Sheepshead Bay Speedway Corporation, was in charge of design and construction. The Lackawanna Steel Co. furnished the steel, and the Lackawanna Bridge Co. erected it. Erection began June 5, and by Sept. 17 the steelwork had received its final coat of paint.

Although in an outlying district, the racetrack is within the city limits, and the New York Building Code governed. Plans were approved by the Bureau of Buildings of the Borough of Brooklyn, which required the seating banks to be designed for 75 lb. per sq.ft.

NOTES

Batch Mixers To Be Rated By Mixed Batch—Some mixer manufacturers rate their machines by their capacity in mixed concrete, while others rate them by their capacity in loose unmixed material, although it is a well-known fact that a mixer having a batch capacity of 8 to 9 cu.ft. of unmixed sand, stone and cement will hold only about 6 cu.ft. of mixed concrete per batch. The National Association of Mixer Manufacturers at its August meeting took steps toward remedying this difficulty by adopting a resolution providing for the uniform rating of batch mixers. This resolution provides that the members of the association in future catalogs and circulars shall specify the capacity of their mixers as "size of wet mixed batch," and not otherwise. The dry unmixed capacity of a mixer, says the association, may be approximated at 1½ times the wet mixed batch, assuming the use of cement, sand and 1½-in. crushed stone, with 1¾ gal. of water per cubic foot of mixed concrete. The members of the association further agreed not to use the dry-batch rating in their correspondence, advertising, etc., unless the standard wet-batch rating was used also and with equal prominence.—From H. E. Smith, Secretary, National Association of Mixer Manufacturers, 1125 32nd St., Milwaukee, Wis.

Highway Signs Made of Old Saws—A unique sign for marking the various highways has been devised by Arthur P. Denton, of Seattle, Engineer of King County, Wash. Discarded shingle saws have been purchased, the rust removed and the steel disk painted as shown in accompanying sketch. The saws can be purchased in bales for practically the price of crating and taking them away from the mills, and as this is particularly a lumber country, the signs are peculiarly



HIGHWAY SIGN MADE OF OLD SHINGLE SAW

appropriate. To protect the signs from mutilation at the hands of hunters, and as targets for the rocks of small boys, the Board of King County Commissioners has had posted warning notice that a term in jail would result from the mutilation of any county property, and teachers in the various public schools have been instructed to warn their small charges. Several hundred signs have been erected and more will be added from time to time as neded.—C. A. Osier, Seattle, Wash.

Handling Plaster by Wheelbarrows and a hoist was the method employed for the interior finish of a reinforced-concrete building at Stevens Point, Wis. The plaster was mixed by hand and shoveled into steel wheelbarrows. A steam hoist on the ground had its cable led through a boom on the tower of the concrete elevator, and a landing platform projected from the floor where the plastering was in progress. The end of the cable had a three-rope sling; one rope had a hook which engaged the wheel of the wheelbarrow, and the others had iron rings to be slipped over the handles of the barrow. Four men were employed: One mixed the plaster and loaded the wheelbarrows; one handled the hoist; one wheeled the barrows to and from the hoist, attached and detached the sling and held a tag line to steady the barrow and keep it clear of the building in raising and lowering; the fourth man was on the upper floor to swing in the loaded barrow on the landing platform, unhitch the sling, wheel the barrows on the floor and attach the sling to the empty barrows.

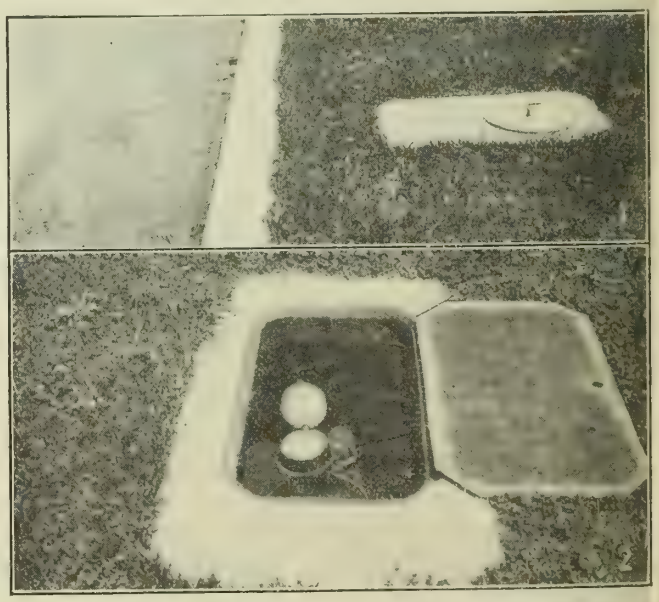
A Large Shop for plate and angle work, under construction by the Aberthaw Construction Co. for the Fore River Shipbuilding Corporation at Quincy, Mass., will be 188x769 ft. Its steel columns are composed of unusually large rolled sections, some of them 30-in. 200-lb. I-beams. The crane girders along each side of the center row of columns, as well as those along the walls of the building, are all 28-in. 150-lb I-beams. The crane rails are about 28 ft. above the floor, while the first story reaches a total height of some 44 ft. The building is roofed with plank covered with tar and gravel. The sides are largely of glass in steel mesh, with pilasters of brick. There is one very high story for handling plates and angles for shipyard work. A partial second story above this includes the mold loft, 605x92 ft., and the sheet-metal shop, 164x92 ft.—S. G. Koon, Boston, Mass.

Using a Pneumatic-Hammer Drill Under Water is described by Charles A. Fritz, who during the summer and fall of 1914 was engineer in charge of the construction of a sewer outfall at Manchester, Mass. The outfall extended 2 mi. into tidal waters ranging in depth below mean low water from zero to 40 ft. At a depth of about 16 ft. two small ledges were encountered in the trench. The contractor (the T. A. Scott Co., New London, Conn.) had a timber crib, which was to be used to support a steam drill on a tripod. Mr. Fritz suggested the use of a "Jackhamer" pneumatic-hammer drill, which was successfully tried. The only drawback to this use of the drill was that the exhaust annoyed the divers, but this was easily remedied by bringing the exhaust to the surface by the use of a common garden hose.

Reducing Square Feet to Acres—Mr. Andrews' short cut in computing acreage ("Engineering News," Sept. 9, 1915, p. 512) involves two multiplications. Try this:

Square feet multiplied by 0.000023, minus 0.02 for each figure in the result in all ordinary cases; or, where accuracy within 0.001 is essential, subtract 0.019 instead of 0.02 for each figure or integer.—C. M. Lawrence, County Surveyor, Hughes County, Holdenville, Okla.

Cement Water-Meter Boxes of two types now being used by the City of Pasadena, Calif., are shown by the accompanying views. The smaller of the boxes shown (Fig. 1) is about 10x18 in. in plan and 14 in. deep and its walls are about 1½ in. thick. The round cement lid is lifted by a piece of heavy cord.



CEMENT WATER-METER BOXES, PASADENA, CALIF.
1—Small box with cement lid. 2—Large box with iron lid

A box for larger meters (Fig. 2) is 14x30 in. in plan, 18 in. deep, has walls 2 in. thick and is provided with an iron lid.—From Arthur Marple, Tropico, Calif.

Editorials

Safety in Subway Construction

The coincidence of two serious accidents in the subway-construction work in New York within three days has aroused uneasiness to the point of alarm. City officials share with the general public the uncomfortable suspicion that miles of timbered streets over the excavation for new subways are unsafe. The feeling is justified. Coincidences inevitably are suspicious. The first accident, Sept. 22, was alarming enough, with its mysterious spread of a local collapse to a general wrecking action that traveled along the timbering up to the point where permanent steelwork was in place. When the same contractor's work was visited with a second collapse only three days later, the municipal authorities became aroused. The coincidence struck even the slowest mind. A third collapse, however accidental, would probably make the suspicion a certainty.

To conclude anything from the fact of the coincidence is wrong in the present case, however, because the two accidents were fundamentally different in character. Any engineer, and for that matter nearly any layman, will clearly recognize this from the description printed elsewhere in this issue, drawn up on the basis of observations and sketches made on the ground. The Broadway accident was due to what the lawbooks call an act of God, in this case a catastrophal rock fall. Rock falls are not quite so unforeseeable as hurricanes and floods, but they remain the ever-continuing threat in rock excavation, whether for mine or structural use. Mining engineers, who boast of the perfection of their timbering practice, admit that the heaviest proportion of mine fatalities is due to rock falls.

The Seventh Avenue collapse is unquestionably a very serious matter. But any thoughts or sentiments based on it should not be complicated by reference to the Broadway accident.

What is more, if the relation between the two accidents is rightly interpreted the second collapse is reassuring with regard to the very danger which the first collapse seems to point out. The alarming thing about the Seventh Avenue collapse was its spreading from the point of initial failure. The man in the street concluded that the underground falsework was built more or less like a house of cards, that a loose or weak construction was being employed to support streets carrying heavy and dense traffic, and that therefore anything was liable to happen along the work, since the slightest give or fall at any one point would spread, tearing down whole block-lengths of streets. If this same man considered the circumstances of the Broadway accident, however, he could see good proof that the street supports are in fact robust and stable. The impact of hundreds of tons of rock against the timbering brought down only the little section of the street directly over the slide; immediately alongside, the posts and struts held, while the broken parts pulled clear.

Judging from the present attitude of New York City authorities and citizens, it seems to have been the popular idea that subway construction is a class of work which is 100 per cent. safe. The city officials themselves appear to have joined in this belief, forgetful of the fact that engineering construction enterprises of large magnitude cannot be wholly divested of risk. Cutting away the earth and rock under long lengths of city streets, supporting a dense and heavy traffic over the working pit, dealing with variable rock strata and uncertain building foundations, protecting suspended pipes and sewers—such operations cannot be made mechanically regular and certain, or safeguarded against all chance happenings.

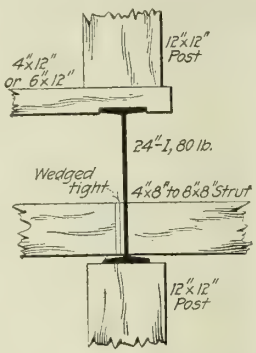
The risk remains. It cannot be eliminated, though it can be reduced, even down to a minute remnant if desired. Care and safeguard may be multiplied up to the point where added complexity and delay add danger. Increased safety-margins may be used and increased provision made against abnormal contingencies. All this, of course, is at a price. Still some risk will be left.

The present occasion is well suited, therefore, for a careful review of the subway situation to determine how much severer the requirements should be or how much more cautiously the work should be conducted than is customary in first-class engineering construction elsewhere. Some modifications, it may perhaps be found, can be made at small cost, and these will doubtless recommend themselves to all. For the rest, however, the financial question—how much can we afford to spend for it—must first be thrashed out. New York will never pay as much to safeguard Seventh Avenue against the possibility of traffic interruption as it will to safeguard Broadway. At present the Broadway and Seventh Avenue contracts are on the same footing.

But such a review must be general. To adopt only such refinements or safeguards as are directly indicated by the present accidents would be a vain measure. The same chance causes will likely not act again—others would come to light. Groups of domestic and foreign engineers have been assembled by various of the city authorities to study the timbering of the excavations. It has not been heard that investigations of blasting, dynamite handling, underpinning, water-pipes, concrete mixtures and all the other phases of the work are to be carried on. But these matters should be studied as well as the single one now in the spotlight. It is useless to shut one door to trouble if other doors are left open.

To discuss the original and most interesting element in the situation, the great collapse in Seventh Avenue, is not easy while the official inquest is yet to be held and many points of evidence must be brought to light. These will probably refer to the origin of the collapse, however, a matter which is only of minor interest to engineers. As to the timbering itself, fairly good data are given by the sketches elsewhere in this issue and a word of comment is possible and indeed inevitable.

The weak-kneed makeup of the post system is the striking feature of the timbering. Drawn in true proportion (see sketch alongside), it is an assemblage that the structural sense hesitates to accept. Instability of the post as a whole and doubtful stability of the I-beam forming its middle section are inherent in the assemblage. In the absence of longitudinal bracing in the structure, nothing to hold the posts from buckling except the spreader timbers between the I-beam webs, a moderate disturbance of the middle of the post system would be able to bring down a whole forest of these posts. As to whether this was the actual happening in the collapse of Sept. 22 can only be speculated. A blocky piece of the bench, shot out by a blast so as to hit the forward one in the tier of I-beams, could readily start the buckling of the posts.



POST SYSTEM AND MAIN BEAMS

State Control of City-Owned Utilities Much Needed

The need for as complete supervision over municipally owned utilities as over private companies has been presented in the editorial columns of *Engineering News* from time to time and from various viewpoints. Necessarily, in these discussions there has been little specific information presented on the experiences of any of the public-service commissions of the country and no data on the extent to which the municipal utility departments have been lax. Naturally, these are matters on which the commissioners and their engineers have felt hesitant to speak. Therefore it is of special interest to show specific information on the way in which utility regulation works out in its daily detail and to give definite comparisons between municipal and private utilities. Some notes of just this sort are found in a paper by C. M. Larsen, Chief Engineer of the Wisconsin Railroad Commission, printed in the September *Journal* of the American Water-Works Association.

Wisconsin is generally looked on as one of the most enlightened states in the matter of utility regulation, and it is one where equal demands are made on public and private enterprises. But evidently the responses are not uniformly satisfying. In 1914 there were 196 privately owned electricity works and 72 municipal plants. There were 26 private water companies and 163 municipal water departments. All the telephone systems and gas-works were under private control. Of the private electric plants 53% made unsatisfactory reports and so did 71% of the municipal departments. Among the private water companies 42% made unsatisfactory reports and 71% of the municipal water-works were lax. Interest in the development of the respective utility arts is reflected in the membership of utility associations. Seven of the 26 privately owned water companies had joined one or the other of the major water-works associations, which is far too few, but worse yet only 10 out of the 166 municipal water departments were represented. In the state electrical association, whose membership probably comprises practically all the local private companies, there were four departments and five individuals representing municipal works.

Continual violation of commission regulations has required repeated inspections to hold up the service standards established. The troubles were usually excess voltage or gas pressure, low heat value of gas, failure to test customers' meters, and unsatisfactory reports. (No standards were then imposed on water-works.) In all of these ways the private companies were the lesser offenders and showed a more stable management. At one municipal electric plant the engine broke down and lighting was entirely discontinued. An inspector arrived on the scene, hunted up a traction engine, connected it to the generator and restored the service. The water department of a large city was found to be pumping raw river water into its mains. The commission on investigation found vacant land near-by from which a good well supply could be developed. The city was required to develop the project, install pumping machinery and safeguard its customers.

All this evidence points to the great need for adequate means of holding the municipal utilities to the same standards of service which it is reasonable to demand of the private concerns. Could a multitude of little local regulating commissions have coped with the situation successfully? In each case of inferior service an experienced board with a staff of well-trained engineers, accountants and inspectors has been necessary to assist and supervise the weaker utilities. Few of the local municipalities could have afforded such an organization, and without it all effective control would have disappeared. Moreover, attempted regulation of one department by another branch of the same municipal government would have usually produced no benefit. "Home rule" pushed to such an extreme as advocated by the opponents of state-utility regulation means no rule at all.

The remarkable progress of violet-ray water disinfection in the United States is shown by the article published on page 634 of this issue. All of the plants thus far installed are small, and many if not most appear to have been built with little regard to cost, the process being an alluring one from various points of view. The ultra-violet ray seems to be far outdistancing ozone as a means of water disinfection. Neither method has yet made much progress as a means of disinfecting municipal water-supplies, and neither is likely to overtake chlorination in popularity and cost efficiency for years to come, if ever. The company developing ultra-violet apparatus, however, is quietly working upon the problems of large-scale disinfection though it is not actively seeking municipal business at the present time.

The blowing up of the sewage-pumping station at Batavia, N. Y., on Sept. 17 adds another to the growing list of explosions which seem to be due to either gasoline or illuminating gas that has accumulated in sewers and wrecked either these or structures connected with them. The cause of these explosions should be given more study than it has yet received, and far more attention should be given to the detection and prevention of such dangers. One of the simplest of precautionary measures is never to carry an unprotected light or strike

a match in a sewer, tank or pump-well where there is the least likelihood that explosive gases may have accumulated.

Now that a letter-ballot vote of 2,024 to 592 has given the Board of Direction of the American Society of Civil Engineers a free hand to favor or oppose legislative bills for the licensing of engineers, it will be interesting to see what it will do when the next opportunity arises.

"Drink at your own risk"—meaning water, of course—is the rule of law laid down by the learned judge of Pickaway County, Ohio. More specifically: A water company need exercise only "reasonable care" to see that its supply is not infected, but a water consumer must use extraordinary care to guard against danger of infection provided the danger has become the subject of "common talk." Some details of the lawsuit in which this rule was announced are given elsewhere in this issue (page 631). Perhaps the evidence in this case warranted no other conclusion in a suit for damages, but it seems to show clearly that here was another typhoid outbreak due to a defective check valve between a polluted mill supply and the water-supply of a city.

All "topsy-turvy" would describe most city plans in America. This is no wonder, since with very few exceptions they "just growed." How difficult it is to make good this lack of planning, even in areas still largely undeveloped, and how much may be accomplished when a determined attempt is made, are shown by the first of two articles on city planning in Queens Borough, on pages 638-41 of this issue. One of the lessons of the article now printed is the need and value of a good topographical survey for any thoroughgoing city-planning task.

Letters to the Editor

Why Railway Engineers Often Fail in Highway Work

Sir—In the article headed "Give the Experienced Engineer a Chance in Highway Work" in *Engineering News* of Aug. 19, Mr. Mielly falls into the common error of assuming that highway and railroad engineering are the same thing. It is true that there is much similarity, but it is more a similarity of form than of substance. Take the question of grades. For a reasonable distance a horse is capable of exerting a pull twice or three times as great as his normal tractive power, and for this reason, within reasonable limits, one maximum grade on a highway does not of necessity limit the loads that may be drawn over it. For illustration, a series of long 3% grades may have more influence on traffic than one 5% grade. In other words, highway grades and railroad grades are two entirely different propositions. In the latter case, one maximum grade will limit the length of trains on an entire division; in the former case, a corresponding statement would in all probability not be the truth.

There is no question but that an engineer who has had several years of experience on railroad construction would be a valuable man on highway construction if he would adapt himself to the change in conditions and requirements. But that is just the rub. As a general rule he cannot or will not do so. I served my time on a railroad-engineering corps, and am quite free to admit that I received as much benefit from the experience as the railroads I worked for did from my services; but I could not help noticing that the rank and file of the men in the corps, who had been in railroad work for from ten to twenty years, were in a hopeless rut. They were excellent cogs in a powerful and efficient machine, but apart from that or a similar machine their value was certainly open to question.

This may explain why recent graduates, willing and able to learn, may be preferred to old hands who have forgotten how to adapt themselves to changed conditions. Again, a young man, fresh from school, is much more apt to exert himself in a position that pays $75 a month than an older man, who is likely to resent instructions and to think himself above the job. Blunders due to pigheadedness are usually much more expensive than those due to inexperience, and whereas the latter fault can be corrected, the former rarely yields to treatment.

B. K. Coghlan,
Associate Professor of Highway Engineering.
College Station, Tex., Aug. 27, 1915.

NOTES AND QUERIES

Concrete Ties—A correspondent inquires as to the reasons why concrete ties have not been a practical success. One of the main troubles is the disintegration of the concrete caused by vibration and pounding under traffic. Some of them have cracked and fractured. The weight, the cost, and the necessity (in most cases) of special fastenings are other unfavorable factors. Some ties have given good service, however. Concrete ties of various designs have been proposed, and several of these have been tried in the track, but only in small numbers, so that the aggregate number of such ties is very limited.

Relative Size of Engineering Societies—Referring to the footnote on p. 569 of "Engineering News" of Sept. 16, 1915, Edw. C. Sherman, of Boston, remarks that the Boston Society of Civil Engineers, which had a membership of 962 in June and has since admitted some new members, should have been given as ranking next in size to the Western Society of Engineers. Mr. Sherman also states further that it seems probable that by "Associated Engineering Society" was meant the Association of Engineering Societies, and calls attention to the fact that this association is really composed of various local engineering societies banded together for the sole purpose of publishing their proceedings jointly, so that it ought not to be compared with any single engineering society of equal size.

International Engineering Congress Opens

EDITORIAL CORRESPONDENCE

An audience of nearly a thousand assembled in the Civic Auditorium, San Francisco, at the opening session of the International Engineering Congress on Monday, Sept. 20. A large proportion of those present were men who have gained distinction in the engineering profession; and while the Pacific Coast was most largely represented, engineers were there from all parts of the United States. Seldom has a more notable gathering of eminent American engineers been assembled in this country. If the large attendance of engineers of other nations, expected when the congress was planned, was lacking, the number of American engineers present was a reward for the energy and courage of those who have labored for the success of the congress, and who persevered when the undertaking seemed most doubtful a year ago.

"This is the moment to which we have been looking forward for four years," said Dr. William F. Durand, Chairman of the Committee of Management, in calling the assembly to order. Continuing, he outlined the story of the origin of the congress, which grew out of plans made by a few members of the engineering societies of San Francisco and other Pacific Coast cities. Eight of these societies joined in planning for the event, and soon afterward the five national societies of civil, mechanical, mining, electrical and marine engineers gave to the enterprise their support, moral and financial. The joint committee representing all these societies has been at work for nearly three years and has received in time for advance publication 200 papers, while 30 more are in hand. The eleven volumes in which the proceedings of the congress will be published will contain over 7,000 pages.

Doctor Durand then presented the Honorary President of the congress, Gen. George W. Goethals, who received a remarkable ovation. After speeches of welcome by Mayor Rolph of San Francisco, and Charles C. Moore, President of the Panama-Pacific Exposition, General Goethals gave an informal address on the history of the Panama Canal enterprise, with reference not to its technical features, but to award credit to those prominently connected with it in a responsible capacity. He began with the building of the Panama Railroad in the early 50's by George M. Totten as Chief Engineer. The difficulties encountered in building that comparatively small work at that early day were quite comparable with those that have been met and overcome by the canal engineers.

Coming down to the attempt of a French company to build the canal, General Goethals said the engineering work done both by the first French company and its successor deserved nothing but praise. The failure at that time was due to maladministration by the promoters and directors rather than to the engineers.

The war with Spain in 1898 had a large influence in furthering the undertaking of the canal by the United States, not only because the run of the battleship "Oregon" around the Horn demonstrated to the public the military need of the canal, but also because in connection with the sanitation of Cuba, the cause of yellow fever and the methods necessary for its prevention were discovered. Under direction of Colonel Gorgas, who had done notable work in Cuba, the Isthmus was transformed from a pesthole to a reasonably healthy locality.

The short-lived commission originally appointed to build the canal deserves credit for obtaining, through General Davis, control of the terminals, which, under the original concession from Panama, were outside the Canal Zone. John F. Wallace, Chief Engineer under this commission, inaugurated the work of building houses and recruiting labor for the work, and he purchased the equipment that was used in construction.

To John F. Stevens, who succeeded Mr. Wallace, and his associate, Mr. Bierd, was due the rebuilding of the Panama R.R. to make it an effective tool for construction and also the accomplishment of a vast amount of preliminary work so that when the so-called Army Commission took charge, the excavation had almost reached the million-yards-a-month volume.

The basis of the reorganization effected in 1908 was that there should be one responsible head in charge of every task from the top to the bottom, so that there was never any question as to who was accountable for failure or deserved credit for accomplishment. To Col. H. F. Hodges and Civil Engineer H. H. Rousseau of the Navy General Goethals gave high praise for their loyal support and effective aid. They had been, he said, his right and left bowers.

In order to create active competition in carrying on the work efficiently he placed the Atlantic Division in charge of army engineers under Col. Wm. L. Sibert, while the Pacific Division was under S. B. Williamson and a staff of civilian engineers. General Goethals said the canal force was the finest construction organization that ever existed until the water was turned into the canal, when the desire to continue on the Government payroll became the controlling motive.

Some have claimed that the locks of the canal, 110 ft. in width and 1,000 ft. in length, had not been designed large enough for future naval vessels. If that is so the responsibility belongs to the Navy and not to the canal engineers, for before the locks were built an official board of the Navy reported the dimensions that they deemed ample for future ships and those dimensions were adopted.

In planning the organization for the operation of the canal some had claimed that the office of chief engineer should have been created under the governor. General Goethals, howver, thought that with the Zone depopulated, a governor would have little to do and probably would be a political appointee who would be constantly interfering with the chief engineer's work. He thought it far better, therefore, to give the governor entire responsibility and hoped that an engineer would always be in control of the Canal.

General Goethals then introduced the only one of the nineteen honorary vice-presidents of the congress from foreign countries who was present, Major J. L. De Pulligny, of France, who has been in charge of road maintenance for the French army over a large section of the western battle front, and who was given a two months' leave of absence by the French Government to attend the congress. Major Pulligny was for some years in the United States prior to the outbreak of the war, in charge of French engineering students in the United States. His address was notable for its eloquence.

Brief addresses were then made by delegates to the congress from Canada, Cuba, China, Guatemala, Japan, Holland, Nicaragua, Spain, Sweden and Switzerland.

In the afternoon the congress again assembled in a general session to hear half a dozen papers on the Panama Canal. Major Pulligny presided at this session. The opening paper by General Goethals reviewed the history of the canal enterprise in much more detail than in his formal address at the morning session. Space may be taken here only for the interesting fact that while the revised estimate of cost of the canal made in December, 1907, was $375,201,500, the total cost of the canal to date, including the $50,000,000 paid to Panama and to the French company and the amounts spent on fortifications, is less than $333,000,000. The remaining papers at this session were by Dr. Emory R. Johnson, on "Commercial and Trade Aspects of the Canal"; Maj. R. E. Wood, on "The Working Force of the Canal"; Maj. F. C. Boggs, on "The Purchase of Supplies"; D. F. MacDonald on "Canal Zone Geology," and F. D. Willson, "Climatology and Hydrology of the Canal."

In the evening a reception was held at the Palace Hotel for all the members of the congress and their ladies.

On Tuesday morning began the separate meetings of the eleven sections of the congress devoted to special fields of engineering.

National Engineering Societies Meet in San Francisco

EDITORIAL CORRESPONDENCE

Engineers from all parts of the United States, with representatives of the profession from foreign countries, began a notable series of meetings in San Francisco on Thursday, Sept. 16.

The American Society of Civil Engineers held its annual convention at the Hotel St. Francis on Thursday morning with some 400 in attendance. President Charles D. Marx, of Stanford University, delivered the annual address, taking as his subject, "Idealism and the Engineer." He urged that the engineer is as truly an idealist as the artist or the poet. Every engineering work must exist in the imagination of some engineer before it can assume physical form. Whoever does his duty at personal risk in a useful work is a hero as truly as those who risk their lives in warfare.

Professor Marx alluded to the fact that the head of the Belgium Relief Commission, Herbert C. Hoover—of whom prominent Belgians have said, "Hoover is the hope of Belgium"—is a member of the Society. Taking illustrations from many different departments of engineering, Professor Marx showed how great works effecting most public benefits were being performed by engineers.

At a brief business meeting following, Secretary Hunt announced that the ballot for the place of holding the summer convention of 1916 had resulted in 118 votes in favor of Pittsburgh, 51 for Boston and 48 for Washington, with many scattering.

The board of direction had recommended that the Society by letter ballot should rescind its action taken some years ago opposing legislation for the licensing of engineers. The result of the ballot showed 2,024 votes to rescind the former action and 592 against rescinding. This vote leaves the board free to act on this matter according to its best judgment.

On Thursday evening a dinner was given by the San Francisco members of the Society to the visiting members.

On Friday afternoon many of the members of the Society and their guests went to Del Monte, where a golf tournament was arranged for the following day and an automobile tour from Santa Cruz to the Big Basin and San José on Sunday.

The American Society of Mechanical Engineers held sessions on Thursday morning and on Friday morning. At the first of these the engineering features of the Panama-Pacific Exposition were reviewed in papers by Guy F. Bayley, Chief Mechanical Engineer of the Exposition, and George W. Dickie, vice-president of the Society. Following this session the visiting members were entertained at luncheon on the exposition grounds.

At the session on Friday morning papers on the heavy-oil engine and the Diesel engine were presented by A. H. Goldingham, Engineer of the De La Vergne Refrigerating Co., of New York, and Prof. W. H. Adams, of Throop Polytechnic Institute, at Pasadena. These papers were discussed by C. R. Weymouth, Chief Engineer of Charles C. Moore & Co., who maintained that under the prevailing conditions of cheap fuel in the United States there were very few places where the Diesel engine could show a commercial success. He stated that the total capacity of Diesel engines now in use in the United States, after a dozen years of attempted exploitation, is only about 100,000 hp., while in steam turbines, single units of 50,000 hp. are already talked of.

A notable social event on Friday was a luncheon given in honor of the president of the Society, Dr. John A. Brashear, by Charles C. Moore, president of the Panama-Pacific Exposition. The invited guests included members of the Society's council and other noted engineers. Dr. Brashear has been named by Governor Brumbaugh of Pennsylvania as the most distinguished citizen of that state, and Wednesday, Sept. 22, was celebrated at the exposition as Brashear Day in his honor.

The American Institute of Electrical Engineers, at a special convention, distinguished itself by dealing with a long list of technical papers, 26 in number, and holding sessions both morning and afternoon on Thursday and Friday. Two and three parallel sessions were held to discuss simultaneously such special subjects as electric transmission, valuation of public utilities and wireless telegraphy. Joint sessions were held with the American Institute of Radio Engineers. The principal social event was a dinner-dance on Thursday evening.

A Pan-American Road Congress, consisting of a joint convention of the American Highway Association and the American Road Builders' Association, was held at Oakland, Sept. 13 to 17. Some 27 papers on various phases of highway construction and maintenance were scheduled for presentation. Considerable interest was aroused in the convention by the proposal brought forward by the Pacific Coast delegates that the Federal Government should construct a national highway along the Pacific Coast from British Columbia to Mexico. After discussion the project was approved in modified form as follows:

> Resolved, That the Pan-American Road Congress recommends to the Congress of the United States the advisability of investigating the necessity of building a hard-surfaced highway along the Pacific Coast from Canada to Mexico, and other national highways to be used for military and commercial purposes.

The pacificists and militarists had it out on the insertion of the words "military" in this resolution, with the result shown.

Subway Timbering Accidents; Two New York Streets Fall

Blast Starts Collapse on Seventh Ave. Line

More than a block's length of New York street surface, with a fully loaded street car and several wagons, dropped into the subway excavation underneath on Wednesday, Sept. 22, 1915. The collapse was the indirect result of a regular blast in the bench at the north face of the excavation. It is not only the worst construction accident in the history of the new subway work in New York City, but it has also made the people and the officials of the city suspicious about the safety of all the many miles of timber-supported street surface over subway construction work.

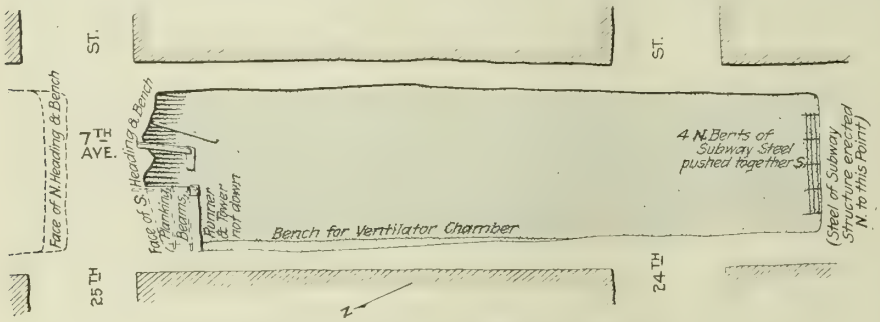


FIG. 1. SKETCH PLAN OF SEVENTH AVE. COLLAPSE

The accident is unexplained. Its origin—a local failure or knocking-down of timbers by flying rock or other effects of the blast—is readily understood. But no explanation has been given by the parties involved of the extension of collapse backward along the completed timbering—presumably secure and solid—for a distance of at least 300 ft., or about 30 bents. Suggestions have been made that some general cause, as a gasoline-vapor explosion set off by the blast, brought about the wreck; these suggestions are only hypothetical, as no facts have been learned to support them.

Subway work in Seventh Ave. extends south from 42nd St. to a connection with a pair of tunnels under the East River at Old Slip. All but the extreme southerly part is four-track structure with all tracks on the same level. The structure is generally as near the surface as the pipe and sewer systems permit.

The collapse occurred in the section from 16th to 30th St., which is being built by the United States Realty and Improvement Co. as contractor. The south end of this section is in sand for the full depth, while the north half is in all rock (schist). The same working system is employed in both parts, with only minor differences. As in all the subway work now going on in the city, the excavation is done underground, after replacing the pavement by planking laid on joists and beams. These beams are underpinned by girders and posts as the subsurface digging proceeds.

On Sept. 22 the excavation and timbering of the section were so far advanced that only 50 ft. of ground was left between the main south heading, which had reached the south line of 25th St., and the north heading, which had crossed the north line of 25th St. Advance work in the north heading had been shut down, and back of it most of the permanent subway steelwork (columns and roof beams) had been erected. In the south heading the steel erection had extended to a point between 23rd and 24th St., while from here north to the face of the bench the footings for the permanent steel were being prepared.

A blasting gang came on duty in the south heading shortly before 8 a.m., Sept. 22, to shoot the holes in the

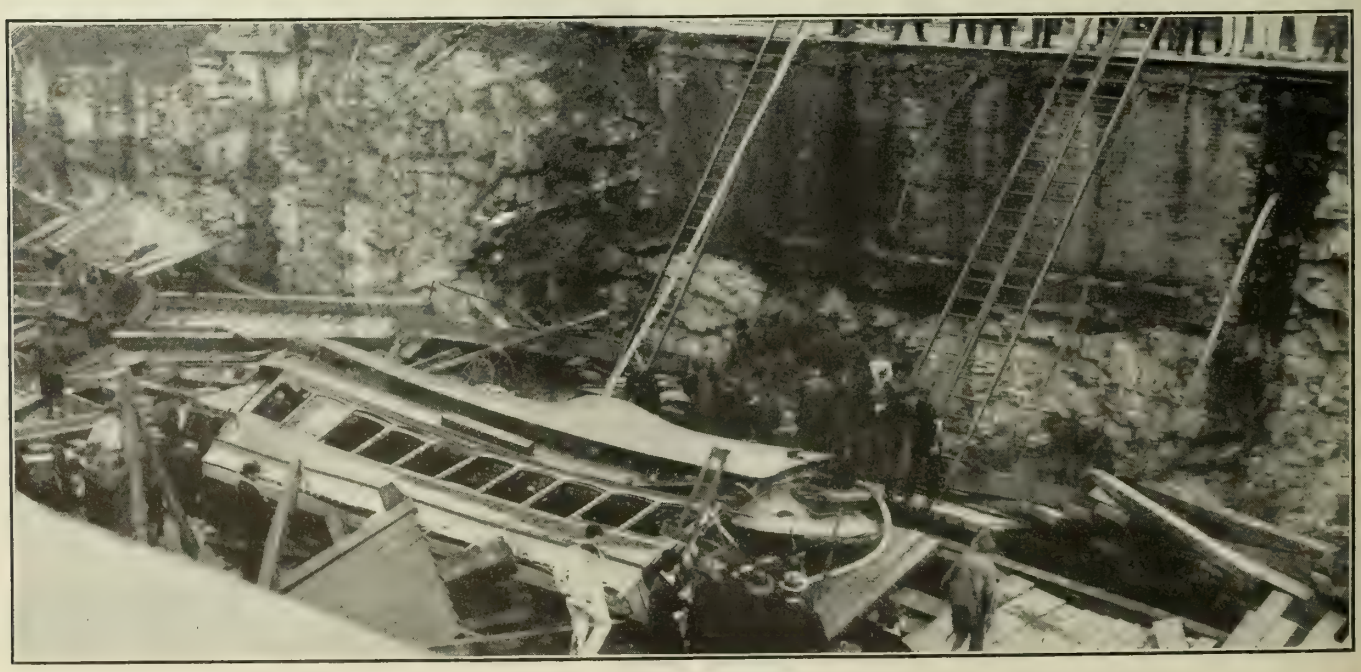
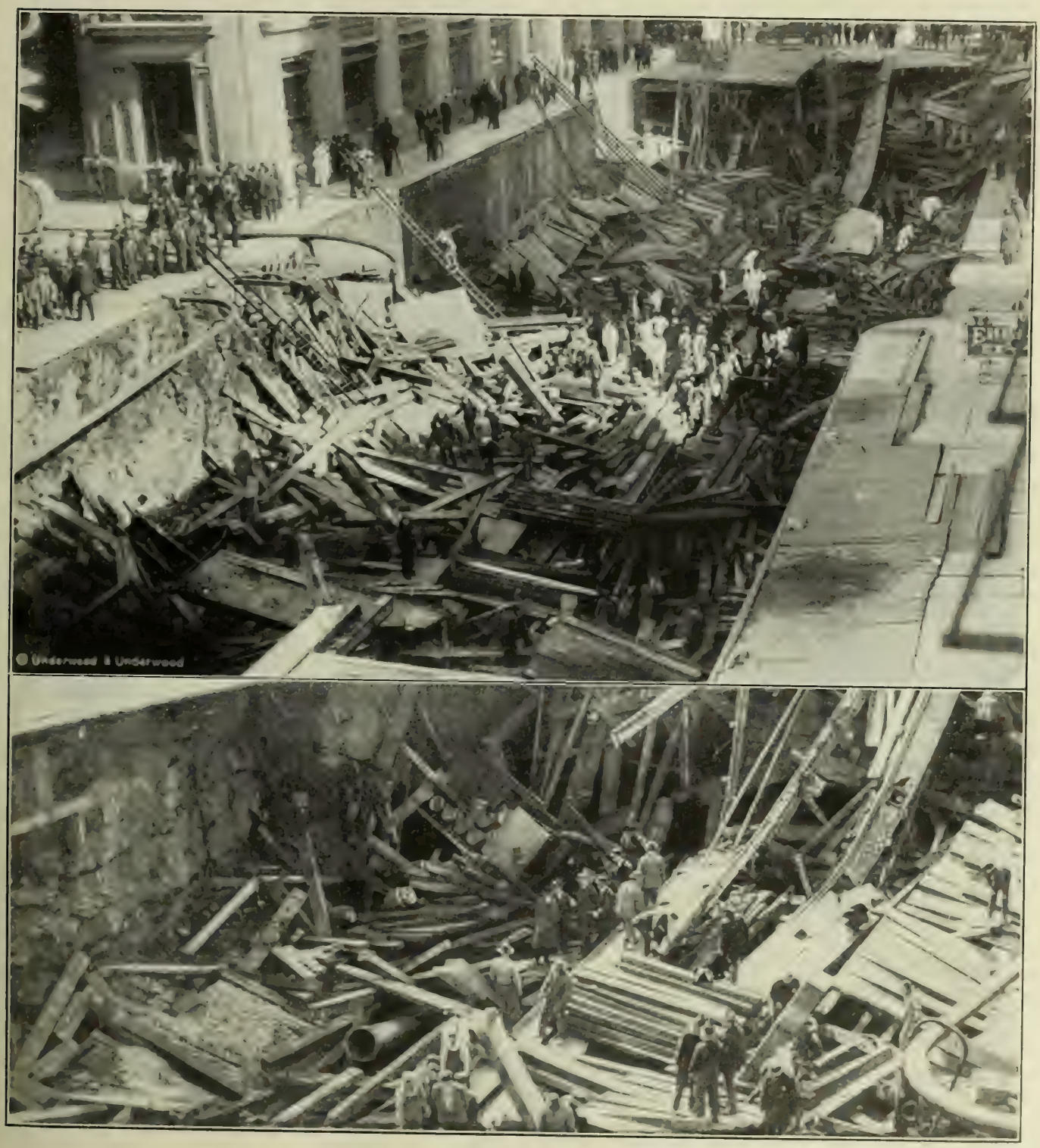


FIG. 2. LOOKING SOUTHWESTERLY INTO THE EXCAVATION AT THE COLLAPSE

east half of the bench—east and west halves being worked separately. One blast, possibly two, were shot, and then at once the whole street roadway came down, over the full width of the cut, and back more than a block, to the point where the permanent steelwork was in place (see sketch, Fig. 1). A loaded northbound street car, which was held by a flagman halfway between 24th and 25th St., fell to the bottom with the tracks, and two wagons also went down. Eight dead were later taken out of the car.

The wreck showed the roadway planking lying in fairly regular arrangement on top of the pile in the cut (see view, Figs. 3 and 4). It seems to have fallen straight down. The supporting timbers and I-beams were not so regular in position; such of them as could be identified as to original location indicated a movement south. The four or five northerly bents of permanent steel, at the south end of the collapse, were crowded together and leaning south.



FIGS. 3 AND 4. HOLE IN SEVENTH AVE., NEW YORK, AFTER COLLAPSE OF TIMBERING IN SUBWAY EXCAVATION

Upper view looking north, shows point of initial failure at right. Lower view looking at south end of collapse, where the street timbering was carried on permanent subway steelwork.

The timber used in the United States Realty section is shown in Fig. 5. The beams under the street planking and car tracks are carried by one 12x16-in. longitudinal stringer on either side of a central aisle. Bents of 6 to 8 posts, spaced 10 ft. apart along the work, support the stringers and also directly the roadway beams. These posts in turn foot on transverse 24-in. 80-lb. I-beams, one 25-ft. length on either side, set 12 to 15 ft. above the floor of the excavation. Four 12x12-in. posts, two under each I-beam, carry the load of the entire bent.

For bracing, the I-beams are strutted longitudinally by 4x8-in. or 8x8-in. spreaders wedged between their webs. Two or three such spreaders are used on either side of the central aisle. Also, the upper tier of posts is set on 4x12-in. or 6x12-in. foot-planks dapped over the top flanges of the I-beams in alternate bays between bents. Longitudinal spacer planks under the roadway beams also act as struts.

Transversely, the two I-beams of each bent are spread and tied by a pair of 12-in. 20½-lb. channels spanning the middle aisle and bolted to the I-beam webs. There are other spreaders, and at many places transverse diagonal bracing in the upper tier of posts, as indicated in Fig. 5. The outer posts are blocked against the side walls of the cut.

There is no longitudinal diagonal bracing in either upper or lower tier of posts.

At the forward end or bench, the timbering is bridged over to the top of bench by four longitudinal flying girders or "runner beams," two on either side, which extend from a support on the bench backward over at least three bents, and rest on independent framed towers at their back ends. These runner beams are 30-in. 200-lb. wide-flange I-beams, 42 ft. long. They carry the forward two bents (nearest the bench, where posts cannot be set, or if set might be displaced by blasting) by hanger bolts holding up the 24-in. I's of the bents. As bench excavation proceeds, the runner beams are set forward in 10-ft. steps, and their rear towers are moved in 20-ft. steps.

Conditions at the bench of the south heading at 25th St. are these: The west bench system is undisturbed, the runner beam and its tower (only one beam was used in the west half of this point) being still in place holding up the street planking; just back of the runner-beam section, however, everything is down. In the east half, not only is all the timbering down, but both runner beams are down, leaning up against the bench with their forward ends nearly at its top; both towers also are down, but the inner one of the two is lying on the floor of the pit, overturned and crushed flat, not far out of place. Fig. 1 sketches the conditions roughly.

The difference between the east and west bench conditions proves that the east runner beams or their towers were displaced or wrecked in the very origin of the collapse. Had the collapse started behind them the posted timbering should have pulled clear and left the bench section standing as in the west half. The collapse of the timbering southward of the bench section was apparently a southward tipping or buckling of the post system, possibly started by a heavy blow delivered against the front end of the timbering near the level of the 24-in. I-beams.

As a precautionary measure since the collapse, longitudinal diagonals have been spiked or bolted to the lower posts at intervals in the remaining timbering of this contract section.

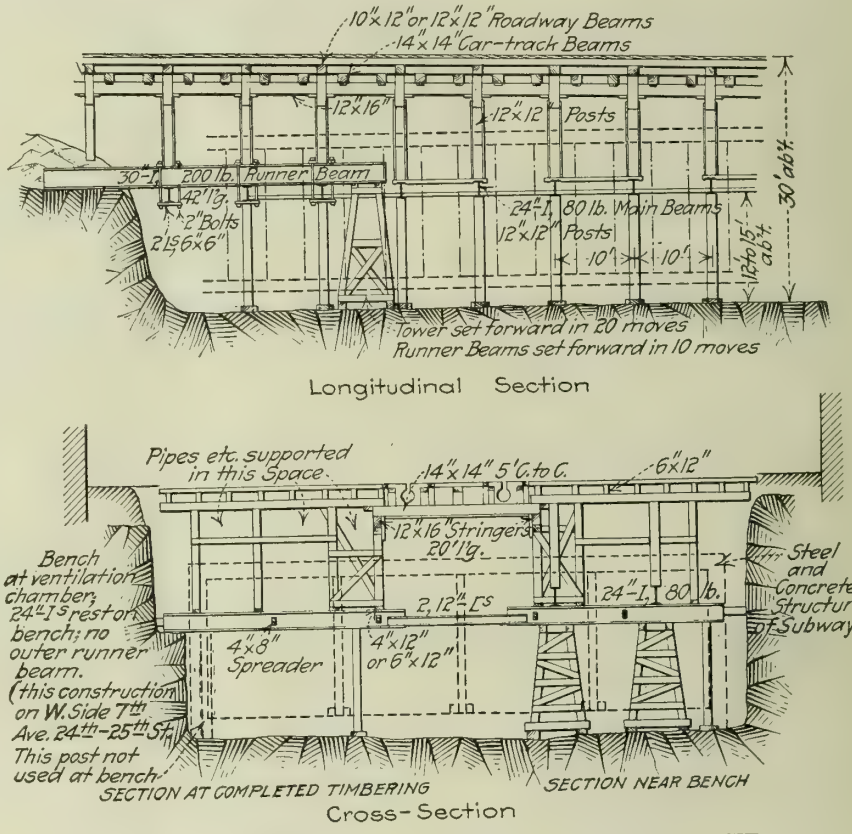


FIG. 5. ARRANGEMENT OF TIMBERING IN SEVENTH AVE.

The working system involves the use of transverse I-beams suspended from flying girders or runner beams near the face of the bench and carried on posts farther back

Investigations of the accident have been started by the coroner, the contractors, the Public Service Commission, the Mayor and other authorities.

Second Fall Due to Rock Slide in Broadway Excavation

Only three days after the Seventh Ave. accident described in the preceding article, a second collapse of subway timbering occurred in the work of the same contractor, but on another contract section. About 7 p.m., Saturday, Sept. 25, the timbering under Broadway near 38th St. was wrecked by a rock slide. Partly crushing and partly dislocating the system of posts and brace-struts, the slide dropped the roadway planking of half the street width for a length of 70 ft. into the pit. The planking of the east half, together with the two car tracks, remained hanging across the wrecked section by the suspension action of the track rails. One vehicle fell with the street planking, causing one death.

The point of collapse is directly in front of a theater, and four or five other theaters are within a radius of 300 ft. Had the collapse occurred half an hour later, therefore, the results would have been more serious.

The work at this point is part of the new Broadway-59th St. subway line to be operated by the New York Consolidated Railroad Co. (Brooklyn system). The section from near 32nd to 39th St. is being constructed by the United States Realty and Improvement Co. The structure is to be one-level four-track subway, with floor about 35 ft. below street. Rock is within 5 to 6 ft. of the surface; it is Manhattan schist, whose strata here stand nearly on edge. As indicated by the elevation of the bench face in Fig. 7, the dip is to the west. On the east side of the cut (right side in Fig. 7) the rock slopes so as to slide into the cut, and here some of the slabs have been doweled in place by steel rods grouted in holes. On the west side the blasting produces an irregular side face, with sheets of rock standing up partly undercut. Jointing planes slope down inward toward the cut.



FIG. 6. BROADWAY TIMBERING WRECKED BY ROCK SLIDE ON WEST SIDE OF CUT

The slide (Fig. 7) was a slip along such jointing planes of the rock of the west face. The appearance of the break shows this clearly (see Fig. 7 and view, Fig. 6). What disturbance started the slip could not be learned. According to the best evidence at hand up to now, no one suspected the seamy, dangerous nature of the rock at this point. The slip was about 12 ft. in thickness at its maximum, measured out from the original side of the cut.

The timbering of the Broadway excavation (Fig. 8) is closely similar to that used on the Seventh Ave. section of the same contractor (see Fig. 5, in preceding article). The main beams, however, are set above the permanent subway structure, and thus are located just beneath the piping under the street; the posts under them are strutted by two lines of longitudinal and transverse timbers. There are four posts in each bent, two under the 12x16 main stringers and two at the walls. Bents are spaced 10 ft. The outer posts, as observed in the standing work just south of the collapse, are blocked against the sides of the cut, both to hold the rock and to stiffen the timbering; this blocking varies from post to post. However, in the collapsed section the east face of the cut slopes inward on what appears to be a stratification surface, in a way to give little opportunity for effective lateral blocking.

The extent of the collapse is indicated in Fig. 7. Seven bents just south of the face of bench are totally destroyed. Three others are partly destroyed and partly distorted by having the tops of the posts pushed over eastward. South of this the timbering is in place and plumb, and there is no indication that the collapse transmitted any injurious action to it. Nevertheless, the posts in the undamaged portion were braced longitudinally by heavy tim-

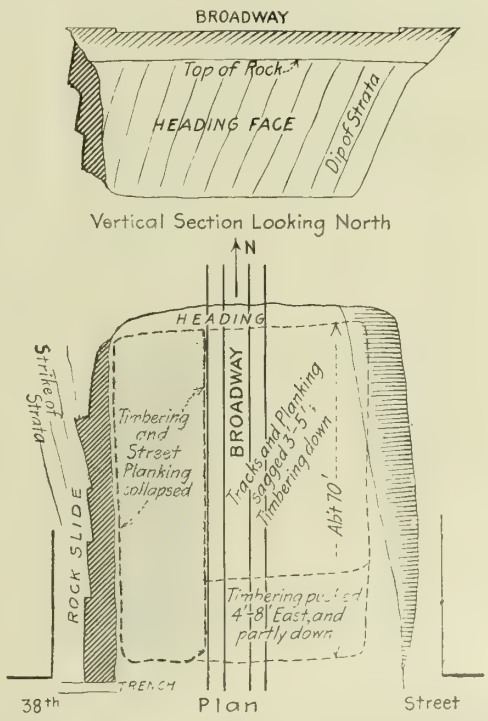


FIG. 7. SKETCHES SHOWING LOCATION OF ROCK SLIDE AND RESULTING COLLAPSE OF STREET SUPPORTS

ber diagonals immediately after the collapse, as extra assurance of security.

Where the collapse occurred the bench of the excavation had advanced to within 100 ft. of the north end of the United States Realty contract section. The adjoining section had not yet been attacked in the immediate neighborhood, so that there has been no opportunity to develop the rock structure just north of the region of the slide.

The police department stopped traffic on many of the most important thoroughfares of the city. Seventh Ave. was closed from 31st St. south. Broadway was closed from 26th St. to 39th St. to all except street cars, and from 33rd St. to 39th St. to all traffic. Crossings were closed along Broadway at 8th, 14th, 23rd, and at all crossings from 28th to 39th Sts. On Seventh Ave. the crossings of 14th, 23rd and 34th Sts. were closed, as were also the crossings of Sixth Ave. and 34th St., W. 10th and W. 4th Sts., and Christopher and Varick Sts.

This procedure stopped through traffic on the 8th, 14th, 22nd, 29th and 34th St. crosstown lines, as well as on

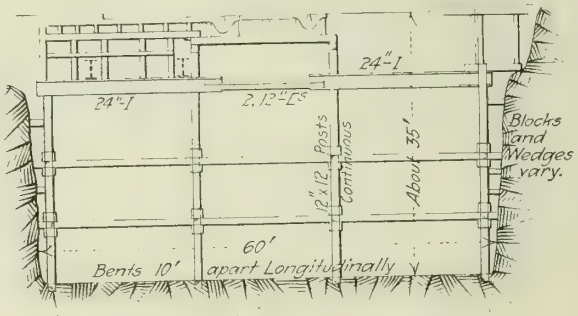


FIG. 8. TIMBERING SYSTEM USED ON BROADWAY

Arrangement similar to that used on Seventh Ave. (Fig. 5), but with main beams above subway structure and close to street surface; two sets of struts between posts

Broadway and on Sixth Ave. and Seventh Ave. This interference necessitated the operation of an improvised system of shuttle lines.

These rigorous measures were adopted by order of Police Commissioner Woods, following a resolution adopted by the Public Service Commission at its meeting on Sunday morning. The resolution was introduced by Commissioner Hayward, and recommended that all traffic on decked-over streets (except street cars) where the street supports were not of steel should be prohibited. Commissioner J. S. Cram offered an amendment to the effect that all heavy traffic be prohibited on Broadway.

This meeting was attended by all the members of the commission, its chief engineer Alfred Craven, Mayor J. P. Mitchell, and M. H. Smith, Chief Engineer of the Department of Water Supply, Gas and Electricity.

The city authorities from mayor down to Public Service Commission became enough aroused over the Broadway collapse that they appointed several experts and investigation boards.

The mayor's committee of engineers consists of the following members of the city's engineering forces: Nelson P. Lewis, chairman, E. P. Goodrich, J. W. F. Bennett, George W. Tillson, Eugene W. Stern, Merritt H. Smith, Amos L. Shaeffer, Edwin J. Fort, John R. Healy, Benjamin Welton, Francis Ferry, and R. W. Creuzbaur. For the Public Service Commission, investigations by its engineering staff will be supplemented by the services of Henry H. Quimby, Chief Engineer of the Philadelphia subways, Edmund S. Davis, Chief Engineer of the Boston subways, and J. H. Hammond, Jr.

The inquiries being conducted by the coroner and the district attorney are assisted by H. de B. Parsons as expert.

Danger of Collapse in Subways Is Not General

By Fred Lavis*

The two accidents on the new subways in New York City, occurring so close together both in time and location and resulting in the collapse of the roadway supported over the subway excavations, have, perhaps naturally, caused some apprehension in the minds of the responsible officials as to the general security of the comparatively large amount of street surface of this character now in existence. The writer made a very careful examination of all the work in progress a little over a year ago and was at that time impressed by the care exercised and the precautions being taken to avoid accidents of this kind.

It was recognized on all this work that owing to the greatly varied character of the so-called "New York rock" (the mica schist that underlies the whole city) it was impossible to predict with certainty what the results of every blast would be, and precautions were therefore taken to provide against complete collapse of the decking, even though one or even several supports were displaced either by rock thrown out by blasting or by slipping or sliding of the rock mass.

The extremely unstable character of the New York rock has always been realized, but even among the most competent of those who have had to handle it, it has not always been possible to entirely prevent trouble, as the series of disasters in 1902 in the Park Avenue tunnel of the original subway testifies.

In view of these conditions, therefore, it seems advisable to mention here briefly some of the general principles and methods adopted on the work referred to, which was described in some detail by the writer in a series of articles in *Engineering News* during the second half of 1914. This may tend to allay the fear that the conditions that have caused these last two accidents are general or that there is cause for general alarm over the situation.

Article VII of the series referred to describes the methods of timbering (*Engineering News*, Nov. 26, 1914, p. 1068), and the references herein to the figure numbers are to those of that article. At the outset it may be noted that, speaking generally, all the excavation below, say, 14th St. is in earth and above that point almost all in rock. Little danger from blasting or from sliding rock is to be expected, therefore, on the downtown sections.

At the time of the writer's examination of the construction work, and in conversations with both the engineers of the Public Service Commission and of the contractors, he was impressed by the evident realization on their part of the necessity of continuous support and the need of adequate bracing in all directions, as is shown by the following quotation from the article referred to, where it is noted that the design of the timbering in all cases not only provided for a clear working space, but was designed to

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"guard against disaster by the loosening or destruction of one or more supports by the blasting operations or by slides in the very unstable New York rock."

Taking up the references in order, it will be noted that in the fully timbered section of the usual ranger and cross-braced type (illustrated in Fig. 35 of the article cited) "tension rods were used throughout to hold up the bottom braces, and carefully placed *additional horizontal cross-bracing* was carried diagonally from the center at each of the shafts back through several bents to the sides." The vertical diagonals are shown in the photographs.

On Lexington Ave., "after some trouble with slipping and sliding rock, continuous girders were erected on the sidewalk line, spanning the section in which excavation was being carried on, and from which the street decking was hung as well as being supported from the bottom." (Figs. 36 and 41.)

Through the deep cutting for the 125th St. Station, a system of six pairs of 20-in. I-beams was used, three pairs under each track of the street railway. One pair under each track—that is four in all of these I-beams—was continuous throughout the length of the work, the joints being spliced to develop full strength; a second pair under each track—that is, another four beams—was 120 ft. long (with fully spliced joints) and they, as well as four more 80 ft. long, spanned the working space and were moved ahead as the work progressed, but they were all supported at more than one point. Unusual care was taken in all this work to splice all joints and to nail cleats at all connections. This made it somewhat more difficult to take the timber apart when it was necessary to remove it and of course damaged it more, but the structure was well framed and fastened together.

Figs. 37 and 42 show the vertical diagonals, or so-called "arch bracing" used on the section under Church St. and on Sec. 3—lower Broadway.

Fig. 40 shows a Lexington-Ave. section which was quite deep and where the rock was bad in many places. Here three pairs of I-beams spliced to develop full strength were placed immediately under the decking, one pair between the track and one pair on either side. There are three more pairs further down, and the whole structure is tied together. The vertical diagonals just below the deck form an arched support, the rakers at the side forming desirable supports, but arranged in such a way that the entire removal of even two or three at a time would not cause a collapse of the structure. Fig. 51 of the succeeding article (*Engineering News*, Dec. 3, 1914, p. 1108) shows a typical rock slide on Lexington Ave.

These references, it is believed, are sufficient to show that the difficulties and dangers of this work have been realized and at least on much of it fully provided for.

News of the Engineering World

Another Septic-Tank Decision

Another stage in the seemingly endless litigation over the Cameron septic patent in the United States has been reached by the denial of a plea entered by the defendant in one of the suits. (Cameron Septic Tank Co., complainant, vs. City of Winchester, defendant, United States District Court, Eastern District of Kentucky.) Some time time ago the company brought suit against the city, alleging that the two-story settling, or Imhoff, tank at Winchester, Ky., was an infringement of the Cameron, Commin & Martin United States Patent No. 634,423, of Oct. 3, 1899, process claims Nos. 1, 2, 3, 4, and 21. Proof on the main issue has not been submitted, the defendant pleading that the process claims just named expired in 1909 with the apparatus claims of the Cameron & Commin British patent (for 14 years) No. 21,142 of Nov. 8, 1895.

In a brief filed in May, 1915, the company denied the plea of the city and maintained that the process claims remain in force in the United States for the full 17-year term of the patent, or until Oct. 3, 1916. The United States District Court filed an order on Sept. 15, 1915, sustaining this plea. The order was not accompanied by an opinion. Unless the city appeals, the case will presumably go to trial on the main question of infringement, regarding which no evidence has yet been offered.

It may be added that in the Knoxville, Iowa, case (see *Engineering News*, Jan. 23, 1913, p. 189, and Feb. 6, 1913, p. 275) the United States Supreme Court ruled that Patent No. 634,423 expired in 1909 with the British patent already named, and that while the Cameron Septic Tank Co. maintains that ruling to be of no significance except in the Knoxville case, opposing attorneys have claimed the contrary. (For both contentions, see *Engineering News*, Feb. 6, 1913, as cited.)

Activated-Sludge Progress at Milwaukee, Wis.

Rapid progress with activated sludge as a means of sewage treatment is being made at Milwaukee, Wis. The status of both construction and experimental work is shown in the following statement prepared for *Engineering News* by T. Chalkley Hatton, Chief Engineer Milwaukee Sewerage Commission:

Three tanks of the 2,000,000-gal. unit will be in use by Oct. 1 in order to secure activated sludge for priming the entire unit, which will be completed by the middle of November.

The experimental continuous-flow tank which has been in operation since July (see *Engineering News*, July 15, 1915) has been giving splendid results. The volume of flow through the tank has been gradually increasing and the amount of air required for aeration decreasing, until now (Sept. 24) the sewage is being treated at a cost of about $4 per 1,000,000 gal., and that, too, with a resulting effluent that is stable, clear as tap water and that shows a bacterial reduction of between 95 and 99%.

We have gotten so far along with our experiments in the treatment of the liquor that we have no doubt in our minds of its success both from the sanitary and economical

standpoint, and we are now investigating very earnestly the disposition of the resultant sludge.

We have had this sludge analyzed by two fertilizing manufacturing companies, who have given us its available value based upon the nitrogen and fat content of about $12. We have been assured that there is an ample market for it as rapidly as it can be manufactured, and we are now engaged in making a study of the best apparatus for dewatering, degreasing and drying the sludge, and we think there will be no difficulty in securing proper apparatus for performing this work economically so as to leave a considerable margin of profit in the output.

Wind Wrecks Wireless Tower at Tufts College

By Frank B. Sanborn*

A high wind wrecked a 300-ft. wireless tower under erection by the American Radio and Research Corporation at Tufts College, Mass., on Sept. 26. The top section of the tower had just been put in place, but was not permanently secured when the workmen left the job on Saturday. During Sunday afternoon a 38-mi. wind, as recorded by the Weather Bureau, came up.

The tower, which was like a steel mast 300 ft. high, fell across a main street and the tracks of the Boston & Maine Railroad, Southern Division. (See views, Figs. 1 and 2.) It struck the track in front of an express train, derailing the locomotive but doing no serious damage.

The failure of the tower is attributed to defects in the guys. The top set of wire guys had not been completed; instead of the permanent set which was to be placed at the top, a temporary set of $\frac{5}{16}$-in. wire guys, and heavy manila rope as auxiliary, had been left in place. Furthermore, the guys had not been made-up tight and the tower was observed to sway excessively just before it fell. The guys broke on the windward side, and the tower fell with some evidence of twisting but no signs of buckling.

As shown by Fig. 2, the tower was composed of angle irons (3x3x$\frac{1}{4}$-in.) for posts and horizontal and diagonal braces (2x2x$\frac{3}{16}$-in.). The braces were spaced 4 ft. apart in the vertical and bolted at each end with a $\frac{7}{16}$-in. bolt. In cross-section the tower was 3½x3½ ft. Three sets of guys were to be used, one at 100 ft. above the base, one at 200 and one at 300 ft. Each set contained three ropes placed 120° apart. There were three concrete anchorages about 150 ft. from the base. The lower guys were ⅝-in. diameter, and the upper ones were to be ¾-in.

The tower was designed by J. R. Worcester, Boston, Mass., and the contract for erection was in the hands of the Builders Iron and Steel Co., Cambridge, Mass., but had been sublet by that company.

It is proposed to start erection again at once, making use of about one-third of the original members. A reinforced-concrete base (see Fig. 1) 5½x5½ ft. and 1 ft. thick, remained rigidly attached to the tower, and without cracking it supported the weight of the tower as thrust upon it during the fall.

*Professor of Civil Engineering, Tufts College, Mass.

New Mississippi River Barges with Deck Gantries

A fresh start has been made in developing transportation on the Mississippi River and its tributaries. The Inland Navigation Co., recently organized under the presidency of John H. Bernhard, has begun the construction of 36 self-propelled shallow-draft steel barges. The first one of the fleet is now nearing completion at the Howard Ship Yards Co., Jeffersonville, Ind.

The barge, built under the regulations of the American Bureau of Shipping, is in all respects of steel construction. Transverse bulkheads divide it into five water-tight compartments. The propelling machinery consists of four three-cylinder oil engines of the four-cycle type, each operating one propeller.

The barges are 240 ft. long and 43 ft. wide over all, with mean draft (at 500 tons' load) of about 3½ ft. and full-capacity draft (at 1,600 tons' load) of about 7 ft. The deck is surmounted by a steel waterproof cargo box having removable sectional roof. Over this an electric traveling gantry is arranged to load and unload cargo, and by means of a 70-ft. extension boom to handle it to and from the bank.

There is the necessary auxiliary electric plant for lighting as well as for cooking, and for all power uses, including winches, steering, etc.



VIEWS OF WRECKED WIRELESS TOWER ACROSS RAILROAD TRACK AT TUFTS COLLEGE, MASSACHUSETTS
1. General view. 2. Detailed view at railroad crossing. From photographs by M. S. Munro

It is expected that these boats will prove so economical in operation that if sufficient advantage is taken of the new line by shippers an important increase in present transportation facilities will result.—John M. Sweeney, Monadnock Block, Chicago.

Water-Supply Improvements for Providence, R. I.

Extensive improvements to the water-supply of Providence, R. I., are to be carried out under direction of a water-supply board established at the last session of the Rhode Island legislature as the result of investigations that have been carried on during the past two years.

The present supply of the city is taken from the Pawtuxet River at Pettaconset, about five miles southwest of the city. While the upper reaches of the Pawtuxet River flow through a sparsely populated farming district, the lower portion of the valley is lined with manufacturing towns. The water is now pumped by electric centrifugal pumps onto sand filter beds, and the filtered water from these beds is pumped to a distributing reservoir, requiring a lift of about 180 ft. Additional pumping of this supply is necessary to reach elevated portions of the city. The new source of supply is demanded, not only because of the serious and increasing pollution of the Pawtuxet River at the point where the city takes its supply, but because at low water the river has a flow of only 12,000,000 gal. per day, while the average consumption of Providence is nearly 20,000,000 gal. per day, with a maximum consumption of over 25,000,000. The numerous milldams in the Pawtuxet above the city's intake also greatly interfere with the regularity of the river flow.

A joint special committee on increased water-supply, of which B. Thomas Potter was chairman, investigated a number of possible sources for future supply, with the assistance of Samuel M. Gray and Frederick P. Stearns as consulting engineers. As a result of these investigations, the north branch of the Pawtuxet River was selected as a future source of supply and the special committee was continued as a board to construct the works it recommended.

It is proposed to build a dam about 80 ft. in height and thus create a large storage reservoir. The drainage basin supplying this reservoir is sparsely populated, nearly all the mills in the river being located lower down on the stream at various falls. Water from this reservoir will be delivered by gravity to the distributing reservoirs in Providence, thus eliminating all but high-service pumping. The conduit to be built will be about 8 ft. in diameter, mostly in tunnel.

The legislative act enabling Providence to build the proposed new works contains an interesting requirement for the maintenance of the flow of the Pawtuxet River. During the period while the reservoir is filling, the city must allow 20,000,000 gal. per day to flow down the stream and may store only the water in excess of such a rate of flow. After the city has accumulated 20,000,000,000 gal. of water in its reservoir, it must draw from the reservoir in each month a quantity equivalent to at least 70,000,000 gal. daily, of which such portion as is required may be devoted to municipal use, the remainder to be discharged into the stream below the dam. Additional provisions are inserted requiring the city to forever discharge from its reservoirs sufficient water to maintain a certain rate of flow at specified milldams and manufactories farther down the stream. At one of these it is required that a quantity of not more than 72,000,000 gal. per week must be delivered as the owner of works shall certify from time to time is necessary for his use for manufacturing purposes other than the production of water power. The city may be required to pay damages to the employees of any manufacturing establishment that is condemned under the act by reason of their loss of employment.

The Providence Water-Supply Board has recently appointed Frank E. Winsor as chief engineer and Samuel M. Gray as consulting engineer. The engineering force for the work is now being selected.

C. & A. R.R. Adopts Automatic Mail Exchange

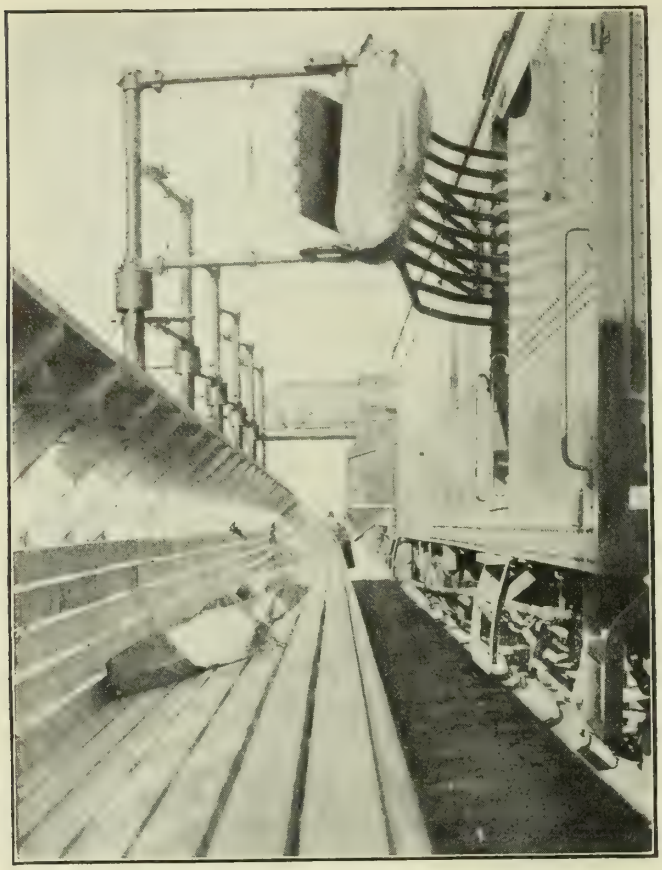
An automatic apparatus for the exchange of mail bags between stations and moving trains has been adopted by the Chicago & Alton R.R. for its line between Chicago and St. Louis. The distance is 284 miles and there are about 35 exchange points.

The station equipment consists of a platform on which are mounted the mail cranes, and beneath which is a trough with floor sloping away from the track. This trough is to receive the bags dropped from the cars, thus reducing the fall and protecting the contents from injury. The trough is about 100 ft. long and 5 ft. wide. The mail cranes are somewhat similar to those ordinarily used, but are set farther from the track and are so made that the arms swing aside when unlatched by the removal of the bag. The crane carries only one bag, but the number of cranes at any point depends upon the amount of mail to be handled, and the train will pick up practically any number of bags in succession.

The equipment on the car includes the mechanism for operating the door, catcher and delivery chute. This is driven by gearing from one of the car axles, but is in operation only while passing an exchange point. It is set in action by a track instrument, or trip, and the corresponding trip on the car is so housed that no obstruction except the track trip can engage it. As soon as the series of motions has been completed the mechanism goes out of action until started again at the next exchange point. The mechanism moves slowly, owing to the use of reducing gear, there being one revolution of the operating shaft to 115 revolutions of the car axle, so that there is no violent shock or slamming in the several movements.

The accompanying figure shows both the station and car equipment with the system in operation. In this view the train has taken five bags and the catcher is just engaging the sixth. At the rear will be seen the mail-delivery compartment projecting from the side of the car and with its bottom chute dropped to deliver the bags to the timber trough.

The track trip is set 456 ft. in advance of the exchange point and starts the mechanism, the operations being controlled by three slowly moving cams. The first cam unlocks and opens the sliding doors while the train travels 180 ft.; it holds them open during a travel of 480 ft. while the bags are taken and delivered, and it then closes and locks the doors during a travel of 180 ft. Thus the



C. & A. TRAIN TAKING AND DELIVERING MAIL

total distance from the time the doors begin to open until they are closed is 840 ft.

The distances given are for cars having 36-in. wheels, but for larger or smaller wheels the track trip is set at the proper distance. When the trip is engaged a gong is sounded in the car, announcing that the exchange is about to take place.

The second cam operates the catcher. This apparatus consists of a curved arm, or chute, to take the bags from the cranes, guide them through the door and drop them upon the floor. This arm, the curved part of which extends inside the car, lies normally against the outside of the car and is swung into catching position (after the doors have been opened) while the train is traveling 180 ft. They are held in this position for a similar distance and then closed, their complete operation being effected during a travel of 540 ft.

The delivery chute is an upright steel compartment, or locker, extending nearly the full height of the side of the car and its outer face forming a part of the side. Within this the mail bags are stacked. The third cam operates this simultaneously with the operation of the catcher. The chute is thrust outward on horizontal guides while the train moves 180 ft. The bottom then drops, forming an inclined apron to deliver the bags into the receiving, or station, trough, which is only a few inches below the level of this apron. The chute is withdrawn into the car and locked in its normal position during a second distance of 180 ft.

Delivering the bags in this way greatly reduces the liability of damage to mail matter (even with parcel-post packages), while it eliminates the present liability of injury to persons being struck by bags thrown out at stations and road crossings. It also eliminates the liability of dropping bags at wrong places, because of mistake or miscalculation of the mail clerk, and the further chance of a bag striking some obstruction and being thrown under its wheels, with consequent loss and damage to the contents or, possibly, derailment of the car.

This mail-exchange system is the invention of Albert Hupp. It is being introduced by the Hupp Automatic Mail Exchange Co., Washington, D. C., and Chicago, Ill.

A Gasoline-Vapor Explosion Killed 31 and injured 200, and caused property loss estimated at $500,000, in Ardmore, Okla., on Sept. 27. The explosion resulted from a spark from the hammer of a workman engaged in repairing a leak in a tank car. The car is reported to have contained 250 bbl. of gasoline. The spark undoubtedly ignited gasoline vapor in the tank above the liquid. The concussion wrecked two blocks of buildings, and the scattered blazing gasoline started numerous fires. The accident indicates a serious lack of adequate fire-prevention regulations.

The Permit for Building the Coatesville Dam for the improvement of the water-supply of Coatesville, Penn., will not be rescinded by the State Water-Supply Commission, notwithstanding the arguments for such action summarized in "Engineering News" of Sept. 2, page 477.

Experiments on Treating Lake Water with Copper Sulphate to prevent trouble from algae growths were conducted for the City of St. Paul, Minn., from June 12 to Sept. 12, 1915, as recommended by Allen Hazen, consulting engineer, New York City. The work was in the immediate charge of N. L. Huff, Professor of Botany, University of Minneapolis, who will make a report on the subject.

Work on Quebec Bridge continues to make good progress. Since the notes in "Engineering News," Sept. 2, 1915, the fifth main panel on the north cantilever arm has been completed. On the south shore the lower web members are all in and two panels of the upper web members and top chord. The high record noted on p. 473 of the issue of Sept. 2, as 1,240,000 lb. erected in one week should have read "in one day."

Extensive Improvements to the Water-Works of St. Paul, Minn., are soon to be started with the proceeds of a proposed $400,000 bond issue. Plans and specification for a 15,000,000-gal. pumping engine will be ready Nov. 1, so a 4,500,000-gal. pump may be replaced during the winter. By Feb. 1, 1916, plans and specifications will be ready for motor-driven revolving screens, 30,000,000- and 7,000,000-gal. covered reservoirs, and two venturi meters with necessary piping. These improvements are a part of those recommended some months ago by Allen Hazen, consulting engineer, New York City. G. O. House is general superintendent of the St. Paul works.

Plans for Rebuilding the Sewage-Pumping Station of Batavia, N. Y., which was wrecked on Sept. 18, are being made by Chester & Fleming, consulting engineers, Pittsburgh, Penn. The pump well and superstructure will be rebuilt as a structure completely isolated from the water-works and electric-light station, which the old sewage-pumping station adjoined. Electric-driven pumps will be substituted for the old rope-driven pumps, which were put out of commission by the explosion—perhaps only temporarily. The primary explosion may have been caused by striking a match to relight a gas jet between a wooden first, or main, floor and a reinforced-concrete floor below it, for the main floor was forced upward and part of the other floor downward. The forcing upward of a quadrant of the lower floor suggests a second explosion, set off through a stairway leading down to a third landing.

The Railway-Terminal and Grade-Crossing problem at St. Joseph, Mo., has been reported upon at the request of the Commerce Club by Hiram J. Slifer, consulting engineer, of Chicago. The nine railways (trunk and terminal lines) have 33 mi. of main track and 90 mi. of sidetrack, and own or occupy 720 acres of land. There are about 85 regular passenger trains and 60 regular freight trains daily. Within the city limits there are 112 grade crossings (some used by two or more railways), and several of these are in the business district and near the union station. As all the lines enter the city on descending grades, Mr. Slifer advocates track elevation. He proposed to replace the present lines in the heart of the city by a four-track embankment along the water front, with connections at either end to the existing lines and with a new union station at the foot of Francis St., where ample property is owned by the railways. It is proposed that a more detailed study of the project should be made by a commission representing the railways, the State Railway Commission, the city, and the Commerce Club.

PERSONALS

Mr. Alexander J. Taylor, Assoc. M. Am. Soc. C. E., City Engineer of Wilmington, Del., has resigned to join the engineering corps of the E. I. du Pont de Nemours Co. Mr. Taylor has been in the employ of the city for about 16 years.

Prof. G. L. Larson, formerly Professor of Mechanical Engineering at the University of Idaho, and for the last year Fellow in the Department of Steam and Gas Engineering of the University of Wisconsin, has become Associate Professor.

Mr. P. M. Fogg, Assoc. M. Am. Soc. C. E., formerly Project Engineer of the United States Reclamation Service at Lawton, Okla., has entered into partnership with Mr. E. E. Miller, Consulting Engineer, with offices at 1136 First National Bank Building, Denver, Colo.

Mr. Karl R. Kennison, Assoc. M. Am. Soc. C. E., until recently Principal Assistant Engineer to Mr. John R. Freeman, M. Am. Soc. C. E., Consulting Engineer, of Providence, R. I., has been engaged as Assistant Engineer on the staff of the Providence Water-Supply Board.

Capt. James J. Loving, Corps of Engineers, U. S. A., now on duty at Ravenswood, W. Va., in connection with the construction of the locks and dams in the Ohio River, has been transferred to Washington, D. C., where he will relieve Capt. W. D. A. Anderson as Assistant Engineer Commissioner of the District of Columbia.

Prof. Elwood Mead, M. Am. Soc. C. E., Professor of Rural Institutions at the University of California, has been appointed a member of the California Rural Credits Commission. Professor Mead recently returned to this country after a number of years of service as Chairman of the State Rivers and Water-Supply Commission, Victoria, Australia.

Capt. William D. A. Anderson, Corps of Engineers, U. S. A., has been transferred to Panama as Assistant to Colonel Harding on fortification work. He will succeed the late Capt. William F. Endress, who died of pneumonia en route to the United States from Panama. Captain Anderson for the past year has been Assistant Engineer Commissioner of the District of Columbia.

Mr. A. A. Bull, recently associated with the Northway Motor Manufacturing Co., of Detroit, has been appointed Assistant to Mr. Charles S. Crawford, Chief Engineer of the Cole Motor Car Co., of Indianapolis. Mr. Bull is well-known in Great Britain, where previously to coming to America he was connected with Humber, Ltd., and the English branch of the Daimler Co.

Prof. J. G. Callan, formerly associated with the General Electric Co. and later connected with the Arthur Ladder Co., has been appointed Head of the Department of Steam and Gas Engineering of the University of Wisconsin, to take the place of Prof. H. J. Thorkelson, M. Am. Soc. M. E., who has been made Business Manager of the University. Professor Callan was at one time consulting engineer for the City of Boston.

Messrs. A. H. Smith, Assoc. M. Am. Soc. C. E., and L. A. Boulay, who have been associated under the firm name of the Smith & Boulay Co., Consulting Engineers, 320 The Nasby, Toledo, Ohio, announce that beginning Oct. 1 Mr. Smith will conduct an office and business under the name of the A. H. Smith Co., Consulting Engineers, at the foregoing address, and Mr. Boulay under the name of the L. A. Boulay Co., Civil and Sanitary Engineers, 1248 Nicholas Building, Toledo.

Messrs. George H. Frost, Assoc. M. Am. Soc. C. E., formerly President, and Francis W. Frost, formerly Treasurer, of the Engineering News Publishing Co., are now President and Vice-President and Treasurer respectively of Frost & Cundill, Inc. This is only a change in the firm name of Suffern & Co., 64 Wall St., New York City, and does not in any way affect the policy of the company or the personnel of its management. The company does an export and import business.

Messrs. A. V. Kieslich and Oscar Heininger, of Burlington, Vt., and A. H. Heininger, of Boston, have formed an engineering and contracting firm known as the Kieslich Construction Co., with offices at Burlington. Mr. Kieslich for 10 years has been in engineering and contracting work about New England and retires from the firm of Elliott & Kieslich, of Burlington. Mr. Oscar Heininger has been connected with the Burlington Water-Works Department for over 30 years. Mr. A. H. Heininger for seven years has been with the sales department of the Boston Edison Illuminating Co.

Prof. Albert Victor Bleininger, who has been in charge of the Ceramic Section of the U. S. Bureau of Standards at Pittsburgh since 1912, has been appointed Professor and Head of the Department of Ceramic Engineering of the College of Engineering of the University of Illinois. After graduation from Ohio State University in 1901, Mr. Bleininger was in turn Instructor, Assistant Professor and Associate Professor of Ceramics in that institution, leaving there in 1907 to become Professor of Ceramics in the University of Illinois. The next year he was in charge of the Clay Products Laboratory of the U. S. Geological Survey, and two years later became Professor and Director of the Department of Ceramics at the University of Illinois, which appointment he resigned to become associated with the Bureau of Standards.

Mr. C. Stanley Sale, formerly Secretary and General Manager of the Engineering Publishing Co., of Indianapolis, and more recently Editor for the Chicago Association of Commerce Committee of Investigation on Smoke Abatement and Electrification of Railway Terminals, has been appointed Assistant to the Director of the Engineering Experiment Station and Instructor in Civil Engineering of the University of Illinois. Mr. Sale graduated from Purdue University in 1906 and was Assistant Engineer of the Florida East Coast Railway until 1907, at which time he became Associate Editor of the "Railway Age Gazette." Two years later he entered the employ of the Blount Plough Works, of Evansville, Ind., as Sales Manager, and the following year was made Business Manager of the Municipal Engineering Co., of Indianapolis, which connection he severed in 1912, when he joined the staff of the Engineering Publishing Co.

OBITUARY

John T. Johnson, General Superintendent of the Central Georgia Ry., died at Savannah, Ga., on Sept. 22.

Oscar G. Higgins, Chief Engineer of the Royal Baking Powder Co., died recently at his home in Brooklyn, N. Y., at 60 years of age. He was a native of Boston.

G. H. Williams, of Cleveland, Ohio, President and Treasurer of the G. H. Williams Co., of Erie, Penn., was killed on Sept. 25 in an automobile accident whech occurred at Harbarger Crossing, one mile west of Erie.

Fields C. Pendleton, of Brooklyn, N. Y., a member of the firm of Pendleton Bros., ship brokers, of New York City, and a master mariner and shipbuilder, died on Sept. 22 at Isleboor, Me., his birthplace.

Robert S. Greenleaf, an engineer formerly on the staff of the Oregon-Washington Railway and Navigation Co. and well-known in the State of Oregon, died at his home in Portland, Ore., on Sept. 2, at 67 years of age. He was born in St. Louis and served throughout the Civil War. In 1884 he went to Oregon and entered the service of the Oregon-Washington Co.

Maximilian Lewinson, M. Am. Soc. C. E., President of the contracting firm of Lewinson & Co., of New York City, died suddenly at his home in Scarsdale, N. Y., on Sept. 19. He was born in Poland and came to America 35 years ago. He began his career in this country as a civil engineer in the employ of Mr. Leopold Eidlitz, Sr., of New York City. He was in his 61st year.

Charles Edwin Williams, founder and senior member of the firm of Williams, McNaughton & Bapst, contractors, of Buffalo, N. Y., died at his home in that city on Sept. 22. Mr. Williams was born in Buffalo in 1852 and after leaving school he entered the office of his father, a general contractor. Later, he took an engineering course at the Polytechnic Institute of Stuttgart, Germany, and on returning to Buffalo entered the general contracting business, from which he retired in 1909. One of the most notable pieces of work which Mr. Williams executed was the government breakwater at Buffalo in 1885. He was also President of the German Rock Asphalt and Cement Co.; Vice-President of the Buffalo Dredging Co.; President of the Buffalo Northern Realty Co., and President of the North Collins Fuel and Gas Co.

Cornelius J. Field, formerly Chief Engineer and Superintendent of the Edison Electric Illuminating Co. of Brooklyn, N. Y., and widely known through his association with Thomas A. Edison in the development and adoption of the electric motor omnibus in this country, died at his home in Brooklyn from typhoid fever on Sept. 25. Mr. Field was the first Chief Engineer of the old Edison United Manufacturing Co. and superintended the construction of the first central station for the distribution of electrical energy in Brooklyn. He built

the electric street-railway systems in the cities of Buffalo, N. Y.; Newark, N. J.; Worcester, Mass.; Bridgeport, Conn.; Philadelphia, and other cities in the Eastern States, and did considerable construction work of the same kind in Europe. He constructed many miles of railway and several large sugar plants in the West Indies and at the time of his death was interested in engineering work for English sugar concerns in Cuba.

ENGINEERING SOCIETIES

COMING MEETINGS

NORTHWESTERN ROAD CONGRESS
Oct. 4-7. At Cedar Rapids, Iowa. Secy., Jas. P. Keenan, Milwaukee, Wis.

RAILWAY FIRE PROTECTION ASSOCIATION.
Oct. 5-7. Annual meeting at Chicago. Secy., C. B. Edwards, M. & O. R.R., Mobile, Ala.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Oct. 11-12. Secy., Will P. Blair, Engineers Bldg., Cleveland, Ohio.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 12-14. Annual convention at Dayton, Ohio. Secy., Charles Carroll Brown, 702 Wulsin Bldg., Indianapolis, Ind.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. 19-21. Annual meeting, at Detroit, Mich. Secy., C. A. Lichty, 319 N. Waller Ave., Chicago.

SAN FRANCISCO MEETINGS

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secy., H. G. McConnaughy, 165 Broadway, New York City.

American Society for Testing Materials—The letter ballot on the amendment of the by-laws, the revision of certain standards and the adoption of new standards, canvassed on Aug. 21, resulted in an affirmative vote on every item. The list of standards as revised includes 88 titles, as compared with last year's 70.

Engineers' Club of Kansas City, Mo.—Arrangements have been made with Maj. S. A. Cheney, Instructor in the School of Engineers, Fort Leavenworth, Kan., to give a course of lectures and lay out a reading course for interested members of the club who desire to take up the same during the coming winter. The subject will of course be military engineering, and the method of presentation will be designed to enable the men to qualify as officers in volunteer army organizations.

International Irrigation Congress—At the 22nd Congress, which was held at Stockton, Fresno, Sacramento and San Francisco, Sept. 13-20, the Engineering Section elected as Chairman for the ensuing year, F. C. Herrmann, Consulting Engineer for the Modesto Irrigation District, Merchant's Exchange Building, San Francisco. Richard F. Burges, El Paso, Tex., was elected President of the Congress; J. S. Dennis, Calgary, Alberta, First Vice-President; and Arthur Hooker, Fresno, Calif., was reëlected as Secretary. Resolutions were adopted in favor of rural credits and aid in land settlement; a national marketing commission; the completion of "meritorious" irrigation "projects outside of those begun by the Reclamation Service"; state control of irrigation districts and of private irrigation projects; revision of Reclamation-Service costs; Federal, state and provincial appropriations for stream gagings and for irrigation and drainage investigations; favorable consideration by Congress of the Newlands-Broussard bill for river regulation and control and the fullest possible use of the water resources of the West; and the appointment of a committee to report on permanent headquarters for the Irrigation Congress.

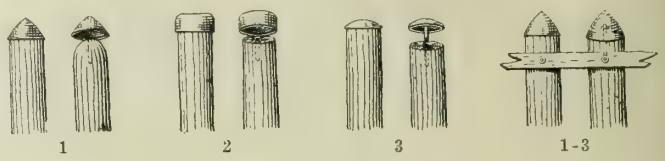
Appliances and Materials

Electrically Driven Fire Pumps

A line of centrifugal fire pumps with their shafts connected to an electric motor on the same bedplate is being introduced by the Hill-Tripp Pump Co., of Indianapolis, Ind., and has been approved by the Fire Underwriters' Associations, being equipped with the special fire-service fittings required by these associations. The discharge elbow, with manifold, hose valves, relief valves, etc., is supported on a pedestal adjacent to the bedplate. The pump is built in sizes of 500 to 1,500 gal. per min. capacity, with motors of 50 to 125 hp. respectively. The pressure is 100 lb. per sq.in. for all the pumps.

Permanent Iron Caps for Protecting Timber Piles

A variety of pile caps devised by Oscar A. Logan, 261 Broadway, New York City, are shown in the accompanying sketches. No. 1 is recommended for protecting old piles with rounded tops. Cap No. 2 is designed for new work. Cap No. 3



FOUR DESIGNS OF IRON PILE CAPS

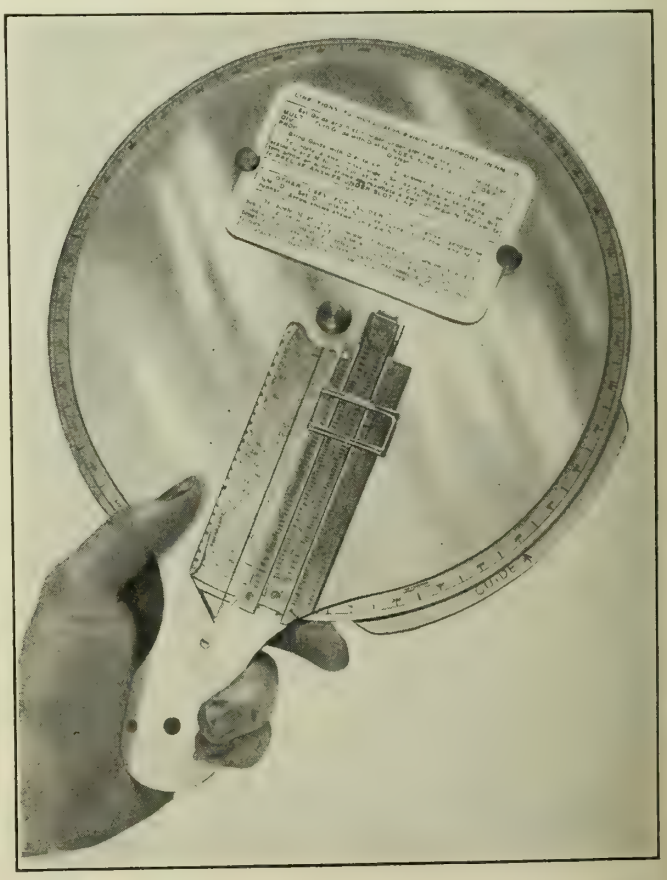
is recommended for placing on bunched piles. The caps are made of cast iron with wrought-iron spindles 1 in. in diameter and 8 in. long. No. 1 weighs 50 lb.; No. 2 weighs 60 lb., and No. 3, 17 lb. Pressed-steel caps can be furnished, but are not recommended. The fourth sketch shows a modified fastening.

* * *

New Graduated-Spiral Slide-Rule

A slide-rule that may be directly read to four places and estimated to a fifth has been put on the market under the name of the Ross Precision Computer. It is designed to be particularly useful for engineering computations, and is the invention of Louis Ross, of San Francisco, who invented and now manufactures the "Meridiograph," described in "Engineering News," Feb. 26, 1914. The new device is manufactured by the Computer Manufacturing Co., 268 Market St., San Francisco.

The logarithmetic graduations are along a 29-ft. spiral on a disk about 8 in. in diameter. The outside ring of



ROSS PRECISION COMPUTER—A SLIDE RULE WITH GRADUATION ON A SPIRAL

graduations is a scale of equal parts for addition and subtraction. The operations of multiplication and division are as simply performed as with any logarithmic scale. The auxiliary 4-in. slide-rule on top gives logarithmic numbers on the left-hand fixed scale and corresponding square and cube roots on the right-hand fixed scale. On the slide between are two logarithmic scales, both corresponding to the left-hand fixed scale but graduated in reverse directions. The computer is made of aluminum and german silver.

Engineering News

VOLUME 74 OCTOBER 7, 1915 NUMBER 15

Flooding and Recovery of the Astoria Tunnel--I

By Harold Carpenter*

SYNOPSIS—The great difficulties in holing through the headings of the Astoria tunnel, described in these pages two years ago, were surpassed by troubles arising in the bench excavation. The tunnel was drowned out, except for the Bronx end, which was saved by a narrow margin. Grout sealing on a huge scale finally controlled the leak.

Two years ago, at the very time when the writer's previous article describing the construction of the Astoria tunnel up to the point of holing through on July 17, 1913, was going to press[1], a tremendous flow of water burst into the tunnel, flooded three-quarters of its length and, filling the Astoria shaft, submerged the pumping plant. The following recounts the chief events in the successful struggle to recover and complete the tunnel.[2]

The tunnel is 4,662 ft. long. Its ends are in Fordham gneiss, for distances of 1,200 ft. north from the Astoria shaft and 750 ft. south from the Bronx shaft. Between these two points it passes through Inwood dolomite, and it was on the contact between these two rocks nearest the Bronx shaft, for a distance of about 400 ft., that seams of disintegrated rock carrying water under high pressure (95 lb. per sq.in.), were constantly encountered.

The width of this contact zone of decomposed rock was found to be about 150 ft. normal to the strike, but owing to the tunnel's crossing it at an angle, the greater distance was involved.

Because of the fact that the tunnel was 250 ft. below the surface of the river and therefore compressed air could not be used, the building of the tunnel through this water-bearing section presented unusual difficulties and required unusual methods to overcome them. Still

*Resident Engineer, Astoria Tunnel; Astoria Light, Heat and Power Co., New York City.

[1]See "Engineering News" of Oct. 16, 1913, p. 737.

[2]The Astoria Tunnel connects the Astoria plant of the Consolidated Gas Co. of New York at Astoria (on the northwest corner of Long Island) with a future distributing station at East 132nd St. and East River, Bronx (see Fig. 2). It will be used to carry gas by means of 72-in. cast-iron mains from the Astoria plant, which will be the largest gas plant in the world, with its ultimate capacity of 240,000,000 cu.ft. of gas in 24 hr. (40,000,000 cu.ft. capacity is now constructed and in operation), to the growing northerly section of New York City, the Borough of Bronx, the population of which has increased from 88,000 in 1890 to 730,000 (estimated) in 1915. The reasons for its construction, its general details (see Figs. 2 and 3 of the present article) and the difficulties encountered and successsfully overcome up to the time of holing through the heading, were described in the previous article (see preceding note).

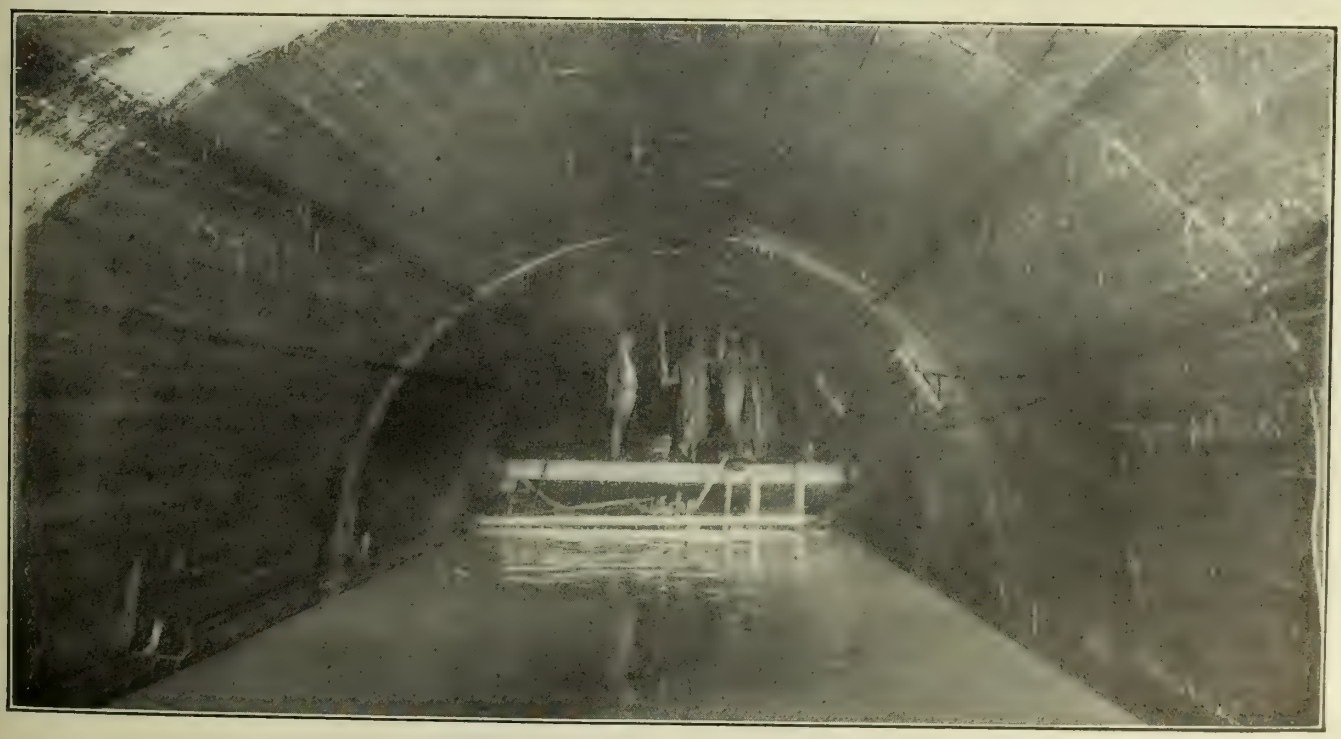


FIG. 1. THE ASTORIA TUNNEL, NEW YORK CITY, DEC. 1, 1913

This shows tunnel partly unwatered after flood of Oct. 5, 1913, caused by a leak of 12,000 gal. per min. in bench

greater difficulties presented themselves when the tunnel was flooded by the great leak of Oct. 5, 1913.

Holing Through Heading; Further Trouble With Leakage Was Not Expected

At the time of holing through the heading, July 17, 1913, all trouble from disintegrated rock seams and water in the heading had been overcome. Two safety bulkheads across the full section of the tunnel and three across the heading to protect completed portions of the tunnel against flood, as well as 29 temporary bulkheads across all or part of the heading to confine the water for grouting, had been constructed during the excavation of the heading through this 400-ft. section.

After holing through there remained 43 ft. of heading to be widened to full cross-section and 474 ft. of bench to be removed, which included all of the bench through the trouble zone. The two safety bulkheads across the full section of tunnel were still in position, one at each end, and two safety bulkheads were still in place across the heading on top of the bench.

All water-bearing seams encountered during the driving of the heading had been successfully grouted under high pressure (500 lb.), and the flow of water had been stopped. Direct connection of the seams with the surface of the river had been revealed during the grouting, but all evidence led to the belief that this had been shut off with the grout.

Test holes 16 ft. long had been systematically drilled along the bench at the points where the seams lay, from 1 ft. to 5 ft. apart, without striking any water, and as the water had always come in from above and never from the bottom, it was considered improbable that further trouble would be encountered.

Excavation of the heading to full cross-section was completed July 24, 1913, and the concrete lining of the arch above springing line July 25, 1913. The two safety bulkheads across the full section were too far from the faces of the bench to be of use (150 ft. and 200 ft. respectively); they were therefore removed, and as there appeared to be no further need to construct new ones closer to the work, excavation of the bench was resumed Aug. 14, 1913. The bench had not been advanced at the Bronx end since July 23, 1912, and at the Astoria end since Nov. 14, 1912, on account of trouble in the heading.

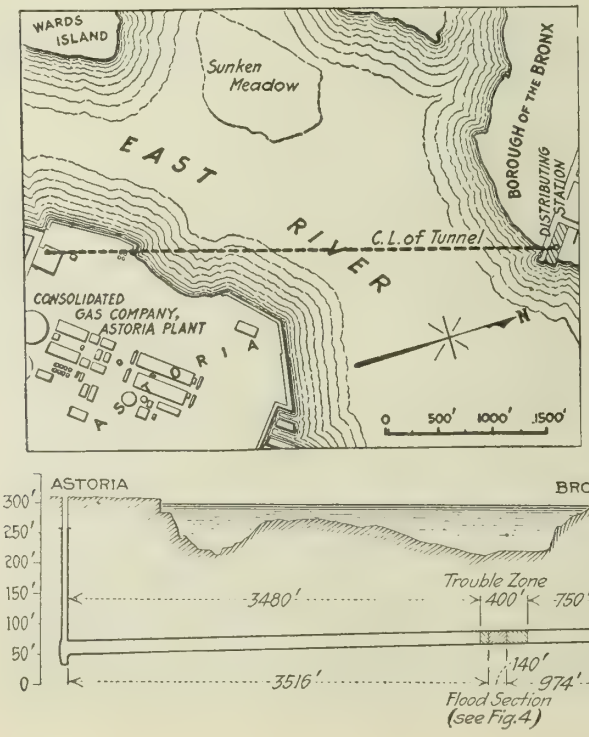


FIG. 2. PLAN AND PROFILE OF THE ASTORIA TUNNEL

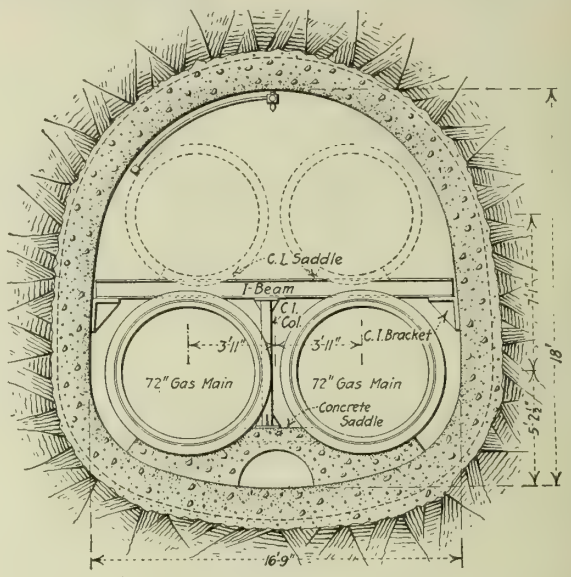


FIG. 3. CROSS-SECTION OF ASTORIA TUNNEL
Showing pair of 72-in. mains now being installed and future additional mains.

Water in Bench and Attempt at Grouting

For three weeks work progressed satisfactorily, 353 ft. of bench being removed. On Sept. 4 a test hole at the Astoria end of the bench, about 3,544 ft. from the shaft, drilled in an exactly similar manner and location to the previous exploring test holes, struck water under full pressure, giving a flow of 1,000 gal. per min. Several additional holes also struck water under pressure. The total flow from these holes was about 1,600 gal. per min. On the same day a test hole at the Bronx end, or 100 ft. north of the others, struck a 3-in. stream of water, but without pressure.

A temporary buttress 20 ft. long was built along the top of bench against the side of the heading and timbered against the opposite side of the heading to confine the water for grouting. The holes were piped through the buttress and valved as usual, being allowed to flow for one week, until the concrete had thoroughly set. The valves were then closed, preparatory to grouting, when instantly the water burst out through the top of the bench. The water pressure cracked the buttress in both directions.

Safety Bulkheads Built in a Hurry

Work was immediately started Sept. 11, 1913, on a safety bulkhead at each end of the bench, across the full section of tunnel, to protect the completed portions of the tunnel and shafts from flood.

In the meantime, on Sept. 12 a heavy flow of water occurred through the buttress drains and the top of the bench, bringing in large quantities of beach sand, shells, all sorts of débris, including wood, spools, tin cans, etc., and about a ton of coal in pieces as large as 4 and 5 in., showing that there was a direct connection with the river bottom. About 100 cu.yd. of material came in in less than an hour, when the holes clogged and the flow of refuse stopped, the water continuing.

Although such a direct connection existed with the river bed, no fish came in at any time during this flow or the subsequent flooding, while during previous water flows, when driving the heading, large quantities of live fish as long as 8 in. came in.

On Sept. 24 the two safety bulkheads across the full section of tunnel, one at each end of the 121-ft. section of remaining bench (*A* and *B* in Fig. 4), were finished, ready for use in an emergency. Several 8-in. and 10-in. drain pipes were built into each of these bulkheads below the doorways, with valves on the outside of the bulkheads. The doors were hinged on the inside and arranged to drop instantly on releasing a cable from the outside.

These bulkheads were completed just in time. Had it not been for them, the entire tunnel and both shafts would have been flooded on Oct. 5, 1913, under the circumstances described in what follows. As it was, only

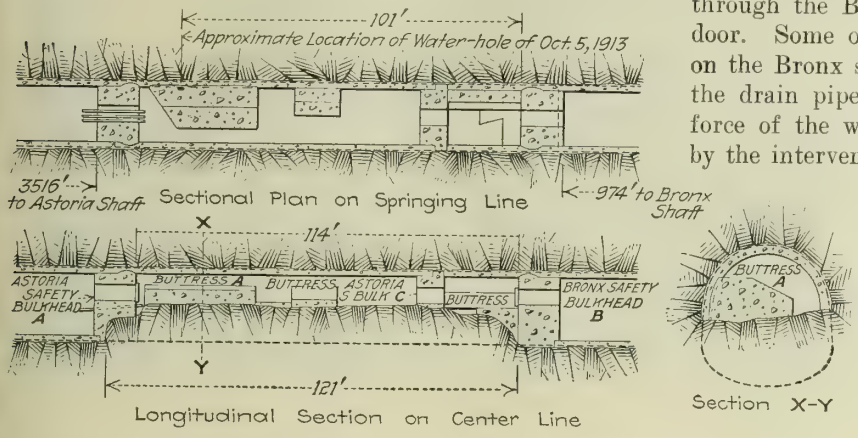


FIG. 4. CONDITIONS IN FLOOD SECTION AFTER FAILURE OF BUTTRESS, OCT. 1, 1913

Conditions at time of flood of Oct. 5 same except that buttress A had been removed

one shaft and one end of the tunnel were kept from being flooded; this undoubtedly prevented much more serious difficulties and much greater expense in recovering the tunnel.

Second Attempt to Grout the Leak

The buttress that had failed was now removed and a much larger one was built, about 35 ft. long, at the same location, well tied into the side of the heading and very heavily timbered against the opposite side of the tunnel. Other buttresses were also constructed along the bench wherever test holes had shown the presence of water or the rock seemed bad. (See Fig. 4.)

On Oct. 1 the buttress having had one week to set, the pipe valves were closed and grouting began. Immediately the 112-ton buttress (*A*, Fig. 4) cracked in both longitudinal and transverse directions and moved bodily away from the side of the heading a distance of ¾ in., crushing the timbers that were braced between it and the opposite side of the heading.

Its removal was at once started, in order to gain space in which to construct another in the form of an inverted arch. The buttress was removed as carefully as possible, blasting being done by means of very light charges, in order not to disturb the rock and start a flow.

On Sunday morning, Oct. 5, 1913, the removal of the large buttress (*A*, Fig. 4) was completed ready for concreting a new one, in the form of an inverted arch to replace it. At 7:40 a.m. the water coming in through the pipes and the top of the bench suddenly increased in volume and brought in a large quantity of green sand and débris. It ran thus for about half an hour, when it suddenly subsided again to its average flow of about 2,500 gal. per min. The sand was cleared away from the bulkhead doors, but it did not appear necessary to close them, as the flow had subsided.

Tunnel and Astoria Shaft Flooded

At 9:30 a.m. the heavy flow of water with sand and débris again broke out, in much greater volume than before. The men on duty, alarmed, at once prepared to close the bulkhead doors. Only with the greatest difficulty was the débris cleared away from the Astoria bulkhead *A* enough to allow the safety door to drop. This was finally accomplished, some of the men remaining on the outside to close the valves on the drain pipes. Others went out through the Bronx bulkhead *B* and dropped the Bronx door. Some of the men ran for the shafts. The men on the Bronx side were able to close all of the valves on the drain pipes through the Bronx bulkhead *B*, as the force of the water was broken and the sand held back by the intervening bulkhead *C* (see Fig. 4).

At the Astoria bulkhead, however, after the men had dropped the door, the rush of water and sand came so fast that they did not have time to close one of the drain pipes. This, remaining open, continued to discharge an 8-in. stream into the tunnel under 95 lb. pressure. It was afterward found that a 1-in. board had jammed in the doorway and water also poured into the tunnel underneath the door.

In about an hour and a half the pumps at the Astoria shaft, which had a rated capacity of 7,700 gal. per min., were all submerged. Some of the pumps continued to work until 4 p.m., when the last one stopped. The estimated flow of water from the leak was 12,000 gal. per min. At 8:15 p.m. the next day, Oct. 6, the water reached low-tide level and began to rise and fall with the tide.

From 9:15 a.m. to 6 p.m. bubbles appeared on the surface of the river directly over the point of leak for an area about 250 ft. square, one main body of bubbles extending over about 50 ft. by 100 ft. These bubbles appeared at a point about 400 ft. south of the point where similar bubbles had appeared on Apr. 8, 1913, during the grouting of a large leak in the heading with air pressure of 500 lb. (which had successfully shut off water from the heading). This showed that the new leak was from an entirely separate and new connection with the river bottom. Air also escaped from a small pipe through the Bronx bulkhead *B* at the same time.

The water in the shaft reached high-tide level for the shaft at 7 p.m. Oct. 7. Thereafter it rose and fell with the tide in the river, but lagged behind it in time between 2 and 3 hr. and in elevation by from 6 to 10 ft. Owing to an unusually high tide on Oct. 20, the water in the shaft reached its highest elevation of 4 in. below mean sea level, or 11.5 ft. below the top of shaft.

The Astoria shaft and 3,655 ft. of tunnel was now flooded with 10,000,000 gal. of water. A direct connection existed between the river and the heading, capable of discharging about 12,000 gal. per min. As the flow had



FIG. 5. FACE OF BENCH SHOWING SEAMS AND DISINTEGRATED ROCK, JAN. 30, 1914
Looking south from Bronx bulkhead to Bulkhead C

increased by five times in a few minutes, its liability to further increase had to be reckoned with. The entire pumping plant at Astoria was under 275 ft. of water. At the Bronx shaft a pumping capacity of only 1,200 gal. per min. was available.

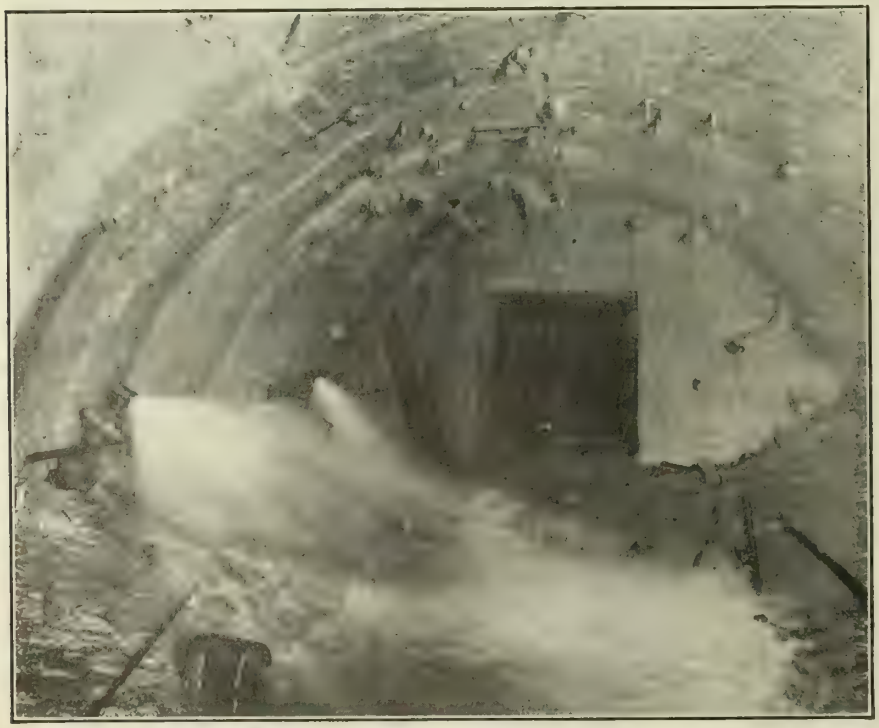


FIG. 6. WATER FLOWING FROM TEST HOLES IN BENCH, JAN. 27, 1914
Test holes through temporary concrete invert just south of Bulkhead C

Only the Bronx shaft and the northerly 974 ft. of tunnel remained free from water, and this was protected only by a single bulkhead against which a water pressure of over 200 tons was acting. The nearest point of approach to the leak was the face of this bulkhead, about 114 ft. distant from the leak. While the Bronx bulkhead figured amply strong to withstand the pressure, the fact that the flooding of the entire tunnel, which would have presented a situation probably unprecedented and would have involved immensely more difficult and costly methods of unwatering, had been escaped by the narrowest margin, caused every possible additional precaution to be taken.

Work was at once started on a vertical abutment reinforced with rails and braced horizontally against the center of the Bronx bulkhead *B* (see Fig. 4) to strengthen it. Construction of a secondary safety bulkhead, reinforced with rails, 105 ft. north of the other, located in a section of the tunnel which had been previously lined with cast-iron rings, was begun as a further protection.

As the Astoria boilers could pump only 9,000 gal. per min. and the Bronx boilers 3,000, a total of 12,000, and the area in the Astoria shaft available for a float to mount pumps was

limited, it was impossible to unwater the tunnel until the flow from the leak was largely shut off. A steel pontoon, specially built, for mounting pumps in the Astoria shaft, and pumps of a capacity of 6,600 gal. per min. were purchased. The pumping plant at the Bronx was increased from 1,200 to 3,000 gal. per min., the capacity of the boilers.

During this time and during all of the operations that followed, close observations of the water level in the Astoria shaft were plotted, together with tide readings, and these gave quite a reliable indication of conditions in the flooded heading. At times the level of the water in the shaft closely approached, and several times even exceeded, the elevation of the river. These observations proved that there was still between the heading and the river a free connection, which must be shut off in some way.

Attempt to Grout Leak Through Core Borings

After discussing various methods, it was decided to first try drilling core borings through the Bronx bulkhead and the bench, in an attempt to reach the seam at a point outside the tunnel line and, by grouting the borings, shut off the water from the heading.

On Oct. 27, the bulkheads and additional pumps at the Bronx (to protect the Bronx shaft and end of the tunnel against flood) having been completed, work was started drilling the first 2-in. core boring, carefully aimed to reach the seam just outside the tunnel line and below the top of the bench. This hole was drilled a distance of 120 ft., struck water and green sand under full pressure, and was grouted with 870 bags of cement. Although it is believed that this hole entered the seam, it did not produce the desired result, as indicated by the action of the water in the Astoria shaft.

Filling the Entire Heading with Cement

It was now decided to fill the entire heading between bulkheads *A* and *B* with grout, in order to stop the flow of water from the leak in the tunnel sufficiently to allow the unwatering of the Astoria shaft and tunnel. In the meantime additional core borings were drilled with great difficulty, but very little grout could be forced into them, although water and sand with pressure was encountered, and they were not a success.

In order to grout into the heading a hole was drilled through bulkhead *B* and a 3-in. casing forced through this hole and up against bulkhead *C* (see Fig. 4). A diamond bit was then placed on the end of a 2-in. pipe and used as a drill rod to drill a hole through bulkhead *C*. When it was through, the 2-in. pipe was forced into the heading to a point opposite the leak. This work consumed 5 days. It was accomplished with great difficulties against the high pressure.

Grouting through this pipe directly into the heading to fill the entire heading with cement proceeded continuously from 3 p.m., Nov. 10, until 4 p.m., Nov. 12, with 400 lb. pressure; it consumed 8,600 bags of cement. This caused the water in the Astoria shaft to largely stop fluctuating and showed that the flow was largely shut off. Upon allowing water to flow from several small pipes in the Bronx bulkhead *B* to further determine conditions, the water in the Astoria shaft lowered 17 ft.

The consequent loss of pressure in the shaft and corresponding increase of pressure from the river on the



FIG. 7. EXCAVATION THROUGH GROUT; ASTORIA TUNNEL, NEW YORK CITY

Jan. 10, 1914. Drift excavated through grout between safety bulkheads placed to stop flow of water from flood of Oct. 5, 1913. Pipe at right is core drill rod through which the heading was filled with grout; drill head and 28 ft. of pipe removed. Timber at top is part of a strut to buttress A

grout caused it to give way, and the water in the shaft resumed its rise and fall. Grouting through the pipe (which had been kept free) was therefore resumed on Nov. 14 and 15. When some 1,700 bags had been forced in, the pressure gage on the Bronx bulkhead *B* exceeded the river pressure and grout appeared through the bulkhead pipes, so grouting was temporarily discontinued. On Nov. 17 grouting was completed, with a total of 11,542 bags of cement.

This grouting caused the water in the Astoria shaft to stop fluctuating except for a few inches, and on opening pipes through the Bronx bulkhead, they gave water but no pressure. Both phenomena showed that the flow into the tunnel had been shut off. Preparations were therefore made to begin pumping out the Astoria shaft and tunnel.

(*Concluded in next week's issue*)

Intensity of Rainfall Studied at Columbus, Ohio

By Charles Herrick*

The attempt to arrive at a more reliable method of obtaining the correct size of storm sewers has made it desirable to have accurate records of the intensity of rainfall for different periods of time. Such records have not been obtained in many places for a sufficient time to be of much service, so all records of this kind should be made available. The United States Weather Bureau Station at Columbus, Ohio, has had a recording rain gage in operation for the past 18 years, but the records have never been tabulated before.

The early rainfall records at Columbus are not very satisfactory, but there are three storms that should be mentioned in any discussion of the subject. The first occurred in 1867, but there are no records of its intensity. The second was on July 30, 1886. The rain started at 2 p.m., continued furiously till 2:40 p.m., then slackened, and stopped at 3:20 p.m. In 1 hr. 20 min., 2.83 in. of rain fell, which gives a rate of 2.12 in. per hr. The third unusual storm occurred July 24, 1896, when it is estimated that 2 in. of rain fell between 12 and 1 a.m.

The recording rain gage has been in operation at Columbus since Apr. 21, 1897. Between that time and the end of 1914 there were 65 storms with an intensity of precipitation of over 1 in. per hr.[1]

*1447 Highland St., Columbus, Ohio.

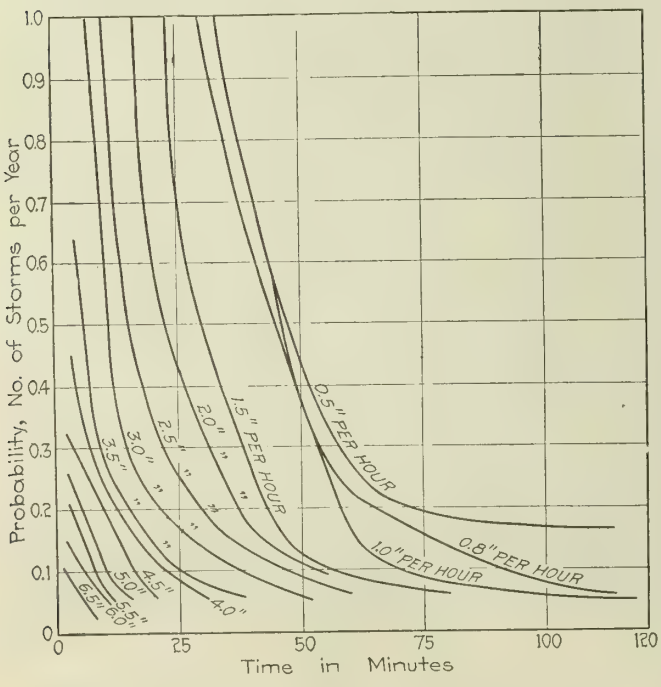


FIG. 1. PROBABILITY AND TIME FOR STORMS OF VARYING INTENSITY AT COLUMBUS, OHIO

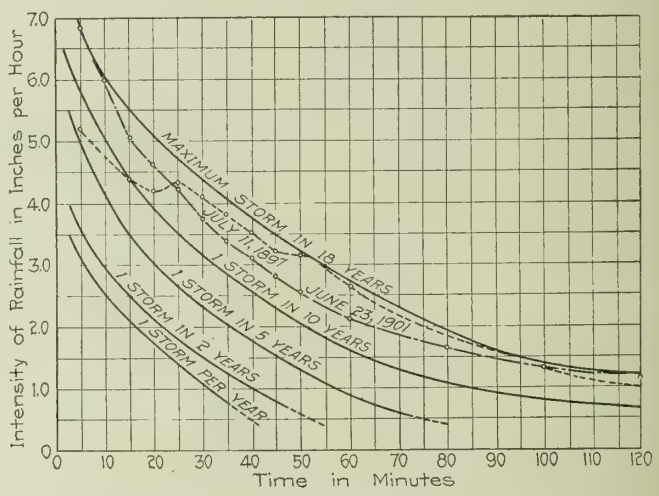


FIG. 2. RELATION BETWEEN TIME AND INTENSITY OF RAINFALL FOR STORMS OF DIFFERENT PROBABILITY OF OCCURRENCE AT COLUMBUS, OHIO

In the monthly summary of observations special mention is made of all storms with an intensity of over 1 in. per hr. and with a total of over 2 in. per day. For the storms with an intensity of over 1 in. per hr. the following information is given: Date of storm; amount of precipitation before excessive began; accumulated depths of excessive precipitation in 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 80, 100 and 120 min.; and the maximum precipitation in 5, 10, 15 and 30 min. Most of the data used in these studies were taken from these records, and from the sheets from the automatic gage for some of the heaviest storms.

The accompanying table shows accumulated and maximum rates of rainfall at Columbus for all periods of excessive precipitation from 1897 to 1914, inclusive. From this table the number of storms of an intensity of 0.5 in. or greater per hour, in 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 80, 100 and 120 min. were determined. The same thing was done for intensities of 0.8, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, and 6.5 in. per hr. These results were divided by 18, the number of years over which the records extend, and the probability, or number of storms of different intensity per year, obtained. These results were then plotted (Fig. 1) and from these curves were derived those given in Fig. 2. The points where the curves cross the horizontal line 1 give the number of

[1]When this gage was put in operation the station was in the Eberly Building, 215 South High St., 80.7 ft. above ground level. Since May 31, 1902, the station has been on the 12th floor of the New Hayden Building, 16 E. Broad St., where the gage is 170.6 ft. above the ground. The gage was moved from the south to the north end of the New Hayden Building on Sept. 26, 1906. The exposure had been slightly affected by a building 34 ft. higher on the west for a few weeks previous to this date. The rain gage is of the Friez tipping bucket type, with electric recording apparatus. (See Metcalf and Eddy's "American Sewerage Practice," Vol. 1, pp. 211-212.) The record-sheet cylinder is 15.07 in. in circumference and revolves four times in 24 hr., so that 0.21 in. represents 5 min. The water in the reservoir of the gage is measured at the end of the storm, and the excess is added to the amounts shown on the record, the most of this addition being made in the periods showing the heaviest rainfall.

minutes that these intensities might be expected to last in a storm that will probably occur once a year. The points where the curves cross the horizontal line 0.5 give the same information for storms occurring once in two years; the .0.2 line gives storms occurring once in 5 years, and the 0.1 line gives storms occurring once in 10 years.[2]

On examining similar records from other cities, it is evident that local conditions have a great effect on the intensity of rainfall. It is natural to expect greater rates of precipitation in Boston and smaller rates in Denver or San Francisco, than would occur in Columbus; but it is surprising to find as much difference as there appears to be in the rates of precipitation in such cities as Louisville, Cincinnati, Chicago and Columbus. In Cincinnati, the formula

$$i = \frac{16}{\sqrt{T}}$$

is used for the intensity of rainfall. For storms of from 10 to 85 min. duration this gives a smaller intensity than the maximum at Columbus, and for storms of 35 min. duration, is 1.3 in. per hr. less. For storms of over 90 min. duration the Cincinnati curve gives greater intensities than we have ever had in Columbus. It seems probable that a simple equation will not apply to such a range in the duration of storms and that a curve drawn through observed points is better than any mathematical expression.

It seems that storms approaching the maximum curve of Fig. 2 have occurred at intervals of from 7 to 9 years (1867, 1886, 1896, 1897 and 1901), but that no storm of this character has occurred since 1901. The curves for 5 and 10 years probably show too low an intensity on this account.

A very unusual rainfall occurred at Cambridge, Guernsey County, Ohio, on July 16, 1914, when 7.09 in. of rain fell in 1 hr. 30 min., or at the rate of 4.72 in. per hr. This excessive rainfall was confined to a nearly circular area not more than 8 or 10 sq.mi. in extent. While we may never have such a storm in Columbus, it is probable that we will at some time have a storm of greater intensity than any of which we now have records.

The studies summarized were made for the Division of Sewer Construction, Columbus, Ohio, and were based on the records of the Columbus station of the United States Weather Bureau.

[2]This method was used in Boston in 1904, and is described in Metcalf and Eddy, "American Sewerage Practice," Vol. I, pp. 231-234, and Fig. 98 and 99, p. 229.

The Production of Stone in the United States in 1914 amounted in value to $77,412,292, according to G. F. Loughlin, of the United States Geological Survey. This total was divided among the various classes of stone as follows: Granite, $20,000,000; trap-rock, $7,800,000; marble, $8,000,000; common limestone, $33,900,000; sandstone, $7,500,000. The value of the building stone produced in 1914 amounted to $17,796,000. Marble showed a slight increase. The value of paving stone produced was $3,772,000, while curbstone was valued at $1,870,000. Values of other classes of stone were as follows: Flagstone, $541,000; stone for rubble, $1,256,000; stone for riprap, $3,707,000; crushed stone, $30,162,000. There was a general decrease in the value of production since 1913. Pennsylvania is the greatest stone-producing state, Vermont being second, with New York, Ohio, California, Indiana, Massachusetts, Illinois, Wisconsin, Missouri, Georgia and Virgina following in order.

ACCUMULATED DEPTHS AND MAXIMUM RATES OF EXCESSIVE RAINFALL AT COLUMBUS, OHIO, 1897 TO 1914

Date	Note	Accumulated Depths of Excessive Precipitation, In. in Min 5	10	15	20	25	30	35	40	45	50	60	80	100	120	Maximum Rates of Rainfall for Different Periods, In. per Hr. 5	10	15	20	25	30	35	40	45	50	60	80	100	120
July 11, '97*		0	0.20	0.28	0.40	0.65	1.05	1.35	1.65	2.00	2.45	2.62*				5.40	4.80	4.40	4.20	4.32	4.10	3.81	3.51	3.23	3.14	2.68			
July 21, '98			0.25	0.47	0.66	0.80	0.87	0.92	0.93	0.94	0.97	1.03	1.08	1.08	1.17	1.38	3.00	2.82	2.64	2.40	2.09	1.84	1.59	1.41	1.29	1.24	1.08	0.81	0.70	0.69
Aug. 3, '98			0.25	0.61	0.85	0.99	1.04	1.23	1.50	1.53	1.55						4.32	3.66	3.40	2.98	2.50	2.46	2.57	2.30	2.07					
July 19, '00	Tr.		0.10	0.31	0.66	0.75	0.85	1.08	1.20	1.27							3.60	2.70	2.28	2.04	2.09	2.02	1.87	1.54					
Aug. 16-17, '00		0.01	0.09	0.37	0.44	0.45	0.51	0.64	0.78	0.98	1.08	1.11					3.36	2.22	1.76	1.34	1.23	1.28	1.34	1.47	1.44	1.33			
June 23, '01†			0.27	0.84	1.27	1.54	1.75	1.86	1.92	1.98							6.84	6.00	5.08	4.62	4.22	3.76	3.40	3.10	2.80	2.59	2.16	1.67	1.33	1.13
Mar 7, '03			0.07	0.13	0.17	0.27	0.40	0.51	0.52	0.53	0.53	0.54	0.57	1.09	1.13	1.14	1.56	1.46	1.56	1.56	1.30	1.10	0.96	0.89	0.79	0.71	0.59	0.82	0.68	0.57
June 20, '03			0.13	0.20	0.24	0.41	0.51	0.57	0.58								2.04	1.62	1.32	1.23	1.22	1.14	1.00							
May 14, '05			0.27	0.32	0.38	0.43											3.24	1.92	1.52	1.29										
Aug. 5, '05			0.09	0.16	0.23	0.31	0.42	0.70	0.75	0.89							3.36	2.34	1.88	1.74	1.58	1.46	1.37	1.34						
Aug. 5, '05			0.18	0.27	0.36	0.44											2.16	1.62	1.44	1.32										
Aug. 14, '05			0.15	0.43	0.68												3.36	3.18	2.72											
Aug. 19, '05			0.17	0.24	0.44	0.52	0.56										2.40	1.44	1.76	1.56	1.34									
Oct. 18, '05			0.12	0.25	0.38												1.56	1.56	1.52											
May 2, '06			0.24	0.34													2.88	2.04												
May 22, '06			0.18	0.31	0.39												2.16	1.86	1.56											
July 3, '06			0.20	0.37	0.46	0.52											2.40	2.22	1.84	1.56										
July 8, '06			0.20	0.55													4.20	3.30												
July 22, '06			0.07	0.18	0.38	0.59	0.64										2.52	2.46	2.08	1.77	1.54									
July 29, '06			0.17	0.30													2.04	1.80												
Aug. 3, '06			0.05	0.26	0.49	0.58	0.71	0.79	0.81	0.81	0.87	0.92					2 76	2.64	2.12	1.98	1.78	1 58	1.39	1 22	1 16	1.10				
Aug. 17, '06			0.19	0.43	0.44	0.44	0.52	0 66	0.67	0.73	0.86	0 97					2 88	2.58	1.76	1.32	1 25	1.32	1 15	1 10	1.14	1 16				
Aug. 19, '06			0.19	0.38	0.47												2.28	2.28	1.88											
Apr. 7, '07			0.13	0.35													2.64	2.10												
May 25, '07			0.06	0.25	0.36	0.48											2.28	1.80	1.68	1.44										
July 9, '07			0.11	0.18	0.18	0.22	0.32	0.37	0.54	0.70	0.78						2 05	1.98	1.64	1.44	1.35	1 20	1.03	1 01	1 04					
July 11, '07			0.18	0.32	0.49	0.57											2.16	1.92	1.96	1.65										
July 25, '07			0.28	0.41													3.36	2.43												
Aug. 20, '07			0.16	0.49	0.72	0.82											3 96	3.36	2.88	2.46										
Sept. 28, '07			0.25	0.36													3.00	2.16												
Mar. 18, '08			0.25	0.41													3.00	2.46												
June 22, '08			0.07	0.15	0.27	0.40	0.46	0.53									1.56	1.50	1.32	1.20	1.11	1.06								
July 24, '08			0.19	0.53	1.00	1.17	1.30	1.35									5 64	4.85	4.00	3.51	3.12	2.70								
Aug. 17, '08			0.16	0.23	0.23	0.24	0.29	0.47	0.57	0 70	0.85	0.89	0 98				2.16	1.68	1.64	1.68	1.46	1 30	1 20	1 11	1 13	1 07	0.98			
Apr. 25, '09			0.20	0.32													2.40	1.92												
June 8, '09			0.12	0.29	0.43	0.51											2.04	1.86	1.72	1.53										
July 12, '09			0.15	0.38	0.54	0.65											2.76	2.34	2.16	1.95										
Aug. 15, '09			0.15	0.38	0.50												2 76	2.28	2.00											
Aug. 15, '09			0.14	0.21	0.46	0.57	0.59	0.62	0.65	0.78	0.82						3.00	2.16	1.84	1.71	1 42	1 24	1 12	1 17	1 09					
Sept. 3-4, '09			0.26	0.46	0.54												3.12	2.76	2.16											
July 6, '10			0.14	0.34													2.40	2.04												
Aug. 4, '10			0.20	0.23	0.40												2.40	1.38	1.60											
Aug. 8, '10			0.10	0.19	0.33	0.46	0.47										1.68	1.62	1.44	1.38	1.13									
Aug. 8, '10			0.17	0.28	0.41	0.44											2.04	1.68	1.64	1.32										
June 17, '11			0.06	0.57	0.62	0.68	0.79										6.12	3.42	2.48	2.04	1.90									
June 24, '11			0.26	0.40	0.47												3 12	2.40	1.88											
July 8, '11			0.30	0.68	1.05	1.30	1.41										4.56	4.50	4.20	3.90	3.38									
July 16, '11			0.13	0.25	0.41												1.92	1.68	1.64											
Sept. 8, '11			0.19	0.40	0.58	0.67											2.52	2.40	2.32	2.01										
Sept. 15, '11			0.10	0.39	0.51	0.72	0.90	1.02	1.06								3.48	2.46	2.48	2.40	2.20	2.04	1 81							
Sept. 15, '11			0.07	0.16	0.28	0.38	0.47										1.44	1.34	1.24	1.20	1.13									
Sept. 18, '11			0.05	0.13	0.25	0.45	0 56										2.40	1.92	1.72	1.53	1.34									
Oct. 6, '11			0.15	0.47	0.65												3.84	3.00	2.60											
Oct. 6, '11			0.06	0.24	0.49	0.57											3.00	2.58	2.04	1.71										
July 3, '12			0.25	0.30													3.00	1.80												
July 21, '12			0.17	0.50	0.54												3.96	3.00	2.16											
July 24, '12		0.01	0.09	0.24	0.27	0.29	0.33	0.34	0.57								2.76	1.44	1.12	0.90	0.82	0 96	0 98							
Aug. 31, '12		0.08	0.15	0.34													2.28	2.04												
Mar. 24, '13		0.01	0.14	0.28	0.35												1.68	1.68	1.40											
June 18, '13		0.02	0.21	0.43	0.50												2.64	2.58	2.00											
July 27, '13		0.01	0.16	0.30	0.43	0.58	0.61										1 92	1.80	1.72	1.74	1.47									
Aug. 21, '13		0.00	0.18	0.20	0.25	0.43	0.63	0.79	0.91	1.01							2.40	2.38	2.16	1.98	1 83	1 62	1 55	1 52						
Sept. 17, '13		0.08	0.13	0.25	0.49	0.52											2.88	2.16	1.96	1.56										
Sept. 17, '13		0.63	0.05	0.14	0.41	0.64											3.24	3.00	2.36	1.92										
Aug. 20, '14		0.01	0.17	0.30													2 04	1.80												

Note—The figures in this column are inches of accumulated rainfall before the excessive rainfall began.
* July 11, 1897: Total of 2.56 in. fell in 56 min.; no rain for seven days before. In 4 hr., 1 min. 3.81 in. fell, a rate of 0.95 in. per hr.
† June 23 1901: Rain for 12 days before. Total of 2.3 in. fell in 2 hr., 55 min., a rate of 0.19 in. per hr.

Newark Terminal to Relieve Traffic Congestion

SYNOPSIS—The development of the business district and street-railway facilities of Newark, N. J., along two main arteries has resulted in great congestion. This article shows how the trouble will be removed by a double-deck railway terminal.

The development of Newark, N. J., has produced two main arteries of travel—Broad and Market Sts.—which have become so overcrowded with pedestrians, wagons, street cars, and motor vehicles as to interfere with the operations of the Public Service Railway Co. Practically all the street-railway lines in Newark converge on the "Four Corners," and close to 550 cars per hour are scheduled to pass through the intersection.

Development of Terminal Plan

Some relief was found by employing traffic policemen and by turning off a few cars where possible before they reached the intersection of these two main streets. But these were recognized as only partial remedies. The problem of an adequate solution was very difficult, since many of the railway's franchises provide that the cars must pass through the congested district and any proposition for extensive rerouting involved the nearly impossible task of rearranging the whole business district. The city, while having nearly 400,000 people, is not sufficiently developed to warrant extensive subway and elevated lines.

It should be noted that Newark is the center of a large, thickly settled district of about a million population served by the Public Service Ry., so that while the lines of the railway are politically interurban, the characteristics of the traffic on most lines are those of a very large distributed city—more like Chicago, Philadelphia, Boston, Milwaukee, St. Louis, Pittsburgh or Detroit than casual observation would show.

The key to the present scheme to eliminate the congestion on the lines of the Public Service Ry. was found by T. N. McCarter, president of the company, in 1912 while making an extensive tour of the country as president of the American Electric Railway Association. He was much impressed with the conveniences afforded by electric-railway terminals, especially in the West, and finally he became convinced that a terminal was the solution of the Newark problem—in spite of the fact that here was a decidedly urban railway development, while many of the Western terminals were brought into being by interurban traffic.

A site for a terminal was secured relatively near the junction of Market and Broad St., well inside the important business district. Thereupon the railway organization set out to devise a suitable track layout. Finally, a suggestion by Mr. McCarter that the terminal be separated into two floors led to the development of an acceptable arrangement. It was proposed that cars coming from the west should be brought to the terminal through a subway and should discharge their passengers on a subsurface level, going around a loop and returning by the same subway. Cars from the north, east and south would be brought in from the rear on an elevated floor, discharging their passengers, rounding a loop and returning in the same way. The approaches, track arrangements, etc., finally devised, are shown in Fig. 2.

The site also offered a fine opportunity for a large office building of the allied Public Service Gas, Electric and Railway companies—a convenience which was greatly needed. The design of the terminal and office building will be further presented in a second article.

A large number of changes in the street-railway tracks were required to make the terminal plans effective. These are shown in Fig. 1. The franchises for all this work constituted what was locally known as the "Twenty-Seven



FIG. 1. MAP OF NEWARK BUSINESS DISTRICT SHOWING STREET-RAILWAY CHANGES

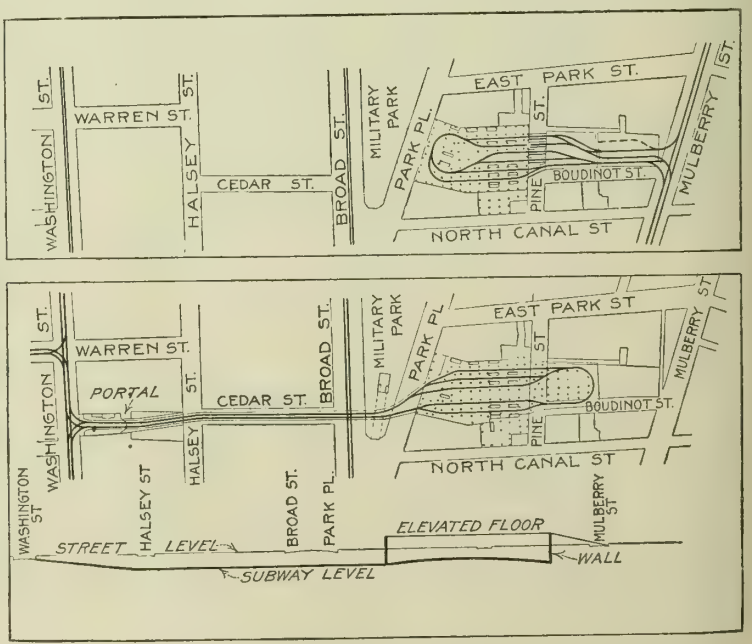


FIG. 2. TRACK ARRANGEMENTS FOR PUBLIC SERVICE RAILWAY TERMINAL

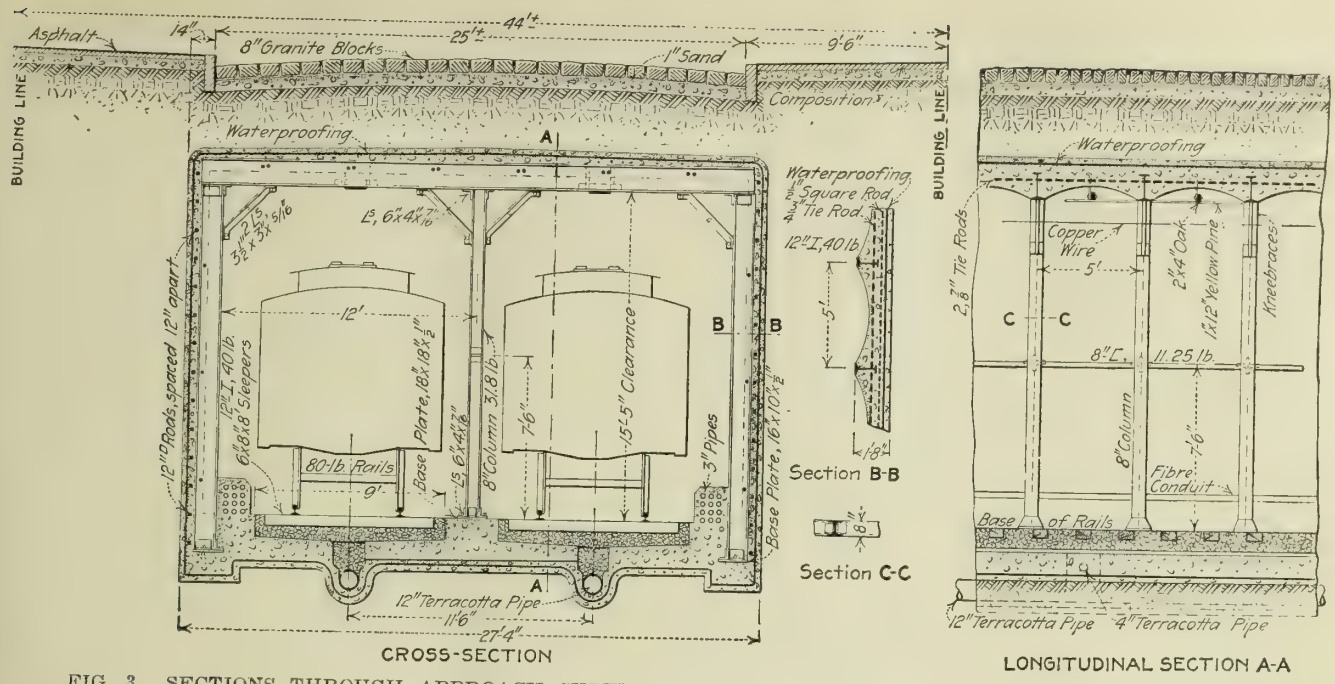


FIG. 3. SECTIONS THROUGH APPROACH SUBWAY; PUBLIC SERVICE RAILWAY TERMINAL, NEWARK

Group," and these were secured from the city, with the approval of the State Public Service Commission, after the legislature had passed an act enabling the company to build a subway and terminal on terms and under conditions prescribed by the Newark Board of Street and Water Commissioners.

These plans for the terminal were first presented to the mayor and board on Jan. 24, 1913. On Apr. 17, 1913, after broad publication of the plans, formal application was made for the 27 franchises. The first of these was approved Aug. 21, and the last on Sept. 18. The Public Utility Commissioners on Mar. 16, 1914, approved all the ordinances, after some changes had been effected in a so-called "Blanket Ordinance," containing general provisions. Ground was broken for the contractor on June 24, 1914. The cornerstone of the terminal was laid with appropriate ceremonies July 20, 1915. The terminal is expected to be opened for railway traffic and office occupation by May, 1916.

Subway Approach

A two-track subway approach to the terminal begins about two blocks west of the building with an open cut, on private right-of-way off Washington St. near Plum. The tracks gradually drop to the portal of the subway and shortly after cross under Halsey St. and are carried along and under Cedar St. to Broad. From here the line cuts across under Broad St., under the southerly point of Military Park and Park Place to the terminal.

A section through the subway is shown in Fig. 3. There is a clearance of 15 ft. between trolley wire and track, and the top of the subway is 4 ft. under all streets. A composite concrete-and-steel design was used on account of the restricted clearances, but even with this arrangement the outside walls extend 14 in. beyond the curb line. The clearance of a car from the inner walls will be 22 in. The subway was run as near the surface as possible, so that the bottom level would approach the bottom of the Morris Canal. This was done so that in case another subway should ever be built up Broad St., no extra difficulty would be imposed in clearing the present subway.

The track construction will consist of 80-lb. T-rail laid in 6 in. of gravel ballast on a concrete bed.

Under the park the tracks diverge. The ingoing tracks lead to two 280-ft. 10-car unloading tracks on the southerly side, and these again unite in a loop (50 ft. radius) connecting them with three 225-ft. 15-car loading tracks on the northerly side. These three finally converge on the outgoing track. Four stairways come up from the unloading tracks to the terminal concourse street level and six stairways lead down from the concourse to the loading tracks. There is a single stairway to the center platform which is not to be used for traffic.

Cars coming into the subway will stop for interchange of passengers before turning off Washington St. The outgoing traffic will also stop on the private right-of-way just east of Washington St., and here will be a small waiting room.

Elevated Approach

The tracks in the rear of the building turn off Mulberry St. at right angles and ascend to an elevated structure crossing Pine St., continuing at that level into the terminal. There are two six-car tracks on the north side, 140 and 170 ft. long. South of these and connected to them by a loop are three loading tracks, 190, 180 and 140 ft. long. The loop has a radius of 47 ft. Five stairways lead down from the unloading platforms to the concourse, and six stairways lead up to the loading platforms. A fourth loading track may be added if needed later to accommodate traffic.

An electric switch and block-spacing system will be installed for both subway and elevated tracks to segregate the cars on different lines and to secure prompt dispatching. There will be a double crossover in the subway under Military Park, so that a blockade on any of the terminal tracks will not tie up the whole system.

The height of the subway and both terminal floors allows the operation of a double-deck surface car if use of one should be found advisable.

It is expected that 400 cars per hour can be handled at the terminal, giving a capacity of 25,000 people per

hour in each direction, satisfying all traffic requirements for many years to come.

Concourse Floor

It is seen that by this design the two train floors are superimposed so that the unloading tracks of the subway are directly underneath the loading tracks of the elevated platform, and *vice versa*—an arrangement which is obviously convenient for the interchange of passengers.

From the subway floor to the concourse floor is 18 ft., and from the concourse to the elevated floor is 17 ft. This gives some passengers a total climb of 35 ft., which is to be compared with the following ones for New York City stations: 32 ft. for the Hudson Terminal at Fulton St.; 30 ft. for the Bronx subway station at 180th St.; 58 ft. from the Brooklyn Bridge subway platform to bridge-train platform; 40 ft. from the Pennsylvania Terminal train platform to the street and 43 ft. from the Long Island R.R. platforms to the street.

The separation of the facilities on two floors provides a clear space of 70,000 sq.ft. on the street level, which serves as an entrance and exchange concourse ample for the large crowds which will have to be taken out at rush hours. This level may be entered from Park Place, Pine St., North Canal St., and East Park St. In addition to the waiting rooms, lavatories, newspaper and candy booths and the office-building elevators, there will be here the showrooms of the commercial departments of the gas and electric companies.

Engineers and Contractors

The design and construction of the terminal and subway have been carried out under Martin Schreiber, Engineer of Maintenance of Way. The special staff for the terminal work has been headed by C. F. Bedwell, Assistant Engineer in Charge. Jacobs & Davies, of New York City, were the consulting engineers on subway and foundations; Geo. B. Post & Sons were the consulting architects.

The contract for the subway and the excavation under the building, with the foundations, retaining walls, etc., was let to the Holbrook, Cabot & Rollins Corporation, of New York City. The contract for the superstructure and remaining work was awarded to the Hedden Construction Co., of New York. The Hay Foundry and Iron Works was the subcontractor for the steelwork covered by both main contracts.

Better Looking City Railway Bridges in Philadelphia*

The improved designs that have been adopted in the Bureau of Surveys for the erection of artistic railway bridges, though started several years ago, are only now beginning to show appreciable results. A railroad bridge crossing a highway has a psychological value. If inartistic, constructed only for strength and utility, it creates the impression that a person is entering an industrial neighborhood where manufacturing interests have been given preference over all the factors that represent the culture and artistic taste of the community, and as such it seems to act as a barrier against the development along any other than commercial lines of the sections lying beyond.

Nobody ever desires to pass under an open trellis of a truss bridge, even though on the footway he may be protected by flashboards from annoyance due to dripping water. If, however, the bridge is constructed along artistic lines with at least as much attention to detail as would be spent on a residence or office building—a concrete-covered girder or cantilever arched bridge with its abutments ending in full sweeping curves and passing trains at least partially screened from view—it has a better effect upon the public. The artistic construction of bridges might reasonably be expected to result in the more rapid development of those sections to which access must be had by passage under the bridge. The same is also true where the highway has to be carried over the railroad line.

This comment on the matter of design in railroad bridges raises a general question. In all such undertakings we are undoubtedly spending entirely too little on the æsthetic features of the work. Our engineers and their assistants are employed principally to draw up plans and specifications to carry out work for purposes of utility. We put a premium on the smallest possible "first cost," and for structures which can be kept in repair at the least expense. Unfortunately it is easily conceivable that we might have all our construction work done at an exceptionally low first cost, and so as to require low maintenance charges and yet have a very inartistic city in which to live.

Through the influence of public-school education, art classes and splendid specimens of home building, our people are becoming more and more educated to the possibilities of artistic fitness in all kinds of structures. I think it would be a very popular move if councils should see their way clear to allow a certain percentage of the appropriations made for certain classes of construction contracts (that is, those for bridges, boulevards, buildings of all kinds, parks and open places and other such undertakings) to be expended for professional advice as to art and pure-design considerations. The public is unconsciously impressed by work that has been artistically designed and gives credit where in the absence of such a quality they just as unconsciously censure it.

Ultimately, of course, we should have here a division of design which will have as its main function everything that is done by this and perhaps other departments affecting the beauty of the city. Such a division should not have a large staff of regular employees. Perhaps its main function will be to organize its work so as to be able to lay its hands on the services of those best qualified to do a certain kind of original work at any given time and place.

The usual conception of the function of the Art Jury is that it was intended to fill this niche. This is absolutely wrong, and unless it is corrected will defeat the very purpose for which the Art Jury was created. The Art Jury is simply a critical division—one to comment on the work of others and to suggest the lines along which changes may profitably be made. An effort to combine with this a function of original design will put a burden on the Art Jury that will make it impossible to get the best class of jurors to serve. The functions of original design and of criticism must always be kept distinct if the best results are to be accomplished.

*From the 1914 report of M. L. Cooke, Director Public Works, Philadelphia, Penn.

Rebuilding Elevated Railways in New York City—II

SYNOPSIS—Concluding part of a description of elevated-railway rebuilding work costing over ten million dollars and requiring 50,000 tons of new steel. Summary of the changes made in the various portions of the line. The old express-train system, with long runs from the City Hall district to Harlem, is replaced by a system of operation with express stops about a mile apart. This required building new stations into the existing trackage.

It is interesting to see that as shown by the work now in progress the old structure has in many places sufficient excess of strength to support the 100 per cent. or more increase of loading without requiring reinforcement. In the case of the old single-stem construction on New Bowery, where a second deck with two tracks is being added (see *E*, Fig. 6, for an outline sketch and Fig. 1 for a view), the 15-in. two-channel columns have sufficient sectional area not to require reinforcing. However, the structure is provided with a large amount of new bracing. Transversely, the connection of the new cross-girders which support the upper deck reduces the free length of the columns; longitudinally, portal frames of truss construction are inserted between the columns as shown in the side elevation in sketch *I*, Fig. 6.

Bracing the Old Structure

Bracing was added at the 50- to 60-ft. high structure along Eighth Ave. near the 116th St. station (Ninth Ave. line). The towers here are of Phœnix columns with longitudinal and transverse portal diagonals and struts (the latter four-angle balloon struts), while transversely the deep pin-connected trusses carrying the track girders brace the columns. As these portal systems end some 30 ft. above the street, it was considered desirable (because the operation of through expresses would increase the impact and vibration) to add another panel of bracing, extending the bracing down to within minimum clearance height of the street. The result may be seen in Fig. 8. While the old struts and ties were attached to the columns by through bolts or pins, the attachment of the new members is made by a carefully devised riveted connection to the flanges of the column bars, the gusset-plates being notched around the old column rivets and fastened by new intermediate rivets.

Column and Girder Types

The old structure contains a picturesque variety of types of columns—Phœnix columns, two-channel latticed columns, columns made of four 6-in. I-beams set with their webs in radial planes and connected by cast-iron spreaders and cap blocks, etc. While all of these columns are in excellent condition and of ample strength for the normal service, many required replacement on account of the increase of loading. In some instances the old columns could be retained by strengthening a detail. In the case of the double-channel columns built with a spread head-portion (the channels being bent outward to form the head) the original latticing at the spread portion has been replaced by large side plates; thus reinforced, most of the columns proved ample for the increased loading.

The majority of the old track girders and many of the cross-girders were of truss construction, with angle web-members usually joined by two- or three-rivet connections to the legs of the flange angles without the use of gusset-plates. Most of the new construction is of the plate-girder type, as this is no more expensive in first cost than lattice construction and from the maintenance standpoint is cheaper in the long run. However, on the Bowery where the structure is being entirely rebuilt with three tracks over the street in place of two single tracks over the curbs, all tracks girders are of lattice type, to give more light and obtain uniformity. In some instances where lighting requirements made openings in the webs desirable, these are obtained by cutting holes in the plate-girder webs rather than by resorting to truss construction, as exemplified in Fig. 3, where such a perforated girder admits light to the windows of the mezzanine station.

General Summary of Work

Third Ave. Line—On Park Row leading north from the City Hall terminus, the old double-track structure has been replaced by a new four-track structure including a double-deck station at City Hall, inclines connecting the two decks, and with a single-deck four-track station at Chatham Square. The most vital change here is the elimination of the Chatham Square grade-crossing, where the Third Ave. and Second Ave. lines came together and the South Ferry and City Hall lines diverged, all formerly double-track. The plan in *A*, Fig. 6, shows the rearranged trackage. Practically all the structure here is new, except for some old longitudinal girders and a few old platform girders at the City Hall station.

On New Bowery, just south of the Chatham Square junction, the two old single-track single-column structures south to Franklin Square, about 1800 ft., have been altered into a double-deck four-track structure. Where the headroom for street traffic was sufficient, the two additional center tracks are carried by new cross-girders riveted into the sides of the old fan-top columns. Where the street clearance was not sufficient, the cross-girders for these two additional upper-deck tracks are carried on the tops of the old columns. The new center tracks ascend from a junction with the two old tracks near Franklin Square to the overhead crossing at the Chatham Square junction, whence they descend again, each track on a separate bent seated on the lower-deck cross-girders, until they join the lower-deck three-track structure at the south end of the Canal St. station.

Where these two new tracks pass over the old South Ferry branch station at Chatham Square, an additional upper-deck platform has been constructed between the two tracks, thus transforming this station into a double-deck structure.

The two single-track single-column structures in the Bowery for a length of about 5200 ft. north to Fifth St. are replaced by a five-track structure from Chatham Square north to Canal St., and by a three-track structure

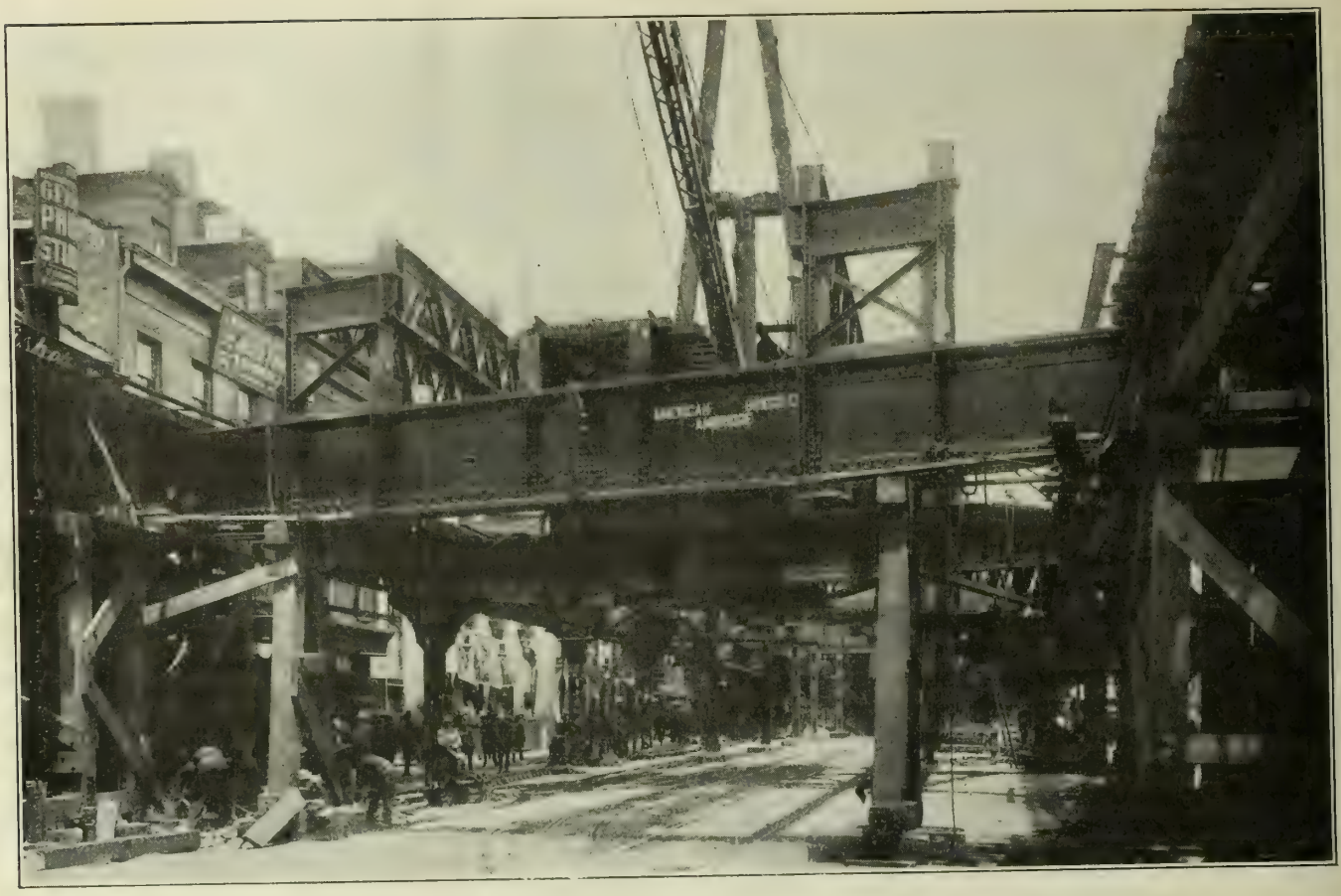


FIG. 10. NEW FIVE-TRACK STRUCTURE; BOWERY, SOUTH OF CANAL ST., MANHATTAN
Old structure, two single-track single-column lines. New columns at location of old columns

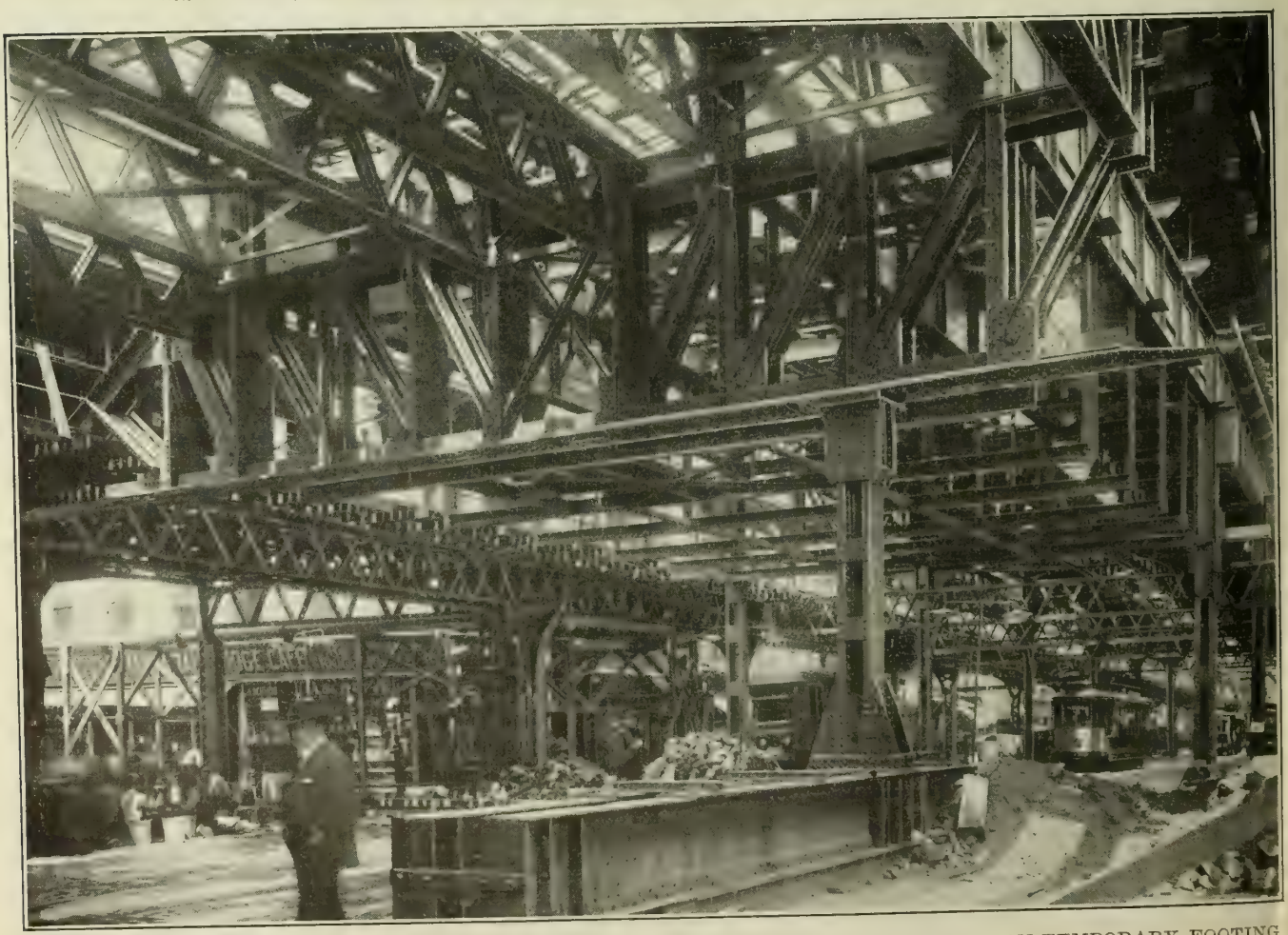


FIG. 11. MEZZANINE STATION FRAMING; CANAL ST. AND BOWERY; TRANSVERSE TRUSS ON TEMPORARY FOOTING



FIG. 12. NEW THREE-TRACK ELEVATED STRUCTURE ON THE BOWERY
Outer ends of cross-girders interfere with old structure



FIG. 13. BOWERY ELEVATED-RAILWAY STRUCTURE IN STREET. OLD STRUCTURE AT SIDES TO BE REMOVED
No interference with old structure at this point

thence north to Fifth St. The five-track structure is needed to carry the two overgrade tracks at Chatham Square station down to a connection with the lower-deck tracks. There are extensive interferences between the new and old steelwork in this section, making the work very difficult. Further, new stations are being built at Canal St., at Grand and Broome St., and at Houston St., all three being mezzanine stations with island platforms.

From Fifth St. north through the Bowery and Third Ave. to 116th St., a distance of 5½ mi., about one mile of center track has been laid to complete the express tracks. Stations of the "hump" type for the express track are being built at Ninth, 23rd, 42nd and 106th St.; this work includes the complete replacement of 35 bents and the raising of the center-track girders to form the hump, in addition to the work in the stations proper.

Second Ave. Line—The Second Ave. line from Chatham Square to 116th St. requires the construction of about 23,000 ft. of new middle track on new girders; the cross-girders in general are sufficiently strong. In this section the longitudinal girders have lips resting on top of the cross-girders, while on the greater part of the other lines the track girders frame into the webs of the cross-girders. Express stations are provided for at 14th, 86th and 42nd St., the former two of the hump type, the last of the island-platform type with mezzanine station. A local station at 92nd St. has been reconstructed for outside platforms.

North from 116th St. to the south end of the Harlem River bridge at Second Ave. and 129th St., the trackage is revised and track inclines built to form approaches of the express track to the upper deck of the new bridge. This involves renewing about one-half the columns and cross-girders in addition to constructing the upper-deck structure. The revision of trackage also involves spreading the running track and track girders while in service, on part of the line. The old station at 127th St., Second Ave., has been demolished and a new mezzanine station built at 125th St.

Replacement of the swingbridge and its two approach spans by new double-deck spans is now completed. The old piers were found ample to carry the new structure. The swingbridge was floated into place Aug. 22, 1915 (see *Engineering News* Sept. 2, 1915, p. 437), completing the transformation, the other spans having been floated in several months ago. In all cases the spans were built on falsework along the shore just south of the bridge and were lifted off by scows fitted with sandboxes on falsework; the raising and lowering of old and new spans to remove and place them was accomplished by the tide, hydraulic jacks, and the use of the sandboxes.

Third Ave. in the Bronx (Suburban Line)—North of the Harlem River bridge the two existing tracks are sufficiently far apart to admit of the old independent structure between them (which carries the New Haven shuttle connection), being supplemented by an upper deck to 132nd St. From here on to 133rd St. the express tracks are carried on an entirely new structure between the two old local track structures. North of 133rd St. the same construction is continued, but the westerly track of the present line has been shifted west under traffic 13 ft. on a length of 2600 ft. to make room for the new structure. The track girders carrying the southbound track were originally supported on masonry piers between 133rd and 143rd St.; new piers were constructed to support the southbound track while it was being shifted westward. Double-deck stations have been built at 133rd, 138th and 143rd St., replacing the existing stations.

North of 143rd St. the two upper-deck tracks merge into one at the lower level, and a three-track structure continues thence north to the end of the line at Fordham Road, about three miles. On the southerly two miles of this section it was necessary to replace all the columns, as they were not sufficiently strong to carry three tracks. Seven island-platform stations in this section are being rebuilt as stations with outside platforms (for local service only) and three island-platform stations are being rebuilt as express stations with two island platforms.

Ninth Ave. Line—The Ninth Ave. line required as its largest item of work the construction of a middle track for 10,500 ft. from Cortlandt St. to 14th St. About one-third of the columns required renewal. The old structure was composed of two single-column single-track structures on the curbs, and cross-girders existed only at stations. These cross-girders had to be renewed or reinforced, and for the rest of the line new ones had to be placed. About 4300 ft. of the old track girders are also being renewed, as they are of a peculiar type not adapted to connect to the new structure. In order to make the work on the old tracks possible, the center track had to be completed and southbound traffic diverted over it, thus permitting first one and then the other outer track to be rebuilt. For this purpose the center track, although its northerly portion later had to form an incline to the 14th St. station "hump," was first constructed on the level of the old track. After completion of the rebuilding of the outer tracks the northerly part of the center track was jacked up to the grade of the incline.

The stations at 14th St. and 34th St., which had outside (local) platforms only, have overgrade platforms added for the express track, and this track has correspondingly been raised to a "hump" at the station on new bents and new track girders.

Where the Sixth Ave. line joins the Ninth Ave. line, at 53rd St., the express track of the Ninth Ave. line crossed the southbound Sixth Ave. turnout track at grade. This crossing has been improved by elevating the center track over the crossing. A number of the cross-girders and columns were renewed in connection with this work, on account of the increased stresses in the structure resulting from the higher position of the express track.

At 66th St. and 145th St. the existing local stations are being rebuilt into hump stations like those at 14th St. and 34th St.

At 116th St. and 125th St., the outer tracks have been spread 6 ft. and 5 ft. 9 in. respectively, and the center platforms, which formerly interrupted the middle track, have been moved and lengthened and now form island platforms constructed between the southbound and middle tracks and between the northbound and middle tracks alternately, with the adjacent ends sufficiently separated to enable the middle track to run through. In connection with this work a considerable amount of bracing is added to the towers supporting the structure between 114th and 117th St., where the roadbed is about 60 ft. above street level. The mezzanine concourse at the 125th St. station required enlargement, while at 116th St. the old stations formerly at the inside ends of the platforms at

track level have been removed and a new mezzanine station constructed at the level of the passage from the elevator.

The present terminal of the Ninth Ave. line at 155th St. and Eighth Ave. has been almost completely rearranged as to trackage and gradients, yard tracks have been added, and the roadbed has been raised 4 ft. on the average to admit a mezzanine station below and enable a new mezzanine station to be built at 157th St. (alongside the baseball grounds). The old east and west stations at 155th St. have been abandoned as stations; they will be used by the trainmen for other purposes. An entirely new commodious station was built just north of the 155th St. Viaduct with stairs leading up to the viaduct and down to two new island platforms which extend northward to the 157th St. mezzanine station. The new mezzanine station near 155th St. is located below the south end of these platforms.

The existing connections with the New York & Putnam R.R., running north from this point on an elevated structure and crossing the Harlem River to its suburban line northward, will be maintained, but the line from 157th St. across the Harlem River will be taken over by the Interborough Rapid Transit Co. and a new line built eastward from the north end of the bridge to connect with the new city elevated railway on River Ave.

Figures and Names

The total weight of new steelwork involved in the elevated improvements is a trifle over 50,000 tons. The entire enterprise includes, besides the work outlined in the foregoing pages, two extensions, and two connections: (1) A connection to the Queensboro Bridge from the Second Ave. line at 60th St., involving also considerable rearrangement of the trackage on the Second Ave. structure for some distance south of 60th St.; (2) a connection with the West Farms elevated section of the present Interborough subway diverging from the Third Ave. line at about 143rd St.

The entire work has been planned throughout by, and is being carried out under the supervision of George H. Pegram, Chief Engineer of the Interborough Rapid Transit Co. F. W. Gardiner is Principal Assistant Engineer, and S. Johannesson, Assistant Engineer of that company.

The construction organization consists of a temporary association of three contracting concerns, T. A. Gillespie Co., Terry & Tench, and the Snare & Triest Co. The associated affairs are managed by E. J. Govern of the T. A. Gillespie Co. The construction work between these three is divided as follows:

The Gillespie Co. handles all the foundation and all station reconstruction (other than that portion of station reconstruction handled by Snare & Triest), except for the supporting steel. The Snare & Triest Co. carries on all erection and reconstruction work other than foundations on the Ninth Ave. line from 66th St. north to 145th St., and on the Third Ave. line from 149th St. north. Terry & Tench are handling the erection and reconstruction on the other portions of the Ninth Ave., Second Ave., and Third Ave. lines.

Work was begun on Mar. 25, 1914, and at the present time is 85 per cent. completed. Already trains are running over some of the revised tracks, although complete service has not been established.

Old Wooden Turbine Tested

By Clinton B. Stewart*

During the period 1850-60, while the American type of hydraulic turbine, inward and downward flow, was being developed, many wooden turbines were built for small powers by ingenious millwrights, employing some of these same ideas. The general principle was to use a central downward-discharge chamber which contained a paddle wheel made of flat blades revolving about a vertical axis, the water being admitted to the chamber through a single scroll entrance or several curved guide passages equally distributed around the circumference of the casing.

No reliable records of tests on such a turbine have been found, but the drawings of one used at Wausau, Wis., from 1858 to 1877 have been preserved and a full-sized model was made and tested. The results of these tests are



FIG. 1. MODEL OF OLD WOODEN TURBINE

given in the following paragraphs, as being the nearest possible approach to knowledge of the performance of the old machines.

Model of Old Wooden Turbine

This turbine was used to drive a "run of stones" by means of a belt from the vertical turbine shaft to the vertical mill shaft.[1]

Fig. 1 is from a photograph of the model, and Fig. 2 shows the details and flume setting for tests. It will be seen that the runner was made by bolting four 2x12-in. planks, about 2 ft. 2 in. long, to a 12-in. vertical shaft,

*Consulting Hydraulic Engineer, Madison, Wis.

[1]A common practice when this turbine was installed. A "run of stones" signified a circular pair, 3 to 5 ft. in diameter, the upper one revolving with the vertical spindle and the lower one being stationary. Water-power grants frequently included the right to sufficient water to drive a stated number of runs of stones. The American type was developed largely as a result of the demand of the grain-milling industry and it displaced the Fourneyron outward-flow and Jonval axial-flow types. These had supplanted the breast, overshot and curved-blade undershot wheels, which had been developed from the primitive flat-vane undershot impulse wheels. The breast and overshot wheels reached an efficiency of 60 to 80 per cent., compared with the 20 to 30 per cent. of their prototypes; but the difficulties of fluctuating tail-water remained unsurmounted until the Fourneyron outward-flow type (1827), the Fourneyron inward-flow type, Howd wheel (1838), and the Jonval axial-flow type (1840) appeared—utilizing the reaction principle and working submerged. These gave good efficiencies and were used up to 1860 in the larger installations. But they were comparatively expensive and did not find general service in small plants. Apparently up to about 1860, when the iron runner with double curved buckets was introduced, there was no simple, inexpensive turbine for small powers and low heads which would work submerged with an efficiency above about 30 per cent.

allowing the end of each plank to project beyond the side of the shaft about 12 in. There were four curved guide passages, rectangular in cross-section, for the entrance of the water, so arranged that the inner end of one guide overlapped the outer end of the adjoining guide. At the entrance of each guide passage there was a butterfly valve, as shown, and an arrangement by means of a collar around

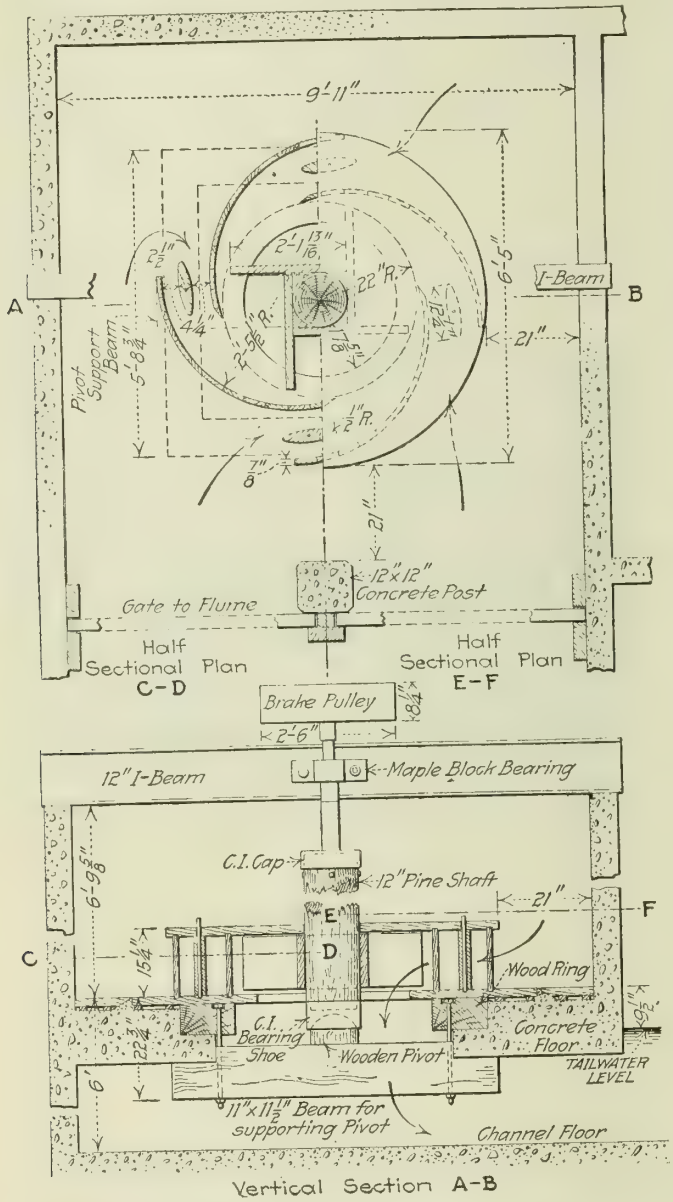


FIG. 2. TURBINE DETAILS AND TEST ARRANGEMENT

the shaft whereby all valves could be closed or opened by a wrench. The opening in the flume floor through which the water was discharged was circular, the radius being about 4 in. less than that of the circle described by the outer ends of the planks forming the runner. It was evidently intended to act as a submerged impulse wheel rather than to obtain any benefit from reaction.

Tests and Their Results

The object of the tests was to determine the amount of water used, the power developed by the turbine and the efficiency, under hydraulic conditions duplicating as nearly as possible those in the mill. The discharge of the turbine was measured by means of a submerged orifice 4 ft. square, placed in the flume leading to the turbine, which had been carefully calibrated by the writer in 1908.[2] The horsepower was measured by means of a prony brake

The results of this test are shown by Fig. 3, which gives the relations of speed to efficiency, power and discharge. It will be noted that the maximum efficiency under the best working conditions was about 27 per cent., while the maximum power developed at the turbine shaft was about 6.4 hp.

In order to determine the approximate loss in the bearings and the effect of this loss on the efficiency, a test was made of the starting torque. This test showed that 15 lb. on the 3½-ft. arm of the prony brake was required to start the turbine. Using this torque as a measure of the friction during motion the results indicate that not more than about 8.7 per cent. of the total power was absorbed in the bearing, and that the hydraulic efficiency was about 30 per cent. With an allowable 5 per cent. loss in the bearings, the actual efficiency would have been about 28 per cent.

Tests were also made with the tail-water lowered so that air was admitted freely under the flume floor. The results showed that there was no measurable change in the efficiency of the turbine.

The cause of the low hydraulic efficiency of 30 per cent. is quite evident. When a jet of water impinges normally on a moving plane surface, not over one-half of the energy of the jet can be transformed into work. The vanes of the runner were formed of plane surfaces, were few in

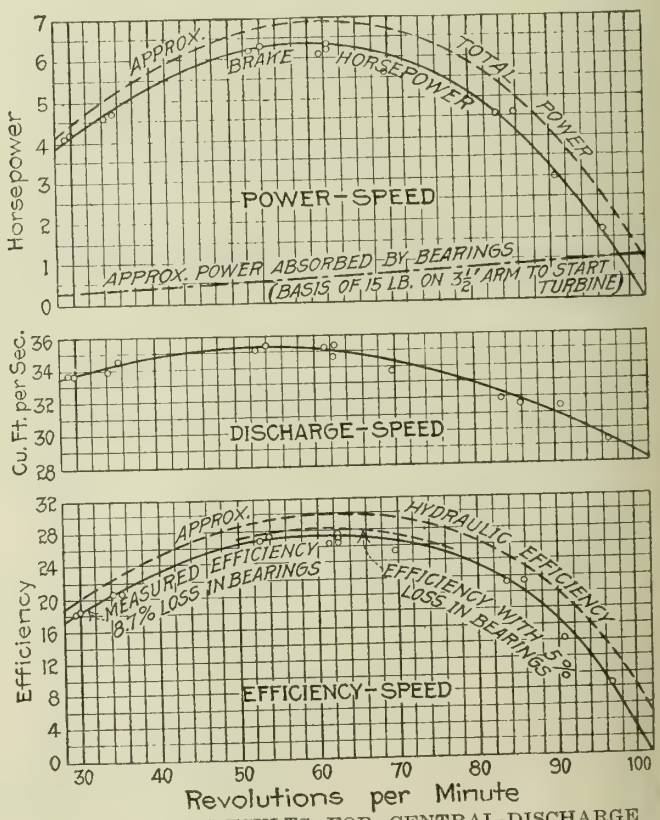


FIG. 3. TEST RESULTS FOR CENTRAL-DISCHARGE WOODEN TURBINE

Headwater, 5 ft. deep in flume; tailwater, 0.8 ft. below flume floor; effective head, 5.8 ft.; gates wide open

number and so arranged as to cause a large loss of energy because of sudden change of velocity and impact at entrance.

The tests were made in the hydraulic laboratory of the University of Wisconsin, to the officers of which credit is due for the use of instruments and facilities.

[2] "Bulletin No. 218," University of Wisconsin.

City Planning in Queens Borough, New York—II

By Frank B. Tucker*

SYNOPSIS—The preparation of the tentative map, surveys for the final map, the final map and what data it contains—all these details of practical city planning in a rapidly growing community are described.

The numerous preliminary details in connection with the laying out, widening and discontinuing of streets in the Borough of Queens, New York City, having been discussed in *Engineering News*, Sept. 30, 1915, the present article is confined to the engineering work of establishing the predetermined city plan.

Tentative Map of the Borough

Upon the assembled reproductions of the planetable (sheets of the original topographic survey) is laid out the proposed street system as determined after a careful study of the many legal and engineering considerations, and of other facts requiring investigation before committing the city to a definite street plan. The design is then carefully plotted on a scale of 1 in. = 200 ft. on the mounted sheets themselves, and a tracing made.

To this tracing is given the appellation "Tentative Map" (Fig. 1 is a small section). It is formally adopted by the city Board of Estimate and Apportionment, and thereafter is available to the public on a scale of either 400 or 800 ft. to the inch (to which scales it is photolithographed) for a very nominal charge.

The complete Tentative Map of the Borough of Queens will consist of 14 units, separately prepared but collectively studied, varying in the areas comprehended from 1000 to 8450 acres. Of these, 13 have already been completed; the 14th, which is for the lowland adjacent to Jamaica Bay, will be completed this year.

The Tentative Map is an effort on the part of the city to control its future growth. It is intended as a warning and a guide to real-estate developers and promoters as to the lines along which they must develop their property if they would have the city take official cognizance of their streets. While it gives no block dimensions, it is accurately drawn to scale, and is readily adaptable to locating new streets.

Making Surveys for Final Map

Any real-estate developer or promoter who disregards the Tentative Map and lays out his property to suit his own immediate ends is inviting future trouble for himself and for all who may purchase property from him, for the city is determined to exercise surveillance over the opening of all new streets; and while there is no compulsory legislation requiring property owners to observe the Tentative Map, the fear that the city will otherwise omit their streets from its final map has a most salutary influence.

Coincident with the preparation of the Tentative Map has proceeded the preparation of the Final Map (of which Fig. 2 is a small section). The preparation of this map is quite different from that of the Tentative Map, which is based upon the planetable and traverse survey of the existing streets, and is devoid of dimensions other than street widths and tentative grades. The Final Map is based upon an accurate property survey of each and every existing street to determine its true relations to abutting private property and to every other street; it is replete with dimensions.

For the survey for the Final Map all the data obtainable are secured. The deeds, the sale and survey records and the old road maps on file with the county clerk or elsewhere are carefully studied and such information gleaned therefrom and from private surveyors and title guarantee companies as will be of assistance in picking up street lines upon the ground. But no matter how complete the data gathered from these sources may be, the real work must be done upon the ground with transit and tape.

First, average lines are independently picked up on each street and compared with each other to see how they hold to the private property dimensions given by deeds and sales maps. Then it becomes a case of cut-and-try until the line of each street is determined beyond all question.

Street Monuments; Map Computations

When this line is obtained, it is marked with granite monuments 4 ft. long with a minimum square cross-section of 8 in., to which dimensions their tops, with side drafts of 2½ in., are dressed. In general, monuments are set every other block along the short dimension of the blocks and every block along the long dimension.

Deciding the best offset from the building line upon which to set monuments has proved something of an enigma. In old Long Island City, which was monumented in the seventies, a 5-ft. offset was used. With a view to clearing building appurtenances which often encroached this much beyond the building line, preventing a direct sight between monuments, the Topographical Bureau during its early experience used an 8-ft. offset, but this was found to fall within the catchbasin area, so the 5-ft. offset was resumed.

All preliminary measurements to determine the location of monuments are most carefully made by the method described in the article entitled "The Method and Apparatus for Chaining Used in Topographical Bureau, Borough of Queens," by George J. Falkinburg, *Engineering News*, page 291, Mar. 14, 1907. Angles are measured by 12 repetitions.

Computations for Final Map

When the survey of an area is completed the results are turned over to the computers for adjustment, coördination and the determination of block dimensions. The results of the fieldwork as received by the computers is usually a plot showing all monuments, with the angles and distances between them, together with the field-books, that the plot may be verified.

*Assistant Engineer, Topographical Bureau, Borough of Queens, New York City.

The adjustment of the monument traverse is the first and most difficult part of the computations. Adjustment is a matter of experience and judgment, the common proportional methods of traverse balancing being applicable only to a limited extent. There is a gridiron system of monument lines, running through every street or every other street, which must be whipped into proper relationship with the other systems, and with similar lines in sections already adjusted—due consideration being given to their subsequent connection with monument lines yet to be run. The demands of widely separated communities for final maps make it impossible to prepare the final map as a unit.

No rules can be laid down for effecting these adjustments. The procedure is to make all possible tests to prove the accuracy of the fieldwork, and then make such shifts and swings in the monument lines, both individually and collectively, as the tests indicate will more closely approximate actual conditions and make the whole survey consistent with itself and its measurements mathematically correct.

When the adjustment is completed a traverse is run through all the monuments to test the accuracy of the adjustment and for the determination of the coördinates of all monuments.

The block dimensions are next determined by reduction from the monument lines, and where already subdivided, are carefully compared with the private sales maps to see that private property is not affected. Any surplus or deficiency that may be discovered is distributed *pro rata* among the blocks. In almost every case, there is a surplus resulting principally from the fact that until quite recent times most of the surveyors in the borough used a standard that was an inch longer per 100 ft. than the United States standard.

Drafting the Final Borough Map

When the computations of a given section are completed, a rough-draft working sheet with all dimensions goes to the drafting room where a careful plat of it is made to a scale of 1 in. = 80 ft. upon mounted sheets, 31x53 in. The monuments are first plotted by their coördinates in the Tenth Ave. and 225th St. system (described in *Engineering News*, Sept. 30, 1915), and then connected. From the monument lines the blocks are drawn in by their offsets. These mounted sheets are then taken in adjacent predetermined pairs, and a finished tracing made.

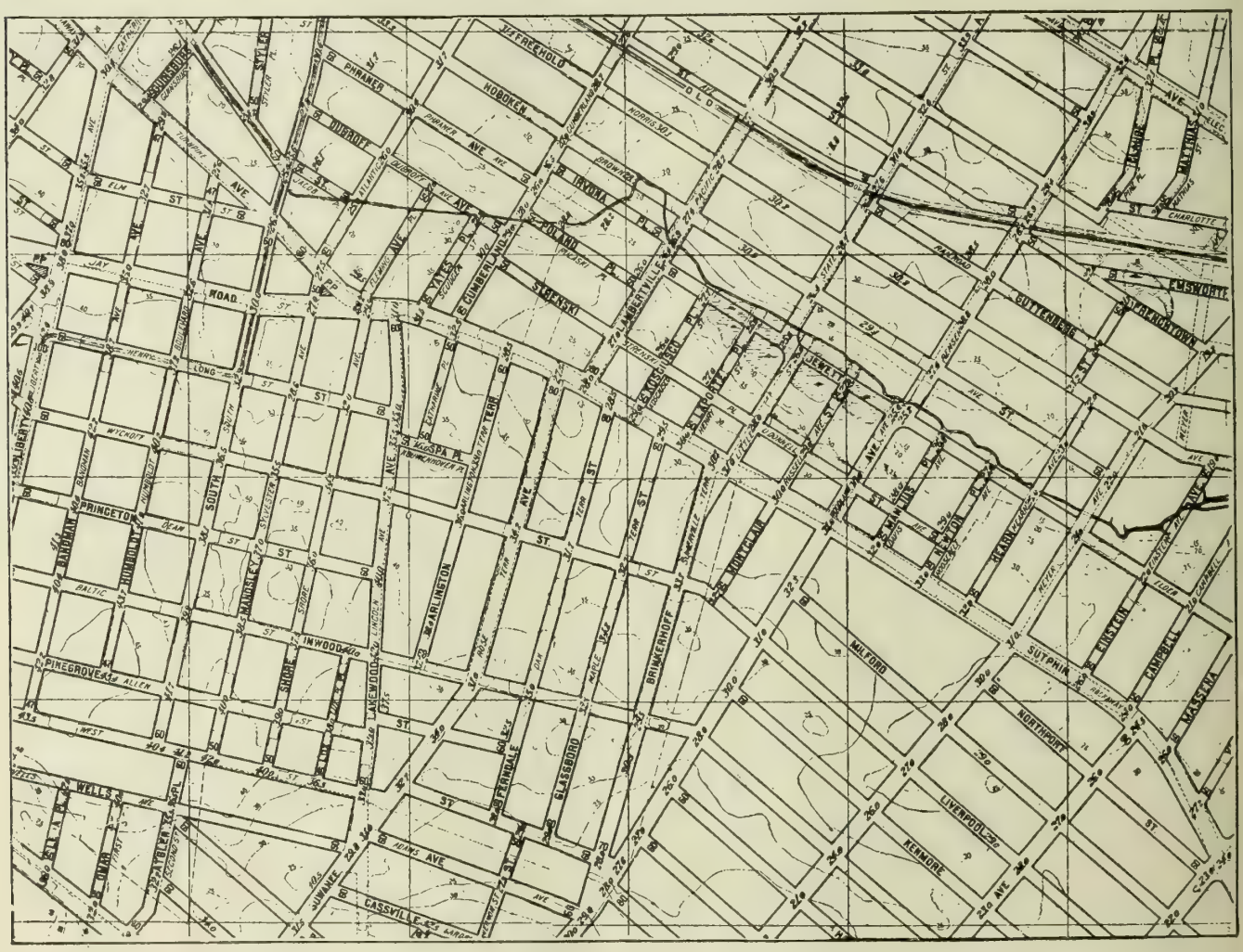


FIG. 1. SECTION OF THE TENTATIVE MAP OF THE BOROUGH OF QUEENS, NEW YORK CITY

Completing the Final Map

This tracing (Fig. 2) is a sectional unit of the final map of the Borough of Queens, and fulfills the charter requirements for the area it embraces. Each section covers an area of approximately 367 acres, and is numbered according to the predetermined system for identification and for cross-reference with adjacent sections.

Upon its completion, each section is sent to the Board of Estimate and Apportionment for approval, following which it becomes the final and authentic plan of the lines and grades of the streets shown thereon, and as such, certified copies are filed in the several offices of record required by the city charter; namely, the county clerk's, the corporation counsel's and the borough president's. For general use, for the purpose of filing and for sale to the public, each tracing is photographed down to a scale of 1 in. = 200 ft., and at this scale makes an atlas sheet 24½ in. square.

The importance of the Final Map lies in the fact that no street improvements are made by the city in its absence. On it also is predicated the legal proceedings followed by the city in acquiring title to its streets under its statutory right of eminent domain—a mete and bound description of each street as laid down on the Final Map forming part of the court's record.

To date 74 sections (about ⅓ of the Final Map) have been completed, besides numerous special final maps of small areas and of single streets, necessitated by some exigency. In the interest of economy or to facilitate industrial enterprises, maps altering the final map are from time to time made. Certified copies of the revised maps, of course, are filed in the several offices of record as outlined in a preceding paragraph.

C. U. Powell is engineer in charge of the Topographical Bureau of the Borough of Queens and L. M. Schoonmaker is principal assistant engineer.

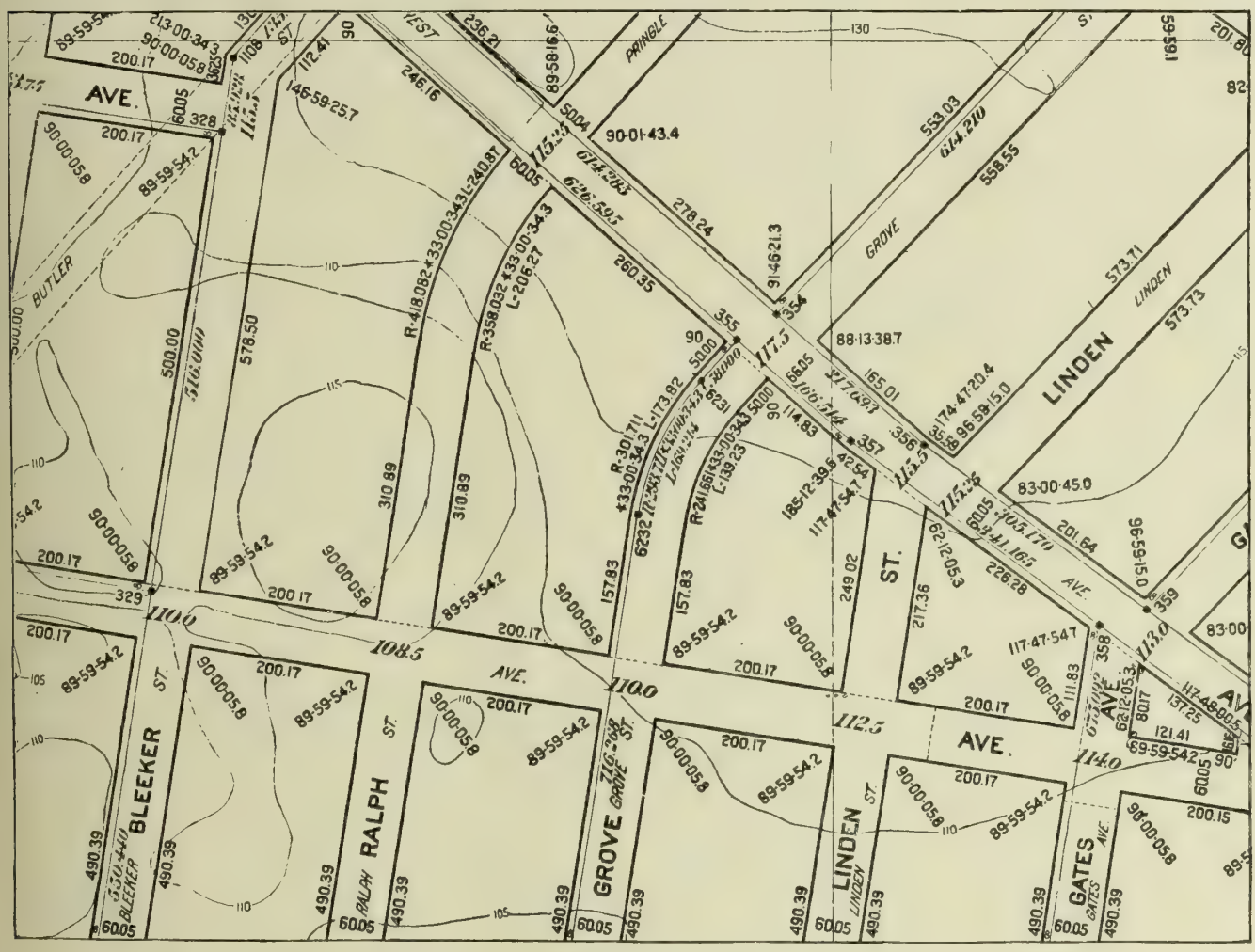


FIG. 2. SECTION OF THE FINAL MAP OF THE BOROUGH OF QUEENS, NEW YORK CITY

Daily Surveys on Panama Slides

The continued slides along the Gaillard cut on the Panama Canal have made it necessary that daily surveys of the canal sides and bottom be made there in order to keep the authorities informed as to the state of the channel. The *Canal Record* reports the details of these surveys as follows:

Three field parties leave Paraiso every morning at 7 in launches, proceed to their respective parts of the 2,800-ft. section in question, run transverse lines of soundings every 50 ft., making soundings on each line at intervals of 15 ft., from water's edge to water's edge, an average of about 300 ft., plot the soundings, trace the 5-ft. contours determined by them, and submit completed blueprints before 10 a.m. This requires rapid methodical work, and it has been calculated that the field parties, through their developed proficiency, require on the average approximately seven-tenths of a second to drop the lead, read the sounding, raise the lead and cast it for the next sounding.

The contour chart that results from this survey indicates the status of the channel and reveals the points at which extra effort is required. Copies are placed in the hands of the resident engineer, the superintendent, and the supervisor of the Dredging Division, another copy is sent to Balboa Heights for the information of the Governor and the Marine Superintendent, and a fifth is filed with the office records.

As soon as the soundings are completed, four drag parties proceed to drag the channel for bumps that do not show on the cross-section soundings. This dragging is carried on until after the passage of the commercial shipping. By such means it is possible to determine to the inch the depth of the channel; ships are held up or passed on the information received; every inch of the buoyed channel is covered; and the dragging between the passages of shipping takes care of changes that may occur.

This work, as well as the dredging, is carried on every day, including Sundays and holidays.

Albany Sewage-Disposal Works

By John H. Gregory*

SYNOPSIS—A pumping station, grit chamber, Imhoff tanks and sludge-drying beds are being built to prevent a visible nuisance and sludge deposits. The 16 Imhoff tanks have a nominal capacity of 30,000,000 gal. a day.

The City of Albany, N. Y., has under construction a sewage-disposal works for treating the dry-weather flow of sewage as recommended in a report[1] submitted to Wallace Greenalch, Commissioner of Public Works, by Hering & Gregory, of New York City, in July, 1912. The works are being built to prevent a continuation of the offensive conditions in the Albany Basin, a small land-locked harbor which the city is now improving at considerable expense, and also the excessive pollution of the Hudson River in general along the Albany waterfront. To accomplish this result the following recommendation was made in the report referred to:

> That the dry-weather flow of sewage of the City of Albany be collected and carried to one central point and there treated to such a degree as to remove suspended matters which would float on the surface of the water and be displeasing to the eye or which would settle on the bottom and banks of the river and form objectionable sludge deposits, and that the clarified effluent be discharged into the Hudson River off Westerlo Island.

It was not considered necessary to provide, at the present time, for a higher degree of purification, as the ordinary dry-weather flow of the Hudson River at Albany is many times the volume of the sewage to be treated.

The works needed to carry out the recommendation cited consist of a main intercepting sewer along the river front, with connections to the existing sewers, practically all of which have been built on the combined system; a small pumping station for pumping the sewage from a district which would not drain into the intercepting sewer except by lowering the sewer at excessive cost; a grit chamber and main pumping station at the end of the intercepting sewer, for pumping all of the sewage to the sewage-disposal works; and a sewage-disposal works consisting of Imhoff tanks and sludge-drying beds.

The plans and specifications for the sewage-disposal works were prepared early in 1912, but owing to unavoidable delays in securing rights-of-way construction did not begin until July, 1914.

The works now under construction have a capacity of treating an average volume of sewage of 30,000,000 gal. per 24 hr. but are designed to handle the sewage at a maximum rate of 45,000,000 gal. per 24 hr. The present population of Albany is about 108,000, but the plant has been designed to serve a population of 150,000 with a sewage flow of 200 gal. per capita per day.[2]

*Of Hering & Gregory, Consulting Engineers and Sanitary Experts, 170 Broadway, New York.

[1] "Engineering News," Aug. 22, 1912, p. 373.

[2] The water consumption in Albany in the year immediately preceding that in which the sewage-disposal works were designed was about 242 gal. per capita daily. In the report previously referred to it was recommended strongly that all water services be metered (at that time only 26 per cent. were metered), not only to reduce the waste of water but also the volume of sewage to be handled. While it is confidently expected that the water consumption per capita will sooner or later be materially reduced it was not considered advisable to design the sewage-disposal works for a flow less than 200 gal. per capita per day. Should the flow be reduced below this figure the disposal works will be able to serve a population greater than 150,000.

The sewage-disposal works are located in Bethlehem Township, on Westerlo Island, immediately adjacent to the southeast corner of the city and separated therefrom by water known as Island Creek. The city has purchased here about 75 acres of land on which the works are being built. Sufficient land has been secured not only for the present plant but also for its extension in the future, as well as for the construction of sprinkling filters should a higher degree of treatment be needed at some later date.

The ground at the site of the works is several feet above mean high water in the river, the Hudson River at Albany being tidal, with a mean rise and fall of the tide of about 2.8 ft., but is below maximum flood level. In order to protect the works from flooding they have therefore been surrounded by a levee, a portion of which has been made use of in the construction of the Imhoff tanks.

On reaching the pumping station the sewage will first pass through a grit chamber and will then be pumped through a reinforced-concrete force main to the settling tanks. These tanks, which are of the Imhoff type, are 16 in number and are arranged in four groups of four each. Fig. 1 shows a plan of one group together with longitudinal and cross-sections.

Each tank will have one large settling chamber and four sludge chambers, the two sludge chambers adjacent to each other at each end of the tank being connected by an opening in the dividing wall so as to equalize the accumulation of sludge in the two chambers.

When handling 30,000,000 gal. of sewage per 24 hr. and with all 16 tanks in use the settling chambers provide an average detention period of 3 hr. The sludge chambers are designed to hold an accumulation of sludge from a population of 150,000 for an operating period of from six to seven months.

The tanks are rectangular in plan, each being 33 ft. wide, 98 ft. long and having a total depth of 27 ft. 2½ in. measured from the water line in the settling chamber to the bottom of the sludge chamber. From the water line to the slot at the bottom, the settling chambers have a depth of 13 ft. 11½ in.

Over each sludge chamber, which is 20 ft. square inside, a gas outlet is provided, consisting of a hollow truncated square pyramid surmounted by a hollow shaft 6 ft. square inside and extending 2½ ft. above the water line. For convenience of inspection and operation the gas outlets in each tank are connected one with another and with the ends of the tank by a reinforced-concrete footwalk 2 ft. wide, located on the center line of the tank 1 ft. above the sewage level. Similarly, a footwalk of the same type of construction has been provided inside of and at the top of each gas outlet. By means of these footwalks all parts of the tanks that cannot be reached from the outside are made accessible.

The sewage enters each group of tanks at the inflow chamber, from which it passes into the upper channels. From the latter it enters the tanks over a set of submerged weirs. After passing slowly forward in a horizontal direction through the tanks the settled sewage is discharged at the outlet and over another set of weirs into the lower channels. Both sets of weirs are made

adjustable so as to distribute the flow of sewage as equally as possible to all of the tanks.

From the lower channels the settled sewage passes into the outflow chamber and from there into the outflow conduits, which are built in, and as a part of, the walls of the settling tanks and lead to two outlet chambers. From these the settled sewage passes directly into the outfall conduit and flows thence to the river, where it will be discharged under water. Owing to contemplated improvements in the river by the Government the outfall conduit will, for the present, terminate at the outer edge of the government dike.

With Imhoff tanks having more than one sludge chamber it is well known that for the best results it is desirable, from time to time, to reverse the direction of flow through the settling chambers of the tanks in order that the sludge will accumulate at a more nearly uniform rate in the sludge chambers. The tanks have been designed to permit

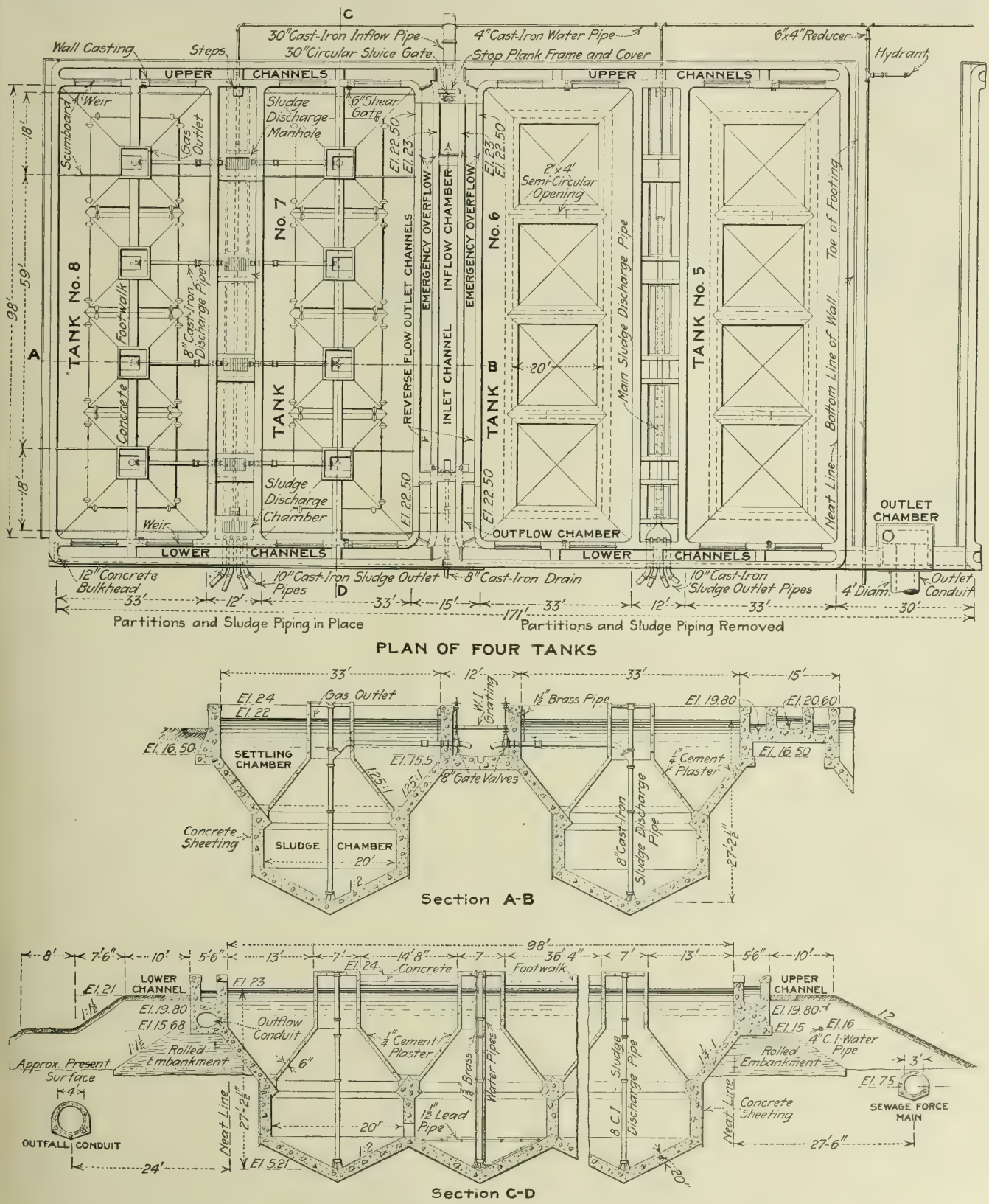


FIG. 1. PLAN AND SECTIONS OF ONE GROUP OF FOUR IMHOFF TANKS, ALBANY, N. Y.

of this method of operation. When thus operated the sewage from the inflow chamber will pass through the reverse-flow inlet channel direct to the lower channels and thence over the weirs into the tanks. After passing through the tanks in the reverse direction, the settled sewage flows over the weirs into the upper channels and corners, are readily accessible for cleaning and have been kept as small as seemed feasible. This is especially desirable, as it may be difficult to maintain at all points, under all conditions, sufficiently high velocities to absolutely prevent some slight deposition in the channels. Should deposition take place the material can be swept along and

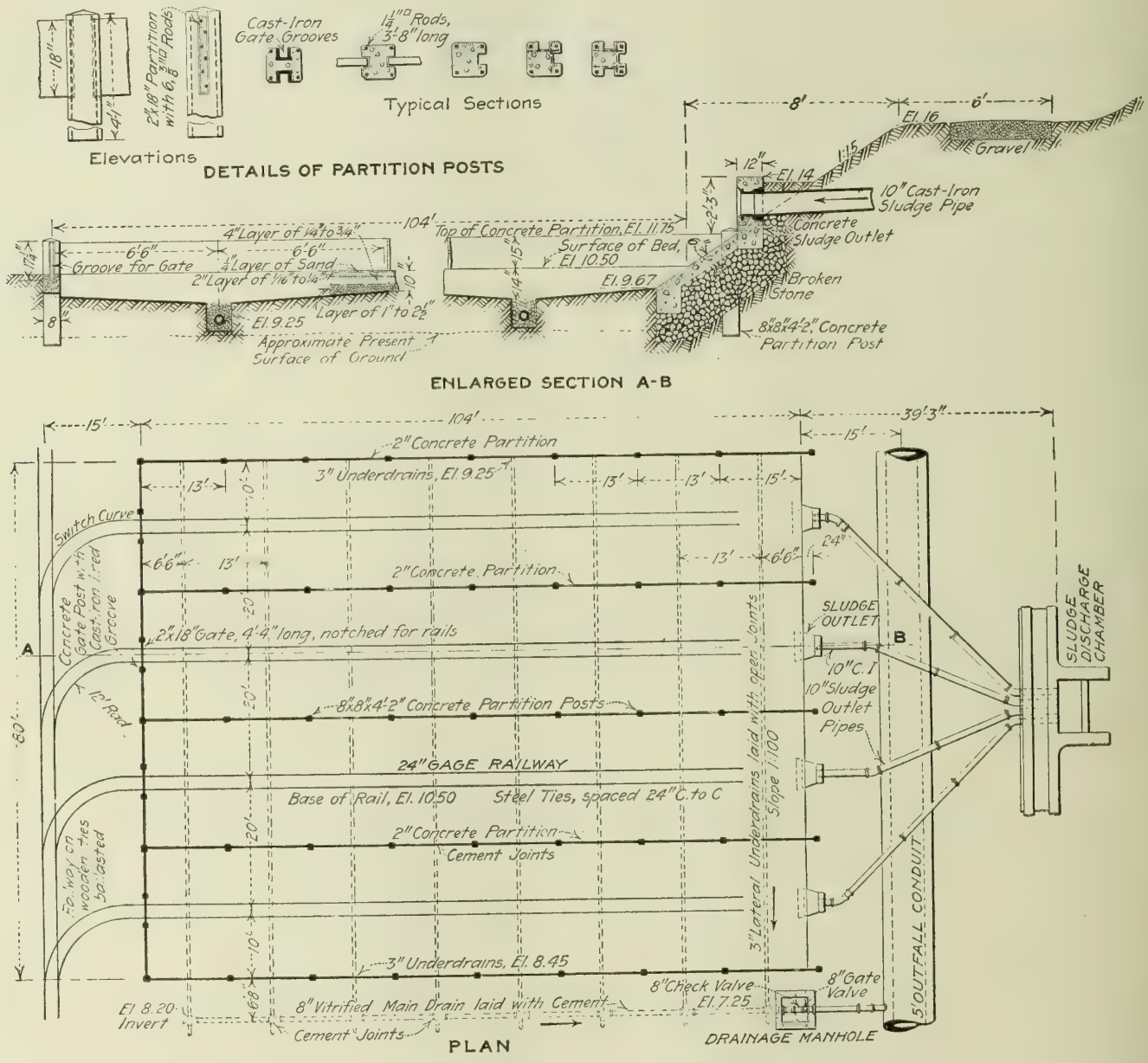


FIG. 2. PLAN AND SECTIONAL DETAILS OF ALBANY SLUDGE-DRYING BEDS

then through the reverse-flow outlet channels to the outflow chamber.

The direction of flow through the channels and tanks can be easily followed by an examination of the plan shown in Fig. 1. The total loss of head through the channels and tanks from the inflow chamber to the outlet chamber when the sewage is flowing in the reverse direction, and with a total rate of flow through the works of 45,000,000 gal. per 24 hr., will be about 1.2 ft.

The direction of flow through the tanks is controlled by means of stop planks held in cast-iron grooves. By means of sluice gates placed in the inflow chambers it is possible to shut off any group of four tanks, as desired.

All of the channels through which unsettled sewage flows to and around the tanks are open, have rounded discharged into the tanks under water through openings provided especially for the purpose and without interrupting the flow through the tanks. When the reverse-flow channels are not in use they can be drained and emptied so as to prevent the holding of stagnant sewage and the production of offensive conditions.

Scum boards are provided at both the inlet and outlet ends and at two intermediate points in each tank. They are of reinforced concrete, are held in cast-iron grooves and can be raised or lowered or removed at will.

The water line in the tanks has been set at such an elevation as to put it above flood level in the river and also so as to provids sufficient head for the passage of the clarified effluent through sprinkling filters, should these be required at some later date. Owing to these

requirements the tanks are being built partly in excavation and partly in embankment.

The sludge chambers are of reinforced concrete. Sheeting, which is left in place, is being used for supporting the sides of the excavation while the chambers are being built.

The outer walls of the settling chambers consist of a heavy facing of concrete placed directly against the inner slope of a carefully made rolled embankment and carrying at the upper end of the slope a vertical concrete wall extending up 2 ft. above the water level in the tank.

From each sludge chamber the sludge is withdrawn through an 8-in. cast-iron pipe terminating in a sludge-discharge manhole, or shallow chamber, just outside of and built as part of the tank. The gates for controlling the flow of sludge are located in these manholes, but are controlled from above so that the operator will be able to see immediately the character of the sludge emerging from the pipe and will have full and rapid control of the whole process of withdrawing sludge. This is especially essential in order to avoid withdrawing partly digested sludge.

From the sludge-discharge manholes the sludge flows through a main sludge-discharge pipe, located between each two adjacent tanks, to a sludge-discharge chamber. From this chamber it is discharged to the sludge-drying beds through any one or all of four 10-in. cast-iron pipes, each of which terminates at the upper end of a sludge-drying bed. With the sludge-withdrawing facilities provided it is possible to withdraw sludge from any one sludge chamber of each two adjacent tanks and to discharge it on any one of four sludge-drying beds.

Ample water connections have been provided so that water under pressure is available at all points for flushing out sludge pipes, for forcing down possible floating sludge in the gas outlets of the tanks and for general cleaning and miscellaneous purposes.

The sludge-drying beds (located immediately adjacent to, but at a lower level than, the tanks, so that sludge can be discharged onto them by gravity) are 32 in number and have a total area of about 66,560 sq.ft. They consist of layers of graded gravel or broken stone, the coarsest material being at the bottom and the finest at the top, the average thickness of the bed being about 12 in. The top surface will at first be covered with a thin layer of coarse sand, but under ordinary conditions of operation the grit removed from the grit chamber will be used for this purpose. Details of one set of four sludge-drying beds is shown by Fig. 2.

The bottom of the sludge-drying bed will be graded into ridges and valleys, a 3-in. drain with open joints being provided in each valley. All the drains from each set of eight beds discharge into an 8-in. main drain, which in turn passes through a drainage manhole and discharges into the outfall conduit. In each of the drainage manholes, of which there are four, the main drain is provided with a check and gate valve to prevent sewage or river water from backing up, at times of high water in the river, into the underdrains and flooding the beds.

The several sludge-drying beds are separated one from another by thin concrete partitions held in position by concrete posts firmly set in the ground. This type of construction has been used in some other plants that have been designed by the writer and has been found to work out very satisfactorily. Not only is the material of a permanent nature, but the concrete posts and partitions present a very much neater appearance than do those of wood. While the first cost is a little more than that of wood, the additional expense is well warranted. The details of the concrete posts and partitions are shown in Fig. 2. This same type of construction is used also for the outer edge of the beds except along the sides adjacent to the settling tanks.

The sludge will be removed from the sludge-drying beds in small cars running on narrow-gage railway tracks laid at the surface of the bed. A track laid at the surface of the bed is not only cheaper but more convenient than one supported above. These tracks connect with a main track extending along the southerly end of the drying beds. The cars will be loaded by hand and pushed along the tracks from the sludge-drying beds to the main track and thence along the latter and up onto the levee and to the point of final disposal.

In designing the works the viewpoint of the operator has been constantly kept in mind, and the various details and arrangements have been carefully studied and worked out so to make all of the operations as simple and as convenient as possible for him.

The total cost of construction of the sewage-disposal works, including the outfall conduit to the river but not including the land, grit chamber and pumping station, based on the estimated quantities and contract prices, will be $277,302. With a population of 150,000 and a sewage flow of 30,000,000 gal. per 24 hr., for which the works are designed, the cost will be about $1.85 per capita and about $9240 per 1,000,000 gal. daily.

The works are being built under the direction of the Department of Public Works, Wallace Greenalch, Commissioner, and Frank R. Lanagan, City Engineer. Stephen B. Vernon, Engineer Intercepting Sewer Design and Construction, is in immediate charge of their construction. The works were designed by Hering & Gregory, of New York City, and the contract for their construction was awarded early in July, 1914, to the Riverdale Contracting Co., of New York.

New Coast-Survey Vessel

The contract for the "Surveyor," a new United States Coast and Geodetic Survey vessel, has been awarded to the Manitowoc Shipbuilding and Dry Dock Co., located on Lake Michigan at Manitowoc, Wis. The contract price was $189,000 for the bare hull and machinery, but the ultimate cost of the vessel fully equipped will be $220,000.

The "Surveyor" will be used in surveying and charting the dangerous waters of Alaska and the Bering Sea in the summer and the coasts of Washington, Oregon and California in the winter. She will be a steel steamer of about 1,000 tons displacement, with triple-expansion engines and will use crude oil as fuel. She will accommodate 66 officers and men and carry enough fuel and stores to stay at sea on a surveying cruise for about three months at a time without returning to her base of supplies.

The contract calls for completion within one year, but E. Lester Jones, Superintendent of the United States Coast and Geodetic Survey, has been informed by the contractor that the vessel will be completed in much less time, possibly as early as August, 1916, which will leave ample time to take it to the Atlantic coast before the close of navigation in the Great Lakes.

Concreting Methods and Records, Elephant Butte Dam

By E. H. Baldwin*

SYNOPSIS—Follows article in issue of Sept. 30, 1915, describing masonry work on large Reclamation Service Dam at Elephant Butte, N. M. This article gives details of concreting plant, method of handling concrete and records made in placing concrete.

The masonry of the Elephant Butte dam is concrete, in which large stone is embedded. As concrete was to be the main feature, careful preliminary study was made to design a plant that would be nearly automatic in its operation, require a minimum amount of labor, have large capacity and permit of using as large a percentage of "plum" rock as governing conditions would allow. This point largely decided the use of cableways and derricks for placing the material in the dam rather than the chuting method, though the large amount of excavation to be made and the necessity of storing considerable of it for use as concrete aggregate also had a bearing on the decision in regard to the method to be used.

The concrete-mixing and handling plant was described in detail in *Engineering News*, Aug. 6, 1914, for which reason it will be only briefly outlined here. All concrete is furnished from the main mixing plant near the easterly end of the dam. The materials for the concrete aggregate are delivered to the plant from the main railroad and dumped by gravity to the crushers and sand elevator. The sand and gravel are carried by a separate elevator to the top of the plant, where they are screened, the sand passing into the sand bin, while the gravel is deflected into the bin for broken stone. The rock is crushed and elevated to the top of the plant, where it is screened and distributed to the proper bins, of which there are three—rock, sand and cement. From these the material feeds by gravity through automatic measuring machinery to the mixers.

The mixers are three in number, of the nontilting dump type, with a capacity of 81 cu.ft. each of dry material; but it has been found that a batch of 1.63 cu.yd. of mixed concrete gives the best results. From the mixers the concrete is dumped into hoppers of 3-cu.yd. capacity, from which it is drawn into concrete skips of 3 cu.yd. capacity placed on flat cars, which are drawn by cable and hoist to either of the three cableways spanning the dam. Fig. 2 shows the layout of this part of the plant. The concrete haulage system enables one operator with a 3-drum hoist to deliver the concrete from either mixer to either cableway and return the empty skip to the mixer.

The flat cars are of sufficient length to hold two skips, and are attended by two men, who place the empty skip when lowered by cableway and release the chains. The car is then moved until the loaded skip is directly beneath the cableway; the loaded skip is then hooked up, raised and carried to the dam by cableway and the empty skip returned to mixer for another 3 cu.yd. of concrete. As with the excavation, it was found that the capacity of the plant was generally limited by the cableways, and everything possible was done to increase their efficiency. Time studies were made of the different operations and all false moves eliminated. The same procedure was used on the dam in transferring from loaded to empty skips. The consequence is that the utmost capacity of the cables has been reached whenever conditions permitted of rapid placing.

*Assistant Chief of Construction, United States Reclamation Service, Denver, Colo.

Handling the Concrete

The concrete is handled on the dam with stiff-leg derricks, of which there are eight in use. The presence of contraction joints in the dam structure has considerably retarded progress. They also have an important bearing on the placing of derricks and the methods used. Below El. 4215 the masonry is monolithic, without joints; but as only a portion of the foundation could be prepared at a time, different blocks began to appear before the entire bottom could be covered, which made the placing of derricks troublesome from the beginning. The derricks are set on pedestals made of concrete blocks manufactured for the purpose. These are 5x6 ft. in plan and 3 ft. high. They are set in mortar and built to a convenient height, usually three blocks or 9 ft. high, but occasionally higher. They are concreted in place as plums and cost very little more than the remainder of the concrete, as they are cast in a special block yard convenient

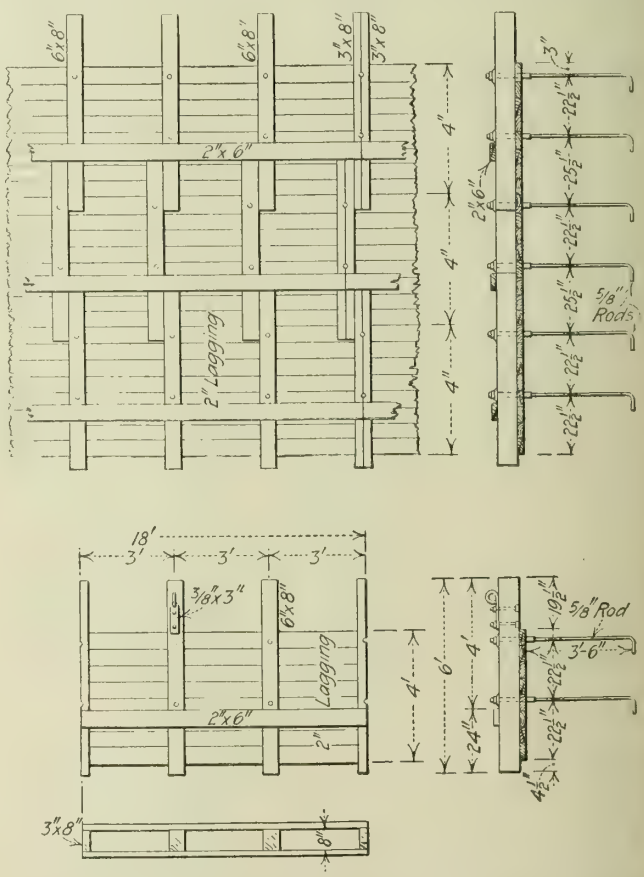


FIG. 1. MOVABLE WOOD FORMS FOR ELEPHANT BUTTE DAM FACE

to the cableways and contain a large percentage of hand rock.

During the early stages of the masonry work it was possible, where the area was quite large, to carry out a program that would permit of raising all derricks on Sunday; but later it was found necessary to move them occasionally during the week, and now that is the general practice. The pedestals are usually prepared by the night shift on prearranged locations and the derricks moved the following morning. This is done by putting slings beneath the sills and engine frame, brought together at the top of the mast, and hooking on to them with two

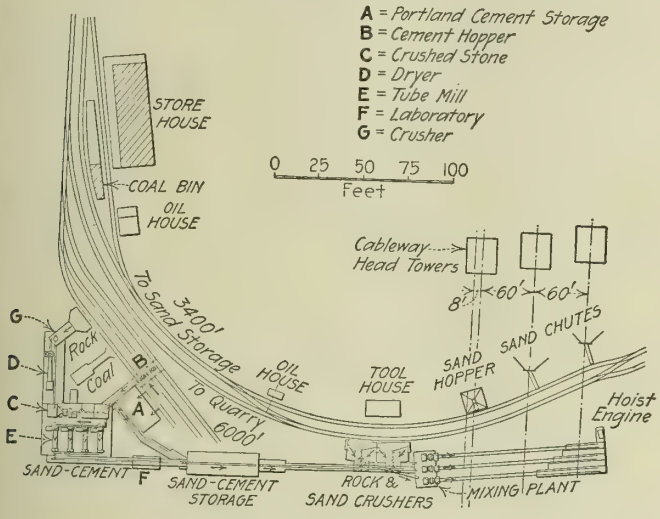


FIG. 2. CEMENT, CRUSHING AND MIXING PLANTS, ELEPHANT BUTTE DAM

cables. A derrick and hoist combined weigh 27 tons, but the change is made in a very few minutes. Ballast blocks are also made of concrete, which facilitates their removal and replacement.

The work on most features in connection with the dam is carried on in three 8-hr. shifts; but the placing of masonry is confined to two shifts, the second and third. On the first shift materials are taken to the dam, repairs to mixing and crushing plants are made and all bins are filled ready for the day's run. The plum rock is loaded on standard-gage flat cars in the quarry, cleaned, washed and side-tracked during the day, then run under cableways at night to be sent down on the first shift. A track scale of 80 tons capacity over which the loaded cars are required to pass enables all stone to be weighed; and as this can be done in a few minutes by the train crew, the custom has been followed from the start. All plum rock and spalls sent to the dam are weighed and recorded, thus giving an excellent measurement of all such material. The plum rock and spalls are placed in convenient piles on the blocks that are to be worked on.

Placing the Concrete

The concrete is delivered on the dam in 3-cu.yd. skips by the cableways, an empty skip is sent back and the loaded skip swung to its place by derrick. The skip is set down for a moment, the front chains released, the skip raised from behind and the concrete flows out. The empty skip is then swung out to the cableway landing and the derrick boom moved out of the way to wait for the next skip of concrete. Four or five men distribute the concrete, spading it against the forms or sides of plum rock, as the case may be. When a layer of sufficient size and thickness has been made plum rock or spalls are embedded in it. As a rule, spalls are only used near forms, between drainage wells or between large rock, as the large plums are cheaper, and a spall improperly placed may spoil a bed for a large stone. As the cableways usually take about 4 min. to make a round trip, and the derricks place a skip of concrete in 2 min., there is generally time to set a stone with the derrick while waiting for the next skip of concrete. This is done by swinging a stone into place and "shaking" it with the derrick. This gives better results than when joggled with a bar, and is much quicker, though rather hard on the derrick.

The organization for each of the two masonry shifts consists of three small placing gangs, one for each cableway, headed by a subforeman. Over these gangs is a foreman in charge of all the masonry work on that shift. In addition to directing these small crews he frequently takes a man or two and sets plums with an extra derrick, and usually has a small cleaning gang to look after in order to keep the working area ready ahead; although the cleaning of any extended area is uniformly done on the first shift. The shifts change each month so that one has no advantage over the other. There is a masonry inspector with each placing gang, one of whom is the chief inspector and has absolute authority in regard to the quality of the work and materials.

There is keen rivalry between the two shifts, and this is fostered by issuing daily bulletins showing the accomplishment of each shift. A system of daily reports that requires every man to be reported by some foreman is in use all over the work. Daily reports showing what they have done are also required from all who are on independent work. In this way a complete and prompt record is obtained of the work performed by every derrick, cableway, locomotive, concrete mixer, crusher, and in fact every machine on the job. These data are assembled in concise manner on printed forms; several copies are made and issued every morning, covering the preceding day's work to those most interested, and are posted in a conspicuous place for the benefit of all.

The placing of masonry as a principal feature did not commence until Mar. 1, 1914, on which date the complete plant was first used. Prior to this time only one cable was used for transporting concrete and plums. The capacity of the plant for mixing and placing concrete was never fully reached. This was due to several unavoidable reasons. Considerable delay in receiving some of the gate and valve castings greatly interfered with the construction programme. Inferior quarries were often responsible for small output, it occasionally being necessary to put the major portion of a quarry force to mucking out the waste. Contraction joint forms and innumerable tunnels, conduits, shafts, gate chambers and drainage wells all tended to curtail output.

Records of Placing

During the twelve months from Mar. 1, 1914, to Mar. 1, 1915, which was the first full year the entire plant was used on masonry work, a total of 380,200 cu.yd. of masonry was placed. With the exception of Kensico Dam in New York State, it is believed that this is the largest quantity ever placed in a single structure in the same period. The best day's run was on Jan. 25, 1915, when 2651 cu.yd. of mass masonry was placed in two 8-hr. shifts. This was made up of 2129 cu.yd. of concrete and

522 cu.yd. of plum rock. The total quantity of masonry placed to Sept. 1, 1915, is 560,000 cu.yd., there being about 610,000 cu.yd. in the completed structure; this leaves 50,000 cu.yd. to place after that date.

As it is not desired to complete the dam during hot weather, and as the working area is rapidly becoming much smaller, especially as every third block is to be left low (El. 4,340) for winter closure, the force was reduced Apr. 1 to such a size as will complete the dam by Feb. 1, 1916. On this account it is probable that the maximum masonry-laying record has already been made.

The flow of the river during early construction was carried in a flume built across the dam and forming a part of it, near the easterly side of the cañon. Early in January of this year, the remainder of the masonry being considered at a safe height, and it being desired to make this closure during cold weather, the flume was closed and the river diverted through the outlets provided in the dam. As these outlets were 20 ft. higher than the bottom of the flume, it was necessary to build up the gap as fast as the water rose in the reservoir. This was successfully accomplished, though at times the water was higher than the concrete, with only leaky forms between. In 29 hr. the concrete was brought up 24 ft., which was sufficient to turn the small quantity of water flowing at the time.

Forms for Concrete

All faces of the dam are cast against forms. The forms for the downstream face and for contraction joints are faced with No. 23 sheet iron, as it is desired that these faces present a smooth finish. Forms for the upstream face are not covered with metal, as a rough finish is desired here in order to get the best obtainable adhesion for the mortar facing. The forms used are the result of careful designing and some experimental work. They have proved very satisfactory, being absolutely self-contained and retaining their true position even with rapid pouring. Fig. 1 shows the details of the principal forms used. Where special forms are required, as around gate wells and offsets, the same principle of fastening and assembling is used, as is shown in the drawings of the simpler type.

Personnel

The construction of the Elephant Butte Dam and auxiliary features is being done by Government forces. From the time the work was commenced until Mar. 1, 1915, it was under the general supervision of L. C. Hill, Consulting Engineer. Prior to October, 1912, H. J. Gault was in direct charge as Construction Engineer. Since that date the work has been under the direction of the writer. L. J. Charles has been principal Assistant Engineer; R. J. Schmalhausen, Superintendent of Construction; R. R. Coghlan, Manufacturing Cement Chemist; W. C. Beatty, Master Mechanic, and Walter Cowell, Chief Masonry Inspector. Since Mar. 1, L. J. Charles has been Construction Engineer under the general supervision of the writer.

It is manifestly impossible to give here individual credit to all who are responsible for the excellent results obtained, as the results accomplished are due to an organization in which every employee of any responsibility whatever rendered loyal and efficient service with the idea of building the dam in the best manner in the quickest time, and at a minimum cost.

Submarines and Torpedoes*

By C. N. Hinkamp†

Interest in the submarine has reached a point hardly dreamed of five years ago. The types developed by the American inventors Holland and Lake have now been adopted as practically the standards of the world Holland's experiments began in 1875, but it was not until 1893 that his plans were approved by the American Naval authorities. In 1904 Lake's boats were built for Russia.

Up to 1898 the submarine was in the embryonic state. From then up to the present time it has developed rapidly.

There is nothing mysterious in the operation of a submarine. The orders used in the handling of a boat are few and are so given as to eliminate any possible confusion. Preparing to submerge includes all preliminary work up to the closing of the conning-tower hatch. This comprises the stowing of the deck gear, taking down the bridge, unrigging the radio, closing the hatches, unlocking the valve-operating mechanism, securing the engines—in fact, a clearing ship for action. This operation requires from two to twenty minutes, depending on the amount of rigging to be taken down.

In the static dive, also known as "balancing," the boat is submerged but moves only in the vertical plane.

The mass of the submarine itself amounts to several hundred tons, but the actual forces used to sink it from a neutral state are very small. The addition of 50 lb. of water will cause the boat slowly to descend. As soon as the vessel has started on its downward path it is necessary to remove part of the ballast in order to keep it from continuing on this path.

The running dive is made from the awash condition. In the awash condition the trimming tanks and auxiliary ballast tanks are flooded to the amount necessary for the proper trim when submerged; the main ballast tanks are empty. The running dive is used for all tactical purposes except balancing.

The vessel being underway "awash," the order is given to submerge. All hands get into the boat, the engines are stopped and the electric motors started. As soon as the engines are stopped the conning tower is closed, all ventilators are housed and the main ballast tank is flooded. Knowledge that the trim will be approximately correct when totally submerged renders careful adjusting of ballast unnecessary. The boat is inclined slightly, about one-half of a degree down by the head, and the inrush of the water is controlled by manipulation of the valves. All this is done in the short period of from one to two minutes.

Submerging a submarine is distinctly a one-man job. The commanding officer must be thoroughly conversant with all the details of the actual submerging of the boat and he must at all times be thoroughly informed as to existing conditions in the boat. The second officer assigned to the submarine generally assists the commanding officer where possible, and endeavors to acquire all the information possible on the details of the operation in order that he may take charge in case of any emergency.

Depth is maintained by the use of the diving rudders. Down rudder sends the stern up and the bow down. As soon as the boat is inclined downward the plane of the

*Extracts from a paper in the "Journal" of the American Society of Naval Engineers.

†Lieutenant, United States Navy.

deck gives a large surface for the water to act on. The hull is so built that normally there is a tendency for the boat to rise, brought about by the angle of the hull and the unbalanced pressures caused by inequalities in the areas of the surfaces on the bottom of the boat and on the top of the boat. This tendency must be counteracted by the trimming of the vessel and the action of the diving rudders.

The steering of the vessel in azimuth is done the same submerged as on the surface, using either hand or electric power. The use of gyroscopic compasses renders the tactical problems far simpler, as it is possible with this compass to steer the vessel within narrower limits than was possible with the magnetic compasses.

The periscopes are the eyes of the submarine. There are many styles of periscopes—monocular, binocular, stationary, revolving, rotating eyepiece, stationary eyepiece and "walk around." There are also devices known as omniscopes, in which the entire horizon is reflected on a ground glass and any part can be separated from the rest by means of screen sectors. The periscopes are long tubes with lenses in the top and bottom and so fitted with prisms that the rays of light are paralleled. The general impression one gets is that of looking through a telescope.

The periscope that is in most general use in the United States Navy is the walk-around type, with normal and magnifying eyepieces. Each boat is required to have at least two periscopes, one for the commanding officer and one for the helmsman or the second officer. In the recent boats, fitted with gyroscopic compasses, the helmsman takes his station at the compass while the lookout is at the periscope from which he directs the helmsman. The commanding officer usually stations himself at the after periscope and directs the movements of the vessel. Should he leave the periscope for any purpose, such as to consult chart or to get signals, some one always takes his place, so that there is never a time that both periscopes are not manned.

Signaling while submerged is a subject of much interest. In the early days of submarine navigation signaling under water was done in a most crude manner, for which the hull of a vessel was found to be peculiarly adapted. Sending was accomplished by tapping on a rivet with a hammer and receiving by holding the forehead to a frame of the boat. For several years inventors have investigated and experimented extensively, with the result that there are now in practical use in submarine signaling the submarine bell, the Fessenden oscillator and the vibrating wire, by which it is possible to signal effectively at distances greater than 5 mi. under favorable conditions. All these systems set up vibrations in the water which are detected by microphones and heard through the ordinary telephone receiver.

Each submarine is equipped with one bell, some with two, and on every submerged run, in peaceful maneuvers, these bells are rung so that it is possible for those in one boat to know the approximate location of other boats.

The submarine of the present day can operate at its maximum speed submerged for about 1 hr. At about one-third of this maximum speed she can operate practically 24 hr.

The offensive weapon of the submarine is the torpedo, or if necessity demands, the vessel itself can be used as a ram. The effect of the submarine as a ram may be illustrated by the fact that in a collision between a United States submarine and its tender several years ago, the tender was so badly damaged as to require beaching in order to save her.

The principal offensive weapon is, however, the torpedo. Ramming would be resorted to only in an exceptional case. The torpedo is an intricate mechanism built along the lines of the submarine itself, but automatic in its action after leaving the tube from which it is fired. The torpedo is divided into four main parts—the head, air flask, afterbody and tail. The head contains the explosive and the mechanisms to fire it. These heads are carried on the torpodeos only in war time. In time of peace exercise heads containing water are used. Abaft the head is the air flask. This contains the compressed air for the propelling machinery. In the next division of the torpedo is found the depth-controlling mechanism, the air superheater, the main propelling engines, the steering engines and gyroscope, and the shafting to the propellers, as well as the rods to the rudders. The tail inside contains the gear wheels for the propellers; on the outside are the supporting parts for the propellers, the diving rudders and the vertical rudders. The early torpedoes had an effective range of about 500 yd. The most modern product has an effective range of more than 10,000 yd.

An attack on a hostile vessel can be made in so many ways, and would have to be made under so many different conditions, that it is impossible to lay down any hard and fast method of procedure. The best time to attack is at dawn or twilight, or at a time when there is enough sea running to make the detection of the presence of the boat most difficult. Submarines have been known to approach within 500 yd. of a battleship in a choppy sea and in a fog to come up under the stern before being discovered, notwithstanding the fact that lookouts were stationed on the battleships to watch for the submarines.

The best situation for an attacking submarine is forward of the enemy's beam and approaching her. From such a position it is possible to get within range most easily and lie in wait until the enemy crosses the path of the submarine. In such a case it is possible for the submarine to pick the time for firing with some degree of assurance that the torpedo will reach the enemy and destroy her. Should the enemy be very much faster than the submarine, tactics become a case of hare and hound, with the advantage in favor of the enemy, as the speed of a submarine is limited.

The subject of safety in the submarine has received much attention and many devices have been invented designed to obviate the dangers said to attend the operation of this type of vessel. Each designer and builder has his own method of escape.

As submarine design improves, dangers of operation are becoming fewer. Today the submarine possesses no more inherently dangerous features than are possessed by any ship. In fact, they are safer to cruise in than a surface craft and for the same tonnage are far more comfortable in a heavy sea.

The personnel of a submarine depend for air for breathing purposes while submerged on the free air in the boat at the time of submerging and the compressed air carried in storage flasks, which is used in freeing ballast tanks of water as well as for breathing. In the average submarine in commission today the air contained in the boat at the time of submerging is sufficient to last officers and crew, numbering 18 men, for a period of from 9 to 12 hr.

Field and Office

New York Tunnel Power Plants

Two large plants have been erected by the Flinn-O'Rourke Co., on the Manhattan and Brooklyn sides of the East River, New York City, for supplying compressed air and high-pressure water to 12 shields in the four rapid-transit tunnels being driven by this company. These stations are of particular interest because of the large aggregate capacity of air compressors installed (in accordance with the requirements of the Public Service Commission, under whose direction the tunnels were planned and are being built) and because of the types of equipment assembled.

These plants must meet heavy requirements as to continuity of service and reliability. They are therefore examples of first-class practice, within the limits imposed by space conditions.

The plant on the Brooklyn side has, roughly, twice the capacity of the Manhattan station, since eight shields are being driven on this side and only four in Manhattan. It is seen from Fig. 2 that there are eight large compressors for the main air supply. These are of the latest duplex motor-driven type built by the Ingersoll-Rand Co. and equipped with thin plate valves (Rogler type), which have found extensive and successful use in Europe. Each unit has a delivery capacity at 166.6 r.p.m. of 4900 cu.ft. (free air) at 15 lb. per sq.in. and it then requires 350 electrical horsepower. The machines will deliver air at up to 45 lb. pressure and for such possible service the motors used are of 600-hp. rating. The motors are

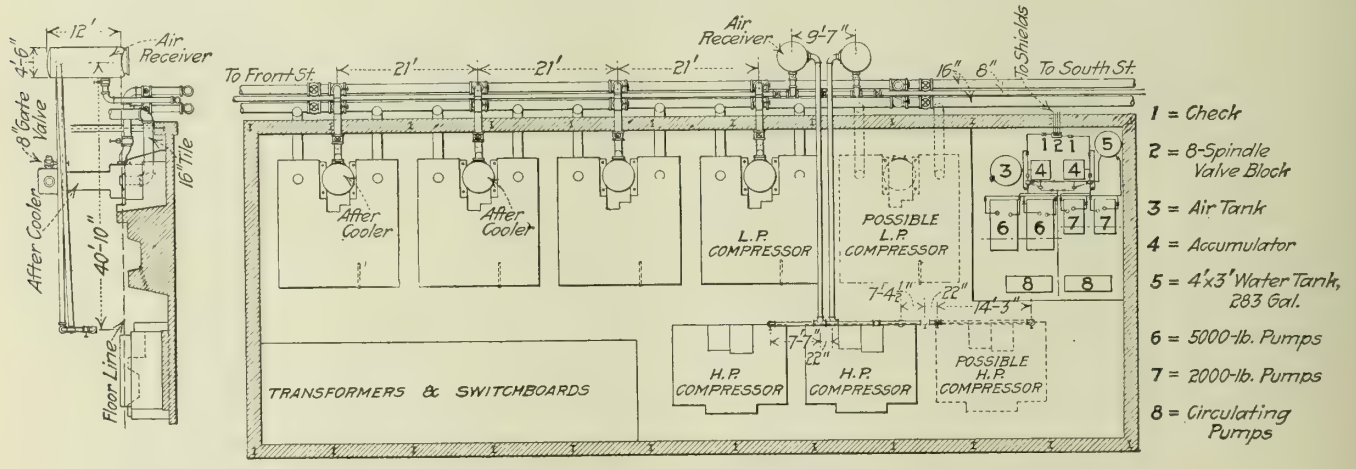


FIG. 1. GENERAL PLAN AND AIR PIPING; MANHATTAN TUNNELS POWER PLANT

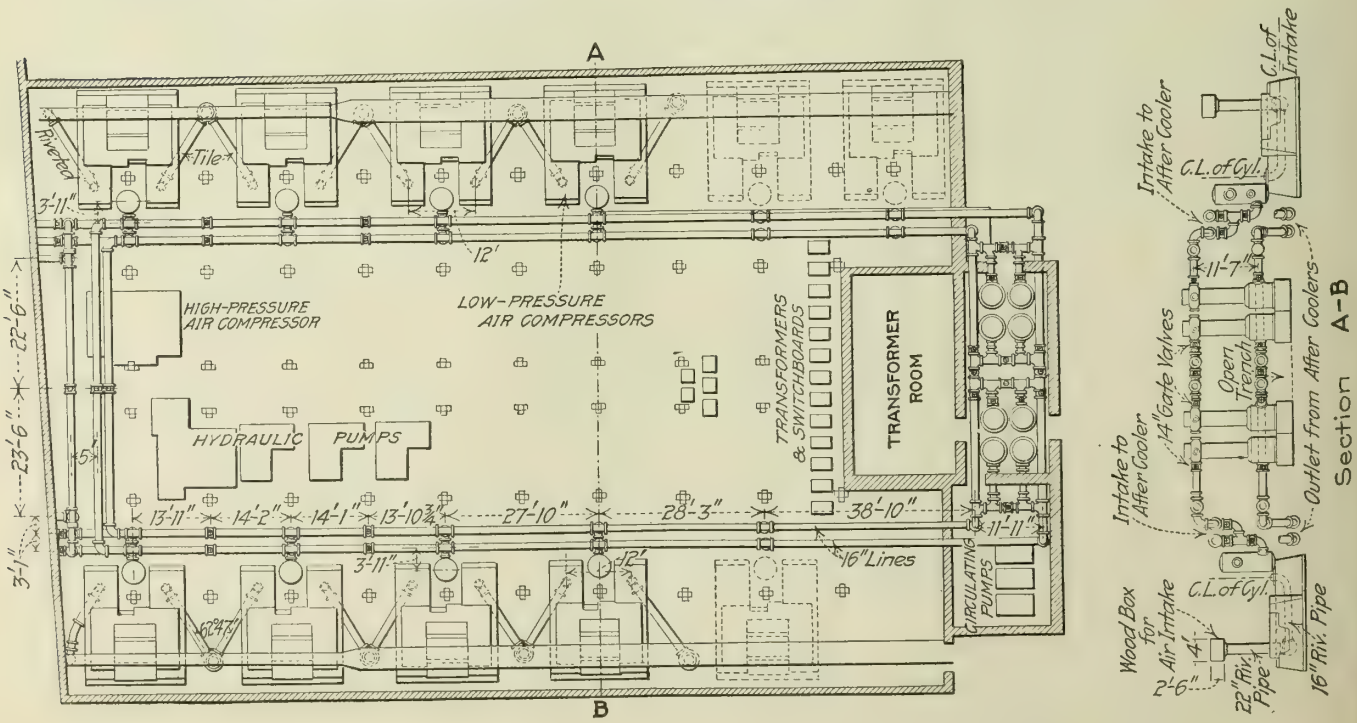


FIG. 2. PLAN OF MACHINES AND PIPING; BROOKLYN POWER PLANT, FLINN-O'ROURKE CO.

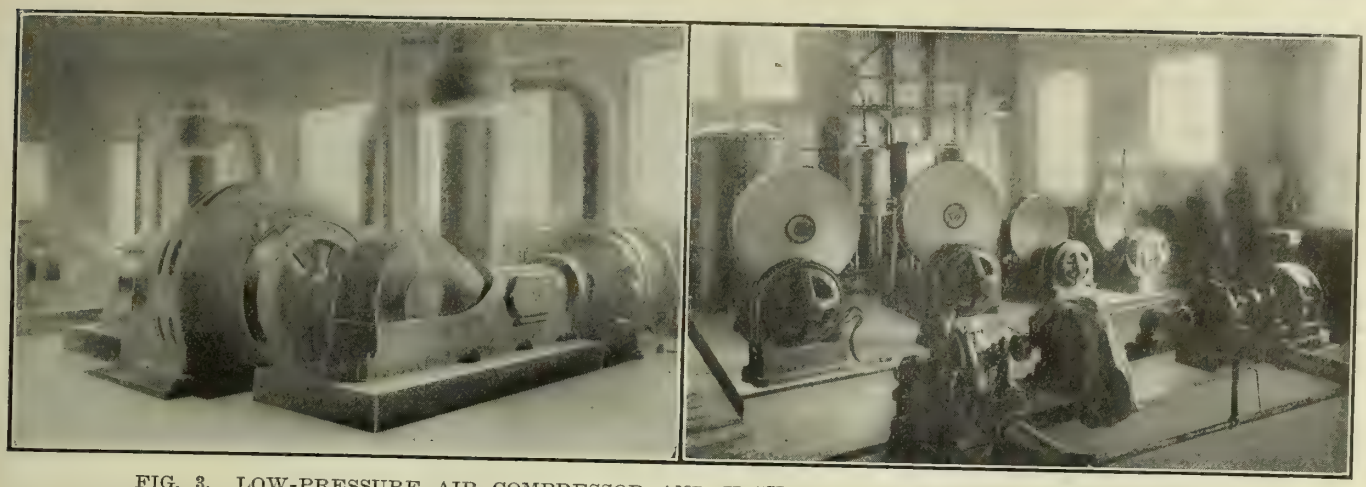


FIG. 3. LOW-PRESSURE AIR COMPRESSOR AND HIGH-PRESSURE PUMPS, FLINN-O'ROURKE MANHATTAN STATION

of 6600-volt three-phase synchronous type with individual belted exciters; they start as induction motors. Power is secured at 6,600 volts from the local Edison company, direct feeders running to the nearest substation.

Because of lack of room in this plant (it being the basement floor of an old warehouse and having heavy wooden columns about 14 ft. apart) the aftercoolers have been grouped at one end of the building, as shown in Fig. 2. The air-piping layout is also seen from this sketch.

For the tunnel-shield jacks and erector there are a 5000-lb. pump of 25 gal. per min. capacity and a 2000-lb. pump good for 15 gal. per min. Both are motor-driven and connected to accumulators. Besides this there are three 75-hp. motor-driven high-pressure plunger pumps for miscellaneous service.

In the Brooklyn plant there is one compressor for supplying high-pressure air (140 lb.) for tools in the tunnels. This is an old 20x14x18-in. Sullivan compound machine driven by a 400-hp. synchronous motor.

Equipment of the Manhattan Station

In the Manhattan plant there are four of the new 28x24-in. duplex low-pressure air compressors such as are installed in the Brooklyn plant. The aftercoolers, however, are placed in their usual position close to the machines. There was plenty of room in this plant, as a large steel building (with concrete floors) was erected in Jeannette Park. Half of it was given over to forge shops and stores and half to the power station.

The high-pressure air for tools, etc., is supplied by two old Sullivan compound machines—a 26x15½x18-in. for 100 lb. and a 25x14x16-in. for 135 lb. Each is driven by a 400-hp. synchronous motor.

The arrangement for the high-pressure hydraulic service is shown by Fig. 1. The 15-gal. 5,000-lb. and 10-gal 2000-lb. pump are in duplicate. The suction comes from an open tank, and the discharge is fed to the accumulators. For each system there is an automatic controller that lets the water be spilled back into the storage tank when the accumulators are full, a pump running continuously during the interval in which water is needed for the jacks or rams in a shield. A valve block, similar to those used on the tunnel shields, distributes either 5000- or 2000-lb. pressure to one or more main lines of 1½-in. XX pipe running to and down each shaft. A similar design is employed in the Brooklyn plant.

Moving Brick by Wheelbarrow

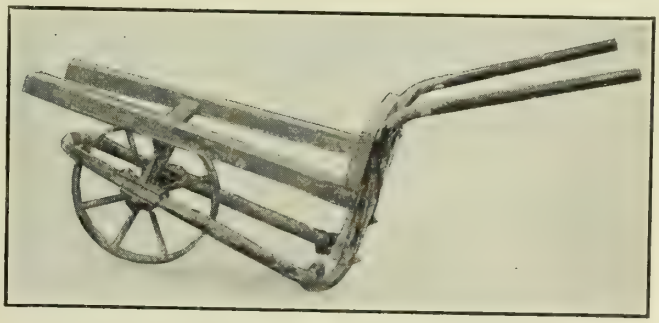
By W. B. Conant*

A specially designed wheelbarrow has been found very satisfactory for handling brick and other building materials by hand. It is constructed of a bent steel frame that encircles the wheel axles with handles of one piece with the frame. From the handles forward over the wheel is a stout wooden rack 24 in. wide at the back and tapering toward the front, where the joists are 7½ in. apart.

Three 18-brick trays are usually carried at a load. It has been found that 150 ft. is about the maximum distance over which brick can be economically transported by wheelbarrow. In all cases a smooth plank runway should be provided. For greater distances, industrial-railway or wagon haulage is more economical.

A recent test showed that three trays (54 bricks) could be wheeled 150 ft. and delivered to an elevator and the wheelbarrow returned, in 2 min. Increasing the distance to 200 ft. lengthened the time of the round trip to 3 min.

In wheeling bricks to an elevator the loaded wheelbarrow is left to be cared for by a man stationed to transfer the trays to the elevator, and the laborer returns with an empty wheelbarrow to the storage pile or car. Two men can supply the material for 19 masons provided the bricks are within 150 ft. and the mortar within 100 ft. of the elevator.



SPECIAL WHEELBARROW USED BY ABERTHAW CONSTRUCTION CO. FOR HANDLING BRICK

The wheelbarrow men should be under orders of the man at the base of the elevator or hoist, who directs the delivery of either mortar or brick as required on the

*Concord, Mass.

scaffold. There the boxes of mortar and trays are transferred by wheelbarrows three at a time to the bricklayers.

Doctoring Test-Pieces for Steel of Panama Lock Gates

The necessity for great vigilance and ingenuity on the part of mill inspectors was demonstrated in a peculiar way in an action recently brought by the United States Government against certain officers and employees of the Carbon Steel Co. for conspiracy to furnish defective steel for the Panama lock gates. When the case was tried in the United States District Court at Pittsburgh, some of the defendants were found guilty.

Test-pieces from nickel-steel forgings were annealed surreptitiously in the blacksmith shop to give them just the right qualities for passing the specifications, although the annealed forgings did not have these qualities. The inspectors at first were in the habit of marking the steel slabs before annealing, the marked pieces being cut off and annealed in the furnace with the slab, test being made on the test-pieces after coming from the furnace. It was discovered, however, that some of the steel was not annealed, but was merely "smoked"; that is, put through the furnace at a low heat to discolor it just enough so that it would appear to have been annealed, while in reality having the qualities resulting from heating and quenching. The men in charge of the work for the company would take test-pieces and privately subject these to quenching and drawing tests until they had found just what heat-treatment would bring the test-piece within specifications. Thereupon the government test-piece would be put through the heat-treatment so determined.

The peculiar appearance of one or two of the test-pieces, resulting from the special treatment they were subjected to, aroused the inspectors' suspicion. Going into the plant when not expected, an inspector found one of the defendants standing at a furnace in which were some test-pieces. The latter explained that he was making private tests of his own and refused to show the pieces, but the inspector on pulling them out of the furnace found that they were his selected test-pieces bearing his stamp.

Loading Excavated Material from a street subway across the Illinois Central R.R. at Chicago was accomplished in a novel manner. The tracks were supported on a pile trestle. The excavation was done by hand, and the material was loaded into small steel dump cars on a narrow-gage track at the street level. These cars were pushed by hand to one side of the right-of-way and dumped into a large elevator bucket working in a tower built alongside the nearest track. A railway car was placed on this track, and the elevator bucket dumped the material into it.

Reducing Decimals of an Acre to Square Feet

A very handy table which gives the equivalent of any decimal of an acre (in thousandths) in square feet directly, without interpolation, is sent to *Engineering News* by C. H. Eiffert, Assistant Engineer, Windes & Marsh, Engineers-Contractors, Winnetka, Ill. This table forms a useful supplement to the table for reducing square feet to decimals of an acre in *Engineering News*, Aug. 19, 1915, p. 363.

DECIMALS OF ACRES IN SQUARE FEET

	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
0.00		44	87	131	174	218	261	305	348	392
0.01	436	479	523	566	610	653	697	741	784	828
0.02	871	915	958	1002	1045	1088	1132	1176	1219	1263
0.03	1307	1351	1394	1438	1482	1525	1569	1612	1656	1699
0.04	1742	1786	1829	1873	1916	1960	2003	2047	2090	2134
0.05	2178	2222	2265	2309	2352	2396	2439	2483	2526	2570
0.06	2614	2658	2701	2745	2788	2832	2875	2919	2962	3006
0.07	3049	3093	3136	3180	3223	3267	3310	3353	3397	3441
0.08	3485	3529	3572	3616	3659	3703	3746	3790	3833	3877
0.09	3920	3964	4007	4051	4094	4138	4181	4225	4268	4312
0.10	4356	4400	4443	4487	4530	4574	4617	4661	4704	4748
0.11	4792	4836	4879	4923	4966	5010	5053	5079	5140	5184
0.12	5227	5271	5314	5358	5401	5445	5488	5532	5575	5619
0.13	5663	5707	5750	5794	5837	5881	5924	5968	6011	6055
0.14	6098	6142	6185	6229	6272	6316	6359	6403	6446	6490
0.15	6534	6578	6621	6665	6708	6752	6795	6839	6882	6926
0.16	6970	7014	7057	7101	7144	7188	7231	7275	7318	7362
0.17	7405	7449	7492	7536	7579	7623	7666	7710	7753	7797
0.18	7841	7885	7928	7972	8015	8059	8102	8146	8189	8233
0.19	8276	8320	8363	8407	8450	8494	8537	8581	8624	8668
0.20	8712	8756	8799	8843	8886	8930	8973	9017	9060	9104
0.21	9148	9192	9235	9279	9322	9366	9409	9453	9496	9540
0.22	9583	9627	9670	9714	9757	9801	9844	9888	9931	9975
0.23	10019	10063	10106	10150	10193	10237	10280	10324	10367	10411
0.24	10454	10498	10541	10585	10628	10672	10715	10759	10802	10846
0.25	10890	10934	10977	11021	11064	11108	11151	11195	11238	11282
0.26	11326	11370	11413	11457	11500	11544	11587	11631	11674	11718
0.27	11761	11805	11848	11892	11935	11979	12022	12066	12109	12153
0.28	12197	12241	12284	12328	12371	12415	12458	12502	12545	12589
0.29	12632	12676	12719	12763	12806	12850	12893	12937	12980	13024
0.30	13068	13112	13155	13199	13242	13286	13329	13373	13416	13460
0.31	13504	13548	13591	13635	13678	13722	13765	13809	13852	13896
0.32	13939	13983	14026	14070	14113	14157	14200	14244	14287	14331
0.33	14375	14419	14462	14506	14549	14593	14636	14680	14723	14767
0.34	14810	14854	14897	14941	14984	15028	15071	15115	15158	15202
0.35	15246	15290	15333	15377	15420	15464	15507	15551	15594	15638
0.36	15682	15726	15769	15813	15856	15900	15943	15987	16030	16074
0.37	16117	16161	16204	16248	16291	16335	16378	16422	16465	16509
0.38	16553	16597	16640	16684	16727	16771	16814	16858	16901	16945
0.39	16988	17032	17075	17119	17162	17206	17249	17293	17336	17380
0.40	17424	17468	17511	17555	17598	17642	17685	17729	17772	17816
0.41	17860	17904	17947	17991	18034	18078	18121	18165	18208	18252
0.42	18295	18339	18382	18426	18469	18513	18556	18600	18643	18687
0.43	18731	18775	18818	18862	18905	18949	18992	19036	19079	19123
0.44	19166	19210	19253	19297	19340	19384	19427	19471	19514	19558
0.45	19602	19646	19689	19733	19776	19820	19863	19907	19950	19994
0.46	20038	20082	20125	20169	20212	20256	20299	20343	20386	20430
0.47	20473	20517	20560	20604	20647	20691	20734	20778	20821	20865
0.48	20909	20953	20996	21040	21083	21127	21170	21214	21257	21301
0.49	21344	21388	21431	21475	21518	21562	21605	21649	21692	21736

DECIMALS OF ACRES IN SQUARE FEET

	0.000	0.001	0.002	0 003	0.004	0.005	0.006	0.007	0.008	0.009
0.50	21779	21823	21866	21910	21953	21997	22040	22084	22127	22172
0.51	22215	22259	22302	22346	22389	22433	22476	22520	22563	22607
0.52	22651	22694	22738	22781	22825	22868	22912	22955	22999	23043
0.53	23087	23130	23174	23217	23261	23304	23348	23391	23435	23478
0.54	23522	23565	23609	23652	23696	23739	23783	23826	23870	23914
0.55	23957	24001	24044	24088	24131	24175	24218	24262	24305	24350
0.56	24393	24437	24480	24524	24567	24611	24654	24698	24741	24785
0.57	24829	24872	24916	24959	25003	25046	25090	25133	25177	25221
0.58	25264	25307	25351	25394	25438	25481	25525	25568	25612	25656
0.59	25700	25743	25787	25830	25874	25917	25961	26004	26048	26092
0.60	26136	26179	26223	26266	26310	26353	26397	26440	26484	26528
0.61	26571	26614	26658	26701	26745	26787	26831	26874	26918	26963
0.62	27007	27050	27094	27137	27181	27224	27268	27311	27355	27399
0.63	27442	27486	27529	27573	27616	27660	27703	27747	27791	27834
0.64	27878	27921	27965	28008	28052	28095	28139	28182	28226	28270
0.65	28314	28357	28401	28444	28488	28531	28575	28618	28662	28706
0.66	28749	28793	28836	28880	28923	28967	29010	29054	29097	29141
0.67	29185	29228	29272	29315	29359	29402	29446	29489	29533	29577
0.68	29620	29664	29707	29751	29794	29838	29881	29925	29968	30012
0.69	30056	30100	30143	30187	30230	30274	30317	30361	30404	30448
0.70	30492	30535	30579	30622	30666	30709	30753	30796	30840	30884
0.71	30927	30971	31014	31058	31101	31145	31188	31232	31275	31319
0.72	31363	31406	31450	31493	31537	31580	31624	31667	31711	31755
0.73	31798	31842	31885	31929	31972	32016	32059	32103	32146	32190
0.74	32234	32277	32321	32364	32408	32451	32495	32538	32582	32626
0.75	32670	32713	32757	32800	32844	32887	32931	32974	33018	33062
0.76	33105	33149	33192	33236	33279	33323	33366	33410	33453	33497
0.77	33541	33584	33628	33671	33715	33758	33802	33845	33889	33933
0.78	33976	34019	34063	34106	34150	34193	34237	34280	34325	34368
0.79	34412	34455	34499	34542	34586	34629	34673	34716	34760	34803
0.80	34847	34891	34936	34980	35023	35067	35110	35154	35197	35240
0.81	35284	35327	35371	35414	35458	35501	35545	35588	35632	35676
0.82	35719	35763	35806	35850	35893	35937	35980	36024	36067	36111
0.83	36155	36198	36242	36285	36329	36372	36416	36459	36503	36547
0.84	36590	36634	36677	36721	36764	36808	36851	36894	36938	36982
0.85	37026	37069	37113	37156	37200	37244	37287	37331	37374	37418
0.86	37462	37505	37549	37592	37636	37680	37724	37767	37811	37854
0.87	37898	37941	37985	38029	38072	38116	38159	38203	38246	38289
0.88	38332	38376	38419	38463	38506	38550	38593	38637	38680	38725
0.89	38769	38812	38856	38899	38943	38986	39030	39073	39117	39160
0.90	39204	39247	39291	39334	39378	39421	39465	39508	39552	39596
0.91	39639	39682	39726	39770	39812	39856	39901	39945	39987	40032
0.92	40076	40119	40163	40206	40249	40293	40336	40380	40423	40467
0.93	40511	40554	40598	40641	40685	40728	40772	40815	40859	40903
0.94	40947	40990	41034	41077	41121	41164	41208	41251	41295	41338
0.95	41382	41425	41469	41512	41556	41599	41643	41686	41730	41774
0.96	41818	41861	41905	41948	41992	42035	42079	42122	42166	42210
0.97	42254	42297	42341	42384	42428	42471	42515	42558	42602	42645
0.98	42689	42732	42776	42819	42863	42907	42950	42994	43037	43081
0.99	43125	43168	43211	43255	43298	43342	43385	43429	43472	43516

Multiplying Large Numbers on Adding Machines

By R. C. Hardman*

In many offices where engineers are employed adding machines form part of the equipment, but generally their use is not thoroughly understood. The simple operations of adding and subtracting and of performing the multiplication of small numbers are familiar, but few even know that multiplication of numbers of seven or eight places may be made. However, such numbers, although their product will be far beyond the capacity of the adding machine to record, can be easily and rapidly multiplied. With a little practice, a great saving of time can be effected. This is especially true of the 10-key machines. The 81-key types are not nearly so efficient.

For example, multiply 29,476,392 by 41,242,342, which is equivalent to the multiplication of two trigonometric functions carried to seven decimal places. In order to perform this operation on the machine, we first divide the numbers mentally as follows:

$$(A)\ 2947\ \ 6392\ \ (B)$$
$$(C)\ 4124\ \ 2342\ \ (D)$$

This is equivalent to multiplying $(10{,}000A + B)$ by $(10{,}000C + D)$, or,

$$\begin{array}{r} 10{,}000\,A + B \\ 10{,}000\,C + D \\ \hline BD + 10{,}000\,(AD + BC) + 100{,}000{,}000\,AC \end{array}$$

Substituting the values of A, B, C and D we have:

$$\begin{array}{rr} BD = & 14970064 \\ 10{,}000\,(AD + BC) = & 332624820000 \\ 100{,}000{,}000\,AC = & 12153428000000000 \\ \hline & 12156754397900 64 \text{ (product)} \end{array}$$

On the machine we do exactly the same thing, the printed slips issuing thus:

BD	$AD + BC + 1497$	$AC + 3326$
6392	1497	3326
6392	2947	2947
63920	2947	2947
63920	29470	2947
63920	29470	2947
63920	29470	29470
639200	29470	29470
639200	294700	294700
639200	294700	2947000
6392000	294700	2947000
6392000	2947000	2947000
14970064	2947000	2947000
	6392	*12156754*
	6392	
	6392	
	6392	
	63920	
	63920	
	639200	
	6392000	
	6392000	
	6392000	
	6392000	
	33263979	

*Colorado Springs, Colo.

The product is 12156754 3979 0064. It will readily be seen why the 1497 is carried from the first total and added to the second operation, and 3326 from the second total added to the third, after an inspection of the product found by the substitution of values in the algebraic function above.

Practically speaking, the multiplication of eight-place numbers is the limit of a nine-place adding machine, as the single product of four-place B and D makes an eight-place result. However, the divisions A, B, C and D might be further subdivided indefinitely and the same process gone through. This would be too complicated to be of any value, although 16- or 32-place numbers could be multiplied. Thus, 16-place numbers would be divided:

$$\begin{array}{cc} a\ \ b & e\ \ f \\ A & B \\ c\ \ d & g\ \ h \\ \\ i\ \ k & n\ \ o \\ C & D \\ l\ \ m & p\ \ q \end{array}$$

It will readily be seen that the great amount of cross multiplying would prove unwieldy.

Laying 48-In. Concrete Block Sewer

A 48-in. concrete-block sewer using the Parmley type of block is being constructed in Harrisburg, Penn., by M. M. Sheesley & Sons, of Johnstown. The total length is about 1500 ft. Most of it is in a trench 5 to 12 ft. deep and follows normal construction methods except that the soil is all filled ground, which produces some complications. A short length of the sewer, however, is 3 to 5 ft. above ground, at the bottom of a depression remaining as the last portion of a partly filled gully. Here the sewer is built on three-post bents 5 ft. 4 in. wide out to out and 5 ft. apart. The invert blocks are bedded on a thin layer of concrete placed on longitudinal timbers laid over the bent caps. Concrete fill under the haunches and extending up to the middle line of the pipe, with a thickness of 4 in. at this line, braces and retains the sewer.

The blocks were made on the ground by the contractor's men. There are four blocks per ring, and each ring is 12 in. long. Metal forms with removable pieces to give the changes for the bottom, side and top blocks were employed. With two forms and an unlimited supply of wooden baseboards, or pallets, fitted with a curve strip to make the groove of the ring joint, a gang of nine men was kept busy. The best day's work was 225 blocks (10 hr.) The same contractors, however, were able to make 250 blocks with eight men on a similar job in Johnstown some months ago. The concrete is mixed rather dry and is tamped hard into the form and leveled off on top, the form then being immediately stripped to use again.

The sewer trench is excavated by clamshell handled by a Marion-Osgood locomotive crane. In the deeper portion, on account of the tendency of the sides to cave, only 20 ft. or so is kept open ahead of the sewer laying, and some bracing is used. The bottom is trimmed by hand. Where the ground is bad two boards are laid down on the line of the pipe to proper bottom level, and the space between and alongside them is leveled up with

concrete. Then the flat-bottomed lower section of the sewer is set on this cradle with a 2-in. strip of tar paper under the joint, long enough to come up along the side section. Concrete filling is then placed under the haunches. The sides of the trench, if it is too narrow, are trimmed to template to enable the side sections to be placed, and these are set in mortar beds after placing dowel rods in the longitudinal joints and a ring rod in the circular joint. Using a diameter gage to get the correct position for the upper corners of the side blocks, they are braced from the sides of the trench. Finally the key block is set.

Striking off and pointing the joints inside and outside finishes the upper half of the sewer. The lower half joints of the side blocks, however, are not filled with mortar when the blocks are set, but are left to be grouted afterward, the tar-paper strip being the form, or cover, for this grouting. Backfill is placed at the sides of the pipe up to the middle line and tamped with a board or other rammer, according to the width of the space to give the sewer solid side support and at the same time fix the tar-paper strip in place. Grout is then poured into the ring joint to fill, completing the work.

The speed of laying blocks on this work has been limited in most cases by the trench work, but on one or two occasions there was a chance to lay sewer at maximum rate. One mason and helper laid 74 lin.ft. of invert block in an 8-hour day, and at the same time 51 lin.ft. of side and top blocks were set by another man and helper.

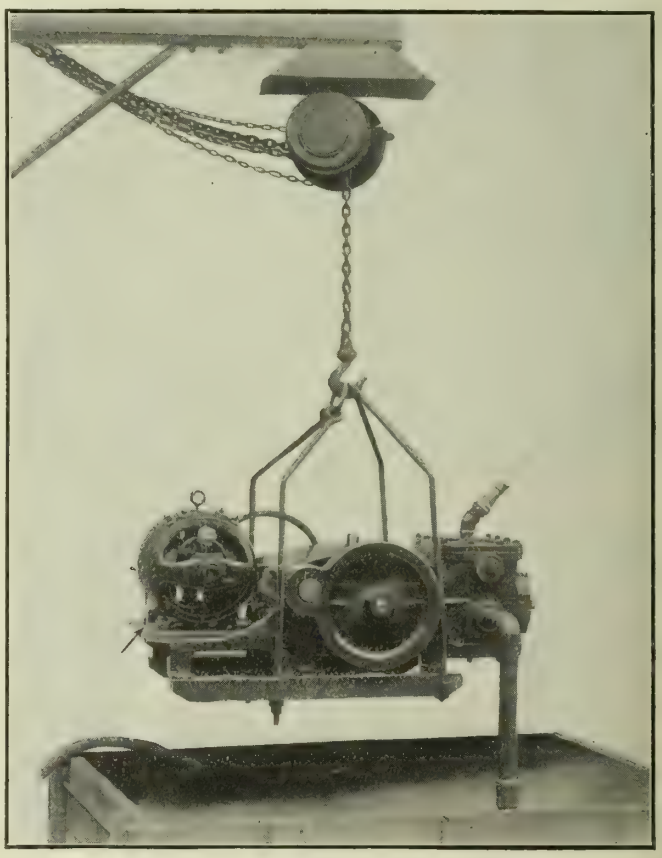
NOTES

Limestone as a Concrete Aggregate—A county highway commissioner of Wisconsin has objected to the use of crushed limestone as coarse aggregate in concrete-road construction. He based his objections on two points—first, that limestone is softer than gravel; and second, that the dust which adhered to the limestone interferes with its bonding in the concrete. Conceding that there is reason for the first objection where the limestone has a French coëfficient of less than 12 and a hardness of less than 10, it still seems that the second point is rather far-fetched. Where machine mixing is used, it would seem that the slight dust coat would be washed or rubbed off into the fine aggregate, causing there no greater harm than the relatively greater volume of inert material often added for waterproofing purposes. If that objection were generally held, it would seriously interfere with the use of limestone for concrete purposes in localities where it is the most economical material. The experience of some of your readers would be of great interest.—George F. Prussing, Lennon, Wis.

Rapid Work in Road Surveying—The survey of a 5½-mi. stretch of country road was made by me recently in two days, using a one-horse team and driver and an inexperienced rodman. The actual time spent in surveying was about 6½ hr. per day. All angles were turned twice with a transit and the distances measured with a 100-ft. steel tape. All prominent topographical features were noted. The shots averaged 1,400 ft. in length. The method of working was as follows: The instrumentman, with the rodman in the buggy with him, would drive ahead and choose the location for the hub. The rodman would set the hub and tack and remain to give the forward sight. The angle was then turned, and both rodman and driver returned to the instrument point. The driver then took the transit in the buggy and carried it to the point ahead. The rodman and instrumentman chained the distance to the point ahead. The process was then repeated for the next point. The actual cost of the survey, figuring the instrumentman at $5 per day, rodman at $1.50, team and driver at $2, was $17.—T. J. Wright, Jr., Engineer-in-Charge, Board of Water Commissioners, Portsmouth, Va.

A Fire Engine Has Been Commandeered to furnish a water jet to break up some refractory material being excavated in the new deep-water terminal work at Halifax, Nova Scotia. The corner of one of the quay walls is being laid inside of a coffer-dam made up of sheet piles with hardly any penetration in the hard cemented rock bottom, which resisted the attack of the clamshell with which the excavation was attempted. The coffer-dam was of so temporary a nature as to preclude the possibility of blasting within it, so as a solution of the difficulty a local fire engine was brought to the site and, using a 1-in. nozzle on a 3-in. hose, a jet was forced down into the bottom under a pressure of 150 lb. This jet has broken up the formation, or at least loosened the cemented areas between the rock to such an extent that clamshell work has been made possible. It is stated by the engineers on the work that while this jetting is not remarkably good and possibly would not be used for similar future work, still in this particular case it does loosen the material so that the work can be carried on, and therefore will have overcome what at least promised to be a temporary difficulty.

A Remarkably Steady Pumping Set—The accompanying view shows a motor-driven triplex pump set suspended over a supply tank. The steadiness of the outfit and the freedor from vibration is shown by a 5-in. wire nail placed upright on the motor base. The pump is a 3x3-in. double-acting Luitwieler type pumping 82 gal. per min. at 150 r.p.m. Each piston is thrown by a cam working between roller guides,



STEADY SUSPENDED PUMPING SET

the cam outline and spacing being designed to secure uniform water pressure and flow and perfect balance of moving parts. The working parts of the pump are incased and given splash lubrication. The total weight of the unit shown is 1,385 lb., including that of the 3-hp. 1,600-r.p.m. motor. The nozzle has a 1⅛-in. opening and is spouting under 50 lb. per sq.in. pressure.

Rounded Pier Nosings were required on the piers of the Cumberland Valley R.R.'s new bridge over the Susquehanna River at Harrisburg, Penn., by the State Water-Supply Commission. The old piers had V-shaped nosings on the upstream cutwaters and square ends downstream. Considerable deposit had accumulated in the river bed some distance downstream of each pier. The new bridge having twice as many piers and the old piers being thickened, a reduction of waterway (at extreme flood) of about 8% was produced. With a view to making the waterway as efficient as possible for the flow, the Water-Supply Commission engineers required the use of circular or elliptic nosings at upstream and downstream ends of the piers, in order to reduce the disturbance and eddying caused by the piers, and largely prevent the formation of deposits below them.

Editorials

Success of the International Engineering Congress

The engineers of the United States may justly be proud of the success achieved by the International Engineering Congress held at San Francisco last month. This is the third engineering congress held in connection with a world's fair in the United States, the first being that held at Chicago in 1893 and the second that at St. Louis in 1904. Those of the profession who have attended all three of these congresses will agree that the one just closed at San Francisco exceeded in importance and interest each of its predecessors. This success has been attained in the face of difficulties and discouragements wholly without precedent. The European war did indeed rob the congress of much of its international character, especially in preventing the attendance of the great number of foreign engineers who would otherwise, without doubt, have been present. It speaks volumes for the courage and nerve of the Pacific Coast engineers, to whom the success of the congress is mainly due, that they only worked the harder to make the event a success in the face of the world calamity that threatened to make shipwreck of their enterprise, as it has made of so many others.

One noteworthy fact in connection with the congress, which is unquestionably in some degree responsible for its success, is that five great national engineering societies, representing five leading branches of the profession, united in giving to the congress both moral and financial support. The sentiment freely expressed at the congress by leading members of all the societies was that the demonstration of the solidarity of the profession and of the feasibility of effective coöperation by its representative bodies in bringing about results of general benefit to the profession as a whole was in itself an achievement of great value.

Too much praise cannot be given, however, to the engineers of San Francisco, to whose self-sacrificing labor the success of the congress is chiefly due, and especially to the chairman of the Committee of Arrangements, Dr. William F. Durand, and its secretary and treasurer, W. A. Cattell. For many months these San Francisco engineers have given their time to preparations for the congress wholly without compensation other than the privilege of aiding in the success of an enterprise for the benefit of the profession. It deserves record, too, that at the very outset of the congress enterprise engineers of the Pacific Coast contributed $10,000 in cash toward a fund to meet its necessary expenses.

The profession owes a debt to these engineers of the Pacific Coast, whose energy and self-sacrifice have made it possible worthily to celebrate the completion of the nation's great engineering achievement, the Panama Canal, not only by that other great engineering achievement, the Panama-Pacific Exposition, but by a published record of contemporary engineering achievement in all branches and by an assemblage of leading members of the profession such as is seldom brought together.

Astoria Tunnel Romance

Stories of struggles with desperate difficulties are plentiful in the history of subaqueous tunneling, but few surpass in interest the narrative of events in the Astoria Tunnel work as printed in this and next week's issues of *Engineering News*. Those who take pleasure in the dramatic phases of engineering work ought not to miss this story; it reads like a romance of adventure. The courageous and resourceful builders of the tunnel, working in fissured and decomposed rock more than 200 ft. below water, proved their worth by fighting time after time against great inrushes of water, and always holding their ground. Success was almost within reach, when one Sunday morning a flow of such overpowering vehemence broke out that they had to run for their lives, while the water filled up tunnel and shaft and drowned out the pumps. Only a few days earlier the flood might have engulfed men and all, submerging the tunnel perhaps for good. But in the nick of time two safety bulkheads had been erected, which partly blocked the flow of the water. As if to keep up the dramatic sequence of the action, however, the bulkheads were only partly effective, saving the actors in the play, but failing just sufficiently to complicate the plot and make its final solution more impossible. How the story ends—how the lost tunnel was regained and the remaining work completed, making everything safe—the reader will find set forth in the article.

Two years ago *Engineering News* printed an earlier story of the same tunnel, only less absorbing than the present one. It told of the early difficulties and how by skill and persistence they had been overcome. But even while that story, announcing the "final" success, was being printed, the new and greater flood burst in. We now have the sequel to the story of two years ago.

The art of rock grouting has been advanced materially by the Astoria Tunnel work. Continuous injection of grout in remarkable volume, under very high air pressures, was the key feature of the operations. The results attained with the process speak for themselves. The necessity of closing seams in rock against high pressure and while rapid flow continues does not arise often, but when it arises the situation is grave. With knowledge of what was done in the Astoria Tunnel such situations may be faced more hopefully.

The past half dozen years have virtually created rock grouting; at least they have made its value widely appreciated. Now the process is likely to become still more important an expedient in construction.

No cost figures have been published for the Astoria Tunnel. It is obvious that the expense was great, probably exceeding very largely even the most pessimistic advance estimates. This should be well noted in connection with the general question of tunneling, and especially should it be remembered when reading about a tunnel of easy construction and low cost. More than most other kinds of construction, subaqueous tunneling ranges over very wide limits of cost, due to conditions usually

not determinable in advance. The chance of great difficulties must always be reckoned with when starting on a tunnel enterprise. They may come or they not come; but the wise engineer in his advance calculations will count in a measure on the unfavorable chances. He will not adopt the cost figures of an easy tunnel, nor those of the most difficult—like the Astoria Tunnel—but by placing his estimate somewhere between the two he will make allowance for the possibility of striking costly trouble.

A Satisfactory Alternative

In the coming November election in the State of New York the voters will be asked to pass upon a referendum authorizing the issuance of $27,000,000 of bonds to be devoted to the completion of the New York State Barge Canal. Apparently, the opposition to the canal in its entirety is as violent as ever, for there is being circulated, under the head of the "State Committee on Canal Referendum," a letter in which the addressee is urged to contribute to a fund which "will be required to properly place the matter before all the people of the State" so that the bond issue may be carried.

Now that the canal is all but completed, it would of course be the sheerest folly not to vote the sum required to finish the work, particularly as the excess is largely due to land condemnation not contemplated in the original estimate; but there appears to be a peculiarly satisfactory alternative to an adverse vote. According to the circular letter noted, in case the referendum fails the money will have to be raised by direct tax. In this case the City of New York will have to pay 70% of the total, or, as the letter puts it, "$19,000,000 by direct tax—a crushing blow to the taxpayers of the city."

Those who remember that the original Barge-Canal plan would never have carried except for the voters of New York City, will be able to see the hand of Nemesis in any such necessary tax levy.

Incidentally, the "State Committee on Canal Referendum" can afford to be more precise. It states that "the Barge Canal has cost the State of New York $100,000,000." It has cost already some $27,500,000 more. The original bond issue was $101,000,000, the Cayuga and Seneca branch issue was $7,000,000 and the terminals issue was $19,800,000. The amount to be asked for in November will bring the total to $154,800,000, not counting the interest on the bonds during construction, which already amounts to many million more.

Revising Elevated Railways

Busy city streets are not ideal sites for steel erection or reconstruction. Matters are still less ideal when not only the street traffic must be cared for but also railway traffic over the structure being rebuilt. The New York elevated-railway third-tracking, carried on under these doubly complicating conditions, takes high rank in the records of structural erection. The account of the work in this week's *Engineering News* and in the preceding issue notes that a traffic of some 300 trains each way per day was maintained over the elevated railway while the old columns were taken down and new ones placed, new main girders put in, additional track built and stations (in full service) altered and shifted.

Doing the work at all under this heavy traffic, and doing it without accident to the railway, are achievements that call for high commendation. Of equal rank is the rapid execution of the work. The contractors and the railway company share the credit for bringing about these results. A factor whose bearing on the results is likely to be undervalued is the thoroughness of the preliminary planning, which was so minute and farseeing as to reduce the actual building almost to the level of mechanical routine. The railway engineers merit a large part of the credit for the smoothness and rapidity of the operations. On the other hand, the high degree of safety which was realized stands to the credit of those who actually handled the work—the contractors.

One-fourth as many papers on the program as there were members on the registry list appears to have been the record at the International Engineering Congress held recently at San Francisco. As the congress was divided into ten sections, many of which were in session at the same time, it is no wonder that the sectional attendance was small, ranging from 150 to 30, according to the breadth of appeal of the various sections. The editorial summaries of the proceedings in last week's and this week's issues bear witness of the value of the congress, but indicate that if it is to justify all the expenditure of energy and money which it has cost, then there should be liberal subscriptions to the proceedings. These may be secured either in part—by sectional topics—or as a whole, as stated at the close of the report of the congress elsewhere in this issue. The volumes should be in every engineer's library.

Though many months must pass before the world's greatest steel arch—the Hell Gate crossing—will be reported as finished, bridge engineers will appreciate that the virtual completion is to be dated last Friday, when the cantilever half-arches were lowered to junction and the arch with its abutment thrust came into existence. The work of the day (reported in our news columns) was a real event, and while no celebration featured it, the half score of engineers who were on the ground are likely to remember it. Samuel Rea grasped the importance of the event, as shown by a congratulatory message which he addressed to Gustav Lindenthal, the engineer of the bridge, dwelling on the fact that the bridging of Hell Gate, accomplished that day, was the realization of a project born twenty-five years ago.

The broad-minded and businesslike way in which the Illinois State Board of Health is going about the selection of a chief sanitary engineer is refreshing indeed to those who are wearied with the common political methods of filling such positions and have only a little more patience with the other extreme—routine civil-service examinations. The aim of the board named and of the Illinois Civil Service Commission is to follow much the same plan as would a private employer who had an important scientific position to fill. This, combined with salary prospects commensurate with ability, should attract applicants from all parts of the country. Details of this unusual opportunity are given under News of the Engineering World, in the last part of this issue.

Letters to the Editor

Effect of Iron on Paint

Sir—I am naturally much interested in the letter published on page 613 of your Sept. 23 issue under the caption, "Does Good Iron Preserve Paint?"

The Research Department of the American Rolling Mill Co. at Middletown has, as you are aware, conducted for the past ten years perhaps the most extensive and elaborate series of tests ever instituted on iron and steel with relation to corrosion resistance. These have included exposure tests on all types of ferrous metals under a wide variety of conditions. They have also included careful observations of the behavior of paints of different types on "Armco" (American Ingot) iron and on various other sheet metals. The results absolutely verify Mr. Sanborn's statements.

Similar conclusions are drawn from the behavior of pure openhearth iron in service. It is often used with a protective coating of paint and also quite extensively as a base for painted sheet-metal signs. Experience shows that it retains the paint in a comparatively perfect condition long after the same paint on a steel base is so roughened and loosened as to be of little use.

B. G. Marshall,
The American Rolling Mill Co.
Middletown, Ohio, Sept. 27, 1915.

Hooke's Law and the Form of Stress-Strain Curves

Sir—I read with intense interest Professor Hedrick's article on a generalized form of Hooke's law, but I think there is one important point that he overlooks. In the case of the cast and worked metals the experimental loading was most likely not the only loading causing strains in the material and his empiric stress-strain relation took care of both types of strains. We have so much experimental and mathematical verification of Hooke's linear relation between stress and strain (not only for static loadings but also in the case of vibrations) that strong negative proof should be required to modify the law.

The tests on isotropic materials where the initial strain is zero have clearly demonstrated the authenticity of the law. The tests on æolotropic materials may have failed to demonstrate the law (assuming the initial strain was zero) because our coefficients were deduced from faulty theory.

For example, a tension test made on a material æolotropic in the direction of the load would probably neglect the torsional effect produced. Likewise, coefficients deduced from flexural tests based on the common Bernoulli theory may be misleading.

It would seem possible, starting with Professor Hedrick's parabolic relation and assuming Hooke's Law to hold, to ascertain the initial conditions in the material.

G. Paaswell.
New York City, Sept. 20, 1915.

How To Light a Blasting Fuse

Sir—The concluding sentence of the article, "Explosives for Driving Concrete Piles," in *Engineering News*, of Sept. 16, recalls many nervous moments of waiting for a man who is trying to get a common safety fuse to burn. In describing the proper method of lighting a fuse the article states that "this must be done quickly; hence a torch or other large flame is best." On the contrary, I believe the quickest, surest and safest method of lighting a fuse is with the ordinary friction match, lighted and touched to the fuse *while the head is still burning*. This will cause the "spit" of the fuse powder at once, without lighting the braid of the fuse, so that by the time the match head has stopped burning, one knows whether the fuse is lighted. Using a large flame, the chances are that the wrapping will light first and the "spit" of the powder will not be visible through the flame.

Splitting the fuse assists in quick, sure lighting; the split should not be longer than ¼ in. to ⅜ in. at the end and should be spread to expose the powder. I have considered it safe to light four or five fuses with length of 18 to 20 in., before seeking safety. With longer fuses a greater number may be lighted, but in firing larger numbers there is always the danger that by missing count of explosions some person may return before all charges are fired. In regard to short fuses I will affirm that other opportunities of saving time or money are generally available.

T. Ray Martin.
2172 E. 89th St., Cleveland, Ohio, Sept. 18, 1915.

Another Flat-Slab System To Be Licensed

Sir—Statements and letters have recently appeared in the technical press regarding flat-slab patent suits and the court decision rendered sustaining the Norcross patent. While this decision declares the Norcross invention to be fundamental for flat-slab construction, it should be borne in mind that a basic patent does not cover improvements that often are required to make an invention a commercial success.

As owners of an important improvement patent used in over twenty million square feet of floors already built, we have, in view of the decision rendered in the Norcross case, taken a license under that patent for the protection of our patrons, and therefore are authorized to issue licenses under both the Sinks and Norcross patents. In order that no one may unwittingly infringe or permit infringement of these patents in buildings for which they are responsible, we have issued a bulletin entitled "Flat-Slab Patents," which we will gladly send free to any of your readers upon request.

Condron Company,
By T. L. Condron.
The Monadnock, Chicago, Ill., Sept. 18, 1915.

The 977-Ft. Hell Gate Bridge Becomes an Arch

After a season of fast work in erecting steel on the Hell Gate 977½-ft. arch, New York, the American Bridge Co. placed the closing section of bottom chord on Thursday, Sept. 30. The next day, Oct. 1, the important operation of slacking off the backstays was performed very successfully, and thereby the two half-span cantilevers were converted into an arch.

The photographs herewith show how the closure chord of the south truss was set in place, and (lower view) how the structure appeared with the first continuous steel over the entire span-length. Shortly after these views were taken the north middle chord member was similarly set, and on the same day one diagonal of the middle panel was placed and bolted and drifted tight. This made the bridge ready for lowering the two half-arches to contact and slacking off the backstays completely. The successful lowering on the next day made the structure a three-hinged arch, the center hinge formed at the butting contact of the west end (left-hand end in the views) of the middle-chord member.

The top-chord members of the middle panel are being set in place as this paper goes to press. They will have no structural function for the present, but will rest in position idle, with only one end connected up, until the floor hangers and all the steel of the suspended floor-system have been set. When this stage is completed, their unconnected ends will be riveted up in a carefully devised procedure. A temporary connection will first be made by a heavy tension rod or bolt inside the chord, which takes hold of diaphragms in the closure member and the adjoining chord-member. The closure end splice-plates are blank; when the tension rod is screwed up, and thereby a connection made, strong enough to hold the blank splice immovable against temperature effects, the splice rivet-holes will be drilled and finally the joint riveted up. This changes the bridge to its final two-hinged condition. The concrete floor is to be put in after this stage; therefore the load of this concrete and of the ballast and track, the railway live-load, and temperature and wind effects will stress the bridge as a two-hinged arch, while the weight of the steel stresses the bridge as a three-hinged arch.

The center section of bottom chord weighs about 85 tons as hoisted; this is for one truss. Two 17-part falls from the two top-chord travelers lifted the piece from a scow and entered it in place. The gussets on this piece are extraordinarily large (208 in. wide) but were made in two pieces, the joint being on the vertical line through the panel point. The plates of the adjoining sections had to be spread to allow the gussets and splice plates to enter and interleave as the piece was lifted vertically into place.

The arch had built out to a separation (across the middle panel) about 1½ to 5 in. greater than the length of the closure member. As the backstays were set to hold the half-arches slightly above true position, the distance was as desired. The closure member, when entered, was bolted and drifted up full at its east end; that is, it was connected to the Astoria cantilever, and hung free at the other end, holding by the torsional resistance of the Astoria joint. The diagonal from the Astoria top chord to the free end of the closure chord was then set and bolted up, as was also the lower half of the opposite diagonal (the middle panel has crossed diagonals).

This work was completed late on Sept. 30, ready for slacking off the backstays the next day.

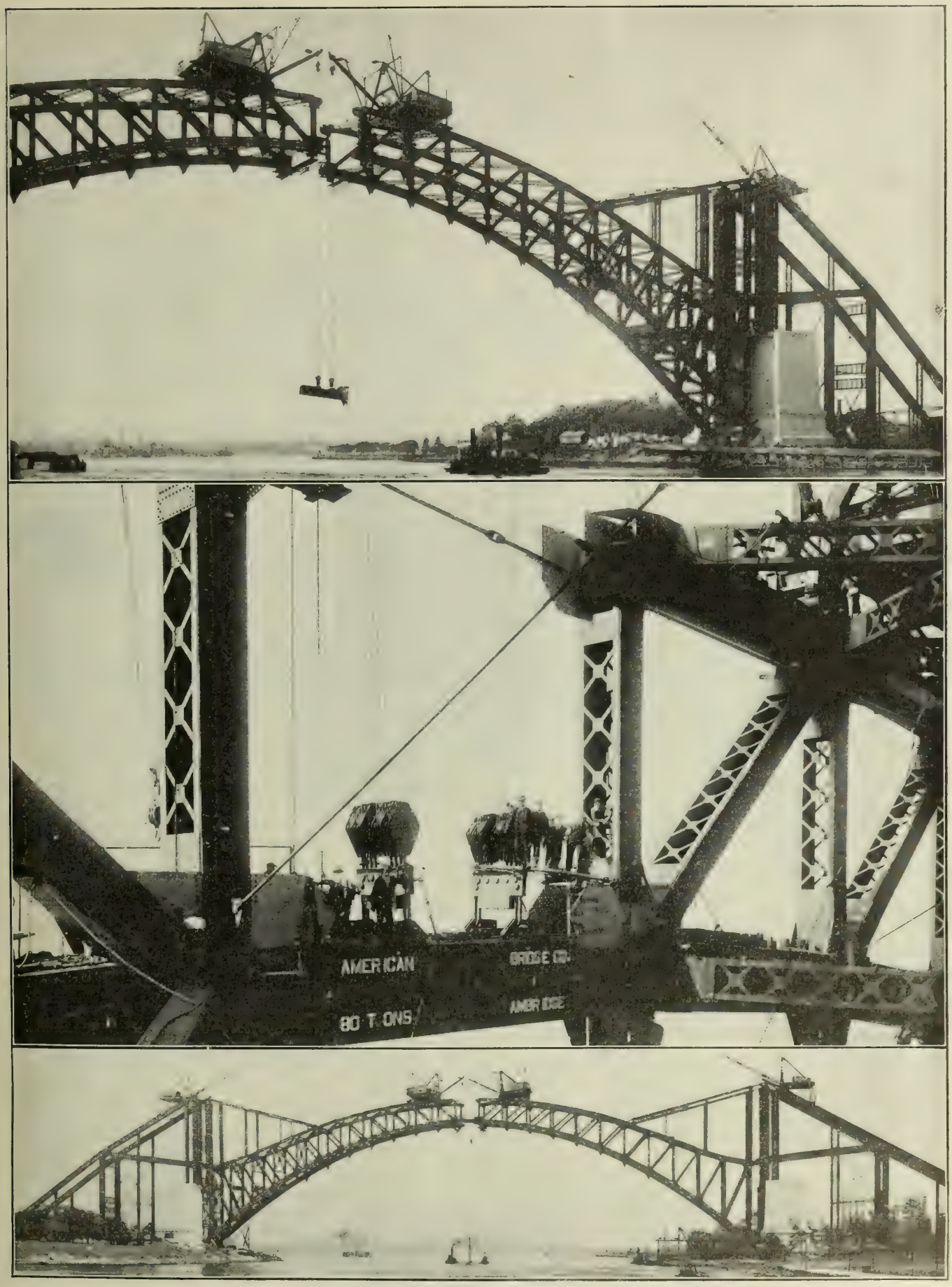
The backstay saddles rest on jacks, one per backstay, or two on each bank. These are special 39-in. jacks designed for a maximum working pressure of 5,000 lb. per sq.in., giving them a lifting capacity of 3,000 tons each. Early on Oct. 1 the jacks were raised about 1½ in. to take the load, relieving the pile of ½-in. lateral plates used as blocking under the saddle. The pressure required was about 4,450 and 4,200 lb. per sq.in. respectively for the Astoria and Ward's Island sides. The jacks were lowered slowly to bring the joint at the meeting of the bottom chords into contact. In this stage it was necessary to observe closely the alignment and relative levels of the four chord ends and manipulate the four jacks to bring them into correct contact; some re-jacking was required. The total lowering in this stage was something over 2 in.

Before further lowering, the splice plates at the point just brought into contact were bolted up, to make the joint secure against any vertical shear that might develop from unequal lowering on the two sides. About 1:15 p.m. lowering was resumed, under control of an open telephone connection between the two jack stations, the crown, the two anchorage counterweights and the office. Lowering was reported on this line by both jack stations every ⅛ in. or ¼ in., and at the same time the jack pressure was given. Levels to note any settlements were read on the two counterweights, whose load of 5,200 tons (each) was being released by the backstays and coming to bear on their sills. The final pressure of about 4 tons per sq.ft. produced a mean settlement of 2½ in. at the Astoria counterweight and ¾ in. at the other.

In one-half hour the jacks were lowered about 5½ in., never differing more than ⅛ or ¼ in. (the maximum). The structure was already in partial arch condition, and safe against lifting from any possible temperature decrease. The jack pressures had decreased uniformly to 2,200 and 2,250 lb. By this time the counterweights began to show slight settlement, but as the rate was not greater than expected the jack lowering continued. The pressure then dropped at a faster rate than up to this point, and finally reached zero with slightly over 15 in. lowering, at which time the eye-bars which made the hitch between backstay and arch had become fully loose. The total time of lowering from the stage of bolting up the middle splice was 1¼ hr., a rate of 12 in. per hr.

The release of compression in the anchor struts of the backstays caused no trouble (the counterweights were mounted on rollers).

The critical operation of lowering was watched by a number of representatives of the bridge company and the railway company, among them Richard Khuen, manager of erection, J. B. Gemberling, district manager of erection, C. G. E. Larsson, assistant chief engineer, and J. Lowenstein, assistant engineer, all of the American Bridge Co.; and O. H. Ammann, assistant chief engineer, H. W. Hudson, construction engineer, S. D. Heed, assistant construction engineer, and D. B. Steinman and W. A. Cuenot, assistant engineers, all of the New York Connecting Railroad (Gustav Lindenthal, chief engineer). The operation was carried out by Daniel Burns, foreman of erectors, and H. H. Starr and Walter J. Parsons, assistant engineers.



CLOSURE OF THE 977½-FT. HELL GATE ARCH

Upper view, hoisting closure member of south truss; Astoria (east) end of bridge at right. Middle view, closure member entered into position. Lower view, the south truss of the arch making the first continuous connection over Hell Gate. Views taken Thursday, Sept. 30, 1915.

Engineering Aspects of New Orleans Hurricane

By W. H. P. Creighton*

New Orleans and vicinity experienced on Sept. 29 the worst storm on record. The wind velocities surpassed all previously observed, and the rainfall was very high. In consequence there was much destruction of minor buildings and of overhead wires and some damage from flood.

The barometer, wind and rainfall records as observed at Tulane University[1] are as follows:

BAROMETER RECORD, NEW ORLEANS, SEPT. 29

12 : 08 p.m.	29.24 in.
2 : 35 p.m.	28.99 in.
4 : 25 p.m.	28.63 in.
5 : 21 p.m.	28.22 in.
5 : 42 p.m.	28.09 in.
8 : 00 p.m.	29.00 in.

WIND RECORD, NEW ORLEANS, SEPT. 29

86 mi. per hr. for 10 min.
120 mi. per hr. for 20 sec.
66 mi. per hr = maximum previous record.

RAINFALL, NEW ORLEANS, SEPT. 29

0.27 in. for 5 min.
0.59 in. for 10 min.
0.73 in. for 15 min.
1.11 in. for 30 min.
1.65 in. for 60 min.
2.54 in. for 120 min.
Maximum previous record, 8.2 in. for 20 hr.

On 40 sq.mi. of city streets 240,000,000 cu.ft. of rain fell in two hours. Normally this enormous precipitation could have been handled with but little delay, as the city possesses the largest and most economical low-lift pumps in the world. As a matter of fact, in the business section and main residential sections the water was off the streets almost as fast as it fell. In the outskirts and lower sections of the city the streets were badly flooded and the water was not completely removed till Saturday. This was due to backwater from Lake Pontchartrain raising the level of a canal and thereby flooding the city when its embankment was carried away, combined with the falling of wires for electrically driven pumps of the city drainage system and the presence of obstructions in one of the large canals under construction.

The falling of transmission lines either from wind pressure or the weight of falling trees caused all current to be shut off as a precaution from the street railway, light and telegraph systems. Nine thousand telephones were disabled. All the railroads were temporarily interrupted and only two have resumed approximately normal operations (Oct. 3).

Fallen church steeples, roofs, fences, buildings, sheds, house chimneys, wrecked bridges, railroad sheds, schooners, coal tows and window glass give ample evidence of the force of the wind.

What lessons can the engineer learn from this widespread disaster? We must separate the destruction caused directly by the wind from that caused through such subsidiary agents as water, waves, uncontrolled drifting barges, falling trees or flying missiles. On doing this we note that the damage done by wind is entirely unlike that done by earthquakes. Wind destruction is capricious and is single rather than widespread or general. Of ten large plate-glass windows of the same size and in the same line in a large department store each alternate glass was broken to bits and the others left in perfect condition. Only a part of the tiles are taken off a ridgepole; one chimney is overturned and a dozen apparently similarly situated are left untouched.

A careful survey of all the destruction will show that there is a fairly satisfactory reason for each failure. Many church steeples did not fall and those that did were either old or square and of limited cross-section. Comparatively few smokestacks fell. Brick walls were overthrown, but the mortar is easily taken from the bricks that fell. Open sheds, carbarns and docksheds suffered, but they were of flimsy construction and when lifted from the ground easily collapsed. Thus the Dumaine dockshed, a steel structure 600 ft. long and 50 ft. wide was lifted clear of its inadequate footings on a wharf and deposited 30 ft. to leeward of its original position, with columns unbroken but badly twisted at the junction of the roof truss and columns. Trees were overturned, but their root system was either small or rotten; the Louisville and Nashville R.R. lost a large part of a well-constructed bridge, probably because an uncontrolled barge was slammed upward against the floor. The Gulf Beach railway system will have to rebuild a large portion of its roadbed, but the wash of the waves is responsible as the direct agent.

The destruction in the closely built sections of the city is insignificant. The largest and tallest buildings have trivial damages. Even the grain elevators on the riverfront are operating as usual. The greatest destruction is among the flimsy structures in the outskirts and environs of the city.

To sum up, no well-designed engineering structure received more than trivial damage, hence the present factor of safety is more than ample, especially where buildings are closely set.

*Dean, College of Engineering, Tulane University, New Orleans, La.

[1]Compare with Weather Bureau records on opposite page.

Meteorology of West Indian Hurricane, Sept. 22-Oct. 2*

Between the northeast trade winds of the North Atlantic and the southeast trades of the South Atlantic, which on crossing the equator become southwest winds, there lies a belt of relatively low pressure, light variable winds and calms and vapor-laden air, commonly referred to as the "doldrums" and occasionally called the "meteorological equator." This belt of calms separates the general wind circulation of the Northern from the Southern Hemisphere, and it advances northward and retreats southward with the sun, but lags behind the sun—that is to say, the sun reaches its maximum north declination in June, while the "meteorological equator" is farthest north in August. This belt is an ideal breeding ground for tropical cyclones or hurricanes, but it is only when it lies farthest north that the right-hand deflecting effect of the earth's rotation becomes effective and gives the air that moves toward some local area, where the air has become superheated, a gyratory motion. Hence it is found that hurricanes are most frequent during the months of August and September. Why they should be more frequent in some years than in others is not understood.

On Sept. 22, 1915, in the doldrums in about Lat. 15° and Long. 64°, the forecaster on duty at the central office

*Report furnished by United States Weather Bureau, through District Forecaster E. H. Bowie, Washington, D. C.

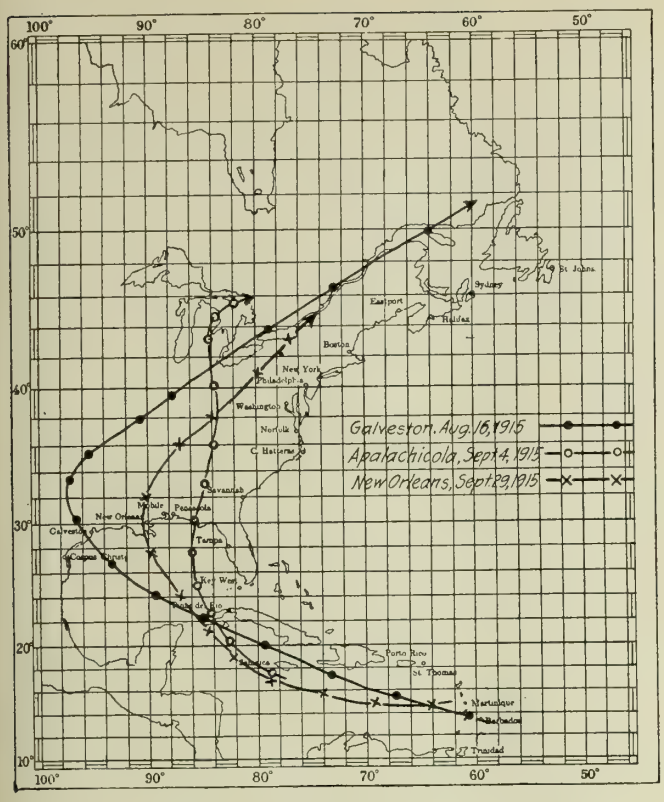


FIG. 1. PATH OF THREE RECENT HURRICANES THROUGH EASTERN UNITED STATES

at Washington, D. C., detected the first signs of the formation of a hurricane, although no reports were had from that immediate region. This storm then began to manifest its presence by the changed wind directions and the clouds and their peculiar movements as is usually the case when a hurricane is somewhere near. Advices concerning this storm were sent on the 22d to West Indian stations and shipping bound for West Indian waters. The deduction that a storm was in process of formation was confirmed by later reports. And day to day thereafter until the storm had passed inland near the mouth of the Mississippi River, and thereafter rapidly lost intensity, advices and warnings were issued for the guidance of shipping and the residents of the Gulf Coast regions. The track of this hurricane is shown on the chart in Fig. 1,

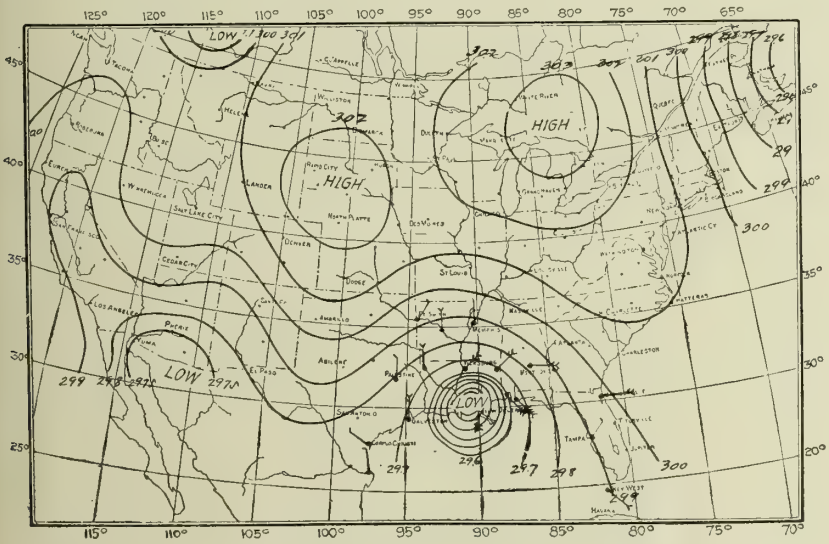


FIG. 2. WEATHER MAP OF THE UNITED STATES, SEPT. 29, 1915

RECORD OF OBSERVATIONS AT NEW ORLEANS, LA., SEPT. 29, 1915

Date	Time 75th Mer.	Time Local (Standard)	Barometer, Reduced to Sea-Level	Thermometer, (Dry)	Wind Direction	Wind Velocity	Wind Max. Since Last Observation	Wind Direction	Precipitation	State of Weather
29th	8 a.m.	7 a.m.	29.54	78	E	40	40	E	0.40	Raining
29th	10 a.m.	9 a.m.	29.44	74	N.E.	40	42	N.E.	0.72*	Raining
29th	Noon	11 a.m.	29.30	74	N.E.	44	52	N.E.	1.86	Raining
29th	2 p.m.	1 p.m.	29.10	76	E	62	64	N.E.	4.02*	Raining
29th	4 p.m.	3 p.m.	28.90	76	E	56	64	N.E.	5.64*	Raining
29th	5.50 p.m.	4.50 p.m.	28.11	(Lowest pressure during storm)						
29th	8 p.m.	7 p.m.	28.26	76	S	24	*88	S.E.	7.32†	Raining
30th	8 a.m.		29.58	74	S.W.	18	36	S.E.	0.08	cloudy

*Maximum wind velocity for 5 minutes; the extreme velocity was 130 miles per hour.
† Amount since 8 a.m.

which also shows the track of the hurricane that passed near Galveston on Aug. 16, 1915, and the one of lesser importance that passed inland near the mouth of the Apalachicola River on Sept. 4, 1915. It is unusual, in fact unparalleled, that three hurricanes should reach the Gulf Coast within a period of approximately six weeks.

The New Orleans hurricane was equal to and possibly surpassed in intensity the one that occurred at Galveston in August. At New Orleans on Sept. 29, 1915, the lowest pressure, reduced to sea level, standard gravity, etc., was 28.11 in., the lowest reading ever recorded at a Weather Bureau station; and the extreme wind velocity

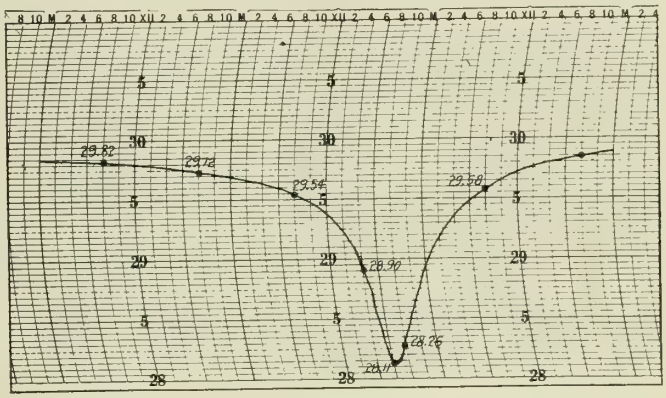


FIG. 3. BAROMETRIC RECORD AT SEA LEVEL, NEW ORLEANS, SEPT. 28-29, 1915
Trough of curve at 6 p.m., Sept. 29

was (approximately) 130 mi. per hr. from the east. Fig. 3 shows the sea-level pressure at New Orleans during the coming and passing of the storm. This barogram was constructed from reports received by telegraph, and no doubt will differ in minor particulars from the automatic record. Fig. 2 is the weather map of 8 p.m., Sept. 29, approximately 2 hr. after the center of the storm passed to the north immediately west of New Orleans. The pressure at New Orleans was then rising. The continuous lines on this chart are drawn for each 0.10 in. of pressure, except in the immediate vicinity of the storm center, where the gradient is so steep that it is not possible to show the lowest closed isobar. The arrows show the direction of the wind at the various stations within the storm area; the number of feathers on the staff of the arrow indicates the force of the wind (Beaufort scale) at the time of the observation.

The table contains what is known of the meteorological conditions at New Or-

leans on the day of the hurricane. These reports were received at the central office of the Weather Bureau by telegraph.

Complete data as to the loss of life are not available. A preliminary report by the official in charge of the New Orleans station follows:

Total deaths in New Orleans, sixteen; outside of New Orleans, estimated deaths, 300 to 340; no change in estimated damage reported in New Orleans and on river.

In a previous report it was stated that nearly every building in New Orleans was damaged. The total damage in the city is estimated at $2,000,000. The damage to shipping and coal interests on river is estimated at $1,500,000. Great damage was done outside of the city. The storm tide in some localities was more than 15 ft.

That the losses of life and property were no greater is unquestionably due to the timely warnings issued by the Weather Bureau of the severity of the hurricane and their extraordinary dissemination. On the morning of Sept. 28 the following warning was sent to Gulf ports, whence it was disseminated by every available means:

Tropical storm attended by dangerous winds central this morning over the Gulf of Mexico in approximately Lat. 24° and Long. 87°, moving northward toward the mouth of the Mississippi River. Its influence will be felt late tonight and Wednesday on the middle Gulf coast.

At 3 p.m. of the 28th hurricane warnings were ordered displayed and disseminated on the Gulf Coast from New Orleans, La., to Pensacola, Fla. The message read as follows:

Hoist hurricane warnings 3 p.m. New Orleans to Pensacola. Tropical storm center near Lat. 26° and Long. 88° and moving northward. Dangerous winds late tonight and Wednesday. The storm center will probably strike the coast near or immediately east of the mouth of the Mississippi River. Advise all interests.

Of especial importance and helpfulness to the forecaster in the preparation of the advices and warnings concerning this storm, which from the time of its formation in the eastern Caribbean Sea to the time it struck the mouth of the Mississippi did not pass close to a land station, were the wireless reports received from vessels at sea. While no one of these vessels reported from the immediate storm center, yet the reports were invaluable in that they permitted the center to be located approximately twice each day.

An Engineer's Backbone and the Ottawa Water-Supply

SPECIAL CORRESPONDENCE

The position of an engineer in relation to contract awards to be made by a city council is not always pleasant and unless he has backbone is liable to become humiliating. A shining example of how one engineer dominated the situation comes from Ottawa, Ont., in connection with the award of contracts for improving the water-supply of that city by building a pumping station on Lemieux Island, in the Ottawa River, and laying a force main from there to the mainland, crossing the river channel on a bridge in order to avoid the dangers of a submerged pipe line beneath Nepean Bay.

The plans for the work in question were drawn some months ago by J. B. McRae, of Ottawa, in consultation with Messrs. Lea, of Montreal. The longest item in the recent contract letting was for pipe. Mr. McRae recommended that the contract for this be awarded for $194,400 to Laurin & Leitch, who proposed to use welded lock-bar pipe. This bid was $29,000 above the lowest bid, which was for an electric-welded pipe, and it was also higher than a bid for riveted pipe. The recommendation to award the contract to the highest of the three bidders caused much discussion and bickering among the aldermen, but Mr. McRae won.

But it was in the award of contracts for the electrical part of the pumping equipment that McRae showed the stiffness of his backbone. He had advised the acceptance of the bid of the Canadian Westinghouse Co. for two motors, switch gear and transformers at a total of $37,765. The meat of a lengthy discussion on this subject was as follows:

Mr. McRae—I have given this matter careful consideration. I am convinced that these motors are the best for the purpose for which we want them. Fortunately, they are the cheapest. . . . I am acting in the city's best interest in recommending them as I have. If you do not think so, I am quite ready to step down and let someone else do the work. It is a matter of principle on my part.

Alderman Meier—Do you mean that you will resign if we do not accept these recommendations

Mr. McRae—Yes. I have seen so many engineers get into trouble by giving in on one point and then on another that as a matter of principle I take the full responsibility for the recommendations and will resign if they are voted down.

Mayor Porter—The City of Ottawa has lost a great deal by interfering with its engineers. My principle is to give him a free hand and hold him responsible.

This settled it, and the recommendations were unanimously adopted.

The contract for pumps went to Escher-Wyss (Zurich, Switzerland) for $10,900, with an alternative tender of $15,600 for pumps from the Boving Hydraulic and Engineering Co. Contracts for valves, specials, trenching and pipe-laying and a reinforced-concrete arch bridge (the latter, $42,537) brought the total awards up to about $375,000. Other contracts to be let will bring the cost of the "overland pipe" water-supply, as this project is called, up to about $500,000.

It may be added that this is the fifth Ottawa water-supply project during the past few years, the voters having defeated bond issues for a near-by lake gravity supply and for a mechanically filtered supply from the Ottawa River, both after plans by Allen Hazen; and changes of city administration having killed the expensive Binnie-Houston (London, England) project for a distant-lake gravity supply and the subsequent modified Ottawa River filtered supply. The present scheme is the outcome of a threatened 50% fire-insurance rate increase, followed by efforts of the insurance interests and local board of trade.

Extra-Work Clauses in the contract for the Broadway subway between 38th and 51st streets caused a recent disagreement between the Public Service Commission and the Board of Estimate and Apportionment. The contract for this section, recently awarded to the Holbrook, Cabot & Rollins Corporation for $3,740,913, contained a clause permitting the chief engineer of the commission to agree with the contractor for extra work not provided for in the contract, either on the basis of unit prices or a lump sum. The Board of Estimate refused to approve the contract unless the clause permitting a lump-sum allowance were striken out. As the contract between the Public Service Commission and the contracting firm had already been signed, counsel for both the contractors and the commission denied the right of the Board of Estimate to alter the terms of the contract and appealed to the Supreme Court for a writ of mandamus, ordering the Board of Estimate to give its consent unconditionally. This writ was granted by the court and complied with by the board. An informal agreement was made, however, between the board and the commission, under which the latter will confer with the board before approval of any lump-sum extra allowances exceeding 5 per cent. of the amount of the contract.

International Engineering Congress Concludes

EDITORIAL CORRESPONDENCE

Following the general sessions of the International Engineering Congress on the opening day, which, as reported last week, were devoted to the Panama Canal, the separate meetings of the ten sections of the congress began on Tuesday morning, Sept. 21.

The most largely attended sections were Waterways and Mechanical Engineering, in each of which an audience of 150 or more was usually present. The attendance in Materials and in Naval Architecture was comparatively small, yet in these an audience of 30 to 50 was present most of the time.

Beside the 850 members registered, there was a large attendance by the younger engineers of San Francisco and vicinity and by engineering students from the universities of California and Leland Stanford, Jr., the engineering departments of which suspended regular work for the week to permit both instructors and students to attend the congress.

Turning now to the 230 papers at the congress, the authors had been requested to summarize current practice in the fields covered and to review the changes of the past ten or fifteen years.

The plan of procedure adopted was to present the papers before the section, usually by extended abstract, but occasionally by title only. This was followed by such written discussions as had been received, often by reading the name of the contributor only, and the balance of the time was devoted to general discussion. In the final publication only such portions of the discussions will be printed as are deemed to be of permanent value.

SECTION II: WATERWAYS AND IRRIGATION

The two sessions of this section on Tuesday took up ten papers on the Panama Canal in addition to those read in the general session on the opening day. The authors of the papers were Generals Goethals, Hodges and Sibert, and Messrs. W. G. Comber, S. B. Williamson, Henry Goldmark, L. D. Cornish, E. C. Sherman, T. B. Mönniche and R. H. Whitehead. General Goethals described the work of dry excavation carried on chiefly in the Culebra Cut, under the late Col. D. D. Gaillard, in whose honor the cut has been renamed. The other authors each described the work that was under his special direction. Panama Canal papers were also presented before at least four other sections. Thus, in the section Municipal Engineering three papers were read describing the work of cleaning up the cities of the Canal Zone, the authors being H. W. Durham, of New York City, and George M. Wells and Col. Charles F. Mason, of the Canal Zone.

In the Railway Section, Lieut. Frederick Mears described the rebuilding of the Panama R.R.; in the Mechanical Engineering Section there was a paper on the permanent shops for the canal; in the Electrical Engineering Section, Edward Schildhauer took up the electrical and mechanical installations; and in the Marine Engineering Section, Admiral H. H. Rousseau described the dry docks, wharves and terminals, and W. F. Beyer the aids to navigation.

On Wednesday morning the Waterways Section took up four papers on the general subject of waterways, the authors being Gen. William H. Bixby; Colonels Riché and Harts, of the Corps of Engineers, United States Army; and C. A. Jolles, of Holland. In the afternoon the entire session was devoted to a long and valuable paper on "Flood Control," by Gen. H. M. Chittenden. This was an admirable summary of the problems of river-flood control in the United States, with descriptions of the problems presented by nine important rivers and the methods proposed for solution in each case. This paper alone, with the discussion upon it, is so valuable that every engineer interested in flood-prevention work would do well to obtain the volume of the congress proceedings containing it.

Other papers at this session were on the flood-control problem in China, by Charles D. Jameson, and two papers describing river and harbor improvement works in Italy and in Japan.

The four remaining sessions of Section II were devoted to papers on Irrigation, of which there were 16. It is doubtful if there has ever been in the history of engineering a better symposium on irrigation work than these papers furnish. The number of leading irrigation engineers present at the congress made the discussions active and profitable. Several of the papers described foreign practice in irrigation, in Italy, Spain and the Argentine Republic. It is noteworthy that the uniform report from all these countries was that the investments in large works for the storage and distribution of water had almost invariably proved unprofitable. The experience in these countries and in the successful irrigation work in Canada and Australia showed that the irrigation farmer must be given financial aid to prepare his land for irrigation or it will be impossible to rapidly colonize irrigation projects with permanent settlers.

SECTION III: MUNICIPAL ENGINEERING

This section had five sessions, opening its work with a paper on city planning, by Nelson P. Lewis, of New York City. This was followed by papers on London traffic, by Sir Albert Stanley, and on the transit problem in American cities, by W. F. Reeves, of the New York Interborough Co. In the discussion upon these papers M. M. O'Shaughnessy, City Engineer of San Francisco, who presided at the section meetings, said that San Francisco's municipal street-railway system had cost about $250,000 per mile of double-track road. It had been estimated that under the conditions in San Francisco, elevated railways would cost about $800,000 per mile and subways about $3,500,000. San Francisco has expended about $5,000,000 in building its municipal street-railway system which has about 40 miles of track.

On Wednesday this section took up three papers on water-supply and two on sewage. On Thursday the entire day was devoted to seven papers on roads and pavements, the authors being from France, England and Argentine, as well as from the United States. Notable among these papers was one by James E. Howard, the well-known testing engineer, describing his investigations into the stresses produced in pavements by temperature changes and by traffic.

A paper by Dr. A. C. Humphreys, President of Stevens Institute, on public utilities, opened the session on Thursday. Doctor Humphreys expressed in characteristic fashion his well-known opposition to municipal ownership of gas and electric utilities, although he admitted that a municipality should own its works for water-supply

and sewage. The questions of municipal ownership and state control of public utilities are burning questions on the Pacific Coast, and there was prompt and pointed discussion of Doctor Humphrey's paper. But for the arrival of the luncheon hour, this discussion would have been prolonged indefinitely.

Among other noteworthy papers in this section were a summary of municipal fire-protection methods, by John R. Freeman; a paper on "Arch Bridges of Hooped Concrete with Cast-Iron Reinforcement," by Fritz von Emperger, of Vienna; and "Soliditit-Concrete Roads in Italy," by Doctor Luiggi, of Rome.

Doctor Luiggi's paper describes recent road construction in Italy with a concrete made from a new kind of cement produced by the Portland Casalesi Co., of Genoa. It is claimed that this differs from portland cement in that it forms a chemical combination with the sand and gravel with which it is mixed to form concrete, so that the resulting concrete has double the compressive strength of concrete made from portland cement. Some of these "Soliditit" concrete roads near Alexandria and Casale have been in service for five years and under a heavy traffic are said to show a wear of only $\frac{1}{16}$ in. to $\frac{1}{8}$ in. per annum. The cost, however, is $2 to $2.25 per sq.yd.

Section IV: Railway Engineering

A remarkable paper by William Barclay Parsons, of New York, opened this section. It was a study of railways and railway development in all countries of the world and contained statistics of railway development of a sort that have never before been compiled—at least by an authority competent to sift and analyze official statistics in the interest of accuracy. These statistics covered, among other things, mileage at different periods, growth in size of locomotives and cars relative to safety of railways in different countries, railway gages of the world, volume of passenger and freight traffic, extent of government ownership and state railway control in the United States.

The remaining papers at the opening session went far to justify the international character of the congress, for they dealt with railways in South America, Italy, India, China, Russia and the Dutch East Indies.

At the following session a paper by John F. Stevens, "Economic Considerations in the Building of New Lines," was first on the list, and papers on railway location, by William Hood, chief engineer of the Southern Pacific, famous throughout the West for his ability as a locating engineer, and by David Wilson, of South Africa, followed. Then came three papers on tunnels in the United States, Italy and Switzerland. The first of these, by Charles S. Churchill, of the Norfolk & Western, was a valuable review of recent American practice in tunnel driving.

Among the noteworthy papers at the sessions on Thursday were: "American Railroad Bridges," by J. E. Greiner; "Recent Locomotive Development," by George R. Henderson, of the Baldwin Locomotive Works; and "Railroad Terminals," by B. F. Cresson, Jr. At the closing session on Friday, two papers on "Electric Motive Power for Railways," by E. H. McHenry and William Hood, and a paper on "Signals and Interlocking," by Charles Hansel, were presented.

Section V: Materials of Engineering Construction

The attendance was small and discussion limited. The opening session was devoted wholly to timber, five papers being dealt with. At the next session, concrete was the chief subject considered. Prof. Alfred H. White, of Michigan University, described tests to determine changes of volume in concrete. Bertram Blount, the English authority on cement, discussed the probable life of concrete made from modern cement, concluding that if properly made such structures should last until obsolete.

Wednesday morning's session opened with a paper, "The Outlook for Iron," by Prof. James F. Kemp, in which he concluded that while the sources of rich iron are all being rapidly exhausted, there is low-grade iron ore enough to supply the world for many centuries. Dr. J. A. L. Waddell discussed the use of alloy steel in bridge work and concluded that at present prices of alloy steel there are several kinds of high-strength steel that it will pay to adopt for long-span bridge work. Nickel steel was used in the Municipal Bridge at St. Louis at an excess cost over carbon steel of 1.65c. per lb. and is being used for the trusses of the suspended span and channel arms of the cantilevers of the Quebec Bridge. Mayari steel—a chrome-nickel steel with an ultimate strength of 85,000 to 100,000 lb. per sq.in.—is being furnished by the Pennsylvania Steel Co. for the new Mississippi River Bridge, at Memphis. The new Ohio Bridge for the Chicago, Burlington & Quincy, at Metropolis, Ill., is to be built of silicon steel, which has an ultimate strength of about 80,000 lb. and a yield point of about 45,000 lb. The material cost about ½c. per lb. more than carbon steel and the shopwork about 0.15c. more.

The life of wood and of concrete in docks and piers was the subject of a paper by Harrison S. Taft, of Seattle. In this, valuable data on creosoting practice were given.

In the sessions on Thursday, papers on copper, aluminum, alloys and testing of materials were considered.

Section VI: Mechanical Engineering

Here, interest in the papers and active discussion were maintained throughout. A series of valuable papers on foundry work, forging and machine-shop practice occupied the first two sessions. The session on Wednesday took up two papers on internal-combustion engines and two on steam turbines.

The climax of this section was reached in the session on Thursday devoted to water-power development, a subject of intense interest on the Pacific Coast. Two papers on hydraulic turbines, by Doctor Zoelly, of Zurich, and Arnold Pfau, of the Allis-Chalmers Co., and a paper on impulse waterwheels by W. A. Doble, of San Francisco, were summaries of present-day practice by high authorities in the field. Other papers at the session were on the general subject of hydraulic power development, by J. D. Galloway, of San Francisco, and Canadian hydraulic power development, by Charles H. Mitchell, of Toronto.

Section VII: Electrical Engineering

The subjects considered related rather to the applications of electricity than to the technicalities of electrical-engineering design. Four of the papers related to the economic, social and industrial effect of electric-current distribution and electric motive power. A. L. De Leeuw discussed the effect of the electric motor on the design of machine tools. A remarkable analysis of the stresses in the connecting-rods and parallel rods of the electric locomotives used in the Pennsylvania tunnel at New York City was presented in a paper by G. M. Eaton, of the Westinghouse Electric Co. Prof. A. F. Ganz, of Stevens

Institute, discussed the effect of electrolysis on engineering structures and showed that every effort should be made to hinder the passage of return current through the earth. Other papers discussed electric welding, the production of high permeability in iron and electric illuminants. In the latter paper, by S. H. Blake, of the General Electric Co., it was stated that the present high-efficiency incandescent lamp produces about six times as much light from a given expenditure of electric energy as the first incandescent lamps used.

Section VIII: Mining Engineering

The first session of this section was devoted chiefly to half a dozen papers on the valuation of mines of different sorts. "Mine Safety and Workmen's Compensation" was the title of a paper by Herbert M. Wilson, long connected with the Federal Bureau of Mines. Mine finance was the chief subject taken up at the second session, and at the third session the organization of mining companies and mine inspection were the main topics.

Section IX: Metallurgy

While the previous section had only 14 papers on its schedule, the Metallurgy Section had 37. The first day's session was devoted to iron and steel, seven papers being presented under the general editorship of Dr. Henry M. Howe. A paper on electric metallurgy, by E. F. Roeber, concluded this session.

At the following two sessions 13 papers on copper metallurgy, edited by E. P. Mathewson, manager of the Anaconda Mining Co., were presented. On Friday morning five papers on gold and silver, under the general editorship of C. W. Merrill, of San Francisco, and in the afternoon two papers on zinc, edited by W. R. Ingalls, Editor of the *Engineering and Mining Journal,* and a paper on lead, by Dr. H. O. Hoffman, of the Massachusetts Institute of Technology, were considered. At the closing session fuels was the main theme, the papers being edited by Prof. C. H. Fulton, of Case School, and the subjects covered including pulverized coal, gas producers and surface combustion.

Section X: Naval Architecture and Marine Engineering

This section had a full program, with 30 papers covering a wide range of subjects. Admiral D. W. Taylor, Chief of the Bureau of Construction, United States Navy, was the author of the opening paper on "Ship Design, Resistance and Propulsion." Ocean freighters were discussed by Ernest H. Rigg, of the New York Shipbuilding Co., and lake freighters, by Prof. Herbert C. Sudler, of Ann Arbor.

Wednesday morning's session was devoted to naval vessels. At the afternoon session marine boilers and steam turbines were the chief topics. On the following day freight-handling methods and marine terminals were considered, the authors of the papers including F. H. Cooke, of the Panama Canal staff; H. McL. Harding, of New York City; and D. B. Rushmore, R. H. Rogers and James A. Jackson, of the General Electric Co.

On Friday the subjects covered included fuel oil, the Diesel engine and dry-dock construction.

Whoever attempts to partition off the engineering profession or its work into any small number of compartments soon finds some important branches which won't fit anywhere. Those who planned the congress program solved this difficulty by bunching under "Miscellaneous" the paper in certain special fields which were too few for a section by themselves. The opening session of this section was devoted to four papers on aviation, and the following session to refrigeration. At the third session the time was divided between agricultural engineering and engineering education, the contributors to the latter being Dr. George F. Swain and President Ira N. Hollis. A symposium in 14 parts on engineering in Chile was also scheduled for this session. Efficiency engineering, with two papers, and heating and ventilation, with three papers, wound up the work of the section.

Excursions and Social Events

The technical excursions in connection with the congress were scheduled for the three days preceding its opening and included visits to an extended list of engineering works both in San Francisco and a considerable distance away. A large proportion of the visitors took part in these excursions. During the congress week a reception was held at the Palace Hotel on Monday evening. On Thursday afternoon a lawn party was given at the University of California. A banquet at the Palace Hotel on Friday evening was the culminating social event of the week. Many of the Eastern visitors left on Saturday afternoon for the return excursion via the Canadian Pacific Ry., visiting numerous Canadian power plants and irrigation works on the way. Those remaining in San Francisco, with many of their hosts, enjoyed an excursion around the waterfront and bay on Saturday afternoon, through the courtesy of the State Harbor Commission, of which Jerome Newman is chief engineer.

It may be noted in conclusion that the secretary of the congress, W. A. Cattell, Foxcroft Building, San Francisco, will book subscriptions for the congress "proceedings" while further written discussions upon the papers are being received and edited.

Chemical Engineering Course at Columbia University

Courses leading to the degree of Chemical Engineer have been offered in the Department of Chemistry of Columbia University for ten years but the trustees have established a Department of Chemical Engineering upon the same plane of importance in the Columbia Graduate Engineering School as the Mining, Civil, Electrical and Mechanical Engineering departments. The head of the new department is M. C. Whitaker, who has been professor of chemical engineering at Columbia for five years.

The new chemical-engineering laboratories which were recently installed, where the students are taught to use engineering methods and engineering appliances in the study and development of chemical industries, have been provided with still further equipment during the past summer. These laboratories are equipped with apparatus to illustrate the various fundamental operations of chemical and electro-chemical processes and to apply fundamental principles to industrial problems. Research may be conducted here on such a scale as to establish the dependable engineering data necessary for intelligent and accurate process design. The registration in this department reached a total of 81 during the past year.

News of the Engineering World

Recommendations for Safety of Subway Timbering

A report has been made by the committee of municipal engineers who on order of the Mayor of New York City made an emergency investigation of timbering in subway excavations immediately after the collapse in Broadway on Sept. 25 (*Engineering News*, Sept. 30, 1915, p. 662). The committee inspected all parts of the subway work where the street surface is now carried on other than permanent steel structures: Broadway from 12th to 39th St., the Seventh Ave. line from 34th St. south via Varick St. and West Broadway to the Old Slip tunnels, the approach to the South Ferry tunnel, Canal St. east of Broadway, Flatbush Ave. (Brooklyn) from Dean St. to Prospect Park, Eastern Parkway, Park Ave., Lexington Ave. from 41st to 53rd St. and just south of the Harlem River, 59th St., 138th St., and Southern Boulevard to Hunts Point Road.

During the inspection the committee made various recommendations to the engineers of the Public Service Commission. These recommendations called for diagonal bracing of the timbering, for shoring of walls of rock cuts by braces independent of the street falsework and for other improvements not disclosed.

Timbering Declared Unsuitable

The report describes the timbering used in Broadway from 26th to 39th St. and in Seventh Ave. from Commerce St. to 30th St. as being materially different from that used elsewhere, and inherently unsuitable:

> The most conspicuous feature is the transverse bents, which are commonly composed of two separate bents, the top horizontal member of each of which consists of a heavy I-beam projecting beyond the vertical supports.[1] These beams are not connected securely with each other, and they generally do not extend to the sides of the cut. There was little if any protection against the overturning of these beams in case of a longitudinal shock or movement. With such method of construction diagonal bracing, both transverse and longitudinal, is very necessary, but we believe the type of structure originally used to be entirely unsuitable for the purpose for which it was designed.

Diagonal bracing was recommended for Broadway, to be placed in towers at cross-streets and halfway between, or about every 100 ft. The purpose of this is to "stiffen the supporting structure and tend to minimize the effect of any local disturbance." Occasional use of "horizontal strut bracing to the sides of the cut, in place of the vertical diagonals," was approved, to reduce interference with erection of the permanent subway steel.

Other sections of the work gave little opportunity for suggestions or criticisms. "The supporting structure is generally well designed and has been erected in a workmanlike manner." Diagonal bracing was put in originally at a few localities, and elsewhere only recently. The committee's report is very general in its references to diagonal bracing and fails to say how much bracing has been required.

[1]Shown better by drawings in "Engineering News," Sept. 30, pp. 664 and 666.

The committee calls for bracing to protect sides of rock cuts, not everywhere but only "where the stratification of the rock and its unsound character render a movement or falling of rock fragments at all likely." The bracing should be independent of the street falsework, "so that the safety of the latter should not be impaired by such movements of rock."

Risk Cannot Be Eliminated

The committee dwells on the impossibility of eliminating all risk in work of the character of subway excavation. Its recommendations are described as intended only to reduce the risk. The committee fails to state the fact that this risk has heretofore not been recognized by the city officials.

Two blanket recommendations are made which relate to risk in general rather than to specific defects or weaknesses.

Reduce Falsework and Street Speeds

In several places the committee found long sections of timbering where excavation was completed but steel erection had not been begun. In one case there was a 2,000-ft. length of this kind.

> We believe that it is unnecessary to assume the risk inseparable from such long stretches of temporary supports for the street surface, and that in the interest of safety to street traffic a limit should be placed on the extent of continuous temporary structure.

While maintenance of street traffic is the characteristic element of the subway work now in progress, the committee thinks that a limit should be placed on loads and speeds, now wholly unrestricted. After the recent accidents the police established such traffic restrictions (maximum weight of vehicle, 10 tons loaded; maximum speed, 8 mi. per hr.) on streets where the roadway is on temporary support, and these restrictions the committee approves both for the present and for continued use throughout the work.

Nine Engineers Honored

The nine engineers who had the chief responsibility for the planning and construction of the Panama-Pacific Exposition were awarded formal honors by the Exposition Board on Sept. 24, when each was presented with a bronze plaque inscribed:

> Presented in recognition of services as one of the engineers of the Panama-Pacific International Exposition by its Board of Directors.

The plaques were presented after a luncheon given by C. C. Moore, president of the exposition. The nine engineers so honored were: H. D. H. Connick, director of works; A. H. Markwart, assistant director of works; G. L. Bayley, chief mechanical and electrical engineer; E. E. Carpenter, chief civil engineer; Shirley Baker, construction engineer; H. D. Dewell, chief structural engineer; William Waters, superintendent of construction; W. M. Johnson, engineer of fire protection, and L. E. Leurey, assistant chief mechanical and electrical engineer.

Activated-Sludge Progress at Houston, Tex.

Progress with the activated-sludge method of sewage treatment at Houston, Tex., is summarized for *Engineering News* under date of Sept. 27, 1915, by E. E. Sands, City Engineer, as follows:

We now have one large activated-sludge tank in operation and also have a small tank about 12 in. square and 8 ft. deep, with a glass front and a small filtros plate in the bottom of tank. We have been operating our large tank (14,000 gal.) but a few days and have only accumulated 5% of sludge so far, but we find that at a certain time of the day our sewage carries a considerable amount of solid matter, so we are able to build up our sludge quite rapidly, and we expect within the next three or four weeks to have the tank running at a normal condition. Our work was delayed because our blower was on a steamer which was wrecked during the Galveston storm.

Arrowrock Dam Dedicated

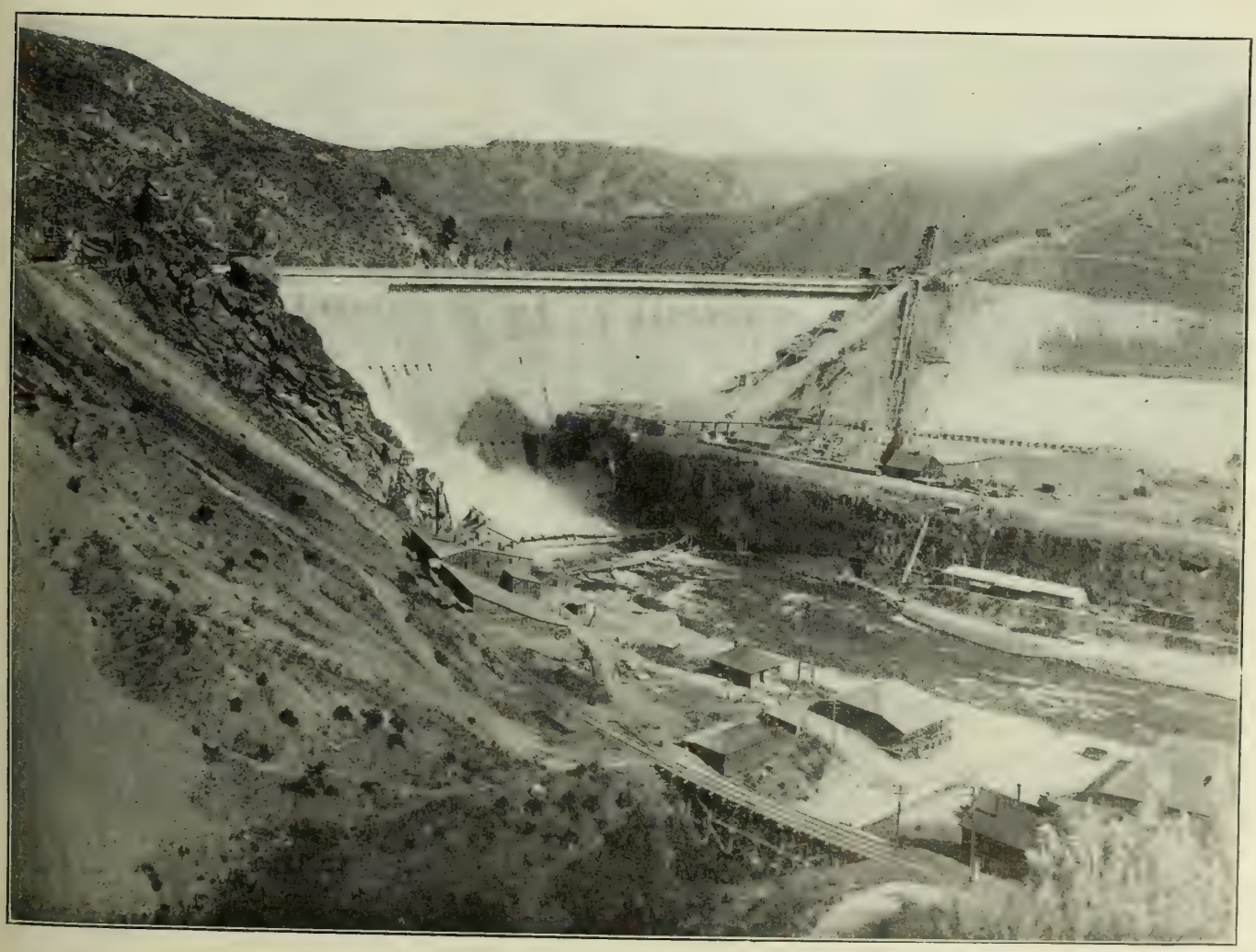
The Arrowrock Dam across the Boise River just above Boise, Idaho, the highest dam in the world, was officially dedicated with appropriate ceremonies on Oct. 4. This dam, which is on the Boise project of the United States Reclamation Service, is 348.5 ft. above bedrock and about 250 ft. above the river bed. It is arched in plan to a 662-ft. radius and a 1,060-ft. length. The section is the normal gravity type. About 530,000 cu.yd. of cyclopean concrete was used in the construction.

Sanitary Engineers Wanted

Sanitary engineers throughout the country will be interested to know that a chief sanitary engineer and an assistant are wanted by the Illinois State Board of Health at salaries of from $250 to $500 and $100 to $250 per month; that they are to be selected on merit from whosoever wish to apply, regardless of residence; and that although an "examination" of candidates will be held by the State Civil Service Commission it will not be of the common written type.

These appointments result from recent legislative authorization for the creation of a sanitary engineering bureau in the State Board of Health. As a preliminary to such action Paul Hansen, engineer of the State Water Survey of Illinois, was invited to study the situation and was granted leave of absence for the purpose. Presumably he had a hand in framing the following specifications, just announced by Dr. St. Clair Drake, secretary to the State Board of Health:

Minimum age, 30 yr. Sex, male. Duties will involve: Under the direction of the executive officer of the State Board of Health, responsible charge of the sanitary-engineering bureau of said board, which will include examinations of projects of water-supply, sewage, garbage and other wastes disposal, city and rural; drainage; investigations of water-borne diseases; special studies relative to water purification, sewage and wastes disposal; investigation of sanitary conditions of cities and rural communities, buildings, summer resorts, fair grounds, amusement parks, construction camps, railroad properties, shipping warehouses, cold-storage plants,



THE HIGHEST DAM IN THE WORLD COMPLETED
Arrowrock Dam of the United States Reclamation Service near Boise, Idaho

rendering plants, stockyards, factories, schools, etc., etc.; examination and approval of plans for plumbing, ventilation, heating and lighting of public buildings and public houses; furnishing information, counsel and advice to state, city, county and township authorities on matters which lend themselves to engineering treatment; and such other duties as might properly be expected of a sanitary engineering service.

Experience and Training: Graduation from a reputable engineering school in either a sanitary, municipal or civil-engineering course and at least five years responsible charge of sanitary engineering work. Preference to be given to applicants having previous experience in state board of health work or along similar lines and to applicants having familiarity with the State of Illinois.

The examination should embrace questions relating to the following: Experience in the supervision of other employees; reports and other publications; experience as expert witness; knowledge of water-supplies, sewerage and sanitary conditions in Illinois; experience in reviewing plans for water purification, sewage treatment, and city-cleaning projects; experience in design and construction of water-purification and sewage-treatment projects; and, possibly, membership in engineering and technical societies.

For the position of assistant sanitary engineer, essentially the same education is required, with two instead of five years' practical engineering experience and with less extensive experience and duties in general.

An "examination" of candidates for the position of chief sanitary engineer will be held by the State Civil Service Commission early in November. Applications for the position will be received until Oct. 30, 1915. Furthermore, W. R. Robinson, secretary State Civil Service Commission, Springfield, Ill., states:

The inquiry will be unassembled and not of the usual written type. Applicants will be asked to forward complete statements of their qualifications and experience. Their statements will be verified where necessary, and those who are considered qualified for the position will be called to Illinois for a personal interview. This method will recommend itself to busy men, as it follows the methods ordinarily used by private concerns in selecting employees.

Erie Flood-Protection Report

The problem of protecting Erie, Penn., against destructive floods in Mill Creek like that of Aug. 3, 1915, was studied for the City Council by Farley Gannett, consulting engineer, Harrisburg, Penn. His report, rendered last week, recommends a concrete conduit (8,100 ft.) and a concrete channel (4,800 ft.) through the city, and a dry reservoir of 52,000,000 cu.ft. capacity about a mile above the city, which can be built for $798,000 (without land damages). The channel and conduit are to carry 6,000 cu.ft. per sec., which is half the greatest flow of the flood of Aug. 3. The conduit is horseshoe-shaped, 18x14 ft.; the channel has sloping side walls and is 24 ft. wide on the water line by 10 ft. deep. As second choice a project without reservoir is presented, costing $917,000. This employs a conduit of 12,000 ft. capacity, 22x18 ft., and a channel 30 ft. wide on the water line by 12 ft. deep. Diversion projects are reported to be not desirable.

Nine Tunnel Workmen Were Killed by an express train on the Philadelphia & Reading R.R. at Phoenixville, Penn., on Sept. 28. A gang of about 20 workmen was engaged in enlarging the Black Rock Tunnel when the train passed through.

A Falling Steel Bucket killed a workman, on Sept. 26 at the new Point-No-Point power station being erected for the Public Service Electric Co. of New Jersey. A gang of four men was hoisting lumber, utilizing an ordinary dump bucket, when, according to report, the hoist brake slipped.

The Latest Panama Canal Slide continues to obstruct the canal. This slide, or series of slides, is at Culebra near Gold Hill and started on Sept. 18, at which time the canal was closed to traffic. Under date of Oct. 4 cable dispatches from the Isthmus announced that the canal would probably not be opened for traffic until Nov. 1. At the time of the dispatch there were already 90 vessels tied up awaiting the opening, although all nearby ports had been warned of the probable delay in transit.

An Engineer on the Public Service Commission of Pennsylvania may be advocated by the engineering societies of the state in a petition to Governor Brumbaugh to fill an existing vacancy in that way.

Transcontinental Radio Telephony was established on an experimental scale Sept. 30 by the American Telegraph and Telephone Co. T. N. Vail, president, talked from New York with J. J. Carty, chief engineer, at Mare Island, Calif. The regular wire circuits of the company were used to Arlington, Va., and the wireless towers of the United States Navy were employed there and at Mare Island. The conversation was heard by one of the company's engineers, stationed for observations, at Pearl Harbor, T. H., 4,600 miles from New York. It is stated by the telephone company that no new principle is involved in its system but that improved sending and receiving apparatus have been developed by the telephone company in connection with the Western Electric Co. (its manufacturing associates) and the research department of the General Electric Co.

The Municipal Bridge at St. Louis over the Mississippi River is having the work on its eastern or Illinois approach seriously delayed by strikes. The city had agreed to do the work by day labor and to employ only union men, but trouble soon developed through jurisdictional disputes among the various unions, resulting in several strikes. Later there was a demand for the dismissal of an assistant superintendent, which was refused. Press reports state that Mr. Kinsey, president of the Board of Public Service, has declared that unless the unions stop hampering the work in this way the city will be forced to let the work to a contractor. Mayor Kiel is said to have told the union leaders that if the construction of the approach by union day labor under the Board of Public Service has to be abandoned it will be a discredit to the unions and to the city administration.

PERSONALS

Mr. Lloyd Runkle has been appointed City Engineer of Tiffin, Ohio, to succeed H. B. Puffenberger.

Mr. C. E. Curtis, M. Am. Soc. C. E., Assistant Engineer on Grade-Elimination Work of the Nickel Plate R.R., in Cleveland, has been appointed Superintendent of Buildings and Grounds of Cornell University, Ithaca, N. Y.

Mr. John A. Beeler, M. Am. Soc. C. E., has resigned as Vice-President and General Manager of the Denver (Colo.) Tramway Co. He will remain with the company indefinitely in an advisory capacity, at his former salary of $10,000 a year.

Mr. Frederick W. Hild, Assoc. Am. Inst. E. E., formerly Manager of the Portland (Ore.) Traction, Light and Power Co., has been appointed General Manager of the Denver (Colo.) Tramway Co. He succeeds John A. Beeler, formerly Vice-President and General Manager.

Mr. Jacob L. Jacobs, Assoc. M. Am. Soc. C. E., formerly Engineer in Charge of the Municipal Efficiency Division of the City of Chicago, announces that he is prepared to give counsel and undertake supervision of expert investigations connected with service and efficiency surveys, management, appraisals and cost accounting for industrial and public institutions.

Mr. John T. Broderick, Chief Clerk to the Third Vice-President of the Baltimore & Ohio R.R., has been promoted to supervisor of special bureaus of the Operating Department, and is in charge of the Safety-First Department, records of Federal and State commissions, free transportation, and the employees' magazine. Mr. Broderick will be succeeded by Mr. P. C. Lantz.

Mr. J. H. Prior, formerly Assistant Chief Engineer of the Illinois Public Utilities Commission, has been appointed Chief Engineer. Mr. Prior was educated at the Armour Institute of Technology and at the University of Chicago. He was Engineer of Design of the Chicago, Milwaukee & St. Paul Ry. from 1905 to 1914. In 1906-1907 he made valuations of that company's structures in Minnesota and South Dakota, as required by those states.

Mr. S. Shirley French, Chief Clerk at the general offices of the Brier Hill Steel Co., has been appointed Assistant General Manager of the William Tod Works, of Youngstown,

Ohio. Mr. French began his career at the Mahoning Valley Works of the Republic Iron & Steel Co., of Youngstown, and was later transferred to Toledo. He left Toledo to enter the employ of the United States Steel Corporation, at Gary, Ind.

Mr. Oscar F. Lackey, M. Am. Soc. C. E., for the past nine years President and Chief Engineer of the Harbor Board of Baltimore, Md., has severed his connection with the city and opened an office at 4 West Eager St., Baltimore. Previous to his work in Baltimore, Mr. Lackey spent some years in the service of the United States Government, in Cuba, where he was connected with the construction of streets, sewers and water-supply for the City of Santiago.

Mr. C. E. Henderson, Assistant City Engineer of Port Arthur, Ontario, since 1910, has been appointed City Engineer of St. Augustine, Fla. Mr. Henderson graduated from the University of Illinois in 1906. He was afterward in the service of the Missouri, Kansas & Texas Lines as Assistant Engineer of Maintenance-of-Way, and still later was with the Chicago, Minneapolis & St. Paul Ry. as Assistant Engineer of Masonry Construction, Department of Bridges and Buildings. In 1909 he was appointed Instructor of Civil Engineering at the University of Illinois, leaving there a year later to enter the employ of the City of Port Arthur.

Mr. W. O. Thompson, since 1907 District Master Car Builder at Buffalo, of the New York Central Lines West of Buffalo, has been appointed Superintendent of Rolling Stock, with headquarters at Cleveland. Mr. Thompson started his railroad career in 1880 as clerk with the Fort Wayne, Jackson & Saginaw Ry., later becoming a locomotive engineman on that road. In 1890 he was appointed traveling engineer of the Lake Shore & Michigan Southern Ry., and three years later was made dispatcher. In 1901 he entered the service of the New York Central as General Locomotive Inspector, and the following year was appointed Superintendent of Motive Power of the Rome, Watertown & Ogdensburg Ry., which position he held up to the time of his recent promotion.

Mr. Julius E. Willoughby, M. Am. Soc. C. E., formerly Assistant Chief Engineer of the Atlantic Coast Line R.R., has been appointed Chief Engineer. Mr. Willoughby succeeds the late Edward B. Pleasants, whose death was noted in issue of Sept. 2. After graduation from the University of Alabama in 1892, Mr. Willoughby entered the service of the Louisville & Nashville R.R. as traveling land agent. Eight years later he was made Principal Assistant Engineer of Construction on new lines in Alabama, and in 1901 was appointed Engineer of Construction on the Alabama & Florida division of the road. In 1902 he was appointed Division Engineer of the Knoxville, LaFollette & Jellico R.R., later becoming Chief Engineer. He returned to the service of the Louisville & Nashville in 1905 as Engineer of Construction, and in 1912 was appointed Chief Engineer of the Caribbean Construction Co., building a railroad in Haiti that year. In 1913 he was appointed Assistant Chief Engineer of the Atlantic Coast Line.

OBITUARY

John E. Thompson, a member of the firm of the Quincy Iron Co., of New York City, died at his summer home in Warren, R. I., on Sept. 26, from heart failure. He was 75 years of age.

William Herod, a well-known builder of Brooklyn, N. Y., died on Sept. 28 at Los Angeles, Calif., while on a trip to the Panama-Pacific Exposition and the Panama Canal. He was 68 years old.

J. W. Bookwalter died at San Remo, Italy, on Sept. 25, at 76 years of age. He had been connected with James Leffel & Co., of Springfield, Ohio, for half a century, up to the time of his death. He was born in Fountain County, Indiana.

Charles E. Litter, of Chillicothe, Ohio, died on Sept. 23 from a fractured skull following a fall from a scaffold the day previous while supervising the construction of a grain elevator at Climax, Mich. Mr. Litter was a member of a Chicago engineering concern which was building the elevator. He was 40 years of age.

Henry C. Shaw, Vice-President of the A. Garrison Foundry Co., died suddenly on Sept. 27, at the age of 61. Death was due to an attack of acute indigestion. He was born in Pittsburgh on Feb. 26, 1854, and was the son of the late Dr. Thomas Wilson Shaw. Mr. Shaw was a graduate of the Rensselaer Polytechnic Institute in civil engineering. Before his association with the A. Garrison Foundry Co. he was connected with the Lewis Foundry and Machine Co.

Richard R. Williams, son of John Williams, the founder (in 1855) of "Iron Age," and brother of David Williams, who in 1868 became sole proprietor of that magazine, died at his home in Glen Ridge, N. J., on Sept. 30, at the age of 72. Doctor Williams was born in Ireland. He first studied law, but later entered the Union Theological Seminary and was ordained a minister in 1870. He received a charge at Canajoharie, N. Y., as pastor of the Dutch Reformed Church, and remained there for 14 years. In 1883 he gave up the ministry and went to New York to join the staff of "Iron Age" as editor of the Hardware Department. Doctor Williams was one of the organizers of the Hardware Club of New York City and was twice its president.

Clinton Stephens, formerly a member of the engineering and contracting firm of Stephens & O'Rourke, of New York City, and recently proprietor of the Clason Point Amusement Park of that city, died at South Bay, N. Y., his birthplace, on Oct. 2, at 81 years of age. Mr. Stephens handled contracts to construct the Erie Canal enlargement and the Erie R.R., the Albany & Susquehanna R.R., the Shawangunk Mountain tunnel, the Hawks Mountain tunnel and the Haverstraw tunnel. In 1897 he received a contract to drive the San Hilario tunnel, which was to drain silver mines in central Mexico. He transported workmen and plant into Mexico and commenced construction. But the next year he and his men were attacked by a mob of Mexicans and Indians, who killed three superintendents and many workmen, while Stephens himself narrowly escaped a similar fate. The plant was left in ruins. With Mr. John O'Rourke, Mr. Stephens handled a large amount of work for the New York Aqueduct commissioners and for the New York & New England R.R.

William Watson, M. Am. Soc. C. E., Professor of Mechanical Engineering at the Massachusetts Institute of Technology from 1865 to 1873 and Secretary of the American Academy of Arts and Sciences since 1884, died at his home in Boston on Sept. 30, at the age of 81. Professor Watson was born at Nantucket, Mass., and was graduated from Harvard College in 1857, taking the Boyden prize in mathematics. He then became an instructor in mathematics. Later he took a special course at the École National des Ponts et Chausées in Paris, and upon his return to this country became university lecturer at Harvard. The information on technical education collected by him in Europe was made the basis of the plan of organization of the Massachusetts Institute of Technology in 1864. Professor Watson was United States Commissioner to the Vienna Exposition in 1873 and a member of the international jury of the Paris Exposition in 1878. He was Honorary President of the Paris Congress of Architects and Vice-President of the International Congress of Hygiene in 1878; Honorary President of the Engineering Section of the French Association for the Advancement of Science for several terms and Vice-President of the International Congress of Construction in 1880. He was the author of many works on technical education and science, engineering and architecture.

ENGINEERING SOCIETIES

COMING MEETINGS

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Oct. 11-12. Secretary, Will P. Blair, Engineers Bldg., Cleveland, Ohio.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 12-14. Annual convention at Dayton, Ohio. Secretary, Charles Carroll Brown, 702 Wulsin Bldg., Indianapolis, Ind.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. 19-21. Annual meeting, at Detroit, Mich. Secretary, C. A. Lichty, 319 N. Waller Ave., Chicago.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.
Oct. 18-24. Annual meeting in Chicago. Secretary, J. A. Andrencetti, C. & N. W. Ry., Chicago, Ill.

MAINTENANCE OF WAY AND MASTER PAINTERS' ASSOCIATION.
Oct. 19-21. Annual meeting in St. Louis. Secretary, T. I. Goodwin, C. R. I. & P. R.R., Eldon, Mo.

NATIONAL MUNICIPAL LEAGUE.
Nov. 17-19. Annual meeting in Dayton, Ohio. Secretary, C. R. Woodruff, North American Bldg., Philadelphia, Penn.

SAN FRANCISCO MEETINGS

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 4-9. Secretary, E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.
Oct. 4-9. Secretary, H. G. McConnaughy, 165 Broadway, New York City.

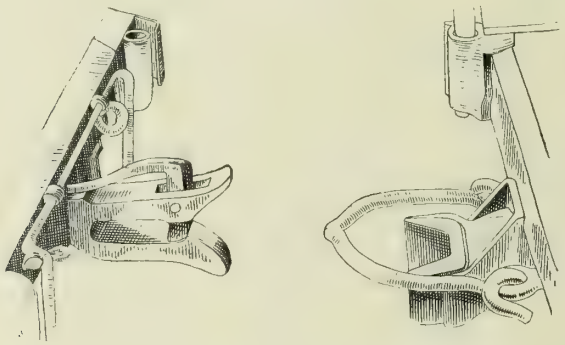
Engineers' Society of Western Pennsylvania—Beginning Oct. 1, announcement of positions open and men available will be published twice a month in the bulletin of the Engineers' Society of Western Pennsylvania. The employment bureau is carried on by the secretary, Elmer K. Hiles.

American Builders' Week will be celebrated in San Francisco Oct. 18 to 23. The date was fixed by the National Association of Builders' Exchanges at their annual convention held in Columbus, Ohio, in January, 1915. The program will be in charge of the entire building industry of San Francisco, which includes the following associations: Brick Manufacturers, Builders' Exchange, Contracting Lathers, Concrete Contractors, Electrical Contractors, Erectors' Association of California, General Contractors, Granite Manufacturers, Lumbermen's Club, Masons and Builders, Master Painters and Decorators, Master Plasterers, Master Plumbers, Planing Mill Owners, Rock, Sand and Gravel Association and Sheet Metal Contractors. The general chairman is John D. McGilvray. E. T. Thurston is general secretary, 57 Post St., San Francisco.

Appliances and Materials

Automatic Coupler for Freight Trucks

An automatic coupler for motor and trailer freight trucks, such as are used in freighthouses, has been invented by Edward Fitzgerald, freighthouse foreman of the Chicago & Eastern R.R. at Chicago, and is now made by Guilford S. Wood, of Chicago. On the forward end of each truck is a malleable-casting bumper with a horizontal ¾-in. round-rod bail or half-link supported in front and slightly above it. On the rear of each truck is a malleable forked coupler head engaging the forward-end link and locking the latter in place with a latch, or trigger. The top of the latch is extended as a bell crank so that the latch may be easily lifted to disconnect two coupled trucks. A cross-rod and link much as are used with the standard M. C. B. car couplers, facilitate



FITZGERALD AUTO-TRUCK COUPLER

uncoupling. The lower arm of the forked head engages the forward-end bumper head before the link strikes the slot base.

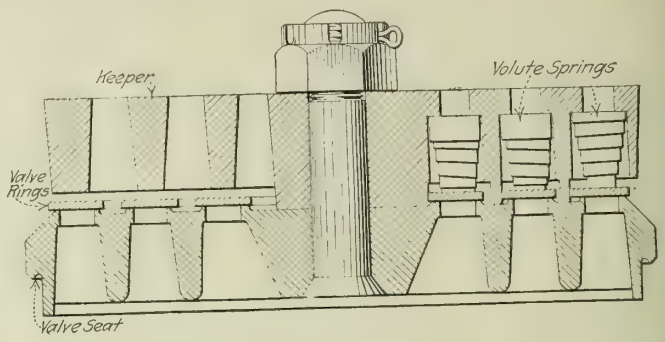
Trucks in being coupled do not have to be carefully centered or leveled, as there is 7¼ in. horizontal spread in the link and 5¼ in. vertical flare of the fork. This device is reported to have contributed much to the success of the power-trucking system employed in the Twelfth St. freighthouse of the Chicago & Eastern Illinois R.R. at Chicago.

* * *

Another Thin-Plate Air-Compressor Valve

A new automatic air-compressor valve of the thin flat-plate type, termed the "Simplate," has been developed by the Chicago Pneumatic Tool Co. for its line of compressors. It consists of three concentric flat rings seated over annular ports and held to the seats by volute springs. The springs are fitted to pockets in a keeper placed over the valve, and this keeper has guides for the ring plates. Each ring has its own springs, so that the rings can move independently. Thus at low speed only one ring will open; a second will open as higher speed requires greater capacity, and the three will open when the compressor is running at full speed. The area of opening is thus varied automatically to meet the requirements. A typical cross-section of the valve is shown in the accompanying sketch.

For the inlet valve the springs are of very light tension and are so calibrated that the outer ring plate will open at, say, ¼-oz. pressure, the middle ring at 1-oz., and the inner ring at 2½-oz. This secures the benefit of the varied opening of the different plates when the piston speed is changed. For the discharge valve, springs of heavier tension are used. The



FLAT RING VALVE FOR AIR COMPRESSORS

valves work noiselessly, require no lubrication, and may be used for either high-pressure or low-pressure service.

* * *

Collapsible Horses for "Street Closed" Sign

A novel type of folding horse for closed-street warning signs has been developed by H. W. Allard, of the Dralla Manufacturing Co., 24 Springdale Ave., East Orange, N. J. A pair open and one horse folded up are shown in the accompanying view. It may be seen that each pair of steel-pipe



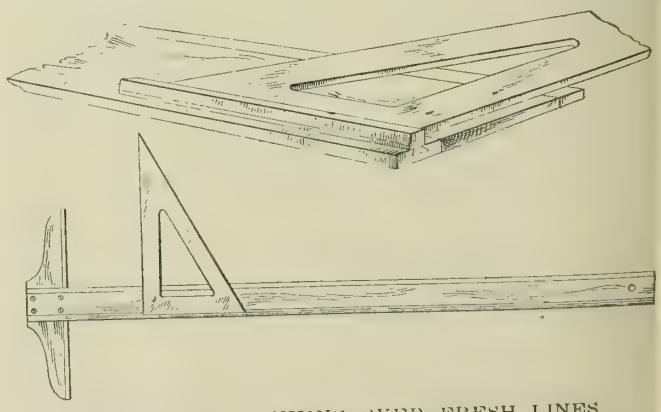
DRALLA FOLDING HORSE WITH "STREET CLOSED" SIGN

legs is fastened to a light cast saddle, holding the signboard on edge, and that the saddles are hinged at the top. A set of four horses folds together to about 10 in. thickness and is much more easily transported from one piece of local work to another than the rigid supports usually employed.

* * *

T-Square for Inking Over Fresh Lines

A T-square with three working edges on the bar has recently been patented by E. R. Ruehle & Co., 119 Fulton St., New York City. The third edge is furnished by a stop along the bar; by means of this addition the draftsman's triangle



T-SQUARE FOR INKING OVER FRESH LINES

can be slid along the board but held clear of the tracing. Additional ink lines can be placed on a drawing without waiting for any fresh lines beneath to dry.

Engineering News

VOLUME 74 OCTOBER 14, 1915 NUMBER 16

Storm King Highway, New York

By H. Eltinge Breed*

SYNOPSIS—The contract for Storm King Road, on the west side of the Hudson River, has at last been let. The article sketches the history of various plans to build this road, gives extraordinary survey methods employed and present plans for the work; extracts from unusual specifications.

The projected Storm King Road lies along the famous gateway to the Highlands on the west bank of the Hudson River about 50 mi. from New York City. For scenic grandeur no section of the Eastern country surpasses these mountains between West Point and Cornwall, with their rugged slopes and constantly changing vistas. Many of them rise abruptly from the river to an elevation of 1,400 ft., with sides so precipitous as to have sheer drops, sometimes of 500 ft.

The road along the river across the hitherto impassable faces of these mountains will be the connecting link between northern New York and the great new playground of New York and New Jersey, the Palisades Interstate Park. It will also provide an outlet from Highland Falls, West Point and other towns below to Albany and intermediate places along the river. Formerly, traffic from these towns had to traverse a dangerous mountain pass some distance back from the river in order to reach the Albany road. The New York State Highway Commission has designated the West Point-Cornwall Road as No. 5,498; the section across Storm King Mountain will be part of Route No. 3 of the state highway system, extending from New Jersey to Albany.

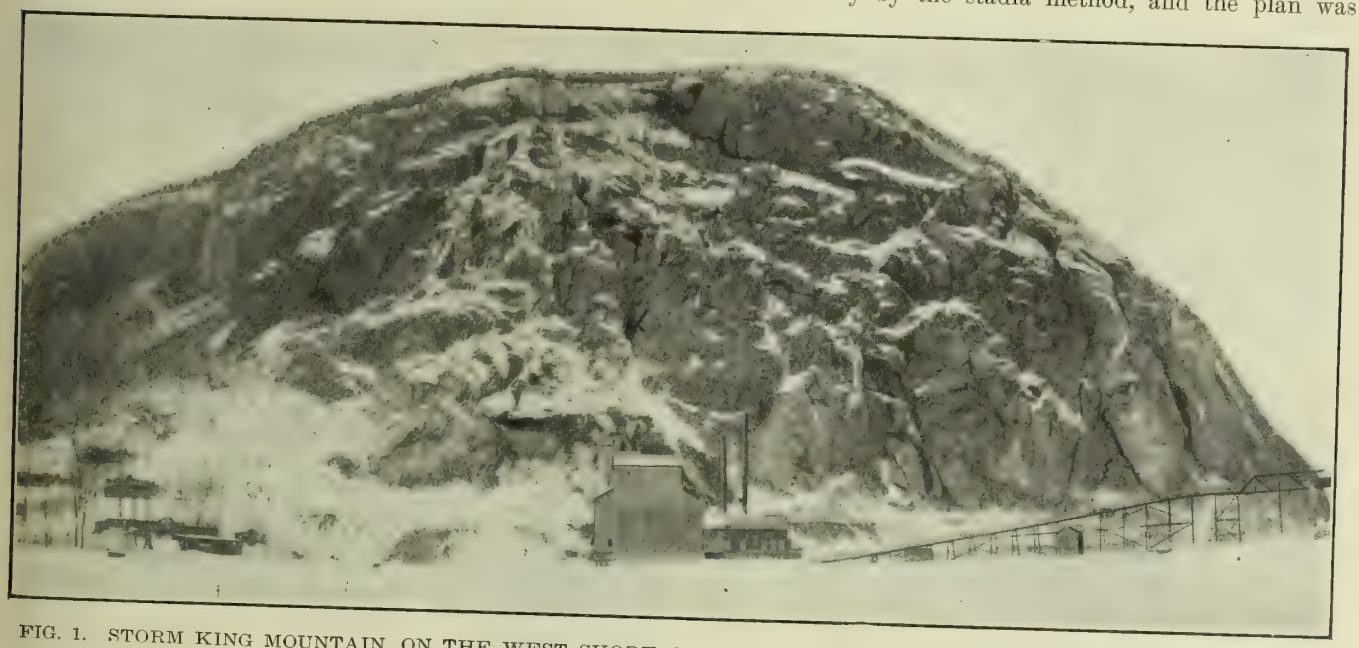


FIG. 1. STORM KING MOUNTAIN, ON THE WEST SHORE OF THE HUDSON RIVER, NEW YORK, ON THE FACE OF WHICH IT IS PROPOSED TO BUILD A STATE HIGHWAY

The top of the mountain is 1,340 ft. above the river. The proposed highway passes around the nose at an elevation of 390 ft. above the river

Earlier Surveys and Plans for Highway

For this important piece of work there have been many surveys by different engineers and many designs and redesigns. The original survey was made in 1904, almost wholly by the stadia method, and the plan was drawn to show 2-ft. contours when possible, and in the steep sections, 10-ft. contours. The maximum grade designed in these plans was 5%.

Along the side of Storm King Mountain a sheer rock face rises 360 ft. above the river, and close examination shows that this is shattered with seams running in every conceivable direction. As the 5% grade would have brought the road profile to an elevation of only 200 ft., instead of 360 ft., it would have been necessary, according to this first survey, to tunnel 700 ft. through the dangerous and uncertain rock on the face of the mountain. These original plans also called for 1,000 ft. of gallery construction; the rest of the road was to be located along the face of the mountain.

*First Deputy Commissioner of Highways, Albany, N. Y.

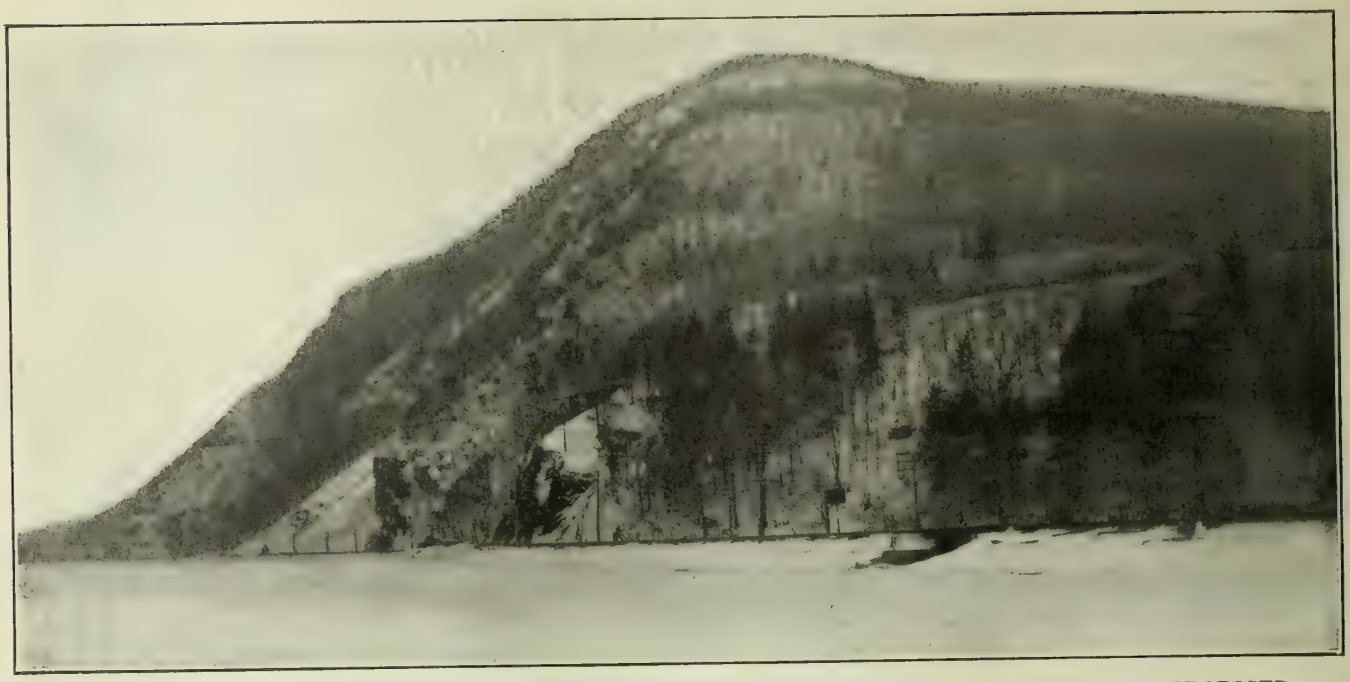


FIG. 2. CROW'S NEST MOUNTAIN, BELOW STORM KING, AROUND THE BASE OF WHICH THE PROPOSED HIGHWAY IS TO RUN

Plans were completed for the work covering a distance of 2.31 mi., and the contract was awarded Dec. 2, 1907, for $187,000. The contractor had barely commenced construction when he was stopped by a taxpayer's injunction brought to protect the county from the exorbitant demands made by a local stone company for right-of-way. This controversy lasted for over eight years.

It was finally adjusted, and in 1913 a new survey was made. This time the road was so designed that the limiting grade was 7%. This brought the road to an elevation of nearly 390 ft. above the river, around the face of Storm King, and obviated the necessity for any tunnel construction. Again, in 1914, bids were received. Of these, the lowest, for only 1.27 mi. of the road, was $197,000.

Because of the high cost of this one section, it became necessary to reject all bids and to redesign the road; otherwise the amount of money available would not have been sufficient to build both sections. If the contract for this first section had been let and completed it would have stood isolated with no outlet to the south unless other funds had been appropriated by special legislative enactment.

Redesigning and the Present Plans

With further redesigning it was found that the whole road could be built within the appropriation, and on July 26, 1915, bids were received for this work, the contract being awarded to the John L. Hayes Construction Co. of Yonkers, N. Y., for $273,736.70. In the redesign two short bridges along the south side of Storm King Mountain, which were a part of the 1913 design, were eliminated because in addition to being a source of constant expense for maintenance there was always the possibility that some of the overhanging rock might become loosened and fall on them. At these points the proposed alignment has been carried back into ledge rock so that there the roadway is supported on a shelf cut into solid rock.

A concrete viaduct was also eliminated. This had been planned to cross at the top of a slide, which appeared to be in motion. Subsequent field examination discovered that directly under the loose material of the slide there was a fairly sound talus. The center line was therefore thrown back so as to make the road over this section by excavation, which effected the saving of a considerable amount of money as well as the elimination of a curve of 250-ft. radius.

Extraordinary Survey Methods Employed

In the many surveys made, it was necessary quite often to devise extraordinary means of carrying on the work because of the rough, dangerous and impassable slopes. The first survey was made in the winter, when

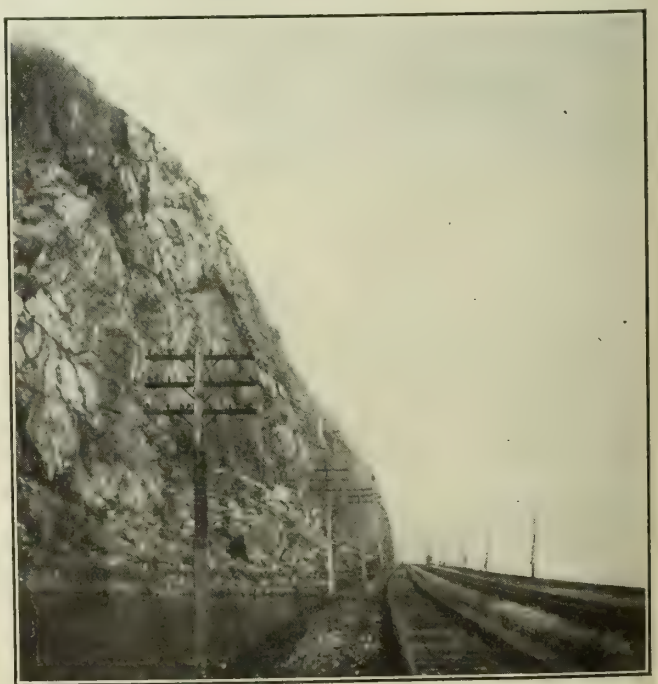
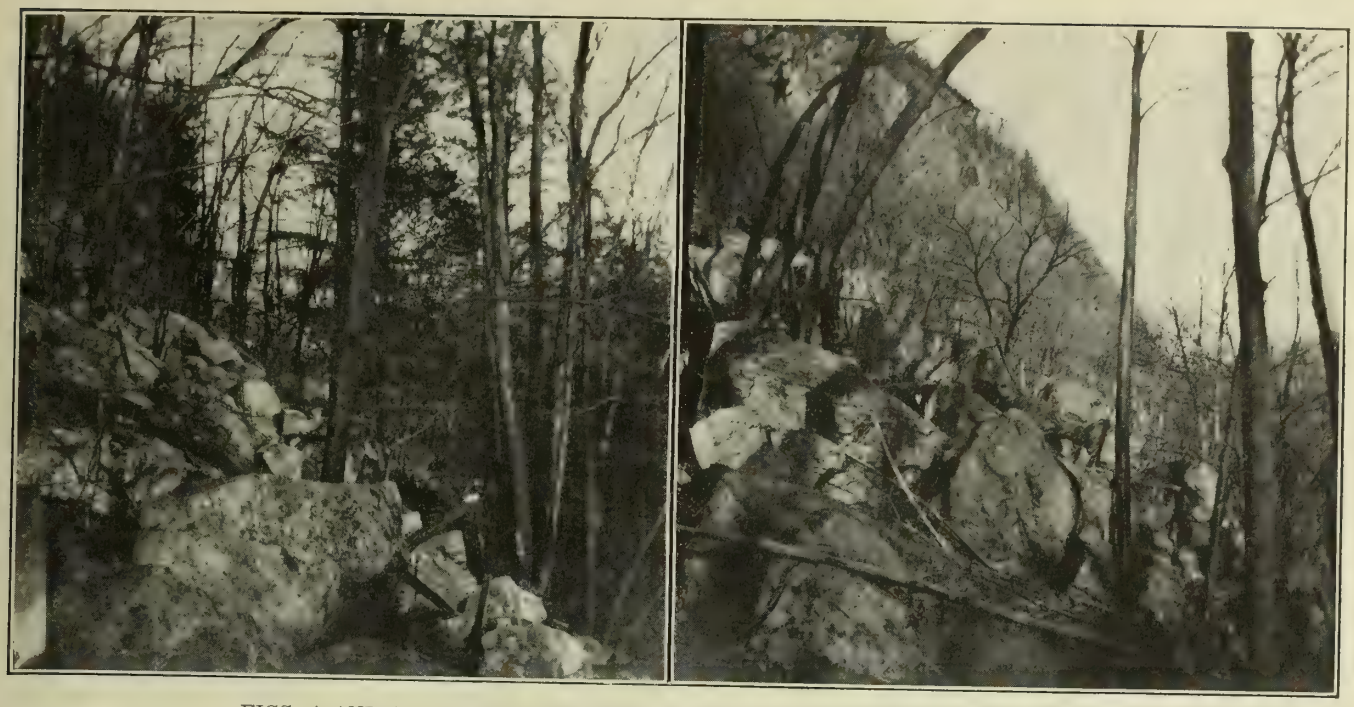


FIG. 3. NOSE OF STORM KING MOUNTAIN, SHOWING TRACKS OF WEST SHORE R.R.



FIGS. 4 AND 5. TYPICAL BOULDER SLOPES AT HIGHWAY CENTER LINE

the snow and ice made every foothold precarious. For protection against slipping, all of the men wore creepers, as well as belts which were attached to ropes and snubbed around a convenient tree, so that should the wearer lose his foothold he would be held by the rope instead of dropping to the railroad tracks. Even with these precautions two or three accidents occurred which only good luck kept from being very serious.

A part of Storm King is absolutely inaccessible because of the almost perpendicular drop on the face of the mountain and on the first survey the topography was worked out by triangulation from such points as stood out and were readily distinguishable from two instruments, as well as such points as could be marked. Observations were taken from a base along the West Shore railroad tracks on which two transits were used simultaneously. As there were still many places that were inaccessible, an ordnance sergeant in the United States Army post at West Point was called in to help. At his suggestion rockets containing a glass can of white and red lead were shot at the points where observation marks were desired. The results were most satisfactory.

Some of the difficulties on the second survey are evidenced by the fact that it took six days to cross-section 1,000 ft., whereas during average progress on ordinary roadwork a cross-section party will survey a mile a day.

For 700 ft. along the face of the mountain no cross-sections could be taken by ordinary means. For this work a special diamond-shaped target, 1 ft. on a side and 1 ft. across, was made of heavy-gage galvanized iron. The target was divided vertically and horizontally into four parts, painted alternately red and white. Half-inch holes were cut near the acute points of the diamond, and through these holes the target was fastened to 300 or 400 ft. of braided cord and pulled over the ledges.

When at the point desired, the target was bisected by three transits located at known points and the vertical and horizontal angles read and the time noted simultaneously by the three transitmen. Two of the transits were located on the West Shore railroad tracks about 600 ft. apart; the third (for a check) was placed a part of the time on the face of the mountain and finally at the base of the mountain. The movement of the target was governed through the cord by two men, one

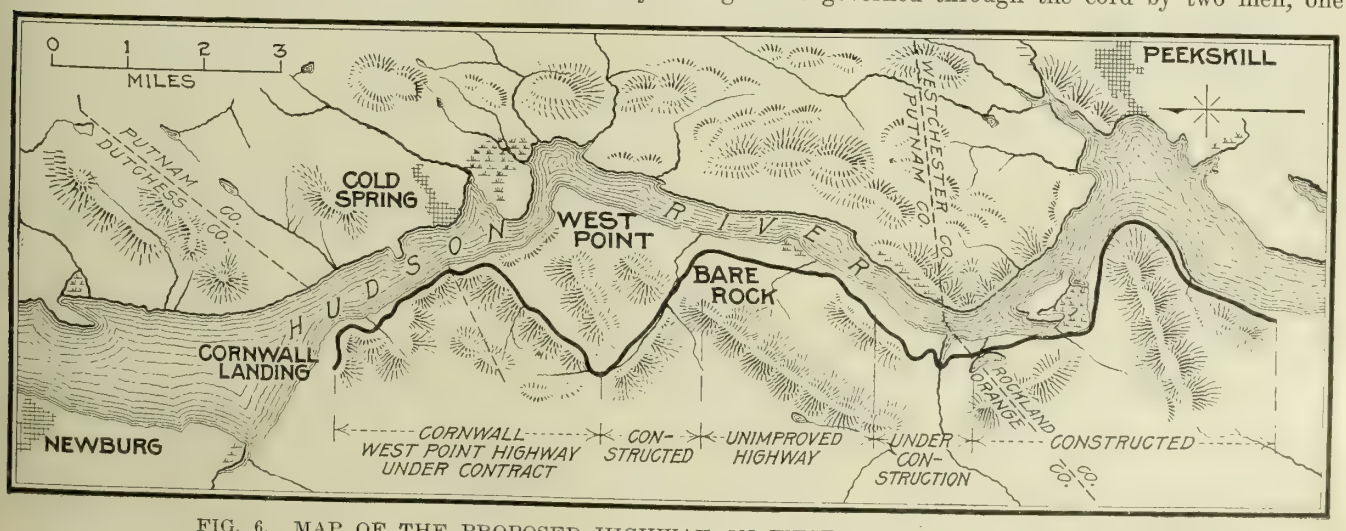


FIG. 6. MAP OF THE PROPOSED HIGHWAY ON WEST SIDE OF HUDSON RIVER

above and one below the ledge. It was found impracticable to take these cross-sections at right angles to the base line, for there were only a few niches in the ledges from which the ends of the target cord could be operated.

Description of Proposed Construction Work

According to present plans, the road starting at Bayview Ave. in Cornwall rises gradually along the general the roadbed will be constructed in sidehill cross-sections partly cut into solid rock and partly carried by retaining walls, the design being worked out to the greatest economic advantage. The maximum grade is 7%, and the minimum radius of curvature is 200 ft. The greatest depth of rock cut measured from ditch line to the top on the inside of the cross-section is 130 ft.; the highest retaining wall is 38 ft.; the greatest

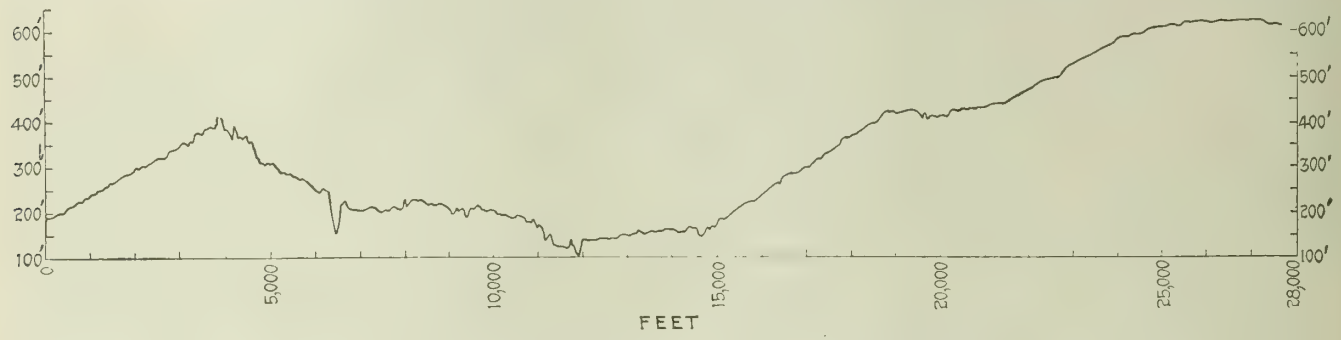


FIG. 7. PLAN AND PROFILE OF PROPOSED STORM KING ROAD, NEW YORK STATE HIGHWAY DEPARTMENT

side of the mountain on an average grade of about 5½% until an elevation of nearly 390 ft. above the river is reached at Sta. 38. This is one of the controlling points, for at a point a few feet east of the center line there is a sheer drop of nearly the whole 390 ft. This is just above the point where the toe of Storm King reaches out into the river.

The grade then descends at about 7% or less to an elevation of about 200 ft. at Sta. 68, which is in a cove. From here the grade is undulating around Crow's Nest Mountain, but on the average descends gradually to

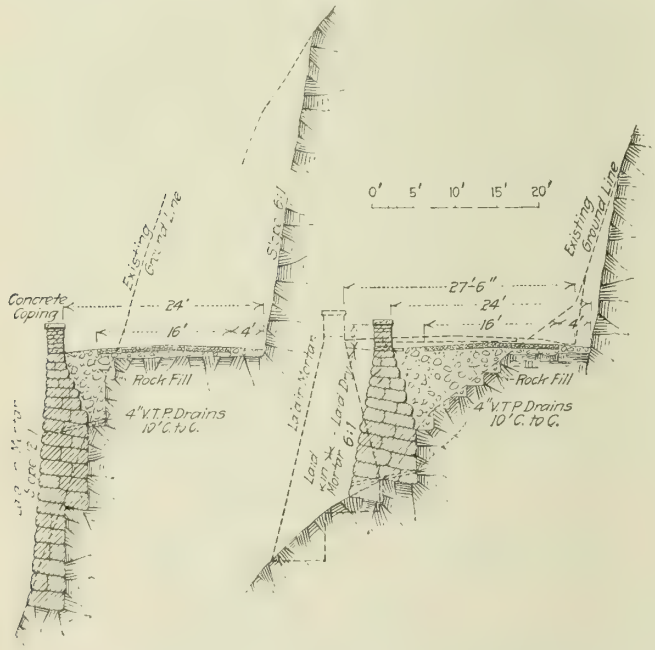


FIG. 8. TYPICAL CROSS-SECTIONS ON THE PROPOSED STORM KING ROAD

an elevation of about 150 ft. at the reservation line of West Point. From here the line skirts along the base of Crow's Nest Mountain, partly on new location and partly along the existing Washington Valley road to its intersection with State Highway No. 5,328A about 2 mi. west of Highland Falls.

The usable width of roadway will be 24 ft., with 16 ft. of bituminous macadam penetration method. In depth of fill is 75 ft. The estimated total amount of excavation is 119,000 cu.yd., of which about 50,000 cu.yd. is ledge rock—much of the remainder is large boulders. There is 25,500 cu.yd. of stone masonry of different classes, about three-fifths of which will be laid dry. A greater part of this is for retaining walls.

Unusual Provisions in Specifications

Specifications for this work have a few features uncommon in state-road construction. The classification of material varies from earth with small pieces of rock to earth with boulders up to a cubic yard in size, to all boulders and ledge rock. In order that there may be but few disputes after the work is done and to get a more equitable classification and estimated price for the different grades of material, there are four classifications of combined earth and rock excavation designated, ledge rock (in the same instances) being divided into two classes—excavation for the prism and excavation for culverts, footings of retaining walls and steps under fills.

The specifications provide for furnishing, installing, maintaining and operating a traveling crane and standard-gage car of at least ten tons' capacity on the railroad tracks at the foot of the mountain during the full period of excavation and wall construction along the face of Storm King and a section of the face of Crow's Nest.

It is also provided that the contractor shall install compressed-air lines leading to the West Shore railroad tracks, of sufficient capacity to furnish 300 cu.ft. of free air at 60 lb. pressure per min. to facilitate the removal of boulders or rocks from the tracks. It is also specified that while work is in progress on the sections directly over the tracks the "safety and continuity of the operation of traffic on the West Shore R.R. shall be of the first importance and shall at all times be protected."

It is provided that the contractor shall arrange for a telephone connection to be installed from the watchmen's building to the nearest train dispatcher of the railway company in order that communication may be had at all times with the superintendent of the railway to advise him of blasting and other operations affecting the safety of trains. With these plans and precautions it is hoped that the Storm King Road may be completed and opened to the public within the next two years.

Reinforced-Concrete Viaduct at St. Louis, Mo.

By Charles W. Martin*

SYNOPSIS—This 1481-ft. viaduct has a deck slab and beams carried by cross-girders on two-column and four-column bents. A special feature is that it consists of two independent longitudinal sections, separated by a 1-in. open space in the deck and cross-girders. The presence of sewers made it necessary to avoid all footings along the center of the structure. The concreting at one end was done with long inclined chutes from an elevator tower. At the other end it was done by a cableway handling drop-bottom buckets discharging into a hopper with short chutes.

The 12th St. viaduct at St. Louis, Mo., is one of a number of long bridges carrying streets across the group of railway tracks in the Mill Creek valley. The new structure consists of 36 reinforced-concrete slab and girder spans and one 58-ft. plate-girder deck span. It replaces an old steel structure. The length is 1481 ft. between abutments, or 2225 ft. including approaches. The approach grades are 2.3 and 1.8 per cent. L. R. Bowen is Bridge Engineer. The writer was in charge of the design, and Winters Haydock was in charge of the construction. The Fruin-Colnon Contracting Co. had the contract, and Preston Richardson was the company's superintendent. The total cost, including pavement, light and trolley poles, etc., was about $385,000.

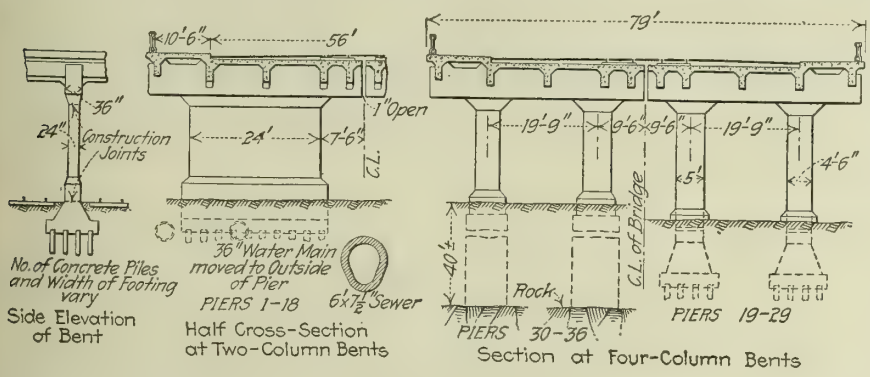


FIG. 1. TYPICAL SECTIONS OF THE 12TH ST. VIADUCT AT ST. LOUIS, MO.
Note the 1-in. open joint in cross-girders and deck. The viaduct consists of two parallel but independent sections

Varying Foundation Conditions

Tests indicated that the character of soil and depth to bedrock varied considerably and that at some points settlement might be expected from soil loadings exceeding about 1 ton per sq.ft. A large portion of the site near Gratiot St. was formerly occupied by a pond, and here no indications of rock were shown by borings 71 ft. below the filled-ground surface. The dead-weight loading of the soil-bearing piers of the old bridge was about 1¼ tons. Their settlement is unknown.

Four 30-ft. test piles of 10x10-in. timbers showed an average penetration of 4 in. under the last 25-ft. drop of the 1700-lb. hammer. From this a safe load of 9 tons per pile might be computed from the *Engineering News* formula. Test loads were applied to two of these piles. One settled ⅝ in. in 30 days under a load of 28 tons. The other was progressively loaded with 26 tons in a period of six days, and after having stood six days under full load it showed a settlement of ¼ in.

Most of the piers are built on reinforced-concrete piles 25 to 35 ft. long, but at the south end some of the piers were carried to rock. For the former, each pile was assumed to carry 15 tons of the dead-load. The gross average soil bearing was noted, however, and endeavor made to distribute the gross bearing area (as well as the piling) properly about the dead-loading centroid.

Design Adopted for the Viaduct

The design was governed largely by the sewers, a space in the center of the street being reserved in which sewers might remain or be built and upon which the bridge foundations could not encroach. This developed the idea of building the viaduct as two independent longitudinal sections, with piers on each side of the sewers, as shown in Fig. 1.

For the north half of the structure each bent consists of two piers, one for each section of the bridge. For the remainder each bent consists of four piers, as shown. The piers are 2 ft. thick, 24 ft. long in the two-pier bents and 4 or 5 ft. in the four-pier bents. All are reinforced longitudinally and laterally to resist the flexure and shear resulting from unbalanced deck loads and temperature distortions, as well as their direct axial load.

The reinforced-concrete deck spans vary from 28 to 54 ft. c. to c. of piers, and consist essentially of a slab and five stringers for each half-width of deck, as shown in Fig. 2. The roadway portion of the slab is 12 in. thick. Its top is flat and 12 in. below the street grade, allowing street-railway track construction with 7-in. rails and 4-in. steel ties of I-section. But it requires considerable filler concrete for the base of pavement and thereby augments the cost and dead-weight of structure considerably. At the curb the slab is stepped up to 3½ in. below the sidewalk grade, which allowed the independent construction of sidewalk blocks.

The stringers, slabs and cross-beams of piers were designed to be cast integrally for each half-width unit of bridge deck between consecutive expansion joints. At the girders the inside track stringer and the outside railing stringer overhang the pier about 5½ and 6½ ft. respectively. This cantilever arrangement compelled heavy construction for the pier girders. The outside stringers are of uniform depth for the sake of appearance. Those carrying the roadway are 28 to 56 in. deep beneath the slab, depending upon the load carried.

*Engineer, Bridge Division, City of St. Louis.

Stringers and girders are reinforced generally with two layers of bars, and at points of maximum shear in stringers about half of the bars are bent diagonally. Except for piers at expansion joints, such an amount of reinforcement is extended over and beyond the pier beams as to develop about the same figured compression unit in the bottom of the stringers as that in the slab near mid-

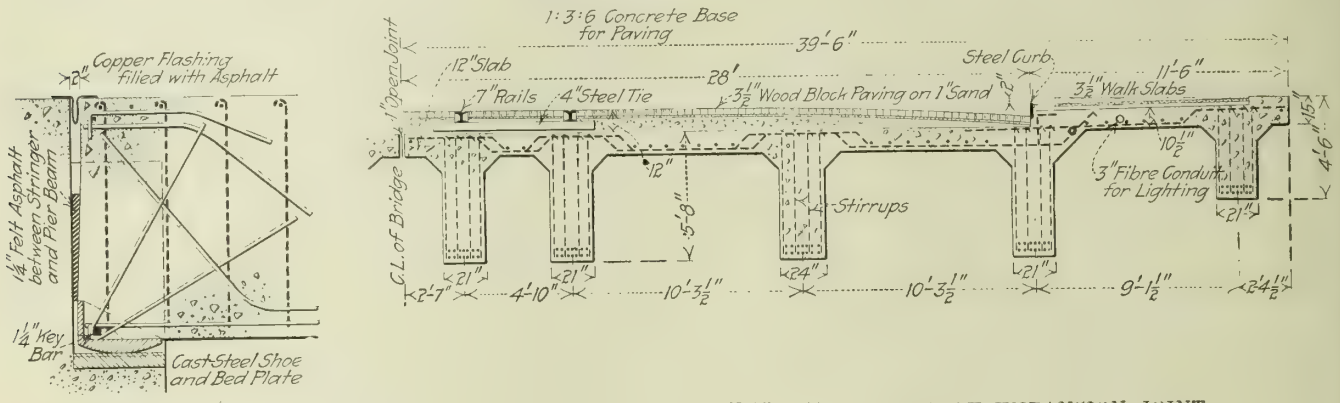


FIG. 2. HALF CROSS-SECTION OF DECK OF VIADUCT, AND DETAIL OF EXPANSION JOINT

span. This reinforcement is augmented by vertical stirrups, the stringer stirrups engaging the bent-up portions of the transverse bars of the slab. Expansion joints have a maximum spacing of 120 ft. The stringers of the free-end span are tenoned into the adjoining pier beam, and steel shoes and bedplates are provided, as shown in Fig. 2.

Other Features of the Structure

No reinforcement is extended across the 1-in. space that divides the structure longitudinally, but a 1-in. opening is left in the pier girders as well as in the deck slabs. This obviates the shear which might be generated in a full-width monolithic structure by unequal settlement of foundations on either side of the sewers. This opening was covered with an 8-in. plate of galvanized iron before the roadway concrete was laid.

The bridge deck provides a 56-ft. roadway and two 10-ft. sidewalks, the former being paved with wood blocks. Drainage is provided by cast-iron scuppers at the curbs, with cast-iron pipes in the piers and leading to the sewers. Combination trolley and lamp posts of limestone concrete are set along the curbs at intervals of 106 ft. Their surfaces are treated with acid. The lamp brackets and wire fastenings are of bronze. The 58-ft. span has ten steel girders, carrying an 8-in. concrete slab which conforms to the crown of the roadway. The girders are protected and masked by concrete so as to harmonize with the general structure.

The loadings employed in the design were as follows: A 56-ton street-railway cinder car; an 18-ton road roller; a uniform load of 125 lb. per sq.ft. of roadway; a uniform load of 100 lb. per sq.ft. of sidewalk. Wind pressure was not considered. The given loadings augmented by a nominal live-load impact allowance (varying 20 to 40 per cent. for different ratios of live- to dead-load effect) generate the following principal figured maximum unit stresses (bending effects were computed on the simple beam basis and unit stresses determined by the generally used straight-line theory): Tension in steel at points of low and high shearing stresses, 16,000 and 12,000 lb. per sq.in.; flexural compression in concrete, 650; axial compression in concrete, 400 for dead-load only and 700 for dead- and live-load, flexure, etc.; shear in concrete, 120 lb. per sq.in.

The foundation piles were all precast and varied in length from 16 to 35 ft. The specifications called for a section equal in area to a 15-in. circle with 1¼-per cent. reinforcement. The type most generally used was 13½ in. square, with beveled corners, without taper, and reinforced with four ¾-in. deformed round bars hooped with No. 8 wire at 2-in. pitch. These were fabricated at the site by the contractor. Another type was the "corrugated" piling having a fluted or ribbed section. These were delivered on cars and were employed in pier foundations adjacent to the tracks. The heads of all piles were given extra reinforcement by cylindrical hoops of $\frac{3}{16}$-in. plate steel with riveted joints. These hoops were tried experimentally at first and proved to be a better preventive against shattering of pile heads than the usual extra wraps of hooping reinforcement. They obviated the necessity of an adjustable clamped driving head and thereby effected a considerable saving of time in driving.

The driving equipment consisted of a steam hammer in 45-ft. leads mounted (with boiler and hoist) upon a roller



FIG. 3. CONCRETING THE 12TH ST. VIADUCT AT ST. LOUIS, MO.

At the right are the cableway and drop-bottom bucket used for one end of the viaduct. At the left is the elevator tower of the spouting system used at the other end.

carriage. The weight of moving part in this hammer was 5000 lb. and its drop 42 in. A lighter hammer was tried and discarded. The number of piles driven was 1,980, a total of 51,300 lin.ft. The average performance was 330 lin.ft. and the best record 720 lin.ft. per 8-hr. day. In

128 piles (6.5 per cent. of the total) less than 20 per cent. of the length was broken by the hammer, while 89 piles (4.5 per cent. of the total) had 20 per cent. or more of their length broken. For the latter, extra piles were driven. No marked difference in the driving resistance of the two types of piles was observed. The percentage of breakage in the fluted tapering type exceeded that for the other, but differences in methods of fabrication and curing probably account for this.

Concrete Mixing and Distributing Plants

Two independent concrete mixing and distributing plants were installed on opposite sides of the railway yard. Sand and gravel were delivered in cars. A stiff-leg derrick with clamshell bucket handled the material from cars to the stock pile and thence to the bins over the mixers.

These plants had different methods of distributing the concrete, shown in Fig. 3. At one plant (with a mixer of 18-cu.ft. capacity) there was an elevator tower 175 ft. high, with a system of suspended chutes. At the other plant (with a 1-yd. mixer) a cableway 700 ft. long with 60-ft. A-frame towers handled the concrete in 1-yd. bottom-dump buckets. The buckets were placed on trucks and pushed a short distance out from the mixer by hand; then picked up by the cableway and carried to a portable receiving hopper, from which the concrete was delivered to the forms by means of short chutes. Under fair working conditions the average output was 32 and 22 batches per hour for the tower and cableway plants respectively, so that their output of concrete was practically the same, say 22 cu.yd. per hr.

The plans indicated construction units, each of which was to be poured in one continuous run. Each pier footing constituted one unit, each pier shaft another, and each portion of the deck structure (together with the pier girders for one-half width of bridge between consecutive expansion joints) constituted a third. These deck units included one to three spans, and in some cases required as much as 350 cu.yd. of concrete. For these larger units work continued through two or more shifts of eight hours each.

The only feature of note in the formwork was, that for spans over the railway yard steel I-beams from the old structure were employed as the principal longitudinal elements. These were supported by framed bents adjacent to the piers and generally at points between tracks.

Small Sweeping Machines for Power and Hand Operation

The two sweeping machines shown herewith are designed for cleaning the floors of industrial plants, and also for driveways and yards. They are built by the Briggs-Chicago Co., 108 South La Salle St., Chicago.

The broom (of Japanese fiber) is carried by radial rods, so that it can adapt itself to an uneven surface, and it can be raised and held clear of the floor while the machine is being moved. A spring counterbalance provides for taking up the wear of the broom and for adjusting its pressure to suit the quantity and character of dirt to be handled.

The dirt is swept into a transverse pan 4 in. from the floor, and from this a conveyor (on the power machine) delivers it to a bin. In the hand machine the pan is raised by a lever to dump the material into the bin. In both cases the bin is of 2 cu.ft. capacity, and a hinged door in the housing provides for dumping dirt from waste cans, etc.

The power sweeper, shown in Fig. 1, has a 3-hp. Ellis gasoline engine which is equipped with a magneto and

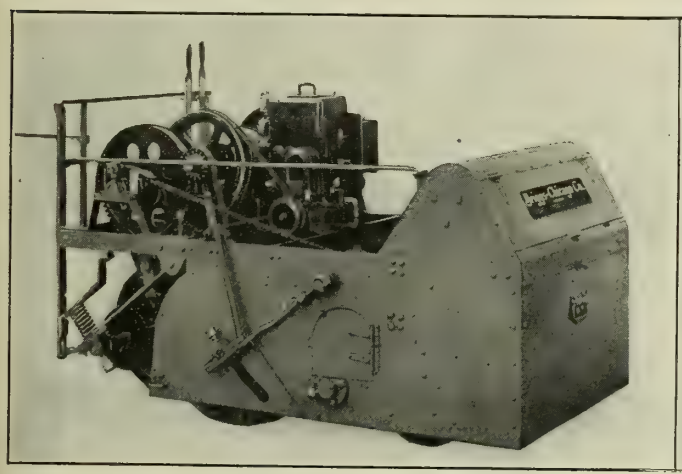


FIG. 1. POWER-OPERATED SWEEPER FOR FLOORS AND DRIVEWAYS

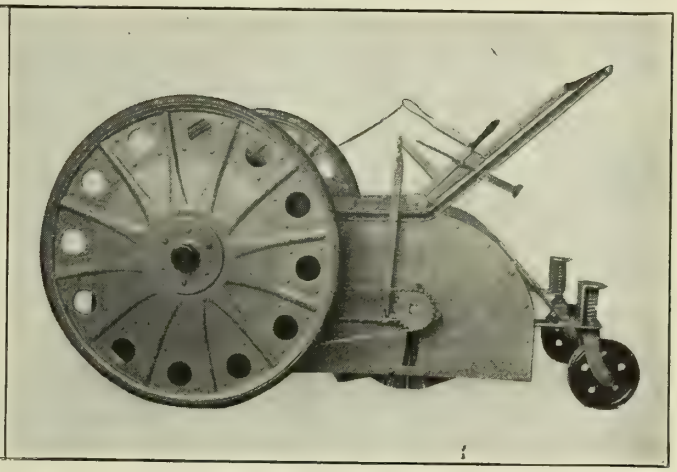


FIG. 2. HAND-OPERATED SWEEPER FOR FLOORS AND DRIVEWAYS

requires no batteries. It is 63x34½ in. over all, with a maximum height of 39 in., and weighs 700 lb. with its supply of gasoline, oil and water. At the normal engine speed of 600 r.p.m. the machine moves at 2 m.p.h. and will sweep 27,000 sq.ft. per hr.

The power-operated sweeper is carried on three steel wheels having shock-absorbing duck tires. They are all within the 30-in. track of the broom, which can work to within 4 in. of a curb or wall. The broom is 18 in. diameter and 30 in. long. The engine is geared to the countershaft, from which the broom shaft and rear axle are driven by nickel-steel chains, but the machine can be moved by hand when desired.

The hand sweeper, shown in Fig. 2, is 40x56 in., and 34 in. high, and weighs 300 lb. The two 30-in. front wheels are of pressed steel, with rubber tires and ball bearings. The rear is supported by a pair of 7-in. caster wheels with rubber tires and having spiral springs on the casters. Cut gears are used, with a nickel-steel driving chain to the broom shaft. A pressure of 26 lb. on the handle bar is sufficient to propel the machine at 2 m.p.h., sweeping 20,000 sq.ft. per hr. at this rate. When the broom is raised clear of the floor a pressure of 15 lb. is sufficient to move the machine.

Rebuilding the Burlington's Platte River Bridge

By J. H. Merriam*

SYNOPSIS—Very long plate-girder bridge. Reconstruction involved the building of new piers and utilization of some of old plate-girder spans moved temporarily 14 ft. downstream to carry traffic during reconstruction. Variation in pier design. Steel caissons and concrete caissons used and special type of concrete piles in some piers.

The bridge for the Chicago, Burlington & Quincy R.R. across the Platte River near Ashland, Neb., was first built in 1886, as a pile trestle with sixty-two 20-ft. wooden stringers and six 105-ft. Howe truss spans. In 1898 the east channel, which was dry at this time, was filled and the bridge was shortened on the west end, making a total length of 1,643 ft. In 1901 it was rebuilt with 28 steel deck-girder spans on pile piers, protected by rock-filled cribs. The girders were of lengths varying from 50 to 60 ft., so as to use as far as possible the old piers which supported the Howe spans.

*Resident Engineer, Chicago, Burlington & Quincy R.R. Co., Bridge Department, Kansas City, Mo.

During the high water in the spring of 1912, an ice gorge formed at the bridge, causing the river bed to scour to such a depth at one point as to undermine one of the bridge seats, which was washed out. Fortunately the girders which it supported were not dropped into the stream, but were held over the opening by the track rails acting as suspension cables (Fig. 2). Temporary repairs were soon made but rebuilding was immediately decided upon. The new bridge is also of the plate-girder type, but has an entire new set of piers, the construction of which presented many novel problems.

A peculiar characteristic of the Platte River is that it invariably has adjoining one bank a main channel and against the other bank a secondary channel. These two channels are from one-quarter to one-half mile apart with stretches of extremely shallow water and sand bar between. The banks are low and very seldom overflow, except at times of ice gorges in the early spring. The fall is great and the current rapid and during high water the amount of silt carried is considerable. The sand is rather heavy, although not so heavy as to prevent its being readily scoured when the stream is confined.

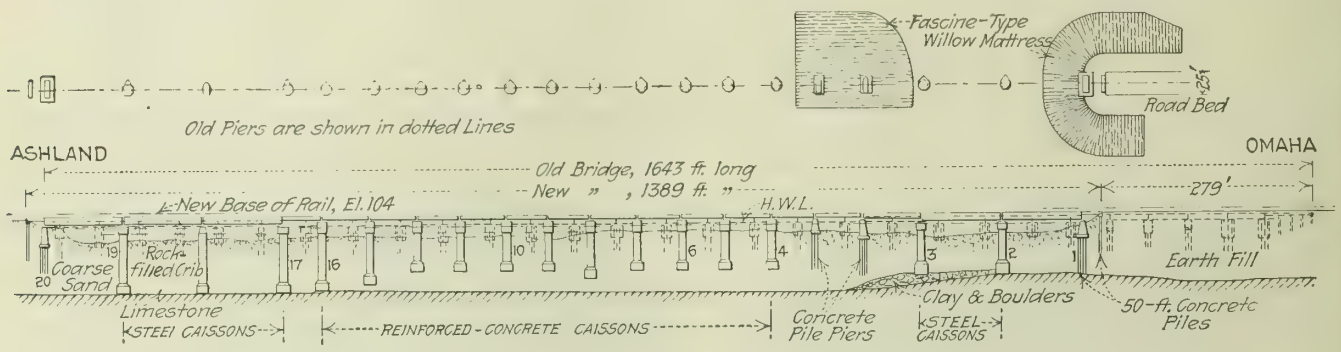


FIG. 1. THE CHICAGO, BURLINGTON & QUINCY BRIDGE ACROSS THE PLATTE AT ASHLAND, NEB.
Dotted lines show old bridge and solid lines new bridge

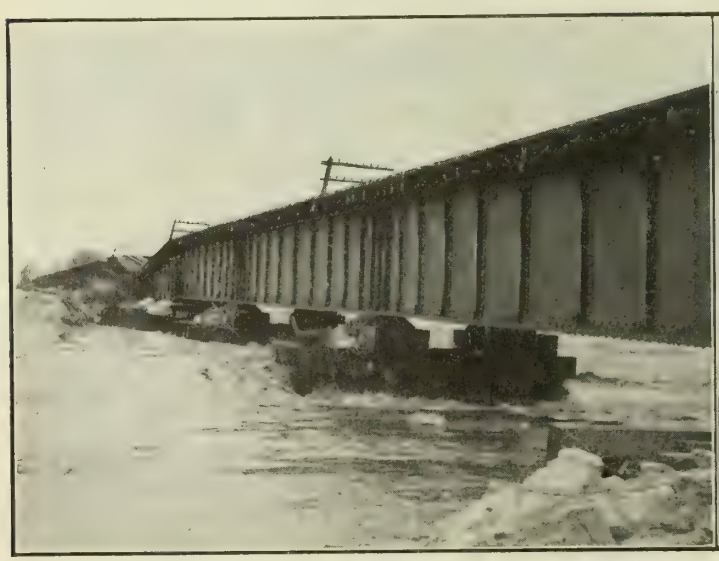


FIG. 2. THE OLD ASHLAND BRIDGE WITH THE WASHED-OUT PIER IN BACKGROUND

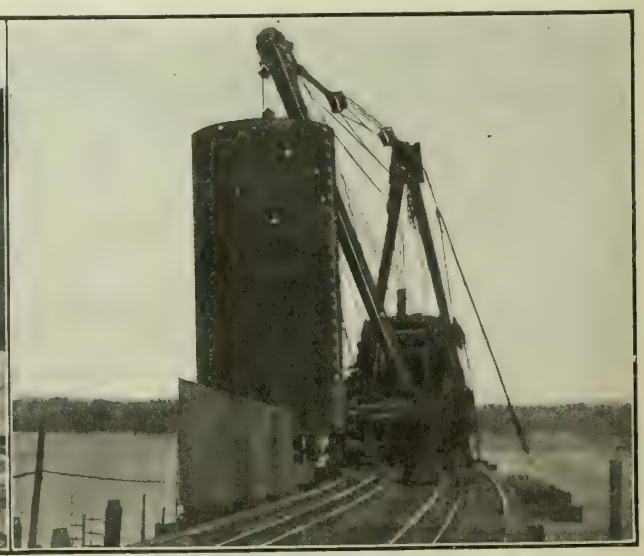


FIG. 3. PLACING 20-FT. SECTION OF STEEL CAISSON FOR ASHLAND BRIDGE PIER

For this reason it has been found the better practice to narrow the stream as much as prudence will permit, causing the channel to scour, providing at the time of the spring breakup wider and deeper openings for the passage of the very heavy ice which often forms, and reducing the width of the sand bars between the channels to the minimum. These characteristics determine the design of this bridge in large measure.

It will be noted from the elevation of the bridge in Fig. 1 that on either side very deep foundations are carried to bedrock or very light hardpan, while in the middle of the bridge, where the depth would in ordinary streams be the greatest, the foundations are carried only to a stratum of coarse sand or fine gravel which has demonstrated its bearing power and in which location the probability of scour is extremely remote.

The narrowing up of the original bridge by about 300 ft. was expected to result, and has resulted, in slightly increasing the depth of the channel in low water and it is anticipated that a further increase in channel depths will be secured during the next floods.

Type of Bridge

Before beginning construction it was necessary to move the entire bridge 14 ft. downstream to care for traffic while constructing the new piers on the old line. The new work comprised 20 new piers so located as to miss the old bridge seats. Deep piers were placed for spanning the two channels, using one 75-ft. and two 105-ft. spans over the east or secondary channel and one 103-ft. and two 100-ft. spans over the west or main channel, with one 50-, five 55- and seven 60-ft. girder spans from the old bridge for the remainder or middle portion of the bridge. The girders were spaced 7 ft. c. to c. and carry the single track on a solid concrete deck with ordinary ballast tie and rail construction. The deck slabs were premolded and placed on the bridge in 5-ft. sections. Each slab measures 14 ft. wide by 10½ in. thick, is reinforced throughout and provided with two 1¾-in. drain holes in each section. Joints between slab sections are calked with oakum, tar and cement. Expansion joints at the ends of each span are covered with apron plates.

The new bridge is 4½ ft. higher than the old in order to give a full open waterway under the long girders. Raising the bridge necessitated elevating the approaches, which are now on a 0.4 per cent. grade for a distance one-quarter mile east and one-half mile west from the bridge. Fascine-type willow mattresses, as shown in the plan in Fig. 1, were used to protect the new fill at the east end of the bridge and to maintain a channel under the long spans at this point.

This is the first bridge of its kind to be constructed in a permanent manner on the lower Platte River and in order to obtain data for future work various types and methods were used in constructing these piers.

Caissons for piers 2, 3, 17 and 19 were of steel construction of the design shown in Fig. 4. They were lined with 18 in. of concrete, leaving an 8-ft. well, through which a dredge bucket was operated from a track derrick

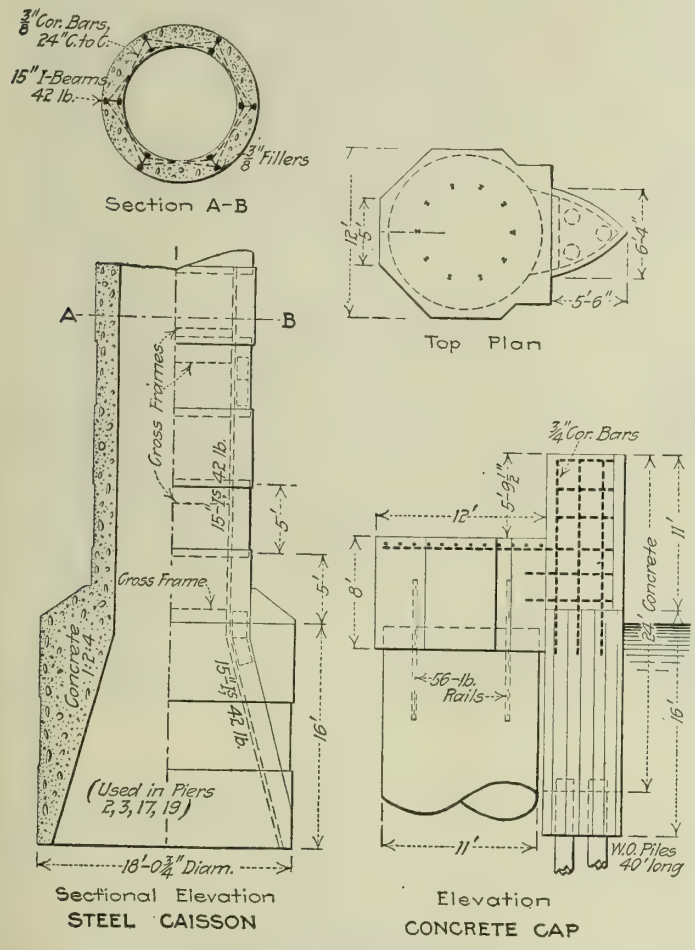


FIG. 4. STEEL CAISSONS AS USED ON PIERS 2, 3, 17 AND 19

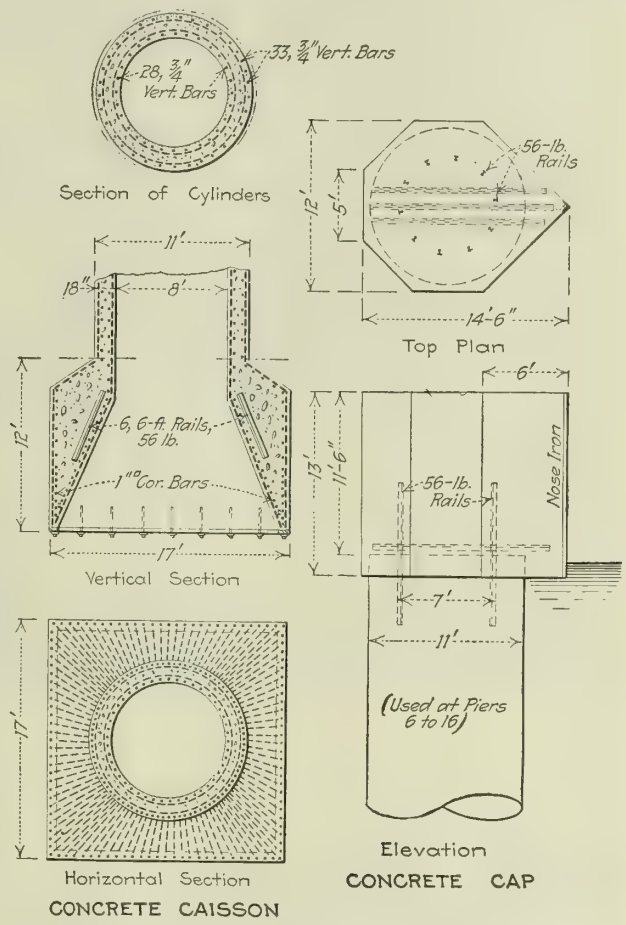
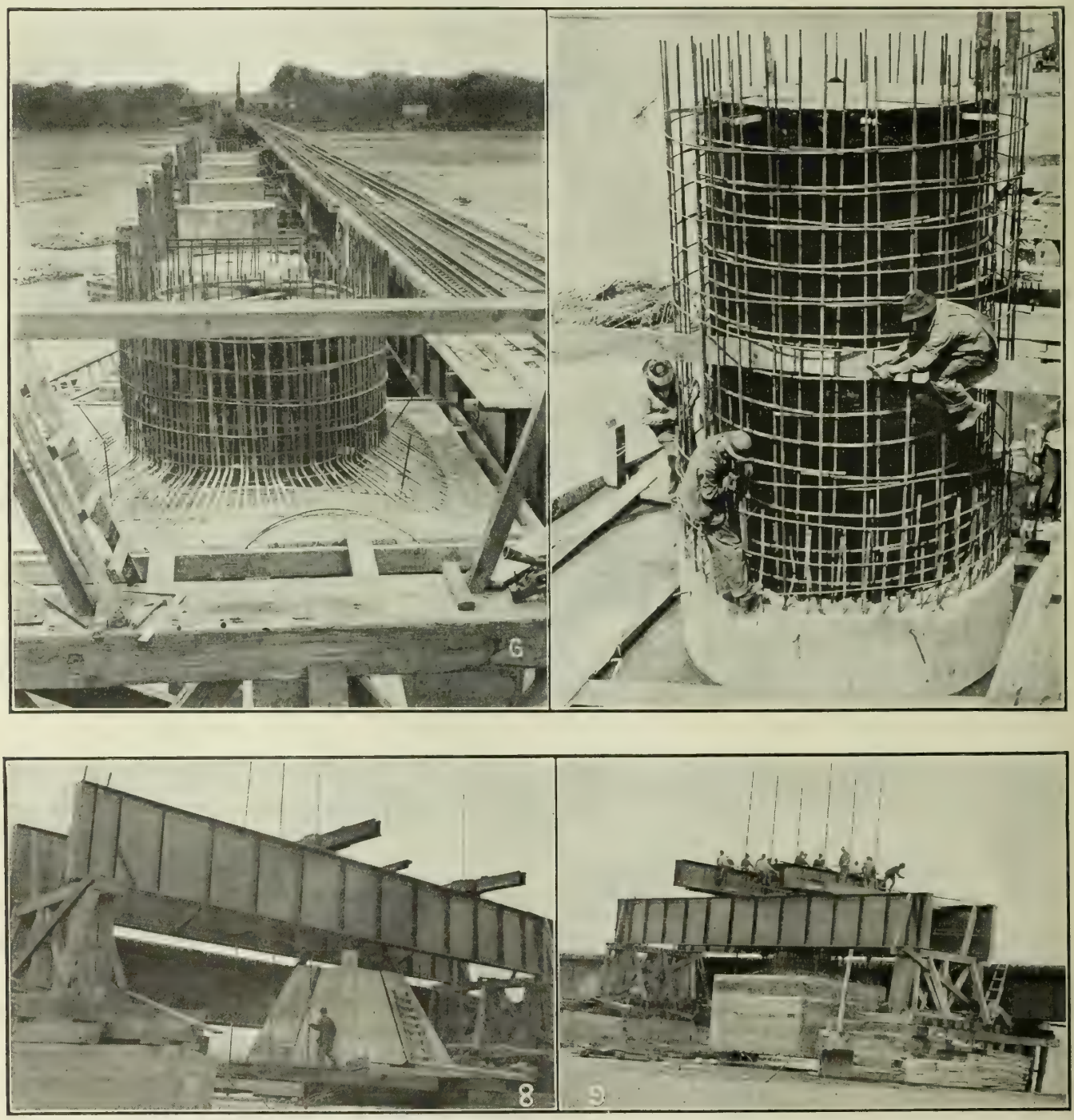


FIG. 5. CONCRETE CAISSONS AS USED ON PIERS 6 TO 16

on a temporary bridge or from a stiff-leg derrick and hoist when that rig could be erected.

The bottom section of the caisson was assembled on the bank and was carried out and set in place by a locomotive crane. Twenty-foot sections were added to this as sinking progressed in the manner shown in the view in Fig. 3.

The caissons were sunk by open dredging through the 8-ft. well in the center and by shooting one ½-lb. stick 40% dynamite in the excavated pit after each 5 to 8 cu.yd. of sand was removed. By using dynamite, it was possible to keep the sand from rushing in at the bottom; it seemed, also, to help materially to sink the caisson. The perpendicular position of the caisson was maintained by regulating the excavation in the bottom and by means of shores against the outside. At times it was necessary to employ divers to remove rock, boulders and logs from under the cutting edges. Excavation was usually from 3 to 4 ft. below the cutting edge when the caisson started to move. In order to found the cutting edge on bedrock, the last 3 or 4 ft. of depth was made by lowering the water on the inside, thereby reducing the pressure and allowing the sand to be forced in under the cutting edge and permitting the caisson to settle by its own weight to within a few inches of bedrock. Sand around the cutting edges which could not be removed was then thoroughly grouted



FIGS. 6 TO 9. THE BURLINGTON'S ASHLAND BRIDGE UNDER CONSTRUCTION

Fig. 6—Looking across bridge with concrete caisson in foreground. Fig. 7—Inner form and reinforcement in place for 13-ft. section of concrete caisson. Fig. 8—Pier 11, showing suspended platform with forms partly erected. Fig. 9—Pier 11, lowering bottom of sections of caissons by screws

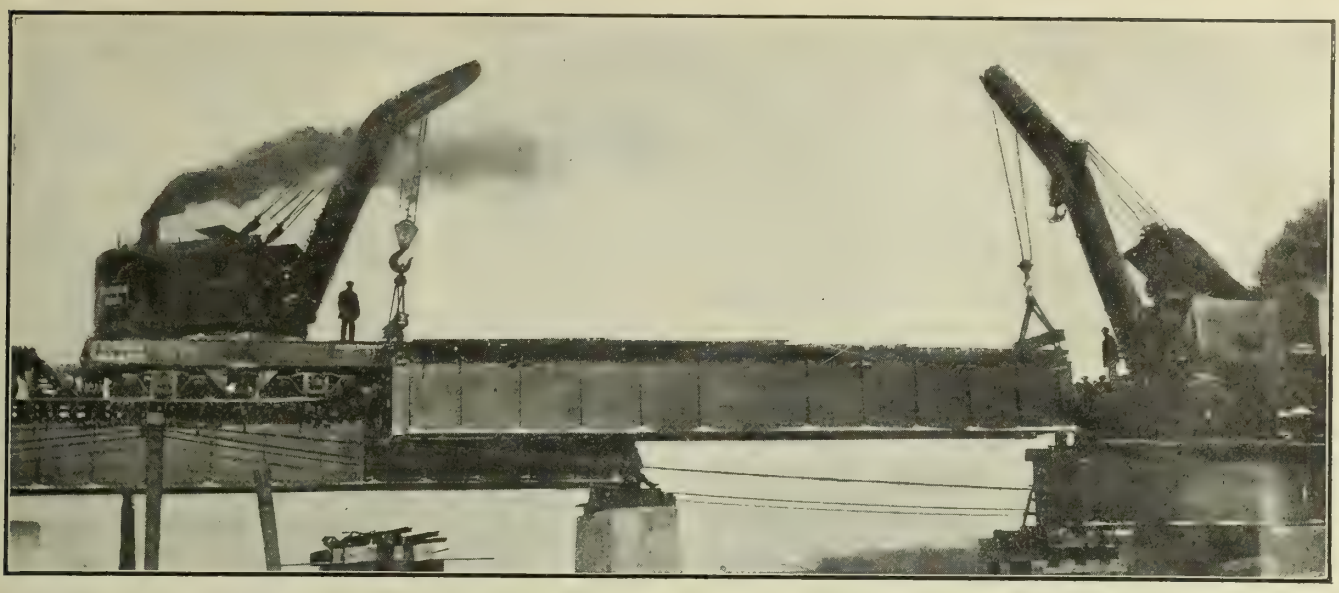


FIG. 10. MOVING GIRDER SPANS ON CHICAGO, BURLINGTON & QUINCY BRIDGE ACROSS THE PLATTE RIVER FROM OLD TO NEW PIERS

with cement, applied through a 2-in. steam jet. The bottom was then sealed with a 5-ft. course of 1:2:4 mix placed through the water in a ¾-yd. drop-bottom bucket. After this had set for 12 hr. a second course was placed, making a total of from 10 to 14 ft. of sealing material. This was allowed to set for 24 hr. when the caisson was unwatered and filling with concrete was carried on in the dry. A mix of 1:3:6 was used to complete this dry filling of the core of the piers.

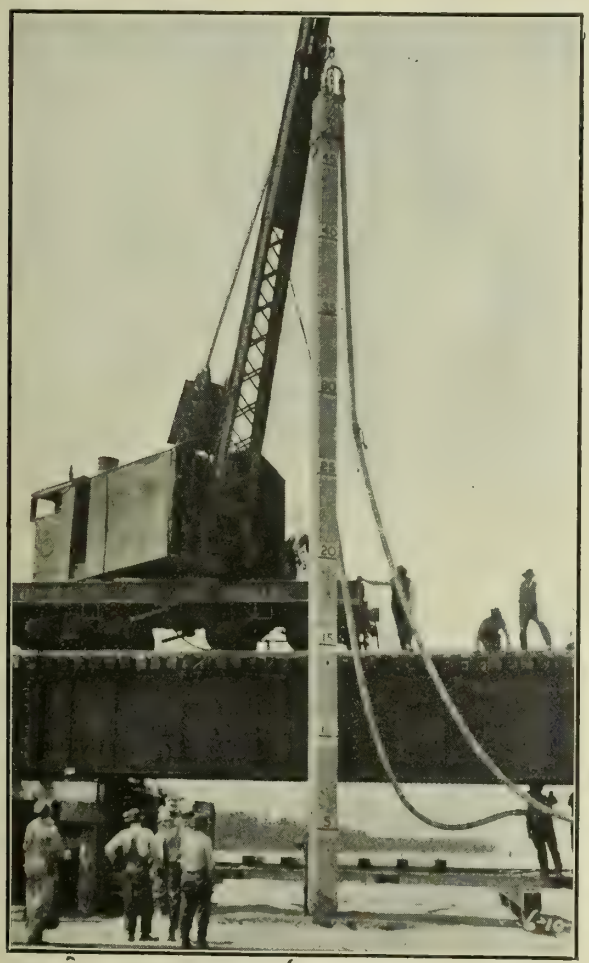


FIG. 11. SINKING SPECIAL CONCRETE PILE ON ASHLAND BRIDGE

The piers were completed to proper height by placing reinforced-concrete caps with ice-breakers on the upstream side. With a track derrick using a 1-yd. Browning orange-peel bucket a maximum of 6 ft. was sunk in 10 hr., which includes 25 per cent. loss of time on account of traffic. Where a stiff-leg derrick and hoisting engine were used, a maximum of 10 ft. in 10 hr. was made, with no loss of time on account of traffic.

Reinforced-Concrete Caissons

Caissons for piers 6 and 16 inclusive were made of reinforced concrete with a 17-ft. square base converging to an 11-ft. cylinder 12 ft. above the cutting edge. All forms for molding this caisson were of wood and so constructed that they could be removed and used again. Details of these caissons are given in Fig. 5.

They were sunk and finished in the same manner as the steel caissons previously described. Pier 16, only, was founded on bedrock; pier 15 was founded on a stratum of cemented gravel about 10 ft. above bedrock, and the remainder of the series were sunk to a depth of about 50 ft. below low water and founded on coarse sand or gravel, which is below any possible line of scour. Owing to the shallow water it was possible to build diversion dams of brush and rock upstream from where a new pier was to be started, thereby obtaining still water in which a wooden box coffer-dam, measuring 24 ft. square and from 4 to 6 ft. deep, was placed and filled with sand, on which forms for the bases of the caissons were erected. After sinking the caisson to a depth of from 10 to 12 ft. this coffer-dam was removed and used again at the next pier.

Piers 6 to 16, except No. 11, were started in this manner. At pier 11 the water was 12 ft. deep, so it was decided to erect base forms and concrete the lower section of the caisson on a suspended platform. This was accomplished by spanning the location of the new pier with two 60-ft. girders placed at 13-ft. centers on pony bents built on the old bridge seats. Crosswise on these girders were placed two pairs of smaller girders from which a platform was suspended just above the surface of the water, by means of six 2-in. lowering screws 24 ft. long. The form for the base was erected on this platform and con-

crete was placed to a sufficient depth to properly embed and anchor six eye-bars to which six 2½-in. lowering screws were attached to aid in supporting the load as concreting progressed.

After the forms were removed, the six 2-in. screws were released and the platform was removed from under the caisson, throwing the entire weight (approximately 175 tons) on the six 2½-in. screws. The caisson was then lowered to the bed of the stream by means of these screws, after which they were removed and the work progressed as on the other piers previously described. (See Figs. 8 and 9.)

Concrete-Pile Footings

Piers 1, 4 and 5 are built on Bignell concrete piles, pier 1 and pier 4 having 36 piles each and pier 5 having 21 piles, sunk to depths respectively of 57, 62 and 50 ft. below water. The tops of these piles are embedded in a concrete cap, on which forms were erected and piers finished in the usual manner.

The concrete pile referred to is of a new type (see *Engineering News* of Oct. 8, 1914) and these are the first of their kind to be used. They are 16 in. sq., 50 ft. long and weigh 12,300 lb. each and are made of reinforced concrete. Each pile has a 4-in. pipe through its length which is reduced to 2 in. at the bottom. This is tapped by ¾-, ½- and ⅜-in. pipes fitted with elbows turned up on the outer edge of the piling and are spaced from the bottom or point of pile, 1½, 2, 4, 8 and 12 ft., thus furnishing five openings on each side of the pile. Also a 2-in. pipe extends through the 4-in. pipe and fits into the reducer at the point, the 2-in. pipe being fitted with a brass nozzle that reduces the opening to 1⅛ in.

Water is applied at the top of the piling, through two 3½-in. hose, at a pressure of 100 to 150 lb. per sq.in. in the 4-in. pipe and 250 to 300 lb. in the 2-in. pipe (see Fig. 11). The high pressure is used at the point of the pile, through the inner pipe, to loosen and displace sand in front of the pile in sinking. The lower pressure in the 4-in. pipe supplies the side openings with enough pressure to keep the sand loose and to give it an upward movement to overcome the side friction. The pile sinks by its own weight.

Abutment Design

The east abutment consists of a prismatic pier resting on 50-ft. Bignell concrete piles, 12 of which were sunk to a depth of 35 ft. below low water, supporting the east end of a 25-ft. slab, weighing 80 tons. The other end of the slab is supported by a small cone block on brackets attached to ends of girders. Two of these slabs are used, one at each end of the bridge. They were manufactured at the Chicago, Burlington & Quincy R.R. concrete plant at Havelock, Neb., each slab being made in two parts measuring 3 ft. deep, 7 ft. wide by 25 ft. long to facilitate handling and placing.

The west abutment was built the same as the east one, except that it is supported by twelve 30-ft. by 14x14-in. solid concrete piles.

Pier 20 is similar to pier 1, but the foundation piles are white oak instead of concrete.

Pier 18, which was the last pier to be completed, presented many difficult problems, owing to the nature of obstructions in the river bed, through which it was sunk. A coffer-dam, 19 ft. square, was planned, but before driving, a Davis calyx core drill was used to drill holes 18 in. apart to penetrate through the obstructions and on the proposed line of coffer-dam. Each hole was blasted with 5 to 15 lb. of 60% dynamite and sheetpiling was then driven with but little trouble. By the use of dynamite, divers, dredge buckets and sand pumps, this coffer-dam was finally cleaned and the obstructions removed, after which it was filled to the surface of the water with sand on which forms were erected for a concrete caisson similar to the ones used at piers 6 to 16. Thereafter work proceeded without interruption until the pier was completed.

Steel Erection

Three new spans were placed at each end of the new bridge, and track laid and completed as far as possible. Traffic was then diverted for 34 hr. while the girder spans from the old bridge were shifted to the new piers. This was accomplished by the use of one 75-ton derrick and one 100-ton derrick, which picked each entire span with ties and rails in place, raised it 7 ft., moved it endwise 25 ft. and swung it to place on the new piers, 14 ft. out. These three movements required 20 to 45 min. for each span. Thirteen spans were moved in this manner, during the worst storm of the winter. High wind and heavy snow greatly retarded this work. The actual time for changing the spans was 10½ hr. (Fig. 10).

The construction was all carried out by the forces of the Chicago, Burlington & Quincy R.R., under the direction of C. H. Cartlidge, Bridge Engineer; C. R. Fickes, Assistant Engineer. The writer was Resident Engineer.

Okanogan Pumping Plant Is Irrigators' Insurance

Two power plants and one pumping station have been built on the Okanogan Project of the United States Reclamation Service in Washington as insurance against the contingency of lack of water. About 10,099 acres of private and project land here are watered from Salmon Creek, requiring an annual runoff of 30,000 acre-ft. The creek has always maintained a runoff greater than this, except for a period of shortage between 1908 and 1914. In 1911 there was an actual shortage for irrigation. A supplementary water-supply for the project was determined upon to be secured by pumping from the Okanogan River. It is expected that there will be more seasons when the pumps will be idle than when used. The cost of the pumping and power plants when fully completed will be about $61,000. If the use of this plant should save the apple crop of one season it would pay for itself.

In the pumping station are two units, each consisting of a 200-hp. induction motor direct-connected to a two-stage centrifugal pump of 6 sec.-ft. capacity. The two pumps are connected by 12-in. pipes to a Y in a 30-in. line, 225 ft. long, and a wood-stave pipe 4,400 ft. long. The water is raised 177.5 ft. above low water.

To supply the pumping station with current two generating stations have been built at drops in the irrigation-canal system. At one plant there is a drop of 105 ft. with a normal water flow of 27 sec.-ft., developing approximately 250 hp. At this plant the machinery comprises a Francis turbine connected to a 187-kv.-a. generator. At the second power station there is a drop of 56 ft. and a flow of 55 sec.-ft., developing about 300 hp. The equipment is the same as noted in the first plant.

Cost of Drainage Pumping in Southern Louisiana

By C. W. Okey*

SYNOPSIS—The costs of operation of drainage pumping plants in southern Louisiana are given with full data on the equipment of each station and on the kind and costs of fuel and labor. To facilitate the comparison of plants of different capacities and heads the unit used is the cost of lifting 1 acre-ft. through 1 ft. height.

The data set forth in this article have been obtained during the course of investigations carried on by the writer in southern Louisiana since June, 1909, under the auspices of Drainage Investigations, Office of Experiment Stations, United States Department of Agriculture. The work has consisted of a general study of the problems involved in the reclamation of the wet prairie lands of southern Louisiana, particular attention having been paid to the subject of run-off, including its amount as determined by continuous records kept, and the cost of its removal by pumping.

The equipment of each pumping plant, as well as the kinds and costs of fuel and labor, are shown in Table 1. Except for the last three districts enumerated, the descriptions apply to conditions obtaining in 1912, but any important changes since made have been noted. Table 2 shows the costs of operation, including those of fuel, labor and repairs; it also shows the conditions under which the plants were operated. For the purpose of comparing the costs for the various plants, a unit has been chosen which eliminates any effect of difference in the amounts of water pumped and the lifts of the pumps; this unit is the cost of lifting 1 acre-ft. of water 1 ft. The performance of each plant is expressed in the equivalent number of acre-feet lifted 1 ft. It should be noted that the table shows average effective lift rather than the actual, the former being the difference between the elevation of the water surface from which the water is being pumped and that of the water surface where the pumps discharge. The cost of pumping is likewise expressed as the cost of lifting 1 acre-ft. one effective foot.

Notes on Cost Tables

Prior to 1913 figures for the costs of repairs for the Willswood and the Little Woods plants were not available, and it has therefore been assumed that such costs were 15% of the combined cost of labor and fuel. This is an average figure for the plants for which the actual costs of repairs are known. An unusually large amount for repairs and incidentals is recorded against the Little Woods plant for the year 1913, as this item covers a thorough overhauling of the plant; strictly speaking, this extra expense should be charged to the whole succeeding period of operation instead of to the one year.

Prior to September, 1913, the design of the suction and discharge piping at the Poydras plant was such that the resulting loss of head amounted to about 2.5 ft.; with a better design of piping this loss was reduced to about 0.5 ft., with consequent increase of efficiency.

The area drained on Unit No. 1 at Gueydan was changed in July, 1915, from 6,500 to 7,500 acres by the addition of about 1,000 acres of raw land; consequently the run-off from the district as a whole was a very large part of the total rainfall. Fuel oil during most of the year cost $1.50 per bbl. (42 gal.) by the time it was barged to the plant. By means of an oil meter a careful record was kept of the amount of fuel required for each boiler to bring the steam pressure up to the point necessary to operate the plant; this was found to be 55 gal. for each time. Labor was estimated at $0.50 per fire-up, so that the average cost for each boiler of the plant was $2.50.

The Only Electric Plant

On the Little Woods tract the area was decreased about 10% at the beginning of 1913, and on the first of May it was further reduced to 2,400 acres. The area drained by the plant continued to be 2,400 acres to the close of the year, except during the month of October, when 6,858 acres was drained. The service of the plant was very intermittent as it was desired to obtain the deepest drainage possible. Consequently the reservoir channels were kept as nearly empty as practicable. From the first of the year 1914 and until the middle of May, this district was drained by two plants. The old plant drained an area of 2,400 acres and the new plant drained the remaining 4,543 acres. After the date mentioned the entire area was drained by the new plant. This is the only electrically driven plant on which records were taken. The motors are of the fixed-speed type, so that the speed of the pump remains constant whatever the lift. This arrangement gives the greatest capacity when the lift is low, at which time the greatest capacity is necessary. While the capacity decreases very materially with the increased lift, the water to be pumped also greatly decreases.

The cost figures given in the table must be compared with due regard to conditions of operation and to the average lifts of the pumps. A comparison of the costs of lifting 1 acre-ft. of water 1 ft. on the Little Woods tract for the years 1910 and 1911 will show the increase of cost that results from very intermittent operation. The increase in this case is due largely to the relatively large charge for labor during 1910. However, it will be noted that the fuel charge is greater for 1910 than 1911.

The effect of a change in the average lift of a pump is shown in the figures for nearly all the plants, but especially in those for Unit No. 1 Poydras, No. 2 Des Allemands, and No. 3 Raceland. On some of the other plants where an increase in lift has not caused a decrease in unit cost the cost of fuel has increased.

As all of the Corliss-engine plants are on large districts, thus causing a relatively large reduction in the labor charge per unit of water lifted out of the district, it will be of more value to make the comparison on cost of fuel alone. This will largely eliminate the effect of the size of the district. With the exception of the year

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TABLE 1. EQUIPMENT DETAILS AND UNIT PRICES OF OPERATING EXPENSES; SOUTHERN LOUISIANA DRAINAGE PUMPING PLANTS

Plant and Location	Pumps: Number and Kind	Pumps: Capacity: Size	Pumps: Capacity: Total Sec. Ft.	Pumps: Capacity: Depth, In. per 24 Hr.	Excess Lift (Actual Exceeds Effective), Ft.	Engines: Power Transmission	Engines: Number and Kind	Engines: Size	Efficiency of Engine, Pump and Piping at Aver. Effective Lift, Per Cent.	Boilers: Number and Kind	Boilers: Size	Fuel: Kind	Fuel: Unit Cost	Labor: Grade	Labor: Wages	Labor: General Plant Condition	Notes
Smithport, Lockport, La.	1 square wood-case centrifugal	32x12-in. impeller	...	....	2.0	Rope drive	1 slide-valve noncondens	11x12-in.	Not tested low	1 return-tubular	100 hp.	Coal and oil (a)	$4.00 per ton	Unskilled	$1.50 per day of operation	Poor	Large plant, on account of leaking levees
	1 do.	24x8-in. impeller	34	1.1	.....	do.	1 do.	12x10-in.					$1.15 per 24 gal.	do.		do.	(a) Fuel changed from coal to oil in September, 1912
Willswood, Waggaman, La.	1 square wood-case centrifugal	42x16-in. impeller	...	....	5.0	Rope and bevel gear	1 slide valve noncondens	16x24-in.	12	2 water-tube	150 hp. each	Oil	$0.80 to $1.70 (b) per bbl.	Good	$3.00 per day of operation	Good	(b) In 1912, cost of fuel oil rose from $0.80 to $1.70 per bbl.
	1 rotary	7 ft. wide	...	.	5 0	Rope drive	do.	16x24-in.	32	1 return-tubular	80 hp.	do.		Unskilled assistant	$1.50	do.	
	1 horizontal cast-iron	36-in discharge	152	1.4	2.0	Direct-connected	1 double slide valve vertical	14x14-in.				do.					
Unit No. 1, Poydras, La.	1 horizontal cast-iron centrifugal	36-in. discharge	. .	....	2 5 (c) 0.6 (d)	Direct-connected	1 slide valve noncondens	14x18-in.	28 to 45 (e)	2 return-tubular	80 hp.	Oil and coal	$0.90 per bbl.	Engineer good	$1.80 per day of operation	New	(c) March, 1912, to August, 1913 (d) Since August, 1913
	1 do.	24-in. discharge	92	0.88	...	do.	do.	10x14-in.	32 to 55 (e)				$3.25 per ton	Fireman fair	$1.00 per day		(e) Increased efficiency due to changes in pumps and piping during 1913
Drainage District No. 1, Des Allemands, La.	2 horizontal cast-iron centrifugal	24-in. discharge	75	0.95	0.3	Direct-connected	2 slide valve vertical	12x12-in.	55	2 return-tubular marine	60 hp. each	Oil	$1.15 per bbl.	Good	$1.50 per day of operation	Good	
Drainage District No. 3, Raceland, La.	2 horizontal cast-iron centrifugal	30-in. discharge	120	1.25	0 75	Direct-connected	2 slide valve vertical	14x16-in.	35	2 return-tubular	100 hp.	Oil	$1.15 per bbl	Unskilled	$1.50 per day	Fair	
Unit No. 1, Gueydan, La.	2 horizontal cast-iron centrifugal	54-in. discharge	385	1.4	0.3	Direct-connected	2 Corliss non-condens	16x36-in	55	2 return-tubular	150 hp.	Oil	$0.80 to $1.25 per bbl.	Expert engineer, good fireman	$100 per mo. in 1912; $3 per day $1.50	New	About January, 1913, the engineer was changed from monthly wage to rate per day when operating the plant
Little Woods (Old Plant)	1 horizontal cast-iron centrifugal	48-in. discharge	100	0.32	2.0	Direct-connected	1 Corliss noncondens	16x36-in.	2? (f)	1 water-tube	150 hp.	Coal	$2.75 per ton	Expert engineer, good	$90 per mo.	Good	(f) Test in 1909; change in pump and piping in 1911 probably much increased the efficiency
Little Woods (New Plant), Little Woods, La.	2 do.	48-in. discharge	380	1.30	0.6	Herringbone gear	Electric motors	215 hp. each	50				(g)	fireman	$1.50 per day		(g) 1c. per kw.-hr. plus $230 per month fixed charge
Jefferson Drainage District No. 3, Barataria, La.	2 horizontal cast-iron centrifugal	48-in. discharge	300	1.44	0.4	Direct-connected	2 Corliss noncondens	16x36-in.	55	2 return-tubular	150 hp. each	Oil	$1.15 per bbl.	Expert	$55 per mo.	New	

TABLE 2. COSTS AND CONDITIONS OF OPERATION; SOUTHERN LOUISIANA DRAINAGE PUMPING PLANTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20						
							Cost												No. of times plant was run continuously more than following No. of days:						
Plant	Area, Acres	Year	Rainfall, In.	Runoff, In.	Aver. Effective Lift, Ft.	(a) Acre-Ft.-Ft.	Fuel	Labor	Repairs and Incidentals	Total	Per Acre	Per Acre-Ft.-Ft. (a) Total	Per Acre-Ft.-Ft. (a) Fuel	No. Days Plant Operated	No. Times Boilers Fired Up	No. of 24-Hr. Days per Year at Full Capacity	Hr. at Full Capacity per Fire-Up	Longest Period of Continuous Operation, Days	1	2	3	4	6	10	Notes
Smithport	647	1911(b)	57 52	33.35	5 2	9,400	$667	$351	$150	$1,168	$1.80	$0.125	$0.071	115	103	33	7.7	2	8	1	0	0	0	0	(a) Acre-feet of water lifted 1 ft.
	647	1912(c)	52 23	40 80	5 5	12,190	795	342	170	1,307	2 02	.108	.066	108	77	49 5	12 9	4 3	12	5	3	1	0	0	(b) March, 1911, to February, 1912, inclusive
	647	1913	60 01	37.77	5.8	11,840	780	215	35	1,030	1.60	.087	.066	86	68	34 2	12 0	3 8	10	3	1	0	0	0	
	647	1914*																	3	1	0	0	0	0	(c) March to December, inclusive
	2,400	1909(d)	43 32	16.33	5.0	16,330	936	600	230	1,766	.73	.108	.057	45	39	20.0	7.3	2 5	5	1	1	0	0	0	(d) June to December, inclusive
	2,400	1910	43.08	11 58	5 0	11,580	616	500	180	1,296	.54	.112	.053	45	41	8 4	4 9	0 75	0	0	0	0	0	0	
	2,600	1911	52.32	23.42	5.0	52,290	1,267	753	300	2,320	.89	.092	.050	69	61	19 2	7.6	3 50	5	1	1	0	0	0	
	2,600	1912(e)	48 22	34.42	5 0	37,290	2,676	765	514	3,955	1.52	.106	.072	81	63	35.0	8 9	4	10	4	1	1	0	0	
	2,600	1913	51.52	27 08	5.0	30,180	2,412	848	457	3,717	1.43	.123	.080	68	60	17.5	7	2	6	2	0	0	0	0	
	2,600	1914	42 25	15.05	5.0	16,320	1,210	426	464	2,100	.81	.129	.074	41	39	9.7	6	2 2	2	1	0	0	0	0	
Unit No. 1, Poydras	2,500	1912(f)	70 52	28.28	2.1	12,420	1,098	640	244	1,982	.79	.160	.088	114	77	41.8	10.5	14 0	12	9	7	4	1	1	(e) January to May and October to December, inclusive
	2,500	1913	63 45	38 82	4.5	36,580	2,314	1,261	347	3,922	1.57	.107	.063	155	131	46.5	8.5	6 5	4	3	2	1	1	0	
	2,500	1914	47 70	16 46	5.2	18,320	743	764	408	1,915	.77	.105	.041	73	71	17 8	6.0	2 0	2	1	0	0	0	0	(f) March 9 to December 31
Drain. Dist. No. 1, Des Allemands	1,880	1913	47 37	31 00	5.1	24,910	1,526	564	116	2,206	1.18	.089	.061	210	198	40.0	4.8	5 0	5	4	2	1	0	0	
	1,880	1914	45 70	25 83	5.3	21,340	871	517	65	1,453	.77	.068	.041	178	159	35 3	5.3	4 8	8	5	2	1	0	0	(g) March 17 to December 31
Drain. Dist. No. 3, Raceland	2,250	1913	52.04	20.84	2.9	11,270	930	306	331	1,567	.70	.140	.082	90	90	15.5	4.1	0 75	0	0	0	0	0	0	
	2,250	1914	58 95	23.40	3.5	14,870	1,140	233	194	1,567	.70	.106	.077	78	71	18.7	6.3	1 60	3	0	0	0	0	0	(h) Area increased to 7,500 acres in July
Unit No. 1, Gueydan	6,500	1912(g)	41.71	37.26	3.6	75,200	2,640	1,225	795	4,660	.72	.062	.035	196	185	40 0	4.1	4	6	3	2	1	0	0	
	(h) 7,500	1913	77 61	65.86	5.0	194,000	6,013	1,321	631	7,965	1.06	.041	.031	No record	169	58 0	8.2	No record	No record						(j) October to December, inclusive
	7,500	1914	59.18	34.49	5.1	109,350	No record			5,175	.69	.047	...	166	162	28.00	4.1	5 2	7	1	1	1	0	0	
Little Woods	7,500	1908(j)	3 26	3.88	1.5	3,730	137	381	77	595	.08	.160	.037	23	23		9.2	0 5	0	0	0	0	0	0	(k) Average for year
	7,500	1909	65.40	29 17	3.0	55,610	1,168	1,629	420	3,217	.43	.058	.021	233	193	82 00	10.2	8 5	11	8	5	3	1	0	
	7,500	1910	51 25	7.94	4.9	24,380	652	1,303	295	2,250	.30	.092	.027	134	134	31 00	5.5	0 5	0	0	0	0	0	0	(m) January 1 to May 2; old plant
	7,500	1911	53 85	18.36	4.7	53,620	1,060	1,505	385	2,950	.39	.055	.020	163	142	52 00	8.8	7.0	8	6	4	3	2	0	
	7,500	1912	63 50	42.39	5.1	136,650	3,100	2,121	670	5,911	.79	.043	.022	294	204	145.00	17.1	23.0	7	7	5	4	4	2	(n) Average for year; new plant
	(k) 4,260	1913	46 04	24 28	5.6	62,390	1,375	1,565	1,000	3,940	.92	.063	.022	182	180	60.00	8.0	2.0	2	1	0	0	0	0	(p) Electric power
	(m) 2,400	1914	17.40	13.13	5.6	14,770	No record			2,120	.88	.142	...	59	58	39.00	5.8	1.2	1	0	0	0	0	0	(q) March 12 to December 31
	(n) 6,040	1914	50.60	20.46	4.5	46,760	3,932(p)	No record		5,650	...	...	.1 (p)	308	308	16.00	1.2	0.6	0	0	0	0	0	0	
Jefferson Drainage Dist. No 3	(q) 5,000	1913	49 60	28 42	5 1	59,970	2,565	692	480	3,737	.75	.062	.043	121	119	29.00	4.9	2.5	1	1	0	0	0	0	*No record
	5,000	1914	48 16	26 45	4 7	51,630	2,274	595	261	3,130	.63	.061	.044	104	97	18.3	4.5	2.9	5	1	0	0	0	0	

1914 the cost in fuel of lifting 1 acre-ft. of water 1 ft. was much less for the Corliss-engine plants than for those which use slide-valve engines. The cost is especially low for Little Woods, because of the low price of fuel. The longer run per fire-up for this plant gives it further advantage in some of the years. The plants in District No. 1 at Gueydan and Jefferson Drainage District No. 3 are similar in equipment except that the pumps in the former are larger. It will be noted that the cost of fuel used per unit of water lifted is less for the Gueydan district than for the other. The lifts and the lengths of run per fire-up are about the same, while the unit cost of fuel is lower for the Jefferson plant. The difference may be due to the faulty firing in the latter, but it probably is caused by the fact that while the engine at Gueydan is of about the correct size for the 54-in. pump, the same-sized engine connected to a 48-in. pump in the Jefferson Drainage District plant is rather larger than necessary and is underloaded.

Slide-Valve Engine Plants

For the slide-valve plants, a comparison of the costs of fuel for lifting 1 acre-ft. of water 1 ft. will show that the effect of the highest average lift and the longest run per fire-up for the year 1913, which occurred in the case of the Smithport plant, has served to make the latter compare very favorably with the other slide-valve plants—although it is by far the poorest plant of the five. On the other hand, the effect of the lowest lift and the shortest run per fire-up for the year 1913, which occurred in the Raceland plant, has served to make it the most expensive plant per acre-foot of water lifted one foot—although the Raceland pump is the equal of any of the other slide-valve plants. It will be noted that the unit fuel costs for the four slide-valve plants from which cost figures were available showed, for 1914 as compared to 1913, some decrease in all cases and a decided decrease in two. In the case of Willswood this decrease was caused by a cheaper price on the fuel oil burned, and in the other three by increased lift and greater care in operation. Tests of the plants had showed that they were being operated at an overload, and during 1914 the engine speeds were considerably reduced. At Poydras changes in the piping to the pumps and in the impellers also aided in achieving more economical operation. It will be noted that the cost figures for the plants at Poydras and Des Allemands are about the same as those for the Corliss-engine plant at Jefferson.

The only plant operated by electricity shows a considerably higher cost for power for lifting 1 acre-ft. of water 1 ft. than do most of the steam plants. However, it will be noted that the amount pumped was small and the service was very intermittent. The plant was started about twice as often as any of the others and the average length of run at full capacity for each time it was started was less than one-fourth as long as in the case of most of the others. Of course the loss due to starting so often was much less relatively than with a steam plant.

The conditions of operation as set forth in Table 2 may also need some explanation. Column 17 gives the total time in each year that the plant was operated at full capacity, expressed in terms of full 24-hr. days. Where the period given in column 3 is less than a year, the length of time that the plant actually operated during the period is so corrected as to give the rate per year. For example, if the plant operated 10 days in a period of 6 months, the number that would appear under column 17 would be 20. The figures in column 18 are obtained by dividing the actual number of hours during which the plant operated in the given period by the number of times the boilers were fired. Where the period given in column 3 is a full year, the figures in column 18 may be obtained by multiplying those in column 17 by 24 and dividing by the numbers given in column 16. If the period is less than a year the figures in column 17 should first be corrected by column 3 and notes.

Conditions on some of the districts during the various years are such that the amounts and costs of operation are not typical and could not safely be used for drawing general conclusions. Thus in the case of Smithport the amount pumped and the number of 24-hr. days per year that the plant operated are both increased by seepage through the levees; this is particularly true during 1912. The length of run per fire-up is also increased by the same influence and under normal seepage conditions would probably be about one-third less. The Willswood plant has been in operation about 19 years; the number of days per year it operates (an average of 17) and the average length of run per fire-up (7 hr.) are about what would be expected for lands that have been reclaimed for a number of years. The Poydras, Gueydan, Des Allemands and Jefferson plants are all on newly reclaimed lands. Up to the beginning of 1914 no very large percentages of the lands in the respective districts were in cultivation, and the character of the service and the number of days per year that the plants operated are comparable only to the same items in plants on newly reclaimed land. The conditions of operation at the Little Woods plant were far from being typical up to the beginning of 1914, as its capacity was relatively small and the water was allowed to come to it very slowly from the portions of the district not in cultivation. During 1914, since the addition to the plant capacity, the district could be drained in about the usual time.

Some Typical Results Shown

In the year 1914 the results from the Poydras, Des Allemands, Jefferson and Raceland plants may be said to be typical. In addition, the results from the last-named district for 1913 are also typical. An average of the records for 1914 from each of the districts and including records for 1913 from the Raceland district shows:

Rainfall, in.	50.85
Run-off, in.	22.59
Days per year on which operation occurred	104.00
Number of times per year boilers were fired	97.00
Number of 24-hr. days per year at full capacity	21.10
Average number of hours run at full capacity, per fire-up	5.20

While the rainfall given is slightly below normal for this section of the state, it is believed that the percentage of rainfall appearing in run-off in the average given will not be far from normal. With the mean annual rainfall of 56 in. and the same percentage, the amount to be pumped would be 25 in. per yr. Therefore a plant with a 24-hr. capacity of 1.25 in. in depth of water over the area drained would have to operate an average of about 20 days of 24 hr. each, per year. Where such factors as leaky levees enter in, the amount of pumping would of course be greatly increased. Where the capacity of the plant is much less than specified, the amount pumped would be somewhat less, owing to evaporation.

Flooding and Recovery of the Astoria Tunnel—II

By Harold Carpenter*

SYNOPSIS—Tunnel pumped out, while some leakage still continued, by combined air lift and pump work. Erratic pressure-gage readings in the bulkheaded heading. The jammed bulkhead door and the open drain-pipe. Leak finally grouted through a 22-ft. drill hole from the Astoria bulkhead. Excavating the grout filling the heading—a volume twice that of the cement used. Final bench work and lining with cast-steel rings.

For pumping out the tunnel after the leak had been controlled by filling the entire heading with grout, the following preparations were made: One 1,000-gal. and one 800-gal. pump were mounted on a steel pontoon in the Astoria shaft. An 18-in. ventilating pipe and three 8-in. pump discharge lines which were already in the shaft were converted into air lifts by installing small air lines in them. The three elevators were removed so that the elevator framework could be used to mount additional pumps.

On Nov. 24, 1913, at 7:50 a.m., the 18-in. and two 8-in. air lifts were turned on. They lowered the level of the water 160 ft. by 9 p.m., removing 1,140,000 gal., an average of 1,440 gal. per min. The 1,000-gal. pump was then cut in. As the work progressed two pumps were used from the pontoon assisted by the air lifts and three 600-gal. pumps mounted on the elevator framing. The discharges of the pumps were connected to discharge lines already in place in the shaft for the original pumping plant by means of 8-in. hose, and steam connections were made in the same manner. The bays of the elevator framing were 25 ft. apart, and after the water was pumped down low enough so that the three pumps could be shifted, the pumps on the pontoon were used to hold the level of the water while the shift was being made. Conversely, the pumps on the elevator framing were used to hold the water while the connections of the pontoon pumps were being changed.

When pumping began, a gage on a pipe in bulkhead *B* (see sketch, Fig. 4, p. 675, last week's issue) read 92 lb., the exact figured pressure for that point. In the early pumping this gage dropped slower than the head in the shaft by 19 lb. A 5-in. pipe in bulkhead *B* was opened in order to assist the pumping by using the Bronx pumps, when the gage began to rise rapidly until it was 24 lb. higher than the shaft pressure, indicating that the flow was opening up connection with the river pressure. The pipe was closed, and the gage jumped to 58 lb. higher than the shaft pressure.

At 10 a.m., Nov. 25, the 18-in. air lift was shut down, having operated until the water was 200 ft. below the top of shaft, which was an unusual performance, as the air pipe only extended down a distance of 256 ft. About 2 p.m. the amount of water coming into the shaft appeared suddenly to increase, as if some stoppage had given way in the heading.

On Nov. 26, as the gage at bulkhead B had been continually dropping and had apparently lost its connection with the river pressure, the 5-in. pipe was again opened and the Bronx pumps operated, when the gage instantly dropped 13 lb. more.

As the Astoria heading was about 20 ft. higher than the Astoria portal, it was feared that a vacuum would form in the heading and cause a rush of water that would swamp the pumps. In looking for a means of forcing air into the heading a 2-in. pipe in bulkhead *B* was cleared; and instantly the gage, which was on another pipe on the opposite half of the bulkhead, dropped another 15 lb. to the shaft pressure and then 3 lb. more.

The gage fluctuated back and forth—first higher, then lower than the shaft pressure—in a very extraordinary manner. On Nov. 28 when it should have read zero it read 7 lb. and continued to do so to the end of the pumping. When the water reached an elevation about 14 ft. above the bottom of tunnel at the portal, the submerged pumps were cut in. Approximately 24,000,000 gal. of water was pumped.

Vacuum in Heading Holds Back Water

The attempt to force air into the heading from the Bronx end had failed. At 3:30 p.m., Nov. 28, it became evident that a vacuum was forming in the heading, as the water level had reached a point at that time which it should not have reached until midnight. It was calculated that 1,000,000 gal. was held back in the tunnel above the elevation of the water in the shaft.

An attempt to force air through an air line which was known to extend well into the tunnel finally succeeded, most fortunately, when the air pressure reached 165 lb., evidently blowing out some stoppage, as the air then went in at 35 lb. Air was then kept constantly on this line, and lowering of the water proceeded.

The last of the 8-in. air lifts was shut down at 11:30 a.m., Nov. 29, having worked continuously from 7:50 a.m., Nov. 24. The water was 234 ft. below the top of shaft, and the end of the air pipe had only 13 ft. submergence, an unusual performance for an air lift.

Entering the Tunnel for Inspection

At 5 a.m., Nov. 30, when the water reached a point 4 ft. above the crown of the arch at the portal, the air which had been forced into the heading began to break into the atmosphere, bubbling up through the water violently. The pumps were slowed down and the escape of the air lowered the water to the level of the portal. The full 100 lb. of air was then blown into the tunnel to ventilate it. At 7:30 p.m. the water reached a level of 4.5 ft. below the crown of arch at the portal, which meant that it was 13.5 ft. deep at the portal, diminishing to nothing at a point 2,600 ft. from the portal, or 900 ft. from bulkhead *A*. As it was most important to know the actual conditions in the heading, the

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Engineers' Agent and Resident Engineer manned two rowboats and with safety electric lamps proceeded to the heading, the pumps holding the level of the water. Heavy timber jams were encountered and had to be cleared away as the boats proceeded. On reaching the face of bulkhead *A*, it was found that, while the safety door had been dropped as reported, it had jammed on something (afterward found to be a small piece of wood) and had not closed tight. This, together with the 8-in. drain pipe, was responsible for flooding the Astoria end of the tunnel. Also, when the heading was pumped full of cement grout, the partly open door allowed the grout to run out into the main tunnel for a distance of 500 ft. A dam that had been built to hold drainage water while concreting the invert, stopped the flow of the grout along the tunnel invert so that the latter gradually formed a bank against the door and finally sealed it off. This bank was from 12 ft. deep at the bulkhead to 1 ft. deep 500 ft. distant, and varied from fairly well-set cement at the doorway to white mud farther away, through which one had to wade.

The inspection showed that the only leaks into the tunnel were through a 3-in. cable pipe (see Fig. 9) and through one of the 8-in. drain pipes (whose valve had not been closed, as already noted), amounting in all to less than 1,000 gal. per min., with practically no pressure. Through the open drain pipe and an 18-in. pipe that led away its discharge to a point 1,000 ft. distant there had run into the tunnel about 500 cu.yd. of green sand, coal and refuse. This was entirely separate from the grout. The party reached the shaft again at 9 p.m. The unwatering of the tunnel was completed at 4 p.m., Dec. 1.

On Dec. 3 a trench was excavated in the grout bank to get access to, and control of, the valves on the bulkhead drains, from one or more of which water was flowing. Two of the pipes were found closed, but the third pipe was open and running a part stream. As soon as the valve was moved, water broke out in large volume. The valve evidently had choked with rubbish from the leak and, fortunately, had remained so during the unwatering of the tunnel and the subsequent period. It was most fortunate that the partial stoppage of this pipe did not give way while the inspection party was in the heading on the night of Nov. 30. The condition of this pipe accounted for some of the peculiar and sudden changes in pressures and conditions which had occurred during pumping.

The large flow caused by disturbing the valve reduced the pressure at the gage in bulkhead *B* from 32 to 17 lb., showing direct connection between the two and showing also that the source of the leak had not been completely shut off from the river. The valve was then regulated so as not to disturb the pressure between bulkheads.

In the meantime work had been started on an additional safety bulkhead reinforced with rails, 60 ft. back of bulkhead *A*, for additional protection of shaft and tunnel. The pumping plant at the Astoria shaft was increased to a capacity of 9,800 gal. per min., which was greater than the boiler capacity.

Final Grouting of the Leak

On Dec. 16 drilling of test holes and core borings into the side of the tunnel just outside bulkhead *A* was begun, in an attempt to locate the water-bearing seam and grout it to shut off the remaining connection with the river. The test holes were calculated to be only about 20 ft. from the seam and were carefully directed to intersect the line of the seam as plotted from the data

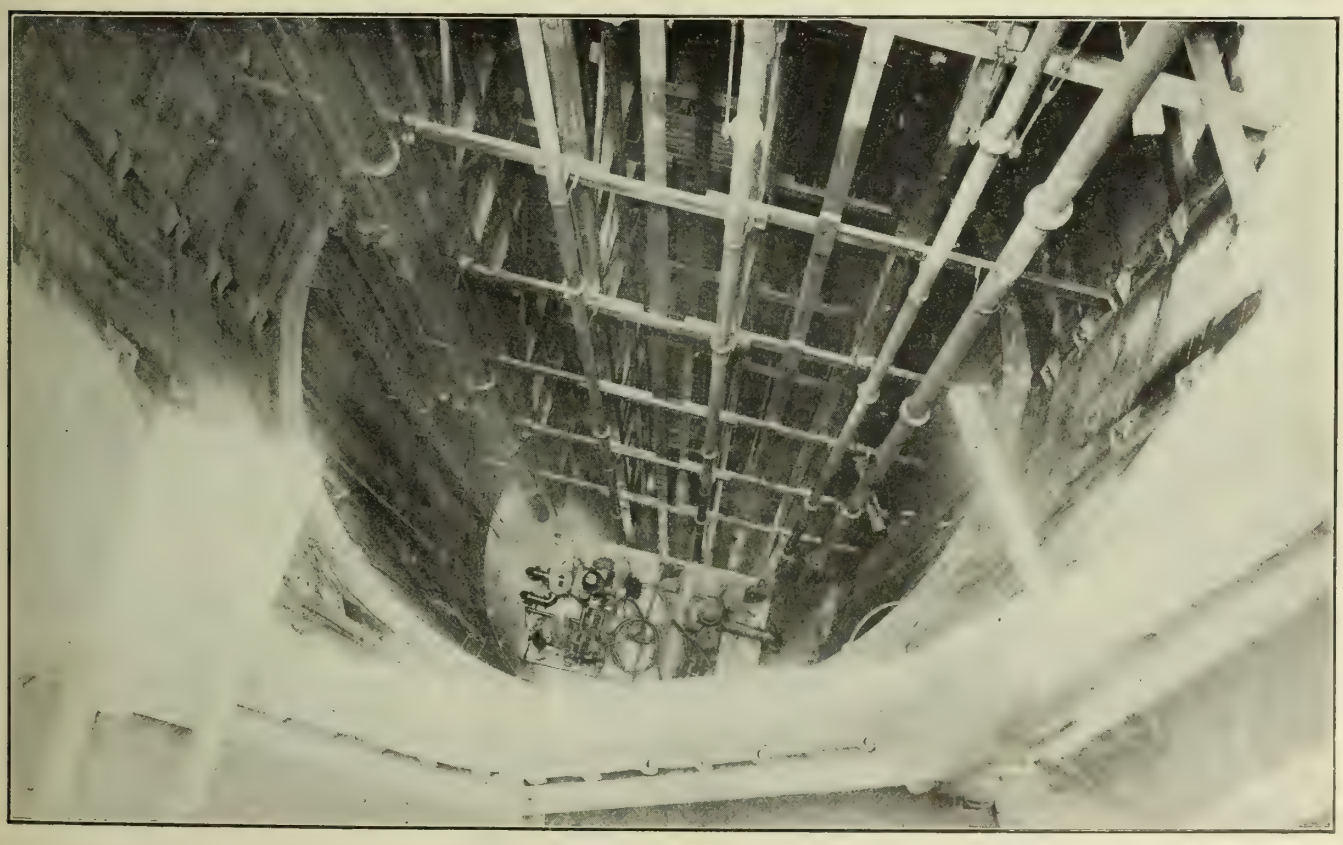


FIG. 8. PUMPING OUT THE ASTORIA SHAFT, NOV. 24, 1913
Three air lifts in operation. Pumps on pontoon started a few hours later

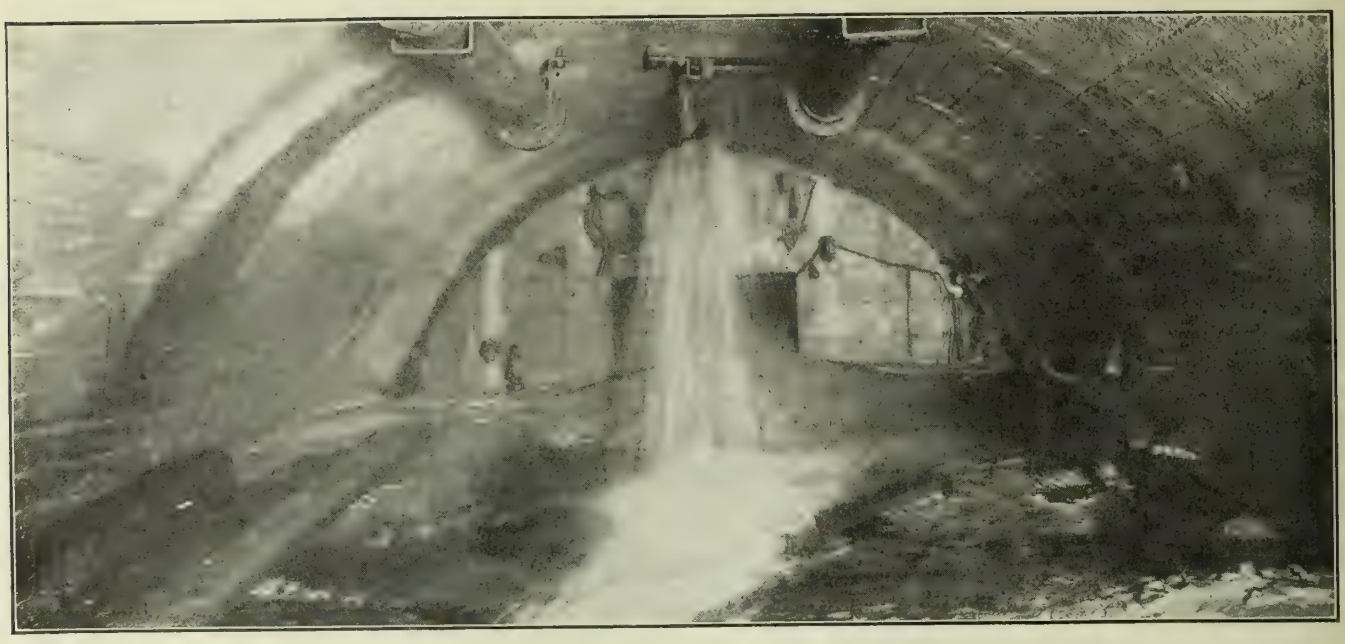


FIG. 9. BULKHEAD AND GROUT BANK

Dec. 1, 1913. Showing grout bank which piled up against bulkhead door and finally stopped flow of water. Door had jammed on stick of wood, allowing water and grout to come through. Drain pipes are 3 to 4 ft. below door

available. The core borings were aimed to reach the seam at a point further in, nearer the original water hole. About 17 test holes and 10 diamond-drill core borings were drilled into the side of the tunnel and through the bulkhead *A* into the bench near the water hole.

One of these test holes, about 22 ft. long, on Dec. 17 struck decomposed rock (green sand) and water under the full pressure. It was grouted with 3,351 bags of cement under high pressure. Conditions were noted by means of pressure gages on bulkheads *A* and *B*, and by permitting pipes in bulkhead *B* to remain open. Grout appeared at once at bulkhead *B*, showing that the grout hole was connected to the original leak and that the latter was still open into the heading. This grouting was effective in stopping the flow.

While the grout was being given time to set, a thorough exploration of the bench and heading was made through bulkhead *A* by means of core borings, but no further water was encountered. This work was completed on Jan. 4, 1914, three months after the flood of Oct. 5.

Excavation of Grout from Heading

On Jan. 5 excavation of the grout from the heading between bulkheads *A* and *B* was begun (see Fig. 7, p. 677, last week's issue). The bulkhead door was found jammed open by a stick of wood 4 in. by 1 in. The door was opened on Jan. 7. A drift through the grout was completed up to the door in bulkhead *B* and the door opened on Jan. 13. The entire space between bulkhead *A* and bulkhead *C* was filled with grout except for some sand at the bottom; and the space between bulkhead *C* and bulkhead *B* was filled with grout to within 2 ft. of the top. This grout was highly stratified, some of it being set fairly hard, while next to it would be a layer of grout of the consistency of chalk.

A most peculiar fact was that, while the total amount of cement used in grouting from both ends was only about 600 cu.yd., nevertheless 1,200 cu.yd. of solid grout was removed from the tunnel and the space between bulkheads, not to mention the quantity that evidently must have remained in the seams and stopped the flow of water.

This more than doubling in volume of the grout can only be explained on the assumption that cement in the form of grout does not maintain constant volume. The fact that the discharge of sand and débris from the leak was mostly carried 1,000 ft. away and kept entirely distinct and separate from the white material, and, further, that this discharge had no white material in it whatever, makes it improbable, in the writer's opinion, that the increased volume was due to a mixture of grout and dolomitic sand from the leak. The discharged material was all very dark in color, and the sand from seams had always been dark except in a very few instances when material similar to beach sand had come in.

Most of the grout was poorly set and was in fact largely removed with picks. The diamond bit was found embedded in a block of grout that in turn was buried under 4 ft. of green sand and débris, being completely separated from the main mass of grout. The removal of the grout was completed on Jan. 14.

The top of the remaining bench between bulkheads *A* and *C* was trimmed off 2 ft. below springing line and a concrete arch invert built over the entire top of the bench, bonded underneath the concrete arch lining. The purpose was to explore with test holes the entire bench and grout any water seams through the invert arch before excavating. This invert was completed Jan. 20.

Bench Excavation Resumed Under Protection of Temporary Invert

On Jan. 22 the excavation of the 23.5 ft. of bench between bulkheads *C* and *B* was resumed very slowly, preceded by many test holes. The drilling of test holes systematically located was also begun through the invert on top of the bench between bulkheads *A* and *C*. On Jan. 27 water and green sand under pressure was encountered in some of these test holes just south of bulkhead *C* and grouted. On Jan. 31 very bad ground was exposed in the west side of the excavation between bulkheads *C* and

B, and at 3 a.m., Feb. 1, water broke out and flooded this section to springing line but developed no pressure. The section was lined with thick concrete walls, draining the water through pipes that were later grouted.

After the top of the bench between bulkheads *A* and *C* had been thoroughly explored with test holes drilled through the temporary invert, three test-hole pits were excavated across the bench and concreted, in order to allow still deeper exploration with test holes from these pits. In all, 284 test holes were drilled in the bench between bulkheads *A* and *C*.

On Feb. 16 excavation of the bench in the danger section just north of the Astoria bulkhead *A* was resumed, and advanced very carefully and with as little blasting as possible. As soon as each section of about 20 ft. was excavated, it was immediately lined with concrete before proceeding farther. The rock of this entire section was very much disintegrated, wet and full of seams.

Seam That Caused the Flood Laid Bare

On March 2-4, 1914, the second section, 17 to 46 ft. north of bulkhead *A*, was excavated. The rock was very bad. The excavation on its westerly side exposed what was undoubtedly the seam that caused the flood of Oct. 5, 1913.

This seam was from a few inches to 2½ ft. wide, as exposed. Portions of it were filled with refuse exactly like what came in during the flood, other portions were filled with grout, and still others with a combination of grout and refuse. The west side of the excavation was very bad disintegrated rock and seams of sand and grout. At one point there was a synclinal fold which changed the stratification from 25° with the horizontal abruptly to the vertical. One seam was grouted solid 6 in. thick. Several flows of water occurred, during one of which a seam was exposed for an area of 7x9 ft. (apparently a vertical section) and a water hole washed out 3½ ft. square. They were stopped by grouting through pipes and drill holes without unusual difficulties.

Excavation of the bench was completed on March 19, except for a small portion underneath bulkhead *A*, which could not be removed until June 16, 1914.

Cast-Steel Lining in Trouble Zone

It was decided to line 400 ft. of the tunnel through the trouble zone with cast-steel rings. Work was begun on this Apr. 17, 1914, and completed Nov. 29. During the placing of steel rings the tunnel and shafts at each end were always kept protected by safety bulkheads, three additional ones being constructed for this purpose. No further flows of water occurred, however. The removal of these bulkheads was completed Nov. 24, 1914.

In the meantime the lining of the rest of the tunnel with concrete was going forward. The concrete lining (including the concrete inner lining of the steel rings) was completed Jan. 10, 1915. The first piece of the 72-in. gas mains was lowered and placed in position Jan. 23, 1915. The work of installing the two mains is now nearing completion.

Quantities of Materials; Accidents

Eight safety bulkheads across the full-section tunnel and three across the heading were constructed to protect the tunnel from floods. In addition 35 temporary bulkheads had been built over portions of the heading or bench to confine water for grouting.

The construction of the tunnel involved about 100,000 cu.yd. of excavation, including surface and miscellaneous, of which about 90,000 cu.yd. was rock. Of this 39,500 cu.yd. rock was crushed on the job, and largely used in the concrete lining. Concrete placed amounted to 36,000 cu.yd., of which 32,000 was for permanent lining. The lining required 200,000 bags of cement; foundations, bulkheads, etc., 27,000 bags; for grouting 118,000 bags was used; making a total of 345,000 bags.

Test-hole drilling to explore for water included 3,318 holes of a total length of 43,300 ft.; they were grouted

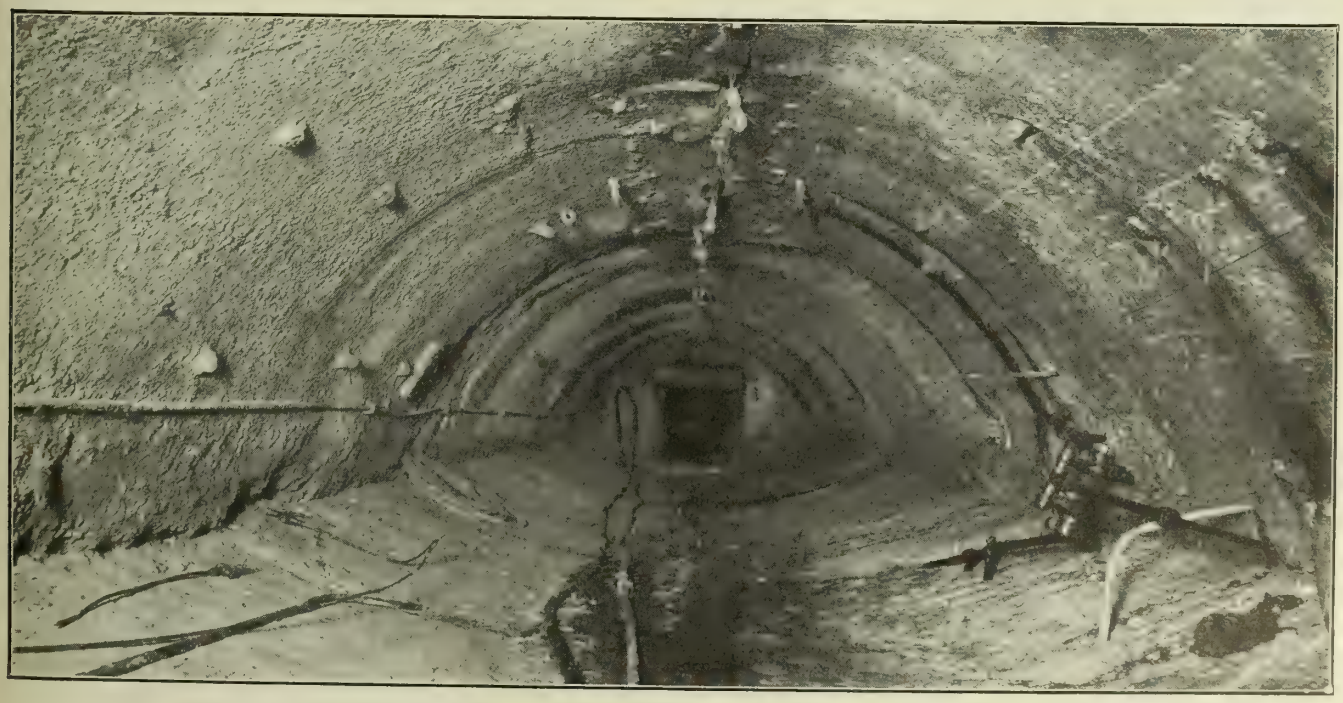


FIG. 10. TEMPORARY CONCRETE INVERT ON TOP OF BENCH BETWEEN BULKHEADS A AND C
Jan. 22, 1914. Constructed for protection in exploration of bench for water before removal

with 26,700 bags of cement. Further, 17 diamond-drill holes totaling 1,500 ft. were drilled, consuming 1,800 bags of cement in grouting them. For grouting shaft and tunnel lining, both concrete and metal, 63,000 bags of cement was used. Grouting behind bulkheads consumed 26,500 bags.

For blasting, 195,000 lb. of dynamite was used, with a record of only one accident from its use, resulting in only one death. The coal consumption was 62,000 long tons (up to Jan. 1, 1915). About 226,000,000 cu.ft. of water was pumped out of the tunnel, representing a consumption of approximately 628,000 hp.-hr. for pumping alone.

Notwithstanding the extremely hazardous nature of the work, extending over a period of 4½ yr., only six fatal accidents occurred, of which only one was due to dynamite and none to the dangerous conditions due to floods. This is perhaps a unique record for construction work of a similar nature, and is due to the unusual precautions taken for safety.

Inception of Project and Organization

The credit for the inception and carrying out of the project of providing for the ultimate removal at a future date of all the gas plants from Manhattan to a great central plant on Long Island (the Astoria plant) and the conveying of gas from this plant to Manhattan and Bronx by means of tunnels is entirely due to William H. Bradley, Chief Engineer of the Consolidated Gas Co., who originally conceived this plan nearly 30 years ago and, with the completion of the tunnel described in this article, now sees it finally certain of being carried to completion.

The entire work of engineering, organization and construction was carried on by the Consolidated Gas Co., of New York, through its subsidiary, the Astoria Light, Heat and Power Co., under the direction of William H. Bradley, Chief Engineer; W. Cullen Morris, Engineer of Construction; and Harold Carpenter, Resident Engineer; by Jacobs & Davies Inc., as Tunnel Engineers, who engineered the Pennsylvania Railroad Hudson River tunnels, the Hudson & Manhattan Ry. tunnels and other similar work in other parts of the world. Vivian Messiter, Engineer's Agent, was in charge of the Astoria tunnel construction work for Jacobs & Davies.

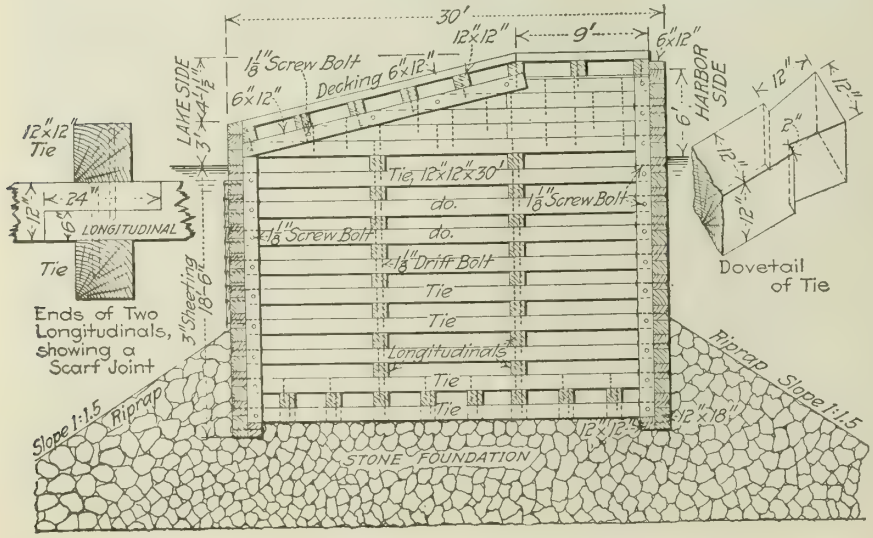


FIG. 1. CROSS-SECTION OF STONE-FILLED TIMBER-CRIB BREAKWATER AT CHICAGO

Chicago Breakwater Extensions

The establishment of a lake-front harbor at Chicago and the construction of the municipal pier, described in *Engineering News* of July 29, 1915, necessitate the provision of breakwaters to form an inclosed area and afford protection for vessels approaching or moored at the pier. The present breakwater is a stone-filled crib structure about 5,500 ft. long, extending northwest from its outer end toward the shore. The new work provides for closing the gap at the north end and extending the breakwater from the south end. The work is under the direction of Lieut.-Col. W. V. Judson, United States Corps of Engineers, Chicago. G. A. M. Liljencranz is United States Assistant Engineer at Chicago.

Timber-Crib Breakwater

The extension to close the gap between the present breakwater and the shore will consist of 2,250 ft. of stone-filled crib running due west, leaving a 400-ft. opening for ships between the old and the new work and extending to within 540 ft. of the shore. At present only the outer 1,500 ft. of this is to be built. The depth of water is from 19 to 24 ft., and the lake bottom is of clay covered by from 12 to 24 in. of sand.

The construction is shown clearly in Fig. 1. The cribs will be 30 ft. wide and 100 ft. long. The five cribs at each end will be 18½ ft. high on the lake side, and the others 16½ ft. high. They will be built mainly of 12x12-in. fir timbers, drift-bolted together and having the ends of the transverse ties dovetailed into the wall timbers. The bottom of each wall is a 12x18-in. footing timber backed by another 12x12 in. The cross-walls are about 8 ft. apart. At the corners of alternate cross-walls are posts, secured by scow bolts. The outer or lake side will have a sheathing of 3-in. white oak or maple plank placed vertically and secured by lagscrews. The top will have a deck of 6x12-in. planks 2 in. apart. The corners of the end cribs will be sheathed with steel plate.

A foundation of rubble stone will be laid in advance, at least two weeks before the crib is placed upon it. This will have a top width of 44 ft. with slopes of 1 on 1½, forming berms of 8 and 6 ft. on the lake and harbor sides of the crib. This foundation will be leveled before sinking a crib, so as to insure a continuous bearing for the longitudinal footing timbers. As soon as the crib is in place, it will be filled with stone to the top of the upper cross-ties, and riprap stone will be deposited along both sides to a height of 8 ft., with slopes of 1 on 1½. The superstructure or deck will be continuous over the cribs, and it will be filled with stone. The foundation will be of stones weighing from 50 to 200 lb. each, with not less than 10% weighing under 10 lb. For the upper 2 ft. of its thickness, however, the stones will weigh from 10 to 100 lb., to facilitate leveling the surface for the cribs. The filling will be of 3- to 120-lb. stones for the first five courses of the crib, and then stones weighing not less than 40 lb. each will be used. The riprap stones must weigh at least 200 lb. for the harbor side and 1,000 lb. for the lake side.

The east end of the breakwater, at the 400-ft. channel opening, will be protected by two clusters of 19 white-oak piles, wrapped with 1¼-in. wire cable. The piles will be about 6 ft. above the water, with bark removed to 1 ft. below the water. The tops will be rounded off and given three coats of hot carbolineum avenarius for 2 ft. from the top. These pile clusters will be surrounded by riprap of 1,000-lb. stones.

Rubble-Mound Breakwater

From the outer or southeast end of the present breakwater an extension will run due south for about 7,000 ft., with a 400-ft. opening opposite the mouth of the Chicago

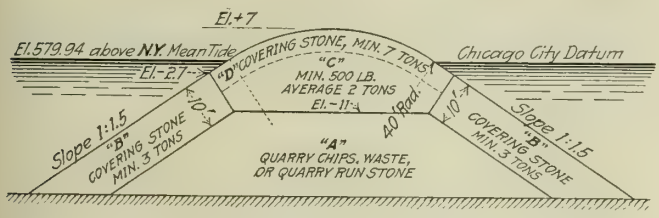


FIG. 2. CROSS-SECTION OF STONE RUBBLE-MOUND BREAKWATER AT CHICAGO

River. The present work, however, is for the first 2,270 ft. to this opening. The depth of water is from 27 to 31 ft.

This breakwater will have no cribs, but will be a mound of rubble stone approximately 125 ft. wide on the base, with side slopes of 1 on 1½ and a top radius of 40 ft., the crown being 7 ft. above the water. The cross-section is shown in Fig. 2.

The lower part of the core or central mass, extending to within 11 ft. of the water, will consist of quarry chips or waste, or quarry-run stone, with not more than 5% (in volume) of stone dust in any one load. The upper part of the core will consist of stones averaging 2 tons each and weighing not less than 500 lb., except for a limited amount of smaller stone to block and level the covering or outer course.

The sides of the core will be covered to a thickness of 10 ft. with stones weighing not less than 3 tons. This covering will extend to within 27 ft. of the water surface. The covering of the crown of the breakwater will be 5 ft. thick and composed of stones weighing not less than 7 tons each.

The stone for the two portions of the core (*A* and *C*, Fig. 2) may be placed by dropping or dumping it into the water, but the use of dump scows will be permitted only for the lower portion *A*, which includes the smallest class of material used on the work. The stones for the covering of the sides *B* and crown *D* must be set in place before being released. The former *B* must be placed before the upper part of the core *C* is deposited. The latter *D* must be placed as the core *C* is built up. All covering stones must be well supported on the underlying stones, the interstices being kept at a minimum for this class of work.

The amount of stone required per 1,000 ft. of breakwater in 29 ft. of water is estimated as follows: Lower core, *A*, 65,730 tons; side covering, *B*, 42,190; upper core, *C*, 24,810; crown covering, 14,460—total, 147,190 tons. This is based on an assumed average weight of 96 lb. per cu.ft. of stone and voids, with an allowance of 10 per cent. added for settlement and for stone outside of the normal section.

Volunteer Engineer Officers

Engineers who have been impressed with the "preparedness" arguments now being advanced so earnestly by those who think this country ought to be ready for war any moment will be interested in the recently amended requirements which must be complied with by candidates for commissions as officers of volunteer engineers. This amendment was issued by the War Department on Aug. 25, 1915, as General Orders No. 50.

After referring to the necessity for passing physical and moral examinations, and answering general questions as to experience, submitting documents in evidence before boards of officers of the Corps of Engineers and of the Medical Corps, United States Army, the order proceeds to give the qualifications for the grades of lieutenant and of captain. These are as follows:

3. Lieutenant—(a) The candidate must be an engineer in the active practice of his profession or in some business immediately connected with or concerned in engineering matters.

(b) He must either hold the grade of junior engineer, civil, electrical or mechanical, or higher grade in the civil service, or he must be a graduate from an approved engineering college, or belong to one of the following national engineering societies in a grade not lower than that shown opposite to each: The American Society of Civil Engineers—junior member; the American Institute of Mining Engineers—member; the American Society of Mechanical Engineers—junior; the American Institute of Electrical Engineers—associate. Or he must be or have been a noncommissioned officer of the grade of sergeant or above from one of the regular battalions of engineers.

4. Captain—(a) Same as 3 (a).

(b) He must either hold the grade of assistant engineer in the Engineer Department at Large or a corresponding engineer grade in the civil service in another department of the Government service, or be an associate member, or member of one of the national engineering societies enumerated under 3 (b), or have held a commission in the Corps of Engineers of the regular army.

(c) Sufficient knowledge of Field Service Regulations, Army Regulations and Tables of Organization to understand the type of information of which these regulations are the source.

5. Field Officer—(a) Same as 3 (a).

(b) He must either hold the grade of assistant engineer in the Engineer Department at Large or a corresponding engineer grade under the civil service in another department of the Government service, or be a member of one of the first three national engineering societies enumerated in 3 (b), or be a fellow of the American Institute of Electrical Engineers, or have held a commission in the Corps of Engineers of the regular army not more than two grades below that for which he desires to be listed.

(c) In addition to fulfilling the qualifications given in 5 (a) and (b), the candidate will be required to pass the examination prescribed herein for a field officer of infantry and an examination on the duties of engineer officers and troops in war, what they are and how they are performed.

Equal weights will be given to each of these examinations.

A Train-Ferry Steamer designed to break its way through heavy ice has been built for the Canadian government, to maintain communication across Northumberland Strait, between the mainland and Prince Edward Island. The distance is about 10 mi. The steamer is 285 ft. long and 52 ft. beam, and has a loaded draft of 18 ft. The sides are inclined at the water line, so that any pressure from the ice will tend to lift instead of to crush the hull. There are two tracks, and the stern of the ship is open to enable cars to be run in and out at the dock. For propulsion there are twin screws with triple-expansion engines aggregating 5,000 hp. A third screw under the overhanging bow is driven by a similar engine of 2,000 hp.; this serves to break up the ice by disturbing the water beneath it, and serves also to clear the ferry slip of ice. The six Scotch boilers are arranged beneath the train deck, with uptakes leading through the sides of the superstructure to four smoke-stacks, two on each side of the ship. The steamer has been built by Armstrong, Whitworth & Co., of Walker-on-Tyne, England.

Extraordinary Rain in St. Louis with Study of Runoff

By W. W. Horner*

In the afternoon of Aug. 19 the tail end of the Galveston storm reached St. Louis, and during the evening of that day and continuing up to the morning of the 21st the heaviest rainfall ever recorded in St. Louis occurred. The hourly intensities from one of the gages is shown by curve *A* and the mean intensities for three hours preceding by curve *B*. The intensity did not exceed an average of 0.9 in. in any one hour, but the total precipitation for the storm and for the 24-hr. period was nearly double any previous record.

The rain was accompanied by a high wind, generally from the north, which at one time reached a velocity of nearly 50 mi. per hr. The north walls of almost every building in the city were saturated, a great deal of plastering and decorating ruined and the outsides discolored by the ensuing efflorescence. Owing to the moderate intensity of the rain there was very little damage to the sewer system, one or two minor cave-ins of the older sewers occurring but no serious overcharge.

The total rainfall shown by a number of automatic gages is given in the accompanying table.

INCHES OF RAINFALL BY EIGHT ST. LOUIS GAGES

Station	Aug. 1-19	Aug. 19-20-21
Kingshighway and VonVersen	4.92	10.59
Shawmut and Ridge	4.17	10.54
Union and Patton	4.61	9.98
Forest Park	4.80	10.59
Kingshighway and Natural Bridge Rd.	4.83	8.54
Twenty-fifth and Mullanphy	3.59	8.12
Weather Bureau	3.67	7.39
Clayton	2.85	10.11

The first four gages shown are in the drainage area of the River des Peres within the city limits, and the Clayton gage is near the center of the watershed, about two miles west of the city limits. The Weather-Bureau gage is near the Mississippi River on top of a twenty-story building. All the other gages listed belong to the City of St. Louis and receive the attention of trained observers. The unusual number of automatic gages located closely together in the city is accounted for by the study that has been going on for some time of the variation in rates of rainfall from severe storms over small areas.

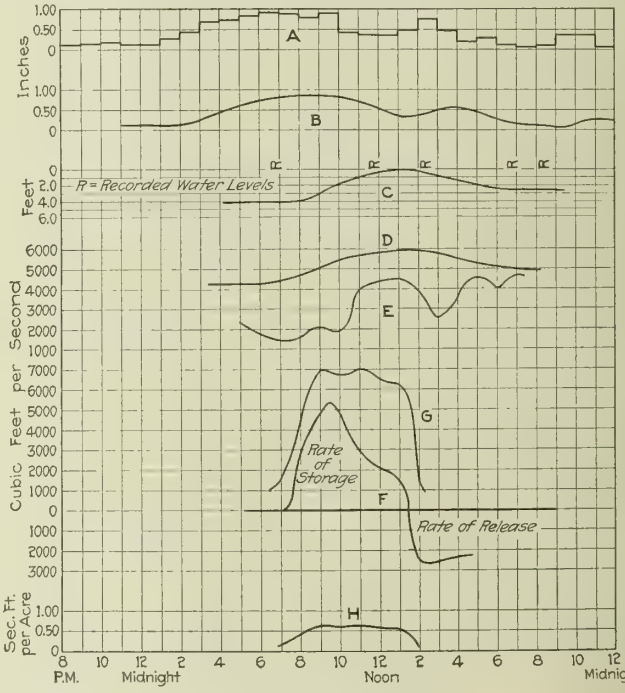
Owing to the general nature of the storm and the low intensity of rainfall, it is improbable that the variation in the totals recorded can be accounted for except by the very high wind, which at times drove the rain nearly horizontally. The five Western gages, which checked so closely at from 10 to 10.6 in. for the storm, are all on the roofs of two-story buildings and have some windbreak within a short distance to the north. Also, the registration of the automatic apparatus was quite closely checked by the amount of water in the reservoirs after the rain. There is very little reason to doubt, therefore, that the rainfall for the storm was approximately 10.6 in. and that for the 24-hr. period about 10.2 in.

St. Louis is unfortunately situated, however, in that along the whole crescent of its western limits it receives drainage from the adjoining county. The largest of the streams is called the River des Peres.[1] It has a total watershed of 70,000 acres, of which 16,000 is within the city limits. During the excessive rain of Aug. 20, this stream reached a stage far beyond any previous records. A brief description of some of the facts may be of interest.

Where the stream enters the city limits near Delmar Ave., the total drainage area from the county is approximately 10,000 acres. Three miles below, in Forest Park, it is crossed by a concrete-arch bridge carrying Clayton Road over it. This bridge has a span of 75 ft. and its arch crown is about 33 ft. above the stream bed. During most of the day of Aug. 20 Clayton Road was the only clear roadway across the stream, all other bridges, both highway and railroad, being flooded and submerged.

Between the point of entrance mentioned and Clayton Road, the stream receives the lateral drainage from 2,750 acres of sewered area and 2,240 acres of park and county area, making a total drainage area at Clayton Road of about 15,000 acres.

Early in the morning it was appreciated that the flood would exceed all records and that it would be advisable, if possible, to secure a measurement of the discharge,



RAINFALL AND RUNOFF AT ST. LOUIS, AUG. 20, 1915

but on account of the poor means of communication and because several bridges that had previously been selected as gaging stations were afterward found to be submerged, it was not until 6 p.m. that a party and the instruments were gotten together at the Clayton Road bridge, the only place where the whole flow was united in one stream. At that time, the water level had fallen from a high-water mark of 53.32 ft. above city datum to El. 51.

Current meter readings taken between 6 and 7 p.m. gave a mean velocity near the surface of 5.85 ft. per sec. Assuming a general average velocity of 4.6 ft. per sec., the discharge through the wetted area of 1,130 sq.ft. would be 5,200 sec.-ft., and it seems probable that the mean velocity at the flood stage must have been about 4.8 ft. per sec. and the discharge through an area of 1,242 sq.ft. about 6,000 sec.-ft.

Curve *C* shows the approximate stages of the stream below high water from 7 a.m. to 7 p.m. of the 20th. The points marked *R* are measurements made by the superin-

*Engineer of Design, Sewers and Paving, St. Louis, Mo.

[1]This stream enters at about the midpoint of the western limits, flows southeast through the main residence section and through Forest Park to a point about 1½ mi. east of the limits, then southwestwardly through a manufacturing district to the city limits again, at Lindenwood, where it is joined by a still larger branch from the county and follows around just inside of the limits of the city to the Mississippi River at the southern end of the town.

tendent at the park stables about half a mile above Clayton Road. The other points are estimated and were introduced for the purpose of the analysis which follows.

As there has for some time been a strong movement to have this stream inclosed as a sewer, it is of interest to compare the measured flow of 6,000 sec.-ft. with what might have occurred had that portion of the stream within the city been completely inclosed.

From high-water marks taken all along the stream and from the standard contour maps of the city, it has been estimated that at the time of the crest about 18,000,000 sq.ft. within the city was under water, most of this being in Forest Park. It has been further estimated, with much less accuracy, that at the beginning of the last sharp rise (that is, at 6:00 a.m., when the water was 4 ft. below the crest) about 14,000,000 sq.ft. was under water. These areas were prorated in accordance with the stages of the river shown on curve *C*, and from the mean flood area in each hour and the rise in that hour, the amount of water going into storage within the city for each hour is calculated. This amount is shown by curve *F*.

The actual flow at Clayton Road at the stage 2½ ft. below the crest had been measured and found to be 5,200 sec.-ft. The discharge at the crest had been calculated at 6,000 sec.-ft. The discharge at other stages within 4 ft. below the maximum was approximated and shown by curve *D*. From the discharges shown in curve *D* was then deducted the probable lateral drainage between the city limits and Clayton Road. This deduction consisted of the runoff from 2,750 acres of sewered area taken at from 80 to 90% of the previous hour's rainfall (an hour being approximately the critical time for the tributary sewers) and also of the runoff from 2,240 acres of park and county area taken at from 25 to 90% of the rainfall for the previous hour, the percentages being prorated at from 25 at 6 a.m. to 90 at 2 p.m. Subtracting these values from curve *D*, curve *E* was obtained. Of course this curve shows an entirely too sharp condition of rise and fall, as the storage in the county on the main stream, of which no account has been taken, would have tended to smooth out the discharge at the city limits and the storage in the sewered and park areas would have been sufficient to balance with curve *D*. For the purposes of this analysis, no attempt was made to assume the actual form that curve *E* should have had.

We have then from curve *E* the amount of water passing Clayton Road due to the runoff from the county, and from curve *F* the amount of runoff from the county that entered the city but was used up in storage before reaching Clayton Road. The summation of the ordinates of these two curves produces curve *G*, which is an approximate theoretical discharge of the county drainage area, and dividing the points on this curve by the acreage of 10,000 gives curve *H* as the approximate runoff per acre of the county area—the maximum being 0.64 sec.-ft.

The analysis given is of course highly speculative and presents no claims to accuracy, as the data on the rate of rise are crude and the discharges, approximately from one measurement, probably missed many variations of importance. It seems safe to say, however, that the maximum discharge from the rural area must have been at least 0.5 sec.-ft. per acre.

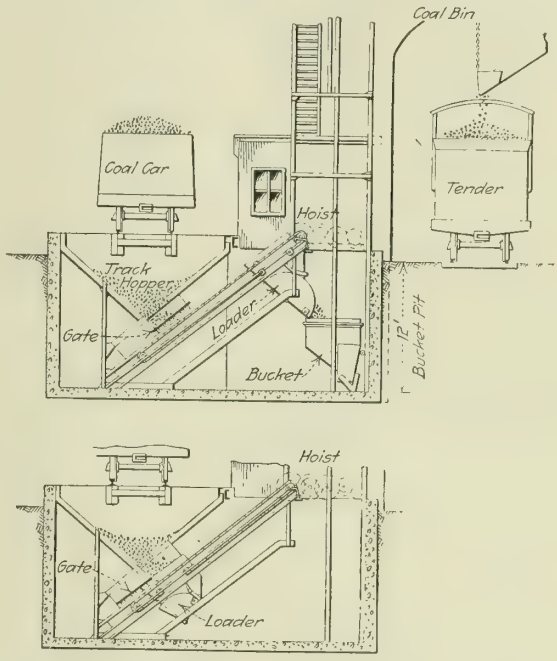
Curve *B* shows the mean intensities for 3-hr. periods, which is approximately the critical time at Clayton Road. Comparing the 0.5 already given with the maximum 3-hr. intensity of 0.85 shows a percentage of runoff of at least 60, which is higher than engineers have been wont to assume for a drainage area of this character and size.

Another interesting point in the demonstration is the evidence that had the storage been eliminated, the crest would have occurred at about 10 o'clock, which is the time indicated by the intensity curves.

Shallow-Pit Coaling Station

A new design of coal-handling plant for railway coaling stations of the elevator-bucket type has a bucket pit only 12 ft. deep. This reduces the cost of the underground work and may preclude trouble with water which would be encountered with the deeper pit usually required where the coal is fed by gravity from the track hopper to the elevator bucket.

The special feature, as shown in the accompanying drawing, is that the coal is fed through an undercut roller



LOCOMOTIVE COALING STATION WITH SHALLOW PIT AND MECHANICAL LOADER

gate to a traveling loader, or bucket. This loader runs up inclined guides and dumps the coal into the elevator bucket, which in turn delivers it to the elevated bin in the usual way. The loader is of 2½ tons' capacity. It is geared to the automatic electric hoist that operates the elevator bucket, and the movement of the loader effects the opening and closing of the gate. This coaling plant is manufactured by the Roberts & Schaefer Co., of Chicago.

A Large Coal-Shipping Pier for the Baltimore & Ohio R.R. is to be built at the Curtis Bay terminal, at Baltimore. It will be of steel construction, 700 ft. long and 115 ft. wide. Two car-dumping machines at the shore end will deliver the coal to belt conveyors leading to movable towers on the pier, from which it can be delivered to vessels on either or both sides of the pier. The car-dumpers will be able to handle 40 cars per hr. (50-ton cars). The conveyor belts will be run at speeds of 250 to 500 ft. per min., giving a capacity of 3,000 to 6,000 tons per hr. The total shipping capacity will be about 10,000,000 tons per yr. The pier was designed by Francis L. Stuart, Chief Engineer. Contracts are to be let soon, and it is expected that 18 months will be required for the construction. The cost will be about $1,500,000.

Construction and Operation of Gloversville Sewage Works—I

By H. P. Eddy* and H. J. Hanmer†

SYNOPSIS—The design, construction and cost of a 3,000,000-gal. sewage-treatment works are here given, and the operating results will be summarized in a second article. The works consist of coarse screens, primary settling tanks, fine screens, a dosing tank, trickling or sprinkling filters, secondary tanks, final sand filters and sludge pumps and beds.

Construction and Cost

This and a following article are designed to give, not only the main features of the design and construction of an unusually complete sewage-treatment plant, but also a summary of its cost and, more unusual, a review of several years' operation.

In 1910 Gloversville had a population of 20,642, about 32 mi. of sanitary and 5 mi. of storm sewers, besides 3 mi. of 15- to 28-in. intercepting and outfall sewer. A large portion of the sewage consisted of troublesome wastes from 20 to 30 tanneries. From 1899 to 1909, about 70 lawsuits due to the pollution of Cayadutta Creek were brought against the city and the mill owners. In 1908-9, experiments on the treatment of the sewage were conducted.[1] As a result of these experiments and of other studies, it was decided to treat the sewage by screening, sedimentation, sprinkling filters, secondary sedimentation and intermittent sand filtration. A high degree of treatment was considered necessary, both because of the character of the sewage and the fact that the dry-weather flow of Cuyadutta Creek at the sewage works was sufficient to dilute but one-third of the volume of sewage, the drainage area being only 14.2 sq.mi. It was also decided that the mill owners must install and maintain settling tanks for the removal of suspended matter from their wastes before the latter were discharged into the city sewers.

Works to treat a daily average of 3,000,000 gal. of sewage, with conduits for a flow of 10,000,000 gal. a day, were designed in 1909 by Metcalf & Eddy, Boston, Mass. The works were put in operation on Dec. 1, 1912.

Preliminary Screening and Settling

Screen Chamber—The sewage discharged from the trunk sewer passes into a screen chamber 12 ft. square in plan, containing a screen made of ⅜x1¾-in. wrought-iron bars spaced 1½ in. c. to c., inclined at an angle of about 60 deg. to the horizontal. The effective area of the screen under ordinary operating conditions is about 15 sq.ft. and the total area is 84 sq.ft.

Primary Settling Tanks—Each of the two primary settling tanks (Figs. 1 and 2) is of reinforced concrete, circular in plan, 36⅓ ft. in diameter at the top of the cylindrical portion and 35 ft. in diameter at its base. The inverted conical bottom is 18½ ft. deep, with side slopes of 1 to 1. The depth of sewage in the tanks under normal operating conditions is about 49 ft. The sewage enters each tank at the top through a wooden trough to a wooden down pipe 3 ft. in diameter, and flows down and out under the edge of a distribution cone, also of wood. The sewage then passes up about 31 ft. to the wooden collectors, or outlet troughs, which are distributed over the surface in order to draw as nearly as practicable a uniform flow from all parts of the tank. The sides of the wooden distribution cone in the west tank are built on a slope of 45 deg. and those in the east tank on a slope of 60 deg., which latter slope has been found to be the more satisfactory. From the collector troughs the sewage goes to the dosing tank for the sprinkling filters.

The total capacity of each tank below the flow line is approximately 268,500 gal. Based on the assumed sewage flow of 3,000,000 gal. per day the velocity of sewage in the vertical tanks is 8.7 ft. per hr. and the time of passing through the tanks, 3½ hr.

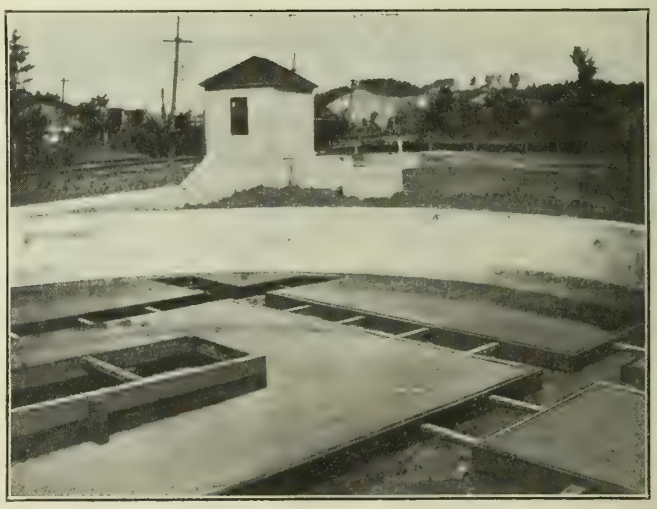


FIG. 1. PRIMARY SETTLING TANK, GLOVERSVILLE, N. Y.

The excavation for these tanks was in gravel, sand and blue clay, with a little hardpan near the bottom. An area 85 ft. long and 47 ft. wide was excavated, using 10x10-in. bracing with 2-in. sheeting. The groundwater encountered required a large pumping equipment, consisting at first of two 6-in. pulsometer pumps and finally of two 8-in. centrifugal pumps. In addition to these, two 3-in. diaphragm hand pumps were operated, using four men to each pump, to lift the water from the bottom excavations 6 or 8 ft. to the pulsometers. The material was shoveled into a 1-yd. skip and then hoisted to the surface by a derrick. The concrete (1 part cement, 6 parts aggregate, hand-mixed) was placed directly on screened gravel, and wrought-iron pipes were inserted at several points in the conical bottoms to serve as drain pipes during the construction work. After the concrete in the conical bottoms had hardened, these pipes were used as

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†City Engineer, Gloversville, N. Y.

[1] A report on these experiments was noticed in the "Engineering Literature Supplement" of "Engineering News," Dec. 15, 1910, p. 63.—Editor.

pump wells for the groundwater coming in through the screened gravel under the concrete and the wrought-iron drain pipes.

Fine Screens—The settled effluent passes in succession through fine screens of ½-, ¼- and ⅛-in. mesh, set in the channel leading to the dosing tank.

Dosing Tank—The dosing tank is approximately 13x24 ft. in plan, with a sewage depth of 3½ ft. (see section, Fig. 3). A 30-in. Pacific automatic dosing siphon discharges the tank automatically into a conduit leading to the trickling filters.

The side walls are 6 in. thick and 5½ ft. high, reinforced every 12 ft. with pilasters, which also support columns for the roof beams. The outside columns are grooved to receive side planks. The main roof beams are of reinforced concrete, 8x15½ in. in section, 12 ft. c. to c., with their tops 6½ ft. above the surface of the filter stone. The stay beams running at right angles to the main roof beams are 5x10½ in. in section, 24 ft. c. to c.

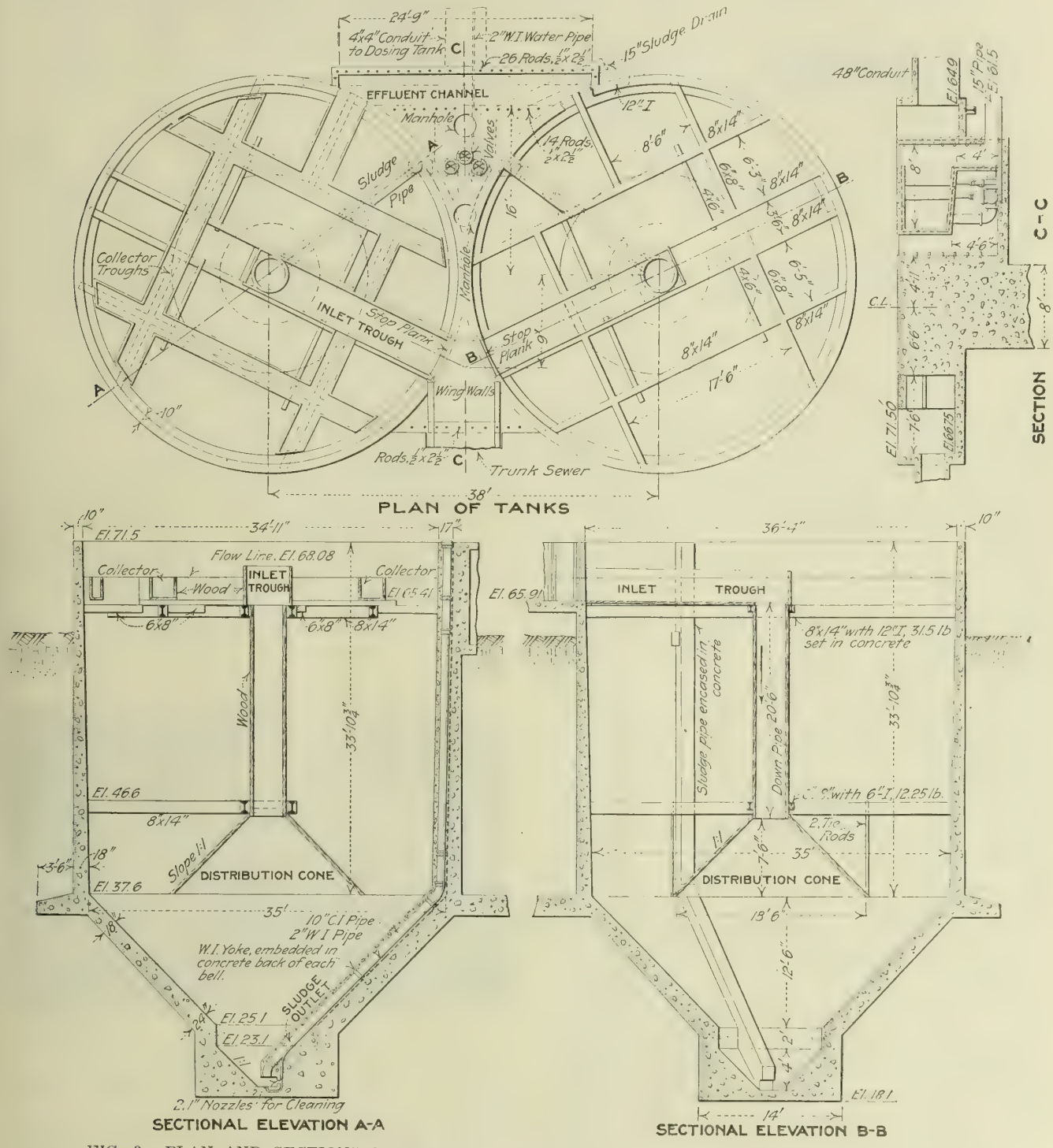


FIG. 2. PLAN AND SECTIONS OF PRIMARY SETTLING TANK, GLOVERSVILLE SEWAGE WORKS

Trickling Filters—The trickling filters have reinforced concrete walls and floors. Their surface area is 3.07 acres, divided into three equal units. The main distribution conduit is in the center of each filter unit.

The beams and columns (Fig. 4) support the wooden plank covering that is put over the filters during the winter months.

Distribution System—From each main distribution conduit there are 31 lateral distributors (Fig. 5), 12 ft. c. to c., on each side of the main distributor. These distributors are 6-in. vitrified pipe incased in concrete, and from

them 3-in. cast-iron risers, 12 ft. c. to c., extend to Taylor four-lobed square spray nozzles. There are 930 nozzles in the three units, or approximately 303 per acre, spaced 12 ft. c. to c. in each direction, with the plane of the nozzle orifice set about 8 in. above the surface of the filter stone. The maximum static head on the nozzles is 6.34 ft.

Crushed Stone—The 23,146 cu.yd. of filtering medium is 1- to 2½-in. crushed and screened limestone, from May-

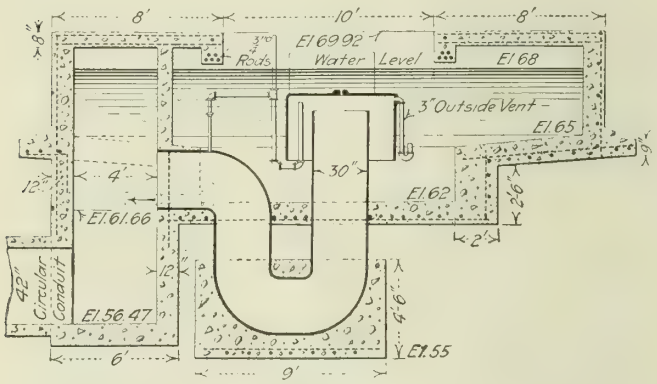


FIG. 3. SECTION OF DOSING TANK, GLOVERSVILLE SEWAGE WORKS

field, N. Y. The stone was delivered at the filter plant over a spur track to an unloading platform and discharged directly into dump cars of 1 cu.yd. capacity run underneath the platform, and thence hauled to any part of the filters over temporary narrow-gage tracks. The depth of stone in the filters ranges from 4½ to 4⅔ ft. and averages 4 ft. 7½ in.

Drainage System—The floor system consists of a 3-in. concrete floor on which 6-in. vitrified slotted half-round undercut tiles were placed with spaces of 1 in. between the ends and 3-in. between rows. The concrete floor was laid on a slope of 1 in 225 from the flushing gallery, in the center of each filter unit, to the outer edge where the underdrain is located. The half-round tiles are intended to support the filter stones, leaving free waterways for the filter effluent and providing space for ventilation. The distance from the flushing gallery in either direction to the main underdrain is approximately 60 ft.

The flushing gallery (Fig. 5) is 3½ ft. high by 2½ ft. wide, and is built directly over and as a part of the structure containing the main distribution conduit located in the center of each of the three filter units, the gallery and conduit being separated by a 6-in. reinforced-concrete floor, the top of which is flush with the top of the concrete drainage floor on either side. There are port-holes through the side walls on the top of this floor opposite the end of each line of floor tiles, for the purpose of flushing out obstacles in the drainage system.

The main underdrains, located on each of the long sides of each filter unit, are from 1 to 2 ft. wide and from 6 to 15 in. deep. They are covered by 3-in. reinforced-concrete slabs. The main underdrains slope 1 in 500 toward the inlet end of the filters.

Treatment of Sprinkling-Filter Effluent

Secondary Settling Tanks—There are two secondary reinforced-concrete settling tanks of much the same type as the primary settling tanks already described. Their total depth is 33¼ ft. The cylindrical portion of each tank is 35 ft. in diameter at the base and 36 ft. at the top. The inverted conical bottoms are the same as those for the primary settling tanks. The total capacity of each tank below the flow line is 121,000 gal.

On the basis of an average sewage flow of 3,000,000 gal. per day, the detention period in the secondary tanks is 1.2 hr. and the vertical velocity 8.7 ft. per hr.

The thickness of the shell of the tanks at the base of the cone is 20 in., at the base of the vertical side wall, 15 in., and at the top of the side wall, 9 in. These tanks were constructed after the primary tanks, the same braces and forms being used again as far as possible. Practically the same kinds of soil were encountered, but the ground-water was not so troublesome because of the lesser depth.

Final Treatment of Effluent

Sand Filters—There are three intermittent sand filters, having a total effective sand area of 2.72 acres. The excavation for these filters varied from 1 ft. to 12 ft. in depth and was practically all done with pick and shovel, most of the excavated material being hauled out in dump wagons, although some of the top soil, which was rather loamy, was hauled out with horse scrapers and some with dump cars. There is a 15-in. vitrified pipe main underdrain in each filter, and 6-in. lateral underdrains, all laid with open joints, the upper half of the bells being removed and the pipes surrounded with two layers of graded crushed stone. The filter sand is 3 ft. deep and was furnished under the following specifications:

> The effective size shall not be less than 0.25 nor more than 0.35 mm. The uniformity coefficient shall not be more than 3. The sand shall not contain more than 1 per cent. finer than 0.13 mm. and shall be entirely free from particles over 5 mm. in diameter. The sand shall consist largely of quartz grains and shall not contain grains liable to disintegration. It shall be free from loam, clay and dust, or perishable matter, and shall, if necessary to render it clean and of proper size, be washed and screened before it is placed in the filters.

The sewage is distributed over the surface of each sand filter by a trough with concrete bottom and wooden sides. Adjustable side openings in the carrier make it possible



FIG. 4. GLOVERSVILLE TRICKLING FILTERS AND WINTER-ROOF SUPPORTS

to control the quantity of sewage discharging to various portions of the filter surface.

Sludge-Pump Well—The sludge flows by gravity from the primary and secondary settling tanks to the sludge-pump well, which is a concrete structure 12x11½ ft. in plan and 17 ft. deep. Here the sludge is lifted about 15 ft. by a motor-driven centrifugal pump and discharged through 1,065 ft. of 15-in. vitrified pipe to the sludge-drying beds.

The pumping equipment comprises a Goulds No. 6 single-stage vertical centrifugal pump of 1,000 gal. per

min. capacity, driven by a 10-hp. Westinghouse motor, 850 r.p.m., operating on 60-cycle two-phase 220-volt alternating current. The pump is protected by a flat bar screen of $\frac{3}{8}$x1$\frac{3}{4}$-in. bars on edge, spaced 1$\frac{1}{2}$ in. c. to c.

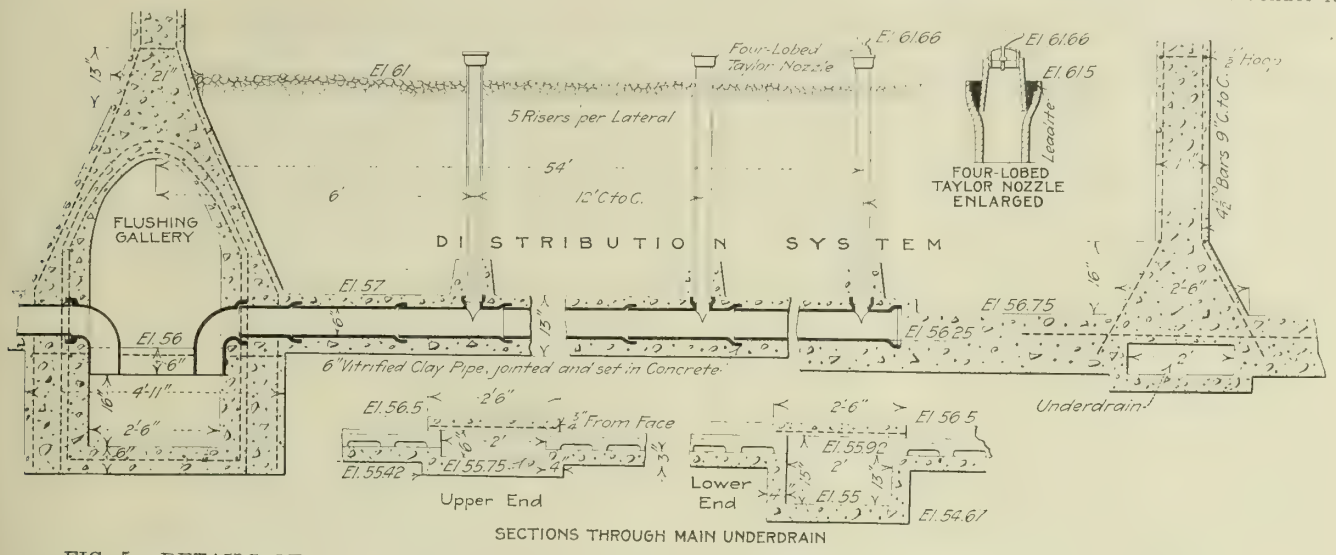


FIG. 5. DETAILS OF DISTRIBUTION AND UNDERDRAINAGE SYSTEM, GLOVERSVILLE SEWAGE WORKS

Sludge Beds—There are four sludge beds, having a total effective sand area of 2.63 acres, the construction of these beds being much the same as that for the sand filter beds. The specifications for the sand, however, are somewhat different:

> The sand of which the sludge beds will be composed shall have an effective size of at least 0.15 mm. and a coefficient of uniformity not exceeding 10. The sand shall be free from clay, loam, or other foreign substances which would render it unsuitable for the use for which it is provided, and it shall not contain material liable to disintegration under ordinary weather conditions.

The main underdrain is 10 in. in diameter with 6-in. lateral underdrains branching from it. The sand is 15 in. deep at the center and 12 in. deep at the edge of the beds next to the embankments.

Loss of Head—The total head lost in the plant is shown by Table 1.

Unit Prices—Table 2 gives some of the main items of work with the unit price of each, and Table 3 summarizes the cost by elements of the plant.

TABLE 1. LOSS OF HEAD IN SEWAGE WORKS

	Elevations	Fall in Feet
Elev. crown trunk sewer at screen chamber	69.00	....
Elev. flow line in primary settling tanks...	68.08	0.92
Max. high water line in dosing tank.....	68.00	0.08
Elev. orifice of nozzles in trickling filters...	61.66	6.34
Elev. flow line in secondary settling tanks..	55.00	6.66
Surface of lowest sand filter bed.....	50.00	5.00
Elev. crown of lowest 20-in. outlet to creek	47.27	2.73
Total fall		21.73

TABLE 2. PRINCIPAL ITEMS AND CONTRACT UNIT PRICES, GLOVERSVILLE SEWAGE WORKS

Earth excavation:	
In trench depth 0-8 ft., per cu.yd.....	$0.45
In trench depth 8-14 ft. per cu.yd.....	0.75
New channel for creek and tailrace, per cu.yd.....	0.39
Deepening present creek channel, per cu.yd.....	0.49
For primary and secondary settling tanks, per cu.yd.:	
Depths 0-10 ft.....	0.75
Depths 10-20 ft.....	1.25
Depths 20-30 ft.....	1.75
Depths 30-40 ft.....	2.50
Depths 40-50 ft.....	3.00
For sprinkling filters, per cu.yd.....	0.39
For sludge beds and sand filter beds, per cu.yd.....	0.39
Below masonry or below grade, per cu.yd.....	1.00
Concrete masonry, per cu.yd.:	
In primary and secondary settling tanks.....	9.25
In sprinkling filter (excl. of floors).....	8.25
In other structures.....	10.00
Sprinkling filter floor system (inc. reinforcement), per sq.yd.	2.25
Steel reinforcing bars for concrete, per lb.....	0.025
Steel channels for supporting reinforcing bars, per lb.	0.03
Steel I-beams, per lb.....	0.025
Steel mesh reinforcing metal, per lb.....	0.065
Gravel filling below grade, per cu.yd.....	1.50

Pipe Laying per Linear Foot (exclusive cost of pipe)

Size of Pipe, In.	Vit. Pipe with Joints of—Cement Mortar	Vit. Pipe with Joints of—Sulphur Sand or Bituminous Compound	Cast-Iron Pipe with Lead Joints	Vit. Pipe Underdrain Including Excavation and Crushed Stone
4	....	....	$0.15	$0.10
6	$0.05	$0.07	0.20	0.12
8	0.07	0.10	....	0.15
10	0.09	0.13	0.30	0.17
12	0.11	0.16	....	0.20
15	0.14	0.21	....	0.21
18	0.20	0.26	....	....
20	0.22	0.29	....	....
24	0.26	0.35	....	....
28	0.30	0.41	....	....

Laying, jointing and surrounding with concrete 6-in. vit. pipe distributors, per lin.ft.....	$0.25
Sand furnished and placed in sludge beds and sand filters, per cu.yd.....	0.90
Placing, jointing and setting risers in sprinkling filters, per riser.....	0.60
Crushed stone for trickling filters (1 to 2½-in.), per cu.yd.	1.75

TABLE 3. ITEMIZED COST OF SEWAGE WORKS

	Total Cost	Unit Cost
Screen-chamber substructure...	$445	
Screen-chamber house (total exterior volume 1,350 cu.ft.)....	535	$0.40 per cu.ft.
Primary settling tanks (total capacity both tanks 537,000 gal.)	15,761	26.10 per 1,000 gal.
Dosing tank (total capacity 8,800 gal.)	1,404	160.00 per 1,000 gal.
Trickling filters (3.07 acres stone area)	106,560	34,700.00 per acre
Secondary settling tanks (total capacity both tanks 242,000 gal.)	9,292	38.40 per 1,000 gal.
Sludge beds (2.63 acres effective sand area)	9,097	2,450.00 per acre
Sand filter beds (2.72 acres effective sand area).....	24,717	9,090.00 per acre
Sludge-pump well (total capacity 16,230 gal.).....	1,233	75.90 per 1,000 gal.
Sludge-pump house (total exterior volume 1,880 cu.ft.)...	535	0.39 per cu.ft.
Sludge-pumping machinery	460	
Conduits and pipe lines (sewage, effluent, sludge, water).....	11,759	
Grading, drives, walks, trees, cleaning up, etc.....	3,801	
Creek deepening and straightening	1,396	
Miscellaneous	58	
Extras, claims, incidentals, delays and damages.....	1,700	
Total cost	$188,754	

On the basis of a daily capacity of 3,000,000 gal. the cost of the plant was $62,900 per million gallons of sewage treated per day.

The construction work was under the general supervision of City Engineer Morrell Vrooman, with Assistant City Engineer Harry J. Hanmer in immediate charge of construction. The consulting engineer was Harrison P. Eddy, of Metcalf & Eddy, Boston, Mass. The contractor was Albert L. Willey, Binghamton, N. Y.

Field and Office

Quebec-Bridge Camp and Yards

The arrangements for storing materials and housing workmen and engineers on a contract as great as the Quebec Bridge are always of interest. A single camp was built for the men working on both sides of the river, although, as it seems now, sufficient accommodations could have been secured without any camp whatever.

The arrangement of bunkhouses, dining hall, office, bungalows, etc., is shown in Fig. 3. Water-supply lines (2 to 4 in.) and sewers (6 to 10 in.) were run to the various buildings. The camp layout was shown in detail in the issue of Mar. 5, 1914, p. 499.

The crane runways for the storage yards are at right angles to the railroad tracks. A single crane is used on each. (This is quite different from the arrangement of the Phoenix company during the work on the old bridge—two cranes on a very long runway parallel to the railway.) The columns of the runway are staggered, Fig. 1, so that members longer than the crane span can be shifted along the runway by traversing the trolleys back and forth as the crane runs along.

Each yard was designed for storing all the members of an anchor arm at the same time, to provide for the chance of delay in erection. The principal piling arrangements are shown in the typical yard sections. To minimize rehandling, only those members which are to be used at about the same time are piled on one another. All members are placed with regard to their ultimate position on the bridge, so that they do not need turning end for end. At least 1 ft. clearance is maintained between adjacent pieces.

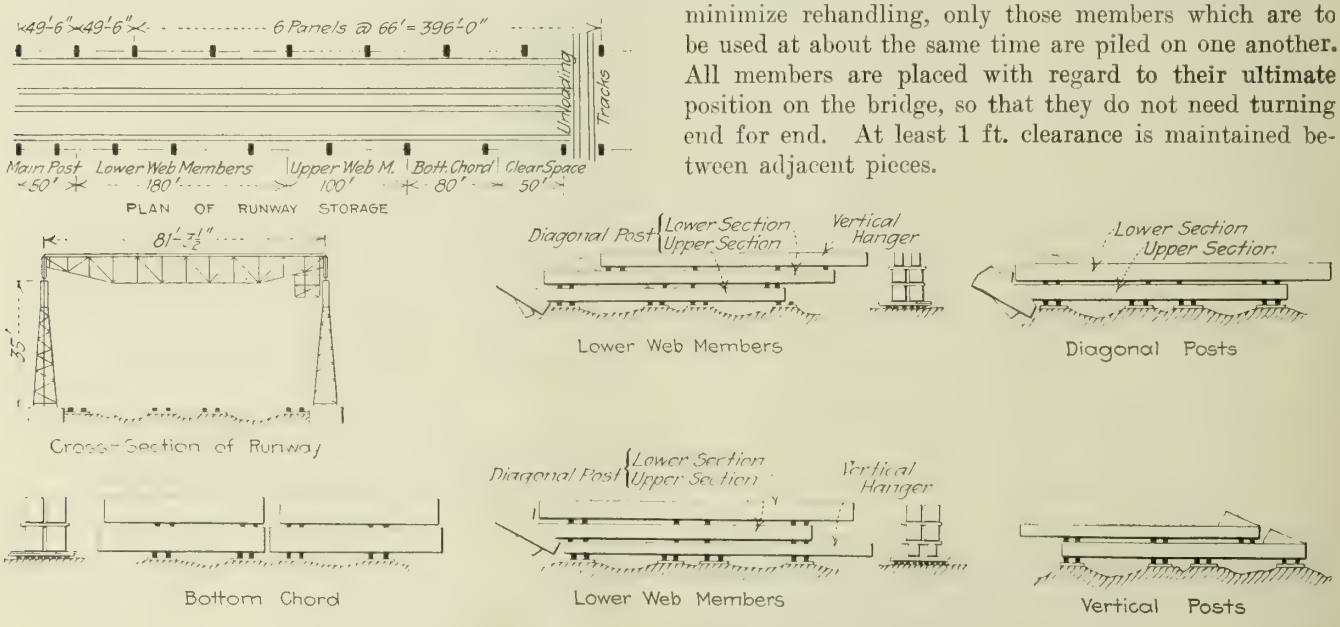


FIG. 1. STORAGE YARD AND TYPICAL PILING, NORTH SIDE, QUEBEC BRIDGE

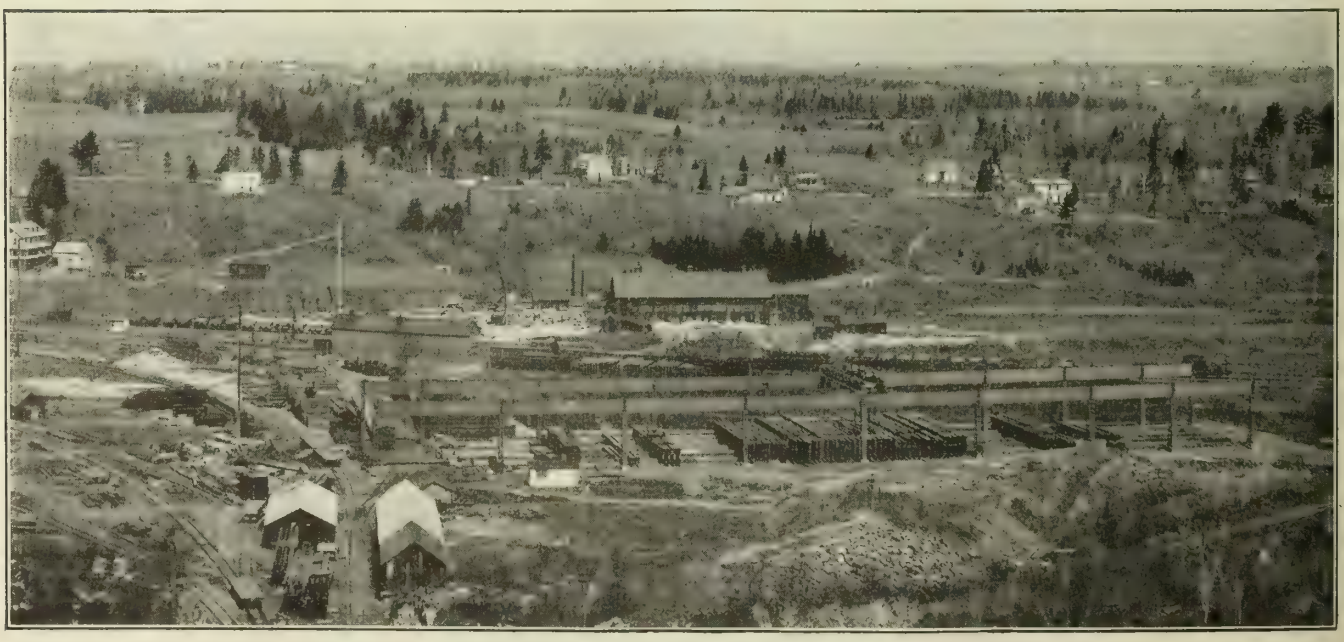


FIG. 2. NORTH SHORE MATERIAL YARD, QUEBEC BRIDGE

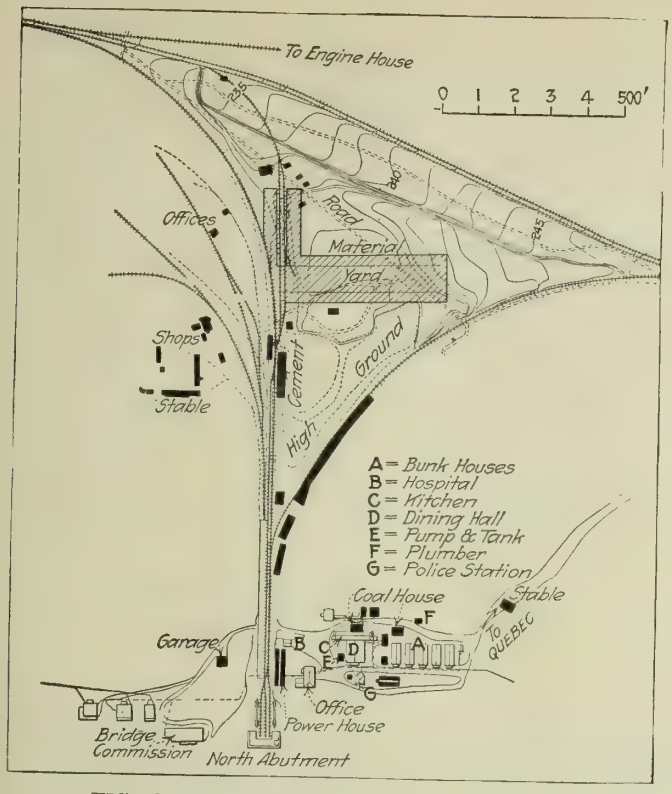


FIG. 3. CAMP AND NORTH SIDE YARD

Pieces with outstanding angles are generally handled with hooks, all others with wire-cable slings. For many parts special handling devices were built. The maximum amount stored at one time on the north side has been 10,000 tons and on the south side 12,000 tons.

The crane runway on the north side, patterned after one in the shops of the St. Lawrence Bridge Co., has box girders to carry the crane track. The runway for the south side has plate girders whose top flange is stiffened by a horizontal lattice-girder bracketed out from the girder web.

Each side of the river has its own electric-power station (or rather, substation; the two are fed from separate sources of energy) and compressor plant. The north-side station contains two 250-kw. motor-generator sets (one regular, one spare) to convert 2,200-volt alternating current to 220-volt direct current for the traveler. The primary supply is received at 22,000 volts. There are also four 100-hp. motor-driven air compressors, delivering air at 100 lb. gage pressure. The south-side plant is similar, but has only three 100-hp. compressors. The incoming current here is received at 11,000 volts.

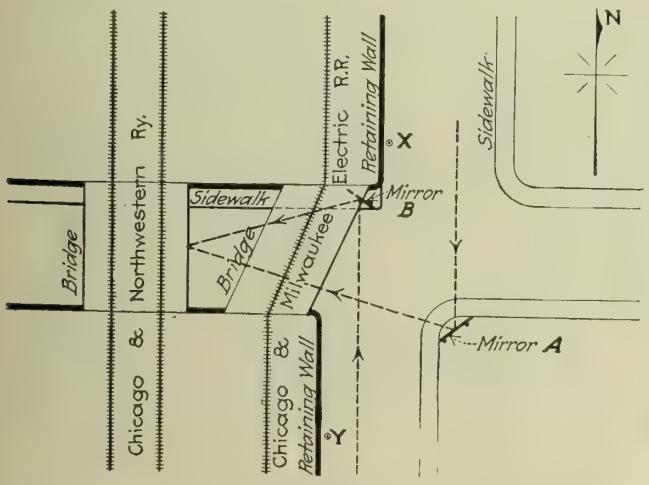


FIG. 1. PLAN OF ROAD CROSSING FITTED WITH MIRRORS, GLENCOE, ILL.

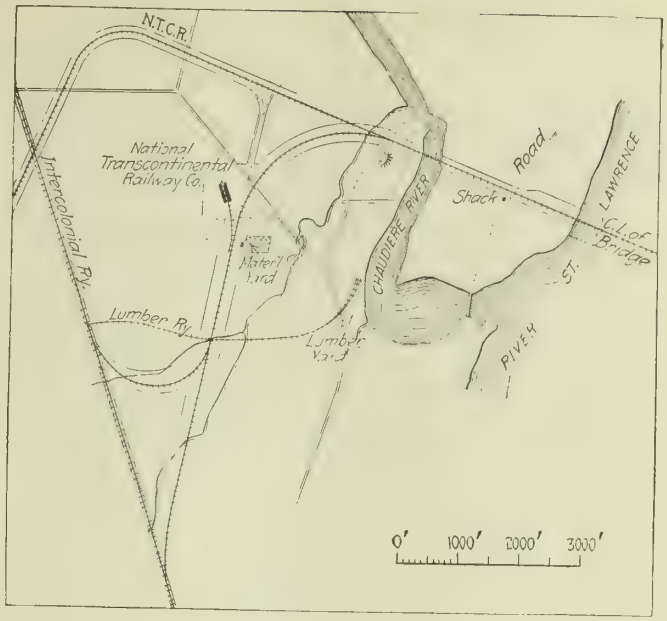


FIG. 4. SOUTH SIDE YARD, QUEBEC BRIDGE

Mirrors at Road Intersections

The use of mirrors for the protection of highway traffic at road intersections where the view is obstructed was noted in *Engineering News,* Aug. 5, and reference was made to an installation at Glencoe, Ill. The situation at this point is shown clearly by the accompanying plan and views, for which we are indebted to Robert A. Allton, Assistant Engineer of the Sanitary District of Chicago.

It will be seen that there is a jog in the street lines at the intersection, while the view is obstructed by the railway fills and bridge abutments.

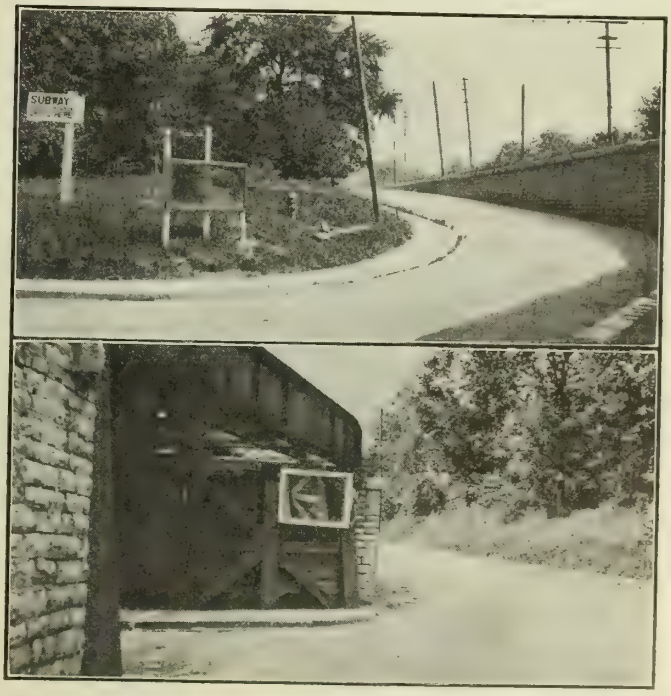


FIG. 2. MIRRORS AT ROAD CROSSING AT GLENCOE, ILL.

Upper view looks south from point X on the plan, showing mirror A. Lower view looks north from point Y, showing mirror B under the railway bridge

Hump-Yard Calculations

By Charles C. Wentworth*

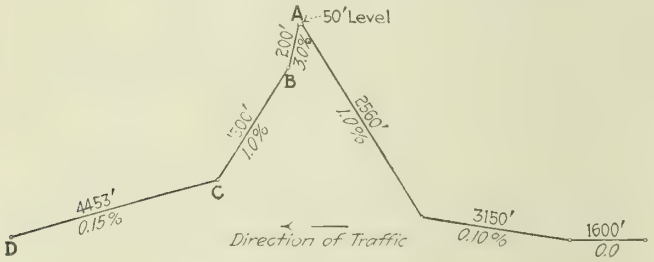
A simple formula expresses the motion of cars when drifting either on level or on up- or down-grades:

$$S_2^2 = S_1^2 + 30\,GL - 1\tfrac{1}{2}\,RL$$

in which

S_1 = speed at beginning of distance L, mi. per hr.;
S_2 = speed at end of distance L, mi. per hr.;
G = rate of grade in ft. per station (uniform for distance L);
L = length of track, in 100-ft. stations;
R = rolling friction, lb per ton.

Evidently GL is the rise or fall in feet from one end to the other of the stretch of track under consideration. It



HUMP-YARD GRADES

is positive when the train is coasting downhill, negative when drifting uphill.

In this formula the weight of a car is immaterial, except as it may govern in selecting a value for R, because the formula applies equally to each single ton.

A gravity hump yard is to be built to the profile sketched, in a nearly level country. The accelerating grade is from A to B; the ladders lie in most part from B to C, and the tracks for classified cars from C to D.

Assuming an initial speed at A of 2 mi. per hr., which will pass about 250 cars per hour, the following figures may be made from the formula. The assumed values for R, as given, are probably too great, but may be met with on some cars.

	S_1	S_1^2	G	L	R	S_2^2	S_2	Speeds, mi. per hr.
A to B.....	2.0	4.0	3.0	2.0	10	154	**12.4**	A = 2.0, B = 12.4
B to C...	12.4	154	1.0	15.0	12	334	**18.3**	B = 12.4, C = 18.3
C to D.....18.3		334	0.15	**44.53**	8	00	00	C = 18.3, D = 0.0

The previously unknown quantity found by each operation is set in heavy type, the others being known or, in the case of R and the final stoppage at D, assumed.

A train of 100 cars pulling in on the approach to the hump would weigh 7,300 tons, including one road engine, and its length would be 4,100 ft. We have then for its resistance of gravity:

1,600 ft. of train on a level grade = 2,800 tons, which at 8 lb. per ton has a resistance of	22,400 lb.
2,500 ft. of train on a 0.1% grade = 4,500 tons, which at 10 lb. per ton has a resistance of	45,000 lb.
Total	67,400 lb.

In the foregoing the engine is included as part of the train both in weight and length, and the tractive force is taken at the driving-wheel contact, not back of the tender, as the traction at the wheel contact is constant for all grades. The wheel traction of the engine under consideration, at 20% of the driving-wheel weight, is 67,460 lb. The train therefore can pull in with its engine ahead.

*Principal Assistant Engineer, Norfolk & Western Ry., Roanoke, Va.

To go over the hump the head engine can be cut off and two pusher engines put in the rear. When the first car reaches the summit of the hump the conditions are:

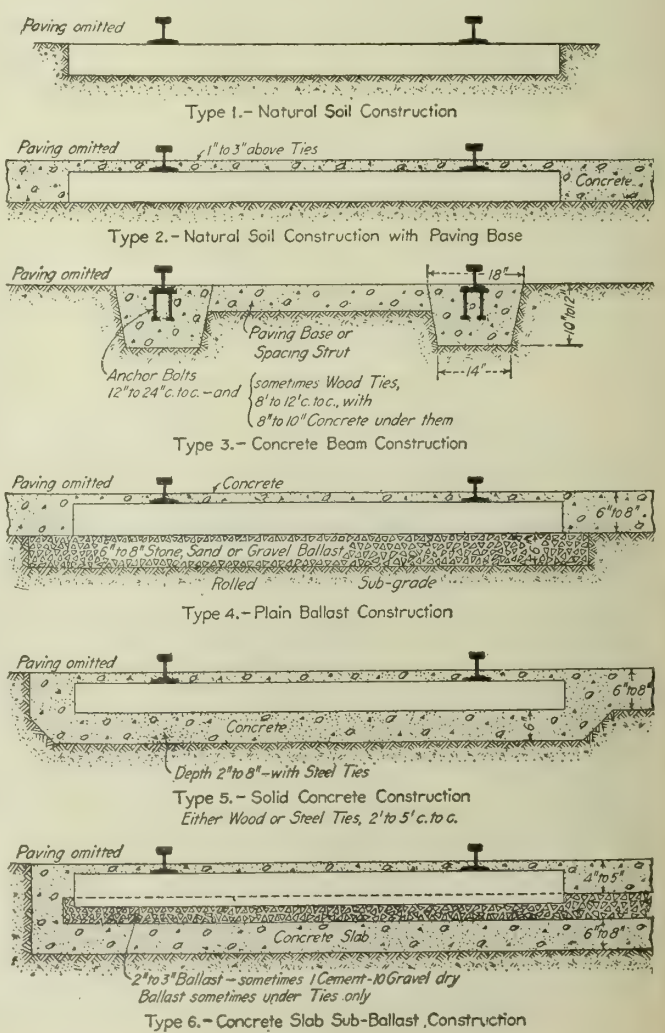
Length of train and two engines, 4,200 ft.; weight, 7,600 tons. Of this, 2,560 ft. of train, or 4,480 tons, would be on a 1% grade which at 28 lb. per ton calls for a traction at rails of	125,550 lb.
The rest of the train and engines are on a grade of 0.1%, or 3,120 tons at 10 lb.	31,200 lb.
Total	156,640 lb.

The rail traction of the two pusher engines under consideration, at 21% of the weight on drivers, is 158,256 lb.

The same formula can be used to determine the rolling friction of a train per ton when starting from rest on a downgrade and achieving a certain velocity in a known distance. If it should be desired to find how far a car will go up a grade with a known initial velocity, it should be noticed that in this case G is negative. On a level, as G is zero, the term containing it drops out.

Street-Railway Track in American Cities

A compilation of street-railway track constructions employed in 41 American cities of over 100,000 population has recently been made by the United Railways and Electric Co., of Baltimore, and is included in the report of the Committee on Way Matters of the American Electric Railway Engineering Association, presented at the



GENERAL TYPES OF STREET-RAILWAY TRACK USED IN AMERICAN CITIES

San Francisco convention Oct. 4-8. The total of 7,331 mi. of track is divided among five types of construction (shown by the drawing herewith) as follows:

Type 2	23%	1718.1 mi.
Type 3	2%	142.5 mi.
Type 4	47%	3415.9 mi.
Type 5	21%	1531.4 mi.
Type 6	3%	253.9 mi.
Modification types 3 and 4	4%	278.8 mi.

If types 3, 5 and 6 are taken together as "concrete-ballast construction," they give 26% of the total mileage. This is in general agreement with the statement made by the same committee a year ago, that 20% of roads reporting to it used concrete ballast. The various types are shown in the accompanying sketch. The many varied details of drainage, rail chairs, spikes, cross-braces, nose blocks and paving are necessarily omitted.

Smoothness-Testing Machine for Pavements

Prof. R. D. Kneale of the department of civil engineering of the Georgia School of Technology proposes that paving specifications include a clause covering smoothness of the finished surface. In connection with his studies of street and road pavements in Fulton County and Atlanta, Ga., he has constructed the smoothness-testing machine shown in Fig. 1.

The machine consists of two steel-shod parallel runners, rigidly braced far enough apart to support between them the working mechanism shown in Fig. 2. The instrument weighs about 70 lb. and can be handled by one man. It folds to 6 ft. in length, which is convenient for transportation in automobile, wagon or train.

The gear L, held in contact with the pavement by a spring, drives by shaft H and bevel and worm gears a recording-paper drum E, usually at the rate of 1 in. for 8 ft. of pavement. On the paper two curves are traced, one representing the vertical motion of the gear L itself, while the other represents the vertical motion of a steel arc P, which is intended to represent a wagon-wheel rim. Both P and L communicate their vertical oscillations to two horizontally moving pencil levers C, arranged with brass points D to mark on the drum E. Their motions are also registered on two dials A, whose reading gives at each moment the total vertical rise (or fall) of L or P.

The manner of registering is as follows: When arc P goes over a hump it rises against the spring pressure;

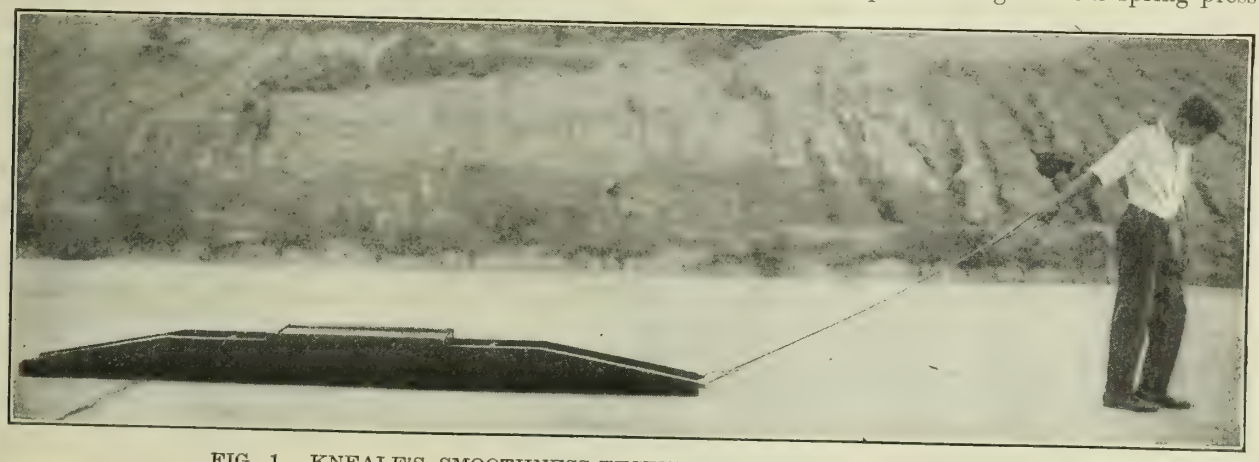


FIG. 1. KNEALE'S SMOOTHNESS-TESTING MACHINE FOR PAVEMENTS

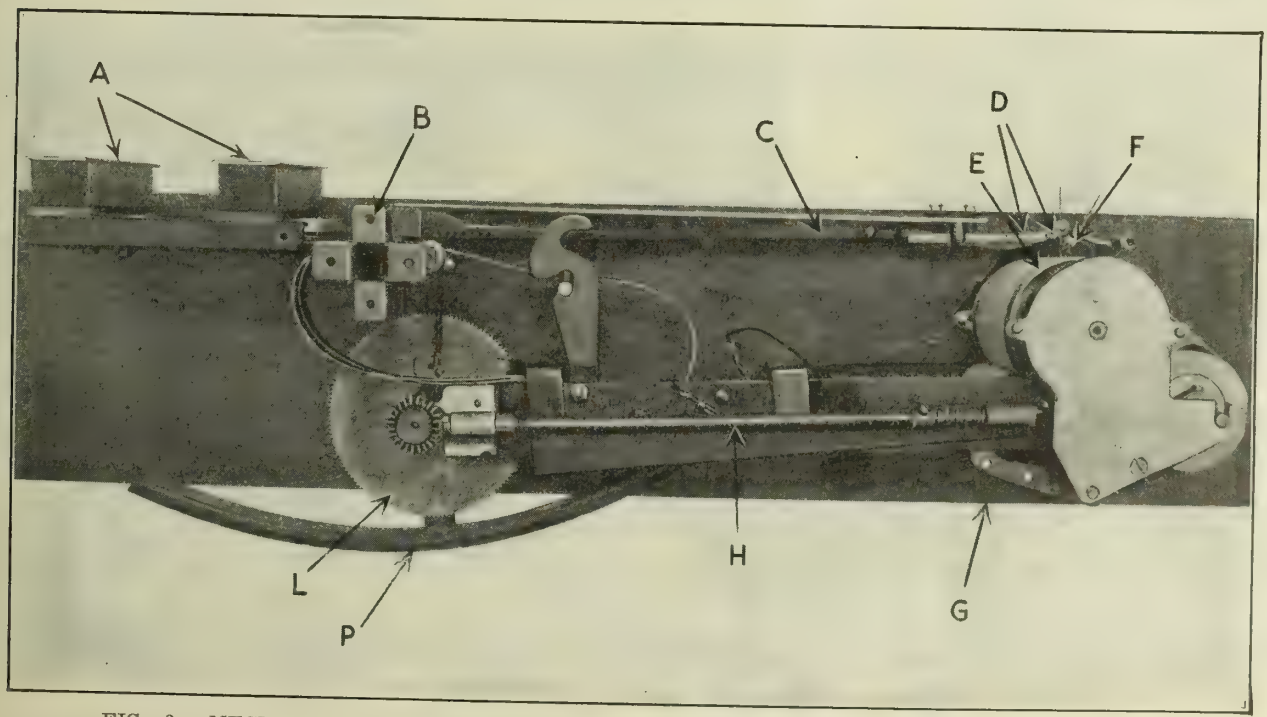


FIG. 2. MECHANISM OF SMOOTHNESS-TESTER, NEAR VIEW; FRONT RUNNER REMOVED

when it descends again the descent registers on the dial. Aftr traveling a mile, the dial therefore indicates a figure representing the total fall in feet per mile, which is called the "coefficient of roughness." Suppose the arc is to 17-in. radius, representing a 34-in. wheel; then the register of 200 for a mile means that an automobile

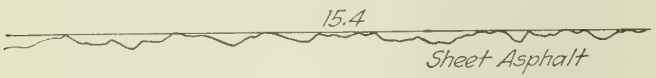


FIG. 3. TYPICAL GRAPH FROM KNEALE MACHINE FOR TESTING SMOOTHNESS OF PAVEMENTS

with 34-in. wheels traveling over the pavement must lift itself vertically 200 ft. in that mile.

Professor Kneale finds that two pavements may give the same coefficient of roughness, but show a very different surface curve. Therefore it is necessary to examine the curve traced on drum *E*, as well as to read the coefficient from the dial.

The vertical scale of the curves traced is 1:1, and as the horizontal scale is 1:96 (1 in. for 8 ft.), a large magnification of the roughness features is obtained.

Track Force for Renewing Rails

In renewing rails in a stretch of railway track the usual practice is to relay one line of rails at a time. There are two methods of handling the work, the new rails in either case being distributed outside of the track. These methods are shown in the accompanying drawing. In the first case, the old rails are shifted outward and the new rails are lifted over them and set in place. In the second case, the old rails are shifted inward to the middle of the track and then disconnected and thrown out after the new rails have been placed. The latter method was advocated in a paper read before the Roadmasters and Maintenance-of-Way Association, by A. M. Clough (New York Central R.R.), who presented diagrams showing the distribution of the gang for the two methods. These diagrams (redrawn) are given in the drawing.

The force for the first method requires 40 laborers, and for the second, 44 laborers. In either case there will be a foreman, two assistant foremen, timekeeper and waterboy. The four extra men required for the second method are employed in throwing out the old rail at the rear of the work. Mr. Clough would add ten men to adze the ties in advance of the rail laying, making a total force of 59 men.

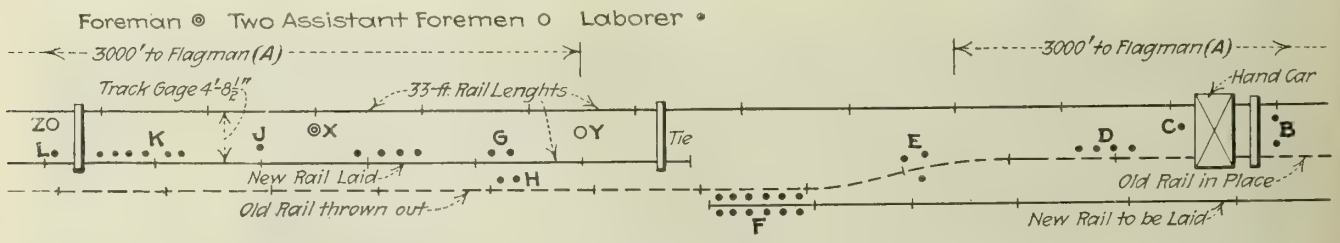
In providing for traffic three or four bolts in a joint are sufficient during the day, but before stopping work for the night all joints should be full-bolted, the bolts made tight and all spikes driven home. To make temporary connections between the old and the new rails it is considered preferable to butt the rails together and splice them with a compromise joint, rather than to close a gap by means of a switch rail butted against one rail and laid against the side of the other.

TRACK FORCE FOR RENEWING RAILS

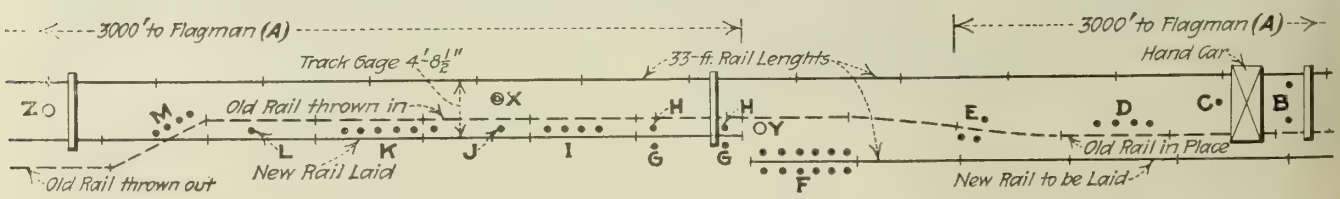
		Plan No. 1 Rails Thrown Out	Plan No. 2 Rails Thrown In
A.	Flagging	2	2
B.	Taking up and putting down crossing and handling insulated joints	2	2
C.	Handling tools and hand-car	1	1
D.	Pulling spikes	4	4
E.	Throwing old rail out	3	
E.	Throwing old rail in	..	3
F.	Tong men placing new rails	12	12
G.	Spiking joints and quarters	2	2
H.	Barring new rail into position	2	2
I.	Spiking	4	4
J.	Adzing ties for new joints	1	1
K.	Applying and bolting joints	6	6
L.	Removing expansion shims	1	1
M.	Throwing out old rail	..	4
N.	Adzing ties ahead of work	10	10
O.	Water-boy	1	1
P.	Timekeeper	1	1
X.	Foreman in general charge	1	1
Y.	Assistant foreman, placing expansion shims	1	1
Z.	Assistant foreman, following up work	1	1
	Total	55	59

To avoid cutting too many rails to make the closure for a splice, the portions of the first rail that is cut should be carried forward and used in connection with short lengths to fill the gap temporarily, until the progress of the work allows a full-length rail to be placed. For convenience the short lengths supplied should have the ends painted green, except that those cut specially for curves should have the ends painted red. The rails should be laid with broken joints, rails 6 to 12 in. shorter than standard being used on the inside of curves to keep the joints on this side from getting more than 6 in. ahead of the middle of the opposite rails.

Care should be taken to see that the new rails are properly supported. Thus if a rail is laid where an old joint was low, the ties should be tamped or blocked up to prevent the rail from being surface-bent by trains passing



METHOD NO. 1 OLD RAILS THROWN OUT



METHOD NO. 2 OLD RAILS THROWN IN

DIAGRAM OF DISTRIBUTION OF TRACK FORCES FOR RENEWING RAILS BY TWO DIFFERENT METHODS

over it. On double track the rail-laying should proceed in the direction of traffic.

J. B. Kelly (Minneapolis, St. Paul & Sault Ste. Marie Ry.) points out, in a paper published in the August *Bulletin* of the association, that in order to make the best progress the distribution of the men must be varied from time to time according to varying requirements and conditions. He sees no advantage in the method of relaying both lines of rail at the same time, either with large or small gangs.

With greater attention to the supply of short rails for closures and for use on curves, there will be a reduction in the amount of rail cut and wasted. For curves the proper number of short rails at each curve should be figured and distributed at the proper place. This was done on a stretch of line 105 mi. long, and only one or two cuts of new rail were made, these being necessary to fit railway crossings. He favors the use of switch points in connecting up the old and the new rails in finishing work for the night. The closures should not be opposite, but should break joint, and a lamp should be hung as a caution signal for trains to pass at slow speed. The night trains should also have orders to run slowly over the new work.

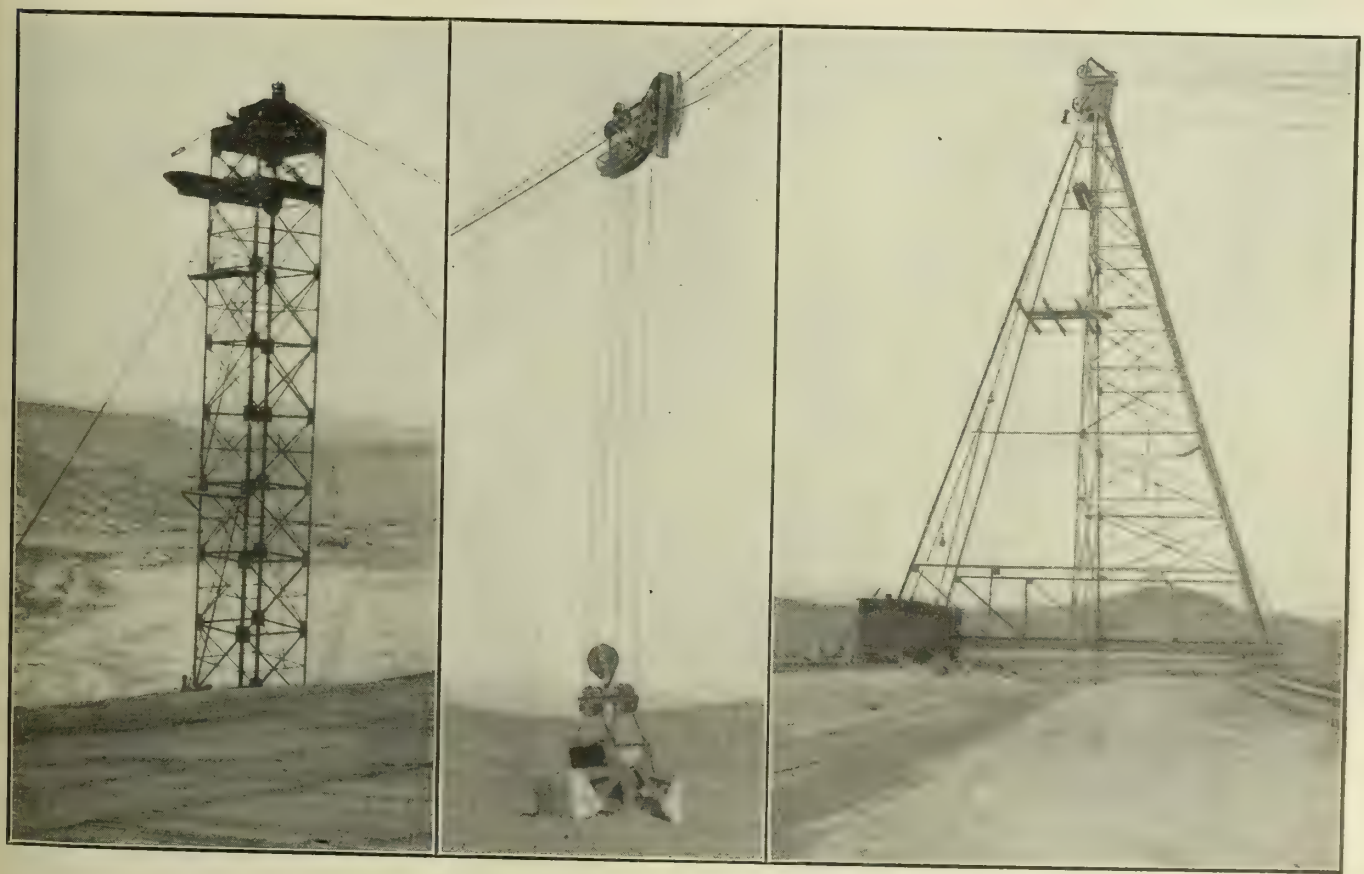
One difficulty, especially with large gangs of 80 to 90 men, is failure to secure proper gage of track without undue work and time. With such a gang Mr. Kelly thinks it well to follow the rail laying with a small crew to finally adjust the track to gage—a matter of great importance both as to safety and as to delay. Before gaging curves the rail joints must be full-bolted and have all the bolts tight or it will be impracticable to keep the track in proper gage.

Temporary Traveling Cableway at Goldfield Mines

A radial traveling, electrically operated cableway of 1,790-ft. span, erected last year, is now in operation at the Goldfield Consolidated Mines Co., Goldfield, Nev., for the transportation of tailings from a waste area to the mill for remilling. The tailings—moist gold-bearing sand that has been worked over once—have been dumped at the present location since 1909 and covers 75 acres. Improvement in the milling process made it worth while to give it a second treatment. The cableway is of the well-known Lidgerwood type and was built by that company.

The radial traveling tower of the cableway is 125 ft. high, and the head tower is 160 ft. high. The tail tower travels through an arc of 109° 40′ about the head, or pivot, tower. Owing to the uneven nature of the ground over which the tail tower travels, it has been found necessary to build a steel trestle in some places to carry the trackway. In the remaining portion the tracks are laid upon the ground. The cableway operates a 4-line, 3-yd. Andresen-Evans bucket, weighing 9,800 lb. The cableway is operated 16 hr. per day in two shifts and delivers 1,000 tons to the mill, which runs continuously to handle this amount.

The grab bucket digs the deposit, conveys and dumps it into a receiving hopper in front of the pivot tower, at a considerable elevation above the tower base. This hopper is mounted to move radially with the cableway travel. From this first receiving hopper a trough on a radial line delivers to the final receiving hopper, from which it passes by the usual method of handling slimes, into a tank and from there it is elevated for retreatment.



CABLEWAY AT GOLDFIELD MINES
Left—Pivotal tower. Center—3-yd. bucket. Right—Radial tower

The three-drum hoist is of the same style as three electric hoists built for the United States Reclamation Service, for use on the Rio Grande project, Elephant Butte, N. M. Each drum is 53 in. in diameter and the motor is of 300 hp., for three-phase 60-cycle current at 440 volts. The main cable is 2¾ in. in diameter.

Safe Distance for Powder Houses

How far powder houses should be kept away from railways, roads and buildings is set forth in a table drawn by a leading authority on the handling of explosives, Col. B. W. Dunn, of the Bureau for the Safe Transportation of Explosives and Other Dangerous Articles. The table is published by the Bureau of Mines in a bulletin[1] just issued.

The recommended distances vary with the quantity of explosive to be stored, up to a maximum of 2,000 to 5,100 ft. (from roads and from buildings respectively) for 200 to 250 tons of explosive.

An important auxiliary rule is given by the authors of the bulletin quoted: "No detonator shall be stored within 100 ft. of other explosives underground, or within 300 ft. of other explosives above ground. No detonator shall be taken into any magazine containing other explosives."

SAFETY DISTANCES FOR EXPLOSIVES STORAGE

Quantity				Safety Distances, Feet		
Blasting Caps, Number		Other Explosives, Pounds		From Nearest Building	From Nearest Railroad	From Nearest Highway
1,000 to	5,000			30	20	15
5,000 to	10,000			60	40	30
10,000 to	20,000			120	70	50
20,000 to	25,000	0 to	50	200	120	80
25,000 to	50,000	50 to	100	240	140	100
50,000 to	100,000	100 to	200	360	220	140
100,000 to	150,000	200 to	300	520	310	200
150,000 to	200,000	300 to	400	640	380	260
200,000 to	250,000	400 to	500	720	430	290
250,000 to	300,000	500 to	600	800	480	320
300,000 to	350,000	600 to	700	860	520	340
350,000 to	400,000	700 to	800	920	550	360
400,000 to	450,000	800 to	900	980	590	380
450,000 to	500,000	900 to	1,000	1,020	610	400
500,000 to	750,000	1,000 to	1,500	1,060	640	420
750,000 to	1,000,000	1,500 to	2,000	1,200	720	480
1,000,000 to	1,500,000	2,000 to	3,000	1,300	780	520
1,500,000 to	2,000,000	3,000 to	4,000	1,420	850	570
2,000,000 to	2,500,000	4,000 to	5,000	1,500	900	600
..	..	5,000 to	6,000	1,560	940	620
..	..	6,000 to	7,000	1,610	970	640
..	..	7,000 to	8,000	1,660	1,000	660
..	..	8,000 to	9,000	1,700	1,020	680
..	..	9,000 to	10,000	1,740	1,040	700
..	..	10,000 to	20,000	1,780	1,070	710
..	..	20,000 to	30,000	2,110	1,270	840
..	..	30,000 to	40,000	2,410	1,450	960
..	..	40,000 to	50,000	2,680	1,610	1,070
..	..	50,000 to	60,000	2,920	1,750	1,170
..	..	60,000 to	70,000	3,130	1,840	1,250
..	..	70,000 to	80,000	3,310	1,990	1,330
..	..	80,000 to	90,000	3,460	2,080	1,380
..	..	90,000 to	100,000	3,580	2,150	1,430
..	..	100,000 to	200,000	3,670	2,200	1,470
..	..	200,000 to	300,000	4,190	2,510	1,680
..	..	300,000 to	400,000	4,670	2,800	1,870
..	..	400,000 to	500,000	5,110	3,070	2,040

NOTES

Saving $5,000 a Year by Testing hacksaw blades bought by the Public Service Ry., of Newark, N. J., is described by Martin Schreiber, Engineer of Maintenance, in the September "Aera" of the American Electric Railway Association. About 450 gross of blades are used per season in connection with track repair. Ordinarily, prices would be obtained on several makes of blades, and possibly crude tests would be carried out in the field. Finally, the blades would be purchased, taking into consideration the price and the tests. After it was decided to adopt scientific tests, prices were obtained on six types of blades, and samples were bought from the stocks of various dealers. Three blades of each manufacturer were then tested in an Olsen file-testing machine, rigged for the purpose. From the machine, with calculations, the following data were obtained: Total inches sawed, total number of 6-in. strokes, average cut per stroke in inches, total cost of blades per inch cut, total time consumed in minutes, time in minutes per inch cut, total labor cost at 18½c. per hr. (assuming the blades are being used in the field), labor cost per inch cut, cost per inch cut (including cost of blade and cost of labor in using saw), relative cost of each type of blade per inch cut, relative amounts cut by three saws of each type of blade. It was found that blades costing $5.70 per gross showed a total cost, taking into consideration the operation of the blade in the field, of more than 2½ times that of another type of blade costing $5.52 per gross. It was figured by the result of these tests that the company was able to save approximately $5,000 per season on the cost of hacksaw blades.

Single Tractor Hauls Big Boiler—The Henderson Co., a large Philadelphia contracting concern, recently received a contract from the city to move a 33-ton boiler from a power plant in Holmesburg, Penn., to the city power plant at Fairmount Park. It was found that it would take 28 horses to haul this load and 10 extra horses with block and falls to start it. The wagon used to mount the boiler weighed eight tons, making the gross load to be hauled 41 tons. About this



TRACTOR HAULING 33-TON BOILER

time a representative of the Knox Motors Associates made the statement that a Knox tractor, although rated as having from 5 to 15 tons capacity, could easily pull this load. The tractor was brought on the scene and was hitched to the load, as shown in the accompanying illustration. No difficulty was found either in starting or hauling.

Correcting River Discharge for a Changing Stage—The following formula has been developed for correcting river discharge for a changing stage. For a description of its derivation and examples of its application in actual use see United States Water-Supply Paper 375-E, by Benjamin E. Jones:

$$\frac{Q_1}{Q_2} = \frac{\sqrt{S_1}}{\sqrt{S_1 + \frac{\text{rate of change of stage}}{\text{surface velocity}}}}$$

Q_1 = Discharge at a given gage height at a constant stage;
Q_2 = Discharge at the same gage height during a changing stage;
S_1 = Slope at the given gage height at a constant stage.

The surface velocity can be obtained from the mean velocity by dividing the latter by 0.85 for small streams and by 0.90 for larger ones.

If K stands for the change of stage per second, V for the mean velocity of the measurement made during the changing stage and N for the coefficient for obtaining mean velocity from surface velocity, the formula may be written

$$\frac{Q_1}{Q_2} = \frac{\sqrt{S_1}}{\sqrt{S_1 + \frac{K}{\frac{V}{N}}}} = \frac{\sqrt{S_1}}{\sqrt{S_1 + \frac{NK}{V}}}$$

Boring for Depth of Railway Fills Over Marshes—In the valuation surveys of the Boston & Maine R.R., now being made, it was suspected that many of the fills made across salt marshes or fresh-water swamps along the coast had settled so that much of the fill was hidden, although no mud-waves or other obvious indications were observed. In order that this important item of cost might not be overlooked, the valuation engineer for the railroad, F. C. Shepherd, M. Am. Soc. C. E., resorted to wash boring. By this means he located the line between the bottom of the sand or gravel of which the fills are composed and the top of the original marsh and found over 2,000,000 cu.yd. of fill, more than was shown by the original cross-sections.

[1] "Rules and Regulations for Metal Mines," by Ingalls, Douglas, Finlay, Channing and Hammond; Bulletin 75.

Editorials

Subway Construction Risks and Reassuring Expert Reports

It is good to learn that experts agree with *Engineering News* in recognizing the existence of an inherent risk in such city work as subway construction and the resulting responsibility of the authorities toward the public. In New York the Mayor's committee of engineers, whose report on subway accidents was summarized last week, laid stress on the inevitable risk, demanded extra safeguards to reduce (not eliminate) the risk and condemned the unstable type of timbering the collapse of which in Seventh Ave. cost eight lives. The experts called from Philadelphia and Boston also mention the risk: "The work is necessarily of a hazardous nature, and some element of risk is inseparable from the carrying on of any such public improvement." They reassure the public by saying that the accidents of three weeks ago cannot repeat themselves. But of course other kinds of accidents may occur, though they do not allude to this possibility.

The city police authorities have taken a common-sense view of the presence of a risk. They have placed certain vehicle-traffic restrictions on the streets in which subway work is being carried on. Though it is a tardy precaution, it is sound in aiming to protect the street-using public. Similarly, the Public Service Commission's orders to the contractors to provide extra bracing are a move in the direction of reducing the risk.

If the city authorities now show an appreciation of their responsibilities to the public as to protecting the street-user from undue risk, the fact only emphasizes their prior neglectfulness in the same matter. It remains true that the authorities permitted, if they did not encourage, the public to consider a timber deck, supported on falsework, over rock blasting and digging, as being just as safe as any normal street. There was a fear of creating a feeling of caution or a tendency to linger less along the timbered streets, because this might affect the business of the property owners along those streets.

Did the fear of creating alarm also control the engineers in drawing their reports on the accidents? Did they consciously make their findings as colorless as possible in the attempt to make them reassuring?

The Seventh Ave. subway collapse of Sept. 22 "was initiated by a blast in the northeast corner of the excavation"—that is the report of the Public Service Commission engineers. From their silence on type of timbering and supervision one must conclude that these were good. The subway experts brought in from Boston and Philadelphia to look over the situation go a little farther and say explicitly that both were good. They say that the timbering was strong; the worst they can say of it is that some details were not in accord with best practice.

Engineering reports that produce results have more life and energy than these and go more directly to the point. The reports just referred to evade the primary question—a question which was placed squarely before the Public Service Commission within a few hours after the Seventh Ave. collapse. The question was not, Why did a collapse occur? A sag or a local collapse due to failure of a support or damage from a blast would have been accepted by even the humblest citizen as a normal mishap. The question was: Why did the collapse extend in such disastrous manner for a length of several hundred feet, far beyond the range of any local accident?

In answer to this very direct and very pressing question the engineers reply that the accident was initiated by a blast in the northeast corner of the excavation. And the chief engineer adds, in further explanation of the rather unusual effect of the blast, that "the blast acted abnormally."

However, longitudinal bracing has been put in the subway timbering at a great many points—in fact, wherever there is a length of more than a few bents of timbering intervening between the excavation space and the permanent subway framework. This measure was due to the praiseworthy promptness of thought and action by the Public Service Commission engineers immediately after the accident. Messrs. Davis and Quimby, the outside experts, seem to think that such bracing is rarely if ever needed. They dwell on the desirability of securely strutting across the subway excavation by continuous transverse struts wedged against the sides, as a means not only of supporting the sides of the cut, but also of making the timbering stable. Longitudinal bracing they admit only grudgingly.

As to the second important question raised by the subway accident in New York—namely, the protection of the sides of rock cuts—the reports leave one quite as much in the air. The Public Service Commission engineers, dealing only with the Seventh Ave. accident, ignore the rock-slide question in their report. The outside experts lay chief stress on it; they say that the rock-slide danger is so great that it is practically the only serious danger menacing the subway construction. Yet finally they come near to retracting all their radical statements, and they do not recommend any measure of all-around protection.

Different passages in their reports, put together, show that they take a conservative and prudent view, but hesitate to express it clearly. They say that the sides of rock cuts should be strutted or shored wherever the rock is loose or subject to loosening. Then they say that strutting and wedging should be used wherever the strata are tilted at an angle so that they might slide or topple into the cut. Again at another point they say that most of the rock which they saw is such that its stability when trenched is not certain in advance, and that in such cases prudence would dictate complete rigid shoring. But when they come to specific recommendations, they advise shoring or strutting only in rock with inclined strata showing open seams.

From the various remarks of the experts one may well draw the conclusion that, were they a little bolder in

their expression, they would recommend as a regular precautionary measure full timbering and bracing of all sides of rock cuts in subway excavation in New York City. Such a recommendation, had they made it, would be a most important one and would inevitably call for very serious consideration.

It is pertinent to note that the Public Service Commission has not issued precautionary instructions concerning the sides of rock cuts either in its specifications or otherwise. Contractors are not very likely to adopt a blanket precaution going beyond ordinary practice until directed to do so. For example, they are not likely to timber an open rock cut unless loose rock is struck. These conditions would have made the recommendation in question a prominent one. In the opinion of *Engineering News* a precaution of this kind would be a most desirable measure of prudence in an extensive enterprise carried on under urban conditions similar to those controlling the New York subway construction work.

Treated Ties Are Little Used

The economy and efficiency of treated timber ties for railway track have been proved in theory and in practice so often and for so long a period of time that it is surprising to realize to what limited an extent these ties have been adopted. In number and in track mileage they make a large aggregate, but the proportion which they represent of the total number of ties and miles of track is comparatively small. Furthermore, this aggregate has been reached only after many years, and the present increase appears to continue at a very slow rate.

This condition is the more surprising when it is considered that in many cases but little increase in first cost is required to obtain the economy due to prolonged life of ties and consequent reduction in the work and expense of track maintenance. This is due, of course, to the fact that the application of a preservative treatment to ties of cheaper kinds and grades (and of inferior quality if used without treatment) may render them equal in quality to high-grade ties of untreated timber.

Estimates of the economy of treated ties are numerous, and one of the latest was submitted at a recent meeting of the operating officers of the Baltimore & Ohio R.R. by F. J. Angier, superintendent of timber preservation of that road. He takes an untreated white-oak tie at 71.7c. and a treated tie at 77.7c. (including 23c. for treatment). With a life of 8 years for the former and 14 years for the latter he arrives at an annual cost per year (including interest) of 24c. and 20c., respectively, or an annual saving of 4c. for each treated tie.

The tie renewals on this road average over 2,000,000 annually, and it is estimated that 1,700,000 of these could be treated with advantage. With a saving of 4c. per tie the net annual saving for the first year would be $68,000, and this amount would be added each year until the whole line is equipped with treated ties. This estimate relates to the ties alone, and Mr. Angier makes no allowance for the resultant saving in cost of track maintenance and tie renewals. But with a large and increasing number of ties of 14 years' life, replacing others of 8 years' life, there should be a material reduction in the track disturbance and the cost of track work due to tie renewals.

In comparison with the 1,700,000 treated ties noted as desirable for annual tie renewals it is found that the numbers of treated ties laid on the Baltimore & Ohio R.R. during the fiscal years 1914 and 1915 were 210,000 and 873,000 respectively. It is probable that few roads can make so good a showing of the proportion of treated ties to the total number of ties used in renewals. Nevertheless, at the end of June, 1915, only 7% of the ties in the track on this road were treated ties.

The foregoing estimate is mentioned in particular not because it is specially better or more important than others but because it is one of the latest, and it serves to call attention again to an opportunity of economy that is ready and waiting for the railways to accept and apply. Similar estimates have always pointed to a great possibility for economy.

Untreated ties continue to form the great majority of the ties used annually for new track construction and maintenance, with treated ties in a decided minority. In view of this condition and of the undoubted and material economies to be obtained by the more general use of the latter, it would be a wise move on the part of railway engineers to bend their energies toward securing a much more rapid and extensive introduction of treated ties.

Latest Canal Slide Formidable

The slide in Gaillard Cut is assuming menacing proportions. In October, 1914, when it first made its appearance, it was estimated to contain about 5,000,000 cu.yd.; in September of this year, when its first serious interference with traffic had been cleaned up, its contents were figured as 7,000,000 cu.yd., after the emergency removal of 2,000,000 cu.yd., and now press dispatches state that there is 10,000,000 cu.yd. to be removed. Apparently the area and volume of this largest of the slides are gradually increasing.

Fortunately the public has become educated up to the slides, so that the latest has not caused the consternation in the press that marked the earlier ones. It is being recognized that the canal has been and for some time will be open only on sufferance and that its commercial and military value can be counted on only after the slipping earth sides of the cuts have finally been leveled down to their required slope.

The main question now is, How long will the present blockade last? This cannot be answered without more information from the Isthmus. If all of the sliding earth were in the channel it would be a year's job to remove it, for in the normally constricted Culebra fairway 1,000,000 yd. a month is almost the limit of excavation. Happily, however, the nature of these slides is such that although ultimately the whole area under motion will have to be removed, the channel section can be cleared up first, always with the proviso that some of the farther earth may at any time slide lower and cause a temporary block. It seems hardly probable, however, that through deep-draft traffic can be resumed before the new year.

While the excavation of the slides is largely a routine matter to the canal engineers, who have been digging now for over eleven years, the added cost to the canal is considerable. Official reports up to now have stated that 30,000,000 yd. of earth has already been taken out from slides at an average cost of from 30c. to 40c. per yd. A total of about $14,000,000 can thus be charged against the insecure geology of the Isthmus.

The Cost of Drainage Pumping

Some very interesting and useful figures on the actual cost of drainage pumping in Louisiana have been collected at great labor and pains by one of the Drainage Engineers of the Department of Agriculture and are printed elsewhere in this issue. The usefulness of the figures is materially increased by the unique tabulation of surrounding conditions. The total operating costs range from 4.1 to 16c. per acre-ft. lifted 1 ft. This means from 3 to 11c. per hp.-hr., with 7c. average, which does not depart from the probable range of figures applying to other small isolated steam plants.

To the annual operating costs, probably some $8 per hp. annual fixed charges on pumping plants is to be added. (The engine and pump equipment for the noncondensing plants would cost some $35 per hp., compared with $45 for the condensing plants, but the boilers and auxiliaries would mount to some $30 instead of $20, so that the total investment per horsepower capacity would remain relatively the same—near $65.) These Louisiana plants operated intermittently from 8 to 145 full 24-hr. days in a year (with an average of 43) so that from 4½c. down to 0.3c. is to be added to the cost per horsepower-hour, the average being some 0.7c. per hp.-hr. This introduced into the tabulated costs in Mr. Okey's article brings the Louisiana figures to from 3.5c. per hp.-hr. at Little Woods to 12.9c. at Poydras—with an average of 8c. for all there shown. For the work of a drainage engineer, Mr. Okey's original figures, expressed for hydraulic units, will be the more useful. For the man approaching drainage from the power viewpoint, the comparisons given above may be instructive—at least they will show that general knowledge of power costs on a horsepower basis can be safely applied to the preliminary study of drainage and irrigation problems.

⁂

The example set by the Engineers Club of Kansas City, in securing the services as a lecturer on military engineering of Major S. A. Cheney, U. S. A., is well worthy of emulation by similarly constituted societies. There are few such societies that are not located at or near an army engineer station, where may be found an officer who doubtless would consider it almost a part of his duty to assist the civilian engineer to a better understanding of the details of military engineering. Furthermore, the state of the public mind makes this the one time to insure a good response on the part of the civilian engineer.

⁂

Los Angeles, Calif., which is noted for its good street surfaces, had 792 automobile accidents during August. Good pavements and a high accident record may be related, as the temptation to speed varies directly with the excellence of the highway. Such an accident record suggests that traffic regulation is not what it should be in Los Angeles. When a city improves its highways it is apparently desirable to brace up its traffic squad at the same time.

⁂

Do local sections of national engineering societies tend to disintegrate the older type of local societies without commensurate benefit to the members of the local sections? A number of engineers in one city say yes. What do others with experience think—in thoughts of say 25 to 50 short words?

Letters to the Editor

Patentees and Royalties

Sir—Some rather surprising mathematics is produced by R. C. Hardman, under the title of "Patentees and Royalties," in his letter in your issue of Aug. 26, 1915. He attempts to show that the patentee has an advantage over his competitors, when all are bidding on the patented plans, the royalty payable to the patentee by his competitors being publicly specified. I had contended in your issue of July 29, 1915, that the patentee has no advantage over the other bidders.

As an illustration in support of my view, let us suppose that Contractor Smith ships $1,000 in gold by boat. The vessel sinks and the owner calls for bids to raise the ship, specifying that the successful bidder shall recover Smith's $1,000 and restore it to him. Contractor Smith concludes to bid himself. How much advantage has he over his competitors? None, of course.

Suppose that instead of a chest of gold buried in the sea, Smith owns a patent on the method of raising the vessel and the owner specifies that Smith should receive $1,000 out of the salvage for his royalty. What advantage has Smith over his competitors, if he concludes to bid himself? None, of course.

The answer to Mr. Hardman's mathematics is that it was the profit that was reduced in each case, and not the royalty. Mr. Hardman assumes that "the work presents few difficulties so that the profit is fairly assured." But the royalty is *absolutely* assured. Why, then, risk any of it? If the patentee-contractor takes the work, it can only be because he has reduced his profits below those of his competitors, and not the specified royalty.

Mr. Hardman intimates that it makes no difference anyway, whether a reduction is made on profit or on royalty. But the difference is just this, that if the reduction is made on royalty it takes money out of the bank, whereas if it is made on the profit it merely reduces the odds on a speculative item.

Let us examine the problem in another way. If the specified royalty gives the patentee an advantage, that advantage will be increased by making the royalty excessive. Let us assume, then, that the work is to cost $1,000 and that the royalty is to be another $1,000 and that to this total cost of $2,000 we add no profit. Now let the patentee bid against his competitors. How much can he cut his bid to get the work? According to Mr. Hardman, he will sacrifice any part of the $1,000 royalty, but if he reduces the royalty by even one dollar, he will

lose money because he will then realize but $999 while the successful bidder would pay him $1,000. Suppose we figure a profit of $1 instead of nothing. Then the patentee-contractor can reduce his bid by any part of that one dollar to secure the award. But when he deducts more than one dollar he loses money. The same reasoning applies as the profit is increased and the royalty reduced to reasonable amounts.

As to Mr. Hardman's actual case, where a cut of $300 was made by the patentee-contractor to permit award at private letting, the answer is the same—that the profit was reduced and not the royalty. But Mr. Hardman even says that it matters not which was reduced. Surely, he has no complaint if his competitor was willing to accept less profit than himself. There is nothing dishonorable in presenting a supplemental bid. Mr. Hardman admits that the statute was complied with. In Missouri the law encourages supplemental bids, and he is evidently from that state.

When the patentee-contractor himself is a bidder, he is actually at a disadvantage, since it is to his interest to supply as nearly perfect a product as possible, whereas his competitors will endeavor to construct at lowest possible cost.

The foregoing illustrations will be found to apply regardless of the merit of the patent or the amount of the royalty, and equally when a patentee or his agent on commission is one of the competitors. The principle may be stated as follows: A patentee-contractor who is entitled to a specific payment from the successful bidder must add that amount to his computed cost if he elects to lose that payment by defeating his competitor. Every other bidder adds it to his cost. Hence all are on an equality.

In this principle, too, will be found an excellent test of breadth of reasoning. Engineers, who are accustomed to view but one side of a case, will find it hard to accept the principle even when demonstrated. Lawyers, who are trained to view both sides with impartiality, will accept it, and the courts hold in accordance with it. A bookkeeper or accountant will grasp the principle readily, but the ability to do so seems to be strangely lacking in the reasoning powers of many of the bidders that compete on patented devices at public lettings.

DANIEL B. LUTEN.

Indianapolis, Ind., Sept. 9, 1915.

Gulf Storms and the Recent Galveston Flood

Sir—I have had to do in various professional ways with eleven points along the coast of the Gulf of Mexico from Gulfport on Mississippi Sound to Coatzacoalcos on the Isthmus of Tehuantepec. I have lived through the storms, the hurricanes and the "northers"—have seen their coming, their activities and their effects. The history of my works there goes back to 1875.

I have read the descriptions of the Galveston disaster in your issues of Aug. 26 and Sept. 2. I have looked for a very important physical feature, but see no special reference to it. I refer to the fact that the gulf storms usually start in the southeast. The wind blows from that quarter for a day or two, steadily growing stronger and stronger. This storm, originating in the central portion of the gulf or even at times in the Caribbean Sea, piles the water up along the northern shore of the gulf, often so high as to be called a "tidal wave." The storm develops into a wind of hurricane velocity before it changes. It then moves around in the direction of the hands of a watch, into the south, southwest, west, and finally quickly whips into the northwest or north, when it blows sometimes with terrific force—75 to 100 miles an hour.

At most points—the mouth of the Mississippi River, Sabine Pass, Indianola (wiped out by the southeast gale in 1875) and elsewhere—the north wind brings relief from the high water, but at Galveston the situation is different. The southeast winds force the rising waters through the two channels, east and west of Galveston Island, up into Galveston Bay, which has an area of 271 sq.mi. When the wind veers into the north the immense mass of water piled up in this great bay is forced toward the gulf. The channel cannot immediately carry it, and it rushes over the island itself, but it is obstructed by the high water which is already on or around the island and outside in the gulf and which, under the reserve force of the southeast hurricane, is still striving to get into the bay, and these two masses of water moving in opposite directions, or striving to do so, pile up on Galveston Island lying between the bay and the gulf.

There is only one remedy. Do as has been done at Cairo, Ill., at the confluence of the Ohio and Mississippi—raise the entire city or at least surround it by walls high enough to keep out the highest floods and tides.

Galveston will have disasters similar to this last one, and perhaps worse, until the entire city is raised at least 16 ft. on the gulf side and 10 ft. on the bay side.

The remark in your editorial of the Aug. 26 issue is correct: "The fact that most of the flood damage seems to have been on the north side of the island, where grades are still as low as they were before 1900, *points the way to future work.*" The italics are mine. I might add that in 1900, in the American Church at Buenos Aires, before a large and interested audience, I delivered an address just after the disaster of that year, described the geographical, physical and meteorological hydraulic situation as here briefly given and predicted the disaster of this year—15 years later.

E. L. CORTHELL.

North Egremont, Mass., Sept. 4, 1915.

Proper Timbering Would Have Prevented Subway Collapse

Sir—In reference to your articles on the subway timbering accidents on Seventh Ave. and on Broadway and the editorial on the same subject, Sept. 30, I would like to offer some comments.

In these articles the system of timbering in use at the scene of both accidents is described in detail with illustrations, as well as the conditions after the accidents. It seems to me that the causes of both accidents are entirely apparent from these descriptions and I do not therefore agree with the vague and indefinite suggestions mentioned as possible causes.

To quote from *Engineering News* as to the timbering in Seventh Ave:

> The beams under the street planking and car tracks are carried by one 12x16-in. longitudinal stringer on either side of a center aisle. Bents of 6 to 8 posts, spaced 10 ft. apart along the work, support the stringers and also directly the roadway beams. These posts in turn foot on transverse 24-in. 80-lb. I-beams, one 25-ft. length on either side, set 12 to 15 ft.

above the floor of the excavation. Four 12x12-in. posts, two under each I-beam, carry the load of the entire bent. For bracing, the I-beams are strutted longitudinally by 4x8-in. or 8x8-in. spreaders wedged between their webs. Two or three such spreaders are used on either side of the central aisle. Also, the upper tier of posts is set on 4x12-in. or 6x12-in. foot planks dapped over the top flanges of the I-beams in alternate bays between bents. Longitudinal spacer planks under the roadway beams also act as struts. Transversely, the two I-beams of each bent are spread and tied by a pair of 12-in. 20½-lb. channels spanning the middle aisle and bolted to the I-beam webs. There are other spreaders, and at many places transverse diagonal bracing in the upper tier of posts, as indicated in Fig. 5. The outer posts are blocked against the side walls of the cut. There is no longitudinal bracing in either upper or lower tier of posts.

From the above description it is clear that the transverse 80-lb. I-beams in each bent (two of which, together with the center 12-in. channels, were bolted together to form a continuous transverse member) inserted in the line of posting broke the posts at this line, toggle jointing each bent, and that there was no longitudinal vertical diagonal bracing of the posts above or below these cross-members. Further it is evident that the toggle joints of the bents were all locked or joined together by the longitudinal struts between the transverse I-beam members, so that a longitudinal end thrust, applied in line of the struts, would break or fold all the bents simultaneously and allow the street structure to collapse. It seems only common sense to assume that this is what actually occurred in Seventh Ave., the blast supplying the end thrust. When the toggle joints of the bents were broken by a south thrust, the result was that the post props were knocked out from under the temporary street platform and it fell into the ditch.

The accident could have been prevented by longitudinal vertical diagonal bracing of the posts above and below the transverse members. Such bracing would have confined the effect of the blast that directly caused the accident to a small injury of local timber only.

As to the Broadway accident, the timbering conditions were quite similar to those in Seventh Ave., and the extensive collapse of timber structure caused by the rock slide is attributable to the same lack of diagonal bracing. The rock slide itself could have been prevented by proper timbering, similar to that employed in subway excavating in earth; that is, cross-bracing and rangers and vertical lagging blocked against the rock face.

In view of the foregoing, therefore, various explanations of the accidents that have been offered seem unnecessarily vague. I do not agree with some of the reasons mentioned in *Engineering News* of Nov. 30. To quote from the editorial, in which it speaks of the coincidence of the two accidents:

> To conclude anything from the fact of the coincidence is wrong in the present case, however, because the two accidents were fundamentally different in character. The Broadway accident was due to what the lawbooks call an act of God, in this case a catastrophal rock fall. Rock falls are not quite so unforeseeable as hurricanes and floods, but they remain the ever-continuing threat in rock excavation, whether for mine or structural use. Mining engineers, who boast of the perfection of their timbering practice, admit that the heaviest proportion of mine fatalities is due to rock falls.
>
> The Seventh Ave. collapse is unquestionably a very serious matter. But any thoughts or sentiments based on it should not be complicated by reference to the Broadway accident.

Why lay the Broadway accident to "an act of God," when a little timbering, properly placed, would have held the rock safe. Also, as to the statement that "mining engineers, who boast of the perfection of their timbering, admit that the heaviest proportion of mine fatalities is due to rock falls," there is no close analogy between the Broadway accident and the dangerous conditions met with in underground mining. In mining, heavy pressures on the roof and the sides of stopes or other openings are often developed that no timber will hold; also most rock falls underground are from the roof of the opening or stope, where the continuous mining of ore prevents secure timbering of the roof at the point of attack. The Broadway subway cut, however, is from a mining standpoint a shallow open cut the walls of which could be easily held by proper timbering, no matter how the dip of the strata or cleavage planes.

There is however a close analogy between the Broadway and Seventh Ave. accidents, in that the failure of the timber structures was communicated over a much greater area than that directly affected by the rock fall and blast. Diagonal bracing of the posts on Broadway would have restricted the area of timbering affected by the rock fall, and it seems to be only a matter of luck that a greater area did not collapse. This diagonal bracing has since been put in on the Broadway section in question and elsewhere.

JOHN SEWARD.

West Nutley, N. J., Oct. 6, 1915.

Percentage-Basis Contracts with Economy Clauses

Sir—I notice in *Engineering News* of Sept. 2 an editorial concerning an inquiry as to contracts made on a percentage basis in which there would be an inducement for economy.

A contract of this character, where the writer was engineer, was made by the Troy Public Works Co., of Utica, N. Y., with a private owner for the construction of a macadam road about 2 mi. in length. The contractor was to furnish all materials and labor, also all incidental expenses at actual cost plus 15%. If the cost exceeded the amount as estimated by the engineer according to the stated schedule of quantities and prices, the contractor was to receive only 7½% on such excess. If less, the contractor would receive, in addition to the 15% of actual cost, 10% on the difference between the cost and the original estimate. However, this contract was not completed, as after the work was well under way construction was discontinued by order of the engineers of the New York Water Supply (since the road went over a hill which will be surrounded with water in the new Kensico reservoir) and settlement was made for work done by mutual agreement. Later a like contract was made between the same parties for steam-shovel work at another place.

E. F. MUSSON.

Norwich, N. Y., Sept. 8, 1915.

A Water Storage Dam 140 ft. high, impounding 3,500,000,000 gal. of water for regulating the flow of the Naugatuck River, Connecticut, has been recommended by Charles H. Preston, Jr., of Waterbury, Conn., in a report to the manufacturers of the Naugatuck Valley. The plans for the dam have been accepted by the State Board of Engineers. The dam, which is the first of a proposed series, would contain 190,000 cu.yd. of cyclopean masonry. The entire project, if carried out, would be the largest enterprise of the kind in New England, and would cost several million dollars. The prospect for its construction is not announced.

New Water-Conservation Scheme at Fall River, Mass.*

SYNOPSIS—Four conduits in a single three-story reinforced-concrete structure would convey pure lake water for power, divert sewage, turn surface water at will into a pond for storage or into a river to waste, and convey condenser water into oil-separating and condenser basins. Water-power for mills would be regulated, the city water-supply increased, river-pollution nuisance abated and 146 acres of land reclaimed.

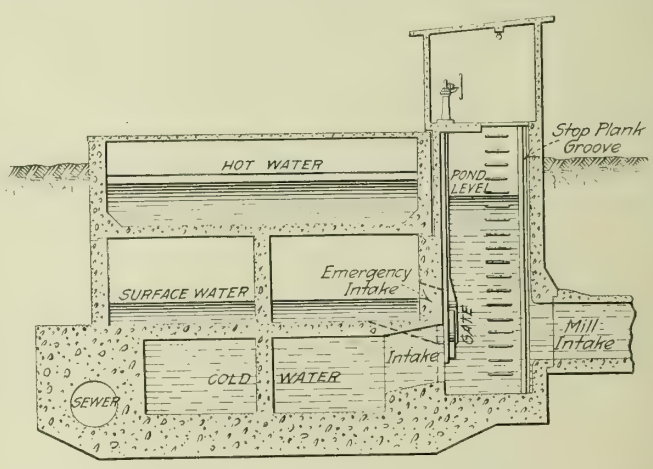
The city of Fall River, the principal cotton-manufacturing center in the United States, is crossed transversely by the Quequechan River, a stream having a total length of only 2½ mi. The stream serves as an outlet for the North and South Watuppa ponds, which together constitute in area the largest body of fresh water in Massachusetts, and which are only 2 mi. from tidewater and 130 ft. above it. In its first 2 mi. the river's course is nearly level, the 130-ft. drop taking place in a series of falls occurring in the last half mile of its length. The Watuppa Dam, built many years ago at the point where the river begins to fall, has caused the upper portion to overflow the flats adjoining the original river bed, so that at some points the river is 2,000 ft. wide.

Upon the shores of the Quequechan are located numerous cotton mills containing about one-half of the 4,000,000 spindles in the city. These mills draw water from the stream for condenser purposes and for bleaching and washing fabrics and return into it the heated water which has been passed through the condensers. They also discharge into it various wastes, including sewage, and the stream is further polluted by oil from the condensers, by surface water from the slopes of the city adjoining the stream and by city sewage discharged from the sewers through various overflows. The larger number of these mills are located along the upper, overflowed reach of the river, which by reason of the pollution which it receives is at times very offensive.

Of the two Watuppa ponds, the North Pond is utilized as the source of the city's water-supply, and is in fact scarcely sufficient for that purpose, and must soon be augmented from another source. This leaves only the South Pond available for supplying through the river the demands of the mills along the stream. This supply varies greatly in quantity with the level of the pond and at times is insufficient to furnish the mills with the desired quantity of water, while at other times much is wasted. Moreover, the hot condenser water discharged from the mills nearest the lake heats the river water to such a degree that mills farther downstream frequently find it necessary to shut down temporarily, as the water is too hot for condensing purposes. At certain times the water is too polluted to serve for washing fabrics.

The improvement of the stream and conservation of the water have been under consideration for about 40 yr., but only within the last year has a complete study, accompanied by plans and details of cost, been made.

The most interesting and unusual feature of the project proposed by the commission [created by the legislature of 1913] for the solution of the problem is the main conduit, a three-level reinforced-concrete structure of large size, which is here shown in cross-section. This structure extends from the South Pond to the Watuppa Dam and has a total length of 9,800 ft. In its lower portion it contains a covered channel sufficiently large to take the entire river discharge and at a sufficiently low grade to enable the lake to be drawn down considerably lower than is possible through the natural river bed, thereby increasing by about 70% the available storage capacity of the lake and insuring for the mills an abundant and regular supply of water of the same purity and temperature as the lake



PROPOSED MULTIPLE WATER AND SEWAGE CONDUIT

water. This channel is level throughout its course and is under pressure; in effect, it extends the lake to the mills. Immediately above this channel is one providing ample capacity for storm water. This channel is also level, and is fitted with controlling devices that permit the storm water to be discharged either downstream into the Taunton River or upstream into the South Pond. At the uppermost level is a covered channel to take the heated and polluted condenser water back to the pond, into which it is discharged after passing through both an oil-separating basin and a cooling basin. In the foundation of this structure, adjoining the cool-water channel, a trunk sewer is constructed for a portion of the length of the conduit. The areas and capacities of the various channels in the portion of the main conduit adjoining the pond are as follows:

	Area, Sq.Ft.	Capacity, Sec.-Ft.
Cold-water channel	110	500
Surface-water channel	143	700
Hot-water channel	81	225

The overall dimensions of the conduit at this point are 37 ft. in width and 23 ft. in height. The cold water is discharged downstream into the existing river bed at a point where the river begins its rapid descent. The sewage and storm water, however, are discharged into an outfall sewer, built as a tunnel and emptying into the

*Abstract of report of the Watuppa Ponds and Quequechan River Commission to the City Council of Fall River, Mass., Fay, Spofford & Thorndike, Consulting Engineers, 308 Boylston St., Boston.

Taunton River. As a protection in case of a severe flood, this tunnel is made somewhat larger than is necessary for sewage alone, and is also connected with the cold-water channel, thereby making possible a flood discharge greater than can now be conveyed by the existing river channel between the Watuppa Dam and tidewater. This portion of the river bed is badly obstructed by various deposits and is contracted by the construction of buildings alongside and over it. Suitable provision for longitudinal expansion is made in the conduit, and special precautions are taken to allow for the independent movement of the hot-water channel.

One of the chief advantages of the conduit is the opportunity it provides for increased fire protection for the mills along the river. The abundant supply of water in the cold-water channel can be readily utilized for fire protection, not only for the district in the immediate vicinity of the conduit, but also in the portion of the city lying along the river valley. The district to which this additional fire protection can be secured includes the central business section of the city, in addition to the manufacturing district bordering the river. The advantage of this additional fire protection is particularly important because of the limitations of the present domestic water supply.

Another important advantage of the plan, so far as the water-supply is concerned, is that by its capacity of lowering the lake to considerably lower levels than can be done through existing means, a far greater storage capacity of the lake is made available and a regular daily supply of 20,000,000 gal. throughout the year can be obtained, this being equivalent to the average yield of the watershed. Under the conditions now existing the daily water-supply may fall as low as 5,000,000 gal.

In addition to the design of the main conduit numerous branch conduits to supply the various mills have been planned, as well as a complete system of sewers for the unsewered portion of the city adjoining the stream, and storm drains where needed. Only a limited portion of these sewers and drains need be built at the outset.

In the process of the investigation considerable attention was given to the separation of oil from the condenser water to prevent its being discharged into the pond, thereby forming a nuisance because of its deposits along the shore of the pond. Experimental studies were conducted on this topic in the laboratories of the Massachusetts Institute of Technology, which resulted in establishing the size and type of the oil-separating basin. Similar study was given to the question of cooling this hot water to prevent undue heating of the lake water near the cold-water intake.

It was found that a cooling basin sufficient in size to permit of cooling the discharged water in very hot weather to the same temperature as the lake was impracticable. The cooling basin as designed will, however, have considerable effect in this direction, and its outlet into the lake is sufficiently remote from the cold-water intake to insure that the partly cooled water will not reach the intake before thorough mingling with the lake water; it will therefore have sufficient additional cooling to make sure that the water reaching the mills will be cool enough for condenser purposes under any conditions that may arise.

The plan also contemplates as a necessary part of the abolition of the nuisance the filling of the entire area of the flats. This will result in the redemption of 146 acres of land, which will immediately become available for manufacturing and civic purposes.

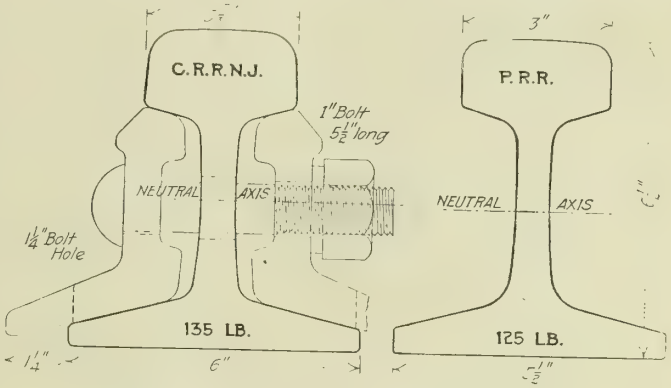
The total estimated cost of construction is $2,592,500, and in addition to this the engineers have made an allowance of $100,000 for damages and $250,000 for general expenses, bringing the total gross cost up to about $3,000,000. As an offset to this it is estimated that the value of the reclaimed land will be $800,000 and the benefits accruing to the mills $1,000,000, thus reducing the cost to the city to somewhat over $1,000,000.

According to the legislative act, the project must be adopted or rejected by the city council within thirty days of the receipt of the report. The project has already been approved by the Massachusetts State Department of Health.

Two Heavy Rail Sections

Rails heavier than 100 lb. per yd. are exceptional, and have been applied mainly where conditions of curvature and heavy traffic combine to cause severe stress and wear upon the track. The Pennsylvania R.R., however, is introducing a 125-lb. rail for general use on its busy main lines, and the New York Central R.R. is using a 105-lb. rail for similar lines.

The heaviest rail now in use is the 135-lb. rail of the Central R.R. of New Jersey. This was adopted a few



DESIGN OF RECENT HEAVY RAIL SECTIONS

	C.R.R. of N.J.	Penna. R.R.
Weight per yd.	135 lb.	125 lb.
Height	6½ in.	6½ in.
Width of base	6 in.	5½ in.
Width of head	3 5/32 in.	3 in.
Sides of head	Sloped	Vert.
Depth of head	2 in.	1⅝ in.
Depth of web	3 9/32 in.	3 13/32 in.
Depth of base	1 7/32 in.	1 7/32 in.
Thickness of web	¾-in.	21/32 in.
Radius of		
Head	14 in.	12 in.
Top corners	5/16 in.	7/16 in.
Bottom corners	3/16 in.	1/16 in.
Sides of web	14 in.	16 in.
Top fillets	⅜ in.	½ in.
Bottom fillets	⅝ in.	¾ in.
Corners of base	⅛ in.	1/16 in.
Head	40.28%	38.9% (4.73 sq.in.)
Web	21.90%	20.3% (2.47 sq.in.)
Base	37.82%	40.8% (4.95 sq.in.)
Moment of inertia	72.39	68.7
Fishing angle, top	14°	18°
Fishing angle, base	14°	14°

years ago and is now in service on about 40 mi. of track. The Pennsylvania R.R. has more recently adopted its 125-lb. rail. Last year 15,000 tons of this section were laid, covering about 75 mi., and the 1915 contracts call for 37,500 tons.

Sections of the two rails and their comparative dimensions and proportions are given herewith. It will be seen that they represent distinct types of design.

Public-Service Engineers on New York Subway Accidents

SYNOPSIS—The engineers of the Public Service Commission of New York City report that the Seventh Ave. collapse of Sept. 22 was caused by a blast in the northeast corner of the excavation. E. S. Davis and H. H. Quimby report that the subway timbering has only minor defects, that continuous longitudinal bracing is unnecessary and that the only danger is from rock slides.

Reports have been made on the two recent failures of subway timbering in New York City (Sept. 22 on Seventh Ave. and Sept. 25 on Broadway) by the engineers of the Public Service Commission, which is in charge of building the subways, and by an expert board composed of Edmund S. Davis, Chief Engineer, Boston Transit Commission, and Henry H. Quimby, Chief Engineer, Philadelphia Department of Transit. The latter report deals with both collapses, but the engineers of the Public Service Commission say nothing about the Broadway accident and confine themselves to the earlier one. The chief points in the reports are as follows:

Cause of Seventh Ave. Collapse

John H. Myers, Division Engineer of the Public Service Commission, whose division included the Seventh Ave. section where the collapse occurred, reports that just before 8 a.m., Sept. 22, the bench on the east side of the north heading at 25th St. and Seventh Ave. was being blasted. One hole near the bottom was shot and then four holes in the bench. The collapse followed immediately after the second blast. The rock, while quite hard, appeared to have a number of seams, and marks at the holes indicated that the rock probably broke out more readily than normal, and may have been thrown a considerable distance back from its original position. Large pieces of rock were found near the wreckage of the tower supporting the middle runner beam (see sketch of timbering, Fig. 5, *Engineering News*, Sept. 30, p. 664). They were probably some of the pieces blown out by the blast.

The eastern one of the three runner beams had been forced south, carrying with it two transverse I-beams (20 in.) suspended from it. Most of the easterly transverse I-beams which divided the street timbering into two stories were found lying in a general southeast-northwest direction. Mr. Myers states:

> I formed the opinion that the blast had been the cause of the accident and that its force had caused the members forming the support of the street and trolley tracks to move to the south, and that this southerly movement was especially evident on the east side of the cut, which was the side on which the blast was fired. I also felt that this movement had in all probability been augmented by the fact that the trolley track, having had the supports taken away from beneath it, had hung in a manner similar to a rope, and that this action by either pulling the posts which were above the cross I-beams to the north or else pushing them to the south had in turn augmented the movement which I believe the blast initiated, and when this disturbance of the track reached the point where the surface car was, its weight added to that of the track increased the force tending to move the supporting structure southward. The car being a northbound one was on the east track, upon which side of the cut there is most evidence of this movement. The posts supporting the cross I-beams fell with tops to the south and bottom ends to the north.

Marks on the web of the most northerly transverse I-beam appear to show the point where a flying piece of rock hit this beam and, according to the explanation given by Mr. Myers, started the collapse.

Robert Ridgway, Engineer of Subway Construction, reports: "My study of the matter has led me to the conclusion reached by Mr. Myers, that the initial cause of this accident was a blast which was fired in the northeast corner of the excavation."

He further states that immediately after the accident he instructed the division engineers throughout the subway work to have a thorough inspection of all shoring and street supports of the subway excavation made at once and take steps to remedy any unsatisfactory conditions, all of which instructions were promptly followed.

Chief Engineer Craven's Opinion

Alfred Craven, Chief Engineer, says: "I am of the opinion that the blast which immediately preceded it, and which I believe acted abnormally, was the direct cause of the collapse of the street decking." However, he also considers that the street-railway track structure played a part in furthering the collapse. This structure (composed of yokes, conductor-rail conduit, conductor rails, track rails and concrete encasement) was very heavy and had considerable tensile strength available for suspension-rope action. When it tore apart, after taking a considerable sag, it exerted an unusual strain on the timbering. Concerning the strength developed by this structure, Mr. Craven says: "The track conditions of the underground trolley exhibited unusual strength under longitudinal strain." And he says that had it not been for the track he believes the timbering "would have withstood the shock of the blast and would not have collapsed."

Mr. Craven reports that the tower-and-runner-beam method of supporting the roof at the headings is generally in vogue and has been deemed safe and adequate. Since the accident showed further safeguards to be necessary, steps to provide them were taken immediately. Swaybracing has been put in place near the headings.

Davis and Quimby Against Longitudinal Bracing

Henry H. Quimby and Edmund S. Davis report that there is little to criticize in the timbering used in the subway work. Quoting from their report:

> The types of timbering used by the different contractors vary somewhat. With special reference to the method used by the United States Realty and Improvement Co., in whose work the two recent casualties occurred, we found that the sizes of the material used for the various members give ample strength for the loads imposed by the street traffic, and we are of the opinion that while some cases of details of the framing and bracing were found that are not in accord with the best practice, the greatest and only serious menace to the shoring and to public safety consists in the possibility of rock slides. . . .
>
> The cases wherein details of the timbering have appeared to us as unsatisfactory are the omission of efficient lateral stays at some joints in the posting, points where needles or cross-beams rest upon posts and carry upper-story posts without struts to stay the points against lateral movement, or where no lateral stiffness has been given by the use of fish-plates or cleats to stay the points against buckling, some

cantilever beams carrying upper-story work without struts at buckling points, and the omission of posts under rangers.

The omission of longitudinal struts at or near the posts of the timbering is not general, the instances of the omission being probably oversights on the part of the workmen, or possibly due to removal either by intention or by accident. Such points in the construction should be the subject of repeated inspection, and the whole structure should be continually maintained in a state of completeness and tightness.

Longitudinal diagonal bracing is probably never needed except in the event of the accidental destruction of one or more of the bents, and as it is necessary to remove it before the permanent steel framework of the subway can be erected, it would seem that a continuous system of longitudinal diagonal bracing is scarcely justified. If a considerable stretch with many bents must be maintained between the permanent subway construction and the heading, the distance might be divided into braced portions to be determined according to the local conditions—say by using diagonal braces at intervals of 30 to 50 ft.—and such diagonal braces might better consist of heavy timbers extending from the needle beams to the floor, so detailed that they can easily be shifted as the permanent construction is advanced.

The lesson of the extensive collapse in Seventh Ave., where the blast that caused the disaster perhaps directly destroyed only the nearest bents, would logically be that, as provision against the occurrence of an accident of any sort that may destroy one portion of the timbering, some diagonal bracing should be provided at such intervals as may be justified by the local conditions. If the permanent subway construction should be kept as close to the heading as is practicable and prudent, considering its liability to injury by blasts, manifestly very little of such longitudinal diagonal bracing will be needed.

Rock Slides Are the Chief Danger

Concerning rock slides, however, these experts are very apprehensive. Under conditions such as prevailed in the Broadway excavation at 38th St., where the second collapse occurred, they think it is highly important that adequate supports be provided for all loose rock by putting in rakers or horizontal shoring or by doweling into the solid rock, wherever the condition of the rock indicates liability of a stratum to separation from its bed. They say:

> Much of the rock in the excavations is of a nature that makes it subject to loosening in the seams when exposed to weather, temperature changes and vibrations, and the determination of liability to slide is often difficult. At such points, if any doubt exists as to the necessity for shoring, the doubt should be resolved on the side of safety and no chance should be taken. . . . An efficient system of supporting, strutting and wedging should be at once adopted and installed throughout every area in which the strata are tilted at an angle that will subject them to either sliding or toppling.
>
> The character of most of the rock that came under our observation in the excavations is such that its stability when trenched cannot be certainly determined; and especially when its exposure to weather and to the vibration of street traffic is to be continued over considerable time, as is said to have been the case in the Broadway cut at 38th St., prudence would dictate that complete rigid shoring be provided to secure it.

With regard to both the danger of disintegration of rock and the danger of loosening of the timber falsework, these experts recommend that the permanent subway construction should follow closely upon the excavation, so that as little falsework as possible should stand between heading and permanent structure.

Recommendations of Davis and Quimby

They recommend four specific items:

1. That throughout the present construction at every point where the trench is in a rock with inclined strata showing open seams or other evidence of actual or threatened disintegration, the sides be shored across the trench so as to form a continuous strut from side to side of the trench, with additional supports in the shape of raker braces if projecting portions of rock afford the necessary hold.
2. That an effort be made to systematize the work so that the sequence of operations will carry the work of excavation and the erection and concreting of the permanent subway structure close together, so as to require as little falsework and temporary decking of the street as possible.
3. That in future work preference be given to a type of timbering that will provide continuous needlebeams or struts from side to side of the trench, with the joints of the uprights firmly spliced to prevent buckling.
4. That a periodic inspection be made of every point of contact of shoring with the banks, as well as of all connections of members, to insure continuous tightness and prevent deterioration of the timberwork from vibration.

They praise the general conduct of the work and the intelligent forethought and faithful execution of plans. Continuing this excellent practice, and observing also the four precautions recommended, the public will be fully safeguarded against repetition of the accidents, they say, in spite of the element of risk inseparable from the work.

Panama Slide Increases

Unofficial dispatches from the Canal Zone state that the slide in Gaillard Cut which started on Sept. 18 is increasing in seriousness and that now nearly 10,000,000 cu.ft. of earth is in motion over an area of 175 acres. It extends 2,600 ft. along both banks and has an average width of about 1,500 ft. back from the canal center line. No official prediction of the date of opening of the canal has been made, but it is stated that practically all the ships waiting for passage have been ordered to other destinations.

This news is confirmed by the following description of the Culebra or Gaillard Cut slides published in the *Canal Record* for Sept. 15, 1915, just after one of the canal stoppages had been cleared up:

> The section of channel affected by the two Culebra slides extends between Sta. 1770 and 1798, a distance of 2800 ft. The east slide lies directly to the north of Gold Hill, and the west slide to the north of Contractor's Hill. The width between the outer limits of the breaks on opposite sides of the cut is greatest at Sta. 1787, where it amounts to 2975 ft.
>
> On the east side the break extends back 1525 ft. from the center line of the channel, and the surface at the outer limit of present breaking is 350 ft. above sealevel. On the west side the break runs back 1450 ft. from the center line, and the present edge is at 585 ft. above sea level. The greater part of the movement at this time is from the west side. On July 1, it was estimated that 5,000,000 cu.yd. were in motion on the west bank in this section, and 4,000,000 cu.yd. on the east bank. Since that date about 2,000,000 cu.yd. of spoil has been removed at the bases of the two slides.
>
> In the past month and a half the forces of the Dredging Division have made some remarkable records in excavation. Five hard material dredges have been employed at the bases of the Culebra slides and they and all the accessories serving them have been worked under heavy pressure 24 hr. a day.
>
> During the month of August the excavation at the bases of the Culebra slides amounted to 793,012 cu.yd. In the same month 66,228 cu.yd. was removed from the base of Cucaracha slide, and the seagoing suction dredge Culebra, which ranges the cut between Gamboa and Paraiso to remove silt and keep the channel clean, took out 132,639 cuyd. The total excavation in the cut by seven dredges was 991,879 cu.yd. From September 1 to the morning of September 13, the total excavation from the Culebra slides was 291,082 cu.yd. and the total from the cut was 380,127.

Until it is known how much of the total slide actually threatens the section of the cut, the time required for the clearing of a ship channel in uncertain.

Major-General Goethals, whose resignation as Governor of the Zone was to have taken effect next month, has returned to Panama from the International Engineering Congress at San Francisco and has announced that he would remain at the canal until "its condition would permit his departure," presumably until the slide situation is satisfactory.

News of the Engineering World

Old Wall Used as Coffer-Dam Fails at Louisville

A section of the old wall of the Louisville & Portland Canal, at Louisville, Ky., which is being widened from 85 to 200 ft., failed on the morning of Oct. 5, admitting a rush of water that flooded the new portion of the canal. A hoisting engineer employed by the contractor, the Henry Bickel Co., of Louisville, was drowned. With a companion he was in a flatboat in the canal opposite the destroyed section, when they saw it begin to move. Both jumped for the solid section, and the engineer, missing it, was caught in the suction. Workmen in the cut, warned by distress whistles from a nearby plant where the accident was seen, escaped with a wetting. Investigation was made immediately by Major J. C. Oakes, Corps of Engineers, U. S. A., in charge of the Louisville District.

The wall was built in 1854 and consisted of cut-stone masonry on a ledge of rock, the construction being shown in the accompanying cross-section (Fig. 3). The contractors had channeled a short distance from the back of the wall, leaving the wall itself with a section of the underlying rock as a coffer-dam. A view of the work, with the old canal on the left and the old masonry wall and ledge in the middle, is given in Fig. 1.

A section 500 ft. in length slid along the seam at El. 404.2, a little over 4 ft. from the bottom, and toppled into the cut. Another section of 100 ft. slid along the bottom of the canal a distance of 50 ft. into the cut, but remained upright. Two sand barges that were tied to the wall near the scene of the break were swept through by the rush of the waters and carried against the new canal wall, while a steamboat which was passing was swept against the old wall. The concreting plant inside the cut was pushed aside about 60 ft. and swept off the rails. The condition after the failure is shown in Fig. 2. The location may be tied up to Fig. 1 by noting the power-plant intake on the left, common to the two views.

The excavation had been completed several hundred yards beyond the point of failure and the wall had been

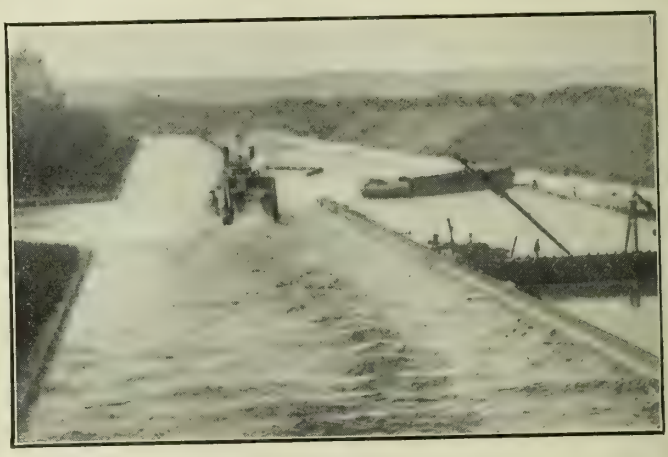


FIG. 2. LOOKING DOWN CANAL TOWARD DESTROYED SECTION OF WALL

standing as it was for several months. The water in the canal had risen about 1 ft. above pool level. It was suggested by a member of the contracting firm that the waves of the passing steamboat had aided in lifting the wall, and by increasing the height of the water added the pressure necessary to move it. Both the Government en-



FIG. 1. WIDENED SECTION OF CANAL BEFORE FAILURE

gineers and the contractor's superintendent, A. G. Butler, had kept a constant watch on the wall and the failure occurred without any previous indication. Butler was on the wall close to the part that failed and was almost caught by the inrush.

The masonry had been reinforced on the excavation side with concrete some time previously. Leaks that had developed had been sealed by applying bags of manure

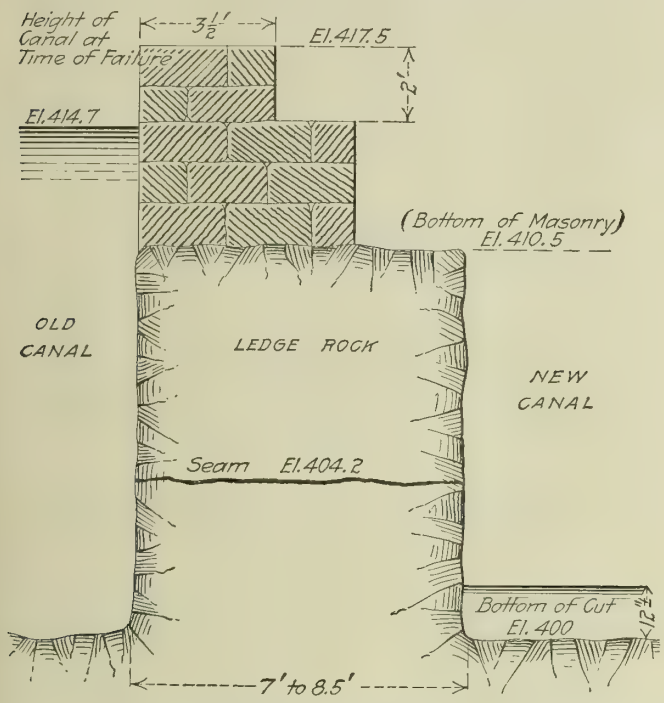


FIG. 3. SECTION THROUGH OLD WALL, LOUISVILLE & PORTLAND CANAL

to them on the canal side and allowing the water to draw them into the holes.

It is probable that the contractor will build a cofferdam beyond the break, permitting the water to remain in the portion already completed. Considerable machinery and trackage were caught, but these can be fished out. The accident is the first that has occurred either in the widening of the canal or the construction of the new locks. A ditch at the lower end of the work will drain a large part of the water after the river falls.

Controlling River des Peres

A 13-mi. river improvement scheme at a cost of $6,000,000 to eliminate flood dangers in the River des Pères valley, St. Louis, has been proposed in a report just made by the Board of Public Service at the request of the Board of Aldermen of that city. The project includes 7 mi. of closed conduits to take the whole of the extreme flood flow and the sanitary sewage of the upper part of that portion of the river within the city and 6 mi. of open storm-water channel to take maximum-flood flows. Beneath this channel there would be a sewer (already built) which would take all the sanitary sewage of the district, the entire dry-weather flow of the river and the storm water from light showers.

The 7 mi. of combined sewer would begin as a single conduit and continue as two and then as three conduits, each 30 ft. in width. The estimated cost of this part of the work is $4,500,000. The lower 6 mi. (open channel) would range from 70 to 100 ft. in width and from 15 to 25 ft. in depth.

The estimated cost of excavating the channel, lining it with masonry and filling the old bed of the river, where property is valuable, is $1,500,000. The existing sewer beneath the proposed open channel cost about $930,000. To complete the system several branch conduits would be required, taking in small streams. The River des Pères drains 16,000 acres within the city and 54,000 outside it in St. Louis County. Serious floods occurred in the valley in March, 1897, October, 1905, both June and July, 1912, March, 1913, and, most serious of all, August, 1915. (For accounts of the last-named see *Engineering News* of Aug. 26 and Oct. 7, 1915.)

Steamship Line Uses Oil Fuel

The Panama-Pacific Line has just announced that oil-fuel will replace coal under the boilers of the twin-screw steamers "Finland" and "Kroonland," now making the 17-day run with passengers and freight between New York, Los Angeles and San Francisco through the Panama Canal. The necessary changes will be made during November and December for installation of mechanical low-pressure oil-burning apparatus (White system). Besides assuring clean decks and eliminating dust, cinders, coaling delays *en route,* etc., the change will allow higher speeds and more continuous high speed. A 40% reduction in fuel bills and a decrease in the fireroom staff from 60 men to 12 are expected.

The "Finland" and "Kroonland" are the largest steamers ever to be equipped in this manner, being 580 ft. long, 60 ft. broad and having a displacement of 22,000 tons. The fuel will be stored in their double bottoms, and this will make available one-third additional cargo capacity, now used for coal bunkering. The same system has worked satisfactorily on the coastwise steamers "Bunker Hill" and "Massachusetts" and in the fleets of the Standard and Texas oil companies.

Structural Damage Slight in New Orleans Storm

The severe windstorms of the past year at Cincinnati, Galveston and New Orleans have all demonstrated that the structure of a well-designed building is safe against the pressure of any wind. In further comment on this observation J. F. Coleman, consulting engineer, of New Orleans, and W. H. P. Creighton, Dean of the College of Engineering at Tulane University, write regarding the Sept. 29 storm at that city when all wind-velocity records were broken:

Mr. Coleman's Comments

Mr. Coleman's comments in part are as follows:

"Practically all of the buildings which collapsed during the storm were light frame structures or very old brick buildings. In the business center of the city the damage consisted principally in broken windows, ripped-off skylights and slate roofs, blown-off chimney tops, and blown-down smokestacks. The tall structural-steel buildings had a very distinct oscillation during the height of the storm, though so far as I know this oscillation was not measured or even estimated. However, it very evidently was not as great as some of the occupants of such buildings

thought, as there is no evidence of cracks in the brick, stone or terra cotta, with which they are faced.

"On the river front the steel wharfsheds suffered to some extent by having the corrugated-iron siding and the wooden sheathing and composition roofing partly stripped off. Some of these sheds appear to have suffered no damage and the only one which collapsed was wrecked as the result of a boat being blown against the wharf on which it rested, so damaging the wharf as to cause wreck of the shed. In the residence districts few houses escaped unscathed, though a number were badly injured.

"In general retrospect it is surprising that the damage was not greatly in excess of what it is. Our modern buildings have been usually designed for wind loads from a 60-mi. velocity, and no doubt in many instances for lesser loads. For 3½ hr. the wind had a velocity in excess of 60 mi. per hour, reaching 86 mi. sustained velocity with one gust of 120 mi. This city contains approximately 75,000 buildings, of which number not much more than 50 were wrecked, and these mostly of the flimsiest frame construction. The casualties within the city were 15 killed and 40 injured."

Professor Creighton's Report

Professor Creighton sends the following information supplementing his report of last week:

"Last week your correspondent declared that no substantial, well-built, modern structure suffered more than trivial damage. After interviewing a number of superintendents, consulting engineers and architects, and after examining a number of wrecked structures, no reason has as yet been discovered for changing that opinion. In the early part of an interview the superintendent or owner would make broad claims for the disabled structure, but ultimately would admit some defect. Incidentally, it must be admitted that it is not necessarily economical to design all buildings to withstand hurricanes.

"The steeple of a prominent church, built in 1857, fell. The mass of wreckage at the foot of this steeple is largely made up of single bricks with no mortar on one side. The failure of the mortar to adhere at all to the brick indicates defective adhesion and probably points to a failure to wet the bricks before laying them. An architect remarked that the mortar on the bricks of overturned house chimneys had evidently deteriorated as it seemed largely composed of sand and that he had noticed no cases where chimneys laid up in cement mortar had fallen.

"New Orleans has now an unexcelled water filtration plant. During the storm the water pressure dropped only 5 lb., although several mains of 8 in. or so were completely broken and caused a great leakage. Formerly, however, people depended upon conducting the rain which fell on the roofs into cisterns made of cypress. This has resulted in the city of New Orleans having more slate roofs than any other city. Slates sweat a little in the early morning before the sun is high and this rusts the iron nail that holds them on the roof. When the head of the nail is rusted badly it requires but little wind to blow the slate away. Fancy tiles should be fastened, preferably by copper fastenings, to the roof or ridge pole. Similarly slates and shingles would be more permanent if fastened with copper fastenings. In this storm a Bedford limestone block about a foot square and three feet long was pushed off a part of the facade of a church. The builders evidently thought that its weight ought to be ample to keep it in place.

"The shipping on the river front was not furnished with heavy enough lines. A couple of light 3-in. hawsers are insufficient to hold vessels of any considerable size. Many of the vessels should have been held by 6-in. lines.

"All observers noticed the considerable pulsations of the barometer during the storm. The wind came in strong gusts. There seems to be no doubt that at times the pressure outside the roof of a building was less than the pressure inside and as a result more or less of the roof would be lifted off. Thus at Tulane University there was a large tank sunk in the ground and covered with boards 3 in. thick, 12 in. wide and 7 or 8 ft. long. The upper surface of these boards was even with the surface of the ground. During the storm the boards were lifted and dropped into the tank. Architects take much care in designing structures against the downward pressure of the air and make little or no provision against the effects of any lifting power it may develop. This cyclone searched out hundreds of open sheds and lifted corrugated-iron roofing and sent it flying, or if the roofs held fast it raised the sheds clear of the ground, and when the sides were well inclined to their proper position, flattened the whole structure."

Wall of Covered Reservoir Slides Out

The clearwater reservoir of the Portsmouth, Ohio, filtration plant was wrecked on Sunday, Oct. 3, by the failure of a 75-ft. length of concrete side wall. The wall at this point was about 30 ft. high and rested on rock of poor quality. The breakout was sudden, although leakage from the embankment outside the wall had been noticed several hours before, and a moist condition of the bank had prevailed for some time previously.

The reservoir is 260 ft. by 260 ft., about 16 ft. deep from floor to roof, with a capacity of about 8 million gallons. The roof is a reinforced-concrete slab on brick piers. The floor is laid directly on the ground (part on fill). The wall is reinforced concrete, 18 in. thick at top, 30 in. thick at floor, and continuing on uniform batter to rock. Buttresses on the water side had their reinforcing tied into longitudinal rods in the wall.

At the point of break the bottom of the wall was about 14 ft. below floor, or 30 ft. below roof, and the reservoir floor was on backfill. The rock contained mud seams, and its surface sloped downhill. The failure appears to have been a sliding on the rock.

Local reports name the J. F. Witmer Co. as engineers for the reservoir. Curtis & Shumway were contractors. Although in use, the reservoir had not been accepted or fully paid for, on account of lack of tightness.

Detroit-Superior Arch Closed—The closing members of the 591-ft. steel arch crossing the Cuyahoga River in the new Detroit-Superior viaduct at Cleveland, Ohio, were placed Oct. 6, 1915. The middle lower chord members of both trusses were placed simultaneously.

A Company of Engineers has been organized in the cadet brigade at the University of Illinois. There will be a captain, two lieutenants and 54 men. The company will receive some infantry drill, such as marching and company movements. There will be also "sand-table" lectures on trench construction and earthwork and possibly topographic surveying and map sketching. It is expected to develop men who would be valuable in the organization of volunteer engineer companies. A similar organization has already been noted in the Cornell University Cadet-Corps.

Cast-Iron Dome for Sale—The old cast-iron dome of the capitol at Madison, Wis., has been taken down to make way for the new dome and is now for sale. The various members were removed in such form as to permit their reërection and are now stored on the university campus at Madison ready for the purchaser. All pieces are marked to fit a specially prepared erection plan to facilitate erection. The total weight of metal is estimated at between 800 and 1,000 tons.

PERSONALS

Mr. J. B. Holtzworth has been appointed Assistant Engineer of the Western Maryland Ry., to succeed J. M. Harris, who has entered the employ of the Poole Engineering Co., of Baltimore, Md.

Mr. W. H. Gould, formerly Sanitary Engineer of Lucas County, Ohio, will in the near future open an office in The Nasby, Toledo, where he will engage in the practice of civil and sanitary engineering.

Mr. Joseph Fawcett, formerly Surveyor of Greene County, Ohio, has been appointed County Road Superintendent under the new Cass law, which places the county surveyor at the head of the road department.

Mr. G. H. Hutchinson, well known in the Middle and Far West among contractors, has become associated with the Bucyrus Co., of South Milwaukee, Wis. He will be in charge of its recently opened office at 900 Hibernian Building, Los Angeles, Calif.

Mr. A. C. Watson, Division Engineer of the Logansport division of the Pennsylvania System, has been appointed Division Engineer of the Cleveland & Pittsburgh division. Mr. Watson will fill the vacancy created by the recent death of E. F. McCrea.

Mr. F. W. Brown, formerly Superintendent of the Louisville division of the Southern Ry., has been promoted to the position of Assistant to the General Manager, with headquarters at Washington, D. C. He will have general charge of train tonnage and efficiency.

Mr. Louis A. Boulay, formerly associated with the firm of the Smith & Boulay Co., Consulting Engineers, of Toledo, Ohio, and now of the recently organized firm of L. A. Boulay Co., Civil and Sanitary Engineers, 1248 Nicholas Building, Toledo, has been appointed Sanitary Engineer of Lucas County, to succeed W. H. Gould.

Mr. Arthur C. Eversham, M. Am. Soc. C. E., formerly Assistant Chief Engineer of the Kansas City Terminal Ry., is now associated with the Kansas City Bridge Co. as Engineer of Construction. He will have entire charge of the construction work of the company and will give special attention to government and railroad construction.

Sir William H. Lindley, City Engineer of Frankfort, Germany, from 1884 to 1896, and engineer for water-works and sewerage improvements in that and many other German cities, has been honored with the degree of Doctor of Engineering by the Technical High School of Darmstadt, Germany. His father, William Lindley, designed the sewerage system of Hamburg after the great fire, which was the first modern sewerage system in Germany.

Messrs. C. H. Vaughan, M. Am. Soc. C. E., formerly Second Vice-President and Chief Engineer of the Penn Bridge Co., Beaver Falls, Penn., and H. R. Hortenstine, M. Am. Soc. C. E., formerly Contracting Manager of the same company and J. O. Childers, formerly with the erection department of the McClintic-Marshall Construction Co., and in charge of the erection of the lock gates at Panama, have purchased the plant of the York Bridge Co., of York, Penn., which will be incorporated under the name of the York Bridge and Construction Co.

OBITUARY

Axel Samuel Berquist, M. Am. Soc. C. E., inventor and patentee of the suspension bunker which bears his name, died at his home in Brooklyn, N. Y., on Oct. 6, after a long illness.

William M. Whelan, Superintendent of the Elizabethtown Water Co., of Elizabeth, N. J., died on Oct. 3 at the home of his sister in that city, at 58 years of age. Mr. Whelan had been in the employ of the water company since boyhood.

L. A. Fowler, head of the contracting firm of L. A. Fowler & Son, died recently at his home in Kansas City, Mo. This firm has done a large amount of building work in Kansas City. One of its larger contracts was for the annex to the Baltimore Hotel in that city.

Arthur S. Mann, M. Am. Soc. M. E., Mechanical Engineer of the General Electric Co., of Schenectady, N. Y., and formerly lecturer at Columbia University, died at Saranac, N. Y., on Oct. 3, at 45 years of age. He was born at Medbury, Mass. Mr. Mann was an authority on steam generation. At various times he also was associated with the Allis-Chalmers Co. and the Metropolitan Street Ry. Co., of New York City.

Gustave C. Kuhlman, founder and former President of the G. C. Kuhlman Car Co., died on Oct. 4 at his home in Cleveland, Ohio. He had been in ill health for some time and had recently suffered a nervous breakdown. Mr. Kuhlman was one of the pioneers in the street-car building industry in the Middle West. In 1881 he organized the company which still bears his name and opened a shop on St. Clair Ave., Cleveland, where he built horse-drawn and cable cars. When electricity was introduced for street-car systems the plant was expanded and moved to the Broadway car barns at Aetna Road. In 1903 Mr. Kuhlman sold his holdings in the company to the J. G. Brill Co., of Philadelphia, at which time the Kuhlman Co. was reorganized. Since his retirement from the company Mr. Kuhlman had been northern representative of the Martindale Mercantile Agency. He was 56 years of age.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. 19-21. Annual meeting, at Detroit, Mich. Secretary, C. A. Lichty, 319 N. Waller Ave., Chicago.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.
Oct. 18-24. Annual meeting in Chicago. Secretary, J. A. Andrencetti, C. & N. W. Ry., Chicago, Ill.

MAINTENANCE OF WAY AND MASTER PAINTERS' ASSOCIATION.
Oct. 19-21. Annual meeting in St. Louis. Secretary, T. I. Goodwin, C. R. I. & P. R.R., Eldon, Mo.

NATIONAL MUNICIPAL LEAGUE.
Nov. 17-19. Annual meeting in Dayton, Ohio. Secretary, C. R. Woodruff, North American Bldg., Philadelphia, Penn.

Southwestern Electrical and Gas Association—The 12th Annual Convention will be held at Galveston, Tex., May 17-20, 1916. H. S. Cooper, the secretary, recently made a trip to Galveston to see whether the storm had rendered it inadvisable to hold the convention there. He states that he found the business of the city almost normal and that there is no reason for changing the place of meeting.

American Institute of Chemical Engineers—The winter meeting will be held in Baltimore, Md., Jan. 12-15. The date selected is later than usual owing to the summer meeting having been held late in August in San Francisco. As the attendance of Eastern members at the San Francisco meeting was small, it is hoped that they will turn out strongly for the Baltimore meeting. The secretary is J. C. Olsen, Cooper Union, New York City.

National Lumber Manufacturers' Association—A series of meetings has been planned by the trade extension department of the National Lumber Manufacturers' Association, which is designed to teach the general public the advantages and general availabilities of wood as a building material. The first of these meetings was held on Sept. 23 in the rooms of the Commerce Club, Toledo, Ohio. The secretary of the association is R. S. Kellogg; the manager is E. A. Sterling, 925 Lumber Exchange, 11 South La Salle St., St. Louis, Mo.

Philadelphia Association of Members of the American Society of Civil Engineers—The annual meeting of the Philadelphia Association was held at the Engineers' Club, of Philadelphia, on Oct. 4. Dr. John A. Brashear, president of the American Society of Mechanical Engineers, delivered an illustrated lecture on "Contributions of Photography to our Knowledge of the Stellar Universe." The officers elected were: President, Edward B. Temple; vice-presidents, Edgar Marburg and John Sterling Deans; directors, J. W. Ledoux, Henry H. Quimby, H. S. Smith and George A. Zinn; treasurer, S. M. Swaab; secretary, W. L. Stevenson.

International Gas Congress—A congress representing the American gas industry was held at San Francisco from Sept. 27 to Oct. 2. The formal sessions opened with the presidential address of A. C. Humphreys, in which he pointed out that public utilities have to face a condition of over-regulation by public authorities. He believed that all should be active to

correct the misleading statements constantly being made. While admitting occasional faults, he claimed that generally the gas business is carried on with due respect to the rights of the public. The first technical paper, by O. B. Evans, was a historical review of the development of water gas. A. G. Glasgow followed with a paper on deep fuel combustion in water-gas manufacture. R. S. McBride, of the United States Bureau of Standards, then presented a paper on the substitution of heating value for candlepower as a criterion of gas quality. Many state and city authorities have already acted to establish the heating-value standard. In the discussion it was suggested that 600 B.t.u. per cu.ft. would probably be generally accepted as the standard. On the second day the congress met in two sections. One considered half a dozen papers on gas for illumination; the other took up nine papers on commercial aspects of the gas business. The discussion in both sections turned largely on the competition between electricity and gas for illumination purposes. The majority of those present represented companies supplying gas alone, and they declared that gas could hold its own in competition with electricity. In order to hold their business in the face of low electric rates the gas companies have engaged in a systematic campaign with both owners and architects, even in some cases furnishing free labor for installing the gas pipes. On the third day a review of modern coal-gas processes was given by the Society of Gas Engineering of New York. A general movement was noted in the East to substitute coal gas for water gas on account of the increase in the price of oil and the uncertainty regarding the future supply.

Appliances and Materials

Flow Meter for V-Notch Weirs

A flow recorder to be used in connection with small V-notch weirs has been designed by the engineers of the Harrison Safety Boiler Works and will be used particularly for measuring-type boiler-feed water heaters. There is a float which moves with each change of head on the weir and in turn rotates a spiral cam (laid out according to the law of the weir, $CH^{\frac{5}{2}} = Q$) through a multiplying gear. The cam moves a pen carriage which records on a paper drum the quantities corresponding to each position of the float. Back-lash has been eliminated by the use of a cable drum instead of a gear and pinion, while friction has been reduced as much as possible by mounting the spindle of the cam upon antifriction rollers. The pen carriage is provided with large rollers or wheels which rest upon horizontal ways, so that the cam follower which is attached to the pen carriage moves diametrically to the cam disk. The pen is suspended from the pen carriage so that it rests lightly against the chart drum and can readily be removed for cleaning or renewing the chart. An integrating attachment consists of a counting train, likewise suspended from the pen carriage and driven by a small roller, which rests upon an aluminum clock-driven disk. When the float and cam are at the position corresponding to the zero head, this roller is at the center of the disk, and hence receives no motion from the rotation of the latter. As the pen carriage is moved away from the zero position, the small roller is carried away the same distance from the center of the aluminum disk, and hence is propelled at a rate corresponding to the rate of flow over the weir. The total movement of the counting train will therefore correspond to the total flow. Further, a visible pointer moving along a large scale with open divisions has been added, making it possible to read the rate of flow from a distance.



HARRISON WEIR FLOW RECORDER

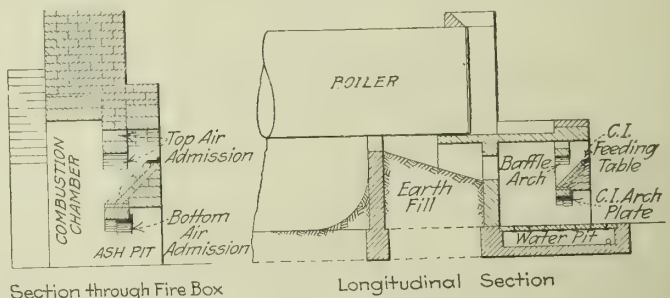
All parts of the mechanism of this recorder are made to accurate dimensions by means of templets and limit gages. To be sure of the accuracy of the instrument it is only necessary to know that it is properly adjusted—that is, when the float is at zero position; in other words, when the level of water upon which it rests is at the zero level of the weir, the cam must be at zero position, the pen on the zero line of the chart and the integrator roller at the center of the aluminum disk.

* * *

Smokeless Firebox for Kilns and Boilers

A radically new design of furnace for clay-products kilns and boilers has been devised by Paul Beer, President of the Grateless Furnace Co., Des Moines, Iowa. The arrangement is shown in the accompanying sketches. A rectangular firebox has a sloping fuel table leading down from a firing hole and having an ignition arch thrown over it. Beneath is an arch and plate spanning the ashpit. The combustion chamber is forward of the coking table and is spanned by a high arch.

The most difficult requirements of clay-products kilns have been satisfactorily met, it is reported by A. W. Clement, Smoke Inspector of Des Moines. During the early firing of a kiln, when low heat is required with great excess of air, the fuel bed fills the space below the bottom of the coking table. The upper portion of the firebox remains open and unobstructed. A little air is supplied through the ashpit. For the second period, which requires an oxidizing heat, coal is piled part way up the coking table. As the fires need cleaning ash and clinker are removed from underneath the coking plate edge and fresh coked fuel falls down to replace it. Volatile matter passes over the incandescent bed of coked fuel below. More air is supplied from the front of the ashpit, which is entirely open and without grate bars. When excess



GRATELESS GRAVITY-FEED KILN AND BOILER FURNACE

air is required the upper part of the firebox is left partly open. During the high heat for vitrification the fuel bed is carried higher up to close the fire hole and all air is cut off over the fire except that which comes through a small hole in the baffle arch. Air admission through the lower fuel bed is obtained by regulating the cleaning period. A reducing gas can be produced without smoke. A saving of nearly $60 per kiln per heat is reported in the paving-brick plant of the Barbour Asphalt Paving Co. The time of firing was reduced from 11 days 8.7 hr. to 9 days 14.3 hr.

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Sworn to and subscribed before me this 30th day of September, 1915.
RICHARD L. MURPHY,
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(My commission expires March 30, 1917.)

Engineering News

VOLUME 74 OCTOBER 21, 1915 NUMBER 17

Ornamental Bridge at Akron Built of Slag Concrete

A highway and interurban railway bridge of rather striking appearance has been completed during the past summer across the gorge of the Cuyahoga River on the line of North Howard St. extension in Akron, Ohio. In addition to its extreme height and artistic design the bridge is notable because it was built practically throughout of reinforced concrete using a blast-furnace slag for aggregate.

The bridge is 781 ft. 9 in. long, made up of five main arch spans 127 ft. c. to c. of piers and an approach at each end, of column and girder construction. It is 190 ft. high from bed of stream to grade, which makes it one of the highest—if not the highest—concrete highway viaducts on record, although the Tunkhannock viaduct now nearing completion for the Delaware, Lackawanna & Western R.R. exceeds it in height by about 50 ft. The bridge carries a 26-ft. roadway, with provision for a single line of interurban railway and two bracketed sidewalks each 4 ft. wide.



NORTH HOWARD ST. BRIDGE ACROSS CUYAHOGA RIVER, AKRON, OHIO

In design all of the arches are alike. Each consists of two reinforced-concrete arch ribs, 4 ft. deep at the crown and 3 ft. wide throughout, carrying the girders and slab of the floor on spandrel columns crossbraced transversely near the springing line of the arch. The ribs are also transversely braced at every other column. Expansion joints are provided at the side of each pier, the longitudinal girders (which are in line with the arch ribs) resting upon brackets and the floor slab resting on a shelf on the beams at each joint.

The approaches are of the same construction as that part of the arches above the ribs, the columns resting on rock instead of on the ribs. They carry the roadway from the abutment of the last arch to the crest of the hill.

The piers, which are founded on solid rock only a short distance below surface, are of hollow box section, 14x23 ft. in outside plan, with longitudinal outside walls 3 ft. thick and transverse outside walls 16 in. thick. These walls are reinforced against bending and are further crossbraced by horizontal diaphragms every 30 or 40 ft. Above the coping the piers are continued up only as walls in line with the arch ribs.

Some gravel concrete was used in the piers, but the bulk of the concrete was made from crushed slag from the Corrigan-McKinney furnace at Cleveland, Ohio, and a sand taken from the site of the bridge. Approximately



FIG. 1. TRAIN ON THE OVERFAIR RAILWAY, PANAMA-PACIFIC EXPOSITION

5,000 cu.yd. of concrete and 180 tons of steel were used in the construction. The roadway is paved with wood block, the cost of which will be partly defrayed by the state, in accordance with the law that provides state aid for main market roads.

The main construction was carried on by a cableway across the valley. The arch centers were framed steel arches, spanning from the copings of the piers. On account of the great depth of the gorge this type of centering was about the only one which could be used.

The bridge was designed by Wilbur J. Watson & Co., Bridge Engineers, Cleveland, Ohio, under the approval of E. W. Paul, County Engineer, Summit County, and was built by the MacArthur Bros. Co., of New York City. George L. Ehrman was the Resident Engineer, representing the county and the consulting engineers.

Carrying the Panama-Pacific Exposition Visitors

Transportation facilities around the grounds of the Panama-Pacific Exposition at San Francisco, Calif., are furnished by a miniature railway and trackless automobile trains operating on the roadways.

The Overfair Ry. is a double-track line 7 mi. long. It is of 19-in. gage, with 20-lb. rails laid on sawed spruce ties in rock ballast, except that along the water front the track is laid upon the sand beach. Timber trestling aggregating nearly 1,000 ft. in length is used at one point to carry the line above the level of high tide. The maximum grades are 2½%, and the sharpest curves are of about 120-ft. radius. One of the trains is shown in Fig. 1.

There are numerous grade crossings with the standard-gage tracks of the exposition terminal system, and at the various roadway crossings the rails are laid flush with the surface. The switches, frogs and crossovers are of standard types in miniature. At three terminals there are turntables of steel-girder construction revolving on center castings and operated by hand. Another terminal has a Y-track for reversing the trains. Numerous stopping points, with platforms, are provided along the line. The yards and roundhouse are located at the Fort Point terminal.

The equipment consists of four steam locomotives, one six-wheel tank engine for switching, 65 passenger and 10 freight cars. During construction a work train was used, consisting of the six-wheel engine and 10 flat cars 14 ft. long. The passenger trains have 6 to 12 cars and run at an average speed of 15 mi. per hr.

The passenger locomotives are of the 4:6:2 type, 5½ ft. high from rail to top of stack and 25 ft. long overall, with a weight of 29,000 lb. The cylinders are 8x9 in., and the driving wheels are 26 in. diameter, with a rigid wheelbase of 4 ft. 10 in. The boiler has 430 sq.ft. of heating surface (tubes and firebox) and carries 200 lb. pressure. The tender is 8 ft. long, carrying a supply of anthracite and 375 gal. of water. A Walschaerts valve gear is used. The air-brakes and couplers are of special design. The cab is made disproportionately large, in order to accommodate the two men. In appearance, as Fig. 1 shows, the locomotives resemble the large passenger engines used in main-line traffic.

The cars are of wood, mounted on low trucks and having fixed cross-seats set back to back, with open sides and a canopy roof. The cars are 22 ft. long and 3½ ft. wide, with capacity for 16 passengers per car. The locomotives and cars were built by L. M. MacDermott, of Oakland, Calif., who also owns and operates the railway.



FIG. 2. AUTOMOBILE TRAIN ON THE ROADWAYS OF THE SAN FRANCISCO EXPOSITION

A more novel means of transportation is that afforded by trackless trains operated on the driveways, each consisting of an automobile and trail cars. This system was invented by R. B. Fageol, of Oakland, Calif., and is operated by the Fadgl Auto Train Co., of San Francisco. One of the trains is shown in Fig. 2.

The automobile, or tractor, is of special design, weighing 6,000 lb. and having 20-in. wheels with solid rubber tires. It carries four passengers. The tractor hauls three trailers, each weighing 1,500 lb. and carrying 20 passengers. These cars have 24-in. wheels and 12-ft. wheelbase. They have side seats back to back, with a passage between for the use of the conductor. At the ends the seats are raised to clear the wheels. The couplings are of special design, causing the trailers to track with the automobile. A shoe brake is operated in connection with the couplings, being lowered to contact with the ground when the couplings are slackened by reduction of speed. The speed limit is 12 mi. per hr.

Slip of Approach Embankment Damages Concrete Bridge

By Arthur T. Clark*

An instructive illustration of progressive damage to a bridge abutment, caused by improper construction of an earth-fill approach, was recently noted at Herkimer, N. Y.

A 400-ft. four-span reinforced-concrete bridge was completed last spring over West Canada Creek, carrying a 25-ft. roadway and a 5-ft. sidewalk on a 4% grade. The east end, where the trouble occurred, is about 35 ft. above the creek bed. Here the bridge is approached by an earth-fill, built separately from the bridge and under a different contract. The fill is about 160 ft. long, and the deepest part, just outside the abutment, was 25 ft. The embankment was constructed early in the spring, of material taken from a near-by blue-clay bank. Most of the clay was saturated and plastic, and part of it was frozen. A certain amount, estimated at one load in 20, was in a fluid condition. Holes were provided in the sidewalls of the abutment, but placing nearly impervious material adjacent to them prevented effective drainage.



FIG. 1. BRIDGE AND APPROACH WHICH SLIPPED, HERKIMER, N. Y.

About the middle of June the finished road surface and the south side of the embankment sloughed off on a curved line, as shown in Fig. 2. The toe of the embankment slipped out about 50 ft., and the subsidence carried the guard rail on the bridge with it to the position indicated by the dotted line. The vertical settlement of the edge of the crown of the embankment was about 20 ft. In addition to this damage, the east end of the south sidewall of the east abutment moved out 4 or 5 in., leaving an open crack at the intersection of the sidewall and cross-wall of the abutment.

When the settlement took place work was immediately started refilling with gravel, but for a few days the embankment continued to slip under the added load of material, so that little headway was made. The slipping finally ceased, and the embankment was restored to its original grade. To prevent further injury to the sidewalls, ten 1½-in. tie-rods with turnbuckles were placed across the roadway at 3-ft. and 6-ft. depths.

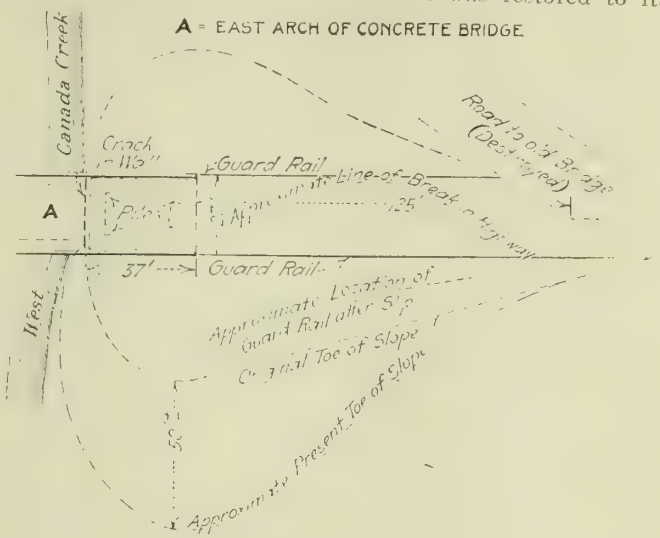


FIG. 2. DIAGRAM OF EMBANKMENT SLIP AT HERKIMER BRIDGE

About Aug. 1 the whole south sidewall of the east abutment tipped out about 5 in. The foundation under the easterly arch abutment consists of a horizontal reinforced-concrete wedge 27 ft. wide and 37 ft. in length, extending into blue-clay soil, which forms the bank and bed of the creek. Four large concrete piles had been sunk below this wedge. Tests showed the clay in the base of the embankment so wet that a crowbar could be sunk into it several feet at a single thrust.

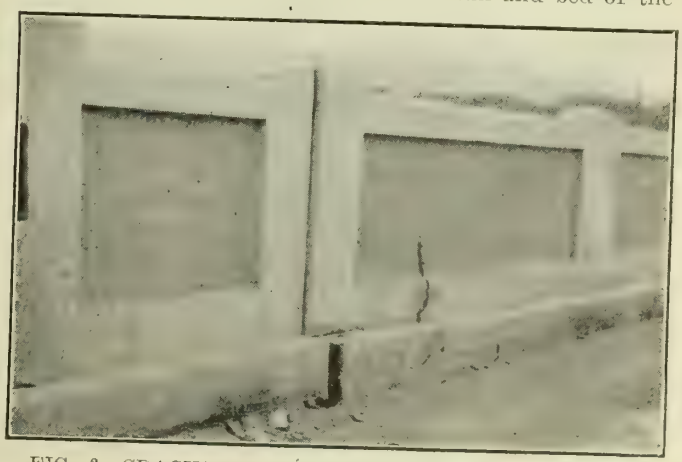


FIG. 3. CRACKS IN PARAPET OF EAST ABUTMENT

*Assistant Engineer with Robert E. Horton, Consulting Hydraulic Engineer, 57 N. Pine Ave., Albany, N. Y.

Of the World's Petroleum Production in 1914, amounting to 400,000,000 bbl. of 42 gal., two-thirds was produced in the United States. The statistics collected by J. D. Northrop, of the Geological Survey, show a production in the United States last year of 265,762,000 bbl. Russia is the next largest producer, with 67,000,000 bbl. to its credit, and then comes Mexico with 21,000,000 bbl.; Roumania, with 13,000,000 bbl., and the Dutch East Indies, with 13,000,000 bbl.

Novel Bulkhead for Wharves at Jacksonville

By H. D. Mendenhall*

SYNOPSIS—Privately owned deep-water terminal on St. Johns River, at Jacksonville, Fla., has quay wall in which bulkhead is a tight concrete wall cast against continuous sheetpiling backing on vertical I-beams. Fill is relieved by a platform resting on timber piles.

The development as deep-water terminals of the area known as Commodore Point, on the St. Johns River, at Jacksonville, Fla., was finally placed on a fixed footing when on Aug. 2, 1915, permits were received from the United States Government to proceed with construction on the lines requested in the petition from the owners. This permit marks the culminating point of a long period of delays and contentions extending over several years. The property in question was the object of animated political controversies for a considerable time, during which it was proposed as the site for the municipal docks. This controversy waged hot and heavy during several seasons, at the end of which a site some miles down the river was chosen.

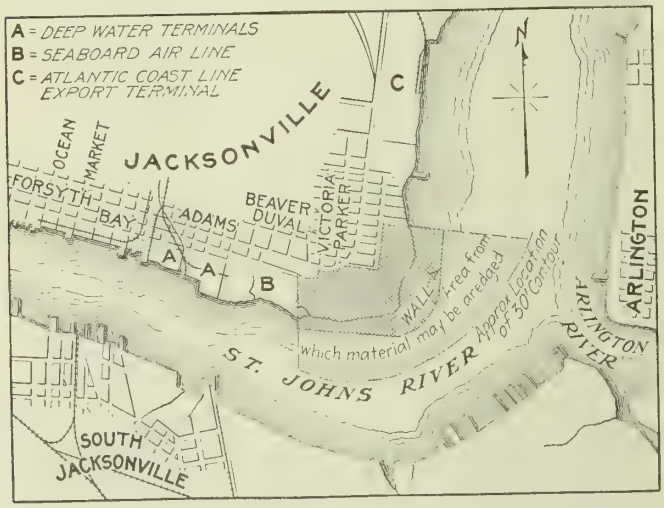


FIG. 1. LOCATION OF NEW COMMODORE POINT WHARVES, AT JACKSONVILLE, FLA.

One reason for rejecting the site in question was the supposed existence of a prohibitive amount of rock that would have to be excavated to render the point available for dock purposes. The owners had reasons to believe that conditions were not really in as bad shape as the committees reported, and early in 1914 the writer was called in to make a thorough examination to discover actual conditions. After the owners' examination had been completed it was found that while there had been no deliberate misrepresentations made as to the amount of rock present, the data from which the estimates had been made were so meager that accurate conclusions could not be reached and erroneous deductions had been made. However, in the meantime the city had resolved to purchase the other site, so the owners determined to develop the property with private capital.

Then came a period of adjusting and readjusting of proposed lines, petitioning and repetitioning to the Government for permits, until finally, after approximately two weeks more than one year from the time the first application had been presented the permits were granted and work permitted to proceed.

Location of Wharf Site

The site, in its relation to the center of the City of Jacksonville, is shown in Fig. 1. The foot of Market St. is approximately the center of the shipping district, and it will be noted that the west edge of the property is about 1¼ mi. east of that point. The property occupies the point made by the right-angle turn of the river and, as finally developed, will cover about 132 acres. Of this area about 75 acres is on the land and 57 in the shallow water adjacent. The land area is a low marsh about 3 ft. above mean low tide at the highest point, but mostly subject to overflow under ordinary tides. The river section will be in water varying from 5 to 20 ft. in depth, although the 20-ft. part is from only a short distance on the extreme point. The river at this point is something over ½ mi. wide, with the channel on the opposite side from the property to be developed.

The river frontage to be developed is 5,182 ft. measured on the outer line. This will be increased as wharf frontage by adding a slip at each end, the one at the west end being 100 ft. wide by 226 ft. long, and the one at the north end being 100 ft. wide by 500 ft. long. The bottom will be dredged to 12 ft. in these slips and to 30 ft. along the main wharf front.

The character of the bottom along the entire face, as determined by a double line 15 ft. apart of wash borings made at 25-ft. intervals on each line, was found to be shell rock for the larger portion of the distance, with a short interval of clay at one point near the west end. Rock is overlain with a stratum of sand varying in thickness from 2 to 40 ft. The rock averages about 30 ft. below mean low tide.

Longitudinal Type of Wharves Proposed

The wharves will be of the longitudinal type, now becoming popular for river improvement where strong currents are encountered. It will be noted from Fig. 1 that they practically parallel the curved axis of the channel. Fig. 2 gives dimensions and bearings in detail. The two main faces, 2,182.3 ft. and 1,500 ft. long respectively, are connected by three short faces of 500 ft. each. This was considered more practical for mooring purposes than to use a continuous curve, and it is contemplated that few vessels more than 500 ft. in length will have to be accommodated for a great many years to come.

It is proposed to dredge immediately to 30 ft. all areas at which rock is found lower than 30 ft. below mean low tide and all the remaining areas to rock only. There will be something over 3,000 ft. of frontage having 30 ft., and for the remaining distance there will be a depth of 24 ft., excepting a few disconnected points that rise to 22 ft. The retaining structure will be designed for an

*Consulting Engineer, Lakeland, Fla.

ultimate depth of 30 ft. so that no additional strengthening will be needed when the deepening is undertaken.

The area behind the wharf front will be filled to 4 ft. above mean low tide with sand dredged from the river bottom. It will require about 1,100,000 cu.yd. of material.

Details of Bulkhead Wall

Figs. 2 and 3 show, respectively, vertical section and plan of the bulkhead to be used to retain the fill. The essential features of this retaining structure will be a concrete and steel vertical wall, anchored back at the

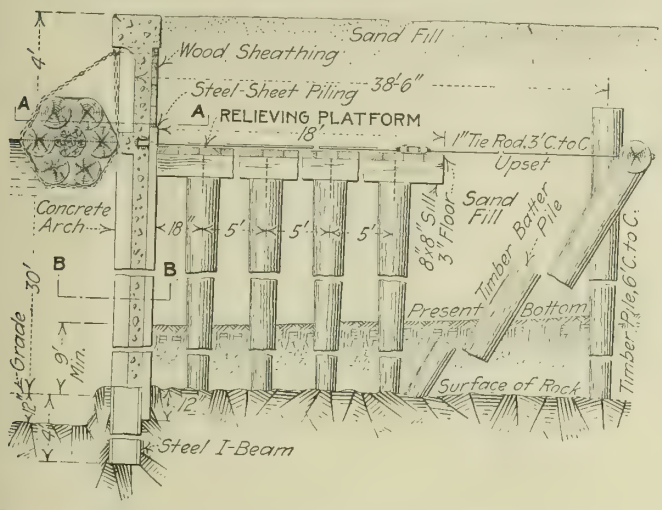


FIG. 2. DETAILS OF CONCRETE AND STEEL BULKHEAD OF NEW JACKSONVILLE WHARVES

water line with rods secured to a braced-pile and deadman system; and a relieving platform of timber piles and flooring to take all load above the water surface.

The design of the concrete-steel wall brings into use a combination of standard steel shapes and concrete that has been little used heretofore for this type of construction. Section *B-B* in Fig. 3 shows the arrangement in its simplest form. It is proposed to drive the 12-in. 31.5-lb. standard I-beams at 3-ft. intervals to a depth of not less than 34 ft. below mean low tide when rock is encountered above the 30-ft. grade, and to a penetration of not less than 3 ft. into rock when rock is found below 30 ft. Tops of I-beams will be left at 3 ft. above mean low tide. Where no rock is to be found, a row of timber piles will be driven along the toe of the wall to prevent its being pushed out by the earth fill. Tops of these timber piles will be left at 32 ft. below mean low tide. Immediately behind the I-beams and secured with steel clips to the flanges at points of contact will be driven a continuous interlocked row of steel sheetpiling. The drawing shows the adaptability to the Wemlinger corrugated section. The specifications provide that the steel piling used shall be not less than ¼ in. thick and have a section modulus of not less than 4. It shall be driven to a penetration of 12 in. into rock where rock is found, and in no case to a greater depth than 35 ft. Tops shall be left about 12 in. above mean low tide. Where no rock is to be found the row of timber piles already mentioned will hold the toe.

The concrete is to be filled in between the I-beams and steel sheetpiling in arched section, as shown. It is to be placed with a tremie after dredging has been completed and the full strain put on the wall. No restrictions are put on the manner of placing the concrete, but it is assumed that the contractor will spring a form in between the outer flanges of the I-beams, and after the concrete has set, release it in some manner and use it again. Concrete is specified to be mixed in proportions of 1:2:4. It is designed to act solely as a protective coating for the steel, although in reality the arched section possesses a definite strength. This strength will simply be considered as increasing the factor of safety of the wall. By applying it as shown, the only steel exposed to the corrosive action of the salt water will be the outer face of the 5-in. outer flange of the I-beams. This amounts to about 14% of the entire face of steel, but as corrosion will occur only at the thickest part of the beam and the application of a coating of some type of protective paint from time to time will be a comparatively easy matter, it is assumed that this exposure will not materially endanger the life of the structure.

The concrete facing is to be not less than 6 in. thick at the thinnest point. Opposite the horizontal wales this thickness will be increased to 10 in. for a vertical space of 8 in. to provide additional protection to the anchorage.

Above the mean-low-tide line the concrete takes the place of the steel sheetpiling as a retaining wall, and is reinforced at intervals of 3 ft. by the extension of the I-beams.

The wall will be finished off with a 12x18-in. coping cast integrally with the main wall and protected on the outer edge with standard metal curb guards.

The anchor system is made up of two 4-in. 5¼-lb. channels, arranged back to back and separated 1½ in. with sections of gas pipe and secured with ¾-in. bolts.

Each wale combination will be 2 ft. 11 in. long, resting against the inner flange of the I-beams. As already noted, these wales will be completely incased in concrete. The tie-rods will consist of two 1-in. by 20-ft. rods, upset

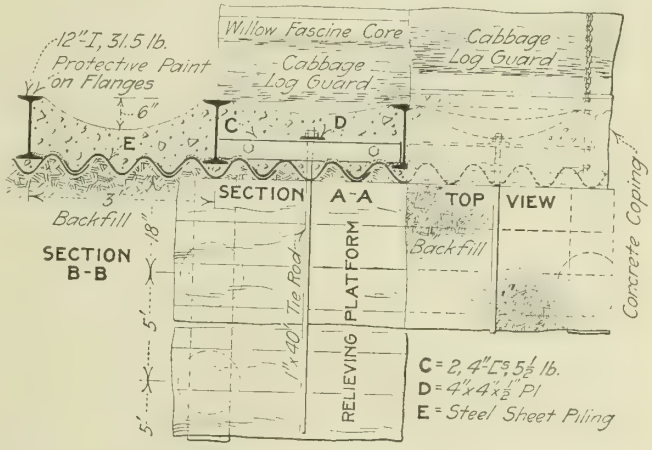


FIG. 3. PLAN AND PLAN SECTION OF BULKHEAD

each end to 1⅜ in. and connected with standard turnbuckles.

Details of Anchor-Pile Construction

The anchor-pile combination consists of a pile driven vertically to rock every 6 ft. on a line 39 ft. from, and parallel to, reference line of bulkhead. Back of this and bolted to it with 1-in. bolts at water surface will be a horizontal timber deadman averaging 12 in. in diameter. To render the system rigid a batter pile will be driven at intervals of 6 ft. at an angle of 30 deg. with the ver-

tical, and butted against and drifted to the deadman as shown with ¾-in. drift bolts. It is estimated that a possible maximum stress of 49,800 lb. will be put on this batter pile during the period of sand filling.

The relieving platform is constructed of timber piles driven on 5-ft. centers normal to line of bulkhead and 6-ft. centers parallel to this line. The piles are to be driven to rock or clay, and the tops are to be cut off 12

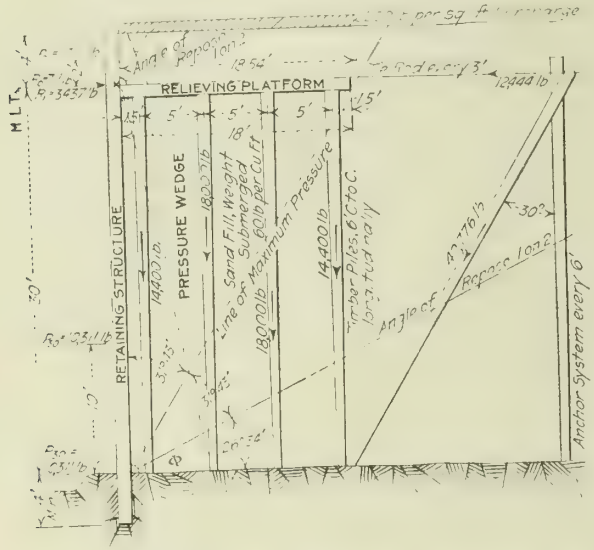


FIG. 4. METHOD OF FIGURING STRESSES IN JACKSONVILLE BULKHEAD WALL

Rational Formula for total Horizontal Pressure

$$P = (\tfrac{1}{2} wh^2 + vh) \tan^2\left(45° - \frac{\Phi}{2}\right)$$

For Loading Above Relieving Platform
$w = 100$ lb. per cu.ft. $v = 200$ lb. per sq.ft. $\phi = 26° 34'$.
$h = 4$ ft.
$P_0 = (\frac{1}{2} \times 100 \times 4 + 200 \times 4) \times .3819 = 711$ lb. horiz. ft.
For Loading Below Relieving Platform
$w = 60$ lb. per cu.ft. $v = 0$. $\phi = 26° 34'$. $h = 30$ ft.
$P_{30} = \frac{1}{2} \times 60 \times 30 \times 30 \times .3819 = 10,311$ lb. per horiz. ft.
Center of Pressure = 10 ft. above toe.

Reaction at M.L.T. $(= 0) = \frac{10,311}{3} + 711 = 4,148$ lb. per horiz. ft.

For uniformly distributed load, maximum moment is for beam supported both ends

$$M = \frac{1}{8} wl = \frac{10,311}{8} \times 30 \times 12 = 463,995 \text{ in.-lb. per horiz. ft.}$$

for beam fixed both ends

$$M = \frac{1}{12} wl = \frac{10,311}{12} \times 30 \times 12 = 309,330 \text{ in.-lb. per horiz. ft.}$$

for compromise of these two

$$M = \frac{1}{10} wl = \frac{10,311}{10} \times 30 \times 12 = 371,196 \text{ in.-lb. per horiz. ft.}$$

By assuming uniformly increasing load, these values would be increased 2.36%.
Weight on Relieving Platform = 600 lb. per sq.ft.

in. below mean low tide. Drift-bolted to these with ¾-in. drift bolts at each point of support will be 8x8-in. yellow-pine caps. These will be placed normal to the line of the bulkhead, will be 18 ft. long each, and be supported by four piles. The floor will be composed of 3-in. yellow-pine planking, fastened to the cap at not less than two points with wire spikes. The flooring will not be laid permanently until after the sand fill has been placed to the top of the caps, after which it will be permanently fastened and the fill then continued to 4 ft. elevation.

It is assumed that the timbers and steel behind the bulkhead, being thus completely submerged and surrounded with sand, will last practically indefinitely.

Fig. 4 shows the diagram of stresses and the various assumptions on which the design was based. It will be noted that an assumption of 100 lb. per cu.ft. is made for all materials above water, with an additional loading of 200 lb. per sq.ft. on the top of fill. Material below water is assumed to weigh 60 lb. per cu.ft. submerged and have an angle of repose of 1 on 2.

After canvassing all known formulas and experimental data relative to earth pressures, it was finally decided that the only one that was known to be absolutely safe was the old original "rational formula," that has stood the test of time. Accordingly it was used, and the resulting pressure against the wall exerted by the sand fill from the water surface to a depth of 30 ft. was computed to be 10,311 lb. per horizontal foot. The weight to be carried by the relieving platform is 600 lb. per sq.ft. The reaction at the water surface due to the pressures applied at the two-thirds point below the surface and the cantilever action of the wall extending above the relieving platform is computed to be 4,148 lb. per horizontal foot. Placing the rods every 3 ft. subjects them to a theoretical strain of 12,444 lb. each. Each pile of the relieving platform will carry a load of 18,000 lb., and the batter pile, as already stated, will carry a computed strain of 49,796 lb.

In computing maximum moments in the lower section of the wall, it was assumed for simplicity of computation that the load was uniformly distributed and that the two ends were fixed, or acting in cantilever. The considerable factor of safety used is relied on to take care of any possible variation of conditions from these assumptions.

Douglas Fir for Paving Blocks

By O. P. M. Goss*

The following discussion is presented for the purpose of showing recent developments in the use of Douglas fir for creosoted wood-block pavements and to show particularly the steps taken on the Pacific Coast by the West Coast Lumber Manufacturers' Association and by the Association of Creosoting Companies of the Pacific Coast to perfect the treatment of this wood for paving purposes. The objectionable features of wood-block pavements—expansion, bleeding and slipperiness—have been made the subject of considerable study by these associations, and the conclusions arrived at are here given with the hope that they may prove helpful in the fullest development of wood-block pavement.

Measures to Prevent Expansion

Expansion is caused by the absorption of water in the cell walls of the wood. Any treatment that will retard this absorption will assist in the prevention of swelling. Experiments have shown that the thoroughness of creosote-oil penetration plays an important part in retarding volume changes. A block treated with 30 lb. of oil per cu.ft. will, when put to an extreme soaking test, swell practically as much as a similar one thoroughly penetrated but containing only 12 lb. per cu.ft. The former will absorb less moisture in amount than the lat-

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ter, but the swelling action will be practically the same in both.

The main point in treating blocks is to secure a thorough penetration with a reasonable amount of oil. Creosoted Douglas-fir blocks thoroughly penetrated with 18 lb. of oil per cu.ft. reduced to 12 lb. per cu.ft. are relieved of 35% of their tendency to shrink and swell when put to extreme soaking tests.

As an additional safeguard against expansion troubles we recommend attention to the following details: (1) Place blocks on an asphalt- or tar-coated base, for this seals the lower end, almost eliminating the possibility of water entering at the base of the block; (2) provide liberal expansion joints adjacent to the curb; (3) lay blocks in courses at an angle of 60 to 67° to curb, that the expansion may be relieved within a short distance, whether it occurs along the short or the long dimension of the block.

If blocks are laid in courses at right angles to the curb, expansion the long way of the block may be taken up at the curb, but if it occurs along the short dimension, longitudinally of the street, there is no relief except in compression of the blocks or in transverse expansion joints. Such joints are to be avoided when possible, as they are very likely to be a source of trouble.

Prevention of Bleeding Troubles

It is the general practice on the Pacific Coast to use a pure coal-tar oil of 1.03 to 1.07 sp.gr. at 60° F. and to treat the blocks with from 16 to 18 lb. per cu.ft., which amount is afterward reduced by "expansion and vacuum" to 12 lb. per cu.ft. This reduction in oil content is accomplished by heating the blocks while submerged in the preservative from 180° (the pressing temperature) to 230° as rapidly as possible and holding them in the oil bath at this higher temperature for one hour.

The increased heat expands the oil and vapors, and the expansion together with the final vacuum reduces the oil content 4 to 6 lb. per cu.ft. This treatment gives an ideally treated block with a thorough penetration of sufficient oil to preserve it. This block will not bleed under street conditions. A pavement of these blocks was laid in Tacoma, Wash., about three months ago, and it has shown no signs whatever of bleeding during a week of as hot weather as is usually experienced on this coast (about 87° F.).

Slipperiness Least with Douglas Fir

Slipperiness is the least of troubles experienced with Douglas-fir blocks. This wood is not extremely hard, but is strong and tough. Its fibers compact and mat together. The hardness of the wood materially affects the slipperiness of the pavement. The ideal paving wood is one strong enough to resist the wear and not so hard but that fine gravel may be rolled into it to produce a surface resistant to wear and one that is not slippery.

If the joints are filled full of asphalt or tar and expansion and bleeding occur, the filler material will be forced to the surface and will mix with the surplus oil, causing a disagreeable and slippery surface. The surface may be scraped clean and sanded, which will in time solve the difficulty, but such a surface is entirely unnecessary.

Douglas fir is unlike most woods from the standpoint of impregnation. It has been necessary to develop treating methods especially for this wood in order to get the results desired. Paving blocks of any wood should be treated in such a way as not to cause any appreciable loss in strength. The steaming process is not suitable for treating Douglas-fir blocks, since the fiber is injured by this treatment. The following treatment has been developed for paving blocks and has proved thoroughly satisfactory:

> The blocks shall be placed in the treating retort, direct from the saw, and the preservative introduced and heated to approximately 215° F. for from 1 to 4 hr. The preservative shall then be drained off and a vacuum of 23 to 26 in. drawn to take out the surplus vapors, etc., from the wood cells. The vacuum shall then be broken by the introduction again of the preservative, which is then pressed into the wood at a temperature of 180° F. until the blocks have received from 16 to 18 lb. per cu.ft. After receiving the required amount of oil the pressure shall be released, and the temperature of the oil gradually raised to 230° F., and held for 1 hr. A final vacuum of 23 to 26 in. shall then be drawn to dry the blocks of the surplus surface oil, leaving a thoroughly impregnated block.

This treatment produces an ideal block, which retains its original strength and is amply suited to resist swelling and decay. In no case should Douglas-fir blocks be subjected to a steaming treatment.

Handling Blocks in Paving Work

Blocks should be delivered from the plant directly to the job and close-piled until laid. Close-piling keeps the blocks in the same moist condition as when they are taken from the treatment. They are not thoroughly green, yet they are quite well up to their maximum volume. The amount of swelling that will follow is desirable in that it tightens up the pavement, almost eliminating joints. Blocks properly treated, after swelling to their maximum volume, shrink very slowly. In fact they have almost a constant volume under normal street conditions. This is because the cell walls are wet and thoroughly painted with coal-tar creosote, and moisture is very slow to pass out through the partially waterproofed cells.

Recommended Specifications

Blocks should be cut from sound, strong, close-grained lumber and accurately dressed. Variations in thickness and depth should not exceed $\frac{1}{16}$ in. They should be creosoted in accordance with the method described and should be placed upon a smoothly finished concrete base, painted with pitch or asphalt immediately before blocks are laid. The painting should be thorough and a bond secured betweeen the paint coat and the concrete.

Blocks should be laid in courses at an angle of 60 to 67° with the curb and with as close joints as possible. The lower portion of the joints should then be filled with asphalt or pitch sufficiently fluxed to enable it to flow into the joints. The upper portion of the joints should be filled with hot dry sand and the entire surface rolled with a 10- to 14-ton steam roller to seat the blocks thoroughly and to fill the joints completely.

Liberal expansion joints should be provided along each curb. The lower half of the expansion joints should be filled with bituminous filler and the upper half with clay. Fine gravel $\frac{1}{4}$ to $\frac{1}{2}$ in. in diameter should then be scattered over the surface and rolled into the blocks until a surface satisfactory to the engineer is secured.

A coat of fine sand should be spread over the surface of the pavement and left for 30 days after the street is opened to traffic. Additional fine-gravel coatings may be spread on the surface from time to time if desirable.

Provisions for Expansion of Blocks

It is very important to provide liberally for expansion. From the following data it is possible to arrive at the proper width of expansion joint for any width of street. On the average each joint between blocks may be counted on to accommodate 0.02 in. expansion. When blocks are treated, handled and laid as described, the following formulas give the proper width of expansion joint along each curb:

When blocks are cut from 4x8-in. lumber, width of expansion joint in inches equals width of street in feet × 0.045. When blocks are cut from 3x6-in. lumber, width of expansion joint in inches equals width of street in feet × 0.04.

The expansion-joint material, to give the best results, should be composed of some high-grade asphaltic cement with 20% by weight of very fine sand stirred in while the pitch is hot. This stiffens up the filler, enables it to remain in place in warm weather and also reduces the cost slightly.

The joint filler should be a good quality of D-grade asphalt or similar material fluxed sufficiently to allow it to be worked into the joints.

The pitch or asphalt used to coat the base should be as stiff as possible, consistent with getting a good bond on the smooth concrete base. One way to secure a bond on the concrete when using a heavy pitch-paint coat is to thoroughly clean and spray the base very lightly with some light oil just before the hot pitch is applied.

Small Mechanical-Filter Plant, Franklin Furnace, N. J.

By R. H. Eurich*

SYNOPSIS—Design and operating results of a small mechanical filtration plant designed to require a minimum of attendance with a view to reducing the cost of operation. This has been attained by providing liberal coagulating capacity, large filter area and very simple control apparatus.

In the fall of 1913 the New Jersey Zinc Co. undertook the construction of a mechanical filtration plant for Franklin, N. J. The population of Franklin is estimated at 2,200 and the takers of water from the distribution system as 1,200. The source of supply is Franklin Pond, area 44 acres, situated in the southern part of the borough. The pond is fed by the Walkill River and Black Brook; the combined catchment area is 31 sq.mi. of steep forested hills, mountain-top swamps, and, in the valley, rolling agricultural land. The water is subject to sudden fluctuations in color and turbidity, the color ranging from 20 to 100 and the turbidity from 10 to 60.

The filtration plant was designed for a normal capacity of 100,000 gal. per day, and a maximum of 150,000 gal. per day. Ever since the plant was put in service it has been supplying 130,000 to 140,000 gal. per day.

The filter plant is on the east bank of the Walkill River about 200 ft. below the dam at the outlet from Franklin Pond. The structures (see plan and section, Fig. 1) are an intake in the narrows of the pond, a coagulating reservoir, regulator house and filters, and a pure-water reservoir. The water flows by gravity from the pond through the intermediate structures to the pure-water reservoir, from which electric automatically operated centrifugal pumps lift the water to a 110,000-gal. standpipe. There is a booster pump for use in case of fire. The construction work was done by the forces of the New Jersey Zinc Co., under the direction of Hazen, Whipple & Fuller, Consulting Civil Engineers, New York City. The work was begun at the end of October, 1913, and the filters were put into service early in May, 1914.

Details of the Coagulating Reservoir

The coagulating reservoir is a covered reinforced-concrete structure, divided into three basins by two walls (see Fig. 1). Each of these basins is divided into three square compartments by two perforated concrete baffle walls. At the far end of the center basin is a concrete skimming weir; at the end farthest from the filters of each side basin is a distributing weir; at the other end of each side basin is a skimming weir. Under the floor, along the center line of each of the three basins, is a 6-in. cast-iron drain opening to each of the three square compartments. The flushing of each basin is controlled by a gate valve placed on the drain outside of the basin in the pipe gallery.

Under normal operating conditions the raw water enters the center basin at the end nearest the filters at a point 4 ft. above the bottom, having been previously dosed with aluminum sulphate, and after being deflected and distributed by a plate placed immediately in front of the inlet pipe, flows through the two perforated baffles and over the skimming weir at the far end. Here it divides into two equal parts and passes through the valves, set in the division walls, to the distributing weirs at the far ends of the side basins. After passing over these weirs it flows through the perforated baffles of the side basins to the skimming weirs at the near end, and from these it passes into pipes that convey it to the filters.

There is an auxiliary raw-water inlet in one of the side basins, thus making it possible to bypass any one of the three basins and to empty it for cleaning or inspection.

The design of the perforated concrete baffles is of interest inasmuch as it is believed to be here applied for the first time. The distribution of the vertical velocities has been regulated by a proper arrangement of circular orifices. These have a diameter of 7/8 in. at the throat, and are

*With Hazen, Whipple & Fuller, Consulting Engineers, 30 East 42nd St., New York City.

flared to a diameter of 3 in. at the downstream side of the 6-in. baffle wall. The distribution of these orifices is the same in all of the baffles and is as follows:

Distance from Floor to Row, Ft.	Number of Orifices in Row	Distance from Floor to Row, Ft.	Number of Orifices in Row
1½	1	5½	5
2½	2	6½	6
3½	4	7½	6
4½	5	8½	7

As a result of this arrangement the velocity at any point in a vertical line varies inversely (nearly) as the distance from the point to the water surface.

Access to the six compartments at the far ends of the basins is through rectangular openings in the baffles.

There are two filter units, each 8x11 ft. in plan, equal to 0.002 acre.

In order to prevent a free passage of water upward along the filter wall, the forms from the bottom up to the sand line were made of corrugated sheet iron. The wash-water troughs are of concrete, were cast separately and erected in place before the filter walls were poured.

The strainer system of each filter consists of twenty 2½-in. wrought-iron pipes 5 ft. long with seven holes $\frac{17}{32}$ in. in diameter, 9½ in. c. to c., drilled along the lower side, capped at their outer ends and screwed into a 10-in. cast-iron main collector partly buried in the concrete of the floor. The clearance between the laterals and floor

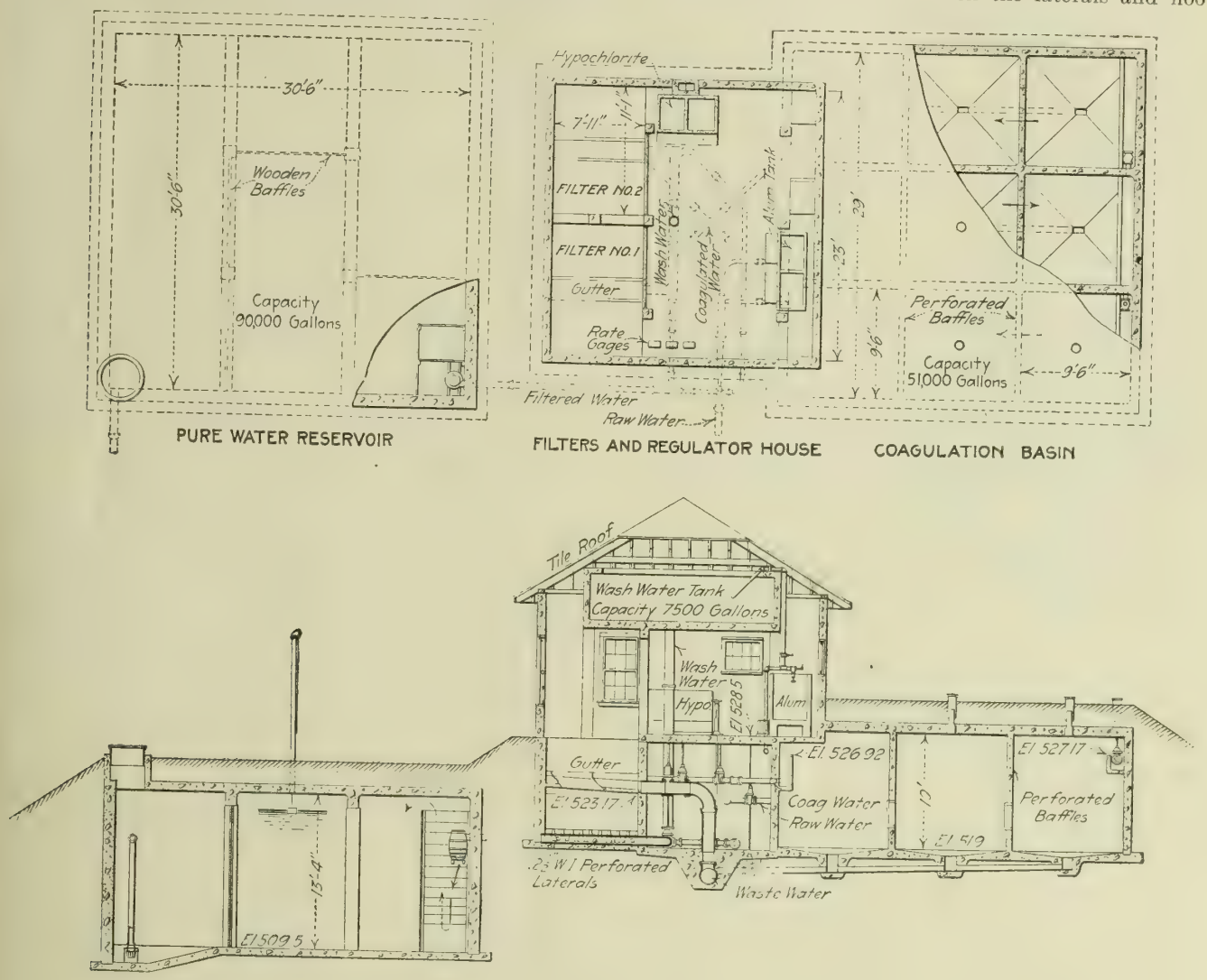


FIG. 1. PLAN AND SECTION OF WATER-PURIFICATION WORKS, FRANKLIN FURNACE, N. J.

These openings are closed by wooden shutters bolted to frames set in the concrete. Each compartment is vented at the middle of the roof.

The nominal period of sedimentation with a flow of 150,000 gal. per day is 7.7 hr. With one basin out of commission the period is 5.1 hr. The reasons for such a liberal time for sedimentation will be taken up under the discussion of the operation of the plant.

Regulator House and the Filters

The regulator house is of reinforced concrete. Within its area are parts of the three basins, the two filter units, the pipe gallery, the wash-water tank and the operating floor, on which are the chemical tanks, feeds and gages.

is 1 in. The wash-water jets are directed vertically downward against the filter floor, an arrangement which breaks up the jets and secures a uniform distribution of velocity in the rising column of wash water without resort to the use of strainers, screens or distributing device other than a layer of gravel.

The filter sand and gravel were obtained from the Cape May Sand Co. There were five grades of gravel, ranging as follows: (1) ½ to 1 in., placed just to cover laterals; (2) ¼ to ½ in., 4-in. layer; (3) $\frac{3}{16}$ to ¼ in., 3-in. layer; (4) $\frac{1}{16}$ to $\frac{3}{16}$ in., 2-in. layer; (5) $\frac{1}{24}$ to ⅛ in., 2-in. layer. The sand had an effective size of 0.32 mm. and a uniformity coefficient of 1.69.

The pipe gallery occupies the space below the operating floor between the filters and coagulating basin. All of the piping is cast-iron hub-and-spigot pipe, except the wrought-iron laterals and pressure pipes and lead pipes for chemical feed.

A 15-in. tile drain serves to convey to the river the sludge from the coagulating basin and the waste wash from the filters.

A wash-water tank of reinforced concrete (Fig. 1) occupies the upper part of the regulator house. It has a

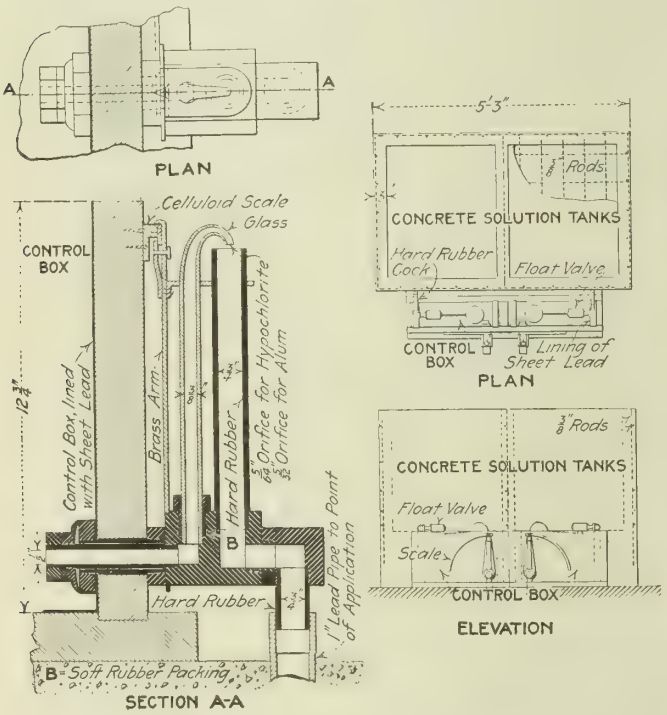


FIG. 2. DETAILS OF ALUM AND HYPOCHLORITE APPARATUS, FRANKLIN FURNACE, N. J.

capacity of 7,500 gal., a quantity somewhat in excess of that required to wash one filter. It is filled from a 3-in. service pipe. The concrete was poured at one operation and is of the same grade as was used in other parts of the plant. When the concrete was 36 hr. old the inside forms were stripped and the bottom and sides were painted with two coats of neat-cement grout. No waterproofing was used. The tank is entirely tight, no dampness showing on the outside.

On the floor of the regulator house, over the inlet end of the coagulating basin, are two alum tanks, each with an independent feed control. The coagulant is applied by gravity to the top of the raw-water inlet pipe just before it enters the coagulating basin. No elaborate means are employed to secure uniform dissemination of the coagulant, but the baffle plate in front of the inlet pipe serves this purpose to a considerable extent. The capacity of each tank is 269 gal., or 14 hr. flow at the maximum rate. From points about 2 in. above the bottoms of the alum-solution tanks, which are 14 in. above the operating floor, ¾-in. hard-rubber pipes lead through cutoff cocks and float valves to two lead-lined control boxes which stand on the floor in front of the main tanks (see Fig. 2). The outlet and control device is built entirely of hard rubber or glass and is mounted on the front wall of each control box and consists of a tube which may be clamped at any position on the arc of a circle, from the vertical to the horizontal, and which terminates in a circular glass nozzle $\frac{5}{32}$ in. in diameter. The alum solution flows from the constant-level control box through the sleeve joint at the center of the arc and up to the nozzle, through which it discharges freely into a tube connecting with a 1-in. lead pipe leading to the point of application of the coagulant.

The scale divisions on the arc are inches and tenths of inches, with zero at the top. The nozzle requires calibration. The discharge is very nearly directly proportional to the scale settling; the maximum rate is approximately 20 c.c. per sec.

The hypochlorite tanks and feed controls are in duplicate and are similar to those for the alum, but have a capacity of only 116 gal. each, or 20 hr. flow at the maximum rate. The discharge nozzle is $\frac{5}{64}$ in. in diameter, and the maximum rate is approximately 6 c.c. per sec. The hypochlorite is applied by gravity to the effluent pipe from the filters at a point outside the regulator house about 15 ft. from the inlet to the pure-water reservoir.

There are three venturi meters—one for the raw water and one for the effluent from each filter.

The indicating venturi-meter rate gages (Fig. 3) are somewhat out of the ordinary. They consist essentially of two tubes, the lower ends of which lead, one to the barrel and the other to the throat of the meter tube; from the upper ends the air is exhausted by a Richard's filter pump until such a degree of vacuum is created as will lift the water in the barrel connection to the zero of the scale, where it is maintained as long as the pump is

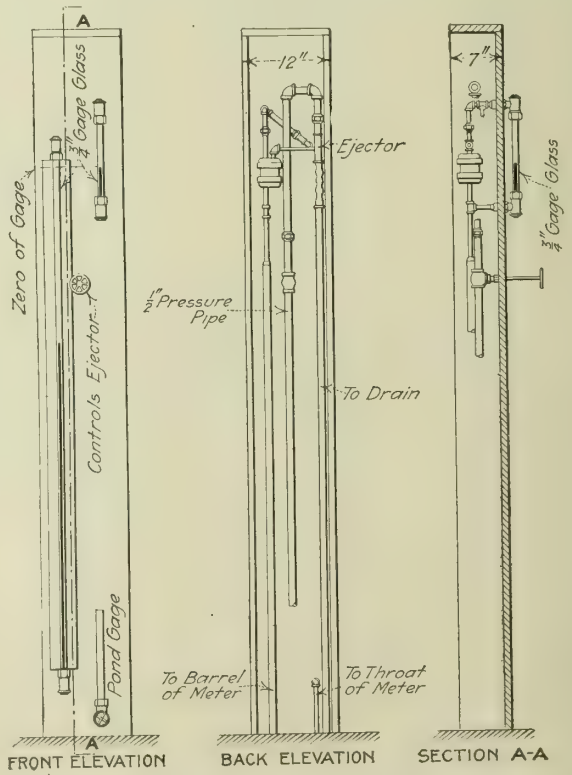


FIG. 3. VENTURI METER RATE GAGE

operated. As the top of the two tubes are cross-connected, the same vacuum exists in both; consequently the difference between the pressures at the throat and at the barrel is measured by the distance from the zero down to the level of the water on the throat tube. The scale is computed for each meter tube. Gages of a similar type have been in use for several years at the filtration plants at Yonkers and Ogdensburg, N. Y.

The loss of head through the filter is ascertained by means of a gage of the float type, by deducting the elevation of the water on the filter from the float-gage reading.

Pure-Water Reservoir Arrangement

The pure-water reservoir is of reinforced concrete and has a capacity of 90,000 gal. It is immediately adjacent to the regulator house, but is built entirely separate.

The calcium hypochlorite is applied to the water before it enters the pure-water reservoir. On entering, it first passes through close baffles which serve to thoroughly mix the disinfecting agent and which have a minimum period of detention of 30 min. The main baffles, as well as the hypochlorite baffles, are of wood.

Operation of the Filter Plant

In a plant as small as the one under consideration the cost of attendance is the determining factor in the cost of operation. Automatic appurtenances, of course, minimize the attendance necessary, but for a very small installation their first cost more than overbalances this saving.

There are no recording gages, no mechanically operated gates and no automatic rate controllers in the equipment of this plant. The attendant spends about an hour morning and evening at the filters.

A very liberal period of sedimentation (7.7 hr. nominal at the maximum rate) has been provided in order that the fluctuations in the raw-water rate will not disturb the filter operations, and in order to provide sufficient capacity in case the filters are ever operated at a higher rate than is now necessary.

Ordinarily, the filters are in service alternately and are allowed to run for about 12 hr. before being washed. The length of run could be increased to 16 or 18 hr. before the loss of head would compel washing, but for practical reasons of convenience this has not been done.

Low Rate of Filtration

The rate of filtration is from 50 to 70 million gallons per acre per day with one unit in operation. This low rate is advisable on account of the infrequent attention which the filters receive. The rate at the beginning of the run is about 140,000 gal. per day and after 12 hr. this has, as a rule, fallen to about 110,000 gal. per day. The factors which control the rate are the level of the water on the filter, the loss through the filter and piping, position of the gate on the effluent pipe and the level of the water in the pure-water reservoir. The level on the filters depends on the pond level, the frictional losses through the system to the filter, and the position of the raw-water gate. The loss of head through the filter and the level of the water in the pure-water reservoir are the two controlling factors, which alone need to be considered during any one run. The level in the pure-water reservoir has no effect when it is below the inlet, but as it rises above this point it reduces the effective head on the filter and consequently the rate. Should the pure-water reservoir fill completely before the attendant arrives, the filters continue to operate, but at a reduced rate, and the effluent is wasted to the drain. The filters are washed with filtered water at a rate of 2 ft. vertical rise per minute. The washing is continued for 5 or 6 min., or until observation shows the bed to be sufficiently cleaned. The procedure in washing is to drain the water on the filter down to about 2 in. above the sand, then, with the wash-water tank full, to slowly turn on the wash water, increasing to the full rate as soon as the top of the sand is broken up, and maintaining the full rate to the end of the wash. The wash-water valve has been calibrated so that the number of turns required to give the 2-ft. rate is known.

Should the rate of filtration fall below the raw-water rate, the water on the filter will rise until it overflows the dividing wall between the two filters and waste to the drain through the wash-water trough of the unit which is out of service.

The normal flow line of the coagulating basin is only enough below the low-water level of the pond to get head to maintain the required flow; consequently when the level of the water on the filter rises it reduces the raw-water flow by backing up into the coagulating basin.

Performance of the Plant

The plant has been in operation for about a year, and the quality of the water produced is thoroughly satisfactory. The infrequent attendance makes it necessary to be certain that at no time shall there be a deficiency of alum. The amount of alkalinity in the water makes a liberal application of alum entirely safe so far as any danger of acid water is concerned. The resultant color is unusually low, being for the greater part of the time below three, which is the value of the lowest color standard used, and consequently it is recorded as having zero color.

This procedure is open to the criticism that it is uneconomical of coagulant, but the total amount used is so small that even with the most careful regulation the saving would not amount to over $30 to $40 per year. The certainty of good operation and a practically colorless water are well worth this expense.

The bacterial results have been consistently good. The count at 48 hr. on lactose agar ranges from 0 to 3 per c.c. for tap water (raw water 40 to 500 per c.c.). After storms the lactose bile test has given positive results from 1 c.c. of raw water, but in no case have positive results been obtained from 10 c.c. of tap water.

The daily records are kept by the card-index system on four blank forms—one showing alum and hypochlorite feed, one for filter operation, one for chemical and bacterial results, and one for B. coli.

David Jenkins, chemist of the New Jersey Zinc Co., has been in charge of the plant since it was put in operation by the writer, who had charge of construction.

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Building Regulation Advance in Pennsylvania—A short act passed by the legislature of Pennsylvania at its 1915 session and since approved by the governor, will interest those who believe that American cities should exercise more control than they do over the character and use of buildings in different parts of the city. The act reads:

> That, for the purpose of promoting the public health, safety, order and general welfare, cities of the first class may regulate the location, size and use of buildings therein and may make different regulations for different districts thereof. The park commission of any city of the first class may make such regulations as to the location, size and use of buildings, any portion of which shall come within 200 ft. of any park, parkway, playground or other public place under its care or management, and upon their approval by the councils of such city, said regulations shall have the same effect as if originally made by said councils.

Although it appears that this act applies only to buildings within 200 ft. of a park or other public land in the care of a park commission of a city of the first class, even that measure of control is a step in advance.

Construction and Operation of Gloversville Sewage Works—II

By H. P. Eddy* and H. J. Hanmer†

SYNOPSIS—Operating results of a 3,000,000-gal. plant consisting of screens, primary tanks, sprinkling filters, intermittent sand filters and sludge pumps and beds.

Operating Methods and Results‡

The Gloversville sewage works has been in operation since Dec. 1, 1912. No means are available for measuring the flow of sewage, but it is estimated to be 2,750,000 gal. per 24 hr., of which about 74 per cent. is domestic sewage and the remainder manufacturing wastes.

Screenings—The coarse bar screen through which the crude sewage passes removes on the average about 4 cu.ft. of screenings per day and requires raking by hand from four to five times a day. This raking is all done between 8 a.m. and 5 p.m. at an expense of about $0.50 per day.



FIG. 6. SEWAGE SLUDGE ON GLOVERSVILLE DRYING BEDS

The primary-tank effluent is passed successively through three mesh screens, having openings ½, ¼ and ⅛ in. square, respectively. When one screen has collected a sufficient amount of material, it is replaced by a clean one, and the dirty screen is taken to the screen-washing house near-by, where it is cleaned by a stream of water from a ¾-in. hose. The material washed from the screens falls into the sludge-pipe line and is handled with the sludge. These screens are washed from four to five times during one 8-hr. shift each day, at a cost of $1.50 per day, and the resulting screenings amount to approximately 4 cu.ft. per week under normal conditions, but in times of heavy rains with a flow of about 6,000,000 gal. per day the amount has been increased to 5 cu.ft. per day. The screenings consist largely of small bits of fat, much of which probably comes from the tanneries, and burnt matches.

Primary-Tank Sludge—The production of sludge in the primary settling tanks has amounted on the average to about 9 cu.yd., or 1,817 gal., per 1,000,000 gal. of sewage treated. When the plant was first placed in operation the sludge was drawn off once every two weeks, but it was soon found that better results were obtained when the sludge was drawn off three times each week, as is now the practice.

Secondary-Tank Sludge—The sludge from the secondary settling tanks, receiving trickling-filter effluent, is drawn off once each week. The quantity produced varies from about 0.8 cu.yd. per day in the winter to about 2.5 cu.yd. per day in the spring when the trickling filters are unloading the deposits on the stone.

Sludge Disposal

In disposing of the sludge it is pumped from the storage well onto sand drying beds (Fig. 6) and when sufficiently dry is removed by teams. In the spring and fall the farmers take nearly all of it, and at other times it is used for fertilizer on city land or for filling low areas. The cost of operating the sludge beds during the year 1914 was $1,000, practically all of which was expended in handling dried sludge. It does not include the cost of pumping the wet sludge.

Dosing Tank—The quantity of sewage discharged per dose by the dosing tank is about 16,720 gal., more than half of which is stored in the collector troughs and conduits in the primary settling tanks. When two acres of sprinkling filters are in use, the time for the discharge is 3½ min., and the rest period varies from 12 min. for the minimum night flow to 6 min. for the maximum day flow.

Trickling Filters—It has been customary to use two acres of the trickling filters at a time, allowing one acre to rest. The period of rest varies from 6 or 7 days in the winter to 2 or 3 days in the summer. During the rest period in the warm weather, the deposit and growth on the stones dry up and wash out into the secondary tanks when the filter is again dosed.

It is interesting to note that the upper layers of stone harbor vast numbers of snails, small fish worms and flies. Examinations of the stone by means of test pits show that growths and deposits are not formed at a greater depth than 8 to 10 in. below the surface, the remainder of the stone and the floor system being substantially clean.

Out of the 930 nozzles (Taylor type) on the three acres of filters, 620 are usually in operation at each dose. On the average, about 60 nozzles require cleaning each day, half in the morning and the remainder in the afternoon. No nozzles are cleaned between 5 p.m. and 8 a.m. The clogging of nozzles is usually caused by burnt matches and grease, and the trouble can usually be remedied by releasing the spindle of the nozzle and allowing the sewage at the next dose to flow through the dome and wash out the obstructions.

Some trouble has been experienced with an incrustation which forms on the under side of the spindle and on the inside of the dome. This has a tendency to lengthen the period of dose and also to cut down the area of distribution. To remove this incrustation, which is done

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†City Engineer, Gloversville, N. Y.

‡The design, construction and itemized cost of this plant were given in "Engineering News," Oct. 14, 1915, p. 744.

twice a year, it is necessary to take off both the spindle and dome and immerse them in a solution of one part water and two parts hydrochloric acid. With a few exceptions there has been no trouble with the distributors, and there has been none at all with the underdrains.

There is but little odor from the trickling filters, especially on week days. What little there is, is from the tannery wastes. On Sundays the odor is a little more pronounced and resembles that of ordinary sewage, but the distance from the filters that it is noticeable does not ordinarily exceed 200 ft.

During the warm weather in the summer little gray flies which breed in the stone of the trickling filters are a source of great annoyance. During the first summer of operation, a tannery that is situated about 200 ft. from the filters, in the path of the prevailing wind, was caused



FIG. 7. GLOVERSVILLE SAND FILTERS RIDGED FOR WINTER USE

considerable inconvenience from these flies, which could get into the skins as they were being tanned. When the flies first make their appearance, bleach (calcium hypochlorite) is applied to the sewage in the dosing tank, 12 lb. of dry bleach being applied to each of three doses in one day, and the operation repeated on the second day following. It was necessary to carry out this treatment on two different occasions during the summer of 1914. It does not appear to kill the fully matured flies, but does kill the larvæ and very young flies and results in a marked reduction in the objectionable conditions.

The original designs provided that the trickling filters should be inclosed during the winter months to protect them from the snow and cold. Owing to the lack of funds in 1912, no covering was provided, and although a very mild winter followed, the ice at times covered two-thirds of the filter area. In the fall of 1913 temporary roof and sides of rough hemlock lumber were provided, requiring 120,610 ft. b.m., costing $4,177, or $1,360 per acre.[1] The annual cost for removing the covering in the spring and replacing it in the fall is about $300. The covering was removed in the spring of 1914 at a total cost of $143, with a force of 6 to 8 men, in 13 days, starting on Mar. 24. The covering was replaced in the fall of 1914 at a cost of $157, with a force of 3 to 4 men in 26 days, starting on Nov. 18.

[1]See "Engineering News," Apr. 9, 1914, for winter views of beds without and with protection, and further details of covering in article by Mr. Hanmer.—Editor.

If the inclosure is made tight, a dense vapor forms during very cold weather, between the top of the filters and the roof, making it extremely difficult for the attendant to see the nozzles that require cleaning. The air in the inclosure is very bad. To remedy these troubles an occasional board is left off the roof and a number of doors on the sides are left open to provide for ventilation.

Sand Filters—Between the hours of 10 a.m. and 5 or 6 p.m. the effluent from the secondary tanks is the strongest, and this portion is turned onto the sand filters for further treatment. The surface of the sand along the distribution troughs and in the low places becomes clogged frequently with a jelly-like deposit which dries very slowly. Two sand filters only are operated at a time, thus giving opportunity for cleaning the third one. Although some trouble is experienced with growths of weeds and grass during the summer, it is seldom necessary to rake the entire surface of the beds by hand, if a horse-drawn weeder is used to stir up and loosen the surface five or six times during this period. In the winter the surface of the sand filters is furrowed (Fig. 7), the ridges being about 2½ ft. c. to c. and the furrows about 18 in. deep, in order to support the ice sheet that forms on the filters and might otherwise freeze to the sand and thus put the entire bed out of use. The cost of furrowing in the fall is about $58; the cost of leveling the ridges in the spring is about $25, and the cost of cleaning is about $165.

TABLE 4. AVERAGE RELATIVE STABILITY OF GLOVERSVILLE SEWAGE EFFLUENT BY MONTHS, 1914

(Expressed in percentages)

Month	Temperature of Air Minimum	Temperature of Air Mean	Trickling Filters	Effluent from Secondary Settling Tanks	Sand Filters
January	—25	18.6	35.2	36.5	100
February	—25	11.8	68*	68*	100
March	0	27.8	75	75	...
April	19	48	65	68	100
May			52	58	100
June			55	62	100
July			51	58	100
August			62	64	100
September			57	62	100
October			62	69	100
November	12	38	65	67	100
December	—30	22	46	51	100

*Samples were not decolorized at the end of 5 days, when they were thrown away.

Stability of Effluents—Table 4 shows the relative stability of effluents from the trickling filters, secondary settling tanks and sand filters, incubated at a constant temperature of 68 deg. F. Samples were taken and incubated every afternoon at about 4:30 o'clock, according to "Standard Methods of Water Analysis."

Cost of Operation

Table 5 shows the cost of operation by items for the years 1913 and 1914.

TABLE 5. COST OF OPERATION OF GLOVERSVILLE SEWAGE-TREATMENT WORKS, 1913 AND 1914

	1913	1914
Supervision by city engineer	.....	$600.00
Operation of screens, etc.	$223.37	574.00
Sludge pumping, labor and repairs	318.34	214.05
Electric power	318.34	214.05
Maintenance of trickling filters:		
Nozzles	897.28	395.00
Removing and replacing covering	278.25	359.00
Maintenance of sludge beds	1,312.46	1,235.00
Cleaning troughs of secondary tanks	35.50	19.63
Maintenance of sand filters	440.33	315.00
Maintenance of grounds	399.97	163.00
Miscellaneous work	169.87	365.00
Chloride of lime and other supplies	835.96	664.27
Telephone	42.00	42.00
Cleaning and repairs to east primary settling tank (this is an unusual item)	.....	709.00
Total cost for year	$5,179.33	$5,951.95
Cost per million gallons treated	5.16	5.92
Cost per capita based on estimated population	0.24	0.27
Estimated population	21,600	21,800

"Dan Patch" Railway Uses Only Gasoline Power*

The Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Co., operating what is popularly called the "Dan Patch Electric Lines," has what is believed to be the first railway operated entirely with gasoline motive power. The company has recently placed in service three 60-ton gasoline-electric locomotives for freight, passenger and terminal service. It already has a 57-ton locomotive of similar design and 13 gasoline-electric motor cars.

The railway line runs south from a terminal building on 7th St., Minneapolis, for 107 mi. to Mankato. From the middle of the line a branch runs northeast from Northfield to Randolph, 7 mi. Another extension is projected from Faribault southeast to Dubuque, Ia.

There are few difficulties in railroad construction throughout this territory, the severest grade on the line being 2%. In the various cities and towns substantial stations have been erected similar to those used by steam roads. Shelters have been erected every few miles at rural stops. Four through trains are run daily each way and constitute the normal schedule. A parlor-car limited makes the 107-mi. run in 3 hr. 25 min. The other trains require 4 hr. 5 min. Between certain points of the line and the terminals local service is given. In the summer season such excursion trains are run as occasion demands.

These various runs are usually made by a 70-ft. gasoline-electric motor car seating 89 passengers. For a moderate increase in travel a trailer car is added to this and for excursions and extra-heavy traffic a train is made up of trailers and a 60-ton gasoline-electric locomotive of the type shown in the accompanying view.

The new locomotives are double ended and have all the weight on drivers. The box cab extends nearly the entire length of the underframe, which is carried by two two-motor trucks. The cab is arranged in a single compartment and has in it two generating sets. Only one engineman is required. The generating sets and motor controllers are in each end of the cab, convenient to the engineer's seat. The auxiliary lighting set, air compressors and air-storage tanks are assembled in the middle.

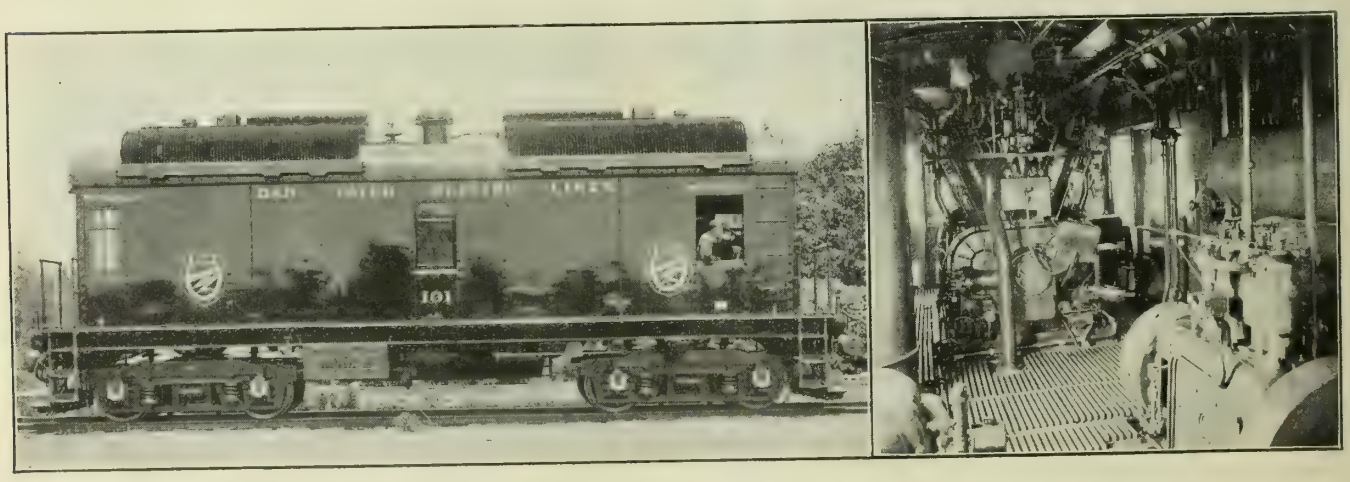
*From data furnished by the makers of the gasoline-electric equipment of this road, the General Electric Co., Schenectady, N. Y.

The cab is of all-steel construction—side posts and rafters of T-irons and angles covered with sheet-steel plates having riveted lap and butt joints. The underframe consists of outside and center sills made up of two 10-in. 30-lb. longitudinal channels. These are tied together by cast-steel buffer end frames and bolster plates (12x1⅛ in.). Cast-steel center plates are bolted to the bolster plates, and cross-sills are riveted in where necessary to support equipment slung below. The drawhead castings are attached to the center sill.

The trucks are a four-wheel swivel type with plate-frame swing bolsters. The wheels are 33 in. in diameter. The axles are 6½ in. in diameter between wheels and 5½x10-in. journals.

A combined straight and automatic air-brake system is used, with 16-in. brake cylinders. About 85% of the weight on the drivers is exerted by the brakeshoes with 50-lb. pressure in the brake cylinders.

Each of the generating sets has a 175-hp. 550-r.p.m. 8-cylinder gasoline engine directly connected to a 600-volt compound-wound commutating-pole generator. The cylinders are arranged in V-pairs and are of 8-in. diameter and 10-in. stroke. Ignition is from low-extension magnetos. The sets are started by air pressure; but with one set running, the second set may be started electrically. Either or both of the generating units may be used to operate the locomotive in either direction, according to the requirements of the train load.



OUTSIDE AND INSIDE OF GASOLINE-ELECTRIC LOCOMOTIVE ON "DAN PATCH" RAILWAY

Compressed air for starting is taken from the main reservoirs of the air-brake system, which are accordingly built with surplus capacity. There are two single-cylinder compressors, driven from the main crankshafts.

Each of the four motors on the truck is a 100-hp. 600-volt type. The gear ratio is 58 to 17, which is well adapted for freight-terminal switching. The motors are suction-ventilated by the engines. The tractive effort at starting is 32,200 lb. At 4 mi. per hr. it is 18,000 lb.; at 8 mi. per hr., 12,000 lb.; at 16 mi. per hr., 6,800 lb., and at 48 mi. per hr. it is 1,000 lb.

The principal dimensions are tabulated below:

Total net weight, equipped	120,000 lb.
Weight per axle	30,000 lb.
Maximum tractive effort	32,200 lb.
Length between coupler knuckle faces	41 ft 4 in.
Length over cab	34 ft
Width over all	14 ft. 10¾ in
Height over all	10 ft. 2 in.
Total wheel base	24 ft.
Rigid wheel base	6 ft. 10 in.

Cincinnati Rainfall Averages

By Harry R. Crohurst*

In connection with the articles in *Engineering News* of June 24, 1915, on the length of record necessary to determine the average rainfall for a given locality, it may be of interest to compare the 65-yr. record of Cincinnati, Ohio, with the 100-yr. New Bedford, Mass., record in accordance with the method for the latter used by Mr. Stineman.

The Cincinnati record is made up from the observations of Dr. Joseph Ray and others (1850-55), Prof. George W. Harper, of Woodward High School (1856-65), reports of R. C. Phillips (1866-70) and the United States Weather Bureau from 1870 to date. The average annual rainfall during this period was 39.23 in.

Table 1 shows the annual rainfall and the average for 5- to 25-yr. periods. The accompanying diagram shows these averages arranged graphically, except that the 5-yr. averages are omitted.

From an inspection of these data it will be seen that the 5-yr. averages range from 51.60 to 29.46 in., or 31.5% above to 24.9% below the mean rainfall for the whole period.

The 10-yr. averages vary from 46.87 to 32.57 in., or 19.5% above to 17% below the mean; 55% of the time it was above the mean and 45% below.

The 15-yr. averages vary from 43.54 to 33.70 in., or 11% above to 13.9% below the mean; 60% of the time it was above the mean and 40% below. Expressed another way, the 15-yr. average is within 5% of the mean either way 33% of the time or within 10% of the mean either way 65% of the time.

The 20-yr. average varies from 43.33 to 34.18 in., or 10.5% above the mean to 12.9% below; 61% of the time it was above the mean and 39% below. The average for 20 yr. is within 5% of the mean 40% of the time and within 10% of the mean 80% of the time.

TABLE 2. RELATION BETWEEN AVERAGE FOR 25 AND 65 YEARS

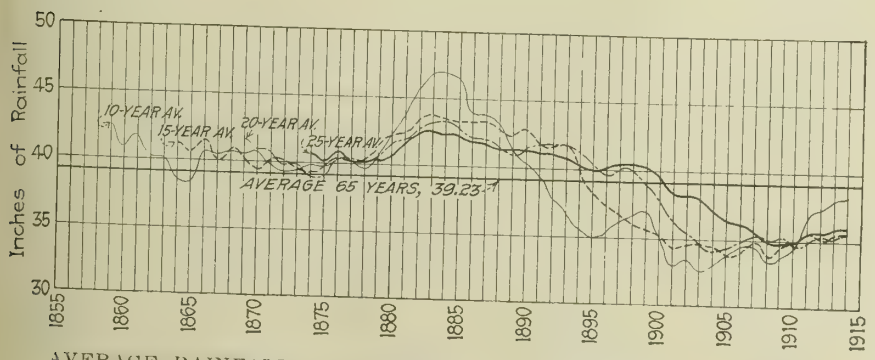
Per Cent. Above or Below the Mean for the Whole Period	Per Cent. of the Time During Which the 25-Yr. Average Was Within the Per Cent. (Given in the First Column) of the Mean
1	2
2	5
3	32
4	39
5	49
6	60
7	68
8	80
9	88
10	93
11	98
12	100

*Sanitary Engineer, U. S. Public Health Service, Cincinnati, Ohio.

The 25-yr. average varies from 42.38 to 34.89 in., or 8% above to 11% below the mean; 66% of the time it was above the mean and 34% below. Using in this case the 25-yr. average, the result would be within 5% of the true mean 40% of the time and within 10% of the true mean 93% of the time.

TABLE 1. ANNUAL AND AVERAGE RAINFALL AT CINCINNATI, OHIO, 1850 TO 1914

Year	Annual	Averages for Periods of Years: 5	10	15	20	25
1850	54.76					
1851	32.49					
1852	54.35					
1853	40.10					
1854	50.77	46.49				
1855	46.73	44.89				
1856	22.88	42.97				
1857	34.90	39.08				
1858	49.17	40.89				
1859	42.57	39.25	42.87			
1860	33.84	36.67	40.78			
1861	42.31	40.56	41.76			
1862	38.83	41.34	40.21			
1863	40.05	39.52	40.21			
1864	34.51	37.91	38.58	41.22		
1865	44.58	40.06	38.36	40.54		
1866	46.90	40.97	40.77	41.50		
1867	32.10	39.63	40.49	40.02		
1868	50.71	41.76	40.64	40.72		
1869	41.51	43.16	40.53	40.11	41.70	
1870	36.19	41.48	40.77	39.40	40.77	
1871	32.07	38.52	39.75	40.02	40.75	
1872	34.89	39.07	39.35	40.02	39.78	
1873	41.38	37.21	39.48	39.50	39.84	
1874	37.61	36.43	39.79	39.17	39.19	40.65
1875	42.58	37.71	39.59	39.75	38.98	40.16
1876	52.62	41.82	40.17	40.44	40.47	40.97
1877	34.65	41.77	40.42	40.16	40.45	40.18
1878	41.62	41.82	39.51	40.26	40.08	40.24
1879	51.60	44.61	40.52	41.40	40.53	40.27
1880	54.67	47.03	42.37	42.07	51.57	40.59
1881	47.24	45.96	43.89	42.10	41.82	41.56
1882	52.12	49.45	45.61	43.43	42.48	42.25
1883	52.35	51.60	46.71	43.54	43.10	42.38
1884	39.28	49.13	46.87	43.39	43.33	42.25
1885	33.94	44.99	46.01	43.24	42.80	42.25
1886	31.35	41.81	43.88	43.19	42.02	41.81
1887	35.08	38.40	43.93	43.21	42.17	41.66
1888	34.88	34.91	43.25	42.77	41.38	41.46
1889	30.92	33.23	41.18	42.33	40.85	41.31
1890	47.70	35.99	40.49	42.67	41.43	41.44
1891	38.44	37.40	39.61	41.72	41.75	41.10
1892	31.95	36.78	37.59	41.54	41.60	41.09
1893	44.00	38.60	36.75	41.70	41.73	40.83
1894	26.59	37.74	35.49	40.03	41.18	40.23
1895	29.33	34.06	35.02	38.34	40.52	39.95
1896	34.48	33.27	35.34	37.49	39.61	40.05
1897	43.89	35.66	36.22	36.95	40.07	40.41
1898	38.97	34.65	36.63	36.05	39.94	40.31
1899	34.69	36.27	37.00	35.75	39.09	40.20
1900	27.78	35.96	35.01	35.34	37.75	39.61
1901	17.99	32.66	32.97	34.45	36.29	38.22
1902	37.30	31.35	33.50	34.59	35.55	38.33
1903	34.69	30.49	32.57	34.58	34.66	38.05
1904	29.54	29.46	32.87	34.49	34.18	37.17
1905	38.69	31.64	33.80	33.89	34.41	36.53
1906	40.83	36.21	34.44	34.05	34.89	36.27
1907	44.56	37.66	34.50	34.89	35.36	35.97
1908	27.29	36.18	33.34	33.77	34.98	34.97
1909	37.43	37.76	33.61	34.50	35.31	34.89
1910	34.42	36.91	34.27	34.84	34.64	34.91
1911	45.05	37.75	36.98	35.54	34.97	35.46
1912	38.61	36.56	37.11	35.19	35.31	35.60
1913	42.15	39.53	37.86	35.40	35.21	35.89
1914	32.78	39.60	38.18	35.27	35.52	35.97



AVERAGE RAINFALL, CINCINNATI, OHIO, FOR THE 65 YR. 1850 TO 1914, COMPARED WITH 5- TO 25-YR. PERIODS

On the basis of a 25-yr. average, Table 2 shows the time and percentage during which the 25-yr. mean would vary from the mean of the whole period.

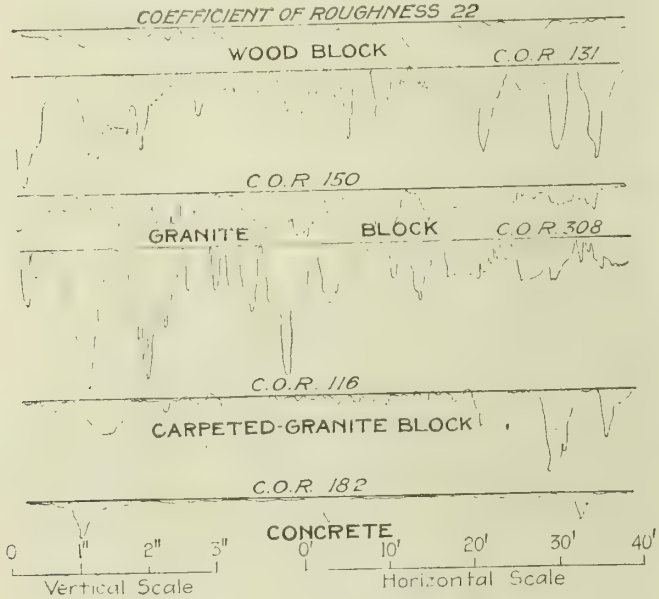
It is interesting to note that in using 15-, 20-, or 25-yr. averages about two-thirds of the time the assumed average would be above the true mean and one-third of the time below the true mean. Also that the variation from the mean is less when the 15-, 20-, or 25-yr. average is above the mean than when it is below it.

Tests of Smoothness Made on Various Pavements

By R. D. Kneale*

With the Kneale testing machine for smoothness of pavement surfaces, described in *Engineering News*, Oct. 14, 1915, p. 751, some interesting studies were made of pavements in Fulton County and Atlanta, Ga. By the use of this machine the coefficients of roughness given in the accompanying table were determined. The coefficient of roughness, as defined in the article previously referred to, is the sum of vertical drops in the pavement surface in feet per mile.

In Table 1 column 1 gives the type of pavement, column 2 its age in years, column 3 its coefficient of roughness (feet per mile), column 4 the average tons traffic carried per day, column 5 the average speed of such traffic, column 6 the estimated maximum traffic carried



TYPICAL RECORDS OF PAVEMENT SMOOTHNESS

by any yard of the pavement's width from construction to date and column 7 gives the estimated percentage of motor traffic as compared with all traffic on dates of census.

TABLE 1. SMOOTHNESS TESTS ON VARIOUS TYPES OF PAVEMENT

1 Type of Pavement	2 Age in Yrs.	3 Coeff. of Roughness	4 Tonnage per Day	5 Speed in Mi. per Hr.	6 Total Tons Carried per Yd. of Width	7 Percentage of Motor Traffic
No. 1. Sheet asphalt	8	15.4	10,000	16	5,210,000	92
No. 2. Sheet asphalt	8	46.2	200	3	270,000	50
No. 3. Wood block	7	22.0	11,000	8	3,150,000	70
No. 4. Wood block	7	131.0	5,500	12	850,000	65
No. 5. Grouted granite block	4	150.0	2,500	12	824,000	70
No. 6. Granite block on soil	25	308.0	3,200	5	2,380,000	40
No. 7. Granite block carpeted	½	116.0	2,000	15	66,000	85
	¼	18.2	150	25	60,000	95
No. 8. Concrete	¼	16.5	2,000	15	730,000	85
No. 9. "Bitulithic"	5	132.0	1,800	10	640,000	65
No. 10. Asphaltic concrete	7	58.0	1,200	15	50,000	80
No. 11. Asphaltic macadam	½	196.0	1,100	12	385,000	85
No. 13. Asphaltic macadam	3	23.0	120	10	12,000	50
No. 14. Top-soil	¼	17.2	800	15	50,000	65
No. 15. Brick	¼	60.5	000			
No. 16. "Roc-Mac"	New					

The test on pavement No. 2 was parallel to No. 1, but was taken in the gutter, where lack of traffic and excess of water from flushing have put the asphalt in bad condition. Test No. 4 was taken between the car tracks, where any combination of factors may have dominated—poor foundation, inadequate drainage and expansion or too light rails. Pavement No. 6 was reset two years ago by convict labor. Resetting improved it very little. By carpeting pavement No. 7 its coefficient of roughness was reduced from 250 to 116. Test No. 8 demonstrates the smoothness of a well-constructed concrete road. About 40% of its coefficient was due to the expansion joints. By the time the coefficient for No. 13 had reached about 130, traffic began to abandon the street for a parallel macadamized street. This macadam was worn out by the excessive traffic in three months. No. 14 illustrates the top-soil road at its best. No. 15 shows a particularly good piece of brick pavement laid on soil. The brick are square-cornered and grouted.

After considerable study of the coefficients of the principal types of construction, the author presents the accompanying Table 2 of coefficients as approximately correct for the standard 6-in. wheel.

TABLE 2. PROPOSED ALLOWABLE COEFFICIENTS OF ROUGHNESS FOR NEW CONSTRUCTION AND FOR MAINTENANCE

Type of Pavement	Construction	Maintenance
Sheet asphalt	11	20
Asphaltic concrete	15	30
Asphaltic macadam	25	60
Waterbound macadam	50	100
Wood block	20	40
Grouted brick	35	80
Granite block	125	200
Concrete	25	50

Both construction and maintenance clauses should also specify a maximum allowable deviation of the graph from the base line, or datum (see accompanying figure). This allowance might well be approximately as shown in Table 3.

TABLE 3. PROPOSED ALLOWABLE DEVIATION FROM DATUM

Type of Pavement	Construction, In.	Maintenance, In.
Sheet asphalt	0.25	0.50
Asphaltic concrete	0.25	0.50
Asphaltic macadam	0.50	1.00
Waterbound macadam	0.75	1.25
Wood block	0.25	0.75
Grouted brick	0.25	0.75
Granite block	0.75	1.25
Concrete	0.25	0.75
Concrete at expansion joints	0.50	1.00

On analysis of the service given per unit expended, it is estimated that the asphalt of street No. 1 is carrying 7,080 tons per sq.yd. per yr. per cent expended on maintenance.

*Professor of Highway Engineering, Georgia School of Technology.

A Bridge Curio Fails—Are All Failures Fortuitous?

By "Bridgebuilder"

A highway bridge at Red Bank, N. J., failed on Sept. 23, 1915, under a motor truck. The full details are not available, but there are a number of points connected with the structure, and others of its class, of such vital interest to those having to do with highway bridges that a brief description of the salient features of this structure may be valuable.

The bridge, known as Hubbard's, crosses the Navesink River from Red Bank to Middletown township. It is an old and very light iron structure, of 10 spans, resting on iron cylinders, which in turn rest on rubble-stone piers. The general dimensions are approximate. The spans are of the bowstring type, 40 ft. long, with five panels of 8 ft. each. The trusses are spaced 17 ft. apart; their center depth ranges from 4 to 5 ft.

The upper chord or arch rib is composed of two 6-in. channels and two 6x¼-in. side plates. All web diagonals are ⅞-in. round rods. Web verticals are 3x3-in. cross-shaped bars forged down at the ends and threaded

for nuts. The lower chords are composed of two 3x½-in. flats, likewise forged down at the ends for nuts placed back of the main shoes. These bars are continuous from end to end of the span. Connections at the panel points are made through a series of clamps which grasp the lower-chord bars.

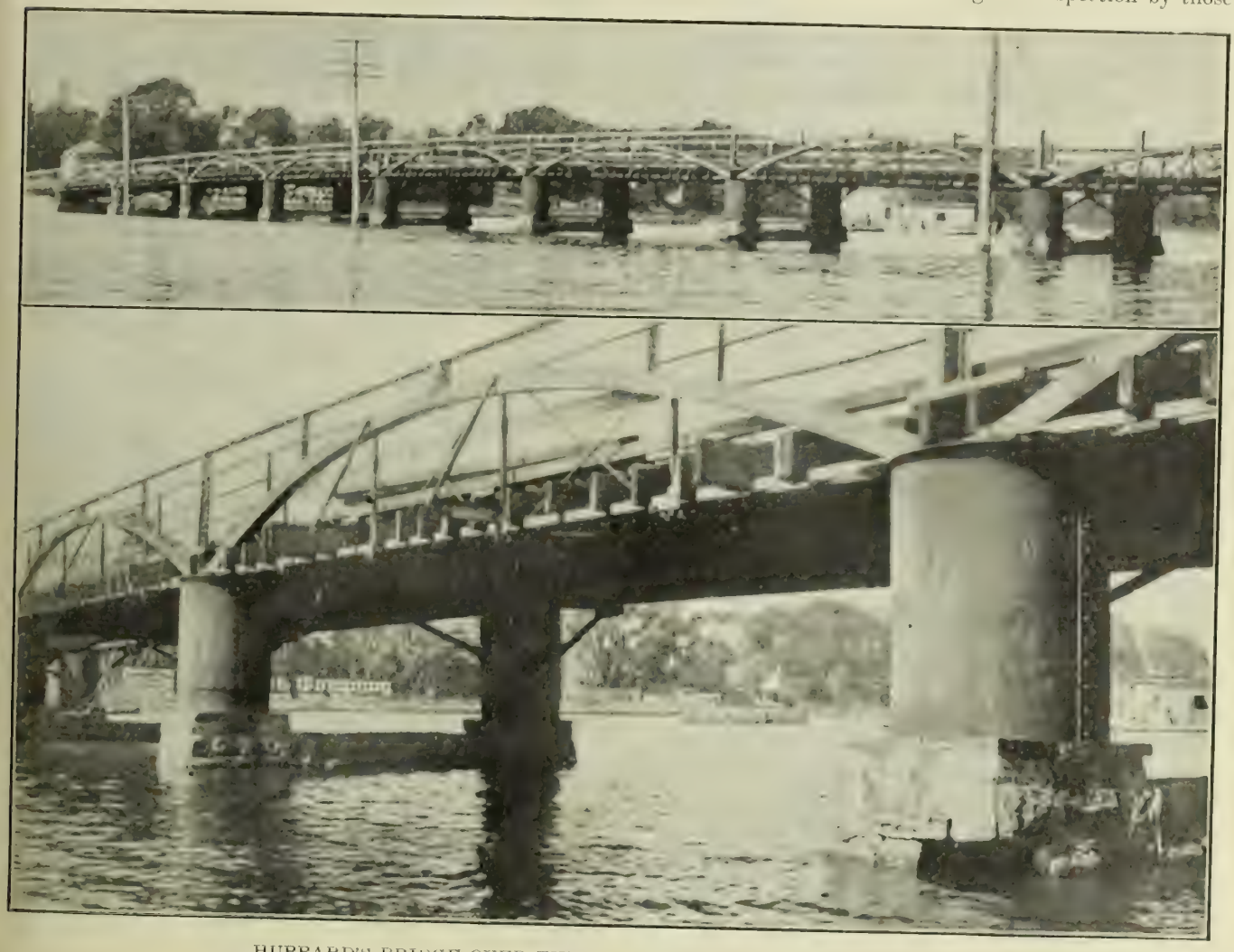
The lower laterals are ⅝-in. round rods. On the lower chord are placed the wooden floorbeams, which are 3x12 in., covered in turn with 2½-in. planking laid diagonally. These wooden floorbeams are notched about 2 in. over the lower-chord bars and are spaced 20 to 24 in. on centers. Next to each of the two center verticals in each truss is laid a 6-in. I-beam with its ends projecting outward beyond the trusses and having a wrought-iron strap fastened to the web, forming a socket for a diagonal brace to the upper chord. This brace is a cross-shaped iron bar forged down at the ends like the truss verticals. On the north side of the bridge is a footwalk about 5 ft. wide, the outer edge of which is carried by the latticed railing resting on light angle brackets attached to the sides of the cylinders. In order that the braces of the trusses should not interfere with the users of the sidewalk, they were omitted on the sidewalk side and nothing was substituted to brace the truss carrying the heavier load.

When the bridge was viewed a day or two after the failure, the truck had been removed and workmen were engaged in removing the bent I-beams in the floor which failed and in laying new wooden floorbeams in the same manner as the old. The lateral rods had not been repaired nor had the web rods in the outer truss been replaced or renewed. Apparently the truck only broke through the floor and pulled out the web rods of the truss without causing the truss itself to collapse—a bowstring truss can stand with little or no web-system.

The amazing fact remains that this remarkable contraption could carry highway loads for a long period of years. The location of the bridge was such that it carried considerable traffic owing to repairs being in progress on the only other bridge leading out of the town.

It is startling to note the great number of bridges which receive no attention or regular inspection by those who are responsible for their maintenance. It is also a cause for wonderment that the truck in the distance was able to get even halfway across this bridge before it broke through, for the lightness and poor condition of the bridge have been commented upon for years. Carelessness regarding bridge structures which are kept in service for the use of the public is little short of criminal. A few states exercise authority over those bridge structures which carry public utilities. New Jersey is foremost in this, having had for years an established system of regular inspections by competent engineers. But mere highway bridges are left wholly without supervision.

Such failures as this one are preventable. They only emphasize the need of placing all public bridges under



HUBBARD'S BRIDGE OVER THE NAVESINK RIVER, RED BANK, N. J.

the control and regulation of a competent and efficient bridge department, whose regular inspections would be the best insurance against similar failures.

The modern juggernaut, the auto-truck, ever increasing in weight and with its heavy axle concentrations, often leaves a wake of broken planks behind it. The passage of such heavy concentrations across a structure not designed for them often starts trouble which a subsequent lighter load will develop disastrously. One wonders what would be the consequence of such frequent and flagrant disregard of the laws of economics in case it became suddenly necessary to provide for the quick transportation of artillery over structures which would have to be rebuilt before such movement were possible.

Earth-Backed Abutments for Concrete Arches

One of the special constructions used in the great Detroit-Superior viaduct over the Cuyahoga River at Cleveland, Ohio, is an arch abutment which relies for stability upon the passive resistance of the earth backing. Sliding friction on the base of the abutment is disregarded. Certain precautions are employed in applying

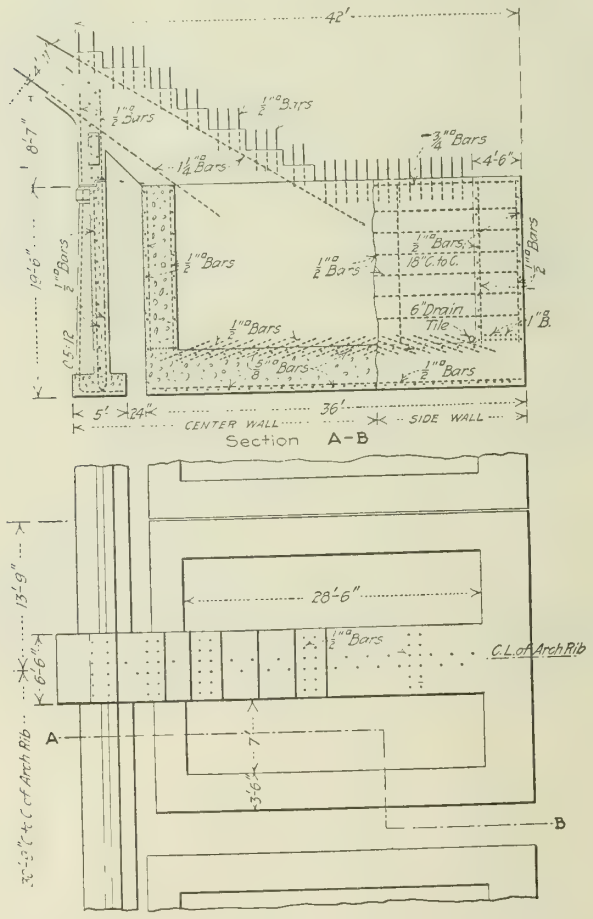


FIG. 1. EARTH-BACKED ABUTMENT, DETROIT-SUPERIOR VIADUCT

this construction, to make sure that the earth behind the abutment will be brought into action.

A. W. Zesiger, bridge engineer of Cuyahoga County, who is responsible for the design, is using similar earth-backed abutments in three other bridges which the county is now building—on South Kinsman Road, Fenkell Road and Ridge Road. The conditions in the four cases differ. The Detroit-Superior abutment, taking the thrust from a 75-ft. arch, is in hard clay, and back of it the ground rises on a hill slope 20 ft. or more. The Fenkell Road and Ridge Road bridges are smaller, and their abutments rest in and against shale. The South Kinsman Road bridge, 106-ft. span, is founded in sand (called quicksand) and has but little rise of the ground behind it; and

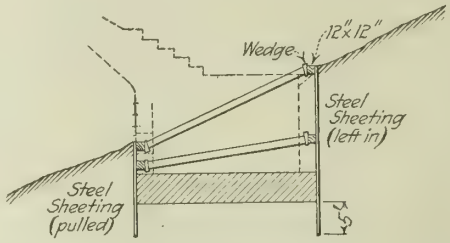


FIG. 2. SHEETING AND BRACING OF ABUTMENT PIT, DETROIT-SUPERIOR VIADUCT, EAST ABUTMENT

here some trouble was experienced in getting the abutment placed solid against undisturbed soil. This arch and two smaller ones are three-hinged, while the Detroit-Superior arch has no hinges.

The design of the Detroit-Superior abutment is shown by Fig. 1. The structure is hollow; the arch load and thrust pass through a central wall to the bottom slab and by the aid of this through central and side walls to the back slab, both slabs being reinforced to distribute their loads. The pressure allowed on the bottom is 2½ tons per sq.ft. (dead-load only); the pressure against the back slab is about half this amount. The keying of walls to bottom slab is obtained by inclined rods sloped in opposite directions in center and side walls, according to the manner of transmission of the thrust.

The pit in which the abutment is built was excavated inside a tight line of steel sheeting all round, with two sets of raking braces between front and back lines, set as the excavation went down, to prevent any give of the sheeting and hence any loosening or movement of the earth backing. When the pit was down to grade, and the bottom approved, the 4-ft. bottom-slab concrete was put in, this being below the lower braces (Fig. 2). After it had set, the lower braces were taken out and the walls concreted; the upper braces were not removed till the finished abutment was able to take the earth pressure and hold the sheeting immovable. The back line of sheeting is left in the ground. By this procedure, the engineers of the bridge believe they get full assurance that the abutment is in direct contact (through the sheeting) with undisturbed earth backing.

Abutment in Sand

The abutment of the South Kinsman Road bridge is shown by Fig. 3. The general principle of design is the same as that represented in Fig. 1. The soil is running sand, but satisfactory abutment action was expected from it. The construction work, however, is said to have let the back sheeting yield slightly, so that some caving and running took place behind it, and the main requirement on which the design is based was violated.

The county engineers solved the difficulty by increasing the crowning or rise of the arch to make up for the probable yielding of the abutment when the load thrust came against it. Their best judgment was that the abutment would move back ½ in. to 1 in., which would produce a settlement of about 6 in. at the crown of the

arch. The centers have therefore been set for an excess in rise of 9 in., allowing for 50% more than the maximum expected yielding. The hinges are expected to take up the movement without injury to the arch ring.

Method of Proportioning

The calculation of pressure distribution with an abutment of the type illustrated is made in consideration of the fact that the abutment is rigid and will tend to rotate

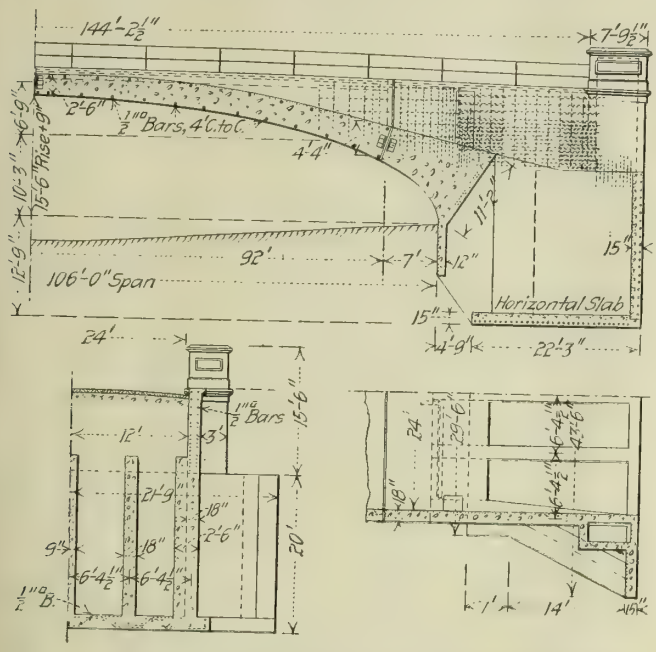


FIG. 3. ARCH AND ABUTMENT, SOUTH KINSMAN ROAD BRIDGE, CLEVELAND, OHIO

equally at bottom and back faces. With very firm soil, the elastic conditions of the backing earth may be the same as those of the soil under the bottom slab, so that, as sketched in Fig. 4, Condition A, the slope of the pressure diagram should be the same for back and bottom. In this case the overturning moment of the arch thrust, referred to the geometrical center of the rectangle, will be resisted jointly at back and bottom, in ratio of the respective section moduli.

Under other conditions, when the soil back of the abutment has less resisting power near the top than near the bottom, the effect of the abutment rotation may not

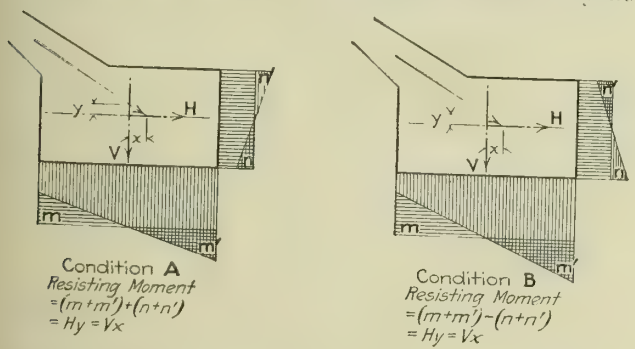


FIG. 4. EARTH-PRESSURE CONDITIONS OF ABUTMENT

give a higher pressure at the top than at the bottom edge of the back wall. But when this occurs the distribution of pressures on the bottom slab will automatically change (see Condition B in Fig. 4) to such a degree that the resisting moment of the base pressures is equal to the full overturning moment plus any moment of the back pressures in the same direction. Thus the stability of such an abutment is not dependent upon securing greater earth resistance at top than at bottom of back wall, but will tend to maintain itself by redistribution of the base pressures.

Reclamation Service Has Unique Library*

It may be of interest to engineers and other interested in irrigation to know that there has been assembled in the engineering section of the Washington office of the Reclamation Service a library of over 500 volumes of histories, specifications, engineering investigations, cost data, etc., of the various projects under construction and being operated by the Reclamation Service. Many of these volumes are in manuscript and often illustrated with photographs.

This library describes the plans leading up to the construction of irrigation works, the actual construction, the cost of the works, the settlement of project lands and operation of works. Each year reports are compiled by project managers concerning the various activities on the projects during the calendar year, chapters being written by each person in responsible charge of work, covering such subjects as clerical, fiscal, engineering, construction, drainage, operation and maintenance, lands, settlement, litigation, health and sanitation, etc. All volumes as far as possible are arranged alphabetically by state, and then by project, as follows:

Arizona, Salt River.
Montana, Huntley.
Washington, Yakima, Sunnyside unit.

A card index is also kept of volumes and contents.

In addition to these "project and feature histories" files are kept in the engineering section of the Washington office of the printed annual reports and congressional hearings having to do with the Reclamation Service, state engineers' reports, state coöperative reports, water-supply and stream-flow bulletins issued by the Geological Survey, bound volumes of the engineering periodicals and a select list of books on engineering and irrigation.

As an aid to correspondence and in order to comply with requests for information by the general public, a file is also kept in the engineering section of price lists and bulletins available for distribution, and also a subject file of information (principally engineering) which it is thought would be of interest. This file is indexed under about 50 headings, among the subjects being the following:

Abutments (standard concrete—plans), cement (standard specifications), dams (plans and specifications), dams, rolling (plans and specifications), excavation tables (handbook), farm-unit plats (price list), flumes (standard plans), gates, high-pressure (plans), hydraulic data (handbook), irrigation farming (pamphlets), land-survey notes (pamphlet), maps of national irrigation projects, pipe (wood-stave—plans and specifications), retaining walls (standard plans), sand-cement manufacture (data and cost), specifications (irrigation structures), telephone lines (cost and specifications), valves (balanced—specifications and plans), water-power development, etc.

An index list of all engineering articles by engineers of the Service and of articles on the work of the Service by other writers is maintained and published at intervals for reference.

*From "Reclamation Record," U. S. Reclamation Service, September, 1915.

Engineering Literature

Bibliography of Engineering Literature--A Beginning

The Library of the Engineering Societies, New York City, has begun a highly commendable work in compiling a bibliography of engineering literature. Of the need of such a bibliography there is no question, as has been often noted in these columns, and it is with pleasure that we are able to announce the publication of the Library's Bibliographical Contribution No. 1, entitled "Catalogue on Technical Periodicals in the Libraries of the City of New York and Vicinity," compiled and edited by the assistant librarian, Alice Jane Gates.

Seven libraries are included in this catalog: Columbia University, Chemists' Club, American Society of Civil Engineers, Engineering Societies, New York Public Library, Plainfield (N. J.) Public Library and Stevens Institute of Technology.

Scientific and engineering periodicals dating back to the beginning of the *Transactions* of the Royal Society of London in 1665 contain a great share of the original contributions to practical science, out of which many tomes have been built, and to the searcher of historical lore these old periodicals are mines of information. The modern periodicals, of course, are of practical everyday use, and this bibliography will be an exceedingly useful tool in the office of any engineer who has access to one or all of the libraries listed. It is hoped eventually to extend the list to other engineering libraries throughout the country.

The book has 128 pages and contains about 2,600 entries, of which the following is typical:

Eclairage électrique. W. Vol. 1-53. September 1894-December 1907. Par., 1894-1907.
Known as La lumière électrique from April 1879-August 1894 and 1908 to date.
Tables générales. Vol. 1-10. 1894-1897 in Vol. 10. N.p., 1883.
Tables générales. Vol. 1-25. 1894-1900. Par., 1902.
E. 1-53; **N.** 1-53; **CC.** 1-21.

It is published by the Library Board of the United Engineering Society, 29 West 39th St., New York City, at the price of $2.50 in paper and $3 in cloth.

CORRESPONDENCE

Direct-Acting Steam Pumps

Sir—Some amazing statements contained in H. E. Longwell's review of my book on "Direct-Acting Steam Pumps" in your issue of Sept. 16, 1915, should not remain unanswered. The opening paragraph was, no doubt, written from the standpoint of a centrifugal-pump man. A visit to our shops at Harrison, N. J., will convince anybody that the direct-acting pump is still very much alive and promises to be with us for some time to come. It supplies a field that the centrifugal pump can never hope to conquer.

The theory always follows the practice, and it can also be said that no such theory of the steam engine as is now used to the greatest advantage existed in the mind of Watt. If the successors did follow the lead of the pioneers blindly, the writer was not one of them. He early recognized the defects of the rules of thumb that were in use for calculating sizes and duties and developed rational methods for arriving at these values.

I agree with the statement that the table of boiler-feed pumps is not as it should be. The ratio should be uniform or should decrease (not increase as was printed) in the larger sizes. A new table calculated according to this idea would, however, be of no value. The table as given represents the sizes in actual use. H. R. Worthington often said that, had he known that every pump builder in the country was going to copy his sizes, he would have used more care in their selection. The ratios are also influenced largely by commercial reasons and the engineer is often defeated by the sales department.

In making the illustrations for single pumps, I followed the method of the designer, who always places piston and valves in a central position. Much may be said for or against this method.

How anybody can proclaim the tables of steam forces of doubtful value passes my conception. The constant demand for a set of these tables proves that they must be of value to somebody.

The remark that the duty of a direct-acting steam pump is pretty much of a joke is also beyond me. It is certainly no joke to the pump manufacturer, who must daily guarantee duties for "tiny simple pumps" as well as for large pumps. Frequently, other considerations than the saving of coal demand that the steam consumption be calculated closely. Foremost of all is the boiler power, since the boiler must be large enough to run the tiny pumps as well as the large ones. This chapter is the result of long and painstaking research. I could have filled several pages of the book with actual test results, giving those usual readings, most of which are of no value, for the determination of the duty that can be guaranteed on some other engine running under different conditions. Numerous tests were investigated and tabulated. From these the average losses were determined and formulas devised; the tables were then calculated by these formulas and have so far proven reliable. In the light of later experience they may be recalculated, and any suggestions are welcome. The greatest value of these tables is that they afford a means to the manufacturer to be consistent in his guaranties.

F. F. Nickel.

East Orange, N. J., Sept. 25, 1915.

[Mr. Longwell submits the following reply to Mr. Nickel's letter.—Editor.]

Sir—To the charge of being a "centrifugal-pump man" I respectfully plead not guilty. On the contrary, a good many years ago, in the self-confidence of youth, I had the temerity to believe that I was fairly well experienced in the design and construction of the type of pump that is the subject of Mr. Nickel's book.

The statement that a machine "has ceased to be of much general interest from an engineering standpoint" does not necessarily imply that it is commercially dead. The ordinary slide-valve throttling engine is still manufactured and sold extensively, and promises to be with us for some time to come, and yet no one would seriously contend that it is a subject of much general interest from an engineering standpoint.

When a device has shown no material development in a quarter of a century, and admitted inconsistencies in its design have remained uncorrected, we may fairly regard it as something that the public may accept as a useful—perhaps indispensable—implement, without being interested in the engineering principles involved.

The demand for copies of the tables of steam forces is hardly a proof of their value. Many people are afflicted with all-devouring and indiscriminating appetites for data sheets of all sorts, irrespective of whether they will in any degree contribute to their welfare or happiness.

Possibly the duty of an engine that may consume from 100 to 200 lb. or more of steam per horsepower-hour is not a joke; perhaps it is a tragedy. It may be that the duty tables are reliable, in spite of the fact that they appear to be inconsistent in some respects. They undoubtedly represent a great deal of hard work on the part of the author. In dealing with efficiencies, however, it is usually more satisfactory to give a reasonable selection of actual tests, with the essential data, so that the reader may have some opportunity for the exercise of his own intelligence, and not have to undergo the humiliation of being spoon-fed with the results of someone else's interpretation and rationalization of the tests. As the author states in his work that "the duty guaranteed by the manufacturer is not the everyday duty," perhaps a few examples of "every-day duties" might be more illuminating than a larger number of estimated duties. It is hardly flattering to the reader to suggest that it is useless to present the actual tests, for the reason that he could not be expected to make intelligent use of them.

Engineers are a trifle prone to give too much weight to thermal efficiency and too little to commercial efficiency. These two efficiencies are not always compatible, and the former may often be sacrificed with advantage in favor of the latter. The direct-acting steam pump is a striking example of an engine of peculiarly atrocious thermal efficiency, which for many kinds of service is commercially efficient to a degree that, as yet, has not been equaled.

I trust that the foregoing paragraph will clear me of the implication that my contribution to your issue of Sept. 16 was an attack on an important industry, masquerading as a review of a technical book.

H. E. Longwell.

New Haven, Conn., Oct. 5, 1915.

Faults in Technical Literature

Sir—The article by R. Fleming, entitled "Faults in Technical Literature," published in *Engineering News* of Sept. 16, 1915, should be reprinted in the various library publications, as the question of faulty technical literature is at least of as much importance to the library as to the engineer.

Aside from the prime importance of the standard of a given publication, there are certain other fundamental facts to be considered when a library purchases a technical book. The sequence of importance is not easily determined. However, as a library exists for its card holders and other users, it may be well to look at that side of the question first.

A publication is bought and placed on the shelves of a library and is then available to numerous users; whereas, when put in the library of an engineer the use of the same publication rarely extends farther than to the engineer or his immediate associates. Take as a concrete example Ketchum's recent "The Structural Engineer's Handbook." This book has already gone through the hands of eleven people here, and twice to another library where still other persons consulted it. While without doubt the general excellence of this book is not to be questioned, the fact remains that if formulas are incorrect the number of chances for working harm are multiplied every time the book leaves the library or is consulted within the library.

Technical books depreciate in value in proportion to the importance of the particular branch of engineering treated, or its future. The librarian has to make allowance for this, since the books on his shelves are his stock in trade.

Technical journals are making long steps in the matter of guiding the would-be purchaser of the present-day publications. The librarian looks forward to a still more active censorship of technical productions. Meanwhile he agrees with Mr. Fleming that "technical literature never was better than it is today."

Kenneth C. Walker,
Head Department of Technology.
Public Library, New Haven, Conn., Sept. 23, 1915.

Sir—My attention has been called several times to an error in the correction of an error in my article, "Faults of Technical Literature," appearing in *Engineering News* of Sept. 16, page 548. The beam of the "American Civil Engineers' Pocket Book" there considered is fixed at one end, supported at the other and uniformly loaded, instead of being a cantilever beam uniformly loaded. In the formula small w should replace large W, so that the correct bending moment should read:

$$M = \frac{wlx}{2}\left(\frac{3}{4} - \frac{x}{l}\right)$$

The error in the article is my own fault, and while I have been reminded that "people in glass houses must not throw stones," it is hoped that the glass will at an early date be replaced by stone walls.

R. Fleming,
American Bridge Co.
30 Church St., New York, Sept. 30, 1915.

[A number of correspondents have called attention to the error which Mr. Fleming acknowledges in the foregoing letter. Their comments, as well as those by Mr. Walker on this page, reinforce Mr. Fleming's remarks in *Engineering News* of Sept. 16 as to the importance of accuracy in technical literature. Some of the letters of correction express appreciation of the difficulties to be met by both authors and publishers in securing accuracy—a difficulty which Mr. Fleming himself pointed out in his original contribution, but which only those who have experienced it to their own discomfiture and regret can understand.—Editor.]

REVIEWS AND NOTES

All About Grinding

REVIEWED BY RALPH E. FLANDERS*

GRINDING MACHINERY—By James J. Guest. New York: Longmans, Green & Co.; London: Edward Arnold. Cloth; 6x9 in.; pp. xi+444; 200 illustrations. $4.20 net.

There have been many good technical books published in this country and many poor ones published abroad. It is yet true that foreign technical books average somewhat higher in useful qualities than American ones—at least in the field of mechanical engineering, with which the reviewer is most familiar. The book under review is written by an Englishman. In lack of padding, breadth of knowledge and originality of material it measures up to the best standards of technical bookmaking.

The examples of mechanism and methods are drawn freely from the practice of England, Germany and particularly the United States, so that it is not handicapped for American use by its foreign origin.

The most interesting section of the book is that in which the author develops his theory that the controlling factor in grinding may be expressed as

$$V^2 \frac{d+D}{dD} l,$$

in which V is the surface velocity of the work, D and d the diameter of the wheel and work respectively, and l the diametrical reduction of the cut. When this factor falls below a certain amount the wheel glazes. When it rises above a certain other, large amount, the wheel disintegrates too rapidly. This theory leads to a somewhat different range of work speeds than has been common in most shops, but the writer brings good evidence to prove that the theory holds good in practice.

Machine grinding is too often considered a matter of mystery and blind empiricism. Mr. Guest's book gives information which will turn much of the grinding man's mystery into clear understanding.

OFFICIAL HANDBOOK OF THE PANAMA CANAL, 1915—Washington, D. C.: Office of the Isthmian Canal Commission. Paper; 6x9 in.; pp. 58; illustrated.

While the Panama Canal was under construction, several editions of an official handbook were issued for distribution to visitors and others, giving the principal facts of popular interest concerning the canal. These books have now been superseded by the new official publication, which deals with the completed canal. It gives tables of distances saved in trade routes by the use of the canal, describes how a vessel is handled through the canal, facilities for shipping, the saving in cost by use of the canal, the manner in which tolls are computed and a brief description of some of the principal features along the line of the canal. An interesting comparison is given of the volume of freight which passed through the canal in the first year of its operation and the traffic that would be required on a railway to pass the same amount of freight. The average freight-train load on the Panama R.R. is about 350 tons. To have carried on the railway the freight that passed through the canal last year would have required the dispatching of 39 trains a day throughout the year.

*Manager, Jones & Lamson Machine Co., Springfield, Vt.

American Travel Illustrated

A HISTORY OF TRAVEL IN AMERICA: Showing the Development of Travel and Transportation from the Crude Methods of the Canoe and the Dog-Sled to the Highly Organized Railway Systems of the Present, Together with a Narrative of the Human Experiences and Changing Social Conditions That Accompanied This Economic Conquest of the Continent—By Seymour Dunbar. (In four volumes.) Indianapolis, Ind.: The Bobbs-Merrill Co. Cloth; 6x9 in.; pp. 1529; 400 illustrations and numerous colored plates. $10. net.

Save for the illustrations and a few pages of text, this work is a history of travel rather than of transportation methods. Steamboat navigation, however, is covered fully and authoritatively and in the section on early railways there are a few pages on track construction. The details of railway facilities and operating methods gleaned from contemporary literature and a host of interesting illustrations make the material both interesting and valuable.

The part that trails, roads, rivers and canals played in the early migrations of Americans is interestingly and completely told. Although the early travel routes and methods of travel between the principal points of the East are described in some detail, the main theme of the history is the steady and never-halting expansion of the population to the westward. Many and all kinds of books have been written of this remarkable achievement of the American people, but this history concerns itself mainly with personal reminiscences of various pioneers and some account of the vehicles and means by which they accomplished their journeys—on foot over trails, with pack trains, wagon trains, stage coach, flatboat, keel-boat, barge, canal boat, steamboat and steam locomotive. It is much more than a history of travel, for it deals comprehensively and intimately with many phases of American life and character that contributed materially to the rapid settlement and development of a great continent.

The author deserves great credit for the bibliography and many annotations the book contains. These, with the 400 illustrations reproduced from many sources unavailable to the general reader, make the four volumes valuable to one interested in engineering history. It is regrettable, however, that more mention is not made of the lives, work and achievements of the early American engineers, for this would have enchanced its value to engineer readers without detracting at all from its interest to the general public.

SURVEYING MANUAL: A Manual of Field and Office Methods for the Use of Students in Surveying—By William D. Pence, M. Am. Soc. C. E., Professor of Railway Engineering, University of Wisconsin, and Milo S. Ketchum, M. Am. Soc. C. E., Dean, College of Engineering and Professor of Civil Engineering, University of Colorado. Fourth Edition. New York and London: McGraw-Hill Book Co., Inc. Flexible leather; 4x7 in.; pp. xiv + 388; illustrated. $2. net.

This is the fourth edition of one of the earliest and best student's surveying manuals. The authors state that the book has been revised, nearly all the cuts redrawn, tables added and the entire text reset. The distinguishing characteristics of the book, the most notable of which, perhaps, is the great variety of problems, have been retained. The many pages of sample field notes and the clear-cut, practical directions for solving many of the problems that are continually occurring in every surveyor's practice have made this manual one of the most popular of its kind. It contains a great many kinks and short cuts in surveying practice that, so far as the reviewer knows, are not found in any other textbook.

Fluid Friction Explained

REVIEWED BY ROBERT E. HORTON*

MOTION OF LIQUIDS—By Lieut.-Col. R. De Villamil. New York: Spon & Chamberlain. London: E. & F. N. Spon, Ltd. Cloth; 6x9 in.; pp. xiv + 210; 86 illustrations and 30 tables. $2.50.

This is not a treatise on the flow of water in the ordinary sense. It does not contain the usual working formulas for engineers, nor tables of coefficients, friction losses or the like.

The book is dedicated to Chevalier Col. W. A. Dubuat and to Col. Duchemin. De Villamil states that Dubuat's work is unfortunately much neglected and that Duchemin's remarkable book on the "Laws of Resistance of Fluids" is almost unknown in England. From the preface it appears that part of Dubuat's experimental work in hydraulics has not been generally accepted, for the reason that it was thought to contain an inconsistency known as "Dubuat's Paradox."

Upon reading the first few chapters of the book, one gets the impression that the object of the author is chiefly to explain the so-called "paradox" of Dubuat; to show that it is consistent with the principles of the resistance of motion of liquids which are revealed in practice in a number of ways, but which have not generally been recognized, and that therefore it is not a paradox; and also to restore to Dubuat the full measure of credit as an experimenter and original discoverer to which he is properly entitled, and in like manner to introduce in English the work of Duchemin, who repeated Dubuat's experiments 50 years later, with results similar to those obtained by Dubuat. On further reading it appears that the attainment of the object stated does not cover the full scope of the book. The author says, on p. 114: "Most unfortunately, in hydrodynamics there is hardly a statement which can be made that is absolutely true in all cases." De Villamil's book deals with the exceptions, he having set forth the established principles of fluid motion in his previous work entitled "A. B. C. of Hydrodynamics." In dealing with the exceptional occurrences in the motion of fluids, the whole treatment by De Villamil centers around the question of the difference in the resistance between a solid and a fluid when either one is moving relatively to the other, according as the fluid is static or not. De Villamil takes the position that there is a difference in the two cases and that this difference is due to the existence of internal motion other than inter-molecular motion. To begin with, he defines a statical liquid as distinguished from one that is nonstatical. The definition he gives, like a number of others throughout the book, seems somewhat labored and more elementary than necessary to meet the intelligence of the class of readers to whom De Villamil's book would be of interest.

Three independent branches of hydraulic investigation have grown up and workers in one field know but little of the results or theories used in the other two fields. The three branches include hydrodynamics, as a branch of mathematical physics, naval hydromechanics and ordinary engineering hydraulics. In his former book on hydrodynamics, De Villamil presented in clear nonmathematical form a digest and correlation of the results attained by investigators of similar subjects in the three different fields, and viewing the subjects from different angles.

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The same policy is pursued, though in a lesser degree, in the present work, in that illustrations and formulas drawn from aërodynamics are sometimes used in support of De Villamil's contentions regarding fluid friction. A number of illustrations are produced in support of the proposition that, with some limitations, when a fluid or liquid flows alongside a nonwetted solid surface eddies are formed between the liquid or fluid and the surface and in some way part of the energy of position used to generate the eddies or vortices is converted back into energy of motion and aids to increase the discharge or flow through an orifice, or to reduce the friction in the case of motion of a solid in a liquid or fluid. De Villamil points out the conditions under which this phenomenon may occur, and since it was first, or at least most specifically, noticed in studies of the resistance to the motion of solids in fluids, it acquired the most particularly unfortunate designation of negative resistance.

On reading the preceding statement one might gain the impression that De Villamil's book is hypertechnical and speculative. That is not, however, the case, except to the limited degree to which suggestions and hypotheses must almost invariably precede the formulation of a true explanation of obscure phenomena. Quite probably De Villamil has been over-enthusiastic in citing illustrations of the occurrence of negative resistance, so called. Some of the illustrations which he cites, such as that of corrasion below a waterfall, or increase in discharge of weirs when the volume of air underneath the nappe is reduced or eliminated, do not appear to the writer to be illustrations of the phenomenon of eddy formation which occasions the transfer of energy described as negative resistance, but are probably due to entirely different causes. One should read De Villamil's book with his mind open and alert.

De Villamil states that Riabouchinsky has agreed to repeat both Dubuat's and Duchemin's experiments at Koutchino. One feels distinct regret that this had not been done at the time the book was written and a number of other simple experiments suggested by the author performed in addition thereto.

There are many books which give the data of fluid friction, but there is perhaps none which goes so nearly to the foundation of explaining the causes of the phenomena as do the two books of De Villamil. "Motion of Fluids" is a book which should be read by engineers who wish to understand as well as to know the facts of hydraulics. It is by no means as satisfying a book as its predecessor on hydrodynamics and leaves one with the feeling that much more could have been accomplished with a few additional experiments and more mature study.

PURCHASING—By C. S. Rindsfoos, C. E., President of the United States Purchasing Corporation; former Secretary-Treasurer, The Foundation Company. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. x + 165. $2, net.

The personality necessary in a first-class buyer or salesman cannot be acquired by reading or study. The technique of buying or selling, however, can be learned. This is what this book endeavors to teach. The chapter on "Strategy" is of especial interest, although it portrays those methods and coups which are well known to most salesmen and buyers. Although written from the standpoint of the purchaser, the seller who needs to know his "enemy's" methods will probably recognize several schemes that have been tried on him in the past.

The chapter on the legal aspects of purchasing contains some important information. The book should appeal not only to buyers and salesmen, but to their employers as well.

Lighting Store Windows

DISPLAY WINDOW LIGHTING AND THE CITY BEAUTIFUL: Facts and New Ideas for Progressive Merchants—By F. Laurent Godinez, Consulting Lighting Specialist; Member, Jersey City Chamber of Commerce; author of "The Lighting Book," "What Do We Know About Lighting?" "Light on Decoration," etc. New York: The Wm. T. Comstock Co. Cloth; 6x9 in.; pp. 222; 114 illustrations. $2, net.

The author has continued in a new volume his previous attacks on commercialized illuminating engineering and "art" as exemplified by the random and indiscriminate use of prismatic-glass shades and globes. In spite of a general improvement of lighting effects observable throughout the country, there is much left to be censured—as this book shows anyone who has not independently observed it.

Great white ways are severely condemned as glaring, unartistic and horribly monotonous. The consequent argument is to place municipal-lighting problems in the hands of a competent group of architects and lighting specialists (not the illuminating engineers who have as a profession, according to the author, become commercialized and gone to seed). The author is the foe of glare and garishness, particularly in store-display lighting. He would conceal his light sources entirely from the passerby and induce softness of illumination through opaque diffuse shades and reflectors in place of the translucent- or prismatic-glass variety which has become so popular. A silver-backed opalescent glass is the material preferred.

Separate chapters take up the problems peculiar to gas and electric lighting, with examples of each. One chapter is devoted to sign lighting—giving good and bad examples.

In a chapter on color attraction the author pleads for the wider use of amber filters and a reduction in the use of white light. There is some general information on various color effects that can be produced easily and economically.

One section of the book takes up in interesting fashion the better window-lighting campaign in Jersey City carried out under the author's direction by the Chamber of Commerce and the lighting company of that city.

PLAIN TALK: Economies, Gas Works, Pigeons, Good Roads, Sign Boards, Garbage, City Plan, Graft, Marketing, Public Singing, Drinking Water, Street Cleaning, Bridges, Contracts, Band Music, Public Utilities, Street Lighting, Water Waste and Other Things of General Interest—A Report by Morris Llewellyn Cooke, Director of the Department of Public Works, Philadelphia, Penn. Paper; 6x9 in.; pp., 108; illustrated. Copies may be had without charge on application to Room 216, City Hall, Philadelphia.

A most unusual report—as intended. The high points in the work of the year, particularly those most likely to appeal to the intelligent and righteous citizen, are treated interestingly. At the same time a general idea of the work, but more particularly of the spirit of the work, of the department in 1914 and the two earlier years of the present administration, is given. For comprehensive details of the year's work the searcher for information will turn to the reports of the several bureaus of the department, some of which are already available in separate form. The present report goes much farther in booming the administration of the government of Philadelphia under Mayor Blankenburg than one would wish to see in municipal reports generally; but the case of "corrupt and contented" Philadelphia is a desperate one, demanding radical treatment.

NEW PUBLICATIONS

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor, the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

THE ABOLITION OF POVERTY—By Edwin Jennings. New York City (142 West 82nd St.): The Author. Paper, 5x7 in.; pp. 31. 25c.

A socio-religious tract by a civil engineer.

ALTERNATING-CURRENT WORK: An Introductory Book for Engineers and Students—By W. Perren Maycock, M. Inst. E. E.; Consulting Electrical Engineer; late Technical Editor to the Westinghouse Companies' Publishing Department in Europe. An enlargement of and an improvement upon the author's former work, "The Alternating-Current Circuit and Motor." New York: The Macmillan Co. London: Whittaker & Co. Cloth; 5x8 in.; pp. xxiii + 415; 258 illustrations. $2.25.

ANNUAL REPORT OF THE TRAINING SCHOOL FOR PUBLIC SERVICE 1914-15—Conducted by the Bureau of Municipal Research, 261 Broadway, New York City. Paper; 6x9 in.; pp. 30.

BOSTON STATISTICS, 1915—Boston, Mass.: City Statistics Department. Paper; 3x6 in.; pp. 25.

THE CALLENDAR STEAM TABLES—By H. L. Callendar, Professor of Physics in the Imperial College of Science and Technology, South Kensington; author of the "The Properties of Steam" New York: Longmans, Green & Co. London: Edward Arnold. Cloth; 6x9 in.; pp. 40. Steam diagram in pocket. 80c.

CATSKILL WATER SUPPLY: A General Description—Board of Water Supply of the City of New York, Municipal Building, New York City. Paper; 6x9 in.; pp. 39.

A new and uptodate edition of a handy and much appreciated description of this great engineering work.

CONCRETE SEPTIC TANKS for Farmhouses and Dwellings in Small Towns—Prepared and published by the Universal Portland Cement Co., Chicago, Ill. Paper; 6x9 in.; pp. 8; illustrated.

Considering its size, this pamphlet contains much misinformation on septic tanks as means of sewage treatment and a considerable amount of useful information on septic tanks, filter beds, etc., as structures. Even the latter is likely to mislead when put in the hands of the farmer or the village householder. If the pamphlet were revised by a competent sewage-works engineer it might promote sound rural sanitation, as well as the sale of cement.

CONFERENCE OF BUILDING INSPECTORS AND BUILDING COMMISSIONERS OF THE UNITED STATES AND DOMINION OF CANADA, Held at New York City, May 14, 1915. Brooklyn, N. Y. (1973 E. 14th St.): J. G. Needham, Official Stenographer. Paper; 8x11 in.; pp. 115. $4.

THE DEVELOPMENT OF THE NEW BEDFORD WATER-SUPPLIES—By Robert C. P. Coggeshall. Old Dartmouth Historical Sketches No. 42 (being the proceedings of the Old Dartmouth Historical Society, held in its building, Water St., New Bedford, Mass., on Apr. 19, 1915). Paper; 7x10 in.; pp. 23.

A detailed sketch, covering a century and more, by the long-time and present superintendent of the New Bedford water-works.

DISPOSAL OF THE SEWAGE AND PROTECTION OF THE WATER-SUPPLY OF CHICAGO, ILL.—A Report to the Chicago Real Estate Board by George A. Soper, John D Watson and Arthur J. Martin. Chicago: The Board. Cloth; 6x9 in.; pp. 212.

The main conclusions of this interesting report were noted on page 1169 of "Engineering News" of June 17, 1915. The report itself has only now become available.

EFFECTIVE BUSINESS LETTERS: Their Requirements and Preparation, with Specific Directions for the Various Types of Letters Commonly Used in Business—By Edward Hall Gardner, Assistant Professor of English in the University of Wisconsin. Cloth; 5x8 in.; pp. xii + 376. $2 postpaid.

THE ELECTRIC RAILWAY—By A. Morris Buck, Assistant Professor of Railway Electrical Engineering, University of Illinois. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xi + 390; 193 illustrations. $3 net.

ELEMENTARY ALGEBRA—By Florian Cajori, Colorado College, and Letitia R. Odell, North Side High School, Denver. (First-Year Course.) New York: The Macmillan Company. Cloth; 5x8 in.; pp. vii + 206; 37 illustrations. 65c.

ELEMENTS OF RAILROAD TRACK AND CONSTRUCTION—By Winter L. Wilson, Professor of Railroad Engineering, Lehigh University. Second edition, revised and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. vi + 396; 210 illustrations. $2.50 net.

EXAMPLES IN ALTERNATING CURRENTS, Vol. I; For Students and Engineers—By F. E. Austin, Professor of Civil Engineering, Thayer School of Civil Engineering, Dartmouth College; author of "How to Make a Transformer for Low Pressures," "How to Design, Make and Operate High-Pressure Transformers," "Examples in Magnetism." Hanover, N. H.: The Author, P. O. Box 441. Flexible leather; 5x8 in.; pp. 223; 70 illustrations. $2.40 postpaid.

FARM WATER-SUPPLIES—Minnesota State Board of Health (Division of Sanitation), Minneapolis, Minn. Paper; 6x9 in.; pp. 29; illustrated.

FIELD ENGINEERING: A Handbook of the Theory and Practice of Railway Surveying, Location and Construction—By William H. Searles, M. Am. Soc. C. E. 17th edition, revised and enlarged by William H. Searles and Howard Chapin Ives, Professor of Railroad Engineering in the Worcester Polytechnic Institute. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Flexible leather; 4x7 in. Vol. I, text; pp. xvii + 309; 148 illustrations. Vol. II, tables; pp. vi + 323. Bound in one volume, $3 net; bound separately, $2 net each.

THE FLOW OF WATER IN IRRIGATION CHANNELS—By Fred C. Scobey, Irrigation Engineer. Bulletin No. 194, U. S. Department of Agriculture. Washington, D. C. (Government Printing Office): Superintendent of Documents. Paper; 6x9 in.; pp. 68; illustrated. 25c.

The author says that this bulletin is based on field tests made for the purpose of determining the retardation factor in Kutter's formula under the various conditions found in practice.

GUIDEBOOK OF THE WESTERN UNITED STATES—Washington, D. C.: (Government Printing Office): Superintendent of Documents. Paper; 6x9 in.; illustrated. Part C: The Santa Fé Route, with a Side Trip to the Grand Canyon of the Colorado—By N. H. Darton and Others. Bulletin 613. Pp. 194. Part D: The Shasta Route and Coast Line—By J. S. Diller and Others. Bulletin 614. Pp. 142.

These complete the set of four volumes of the guidebook. Parts A and B, covering the Northern Pacific and the Overland Routes, with a side trip to Yellowstone Park, were noted in "Engineering News" of Aug. 19, 1915, p. 361. The parts are $1 each.

HANDBOOK OF MATHEMATICS FOR ENGINEERS—By L. A. Waterbury, M. Am. Soc. C. E.; Professor of Civil Engineering, University of Arizona. Second edition. New YORK (29 West 39th St.): Proceedings for 1914. Cloth; Hall, Ltd. Flexible leather; 3x6 in.; pp. xii + 213; 80 illustrations. $1.50 net.

IOWA STATE DRAINAGE ASSOCIATION: Proceedings of Annual Meeting Held at Webster City, Ia., Feb. 25 and 26, 1915. Ames, Ia.: M. F. P. Costelloe, Secretary. Paper; 6x9 in.; pp. 111. 25c. prepaid.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE, Vol. XCI—London (28 Victoria St., S. W.): George C. Lloyd, Secretary. Cloth; 6x9 in.; pp. 711.

LOCATION OF IGNITION SYSTEM TROUBLES MADE EASY: A Chart Giving a Concise Exposition of the Common Derangements That Interfere with Efficient Operation of Internal Combustion Motor Ignition Systems—Arranged by Victor W. Page, author of "The Modern Gasoline Automobile." New York: The Norman W. Henley Publishing Co. Paper; 22x34 in. 25c.

MECHANICAL DRAWING, with Special Reference to the Needs of Mining Students—By Joseph Husband, Assoc. M. Inst. C. E.; Head of the Civil Engineering Department of the University of Sheffield. New York: Longmans, Green & Co. London: Edward Arnold. Paper; 8x11 in.; pp. 79; 230 illustrations. 80c. net.

THE MODERN AUTOMOBILE: Its Design, Construction, Maintenance and Repair—By Victor W. Page, late Technical Editor of "The Automobile Journal," author of "The Modern Gas Tractor" and "Automobile Questions and Answers." 1916 Revised Edition. New York: The Norman W. Henley Publishing Co. Cloth; 5x8 in.; pp. 871; 575 illustrations and diagrams. $2.50.

THE MUNICIPAL ENGINEERS OF THE CITY OF NEW YORK. (29 West 39th St.): Proceedings for 1914. Cloth; 6x9 in.; pp. 544.

NEW JERSEY BOARD OF PUBLIC UTILITY COMMISSIONERS (Trenton, N. J.)—Financial and Miscellaneous Statistics Compiled from the Annual Reports Made by Public Utilities, 1913. Paper; 6x9 in.; pp. 400.

PRINCIPLES OF DIRECT-CURRENT MACHINES—By Alexander S. Langsdorf, F. Am. Inst. E. E., Professor of Electrical Engineering and Dean of the Schools of Engineering and Architecture, Washington University. [Electrical Engineering Texts]. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xxiii + 404; 313 illustrations. $3 net.

REPORT OF THE SECOND INTERSTATE CONFERENCE (OF AUSTRALIA) ON ARTESIAN WATER, 1914—Brisbane: J. E. Slade, Secretary. Cardboard; 8x13 in.; pp. 295; illustrated.

REPORT OF THE WATUPPA PONDS AND QUEQUECHAN RIVER COMMISSION to the City Council, City of Fall River, Mass., Together with the Report of Fay, Spofford and Thorndike, Consulting Engineers. Fall River: The Commission. Cloth; 6x9 in.; pp. 203; illustrated.

An interesting and suggestive report on an unusual combined water-works, water-power, condensing water, storm-water and sewage-disposal project.

RESULTS OF EXPERIMENTS ON SEWER PIPE AND DRAIN TILE—By E. H. Beckstrand, Professor of Mechanical Engineering. Bulletin No. 7, Utah Engineering Experiment Station, June, 1915. Salt Lake City, Utah: State School of Mines, University of Utah. Paper; 6x9 in.; pp. 52; illustrated.

External and internal breaking tests, absorption and other tests, made from 1912 to 1915, chiefly on clay and concrete tile and sewer pipe from 3 to 30 in. in diameter, manufactured in Utah and adjoining states, but including some large 36- to 60-in. reinforced-concrete pipe made in Chicago.

SEWAGE TREATMENT EXPERIMENTAL PLANT IN BROOKLYN, N. Y.—By George T. Hammond, Engineer in Charge for the Department of Sewers, Borough of Brooklyn, New York City. [Reprinted from the Proceedings of the American Society of Municipal Improvements.] Paper; 6x9 in.; pp. 42; 31 illustrations.

STANDARDS OF SERVICE FOR WATER COMPANIES—Established by the State Public Utilities Commission of Illinois, Springfield, Ill. Paper; 6x9 in.; pp. 7.

STATISTICS OF RAILWAYS, 1904-1914, UNITED STATES—Washington, D. C.: Bureau of Railway Economics. Paper; 6x9 in.; pp. 67.

Based on annual reports of the Interstate Commerce Commission and the Bureau of the Census.

STEAM-BOILER ECONOMY: A Treatise on the Theory and Practice of Fuel Economy in the Operation of Steam-Boilers—By William Kent, author of the "Mechanical Engineer's Pocket-Book." Second edition, revised and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xvii + 717; 244 illustrations. $4.50, net.

STEAM POWER—By W. E. Dalby, M. Inst. C. E., London University Professor of Engineering at the City and Guilds Engineering College of the Imperial College of Science and Technology. New York: Longmans, Green & Co London: Edward Arnold. Cloth; 6x10 in.; pp. xvi + 760; 250 diagrams. $6 net.

TECHNOLOGIC PAPERS, UNITED STATES BUREAU OF STANDARDS—Washington, D. C. (Government Printing Office): Superintendent of Documents. Paper; 7x10 in.; illustrated.

No. 44: Investigation of the Durability of Cement Drain Tile in Alkali Soils (Containing Results of First Year's Tests)—By R. J. Wig, Engineer Physicist, and G. M. Williams, Assistant Engineer Physicist, in co-operation with S. H. McCrory, Chief of Drainage Investigations, Department of Agriculture; E. C. Bebb, Engineer, United State Reclamation Service, and L. R. Ferguson, Assistant Secretary of the Association of American Portland Cement Manufacturers. Pp. 56.

No. 47: Value of the High-Pressure Steam Test of Portland Cements—By R. J. Wig and H. A. Davis, Assistant Engineer Physicist. Pp. 34.

No. 48: An Air Analyzer for Determining the Fineness of Cement—By J. C. Pearson, Assistant Physicist, and W. H. Sligh, Aid. Pp. 74.

No. 55: Measurements for the Household. (Circular). Pp. 149.

TELEPHONE APPRAISAL PRACTICE—By J. C. Slippy, author of "Telephone Cables" and "Appendix A, Telephone Construction-Methods and Costs." Pittsburgh, Penn. (428 Oliver Building): The Author. Cloth; 6x9 in.; pp. 97. $4.

A TEXTBOOK ON PRACTICAL MATHEMATICS FOR ADVANCED TECHNICAL STUDENTS—By H. Leslie Mann, Lecturer in Advanced Practical Mathematics, The Woolwich Polytechnic. New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. xi + 487; 149 illustrations. $2.10 net.

TRAMWAY TRACK CONSTRUCTION AND MAINTENANCE—By R. Bickerstaffe Holt, M. I. Mech. E., Highways and Permanent Way Engineer, City of Leeds. London: Tramway and Railway World Offices. Cloth; 6x10 in.; pp. xv + 249; 150 illustrations. 10/6.

UNITED STATES BUREAU OF MINES—Washington, D. C. (Government Printing Office): Superintendent of Documents. 6x9 in.

Rules and Regulations for Metal Mines—By W. R. Ingalls, James Douglas, J. R. Finlay, J. Parke Channing and John Hays Hammond. Bulletin 75. Pp. 296. Paper, 35c.

United States Mining Statutes Annotated—By J. W. Thompson. Part I: Sections and Statutes Relating to Metalliferous and Coal Mining. Pp. 860. Part II: Miscellaneous Mining Subjects. Pp. 1772. Bulletin 94. Not sold separately. Cloth, $2.50.

WATER-SUPPLY PAPERS, UNITED STATES GEOLOGICAL SURVEY—Washington, D. C. (Government Printing Office): Superintendent of Documents. Paper; 6x9 in.; illustrated.

No. 332-B: Surface Water-Supply of the United States, 1912. Part XII: North Pacific Drainage Basins; B. Snake River Basin—By Nathan C. Grover, Chief Hydraulic Engineer and G. C. Baldwin and F. F. Henshaw, District Engineers. Pp. 277.

No. 362-C: Surface Water-Supply of the United States, 1913. Part XII: North Pacific Drainage Basins; C. Lower Columbia River and Roque, Umpqua, Wilson and Nehalem Rivers—By Nathan C. Grover and F. F. Henshaw. Pp. 246.

No. 371: Equipment for Current-Meter Gaging Stations—By G. J. Lyon. Pp. 64.

No. 375-F: Conditions Requiring the Use of Automatic Gages in Obtaining Records of Steam Flow—By C. H. Pierce. Pp. 131-139.

YEAR-BOOK OF THE NEW YORK SOCIETY OF ARCHITECTS—New York City (366 Fifth Ave.): William T Towner, Secretary. Flexible leather; 6x9 in.; pp. 241. $5.

Besides matter pertaining to the society itself and some New York directory features and building statistics, the bulk of this volume consists of the building code of New York City, the tenement-house law applicable to first-class cities in New York State and the state labor law, applicable to factories and mercantile establishments.

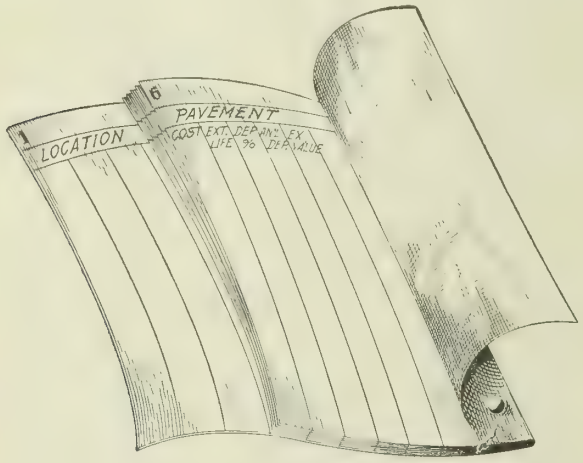
Field and Office

Handy Book-form Data Sheet for Valuation Work

By Robert E. Klotz*

In compiling data for valuations of physical property the custom of assembling all details on one sheet has resulted in the use of sheets of such large size that in some cases two men are engaged in assembling the statistics on one sheet at one time. These sheets are awkward for both compilers and users, owing to the space required in handling and the difficulty of tracing items far removed from their identifications.

In compiling a track and roadway valuation for an electric railway in New York City during the latter part of 1914 and the early part of 1915 I found that a single sheet sufficiently large to accommodate the necessary



DATA SHEET ARRANGED IN BOOK FORM

details would prove inconveniently large both in assembling the data and in referring to them in connection with the litigation for which the valuation was required. After some consideration of various schemes, I finally determined on a sheet made into book form, as shown in a general way in the accompanying sketch. This proved to be a very satisfactory form for the compiler, and it received the distinct approval of the counsel.

As may be seen from the illustration, the book consists of a first, or bottom, sheet sufficiently wider than the remaining sheets to provide, to their left, a space for the section designations, which will remain exposed when all the sheets are closed. The portion of this sheet covered by the others is identical with them in form, and is used for data in the regular manner. Thus in a typical book the first sheet of a railway-track valuation will contain the section designations on the left-hand portion and the data for tram rails on the right. The second sheet will have the data for ties; the third, that for pavement, and so on. The uppermost sheet gives a recapitulation.

While it may at first glance appear that this book would have a more uniform appearance were all the sheets identical and the designations repeated on each, the advantage of being able to retain a certain designation on a single sheet and at the same time refer, within easy reach, to any required data, more than offsets the esthetic shortcomings. Those who have used this book, while they have invariably commented at first upon its apparent "left-handedness," have found it so extremely convenient that I can recommend its adoption by others who may be occupied with the presentation of data or statistics.

*111 West 49th St., New York City.

Measuring-Boxes for Sand and Stone for Concrete Roads

Measuring sand and stone for concrete at the time it is loaded into wheelbarrows at the storage pile by the use of 2-cu.ft. measuring-boxes is called for in the specifications of the Coleman du Pont Road now being built in Delaware. The specifications are as follows:

> Great stress will be laid on the method of measuring the materials used in the concrete. It will not be allowed to measure the materials in ordinary wheelbarrows unless each load is struck perfectly smooth with a straight-edge. This is to insure perfect proportions in the concrete. Contractors shall use measuring-boxes or other similar device if so ordered by the engineer.

The engineer so ordered.

Bottomless boxes or frames are placed in a flat-bottomed wheelbarrow and filled with sand or stone. The



LOADING WHEELBARROW WITH CRUSHED STONE AND MEASURING LOAD AT SAME TIME

frame is then lifted up and the wheelbarrow wheeled to the mixer. In the accompanying view the boxes are being used to measure stone.

At first the contractors did not favor the boxes, but now, according to Charles Upham, chief engineer of the Coleman du Pont Road, Inc., they swear by them. A boxful does not overload the wheelbarrow.

An Electric Dragline Excavates 60,000 Yd. in 18 Days

Fast work was done by the operators of a 1¼-yd. electric dragline excavator on the drainage work of the Boise project, under way by the Reclamation Service. The *Reclamation Record* for October publishes the following data furnished by J. L. Burkholder, assistant engineer:

The machine was operated from noon on Aug. 14 continuously to the end of the month, and approximately three-quarters of the length excavated was in hard material which had to be blasted, 600 lb. of dynamite being used during the period. The dirt was moved at an average rate of two buckets per minute, or 2.3 cu.yd. per min. Counting the time actually spent in digging, the rate was 3 yd. per min.

RECORD ON 1¼-YD. ELECTRIC DRAGLINE

Operator	Amount Excavated Lin.Ft.	Cu.Yd.	Average Number of Cubic Yards Excavated Per Hr.	Per Shift
Martin	3,150	22,617.5	185.8	1,256.5
Gibson	2,680	19,787.7	175.9	1,164.0
Wirth	2,080	16,184.3	173.6	1,135.7
Total and average...	7,910	58,589.5	178.9	1,189.6

MACHINE EFFICIENCY

	Hr.	Per Cent.
Digging	327.30	77.2
Mechanical repairs	58:30	13.8
Electrical repairs	24:30	5.8
Moving	12:45	3.0
Blasting	0:45	0.2
Total	424:00	100.0

There were 491¼ shifts. The record run per shift was 1,583 cu.yd.

Inexpensive Bridge Railing

By George H. Ruhling*

A pipe railing with concrete posts was employed on two 100-ft. single-span concrete-arch bridges which were built across Honey Creek in Seneca County, Ohio, during the past summer. As the bridges were to be located some miles distant from any city, it was deemed inadvisable to build an expensive all-concrete railing. On the other hand, it was not desired to give the bridges a cheap appearance by using the ordinary pipe railing.

Before setting the post forms the two lines of 2-in. wrought-iron pipe were screwed together, lengths being selected so that the sleeves would not come within any posts. The pipe was then painted with two coats of red lead and raw linseed oil, the second coat containing sufficient graphite to give a brown tint. When the paint was dry the pipe was incased in the forms for the posts. These were built in halves and when the pipe was raised to the proper height the halves would slip together, in which position they were secured by two wooden straps running entirely around the form. Where the pipe passed through the form it was wrapped with two layers of asphalt paper. Concrete (1:2:3) was then poured. After the forms were removed the posts were rubbed down with carborundum blocks.

This railing is inexpensive, strong and presents a pleasing appearance. Connecting the pipes together before placing them in position produces a good alignment throughout. The asphalt-paper separators between pipe and concrete allow the pipe to contract or expand independently of the posts. At the same time the pipe is held firmly in position. The pipe works back and forth through the end posts in moderate summer weather.

The writer in conjunction with Charles J. Peters, County Surveyor, designed the bridges and railing. The contractor for the work was the Burke Construction Co., Newcastle, Ind.

*Deputy County Surveyor, Tiffin, Ohio.



GENERAL APPEARANCE OF CONTINUOUS-PIPE RAILING

Concrete Cost Computing Chart

A chart from which the cost of a cubic yard of concrete may be readily traced for different variations in mix and cost of material has been prepared by A. P. Hoover, engineer with the John W. Ferguson Co., building contractor, Paterson, N. J.

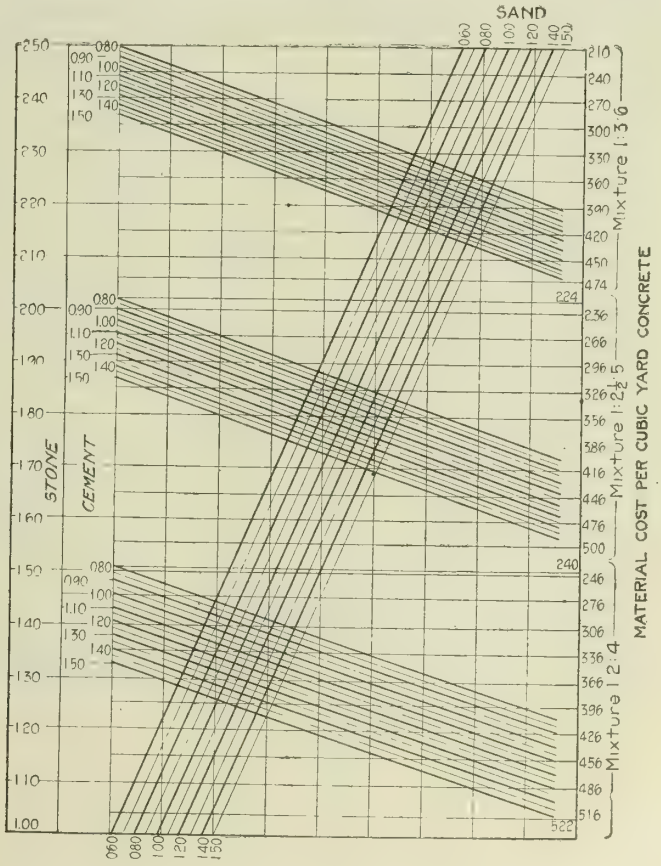


CHART FOR COMPUTING COST OF CUBIC YARDS OF CONCRETE
Devised by A. P. Hoover

On this chart (reproduced herewith) will be found a schedule of prices for stone, cement and sand, in addition to the figures given for the cubic yard under each of the three mixes. Assuming stone at $1.90 per cu.yd., sand at $1 per cu.yd. and cement at $1.40 per bbl., the procedure is as follows:

Follow the horizontal line representing $1.90 for stone until it intersects the diagonal line representing $1 for sand. From this point proceed vertically until reaching the diagonal line representing $1.40 for cement. If the mix is 1 : 2½ : 5, it will be found that the material cost of a cubic yard is $4.04. Similarly, for a 1 : 2 : 4 mix the cost would be $4.32. For 1 : 3 : 6 the cost would be $3.84.

Such a result may be obtained very quickly after a little experience, and in the original chart, which is 12x18 in., the accuracy may be depended on within about 1 per cent.

Concrete Bridge Manhole Form

On the bridge now under construction across the harbor at Portland, Maine, the conduit manholes are built as overhanging boxes tied into the curb-line or outer main girder below the bracketed sidewalk and additionally supported by a bracket, the reinforcement of which also ties into that of the girder. Fig. 2 shows one of these manholes after completion.

The forms for these manholes are put together in one piece on the ground and the reinforcement is all wired into place before the form is lifted into place on the bridge and there joined to the formwork for the bridge proper. After the concrete has set the forms are taken down in sections and are again set up as before for use on the next manhole.

The bridge is under the supervision of J. R. Worcester & Co., Engineers, Boston, Mass., and the superstructure is being built by the T. Stuart & Son Co., Newton, Mass.

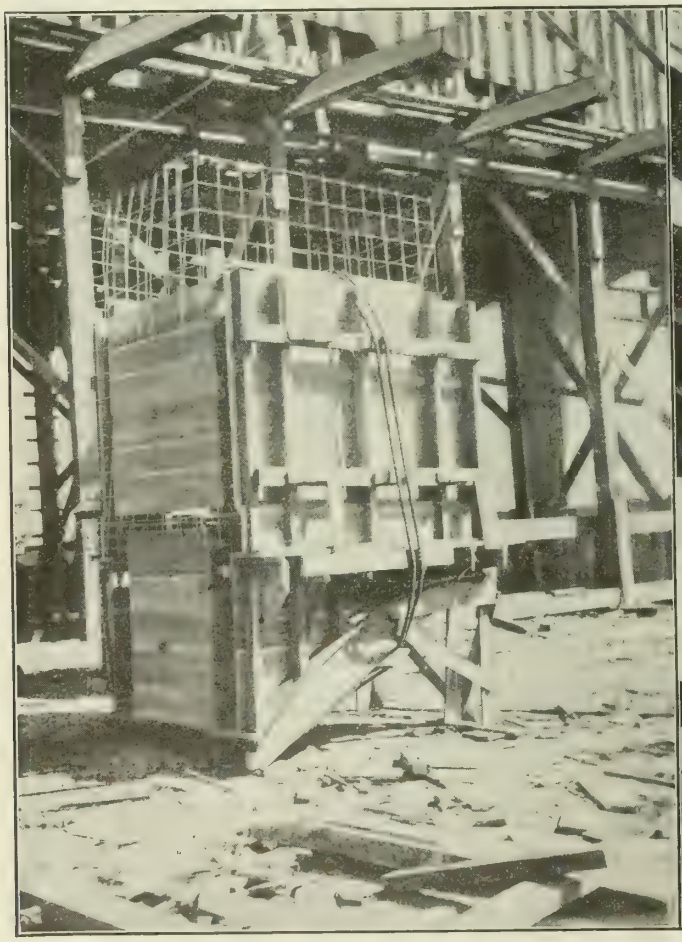


FIG. 1. FORM FOR SUSPENDED MANHOLE IN PLACE ON GROUND

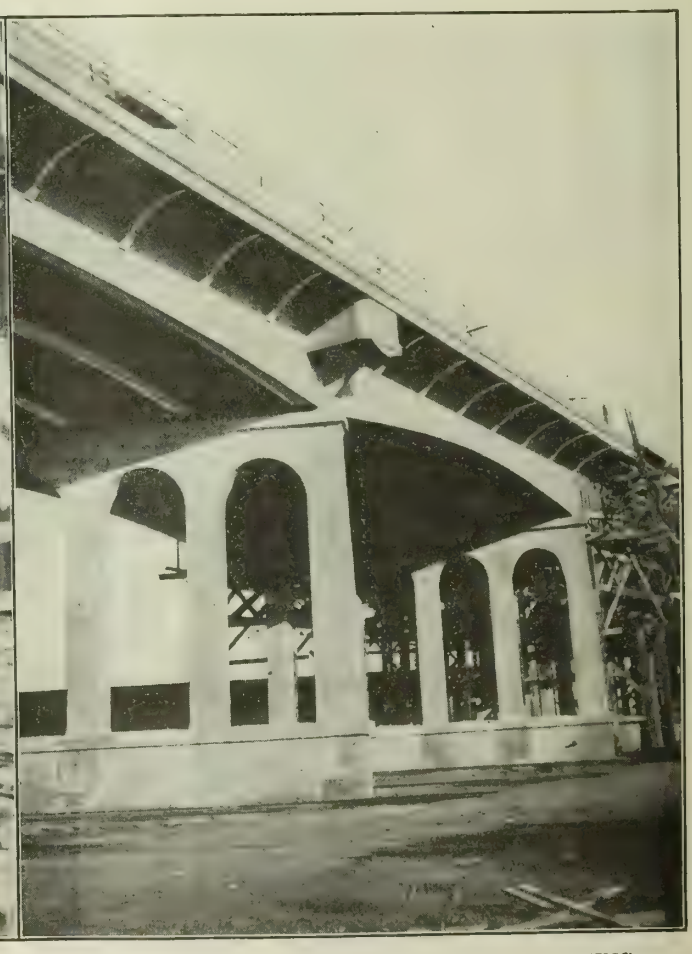


FIG. 2. PART OF PORTLAND BRIDGE, SHOWING SUSPENDED MANHOLE

Eccentric Heel Joint of Roof Truss: Solution of Problem

By Edward H. Rockwell*

The article of E. Godfrey, entitled "Moments at Eccentric Heel Joint of Roof Truss," in *Engineering News* of Aug. 26, 1915, deals with an important principle in structural design, as indeed is stated in the article itself, but a careful examination shows errors of large magnitude, the moments stated being only about one-half the actual ones in the chord members. In fact the method proposed does not seem to possess the finality and exactness one is led to expect from the comments on other solutions.

Fig. 1 herewith is the same as given in the prior article, except that the dotted member *EB* has been added. Mr. Godfrey computes the stress in *ED* by an equation that implies the presence of *EB*. He states that in the graphical construction an assumed member *BE* or *DF* could be used, but that such a construction would give incorrect stresses. This is quite true, and since he has implied the use of *EB* his results are also incorrect. If the use of *EB* is not assumed in computing *ED*, then the figure *EDBF* is assumed to be a solid beam with web, in

*Professor of Structural Engineering, Tufts College, Mass.

which case again the stress computed for ED is incorrect for every point in ED except at X, since taking moments about any point in FB except B gives a different result.

The expression in that article for shear in member ED, $\frac{R\ (b\ -\ a)}{b}$, is simply the value of such a vertical component in ED as will make the resulting stress exactly coincident with the neutral axis of ED provided EB is in the frame. The difference $R\ -\ \frac{R\ (b\ -\ a)}{b} = \frac{Ra}{b}$ is simply the amount of shear taken by the member EB. Mr. Godfrey supposes he has not used EB and therefore divides the shear $\frac{Ra}{b}$ between the chords according to a law discussed in what follows, computing M from these shears. Let us consider what happens to his solution if EB is absent. The stress in FB must now equal the horizontal component of ED, or $\frac{R\ (b\ -\ a)}{DB}$, in order that $\Sigma H = 0$. Fig. 2 represents a free body subjected to the forces as given in the article; D' and B' are the middle points of the chords in the portion l_2, and by the assumption of equal rigidity of joints E, D, F and B are points of contraflexure; $\frac{Ra}{b}$ equals the sum of the vertical forces at D' and B', which are assumed to cause moments in the chords. The equations $\Sigma V = 0$ and $\Sigma H = 0$ are both satisfied. But the equation $\Sigma M = 0$ is not satisfied: Taking moments about E,

$$\textit{clockwise moment} = \frac{Ra}{b}\left(\frac{l_2}{2} + c\right)$$

$$\textit{anti-clockwise moment} = \frac{R\ (b\ -\ a)}{DB} \times EF,$$

and since $\frac{EF}{DB} = \frac{a}{b}$

$$\textit{anti-clockwise moment} = \frac{Ra}{b}\ (b\ -\ a)$$

and the ratio between the clockwise and anti-clockwise moments equals

$$\frac{\frac{l_2}{2} + c}{b\ -\ a}$$

which when c is very small approaches the value $\frac{1}{2}$, whereas it ought of course to equal unity. In other words, the heel joint is not in equilibrium, and if this solution is properly corrected the resulting moments in the chords will be nearly twice the amounts given.

Distribution of Moment Between Chords

Let Fig. 3 represent a joint of three members subjected to a moment caused by imperfect articulation of the members.

The change of slope α is the same for all three members, and if the adjoining truss joints are of equal rigidity, then the points of contraflexure are at the midpoints of the members. Also, for small values of α

$$\sin \alpha = \alpha = \frac{\Delta_1}{\frac{1}{2} l_1} = \frac{\Delta_2}{\frac{1}{2} l_2} = \frac{\Delta_3}{\frac{1}{2} l_3}$$

The true resultant stresses on the joint members all meet at some point to be determined, and these lines of stress must pass through the respective points of contraflexure, at which points there will be forces P_1, P_2, etc., normal to the members which when combined with the longitudinal stresses S_1, S_2, etc., make the true stresses F_1, F_2, F_3, etc.

Then

$$\Delta_1 = \frac{P_1 \left(\frac{l_1}{2}\right)^3}{3\,EI_1}, \quad \Delta_2 = \frac{P_2 \left(\frac{l_2}{2}\right)^3}{3\,EI_2}, \textit{ etc.}$$

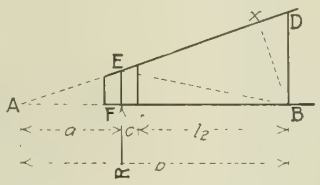


FIG. 1

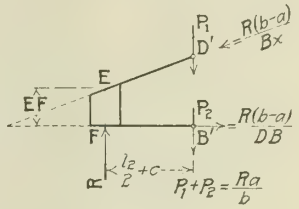


FIG. 2

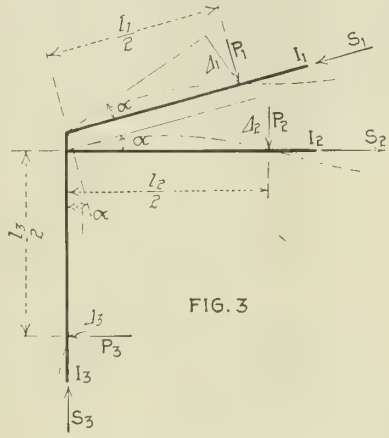


FIG. 3

FIGS. 1 TO 3. DIAGRAMS OF ECCENTRIC HEEL JOINT

Substituting the various values of Δ,

$$\alpha = \frac{P_1 \left(\frac{l_1}{2}\right)^2}{3\,EI_1} = \frac{P_2 \left(\frac{l_2}{2}\right)^2}{3\,EI_2} = \frac{P_3 \left(\frac{l_3}{2}\right)^2}{3\,EI_3}$$

But the moments in the members are $M_1 = \frac{1}{2}\ P_1\ l_1$, $M_2 = \frac{1}{2}\ P_2\ l_2$, etc. Substituting again,

$$\alpha = \frac{M_1 \frac{l_1}{2}}{3\,EI_1} = \frac{M_2 \frac{l_2}{2}}{3\,EI_2} = \frac{M_3 \frac{l_3}{2}}{3\,EI_3}$$

Thus $M_1 = 6\ E\alpha\left(\frac{I_1}{l_1}\right)$; $M_2 = 6\ E\alpha\left(\frac{I_2}{l_2}\right)$; $M_3 = 6\ E\alpha\left(\frac{I_3}{l_3}\right)$

The coefficient $6\ E\ \alpha$ is constant for all values of M in the members at any joint, hence

$$M_1 : M_2 : M_3 = \frac{I_1}{l_1} : \frac{I_2}{l_2} : \frac{I_3}{l_3}$$

In this case therefore moments are to each other as the quantities $\frac{I}{l}$, and not (as stated by Mr. Godfrey) as the quantities $\frac{I}{l^3}$. He obtains the latter expression by assuming moments to vary inversely as deflections, which is untrue.

Solution of Problem, Partly Graphical

The best solution of this and similar problems is based upon the principle that, however eccentric the members of a joint may be, the actual resultant stresses themselves at any joint always meet in a point; otherwise the joint is not in equilibrium. When these true lines of stress are located the direct longitudinal stresses and the moments

are as easily determined as for an arch-ring from its line of pressure.

By the assumptions of this problem the support takes no moment, and therefore the point where the true lines of stress intersect is on a vertical line EF through the

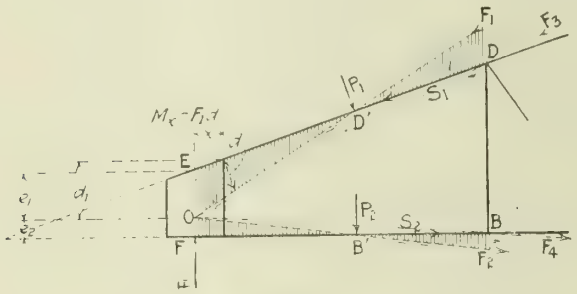


FIG. 4 a

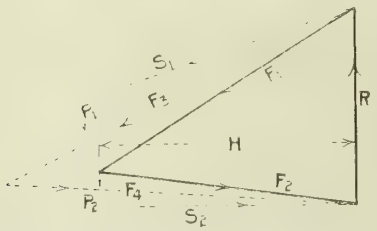


FIG. 4 b

FIG. 4. SOLUTION OF PROBLEM OF ECCENTRIC HEEL JOINT

reaction. The moment, whose amount is as yet unknown, divides between the chords, whose horizontal components of stress are equal. Since M_1 = hor. comp. of $F_1 \times e_1$, and M_2 = hor. comp. of $F_2 \times e_2$,

$$\frac{M_1}{M_2} = \frac{e_1}{e_2} = \frac{\frac{I_1}{l_1}}{\frac{I_2}{l_2}} = \frac{I_1 l_2}{I_2 l_1}$$

in which e_1 and e_2 are measured vertically along EF from the chord axes and $e_1 + e_2 = EF$. In Fig. 4a, EF is therefore divided in the given ratio and the point O is the point at which the actual stresses meet.

For the assumption of equal rigidity in all the different truss joints, lines OD' and OB' are the true lines of stress, whose values are shown as F_1 and F_2 in Fig. 4b. The direct longitudinal stresses are S_1 and S_2. The shears at points of contraflexure are P_1 and P_2. The moment diagram for member ED is $ED'O$, in which the moment at any point x from E equals $F_1 d$ or $H d_1$. If lines of stress are assumed to pass through D and B (when these joints have no rigidity), then F_3 and F_4 in Fig. 4b, now drawn parallel to OD and OB, are the true stresses.

Draftsman's Erasing Knife—A rather clever and efficient little scratcher for the draftsman's use can be made from an old safety-razor blade and a 5- or 6-in. piece of ⅛-in. copper wire. The wire should be split longitudinally for about ⅛ in. by a jeweler's hacksaw, and a portion of the blade soldered into position in this slit, using a small blowpipe with a candle as source of heat, or a blue gas flame. Any soft solder and its appropriate flux, as muriatic acid and tin, will work, but the most convenient flux and solder is "Solderall," which is a pure tin, finely ground, mixed with flux and put up in tubes ready for use. After soldering, the steel may be ground to any desired shape, giving a very thin, sharp edge, which will remove an inked line without cutting the paper or tracing cloth. Incidentally it may be mentioned that "Solderall" is part of every chainman's equipment in the Surveying District of Arizona, it being supplied by the Surveyor-General, together with a number of sleeves just fitting the tape used. If a break occurs in the field, the men fit the broken ends into a sleeve, put "Solderall" at both ends of the sleeve, and hold a match under it.—H. N. Bradstreet, Phoenix, Ariz.

Gasoline Shovels Are Auxiliary to Steam Equipment

There are many localities where the enforcement of smoke ordinances, the cost of coal and water or the demand for licenses for firemen and engineers prevents the use of steam shovels and makes advisable the employment of one driven by gasoline power if certain handicaps of the latter can be overcome. The gasoline shovel therefore has been designed to satisfy a certain limited demand, rather than to produce a machine in competition with the steam shovel. By the use of gasoline shovels a great reduction is possible in some work which contractors have previously done by hand. Gasoline shovels will probably be restricted to medium and light excavation.

Several designs of gasoline-power shovels have been brought out recently, prominent among which is that of the Marion Steam Shovel Co., of Marion, Ohio. The following notes on the equipment and operation of this type have been obtained from the company.

The Marion design has been developed only in the revolving type. All operations are performed by power from one engine and the operation is controlled by friction clutches of the outside-band type. The engine is a constant-speed, four-cylinder, four-cycle vertical marine type with a throttling governor, jump-spark ignition and high-tension magneto. It is splash-lubricated and has a cooling-water pump. A flywheel is carried between the engine and the load to relieve the crankshaft of stresses due to sudden changes in torque. Any fuel can be used down to that of 39° Bé., provided the proper carburetor is employed.

On the end of the engine shaft is a bevel pinion which meshes with two bevel gears loose on a reversing shaft (A in accompanying view). One or the other of these is connected to the shaft by friction clutches. Placing the lever for operating these clutches on center will release both clutches. Geared to the reversing shaft is the hoisting drum C. This is of differential or stepped type, instead of the usual straight barrel seen on steam shovels. This scheme is employed to give greater pull and slower speed on starting the dipper out of the pit and an increased speed with lighter pull when the dipper clears the bank. In this way the difficulty of using a constant-speed drive is minimized. Forward of the hoisting-drum shaft and connected to it by an intermediate shaft E, with gears, is a pair of reversing gears with friction clutches—an arrangement similar to that on the main

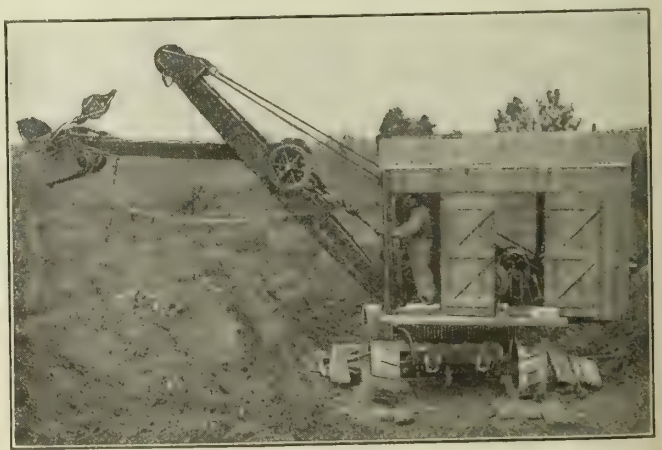


FIG. 1. REVOLVING SHOVEL WITH GASOLINE-ENGINE DRIVE

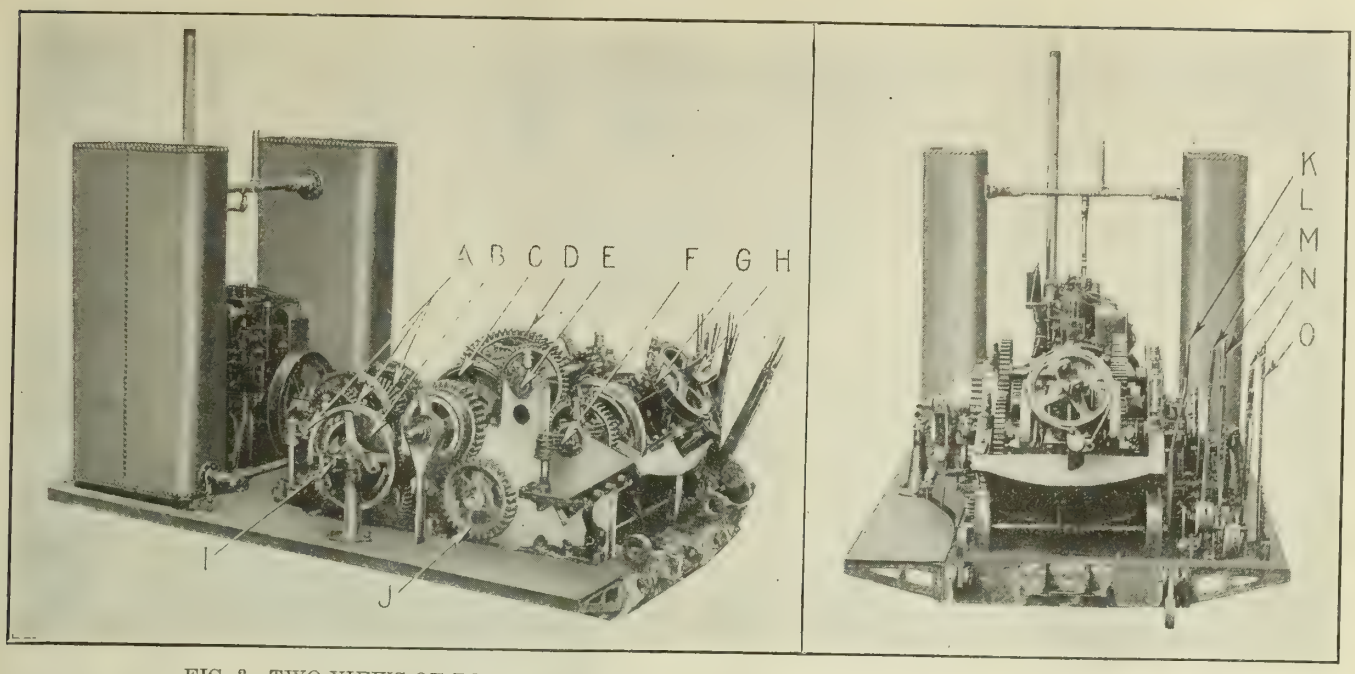


FIG. 2. TWO VIEWS OF POWER AND GEARING UNIT OF A MARION GASOLINE SHOVEL

reversing shaft just mentioned. These control the crowding of the dipper handle, and are both governed by a single lever arranged so that when in central position both frictions are released and a brake *G* is set to hold the dipper handle in any position. Meshing with the reversing bevel gears on the intermediate crowding shaft is a bevel gear on a shaft *H*, running at right angles and having telescopic joints connecting to the crowding gear on the boom. This allows for variation in height of the boom.

The propelling of the shovel is done from a friction clutch and gear *J* mounted on the end of the hoisting-drum shaft. The gear meshes with another gear keyed to a horizontal shaft running directly over the rotating center. Here the shaft carries a bevel pinion, which engages with a bevel gear on the vertical propelling shaft, the lower end of which drives the shovel exactly as on the steam type. Reversing the drive is done at the main reversing gears already noted.

The shovel is swung by a spur gear carried on the main reversing shaft. This gear engages a corresponding spur gear fixed on a swinging shaft *I*, each end of which has a drive-wheel keyed to it and a corresponding friction housing *B*, which is keyed to a gear mounted loosely on the same shaft (with bronze bushings). Both of these gears on the swinging shaft are controlled by outside band frictions, duplicates of those on the reversing shaft; each gear engages another gear keyed to a short shaft below and forward. At the outer end of each short shaft is a bevel pinion meshing into a swinging crown gear on a vertical swinging shaft. The other end of each of these last shafts, exactly as on a steam shovel, carries a spur pinion meshing with a large rotating gear on the lower frame of the shovel. Since there are two swinging mechanisms between the bull wheel and the intermediate swinging shaft, the shovel can be turned in one direction or the other, according as one gear or the other on the intermediate shaft is engaged.

The operator's control of the gasoline shovel is kept identical with that of a corresponding steam shovel; the operating levers have the same position and work in the same manner. The gasoline shovel is a one-man machine—the elimination of the boiler makes a fireman unnecessary. It is not necessary for the operator to leave the shovel levers to look after the engine.

The gasoline type of shovel can be converted into a single-motor electric shovel by the substitution of an electric motor of the proper capacity in place of the gasoline engine. With the control gearing described a constant-speed alternating-current motor may be employed.

Azimuth by a Simple Method

By J. A. Macdonald*

The usual method of obtaining azimuth from Polaris is by making observations at elongation. The following method, not new but little known, will be found much simpler in application and fairly accurate. No instrument and no nautical almanac or mathematical tables are needed.

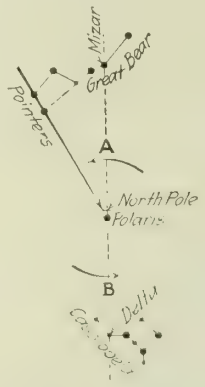
This method is based on the fact that Polaris and two adjacent bright stars are in the same vertical plane only a few minutes before Polaris crosses the meridian. It can be used at only one moment in each 24 hr., and a fairly clear sky is required to enable the stars to be sighted behind a plumb-line. The two stars that can be used in this observation are Mizar, the middle star in the tail, or handle, of the Great Bear, or Dipper; and Delta, in the constellation Cassiopeia. The former can be used only when it is below the pole during the night; when it passes

OBS. ON MIZAR		OBS. ON DELTA CASSIOPEIA	
Jan. 20	5:22 a.m.	July 20	5:30 a.m.
Feb. 20	3:20 a.m.	Aug. 20	3:28 a.m.
Mar. 20	1:30 a.m.	Sept. 20	1:26 a.m.
Apr. 20	11:24 p.m.	Oct. 20	11:24 p.m.
May 20	9:26 p.m.	Nov. 20	9:22 p.m.
June 20	7:24 p.m.	Dec. 20	7:24 p.m.

the meridian above the pole it is too near the zenith to be of service, in which case the latter star is observed. The accompanying diagram shows the principal stars of the

*Topographical Surveys Branch, Ottawa, Ont., Canada.

constellation of Cassiopeia and the Great Bear, with Delta Cassiopeia, Mizar and Polaris on the meridian. The table shows the exact time at which these stars are in the same vertical plane on given dates. The time for other days can be secured by direct interpolation, the daily variation being 4 min. of time.



MERIDIAN PASSAGE OF POLARIS

When it has been determined by observation that Polaris is in the same vertical plane with one of these stars, it can be shown that it will pass the meridian 7.8 min. later during 1915. This interval is increasing from year to year at the rate of 0.33 min., so that in 1916 the interval will be about 8.14 min. The observation can be made either indoors or out by suspending an ordinary plumb-line and marking the direction of the meridian by setting a second point at the stated interval after the two stars are in the same vertical plane.

Table of Chains to Feet

In districts where old deeds generally give distances in chains and links the surveyor will find it advantageous to keep the accompanying little conversion table in his notebook. It gives the feet for each whole number of

CHAINS AND LINKS REDUCED TO FEET

	0	1	2	3	4	5	6	7	8	9	
0	0	66	132	198	264	330	396	462	528	594	0
10	660	726	792	858	924	990	1,056	1,122	1,188	1,254	10
20	1,320	1,386	1,452	1,518	1,584	1,650	1,716	1,782	1,848	1,914	20
30	1,980	2,046	2,112	2,178	2,244	2,310	2,376	2,442	2,508	2,574	30
40	2,640	2,706	2,772	2,838	2,904	2,970	3,036	3,102	3,168	3,234	40
50	3,300	3,366	3,432	3,498	3,564	3,630	3,696	3,762	3,828	3,894	50
60	3,960	4,026	4,092	4,158	4,224	4,290	4,356	4,422	4,488	4,554	60
70	4,620	4,686	4,752	4,818	4,884	4,950	5,016	5,082	5,148	5,214	70
80	5,280	5,346	5,412	5,478	5,544	5,610	5,676	5,742	5,808	5,874	80
90	5,940	6,006	6,072	6,138	6,204	6,270	6,336	6,402	6,468	6,534	90
	0	1	2	3	4	5	6	7	8	9	

chains up to 99; and as links are hundredths, they can also be read off (by pointing off two places) and added to the chains. The table was computed by George M. Foulds and J. E. Thorup, Hackensack, N. J., who have found it very useful in their own work. Suppose a deed calls for a length of 16 ch. 27 lks. From the table 16 ch. is read as 1,056 ft., and 27 lks. (read 27 ch. and point off two places) as 17.82 ft. The sum, 1,073.83 ft., is obtained by mental addition.

NOTES

Lighting Blasting Fuse—The United States Bureau of Mines has recommended a new scheme to replace splitting the end of the fuse and touching off with a lighted match. The scheme has been devised by W. C. Cope, of the bureau, and is of service only where single pieces of fuse are used. A safety match is held against the powder core at the end of the fuse and the matchbox drawn across the match, causing the match and powder core to inflame immediately. It will be noted that this is just the reverse of the usual way of lighting a match—drawing the match across the box. In case safety matches are not at hand, the ordinary household match can be used by placing one match against the powder core and then lighting another and quickly touching it to the first one.

Two Mixers on One Tower—In the construction of the Speed Building at Louisville, Ky., two mixers are being used. At the beginning of the job they were used independently to pour at separate points. It was found that it would be more economical to arrange them so that they could use one tower. One mixer, a Smith gasoline ¾-yd., is at the base of the tower in the pit, while a Milwaukee steam mixer of the same capacity is opposite the tower on the outside and discharges into a chute to a hopper at the bottom of the tower, into which the Smith mixer discharges directly. The operating force consists of a combined engineer and feed operator on the gasoline mixer, an engineer for the steam mixer and a hoisting engineer. The bucket makes a trip every 30 sec. instead of every 1½ min., as at first. The Alfred Struck Co., of Louisville, is the general contractor.—R. B. Shapinsky, Louisville.

High Yardage Record for Hydraulic Dredge—The accompanying view shows material discharged by the 20-in. hydraulic dredge "Stanwix," owned and operated by Grant Smith & Co. & Locher, Rome, N. Y. (built by the Morris Machine Works). This machine was in operation on the New



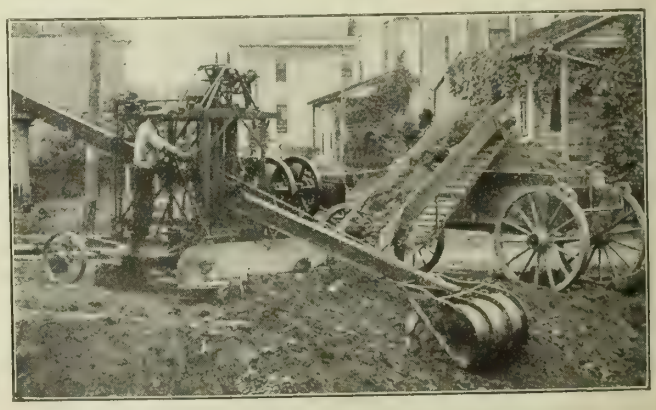
DISCHARGE FROM DREDGE "STANWIX," AT ROME, N. Y.

York Barge Canal at Rome, pumping 800 cu.yd. per hr. (the solid material was a heavy gravel) through 300 ft. of pontoon line and against 12-ft. elevation. It was necessary to deposit a considerable amount of spoil in a small area, which accounts for tilting up the discharge pipe at the angle shown.

Piledriving Formula Wanted for Steam Hammer—Is there in common use any formula that applies to Union Iron Works driver No. 3? I have endeavored to work out a formula from the one ordinarily used, but would like to know what has been customary among engineers.—R. S., Hammond, Ind.

Soil Analysis and Track Construction.—The mechanical analysis of soils, according to Bulletin No. 384 of the United States Bureau of Soils, Department of Agriculture, is recommended by the Way Committee of the American Electric Railway Engineering Association in studying good and poor results with various types of track construction. This analysis classifies material as fine gravel, coarse sand, medium sand, fine sand, very fine sand, silt and clay, according to size of grains.

A Dipper-Handle Drag Scraper—The excavating machine shown herewith has a scraper bucket attached to a rigid boom or handle, which is racked in and out like the dipper handle of a steam shovel. The reach and inclination of the handle are under control of the operator. The scraper delivers



A DRAG SCRAPER WITH RIGID DIPPER HANDLE

its load to the boot of an inclined elevator, consisting of a belt of transverse slats attached to side chains. Power for the excavator and conveyor is supplied by a gasoline engine mounted on the frame of the machine. This excavator was built by a Pittsburgh, Penn., man as a trial device, but it is of sufficient interest to warrant this description.

Editorials

Railway-Track Maintenance

Probably no more alarming picture of defectively maintained railway track has ever been printed than is found in a recent report of the Interstate Commerce Commission's inspector. His remarks are incidental to the description of a train accident, to which the defective spiking and bolting of the rails was a contributory cause. To quote directly:

> At many points spikes were found which were standing away from the rail or which failed to overlap the base of the rail, while many of the splice bolts were loose and some were missing. Measurements were taken in three places of the gage of the second rail east of the point of accident, where it had not been disturbed by the temporary repairs, and the gage was found to be 4 ft. 9¾ in. at one point and 4 ft. 9¼ in. at the other two points. Variations in gage of this character were prevalent. The ties were badly base-worn in many cases and there were also many low joints. The inside rail at the point of derailment had been elevated about 1 in. by the use of shims and braced by planks 11 in. long and 1 in. and 2 in. in thickness. West of the point of derailment one rail was found which had no spikes at the joints, while some of the bolts in the joints were loose. The first spike on the western end of this rail was 53 in. from the end of the rail, and this spike was not holding. The first spike which was holding was 57 in. from the end of the rail. The next spike was 77 in. from the end of the rail and was not holding. On the inside of this rail there were 15 spikes, 8 of which were standing away from the rail and were not holding. On the outside there were 15 spikes, 3 of which were not holding. On another rail west of the point of derailment there were only 3 spikes on the inside of the rail which were holding in a distance of 20 ft. 8 in. The gage of this rail as measured at three different points was 4 ft. 9⅜ in., 4 ft. 9½ in. and 4 ft. 9⅞ in.

Engineering News strongly hopes and believes that such conditions are not very common on American railways. There is no reason to assume, however, that on the particular railway with which the report deals such conditions are only local. So far as the Interstate Commerce Commission report indicates they are typical conditions on that railway. Let all railway passengers hope that they will not long remain normal even on that road.

Of course—the reader will say—the public is amply protected in such matters as this by its national supervisory and inspection authority, the Interstate Commerce Commission. That commission, he will say, will, after noting defects of this kind, promptly proceed to make a thorough investigation of all neighboring track, perhaps of that entire railway, and possibly also of other railways, to determine whether similar dangerous track is found elsewhere and to see that it is immediately brought up to a safe standard. Thus the traveler is protected from abnormal risk of accident—one might almost say, the certainty of accident.

Unfortunately, the case is entirely different. The Interstate Commerce Commission does *not* investigate track conditions elsewhere than just at the point of an accident of this kind. Officials of the commission assert that they absolutely lack legislative authority to investigate. They claim that they are not permitted to determine the safety or dangerousness of railway track, structures or equipment *except after an accident*. Even then they are restricted to the immediate vicinity or direct physical factors of the accident. Our railways may be using dozens or hundreds of weak and unsafe bridges; they may be running over track that has deteriorated so badly as to put every train running over it in momentary danger of being wrecked. Any such conditions, the Interstate Commerce Commission officials declare, must continue to exist, and the commission is powerless to call for remedies or *even to investigate*.

If the commission is right in this view, its powers need extending by legislation at the next session of Congress.

District Representatives of Utility Commissions

A herculean task has been placed on the state commissions for the regulation of public utilities from Maine to California. The great amount of work with which these commissions are loaded leads either to hurried investigations and judgments or to long delays. Complaint comes from certain parts of the country that the state commissions are not in touch with local conditions in the remote parts of the state; and out of this and other complaints has grown the movement for transferring the control of city utilities to local public-service commissions.

This would be full of danger. Such local commissions, experience demonstrates, find it difficult to deal fairly with franchise corporations against the pressure of local public opinion and political attack. If public regulation becomes unfair to capital, no more money can be secured for extensions, proper maintenance will become difficult and public ownership and operation will be the only alternative.

A suggestion that opens a way by which state utility commissions may better satisfy the public demands that the commission shall be in touch with local necessities has been suggested in a letter to *Engineering News* by Prof. Olin H. Landreth, of the Engineering School of Union College, Schenectady, N. Y.—who, by the way, was the only engineer among the 300-odd members of the recent New York State Constitutional Convention. Although Professor Landreth had in mind only New York State, it will be seen that his plan, as presented below without the change of a single word, would be equally applicable to many other states of the Union:

> The plan hereby suggested to improve this defect is that the commission should establish in each of the larger cities of the state a local office in charge of an able, impartial and tactful representative, who would be more than inspector and less than judge, but whose duty would be to keep himself thoroughly informed as to the workings of each of the corporations operating within his territorial jurisdiction and whose duty would also be to hear and investigate tentatively all local complaints and suggestions regarding the quality of the service rendered. While the public and the corporations regulated should still retain the right of final judicial determination by the commission itself, it would doubtless prove to be the case that a large proportion of the matters which now are brought to the commission itself, and many more which are not brought, owing to the remoteness of the commission's headquarters, would be heard and amicably adjusted by the local representative himself, resulting in decidedly better service to the public, a more friendly feeling

between the public and the corporations and an enormous lightening of the burden now thrown on the commission itself. An able, impartial and tactful man, having secured the confidence and respect of both parties between whom it would be his duty to mediate, would be able to accomplish far more by close-range contact and familiarity with local conditions than the formal commission operating at long range and through its system of necessarily formal procedure. The Public Service Commission, when relieved of the burden of trivial complaints and of the tedious procedure necessary to hear and adjust them, would be able to devote its attention more thoroughly to the important judicial matters which come before it.

Although the plan is new as applied to public-service commissions, the underlying principle is not novel. Both in the government service and in great private corporations it has been deemed wise during the last dozen years to multiply district offices and to give those in charge of them greater authority.

It may be claimed that a public-service commission is a judicial body and cannot delegate any part of its authority to deputies, as an executive official can. In answer to that, however, may be cited the extent to which judges delegate the hearing of cases to referees and masters. Surely a state public-service commission, which has been called a quasi-judicial body, could go as far.

Of course it goes without saying that such resident deputies of a public-service commission as Professor Landreth suggests should be men of the requisite ability; and such men would be worth, and should receive, a liberal compensation. This, however, is no objection to the scheme. People should understand that regulation of public utilities costs money and the cost must in the long run be paid by the public. Furthermore, if it is attempted to get something for nothing, to regulate public utilities in a cheap manner by the use of cheap men, the public itself it likely in the end to be the chief sufferer.

Slides or Leaks at Panama?

Anticipating by some weeks the recent heavy slides in the Panama Canal, a correspondent in a recent issue of *Reedy's Mirror* writes:

When the ditch was being forced through Culebra, which is a mountain of rotten earth, the sides frequently slid into the excavation, and just before the water was turned into the ditch all of the walls seemed to be firmer. After the water was turned in, we had reports that slides again occurred.

The real truth is that the canal leaks. As near as I can gather, it is necessary to have a minimum of 27 ft. of water at Culebra. The water seeps through until there is somewhere in the vicinity of a 20-ft. depth; as the water seeps through and runs back through the rotten mud, it undermines the sides, with the result that they break away and slide into the ditch. (It would be interesting to know whether there is actually any truth that slides occur.) It is safer for the builders of the canal to have it appear that shipping through the canal is held up by slides, rather than that the canal leaks. The public has been fed on Culebra slides so long that another report does not make it doubt the truth of it.

To prove that he knows whereof he speaks the correspondent declares that he took a trip through the Canal Zone in August, 1912, and was told a thing worth looking into, but easily proved or disproved. He writes:

While in Panama I met a number of the engineers. One of them told me, in the presence of a number of Americans, that one of the sides of a lock disappeared after it had been practically completed. If this is so, there is undoubtedly some subterranean lake, or perhaps the canal base is over a crater. Whether this is so or not can be determined by getting reports from the canal builders as to the cubic contents of all concrete walls that were constructed and then measuring up the present walls.

It does not seem to have occurred to this truth presenter and seeker that the method he proposes for determining whether the lock disappeared might be applied, with variations, to find out whether there really have been any slides—namely, to measure the earth dredged from the former free channel at the Culebra Cut.

"About This Time Look Out for Concrete Failures"

If construction men were provided with almanacs patterned after the old-fashioned farmers' almanac, the period from the middle of October to the first of December would be embraced by an italic line reading about as the one that heads these paragraphs. In the absence of any such guide it behooves such a journal as this to emphasize the danger such a laconic warning would try to point out.

Many concrete workers will consider this warning unnecessary. They have come to the common enough conclusion that a knowledge of the slow-setting qualities of concrete under a low temperature is a fundamental of the concrete business. A long experience with the peculiarities of some concrete foremen, and more especially a study of the concrete failures of the past, will convince anyone of the contrary. The fact is that while most constructors realize that concrete will not set in freezing weather, many do not appreciate that from 45° F. down to freezing there is a definite slowing up in the setting, which is actually more dangerous than a complete failure to set. Anyone ought to be able to recognize a frozen concrete; it takes a much higher degree of skill to determine a working-strength set.

For the next six weeks, in most parts of this country, night temperatures will be hovering around freezing, although in the daytime artificial heating of the concrete will rarely be required. In consequence, much concrete from which normally the centers could be removed in two to three weeks will be so retarded in set as to be dangerously near failure, unless supported for a week or two weeks beyond the standard period. If the discouraging records of all the autumns of the last ten years are not to be repeated, every man responsible for the laying of reinforced concrete will study his thermometer for the next month or two and be quick to protect his forms when the temperature gets into the forties.

It is a long way from South Carolina to California, but not so far but that the septic-tank explosion at Florence might have been heard of and prevented a like explosion at Pasadena. The Florence explosion (described in *Engineering News* of Feb. 25, 1915, page 410) was caused by burning grass and weeds around the tank. A few weeks ago workmen at Pasadena burned grass around the septic tank there, which caused an explosion in the tank that broke up a considerable portion of its reinforced-concrete roof. These incidents, together with the explosions in the Boston screen chamber, Ocean Grove gate chamber, Batavia pumping station and also the Pittsburgh and Detroit sewer explosions—all within a year or so—illustrate again and again that explosive gases accumulate in sewage-disposal works and sewage-collecting systems and that great care should be taken to guard against them. The primary aim should be to prevent the accumulation of gases; but since even then they may accumulate, a little common sense should be used about lighting cigars in chambers and sewers and setting fire to grass about septic tanks.

Letters to the Editor

How To Collect Royalties on Engineering Patents

Sir—I would like to add something to the current subject of patentees and royalties. The design of girderless plate floors (so-called flat slabs) is something now within the power of every engineer. The methods used by patentees and sanctioned in building ordinances have been published, so there is no mystery about it. In fact, the design of such a floor or roof is generally less arduous work than the design of ordinary beam and slab types. Since the recent decisions of the United States courts, the Flat Slab Patents Co. has been licensing engineers to design flat slabs. As a result of this condition I have had the following experience:

A client employed me to design a reinforced-concrete building. There was considerable chaffering about the price, as competition is strong this year, even when the competition with firms furnishing free (so-called) plans is not taken into account. When the work was started flat-slab men got wind of it and went after the owner. He considered the matter and concluded to have the building designed with flat-slab floors and roof. I informed him that to the cost of designing must be added the royalty of 1c. per sq.ft. This meant an addition of $600 to the engineering expense on the structure. It was too much, and he ordered work stopped. Later, he informed me that he found he could get the flat-slab design free of charge by permitting contractors to furnish competitive designs. So I will be employed merely to check the design of the lowest bidder, unless the bidders succeed in convincing the owner that he does not need an engineer.

It seems the better plan for the Flat Slab Patents Co. and other patentees would be to permit every engineer to design according to the patented method and then make contractors pay the royalty. In the specifications the amount of royalty to be paid can be mentioned, and every contractor can add it to his bid. In this way more business should be done, for engineers that feel they can consistently indorse any special system can be depended on to push its claims. However, when the royalty charge stares up in the face of an owner he will be inclined to do without an engineer and go to contractors for plans and specifications, which will be furnished free (?) by the lowest bidder.

ERNEST MCCULLOUGH.

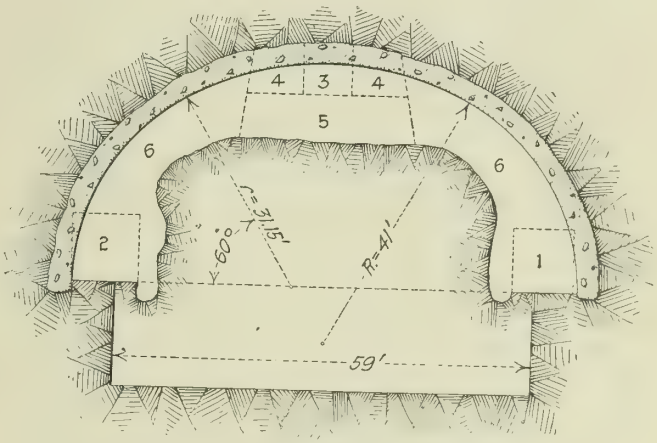
Monadnock Block, Chicago, Ill., Aug. 31, 1915.

Driving the Tunnel for the Marseilles-Rhone Canal

Sir—Having read E. L. Corthell's description of the "Rove Tunnel" on the Marseilles-Rhône Canal in *Engineering News* of Aug. 26, I wish to give a little more exact account of the procedure in excavating and lining that tunnel according to information given in the "Annales des Ponts et Chaussées."

Excavation was commenced by driving at the right a heading with a cross-section of 75 sq.ft., with its base at the elevation of the towpath. A second heading, of 96-sq.ft. section, was driven at the same elevation on the left side, parallel to the right heading; and for the purpose of checking the alignment and for ventilation, this was connected with the first heading by cross-drifts every 328 ft. A third small heading was then driven at the summit of the arch and openings of 43-sq.ft. cross-section were driven to this heading from the two side headings every 60 ft. This third heading was then widened and the excavated material was dropped through the cross-drifts into cars operating in the side headings. The top heading was then lowered and finally the connection with headings 1 and 2 was accomplished as shown in the accompanying sketch.

In the meantime the footings for the masonry arch were laid and the arch centering was erected, being supported on the unexcavated core of the tunnel. The masonry of the arch ring was laid in sections 19 ft. long. Every third one of these sections was built and then the intervening rings were undertaken. After the completion of the arch masonry, the remaining core was removed.



HEADINGS IN THE MARSEILLES-RHONE CANAL

Before the tunnel proper was begun, two shafts 11.48 ft. in diameter, distant 8,200 and 17,800 ft. respectively from the south portal, were constructed, the former having a depth of 460 ft., the latter of 230 ft. These will serve for the ventilation of the tunnel.

To the north of the tunnel is the "Gignac" cut. Near the portal its depth is 99 ft., with an upper width of 335 ft. The sides have a slope of 4 on 5, broken by berms 8 ft. wide, every 32 ft. vertically.

I think that it is slightly hasty to describe the "proposition of building this enormous and enormously costly tunnel merely to save the dwindling traffic by river barges a few miles of navigation in the open Mediterranean as a scheme that would appear absolutely quixotic from the economic point of view." You are no doubt aware that the French have long been masters of the science of eco-

nomics, and I venture to say that they have investigated the proposition in an economic way from all angles and that the canal will be a "paying proposition." It is to be regretted that canals in this country have not received the consideration and study due them, but I hope that time will convince our people when nothing else will.

RICHARD F. WAGNER.

Lynchburg, Va., Aug. 28, 1915.

[Referring to the last paragraph of the foregoing letter, it may be said that some of the ablest engineers of France have been outspoken in public criticism of some of the Government expenditures on waterways, urging that the traffic present or prospective was not sufficient to justify the outlay. In France, as in the United States, politics rather than engineering has often controlled the expenditures on waterways.—Editor.]

Advocating Limestone Concrete

Sir—Referring to the note requesting opinions on the quality of limestone concrete, in *Engineering News,* Oct. 7, 1915, p. 704: This company has for several years used crushed limestone for making machinery foundations, walls and various other things where the concrete has been under heavy load. Most persons who are familiar with cement-mill machinery will agree that everything around the cement plant has to be built very substantially and that the vibration set up in the grinding and pulverizing mills and crushers requires considerable strength in the foundations.

We have used crushed limestone in various grades from dust up to large pudding stones and in very few cases have made any use of sand, grading the limestone so as to get a very dense mass.

The highway commissioner of Wisconsin mentioned in the note seems to be straining at the gnat when he objects to the use of crushed limestone for the coarse aggregate in concrete-road construction.

We would not hesitate to recommend crushed limestone for any work where concrete is to be used.

SECURITY CEMENT AND LIME CO.,
Arthur C. Hewitt, Engineer.

Hagerstown, Md., Oct. 12, 1915.

Lighting Fuses with a Hot Iron

Sir—In *Engineering News* of Oct. 7, T. Ray Martin gives some advice on the lighting of a blasting fuse. I have done a considerable amount of blasting and have found that the safest way to light several fuses at a time is to use a short piece of iron rod ¾ to 1 in. in diameter and about 2 ft. long, heated to a white heat at one end. Touching the heated end of the rod to the square-cut end of the fuse will start the sputter so fast that the writer has lighted as many as 23 charges at one time, using a 24-in. length of fuse.

I don't think that it is a safe practice to light more than four fuses at one time with matches, for everybody knows how easily a match is blown out, and a man gets rather nervous when he is lighting fuses and can't get a light, while a fuse close to him may be burning its way to the charge beneath.

When lighting fuses with matches I have found it of assistance to cut the end of the fuse square and apply a very small amount of nitro-gelatin directly to the end of it. The thinnest film of nitro possible is best. This will help the lighting considerably.

GUSTAVE E. NYREEN.

290 Massachusetts Ave., Cambridge, Mass.
Oct. 12, 1915.

Sir—I note some discussion on the best way of lighting the ordinary safety blasting fuse. The method described by T. R. Martin on page 707 of *Engineering News* of Oct. 7 is undoubtedly superior to a torch or any other flame, large or small. It is probably the best method where only one fuse is to be lit.

Where there are several fuses, however, it is open to objections, and I can suggest a better method, namely, the use of a red-hot iron. I have found it best to employ a piece about ⅝ in. in diameter by about 10 or 12 in. long, heated for a distance of 2 or 3 in. at one end in an ordinary blacksmith forge.

The braid of the fuse should be split about ⅜ in., on the upper half only. By spreading the split it will form a small cup in which to hold the powder. It should be laid on a small, dry rock and another rock about as large as a man's fist placed on the fuse about 3 in. away. If the fuses are prepared in the manner cited they can be lit very rapidly. I have frequently seen one man in my employ light 8 or 10 before running for shelter, the fuses being 16 to 18 in. long. I think that is no more difficult than lighting four or five fuses with matches. One might suppose the iron would cool too quickly, but it does not, and anyone who tries this method is not likely to use any other as long as he has available a blacksmith fire and an old bolt.

J. M. BENJAMIN.

3738 Sheffield Ave., Chicago, Ill.

Largest Electric Drainage Pumping Plant

Sir—The article in the Sept. 23 issue of *Engineering News* entitled "Drainage Pumping Plant with Variable-Speed Drive" is of especial interest to engineers engaged in land-reclamation work in the Gulf-coast country on account of its description of the ingenious method of securing a variable pump speed from a nonvariable motor. The constant-speed conditions imposed by alternating-current motors make it difficult to apply them to drainage pumping on account of the various heads at which the pumps must be operated. Another feature of the plant that would be considered a novelty in Louisiana practice is the long discharge line running over the protection levee and approximately following the slope lines of it. Such construction has been considered prohibitive on account of the expense for long pipes and the friction losses in the pipe, but it is probable that at least in some of the projects where underlying strata of sand are encountered at depths of 3 to 10 ft., it would have been well-warranted and would have prevented much of the trouble experienced from seepage and washouts.

From the rather meager data shown on the cross-section of this plant, it would appear that the suction pipes were belled at their extremities to about twice the cross-section area of the main portion of the pipes, and the discharge pipes do not appear to have been constructed with any increase in section at their outer ends. Prob-

ably a liberal increase in the section of both pipes would have assisted in regaining the velocity head to an amount which would justify the slight additional expense. I suggest study of the following clause which I am using in specifications for similar work:

"Suction and discharge pipes shall be increased in section so that the mean maximum velocities at the extremities farthest from the pump shall not exceed 4 ft. per sec."

It has been found by observation that a velocity of 4 ft. per sec. will retain in suspension the very fine matter usually coming to the pumps through the intake system of canals and will not scour out the material from which the discharge canals are usually excavated.

The article is in error in stating that the plant described is the largest drainage pumping plant in the country to be operated by electricity. The plant of the New Orleans Lake Shore Land Co., which was put into operation two years ago, exceeds it in both power and total capacity. This plant was designed by Prof. W. B. Gregory, of Tulane University, acting as consulting engineer, and the writer as engineer for the land company. The capacity of each of the duplicate units at normal head of 6 ft. is 76,000 gal. per min., with variation in static head from zero to 10 ft. Each unit consists of an inclosed-impeller pump (Worthington), driven through herringbone gears (Falk) with 10:1 ratio by a 230-hp. motor (General Electric), and a cycloidal vacuum pump (Wilbraham-Graham). The equipment was furnished and installed by A. M. Lockett & Co., Ltd., of New Orleans. No provision was made for collecting entrained water in the suction pipes of the priming units, as the pumps will pass a reasonable amount of water without injury to the machinery. Current is furnished by the New Orleans Railway and Light Co. at 2,200 volts. It is brought to the transformer house at the pumping station at 6,600 volts.

So far as my knowledge extends, this is the only electrically driven drainage pumping plant in use in this section for the drainage of agricultural lands. But this plant is insignificant in comparison with those of the City of New Orleans, which has approximately 24,000 acres under pump, practically all of which is served by electrically driven machinery. The present available capacity of such pumps in the city amounts to over 17,000,000 gal. per min. Contracts have been let and the installation commenced for eleven "Wood" screw pumps, each having a capacity of 225,000 gal. per min., as shown in *Engineering News*, Jan. 15, 1914. There is now available in the two central power stations of the Sewage and Water Board 11,000 hp. for operation of the electrically driven drainage pumps of the city.

A. M. Shaw.
Consulting Engineer.
Hibernia Building, New Orleans, La., Sept. 27, 1915.

Autogenous Welding Produces Strains in Metal

Sir—I have read with much interest your statement, on page 572 of the issue of Sept 16, in regard to the difficulties with bronze on the Catskill Aqueduct. I also read in the issue of Nov. 26, 1914, the original statement of the difficulties. The general subject is of great interest to me, but I am particularly interested in the statement that the cracks in the gate valves apparently result from "burning in," or welding.

It is well-known by those engaged in the manufacture of bronze and bronze alloys that unless the conditions of manufacture are properly controlled (and the most insignificant of these have at times an exceedingly important influence) the resulting alloys will not be satisfactory. It is necessary at times to resort to specific heat-treatments in order to obtain the results desired. If this fact is thoroughly appreciated, it is not to be wondered at that the change in structure caused by local heating, due to the burning-in, or welding, process, may entirely nullify the good qualities of the original piece.

It should also not be forgotten that there are undoubtedly strains set up because of the intense local heating and consequent intense local contraction which may not at the time of the repair be manifested. In cast-iron pieces such strains will generally make themselves known on the cooling off of the piece, by reason of the brittleness and low tensile strength of the material. In the case of the tougher materials, steel, bronze, etc., the strains still exist, although their manifestation in the form of cracks or distortion may not be noticed so soon or so prominently.

The changes in structure produced by the burning-in, or welding, processes are readily discovered by the microscope. Under certain conditions they are of no particular importance, but in the case under consideration they may be exceedingly serious. The writer does not pretend to say how such troubles should be overcome, because that is the province of the manufacturer and the engineer in charge of the work, but he does want to call attention to the frequent abuse of the oxyacetylene and electric-welding processes. This abuse generally comes through ignorance, but the extended application of these processes at the present time and the very great future possibilities of their application lead him to utter a word of warning, which is that such methods should not be used unless it is surely known that good results will be obtained.

It will also be found necessary to control in some way the operators who are doing the work, to be sure that the work they do is properly done. I appreciate the difficulty of doing this, but believe that it can be accomplished by careful selection of the men and by proper training. Welding processes have arrived at the stage where they are frequently considered to be applicable to any kind of repairs. This stage occurs in the use of all new processes, and until the limits of application of such a new process are determined difficulties will occur. Therefore the greatest caution should be used in permitting such work to be done, and before welding is employed assurance should be obtained that it can be done correctly and safely.

I cannot too strongly protest against the use of welding of any kind in connection with such parts as locomotive and car tires, where the entire structure of the metal is changed and strains set up which at some time will result in serious injury to property, and possibly loss of life. There is plenty of work that can be safely and economically done by these welding processes without straining them to arrive at results that, to say the least, are questionable in their permanency and safety.

S. W. Miller,
Rochester Welding Works.
406 Orchard St., Rochester, N. Y., Sept. 20, 1915.

Building Twin City Concrete Automobile Racetrack

SYNOPSIS—Grading work and concrete mixing and placing on new motor speedway at St. Paul.

The essential details of design of the concrete-paved Twin City Motor Speedway at Fort Snelling, between St. Paul and Minneapolis, Minn., were described in *Engineering News,* July 29, 1915, p. 233. This two-mile automobile racetrack was recently completed and tried out with a 400-mi. automobile race.

The trackway is 60 ft. wide on the straightaway opposite the grandstand and on the curves; on the straightaway in front of the grandstand it is 80 ft. wide. Along the inner side of the track is a macadamized apron 17 ft.

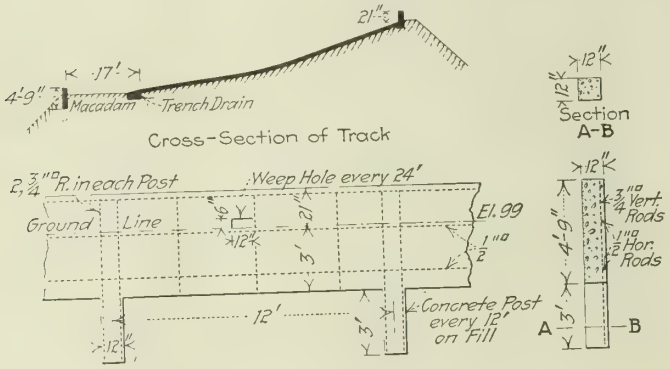


FIG. 1. CROSS-SECTION OF CONCRETE-PAVED RACETRACK; TWIN CITY MOTOR SPEEDWAY

wide, to be used for dead cars, changing tires, repairs, etc. The curves are eased by 800-ft. spirals. The track is oval, 3,865 ft. on the major and 2,500 ft. on the minor axis. The radius of the curves is approximately 1,250 ft. (See Fig. 1, p. 233, *Engineering News,* July 29, 1915.) The accompanying Fig. 1 shows a cross-section of the track on the curves.

The track was first graded to the proper width and form; the superelevation of the spirals and curves was made by earth fills. Fig. 2 shows the beginning of the grading operations. Excavations were made in the high parts of the field by steam shovels, and the earth was moved to the fills by narrow-gage railway trains. The earth was placed in layers and rolled with steam rollers. The specifications called for sprinkling, but rain fell practically every other day during the grading work, and while it was a serious hindrance to the contractor it was of great assistance in compacting the earthwork.

The 6-in. concrete pavement was laid by the use of three concrete mixers, two of 16-cu.ft. capacity and one of 14-cu.ft. The maximum output of any one machine in 10 hr. was 1,333 sq.yd. of pavement. The curbs, or retaining walls, along each edge of the trackway were built separately from the pavement, using three small mixers.

These retaining walls are 5 ft. high and 12 in. wide, and project 2½ ft. above the pavement. The wall around the outside track is reinforced by allowing 2½ ft. of the reinforcing rods to project out from the paving slab. These rods were bent up into the wall form when the walls were poured. It was the original intention to build the outer wall and paving at the same time. This did not work out well, and the wall was put in afterward, with its foundations under the paving, as shown in Fig. 1.

Paving work began July 9 with one machine, and on July 21 the grading had sufficiently progressed so that the second machine was put on. On Aug. 6 the third machine was put to work. All three machines were kept at work until the date of completion, Aug. 26.

The concrete was mixed 1 : 2½ : 4. As soon as a section of pavement was poured and surfaced to grade, a dry finish of 1 : 1 sand and cement was floated on top. The expansion joints were made by using "Elastite," ½ in. in thickness for the transverse diagonal joints (see *Engineering News,* July 29, 1915) and ¼ in. in thickness for the middle longitudinal joint running the entire length of the track.

On curves the outer 20 ft. of the pavement was reinforced with triangular "Trus Con. No. 20," and all pave-

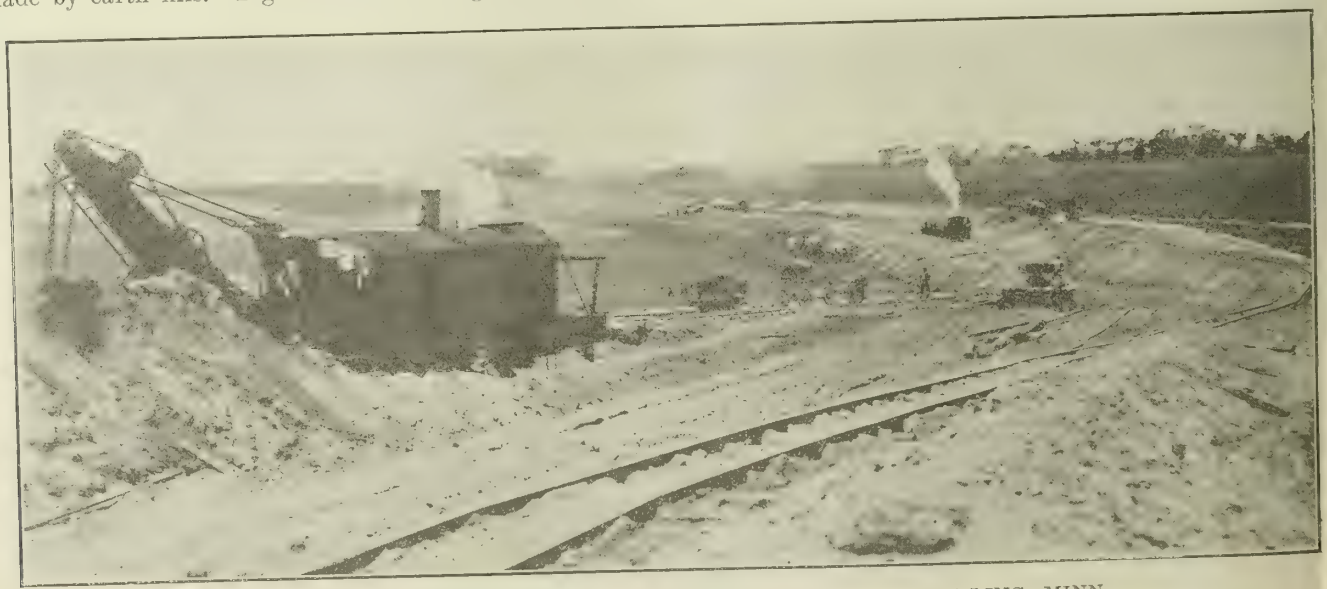


FIG. 2. GRADING TWIN CITY MOTOR SPEEDWAY, FORT SNELLING, MINN.



FIG. 3. POURING THE CONCRETE PAVEMENT, TWIN CITY MOTOR SPEEDWAY, FORT SNELLING, MINN.

ment was thus reinforced where the fill was over 4 ft. in height. The first 30 ft. of all pavement on each side of the entrance subways was also reinforced by use of ¾-in. twisted rods.

Crushed limestone was used, furnished by the St. Paul Crushed Stone Co. The stone was hauled 5 mi. in 5-cu.yd. motor trucks. Six loads a day was considered a day's work. A bonus was paid to the hauling contractor for all loads over six. In a single day one truck made 12 loads, or 120 mi. The sand for all concrete work was found on the ground and was of very good quality. A large part of it came out of the excavation for the entrance tunnels or subway. The crushed rock delivered by trucks was dumped in bins, from which it was loaded into 1¼-cu.yd. dump cars running beneath. An 18-in.-gage track circled the grounds with all necessary switches, side tracks, etc., and was used for the delivery of the stone and cement to the mixers.

A 2-in. pipe line was laid completely around the inside of the track to furnish water to the mixers. There were two feeder mains to this pipe, making the total length of 2-in. pipe three miles. One of the mains was supplied with water from a small lake by a 3x6-in. duplex pump driven by an 8-hp. gasoline engine. On the other main was a small duplex steam pump, which drew from a reservoir in the United States Military Reservation. The gas-engine plant did most of the pumping, and the steam plant was used to keep up the pressure to normal. There were many connections for hose and 1-in. pipe all around the circuit main.

The vitals on this job were the loading station and the pumping plant. With these two working perfectly, everything else was apparently easy. Different methods were tried of operating the paving mixers. An attempt was made to operate one machine along the 6-ft. berm at the top of fills and pave the outer slope for a width of 30 ft. The most successful method, and that ultimately followed, was to run the machines parallel on the trackway, each machine paving a strip 30 ft. wide.

All work was done hurriedly and under pressure. The concrete pavement was completed only ten days prior to the date on which the first great race was run over it. Some slight inequalities in the pavement, hardly discernible to the eye but found by racers in a trial race Sept. 2, had to be ground down and smoothed off.

The grandstands are of wood framing with concrete footings (see Fig. 4). The open boxes in the front part of the stands are furnished with six armchairs each, and in the grandstand behind the seats are fitted with opera-

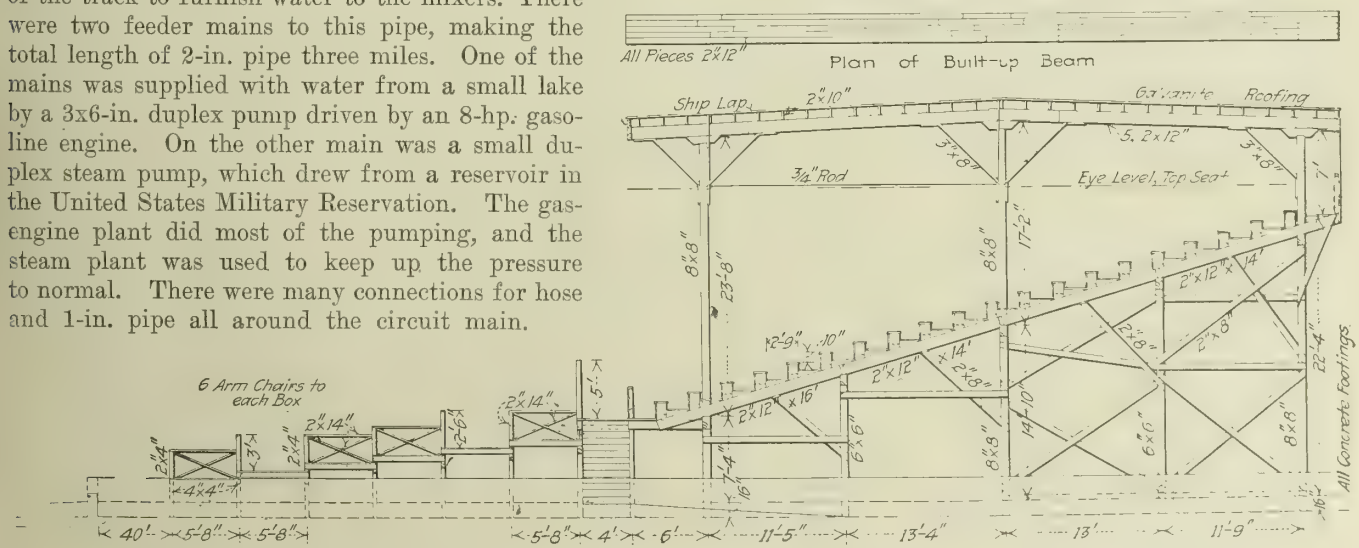


FIG. 4. CROSS-SECTION THROUGH TIMBER GRANDSTAND, TWIN CITY MOTOR SPEEDWAY



FIG. 6. COMPLETED PAVEMENT BEFORE EXPANSION JOINTS WERE TRIMMED

chair backs and arms. The grandstand roof is covered with "Galvanite" roofing made by the Ford Manufacturing Co., of St. Paul. In front of the grandstand is a 10-ft. wire fence on 2-in. wrought-iron pipe posts. The wire is 4x6-in. mesh. About 3,800,000 ft. b.m. of lumber was used in the grandstand and bleachers, and 300,000 ft. b.m. of lumber in fencing the grounds.

According to the local newspaper comment, the track as found by the racers on Sept. 4 was not so smooth as



FIG. 5. CONCRETING PAVEMENT ON THE EARTH-FILL CURVES

was to be expected. The best speed made was 104 mi. per hr. Six of the 14 contestants did not finish because of engine trouble, broken valves, broken springs, etc. Tire changes were numerous; the 14 cars used up 78 tires. The hot, bright sun on the concrete was also annoying to the drivers.

Electric Railway Associations at San Francisco

The 34th annual convention of the American Electric Railway Association and its affiliated organizations was held at San Francisco Oct. 4 to 8. As was to be expected in a meeting held so far away from the center of electric-traction development, the attendance was comparatively small, the total registration of members and guests being about 650. The affiliated associations of accountants, engineers, claim agents and transportation and traffic officials held sessions each afternoon. The parent association's meetings occupied three forenoons. The usual exhibit of machinery and supplies was omitted on account of the exposition.

President C. Loomis Allen, in his presidential address, said that the previous troubles of the street-railway companies due to agitation for municipal ownership and to oppressive government regulation faded into insignificance compared with the financial difficulties experienced by street railways during the past year. The association's Bureau of Fare Research obtained figures from 25% of the large street-railway companies showing a drop in net earnings in the year ended June 30, 1915, of $2,800,000 compared with the previous year.

A feature of the first session was an address by Jesse W. Lilienthal, president of the United Railroads of San Francisco, reviewing the relations of the company with its employees and with the public during the two years of his presidency. The company has to compete with San Francisco's successful municipal electric railway, which under the terms of the city charter pays its employees $3 per day, a rate which the United company cannot afford. The company did, however, increase the wages to its men, furnished them with free life insurance without cost and without physical examination and established a loan system to save them from loan sharks.

Notwithstanding many discouragements and difficulties, Mr. Lilienthal still adhered to the five foundation principles which he had laid down at the start as essential to success, as follows:

(1) Accept loyally the fact that a utility is a public servant and that to give good service is its first duty. (2) Seek publicity, even in case of misfortune or loss. (3) Treat employees fairly, and as far as resources will permit, generously. (4) Keep out of politics, wholly and entirely. (5) Appeal to the public for justice. Circularize. Buy space in the newspapers. Let everything be done openly and in the name of the company. The discussion upon Mr. Lilienthal's address was emphatic in its approval.

At the second session former Senator Jonathan Bourne, of Oregon, gave an address on "Evils of Government Ownership." His argument was chiefly based on the injurious effect of government ownership on the government.

The report of the Committee on Insurance showed that 160 street-railway companies paid last year $964,000 in insurance premiums and incurred $202,000 in fire losses,

for which they received $168,000 insurance, or 17.35% of what they had paid out in premiums.

The Committee on Motor-Vehicle Operations reported a great falling off in the jitney competition. In 60 cities decreases of from 19 to 100% in jitney traffic were reported. Where reasonable public regulation of jitney traffic is established experience proves that the jitney disappears. The committee recommended that the association should undertake a thorough study of the motor bus of large passenger capacity.

At the final session most of the time was devoted to a paper by B. J. Arnold, of Chicago, on "Foundation Principles of Utility Valuation, with Special Application to Resettlement Plans." The paper is 40 pages in length and was hailed as an important contribution to this subject. In general Mr. Arnold urged that street-railway companies should seek to amortize their intangible property as rapidly as possible by devoting surplus earnings to extensions and improvements, so that when the properties are eventually taken over by the public their capitalization will represent no more than the physical value of the property.

Mr. Arnold's paper was also notable for its frank recognition that a radical readjustment of the relations between franchise companies and the public is inevitable and that a fair compromise is all the companies can hope for.

The nominating committee reported the following officers for the ensuing year and they were duly elected: President, Charles L. Henry, Indianapolis; vice-presidents, L. S. Storrs, New Haven; Timothy S. Williams, Brooklyn, and J. H. Pardee, Pottsville, Penn.

At the sessions held by the Engineering Association the time was chiefly devoted to routine work in connection with various details of operation and equipment which the association aims to standardize. Among the subjects taken up were lighting protection, power distribution, block signals, buildings and structures, life of railway physical property, power generation and electrolysis.

The new officers of the Engineering Association are: President, John Lindall (Boston Elevated Ry.); Vice-Presidents, F. R. Phillips (Pittsburgh Rys.), G. W. Palmer, Jr. (Bay State St. Ry.), and W. G. Gove (Brooklyn, N. Y., Rapid Transit System).

Granite-Block Crushing-Test Abandoned

The insufficiency and practical futility of a minimum crushing strength per square inch as a specification for granite paving blocks have been recognized in the standard specifications adopted by the American Society of Municipal Improvements at the recent Dayton convention. The impracticability of the crushing test and the fact that some of the smoothest and best granite-block pavements have been constructed of soft granites having a comparatively low compressive strength were discussed in the editorial on "Granite-Block Pavements" in *Engineering News* of Feb. 25, 1915. Much the same conclusions have been reached by the granite-block manufacturers after a thorough study and investigation of the subject by C. D. Pollock, Consulting Engineer, New York City.

The results of this investigation were placed before the society's subcommittee on granite blocks, and in the new specifications adopted by the subcommittee (and subsequently by the convention) the clause specifying a minimum crushing strength was omitted and specifications for testing the stone for toughness and abrasion were adopted. The testing methods to be employed are those described in Bulletin 44 of the United States Department of Agriculture on testing road materials. For heavy-traffic streets the coefficient of toughness is to be not less than 9 and the French coefficient of wear or abrasion not less than 11. For medium-traffic streets the same coefficients are 7 and 8 respectively.

Defects Caused by Gravel in Joints

In the discussion before the subcommittee on granite-block pavements and in a paper before the society Mr. Pollock demonstrated that the small defects which have occurred in some granite block pavements, caused by breaking or cracking of individual blocks, could in every case be traced to defective methods of filling the joints. These broken blocks were found to occur whether of so-called soft, medium or hard granite, and they occurred at points where the grouting appeared to be in perfect condition for a considerable distance in all directions about the broken blocks.

These failures are explained by Mr. Pollock as follows:

> The fracture of the blocks seemed to indicate that the cause was due to pressure from expansion. Where the grout was poor and broken out there were no broken blocks. Upon removing blocks at these pot-holes by beginning several blocks away from the broken ones, the grout was found to be good and had penetrated well down in the joints; but when the joint immediately adjacent to the broken block was reached, the grout proved to be good for only about 1 in. down from the top of the block and below this was either poor or the joint was filled simply with pea stone. In every case the break followed very closely the bottom line of the good portion of the grout. In other words, the top of the block had crushed and the bottom portion, where the grout was poor or missing entirely, remained intact.
>
> The blocks which had cracks across them like laminations proved to be whole and sound except for the top portion above the bottom line of the good grout. This all thoroughly backed up our theory that the cause of the fracture was the pressure concentrated upon the small area of the good grout. In fact, one sample was removed from about the center of an actual bulge in the pavement, which had lifted from the sand cushion sufficiently to be noticeable and to give forth a hollow sound when struck with a sledge. The fracture of the block was very recent and probably occurred during the extremely hot spell in September.
>
> Careful examination in many localities shows that these small defects in grouted granite-block pavements are not due to hard or soft stone but are the result of poor workmanship.
>
> The grout should be either uniformly poor or it should be uniformly good, preferably of course the latter. An even mixture should be used and the grout should penetrate the joints uniformly to a depth nowhere less than 3 in. With such a depth of good grout no blocks were found to have failed by crushing, not even where quite soft granite was used.
>
> Wherever possible the grout should be mixed by machines and care should be taken to secure a uniform product, like thin cream. The grout should be delivered into the joints directly from the machine by a spout or hose, so that the sand will not separate out, as it is very likely to do with transportation in wheelbarrows and the like.

The suggestions offered in the foregoing were considered by the subcommittee on granite-block pavements, and in the revised specifications gravel is not recommended for filling the lower half of the joints. The joints are to be filled from the bottom up with 1:1 portland-cement grout. A mortar bed in place of a sand cushion for bedding the blocks was considered, but the mortar bed was not approved by the society as a standard method of construction.

American Society of Municipal Improvements at Dayton

The most discussed and perhaps the most important subject before the convention of the American Society of Municipal Improvements at Dayton, Ohio, last week, was the determination of the society's attitude on the bitulithic pavement specification. Up to this time the society had not adopted standard specifications for bituminous pavements, but has published tentative specifications adopted by the subcommittee on bituminous pavements of a year ago. These specifications defined two types of pavement. One was practically the well-known Topeka specification for asphaltic concrete, while the other was for a pavement which, it is claimed by the Warren Brothers Co., of Boston, infringes the patented specification for bitulithic pavement.

After much discussion the matter was placed squarely before the convention whether or not the society would adopt the bitulithic specification as one of its standards, with the assurance that if it did so the Warren Brothers Co. would give a written statement to the effect that the society's alternative specification (practically the Topeka) was not an infringement. The bitulithic specification was adopted by a vote of 32 to 19.

This and other phases of pavements occupied a large part of the time of the convention. Nearly every type of pavement construction was discussed. The 1914 standard specifications were in several cases extensively revised. The exhibit consisted almost wholly of paving appliances and materials. Among other topics considered on the convention floor were water-supply, sewage treatment and garbage and refuse disposal.

The convention, which was held on Oct. 12 to 15, was the largest ever held by the society. The total registration was 469 and the active members and delegates present numbered 215, or over 40% of this class of membership. The discussions were in some cases animated and two sessions were protracted until midnight. In fact, one day he convention was in almost continuous session from 9 : 15 a.m. to 11 : 15 p.m.

Granite-Block and Brick Pavements

Joint fillers for granite-block pavements were discussed by C. D. Pollock, consulting engineer, New York City. Extracts from this paper, together with the principal changes made in the standard specifications, are printed elsewhere in this issue. The new specifications also provide for blocks 4 in. deep, where these are considered advisable by the engineer.

A study and review of brick paving methods was given in a paper by Will P. Blair, secretary of the National Paving Brick Manufacturers' Association, Cleveland, Ohio. The general trend of this paper was to show that poor workmanship and disregard of specifications, rather than faulty specifications, were responsible for unsatisfactory results. While Mr. Blair commended the monolithic method of construction (bricks laid on the green concrete foundation or on a mortar bed), he was by no means ready to abandon the present method of using a sand bed or cushion.

The monolithic method of construction for brick pavements was strongly advocated in a paper by William C. Perkins, Chief Engineer of the Inspection Department of the Dunn Wire-Cut-Lug Brick Co., Conneaut, Ohio. By eliminating the sand bed, it seemed to be generally conceded, many of the hazards involved in the use of a sand cushion can be avoided, for it is undoubtedly proved that the drying out or packing of the sand after the pavement has been laid often leaves a small air space under a grouted pavement.

No recognition of the monolithic method of construction has been made in the society's standard specifications for brick pavements. The subcommittee on brick pavements came to much the same conclusions as those expressed in the editorial in *Engineering News,* Aug. 5, 1915—namely, that radical changes in specifications already giving satisfactory results were not justified in the light of present knowledge of the success of the proposed method. No important changes were made in the 1914 specifications.

A paper by A. D. Duck, City Engineer of Greenville, Tex., described the vertical fiber brick pavements of that city in considerable detail. His conclusions were decidedly favorable to this type of brick pavement, and the subcommittee on brick pavements was requested to study and report upon it at the next annual meeting.

Wood-Block Pavements Considered at Length

Wood-block pavements received a good share of the deliberations of the convention, and some radical changes were made in the 1914 specifications. A strong plea was made by P. C. Reilly, Republic Creosoting Co., Indianapolis, Ind., in favor of a pure distillate oil containing a larger percentage of commercial creosote and less tar than the preservative described in the 1914 specifications of the society. Mr. Reilly claimed that the previously specified oil was only 25% creosote and 75% tar, that the tar was an adulterant and was useless, that waterproofing the block was not necessary if the cell walls of the wood were thoroughly coated with creosote.

These views were opposed by Hermann von Schrenk, consulting engineer, St. Louis, Mo., whose study of old wood-block pavements in various cities has led him to the conclusion that the character of the oil used is of far less importance than the manner of treatment and the method of construction of the pavement. He said that neither of the types of oil under consideration had a superior penetrating ability and that he had never known a paving block to fail because of the quality of the preservative. Bleeding, he said, was experienced with both, and cost only should be the criterion in the selection of the preservative. Failures which have occurred Dr. von Schrenk laid largely to insufficient penetration of the sapwood of the blocks. A paper by J. W. Howard, Consulting Engineer, New York City, also presented arguments against the adoption of a patented oil. He said waterproofness of the blocks was necessary, and he spoke in favor of the use of water-gas tar. A paper by Ellis R. Dutton, Assistant City Engineer, Minneapolis, Minn., summarized experience with wood-block pavements in that city, where there has been a constant increase in the

specific gravity of the oil used from year to year (from 1.071 in 1902 to 1.116 at 38° C. in 1914).

Some radical departures from the 1914 specifications were made in the revised specifications for wood-block pavements. These will be published by the society, although not yet adopted. The subcommittee on wood-block pavement recognized pure distillate oil as a satisfactory preservative, but did not recommend its adoption at this time. Changes are made in the specification as to the sizes of blocks—8 in. is to be the average length, 4 in. the depth for heavy traffic, 3½ in. for medium traffic and 3 in. for light traffic; but no blocks 3 in. in depth are to be longer than 8 in. The clauses defining the preservative oil are so drawn as to admit a pure distillate oil (specific gravity 1.06 to 1.12 at 38° C.) and are otherwise broadened. Only coal-gas or coke-oven tar may be used. Special precaution is to be taken to have the sapwood thoroughly penetrated. Steaming is to be carried on for 2 hr. and the vacuum maintained for 10 min. Clauses have been added to the specifications requiring the blocks to be so piled on the work as to prevent their drying out. The blocks are to be wet before laying and are to be laid with close joints instead of with loose joints, as previously specified. The joint filler may be either sand or coal tar.

Sheet Asphalt and Asphaltic Concrete

The repair of asphalt pavements in small cities by reheating and utilizing storage mixtures made when the pavement was laid, similar to the methods used at Charlotte, N. C. (*Engineering News,* Feb. 11, 1915), was described in a paper by W. H. Taylor, Jr., City Engineer of Norfolk, Va. The paper also described in detail an experimental home-made asphalt plant which is being successfully used for working over material removed from old asphalt pavements. This material, reheated and with the addition of some new asphalt, is used for making repairs to other pavements. The total cost is 40.2c. per sq.yd. for taking up, reheating and relaying the old mixture.

Types of bituminous-pavement construction and their limitations were discussed by Francis P. Smith, New York City. His conclusions seemed to be that the penetration method of construction was doomed to be abandoned, that where heavy traffic was to be carried a hot-mixed pavement was to be preferred to a cold-mixed one, that sheet asphalt is the preferable type of bituminous pavement for city streets and that pavements constructed according to the Topeka specification are unsatisfactory.

The majority report of the subcommittee on bituminous paving recommended a continuation of the 1914 specifications, with a footnote to the effect that the use of one of the two specifications given might involve the city in patent litigation. A minority report of the subcommittee recommended the adoption of the Warren Brothers Co. bitulithic specification and a modified form of the Topeka specification. The minority report was adopted, as previously noted. Independent of either of these is a third specification drawn by the subcommittee on broken-stone and gravel roads (Prof. A. H. Blanchard, New York City, chairman) for an asphaltic concrete pavement utilizing one product of a crushing plant—a specification similar to that under which the Catskill water-supply roads, described in *Engineering News* of Nov. 5, 1914, and the Rhode Island state roads have been constructed. This report was also adopted by the society.

Concrete Pavements on Street-Car Area

The subcommittee on concrete pavements adopted specifications for one-course and two-course pavements, which are based largely on the specifications of the American Concrete Institute, with some quite important changes, however, in regard to the coarse aggregate and the proportions of the mixture. These specifications were tentatively adopted by the society.

The maintenance of the pavement in the street-railway area was the subject of a paper by N. S. Sprague, Pittsburgh, Penn. Mr. Sprague believes that cities should take over the maintenance of the pavement in the railway area and be reimbursed in some way by the railway companies.

Garbage Disposal and Street Cleaning

In the papers and discussions on garbage disposal the fact was established that the majority of cities show little interest in this branch of municipal work. A large number of reduction plants are privately owned and no data on their operation are available. In a paper by B. F. Miller, City Engineer of Meadville, Penn., "Data on Garbage Reduction and Disposal," it was stated that collection is the largest item in the cost of garbage disposal. The most recent developments, according to Mr. Miller, are in high-temperature incinerators, which are proving satisfactory in several places.

Plans for a $55,000 municipal reduction plant, at Dayton, now under construction, were described by J. E. Barlow, Director of Public Service. Since June, 1914, the garbage of the city has been buried under gravel. Arrangements have been made for the sale of grease, and it is believed that the new plant can be made to pay all operating expenses.

Water-Supply and Sewerage

A detailed description of the new water-supply for Victoria, B. C., was given in a paper by C. H. Rust, City Engineer. One of the most interesting features is a 42-in. concrete pipe line 144,000 ft. long. The reconstruction of the water-works of Hamilton, Ont., was described by A. F. Macallum, City Engineer of Hamilton.

The most interesting subject under the head of sewage disposal was a description by T. Chalkley Hatton, Chief Engineer, Milwaukee Sewerage Commission, of the new experimental plant at Milwaukee, Wis., for treating sewage by the activated-sludge method (*Engineering News,* July 15, 1915). Mr. Hatton believes that the activated-sludge process is "the best and cheapest process for treating sewage, where a high standard of effluent is required, and as it becomes better developed it will supplant sedimentation and sprinkling filters."

In discussing this paper Rudolph Hering, while commending the breadth and scope of the Milwaukee experiments, expressed doubt as to the success of the method in winter weather.

The paper of George H. Norton, Buffalo, N. Y., on "Stream Pollution from Surface Drainage as a Limiting Factor in Sewage Purification," dealt with the futility of trying to obtain pure lake water by purifying the sewage of cities beyond the point where an equal amount

of pollution was derived from ordinary surface waters entering the lake. In the report of the committee on sewerage and sanitation the same necessity for sound judgment on the part of the engineer was emphasized. The report gave an analysis from a mathematical and pecuniary standpoint of various public-health measures—comparing the cost of saving human life by sanitation and by hospital treatment—to demonstrate that these problems were capable of engineering analysis and that such analysis could be used to prevent needless and extravagant expenditures for sentimental reasons.

Municipal Government and Finance

Henry M. Waite, City Manager of Dayton, gave a brief address on the Dayton plan of city government.

Other papers which had to do with problems of municipal government were: "The Law and the Public Welfare," by William S. Crandall, Dayton; "The City at Work," by Louis L. Tribus, Consulting Engineer, New York City, and "Obligations of the State to the Municipality in Matters of Public Works," by Alexander Potter, Consulting Engineer, New York City, in which the author took the stand that various state commissions were exerting power to the detriment of municipal public works.

Committee Reports—Officers—Next Convention

On the recommendation of the committee on committees the list of standing committees of the society was extended so that there are now twelve: (1) Paving, (2) sidewalks and street design, (3) city planning, (4) parks and parkways, (5) street lighting, (6) traffic and transportation (to include street-railway problems), (7) waterworks, (8) sewerage and sanitation, (9) street cleaning, (10) city government, (11) standard specifications and (12) exhibition committee of three associate members.

The report of the committee on street paving favored the discouragement of road improvement by large expenditures on a few miles of road, to the exclusion of many miles on which some improvement could be made for the same expenditure. The report stated that more cooperation between the state, county and town or city in roadbuilding was desirable. The committee on sewer construction and maintenance attempted to define the terms used in sewer work, but none of these were unusual except the objection to the term "sanitary sewer," in place of which "house sewer" is recommended. The report of the committee on traffic on streets aroused considerable discussion—mainly with the end in view of determining if traffic censuses were put to practical use and if traffic censuses by different authorities were comparable. The committee on standard specifications has decided that hereafter the society's specifications can be used only by cities represented in the membership or themselves belonging to the society.

The following officers were elected: President, A. F. Macallum, City Engineer, Hamilton, Ont.; first vice-president, N. S. Sprague, Pittsburgh, Penn.; second vice-president, John B. Hittell, Chicago, Ill.; third vice-president, E. R. Conant, Savannah, Ga.; secretary, C. C. Brown, Indianapolis, Ind.; treasurer, William B. Howe, Concord, N. H. The place chosen for the next convention was Newark, N. J.

News of the Engineering World

A Chief Engineer for Baltimore

The latest, and a most notable, example of centralizing the engineering work of a city and creating a position which will attract and hold an engineer of experience and capacity is afforded by the City of Baltimore, which has just honored Calvin W. Hendrick, Chief Engineer of the Baltimore Sewerage Commission, by making him Chief Engineer of that city. How this came about and just what it means, both in itself and in relation to the Sewerage Commission, can best be told in Mr. Hendrick's own words, in a letter to *Engineering News:*

At the last session of the Legislature a new adjustment of the engineering forces of the city was arranged for, creating the position of Chief Engineer and placing the various departments of the city under him, as follows: Highways Department, Commission on City Plan, Topographical Survey Commission, Sewers, Paving, Annex Improvement, Electrical Commission, Water Board, Harbor Board, Inspector of Buildings and City Surveyor.

Until Jan. 1 I will occupy both the positions of Chief Engineer of the city and Chief Engineer of the Sewerage Commission. By that time I will have the sewerage work completed, with the exception of winding up several contracts, which will require a couple of months. About Apr. 1 the Sewerage Commission will go out of existence and its duties will then come under the Chief Engineer and be carried out under the Bureau of Sewers.

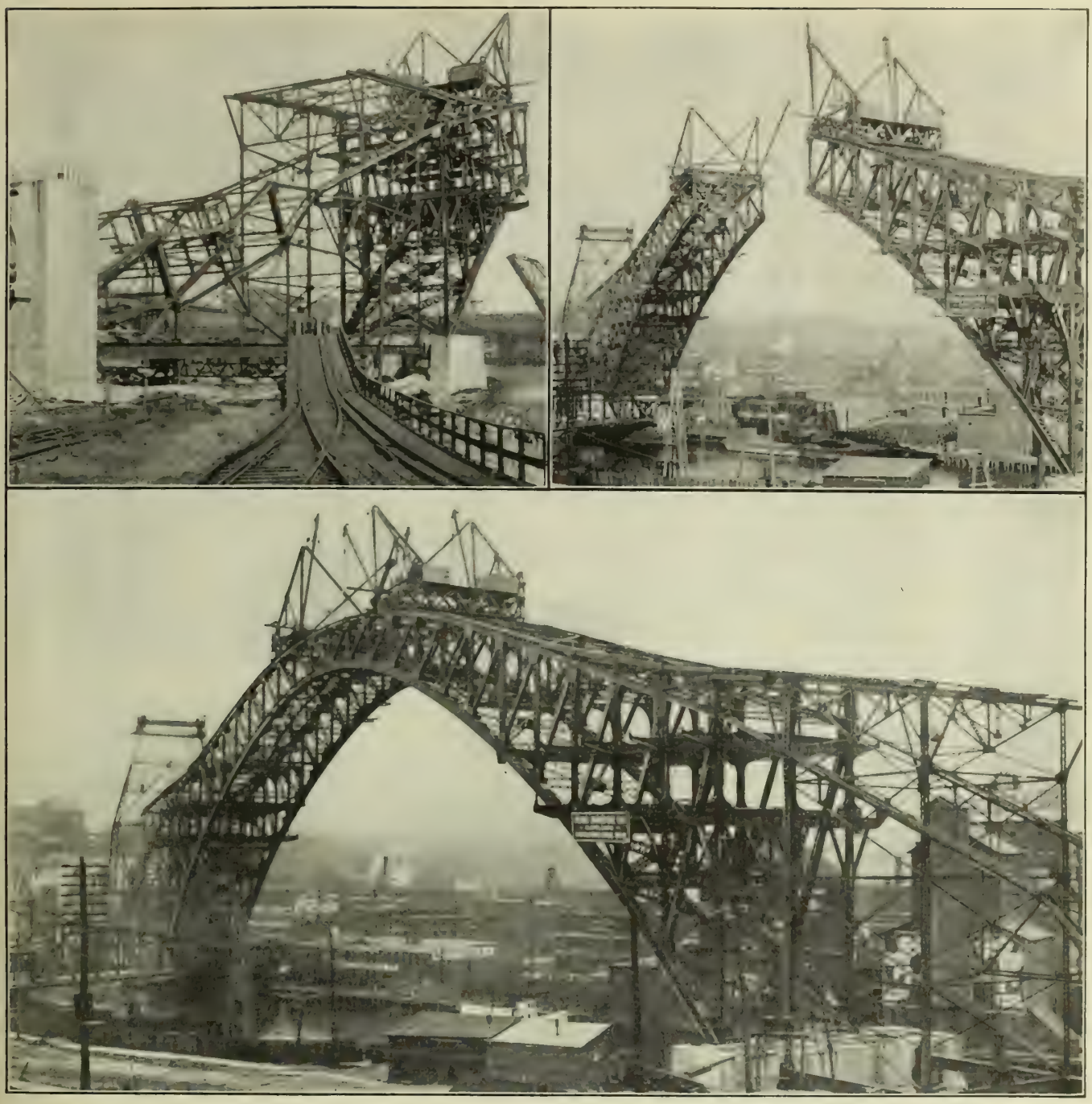
The Chief Engineer is given very broad powers under the new arrangement. The City Engineer's office has been abolished entirely.

Second Exhibition of Street-Cleaning Apparatus

The Second Annual Exhibition of Street-Cleaning Appliances, held under the auspices of the Department of Street Cleaning, City of New York, was held at the First Regiment Field Artillery Armory in New York City during the week of Oct. 11 to 16. The Department had on display some of its more novel and interesting pieces of apparatus. Various manufacturers had exhibits also.

Among the more notable pieces of equipment shown were motor-truck sprinklers, sand spreaders, ash wagons with power lifts, dustless refuse cars, odorless garbage trucks, pavement flushers and cleaners, snow-plow attachments for motor trucks, etc. There was a good representation of the more familiar street-cleaning equipment and of domestic novelties such as odorless garbage cans, etc.

One of the machines which attracted great attention was a tractor-trailer outfit of the Department of Street Cleaning, having eight removable square bell-top cans and holding 10½ cu.yd. of ashes and garbage or 13 cu.yd. of rubbish. In service the cans are lifted out by a crane and dumped on scows. Perhaps the most novel machine displayed was a motorcycle street sweeper (made by Hvass & Co., New York City).



THE 591-FT. STEEL ARCH OF THE DETROIT-SUPERIOR BRIDGE IN CLEVELAND CLOSED OCT. 8

Closing Detroit-Superior Arch

Third largest among steel arches of the United States, the 591-ft. span of the Detroit-Superior viaduct in Cleveland, crossing the Cuyahoga River, was successfully closed on Oct. 8. The two halves of the span were erected by the cantilever method, with anchorage on either side to the concrete pier of the viaduct, one span back of the main arch abutment.

In general method of erection the construction of this arch was the same as that of the Hell Gate arch, the closure of which on Oct. 1 was noted in *Engineering News,* Oct. 7, 1915. But the adjustment of the Detroit-Superior arch was provided for by screw toggles in the backstays, while at Hell Gate hydraulic jacks under the backstay saddles were employed. One of the toggles shows clearly in the first view on this page.

The first steel set in the east half of the Detroit-Superior arch was placed July 29, as described in *Engineering News,* Aug. 5, 1915, p. 283. Erection of the east arm was carried on rather slowly during the first month, however, pending the start of work on the west arm, which was delayed by the fact that the west pier was not completed. On Aug. 27 the first steel of the west arm was set. Only 37 working days later the center pin was placed.

The two toggles of each arm—one in the plane of either truss—were cross-coupled by a transverse shaft and operated by means of this shaft, driven by a rope wheel at the center of the shaft. This made both toggles act together. During the lowering, telephone communication was maintained between the working places on both sides of the river and the crown point, and as a result the en-

tire operation was uniform and under control at all times. The time consumed in lowering to full contact and entirely relieving the backstays was 1 hr. 30 min.

The span is designed as a three-hinged arch, with span 591 ft. and rise 144 ft. c. to c. of pins. The bridge will have two decks—the lower for six street-car tracks and the upper for street traffic. The arch members are of nickel steel, while the floor and bracing are of carbon steel. The completed structure will contain about 4,250 tons of metal.

The work was fabricated by the King Bridge Co., Cleveland, Ohio, of which Harry Fuller is Chief Engineer. This company contracted for both manufacture and erection of the steel span and designed and manufactured the erection material. The erection was performed by the Ferro Construction Co., of Chicago, subcontractor under the King Bridge Co. The bridge is being built for Cuyahoga County, of which W. A. Stinchcomb is County Engineer and A. W. Zesiger Bridge Engineer.

Value of Denver Water-Works

A valuation of $13,415,899 has been placed on the "used and useful" property of the Denver Union Water Co. by W. J. Chinn, special master of the United States Circuit Court in the water-rate reduction case started in May, 1914. The 20% reduction in rates proposed by the city ordinance at issue, Mr. Chinn states, would yield only 3.64% on the valuation named, based on last year's operations. The water rights are valued at about $3,000,000 and the going-concern value is placed at $800,000—two items over which there was the greatest controversy. Another interesting point in the report is the exclusion from the valuation of the cost of pavement over mains, where such pavement was laid after the mains were in place. Corporation costs were also excluded from the valuation. In general the estimates were based upon the present fair market value of adjacent lands and water rights and on reproduction cost less depreciation for structures.

Another Subway-Collapse Report

In addition to the reports noted in these pages Oct. 7 and Oct. 14, a report on the subway timbering accidents in New York City Sept. 22 and Sept. 25 has been made to the Mayor by L. M. Wallstein, Commissioner of Accounts. This report places strong blame on the loose construction of the timbering:

As to the physical causes of the accidents, my conclusions as to both are, that the progressive collapse of roadway was due to inadequate supporting structure beneath the surface. At Seventh Ave. the collapse was initiated by the impact of rocks hurled by a blast against part of the temporary supporting structure, and at Broadway by the impact of rocks which fell from the side of the excavation against part of the temporary supporting structure.

The method of timbering in use by the United States Realty and Improvement Co., described in *Engineering News* Sept. 30, is discussed as follows:

It will be noted with reference to this timbering that there was no cross-bracing in any direction. Other than the tie between the transverse I-beams, there were no ties in any direction. There was no fastening between the steel I-beams and either the main posts below or the posts above them. Nor was there any fastening between the posts below and those above the I-beams. Further, there was no adequate bracing between the transverse I-beams themselves to prevent overturning, and there were no longitudinal timbers between the outside main posts.

In a word, this timbering consisted of a combination of wood and steel loosely connected. Above the steel the timbering was arranged to suit the street and subsurface structures. Below the steel the posts were spaced to give a maximum facility to excavating operations. Neither above the steel nor below it were there any adequate precautions against transverse or longitudinal displacement of the timbering. As a result, the knocking out of any post below the steel or of any steel beam was sufficient to collapse the whole structure.

The method of timbering used in this section of subway construction (7th Ave. between 24th and 25th St.) was different from that employed on any other part of the dual system, except the Broadway section. It was entirely unsuited for the purpose for which it was designed.

With the timbering thus inviting failure, there followed on the morning of Sept. 22 the blast which precipitated the collapse. During the day preceding the accident holes had been drilled in preparation for the blasting to be done on the following morning. Among these were four holes on the east side of the heading. The hole farthest east ran into a long and generally horizontal seam in the rock. The next hole ran into a vertical seam. The four holes, which were fired simultaneously, were loaded with a charge which normally would not have been excessive. The effect, however, of the rock seams was to render excessive the charges which were loaded in the holes that ran into the seams. The result, accordingly, was that the greater part of the force of the dynamite was expended not in fracturing the rock but in breaking it into large fragments and hurling them into the cut and against adjacent parts of the timbering. A large depression in the web of the nearest transverse steel beam clearly showed the effect of the impact of the rock against the beam. Here then was just the kind of attack upon the temporary supporting structure which it was unable to withstand, so that it collapsed from the north heading southward to the concrete walls and steel structure, which were part of the permanent work.

ENGINEERING SCHOOLS

Ohio State University

A four-year course in landscape architecture is being offered for the first time at this institution. The work is under the Department of Horticulture, with P. H. Elwood in active charge. Some of the courses will be given by A. E. Taylor, landscape architect, of Cleveland.

Beginning in 1917, students entering this university will be required to spend two years in the Arts College before being admitted to the schools of engineering, agriculture, etc. Presumably this change will be accompanied by a reduction of the professional courses to three or two years.

Yale University

An organization of Yale graduates engaged in engineering, manufacturing and transportation, known as the Yale Engineering Association, has recently been completed. Its objects are to help the university's educational work (by recommendations about courses, by conferences with faculties, alumni visits, engineering lectures to undergraduates, etc.), to establish helpful relations between Yale men (by joint meetings, visits to work under Yale graduates, obtaining positions for young graduates, finding summer work for undergraduates), to carry on publicity work, to coöperate with other college associations and national engineering societies, and to study engineering education.

The officers are: President, E. M. Herr, Westinghouse Electric and Manufacturing Co., Pittsburgh; Vice-President, H. N. Covell, Lidgerwood Manufacturing Co., Brooklyn, N. Y.; Secretary-Treasurer, R. T. Dana, Consulting Engineer, New York City.

NEWS NOTES

St. Louis Municipal Bridge Labor Disputes—In compliance with an agreement between the city and the union-labor interests in St. Louis an arbitration commission has been appointed to adjust the differences between the union and the city. On this commission a Mr. Haenni is appointed by the unions, C. E. Smith, former Chief Engineer of the Missouri Pacific Ry., by the Board of Public Service and these two selected R. S. Colnon, of the contracting firm of Fruin & Colnon and an associate member of the American Society of Civil Engineers, as the third party. The first matter referred to this commission was the demand of the unions that the city superintendents be discharged, which was refused on the ground that they had been appointed by competent engineers and were familiar with the particular class of work. In this connection the board also announced that it would not consider the question of discharges for incompetency, as it felt that the particular foremen were better qualified than the board to pass on that point. As to jurisdictional troubles between the various unions, the board has announced that it will consider these matters on their merits under the conditions existing on this particular work and expect to rule as to what is reasonable rather than to insist on the city following any general rules of the union, which may not be applicable to the work. The city ordered a full force of union men to report for work on Oct. 18.

The Panama Canal Situation has not changed since last week. Under date of Oct. 12 the Governor of the Canal reports as follows:

The mass of material involved in the break of Oct. 14, 1914, which had been sliding gradually into the prism, moved precipitately. This combined with a similar movement from the break which occurred just opposite on the west bank in August causes the present conditions. The length of channel involved 1,300 ft., of which 200 ft. at present has a width of only 25 ft. and a depth of 3 to 15 ft. For the week ended Oct. 9, 209,000 cu.yd. of material was dredged; but as the movement continued the result has been to maintain only what the slides left in the first instance. The canal is therefore physically closed temporarily. On the east side the bank is upward of 300 ft. above canal level and on the west side varies from 300 to 400 ft. above. Material in settling and moving creates earth waves with deep depressions behind, these being some 500 to 600 ft. from the canal prism, with elevations of 60 to 80 ft. above water surface. These waves undoubtedly counterbalance the weight of the broken mass on either side and when removed may cause another similar movement; hence the impossibility of making any prediction as to the date of opening until after the waves which now block the channel have been removed and action of remaining material determined. Heavy rains materially affect the movement. Whether light-draft ships can pass in advance of 30-ft. draft ships must depend on conditions when a reasonably secure channel is attained.

The general slide conditions do not seem to be radically changed from what they were in 1914, as described by W. G. Comber in "Engineering News" of Apr. 22, 1915.

PERSONALS

Mr. Jay A. Rossitter has been appointed Engineer of Track Elevation for the City of Chicago.

Messrs. John Laylin, Assoc. M. Am. Soc. C. E., of Norfolk, and Ted Brindle, of Columbus, Division Engineers of the Ohio State Highway Department, have resigned from that department.

Mr. J. D. Bowles, recently Engineer of the Missouri Public Service Commission, has been appointed Electrical Engineer of the Springfield (Mo.) Gas and Electric Co. Mr. Bowles succeeds O. S. Clements, who recently resigned.

Mr. Orville Wright, who recently sold his aëroplane patent rights to the newly organized Wright Aëroplane Co., will continue with the company in the capacity of advisory engineer. Mr. T. Frank Manville is president of the company.

Gen. H. M. Chittenden, U. S. A., retired, M. Am. Soc. C. E., has resigned as a member of the Seattle Port Commission. He is now located at Dayton, Ohio, where he is engaged as consulting engineer on the flood-prevention work in the Miami River district.

Mr. A. H. Spahr, Instructor in Engineering Extension at the School of Engineering, Pennsylvania State College, has been appointed Professor of Physics at the Kansas State Normal School, Pittsburg, Kan. Mr. C. F. Kopp, of Amite, La., will succeed Mr. Spahr.

Mr. Alan A. Wood, Jun. Am. Soc. M. E., who has been connected with the venturi-meter department of the Builders Iron Foundry at Providence, R. I., is now located with the company's Pacific Coast agent, Norman B. Livermore & Co., at San Francisco and Los Angeles, in an engineering and sales capacity.

Mr. Harvey W. Hincks, Assistant Engineer of the United States Indian Irrigation Service, has been made Engineer in the Service. He is in charge of the Klamath Indian Reservation irrigation work, with headquarters at Chiloquin, Ore. Mr. Hincks recently supervised the construction of the Modoc Point Irrigation Project and the Sprague River Dam.

Mr. Myron L. Fuller, who has been in China for nearly two years, engaged in exploration work, has returned to this country and will again take up his consulting practice as a specialist on ground-water supplies and dam foundations. Correspondence will reach Mr. Fuller in care of the Bureau of Associated Geological Engineers, 131 State St., Boston, Mass.

Mr. Alvin Bugbee, M. Am. Soc. C. E., Superintendent of Water-Works of Trenton, N. J., who has been Acting Chief Engineer of the water-works since the death of George W. Lenox, about six months ago, has assumed the duties of chief engineer in addition to his superintendency. The assignment of the duties to Mr. Bugbee was made recently by the City Commission of Trenton and the position of Chief Engineer abolished. Mr. Bugbee will receive a slight increase in salary.

Prof. James Ambrose Moyer, M. Am. Soc. M. E., head of the Department of Mechanical Engineering of Pennsylvania State College, has been appointed Director of the University Extension of the State of Massachusetts, which is a new department. Professor Moyer has been connected with the General Electric Co. as mechanical engineer and chief computer, and the Westinghouse, Church, Kerr Co. as general engineer, and recently has been director of engineering extension work and acting director of the Engineering Experiment Station of Pennsylvania State College.

OBITUARY

Thomas P. Fowler, formerly President of the New York, Ontario & Western Ry., died on Oct. 13 at his home in Warwick, N. Y. He was born in Newburgh, N. Y., in 1851.

Edward D. White, for 27 yr. connected with the Brooklyn (N. Y.) City R.R. Co. and for 19 yr. Vice-President, died on Oct. 14 at his home in Brooklyn, in his 94th year. Mr. White retired from the board of directors of the company only this year.

William B. King, M. Am. Soc. C. E., General Manager of the Fort Worth (Tex.) Stock Yards Co. and the Fort Worth Belt Ry., died on Oct. 11 at his home in that city at 65 years of age. He was born in Virginia and went to Texas when a young man, settling in Weatherford. Afterward he became City Engineer of Fort Worth and of Weatherford. At various times Mr. King was resident engineer at Fort Worth for several of the Texas railways and was in charge of the construction of the Texas and Pacific Ry. between Fort Worth and El Paso. Later he established the Fort Worth Stock Yards Co.

ENGINEERING SOCIETIES

COMING MEETINGS

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Oct. 18-24. Annual meeting in Chicago. Secretary, J. A. Andrencetti, C. & N. W. Ry., Chicago, Ill.

The Engineers' Club of Trenton—Following the lead of many other engineering organizations, the Engineers Club of Trenton has established an employment bureau to be managed by the secretary, Joseph E. English.

American Association of Engineers—All engineering societies have been invited to send official representatives to the convention of the American Association of Engineers, to be held in Chicago, Dec. 10 and 11. The Association announces that 55 new members were gained during the latter half of September. The chairman of the National Membership Committee is A. H. Krom, Assistant Engineer, State Public Utilities Commission of Illinois.

A Large Mining Convention will be held in Washington, D. C., on Dec. 16, to act on recommendations regarding a general revision of the Federal mining laws. Van H. Manning, Director of the Bureau of Mines, announces that all the known mining societies in the United States have been invited to send delegates. It is hoped that the mining industry will be so well represented that the action of the convention will be regarded as expressing the wishes of the industry.

American Institute of Electrical Engineers—The 314th meeting of the Institute and the 100th meeting of the St. Louis section were held simultaneously at the Planters Hotel, St. Louis, Oct. 19 and 20. Out-of-town members of the A. I. E. E. were guests of the St. Louis Section at a luncheon held on Oct. 19 and were entertained at dinner on Oct. 20 by the St. Louis Engineers' Club. This was followed by a theater party. The meeting was the first national meeting of the Institute held in St. Louis since the World's Fair, 11 yr. ago.

Boston Society of Civil Engineers—That the social element is not neglected by the Boston Society of Civil Engineers is evident from the society's latest announcement, just received. Relative to an excursion to Salem on Oct. 20, the notice reads: "Everybody guaranteed to reach third base, but the committee cannot assist in getting home." What is termed a "smoker-sing dinner" was held that same evening at the Boston City Club, and was presided over by Charles H. Eglee. Another noteworthy announcement is that the Committee on Social Activities hopes to organize a strictly amateur (there should be no difficulty on this score) orchestra among the members, to furnish entertainment at the winter dinners. The committee requests any member who can play a musical instrument (from ocarina to harp) to communicate at once with Chairman Edmund M. Blake.

Appliances and Materials

Oakland Revolving-Bucket Scraper

A novel improved scraper has been developed from the fresno type by Child and Keir, of Oakland, Calif., and is being marketed by the Graves-Spears Road Machinery Co., of Oakland. The machine is shown in the accompanying view. It is claimed that a 6-ft. scraper of this type will move more dirt than two 5-ft. fresnos. Four sizes are made—with 5-, 6-, 7- and 8-ft. buckets.

A long steel bucket or bowl is pivoted in a stiff steel frame which is carried on shoes forward and wheels at the rear.



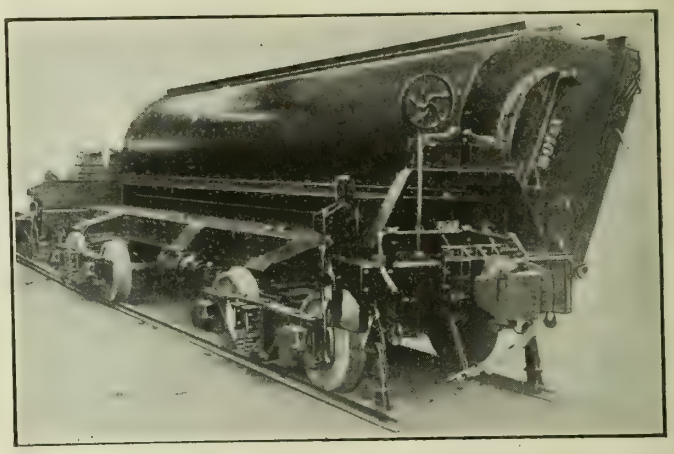
OAKLAND REVOLVING-BUCKET SCRAPER

The driver rides, loading and dumping with a foot lever. He does not have to pull the bucket back into place, as it revolves and locks when it comes into loading position. For grading it can be held at any angle desired. This scraper sells at from $75 to $200.

* * *

Round-Bottom Tilting-Body Dump Car

Tilting-body round-bottom dump cars have been frequently used around industrial plants and by a few contractors, but such equipment has been made in comparatively small sizes and for narrow-gage tracks (see "Engineering News," Apr. 8, 1915, p. 704). A similar car has now been developed by the Orenstein-Arthur Koppel Co., of Koppel, Penn., in large sizes for standard-gage lines and equipped with M. C. B. standard couplers, trucks, air brakes, etc. This is shown in the accompanying view. The particular car pictured was made for the Brittania Mining Co. of British Columbia, which desired ore carriers from which no leakage was possible. The frame



ROUND-BOTTOM TILTING-BODY ORE CAR

consists of a box-girder center sill with projecting buffer frames and body bolsters. The dumping body has a rocker at each end resting on a track supported by the buffer frame. The car tilts about a point just above the center of gravity when loaded. Small force is required to dump, and this is furnished by a crane which hooks under U-castings on the side. To prevent tilting in transit, chains run from the body corners to the buffer-frame ends.

* * *

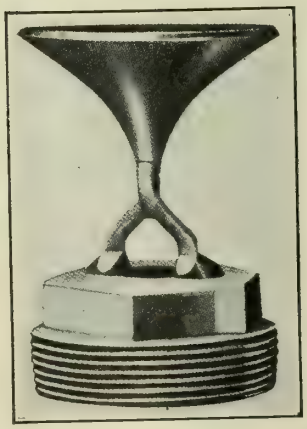
Smith Low-Level Hand-Charging Mixer

A new design of low-level hand-charging concrete mixer is being put on the market by the T. L. Smith Co., Milwaukee, Wis. Eight years ago the company had such a machine, but it was sidetracked by the demand for power-charging types. The recent increased demand for low-charging mixers has brought about the redesigning of the old machine. In general, a low platform takes the place of a gated batch hopper or a gear-driven charger. The platform is only 18 in. high, so that a barrow may be easily run up for emptying directly into the drum. The feed end is left almost entirely open and a narrow hopper is added to receive the upended wheelbarrow. To eliminate splashing, the drum width has been increased and a short wing has been added on the feed side of the blades. The scoop blades in the center of the drum are raised above the interior surface so there are no corners for lodging material. The machines are made in 3-, 4-, 6- and 9-cu.ft. sizes. All sizes are portable, being mounted on steel frames and trucks. The platform is hinged and folds up against the receiving hopper.

* * *

Sewage-Spraying Nozzle

A patented design of sewage-spraying nozzle, shown in the accompanying view, is being marketed by the Snow & Petrelli Manufacturing Co., 152 Brewery St., New Haven, Conn. This is of the circular-orifice type which, it is reported, in service has demonstrated its ability to give an undivided spray and to minimize clogging. Inside the screw-cap is a 2-in. spherical chamber with a ½-in. to ⅝-in. orifice, above which is a trumpet-shaped deflector supported on a knife-edge bridge.



SNOW & PETRELLI NOZZLE

* * *

Permanent-Green Paint

A new paint is being manufactured by the F. W. Devoe & C. T. Raynolds Co. under the name of "Mitis Green," which is claimed to produce a surface which will neither fade nor lose color, as is common with the green paints previously available. The paint is made in six shades of green and can be had in paste form, ground in linseed oil, or in liquid form ready for use.

Engineering News

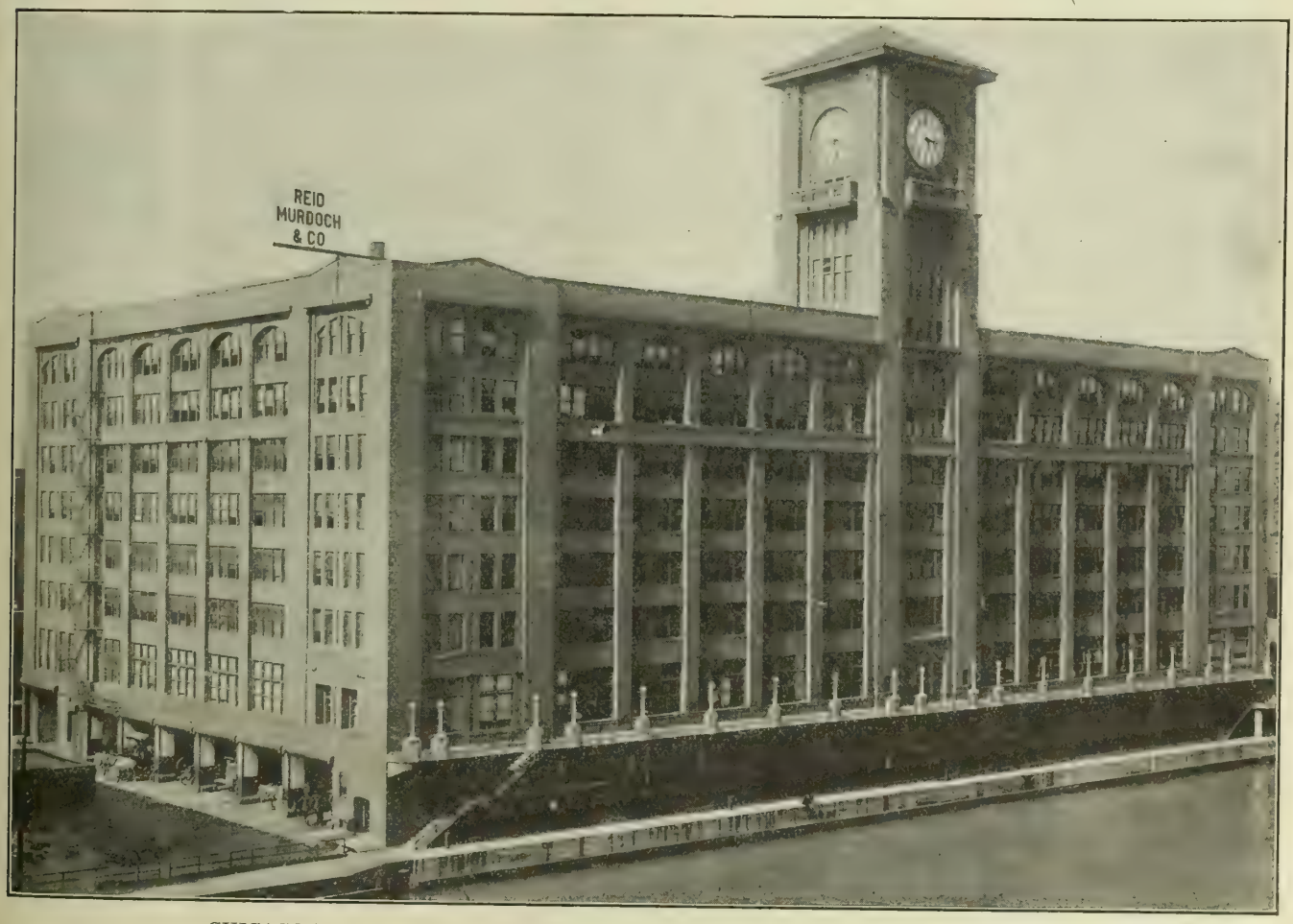
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River-Front Approach to a Chicago Building

The utilization of waterfront and the architectural treatment of buildings fronting upon the Chicago River have been discussed at various times in connection with city-planning movements at Chicago. An example of what may be accomplished in this direction is indicated by the new warehouse for the wholesale grocery firm of Reid, Murdoch & Co., at Clark St. and the river, as shown by the accompanying view. This building was designed by George C. Nimmons, architect, of Chicago.

The river front of the building has a special feature, a balcony or walk forming the approach to the office entrance. This balcony is a little above the level of the Clark St. sidewalk, at the north end of the bridge. At each end are steps leading down (from Clark St. at the east and from the balcony at the west end) to a concrete dock wall for the use of steamers and barges. At the wharf level are doors opening into the main basement and sub-basement, which are respectively above and below that level. The rear of the building has team space and a railway side track and is at the level of the end of La Salle St., which is at this low elevation on account of there being no bridge. Freight elevators descend below this level to the tunnels of the narrow-gage electric freight-railway system.

The balcony is a 6-ft. cantilever extension of the main floor of the building and consists of a 9-in. reinforced-concrete slab. It is designed for a live load of 150 lb. per sq.ft. An attractive appearance is afforded by the concrete lamp posts on concrete pedestals, between which is placed a light and ornamental handrailing with wire-panels. At each end of the balcony is a cantilever girder, the one at the east or Clark St. end supporting the approach platform and stairways. The wharf is 10 ft. wide.



CHICAGO RIVER WAREHOUSE WITH OFFICE ENTRANCE ON THE RIVER SIDE

The building has a river frontage of 322 ft. and is about 180 ft. deep, except that on Clark St. its frontage is only 42½ ft. The contractor was E. C. Scheidenhelm.

Building Low-Grade Line for Norfolk & Western R.R.

SYNOPSIS—Cut-and-fill work amounting to 2,800,000 yd., begun in May, to be finished by December. Shovel work in the cuts. Handling spoil to filling trestles. Slides—one fill still slipping; bad slides in a deep cut.

Fifteen steam shovels are working day and night on a low-grade single-track line of the Norfolk & Western Railway Co. in Virginia, between Burkeville and Pamplin, a distance of 37 mi. The new line will carry the eastbound freight, which is the heaviest traffic of the railway. Westbound traffic will continue to be sent over the existing single track. The location of the two lines with respect to each other is shown in Fig. 2. The location of the new line was started in January, 1915, and the first steam shovels were put to work on May 1. The grading should be completed in November, and it is expected that the track will be connected up complete before January, 1916.

The new line runs southeast from Burkeville until several miles beyond Meherrin, when the general direction becomes northeast. This is exactly the reverse from conditions on the old line, which runs northeast from Burkeville, then southwest toward Pamplin. The first 15 mi. or so of the new line is paralleled by the Southern Ry. and the next 13 mi. by the Virginian Ry. The improvement in grade over the old line is shown in the profile, Fig. 1, the maximum grade in either direction on the new work being 0.5%.

General Character of the Soil

Red clay is the predominating soil. It is everywhere the topsoil and extends usually below a depth of 20 ft. Sometimes it is underlain with a stratum of quicksand or a material closely resembling quicksand. At other times the substratum is soft, wet, slippery clay of greenish color, containing mica, which moves very easily.

There was very little excavation in rock, although there were a few cuts in which rock was encountered. In such cases it was drilled with well drills and blasted in quantity. At one point where the Virginian Ry. in a cut parallels the new line, the Virginian cut was entirely through rock that cropped out to the surface. Estimates of the cost of doing the Norfolk & Western cutting at this point were therefore based on the expectation of encountering rock. At the beginning of September the cut was 25 ft. deep and no rock had been struck.

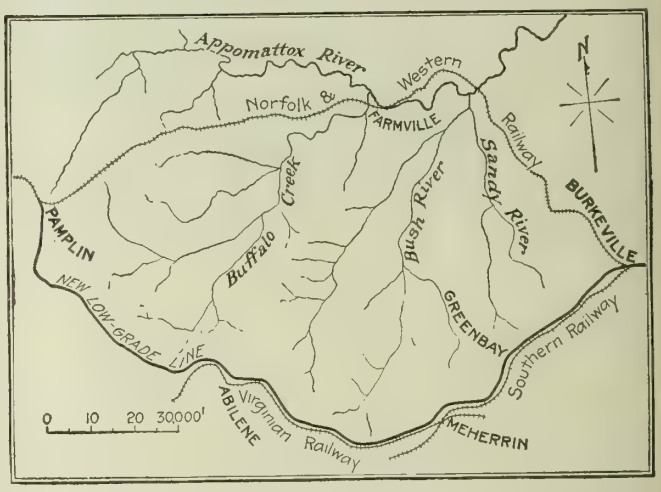


FIG. 2. MAP SHOWING EXISTING AND NEW LINES OF THE NORFOLK & WESTERN R.R.

The excavation totals 2,800,000 cu.yd. The work is divided into five contracts, which are supervised for the railway company by four resident engineers. Each residency embraces about 9 mi. of line. The engineer is assisted by a transitman, levelman, two rodmen and two

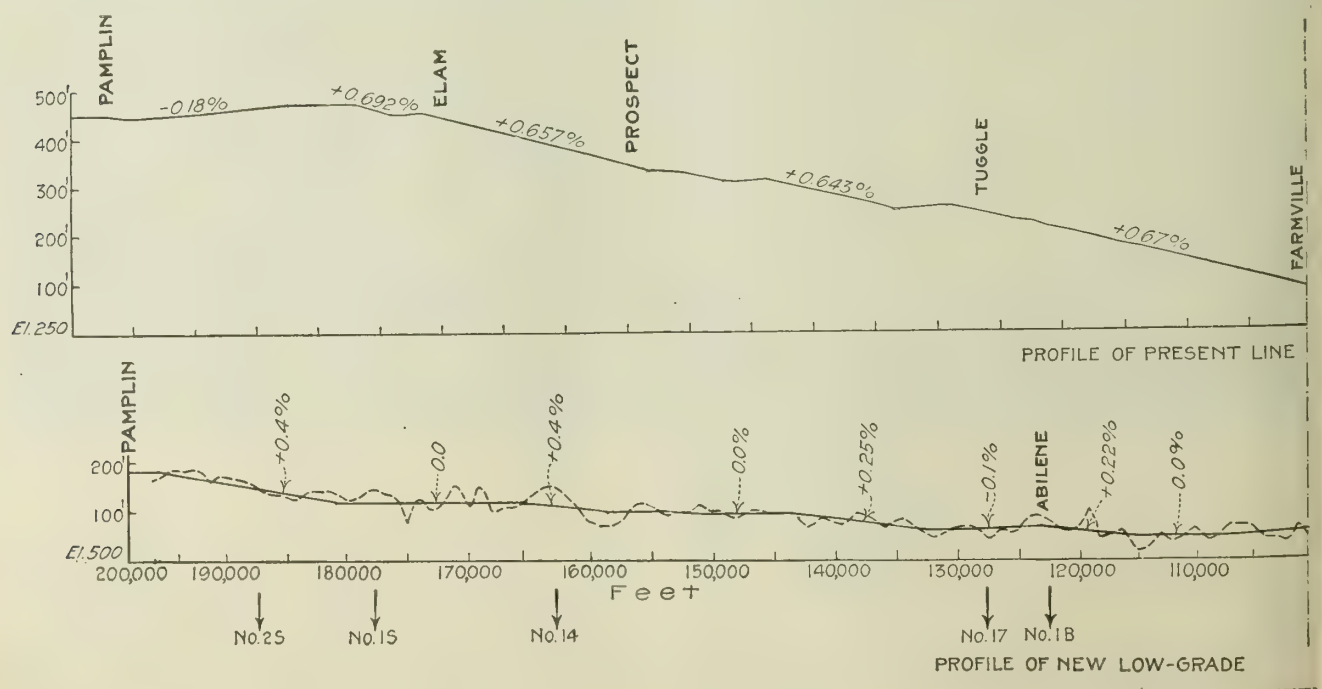


FIG. 1. COMPARISON OF EXISTING AND NEW LINES OF NORFOLK & WESTERN R.R. BETWEEN

chainmen. Each of these engineering subdivisions located its section of the line and has since been in charge of the construction work.

The steam shovels (dippers 2- and 2½-yd.) are distributed over the line as shown on the profile, Fig. 1. Patterson & Moran have the contract for section 1, which starts at Burkeville. The Robert Grace Contracting Co. has sections 2 and 3 (part sublet to Thomas J. Bennett). Rinehart & Dennis have section 4, and J. J. Sheahan has section 5.

Details of the Working Methods

Timber for temporary trestles for making fills is obtained either from the right-of-way (180 ft. wide) or is purchased from adjoining property owners. A steam shovel working in a near-by cut loads a dinkey train of 4- or 5-yd. Western side-dump cars, and the earth is hauled out on the trestle and dumped. Such a train consists usually of from 8 to 11 cars, but in one instance, where it was impossible to put a siding or turnout between shovel and trestle, 17 cars were hauled at one time.

The number of trips that a shovel must make through a heavy cut is indicated by the diagrams in Fig. 3, which are for an actual cut between Sta. 1705 and 1725 on section 5; J. J. Sheahan, contractor. Shovel cuts are 8 to 10 ft. deep. In its first trip the shovel loads into dump cars running on a track laid on the original surface. When this cut is completed the shovel starts the second cut alongside and below the first, loading onto a track in the first cut. When the shovel has finished a trip it is returned to the other end to start forward again, the cutting progressing uphill to provide drainage for the cut. Fig. 4 shows methods of excavating 30-ft. and 40-ft. cuts.

Lack of room in the cut made it necessary to place the siding outside at the entrance, which in the case of long cuts caused an unfortunate but unavoidable delay between the loadings. If a shovel were operating 2,500 ft. in from the entrance and from the siding of a certain cut, a train would have to pull in to the shovel, be loaded and pull out over the half-mile of track before the next train of empties could start for the shovel. This particular delay is represented by the time required to run 7,500 ft. on the construction track, plus the time of actual loading of one train, and at 10 mi. per hr. would amount to about 8 min. for the running time alone. In the meantime the shovel could loosen up some of the bench ahead of it, but for at least two-thirds of the period between trains it would be idle.

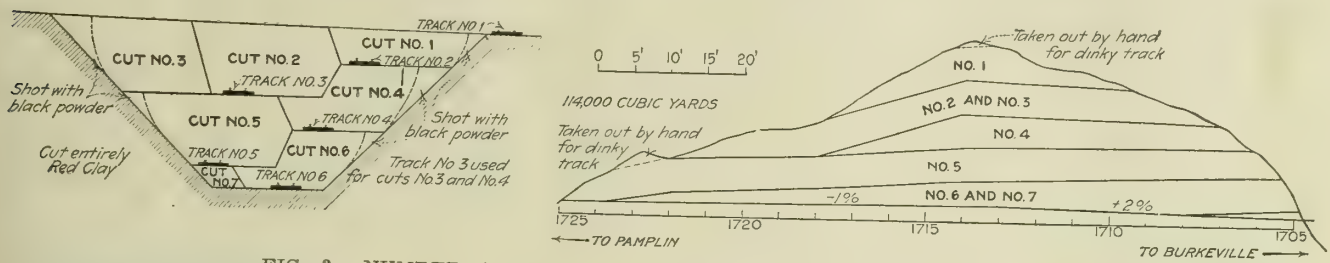


FIG. 3. NUMBER OF TRIPS OF STEAM SHOVEL IN A 45-FT. CUT

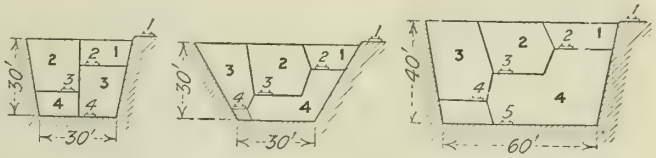
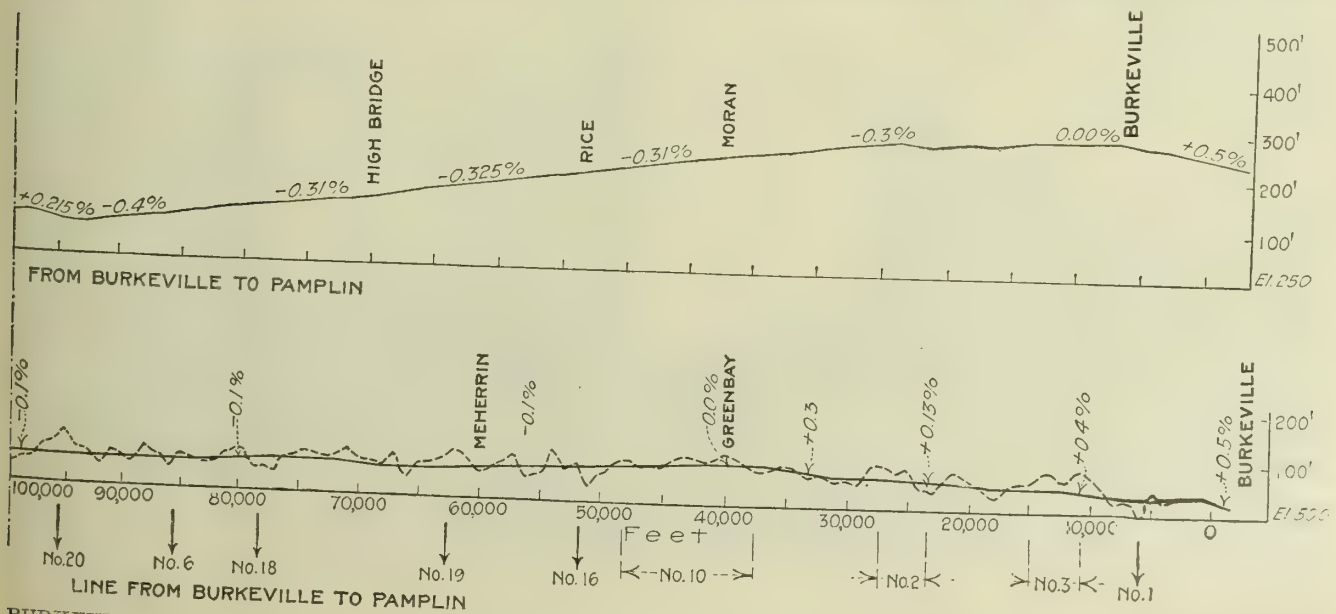


FIG. 4. CROSS-SECTIONS OF 30-FT. AND 40-FT. CUTS, SHOWING SUCCESSIVE LOCATIONS OF SHOVEL

The usual scheme was to employ as the first siding a portion of the first construction track, which, as previously stated, had been laid on the surface and used for loading purposes (Fig. 7), while the shovel was making its first trip through the hill.

After the shovel had completed its work and had moved on to the next cut, trimming of the side slopes commenced. The sides were trimmed by hand to the desired



BURKEVILLE AND PAMPLIN, VA., SHOWING SHOVEL LOCATIONS (BY CONTRACTOR'S NUMBER)

slope, ranging from 1:1 to nearly vertical. The tendency was toward steep slopes, as they are the most economical from the construction standpoint. They are dug nearly vertical by the shovel, and the top is rounded over to reduce slides. The width of cut or fill is determined by the formula 24 ft. plus $\frac{D}{5}$, where D is depth.

TABLE 1. STEAM-SHOVEL EXCAVATION

Month and Week	No. 19	No. 16	No. 18	No. 6	No. 20
May 8	7,000				
15	7,000			3,200	
22	5,200		7,900	5,600	
30	6,500		9,400	1,600	
May total	25,700		17,300	10,400	
June total	43,200		49,500	25,600	44,300
July 8	12,000	300	12,000	3,800	7,200
15	11,200	7,100	11,400	6,500	8,200
22	5,300	7,100	7,900	7,800	14,800
30	11,600	15,800	18,500	6,300	12,700
July total	40,100	30,300	49,800	24,400	42,900
Aug. 9	5,800	9,600	10,300	5,500	10,700
16	9,230	10,700	12,500	5,700	10,200
22	7,500	12,300	12,900	3,600	12,000

There were five gangs at each cut-and-fill—shovel gang, trestle gang, pit gang, track gang and dump gang. There were 366 men at work on the first residency, 700 on the second, about 200 on the third and 170 on the fourth. The rate of excavation is well shown by Table 1, covering the shovel work on the second residency (Robert Grace Contracting Co.)

Sometimes deep fills were made in two lifts by first building and filling a low trestle and then erecting a trestle on top of this and filling from this second trestle. Where there were concrete culverts such procedure would prevent the heavy impact upon them which would result from high dumping.

Sliding of a Fill and of a Cut

Only two slides of importance had occurred up to Sept. 1. One was in a deep wet cut and was caused by the movement of quicksand. The other was on a high fill and was caused by the slippery clay already mentioned.

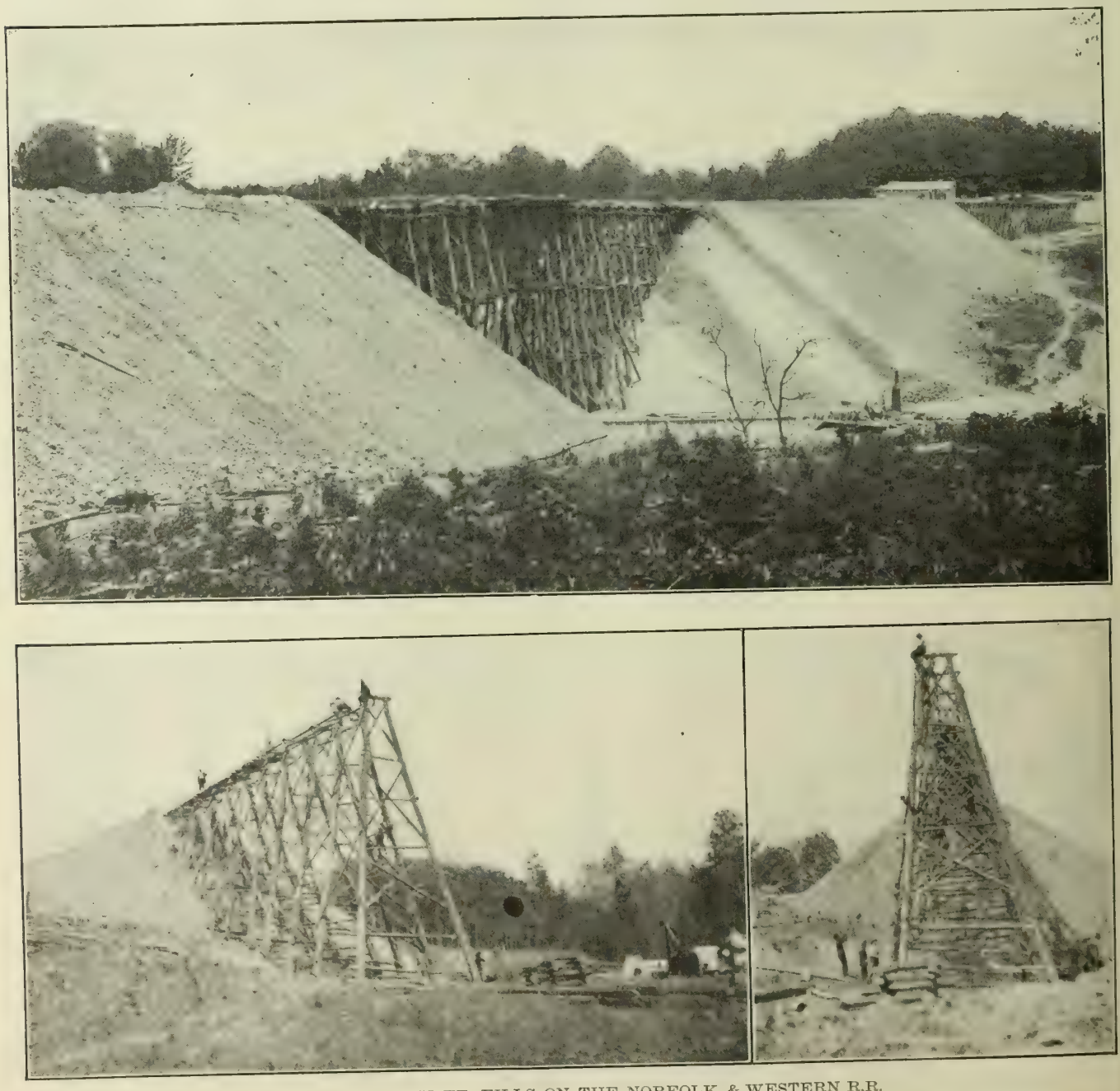


FIG. 5. MAKING 55-FT. FILLS ON THE NORFOLK & WESTERN R.R.
Upper—At Burkeville, Va. Lower—At Meherrin, Va.

The deepest fill on the Burkeville section was left open in the center temporarily to allow a concrete culvert to set (see upper view in Fig. 5). Two weeks were required for setting, and during this time the filling proceeded on each side. The culvert was 243 ft. long, 8x8 ft. in cross-section, crossing on a skew. The open part of the fill

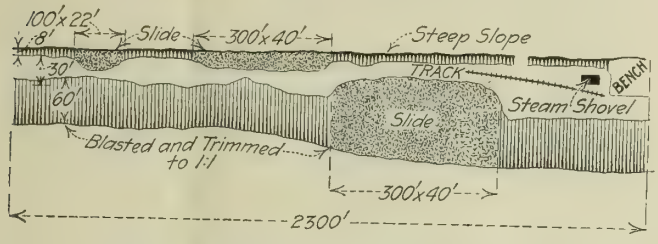


FIG. 6. PLAN OF WET CUT, SHOWING NARROWING DUE TO SLIDES

(and trestle) was 200 ft. long and 55 ft. high. Wet mica clay had been struck in the cut ahead. This was hauled to the trestle and dumped after the concrete had sufficiently set. When the fill had been brought to the top of the trestle it slipped, pushing out the toe on each side, and settled 20 ft. This occurred first on Aug. 1 and was repeated time after time. A certain amount of clay would be dumped onto the fill without its movement; but when more was added longitudinal cracks would occur and the whole would slump.

The first part of the material of this fill had been very wet; by the time a heaped-up carload could be transported to the fill the clay would be level with the side of the car. Later, the earth was taken out of the cut in a drier state and dumped on the fill, but the wet, slimy material formed the core and base and the sliding continued all through the month. One of the slips pushed out the trestle for more than a foot on each side. Some of the slips occurred on the concrete culvert the strength of which was thoroughly tested in consequence.

Bedrock at the site of this fill was only 4 ft. below the surface. To stop the slide it was decided to form an apron



FIG. 7. SIDING FOR DINKEY TRAINS, USING FIRST LOADING TRACK LAID ON HILL

of hard-packed red clay and to build up the fill on a gradual slope, 1¾ : 1 to 2 : 1. The red clay was carted in wagons to both sides of the foot of the trestle, where it was leveled and packed by mules drawing drag-scrapers. Movement of fill has not ceased yet. The contractors are still trying to stop it by teams dragging out the toe, and by making benches out of the material 5 ft. high with a 2¼ : 1 slope.

A series of slides occurred in a wet cut located between Sta. 1606 and 1631. At one point in the cut there was a vertical face 40 ft. high. Evidently slices of the bank had slid forward a distance of 20 ft., probably on a stratum of quicksand at the foot, and collapsed. Where sliding was excessive the slopes were shot to 1 : 1. Elsewhere in this cut the sides were nearly vertical. Fig. 6 is a plan of the unstable portion of this cut and shows narrowing due to slides.

Wet cuts were drained permanently by laying a line of 10-in. drain tile in a trench. This was covered with straw and then with earth. The berm ditches were 2 ft. wide, 1 ft. deep, and placed 15 ft. from edge of cut.

The work is under the supervision of J. E. Crawford, Chief Engineer of the railway; A. Bruner, Assistant Engineer. The following are the Resident Engineers from Burkeville toward Pamplin: White; Derrick; Hughes; Johnson.

Municipal Swimming Pool

An open-air municipal swimming pool is a feature of interest at Grand Rapids, Wis. It is on ground sloping from a main road to the river, just below the water-power dam, and is fed by a continually running stream of water from the river above the dam. Concrete walls were built to form the pool and the bottom is covered with sand. It varies in depth from 1 ft. at the upper end to 6 ft. at the lower end.

A large sluice gate at the lower end provides for emptying the pool, and is arranged for quick operation in case of an accident. The gate can be dropped by gravity, and anybody can operate the mechanism which frees the gate so that it will drop from the pressure of the water in the pond. It was realized that diving for a person drowning would be better than waiting for the water to be emptied from the pool, provided there was always someone on hand to do the diving. But when the pool was built there was no very definite idea as to how it would be taken care of, and no great amount of money has been provided for an attendant. Therefore it was planned to make it as near danger-proof as possible.

The entire pool can be emptied in about two minutes, but of course in a fraction of that time the depth would be reduced sufficiently to permit of wading, while the shallower part would be uncovered in a few seconds after the gate was opened.

The ground was donated by the Consolidated Water Power and Paper Co., which controls the river front rights at this point. The expense of construction was met by popular subscription and a donation from the city. The total cost has been about $5,000. The work was designed and built under the direction of L. A. De Guere, architect and engineer, of Grand Rapids, Wis.

Peru's Demand for Machinery Fell off in 1914, because most of the principal undertakings, such as hydroelectric developments, begun in 1912, were finished in the latter part of 1913. Consul-General William W. Handley, Callao-Lima, states that American machinery of all kinds is popular in Peru and that the sales exceed those of any other country. The imports from the United States in 1913 were valued at $918,933; the figure for 1914 was only $487,121. The total value of imports of machinery from all countries during 1914 was $865,268, as against $1,475,566 in 1913.

Penstock Carries 5,412-Ft. Head

The difficulties connected with the penstock design for the Lake Fully hydro-electric station, Canton Valais, Switzerland, were considered by some engineers very nearly insuperable; but M. Boucher, of Lausanne, the designer of the two plants of next highest head (Vouvry in the same canton and Orlu in the Pyrenees, with heads of 3,116 ft.) was highly successful here and the plant was placed in operation a few months ago. The selection of material, the types of joints and the location of the pipe were the important factors. These were described by S. Larsen, who visited the plant for the Norwegian Government, in a lecture before the Polytechnic Society at Christiania. The translation has been furnished by A. G. Hillberg, Hydraulic Engineer, New York City.

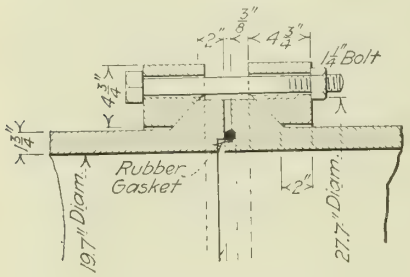


FIG. 1. DETAIL OF FULLY STRAIGHT PENSTOCK JOINT

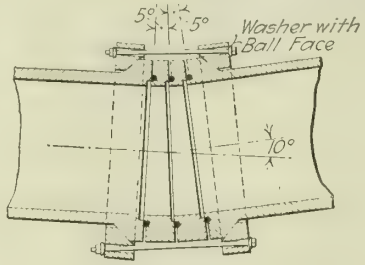


FIG. 2. PENSTOCK JOINTS AT POINTS OF DEFLECTION

The conditions under which the penstock was designed were as follows:

Static head	5,412 ft.
Operating head	5,248 ft.
Average discharge	6.36 sec.-ft.
Maximum permissible velocity	13.12 ft. per sec.
Length of penstock	2.8 mi.

At Lake Fully a dam was built raising the water level about 23 ft. This was done in order to create a sufficient pondage and to economize on the available water supply. From the lake the penstock descends into the Rhône Valley, where the power house is located. The inside diameter of the pipe is 23.6 in. in the upper part and 19.7 in. below. The wall thickness varies from ¼ to 1¾ in. The study of various kinds of pipe resulted in the selection of welded pipes for the upper portion and seamless drawn pipes for the lower sections. In order to keep the weight of each section of pipe as near as possible to 4 tons, the lengths were varied in 3-ft. steps from 20 to 40 ft. At the power house, where the pressure is heaviest, there are 56 pieces, each 20 ft. in length, with a wall thickness of 1¾ in. These pipes were tested at the shops under a hydraulic pressure head of 8,200 ft.

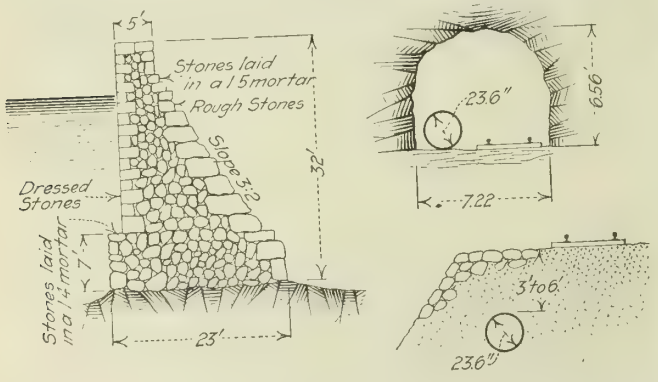


FIG. 3. LAKE FULLY DAM AND PENSTOCK LOCATIONS

The accompanying sketches show the main details of this penstock. Each end of a pipe section is provided with special conical flanges, over which fits a set of chamfered rings held together by bolts. In order to get these rings around the pipes it was necessary to split them in halves and to bolt the sections together. Tightness has been insured by a rubber gasket ring of circular cross-section.

At points where the pipe line was deflected, either in the horizontal or vertical plane or in both simultaneously, the angle was joined by the insertion at the joints of rings with inclined faces, as shown in Fig. 2. The angle between the faces of one of these rings is 5 deg. By using two rings and rotating them in respect to each other, any angle from 0 to 10 deg. was obtained. By using several rings any desired angle within reason could be joined.

In order to avoid supporting piers, anchorages and expansion joints and to insure the continuity of service against freezing and avalanches, the pipe line has been buried in the ground. To obtain a good alignment it was found necessary at several places to lay the pipe in tunnels.

The maximum unit stress in the walls of the penstock is about 13,300 lb. per sq.in.

Care had to be taken to prevent water hammer in this pipe. The Pelton wheels were therefore equipped with automatically operating, double-acting, oil-pressure governors—Piccard-Pictet system. This governor has a movable deflector in front of the nozzle, so that the jet can be quickly cut off from the wheel. The needle is then slowly moved, and when the jet has been regulated to suit the new load requirement the deflector is withdrawn. (See *Engineering News*, Jan. 21, 1915, p. 139.)

The penstock was manufactured by Thyssen & Co., of Mühlheim, Germany. The owner of the plant is the Société d'Electro-Chimie, of Martigny, Switzerland.

What Is the Trouble with Our Engineering Education?*

By Edward Orton, Jr.†

A new expenditure of unprecedented magnitude is being inaugurated here today to provide opportunities for the study of the problems of the clay and allied industries and for the training of young men to enter these industries on a professional or engineering basis. The ceramic school of university grade is a distinctly American institution. The change in the educational ideas disclosed between ceramic training of twenty-five years ago and that being given here and elsewhere in America today is a startling one. And now, at the beginning of still greater and more ambitious preparations, it seems wise and appropriate to cross-examine ourselves and make sure that we are on the right track and that we can give a reason for the faith that is in us.

*From an address delivered at the laying of the corner-stone of the Ceramic Engineering Building, University of Illinois, Sept. 27, 1915.

†Dean, College of Engineering, Ohio State University, Columbus.

Among the friends of technical education there are some, perhaps many, possibly even a majority, who think they perceive in the present increasing subdivision of technical education, in the growing number of courses, with the implied narrowing of the field occupied by any one course, a real and serious danger. The complaint of the users of engineering graduates is most commonly directed to their lack of grasp and power to use their fundamentals—their mechanics, their physics, their mathematics, their English. They say that the young engineer has been over so many subjects that he hasn't had time to go through any. We are accused of forgetting that the capacity of any group of healthy, vigorous young men to absorb knowledge and to acquire power to use knowledge in novel fields is about the same from year to year. To borrow a homely illustration from the kitchen, our technical professors are accused of trying to can more fruit than their cans will hold.

Less Pretentious Schedule Demanded

Not a few eminent engineers and large employers of engineering labor have urged the technical schools to give over trying to do the impossible and to return to the simpler, less differentiated courses, with more time on each subject and more practice in the application of each subject taught. They take the ground that in the nature of the case the industries themselves must act as the final schools for the young engineers who are being brought in for the maintenance and extension of these industries. These appeals from the industry have, if anything, grown in volume and insistence in the last decade. But the technical schools have, so far as I can discern, not yielded much if anything to them. In my judgment the discussion of this educational policy must continue and increase until it brings action. I think technical schools must settle down to a much better defined and less pretentious schedule. The four-year technical course of the future will, in my opinion, prepare young men to enter their profession as beginners, with the very clear understanding that expert knowledge of any field must come through the specialized schools maintained in and by the various industries themselves or through the graduate research and experiment stations at the universities or through both.

The bearing of this discussion of engineering or technical education on the case in hand here today may not at first be clear. We are gathered together to lay the cornerstone of a new structure whose purpose is to teach one of these very subdivisions of knowledge which has been described and in a way frowned upon. Is it justifiable educationally and industrially to make such splendid provision to carry out a plan whose foundation principles are still under debate? In answer to this I say that we must distinguish between subdividing a field of knowledge and cramming a course of instruction.

Subdivision of the field of knowledge in technical schools is not, *per se*, a danger or a weakness. It becomes a weakness whenever the training becomes superficial—whenever the mass of detail is allowed to obscure or replace the foundation. In fact, subdivision of our courses of study is not only not inconsistent with sound educational processes, but may be regarded as a step toward strengthening them. The subdivision of civil engineering, for instance, into railroad engineering, sanitary engineering, municipal engineering, structural engineering, hydraulic or irrigation engineering, to a large extent relieves the tendency to try to crowd a little of each of these subjects into one undivided or unspecialized civil-engineering course.

On the other hand, subdivision in itself is no safeguard against cramming; the temptation to cram is still there and must be resisted alike by school authorities, students and the industries. The views of undergraduates are almost always crude and materialistic in such matters, and they nearly always tend to overestimate the importance of special knowledge over general principles.

The thing which made the old course of two generations ago strong was the thoroughness of the drill in the foundation subjects. With a curriculum meagerly representing engineering, these early schools produced engineers who became famous. Why? Because they hammered their physics and mathematics and English in until the student could use them.

It is no longer possible or desirable for our schools to try to obtain the results of two or three generations ago by return to the methods of that time. The old-fashioned all-round scholar, who was a cultured gentleman first and always, and who knew something in every field, was the product of a social system which has gone. But the principles which made the education of that day sound and productive and fertile are still the same! All that is necessary is to preserve the principle of thoroughness in all that is done—to direct the educational process toward producing power to think.

Specialization Still Necessary

Any good engineering course must, in the nature of the case, contain the same foundation. The foundation subjects, developed as far as is needed for securing the working power previously described, will require from 50 to 60% of the time of the engineering student in his four years. In the first year they take practically all of his time. As he goes further, descriptive and specialized courses founded upon or utilizing the foundation courses come in, together with some few of a more general cultural value. Toward the last these specialized courses may comprise a large part of the work.

The acquirement of the power of constructive thought, which is the object of all technical education, can be had through one set of descriptive subjects as well as through another. I hold that it is immaterial whether the illustrative matter in a course of education is chosen from civil engineering or mechanical engineering or chemical engineering. I hold that it matters not whether it be ceramic engineering or electro-chemistry or aëronautics.

It is perfectly true, therefore, that in our modern specialized and subdivided technical education we may be weakening our product and discrediting the engineering profession or we may be creating strong virile thinkers and apt workers who will be the leaders in their field, according as we disobey old and tried principles or obey them. A specialized education is not *per se* either a good one or a bad one; it is not necessarily either strong or weak. It is as easy to train the human mind using illustrations and problems from one industrial field or scientific field as from another. The whole value of the process and the strength of the character produced will depend not upon the technical content of a course of instruction, but upon the thoroughness with which the foundation is laid and the persistence with which the principles are applied as the work progresses.

Portland Harbor Bridge

SYNOPSIS—A million-dollar bridge connecting Portland, Me., with South Portland across an arm of the harbor. Distinguished by great variety of design, embracing reinforced-concrete girder and cantilever spans and steel cantilever girders with rolling-lift drawspan.

A highway bridge, remarkable not only for its magnitude, but for the variety and originality of its design, is now in course of construction across an arm of Portland Harbor between the cities of Portland and South Portland, in Cumberland County, Me. The bridge takes the place of an old timber structure on approximately the same site and is being built by the County of Cumberland with some assessments on the street-railway company which crosses it and a terminal company over whose yard it passes.

The main section of the bridge, as shown in Fig. 1, extends from the foot of Brackett St. in Portland across the deep cut of the Boston & Maine R.R., Commercial St., the tracks of the Portland Terminal Co. and the harbor (which has at this point a maximum depth at low water of 35 ft. and a tide range of about 13 ft.), reaching South Portland on the line of Ocean St. At the Portland end there are three approaches; the one from Brackett St. descending a steep grade on an existing street to the bridge proper and involving no structural work except at the abutment of the bridge. To the northeast the approach is from a sidehill viaduct to the line of State St., and down this approach the main street-car entrance to the bridge will be made, improving materially the present roundabout entrance to the existing bridge. To the southwest a rather steep approach takes the bridge on the line of Clark St. to the low-level street, through which all of the heavy shore-line vehicular traffic will probably pass. The State St. and the Clark St. approaches are both separate structures, as shown in the so-called "southerly elevation" in Fig. 1.

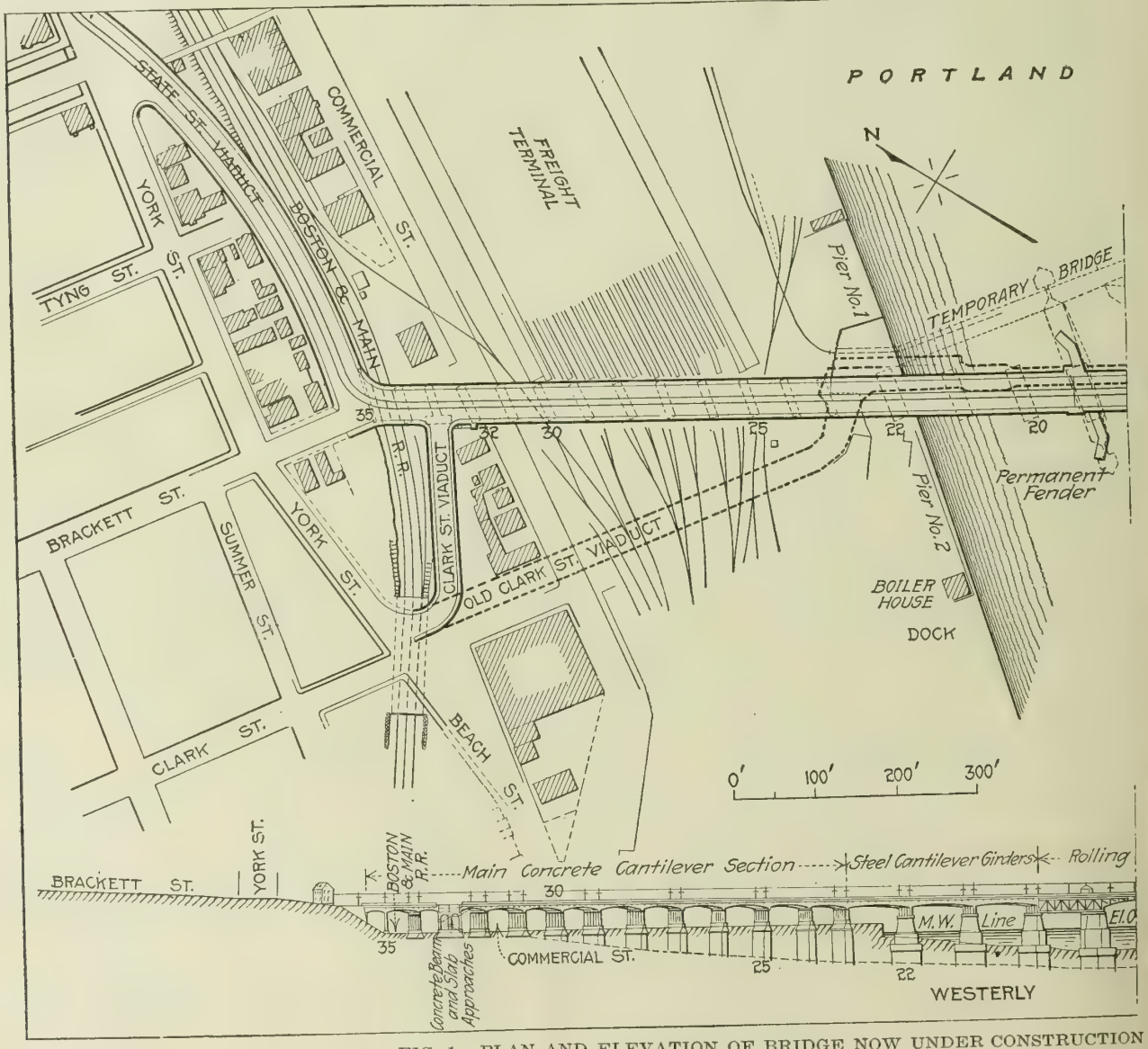


FIG. 1. PLAN AND ELEVATION OF BRIDGE NOW UNDER CONSTRUCTION

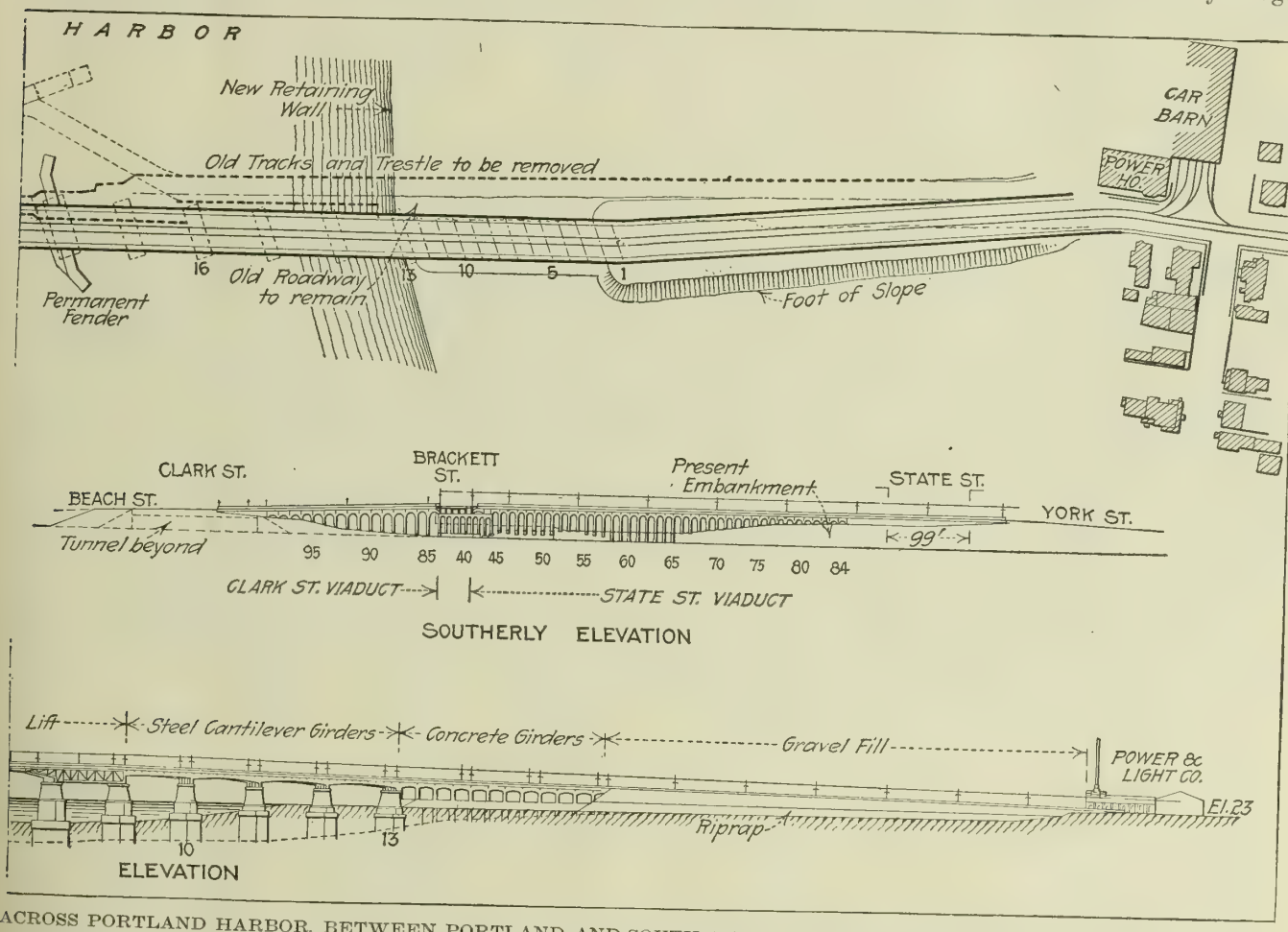
The structures for the various parts of the bridge are so radically different in design and in material that they will have to be described separately.

Beginning from the Portland end of the bridge, the State St. approach is a viaduct built upon the slope north of the railroad track from Brackett St. to State, a distance of about 700 ft., a small part of the street being cut into the slope and the rest supported on reinforced-concrete beams and piers. This section is made up of tall thin beams carrying a reinforced-concrete floor system, the piers being joined together on the showing face with arches so as to give an architectural impression similar to the old Roman-viaduct type. A view of this completed structure is given in Fig. 4-A. The southerly approach is a reinforced-concrete viaduct extending westerly from near the northerly end of the State St. viaduct to the junction of Clark and York St., a distance of about 320 ft. This section, while resembling in its facia appearance the State St. viaduct, is in reality a reinforced-concrete floor carried on tall slender reinforced-concrete columns joined together in both directions with arched beams. From the juncture of these two approaches (see Fig. 4-B)—that is, from the north approach of the bridge—to the northerly water edge of the harbor the structure consists of a reinforced-concrete viaduct about 700 ft. in length, which is made up of a series of reinforced-concrete cantilever beams carrying a reinforced-concrete floor and resting on concrete piers of the column-bent type.

Over the harbor the structure is composed of steel cantilever girders with a central section comprising a Scherzer rolling-lift bridge with two truss approach spans of steel. The total length of this section is about 1,009 ft., with 10 piers, 7 steel plate-girder spans, 2 steel truss spans and a rolling-lift drawspan. The piers are of rectangular plan and with a section decreasing as the pier rises. They are of concrete, faced with cut granite as a protection against wear in the intertidal space, and are founded on wooden piles. The steel spans are on piers of a uniform skew and have a uniform c. to c. pier distance of 98 ft. The cantilever overhang is uniformly 16 ft. 4 in.

From the south bank of the harbor a distance of about 275 ft., the structure is made up of a fill portion on the westerly side of the existing roadway up to an elevation 12 ft. above mean low water, and a superstructure consisting of a reinforced-concrete viaduct of the short arched-beam type supported on concrete piers and foundations resting on wooden piles. From this point south a distance of 875 ft., the southern approach is an earth fill partly over the old-filled southerly approach to the old bridge.

The total length of the main bridge is about 3,000 ft.; its width is 60 ft., and it carries a double-track interurban railway system, with a roadway and a sidewalk on each side. Work on the structure was started about a year ago, and its completion is expected some time during the coming summer. In spite of the general appearance of the bridge, there is not an arch structure in it.



ACROSS PORTLAND HARBOR, BETWEEN PORTLAND AND SOUTH PORTLAND

The State St. viaduct approach parallels a deep cut of the Boston & Maine R.R. made many years ago. This cut was in a rock formation which was left with rather a steep bank on the upper face, protected at its bottom with a cut-stone wall. In the original design of the new bridge it was supposed that this stone wall was of sufficient stability to permit its being used as a base for columns or wall

of the viaduct, but in construction it was found that the old stonework was so dilapidated that it had to be torn out and rebuilt at the places where it was used as a footing.

The drawings in Fig. 2 show the details of this structure. As will be seen there, it consists of cross-walls 12 in. thick spaced 12 ft. 3 in. c. to c. carrying a reinforced-concrete floor slab for roadway and a bracketed slab for the outside sidewalk. The inside sidewalk is formed on the natural slope of the hill. This cross-wall is not in reality a continuously supported wall, but is rather a very deep transverse beam carried near its inside end on a stepped pedestal with a short cantilever extending up the side hill, and on its outside end by a deeper pedestal which foots for the most part of the section on the old retaining wall. The outside face of the structure is formed in facia arches for architectural effect.

The expansion is cared for in this section by breaking the flooring, and the facia arches at every other bay, as is also shown. An interesting detail is the dropping of the floor slabs to allow the railway ties to be set directly on the slab except for the 1-in. sand cushion.

The Clark St. approach, which is on a 3.3% grade, carries only the highway and sidewalk. It is of the usual column viaduct type, details of which are shown in Fig. 3. It has no particular distinguishing feature, except perhaps the height of the highest columns, which reach to 25 ft. of unbraced length in one direction, in which case the center line of columns is of 22-in. square section and the outer lines are 22 in. square with a 12x12-in. pilaster on each transverse face; curved cross-beams are used for architectural effect.

The roadway scuppers might also be noticed. Inasmuch as the ground underneath this approach is not in use, it was feasible to lead the surface drainage to scuppers that discharge directly under the bridge.

The main northerly section of the bridge is shown in Figs. 5 and 6. This comprises 13 piers resting variously on hardpan and on wooden piles, depending on the nature of the ground, and carrying a reinforced-concrete structure made up of longitudinal beams with a reinforced-concrete floor. Owing to the irregularity of the railroad tracks in the terminal yard over which this section passes, both the piers and the cross-beams are decidedly irregular in their angle of skew, a fact which increased measurably the difficulty of form work.

The piers consist of prismatic bases carrying reinforced-concrete columns with a transverse integral cross-beam arched between the columns. The longitudinal girders are in effect cantilevers, each main span extending outward a distance of 12 to 15 ft., varying with the location, and carrying an intermediate suspended span. The curving of the bottom line of the longitudinal girders is such as to indicate from a distance that there exists a series of curved beams of continuous construction or else of independent structure. In construction the main spans, with their overhang, were built first and the suspended spans cast on the overhang after the constructed work had taken a set.

The piers for these girders are on a variable skew so that the girder lengths vary in each span. The longest

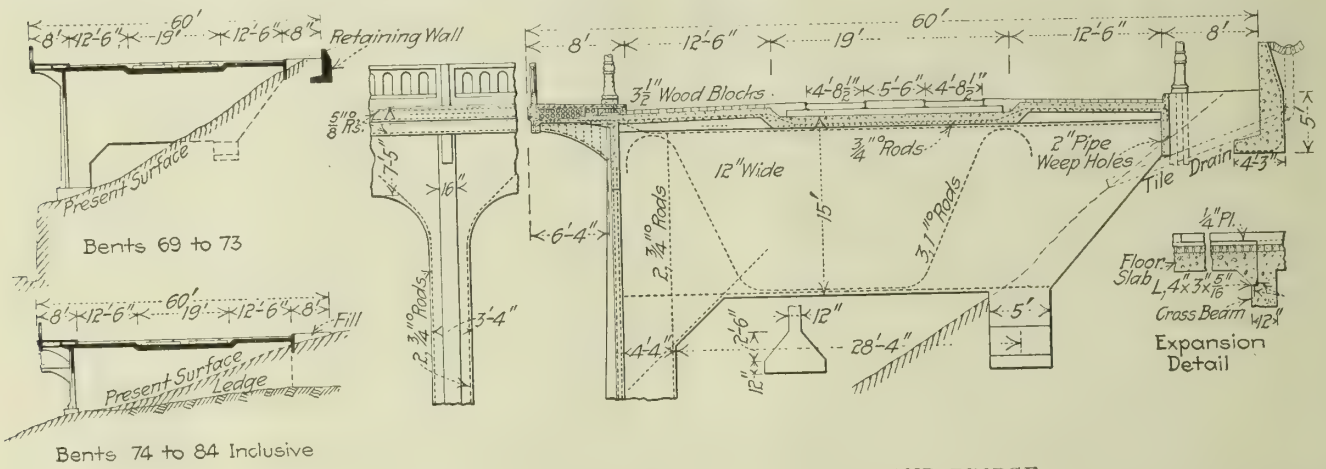


FIG. 2. NORTH, OR STATE ST., APPROACH TO PORTLAND BRIDGE

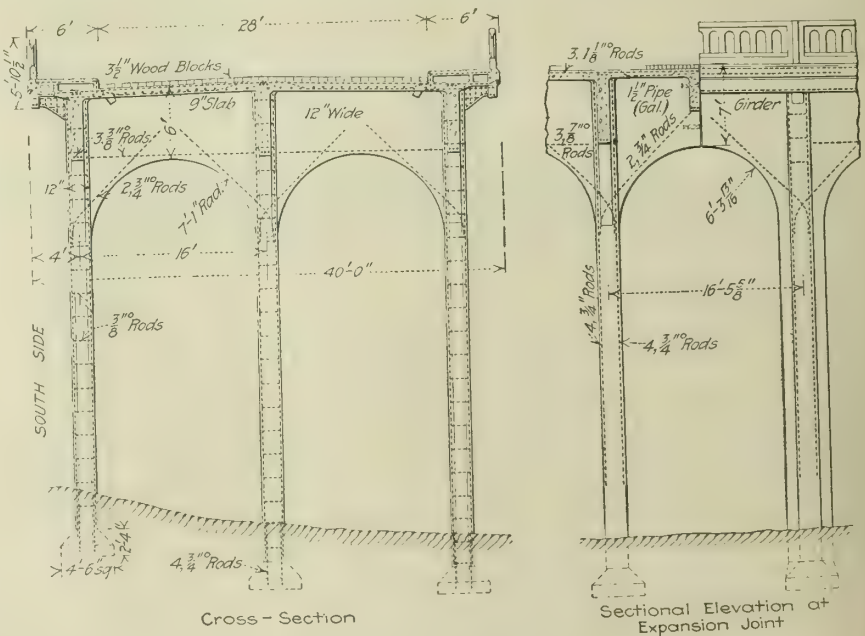


FIG. 3. DETAILS OF CLARK ST. APPROACH, PORTLAND BRIDGE

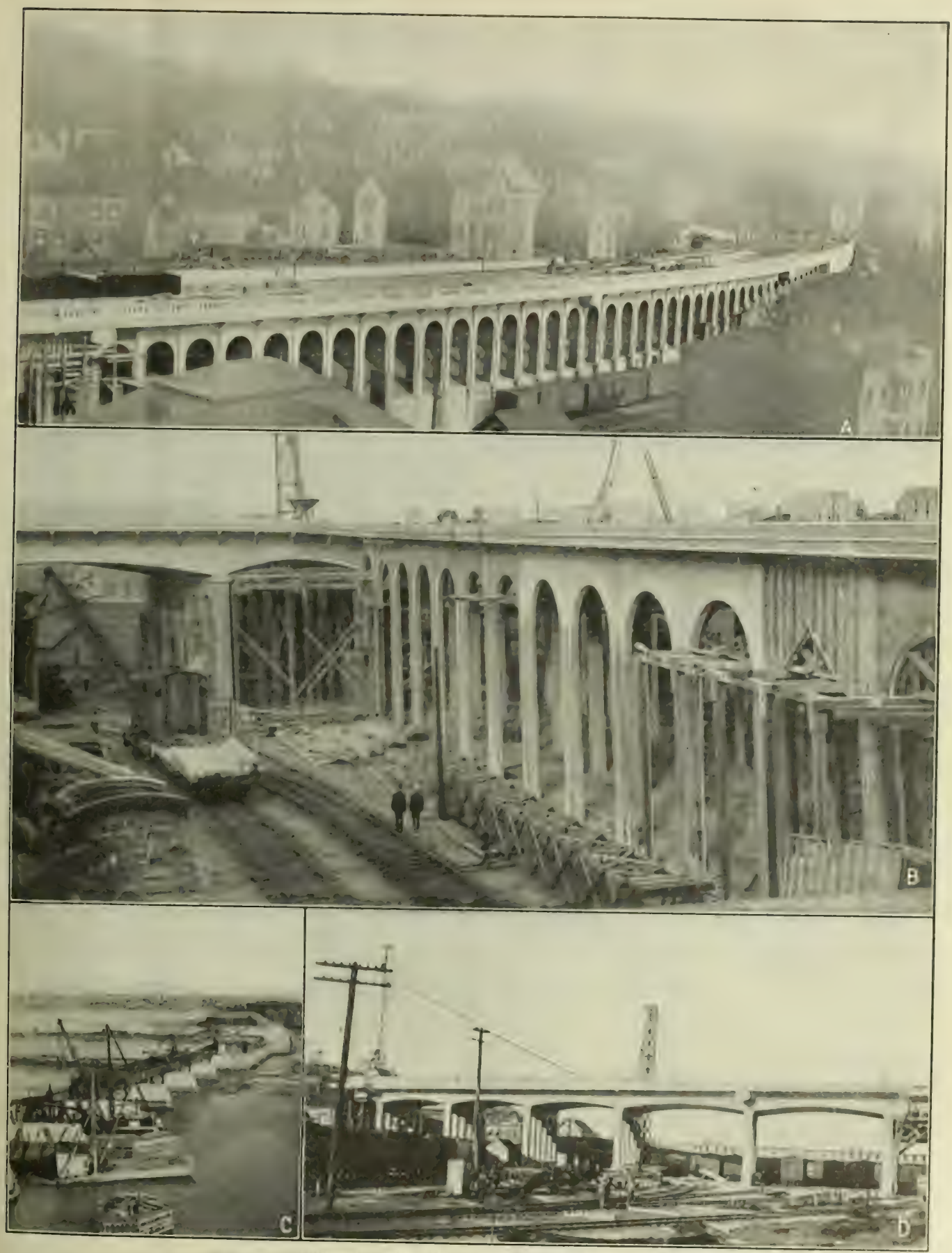


FIG. 1. VIEWS OF PORTLAND BRIDGE UNDER CONSTRUCTION

A—The completed State St approach. B—Looking north toward the juncture of south approach and main north section of bridge; approach on left, bridge on right. C—Looking toward South Portland over the steel spans; approach fill in background. D—Completed cantilever spans of main northerly section of bridge.

spans, however, have the following dimensions: Span 27-28 (main span) is made up of a central section varying from 57 ft. $3\frac{11}{16}$ in. on one side to 58 ft. $\frac{7}{16}$ in. on the other, with overhanging sections of about 12 ft. 6 in. each. Span 28-29 (suspended span) has a total opening of 67 ft. $\frac{15}{16}$ in. c. to c. of piers, of which 41 ft. $11\frac{13}{16}$ in. is the suspended girder and 12 ft. $6\frac{3}{4}$ in. overhang on each end. Span 29-30 (the longest main span) has a central section varying from 57 ft. $3\frac{15}{16}$ in. on one outside girder to 65 ft. $2\frac{11}{16}$ in. on the opposite outside girder. Its overhangs bring its total outside girder length up to 91 ft. $5\frac{13}{16}$ in.

The combination expansion joint and support for the suspended span in this particular section is of great interest. Its detail is shown in Fig. 5. As will be seen in the other drawings and in the view in Fig. 7, the overhang of the cantilever is cast in steps. Into the forms at these steps was placed a frame of steelwork made up mainly of three longitudinal angles with their outstanding legs clipped off in order to allow them to be inserted between the reinforcement of the beams. The horizontal faces of these angles at their extremities carry flat bearing plates riveted to the angle with the upper plane face of the plate flush with the horizontal face of the concrete step. Similar angles are also placed in the forms for the suspended span, except that the horizontal leg of the angle is downward and that it carries a plate slightly beveled in order to form a rocker on the flat plate of the lower angle. Through this rocker bed a $\frac{3}{8}$-in. bolt is inserted to give proper alignment and bearing during construction. It is expected that any perceptible action of the rocker will soon shear the bolts and that the motion thereafter will be perfectly free. This rocker bearing is provided at each of the six longitudinal girders, which are in turn all thoroughly interbraced, so that in effect the suspended span is an integral structure carried

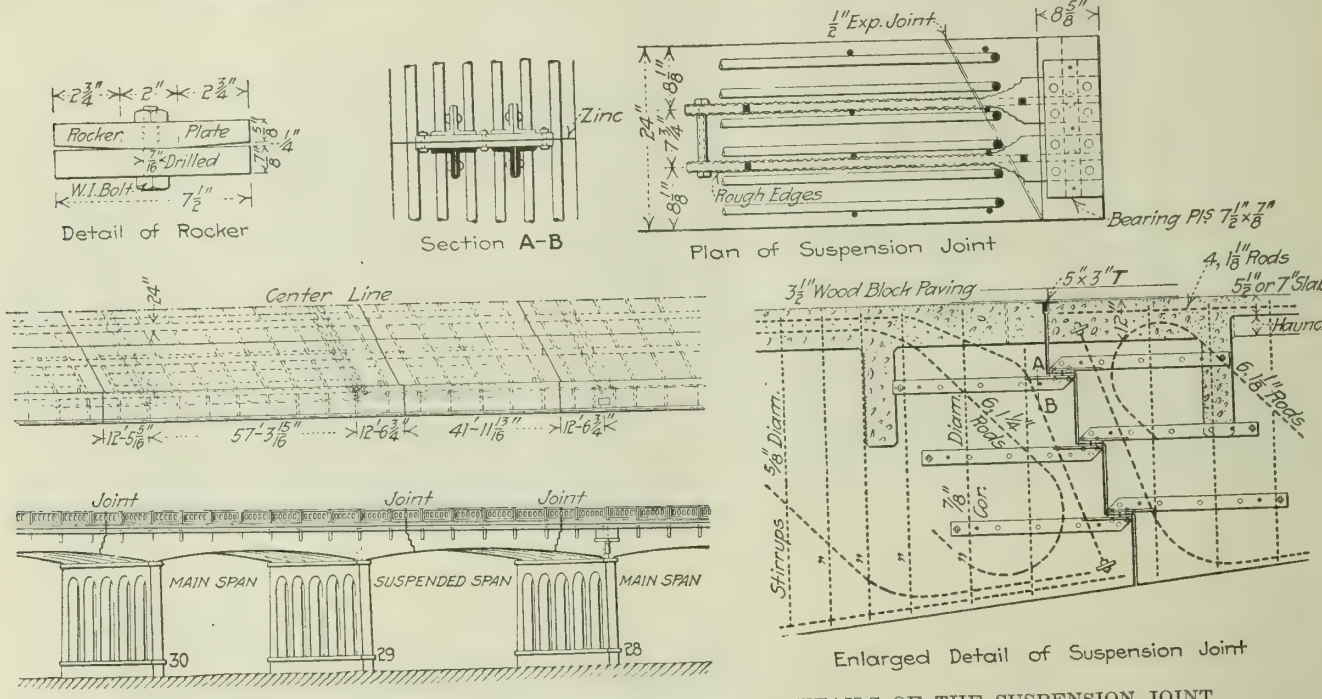


FIG. 5. PART OF THE MAIN NORTHERLY SECTION AND DETAILS OF THE SUSPENSION JOINT

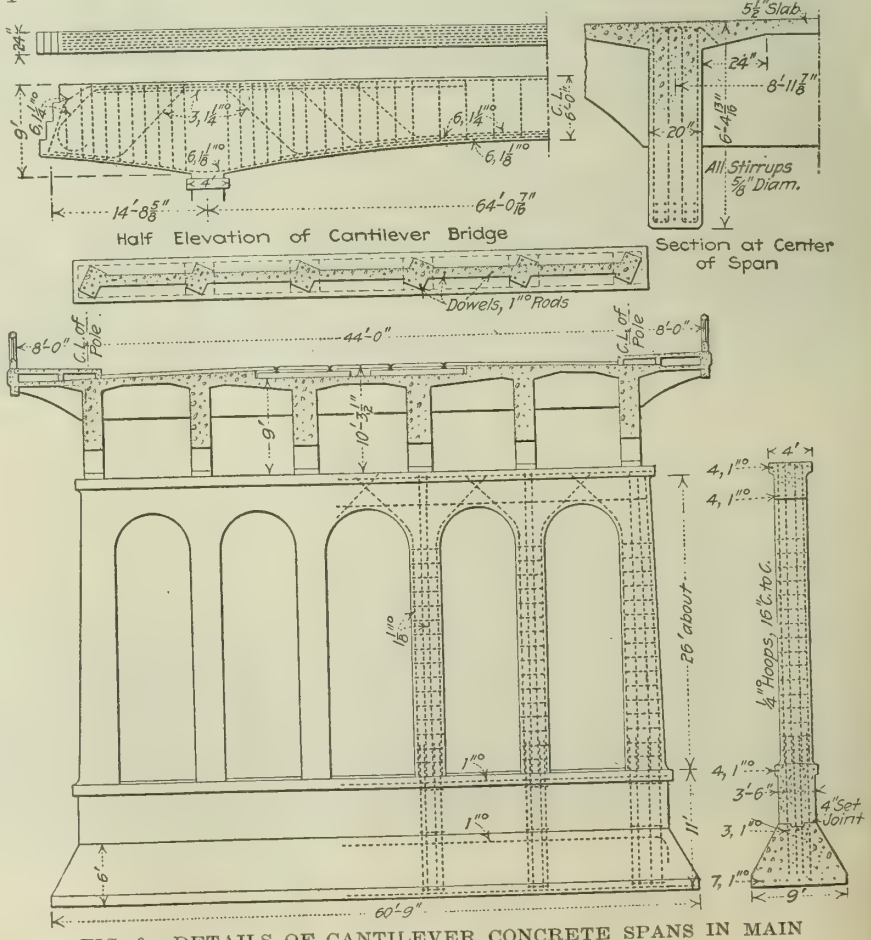


FIG. 6. DETAILS OF CANTILEVER CONCRETE SPANS IN MAIN NORTHERLY SECTION

on the numerous rockers at the joints of the overhanging cantilever girders.

The South Portland Approach

The concrete section at the south end of the bridge comprises a series of reinforced-concrete columns carrying straight cross-beams and curved longitudinal beams, on which the reinforced-concrete floor slab is cast. This exhibits no particular difficulty except that at every three spans there is a transverse wall breaking up the section into intermediate sections separated by expansion joints. There are three lines of columns, one on either side and one in the middle, each founded on prismatic pedestals footing on wooden piles which were mainly through a deep layer of silt.

The south approach is a fill made from a submarine borrow pit farther down the harbor, brought into the work by lighter and rehandled into the fill. It is held on the

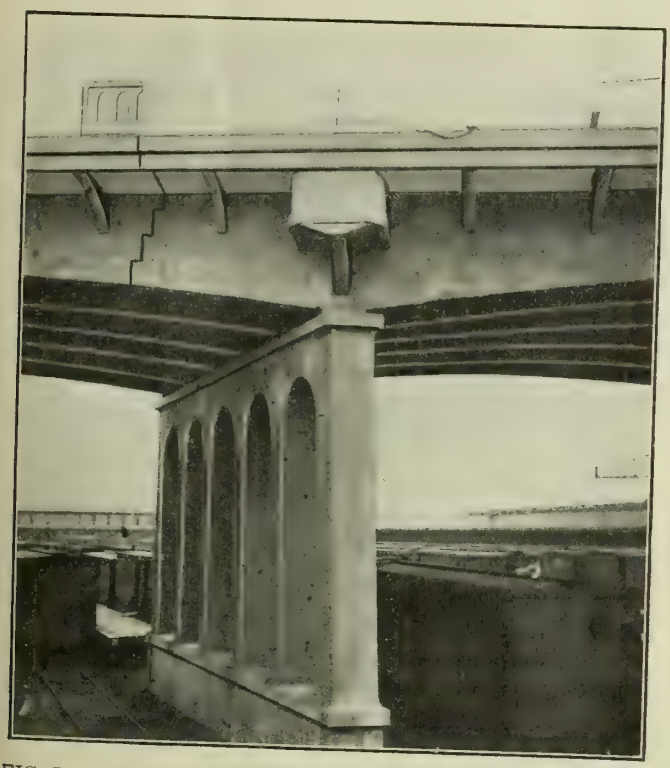


FIG. 7. NEAR VIEW OF THE COMBINED EXPANSION AND SUSPENSION JOINT ON MAIN SPAN

east side by the old bridge abutment wall topped by a new concrete wall, and on the other side has a heavy granite paving to protect the slope against wash.

Special Features of the Structure

Some special features in the detailing of the structure are common to various parts of the bridge and will be described separately. Among these are the use of separately cast sidewalk brackets, separately cast railing and specially cast manhole boxes.

It will be seen from the various drawings herewith that the sidewalk on the reinforced-concrete portion of the bridge is supported on reinforced-concrete brackets. These brackets are cast in Boston by Simpson Bros. in a sand mold; they are reinforced for their service, and the reinforcement is left protruding from the inner face so that when the castings are set in the forms the reinforcement may be tied back to the proper reinforcement in the structure proper. The aggregate used in the brackets is of similar nature to that used in the bridge, and the troweled surface given to the face is similar to that gained by the sand bed, so that in all ways they resemble very closely the structure in which they fit.

In the same manner are cast the railing sections, which go across the entire bridge. They are brought in from Boston, as are the brackets, on cars and are stored on the work until needed. The railings are placed on the bridge after the floor has been built and are boxed together at their joints with the reinforcement protruding into the opening. Into this box a joint is poured, making the railing continuous except at the expansion joints, where a special detail is provided.

The manholes for the conduits are of reinforced concrete and are so designed that the forms can all be set up on the ground and hoisted into place in their proper location, and the concrete poured around them to form the manhole.

Engineers and Contractors

The bridge is being built for Cumberland County, Me., under the direction of J. R. Worcester & Co., of Boston, Mass., as Engineers, with E. E. Pettee, of that firm, as Resident Engineer. The substructure contract was held by Holbrook, Cabot & Rollins, Inc., of Boston, with Luke S. White as superintendent and the superstructure contract by T. Stuart & Son Co., of Newton, Mass., with Albert T. Stuart, of the firm, as superintendent. The Phœnix Bridge Co. has the steel contract.

The details of the steelwork and the methods of construction will be described in future articles.

Life of Port Structures*

The life-expectancy factor frequently is given the least consideration in port and harbor design, if it is not entirely overlooked. "Life expectancy" as used here refers to the useful or commercial life that may be expected of a building. It has been estimated that the average commercial life of structures is about 30 yr. It is safe to assert that the physical life of a structure need exceed but little the commercial-life expectancy, in so far as the durability of materials is concerned.

On the Pacific Coast the timber or heavy mill type of pier and wharf construction is quite generally used. Experience at Seattle has shown that while it is necessary to creosote the piling as a protection against wood borers, yet the cost of a heavy fire-resisting timber structure is less than half one of concrete. By the installation of automatic fire sprinklers and fire-alarm and watchman's control systems a very favorable insurance rate was obtained. Upon analysis of the cost and the problable life of the structures the following facts were deduced:

1. With some redriving of piles, the timber pier may be expected to last from 20 to 25 yr., or about the effective commercial life.

2. Assuming the commercial life of a concrete pier to be 50 yr. and the physical life not less, also assuming that a timber pier would have to be entirely rebuilt at the end of 25 yr. at the close of the 50-yr. period—taking into consideration interest and other cost factors—the construction of timber piers would result in a saving of approximately 40%. In addition there would be the advantage resulting from the opportunity afforded at the end of 25 yr. of designing the new timber structure to meet changed requirements.

3. If the concrete type of pier had been adopted the available construction capital would not have provided more than half the facilities desired.

*Extracts from a paper presented by Paul P. Whitham before the American Association by Port Authorities, Los Angeles, Calif., Sept. 13, 1915.

Havana Rainfall Records

By Frank M. Aguirre*

In *Engineering News* of June 24, 1915, N. M. Stineman groups the New Bedford, Mass., century rainfall records into periods of 5, 10 and 20 yr., and states that it would be interesting to know whether other long rainfall records would show similar results.

In "Revista de la Sociedad Cubana de Ingenieros" for July, 1915, the rainfall records for Havana, Cuba, from 1859 to 1914 are published. I have placed this 56-yr. record in practically the same form as did Mr. Stineman the New Bedford records.

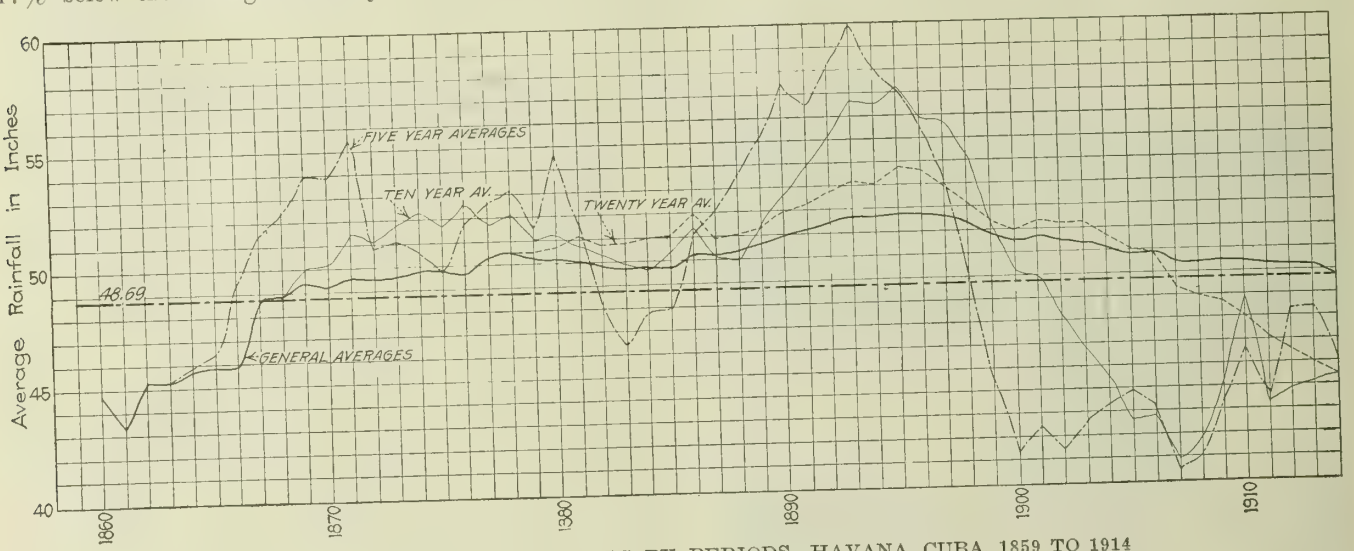
The maximum was in 1867, when 71.40 in. fell and the minimum was in 1907 with only 27.05 in. The average for the 56 years is 48.69 in. The 5-yr. averages vary from 40.4 in. in 1907 to 59.82 in. in 1893 or from 17% below the average for 56 yr. to 22.9% above this average. The 10-yr. averages vary from 40.86 in. in 1907 to 57.20 in. in 1895, or from 16.1% below the general average to 17.5% above. The 20-yr. averages vary from 44.47 in. in 1914 to 53.71 in. in 1895, or from 8.7% below the general average to 10.3% above. By these figures it is seen that although the variation above the general average appreciably decreases with the increase in length of period or of number of records, the variation below does not so decrease with the increase in length of period.

These figures are in accord with the New Bedford observations cited by Mr. Stineman and also with the Milwaukee records for 65 yr. presented by F. H. Millard in the same issue of *Engineering News*. Mr. Millard states that the variations above the average are considerably larger than those below, but the last statement in the preceding paragraph must be remembered, that with the increase in length of period the variation above the average decreases appreciably while the variation below does not.

One very significant fact shown by the accompanying diagram must strike terror to the promoter of water-power schemes who depends on rainfall data. From 1868 to 1914 the general average from year to year as the records increased in length was above that for the entire record; that is, the average from year to year during 46 yr. was above the general average of the 56-yr. record. In other words, if these data were used from 1869 to 1913, the averages in any of those years would have been higher than the average up to date.

Another fact to be noted, and which seems incongruous, is that the 10-yr. periods on four different occasions were nearer the general average of the 56 yr. than the general average for that year; that is, in 1887, 1888, 1900 and 1901. Thus we have a record of 10 yr. coming nearer the truth as shown by the 56-yr. record than the records for 3 yr. show, as in 1901, where the average of the 13 preceding years is 55.89 in. and the average of the 10 preceding years is 48.82 in., or very nearly the same as the average of the 56 yr., which is 48.69 in.

In general, the Havana records show the same characteristics as those of Milwaukee and of New Bedford, in spite of being shorter. They certainly make clear the uncertainty of records of a short duration, unless there is positive evidence that the period under consideration is a dry period, or *vice versa*.



YEARLY AND AVERAGE RAINFALLS BY PERIODS, HAVANA, CUBA, 1859 TO 1914

YEARLY AND AVERAGE RAINFALL AT HAVANA, CUBA, 1859 TO 1914 (EXPRESSED IN INCHES)

Year	Rainfall	Averages of Rainfall in Stated Periods: All Years Previous	5 Yr. Previous	10 Yr. Previous	20 Yr. Previous
1859	44.84	.....	.....	.....	.....
1860	44.45	44.65	.....	.....	.....
1861	40.59	43.29	.....	.....	.....
1862	51.29	45.30	.....	.....	.....
1863	45.10	45.25	45.25	.....	.....
1864	47.88	45.69	45.86	.....	.....
1865	46.86	45.86	46.35	.....	.....
1866	45.95	45.87	49.42	.....	.....
1867	71.40	48.71	51.44	.....	.....
1868	49.80	48.82	52.38	48.82	.....
1869	55.79	49.45	53.98	49.91	.....
1870	46.27	49.19	53.84	50.09	.....
1871	53.84	49.54	55.42	51.42	.....
1872	47.88	49.42	50.72	51.08	.....
1873	51.47	49.56	51.05	51.71	.....
1874	53.18	49.79	50.53	52.24	.....
1875	42.31	49.76	49.74	51.79	.....
1876	53.94	49.60	51.76	52.59	.....
1877	62.01	50.26	52.58	51.65	.....
1878	54.05	50.45	53.08	52.07	50.45
1879	45.07	50.19	51.48	51.00	50.46
1880	47.94	50.09	54.60	51.17	50.63
1881	48.43	50.01	51.50	50.63	51.02
1882	44.43	49.78	47.98	50.28	50.68
1883	46.08	49.63	46.39	49.74	50.73
1884	51.89	49.72	47.75	49.62	50.93
1885	48.37	49.67	47.84	50.22	51.01
1886	64.53	50.20	51.06	51.28	51.93
1887	49.33	50.17	52.04	50.01	50.83
1888	53.51	50.28	53.53	49.96	51.02
1889	59.73	50.59	55.09	51.42	51.21
1890	59.73	50.87	57.37	52.60	51.89
1891	59.73	51.14	56.41	53.73	52.18
1892	58.30	51.35	58.20	55.12	52.70
1893	60.59	51.62	59.82	56.57	53.16
1894	50.71	51.59	57.81	56.45	53.03
1895	55.85	51.71	57.03	57.20	53.71
1896	51.06	51.69	55.30	55.85	53.57
1897	46.21	51.55	52.88	55.54	52.78
1898	39.75	51.25	48.72	54.17	52.06
1899	28.71	50.70	44.32	51.06	51.24
1900	41.12	50.48	41.37	49.20	50.90
1901	55.89	50.60	42.34	48.82	51.28
1902	41.12	50.39	41.32	47.10	51.11
1903	46.56	50.30	42.68	45.70	51.13
1904	39.58	50.07	44.85	44.59	50.52
1905	36.32	49.78	43.89	42.63	49.92
1906	52.48	49.83	43.21	42.77	49.81
1907	27.05	49.37	40.40	40.86	48.20
1908	49.13	49.36	40.91	41.79	47.89
1909	52.50	49.42	43.49	44.18	47.62
1910	46.60	49.37	45.55	47.72	46.96
1911	41.76	49.22	43.41	43.31	46.06
1912	46.80	49.18	47.36	43.88	45.49
1913	49.25	49.18	47.38	44.15	44.92
1914	41.69	48.69	45.22	44.36	44.47

*Civil Engineer, Cienfuegos, Cuba.

Surface Warnings of Street Subsurface Failures

By Robert Klotz*

That concrete forms the most satisfactory material for the support of street pavements is unquestionable, but the fact that the very qualities which render it so satisfactory for the purpose may at the same time result in a source of great danger does not seem to receive sufficient consideration. With pavement laid on sand or on the existing subsoil any subsurface voids caused by leaks from defective water mains or by defective sewers were followed shortly by a noticeable depression in the pavement, except in rare instances in which the blocks had been laid with very close joints and chanced to form an arch over the opening. When the depressions were slight they were, as a rule, occasioned by settlement of the subsoil, and the restoration of the pavement to grade was sufficient to eliminate the defect. Where conditions below the surface were serious, the condition of the pavement was indicative of the need for investigating the underlying mains or sewers, and the source of the trouble was soon located and removed.

With the introduction of the concrete base the practice of restoring the pavement over small depressions to grade without investigation of the underlying cause has been adhered to. However, the use of the monolithic base should naturally point to the necessity for a radical change, as its inherent power of bridging over a void of considerable area and volume should render the investigation of the cause of any noticeable depression of the concrete base obligatory.

An Example from New York City

A good example of the result of lack of appreciation of this requirement was the breaking of a 48-in. water main, with attendant damage to surrounding streets, on Manhattan Ave., New York City, on June 4, 1915.

An examination of the pavement surrounding the break shortly after its occurrence gave remarkably clear indication that the preliminary failure of the pipe had occurred some time before and that the leak had existed and had been washing away the subsoil for 5 or 6 yr.

Where the pavement had been broken out, the sections of the concrete base showed a thickness varying, over the entire street intersection, from 6 in., as called for by the specifications, to 22 in., the minimum thickness being adjacent to the street-railway tracks, which were carried on a masonry structure bridging the water mains and served to prevent the settlement of the pavement adjoining them. This heavy concrete showed distinctly that various layers, from 2 in. to 6 in. in thickness, had been applied from time to time to restore the settled pavement to its proper grade, and that this had been done over almost the entire area affected by the washout.

The continued settlement, as recorded in the many layers of added concrete, should have been recognized as an indication of some defect in one of the mains or sewers.

Further evidence of the need of examination of subsurface conditions was the settlement of the street-railway tracks on Manhattan Ave. between 109th and 110th St., which had been corrected some two years before, although it was, perhaps, excusable to attribute this settlement to the after effects of a severe washout at the north side of 110th St., which had occurred during the early part of 1910. The excessive thickness of the concrete explains the fact that a comparatively small area of pavement was displaced by the actual flow of water.

As the results of the washout required the reconstruction of the street-railway tracks and most of the subsurface structures in the entire block on Manhattan Ave. between 109th and 110th St., the reconstruction of about 200 ft. of double track on 8th Ave. (parallel to and over 400 ft. distant from Manhattan Ave.) and the restoration of portions of the roadways and sidewalks on Manhattan Ave. and on 110th St. at points 600 and 700 ft. distant from the location of the break, it may well be seen that even a very appreciable expenditure of money for the purpose of investigating the cause of the pavement settlement would have been a profitable investment.

As the district lying immediately east and north of the location of the break consists of land filled in on a base of riprap, it may also be assumed that additional settlements will occur from time to time at other points where the dirt has been washed into the voids of the riprap and where the pavement is now supported solely by the concrete base.

Upheaval Due to Gas Explosion

Another example of the preliminary surface indication of a water leak, although the evidence in this case was much less marked, was that resulting in the washout which caused illuminating-gas explosions and the consequent wrecking of the pavement on 23rd St. at 5th Ave., New York City, somewhat over a year earlier.

Early in 1912 a slight hole in the pavement and base along 23rd St. at the intersection of 5th Ave. revealed, upon investigation, a cavity approximately 6 ft. deep and about 4 ft. in diameter. Nothing was done at the time beyond filling in the cavity and restoring the pavement over the opening. As this cavity was located about 10 ft. directly west of the section of the water main which finally broke apart, there is no question but that it was caused by a minor leak existing in the main at that time or for some time before, and that an investigation would have disclosed the existence of undesirable conditions, the immediate correction of which would have avoided the damage resulting from the ultimate break.

That in either of these or in any such cases the initial cracking of the pipe is other than accidental is very doubtful, and the failures of cast-iron mains are too few to warrant any criticism of the accepted types of pipe or the manner of laying them.

The experience in the two cases cited, however, and in others in which slight surface defects have led to the uncovering of extensive cavities, clearly indicates the need of regarding settlements in pavements laid on concrete as a base as distinct warnings of subsurface defects, rather than as minor pavement defects to be corrected by restoring the surface. An investigation of a case of this kind need not necessarily involve extensive or expensive excavation. An examination of the interior of a sewer or a test of the water mains will often indicate the location of defects the existence of which has not been suspected. Where such an investigation yields no results and the settlement of the pavement continues, excavation should be resorted to, unless there is a definite and reliable record of a reasonable cause for the settlement.

*111 W. 49th St., New York City.

Sewer Gagings and Maximum Flow in a Seattle Outfall

By Henry D. Silliman*

SYNOPSIS—Sewer gagings and related data in a Seattle sewer district show that the maximum flow in the outfall sewer occurred about 10 min. after the time of greatest precipitation, as compared with a "running time" of 20 min. between the most distant manhole and the recording gage.

The purpose of this article is to show by records of both rainfall and runoff the truth of a theory used in the design of storm-water sewers and given by O. Hufeland in *Engineering News* of Nov. 5, 1914. The theory is that the maximum flow in an outfall sewer occurs at a period of time considerably less than that ordinarily given as the period or time of concentration, which is defined by Raikes as "the time actually required for the storm-water to flow through the sewer to the outfall."

The data here given in support of the theory just stated were secured during 1914 in the First Avenue intercepting-sewer district of Seattle, which is the only drainage district in the city that can be said to have attained its normal development. Fig. 1 is a map of the district, giving such available data as might aid in the study of the sewer gagings here reported.

Through the coöperation of George N. Salisbury, section director for the U. S. Weather Bureau, the rainfall data for the year 1914 have been obtained. As will be noted from the map (Fig. 1) the Weather-Bureau offices are located near the center of this district.

During the year 1914 there were four rainstorms of more than average intensity. For these storms the data given in the table beneath the caption of Fig. 2 were obtained.

The recording gages were made by the Bristol Co., the type of case used being that known as "moisture-proof." Less trouble would have resulted if their "water-proof" case had been used. It was also found that the pressure-diaphragm case acted as a grease trap, sufficient grease accumulating to affect the pliability of the diaphragm and to fill the inlet holes of the case.

*Assistant District Engineer, City Engineer's Office, Seattle, Wash.

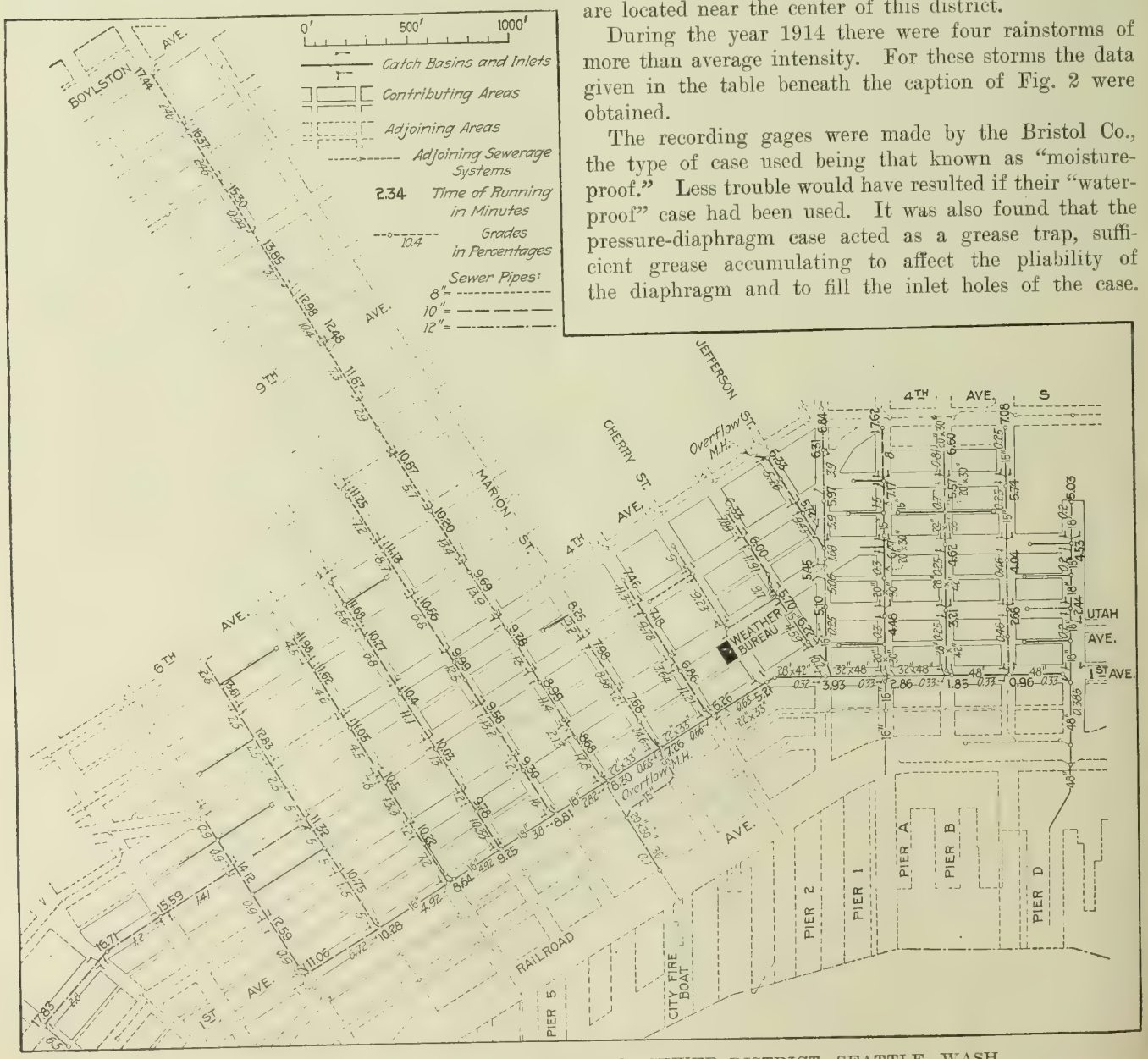


FIG. 1. MAP OF FIRST AVENUE INTERCEPTING SEWER DISTRICT, SEATTLE, WASH.

Estimated population, 26,000. Storm-water inlets, 273. Pavement and sidewalk area, 71.7 acres; built-over area, 61.3 acres; vacant or unpaved area, 23.4 acres; total contributing area bove recording gage, 156.4 acres

The pressure bulb, or case, was set 6 in. above and on the center line of the 48-in. sewer. The bulb was held in place by a collar of ¼x1-in. iron around a 2-in. galvanized-iron pipe secured by a trench-brace screw.

Large quantities of paper, laundry rags, etc., travel through this sewer. The charts show small fluctuations caused by this material gathering on the pressure bulb and its fastenings. After reaching a certain size, in about one hour, this accumulation did not increase. The charts were removed and the rags, paper, etc., cleared off each day except Sunday.

Referring to the map of the district (Fig. 1), it will be seen that the time of running in this sewer system from the manhole where the recording gage was installed to the

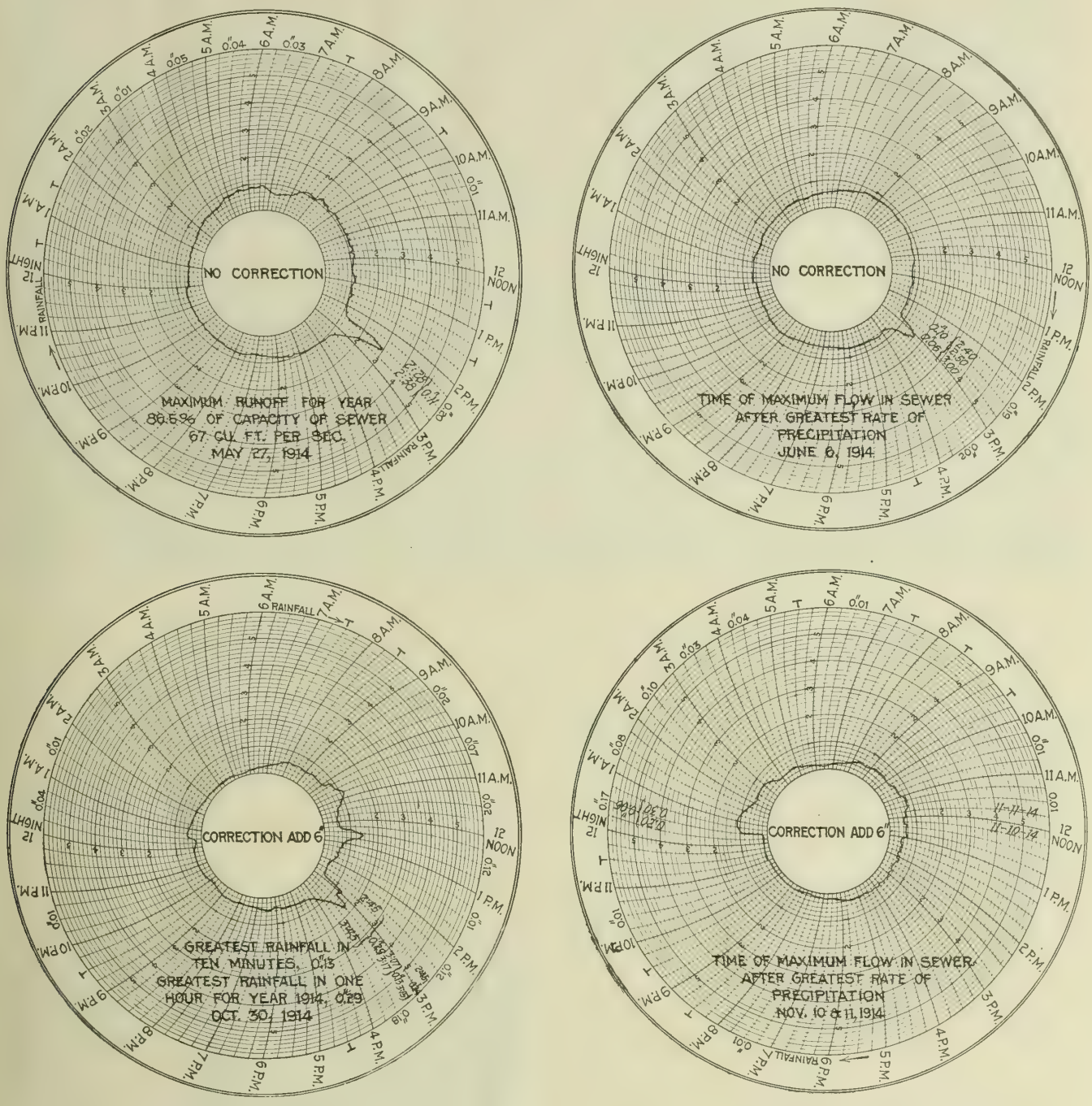


FIG. 2. DEPTHS OF SEWAGE FLOW AT SEATTLE, WASH., DURING FOUR HEAVIEST RAINFALLS OF 1914

Recorded on Bristol water-level gage in First Ave. intercepting sewer, a 48-in. circular sewer, with a 0.385-per cent. grade. The precipitation and runoff for the heaviest portions of these rainfalls were as follows:

Date	Time	Precipitation, In.	Runoff in Per Cent. of Rainfall
May 27, 1914	2:28 p.m. to 2:33 p.m.	0.07	
	2:38 p.m.	0.11	54.5
	2:43 p.m.	0.17	
	3:28 p.m.	0.20	
June 6, 1914	2:40 p.m. to 2:45 p.m.	0.03	
	2:50 p.m.	0.10	23.6
	2:55 p.m.	0.12	
	3:35 p.m.	0.21	
Oct. 30, 1914	3:07 p.m. to 3:12 p.m.	0.11	
	3:17 p.m.	0.13	33.4
	3:22 p.m.	0.14	
	3:45 p.m.	0.29	
Nov. 11, 1914	0:20 a.m. to 0:25 a.m.	0.03	
	0:30 a.m.	0.06	40.0
	0:35 a.m.	0.09	
	1:00 a.m.	0.17	

The percentages of runoff given in the column of the tabulation were calculated by dividing the estimated discharge through the sewer for the maximum depth of flow as shown on the accompanying charts taken from the recording gage on the days in which these storms occurred, less an amount equal to the discharge of sanitary sewage from this sewer in dry weather, by the amount of rainfall over the total area of the district for one minute, at an average rate for the ten-minute period having the greatest amount of precipitation

farthest removed storm-water inlet is approximately 20 min. Now, referring to the charts from the recording gage (Fig. 2), it will be seen that the maximum flow in the sewer occurred on or about ten minutes after the time of greatest precipitation.

These results, then, seem to affirm the conclusions of three American engineers, as follows:

The present percentage of rainfall discharged from the aforesaid urban districts cannot, however, be regarded as permanent, since improvements are constantly being made by the construction of new buildings, pavement and sewers. Hence, not only is the proportion of the impervious surface on these districts steadily growing, but the time required for the concentration of the storm water in the outlet sewers is also becoming materially reduced.—Emil Kuichling. "The Relation Between Rainfall and the Discharge of Sewers in Populous Districts." "Trans. Am. Soc. C. E.," Vol. XX.

The method of finding the time whose rate of precipitation would cause the maximum flood is then as follows:

1. Estimate the time in minutes required for the water to pass from the most distant inlet to A.

2. Take half this time and add eight minutes.

[A being any point on the outfall sewer, eight minutes equals time allowed for water to pass over roofs, pavements, etc., before reaching the sewer inlets.—Ernest Wilder Clarke, "Storm Flow from City Sewers," "Engineering News," Nov. 6, 1902.]

The method given demonstrates that the time of concentration is considerably less than the total time taken for sewage to flow to a given point on the outfall sewer from the farthest removed storm-water inlet.—O. Hufeland. "Graphic Method of Estimating Runoff in Storm Sewers." "Engineering News," Nov. 5, 1914.

These sewage gagings, together with gagings of the flow in some of the larger trunk sewers, for whose drainage districts such complete data could not be offered, were made by me during the year 1914, under the direction of A. H. Dimock, City Engineer of Seattle.

Selecting Rural-Road Types for the State of Illinois*

In order to select the economic type of improvement for the main rural highways of Illinois it is necessary to consider the first cost, the interest on the investment and the maintenance cost.

The problem is in a great many respects directly comparable with the cost of service in railroad transportation, in electric lighting, telephone and telegraph service, etc.

In general it may be said that if the traffic and type of road are properly suited to each other, the cost of service for hard roads is approximately constant for all types of wearing surfaces. Cost of service in this connection is understood to mean the total cost per unit of area per unit of time per unit of load, and to be constant for an indefinite period of time.

It should be kept in mind that the cost of the first improvement bears very directly upon this cost of service, for money at 3½% compound interest doubles in 20 years, and at 5% in 14 years. So that as the first cost goes down, the saving on money invested may be an appreciable item in providing a fund for the purpose of maintaining the roads to a desired standard of excellence and usefulness. In this way, where the lighter types of improvement are sufficient to meet the demands of traffic, it is wasteful to invest money where it serves no purpose. Later on the amount so saved might be used for the purpose of resurfacing the road to meet the increased demands of a greater volume and a changed character of traffic.

Another important factor that should not be overlooked is that the more roads built the easier, and consequently the cheaper it is to build them. This has a double significance, in that the sooner hard roads are in service, the sooner and more generally will their advantages be felt, and also in that the cost of reconstruction will be less proportionately than the cost of first construction, because of the increased facilities for handling materials over better roads.

As to the type of road which the state could assume the burden of maintaining, no one, two or three types could possibly meet economically the wide range of conditions to be found on the 16,000 mi. of designated state-aid roads in Illinois.

The types of pavements which might properly be adopted for main rural highways in Illinois cover a wide range and depend upon cost, which varies with availability of materials; traffic, which varies in amount and kind with different locations, and local preference, which changes largely with popular sentiment.

The state might reasonably assume the burden of maintaining a pavement regardless of type, if the traffic is proportioned to the ability of the particular type in question to resist the wear occasioned by the traffic.

The state might coöperate with the county to share a portion of the cost of maintenance where the type of pavement selected is only partly able to withstand economically the burden of traffic which will come upon it. The state should not assume any portion of the cost of maintaining earth roads unless the partnership between the state and county were extended to cover the entire item of maintenance, in which case an equitable solution of the problem would appear to be an equal division of the cost of maintenance between the state and county.

I recommend that the state adopt some comprehensive scheme for taking a census of traffic and gathering such other information as is necessary for the proper scientific solution of the problem of determining upon its economic types of roads for various localities and conditions.

*Extracts from a special official report of William W. Marr, Chief Highway Engineer, Springfield, Ill.

Handling Bricks with Gravity Roller Conveyors

By W. B. Conant*

Roller gravity conveyors for moving bricks and mortar in mill construction, with an endless-chain elevator to raise the brick trays and mortar boxes from ground level to the scaffolding, have been used by the Aberthaw Construction Co., of Boston, Mass., in several recent factory contracts. A good example of their application is to be seen in the construction of a new mill for the Farrell Foundry and Machine Co., Ansonia, Conn., the conveyors being obtained from the Matthews Gravity Carrier Co., Elwood City, Penn. They consisted of 4-ft. and 8-ft. frames containing rollers 14 in. long and 2¼ in. in diameter, laid 4¼ in. c. to c. Curves of 45° and 90°, in 8-ft. sections, were provided for conveying materials around some very sharp turns.

The cars which delivered the bricks were placed on a siding alongside the job, the bricks being piled into trays inside the car. One of the roller gravity conveyors led into the car (Fig. 2), and on this the trays were laid and transported 120 ft. by their own momentum, turning at

*Concord, Mass.

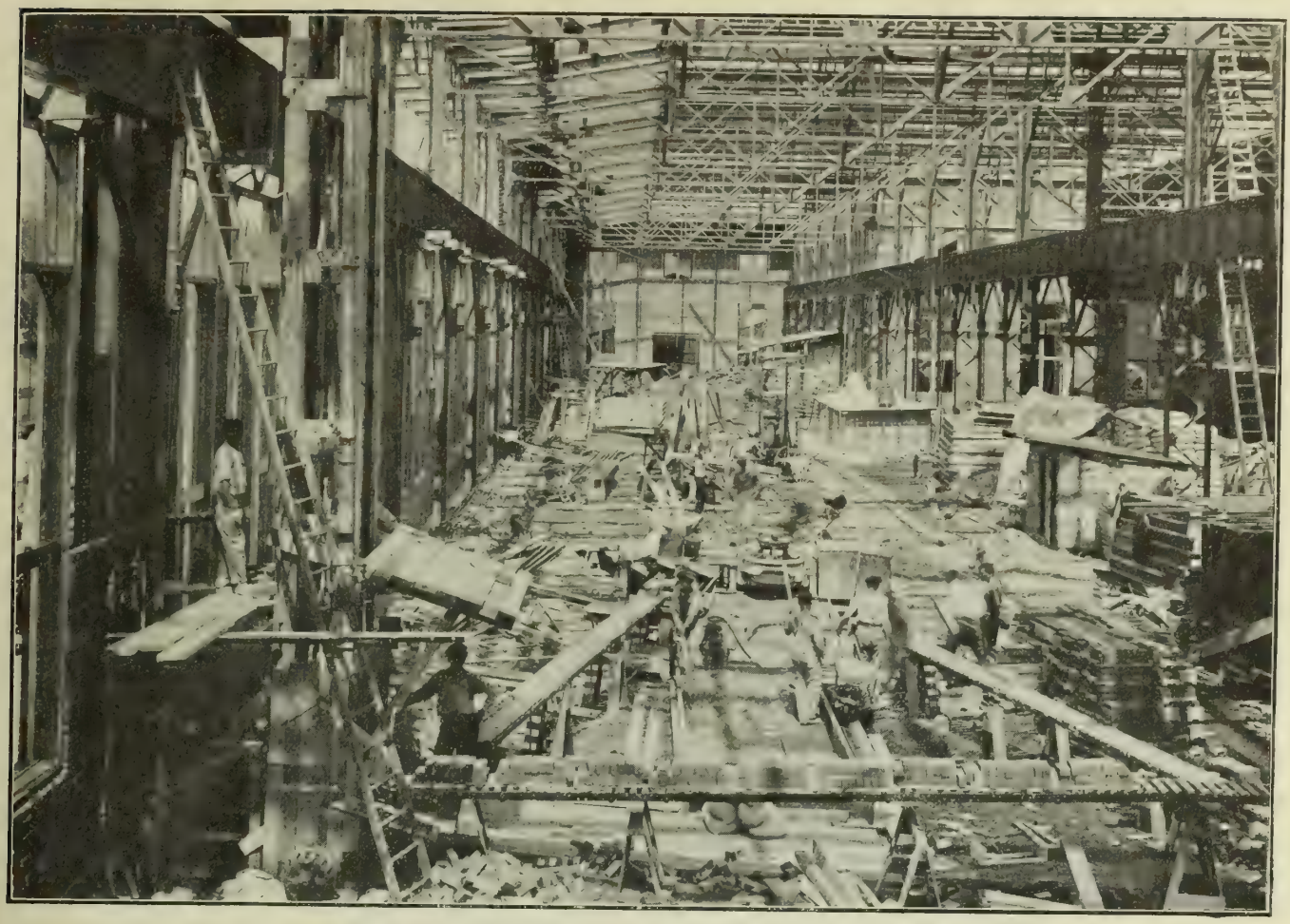


FIG. 1. ROLLER CONVEYORS FOR BRICK AND MORTAR AT THE FARRELL FOUNDRY, ANSONIA, CONN.
Distributing roller conveyor leads from far end of platform at left, out to the scaffold

right angles and coming to the foot of the elevator, 5 or 6 ft. below their starting point.

The elevator was of the endless-chain type, having protruding fingers on which the trays were placed. It was driven by a 3-hp. electric motor, the rise being 60 ft. The most economical speed for the elevator was found to be about 45 ft. per min., at which rate one elevator will supply 45,000 trays of brick or boxes of mortar per 8-hr. day.

The elevator lifted to a platform, which also served as the starting point for the roller carrier. The scaffolds

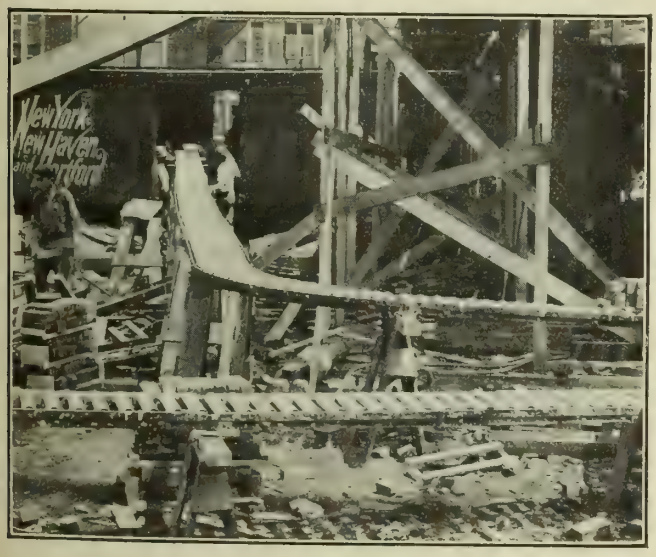


FIG. 2. ROLLER CONVEYOR UNLOADING CAR

employed were furnished by the Patent Scaffolding Co., of New York City, and the loading platform previously mentioned was raised by the same type of mechanism which operated the scaffolds. A man stationed on the platform lifted the trays from the elevator and set them on the conveyor, which ran at right angles after emerging from the building, and continued along a staging which was placed behind the masons. Men at the back of the scaffold transferred the trays from the carrier to the bricklayers' tables. The scaffold and the platform were maintained at the same elevation.

Mortar was handled conveniently and economically by this system, both on the ground and on the scaffold. The containers were made of No. 14-gage sheet iron with electrically welded joints, or of 7/8-in. board lined with zinc and holding a hodful (about 125 lb.). Wheelbarrows were entirely dispensed with on the Ansonia construction.

Chain Elevator vs. Hod Hoist

The chain type of elevator requires very little power, and costs for freight and installing are less than for an elevator of the platform type. Where the platform elevator is used it should always be under the direction of the brick foreman (and no one else), if speed and economy are the chief considerations. In constructing buildings 100 ft. or more in height a platform hoist appears to be a necessity. Every elevator, whether of platform or chain type, requires two men—one to load and one to unload. Intrusting these operations to the men who are wheeling materials is sure to cause delay and congestion, and is at all times an unsafe practice.

Newark Railway Terminal and Utilities Building

SYNOPSIS—Second article on the Newark street-railway terminal of the Public Service Ry. Design of transportation facilities on subway, elevated and exchange concourse floors. Construction to carry heavy moving loads under an office building. Typical office-floor arrangements.

The congestion of traffic at the intersection of the two main arteries of travel in Newark, N. J.—Broad and Market St.—and the plan to divert the street cars from this point to a double-deck exchange terminal for the several lines were described in *Engineering News* of Oct. 7, 1915. It is sufficient to note here that surface cars from the west are brought into a subsurface station through a short approach subway and those from the north, east and south come in from the rear to an elevated station. This is directly over the other, but an exchange concourse (at street level) is between them. The design of the terminal building from both a transportation and a structural standpoint is unusually interesting. The main entrance, shown in Fig. 1, is on Park Place, where there is a frontage of 184 ft. The main building extends back some 350 ft. to Pine St. and has entrance wings to East Park and North Canal St. Property is required east of Pine St. for elevated-track approaches, but this is not built on, except for a large single-story garage under the tracks. In the architectural treatment of the front large arches and a heavy marquise over the sidewalks have been employed to suggest the effect of a railroad station; but all deep reveals and heavy cornices which might collect dirt and ice have been avoided. This elevation will be finished in blue Indiana limestone. The rest of the building will be finished in buff brick. The front will be illuminated at night by projectors along the edge of the marquise.



FIG. 1. TERMINAL AND OFFICE BUILDING, PUBLIC SERVICE RY., PARK PLACE, NEWARK, N. J.

Street-Railway Facilities

The floor and track plans for the subway, concourse and elevated levels are shown in Fig. 2. The subway floor is 21 ft. below street curb; the platform and rails are at the same level. A single incoming track divides into two unloading tracks on the south side, each 280 ft. long and providing trackage for a total of 10 cars. These two tracks converge on a loop (50-ft. radius) and come back to three 225-ft. loading tracks on the north side. These in turn lead to the outgoing line of the subway. From the unloading side four stairways lead up and seven go down to the loading platforms. (The basement of the wing to East Park St. will be used for boiler and service plant; the North Canal St. wing will house the building superintendent, service shops and storage. Some spare room on the Park Place front will be used by the Public Service companies' mailing department, to which a chute and elevator deliver.)

The elevated transportation floor is similar in scheme, but reversed to bring the loading platform directly over the subway unloading side. There are two unloading tracks, 140 and 170 ft. long, and three for loading, 140, 180 and 190 ft. long. Between the concourse and elevated loading platforms there are six stairways, with five on the unloading side. On the elevated level in the East Park St. wing will be the service-plant coal-storage and conveying machinery, and in the North Canal St. wing will be the railway division offices and the employment bureau of all the companies.

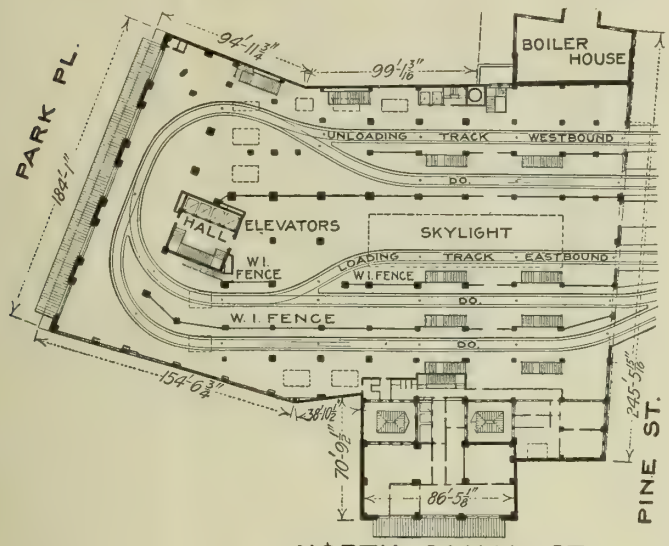
The street-level floor, besides serving as a concourse, with waiting and toilet rooms, information and parcel booths, soda and news stands and other renting space, will be used for the show rooms and order departments of the allied gas and electric companies. It is expected that this location will secure the maximum possible attention from these companies' patrons. The terminal station master and the railway instruction school will be quartered on this floor. Here also will be the coat rooms for an assembly hall above.

The main elevators rise from the front of the concourse, though there are smaller groups in the north and south wings. The main shaft rises through the elevated-track loop and does not extend below the street level. The arrangements for preventing interference between the railway crowds and the office people are seen from

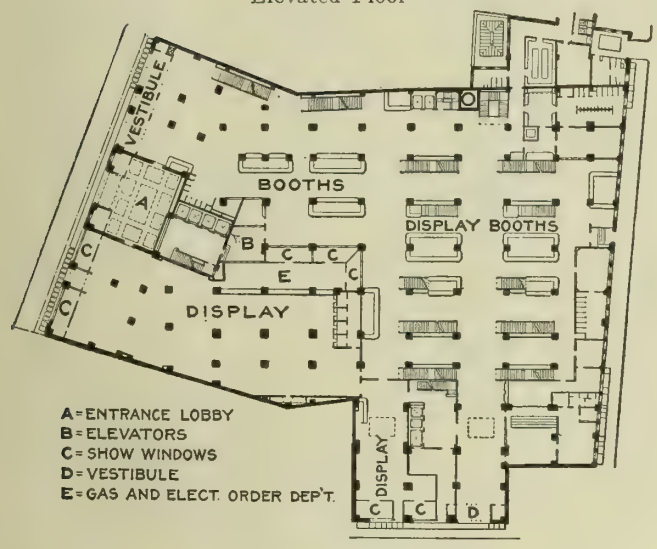
the concourse plan; yet the elevators are accessible to persons entering and leaving the concourse.

The floor space is divided thus (square feet):

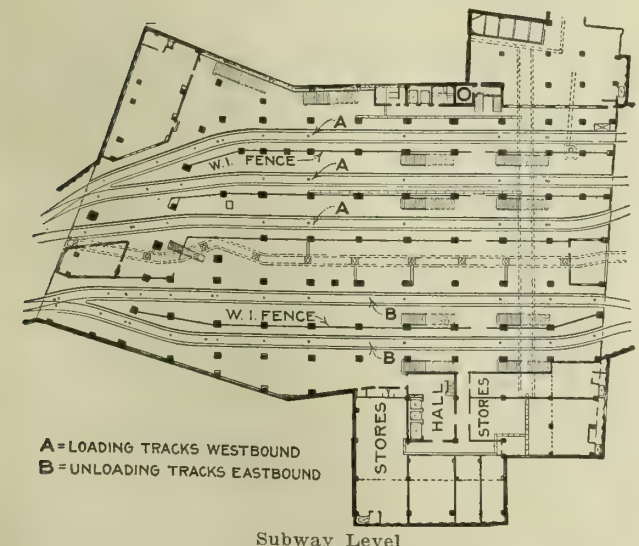
Subway	104,000
Concourse	70,000
Elevated	70,000
Six office floors	180,000
Kitchen and pent house	12,000
Total	436,000



Elevated Floor



Concourse Level



Subway Level

FIG. 2. FLOOR PLANS OF STREET-RAILWAY TERMINAL

The offices are to be used entirely by the Public Service Corporation and the operating railway, electric and gas companies.

Arrangement of Office Floors

Extending above the elevated-train floor are six office stories, each with 30,000 sq.ft. A typical floor (that of the railway company) is shown in Fig. 3. The peculiar shape is due partly to the property lines and partly to the necessity of securing a maximum amount of light and air. Each wing of the office structure is only two rooms deep, so that all offices will have outside windows.

The third story is to be used for the gas and electric companies' commercial-bookkeeping and complaint departments and the closely related offices. The fourth story will provide quarters for the treasurer of the holding corporation, the auditing departments of the gas and electric companies and a general assembly hall. In the fifth story will be the rest of the gas-company offices, the auditing department of the railway company and the publicity departments of all the companies. In the sixth story (Fig. 3) will be the offices of the railway company; in the seventh story will be the legal, claim, real-estate and welfare departments of the parent corporation,

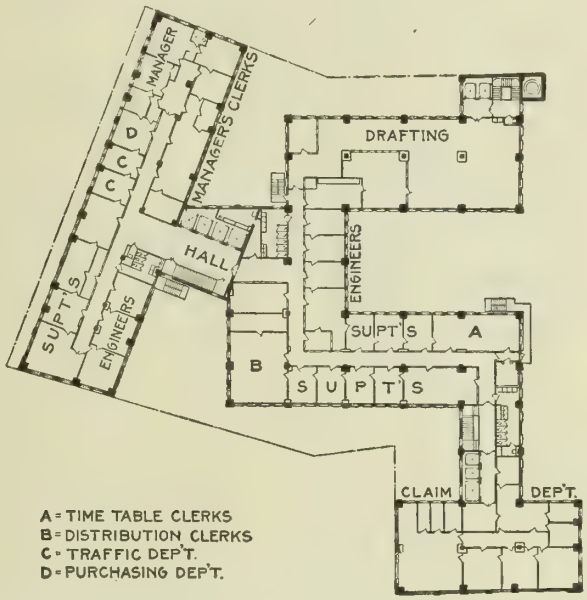


FIG. 3. RAILWAY OFFICE FLOOR, PUBLIC SERVICE TERMINAL BUILDING

the operating officers of the electric company and the law and technical library. The eighth story will be left for the executive offices, the general claim department and the officers' and employees' dining rooms. Over the eighth story will be the kitchen.

Foundations for the Structure

Because of the introduction of a railway terminal, with heavy moving loads, in a large office building, careful consideration was given to the foundations. Test borings for depth of foundations were made to bedrock at various locations over the site of the terminal and subway. The overlying material was fairly regular, and shale rock was found at approximately 55 ft. below the curb. A 15x15-ft. test pit was sunk to disclose the exact nature of the excavation and ground-water conditions.

The effect of traffic-produced vibration on the office structure and on neighboring buildings had to be con-

sidered. Two schemes of construction to avoid trouble were given consideration. One was to have a set of columns for the train floors and a separate set for the office building. The other plan was to use a single set of piers going down to bedrock and to carry the elevated-railway loads on a deep floor system supported by the building columns.

This second plan was adopted partly because the heavy floors would deaden the noise and reduce the vibration from the cars and partly because a single set of columns was very desirable in providing ample clearance for train operation. The foundation piers are from 6 to 12 ft. in diameter and were carried down to rock by air caissons. The building columns are carried on a grillage of steel I-beams as shown in Fig. 5.

The spoil removed in excavating for the foundations was loaded upon motor trucks and carried to a right-of-way which the railway company is building across the Newark Meadows. The contractors had a large fleet of these motor trucks, with a garage and repair shop, on the premises, during the earlier stages of construction.

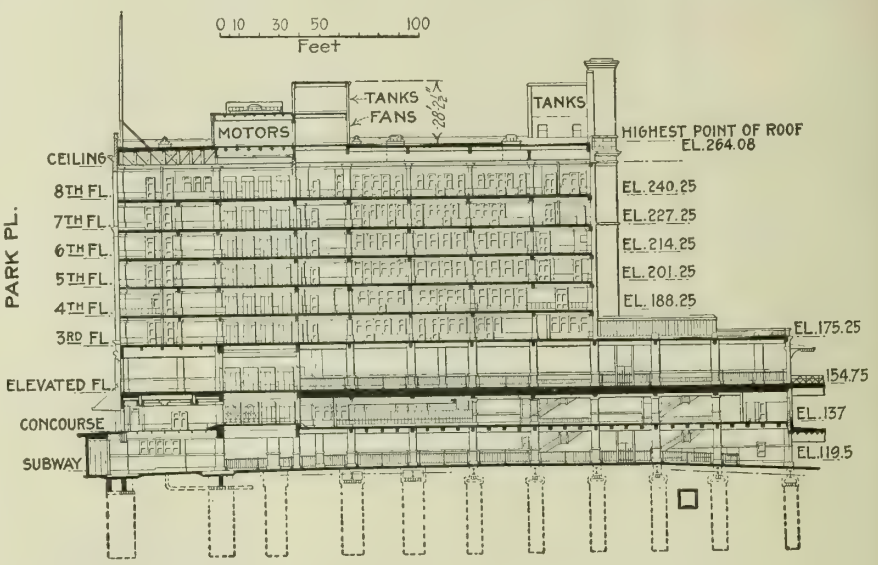


FIG. 4. SECTIONAL ELEVATION, PUBLIC SERVICE TERMINAL

Unique Waterproofing Completed

A continuous waterproof envelope has been put around the grillages and under the platforms and tracks of the entire building and subway to shut off ground-water contact. The waterproofing is unique in building construction because of its extent (500,000 sq.ft.) and because of its evident completeness. The same waterproofing has been employed under the elevated-station floor and approach track, toilets, blueprint rooms, kitchens, etc.

In general the system employed was the "Larutan" system, originated by Oscar Sheffield (Masonry Waterproofing Co., of Brooklyn, N. Y.). It was given severe tests before being specified by the railway engineers. The membrane is built up of a single layer of 1/8-in. bituminous sheets formed by dipping muslin in melted imported asphalt (kept at 225° F.). On this job two sheets lapped under water have been shown to cement perfectly. Great adhesion to concrete or grout deposited wet upon it was developed, due to the penetration of the asphalt.

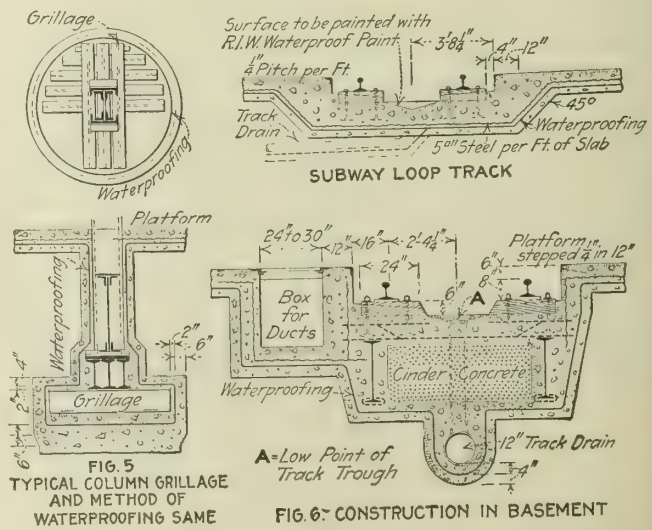
Steel Structure of the Terminal

The building as a steel structure has its greatest interest for the first three floors above the foundation. The office floors are of the usual type. There is in the upper structure, however, the somewhat unusual provision of a 5-ft. space between the roof and the ceiling of the upper floor. This serves as a pipe gallery for the heating system. The floor of this gallery is of reinforced cinder concrete suspended by structural-steel hangers from above and designed to carry a load of 45 lb. per sq.ft. In this gallery space at one place there is a heavy latticed truss from which a line of hanger members support the four floors below—to allow the auditorium in the fourth story to have a clear seating space.

The steel-frame members throughout the whole building have been given a proprietary anti-corrosive paint ("Tockolith"), selected for maintenance of concrete bond.

On the subway floor between the columns transversely and just above the grillages are built-up cross-girders (Fig. 5), and framed between these are stringers parallel to the track above (Fig. 6). The cross-girders rest directly on the grillages and are not joined to the columns, except by a loose-bolted steadying connection. Track live loads are figured for lines of 40-ton cars and 25% impact. The platform live-loads are 150 lb. per sq.ft. Between the stringers and ties is a reinforced-concrete slab as shown in Fig. 6. The passenger platforms, a 12-in. concrete slab, are carried by the fill between tracks, except for the relatively unimportant action of the cross-girders between columns. The platforms are reinforced only for shrinkage with a layer of expanded metal.

The cross-girders vary from 3 to 5 ft. in depth, according to the span. The stringers are 24-in. I-beams. The track-slab reinforcement (Fig. 6) is of 5/8-in. rods on 7½-in. centers, with every other rod bent up over a stringer. The upper reinforcement is of 5/8-in. rods on 15-in. centers. The ties are 6x8x26 in. spaced 24 in. c. to c. All these ties are treated.



FIGS. 5 AND 6. TYPICAL COLUMN GRILLAGE AND SUBWAY TRACK CONSTRUCTION

The construction for the subway loop is varied somewhat, since this is not in the main building but under the elevated approach. The short ties are used bolted to a concrete bed on earth and the waterproofing is carried under the track and floor.

The elevated railway-floor framing (designed for live loads of 100 lb. per sq.ft. up to 6 ft. from track centers and car lines of 40-ton cars with 50% impact) consists typically of 48-in. plate girders spanning 28 ft. between columns and 24-in. I-beams 4 ft. 8 in. apart. Above the floor framing are track stringers parallel to the rails. The track construction is very similar to that on the subway level, except that the ties (treated) are 5x8x27 in. and spaced 2 ft. c. to c. The passenger platforms are reinforced-concrete slabs resting on the floor-beams.

The elevated-approach structure between Mulberry and Pine St. is a steel frame with heavy concrete incasement. The space here over the subway loop and

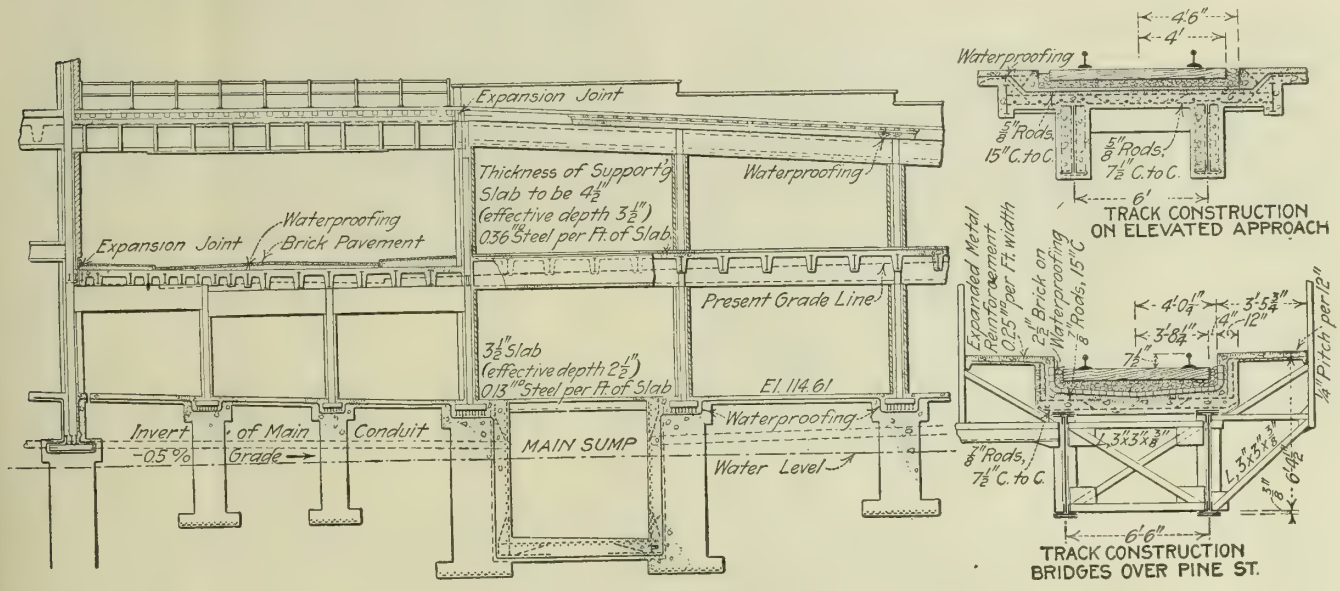


FIG. 7. PART OF ELEVATED APPROACH AND BRIDGES

under the elevated tracks is inclosed as a 45-car garage for companies' and officials' automobiles. Typical construction is shown in Fig. 7.

The trolley wires will be carried through the subway and on the two station floors by bar and hanger in a pine trough fastened to strong cross-pieces and iron hangers.

Roofs, Floors and Interior Finish

All the roofing will be of tarred felt, pitch and slag (or over the office section a wearing surface of ¼x3x6-in. slate will be substituted for the slag).

In the railway terminal the floors have a finish of 1:1 mortar, except that where there is heavy passenger exchanges the surface is 1:1:1 sand, cement and carborundum, treated to prevent dusting.

Only the first three floors are concrete slabs; above is hollow tile (Burchartz two-way system) with 6 to 8 in. of cinder concrete in which floor sleepers are embedded. Most offices have finished floors of 1⅛x2½-in. quarter-sawed Georgia pine. Cork tile on the cinder concrete is to be used in the kitchens, libraries and assembly room. The main executive offices have oak floors.

Marble mosaic floors are used for the entrance lobby, important public spaces on the office floors and in the officers' dining room. Terraza floors are specified for the entire concourse, elevator and stair halls and employees' dining room. The main entrance lobby, elevator hall and concourse will have marble trim. The office-section trim will be quartered oak.

Light, Heat and Other Services

The building will be equipped for illumination by both gas and electricity (combination fixtures). The gas supply comes to an 8-in. header in the North Canal St. basement, from which 4-in. risers supply the various floors. Current will be brought in at high-tension and transformed for a 110- and 220-volt single-phase 60-cycle three-wire system. For power there will be 550-volt direct-current lines. The building feeders will start at a main switchboard and run through a transverse tunnel below the subway level to three electric shafts which have service panels at the several floors. The floor wiring is to be installed in rigid conduits embedded in the concrete fill.

There will be a complete system of call bells, annunciators, telephones, fire-alarms, watchman recorders and electric clocks. In the switchboard room (basement) two small motor-generator sets will step down direct current from 550 volts to 30 to supply the watchman's clocks, fire-alarm boxes, bells, signals, etc. An operating room for the telephone service of the whole building will be provided on the fifth floor.

For heating there are five 6x19-ft. return-tube firebox-type boilers, each capable of carrying 16,600 sq.ft. of radiation. A vacuum system will be employed with the distributing mains in the roof space and risers feeding downward. The returns will be collected in the ceiling of the subway and run to the boiler room. This arrangement is made necessary on account of the lack of ceiling space in the railway floors. Two 20-hp. motor-driven vacuum pumps will be used.

Parts of the concourse floor and all of the larger offices, bookkeeping and drafting rooms, etc., will be mechanically ventilated with washed and tempered air. For this there are two separate plants. One with two supply and two exhaust fans, handling 35,000 cu.ft. of air, is in the basement boiler room and distributes to four floors above

the basement. The second air-washing plant, with two supply and three vent fans, handling 40,000 cu.ft. of air, is in a pent house above the roof and distributes downward to four floors. All fans are motor driven.

Drainage water from the subway and such parts of the terminal as are below street grade is collected in a main sump under the subway loop and is discharged by two centrifugal pumps each having a capacity of 400 gal. per min. and driven by a 7½-hp. motor. Sewage from low levels of the building goes to a separate sump and is lifted 35 ft. into the city sewers by three air ejectors, each of 150 gal. per min. capacity and all supplied from two motor-driven compressors.

The water-supply is taken from the city low-pressure main to the boiler room, whence it is distributed. Automatic motor-driven force pumps (two 6x8-in. triplex, 150-gal. units, with 7½-hp. motors) supply three 10,000-gal. cross-connected tanks on the roof. These tanks are connected to the city high-pressure fire service. From the tanks 2½-in. down-supply lines run to various parts of the building, including the fire-hose outlets. A 5-in. line comes down to a hot-water heating tank and boiler. The hot water is circulated by two triplex 150-gal. pumps giving 70 lb. pressure. Cooled drinking water is supplied to fountains throughout the building.

There are three sets of elevators serving the office floors. The main group is near the Park Place entrance, and here are three having a capacity of 4,000 lb. at 450 ft. per min. and one of 4,500-lb. capacity. Near the East Park St. entrance are two of 3,000-lb. capacity at 450 ft. per min. Near the North Canal St. entrance are two of 3,000-lb. capacity and one of 5,000-lb. capacity at 450 ft. per min. (9,000 lb. at slow speed).

Engineering Work

The engineering required for this terminal project was unusually extensive. It was decided to organize a special force to prepare the plans and specifications, and this organization was made an expansion of the railway-engineering department under the engineer of maintenance of way and with an assistant engineer devoting all of his time to the terminal. The special force included an architect, also track, structural, heating and ventilating and electrical engineers, besides the consulting engineers and consulting architects.

Plans and specifications were completed before any tenders were asked. All equipment, such as lighting and heating, was detailed down to the size and location of pipes and conduits. Even the location of each telephone was fixed. Nothing was left to the contractors to assume. The advisability of going to the time and expense of such completeness was indicated by the slight variation in the contractors' proposals for the superstructure. Proposals were made by eleven contractors, and there was only about 10% difference between the lowest and highest bid. Three of the lowest proposals varied only 1.8%. The total cost of real estate, building and financing is approximately is $5,500,000. The 1,000-ft. subway cost approximately $350,000 more. Various expenditures are not included in these figures—such as the necessary rerouting of tracks elsewhere in the city, as noted in *Engineering News* of Oct. 7, 1915. The excavation amounted to 100,000 cu.yd.; concrete, 92,000 cu.yd., and steelwork, 9,000 tons.

As explained more in detail in a previous article, the general scheme of a railway terminal and the double-decked arrangement employed were the ideas of T. N. McCarter, president of the Public Service Corporation and of the allied railway, gas and electric companies. The project has been under the general supervision of Martin Schreiber as Engineer of Maintenance of Way for the Public Service Ry. C. F. Bedwell has been the engineer in charge. Jacobs & Davies were the consulting engineers on the subway and foundations and George B. Post & Sons were consulting architects.

The contract for the subway, the building excavation and the foundations was let to the Holbrook, Cabot & Rollins Corporation, of New York City. The superstructure and remaining work were awarded to the Hedden Construction Co., of New York. The Hay Foundry and Iron Works, of Newark, was the subcontractor for the steelwork covered by both main contracts. The steel erection was finished Sept. 23. Six floors were completed Oct. 15.

Laying New Rails on Old Ties Embedded in Concrete

The United Railways Co., of St. Louis, Mo., has completed the reconstruction of its tracks on Olive St., between 14th St. and Pendleton Ave. The old tracks were laid early in 1906 and were constructed with 9-in. 112-lb. girder rails of the Trilby type, in which the guard side of the groove is extended to form a bearing for wheels of street vehicles. The rails were supported upon cypress ties 24 in. c. to c. and fastened with ordinary hook-head spikes, $5\frac{1}{2}x\frac{9}{16}$ in. Brace tie-plates on alternate ties and ⅞-in. round iron tie-rods placed 6 ft. apart were used to hold the rails to gage. The rail joints were of the cast-welded type, 14 in. long and weighing 270 lb. per joint. The cypress ties were completely surrounded by concrete, which extended 6 in. below the bottom of the ties and 3 in. beyond their ends. The top of the concrete was 2 in. above the top of the ties where the tracks were paved with granite blocks and 4 in. higher where they were paved with asphalt.

At the time this track was laid it was estimated that the concrete type of foundation would outlast several sets of rails and that a new set of rails could be laid upon the old ties when the first set had become worn out. This was based on the theory that the ties would be preserved by the concrete and protected against mechanical wear under the rails by the steel tie-plates. After more than nine years' heavy service the first rails were worn out and it was necessary to lay new ones. Test excavation showed that the foundation was in good condition, so it was decided to lay the new rails on the old ties as originally planned.

When the reconstruction work was started it was found that the concrete had not been damaged and that the ties were wet and in excellent condition, free from rot and uninjured by mechanical wear. None of these ties had been treated with preservative, and their soundness is due probably to the fact that they remained wet and were free from alternating wetting and drying or freezing and thawing.

The new rails are of the same type, 9 in. high and weighing 132 lb. per yd. The rail section is heavily

reinforced at points where the old rails had been found weak, and it is thought that at least 15 years' service can be secured. About 500 ft. of track was laid with 100-lb. T-rail of the A. R. A. section, in order to demonstrate its wearing quality.

The rails were fastened to the old ties by means of 1¼-in. screw spikes 6 in. long, driven by means of a portable electric machine. Spike holes of ¾-in. diam-

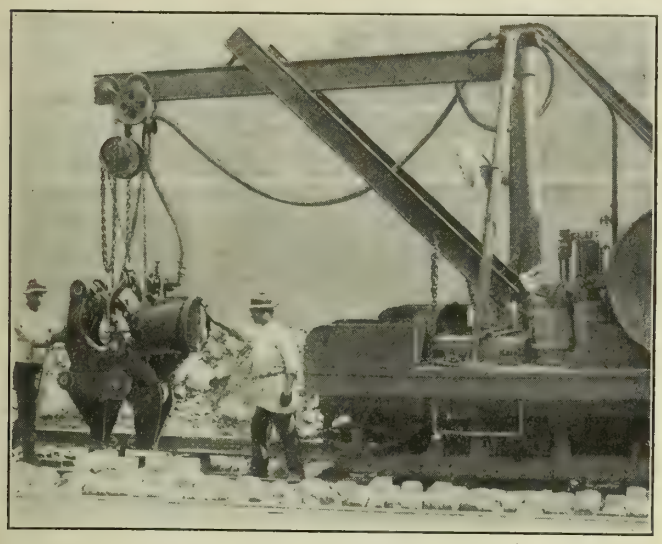


FIG. 1. RIVETING RAIL JOINTS, ST. LOUIS TRACK RECONSTRUCTION

eter were bored in the ties by a similar machine. The ties are protected against mechanical wear by flat tie-plates ½ in. thick, but varying in thickness whenever necessary to bring the new rails to a perfect surface. Tie-rods ⅞ in. diameter were placed 6 ft. apart to assist in holding the rails to gage.

The Nichol rail joint was used. It consisted of a pair of splice bars ½ in. thick and 32 in. long, riveted flat against the web of the rail with 1-in. rivets. The riveter is shown in Fig. 1. The rail ends were cleaned by sand-blasting before the bars were placed. These bars fit loosely around the base and under the head of the rail, and when they were in place molten zinc was poured to fill the spaces and make a solid joint.

The screw spikes were designed and made especially for this railway, and it requires between three and four times as much power to draw one from a cypress tie as it takes to draw the ordinary $\frac{5}{8}$x$\frac{9}{16}$-in. hook-head spike. This holding power was shown at several points where screw spikes had been used on repair work, as the spikes pulled the cypress ties entirely out of the concrete when the old rail was lifted up with track jacks. The difficulty of locating the few screw spikes installed and the extra cost of removing the rail by unscrewing the spikes made it advantageous to pull up these ties. It was also considered advisable to remove these ties at this time, as for each tie there were two hook-head spike holes and two screw-spike holes. Very little damage was done to the concrete foundations by removing the ties in this manner.

The cypress ties thus removed were replaced with 7-ft. lengths of old 6-in. girder rail, which were attached to the track rails by ⅞-in. T-head bolts and rail clips. To expose the old cypress ties so that the new rails and tie plates could be laid, the rails were lifted by heavy track jacks and the old concrete was removed by concrete picks for a width of about 9 in. on each side of the old rails. Very little adzing was necessary to prepare the ties for the new tie-plates.

The new tracks were paved with granite blocks taken from the old tracks and redressed so as to give a very smooth surface. The size of the granite blocks was greatly reduced by the redressing. The blocks are held in place by a grouting of cement and sand, which also protects the edges of the blocks from breaking and becoming rounded, so that a very smooth pavement can be constructed and maintained.

Although weather conditions were unfavorable, approximately 6 mi. of track was reconstructed in five weeks. During this work the cars were removed from one track at a time and rerouted over other tracks. No cars were run over the track during the first eight days after the new concrete was placed along the rail. Fig.



FIG. 2. OLIVE ST. TRACK, ST. LOUIS, UNDER RECONSTRUCTION

One track is in service and the other is given over to the reconstruction work

2 shows the work in progress on one track, with the other track in service. The men are removing the old rails by means of track jacks, the rails being sawn apart between the welded joints.

The reconstruction work was under the direction of C. L. Hawkins, Engineer of Maintenance-of-Way of the United Railways Co.

The Hottest Region in the United States is Death Valley, in southeastern California, according to G. H. Wilson, district forecaster, San Francisco. The highest shade temperature ever recorded anywhere in the open air with standard instruments and under improved methods of exposure was recorded at Greenland Ranch, on the edge of Death Valley, on July 19, 1913, when the thermometer registered 134 deg. F. A remarkable record of high shade temperature occurred July 8 to 14 of that year, the daily maxima being as follows: 128 deg., 129, 134, 129, 130, 131, 127. During this period the temperature never fell below 85 deg. The Greenland Ranch of the Pacific Coast Borax Co. is located, very appropriately, on Furnace Creek. It is 178 ft. below sea level, but somewhat higher than the main floor of the valley. The shelter for the instruments of the coöperative Weather Bureau station is not exposed to the reflected heat from the desert.

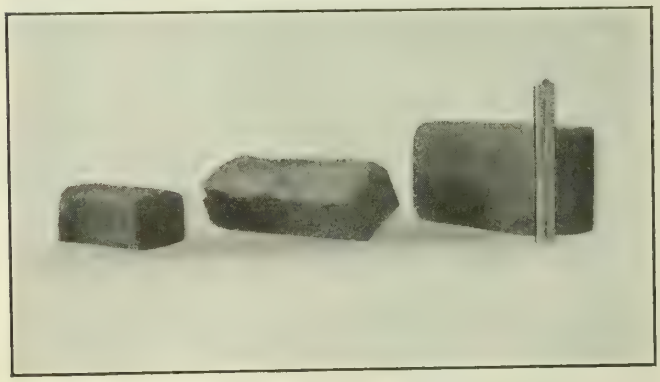
Field and Office

Brick Pavement Lasted 24 Yr.; New Pavement Also Brick

By H. K. Higgins*

The three bricks shown in the accompanying view were taken from Main St., Jackson, Mich., after a useful life of 24 yr. The largest brick was near the gutter at a point of minimum wear and shows the original glaze on all sides and corners. It has a vertical dimension of 4¼ in. The smaller ones were procured from near the middle of the street and are typical of a large fraction of the old bricks. The vertical dimension has been worn from 4¼ down to 1⅝ in.

The foundation for this pavement was a layer of inferior brick, laid flat, parallel to the axis of the street. A 1-in. sand cushion separated the two layers of brick. The filler was sand. Under the standard rattler test three



PAVING BRICK AFTER 24 YEARS' USE

runs with the surface or paving brick showed losses of 31.3%, 23.99% and 20.25%. As these tests were made on worn-out brick, it will be seen that the quality was good. The foundation course proved softer, losing 37%.

The new pavement which is being laid to replace the pictured bricks is also of brick, but of more modern pattern—the Hocking wire-cut lug.

The foundation is a concrete base 6 in. thick laid on the rolled subgrade and allowed to set hard. Portland cement with washed sand and gravel, 1:3:5, in a very wet mix, was used. A very solid base resulted. The concrete was mixed in a Koehring machine fitted with elevating hopper and bottom-dumping bucket on a horizontal boom. The hopper hoist and bucket traverse were fitted with automatic stops, which effectively prevented the usual overrun accidents.

The cushion was sand, 1½ in. deep, rolled and shaped to crown with a templet or "strike."

The bricks were laid, rolled by a 6-ton steam roller, culled, turned and rolled again.

The filler or grout was composed of equal parts cement and sand in a very liquid mix. It was mixed in a Hall mixer, two of which were constantly used. Contrary to the writer's expectation, the machine-mixed grout was in every way greatly superior to hand-mixed.

The prices bid on this work ranged from $1.94 up to $2.30 or more for brick, about 33% higher for creosoted lug block or sheet asphalt and about 12% less than brick for asphaltic concrete.

The street on which the old and new brick were laid is 62 ft. wide from curb to curb and half a mile long. On it is a double-track street railway, with two Y's and three branch-offs. The 100-lb. Am. Soc. C. E. rails of this track are laid on oak ties on an 8-in. concrete slab. The cars of the four interurban lines using the tracks were run during the whole repaving job, with never more than a few minutes' delay.

The contractor for the repaving work was W. H. Ryan, Lansing, Mich. The writer was in direct charge of the new work under City Engineer A. W. D. Hall and City Manager G. C. Cummin.

Trench Spoil Moved Cheaply by Tractor-Trailer Trains

Handling excavated material by small tractor and trailer trains was a feature of the recent construction of a large trench for a pipe subway at the Chicago Stock Yards. This method utilized the equipment of tractors and small trailer carts employed in conveying manure, supplies, etc. The tractors also haul wagons, as well as the small carts. The trench was 2,500 ft. long, 6 ft. wide and averaged 7 ft. in depth. It will contain a 15-in. steam main, a 6-in. return pipe and 20 conduits for electric power and telephone lines.

Cars Lowered Into Trench

The excavation was done by hand, owing to the numerous railway tracks crossing the trench. For the upper part the material was shoveled into the carts on the surface, but as the trench got deeper the carts were picked

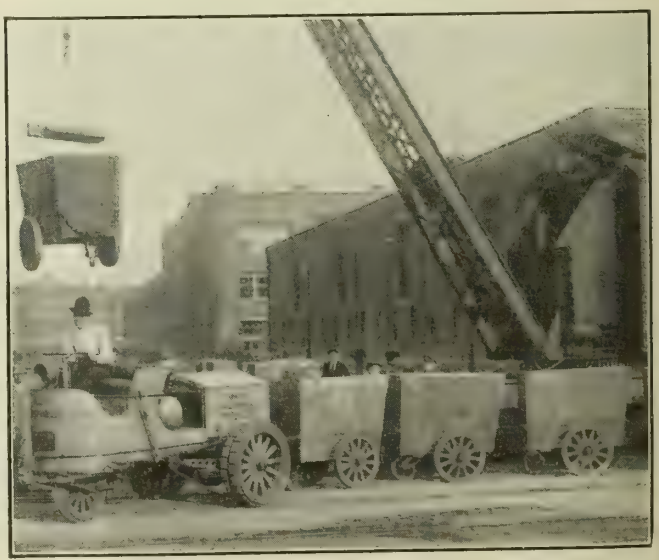


FIG. 1. REMOVING MATERIAL FROM A TRENCH BY TRACTOR AND CART-TRAIN

The crane handles the carts in and out of the trench

*209 McBride St., Jackson, Mich

up by a locomotive crane and lowered into the trench. The loaded cars were hoisted out and placed in the street in the same way. Steel sheetpiling was driven to hold the sides of the excavation. Fig. 1 shows a tractor and train, with one of the carts being hoisted by the crane. The cart is held in wire slings, with plank stretchers.

The carts are of wood, with a capacity of 1.2 cu.yd., mounted on two side wheels and a small caster wheel under the front end. All the wheels have roller bearings. Very little load comes on the casters, and with carts in trains these small wheels are largely clear of the ground. About 500 of these carts are in use at the stockyards. For the trench work, trains of 10 carts (12 cu.yd.) were employed, hauled by gasoline tractors. Special triangular chain couplings are used, which insure accurate tracking, so that the trailers pass curves and turn sharp 90° corners without difficulty, or even make double right-angle turns. The three-wheel gasoline tractors weigh about 5,800 lb.

Dumping Machine Empties the Carts

The excavated material was used to fill low ground at the yards, and a dumping machine was built to handle the carts. This is shown in Fig. 2. It consists of a timber tower with a tilting platform at the base. Cables hitched to the free end of the platform are led to over-



FIG. 2. ELECTRICALLY OPERATED DUMPING TOWER

head blocks and thence to an electric hoist at the side of the tower. The machine can propel itself on planks as the filling advances. Plank runways are laid where the trailer trains run on soft ground.

The tractor on delivering a loaded train at the dump picked up an empty train for return. The men at the dump backed each cart in turn onto the platform, two pairs of angle irons forming guide grooves for the wheels. The rear end of the cart ran against a stop, and horizontal angles projecting over the wheels held it in place. The platform was then tilted by the cables, the arrangement being such that with heavy or sticky material the cart could be completely inverted, while the platform could be jarred to shake all material out of the cart.

Speed and Cheapness the Features

Rapid removal of the excavated material was necessary, as much of the work was in Exchange Ave., a main thoroughfare having very heavy traffic. With wagons and teams the progress would have been slow because of interference with traffic. The following comparative estimate of cost of hauling the material by tractors and trailers and by teams on another similar piece of work (4,000 cu.yd.) was prepared by R. L. Vaniman, the engineer in charge:

There were 270 cu.yd. of material moved daily. Nine wagons and teams were required, each hauling loads of 2 cu.yd. and making 15 trips per day. At $5.50 each, the total daily cost for hauling was $49.50, or 18.3c. per cu.yd. One tractor with a driver and helper cost about $12 per day (including wages, gasoline, oil and allowance for depreciation, interest and machine maintenance). By this method the cost per cubic yard was only 4.5c., a saving of 13.8c.

The trench work described in the foregoing was done by day labor under the direction of George W. Hegel, Engineer for the Union Stock Yards and Transit Co. The tractors are of the Bulley type (of which five are in regular use at the yards), built by the Mercury Manufacturing Co., of Chicago. The same company designed the dumping plant and the couplings for the carts.

Chicago & Northwestern Ry. Valuation Work

The roads of the Northwestern Railway System, consisting of the Chicago & Northwestern Ry. (and its subsidiary lines) and the Chicago, St. Paul, Minneapolis & Omaha Ry., are now actively engaged in the valuation of their property. In compliance with the orders issued by the Interstate Commerce Commission, and in anticipation of its inspections, the Northwestern System is conducting field surveys and investigating its records. It is also collecting and compiling as complete a statement as it is possible to make from these sources of the extent, character, cost, etc., of its physical property and the way in which it was constructed. The work is taken up by states and divisions, and the plan of procedure is to complete entirely a section of its road at a time. The valuation work is under the control of a Valuation Committee on each of the two roads.

Fieldwork for Valuation

The engineering features of the valuation work on both roads are under the direction of George W. Hand, Valuation Engineer. The force engaged in the work consists of 60 men on the Chicago & Northwestern Ry. and 18 on the Chicago, St. Paul, Minneapolis & Omaha. There are three parties in the field—two on the former and one on the latter road. Each field party is in the charge of an assistant engineer who has had several years' experience in responsible charge of construction and maintenance work. He is required to examine personally the character of the materials of which the road is constructed and to study and record all the conditions which would have effect in determining the cost of construction.

Under each assistant engineer there are three instrumentmen. One of these carries on the work of chaining the track and inventorying the main-line items (including rails, track, etc.). He is assisted by three helpers, recorder, rodman and tapeman. Another carries on the level work and is assisted by two helpers, rodman and tapeman. The third inventories the property at station grounds, consisting of buildings and sidings, and he is assisted by two helpers, rodman and tapeman.

A complete set of levels is being run, so that the company will be able to make a system of profiles of its entire lines, all of which will be referred to the same datum. For the purpose of computing grading quantities, or verifying original records, cross-sections are taken at all points where cross-sections could not be constructed from information already available. A complete inventory of all materials, such as rails, ties, fences, buildings, bridges and the like, is made as the survey progresses. The location of land lines is ascertained or verified where already a matter of record. Special effort is made to develop all visible evidences of hidden quantities.

The original chaining is followed as far as possible, so as to perpetuate the relation between existing records and the present condition. Another purpose is to show comprehensively the relation of the property as originally constructed to the present property, which has been affected by changes of alignment, reduction of curvature, grade changes and all the other modifications which have taken place since the road was first built.

On the Chicago & Northwestern Ry. an inspection of interlocking and signal apparatus is being made by a special and independent party, although certain information relative to the location of the signal apparatus is taken by the regular chaining and inventorying party. On the Chicago, St. Paul, Minneapolis & Omaha Ry. all this information is taken by the main-line inventory party, in which there is an extra man who is especially assigned to inventorying the signal apparatus.

MAIN TRACK—1—TIES. Division NORTHERN IOWA File No. 2-23 6-1

Station LINN GROVE Year Reported 1914 Date Compl. 1912 Order No. G.M. 12042
Sub-Division 21 Vol. and Page 2-372 Date Insp. Aug. 1913 Est. No.
Section 2
REMARKS: Use separate card for each track.

Beginning	Ending	Lin. Feet Track	Lin. Ft. Switches	Lin. Ft. Bridges	Lin. Feet Track Ties	Tang. or Curve	No. Ties Per 100 Ft.	Kind	Total Number	Kegs Spikes
9154-63	9160-96	754	121		633	Tang.	56	Cedar	354	5.00
9160-96	9162-14	97		91	6	"	56	"	4	.99
MILE 174										
9163-14	9164-00	86			86	Tang.	54	Cedar	46	.51
9164-00	9169-65	565			565	Curve	28	Oak	158	1.76

MAIN LINE ROADBED—2. Division EASTERN File No. 6-7 3-2

Station BRAINARD Year Reported 1909-14
Sub Division 10 . Sec. 8 Vol. and Page 1-311 3-225
REMARKS. No. Tracks 1
Width Roadbed—Cuts 24'
" " —Fills 16'

CUTS AND FILLS Beginning	Ending	Roadbed, Highway, Ditch, Etc.	Embankment Cu. Yds.	CUBIC YARDS EXCAVATION Earth	Loose Rock	Solid Rock	Cubic yards Overhaul
1831-55	1832-00	R. B.	70				
1848-22	1981-56	R. B.	57494				
1856-00	1868-25	Channel Change		1667			
1877-25		Hy. Xing	142				
1981-56	1995-62	R. B.		6577	255	36	
1991-50	1977-70	Overhaul					22000
1991-50	2004-50	"					4000
1981-56	1995-62	Ditch		55			

MAIN TRACK—3—RAIL. DIVISION SIOUX CITY File No. 1-5 8-2

Station STRATFORD Year Reported 1913 Date Compl. 1910 Order No. V.P. 741
Subdivision 24 Vol. and Page 1-278 Date Insp. July 1913 Est. No.
Section 5
REMARKS If more than one track use a card for each track, and state which track.

Beginning	Ending	Wt. Rail	Rail Lgth	Date Laid	Lin. Ft. Track	ANGLE BARS No. Pairs	No. Holes	No. Base Plates	No. Tie Plates	No. Rail Braces	Anti-Rail Creepers
4536-90	4537-08	60#	30'	1892	18	1	4				
4537-08	4561-48	72#	30'	1904	2440	166	4	166	1237	133	20
MILE 87											
4561-48	4571-00	80#	30'	1908	952	65	4	65	427	65	
4571-00	4572-00	80#	30'	1908	22)	294	4	294	2236	(Equation)	156
4572-00	4614-87	80#	30'	1908	4287)						

FIG. 1. MAIN-TRACK VALUATION-RECORD INDEX CARDS; CHICAGO & NORTHWESTERN RY.

Only the headings and first entries of the cards are shown. Each card

Camp Trains and Headquarters

Each field party is housed and boarded in a camp train consisting of two cars—a diner and a sleeper. A cook and a helper are in charge of each camp outfit. The cars are hauled from place to place in passenger trains and set out on sidings and at stations convenient to the work. Supplies are obtained from Chicago and also from local sources. Such food supplies as can be kept on hand in bulk are furnished from Chicago; and such foodstuffs as milk, eggs, fresh fruits and vegetables are obtained from the nearest local source of supply. Ice and fuel are supplied from the most available source.

The diner is a made-over dining-car. The original dining room is divided into three parts. The end next to the kitchen is used for the dining-room and in the middle of the car a room is partitioned off for a sleeping room for the cook and helper. The remainder of the car is used as a field office for the assistant engineer. The sleeping-car is a made-over mail car. The middle is used for the sleeping room, which contains sanitary steel cots for the accommodation of 12 persons. There is a dressing-room at one end of the car, with a toilet and washroom adjacent. The other end of the car is used as an office and living room. Both cars have stoves and heaters and the usual steam coils for use when the cars are coupled to trains. The cars are lighted by oil lamps.

Field Books and Office Records

In this survey ordinary field books are used, no loose-leaf books being employed. The field books are made up in sets, so that each set forms a complete record of existing conditions. One book contains the record of the chaining and location of main-line items; others contain the records of bridges, signals, sidings and buildings. All books are properly cross-referenced and arranged so that when future changes are made additional notes therefor can be taken and the books kept intact.

In the office, maps and profiles are being made new, or existing maps and profiles are being corrected where possible from these field notes. The information contained in the field books is also collected and entered on a comprehensive card-index system of records (see Figs. 1 and 2). This system serves not only for the valuation work, but for a permanent record for the railway company's general purposes. Existing maps and profiles that are drawn to proper scale and are capable of being reproduced are corrected and lithographed. Otherwise new maps and profiles are made.

SIDINGS. #2 Division WEST IOWA File No. 1-139 19 -2

Station COUNCIL BLUFFS Year Reported 1907-15 Date Compl. 1914 Order No. GMO. 1332
Sub-Division 15 Vol. and Page 1-235 4-55 Date Insp. Nov. 1914 Est. No.
Section 22 Map Corrected 1915 Total Length 3067'

REMARKS: 0-00 = 31-19 on Track # 1
30-67 = 0-00 of Track # 4

TRACK

From	To	Wt.	Lineal Ft.	No. Prs. A. B.	No. B. P.	Rail Braces	Tie Plates
0-00	7-50	80#	750	47-26"	47	35	
7-50	19-70	72#	1220	83-26"	83		435
19-70	23-50	60#	380	28-24"		67	158
23-50	25-00	72#	150	10-26"	10		
25-00	27-90	80#	290	18-26"	18		98
27-90	30-67	90#	277	17-26"	17	42	145

BOLTS

Size	No. Kegs	Nut Locks, No. Boxes	Spikes, No. Kegs
7/8"	1.923	.327	22.15
3/4"	1.911	.483	

TIES

Kind	Ft. Trk.	Spacing	No.
Cedar	2666	65:100'	1733
Switch	150		99

2 Sets #8 = 4104 Ft. B.M.

GRADING

Items	Amount
Earth Excav.	
S Rock "	
L. " "	
Earth Embk.	1735
Overhaul	

FROGS AND SWITCHES

Stand	Switch	Frog No.	Kind	Wt.
Odenkirk	Split	#8	Rigid	80#
"	"	#8	"	90#

2 Switch Lamps

BALLAST

Kind	Lin. Ft.	Depth	Width
Gravel	3067	12"	10'

2454 Cubic Yards

CLEARING Acres | GRUBBING Sq. Rods

RAILROAD CROSSINGS

Angle	Kind	Length	No.	Wt.
65°		13'3"	1	72#

Derails: 1-Hayes P.Con.

Bumping Post

BRIDGES. Division MINNESOTA Bridge No. 237 File No. 8-25 13

Station MANKATO Year Reported 1914 Date Compl. Sept. 1913 Order No. GMO. 12768
Sub-Division 12 Vol. and Page 3-22 Date Insp. June 1914 Est. No.
Section 25 Map Corrected 1915

REMARKS: Minnesota River

DRAWING NUMBERS

Location	Type	No. Spans	Total Length	Height	Grade + or −	Alignment	No. Tracks	Loading Specification	
1853-72	T. R. T.	2	363'6"	26'	0.00	Tang.	1	Coopers	E-55
	D. P. G.	2							

Kind of Spans	Length of Span	No. of Spans	Total Weight	No. of Panels	Floor Beams Kind	Floor Beams Size	STRINGERS No.	STRINGERS Kind	STRINGERS Size	Date Built	Kind of Floor
T.R.S.	121'6"	2	600657#								
D.P.G.	60'0"	2	117894#		Standard		1910	Type Deck		1913	Open

ABUTMENTS

Piling, Lin. Ft.	Grillage, Ft. B. M.	Ht.	Kind	Cubic Yards	Date Built
1043		19'	Masonry	537	1913
			Concrete	75	

PIERS

No.	Ht.	Kind	Cu. Yds.	Piling	Grillage
2	19'	Concrete	354	767	

FIG. 2. VALUATION-RECORD INDEX CARD FOR SIDINGS AND BRIDGES: CHICAGO & NORTHWESTERN RY.

is 5x8 in. The first two columns give the chaining, showing the location

Copies of existing maps are furnished to the field parties, together with copies of the standards required, so that they can readily see what additional information is necessary to make the maps and profiles adequate for the purpose, and also check them.

While all this valuation work is independent of the ordinary work of the engineering department, every effort is being made to adapt as far as possible the information thus obtained to the general purposes of the department. Thus, the plans and profiles are made in continuous rolls for filing as permanent records, although they are also prepared for reproduction in sheets.

Panama-Pacific Wells Sand Up; How Trouble Was Cured

Five 70- to 87-ft. wells were drilled to provide adequate water-supply for the Panama-Pacific International Exposition. These were in addition to an infiltration sump which yielded 350,000 gal. per day. This sump, located in Golden Gate Park, had been so expensive to construct that the well-sinking was decided upon, in spite of the fact that earlier wells in this same territory had been abandoned on account of inability to keep out sand.

In sinking these five wells there were employed a 20-in. outside casing and an inside casing 16 in. in diameter. Both casings were perforated with slots having $\frac{1}{16}$-in. openings. The annular space between casings was filled with gravel ranging in size from rice to pea. The material encountered was a fine beach sand having an effective size of 0.18 mm. and a uniformity coefficient of 1.55. The total yield was expected to be 650,000 gal. per day for the five wells. This work is described in the October *Journal* of the American Society of Mechanical Engineers.

The first, or trial, well was very successful and on the strength of this four other wells were drilled. These gave trouble from the start. All the wells were of identical construction. were within an area of 650 ft. square and penetrated exactly the same kind of soil. The pumps used were vertical three-stage centrifugal pumps, belt-driven by 20-hp. motors and operated at 1,400 r.p.m. against a 75-ft. head. A foot valve was placed below the pump at first, but it caused the pump to choke with sand and was therefore discarded and a check valve placed in the discharge line from the pump. Each of the four wells in turn started to sand up as soon as any considerable amount of water was pumped, making it necessary to withdraw the pump and clear the well of sand.

The pumps were supposed to be adapted for handling water containing sand, but the bronze bearing bushings in some instances were cut out after one day's operation. To obviate this, the tubes inclosing the shafting were discarded and leather rings placed above and below each bushing. They were securely fastened to the bushings and fitted snugly on the shafting. By operating the pumps at 60 to 100 gal. per min. continuous flow could be obtained, but a large amount of sand would be discharged, the wells speedily choking. To avoid the expense and delay incident to removing the pumps and sand-bailing the wells an air ejector was made which could be lowered into a well without disturbing the pump. By this means 50 ft. of sand could be taken out in 3 hr.; but the removal of such large quantities soon caused the ground around the casing to cave, resulting in disturbance to foundations in the vicinity.

Cause of Trouble and the Remedy

The failure of the wells to work satisfactorily was laid to the size of gravel placed between the outside and inside casings. The remedy, therefore, was to find and use a suitable material that would keep the sand out of the well and at the same time let the water flow through freely. Tests resulted in the selection of a naturally graded beach sand having an effective size of 0.42 mm. and a uniformity coefficient of 2.18. With perforations of $\frac{1}{32}$ in. in width in the inside casing, the fine material from the



CANVAS-COVERED FRAMES PLACED OVER FRESH CONCRETE OF COLEMAN DU PONT ROAD

wells would be held back even when the velocity through the perforations was as high as 0.75 ft. per sec.

A sixth well was sunk, using an ejector instead of a well-drillers, standard equipment. Five days were required to complete the well to a depth of 60 ft. It developed on test a capacity of 200 gal. per min., and discharged no sand. The outer casing was 22 in. in diameter, of No. 12 gage steel, with collar joints, and perforated with slots $\frac{1}{16}$ in. wide by 1¾ in. long. The inner casing was 16 in. in diameter, with perforations $\frac{1}{32}$ in. wide (area of perforations estimated at 0.0329 sq.ft. per lin.ft. of pipe). Perforated casing was used throughout, except for the bottom section and the upper five sections. The sand used in the jacket was the grade determined by test to be the best. Instead of drilling additional wells of this type it was decided to reconstruct the other wells (except No. 1) so that they would develop their full capacity.

The inside casing in the four wells could not be removed, but the diameter of the deep-well pumps allowed a 13½-in. casing to be placed inside the well. One of the wells was equipped thus and the space between the inside casing and the middle one was filled with the same grade material as used in No. 6 well. The installation of the third casing required only about 8 hr. work. Under test the remodeled well operated continuously at a rate of 243 gal. per min., and gave no sand. The other three were then reconstructed in the same way.

Protecting Fresh Road Concrete from Sun in Delaware

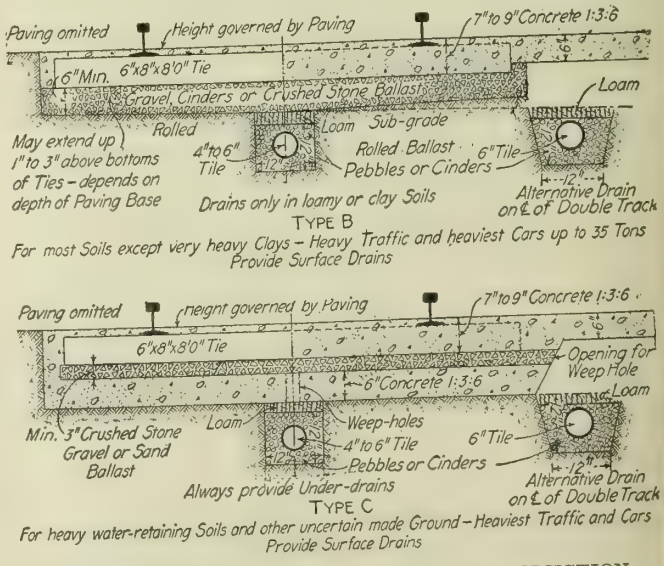
The Coleman du Pont Road in Delaware is being constructed under strong specifications and rigid engineering inspection and supervision. One of the requirements is that the concrete be protected from the sun, immediately after placing, by canvas-covered frames. These are 10x15 ft. and are placed at least 1 ft. above the concrete and kept wet. The frames are removed on the following day and the concrete is covered with 2 in. of earth, kept wet 14 days, and traffic kept off 30 days.

The concrete is a 1:2:4 mix, with 10% (by volume) of hydrate of lime. Mixing must continue for at least 1½ min. at a minimum speed of 15 r.p.m. The concrete is laid 5 in. thick at the sides and 7 in. thick at the crown. Immediately after finishing, the canvas frames are placed.

Charles M. Upham is Chief Engineer of the Coleman du Pont Road, Inc., Georgetown, Del.

Recommended Street-Railway Track Construction

Two types of street-railway track construction in paved streets were presented as "recommended designs" by the Committee on Way Matters of the American Electric Railway Engineering Association, at the recent convention



APPROVED TYPES OF CITY-TRACK CONSTRUCTION

(Oct. 4-8, 1915). These are shown in the accompanying cross-sections. They are known as Types B and C, corresponding closely to the Types B and C recommended by the same committee in 1914 (see *Engineering News*, Nov. 26, 1914, p. 1079, for sketches). The old Type A was eliminated as it was decided that there were too few localities where it could be successfully used. Old Type D was eliminated in favor of Type C.

Tests Fail to Show Cause of Retarded Set of Concrete

By Alfred W. Hartman*

During the construction of a 57-in. concrete pipe drain, one of the main trunks of the Baltimore storm-water drainage system, a 30-ft. section of a 4-in. concrete cradle, placed in advance of the laying of the pipe, failed to harden in 96 hr., while similar concrete made from the same materials placed the day before in the same trench, but on different soil, hardened in the usual manner. The foundation soil under the section that failed to harden consisted of white clay, containing a very large percentage of mica in a finely divided condition, and was quite wet. The soil under the section placed on the previous day was red clay. As the weather conditions at the time of placing both sections were practically the same, it was thought there might be something in the underlying soil that had affected the action of the cement in setting.

The aggregate used in the concrete was clean Chesapeake Bay gravel, which has been used with good results in all of the sewer construction; so this was eliminated as a possible cause of the trouble.

In effort to discover the cause of the trouble, briquettes were made with the sand used on the work and the same cement, which had previously been tested by the municipal laboratory. The briquettes were heavily coated with wet mica clay and with wet red clay, stored in moist air and the seven-day tensile strength determined on a number of specimens.

Briquettes were also made with the sand used on the work, with standard sand and without the addition of clays. These were stored under water and the seven-day tensile strength determined. The time of set of the cement neat and the same cement heavily coated with wet mica clay was also determined.

A sample of the concrete which failed to harden in the trench was brought to the laboratory, to see what effect the indoor temperature would have upon it. In 48 hr. it had set hard.

The results of the tests herewith given in tabular form show no action of the white and red clays on the mortar. The time of set of the neat cement was slowed slightly by heavily covering it with the wet mica clay, but this was to be expected under the conditions. The temperature of the air on the days when the concrete bottoms were placed was about 55° F.

TABLE SHOWING EFFECT OF COATING CEMENT BRIQUETTES WITH MICA CLAY

(Tensile Strength in Pounds per Square Inch)

Standard Sand 1 : 3, Stored Under Water 7 Days	Arundel Sand 1 : 3, Tidewater Cement, Lot No. 3,277 7 Days
275	265
280	270
285	300
280	275

Arundel Sand Covered with Red Clay 1 : 3, Stored in Moist Air 7 Days	Arundel Sand Covered with Mica Clay 1 : 3, 7 Days
275	275
285	295
300	300
287	290

Neat Cement

Time of set, regular
Initial—4 hr., 10 min.
Final—6 hr., 10 min.

Time of set covered with mica clay, wet
Initial—5 hr., 5 min.
Initial—7 hr., 5 min.

Judging from the setting up of the concrete in the laboratory, there is no question that this concrete would have finally hardened in the trench; but as the contractor was anxious to proceed with the laying of the pipe, which required a hardened invert, the slow-setting concrete was torn out and a richer mix substituted. This mix hardened in the usual manner. The retarded set may have been caused by the lean mixture (1:3:7) and an excess of mixing water.

Calvin W. Hendrick is Chief Engineer of the Baltimore Sewerage Commission and George J. Armeling is Engineer of Tests.

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Repairing a Split Water Main

A longitudinal crack in a 12-in. cast-iron water main, which was too long to be repaired in the customary way, by fitting a split sleeve over the leak, was satisfactorily stopped in the manner shown in the accompanying views. The main supplies a section of Concord, N. H., and the inconvenience of shutting off the water for a considerable time, as well as unnecessary expense, was to be avoided. An iron casting about 3 ft. 6 in. by 1 in. thick, curved to conform to the outside diameter of the pipe, was obtained from a local foundry. The wrought-iron rods are about ¾ in. diameter and the yoke plates are about ⅝ in. thick. A ½-in. lead gasket, the same length and width as the casting, was placed between pipe and casting and pushed over the crack; then the nuts were tightened and the joint was calked. It was not necessary to shut off the water from the main, as water from the leak could be cared for by trench pumps.





LEAD-GASKETED PATCH ON 12-IN. WATER MAIN

The superintendent of the water-works of Concord is Percy R. Sanders.

Testing Water-Main Flow

By R. C. Hardman*

The carrying capacity of cast-iron water mains in actual use in Denver, Colo., was tested during the winter of 1913-14 by means of pressure-recording gages and water-meters.

The mains tested were selected for their accessibility, freedom from pump pulsations and the possibility of cutting out the section under test without interrupting service beyond the section and on the connecting gridirons. The tests were conducted after midnight, to minimize the effect of service drafts. The test sections were in general 1,000 ft. in length. Bristol recording gages were installed on taps at each end of the test section, with a third gage approximately midway between the two to serve as a check. The gages, inclosed in large wooden boxes, were supported upon low trestles and connected with the corporation cock by means of a ½-in. rubber hose with the necessary stop and blow-off cocks. As the tests were all made in freezing weather, provisions against freezing were made by placing a candle inside the gage box and immediately outside the main, between the corporation cock and rubber hose, by placing a short section of pipe in a small metal box heated by a gasoline blow torch.

The flow was measured by a 6-in. meter, connected to the steamer nozzle of the first fire hydrant below the section under test. The meter was mounted on a low truck to facilitate moving.

The recording gages were so adjusted that the chart made one revolution per hour instead of the usual 24. As most of the tests consumed more than one hour, ink of a different color was used after one revolution of the chart to obviate any confusion of crossing lines.

TEST OF CARRYING CAPACITY OF 6-IN. CAST-IRON WATER MAIN, DENVER, COLO.

Time, P. M.	Flow, Gal. per Min.	Pressure-Gage Records, No. 1, Lb.	No. 2, Lb.	No. 3, Lb.	Diff. Nos. 1-3, Lb.	Diff. Nos. 1-3, Ft.	Diff. in Elev. by Level	Friction Loss, In. 842 Ft.	Friction Loss, In. 1,000 Ft.
9:44	Static	54.8	56.8	60.5					
9:48	112.5*	52.0	54.0	57.5	—5.5	—12.702	13.200	0.498	0.594
9:53	183.5†	49.7	51.0	54.0	—4.3	—9.929	13.200	3.271	3.885
10:00	297.0‡	42.8	42.8	45.0	—2.2	—5.081	13.200	8.119	9.643
10:07	364.0	36.6	35.8	36.8	—0.2	—0.462	13.200	12.738	15.128
10:16	464.0	29.0	26.5	26.8	2.2	5.081	13.200	18.281	21.711
10:23	519.0	22.6	18.9	18.5	4.1	9.469	13.200	22.669	27.350
	Static	55.5	57.4	61.1					

Location of meter—At end of line.
Kind of meter—Crown.
Location of gages—No. 1, on tap 5 ft. west of Broadway; No. 2, on tap 522 ft. west of Broadway; No. 3, on tap 847 ft. west of Broadway; 842 ft. between No. 1 and No. 3.
Distance between gage No. 3 and draft hydrant—100 ft.
Date—Jan. 8, 1914.
Party—Allen, Hardman, Flood, Amsley, Gayton.
* Plus 3 gal. per min. for leakage at hydrant.
† Plus 4 gal per min. for leakage at hydrant.
‡ Plus 5 gal. per min. for leakage at hydrant.

In making the tests, all necessary valves on the main line and gridirons were closed, the gages were connected to the taps and the meter was connected to the hydrant. The static pressure on the main was then recorded on the gage charts for a period of about 5 min. The hydrant was then opened and the meter flow recorded for a period of 5 min. A large number of such meter readings was made for various conditions of flow—from about 75 or 100 gal. per min. up to a full hydrant flow. The meter readings were made by two observers with a stopwatch which had been synchronized with the gage clocks. At the end of the test the gages recorded static pressure for another 5-min. period.

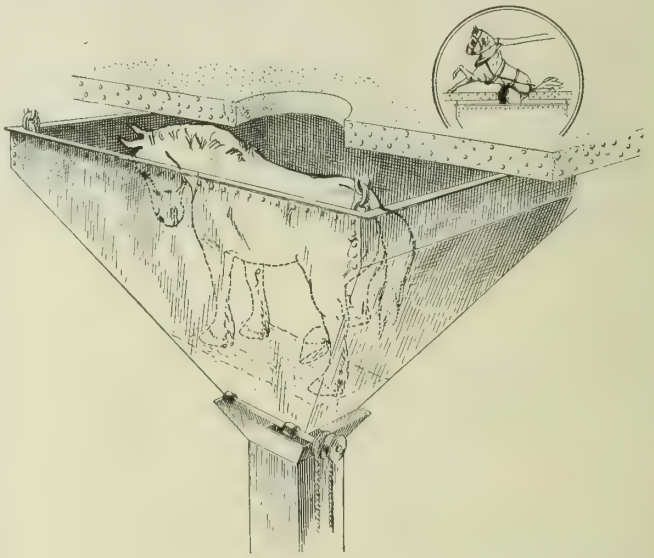
By this means not only the carrying capacity of the main was determined, but also values of the coefficient C for the varying values of Q and s could be deduced.

A typical test record is shown by the accompanying table. This was the only test section other than 1,000 ft. in length; but friction losses are based upon the standard section.

*307 Cheyenne Boulevard, Colorado Springs, Colo.

NOTES

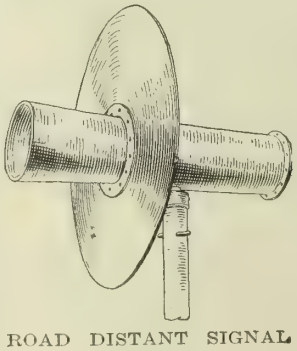
Horse Falls Through Coal Hole—A problem was presented to engineers of St. Paul, Minn., on Sept. 28, when they were called upon to rescue a draft horse which had fallen through a 32-in. coal hole into a hopper. The coal hopper was suspended from the basement ceiling of the Merchants Bank Building



THE COAL-HOLE EPISODE SKETCHED BY LOCAL ARTIST

Rescue was effected after 24 hr. by cutting out a section of reinforced-concrete floor 5½ ft. long by 3 ft. wide and lifting the horse out by means of an improvised derrick. The animal seemed not to have suffered any ill effects from his confinement or his passage through the 32-in. hole.

Distant Highway-Crossing Signals at several dangerous approaches have been used by the Southern Pacific Co., in Tropico, Calif. The scheme resembles standard practice of railway signaling in having "home" and "distant" indications. At the railway grade crossing is placed a regular warning signal of any approved electric-lamp type. A hundred feet or more back from the crossing is the new "distant" signal. The device comprises a 3-in. steel-pipe post supporting an 8-in. by 2½-ft. horizontal steel tube passing through a vertical 20-in. steel disk. The tube and the back of the disk are black; the front of the disk is red. The tube is parallel to the roadway and is open at the front only. Inside is a high-candlepower electric lamp with a reflector in back and a red lens in front. It is reported that the warning light is as plain in the daytime as at night—though the red disk alone gives an added caution signal.



ROAD DISTANT SIGNAL FOR RAILWAY CROSSING

Philadelphia Used Dynamite for Land Drainage—Dynamite for land drainage and mosquito extermination is thus described and commented on in the latest annual report of the Philadelphia Department of Public Works: "The use of dynamite for fighting the mosquito was successfully tried. It apparently is a splendid device wherever you have a large area covered by a shallow depth of water. In one location where we had this condition a hole 20 ft. deep was excavated by a single inexpensive charge of the explosive and the entire area drained into the hole." The water which stood in the sump so created was oiled for mosquito prevention.

Editorials

Improving the Constitution of the State of New York

Choosing a state engineer by popular vote will be done away with and numerous other noteworthy reforms will be effected if the voters of New York adopt the constitutional amendments which will come before them on Nov. 2.

Among the other reforms included in the proposed amendments it is pertinent to mention here the shortening of the ballot in other ways than the one named; a systematic reorganization of the whole administrative service of the state along relatively simple lines, the substitution of serial bonds for sinking funds and the limiting of all bonds to the life of the improvements, these changes being applicable to municipal as well as state bonds; a state budget, to be prepared by the Governor; a considerable degree of municipal home rule, and a slight loosening of the absurd restrictions which now render the vast forest reserves of the state of little use beyond saving them for posterity.

At present the state engineer and surveyor of New York is elected on the general state ticket with the Governor and five other officers. All told, the administrative affairs of the state are now scattered haphazard among 150 bureaus, commissions, boards and individual officers. There is much overlapping and duplication of work, besides no little conflict of authority. Such overlapping makes it difficult to place responsibility, and the mixed system of election and appointment to office, complicated further by gubernatorial appointment and senatorial confirmation, makes holding anyone to responsibility absolutely impossible.

This morass of doubt and despair would be largely removed by the adoption of the administrative scheme proposed in the constitutional amendments. Instead of seven officers elected by popular vote there would be only four—a half-way step to the ideal short ballot—and in place of 150 ill-assorted administrative departments there would be only 17, systematically planned. Moreover, most of the departments would be single-headed, and except for the two elected by popular vote these heads would be appointed by the Governor, without confirmation by the legislature. Three departments, possessing both legislative and executive functions, would be composed of from 3 to 9 members—appointed by the Governor but confirmed by the state. A fourth department, also having legislative as well as executive functions, would be single-headed or not, in the discretion of the legislature. A single department out of the entire 17 is free of control by either the Governor or the legislature. This is the Department of Education, which remains under a Board of Regents, created in 1784. All heads of single-headed departments and the members of at least the two most important commissions would be subject alike to removal by the Governor or by a two-thirds vote of the senate or by impeachment.

The Governor's large power of appointment and removal makes one person ultimately responsible for nearly the whole administrative as distinct from the legislative and judicial work of the state. This accords with the business and efficiency theory of government. The power of the senate to remove executive officers and the power of the legislature to impeach tend to lessen this single responsibility, but it may be a necessary concession to the opponents of "one-man" control.

The 17 departments provided under the proposed new constitution are: Law, Finance, Accounts, Treasury, Taxation, State, Public Works, Health, Agriculture, Charities and Corrections, Banking, Insurance, Labor and Industry, Education, Public Utilities, Conservation, Civil Service. The heads of the first two departments (Attorney-General and Comptroller) are elected with the Governor and Attorney-General.

Chief interest centers in the Department of Public Works, the provision creating which states:

> (7) The head of the Department of Public Works shall be the superintendent of public works. He shall have the construction, care, maintenance and operation of the state's public works, including canals, highways and all public buildings not from time to time assigned by law to any other department, and shall provide for the needs of the several state departments in engineering and architecture.

It will be seen that this provision puts all the public works and buildings of the entire state, except as the legislature may otherwise dispose of buildings, under a single department. This will be welcomed by many engineers as a great step in advance. On its face the clause also puts all the engineering and architectural work of the state under this one department. Whether it really goes so far as to make it impossible for other departments to have engineering and architectural staffs of their own remains to be seen. Certainly the concentration of all engineering services in one department is, in so far as it does not weaken other departments, highly desirable.

The Department of Public Utilities stands next in interest, but requires only passing mention, because the status of the two existing commissions is unchanged, except that they are made creatures of the constitution instead of the legislature.

The Department of Conservation will exercise about, if not exactly, the same functions as the present Conservation Commission, which succeeded the earlier Water-Supply Commission and Forest, Fish and Game Commission. The new department would consist of nine commissioners, each from one of the nine judicial districts of the state, each to serve for nine years, and without compensation. This department is unique in respect of all four of the specifications in the foregoing sentence. It is charged "with the development and protection of the natural resources of the state," and particularly with the state forests and the encouragement of forestry, the "conservation, prevention of pollution, and regulation of the waters of the state"; and the protection of the forest preserve and reforesting, the building of fire trails and

of a single specified road, and the removal of dead timber; but none of the latter may be sold, and no other improvement cutting is permitted. Even these slight steps toward a real forest policy beyond the preservation of the natural wilds are a cause for thankfulness.

No qualifications are stated for appointees to any of the administrative state offices named in the constitutional amendments. Engineers thus fare in this respect neither better nor worse than members of other professions. The legislature will have a free hand to specify the professional or other qualifications of department heads, or to leave the Governor free in the matter.

As to the other features of the amendments mentioned in the opening paragraph of this article, it can only be said that they are in line with the accepted principles of good government and private business alike. Highly commendable is the restriction of the life of future bond issues, either state or municipal, to the life of the improvement for which they are to pay. The home-rule provisions will leave municipalities much freer than now to work out their own salvation, and by lessening the volume of local legislation will give the legislature more time than it now has to perfect important state policies.

Altogether, the provisions of the amendments which most affect engineers, directly and indirectly, are distinct steps in advance. Some of the engineers who devotedly sought to help shape the amendments will doubtless be disappointed with the small outcome of their efforts; but on the whole there is cause for thankfulness that so much was done toward putting a modern constitution before the voters of New York on Nov. 2.

A Lesson in Jitney Regulation

Commissions, municipalities, trolley companies and even prospective jitney-bus operators who are wrestling with the problem of regulating jitney transportation will be glad to know that the New York Public Service Commission, Second District, has established a precedent on which they may hang their practice. Some months ago the legislature provided that jitney-bus men, before starting operation, must obtain a "certificate of convenience and necessity" from the Public Service Commission. This dampened the enthusiasm of many, so that there has been only one case where formal application has been pushed to completion. In this instance one William M. Gray asked for leave to operate six routes in the suburban town of New Rochelle. The commission approved four of the six lines and disapproved of two. The case is so typical that the commission has taken the opportunity of expressing at some length the general principles on which it will judge such cases.

The opinion, written by Commissioner Emmet, states that it is the duty of the commission to protect established utilities from unnecessary competition, but that the public is entitled to some individual liberty in the choice of transportation, except where that choice would obviously lead to ruinous competition. Improvements in automobile construction and highway maintenance are recognized as stimulating the preference which persons residing at distances from a trolley line may have for motor-bus lines.

Applying these principles, the four routes authorized run on the same streets with street cars for only such short distances as are necessary to give the busses access to the railroad station; except for these approaches to the urban center, the lines in general are not parallel or close to the existing trolley lines. The two routes for which certificates were refused would have been parallel to and on the same streets with existing lines.

The commission compliments the city authorities and the applicant for the care of arranging their plans and safeguarding the public from erratic service. For instance, the franchise requires that the busses shall seat from 10 to 17 persons, shall be of the prepayment type, shall have pneumatic tires and shall be kept in good condition. The operator must provide seats for all passengers. Fare for a continuous ride is to be 5c. Children under five years old and policemen and firemen on duty must be carried free. Busses have to run on a 20-min. schedule from 6.30 a.m. to 1.30 p.m. The franchise expires in 10 years, and 3% of the gross earnings is to be paid to the city. The applicant has to give a bond for prompt payment of his obligations. Busses have to stop on signal at the near side of street crossing and conform to present and future traffic regulations.

Such conditions make bus lines really transportation systems, in contrast with the original jitneys, which gave only a precarious hack service. The old jitney operation was much cheaper of course, but at the expense of public safety and convenience. Under such regulation as seen in New York State the bus is little less than a trackless and trolleyless street car.

Something New in Street-Railway Terminals

One of the most novel and interesting structures erected in this country in recent years is the tramway terminal and office building of the Public Service Ry. in Newark, N. J. Even the fundamental idea of a street-railway terminal under the conditions which obtain in a strictly urban district is novel. Of course all through the Middle West interurban terminals on private property with loop tracks are common, and indeed they were the inspiration for the design which was worked out in Newark. Rapid-transit stations with distribution concourses either above or below the car tracks are not new. But the combination of these several elements now seen in Newark and in connection with a city traction system is striking and original.

All engineers who believe in the usefulness of a fresh viewpoint in the solution of a complicated engineering problem will be interested to realize that while the designing engineers were struggling with a complicated terminal trackage on one level, a lawyer—the president of the railway company—came along and suggested the three transportation floors that were finally employed. He also had a keen eye for business when he put the order departments of the allied gas and electric companies on the concourse, where they could alluringly display the apparatus employed in their services.

The structure itself is found to have very many interesting points of design—for instance, the subway-track floor system, which is carried on the main foundation piers, but is only loosely tied to the building columns. The elevated-track system is necessarily carried on the same columns which support the office structure. The entire foundations and all the subway and elevated ap-

proaches are incased in a continuous waterproof envelope to shut off ground water—and the engineers and contractors declare that the vast membrane is truly effective throughout its entire extent.

New York Grows in Importance

New York City, with its metropolitan district, has once again come into its own in the American Society of Civil Engineers. Last year, probably because of the emphasis in Pacific Coast activities, only one of the presidential and vice-presidential incumbents came from New York City. The candidates to be voted on in the coming election comprise a president from New York City, a vice-president from New York City and a vice-president from Troy, N. Y. So that, with the one holdover New York City vice-president, the metropolitan district (by stretching the boundaries up the Hudson to Troy) will have four of the five executive offices, to say nothing of the recurring secretary, the treasurer and six out of eighteen directors.

Undoubtedly this concentration is fortuitous—the result of a careful selection of the right man without regard to his location; but in view of some of the current complaints of metropolitan domination, it is at least unfortunate.

The multiplication of state utility-regulating commissions in a number of states has resulted in an apparent overlapping of the authority of some of these commissions. This is a condition which has been feared by many of the advocates of state regulation because of the opportunities it has offered for friction between the different commissions and for "passing-the-buck" contests—during which offenders against the spirit of the regulating acts are allowed to slip through without attention from any of the commissions. The neat way in which one such situation is being handled in Wisconsin should be broadly copied. The state laws of 1911 conferred on the Industrial Commission authority to establish an electrical safety code. The 1915 legislature empowered the Railroad Commission to enforce reasonable rules and standards and to require changes in construction and operation for public safety or service interference. The two commissions have combined their efforts, have formulated tentative standards of electrical construction and operation and have advertised a joint hearing. After the hearing the rules will be amended and jointly promulgated. Incidentally the safety rules are based on the tentative code of the United States Bureau of Standards and the interference rules embody the conclusions of a joint committee of various technical societies and the California Railroad Commission.

The Portland Harbor Bridge, described on another page of this issue, is in many ways a remarkable piece of work. It is not often that so many different and at the same time novel types of structure are included in one bridge. Offhand one would be apt to think that here was another of those all too numerous instances where the engineer has been dabbling in a variety of new and untried experiments, more to broaden his own experience than to solve most economically the problem in hand. A study of the structure, however, will convince such a critic that the conditions to be met in the three-quarter mile crossing were many and various, and that the most careful effort was made to meet each of the conditions with an economical and at the same time pleasing and safe structure. The resulting design, though consisting of a number of peculiarly individualistic parts, has in appearance a very satisfactory unity.

Letters to the Editor

Railway Engineer Wrestles with Road-Building Problems

Sir—The writer is interested in the letter of Professor Coghlan in *Engineering News* of Sept. 30, 1915, in which he intimates that the railway engineer is not likely to be successful as a builder of roads or highways. This interest arises because the writer's experience has been almost wholly on railway work, and having recently been elected a trustee of the village in which he resides, and promptly made the "Committee on Streets and Sewers," he found himself "up against" a practical proposition with which he had only a general acquaintance.

One of the first matters which came up for consideration was the type of surfacing to adopt for certain new roads. The proposed expenditures were well up toward $100,000 and there was little time for careful investigation. A hurried search of the available literature produced little of value as a guide in this particular case, and the opinions of several well-known experts were obtained by correspondence as a courtesy to the writer. These opinions were divided, however, though it is only fair to say that none of the gentlemen had been on the ground to see the actual conditions. They all agreed that good roads could be built by many different methods, if the methods were carefully and intelligently carried out—a maxim common to the whole art of engineering.

It seemed to the writer then—and this opinion has been confirmed by further investigation of the literature of road construction, by inspection of numerous roads and by talking with many engineers responsible for their construction and maintenance—that the art of highway building is to a considerable extent in an experimental state. There is certainly a lack of data to determine the true economy of any particular type of pavement, based on first cost, density of traffic and cost of maintenance.

The problem is by no means easy, as there are so many variables; but it seems to the writer that it will be solved in the first place by the application of "common sense," as are all engineering problems of this nature, aided later by properly kept and properly interpreted records, of the kind which railroad engineers have for many years

been accumulating in reference to railway location and construction. No one will deny that proper experience is a valuable asset, but it will hardly do to compare an intelligent, progressive, common-sense engineer who happens to have had experience in highway work with any other, be he a railroad engineer or not, who is merely technically educated and lacks the saving grace of common sense and broadness of vision, as do so many men in all professions and businesses.

Taking Professor Coghlan's illustration of the question of grades, there is probably as much dense ignorance of the economic value of grades among the average run of railway engineers as there is anywhere, and no one knows better than those who have studied this subject that many thousands of dollars have been wasted on grade revisions on railways. Railway engineers have learned that the electric motor can exert a tractive effort much above the normal for short periods, and therefore can surmount short stretches of steep gradient. It is not a long way from this to the realization that a horse might do the same thing; but there is an interesting problem in devising a form of pavement for steep gradients which will permit the horse to get a good foothold and smooth enough to reduce the rolling friction to a minimum.

As a student of highway problems, the writer has labored under the impression that his past experience on railroad work would not be a serious handicap. He hopes he will not be disillusioned. F. Lavis.

50 Church St., New York, Oct. 2, 1915.

Curious Sewer Engineering

Sir—I inclose herewith a copy of what purports to be specifications for a sewerage system for a town in Arizona, which I will call Blank.

I have observed with interest the procedure in connection with this work from its inception, and it occurs to me that it is the engineers themselves who are responsible for a condition which tends, and is tending, to depreciate the engineering profession. In the first place, when a sewer system was considered, some four or five men—claiming to be engineers, all of them—were called upon to suggest to the Common Council the best plan for a sewerage system.

After listening to their arguments, a contract was awarded by the council to a Denver concern, which was to furnish plans and specifications, purchase the bonds and finally bid upon the actual work; further agreeing, if their bid was accepted, to make no charge for engineering services up to that time.

The council thought it best to hire someone to see that the Denver consulting engineers designed a proper system. Therefore, through influence or otherwise, it employed a man who is filling a position as water commissioner on an irrigation project in the vicinity of Blank (for which he is receiving a salary of $185 per month). He was unanimously made "city engineer," and since the plans and specifications—which I understand were unique—were then received, he began their modification to suit his own ideas of what they really should be—all this in connection with his other position previously mentioned.

After his revision of the Denver firm's plans and specifications to suit his own ideas, the Common Council decided that, since the original plans and specifications required modification, it could not accept them and therefore compromised with the Denver people by paying $400 or $500 for consulting-engineering services.

At this stage a committee of citizens appeared before the Common Council and insisted that the sewer be put in deep enough so that the basements in the business section at least could be drained, since the city engineer had decided that a surface system was all that would be required.

The writer was present at this conference and was particularly amused at the replies made by this city engineer to various questions put to him. In response to the question as to whether he had ever had any experience in the design of a sewer system or its installation prior to this time, he replied that he had not, but had seen several sewer systems. Notwithstanding his absolute lack of qualifications, he was retained upon a commission basis of some 5%, which, considering the estimated cost of the system ($80,000) amounts to $4,000, out of which he agreed to defray the expense of the Denver consulting engineer's services.

I have wondered whether the engineering profession is to blame for this condition. The writer, being engaged in other engineering work of an altogether different character, could not very well take an active part in the matter.

Blank is a very prosperous, growing town of some 3,500 inhabitants, its population having increased about 300% in the last four or five years. A Reader.

Sept. 22, 1915.

More on New Orleans Storm

Sir—My attention has just been called to the article entitled "Engineering Aspects of New Orleans Hurricane," by Prof. W. H. P. Creighton, in your issue of Oct. 7, 1915, which I think conveys an idea probably not intended by its writer. He says: "Open sheds, car barns, and dock sheds suffered, but they were of flimsy construction and when lifted from the ground easily collapsed. Thus the Dumaine dock shed," etc.

The Dumaine shed was about 600 ft. long. The aggregate length of all the wharf sheds is more than 19,000 ft. The Dumaine shed was designed by the same standards as were all the other 18,400 ft. of sheds, all of which are still standing and all of which without doubt withstood approximately the same wind loads.

The Dumaine shed rested upon the last of the uncreosoted wharves which had been condemned some time since, and I am informed that some of the column footings had been disconnectetd from the floor of the wharf for the purpose of jacking up and shimming. This wharf showed signs of decay, and in addition to this weakness, the engineer of the Port Commission informs me that several vessels from the opposite side of the river were torn from their moorings and driven into this wharf by the force of the wind. He thinks the impact of these vessels was responsible for the collapse of the shed.

In the concluding paragraph of Professor Creighton's article he states that "no well-designed engineering structure received more than trivial damage," in which statement I agree, except that I claim the Dumaine shed to have been a "well-designed engineering structure" which failed, the failure being due to the causes above described. J. F. Coleman.

Hibernia Building, New Orleans, Oct. 15, 1915.

[In explanation of his original statement, Professor Creighton submits the following.—Editor.]

Sir—In my telegraphed report I endeavored to say as much as possible in a few words. Broad generalizations are liable to err in particular phases of certain elements.

The word flimsy was used in connection with structures carrying no load, as in effect they are shelters only. The necessary weight of material used in their construction is therefore a minimum. Carrying no loads and the weight of structural material used being a minimum, it is evident that they are weak in resisting upward pressure.

I agree with Mr. Coleman in believing the weight of structural-steel elements used in building the shed to be ample, as the destruction seems to be confined to that resulting from twisting or bending because of the fall of the shed on its side. The dock is old. For reasons that were sufficient to the engineers in charge of the dock, the foot of all columns inspected on the river side of the shed were free to move as they were not bolted down. As the shed fell away from the river, I do not attach any weight to the theory that the collapse was due to the impact of vessels. W. H. P. Creighton.

New Orleans, Oct. 18, 1915.

Mine-Timbering Methods and Falls of Ground

Sir—In your editorial of Sept. 30 on the subway timbering accidents in New York you refer also to mine timbering and the frequency of rock falls in mines. Although it is true that most of the accidents in mining are due to falls of ground, nevertheless they are very rarely due to failure of timbers as a whole. If they do so collapse, it is for lack of following correct principles.

Square-set timbering, which resembles that in the subway, is braced against the ground it is intended to support. Permanent diagonal bracing in any direction should not be needed as an essential part of the system. When enlarging the open chamber, set by set, there is in each case a short time when the blocking is out. If the ground is unstable, temporary braces or stulls may be necessary to take up the unbalanced pressure of the timbers, and the ground opposite, against the open space. As soon as the timbers are up and blocked against the new faces of ground, the structure is again in equilibrium and the braces may be removed.

This system of timbering may fail from two causes—from excess of pressure either from top or side or from timbers becoming displaced through the failure of blocking.

The first cause has no particular bearing on the subway accidents. In mining, it is usually avoided by decreasing the size of the openings, to take advantage of the arching effect of the ground. Close filling with waste material is almost universally practiced. Large openings maintained on timbers are thus avoided.

The second case is most apt to occur in unstable ground. Therefore when the ground is loose the sets are lagged carefully, and when breaking out for new sets spiling or braces may be used, with special props against loose boulders to hold them in place. They are intended to hold the ground in position and prevent it from raveling away from behind the blocking or timbers, leaving them in the air, when they may fall of themselves or be knocked down by ground sliding in, and perhaps bring the whole stope down with them.

The timber sets are usually 5 to 7 ft. square horizontally, rarely 8 ft., and from 7 to 9 ft. in height, center to center. When accurately framed and well blocked, the timbering has a certain stiffness in itself, which becomes considerable if there is enough pressure to make the timbers "cut down" slightly. It is because of this stiffness that special bracing is not usually necessary in the interval of taking out ground for timbers.

From sketches of the timbering in Seventh Ave. it would appear that the spacing was too wide for it to have any stiffness longitudinally. That was provided only by blocking at the ends. If this is removed from one end, as by blasting, it would require little force—perhaps no more than setting the brakes on a surface car—to knock it down. The structure could have been braced in any number of ways. It is a sad illustration of a too common fault of design to build a framework amply strong to support its load, but brace it so poorly that it fails without developing the safe strength of its members.

The Broadway collapse was from a different cause. The timbering spaces were wide, about 8 ft. in height by 10 ft. in length. Either the cross-timbering was not strong enough to resist the pressure of the slide or the omission of lacing across the wide spaces of the sets (none is shown in the sketches) allowed a small slide to start between them, which would naturally carry down blocking and adjoining timbers with it. It might easily have been both. The cross-struts are long. If a single post broke, it would bring down those over it, the cross-strut at its top and the two longitudinal members against the ground on each side. It is a matter of chance what else might fall down.

There is a tremendous difference in the strength needed to hold ground in place and that necessary to hold it after movement has begun.

The slide might have been prevented by close lagging between the sets or it might have needed more cross-timbers. In any case, it would have been much improved by bracing. The half which remained standing was only saved by the stiffness of its joints.

Something is wrong when a structure fails with only a small proportion of its members broken. It should go down like the "one hoss shay," with each part as strong as the next, but only because of an overwhelming stress. G. S.

Bisbee, Ariz., Oct. 15, 1915.

NOTES AND QUERIES

Difficulty Occasioned by Falling Leaves getting into flumes, and thus into the fine screens in concentrating machinery in the mining section of the far West, leads E. T. Dudley, construction engineer of the Bunker Hill & Sullivan Mining and Concentrating Co., of Kellogg, Idaho, to inquire whether irrigation engineers or firms supplying material for irrigation projects have met and overcome a similar difficulty, and if so, how.

Errata—In the article "Diagram for Determining Pavement Crowns," "Engineering News," Sept. 9, 1915, p. 510, the expressions $\left(\frac{W}{2} + x\right)$ and $\frac{1}{2}\left(\frac{W}{2} + x\right)$, appearing at the right of Fig. 2, should be $\left(\frac{W}{2} - x\right)$ and $\frac{1}{2}\left(\frac{W}{2} - x\right)$. In the first column of p. 510 also the value for "Elevation of left curb' should be 89.67, as shown in Fig. 3, and not 86.67.

Old and New Bear Valley Dams and Crags Dam in Service

By J. B. Lippincott*

Many unusual types of dams have been constructed in southern California for the impounding of flood waters for irrigation purposes. The engineering profession is naturally interested in the physical success of these structures. This is written to record certain tests in service of two of them.

The old Bear Valley Dam in San Bernardino County, California, was built by F. E. Brown in 1885 and was the pioneer in light-arch dams. It was constructed of uncoursed granite ashlar, the stone being of good quality. This dam is curved upstream with a radius of 335 ft. and has a maximum height of 64 ft. Its thickness is but 2.5 to 3 ft. on top and 8.5 ft. at a point 48 ft. below the crest, where it rests on a base of masonry that is 13 ft. wide at this point and increases to 20 ft. The greater pressure occurs at the point where the dam joins this base and amounts to 53 tons per square foot. The dam stood successfully from 1885 until 1913, or for a period of 28 yr., having frequently been subject to full pressure. It was found desirable to increase the storage capacity of the reservoir and a new type of dam was built below the old arch dam as shown in Fig. 2. This latter structure is as novel in its line as the old Bear Valley Dam. The designer was John S. Eastwood (the plan being patented). It was completed in 1910-1911.



FIG. 1. CRAGS DAM WITH 5-FT. OVERFLOW
Flood of February, 1915. The same flood rose 5 ft. higher than shown

This new dam is shown in the accompanying photographs. There are 11 buttresses 32 ft. apart with 10 arches. The length of the dam is 363 ft.; the maximum height, 92 ft. The buttresses are braced together by struts. There is a spillway on each side through the last arch. These spillways have a capacity of approximately 1,220 sec.-ft. The area of the drainage basin above this dam is 56 sq.mi., of which 28 sq.mi. naturally drains indirectly through Baldwin Lake. The maximum flood runoff from the mountain drainage basins in this section of California is fully 200 sec.-ft. per sq.mi. A feature of this dam is the thin buttress walls, which taper in thickness from 12 in. at the top to 26 in. at the base of the higher sections, and the thin shell of which the arches are composed.

This statement is written to record the fact that this reservoir has lately been filled to the level of the waste-way, the storage capacity having been increased from 26,463 acre-ft. at the old dam to 65,065 acre-ft. at the new dam. The dam is quite tight. There is some little seepage through the concrete, which is led by a pipe through each of the buttresses to the measuring-box and weir, which is located between the two center buttresses. Thus the loss can be accurately determined. With water at the 65-ft. contour the seepage was about 0.1 sec.-ft. The old forms have not been stripped from a large part of the rear of the arches. The dam, which was described in *Engineering News*, Dec. 25, 1913, was built by the Bear Valley Mutual Irrigation Co.

Another unusual test of an arch dam occurred at the Crags Country Club, in Los Angeles County, California. It was built by the club in February, 1913, and was designed by G. O. Newman and Cyril Wigmore. The abutments are volcanic trap. The maximum height is 50 ft. It is 2.5 ft. thick on top and 16.66 ft. at the base at the point of maximum height. Its length is about 149 ft. The spillway is entirely inadequate, which makes the dam of an overflow type. Small boulders were embedded freely in the concrete. The radius of the dam is 287.9 ft., and the load on the abutments 27 tons per sq.ft. with a full reservoir. Vertical 1-in. bars were placed about 4 ft. apart in the structure. Temperature reinforcement in the upper face consists of horizontal bars spaced 3 ft. apart and vertical bars 5 ft. apart. River gravel was used for the concrete (1:6, with a richer



FIG. 2. OLD AND NEW BEAR VALLEY DAMS

*Consulting Engineer, Central Building, Los Angeles, Calif.

mix on the faces). The gravel originates from sandstone and conglomerate beds and is not of first quality.

When the dam was 37 ft. high, the upper concrete being new and the form boards still in place a flood passed over the crest 5.5 ft. deep, tearing off the forms but doing no other damage. In January, 1914, another flood passed over the dam 10 ft. 5 in. deep. In February, 1914, another flood of the same depth passed over the crest without damage. The oldest concrete at the time of the first flood was about seven weeks and the upper 4 ft. not over three days.

The drainage area above the dam is about 30 sq.mi., and the flood of Feb. 24, 1914, is estimated at 3,300 sec.-ft. The view given shows the flood passing over the crest of this dam. Considering the green concrete and the overflow, this is a particularly severe test of the arch type of concrete dam. The structure was not injured by any of the floods.

Internal Stresses in Rails Found To Be High

High stresses exist in steel railway rails even when no train is on the track, as the result of the permanent stretching of the outside metal of the head caused by the rolling action of traffic. The outer layers of the head—on the tread and along both gage side and outside of the head—are stretched by the rolling in a manner directly analogous to hammer peening. Since these outer layers are connected to the interior metal of the rail they are prevented from elongating and therefore are thrown into a state of longitudinal compression, while at the same time a slight tension is produced in the interior of the rail.

The first careful measurements of this action were made by J. E. Howard, engineer-physicist of the Interstate Commerce Commission, in connection with an investigation of a railway accident at Talmage, Iowa, where a train was wrecked by a broken rail. Strips were cut off the faces of the rail and their shortening or lengthening when cut loose was determined by gage measurements of the distance between two gage points marked on the rail a known distance apart before the cutting.

Stresses in the Broken Rail

A section of the rail which caused the wreck showed the following stresses: On the gage side of the head, where the rail showed considerable flange wear, compression of 10,200 lb. per sq.in.; on the opposite side of the head, tension of 6,300 lb. per sq.in.; on the top of running surface of the rail, compression of 2,100 lb. per sq.in. The strip from the gage side of the head, which showed the highest stress, also was found to be quite brittle. This rail was the outer rail on a 2½° curve.

The brittleness of the exterior portions of the head where the rolling action has taken place was established by direct test on this rail. In ordinary tensile tests the metal in the interior of the head showed about 20% elongation (on 2 in.) and something over 30% reduction of area, while specimens from the top of the head or running surface showed an elongation of only about 1% and no measurable reduction of area; a corresponding strip after being annealed showed 15% elongation. The strip from the top of the head had an elastic limit of 100,000 lb., which was only slightly below the ultimate strength of the strip, while the strip from the center of the head had an elastic limit of 55,000 lb., or about one-half the ultimate.

Thin strips from the sides of the head were bent to see what angle of bending they would stand before breaking. The strip from the outside of the head could be bent 56° outward or 78° inward. The strip on the gage side of the head could be bent 44° outward (away from the head), but only 5° inward. In all cases corresponding strips when annealed could be bent to much larger angles, ranging from 56° to 85°. This is in harmony with the result of measurements of the internal stresses, which showed that when a piece of rail is annealed the stresses existing in it are largely eliminated.

Initial Stresses in a Relaid Rail

Another rail, not from the same track, showed the highest stresses on top of the head. Two separate test

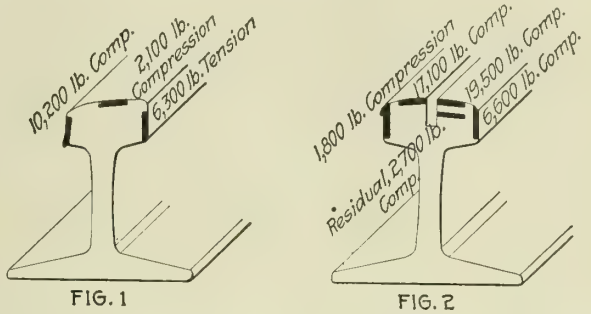


FIG. 1 FIG. 2

PERMANENT INTERNAL STRESSES IN RAILS MEASURED BY INTERSTATE COMMERCE COMMISSION

Fig. 1—Stresses in rail which broke in Talmage wreck.
Fig. 2—Stresses in a relaid rail

strips from the running surface showed compressions of 17,100 lb. and 19,500 lb. per sq.in. The sides of the head both showed compressions—one of 1,800 lb., the other of 6,600 lb. per sq.in. This rail had been relaid, each side in turn having been the gage side. This explains why the peening effect was noticed on both sides of the head.

Another test piece of this rail showed even higher values, the stress on top of the head reaching 21,300 lb. per sq.in. compression. The stresses on the two sides of the head were both compression, respectively 600 lb. and 7,800 lb. per sq.in. In this rail the entire middle part of the width of the railhead was cut out and gradually reduced in height by planing off the under side (nearest the web) and measuring the shortening at different stages of the planing. The computed compressions averaged over the whole strip, when the strip had been planed to various heights, are given in the following table:

Depth, In.	Compression, Lb. per Sq.In.
2	4,500
1½	6,000
1	14,000
½	20,400
1/8	21,300
1/8	21,300
15/100	21,300

Thus the very high compressive effect in the head of the rail extended down nearly ½ in. In the center and lower part of the head the stress is in tension, as is necessarily the case, since the sum of the tensions in the rail must equal the sum of the compressions. Other tests established the existence of this tension specifically, though they did not directly give its amount.

Steel Arch Highway Bridge in the Hudson Highlands

SYNOPSIS—Five alternate steel designs and one concrete design were submitted for a highway bridge crossing a gorge making in from the Hudson River in the Palisades Interstate Park. This article illustrates the competitive designs. The one concrete design requested cost almost three times as much as the accepted steel design.

A steel arch highway bridge in the midst of remarkably beautiful surroundings is soon to be erected in the Hudson Highlands for the Palisades Interstate Park Commission. Although the highway which the bridge carries is under state control its location in the park and the desirability of having an artistic and thereby expensive structure led the commission to offer to build the bridge if the state highway department would build the abutments.

The site on which the bridge is to be located offers a remarkable opportunity to the bridge designer who appreciates the artistic side of his profession. The Popolopen Creek gorge is nearly at right angles to the course of the Hudson River and widens rapidly toward its mouth, so that the bridge will be in full view from passing steamboats on the river as well from the railway trains. The tree-clothed sides of the gorge furnish an admirable setting for the structure.

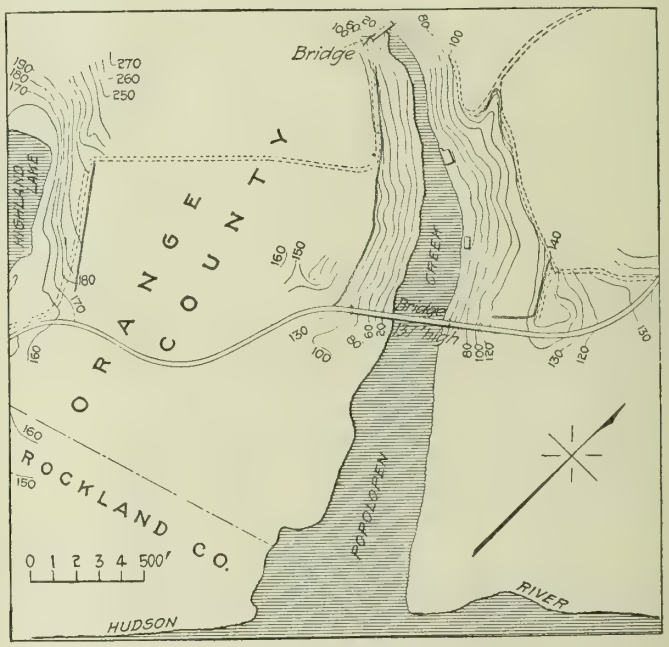
The commission's engineers submitted a profile of the site of the proposed bridge to several well-known bridge companies, with a request for designs and bids, stipulating that bidders should proportion their structures on the basis of Cooper's specifications for highway bridges of 1909, with a roadway loading of an 18-ton road roller and a sidewalk loading of 150 lb. per sq.ft. The width of the gorge to be spanned is 600 ft. at the bridge site. Bidders were left free to choose such spans and proportions as they thought best. As the commission desired to erect the structure of concrete if the cost were not prohibitive, one concrete construction company was also invited to submit a design and bids.

The accompanying drawings show in outline the designs which were offered by the several bidders. All have been redrawn in similar style and are reduced to uniform scale. It should be said in fairness that the extent to which artistic design was of importance in determining the award does not seem to have been clearly understood by all those taking part in the competition. The successful competitor, however, the Phoenix Bridge Co., took special pains to inform itself concerning the conditions at the site. The chief engineer of the company, John Sterling Deans, assigned George Schenck of his staff to make a personal examination of the site of the proposed bridge and sketches of the surrounding country. After this information was obtained, several tentative designs were prepared in the company's office under direction of P. L. Szlapka, its designing engineer. The particular features of the design finally submitted and accepted were the work of Sumner Gowen.

The structure of the Phoenix Bridge Co. is designed for erection as a cantilever. It has two sidewalks and is to carry a permanent roadway with a concrete base and wood-block or other surfacing. The price for the structural steel and hand railing with estimated weight of 1,400,000 lb. was $52,360, not including field painting, concrete roadway or sidewalks.

The design of the McClintic-Marshall Co. was, as shown, a long-span arch. The price quoted was $50,430, which included the erection and two coats of paint after erection, but not the bridge railing.

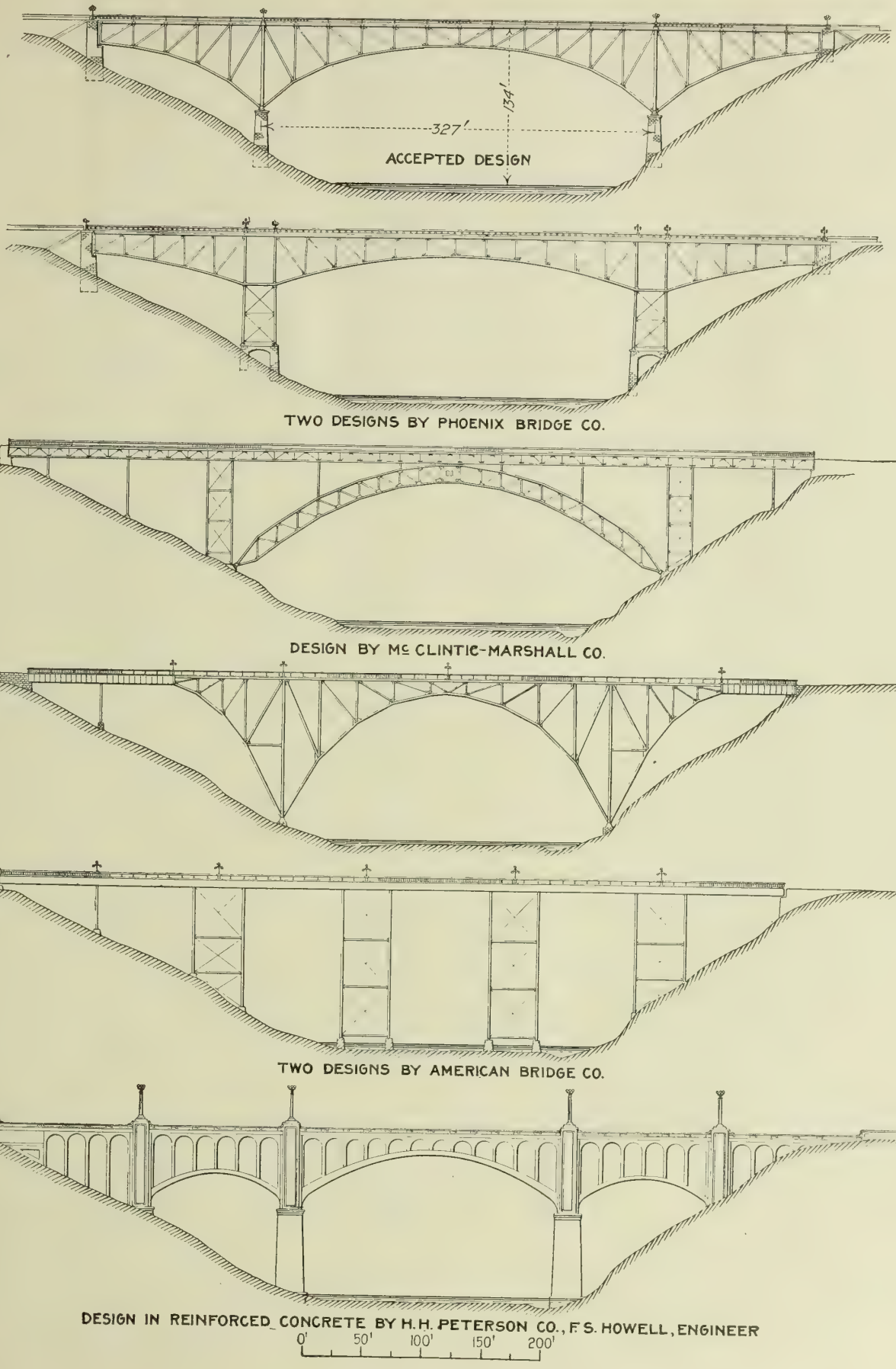
The braced-arch design of the American Bridge Co. was designed to reduce the expense of foundations to the lowest point. The price quoted for this structure was $53,600, which included one coat of paint after erection and the steel railing. This proposal was based on Class A loading of the New York State specifications of 1905, with certain modifications. For the same design



MAP OF SITE OF POPOLOPEN VIADUCT
Note the old and new alignment of the road; new road in full lines, old road dotted

with the trusses proportioned for a uniform load of 55 lb. per sq.ft. and the floor system for 80 lb. per sq.ft., with a concentration produced by a 6-ton wagon, the price quoted was reduced to $46,350. For the alternative design with steel towers submitted by the American Bridge Co., designed for the heavy loading fixed by the New York specifications of 1905, the price quoted was $45,225.

The design for a reinforced-concrete structure was submitted by the Howard H. Peterson Co., of New York City, of which F. S. Howell is engineer. This bridge was designed with a 24-ft. roadway and a 4-ft. sidewalk with a width over all of 36 ft. The total length of the structure is 775 ft., the three arches having spans of 105 ft., 210 ft. and 105 ft. The concentrated live-load assumed was a 24-ton truck. The allowable tension in reinforcing steel was taken at 16,000 lb. and compression in concrete, 700 lb. The price bid, including the piers with foundations carried to bedrock, was $139,000. This price included also the concrete roadway slab and Topeka-mixture paving on concrete base for the roadway.



DESIGNS FOR THE POPOLOPEN CREEK VIADUCT NEAR WEST POINT, N. Y., FOR THE PALISADES INTERSTATE PARK COMMISSION OF NEW JERSEY AND NEW YORK

Railway Bridge and Building Engineers in Convention

The twenty-fifth annual convention of the American Railway Bridge and Building Association, held at Detroit on Oct. 19-21, was a successful meeting in its large attendance (165 members and over 85 visitors) and in the character of the reports and discussions. The president is G. W. Rear (Southern Pacific Ry.), San Francisco, Calif.; secretary, C. A. Lichty (Chicago & Northwestern Ry.), Chicago. The next meeting will be held at St. Paul, Minn.

Concrete bridges, piles and culvert pipe were covered by two committee reports, which were of considerable interest. The report on bridges dealt with construction rather than with design, and with structures of moderate size. It included a compilation of the details of practice on a number of roads in regard to such matters as concreting plants, placing concrete during cold weather and the spouting of concrete. As to the last-mentioned matter, most railways use this method with more or less restriction, but three railways do not permit its use at all.

A special feature of the report relating to concrete piles was the information regarding the extensive use of concrete trestle bridges. These have piles and caps (or sometimes thin piers), carrying slab spans on which the ordinary ballasted track is laid. As to concrete culvert pipe, some roads make these pipes of such great size (oval section, 84x89 in.) that they are used for cattle passes. It was suggested that concrete pipe culverts with cemented joints have great strength to resist any tendency of the bank to separate them.

Timber Trestle Bridges

That the timber trestle is still a very important feature of American railways was evidenced by the long and active discussion of the report on this subject. The report and discussion both related mainly to the deck rather than to the structure as a whole. The committee considered that in spite of the objections to boxing the guard timbers over the ties no better means of holding the ties in place has yet been perfected. Several members, however, considered that spacing blocks are more efficient, although they did not propose to omit the boxing of the guard timbers even if the blocks are used. The blocks should be placed under the guard timbers.

The more general use of solid-deck trestles with ballasted track was recommended, because of their economy, although the first cost of such a structure of creosoted timber is about 50% greater than that of an ordinary trestle of untreated timber. The report suggested a layer of felt-and-pitch roofing to prevent water from getting through the deck to the lower timbers, but few railways seem to consider this extra expense necessary. The use of rerailing devices at the ends of high trestles was advocated by one speaker.

Locomotive Cranes

The extensive use of locomotive cranes is a feature of railway and other work and includes not only the handling of material in innumerable ways, but also such special service as piledriving and excavating. Handling concrete materials and depositing concrete, erecting bridges, renewing ties and rails and unloading and handling heavy freight are examples of the uses of the crane. It may also handle a dragline or grab bucket or a piledriver (with or without leads), and may be so arranged that a dipper handle or a horizontal truss frame and leads may be attached, converting it into a steam shovel or a railway piledriver of long reach. The crane may not work as cheaply as a regular piledriver or steam shovel or dragline excavator, but its advantage (and often economy) comes from its ready adaptability to such uses where a regular machine is not available and where the amount of work of any one kind is too small to warrant the employment of the latter, while the time and cost of doing the work by hand would be considerable.

The machines are of two general classes—the eight-wheel crane, which may be operated in trains and on main-line work, and the four-wheel crane for yard and shop use.

Railway Water Tanks

It has been assumed very frequently that wrought-iron tanks are more durable and economical than steel tanks, but the committee suggested that it is a question whether the wrought iron of today can be compared with that of several years ago. Present conditions appear to justify the continued use of steel rather than a return to wrought iron. An alloy steel with much greater resistance to corrosion than the ordinary metal and of little higher price is a possible development. As to the form of tank, the hemispherical, elliptical and conical bottoms have eliminated the use of the ordinary supporting towers for steel tanks, and the committee advocated the conical form as being more satisfactory in precipitating suspended matter.

Wood tanks continue to be used extensively, but a limiting size is about 20x30 ft. (100,000 gal.). If a greater capacity is required, one steel tank is more economical than two wooden tanks. Flat hoops were considered preferable to round or half-round hoops. The committee suggested the omission of the tank roof in warm climates as being unnecessary (if the water is not used for drinking). Birds get in and build nests and cause more pollution than would occur in an open tank. Nothing was said, however, as to the question of evaporation in an open tank in hot and dry climates. Covered tanks are the general rule, and no cases of the exceptional use of open tanks were given in the report or discussion.

Miscellaneous Reports and Papers

An excellent report was presented on the important subject of "Efficient Methods of Handling Work and Men." It showed how the railway field may be made more attractive to the younger men and how efficiency and economy may result from the proper training of men. As a rule they are employed and then left to find out as best they can how work is to be done and what is required of them. Another important advantage of efficient training is that it develops a supply of men competent for employment as foremen. Methods of keeping efficient records of cost of individual pieces of work were reviewed in another report. This led to some discussion as to difficulties in keeping costs low on railway work. A contractor may purchase material whenever he needs it and can vary his force to suit conditions, but the engineer or superintendent in charge of railway work is usually hampered by restrictions and the necessity of making requisitions even for minor matters, so that he has not a free hand.

Two individual papers were presented. One by C. R. Knowles (Illinois Central R.R.) on "Water Waste,"

showed the innumerable ways in which water is wasted in shops, coach-cleaning yards, engine ashpits, etc. The other, by F. E. Weise (C., M. & St. P. Ry.), was on "Manila Rope." This paper dealt with the manufacture, use and care of rope and pointed out that the substitution of wire rope for hemp rope occurs only in certain lines, while there is an increasing field for the use of hemp rope.

B. J. Arnold States Principles of Utility Valuation

B. J. Arnold, consulting engineer, of Chicago, who perhaps is best known for his numerous street-railway valuations, delivered an address before the recent convention of the American Electric Railway Association at San Francisco. The title of the address was "Foundation Principles of Utility Valuation, with Special Application to Resettlement Plans," and he discussed valuation primarily for resettlement franchises and not for rates. Twenty-five distinct points were presented, and they can best be summarized in Mr. Arnold's own language as follows:

1. The valuation of utilities is still in a developmental stage, without the fundamentals agreed upon by representatives of either capital or the public.
2. The fixed fare of city lines involves as much of a rate problem as any other utility. Rates, service and return are elemental and coördinate factors.
3. Intangible or nonphysical values are receiving more and more recognition, including past losses on a fair actual investment.
4. Historical development and predictions for the future are becoming essential in the comprehensive study of values.
5. Detailed inventory is apparently essential to acceptance by courts and commissions.
6. Every valuation should be so presented as to be readily checked by a competent authority. Elimination of essential details is not in accord with proper procedure.
7. Definite construction schedules should be assumed in reproducing the property, estimating carrying charges and computing life.
8. Fluctuating commodity prices should be averaged over a term of years, using trend prices or the weighted average.
9. Reproduction cost new should consider original as well as present conditions of construction.
10. Appreciation cannot be held to offset depreciation, as a general principle. It may be computed as well as depreciation if necessary.
11. Overhead percentages of from 15 to 25% total in addition to the bare inventory are to be considered reasonable elements of the cost new of a physical property.
12. Franchise values can only be based upon definite contractual relations. Adequate service as defined by public rights thereunder is essential to the computation of correct franchise values.
13. Cost of attaching the business or going value can be definitely computed only where accurate records have been preserved.
14. Renewal funds and amortization of intangible values are a first and prime condition of the permanency of investment.
15. Depreciation expense (renewals) is an operating cost to be provided for by a definite monthly reserve or appropriation, compounded.
16. Renewal funds should be invested, and preferably put back into new property, in order to secure the maximum compounding effect.
17. The simple straight-line method of depreciation, compounded, serves all essential purposes.
18. Maintenance and renewals appropriations should be consolidated in one fund wherever possible.
19. All resettlements should be made on the basis of a continuing investment, carrying permanent funded debt irrespective of ownership.
20. Amortization may then be confined to the intangible values, not to the funded property.
21. Fair rate of return should be dependent upon the risks involved, and should increase with the risk.
22. Valuation and rates is a problem of the second and third generation, not alone of the present.
23. Sliding scale of fares and return best meets conditions of maximum productivity.
24. Resettlement valuations are of the maximum ultimate importance at present. The industry should support fair methods, not oppose all valuations.
25. The electric-railway industry should meet new conditions with the weapons of publicity, standardized accounting and friendly coöperation with the courts and commissions.

Cleveland Municipal Electric Costs Near Estimate

The new municipal electricity works of the City of Cleveland has made great strides in the development of its business. Although its load is only half developed, it shows a cost of current generated of 1.83c. per kw.-hr., compared with 1.25c. estimated under full load. Details are given in "Municipal Lighting Bulletin No. 2," which has just been issued. As promised by F. W. Ballard, Commissioner and Chief Engineer of the Department of Public Utilities, it gives a complete description, with costs, of the new 20,000-kw. municipal electric station and distributing system. It has also a detailed statement of earnings and expenses to Sept. 1, 1915.

The construction costs are as follows:

Main station	$1,137,396
Four substations	194,996
Electric distribution lines	1,079,757
Steam distribution lines	10,623
Office and miscellaneous	41,109
	$2,463,881

The generating station shows the very low unit cost of $56.87 per kw. of capacity. Its generators have a continuous rating of 20,000 kw. Alternating current is transmitted to substations at 11,000 volts and distributed at 2,300 volts. The substations cost on the average $11.82 per kw.

The estimated unit costs of generating and distributing current, made up before the plant was completed were as follows (in cents per kilowatt-hour): Generating, 0.50; distributing, 0.70; administration, 0.05—total, 1.25. This was based on a 40% load factor and 60,000,000-kw.-hr. annual output. The plant has already acquired about half its full connected load and has a daily load factor (ratio of average to maximum power) of more than 60%. The plant load factor (ratio of average daily power to full-load capacity) is 21%—higher than in many old lighting plants. The unit costs of generated current are at present as follows (in cents per kilowatt-hour generated): Operation and maintenance, 1.90; fixed charges, sinking fund and interest, 0.74—total, 1.83.

When the figures for the full year are available there is expected to be an even better showing. Moreover, the municipal plant has been loaded with a $200,000 "white-way" business-street lighting system. Revamping the old distribution lines has been charged to maintenance, though in part it might have been a legitimate charge against new construction. Extraordinary depreciation to the extent of $119,013 is to be charged to surplus at the end of 1915, but does not enter the figures quoted. This depreciation is due to closing down two old small generating stations.

The number of customers is now 14,500. The total revenue from sales of current for eight months of 1915 was $313,800. The average sale price on the basis of kilowatt-hours sold (14,981,595) was 2.09c. On the basis of kilowatt-hours generated (16,846,250) it was 1.86c.

News of the Engineering World

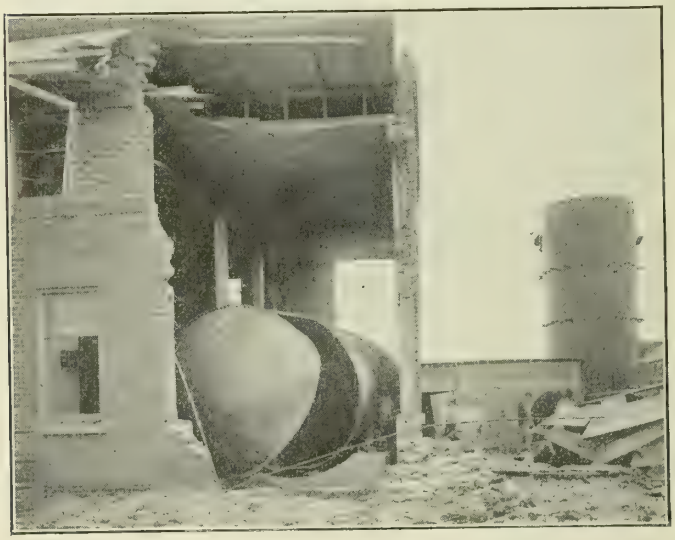
State Will Inspect Shopwork on Highway Bridges

The Illinois Highway Department will in future carry on the bridge-shop inspection for all steel bridges built under plans prepared by the department. William M. Marr, chief engineer of the department, issued notice to this effect during the past week, and requests bridge shops to notify the department several days before material is ready for inspection, so that an inspector can be sent. The department's specifications cover the details.

Municipal Water Tank Bursts Under Air Pressure

By Willis Chipman*

A water tank in Canora, Sask., burst on Sept. 23 while being filled with water. The unfilled portion of the tank contained air under pressure. This accident crippled the fire-protection system of the town and damaged the electric-lighting plant (in which the tank was located), as shown in the accompanying view. A half-dozen rivets



RESULTING DAMAGE FROM BURST WATER TANK

pulled through the metal of the shell, but the remaining rivets held. A strip was torn from the end of the shell through the center of the rivet holes.

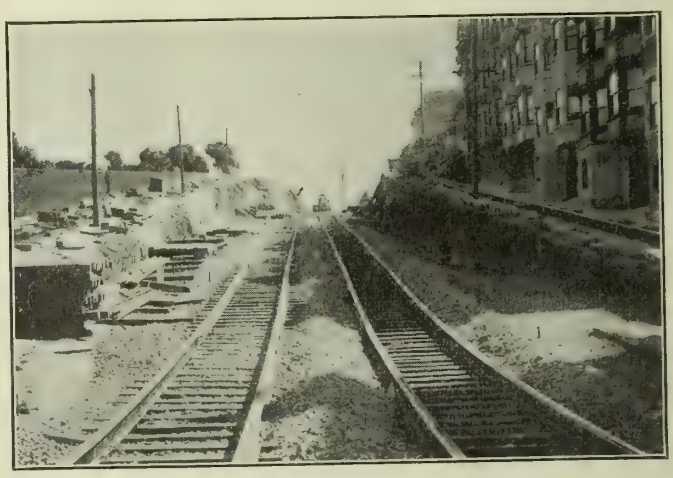
The accident was caused by a badly corroded release valve and a tension spring filled with rust. This valve was so placed that the waste or overflow from other pipes discharged over the top of the valve, which caused the heavy corrosion. The pressure gage was badly corroded and is reported to have registered but 40-lb. pressure, in spite of the fact that the release valve was set at 100 lb.

This tank, 9 ft. in diameter by 30 ft. long, formed a part of the "Hoosier High-Pressure System," which was installed in 1912 for fire protection only. Similar systems have been put in for fire and domestic supply by the corporations of Yorktown, Wilkie, Melfort and Old Battleford, Sask. The town of Canora now has under construction a more complete system of water-works (designed by Chipman & Power). The new plant is about ready for test. The steel standpipe which is being constructed for the new system is shown in the background of the accompanying photograph.

*Chipman & Power, 203 Mail Building, Toronto, Canada.

San Francisco Regrades for Electric Railway

After the San Francisco disaster of 1906 many of the street-railway lines previously operated by cable were converted into electric roads, for which maintenance and operation costs are materially less. A trunk line of cable ran along Market St. and had branches into five different sections of the city. The entire Market St. system has since been converted with the exception of a portion of the Hayes St. road west of Fillmore St., where the grades were too steep for an electric railway. When the cable was abandoned the route of this line was altered, to the detriment of the district immediately west of the incline.



REGRADING HAYES ST., SAN FRANCISCO

A roadway over which electric cars can be operated with safety will greatly benefit this district and improve street-railway traffic facilities. The city engineer, therefore, entered into an agreement with the United Railroads, the holder of the Hayes St. franchise, by which the railway company will at its own expense perform the grading, and the removal and reconstruction of tracks, while the city will pay for erecting retaining walls and terracing the ground adjacent to the cut, as well as to recompense the one property owner who claimed damages from the proposed improvement.

Originally the elevation of the grade crossing at the crest of the hill was 260 ft. above city base. Approaching the summit was a 14.54% grade. When the cut is made the steepest approaching grade will be 10.9%, and the elevation of the crossing at Pierce St. will be reduced to 245 ft. The usual curb takes the form of a retaining wall. Between the sloping grass plot and sidewalk is an ornamental curb.

Panama Canal Still Closed

The Panama Canal slide situation remains unchanged. Every effort is apparently being made to open up the channel through Culebra (Gaillard) Cut by dredges working from both ends, but no official statement has been made as to a date of opening or as to the probability of attacking the slides by any other method than dredging. At the present rate of progress 1,000,000 cu.yd. a month could be excavated by the dredges. The two views on this page show the extent to which the latest Culebra slide has blocked the canal. The upper view was taken in June, 1914 (just before the commercial opening), and is looking south from the west bank of Culebra Cut. In the near background on the left dredges are working on the Cucaracha slide, which was finally cleaned up in January of this year. In the left foreground is Gold Hill, where in October, 1914, the big Culebra slide started. The lower view, taken in September, 1915, shows the blocked canal at the same point after the present slides—both from Gold Hill on the left and Contractors Hill on the right—had closed the Canal.



CULEBRA CUT BEFORE AND AFTER THE LATEST SLIDE
Upper view, June, 1914; lower view, September, 1915

C., M. & S. P. Electrification Progresses Rapidly

Initial orders for equipment for the substitution of electric traction for steam on the Mountain Division of the Chicago, Milwaukee & St. Paul Ry. were placed a year ago, as noted in *Engineering News* of Feb. 12, 1914. In the elapsed time 650 mi. of overhead construction has been completed on more than 200 mi. of line. The 100,000-volt transmission line paralleling the tracks has been finished and tie lines to the Montana Power Co. are ready. The rail bonding has been completed.

Wood-pole construction is used throughout both for cross-span and bracket construction. The twin No. 0000 trolley wires are suspended individually and separately from the same steel catenary and the hangers of one trolley wire are located at points mid-span on the other. In the switching yards only one trolley wire is used.

Seven substation buildings have been completed and the machinery is being installed. Construction of seven more substations for the second half of the 440 mi. of line is under way. These stations have two 2,000-kw. motor-generator sets of three 1,500-kw. units. One will have three 2,000-kw. machines. The total substation kilowatt will be 59,500. Each of the motor-generator sets consists of a 60-cycle three-phase 2,300-volt synchronous motor direct-connected to two 1,500-volt direct-current generators. The generators are connected permanently in series to supply 3,000 volts to trolley. Each set is also provided with an exciter at each end, one furnishing excitation for the revolving field of the alternating-current motor and the other supplying the separately excited fields of the direct-current machines. One new feature has been added—a longitudinal ventilation of the core and field coils, similar to that now employed in railway motors. The use of this method of cooling has effected a considerable reduction in the floor space required per kilowatt. The overload capacity is 150% normal load for 2 hr. and 300% normal load for 5 min. This will provide ample margin for starting a train of maximum tonnage on the most difficult grades. The motor-generator sets are designed to operate inverted in case the regenerated power exceeds that required by other trains operating near by. For this reason there is no necessity for water boxes or other energy-consuming devices, since the excess energy is transmitted to the 100,000-volt system of the Montana Power Co.

Forty-two 282-ton locomotives have been ordered. The first unit was shipped to the railway Sept. 25. Twelve are geared for passenger service and 30 for freight.

Cleveland Will Vote on Large Bond Issues and Franchises

The citizens of Cleveland, Ohio, will vote on Nov. 2 not only for city officials but also for three franchise proposals of large importance: (1) A freight-subway franchise to the Cleveland, Akron & Canton Terminal Ry. Co.; (2) increase of franchise grants to the Cleveland & Youngstown R.R. Co.; and (3) the new Union Station to be built by the New York Central lines.

The chief bond-issue proposal to be voted on is one authorizing the city to purchase the property of the street railways (Cleveland Ry. Co.). Besides this, bond issues of $1,600,000 for paying the city's part of grade-crossing abolition, $100,000 for building public comfort stations, and $300,000 for opening a new street, are to be voted on.

The Cleveland & Youngstown R.R. Co., part of whose line is already completed, is to extend into the heart of the city, with an underground passenger terminal just south of the Public Square, and is to have an extensive union freight station half a mile south of there. Thence it runs southeast to Shaker Heights, making track connection with all crossing railways.

The Cleveland, Akron & Canton Ry. Co., popularly known as the Barber subway, is to build an underground railway from the lake shore southward on 55th St. to connect the lake traffic with the upper Cuyahoga valley. At Broadway the route branches, one continuing south to the city limits while the other follows Broadway to E. 71st St. and thence along 71st St. to the city limits. Yards are to be built south of the city, and docks on a 2,000-ft. frontage on the lake shore.

The Union Station agreement provides for placing the new station between the Court House and the City Hall, and arranges a settlement of disputes between city and railways concerning lake-front lands, chiefly filled-in land under water.

A Wire-Drag Examination of the East River, New York City, from Lawrence Point to Execution Rocks will be made this fall by the United States Coast and Geodetic Survey.

The High-Pressure Fire-Protection System at Toledo, Ohio, is well advanced and the pumping station is being completed. The system is to serve the downtown business district, as the present mains of the domestic system are too small and too old for the requisite fire pressure. The pumping plant will eventually have a capacity of 7,500 gal. per min., but at present there are being installed three Allis-Chalmers electrically operated centrifugal pumps of 2,000-gal. capacity each. The construction of the plant is under the direction of Herbert McKechnie, City Engineer.

The Chicago Municipal Garbage-Disposal Plant is to be operated by the city, although Dr. Robertson, the new Commissioner of Health, had proposed to make a short-term lease of the grease-recovery plant to a contractor. The finance committee of the City Council refused to approve the lease and directed that the entire system should be operated as a municipal plant. It was urged that if a contractor could make this part of the plant profitable the city could do the same, but that profit was a secondary consideration, the main point being the sanitary disposal of the garbage.

A New Dock and Warehouse at Havana, Cuba, were opened for business in September. The owner (the Peninsula & Occidental Steamship Co.) is the first steamship line to possess its own dock and terminal in Havana. Freight from Havana by way of the Peninsula & Occidental ferry-steamer service to the oversea railway extension to Key West of the Florida East Coast Ry. is growing rapidly, according to Henry M. Walcott, vice-consul at Havana. It is reported that the steamship company has ordered the construction of a second steamer capable of carrying 30 loaded standard freight cars.

The Construction of Sewage-Pumping Stations in Kansas cities of the first, second and third classes was authorized by the last session of the legislature of that state, but construction must not be started until after the plans and specifications have been submitted to and approved by the State Board of Health. Bonds bearing interest at not more than 5½% and stating on their face that they are issued under the provisions of the act in question may be issued to pay for such sewage-pumping stations, without regard to the restrictions and limitations contained in any previous act of the legislature relating to municipal bond issues.

Claims Against the United States for losses in business due to the temporary closing of the Panama Canal are to be instituted by various steamship companies using the canal route, according to press dispatches. This action, however, hardly seems likely, inasmuch as the Government has never guaranteed the continuity of traffic, but has, in fact, often called attention to the probability of slides and consequent shutdowns. A special rate has been made for trans-shipment

across the Isthmus by the Panama R.R., and many of the vessels awaiting passage have taken advantage of this.

Street-Railway Subways in Chicago are again being suggested, the idea having been revived by Mayor Thompson. He proposes four-track subways in the congested business district, to be used by the cars of the surface lines and the trains of the elevated railways. The subways would be built by the city and operated by the electric railways on a rental arrangement. This would necessitate an agreement between the city and the two companies which control all the surface lines and elevated lines, and the mayor suggested that the three parties should appoint a commission of experts to investigate the financial and engineering features of the project. The plans determined in this way would be submitted to the City Council and then to a public referendum vote. No action has been taken and very little interest has been shown in the proposition.

PERSONALS

Mr. George J. Ray, M. Am. Soc. C. E., Chief Engineer of the Delaware, Lackawanna & Western R.R., was recently awarded the degree of Doctor of Science by Lafayette College. The degree will be conferred next June.

Prof. Frank H. Constant, M. Am. Soc. C. E., Professor of Civil Engineering at Princeton University, was on Oct. 20 awarded the degree of Doctor of Science by Lafayette College, the occasion being the inauguration of Dr. John N. MacCracken.

Dr. W. McCoy, Surgeon United States Public Health Service, has been appointed Director of the Hygiene Laboratory of the United States Public Health Service at Washington, D. C., succeeding Dr. John F. Anderson, who recently resigned. Dr. McCoy is now in charge of the leprosy investigation at the hospital at Molokai, Hawaii.

Mr. A. C. Mackenzie, Assoc. M. Can. Soc. C. E., Engineer of Maintenance-of-Way of the Canadian Pacific Ry. at Montreal, has been appointed Acting General Superintendent of the Atlantic division during the absence of Mr. H. C. Grout, General Superintendent of the division, who has been given a leave of absence.

Mr. C. T. Delamere, Assoc. M. Am. Soc. C. E., Acting Engineer of Construction of the Canadian Pacific Ry. at Montreal, has been appointed Acting Engineer of Maintenance-of-Way of the company's Eastern Lines to fill the vacancy caused by the appointment of Mr. A. C. Mackenzie as Acting General Superintendent of the Atlantic Division.

Mr. Robert E. Strahorn has been elected President of the new Oregon, California & Eastern Ry. The purpose of the company, it is said, is to open new through routes to San Francisco and Nevada, but with the main object of connecting the Harriman lines in Oregon with Reno, Nev., in such a way as to eliminate the long haul through the Sacramento Valley and over two mountain routes.

Mr. Victor R. Walling, Assoc. M. Am. Soc. C. E., First Assistant Engineer of the Chicago & Western Indiana R.R., has been appointed Principal Assistant Engineer, in charge of construction and maintenance, with headquarters at Chicago. Mr. Walling has been in the company's service since 1912 and has recently been in charge of over 40 mi. of track-elevation work on the Western Indiana main line.

Mr. Curtis C. Westfall, Assistant Engineer in the Bridge Department of the Illinois Central R.R., has been appointed Engineer of Bridges. Mr. Westfall has been employed by the Illinois Central since 1907 as draftsman and Assistant Engineer of the bridge and construction departments, Assistant Engineer in connection with the Chicago Grand Crossing track elevation and Engineer in Charge of Construction of 70 mi. of the company's railroad in North Dakota.

Mr. Frank A. Burr, M. Am. Soc. M. E., formerly Sales Manager and Mechanical Engineer at Chicago of the Spray Engineering Co., of Boston, and recently connected with the Stone & Webster Engineering Corporation, of Boston, has been appointed Instructor in power-plant design at Pennsylvania State College. Mr. Burr is a graduate of Brown University and has had four years' experience as Instructor and Assistant Professor in the mechanical engineering laboratories of Cornell University.

Mr. Charles Carroll Brown, M. Am. Soc. C. E., editor of "Municipal Engineering," Indianapolis, Ind., has been appointed lecturer on water-supply and sewage disposal at Purdue University. It has been erroneously announced in a contemporary that Mr. Brown had been appointed Professor of Sanitary Engineering to succeed Professor Sackett. The appointment, however, requires but one lecture a week and does not interfere with any of Mr. Brown's other duties, which include the secretaryship of the American Society of Municipal Improvements.

Mr. Edward H. Sargent, Assoc. M. Am. Soc. C. E., Assistant Civil Engineer of the New York State Conservation Commission, has been appointed Assistant Engineer of Water Power, Storage and Drainage at an annual salary of $3,000. Mr. Sargent was selected from 69 competitors who took the recent civil-service examination for that position. Mr. Sargent was graduated from the Massachusetts Institute of Technology in 1907, and for a short time was employed in the Department of Water Supply of New York City, afterward being appointed Assistant Engineer in the State Water Supply Commission, which was later consolidated with the Conservation Commission.

OBITUARY

H. M. McCartney, formerly a civil engineer of San Francisco and Oakland, died from heart failure at Los Angeles, Calif., on Oct. 16. Mr. McCartney had been connected for some time with the land department of the Southern Pacific Co. During the construction of the Western Pacific Ry. he acted as Assistant Chief Engineer and was prominently identified with the building of the Northern Pacific Ry., the Union Pacific R. R., and the San Pedro, Los Angeles & Salt Lake Ry.

Augustus J. Du Bois, M. Am. Soc. C. E., for 30 yr. Professor of Civil Engineering in the Sheffield Scientific School of Yale University, died suddenly from heart disease on Oct. 19 at his home in New Haven, Conn. He was born at Newton Falls, Mass., 66 yr. ago, and was graduated in civil engineering from Sheffield in 1869. Three years later he took the degree of doctor of philosophy and then went to Saxony, where he took a two years' course in mechanics at the Mining Academy of Freiberg. He returned to the United States in 1875 and was appointed Professor of Civil and Mechanical Engineering at Lehigh University, remaining there until 1884, when he resigned to accept the chair of civil engineering at Sheffield. Professor Du Bois was a member of the governing board of the school and an author of numerous engineering works.

ENGINEERING SOCIETIES

COMING MEETINGS

THIRD ANNUAL PENNSYLVANIA WELFARE AND EFFICIENCY CONFERENCE.
Nov. 16-18. Conference in Philadelphia.

AMERICAN ASSOCIATION OF ENGINEERS.
Dec. 10 and 11. Convention in Chicago. Secretary, Arthur Kneisel, 29 South La Salle St., Chicago.

American Society of Civil Engineers — The nominee for president for 1916 is Elmer E. Corthell, consulting engineer, New York; for vice-presidents, Palmer C. Ricketts, Troy, N. Y., and Alfred Craven, New York; for directors, Virgil G Bogue, New York; A. C. Humphreys, New York; Otis F. Clapp, Providence, R. I.; Richard Khuen, Pittsburgh, Penn.; F. G. Jonah, St. Louis, Mo., and Edwin Duryea, Jr., San Francisco, Calif. The hold-over vice-presidents are Clemens Herschel, of New York City, and Daniel Bontecou, of Kansas City, Mo.

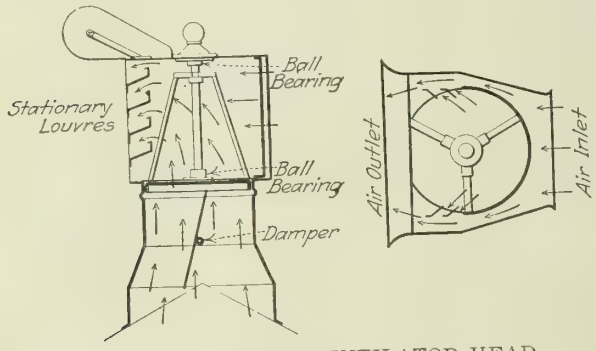
National Paving-Brick Manufacturers' Association—The twelfth annual convention of the National Paving-Brick Manufacturers' Association was held in Dayton, Ohio, Oct. 11 to 13. Except for the opening session, the convention was conducted jointly with that of the American Society of Municipal Improvements. Several papers on brick pavements were read. At the business session on Monday morning the work of the association during the past year was reviewed in an address by the retiring president, Charles J. Deckman, and in papers read by Will P. Blair, secretary, and H. H. Macdonald, assistant secretary. The following officers were elected for the ensuing year: President, C. C. Blair, Youngstown, Ohio; vice-president, J. W. Robb, Clinton, Ind.; secretary, Will P. Blair, Cleveland, Ohio; assistant secretary, H. H. Macdonald, Cleveland, and treasurer, C. C. Barr, of Streator, Ill. These are all rëelections except C. C. Blair. The retiring president, Charles J. Deckman, has served four years and declined to be a candidate. On Tuesday evening the association was host to the members and guests of the American Society of Municipal Improvements at a banquet. Secretary Will P. Blair intro-

duced Robert R. Nevin, a Dayton lawyer, as toastmaster. Among the speakers was Dr. W. O. Thompson, president of Ohio State University, whose subject was "Efficiency and Economy in Public Expenditures." James M. Cox, former governor of Ohio, spoke on "Benefits Arising from Coöperative Efforts."

Appliances and Materials

Another Exhausting Ventilator

A new ball-bearing revolving head for ventilating flues, shown in the accompanying sketch, has been developed by the Burt Manufacturing Co., of Akron, Ohio. In addition to the



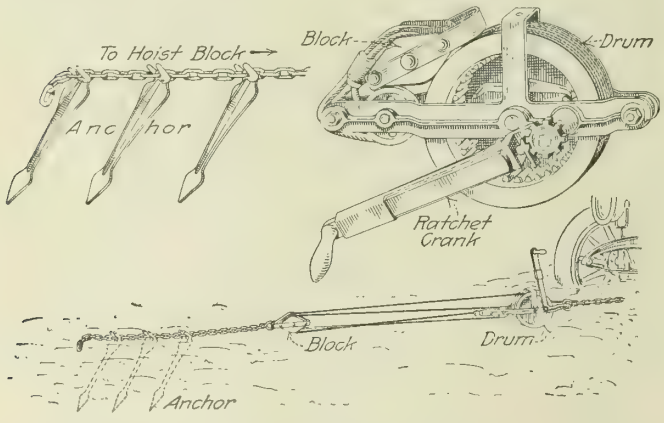
BURT REVOLVING VENTILATOR HEAD

tail which keeps the outlet opening before the wind, the head is designed so that the breeze blows through it and by aspirating action produces a slight vacuum in the flue, which helps the natural draft.

* * *

Portable Geared Hand-Power Hoist

The small geared hoist shown in the accompanying sketch is intended for various applications, such as on a portable shop crane or a motor-truck crane. It may also be used as a car puller, fence stretcher, wrecking hoist, etc. The weight of the hoist is only 24 lb. The cable drum has an internal gear engaged by a pinion driven by the ratchet crank. The 40-ft. cable is led through a block which may be chained to a rail or timber for anchorage. A special anchor consists of three light steel stakes driven into the ground about a foot



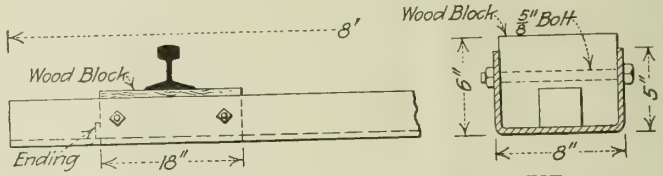
LIGHT HAND-POWER HOIST

apart and sloping in the direction of the pull. In a test made at the Ranken School of Mechanical Trades, St. Louis, the anchor arranged as shown sustained a pull of 3,680 lb. without giving. It is built by the Pull-U-Out Sales Co., 2018 Market St., St. Louis, Mo.

* * *

Combination Steel and Wood Tie

A steel tie with wood bearing blocks, as shown herewith, is being tried on the Pennsylvania R.R., which has laid about 500 ties near Parkesburg, Penn. This tie consists of an 8-ft. steel channel, 5x8 in., ⅜ or $\frac{5}{16}$ in. thick, weighing 130 or 180 lb. Holes in the bottom, at the middle, provide for drainage and for bonding with the ballast. Under each rail is a creosoted-wood block 18 in. long secured by two bolts, and prevented from shifting by end lugs stamped up from the bottom of the channel. A steel tie-plate is placed upon this and the rail is secured by common spikes or screw spikes. The block extends about 2 in. above the sides of the steel channel, and it appears that no additional insulation is required for rails carrying signal circuits. The construction permits of shimming the rail to level and adjusting it to gage. Durability, economy and easy-riding properties are



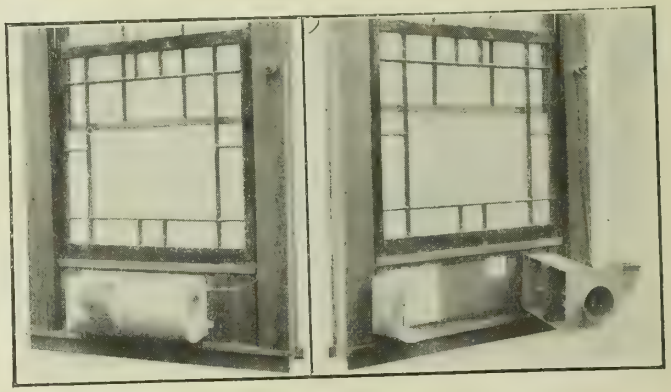
COMBINATION STEEL AND WOOD TIE

among the advantages claimed. The blocks are easily renewable. In some cases they may be made from the sound portions of old ties or other scrap timber, and it has been suggested that increased life of the steel may be obtained by some cheap anticorrosive treatment. The patents on this tie are owned by the Standard Steel Tie Co., of Dallas, Tex.

* * *

Window Ventilator and Air Cleaner

A novel small ventilator, intended particularly for offices and buildings where natural ventilation is insufficient and modern forced ventilation methods cannot easily be employed, has been put on the market by the Hackney Ventilating Co., University and Prior Ave., St. Paul, Minn. As may be seen in the accompanying views, there are both exhaust and supply fans, the latter drawing its air through a cloth filter. The two fans are mounted on the shaft of a $\frac{1}{20}$-hp.



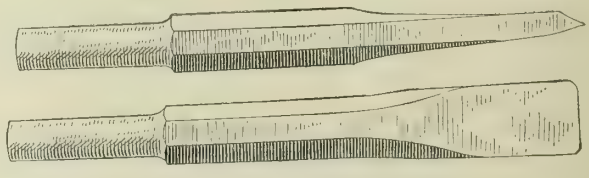
TWO VIEWS OF SMALL EXHAUST AND BLOWER VENTILATOR

1,000-r.p.m. motor. The latter is supported by a cork slab, which deadens the noise of the motor. The casing is split and hinged so as to be easily opened. The delivery tip is reversible—to change the direction of the air current. Three sizes of the machine are available—for 5,000, 7,500 and 10,000 cu.ft. of air per minute.

* * *

New Pipe-Calking Tool

Those experienced in pouring lead joints in pipe know the tendency of the lead to contract around the spigot portion of the pipe, making it necessary to drive the lead to the upper portion or bell end of the pipe or valve in order to make the joint water-tight. This tendency has been taken into account by the Water Works Equipment Co., 50 Church St.,



"REVELATION" CALKING TOOL
Pneumatic type

New York, which has just placed upon the market two calking tools, one for hand, the other (see accompanying view), for air operation. The hand tool is like the other, but has no chuck shank. The "Revelation" calking tool was designed for lifting up the lead. The manufacturer guarantees that the application of this tool once or twice around the joint will make a water-tight joint.

Engineering News

VOLUME 74 NOVEMBER 4, 1915 NUMBER 19

Construction Details of Bridge Across Portland Harbor

The bridge now in construction across an arm of the harbor between Portland and South Portland, in Cumberland County, Maine, comprises two long approaches on the Portland side, each of reinforced-concrete beam-and-girder construction, a stretch of 700 ft. of reinforced-concrete cantilever-girder spans, 1,000 ft. of steel cantilever spans, with a middle rolling lift, and a length of 275 ft. of concrete beam-and-girder construction on the South Portland side. Its design was described in an earlier issue of *Engineering News*. There are, however, some points n the construction which are worthy of separate notice. There existed at the site an old highway bridge which paralleled and overlapped the new bridge from South Portland to the Portland bulkhead line, but which turned westward, away from the new bridge, from that point. On account of the heavy traffic it was necessary to maintain a crossing for vehicles, foot passengers and street cars across the harbor, though the interference of the new and old bridge lines precluded the possibility of using the entire old bridge. As a solution it was decided to tear down the Portland shore crossing of the old bridge and divert the traffic eastward along the waterfront street at the bulkhead line, at the same time building a new pile-bridge diversion—in the shape of a wide open letter V—which crossed the main harbor channel with a temporary swingbridge at the point of the V. The South Portland section of the old bridge—narrowed slightly on account of the encroachment of the new roadway—continued the temporary crossing to the south.



FIG. 1. VIEW ALONG PORTLAND HARBOR BRIDGE, LOOKING TOWARD SOUTH PORTLAND

Main bridge section in middle. Temporary bridge, with angle in plan to provide for drawbridge swing, approached from roadway alongside railway yard at left. Laying tracks on concrete-beam section in foreground. Steel-girder section next beyond under erection. South Portland approach in background

The view in Fig. 1 was taken from a high point at the Portland end of the new bridge. It shows the new bridge under construction on the right, with the temporary crossing at the left. The V diversion, it will be seen, was necessary in order to make space for the swing of the drawbridge. The temporary drawbridge is of the swingbridge type, mounted on a timber-pile center pier and providing two 70-ft. channels. The bridge, which was designed and built for this temporary service, is made up of two trusses, 21 ft. 4 in. c. to c. and extending 86 ft. on each side of the 4-ft. wide center-bearing girder. The timber floor is carried on floor-beams suspended below the posts. Each truss is 8 ft. deep and is self-supporting when the span is closed. When the draw is open the outstanding trusses are carried from a central tower by 1¾-in. rods extending down to a point about two-thirds of the way along the truss. Electric power is used for operation.

The concreting of the various widely distributed sections of the bridge is done from three central points, at each of which is located a mixing and conveying plant. Two of these plants (on the Portland side) are of the chuting type. The one on the South Portland side is the old-fashioned derrick-and-bucket method.

Plant No. 1 was located about midway of the State St. or north approach, at the foot of Tyng St. It comprised a one-yard Smith mixer located in a pit dug below the level of the street and overhead bins, which could be loaded directly from wagons coming down Tyng St. There was a 120-ft. steel tower of the Lakewood type from which the approach could be controlled from the north end to a point near the main bridge, where the other plant took up the work. The extent of the spouting was about 220 ft. from the base of the tower.

For the main Portland end of the bridge and for the west approach the concreting was done from a tower located near the junction of the approaches and main bridge. This equipment was in service at the same time as the north-approach equipment. The details were practically the same, except that the tower was 155 ft. high, though as it was located on the street some 42 ft. below the floor level of the bridge its total height was about the same. It could control some of the north approach, all of the west approach and practically all of the main concrete bridge, though some of the main bridge toward the middle had to be concreted from buggies pushed from delivery hoppers at the end of the extended chute.

It is stated by the contractor that in this work the limit of chuting was found to be at about a 30° angle with the horizontal. For a flatter angle the concrete had to be so wet as to make its integrity doubtful.

For some of the floor slabs of the steelwork a portable ¾-yd. Koehring mixer will be used, bringing in the material across the finished roadway of the bridge in wagons.

On the South Portland concrete section the amount of concrete to be laid was so small that it did not warrant the erection of a tower plant, so a 1-yd. Smith mixer has been mounted there. The material will be brought in over the old approach and the concrete delivered by a swinging derrick.

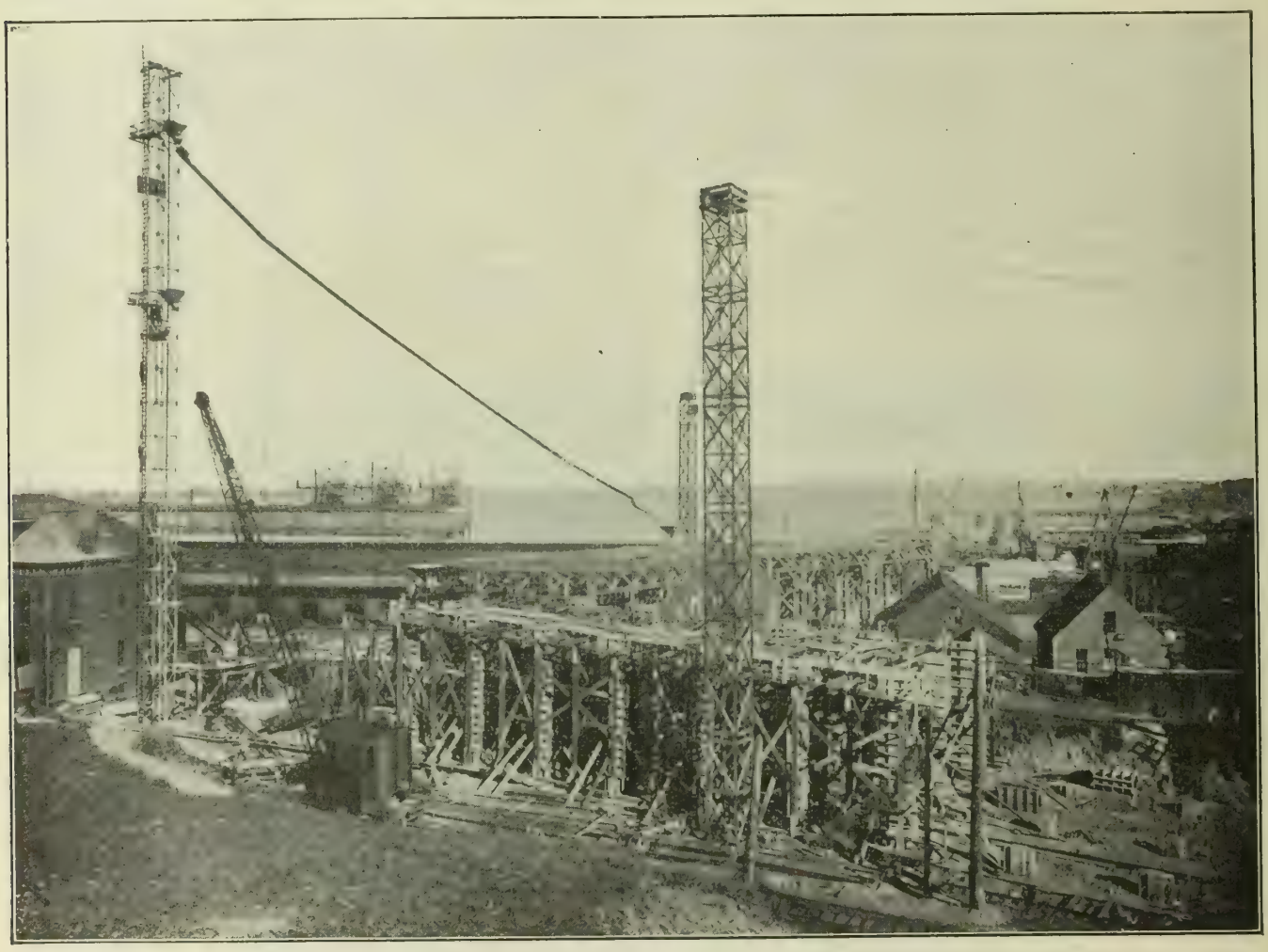


FIG. 2. CONCRETING TOWER AT PORTLAND END OF PORTLAND HARBOR BRIDGE

The view in Fig. 2 shows the second of the tower distributors in action at the juncture of the west approach at the right and the main bridge in the background. It will be noted that two secondary wooden towers had to be erected in order to carry the guy lines of the steel tower out of the way of the yard and also in order to carry the suspension wires for the chute in its extended position.

The aggregate used throughout was a graded sand and gravel obtained from a mixed bank at South Portland, where it is screened, washed and regraded before being carted by wagon to the various concreting plants at the bridge. In the whole job there will be about 30,000 cu.yd. of concrete, of which 12,000 cu.yd. is in the superstructure and 18,000 cu.yd. in the substructure. The steel reinforcement totals 729 tons.

Over 1,250,000 ft. of North Carolina pine was brought in by schooner to Portland to be used in the forms and centering for the bridge. Because of the varied skews and spans very little of the formwork could be standardized; but in spite of this some of the forms were used four or five times. The view in Fig. 3 shows the forms in place for the girders of the main bridge at the Portland end and illustrates the general type of form used. For centering under the cantilever girders over the railway track, wooden trusses (Fig. 4) were pretty generally used, supported by posts located where they could be between the numerous tracks of the terminal yards.

All this work, as well as all material transferred on the Portland end of the bridge, was carried on from a



FIG. 3. FORMWORK ON CONCRETE-GIRDER SECTION

Browning locomotive crane with a 65-ft. boom and a 35-ton rated capacity. On account of the great number of tracks available, this crane, which is provided with standard-gage trucks, could readily reach any part of the bridge. It may be noted in the foreground of the view in Fig. 2.

In concreting the main concrete span at the Portland end the pier bents were first completed to the base of the girder supports before the centering for the girders was placed. Then the cantilever girders were cast in one pouring from one overhang to the other and in groups of three transverse to the bridge. The corresponding three on the other side of the bridge were then cast. About two weeks after the main cantilever spans were all completed the intermediate or suspended spans were cast, all in one day. It required about 196 yd. of continuous pouring for one day's work on the largest of these girders.

Special Construction Details

The use of precast concrete railing sections and sidewalk brackets was commented on in the previous article. Such practice is fairly common, but it is unusual to ship concrete members of this sort by rail as far as from Boston to Portland, as was done in this case.

The setting of the curb forms is somewhat out of the ordinary. The floor slab for the bridge is cast level with the roadway, leaving the conduit space exposed. The conduits are then placed and covered with gravel fill on which is laid the steel-mesh reinforcing for the sidewalk. There is on hand on the job a series of blocked wooden stringers to which are attached at the proper location the steel corner-pieces for the curbing. This blocking is then set up along the edge where the curb would be and wired back to the reinforcement of the sidewalk. All that remains to be done, then, to cast the sidewalk is to pour it on the mesh as laid and to screen it off between the outer coping and the curb block as placed. When set, the wiring can be loosened and the curb blocking removed for future use.

Floating Caissons for River Piers

The river piers on which the steel spans of the bridge rest are all in deep water varying from 25 to 50 ft., with a 13-ft. maximum variation in tide. They are all skewed to meet the thread of the current and all have approximately the same general sections.

In general the piers are rectangular in plan and consist of a base of concrete, footing on timber piles, about 30x88 ft. in section and 11 ft. deep, with a prismatic upper part rising in much smaller section to just below mean low water. All of this part is mass concrete. Above this section the face of the pier is cut granite, with concrete backing, partly to provide a more artistic appearance, but mainly as a protection against the inter-tidal wear on the concrete, since it has been found in Portland harbor—which is salt water and frequently icebound—that concrete does not stand up well between tides.

There was no specified method of constructing these piers, the only provisions in the specifications being that the silt was to be dredged to a depth of at least 5 ft. below present bottom and that piles were to be driven to a resistance satisfactory to the engineer. It was also specified that the concrete foundation block might be deposited through water, provided the space was inclosed in tight sheeting and the method of placing the concrete was such as to insure dense, sound concrete. However, the contractors, after considering the matter, decided to construct

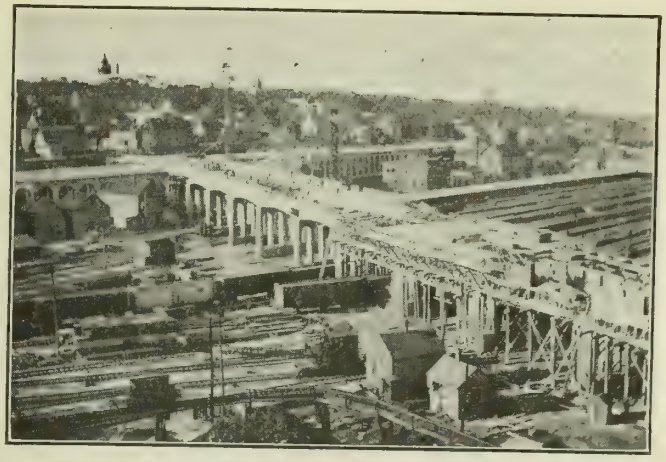


FIG. 4. PORTLAND END OF BRIDGE UNDER CONSTRUCTION

Note trussed centers for girders over railway tracks. State St. approach at right, Clark St. approach at left

seven of the ten piers by means of a floating caisson. This method was utilized and proved eminently successful.

In its elements the scheme was as follows: The pier site was first dredged to grade and the wooden piles driven on the close spacing (average 2½ ft.) required. The number of these piles per pier varied from 170 to 370. By means of a floating saw—with the usual circular-saw equipment of piledriver leads with a vertical shaft between them carrying a horizontally disposed circular saw at its lower end—the piles were cut off with great rapidity. Meanwhile on shore had been constructed a concrete caisson or open box, which was so built as to permit the erection on it of wooden sides. This box was floated

out to the pier site and concrete deposited inside of it in the open. As the concrete was deposited the box sank until it found a level bearing on the piles. It was then carefully adjusted to its proper location and the concrete carried up high enough to insure its being fixed on the piles. The masonry was then carried up to above high water, after which the wooden sides were removed and the pier completed.

Fig. 5 shows a sketch of the base of the concrete box. These boxes varied in size, but the dimensions of the largest were as follows: Length, 88 ft. 4 in.; width,

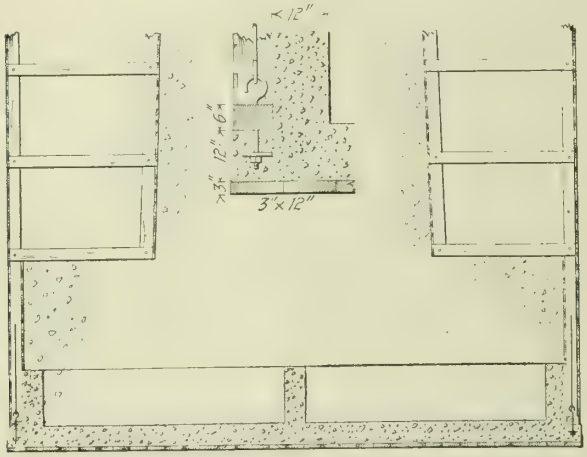


FIG. 5. SKETCH OF LOWER PART OF CONCRETE CAISSON FOR PIERS OF PORTLAND BRIDGE

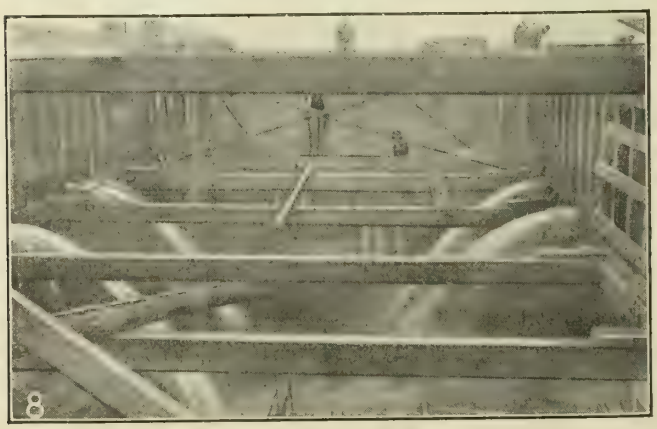
32 ft. 8 in.; height, 4 ft. 6 in. The concrete section was cast on a 3-in. solid wood flooring attached to the concrete floor. The box itself was made up of 12-in. bottom and sides and interior walls. The outside of the bottom was provided with a 12-in. lip, into which were cast hook bolts as shown in the detail in Fig. 5. While still on the ways the studding for the forms for the lower part of the pier was attached to the hook bolts in the manner shown and those sides built up to a height sufficient to insure the floating of the box when it was launched. These sides were then calked so as to make the structure water-tight.

After launching (Fig. 7 is a view of the launching of one of these caissons) it was towed to place and the concrete work started. By careful manipulation of the filling of the concrete in the cells the whole caisson was sunk uniformly at a rate of about 2 ft. of sinking per 1 ft. of concrete total filling, the concrete being continued up into the forms above. When the whole box had its first even bearing on the prepared pile bed, the sluiceways in the sides of the forms were opened (Fig. 8) and the box allowed to take a firm bearing on the pile bed.

Inasmuch as this operation occurred some days after the pouring of the concrete, the wetting was not at all harmful. Only enough water was allowed to enter the forms to insure the stability of the pier on the bed. Then the concreting was continued up inside the forms in the dry, the outer forms serving as a coffer-dam. As soon as the concrete got above the water line the hook bolts were unbolted at the top and eased off, thus allowing the whole outer framework to be taken down to be used on another caisson under construction, the rest of the pier being carried up uniformly in open air, using the granite facing blocks as forms, inside which the concrete was placed. After the pier had taken its bearing, sand was dumped overboard alongside, it being hoped and expected that the sand would tail under the pier and fill up the short distance between the pile tops and the dredged foundation. The foundations are finally protected by a large amount of riprap deposited for a distance of 18 ft. on all sides of the pier.







FIGS. 6 TO 8. VIEWS OF CONCRETE CAISSONS USED IN BUILDING PIERS OF PORTLAND BRIDGE

Fig. 6—Concrete base on ways. Fig. 7—Launching a caisson. Fig. 8—Flooding a caisson in place

The bridge is being built for Cumberland County, Maine, under the direction of J. R. Worcester & Co., of Boston, Mass., as Engineer, with E. E. Pettee, of that firm, as Resident Engineer. The substructure contract was held by Holbrook, Cabot & Rollins, Inc., of Boston, with Luke S. White as Superintendent, and the superstructure contract by T. Stuart & Son Co., of Newton, Mass., with Albert T. Stuart, of the firm, as Superintendent. The structural-steel spans, including the Scherzer rolling-lift, are being built by the Phœnix Bridge Co.

Construction Progress on the Twin Peaks Tunnel

By A. J. Cleary*

SYNOPSIS—Methods used and progress made on long passenger tunnel on line of Market St. in San Francisco.

The principal features of the design of the Twin Peaks Tunnel were fully described in *Engineering News* of Feb. 20, 1915. The project is the largest thus far undertaken in any city for the extension of a street-railway system. The length of the tunnel is 12,000 ft., the width 25 ft. in the clear and the clear height above top of rail 15 ft. On its completion over 10,000 acres of very desirable residential territory, now isolated by reason of inadequate street-railway facilities, will be brought into direct communication with the downtown district.

On Nov. 12, 1914, a contract for the construction of the tunnel was awarded to Robert Storrie & Co. for the estimated sum of $3,372,000. Work was begun on both ends simultaneously on Nov. 30, 1914.

Up to the middle of October, 2,000 lin.ft. had been excavated westerly from the east portal and 1,860 lin.ft. of concrete tunnel lining had been poured. A short distance from the portal a large underground station has been provided for the accommodation of passengers transferring from subway to surface cars, and vice versa.

Excavation for the first 1,300 ft. of tunnel and for the underground station was performed in open cut with steam shovels. A few hundred feet from the portal the cut was so deep that it had to be taken out in two lifts. One shovel first excavated about 12 ft., loading into auto trucks on the bank above the excavation; behind this a second steam shovel completed the cut to the required depth, loading into auto trucks which followed up the steam shovel through the cut.

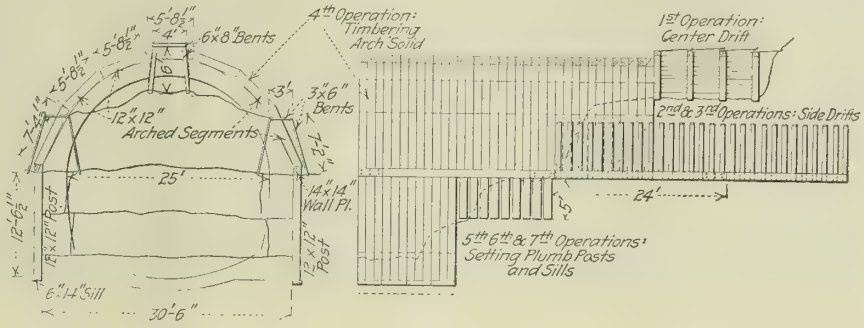


FIG. 2. TWIN PEAKS TUNNEL EXCAVATION AND TIMBERING

Most of the material through which the excavation was made stood without lagging, but near the corner of 18th



FIG. 1. TIMBERED TUNNEL EXCAVATION IN MAIN SECTION OF TWIN PEAKS TUNNEL

*Assistant City Engineer, San Francisco, Calif.

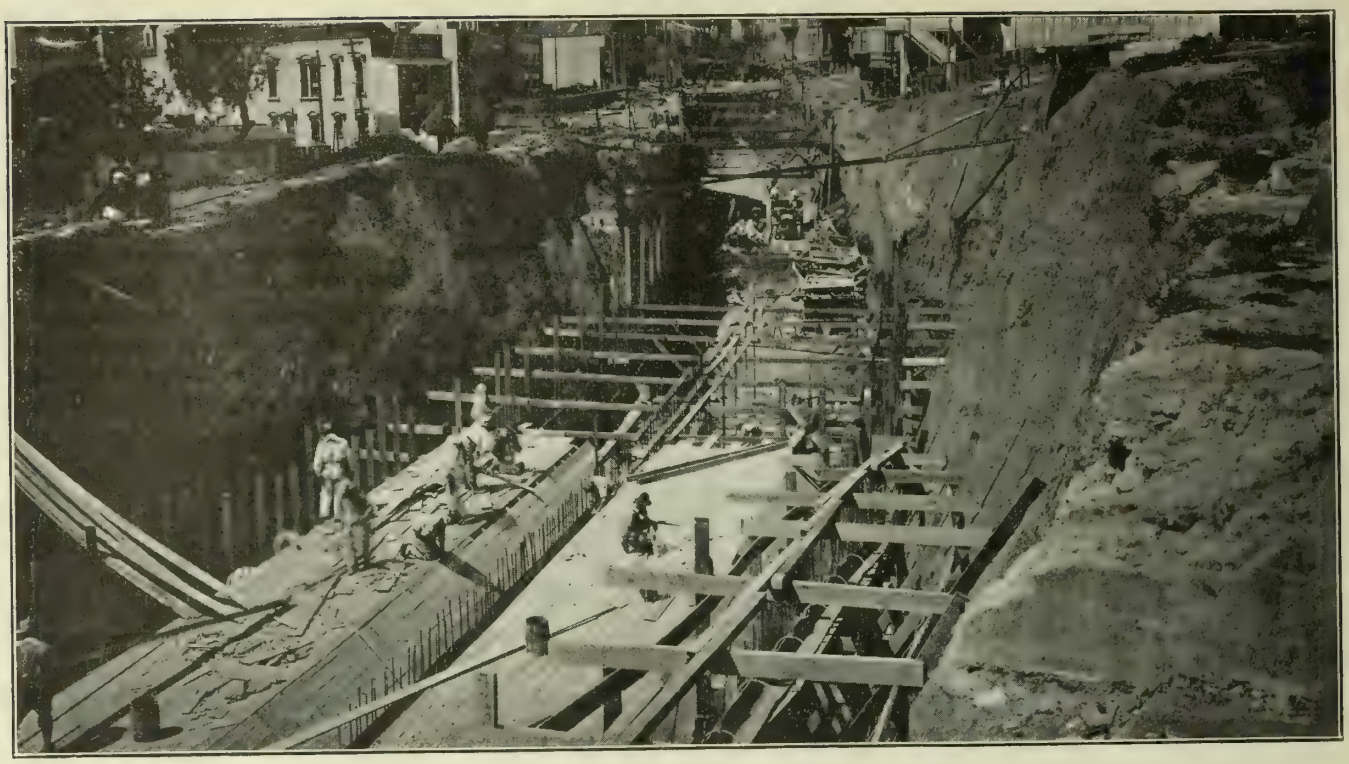


FIG. 4. TWIN TUNNEL FORMS IN OPEN CUT

and Hattie St. a deep fill extended across the line of the work. In this location it was necessary to drive 50-ft. sheeting on each side before excavation and brace across the trench with 12x12 spreaders.

The 18th St. car tracks of the United Railroads had to be carried across this cut without interrupting service. Piles were driven at 4-ft. centers along the sides of the proposed excavation. These were then capped by 12x12 timbers and 14x14 beams placed upon the caps to form

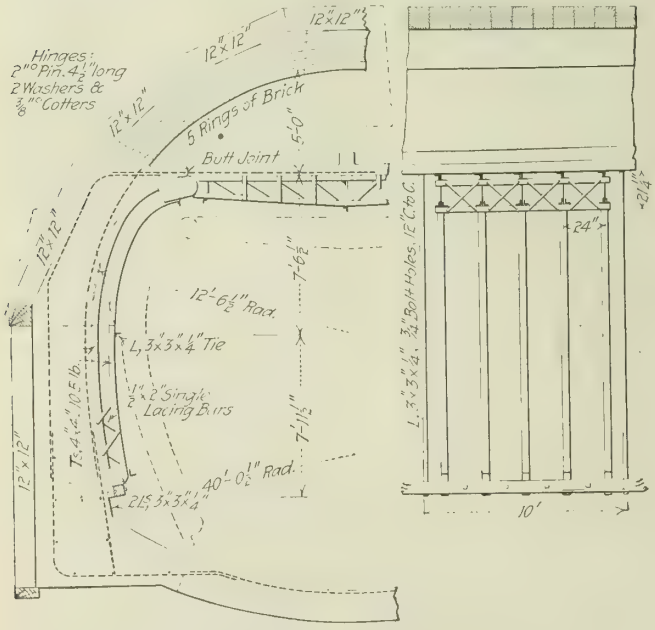


FIG. 3. COLLAPSING FORM FOR TUNNEL CONCRETING

a solid decking under railway and street. Girders were placed on top of the deck under each of the four rails.

The Eureka Valley station is a steel-beam structure, with 300-ft. platforms to accommodate four-car trains. The steel and concrete work has already been completed and the forms have been removed.

Between this station and the portal is a curve with a radius of 716.78 ft. Forms for the curve were built in 8-ft. chords, of 6x⅞-in. matched lumber with 2x6-in. vertical ribs. When the concrete had set and the forms were stripped the inner surface was entirely satisfactory.

Concrete Work with Hydrated Lime

The use as a waterproofing agent of 8 lb. hydrate of lime to every 100 lb. cement gave to the finished concrete a smooth, dense surface, so that little plastering was required.

The concrete at the east end is mixed in a 1-yd. mixer. Niles gravel, Niles sand and beach sand are the aggregate. Concreting has been very rapid. An average 8-hr. run is over 360 cu.yd. Considering that the concrete has to be wheeled for several hundred feet in buggies, the performance is a creditable one.

At the west end 1,650 lin.ft. of excavation and over 750 lin.ft. of concrete lining had been completed up to Oct. 16. Over half of the work so far completed at the westerly end has been done in open cut. Concrete is deposited through a shaft leading to the horizontal ventilating chamber immediately above the tunnel. It is then wheeled through this chamber to the headings and packed by hand in the forms.

Tunneling and Timbering

The method of timbering is shown in Fig. 2. Crown and wall-plate drifts are first driven and timbered. The earth between the drifts is then stoped out and 12x12-in. segmental arch timbers are set on 14x14-in. wall-plates, to form a close lining. Next, 12x12-in. plumb posts are placed along the sides, and finally the core is removed.

The material at the west end is a heavy packed sand and it is therefore necessary to place a solid lining.

An ingenious device has been erected by the contractor for removing the forms from the top of the tunnel after the concrete has been poured. This consists of a double

A-frame, cross-braced, at the top of which is a hinged support, which can be pressed against the roof forms and held horizontal by a prop while the forms are being pulled loose. The hinged support is then slowly brought to an inclined position and the forms allowed to slide down the A-frame. This has proved very efficient in safeguarding the men working beneath.

Excavation for the Laguna Honda station is 60% complete. The floor of this structure is only 62 ft. below the ground surface, so it was deemed most economical to excavate for the entire station from the surface in open cut. The material at this location is a well-compacted sand. Piles were driven by jet along the sides of the cut, to hold the banks in place. It is probable that the construction of the tunnel will be advanced in both directions from Laguna Honda station.

On the surface, directly above the station, a reinforced-concrete building 100 ft. long will be erected to serve as a surface station. Six 50-passenger elevators will operate between the underground and surface stations. As soon as the excavation is to grade, the steel and concrete in the station structure will be placed and the elevator shafts completed, in order that they may be used during construction as service shafts for the tunnel work.

Plans call for the construction of a ventilating shaft west of the center of the tunnel. This has been sunk to a depth of 30 ft., and when complete will probably also be used as a temporary construction shaft.

Funds for the tunnel construction are being provided by district assessment. The majority of the assessments are being paid in ten annual installments, with interest on deferred payments at the rate of 7%.

The tunnel is being constructed by Robert Storrie & Co., under the direction of M. M. O'Shaughnessy, City Engineer. Roy Hackley is engineer for the contractors.

Alleys in the City Street Plan

Should the street plan of a city include alleys? If so, why? These were two of a number of questions discussed by Charles B. Ball, Chief Sanitary Inspector of Chicago, in a paper entitled "The Alley Problem," read before the fourth National Conference on Housing in America, recently held at Minneapolis, Minn. Some extracts from the paper follow:

An alley may be defined as a minor public thoroughfare, not exceeding 20 ft. in width, extending through a block, in order to afford access, light and ventilation to the rear of the premises which abut upon it, as well as a suitable location for the public-service mains.

Three basic considerations in regard to alleys are: (1) Every alley must be dedicated to public use to permit the city to pave, clean, light and police these spaces. (2) Every alley must extend through the block from street to street. (3) Every alley must have a uniform width of not less than 16 ft.

Alleys exist in more than two-thirds of the cities of the United States, and, with two or three exceptions, are still laid out in additions to these cities. The great example of their nonexistence is the City of New York, where they are intentionally absent. I am unaware of any recently planned cities in which alleys have not been provided, although doubtless there are a few.

It is notable that in those American cities which show most careful consideration of the principles of city planning, such as Washington, Zion City, Savannah, Ga., and Vandergrift, Penn., alleys have been provided.

Vandergrift, Penn., laid out by Frederick Law Olmsted in 1895, is an excellent example of thoroughness in designing a small city. The street lines conform to the surface contours, and alleys 15 to 20 ft. wide are provided in each block.

The self-evident advantage of alleys is that they afford facility of access to the rear of premises for the supplying of goods—fuel, ice, milk, groceries, etc.—as well as for the removal of waste materials, such as garbage, ashes, rubbish and the like.

Attention has been directed for a year or two past to the tremendous distance traveled by the delivery wagon in making its ordinary deliveries, as well as to the waste of effort in the collection of household refuse where alleys are not available. It should be observed that the services referred to can be performed with a saving of 50% in distance traveled where alleys exist, as contrasted with blocks in which the service must be performed by street access only.

In addition to the marked saving of distance, as well as the convenience effected by alley access, it must be granted that the natural and desirable place of entrance of all those who perform services of this nature—for example, the iceman—is at the rear of the building rather than at the front.

One of the advantages of an alley system, hitherto little realized, is the convenience and speed with which fire-fighting apparatus may be brought through it into use.

Another advantage of alleys is that they afford more convenient access for the storage of vehicles on the rear of the lot. The man who has a small business, requiring only a single delivery wagon, would much prefer to keep that wagon, whether it be horse or motor propelled, at the rear of his lot. The convenience of the user of an automobile is greatly enhanced by being able to store it on his own premises instead of at a public garage.

No one can question that the day is near at hand when automobile storage on every third lot will be deemed a necessity; hence the argument in favor of providing the alley for this use is much more powerful than it would at first appear.

The use of the alley space for sewers, water mains, gas mains, ducts and wires for telephone, telegraph, lighting and power services has long been recognized by engineers.

In addition to the valid arguments already set forth to show why alleys are needed, the principal reason for their existence is still to be urged. An alley through the center of every city block is required because by this means alone is it possible to assure for the future a sufficiency of light and air in the middle of the block.

Railway Accidents in Germany in 1914 have been compiled and analyzed by the Association of German Street and Interurban Lines. This association embraces 178 lines, which during the year operated 750,000,000 car-km. (460,027,460 car-mi.) and carried 2,750,000,000 passengers. Accidents averaged one of a serious or fatal nature for 349,103 mi. operated. In Aix-la-Chapelle, which has the largest interurban system in Germany, the average was one accident for 402,166 mi. The fact that more pedestrians were injured or killed than passengers was established as usual. The association, taking an average for the 15 yr. from 1899 to 1914, states that 31.81% of the passengers injured suffered accidents through carelessness while boarding or leaving cars. Of the pedestrians injured, it reports that 54.46% were careless in crossing or walking along car tracks.

Torpedo-Boat Berth at the Charleston Navy Yard

The United States Government is building a torpedo-boat berth of reinforced concrete at the navy yard at Charleston, S. C., which involves some notable details in both design and construction.

The Charleston yard, stretching a mile along the west bank of the Cooper River, 7 mi. above its mouth, is used as the home port of the reserve torpedo flotilla, and for this purpose needs extensive berthing space for torpedo boats. Hitherto timber pile-and-deck piers perpendicular to the stream, and one L-shaped pier projecting from the shore for about 200 ft., and thence extending downstream parallel to the shore, have been used for this purpose. The L-shaped pier being in bad condition, it was decided to replace it by a permanent structure.

The design adopted for the permanent berth (shown in Fig. 1 by a general plan and several sections) was in part determined by the fact that the river-bank front of the yard had no permanent wall or wharf. The berth structure therefore was designed to include a shore wharf or quaywall along the bulkhead line of the river, a causeway running 360 ft. out into the stream at an angle of 69 deg. from the quaywall, inclining downstream, and an outer pier parallel to the quaywall. The substructures are all of open construction, so that the current of the river is not obstructed or diverted. Boats enter the basin between the shore wharf and outer pier parallel to the line of the stream, and it should therefore be easy to dock them at all stages of the tide.

The structure was designed by the Bureau of Yards and Docks, United States Navy Department, and is being built by the Snare & Triest Co., New York, the lowest bidder. The contract price for the entire work is $296,964.26.

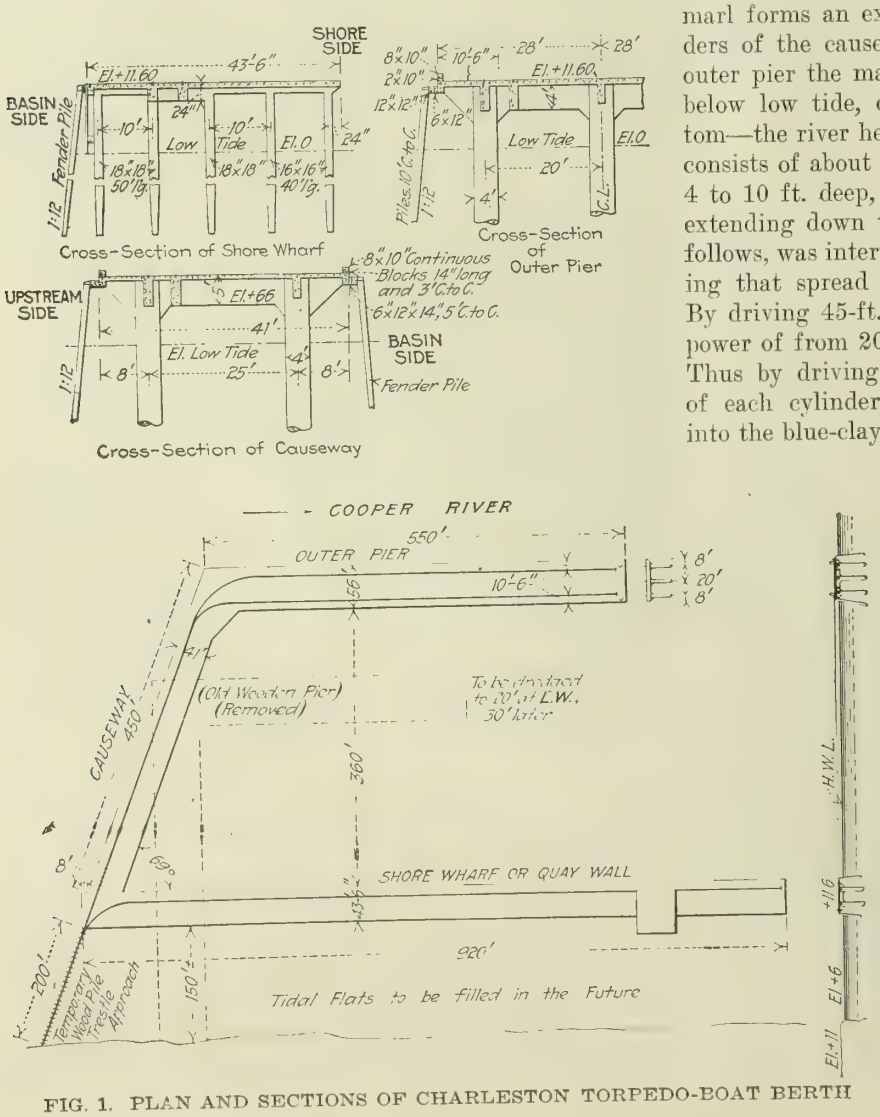


FIG. 1. PLAN AND SECTIONS OF CHARLESTON TORPEDO-BOAT BERTH

Reinforced-Concrete Structure

Two radically different types of structure are used in the berth. The quaywall consists of a concrete deck supported on concrete piles 10 ft. c. to c. each way. The causeway and the outer pier are carried on 4-ft. diameter concrete cylinders spaced 20x25 ft. for the causeway and 20x20 ft. for the outer pier. These cylinders are founded from 35 to 45 ft. below low-water level, resting either on marl or on wooden piles driven in a thick stratum of blue clay. The cylinder foundations are a vital feature of the whole structure.

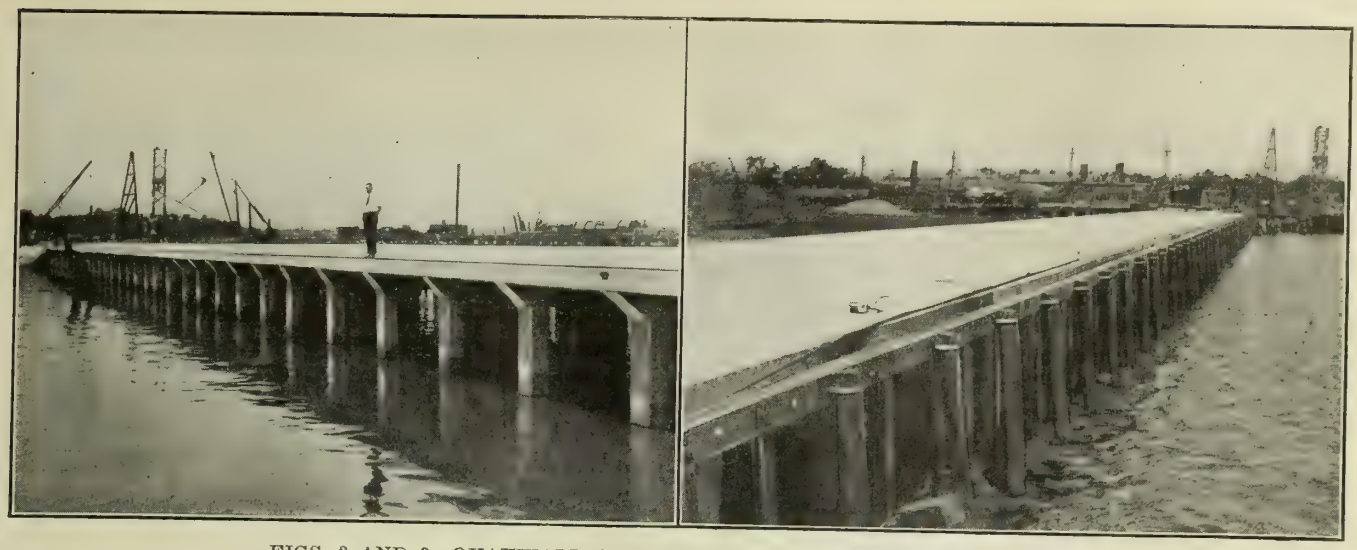
Both in driving the concrete piles and in building the cylinder piers much originality and resource were called for. The methods by which these parts of the work were carried through successfully will be described later.

Foundation Conditions

Marl underlies the quaywall at moderate depth, but this stratum dips rapidly toward the middle of the river. The marl forms an excellent foundation, but only five cylinders of the causeway rest directly upon it. Under the outer pier the marl lies at a depth of from 50 to 96 ft. below low tide, or about 18 to 64 ft. below river bottom—the river here being about 32 ft. deep. The bottom consists of about 3 ft. of soft mud, below this white sand 4 to 10 ft. deep, and below this a bed of stiff blue clay extending down to the marl. A test, described in what follows, was interpreted as showing the clay to be so yielding that spread footings could not be depended upon. By driving 45-ft. piles into the clay, however, a bearing power of from 20 to 25 tons per pile could be developed. Thus by driving a group of seven piles in the footing of each cylinder, and by building the cylinders 4 ft. into the blue-clay strata, the required foundation capacity was obtained, together with full protection against injury by scour or by attack of teredo.

A bearing test of the clay was made by a board of officers while the contract work was in progress and before the adoption of the final plans.

At a point where the marl was about 75 ft. below low tide a steel cofferdam cylinder 8 ft. in diameter was driven down by a steam hammer so that its cutting edge was embedded 4 ft. in the clay. The ground inside the cylinder was carefully leveled 6 in. above the cutting edge, and a grillage of 12x12 timbers, measuring 5 ft. square and 2 ft. thick, was placed on it. Nine concrete piles were then lowered until their points rested on this platform, making a total load of about 80 tons, or a little over 3 tons per square foot. Accurate levels were taken



FIGS. 2 AND 3. QUAYWALL OF CHARLESTON TORPEDO-BOAT BERTH
Fig. 2—Land side, to be filled. Fig. 3—Berth side, with fender piles

during all stages of the loading. As a result of the test it was considered inadvisable to rest the piers directly on the clay. It was specified that piles should be driven to a penetration of ½ in. per blow of a No. 1 Vulcan steam hammer having a 5000-lb. ram, falling 42 in.; but if this minimum penetration was not attained with 45-ft. piles, the piles were to be driven so that their tops would be embedded from 6 to 30 in. in the footing concrete of the cylinders some 3 or 4 ft. below the surface of the clay, where they would be protected from scour and teredo risk.

Deck Construction

The deck slab of the structure is carried by reinforced-concrete girder-and-joist construction spanning between the piles or the cylinders. In the causeway and outer pier the long spans require the girders carrying the railway tracks to be exceedingly heavy (20 in. wide by 5 ft. deep). These girders, the main transverse girders between columns, and the 9-in. deck slab make a total weight of about 140 tons per panel, which had to be carried by the forms and form supports during concreting. Special arrangements were required to take care of this load.

At present the quaywall has been completed and accepted and work on the causeway and outer pier is in progress and is about 40 per cent. completed. It is estimated that the entire structure will be completed in January, 1916.

No Federal Curb on Western Power Development*

By O. C. Merrill†

Eight years of close association with the water-power questions of the Western states have convinced me that the most fruitful cause of difference of opinion on a proper public policy of water-power development is misunderstanding of the actual conditions that exist.

The statement is frequently made that while there is 60,000,000 water horsepower in the United States, but 6,000,000 has yet been developed; and that all that would be necessary to bring about the substitution of water-power for steam and to check the appalling waste of coal is adequate Federal legislation.

Whether there is in fact 60,000,000 water horsepower in the United States no man knows. However, there are, particularly in the West, large amounts of undeveloped water-power. The estimated development of 6,000,000 hp. is correct if the previous rate of increase has been maintained since the last census. Of this amount about one-third is used directly in manufacturing; the remaining 4,000,000 hp. is used in the generation of electric power.

The steam-power development of the United States is about 28,000,000 hp., of which 18,000,000 is used directly in manufacture and 10,000,000 in the generation of electric power. But it by no means follows that if the public domain and the navigable rivers were thrown wide open to private exploitation water-power would or could entirely displace steam power.

Under prevailing practice in hydro-electric systems, even if abundant water-power were available within economical transmission distance from all our markets, and all our industries could be served with electric power, a reserve of not less than 12,000,000 steam power would still be required. But the water-power is not so available. It is absurd to assume that the millions of undeveloped water-power in Oregon and Washington can yet displace other millions of steam power in New York and Pennsylvania. The water-powers of western Pennsylvania and of northern New York, though free from Federal interference, cannot under present conditions be developed and transmitted to compete with steam power in the coal fields of Pennsylvania or at tidewater in the city of New York.

Eastern and Western Developments

The statement is made again and again that although there is urgent need for more power its development is stagnant in the Western states. The demand is made that the Federal Government relinquish its control over the power sites on its lands in order that development may proceed in the West as it has in the East under the stimulus of private ownership or state administration.

It would be only natural to expect that the longer established, more thickly settled Eastern states, engaged so extensively in manufacturing, should have developed

*Extracts from an address before the Western States Water Power Conference, Portland, Ore., Sept. 21.

†Chief Engineer, United States Department of Agriculture, Forest Service.

their electrical industries and their water-power resources to a greater degree than the Western states. Yet the Western states have accomplished more in 20 yr. than the Eastern states in 100 yr. In the Western states—the 11 states west of the Kansas boundary, which contain practically all of the remaining public land—the development of water-power has increased in the last 10 yr. alone by 450%, or five times as fast as in the Eastern states. Furthermore, in proportion to population, 4½ times as much water-power is developed and used in the Western states as in the remainder of the United States, and nearly three times as much as in the Eastern states. These figures are from this year's report of the United States census and are not subject to controversy.

Surplus of Western Power

The power plants of public-utility corporations in the State of California have a capacity of 1,000,000 hp. The sum of the maximum loads carried by the individual plants in 1914 was a little over 700,000 hp. The sum of the simultaneous peaks on the several systems probably did not exceed 600,000 hp. Of course, a certain amount of reserve for emergency and to anticipate extensions of market is necessary; but if we should allow for even a 50% reserve there would still be left a surplus of 100,000 hp. The State of California needs more users, not more power. A similar situation exists in Oregon and Washington and other Western states.

Another common statement is that under existing laws no development is being made or can be made on the public land.

Of the 1,800,000 hp. of developed water-power in the Western states 50% is in plants constructed in whole or in part on the National Forests and operated under permit from the Department of Agriculture. In addition, some 200,000 hp. is in process of construction and over 1,000,000 hp. more is under permit for future construction. If we add the plants which are occupying public land outside of the National Forests we should find that considerably more than one-half of the developed water-power of the Western states is being operated on the public lands under permit from the Federal Government.

This is not merely past history which recent conditions are changing. The Pacific Light and Power Corporation recently completed in California two power plants with an aggregate installation of 94,000 hp. as the initial step in an ultimate development of 250,000 hp., all of which will be on National Forest land and is now under permit. The Great Western Power Co. in the same state has permits for development aggregating 300,000 hp. on the Feather River and is making development as fast as the additional power can be disposed of. The Nevada-California Power Co. has four plants in operation on the National Forest, will complete a fifth this season and will begin a sixth next year. The Portland Railway, Light and Power Co. is operating a plant in the Oregon Forest and has permits for 40,000 hp. more which it proposes to develop as soon as use can be found for the power. Power sites of nearly 100,000 hp. on the Baker and Skagit Rivers in Washington are under permit to the Puget Sound Traction, Light and Power Co. to be developed when the existing surplus is disposed of.

In considering matters of legislation it should be recognized at the outset that two steps are essential—first, to provide conditions, as far as legislation can provide them, under which power may be developed at reasonable cost, and, second, when so developed, to provide the means for obtaining its sale at a reasonable price. The main defect of the present law is its apparent uncertainty of tenure. Although it is very doubtful if any action not justified on its merits could be sustained before the courts; although in the 14 years that the law has been in existence no attempt has ever been made to dispossess any occupant of the public lands or to stop the operation of any power plant, but merely to require compliance with the law, or to secure its interpretation by the courts; and although for many years the Federal departments have administered the law as though the power to revoke a permit save for just cause did not exist, yet there is little doubt that rates of interest and of discount are less favorable under the present law than could be secured under a different law.

The promoter desires to obtain title in order that he may have the potential value of the power site as property security for his financial transactions. This might be well enough in a bona-fide effort toward development; but the history of public-land grants forbids the belief that power sites would not be held more often for speculation than for development.

But even this is not the most serious result which would follow. The lands thus secured would increase enormously in value, and on this increased value, even under the most stringent rate regulation, the public would be required to pay interest and profits forever. Nothing can prevent this except the retention of the sites in public ownership, and no other course should be considered for a moment.

Leasing System Is Sufficient

All the protection that capital needs, all the capital that development requires can be obtained under a proper leasing system. All leases should be for a fixed term, probably not less than 50 years, and should be renewable to the holder upon expiration except only in the event that the Federal Government, the state or a municipality should wish to take over the properties. If so taken over, the lessee should be paid back his investment, less depreciation paid out of earnings and sinking funds accruing from earnings. The leases should be unalterable for their term, should contain every condition binding upon the lessee, and after investment has been made should be subject to cancellation only upon failure to comply with the express terms of the lease and by action instituted in appropriate courts, and even then only when the breach is of such a nature that it cannot be remedied by an action to compel specific performance. It is advisable to charge a minimum rental in all cases to cover administrative costs. It should be established as a general principle that no additional rental should be charged which would increase prices to consumers or reduce earnings of the utility below an adequate return.

Rate and service regulation has an important bearing on the question of securing cheap capital for power development. The states have the powers of regulation, and most of them are exercising it. Duplication by the Federal Government would be both unnecessary and unwise. Only for clearly emergency cases, where a state

had not provided itself with the means of regulation, would I reserve a right of action under a Federal lease.

It has been said that there is an irreconcilable conflict between the Nation and the States because the former claims to own the land and the latter claims to own the water, while power cannot be developed without the use of both. As far as the National Forests are concerned, the Department of Agriculture has solved the matter with mutual satisfaction. In California and Oregon all matters affecting power development are handled by co-operative and concurrent action. The Department would be glad to take similar action in any other state.

Scheme to Relieve Congestion at Busy Street Intersection

The great and increasing traffic congestion in cities has raised a municipal problem of vast importance, to arrive at a partial solution of which the Municipal Art Society of New York City opened a contest[1] and offered prizes for plans for the intersection of a street and an avenue. About 200 contestants entered, submitting plans in which were considered the elements of efficiency, economy and architectural beauty. The first prize was won by J. Floyd Yewell, of Peekskill, N. Y., whose design is shown herewith.

By this scheme automobiles and all horse-drawn vehicles cross the avenue on an underground level. The lower level is used, also, by the electric street cars, but these have a separate entrance and are in no way interfered with by other kinds of vehicle. For those persons desiring to enter the street cars, safety islands are placed at the entrance to the subway. By providing separate entrances for electric street cars and for automobiles, carriages, wagons, etc., space is gained for traffic which, coming from east or west on the cross street, intends to turn north or south into the avenue, as well as for those vehicles which, coming from north or south, intend to go east or west.

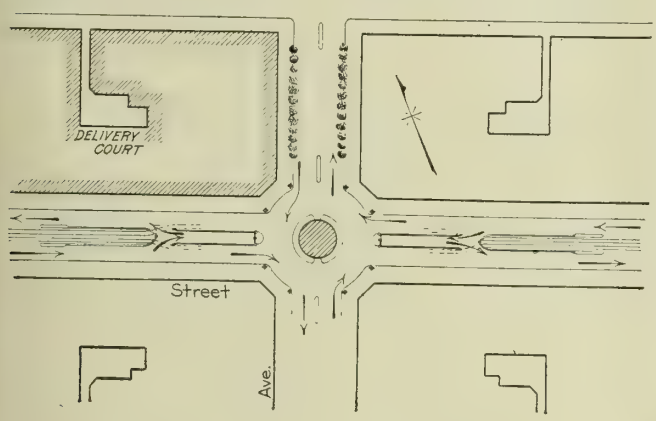
Avenue traffic is on the surface and all turning is rotary. At each crossing, in the very center of the avenue, safety islands are provided for pedestrians. Courts for the convenience of delivery wagons are provided, as shown in the plan. These courts, which are intended to relieve traffic on the main thoroughfares, have entrance on side streets.

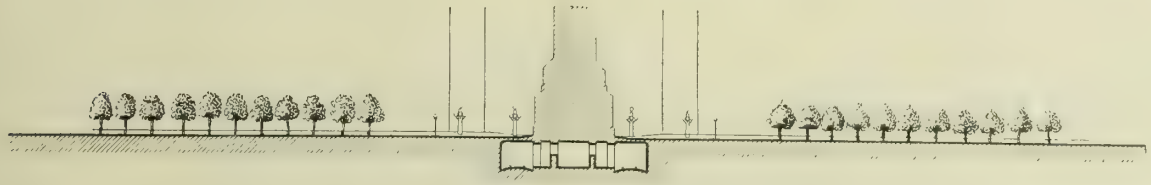
Rotary circulation is made possible by cutting off or rounding the corners of the buildings at the four street-corners and by a monumental tower erected in the center of the intersection.

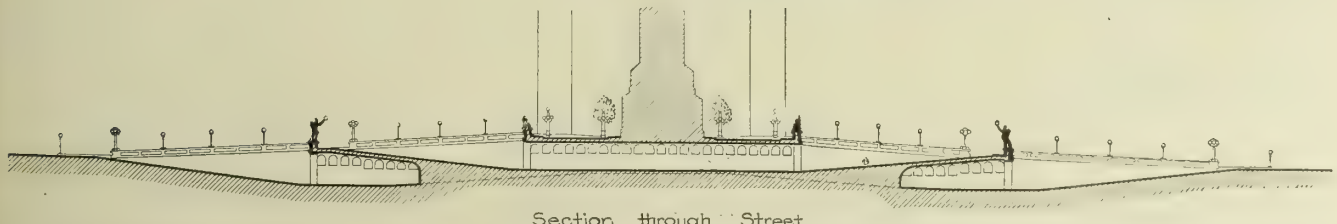
This tower has on its first floor the apparatus and equipment of a fire company with entrances and exits for the street cars on the lower level. On the second floor are rooms for the firemen. An elevator takes visitors and sightseers to the observation platforms, below which is a gigantic clock. On the top a powerful searchlight is installed.

This plan calls for the smallest amount of condemnation of private property; while the beautifying of the streets would tend to increase the real estate values in the neighborhood.

[1]The terms and results of this contest were published in "Engineering News," June 3, p. 1096.




Section through Ave.


Section through Street

METHOD FOR RELIEVING CONGESTED TRAFFIC, WHICH WON FIRST PRIZE OF $300

Results of Magnetic Survey of United States—Observations have been made at more than 1,000 new stations and 200 repeat stations since the publication in 1910 by the United States Coast and Geodetic Survey of a report containing its isogonic chart, based upon the magnetic survey of the United States which was begun in 1899. The results are given in Special Publication No. 33, Serial No. 18, of the Survey, on: "Terrestrial magnetism—Distribution of the magnetic declination in the United States for Jan. 1, 1915, with isogonic chart and secular change tables." The plan for this work contemplated, first, a general magnetic survey of the country, with stations 30 or 40 miles apart, and, second, the addition of more stations in magnetically disturbed areas. It also provided for observations at a sufficient number of "repeat" stations to determine the change in the magnetic elements from year to year. The work has now advanced to the point where observations have been made at a great majority of the county seats, and the examination of areas of marked local disturbance is in progress. The isogonic chart is a map on which lines are drawn through places at which the values of the magnetic declination are the same. The present chart is based on about 6,000 values of declination, including about 800 in Canada and 300 in Mexico and the West Indies.

Double-Deck Bascule Bridge Over Chicago River

By Hugh E. Young*

SYNOPSIS—The new Lake St. bridge over the Chicago River will be a double-leaf bascule of 245 ft. span, carrying an elevated railway on the upper deck and a roadway (with car tracks) and sidewalks on the lower deck. The bridge itself is of interest, and its construction involved specially interesting and difficult problems, since the elevated railway had to be kept in operation over the old swing bridge during the construction of the new bascule bridge.

The Lake St. bridge, on one of the main thoroughfares entering the business district of Chicago, crosses the south branch of the Chicago River just south of the turning basin at the junction of the north and south branches with the main stem of the river. The present bridge has a three-truss swing span, which was built as a single-deck structure in 1888 and strengthened in 1893 to carry an upper deck for the Chicago & Oak Park Elevated R.R.

The river channel is 235 ft. wide at Lake St., but the swing bridge interferes seriously with navigation, giving a clear channel width of only 65 ft. on each side of the center pier. The United States War Department ordered the removal of the bridge several years ago, as an obstruction to navigation, but owing to the desirability of avoiding interruption to elevated-railway traffic and the difficulty of arranging for a temporary means of crossing the river, the city authorities procured an extension of time. Before this was done, however, studies were made for an incline from the elevated structure to the street level just west of the river, the trains crossing the river on the Washington St. bridge (two blocks south) and then rising again to the elevated structure in North Market St. This scheme was abandoned, as it would be too dangerous to run five-car trains on the streets in the busy district.

It was decided therefore to construct the new bridge in such a manner that the elevated traffic could be continued over the old swing bridge, except occasionally for a few hours at a time and when the inconvenience to passengers would be at a minimum. Plans for this new bridge were well-advanced by the end of 1912 and provided for three railway tracks, but later the elevated railway company decided to have only two tracks. The changed plans and specifications were finished in June, and bids were opened on Sept. 18, 1913, but the lowest bid exceeded the estimate for the bridge.

Owners of patents for movable bridges then claimed that a more economical bridge could be built on their plans, and a commission of three engineers was selected in accordance with a resolution passed by the Finance

*Bridge Designing Engineer, Department of Public Works (Bureau of Engineering), Chicago.

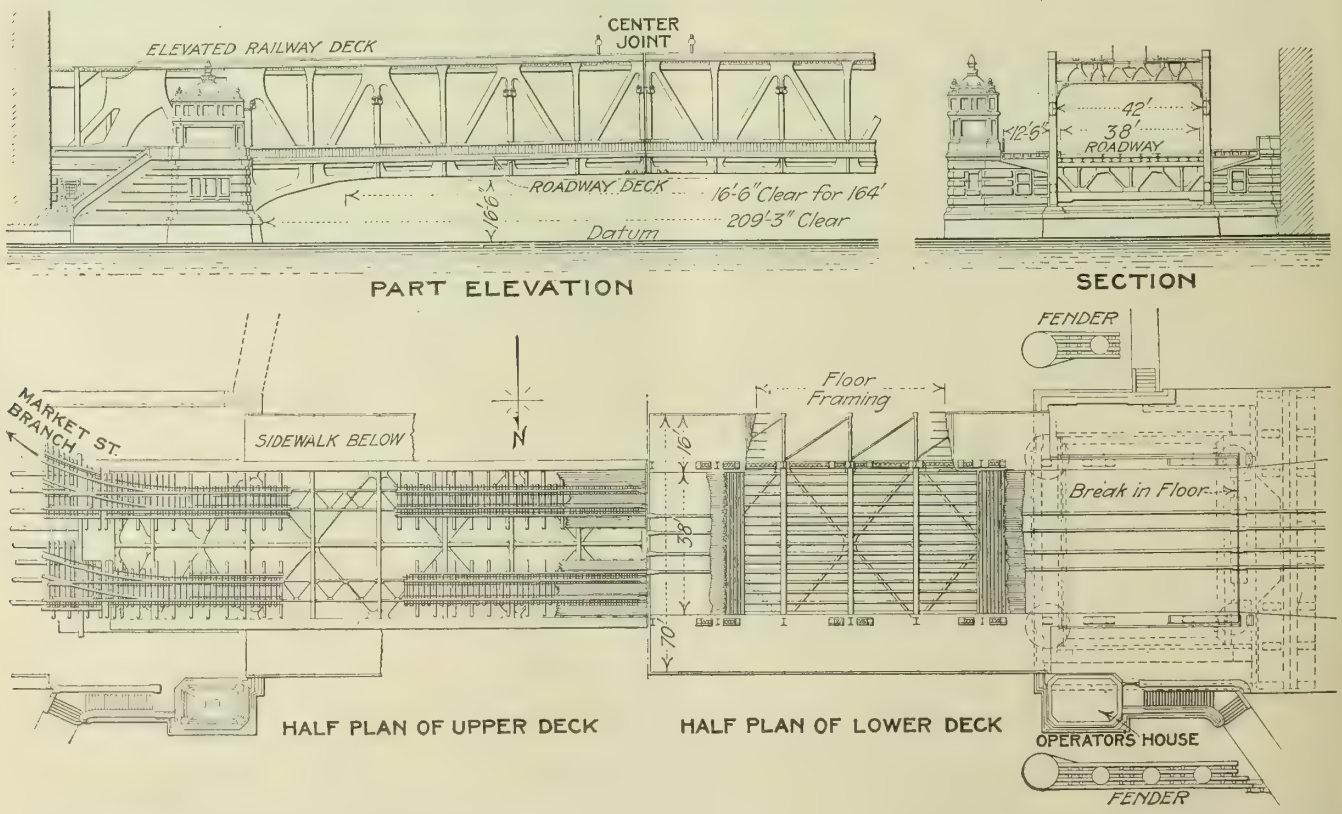


FIG. 1. ELEVATION AND PLANS OF THE DOUBLE-DECK DOUBLE-LEAF TRUNNION BASCULE BRIDGE ACROSS THE CHICAGO RIVER AT LAKE ST., CHICAGO, ILL.

This bridge will carry a roadway, sidewalks and street-car tracks on the lower deck, and a double-track elevated railway on the upper deck

Committee of the City Council on Oct. 24, 1913. This commission consisted of John Ericson, City Engineer; J. E. Greiner, Consulting Engineer, of Baltimore, Md., representing the elevated railway, and W. H. Finley, Chief Engineer of the Chicago & Northwestern Ry. Mr. Finley was selected by the other two members. Competitive plans and estimates were received by this commission for various types of bridges which could be erected without materially interfering with the operation of the existing bridge. These included a double-deck lift bridge and double-deck single-and-double-leaf trunnion bascule bridges.

The lift-bridge design placed the towers straddling the elevated structure on the approaches. The lift span could be erected in place in the open position or erected at the north side of the turning basin and floated into place on scows. The bascule bridges could be erected in the open position without interfering with the swing bridge, by omitting part of the floor system, thus allowing the trains to pass between the trusses. When the bridge was ready to be lowered, traffic would be interrupted long enough to complete the floor system and remove the swing bridge.

The commission recommended a vertical-lift design submitted by the city. On considerations of public policy, however, the City Council recommended the double-leaf bascule bridge (according to the city's plans somewhat revised). Accordingly, the various bids were rejected and the plans and specifications were revised.

Description of the New Bridge

The new bridge (Fig. 1) will have the following main dimensions: 245 ft. c. to c. of trunnions, 217 ft. c. to c. of bearings; clear width of channel, 195 ft.; clear distance between masonry piers, 209 ft. 3 in.; length of counterweight arms, 39 ft.; truss spacing, 42 ft. c. to c.; width over sidewalks, 70 ft.; depth of trusses at center, 30 ft.; clear headway over the water, 16 ft. 6 in. for a width of 164 ft. The lower deck, 70 ft. wide, has two 16-ft. walks and a clear roadway of 38 ft. with two lines of street-car tracks. The upper deck carries the double-track elevated railway.

This type of bridge was chosen mainly because it could be treated architecturally better than any other type, being symmetrical and having the counterweight under the roadway. The counterweight lowers into a tailpit between the river pier and anchor pier. The operating machinery will be placed under the sidewalks at each corner of the bridge and will be inclosed with concrete walls treated with suitable ornamentation. The new bridge is located symmetrically about the center of the present swing bridge and is being erected in the open position. During the construction, traffic on the lower (street) deck of the present bridge is discontinued, street cars being diverted to the Randolph St. bridge, one block south.

The new substructure consists of a tailpit and an abutment on each side of the river. This will be described in a separate article.

Temporary Supports for Elevated Approaches

After the street-railway company had removed trolley wires, rails, etc., from the swing span and approaches, the sidewalk brackets of the swing span were cut off with the acetylene torch, in order to obtain a wider channel with the bridge opened. The operator's house, situated over the sidewalks, had to be removed and a new one erected on the roadway of the lower deck. This involved no great amount of work as the bridge is operated electrically. The old protection (which was almost all broken away) was removed, and a new protection constructed to suit the new channel lines on each side of the center pier.

The approach spans on the street level were removed, the steel being cut with the acetylene torch and removed from the site by scows. Excavation was then started on both

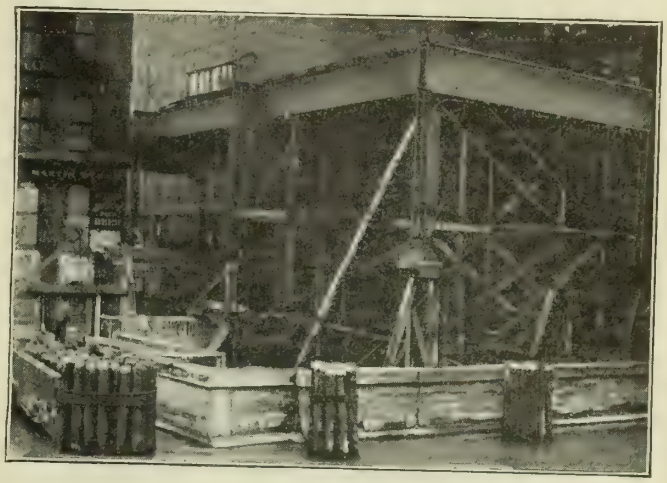


FIG. 2. TEMPORARY SUPPORTS FOR END OF THE EAST APPROACH OF ELEVATED RAILWAY

approaches back of the old abutment. The center part of the old east abutment was removed first. The ends of the abutment were left in place temporarily, as the columns of the elevated structure rested on them.

Timber bents were then erected under the elevated structure, as shown in Fig. 2, which illustrates the east approach. Bents were erected just back of the river pier and in front and back of the abutment. These bents consisted of 12x12-in. posts directly under each girder of the elevated structure, which rested on piles capped just above the water-level surface. Old foundation piles uncovered during the excavation were used for supporting the bents, if suitably located. These were first tested by placing jacks between the bottom of the 12x12-in. posts and the piles. The piles were observed for settlement under this load, and if none occurred during an interval of about a day they were considered suitable for use.

The number of these old piles was due to the fact that, previous to the construction of the present bridge (1888), there had been at least two bridges, both supported on pile foundations. These piles were of a kind not common today, ranging from 18 to 24 in. in diameter at the butt. They were in a remarkable state of preservation, being practically as good as when driven, which must have been nearly 50 years ago. The bents were capped with 12x12-in. timbers, braced with 2x12-in. sway bracing. A batter pile was used in the bent at the river pier.

The columns of the elevated structure were supported on girders spanning the space for the tailpit. These girders rested on groups of piles driven in line with the first and second bents of the elevated structure east of the swing span, as shown in Fig. 3. Each girder consisted of two separate plate girders connected by cross-bracing. Each girder had a 96x¼-in. web plate and four angles 6x6x$\frac{7}{16}$ in.; it was stiffened at points of local load and about every 4½ ft. at other parts, by 5x3x⅜-in. stiffener

angles. Webs were spliced for moment. The overall length of these girders was 78 ft. The double girder for the rear bent was placed first, the abutments having been entirely removed. The girders supporting the front bent and the end of the swing were placed when it was convenient to close elevated traffic for a few hours, as the masonry of the old river pier had to be removed when the swing bridge was open and the bridge could not be closed again for traffic until a new end bearing could be provided.

This work was done July 3, 1914, traffic being closed on the elevated structure from 9 a.m. to 4 p.m. Passengers used the Canal St. station, two blocks west of the river. As soon as the girders were in place, the temporary timber supports under the elevated structure (Fig. 2) were removed.

After the construction of the tailpit, temporary timber bents were erected to support the elevated structure on the east side (Fig. 2). These rested on timbers laid on the pit floor. When these were ready for the elevated structure the box girders were transferred to similar positions on the west side. The girder under the first bent was transferred Dec. 29, when traffic was shut off on the elevated for 7½ hr. The temporary timber bents were removed as soon as the girders were in place.

The contractor for the superstructure started on Jan. 13, 1915, to erect falsework for the erection derrick on the east side and had this practically finished on Jan. 30. This falsework, or tower, required careful study, as the position of supports was not only limited by vertical headroom over the elevated structure, but by lateral clearances of a car swinging around the curve into the North Market St. branch (Fig. 1). This derrick is shown in Fig. 4.

The structural steel began to arrive at the site on Feb. 8. It was delivered on flat cars and unloaded at the railway yard on the north side of the turning basin (just north of the bridge site) where it was stored until needed. Thence it was delivered on scows.

The contractor started as soon as possible to erect the steel of the fixed parts upon which the movable structure

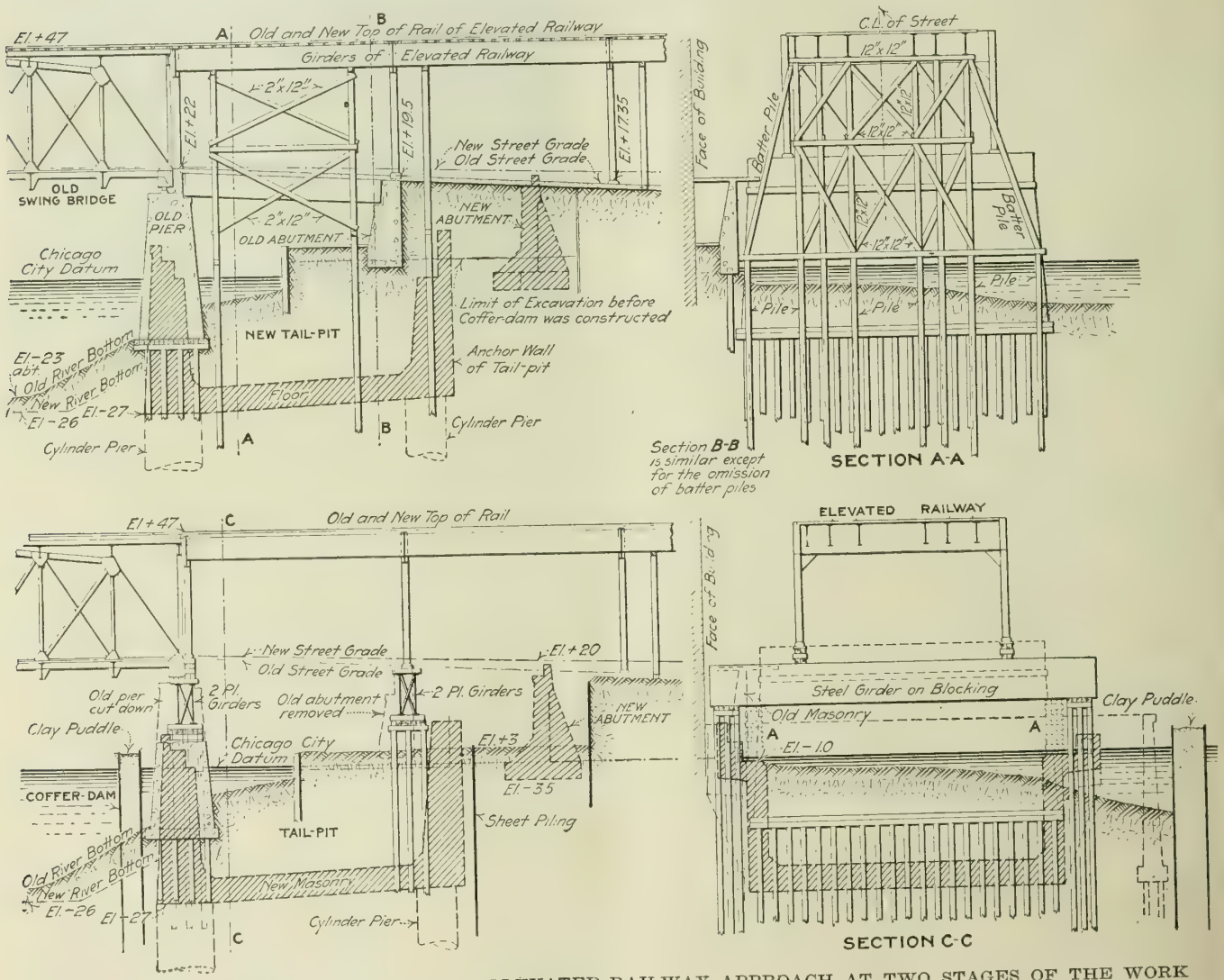


FIG. 3. METHODS OF SUPPORTING THE ELEVATED-RAILWAY APPROACH AT TWO STAGES OF THE WORK

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The machinery girders are 7 ft. back from and parallel with the carrying trusses. The carrying trusses and machinery girders span from river pier to anchor pier, a distance of 53 ft.

The carrying trusses are the supports for the cross-girders (Fig. 5). They also carry the gear trains which are located opposite the racks in the rear arm truss members. The cross-girders are located 14 ft. back of the river pier; they carry the entire dead-load of the bridge, and have a span of 48 ft. c. to c. of carrying trusses, spanning the entire distance across the tailpits.

At the time the superstructure contractor began work on the east side the elevated structure was supported on timber bents resting on the floor of the pit (as shown in Fig. 2). These bents were so placed that the contractor could erect the carrying trusses and machinery girders without difficulty. These trusses and girders, being outside of the elevated structure, could be handled by the derrick. The erection of the cross-girder, on account of its weight and its position under the elevated structure, was more difficult.

Additional falsework was built to place the cross-girder. This consisted of A-frames resting on the floor of the tailpit. On the frames were placed two 15-in. channels, forming a runway for sliding the girder across the pit. The girder was lowered from the A-frame to its final position on the carrying trusses by means of jacks.

The fixed portion of the new elevated structure over the tailpits will be supported on new columns, which rest on the carrying trusses about 7 ft. from the center line of the anchor pier (Fig. 1). These columns are in the same place as the old floor-beams, but are located a greater distance out from center line of structure. The old floor-beam was therefore lengthened in order to provide a connection for the new columns.

The steel columns in the bent at the river pier were also moved out, lengthened by splicing on portions of the

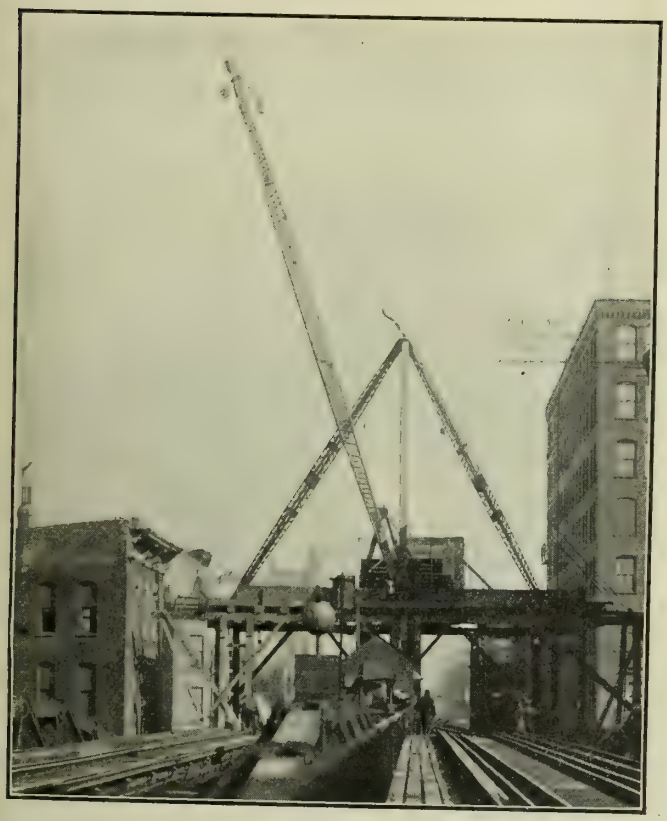


FIG. 4. STIFF-LEG DERRICK OVER THE ELEVATED RAILWAY APPROACH

old columns, removed from the bent near the anchor pier and carried down to a bearing on the carrying truss, the floor-beam of the elevated structure being lengthened as before.

The temporary timber bents under the elevated structure were then removed and the elevated structure carried on the new steel. The erection of the tail end of the bridge was then started, and part of the trusses had been assembled at the time a strike of the structural iron workers was called at the end of April.

During the week ending Apr. 17, 1915, the contractor began erecting his derrick on the west side. This was not placed over the elevated structure but in the tailpit, the mast resting on the floor and the stiff-legs being anchored to the sidewalls of the pit. A strike stopped the work in April and from that time until work was resumed on July 8, 1915, the elevated structure on the west side

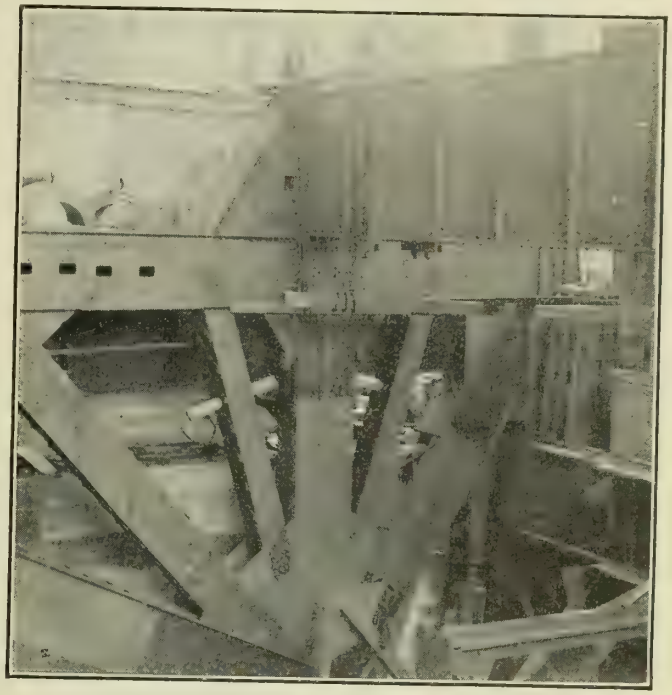


FIG. 5. ONE OF THE TRUSSES OVER THE TAILPIT

rested on two temporary cross-girders, and on the east side on the new carrying trusses with the permanent columns in place for the bent near the anchor pier and temporary bent in place near the river pier.

The leaves will be erected in the open position, a portion of the floor system being omitted to permit of passage of trains. When the leaves are lowered the two spans of the elevated structure over the pits will be removed and the floor system on the upper deck completed.

Engineers and Contractors

The work is under the Department of Public Works, the head of which is W. R. Moorhouse, Commissioner of Public Works. The City Engineer, John Ericson, is head of the Bureau of Engineering, and Thomas G. Pihlfeldt is Engineer of Bridges and Harbor. The final plans were prepared in the Designing Section, under the immediate direction of A. von Babo, Engineer of Bridge Design, and the writer. The construction is supervised by the Construction-by-Contract Section, under Clarence S. Rowe, Assistant Engineer, and the resident engineer on the work is William A. Mulcahy, Assistant Engineer.

The contract for the substructure was awarded to the FitzSimons & Connell Dredge and Dock Co., of Chicago, on Mar. 14, 1914. The contract for the erection of the superstructure was let Mar. 18, 1914, to the Ketler-Elliott Erection Co., of Chicago. The contract for the steel was let to the American Bridge Co.

Raising the Submarine F-4

By J. A. Furer*

SYNOPSIS—On Mar. 29, 1915, the United States submarine F-4 sank outside of Honolulu Harbor in 300 ft. of water. Because it was desirable that the Navy Department should know the cause of the sinking, and in order to recover the bodies of the men who went down in the boat, the unprecedented task of raising so large a body from so great a depth was attempted. In this article Naval Constructor Furer, who planned the salvage methods, designed the equipment and directed the operations, tells how the work was successfully carried out.

The salvage of the submarine F-4 was unique in several respects. Much larger totally submerged vessels have been raised from shallow water, but none has ever been brought up from a depth of 300 ft. A few smaller vessels have been raised from depths of more than 200 ft., but only out of inclosed waters. The previous record for depth was the salvage of a small wooden tug, weighing perhaps 125 tons submerged, which sank in about 250 ft. of water in Puget Sound. The weight to be lifted in the case of the F-4 was 260 tons.

The principal difficulties of the salvage problem were the great depth of water in which the vessel lay, the weight which had to be lifted and the open-sea exposure. The vessel sank in 300 ft. of water outside of Honolulu Harbor, where there is no protection from southerly weather. While high winds from the south are unusual, there is nevertheless always a ground swell which is liable to develop into a heavy sea without warning.

For obvious reasons the customary salvage methods could not be applied in this case. The only plan offering reasonable assurance of success was to lift the vessel mechanically and to tow it into shallower water at the same time.

Preliminary Operations

Two bottom-dumping mud scows (Fig. 2) were rented from a local dredging concern; on each of the scows two specially constructed windlasses were installed. On account of the great depth of water, securing lifting gear to the submarine was impracticable. It was therefore necessary to sweep cables under the vessel and to bring both ends of each sling to the windlasses. Four cables were used, two of which were placed about one-third the length of the vessel from the bow and the other two in a similar position aft. The vessel was therefore lifted in the loops of the four cables. Chain had to be used for the loops of the cables eventually, as will be described later.

Wire cables of sufficient strength to lift the vessel were difficult to find. The assumption had to be made that even when lifting with four cables one-half the weight of the submarine would often be carried by a single sling, on account of the impossibility of keeping the windlasses in step. Then, also, the loads on the slings were live-

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FIG. 1. PREPARING TO TOW IN THE SUBMARINE F-4 SUSPENDED FROM PONTOONS

loads—very much so, in fact, because of the swell. Two galvanized-wire hawsers 2½ in. in diameter, one plow-steel hawser 2⅝ in. in diameter and one plow-steel hawser 2 in. in diameter were finally procured. All these hawsers were about 900 ft. long.

The construction of the windlasses presented a number of difficulties, due to lack of manufacturing facilities. Sugar-mill rolls are fortunately carried in stock in Honolulu. These answered the purpose of a combination windlass shaft and drum, as they were 15 in. in diameter. This diameter was theoretically far too small for the wire cables used, but in no case did a sling fail at the windlasses as the result of stranding. Naturally the short nip ruined the cables for further use over the length affected.

The turning effort was applied to the windlasses by means of a bull-wheel built up solid of steel plates. A cast-steel wheel would have been cheaper and fully as good, but could not be manufactured locally. The bull-wheels were fitted to the square ends of the rolls, thus doing away with a key. Power was supplied by a two-drum, 8x10-in. hoisting engine installed on each scow. The drum lines consisted of ¾-in. plow-steel wire rove up to triple blocks. This purchase, together with the multiplication of power due to the diameter ratio of the bull-wheel and windlass barrel—namely, 50 in. to 15 in.—was sufficient to wind up the load on one of the scows. On the other, on account of the design and condition of the engine, a luff had to be clapped on to the purchase to further multiply the power.

The distance between the triple blocks placed a limit of three turns on the number of revolutions of the windlasses obtainable without fleeting the tackles and rewinding the bull rope. When the running block of the purchase had reached the end of its travel, the windlasses had to be locked to keep them from unwinding. The tackles were overhauled and the bull rope was unshackled for rewinding on the spool by hand. The locking device consisted of a nickel-steel pin, which was slipped through a hole in the bull-wheel disk. The ends of the locking pin rested on pillow blocks provided for the purpose. Four holes were bored in the wheels so as to make it possible to lock the windlasses every quarter turn. A pawl and ratchet would have given a greater range of locking positions, but would have introduced undesirable elaboration into the design and construction of the gear.

Five 30-in. I-beams were used to span the mud pockets of the scows. On these, cast-iron pillow blocks for supporting the windlasses were installed. The shafts were supported at the ends and in the middle. The outside I-beams carried the locking-pin pillow blocks. Stiffeners had to be fitted in the wake of the shaft bearings to prevent web crippling. Heavy angle irons were bolted across the I-beams to counteract racking. The middle I-beam was supported throughout its length by one of the mud-pocket bulkheads, but special timbering had to be fitted under the end beams to prevent deflection. The I-beams needed were fortunately found in a lot of structural steel delivered for a coaling plant in process of erection at Pearl Harbor. It so happened that the beams were almost exactly the ideal length for this job.

The ends of the cables were brought up through the mud pockets of the scows and secured to the windlass shafts by heavy hook bolts. They were further backed up by cable clamps to prevent slipping. Three dead turns were also allowed on the shafts before taking up the load.

Cable-Sweeping Operations

The wire cables were swept under the vessel by means of tugs. The ends were then temporarily taken to a dredge from which the boom and bucket gear had been removed. This craft was anchored at the inshore end in the usual manner, but on account of the great depth of water could not conveniently be anchored at the other end. After the first cable had been swept under the submarine and taken to the dredge this served as the offshore mooring. The dredge was selected as part of the salvage plant because it was equipped with a powerful engine, geared to six cable drums. A central unit of this kind was needed for a number of reasons, but principally because it was impracticable to transfer the cables from the tugs to the windlasses direct, as it was never certain that the loop of the sling had been swept to the desired location under the vessel until an inspection had been made by the divers. It was comparatively easy to rehandle the cables when changes in location had to be made, once the ends were on the dredge. This was usually accomplished by leaving one end secured by a chain stopper to a drum line and transferring the other end to a tug, which then made the new sweep.

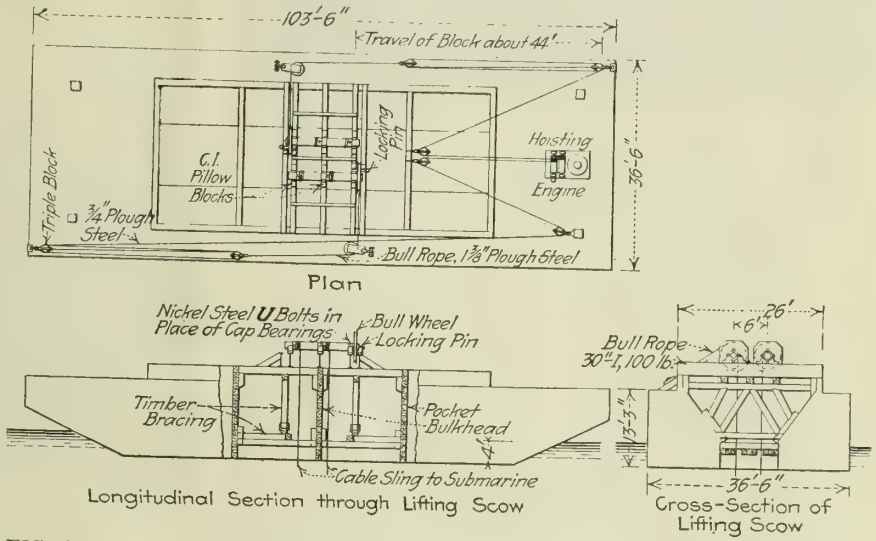


FIG. 2. DETAILS OF SCOW USED IN LIFTING F-4 FROM 300 FT. TO 50 FT. OF WATER IN HONOLULU HARBOR

Deep Diving Accomplished

The divers, while the vessel was in 300 ft. of water, set a new record for depth. It was possible to send men down to this previously unattainable depth only by the use of special methods. The Bureau of Construction and Repair of the Navy Department had been experimenting for some time on deep-sea diving. It so happened that these experiments were brought to the point of practical application just before the accident to the F-4. Four divers, in charge of the officer who had been conducting the experiments, were ordered from the New York Navy Yard to Honolulu for this work.

The diver does not wear a suit of special character for working in great depths. The difference as compared to shallow-water procedure lies entirely in the method of supplying air to the helmet and in the scientific restoration of the diver's body to the normal state by gradual decompression as he comes up from deep water. Air is supplied from flasks charged to a high pressure—suitably reduced before being delivered to the diver's helmet. The dangers in deep-sea diving are due principally to the absorption of nitrogen by the fluids of the body, on account of the high pressure to which the lung tissues are subjected, and to the extreme exhaustion accompanying any kind of manual labor. For the latter reason the divers

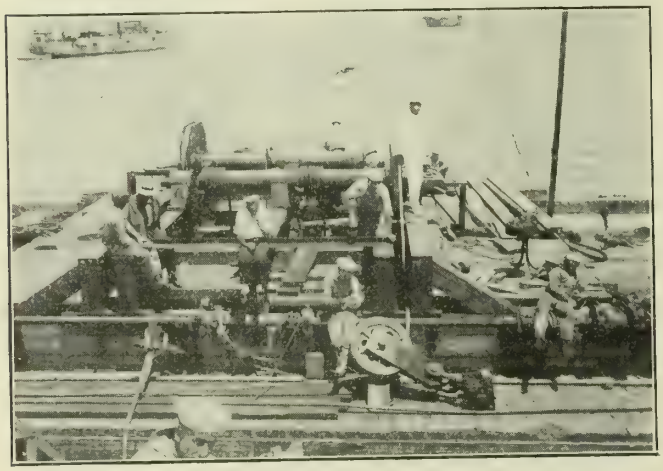


FIG. 3. VIEW OF WINDLASS RIGGED ON SCOW

could not do heavy work at the 300-ft. depth, such as can easily be done by men working in shallow water. Their duties had to be limited to observing and reporting the conditions found below.

Difficulties in Attaching Cables

Placing the slings in satisfactory locations was the most difficult part of the salvage work. The submarine was a very small object to lasso at a depth of 300 ft., especially as the exact location of the bow and stern could not be predicted within perhaps 100 ft.

But after innumerable discouragements four slings were finally swept under the vessel and the ends transferred from the dredge to the scow windlasses. This took from Apr. 10 until Apr. 21. On Apr. 22 lifting the submarine by winding up the cables on the windlasses was started. As the cables were wound up, a towing strain was kept on the scows, thus bringing the submarine into shallower water.

After lifting about 12 ft., one of the cables parted in the loop as a result of chafing on the bilge keels. This cable was one of the first to be placed and had consequently suffered from chafing for almost two weeks, due to the continual motion of the dredge and of the scows in the swell. The broken sling was replaced and lifting was continued until the vessel was in 275 ft. of water. Bad weather now set in and accelerated the impairment of the cables, causing them to carry away one by one. It was apparent that chain would have to be used for that portion of the slings in contact with the vessel.

The use of chain for the loop of the slings was considered when the salvage plan was first being developed, but was rejected, because chain does more damage to the vessel and is much harder to place than wire rope. These disadvantages had now to be accepted. A 15-fathom shot of 2⅝-in. chain was accordingly shackled in to form the loop of each sling. The dredge was again moored as before by sweeping 1¾-in. wire hawsers under the bow and the stern of the submarine and bringing the ends over the corners to the drum lines. The chain slings were finally placed in the same locations as had been occupied by the wire-rope slings. Bringing these combination slings to position was considerably more difficult than placing the wire cables, because they were even heavier and more awkward to handle than the latter. After working 21 days four slings were again in place under the vessel.

As the submarine was lifted a towing strain was kept on the dredge by a tug. This in turn brought a towing strain on the submarine by way of the two 1¾-in. mooring cables. The arrangement proved more satisfactory than towing directly on the scows, because it permitted the scows to ride in their normal state of equilibrium.

Once the slings had been made fast to the windlass drums, lifting was fairly rapid. After the windlass shafts had been filled with one layer of cable it was necessary to cut off the wound-up portion and to shift to a new hold under the hook bolts. It was inadvisable to wind up a second layer, because of the reduction in diameter ratio of the bull-wheel and windlass barrel which this would have entailed. As it was, there was only barely enough power available to wind up the load. One layer of cable corresponded to a lift of 58 ft. The shafts could be filled in about two hours of actual lifting, but the work of cutting off and shifting to a new hold took considerably longer. The cables were cut off by means of an oxyacetylene torch.

In spite of every effort, one of the stern lifting slings could not be located quite as far aft as desired when it

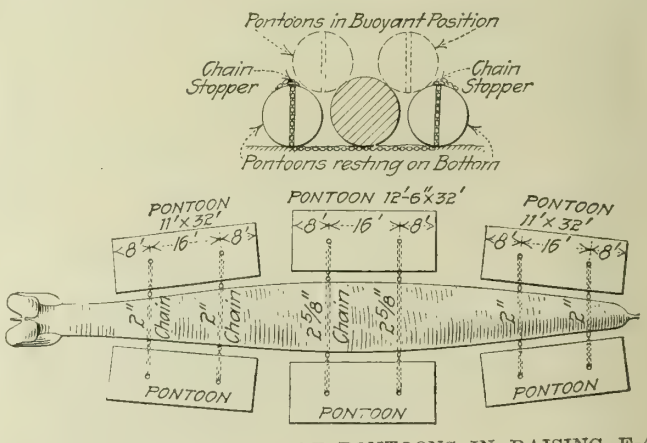


FIG. 4. ARRANGEMENT OF PONTOONS IN RAISING F-4

was put on; consequently the two after slings did not plumb the mud pocket through which they passed. This was immaterial in deep water, but as shallow water was reached the slings began to bind on the framing of the pockets. When a depth of 50 ft. was reached it became necessary to shift the sling to a more vertical position.

Scow Method Abandoned

While this work was going on, a heavy ground swell set in very suddenly. The swell increased rapidly and in a short time high surf waves were breaking near the submarine. The waves and the undertow from the reef caused the scows to charge back and forth with tremen-

dous momentum. The after-sling could not now be replaced in time to resume operations. It was apparent that considerable damage would be done to the submarine by the slings and that possibly the entire plant would be wrecked if an attempt were made to ride out the bad weather. The slings were accordingly cast off and the scows towed into the harbor.

The heavy seas continued for a number of days. As soon as the swell had subsided sufficiently, divers were sent down to examine the submarine. They reported that the forward slings had ruptured the shell and had caused the collapse of some of the framing one-third of the distance from the bow. This made it unsafe to continue operations by the windlass method, as there was danger of breaking off the forward end of the vessel while passing through the channel. This would have blocked the harbor to navigation.

As the submarine now lay in somewhat less than 50 ft. of water, it was possible to apply the pontoon method of lifting, but it was still impracticable to follow the usual procedure of lifting a few feet and towing to a new landing, because conditions were such that the vessel had to be raised in one operation to a draft of not more than 25 ft. This draft was fixed by the depth of water over the blocks of the dry dock in which the vessel had to be landed.

Details of Pontoon Method

The plan adopted to meet these requirements consisted of the use of six specially designed pontoon cylinders sunk alongside the submarine, as shown in Fig. 4. The plan

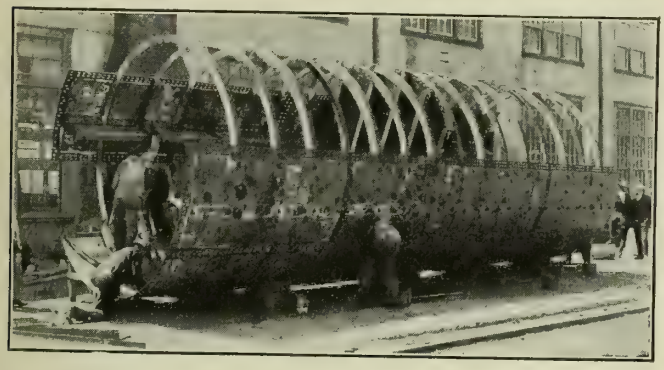


FIG. 5. PONTOON UNDER CONSTRUCTION

further called for the use of six chains rove under the vessel and passing through hawse pipe in the pontoon cylinders. The arrangement consisted in effect of lifting the submarine in a cradle made up of six chains.

Four of the cylinders were 32 ft. long by 11 ft. in diameter; the other two were of the same length, but 12 ft. 6 in. in diameter. The large cylinders were used amidships. The combined lifting capacity of the six pontoons was 420 tons. A margin of 160 tons was allowed for breaking the vessel away from the bottom and for any failure to realize all of the buoyancy available in the pontoons due to cockbilling.

Each cylinder was divided into two compartments by a transverse, water-tight bulkhead so as to facilitate control in sinking. A 4-in. flood and discharge valve was installed in each end bulkhead close to the bottom. Air valves were fitted on top of the cylinders for blowing out the water and for venting each compartment while flooding. Eight feet from the ends 12-in. hawse pipes were fitted through the pontoons. The cylinders were built of ⅜-in. plates ruggedly framed on the inside to resist the large stresses to which they were subjected. Fig. 5 shows a cylinder under construction. On the outside the pontoons were sheathed with wood so as to protect the plating from local damage due to chafing and contact with sharp projections on the submarine. The wood sheathing proved extremely valuable during the salvage work. Without this protection against damage it is probable that the pontoons would have sprung leaks which might have been fatal to the success of the work.

The chains were first of all worked under the submarine in predetermined positions—two forward, two amidships and two aft. The two chains of a pair were spaced 16 ft. apart so as to correspond to the distance between the hawse pipes. The pontoons were planted by means of a wrecking scow which was moored accurately over the submarine. The two cylinders of a pair were towed to the scene of operations and placed one on each side of the scow, directly over a pair of chains lying on the bottom.

Chain-Attachment Operations

The ends of the chains were now fished up through the hawse pipes and the cylinders submerged by opening the flood valves. They were kept under control while sinking by means of 5-in. manila lines made fast to the ends and taken to the hoisting engines on the scow. After the pontoons had landed on the bottom the chains were adjusted so as to leave the necessary amount of slack to permit the pontoons to rise just clear of the vessel on becoming buoyant. A clamp was now fitted to each chain by the divers, just above the hawse pipe. The clamps consisted of two steel castings, molded to the shape of the chain links and of such length that they spanned the hawse pipes. By means of four heavy bolts the two halves of the clamp were drawn together. These bolts kept the clamps from spreading and the chain from slipping through when subjected to the lifting strain. Fig. 6 shows a clamp in place.

After all the six cylinders had been landed on the bottom alongside of the vessel and the clamps had been secured by the divers, the unwatering process was started. For this purpose torpedo air flasks, charged to a pressure of 2,150 lb., were placed on a coal barge. The flasks were piped to an expansion chamber, which in turn was connected to a manifold. Twelve ¾-in. air-hose lines were led from the manifold valves to the blow-out valves on top of the pontoons. A pressure of 35 lb. was used at the manifold for blowing out the water while the cylinders were resting on the bottom. The unwatering operation had to be watched very carefully so as to avoid the danger of springing the heads of the cylinders when the external water pressure was relieved on emerging.

The method proved entirely successful. The work of placing the chains under the submarine was started on Aug. 21. All the chains were in position on Aug. 25. It then took one day to place each pair of cylinders. Fortunately, good weather prevailed during this rather precarious phase of the operations. On Aug. 29 everything was ready for blowing the water out of the pontoons. This operation took about two hours from the time the air was fully turned on.

One end of the submarine came up slightly ahead of the other, as was to be expected. The bow pontoons on emerging were considerably cockbilled. The cause of this

was that the chains were not attached to the submarine but were simply rove under the vessel from the pontoon on one side to its mate on the other side. One end of each pontoon was bound to become buoyant slightly ahead of the other end, no matter how far the subdivision into compartments might have been carried. The buoyant end then pulled the slack chain through under the vessel. The natural result was that the pontoon on the other side cockbilled in the opposite direction. As long as there was a sufficient margin of buoyancy in all six pontoons the cockbilling made no difference, as enough water could be blown out of the high ends to provide the lift needed. The low ends could of course be completely unwatered. Once the pontoons emerged, they immediately adjusted themselves automatically, as the high ends ceased to be water-borne and therefore exerted no pull on the chain.

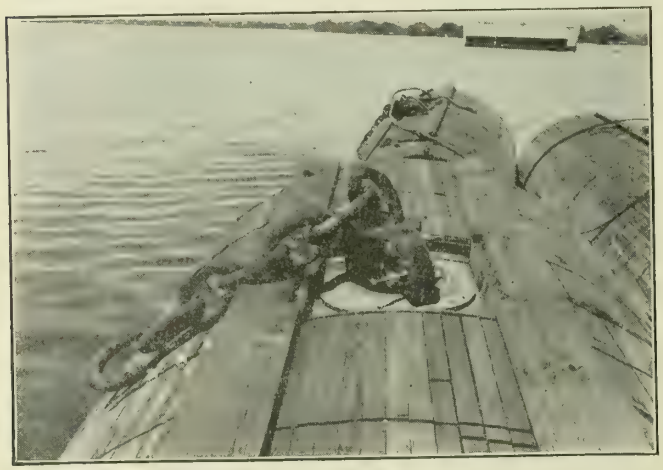


FIG. 6. CHAIN CLAMP IN PLACE ON PONTOON
These clamps were secured by the divers under water with the cylinder lying on the bottom

This permitted the buoyancy of the low end of the opposite pontoon to assert itself, thus causing the chains to render. Fig. 1 shows all the pontoons on the surface, with the submarine suspended in the chains.

The question suggests itself why the pontoon method, which was finally adopted, could not have been used originally for bringing the vessel to the surface. This would have been impracticable because of the great depth of water in which the submarine lay at first. Whereas sinking the pontoons alongside the vessel and fitting the chains was not particularly difficult in 46 ft. of water, the task would have been quite impossible in 300 ft. of water. The divers from the submarine flotilla had to work under water from 5 to 9 hr. a day from Aug. 21 to 29 while placing the chains under the vessel, securing the clamps after the pontoons had been lowered, closing flood and vent valves and later on connecting the hose leads for blowing out. This work could not have been done at a depth of 300 ft., as most of it was extremely arduous and fatiguing.

With the exception of the civilian employees who operated the hoisting engines, most of the work on the water was done by the personnel of the submarine flotilla. The men and officers did this work splendidly, under the most trying conditions. The windlasses were built and installed at the Pearl Harbor Naval Station. The pontoons were built at the Navy Yard, Mare Island, from designs prepared at Pearl Harbor, as there were insufficient material and labor available in Honolulu to permit building them at the latter station.

Observing Contractor Sketches Trip to the Coast

By Contractor

I recently visited the Panama-Pacific International Exposition, and on my way to and from the Coast I kept an eye out for construction work under way. Contractors who are wondering whether they are going to nail a winter meal ticket will be pleased to learn that many of their brother contractors are busy with large contracts.

West of meridian 101 nearly all crops are raised by the dry-farming method or by irrigation. In western Kansas and eastern Colorado, along the Union Pacific and the Rock Island, there are numerous dry farmers and prairie-dog towns and now and then a bunch of steers without chaperons (cowboys). The latter have all gone to the movies. The country roads in that section reminded me of some coffee I had on a Santa Fé train. This beverage consisted of a very weak solution of irrigating water and some white coloring matter (alleged to be cream). I complained to the waiter, but he said that it was all the cows could do there to get along by themselves without giving up anything. It looked about the same with the dry farmers. They were not giving up much for roads, and from the appearance of the country there wasn't much to haul over the roads anyway.

Denver, Colo., is building a new union depot and an X-shaped viaduct of concrete and steel, 3,000 ft. long on one leg and 5,000 ft. long on the other. It is built where two streets cross each other. In other respects the city appeared to be finished as regards construction. Brick and stone are the prevailing building materials, there being very few wood structures. Trees, lawns and gardens are irrigated. Although the streets are well paved and lighted, the street-car tracks are narrow-gage and the electric cars look as antiquated as the horse cars in New York City. A system of good roads runs from Denver to scenic points in the mountains, and the Mountain Telephone Co. each day posts a bulletin that indicates the condition of the roads in each district.

Not much construction was under way at Colorado Springs. I think it only fair to warn the tourist that when he strikes this town he is in the midst of highwaymen, and if he gets away with anything it isn't their fault. The Crystal Park drive did not appeal to me, as I had already seen enough of the plains. I was out to see the country, however, and so climbed aboard the automobile. A prize stunt on this trip is to be compelled to turn the vehicle around in narrow quarters; but 50 yd. of additional excavation would have given plenty of room for the turn.

The Cripple Creek short line between Colorado Springs and Cripple Creek was built to reach the mines, but it does a considerable tourist business as well. The grades and curves are about the limit and make one believe that the engineer who laid them out must have had a crooked transit or used a cross-eyed mule, as they follow the line of least resistance from a construction standpoint. There is a trolley line about 10 mi. long in this vicinity that is claimed to be the highest in the world, its elevation being 11,200 ft.

To construct the Denver & Rio Grande R.R. through the mountains would seem no great engineering task

at the present day, but no doubt at the time it was built it was a serious problem to provide supplies. The problem of a water-supply and the Indian menace were items too important to be forgotten. The old line over the Utah desert has been revised in the past few years. That part over Soldier's Summit has been abandoned, a cut-off having been constructed in which distance and curvature were sacrificed to obtain a lower grade.

In the Yellowstone Park, Government engineers are doing considerable road work, using teams with fresno scrapers. Reinforced-concrete box culverts are being constructed where necessary, utilizing for the concrete the gravel found in the vicinity. Quite a stretch out of Yellowstone, Mont., is being macadamized. The United States Engineer's Office is at Mammoth Hot Springs, Yellowstone Park, Wyo. Autos were let into the park for the first time on Aug. 1. Tanks are located every few miles, and the Government tries to keep the roads sprinkled.

At Victoria, B. C., there were two drill boats, a pile-driver and a big dipper dredge preparing for the large docks to be built there. At Vancouver the Canadian Northern Ry. has planned to build some large docks costing several millions; but when I was there in August things were rather quiet.

From Seattle to San Diego, Calif., there is a series of stretches of road known as the Pacific Highway, which was under construction. Through the Oregon mountains I think macadam is used on this highway, but in California the road is of concrete, with asphalt top. The Pacific Highway follows the line of the Southern Pacific Ry. through the Sacramento Valley, most of the way to San Francisco. On the concrete sections expansion joints were placed about 250 ft. apart. About halfway between the joints I noticed a break, as though the joints had been placed too far apart. The extreme heat of the Sacramento Valley would test the expansion of anything. It was 112° F. when I passed through en route to San Francisco, but before sundown there was steam heat on the train, made necessary by the ocean breezes.

San Francisco and the exposition have already been described by many persons, and I will not add my voice to the tumult. As for contract jobs in the vicinity, the Twin Peaks tunnel is under way, and there is a large sewer being built to the ocean outlet between Sutro Heights and Golden Gate Park. It is about 4,500 ft. long and lined with concrete. The contractor informs me that he had successfully shot concrete with air 3,000 ft. on this job; while I was with him they were blowing it 600 ft. The same man has the contract for lining the Twin Peaks Tunnel. He says that he is not going to use air for concreting in the tunnel. The transportation system of the city comprises trolley cars and a few cable cars, jitneys and some of those Manhattan busses. The crowds were handled very well. The hills are too steep for trolleys, so I suppose the cable cars will always be there. There is one hill near the exposition that is said to have a 32% grade.

Los Angeles has a scheme for saving the sewage for fertilizer and the water for irrigation. In the West you might shoot a man and get away with it, but you must not waste any water. The press is agitating a big appropriation for flood control of the Los Angeles River. When I saw the river there wasn't enough water in it to water a mule. The city and county have very good roads, with concrete base and asphalt top.

San Diego is the cleanest and brightest spot on the Coast, but there is not much doing at the local exposition. It was a big mistake to hold the two expositions at the same time. The paving in San Diego is asphalt and a sort of vacuum cleaner is used for street-cleaning.

I made a two days' stop at Grand Canyon. From a construction man's point of view, the canyon has a great face to it if one wanted to open a quarry.

In New Mexico the creek and river beds do not contain enough water to wet a mosquito's feet, but as the railway bridges are long there are probably times when water is superabundant.

Illinois Utilities Commission Has Water-Works Rules

Water-service standards were established in August by the Illinois Utilities Commission. This is the second state to establish definite rules for water service much like those generally adopted for gas and electric supplies. These rules cover about the same ground as those recently adopted in Oregon, except that they make no provision as to the security of domestic supplies and do not specifically require adequate pressure. They do go beyond the Oregon rules, however, in the matter of interruptions to service.

Rule 1 provides that records and reports required by these rules shall be preserved for at least three years. Rule 2 requires the utility to keep a record of each meter, showing make, size, style, number, date of purchase and the results of every test. Rule 3 requires utilities having 300 or more customers to maintain recording pressure gages. Causes of extreme variations are to be noted on the gage record. Other gages must be set at points fixed by the commission. Rule 4 requires that bills for meter service shall show the date of meter readings and the total quantity supplied. The utilities-operating rules are to be printed on the reverse of the bill.

In Rule 5 prompt reëstablishment of interrupted service is demanded. Interruptions for working on distribution lines are to be done at times of least inconvenience to consumers and only after six hours' notice to consumers and fire departments. In Rule 6 written acknowledgments of complaints and full and prompt investigation are demanded. A record must be maintained, showing complainant, nature of complaint and adjustment.

The rest of the rules relate to meter testing. Sufficient laboratory or shop equipment is required to make the meter tests demanded. Runs are to be made at 1/8, 1/2 and full flow. Not more than 4% excess registration on 1/8 and 1/2 flow is permissible and not more than 2% on full flow. The average error must not be more than 2%. Tests may be made at the place of installation, provided the method employed is approved by the commission. Untested meters are not to be placed in service. The time that a water meter may be kept in service without testing is 10 yr. (or the passage of 100,000 cu.ft.) for a 5/8-in. meter, six years (or 300,000 cu.ft.) for a 1-in. meter and four years for larger sizes. A meter must be tested free on request once in 12 months. For more frequent tests a fee of $2 to $5 may be imposed. The commission will test a meter on application and if the meter is too fast the utility must pay the fee.

How Low Fixed Charges Favor Centrifugal Pumps

By G. H. Gibson*

A pumping unit can be highly efficient in the conversion of heat units to work, and still have a smaller money economy than another unit of lower thermal efficiency. A good example of this fact is supplied by two notable steam pumping units which were installed and tested during the last year. One was a steam-turbine-driven centrifugal pump at Cleveland, Ohio, and the other a triple-expansion reciprocating pumping engine at St. Louis, Mo.—each probably being the most efficient representative to date of its respective type.

The Centrifugal Pumping Unit

The steam-turbine-driven centrifugal pump (designed and built by the De Laval Steam Turbine Co. and installed by Dravo-Doyle Co.) is at the Kirtland Pumping Station of the City of Cleveland and consists of a turbine of 14 pressure stages, running at 3,600 r.p.m. and driving two 24-in. centrifugal pumps at a speed of 600 r.p.m. through a double-helical speed-reducing gear. The specifications required the pumps to deliver 30,000,000 gal. per day against a total head of 206 ft., some 18 ft. of which was to be suction lift. It was guaranteed that when operating with steam at 150-lb.-gage pressure, superheated 100° F., the unit should develop a duty of 115,500,000 ft.-lb. per 1,000,000 B.t.u. The vacuum was not specified, as the contractor was required to supply the condenser. The unit was also designed to operate against a 250-ft. head.

Due to the nature of the subsoil, it was impossible to excavate deep enough for the condenser to be placed in the suction line, according to the usual practice. The condenser (designed and built by the Wheeler Condenser and Engineering Co.) was therefore designed for a pressure of 150 lb. per sq.in. and was connected in the discharge line. It is a water-works type, all of the water handled by the pump passing through the shell and the steam being condensed inside the tubes. The exigencies of available space and a desire to shorten as much as possible the connection between the exhaust flange of the turbine and the condenser made necessary two short-radius right-angle bends between the discharge flange of the pump and the water-inlet flange of the condenser. The condenser contains 2,120 sq.ft. of cooling surface and is served by a dry-air pump and a horizontal duplex hot-well and condensate pump, both pumps exhausting into an open feed-water heater. The condensing equipment was designed to provide a vacuum of 28 in., referred to a 30-in. barometer. This has been slightly exceeded in practice.

TABLE 1. RESULTS OF TESTS OF KIRTLAND CENTRIFUGAL PUMPING UNIT, CLEVELAND

	Dec. 22, 1914			Dec. 30, 1914
Began	9 A.M.	3 P.M.	4 P.M.	10 P.M.
Finished	3 P.M.	4 P.M.	9 P.M.	11 P.M.
Steam pressure, lb.	150.3	151.5	149.9	153.58
Corrected vacuum, in.	28.34	28.47	28.47	28.25
Discharge pressure, ft.	181.9	171.5	188.1	214.5
Suction lift, ft.	25.3	22.8	21.8	21.7
Suction-head loss, ft.	7.1	8.3	7.6	8.4
Total average head, ft.	207.2	194.3	209.9	236.3
Av. temp. of condensate leaving condensate heater, deg. F.	84.6	82.7	82.0	81.3
Av. temp. of condensate, heated by auxil. exh., deg. F.	105.1	102.0	102.2	102.0
Superheat in steam, deg. F.	86.2	86.6	74.6	102.6
Equiv. total heat supplied above temp. of condensate, B.t.u. per lb.	1171.7	1174.6	1168.3	1183.9
Total steam cons. per hour, lb.	14,975	14,908	14,998	16,372
Average pump r.p.m.	583.6	582.0	580.2	608.4
Av. rate of pumping, million gal. per day	29.60	32.40	30.38	30.30
Av. water, hp.	1077.0	1105.2	1120.4	1257.0
Duty, 1,000,000 ft.-lb. per 1,000,000 B.t.u.	121.53	124.96	126.78	128.40
Duty, 1,000,000 ft.-lb. per 1,000 lb. superheated steam	142.40	146.79	148.12	152.02
Steam per water hp., per hr., lb.	13.90	13.50	13.37	13.02
Overall thermal efficiency, %	15.6	16.1	16.3	16.5

The temporary nature of the installation also explains the character of the supply and delivery connections to the pump. In order to utilize a 48-in. suction line running from the well to a compound direct-acting pump installed on the other side of the building, a 48x48-in. T was inserted. As may be seen from Fig. 2, the location of this T, relative to the bottom suction opening of the pump, resulted first in a dead end approximately 30 ft. long beyond the point where the suction connection for the pump is taken off, and also the existence of a high spot or inverted siphon in the suction line rising to approximately 6 ft. To overcome the possibility of trouble from these sources, a vertical chamber was put on the 48-in. suction line, close to the outlet to the pump, and the top of this chamber connected to the air pump. This has worked successfully, as the pump operates quietly with a suction lift as high as 26 ft. when handling water at the rated capacity.

The turbine, gear and two pumps comprising the unit occupy a space approximately 10 ft. wide by 35 ft. long, measured over the foundations; and as they weigh altogether only 57 tons, the pressure per square foot of sur-

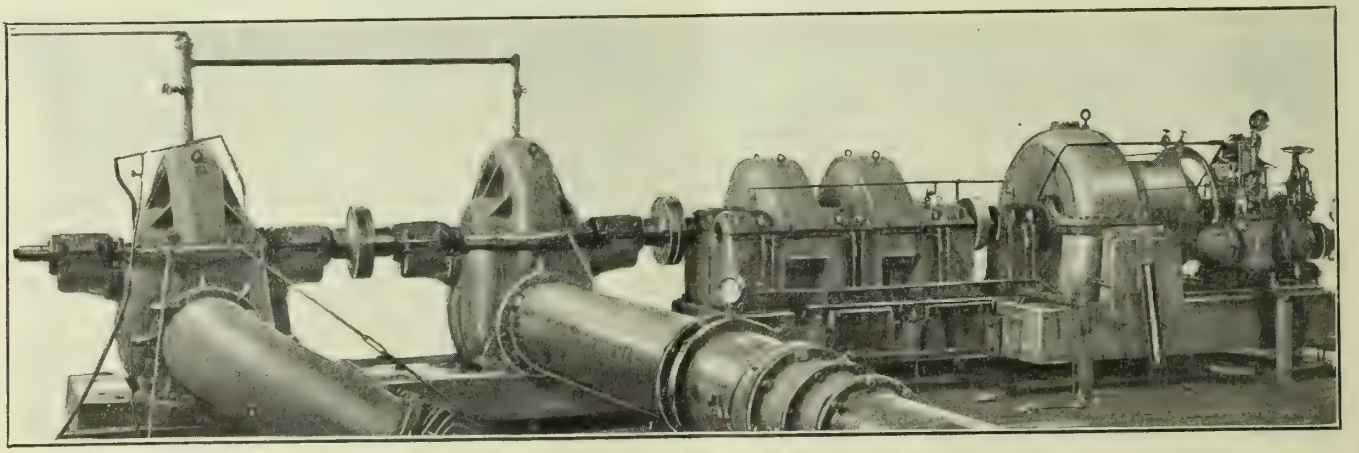


FIG. 1. GEARED TURBINE-DRIVEN PUMPING UNIT AT KIRTLAND STATION, CLEVELAND

*Tribune Building, New York City.

face is only about 326 lb., rendering the construction of foundations a comparatively simple matter in spite of the nature of the ground.

Tests of Centrifugal Unit

A preliminary test for duty was made under full load at the builder's shop, the results of which agreed within 1% with the results of the acceptance trials made at the Kirtland Pumping Station, Cleveland, on Dec. 22 and 30, 1914, a résumé of which is given in Table 1.

The third test most closely corresponds to the specified conditions upon which the guarantees were based. The duty guaranteed was equivalent to 136,500,000 ft.-lb. per 1,000 lb. of superheated steam, while the duty actually realized in this test was 148,121,000 ft.-lb., although the steam pressure was 0.1 lb. less than specified, the superheat was 15.4° less and the suction lift was 3.8 ft. greater—due to friction in piping which was not furnished by the contractor. In the fourth test, in which the conditions more nearly approximated those for which the unit was designed (with a view to the conditions under which it would ultimately be required to operate), a duty of 152,020,000 ft.-lb. per 1,000 lb. of superheated steam was realized, equivalent to 128,400,000 ft.-lb. per 1,000,000 B.t.u.

TABLE 2. COMPARISON OF KIRTLAND STATION AND BISSELLS POINT PUMPING UNITS

	Kirtland Centrifugal		Bissells Point Triple-Expansion
Capacity, gal. per day	30,000,000		20,000,000
Head, ft.	206		125 lb.-288.3 ft.
Suction lift, ft.	18		
Steam pressure, lb. gage	150		160
Superheat, deg. F.	100		100
Water hp. specified	1,081		1,013
Duty guaranteed, ft.-lb. per 1,000 lb. steam	136,500,000		195,000,000
Weight, including bed plates, tons	57		875
Space occupied, ft.	35x7x18		30.5x22x51
Price of unit, including condenser	$35,750		$193,697
Price plus bonus			$200,697
Date tested	Dec. 22, 1914	Dec. 30, 1914	Apr. 23-24, 1914
Test data	Test 3	Test 4	
Delivery, gal. per day	30,380,000	30,300,000	20,610,000
Head, ft.	209.9	236.3	297.7
Suction lift, ft.	21.8	21.7	
Steam pressure, lb.	149.9	153.85	159.43
Superheat, deg. F.	74.6	102.6	105.23
Vacuum, in.	28.47	28.25	28.00
Boiler hp. required	477.7	545.7	350.1
Duty developed:			
Ft.-lb. per 1,000 lb. steam	148,120,000	152,020,000	202,628,616
Ft.-lb. per 1,000,000 B.t.u	126,780,000	128,400,000	166,719,796
Water hp. developed	1120.4	1257.0	1074.91

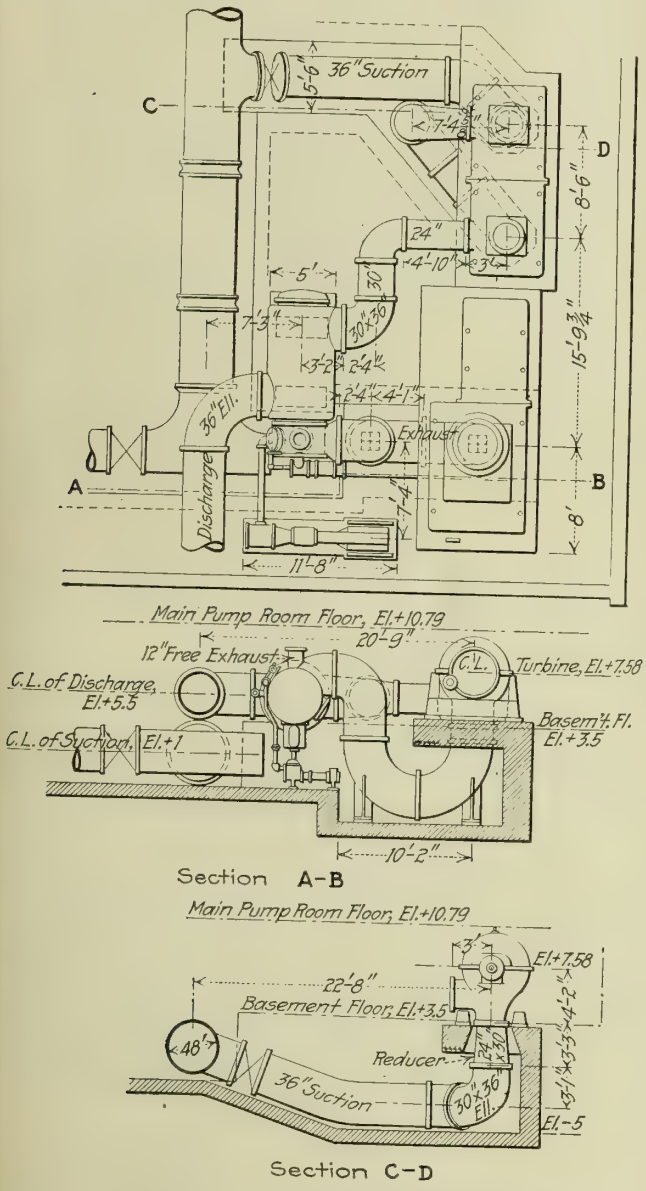


FIG. 2. PLAN AND SECTION OF CENTRIFUGAL-UNIT INSTALLATION, KIRTLAND STATION

Comparison with St. Louis Unit

It is instructive to compare the results of these tests with those of tests made eight months previously upon a vertical triple-expansion reciprocating pumping engine (Holly type) installed at the Bissells Point Station of the St. Louis water-works. It was designed to deliver 20,000,000 gal. per day against a pressure of 125 lb. per sq.in., corresponding to 1,013 water horsepower. The water horsepower corresponding to the Kirtland Station specifications was 1,081, so that the efficiencies and economies of the two units, each representing, so far as known, the highest development of its type, are properly comparable. The Bissells Point pumping engine was guaranteed to deliver 195,000,000 ft.-lb. per 1,000 lb. of steam at 160 lb. pressure and 100° F. superheat, and a bonus of $1,000 was to be paid for each 1,000,000 ft.-lb. of work done by the engine in excess of this duty, while a forfeiture of a like amount was to be deducted for each 1,000,000 by which the duty fell short of the guarantee.

The steam cylinders were jacketed and covered with magnesia insulation. The valve gear was of the corliss type, with poppet exhaust valves on the low-pressure cylinder. The water ends were of the single-acting outside-packed plunger type, arranged for direct flow, with removable-valve decks, containing 1,482 valves for each of the three pumps. Rubber valves with bronze stems are held on gun-metal seats by brass springs. The condenser, which is of the water-works type, with steam in the tubes, contains 1,800 sq.ft. of cooling surface, and the total weight of the unit, including a two-stage air compressor for supplying the air chambers, is 875 tons.

The foregoing particulars and the following test results are taken from an article in *Engineering News* of Sept. 3, 1914:

Steam pressure, lb.	159.43
Vacuum, in.	28
Water pumped in 24 hr., gal.	20,610,000
Superheat, corrected, deg. F.	105.23
Total head, ft.	297.703
Duty, ft.-lb. per 1,000 lb. of steam, without correction	202,628,616
Duty, per 1,000 lb. deducting for 5.23° superheat	202,105,616
Total heat consumed, including jacket and auxiliaries, B.t.u.	306,384,969
Duty, ft.-lb. per 1,000,000 B.t.u.	166,719,796
Water horsepower	1,074.91
Steam per water horsepower	9.77

As will be noted, the head pumped against, and also the water delivered, were somewhat greater than those specified in the contract. For purposes of comparison with this test, therefore, both the third and the fourth tests on the De Laval centrifugal pump have been taken. Table 2 compares the leading facts in regard to the two units and their performances.

To make a further comparison of these two units it would be necessary to consider installation at the same location, as the cost of buildings and foundations depends largely on local circumstances. The total weight of the reciprocating engine is over fifteen times that of the turbine-driven centrifugal pump, while the cubical space occupied is about ten times as great. In view of this, it may be assumed for comparison of economic results that the buildings and foundations for the reciprocating unit would in general cost four times as much as for the centrifugal unit, although they might be even more.

The cost of bituminous coal (13,000 B.t.u. per lb.) to the City of Cleveland is $1.64 per ton, whereas in St. Louis washed coal showing 11,000 B.t.u. per lb. is purchased for $1.69 per ton. For the purpose of comparison it has been assumed that both units are supplied with steam generated from the coal costing $1.69, which, if burned under boilers of 65% efficiency, would give a fuel cost of 13c. per 1,000,000 B.t.u. It has further been assumed that the nominal horsepower capacity of boilers installed will be the same as the boiler horsepower of steam used. Operation at 200% above nominal rating is now common, so that this gives ample spare boiler capacity. The interest rate upon money has been taken at 4%, maintenance and supplies for pumping engines and buildings at 2%, with 30 years as the probable life. This gives a total annual charge against engines and buildings, including depreciation or amortization, of 7.6%. For boilers the same rate of interest has been assumed, while maintenance and supplies have been put at 4% and the probable life at 20 years, making the total 11.3%. These assumptions give the following figures for comparison, using the results of the fourth test upon the centrifugal pump:

	Centrifugal Unit	Reciprocating Unit
Cost of buildings and foundations, assumed	$20,000	$80,000
Cost of boilers, settings and stack, assumed as $30 per nominal boiler horsepower	16,371	10,503
Annual interest, maintenance and depreciation charges on pumps and buildings	5,130	21,310
Annual interest, maintenance and depreciation charges on boilers	1,849	1,188
Total interest, repairs, maintenance and depreciation charges	6,979	22,498
Annual fuel cost of steam, at 13c. per 1,000,000 B.t.u., based on full load 24 hr. per day, 365 days per year	22,030	14,540
Total annual cost per water horsepower, exclusive of attendance and supplies, assuming 100% load factor	23.11	34 45

As will be seen, the annual cost per water horsepower is $23.11 for the steam-turbine-driven centrifugal pump and $34.45 for the vertical triple-expansion reciprocating pumping engine. In neither case has any charge been made for supervision and attendance, although there can be no question that in view of the great complexity and great number of valves, packings and other parts connected with a reciprocating pump, its cost for attendance will be greater, both because more men will be required and because they will need to possess a greater degree of skill and intelligence. For the same reasons, and also because of the rapid wear of valves and packings, the probabilities of falling off in duty are greater for the reciprocating unit.

Further, full-load operation 24 hr. per day and 365 days has been assumed—an improbable condition. If the load factor is put at 66.6%, the comparison is still more favorable to the centrifugal pump. The annual fuel costs become $14,690 and $9,690 for the centrifugal and reciprocating units respectively and the annual costs per water horsepower-year become $25.90 and $44.90.

For average operations, therefore, and with fuel prices such as are generally found in the Middle West, a modern steam-turbine-driven centrifugal pump will deliver water at about half the cost for pumping as compared with the highest development of the reciprocating type of pumping engine.

Track Elevation on the Nickel Plate Railroad at Chicago

SYNOPSIS—The piece of work described in this article is peculiar in that conditions necessitated abandoning the original line and building an elevated line on a new location. The line has to rise to cross one railway, then descend to pass under two railways and then rise again to connect with one of the latter. There is a large amount of concrete work for the length of the line, and a notable structure is a steel skew bridge with plate girders of from 125½ to 132 ft. in length.

The track elevation at Grand Crossing, Chicago, includes the elimination of railway crossings of both streets and railways at grade, and has involved special problems for the New York, Chicago & St. Louis Ry. (Nickel Plate), which is one of the four railways concerned. The situation is shown by the sketch plan and profile, Fig. 1.

Originally all the railways were at the street level. The two parallel lines of the Lake Shore & Michigan Southern Ry. (now New York Central Lines) and the Pennsylvania Lines crossed the Illinois Central R.R. at grade, and the New York, Chicago & St. Louis Ry. (parallel with the Illinois Central R.R.) crossed the Pennsylvania Lines at grade (by a 14° curve) to connect with the Lake Shore tracks. To eliminate the street grade crossings the Illinois Central was elevated sufficiently to clear the streets, which were depressed at the intersection, and the parallel lines of the Lake Shore and Pennsylvania were elevated still higher in order to pass over the Illinois Central R.R. Each road has numerous tracks and heavy traffic at this point.

To eliminate the grade crossing of the Nickel Plate with the Pennsylvania Lines, the old connection was abandoned and a new one located as shown on the plan. Beginning at 87th St., this connection rises on a grade

of 0.6% and swings with 10° curves so as to cross over the Illinois Central. It then swings north on a long curve of 1° 36″ and descends at 1% grade to pass under the other two lines in a skew subway (on a 10° curve), and then, running parallel with the latter, it rises on a grade of 0.638% till it is on a level with the Lake Shore

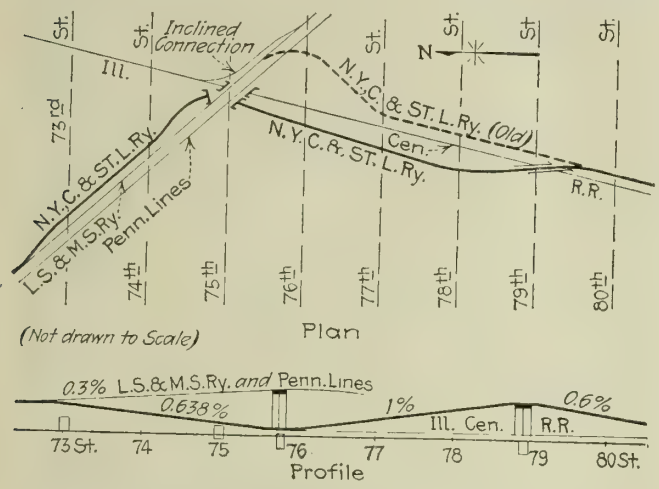


FIG. 1. TRACK ELEVATION AND GRADE-CROSSING ELIMINATION AT GRAND CROSSING (CHICAGO)

Ry., with which it connects a little north of 73rd St. Only two tracks have been built as yet, but the plans provide for four tracks.

The elimination of the Nickel Plate grade crossing in 1909 closed the original connection with the Lake Shore Ry. As the new connection had not been built it was necessary to divert the Nickel Plate trains to some other route, and since November, 1909, they have been detoured from 95th St. over the Rock Island Line, which brings them into the same terminal station (the La Salle Station). The new connection is expected to be put in service by December, 1915. Unlike most of the track-elevation work in Chicago, this line has been built without the complications involved in doing the work while the line is carrying traffic.

Concrete Retaining Walls

From 87th St. the new line is on an ordinary embankment as far as the bridge over the Illinois Central R.R., the fill being made by dumping from a temporary trestle. At the approach to the bridge, however, long retaining walls are required in order to keep the slopes of the fill clear of street lines and property lines on the east side and clear of the Illinois Central R.R. right-of-way on the west side of the tracks. This is shown in Fig. 2, and the sections of walls are given in Fig. 3.

The east wall is 600 ft. long, with a height of about 35 ft. for 200 ft. at the middle, the ends then sloping down on grades of from 12 to 18%. It is built in sections 50 ft. long (with expansion boards at the center of each section), except that at the north end, where the wall is low, there are sections 35 and 45 ft. long. Two layers of tar paper were placed between the sections.

The wall has a vertical face, with no coping, and the back is stepped. It was originally proposed to put a line of concrete piles under the face of the wall, but this was abandoned and the footings were made somewhat deeper, being carried 1 ft. into the solid clay subsoil. The width of base of wall as built is 50% of the height plus 1 ft. The west retaining wall is an extension of the bridge abutment.

West of the Illinois Central R.R. the line is mainly a fill between concrete retaining walls. At 78th St. an incline has to be provided for an industry track on a

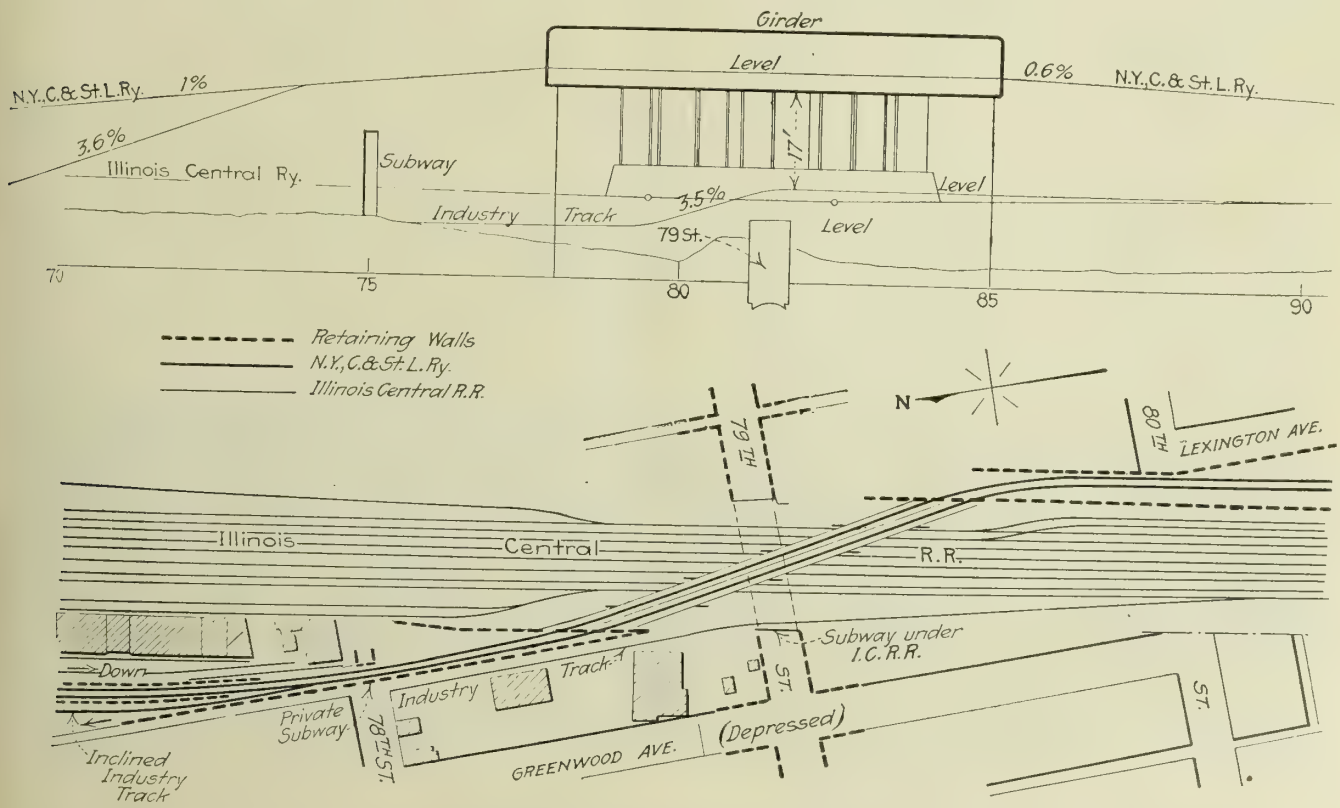


FIG. 2. SKEW CROSSING OF THE NEW YORK, CHICAGO & ST. LOUIS R.R. OVER THE ILLINOIS CENTRAL R.R. AT GRAND COSSING (CHICAGO)

grade of 3.6%, with a subway beneath this to give access to the railway company's property. This necessitates the triple-wall arrangement shown at the left in Fig. 2. At the 79th St. bridge over the Illinois Central R.R. the retaining wall and abutment meet in a sharp angle, as shown on the plan. The sections are given in Fig. 3. Fig. 5 is a view at this angle, with the wall at the left and the bridge abutment on the right. The tie bars are pieces of old rails which anchor the walls together.

All concreting was done by means of a train having a mixer and elevator tower on the first car and material cars behind, as described in *Engineering News*, Aug. 12, 1915. The walls are surmounted by pipe hand railings carried in standards, which are secured to the outer

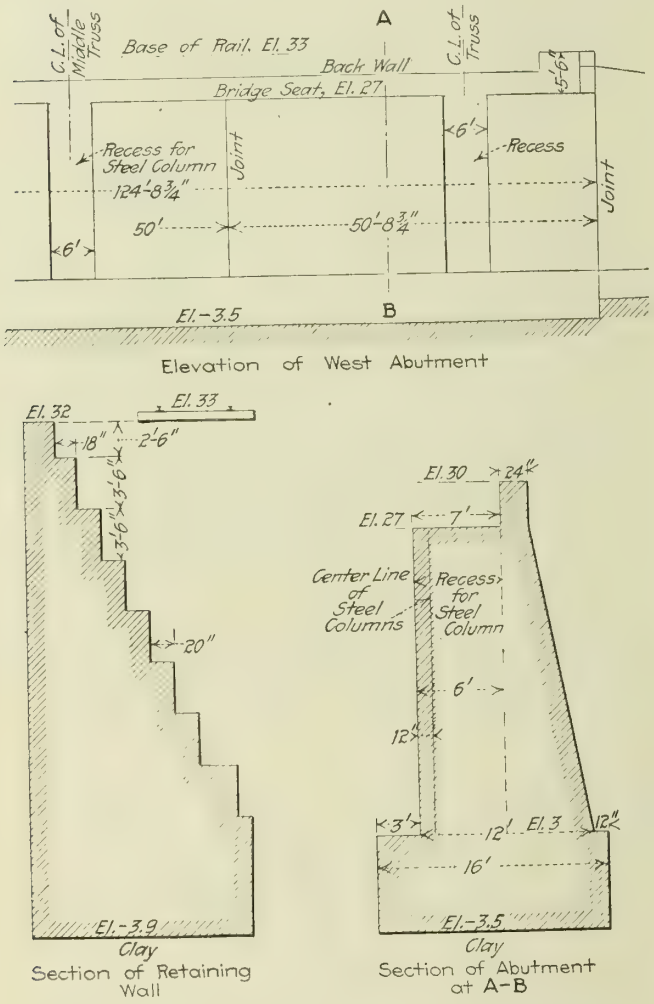


FIG. 3. ABUTMENTS AND RETAINING WALLS

face of the wall. Each standard is a flat bar, twisted at the middle so that the lower part lies against the wall. As the walls have no coping this construction is very simple, but rust streaks occur on the wall as soon as the metal is placed.

The filling was of bank sand hauled from South Gary, Ind., where it was loaded by a 70-ton steam shovel on side-dump cars and side-door gondola cars. The cars were supplied by the railway, which also hauled them in trains of 30 cars each. Most of the material was unloaded by hand shoveling, and was spread and leveled by means of a Jordan spreader car. Part of the filling was deposited from a temporary trestle, but on a considerable part of the work it was necessary to jack up the track as the filling progressed. The work required only about 42,500 cu.yd. of material and was done between July 1 and Aug. 3, 1915.

Bridges and Subways

The private subway at 78th St. is 12 ft. wide and 13 ft. high, with a roof of 15-in. I-beams embedded in a concrete slab, as shown in Fig. 5. The end walls are carried up to hold the fill for the main tracks and wing walls provide for the slope of the fill on the inner side. Streets are crossed by steel bridges having four spans, with bents on the curb lines and in the middle of the roadway. The steelwork of girders and bents is all incased in concrete. The roadway spans have through plate-girders, while the sidewalk spans are of I-beams. Some of the bridges are built as two parallel single-track bridges, with a narrow space between them, giving light in the street. Over the sidewalks this space is covered by concrete slabs. The bridge floor is a concrete slab on transverse I-beams.

The 78th St. crossing is shown in Fig. 6, with three structures. On the higher level is the Lake Shore & Michigan Southern Ry. and on the lower is the Nickel Plate railroad. At the left the latter passes under the

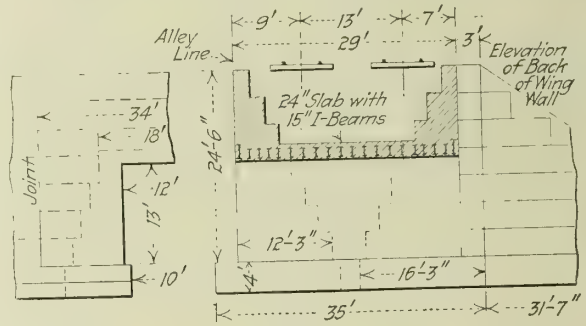


FIG. 4. SMALL SUBWAY UNDER TRACK ELEVATION AT 78TH ST.

former by a long skew subway on a curve and then runs parallel with it on an ascending grade (to the right) until it comes to the same elevation and makes a junction with it. It will be noted that the wing wall of the bridge at the left is extended as a dwarf retaining wall to confine the toe of the upper slope and give room for the tracks on the lower level.

The most important structure is the five-span skew bridge over the Illinois Central R.R. at 79th St. It is notable in having plate girders 125 ft. 6 in. long and one girder 132 ft. long. It has three lines of girders. An unusual feature of the abutments is that the girders do not rest upon bridge seats in the usual way, but each rests upon a steel column in the face of the abutment. This is done to reduce the length of span as far as possible. The abutment was built with rectangular recesses, the steel columns being set later, each on an I-beam grillage on the footing. The recesses will be filled with concrete flush with the face of the abutment. This construction is shown in Figs. 3 and 5. Steel bents with wide columns on concrete footings form the intermediate supports. The superstructure will be described in a separate article.

The construction is under the direction of E. E. Hart, Chief Engineer of the New York, Chicago & St. Louis R.R.; and A. C. Harvey, Assistant Engineer, is in di-

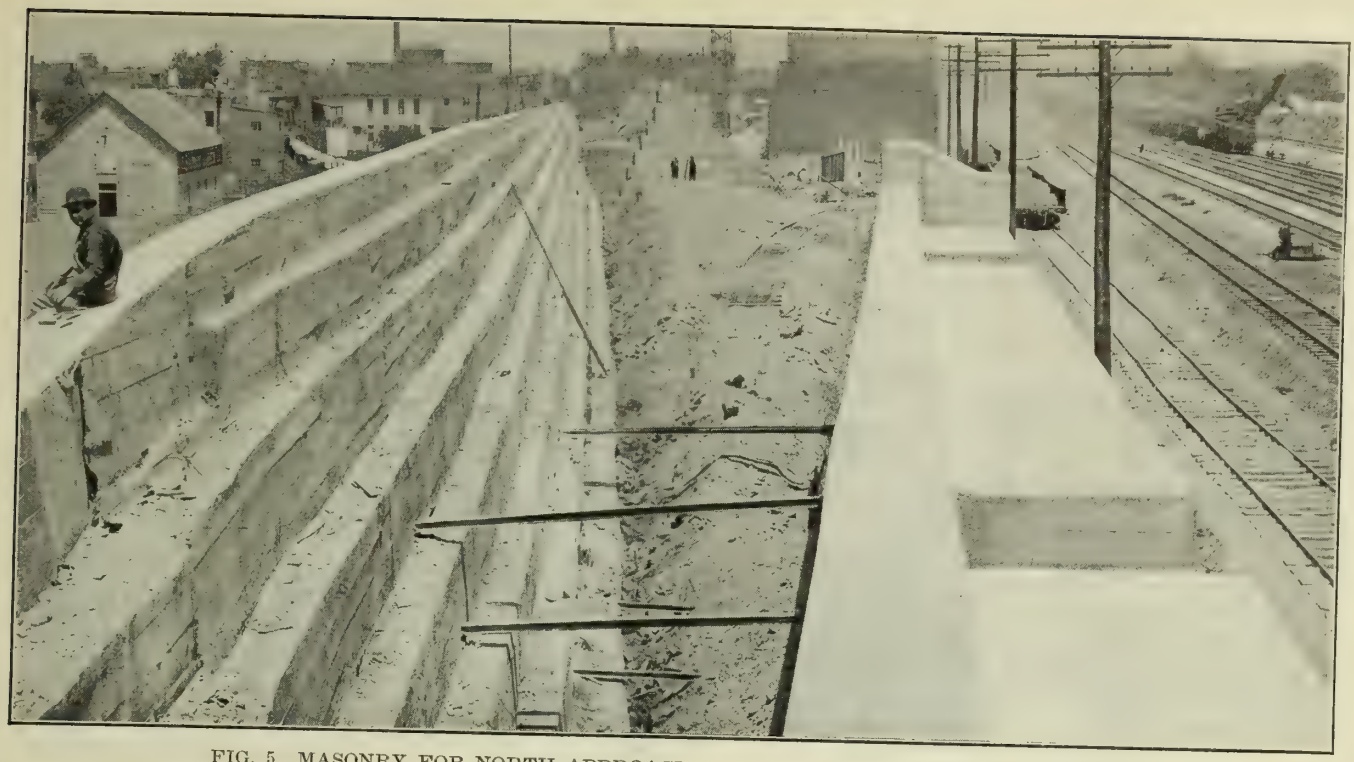


FIG. 5. MASONRY FOR NORTH APPROACH TO THE 79TH ST. BRIDGE AT CHICAGO

The railway comes down from the direction indicated by the concreting tower in the center and swings across the Illinois Central R.R. at the right. At the left is the retaining wall along the alley, which unites with the end of the bridge abutment. The recesses in the face of this abutment are to receive steel columns which support the ends of the bridge girders

rect charge. The Brownell Improvement Co., of Chicago, had the contract for the concrete and P. T. Clifford & Son, of Valparaiso, Ind., had the contract for the filling. The steel street bridges and the bridge over the Illinois Central R.R. were built by the Pennsylvania Steel Co., of Steelton, Pa.

The New York State Barge Canal can be put into complete service in two years, according to a statement in the "Barge Canal Bulletin," the organ of the State Engineer's office. It is stated in the October issue of this journal that "if the referendum of Nov. 2 is approved and if the money can be appropriated soon after the first of next January, it is safe to assert that the Champlain Canal can be completed in one year, as can also the canal between Waterford and Oswego and the branch into Cayuga and Seneca lakes. The balance of the canal through to Buffalo will require one additional year to finish." The statement goes on as follows: "It is not necessary at the present time to enumerate the advantages expected to follow the completion of the canal and its terminals. These benefits have been ably set forth by numerous advocates. However, it may be well to state that there is ample evidence to indicate that transportation men and navigation companies stand ready to make quick use of the canal as soon as the new channel is opened throughout its entire length. Some companies are already organized and are prepared to put fleets in service, chiefly for local traffic, the kind of traffic from which the people of the state will derive most direct and greatest benefit. With wisdom the state decided to add the building of terminals to the canal project. The lack of terminal facilities was one of the greatest faults of the old canal system. In fact, unmonopolized terminals is the crying need of our American waterways today."



FIG. 6. DOUBLE-DECK TRACK ELEVATION AT 78TH ST., CHICAGO (GRAND CROSSING)

The upper line is the Lake Shore & Michigan Southern Ry. The New York, Chicago & St. Louis R.R. crosses under it by a long skew subway and then runs parallel with it on an ascending grade until at 73rd St. it reaches the same level and makes a junction with the Lake Shore R.R.

Field and Office

Temperature Influence on Set of Concrete

As a result of a series of tests conducted under his direction at the University of Illinois, Prof. A. B. McDaniel has prepared a diagram giving the relation of strength of concrete to external temperature for different ages. This diagram is reproduced herewith. It is taken, together with the other data in this article, from Bulletin 81 of the Engineering Experiment Station of the University of Illinois, entitled "Influence of Temperature on the Strength of Concrete," by A. B. McDaniel.

The tests included 45 on 6x6-in. concrete cylinders, 51 on 6-in. cubes and 60 on 8x16-in. cylinders. They were all made in compression and at periods varying from 3 to 28 days, with intervals of 3 days between the tests

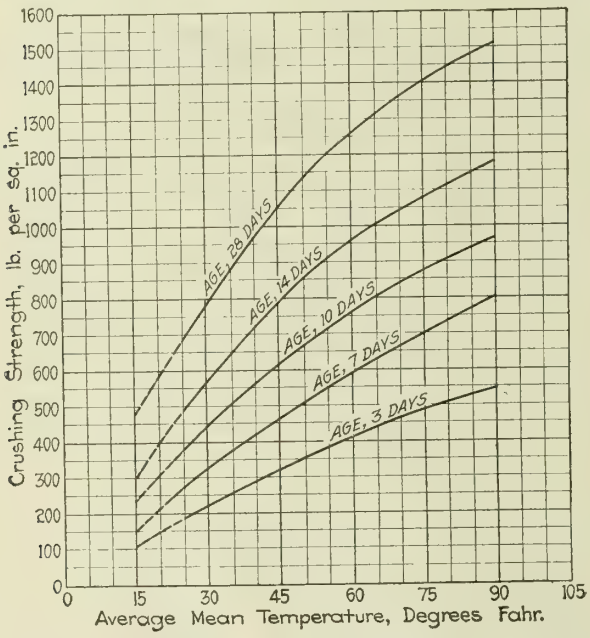


DIAGRAM FOR DETERMINING STRENGTH OF CONCRETE AT DIFFERENT AGES AND TEMPERATURES

at the early ages. The concrete was a 1:2:4 mixture by weight, or 1:2.2:3.6 by volume, of cement sand and crushed limestone. All of the specimens were molded at 70° F., but they were stored in temperatures varying from a mean of 25° F. to 95° F. For the most part they were tested within one hour after being removed from storage. The first series, however, was kept 20 hr. at 70° F., which slightly raised the compression strength of those specimens which had been stored at a lower temperature.

The diagram is an ideal one, made up from the various curves of the large cylinder specimens. Professor McDaniel says that it may be employed to determine the strength which the concrete attained at different stages under a constant temperature, the age at which a particular strength was gained under different temperatures and the strength which may be expected at different ages under different temperatures. The relative strength attained by concrete at different temperatures during hardening and at different ages may be expected to vary somewhat with differences in cement, aggregate and consistency; but it is thought that the values in the figure may be taken to represent the effect upon strength of the variation in the temperatures during hardening.

One noteworthy observation in the tests was that one series which was subjected to temperatures varying below and above freezing so badly disintegrated as to have very little compression strength. Another notable fact which differs somewhat from previous experience was that in some of the tests under a temperature slightly below freezing the concrete gained strength continuously, which explains why the curves in the diagram descend below the freezing point.

Building Invert of Milwaukee Intake Tunnel

By Lee G. Warren*

Concreting the invert of the new Linwood Ave. intake tunnel for the water-supply system of Milwaukee, Wis., is of particular interest from the fact that this operation followed the completion of the arch and side walls.[1] In driving the main part of the tunnel the excavation was carried down only to the bottom of the side-wall section, as shown in the lower section at the left of the accompanying drawing. This left about 0.70 cu.yd. per lin.ft. of tunnel to be removed in advance of the concreting of the invert. The material is Hamilton shale.

Excavation Method and Progress

The floor excavation was done by a night crew consisting of a foreman, 1 drill runner, 1 drill helper, 24 muckers and 4 teamsters. This crew attained an average speed of 60 lin.ft. or 42 cu.yd. per 10-hr. shift, with a maximum of 92 lin.ft. or 64.4 cu.yd. Steel side-dump cars of ⅔-yd. capacity, drawn by mules, were used. The blasting was done with light charges of 60% gelatin dynamite in 2-ft. holes.

The finished invert consisted of 1:2:4 concrete having a minimum thickness of 18 in. and a minimum length of arc of 10.07 ft. It averaged 0.62 cu.yd. of concrete per lin.ft., an excess of 0.05 yd. per lin.ft. over the plan quantity, due to the fact that the excavation had a horizontal bottom. Reinforcement consisted of ¾-in. round steel rods placed 12 in. c. to c. transversely and 15 in. longitudinally. The transverse rods were tied to the rods in the side walls, projecting 18 in. below the bottom of the walls. In placing the side-wall reinforcement the rods had been driven down 18 in. into the shale bottom, and upon excavating for the invert these projections were exposed.

*Resident Engineer, Linwood Ave. intake tunnel, Milwaukee, Wis.

[1]Previous articles on this 12-ft. tunnel extending 4,000 ft. under Lake Michigan will be found in "Engineering News," of June 18 and Oct. 29, 1914, and Apr. 8 and June 3, 1915.

A crew of 18 men placed the invert concrete—6 laborers helped to handle the cars, 6 shoveled the concrete after it was dumped from the cars and 2 laborers tamped the concrete; 2 finishers, 1 foreman and 1 hoisting engineman completed the crew. Two of the shovelers placed the rods and set the templets. The concrete cars were hauled by mules to within 40 ft. of the work and were then hauled by a hoisting engine operated by compressed air. The track was supported over the work on 6x6-in. timbers, 10 ft. c. to c., resting on or against the side walls. This arrangement gave an opportunity to dump the concrete from cars directly into place, as shown.

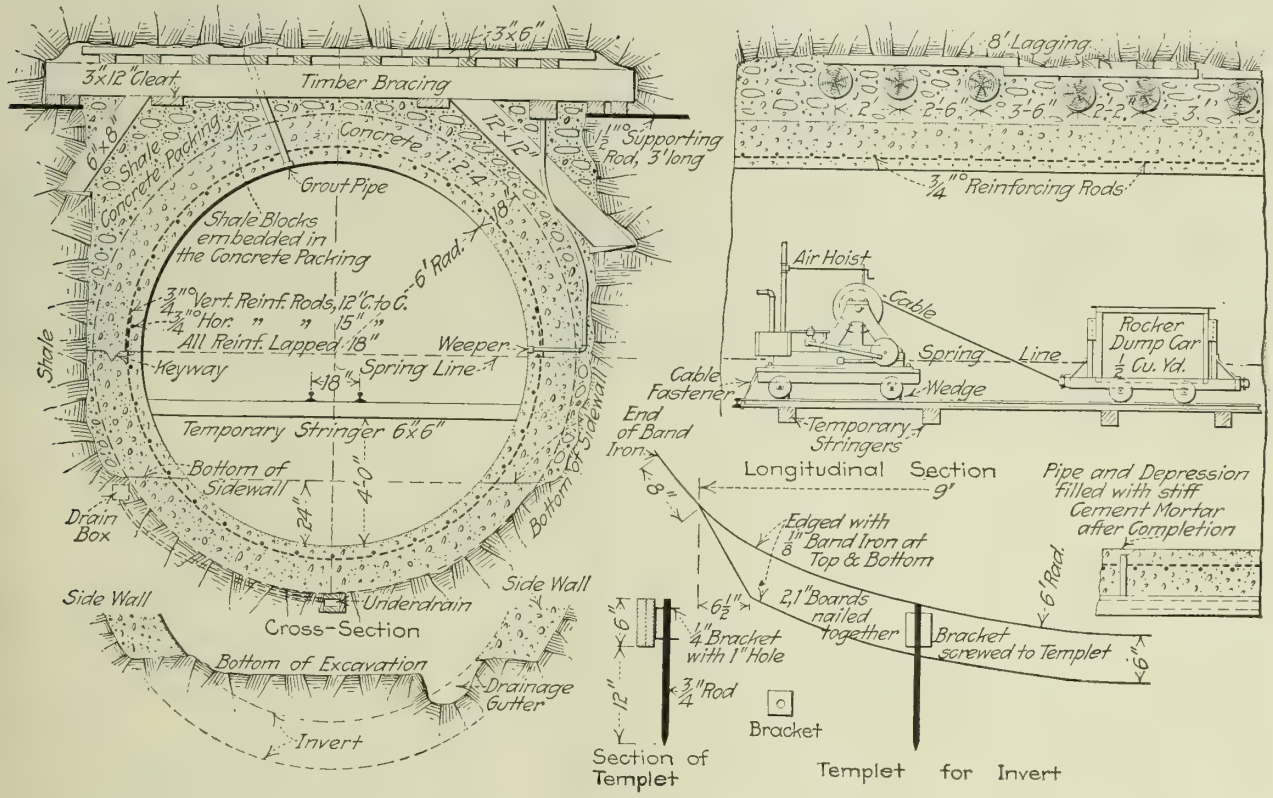
Concrete Tamped Continuously

Previous to placing the concrete the bottom of the side walls was thoroughly cleaned with small hand picks to remove the pieces of shale. This bottom was then cleaned by two applications of a compressed-air blast at 70-lb. pressure, which completely removed all dirt and mud. The side-wall bottom was then painted twice with 1:1 cement mortar. The invert concrete was placed in two layers—the lower one being 12 in. thick and the upper one 6 in. The reinforcement was placed between the two layers. The two laborers never ceased tamping the concrete, one operating on each side. Great care was taken thoroughly to tamp this concrete below the side walls. After placing the concrete, a 1-in. finish of 1:2 cement mortar was applied.

The only forms used for the invert were wooden templets, which are shown in the drawing. They were set by the inspectors as soon as 12-in. depth of concrete was laid. They set the templets every 25 ft. by measuring down from grade marks in the concrete arch. The templets were held in position by means of three ¾-in. steel pins about 18 in. long, each held by two eye-bolts on the templets. The operation of these templets was found satisfactory by the engineers and the contractor's forces.

The progress attained in placing the concrete equaled the invert excavation progress; in fact, the latter retarded the concrete work. A 1-in. finishing coat of 1:1 portland cement mortar was placed upon the completed concrete at the end of the day's operations. During the following night shift the two finishers brought this to the proper curve of the invert.

A wooden box drain of 2x8-in. planks, giving an open area of 8 sq.in., was laid the entire length of the tunnel. This drain emptied into sumps, from which air-operated pumps pumped the water to the large sump at the shore shaft, large enough to care for all water encountered. At intervals of 50 ft., 2-in. galvanized pipes were placed, leading from the invert surface to the drain. These carried off all water collecting upon the finished invert



CONSTRUCTION OF THE INVERT OF THE LINWOOD AVE. INTAKE TUNNEL; MILWAUKEE, WIS.

Invert Proves Solid; No Settlement

Three months have elapsed since the completion of the entire invert and no cracks or settlements have developed. Before starting the work it was thought there might be some danger of the invert concrete settling and separating from the bottom of the side-wall concrete, thereby breaking the bond. However, the careful tamping of the invert concrete beneath and against the side walls undoubtedly prevented this separation.

This tunnel is being constructed by Joseph Hanreddy, of Chicago, Ill., under the direction of George F. Staal, City Engineer. The writer is resident engineer of construction.

Barney Incline for Hauling Wagons Out of Pit

The views herewith show a barney incline rigged up in the foundation pit for a new loft building at 24th St. and Broadway, New York City, by the Thompson-Starrett Co., builder, for hauling the dirt wagons up to street level. The arrangement is simple, enables wagons to take a full load, avoids the use of snatch teams and is much more convenient than any other arrangement of hauling line. It is not strictly new, but in New York City it is an innovation in building practice. A. G. Moulton, superintendent for the builder, is responsible for using it in this case.

The barney car runs on a narrow-gage track of light rails laid on the incline. The nose of the car comes above the level of the rear axle of the wagon and thus when placed behind the axle pushes the wagon up the slope. A cable from the front of the car goes up the incline to a snatch block near the top, where it passes through the decking and laterally downward to a hoisting engine.

The car, as will be noted in the view in Fig. 1, is quite heavily made, and the butting block is well braced back to the main frame.

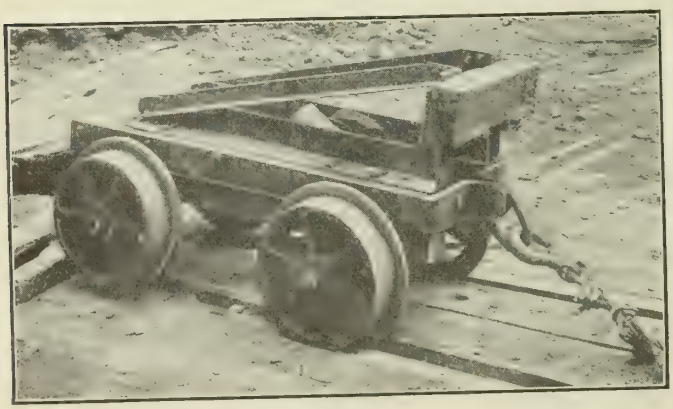


FIG. 1. BARNEY FOR HAULING DIRT WAGONS OUT OF FOUNDATION PIT

Railway-Valuation Office Index and File System

By H. J. Saunders*

In the work of the Pacific District of the Division of Valuation, Interstate Commerce Commission,[1] it was early realized that for filing the mass of notes and other accumulated material some system must be found which would be practically self-indexing and would allow for unlimited expansion. The Pacific District, with headquarters at San Francisco, includes some 300 railroads, covering 15 Western States. Further, it was found that the notes for the first 1,000 mi. of roadway alone occupied eight 12x24-in. filing drawers. Multiply this by 50 (50,000 being the approximate total mileage in the district) and one can begin to appreciate the problem presented.



FIG. 2. THOMPSON-STARRETT CO.'S BARNEY IN POSITION FOR HAULING A LOADED WAGON UP THE INCLINE

The actual inventory work is divided among the several district departments—roadway, structural, mechanical, telephone and telegraph, and land. The Roadway Department, having the largest force in the field, and accumulating the most material, is the only department that will be described here.

The notes which are taken and computed by the field parties are forwarded to the district office for final checking and compilation. They are bound into volumes, having heavy manila covers marked as indicated in Fig. 1. After receipt in San Francisco they are divided into convenient size for handling and are filed in 12x24-in. steel filing drawers, 42 to a section. In these drawers the various classes of notes, such as "cross-section," "track," etc., are separated by brown letter-size folders with heavy blue guide cards (one-third cut) separating the valuation sections.

Maps, profiles and plans are forwarded by the field parties with the notes, and after being marked by the

*731 Wells Fargo Building, San Francisco.

[1]The work of the Division of Valuation of the Interstate Commerce Commission was described quite fully by George H. Burgess in "Engineering News" of July 1, 1915.

district office filing clerk with their appropriate file number are card-indexed and filed in pigeonholes, which were found to be much more accessible than drawers. Maps and profiles are rolled and plans are folded.

A decimal system of indexing was adopted, the following primary numbers being selected to distinguish the different classes of material and the correspondence regarding the same:

420 Field Notes.
430 Maps.
440 Profiles.
450 Plans.

Immediately following one of the above-cited numbers is the number designating the carrier, after which is added a number showing kind or account. Thus the file number 420.3 M 03.2 would indicate field notes (420), Great Northern Railway (3), Montana Valuation Section (M 03), cross-section notes (2). If the last figure had been 1, it would have indicated track notes; 3, structure notes; 4, assistant engineer's notes; 5, platted cross-sections; and 6, general data or correspondence regarding some particular point in the inventory.

File number 430.3 M 03.2 would indicate map (430), Great Northern Railway (3), Montana Valuation Section (M 03), station (2). If the last figure had been 1, it would have indicated alignment; 3, miscellaneous. The last figure indicates in every case the account number in the Interstate Commerce Commission classification to which the item in question is chargeable.

Each book of field notes after being indexed as indicated above has then but one place for filing—the drawer for the carrier concerned, which is divided into valuation sections and each section subdivided as to kind of notes.

Maps, profiles and plans after being marked are card-indexed as shown in Fig. 2. The serial number is placed on each print, so that it can be conveniently picked out from the pigeonhole containing other prints of that file number. This card index is on 3x5-in. white cards, blue guide cards one-half cut being used to distinguish different carriers, and salmon guide cards one-third cut being used to distinguish valuation sections of each carrier.

Before any carrier's notes are considered in the district office all notes are thoroughly gone over, a general

Carrier

Val. Sec. _____

Kind of Notes

Mile Post _____ to Mile Post ____

Station _____ to Station ____

Party No.___ _____

Engr in Charge

_____, 191_

Fig. 1

	STATION MAPS	430.3-M 03.2 Serial No
	Linne	1112
	Stockton	1113
	Stockton City	1118
	Hayward	1136
	Trevarno	1135
	Goecken	1137
	Ludwig	1138
	Midway	1139
	Sunol	1140
Fig 2	Orteg.	1141

RECORD OF COMPUTATIONS.

CARRIER NO.....VAL. SECT. NO.....

M.P.....to M.P.....STA.....to STA.....

Name of Computer	Class of Work	Date From	Date To	Miles	Hours	Hours Per Mile	Remarks

Fig. 3

	S.P. L.A. & S.L. R.R. CO.	1
Acct.#10	Los Angeles Yard, Calif. Mi.3 South (So.Pac.Ry.Conn.)	420-1-031
	R.R.Crossing (Track #225-Sta.45+05.2)	P.239 A
	Tr. #225 and Jt. Tr. #261	
	S.P. L.A. & S.L. R.R. Co. 50%	(420-16-Kings
	Southern Pacific R.R. Co. 50%	P.10
Fig. 4		

Form No. P-26
4-9-15

INTERSTATE COMMERCE COMMISSION
DIVISION OF VALUATION
PACIFIC DISTRICT

Date _____
Carrier ___
Val. Sec. ___

Compiled by ___
Checked by ___

ABANDONED PROPERTY

Acct. No.	File No., Page, Etc.	Detailed Description	Unit	Total Quantity

Fig. 5

Acct.No.		
3-11	S.P.L.A.& S.L.R.R.CO. VAL.SEC. NO. 2	420-1-01
	Lowering Grade on California St., Long Beach	
	Necessitated by City Ordinance, work done in 1905.	
	Actual charges to Appro. #317,	
	Royalty on 1677 Cu.Yds. Gravel -	
	Amt. not given.	
	Company labor $2170.44	
	(This Revision included in excavation)	
196	7-20-15 Compiled by A.E.M.	69

FROM	Claim	730-9 Serial No.
Utah	Class and Commodity Rates (S.L.R. No.21 A)	8
"	Cement (O.S.L.3369 A. S.L.R. 344 B)	20
"	Lumber (S.L.R. No.21 B)	20
Oregon Washington California	Lumber (S.F.Co.No.47, F)	9
Utah Nevada	General Commodities (S.L.R.133 C)	20
Fig 7		

RAILWAY VALUATION OFFICE-INDEX AND FILE CARDS

Fig. 1—Field-book cover marking. Fig. 2—Index to station maps. Fig. 3—Computation record. Fig. 4—Joint-ownership file card. Fig. 5—Abandoned-property file sheet. Fig. 6—Carrier-claim file card. Fig. 7—Freight-tariff index card

scheme of instructions prepared, table of weights of track material compiled and other standard data worked up. The work of assembling the data by accounts on the Commission's 11x17-in. assembly forms is then begun, each computer having his special work outlined in advance and the work proceeding in a systematic manner, as many helps as possible, such as computing machines, diagrams, tables and slide rules, being used. A record of all computing work done in the district office is retained on the form shown in Fig. 3, which is used as the back cover of each book.

The computers enter certain data obtained from the notes in other card-index files, among which is the joint-ownership file shown by Fig. 4. Filing one of these cards under each carrier concerned will doubtless be the means of avoiding a large amount of duplication. Another is the abandoned-property file, which is made on

letter-size sheets, as shown in Fig. 5. These are filed in regular 12x24-in. file drawers by carriers and subdivided by accounts. A carrier's-claim file is made on 3x5-in. white cards subdivided by suitable guides into carriers, states and valuation sections. This file shows a convenient record of items regarding which there has been no final agreement between the Government and the carrier's engineers. A sample from this file is shown in Fig. 6.

A card file on 3x5-in. white cards is maintained to show the general file number assigned to each carrier, filed alphabetically. The corporate name is given in full, with the mileage of main track, date of inventory and other general information.

A complete file of freight tariffs is maintained for use in figuring freight on all articles inventoried in this district. These are card-indexed as shown in Fig. 7, the cards being divided by suitable guides into states and carriers.

The foregoing system of indexing and filing seems to be flexible enough, so that there will be no danger of its becoming burdensome, and at the same time it is capable of almost unlimited expansion.

For the Pacific District R. A. Thompson is member of the Engineering Board; M. P. Paret is District Engineer; C. H. Byers is Assistant District Engineer and the writer is Office Engineer.

Connecting Cast-Iron Pipe Sections Under Water

A new 36-in. cast-iron water-works intake has been laid at Quincy, Ill., to replace a 30-in. wood-stave pipe line. The new intake is 1,823 ft. long, the individual pipes being of the bell-and-spigot type. The initial operation in the actual laying of the pipe was to place four 12-ft. lengths on skids, parallel to the shore line. The lengths were connected together by ordinary lead joints calked by pneumatic hammer. These 48-ft. sections were made up with a 6-in. bell forward and a machined spigot at the rear end. A bead had been cast on the pipe 18 in. from the special spigot.

The lead joint was poured into the 6-in. bell around a cast-iron form turned to the exact shape and size of the machined spigot. After the lead had set, the form was removed. Heavy steel clamps were then bolted around the pipe back of the forward bell and around the bead.

When a section was to be taken out for laying, a large scow was anchored with the A-frame derrick over the section to be hoisted (see Fig. 2). Two hitches were taken around the side of the pipe, which was hoisted off the skids; the scow was then pushed out to an anchorage over the site. The pipe was carried above the water as shown in Fig. 1.

When the trench had been reached the section was lowered and with the help of a diver the spigot end was led into the bell of the preceding section. Bolts were passed through the clamps (which had already been bolted around the bell and spigot), and by tightening the nuts on the bolts, the spigot was forced as deeply as possible into the cold lead in the bell. The diver then calked the lead around the pipe with a pneumatic hammer. All the clamps and bolts were left on the pipe

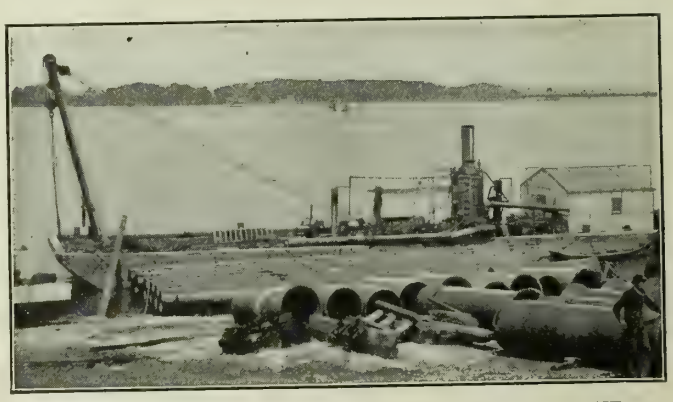


FIG. 2. PIPE SECTIONS MADE UP ON SHORE AND AWAITING TRANSPORTATION

to strengthen it. No backfilling had to be done, as the sand drifted into the trench very rapidly, and within a few hours the pipe was entirely covered.

The new intake was designed by W. R. Gelston, Superintendent of the Citizens Water-Works Co., who also supervised the construction. The contractor was Joseph G. Falcon, of Evanston, Ill.

New Theory for Long Life of Cast-Iron Pipe

A new explanation for the claimed longer life of buried cast-iron pipe over rolled steel or iron pipe was given in a paper presented before the last annual meeting of the American Foundrymen's Association by R. C. McWane

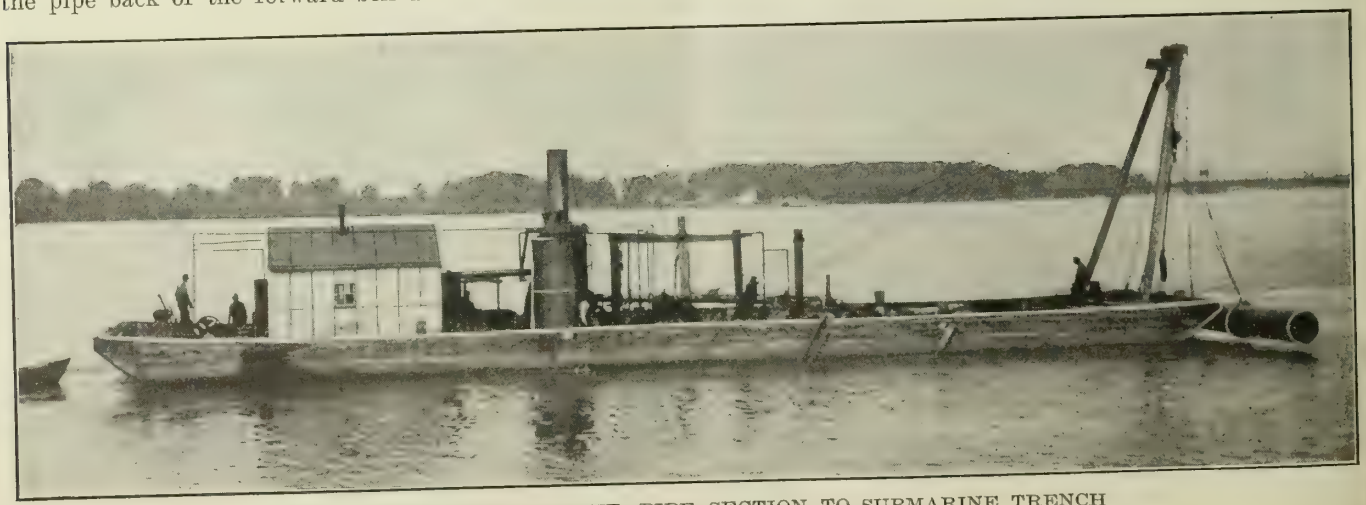


FIG. 1. TRANSPORTING 48-FT. PIPE SECTION TO SUBMARINE TRENCH

and H. Y. Carson, of New York. The initial rusting of cast iron is pictured as taking place rapidly, owing to the impurities in it like phosphorus, sulphur, silicon, etc. But the rusting soon stops, since the undisturbed crystals are held together at one or more points by metallic bonds and the surface rusting is so intermeshed with the irregular aggregations of crystals that the force exerted by absorbed moisture is not sufficient to separate the crystals and the oxide. The rust therefore remains as a protective coating. Rolled metals, on the other hand, are pictured as having their original structure destroyed and as consisting of a series of laminations and leaves which are easily dislodged when rusted.

Novel Method of Draining a Swamp for an Earth Fill

That part of Delaware through which the Coleman du Pont Road is now building, between Georgetown and Selbyville, is level and for the most part free from swamp lands. Although the specifications required all swamps to be drained and excavated to solid foundation, it was thought inadvisable, on account of expense, to do this in all cases. In one instance a swamp was reached



BUILDING THE FILL WHICH REMAINED UNSTABLE UNTIL DRAINED BY SUMP HOLES

which consisted of a network of roots and shrubs about 2 ft. in thickness, floating on about 4 ft. of muck of a semi-liquid consistency. Below this was solid foundation of a sandy-clay nature. The grade of the road required about a 6-ft. fill over the swamp, and it was decided that so heavy a fill would soon seek a solid foundation.

When the fill was partly completed it was noticed that it did not settle as much as was expected, but was floating on the network of roots and shrubs that constituted the surface of the swamp. A method of overcoming this was suggested when a stump was blown. The hole left by the uprooted stump extended through the network of roots into the muck. The muck floated up through the hole, being pushed out by the weight of the fill. Following this observation many holes were dug through the network of roots, which allowed the underlying muck to escape and permitted the fill to settle to good foundation. The holes were dug in each case parallel to the fill and about 3 ft. from its toe. About $1,500 was saved by this method, according to Charles M. Upham, Chief Engineer of the Coleman du Pont Road, Inc., Georgetown, Del.

New Iron-Cobalt Alloy Shows Promising Properties

Studies of an iron-cobalt alloy, formula Fe_2Co, made by T. D. Yensen at the Engineering Experiment Station of the University of Illinois, have shown magnetic properties of great promise in electrical design. The iron was of a double-refined electrolytic product and the alloy was melted in a vacuum furnace. Impurities did not rise above 0.03%.

The saturation value of magnetization was found to be 13% higher than that of pure iron. Moreover, its permeability in medium-strength magnetic fields is 25% higher than for pure iron or commercial grades of iron. Its hysteresis loss in medium high densities is considerably less than for the best grade of commercial transformer iron. At maximum densities the hysteresis loss is about the same as for commercial iron. The specific electrical resistance is about that of pure iron.

Mechanically the alloy is brittle, but fairly strong. In the forged state the alloy is over twice as strong as pure iron, but when annealed the ultimate strengths of the alloy and of the pure iron are about the same.

The high cost of cobalt at the present time prohibits the wide use of such an alloy, but if the price of cobalt should drop, the alloy might find use in parts of electrical machinery where the magnetic density is necessarily high.

such as the armature teeth of motors and generators. It is expected that the electrical resistance, now low, can be raised by the addition of other alloying metals. This would reduce the eddy-current losses.

NOTES

A 240-Ft. Plate-Girder Swing-Bridge — A remarkable swing-bridge was completed a few months ago on the Canadian Pacific, where its "Short Line" crosses the Lachine Canal at Caughnawaga, near Montreal. It was built in phenomenally short time—Dec. 1, 1914, to June, 1915. The crossing is double-track, and four girders are used. Their length is 239 ft. 7 in. and their depth 13 ft. 6½ in. over the pivot pier and 8 ft. at the ends. The girders weigh 112 tons each; the whole swing-span weighs 615 tons. The photograph shows the swing-bridge and a 90-ft. span on the south bank of the canal for a future railway crossing.

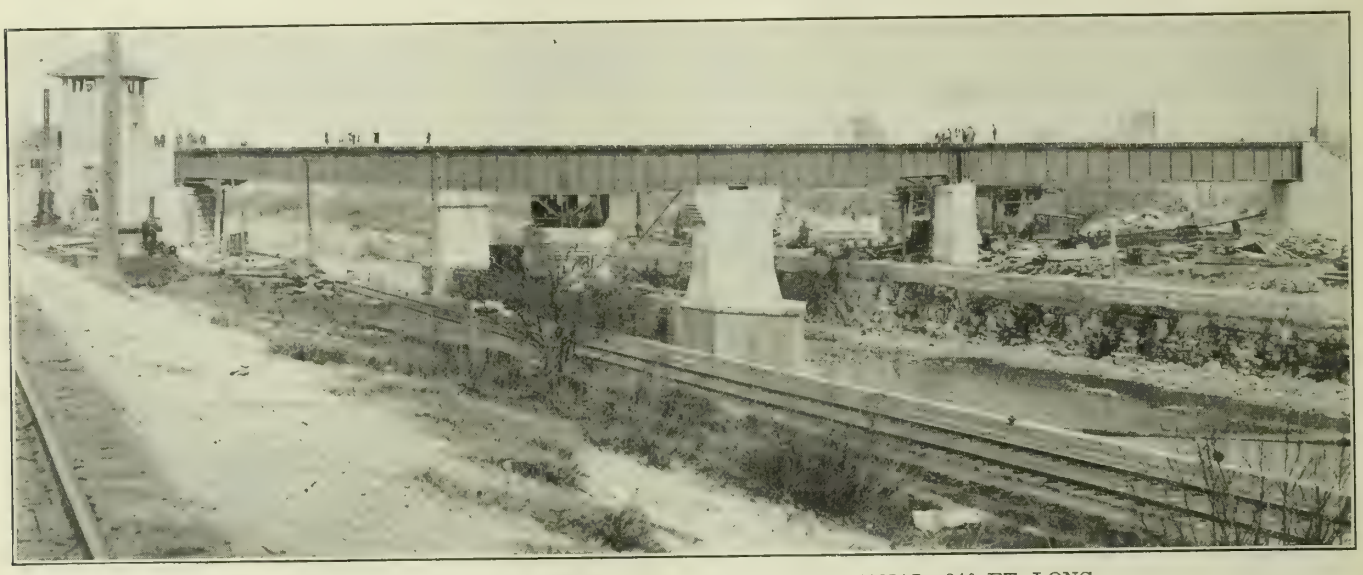


PLATE-GIRDER SWING-BRIDGE OVER LACHINE CANAL, 240 FT. LONG

Why Some Retaining Walls Fail—The picture shows a retaining wall holding a bank in front of a California suburban residence. It is claimed by some to be a model of beauty in cobblestone walls. Its dimensions, however, are more interesting than its beauty. The wall is reported as being about 400 ft. long and from 2 to 12 ft. high. Its thickness at the top is 12 in. and at the base 24 in. There is a footing 3 ft. wide under the wall. The face of the wall is formed into pilasters at intervals, but these have only an architectural effect and their buttress function is negligible.



TWELVE-FOOT COBBLE RETAINING WALL, ONLY 24 IN. THICK AT BASE

In spite of the fact that the proportioning of the wall violates all rules and principles as to thickness, it is still standing and will probably continue to stand so long as the earth behind it remains fairly dry and coherent. The wall is said to have cost $1,400 to build, but the owner got the cobbles and the sand for the cost of hauling them 2 mi.

Tunneling With Canary Birds No Cruelty—Use of canaries to test the condition of the air in the West Side tunnel, far beneath the bed of Lake Erie, in which scores of men are working, is not a violation of the law prohibiting unnecessary cruelty to animals, in the opinion of Cheney C. Jones, general agent of the Cleveland Humane Society. G. C. Van Duzen, superintendent of construction, said yesterday that the birds, kept in a cage in the tunnel office, spend but one-half hour each day in the tunnel.—From the Cleveland "Plain Dealer," Oct. 21, 1915.

To Prevent Washouts on Roads in Maryland low concrete barriers are built diagonally through the shoulder, from edge of road to ditch. These are constructed flush with the shoulder, and on 5 to 6% grades and medium soil are spaced 25 to 30 ft. apart. On steeper grades the spacing would be closer. The Maryland "breakers" are 12 in. wide by 18 in. deep. Where the shoulders are kept in repair the "breakers" do not obstruct travel.

Cost of Ditching by Dynamite—Two interesting cases are noted in the November issue of the Du Pont powder company's house organ. A large contract for ditching by dynamite was recently executed by L. W. Acheson, of Salem, Ore., at a contract price of $1.41½ per rod where the right-of-way was cleared. Holes for a 4x3½-ft. ditch were spaced 18 in. apart and were 18 in. deep, except where stumps and matted roots prevented. In each hole one-half stick (¼ lb.) of 60% dynamite was used. In the holes of small depth heavier charges were employed. About 6,000 lb. of explosive was used. Three electric blasting caps were placed at intervals in each 150-ft. section. A crew of four men blasted a maximum of 1,800 ft. of ditch in 8 hr. Working through an open swamp, 600 ft. was blasted out in 2 hr. In the second case a ditch 12 ft. wide, 4 ft. deep and about 400 ft. long was recently blasted across a mud flat at Carney's Point, N. J., by A. E. Anderson. Three rows of holes, 4 ft. apart, were put down along the line of the ditch. The holes were made with a shovel handle and were 18 in. apart in the row and 3 to 4 ft. deep. Each hole was loaded with two cartridges of 60% dynamite—one at the bottom and one 15 to 18 in. down from the top. In the middle row for part of the line two cartridges were put on the bottom and a third was placed at the top. The charges were primed with No. 8 blasting caps every 15 ft. The cost covered 800 lb. of dynamite, $120; exploders, 50c.; labor of four men for one day, $8—total, $128.50.

The Strength of Bridge Stringers as affected by creosoting has been the subject of tests made under the direction of the Forest Service, United States Department of Agriculture (Bulletin 286, Sept. 27, 1915). The woods used were loblolly pine, longleaf pine and Douglas fir. The treatment was of two kinds—boiling and steaming. The following deductions were reached: (1) Timber may be very materially weakened by preservative treatment, but creosote in itself does not appear to injure it. (2) Treatment which will seriously injure one timber may have little or no influence on the strength of another, and the same treatment may have different effects upon different pieces of the same species. (3) Comparisons should not be made of the effect of a preservative process upon timbers of different species.

Editorials

Brick and Stone Pavements on Mortar Beds

A live subject of discussion at the recent Dayton convention of the American Society of Municipal Improvement was the desirability of mortar beds or monolithic construction for brick pavements. The question of adopting standard specifications covering the use of mortar beds for stone-block and brick pavements was thoroughly investigated by the subcommittees on these types of pavement, and in each instance the conclusion was reached that this method of construction had not yet got beyond the experimental stage and that the society should not yet approve it. This seems to justify—if justification is necessary—the attitude taken by *Engineering News* in the editorial of Aug. 5, 1915.

Emphasis was placed on the fact that the monolithic method of constructing brick and stone-block pavements is an experiment; and the point of view taken by this journal in this and in similar instances is that any departure in practice from that which has been long established should be thoroughly tested before it is adopted, especially if the established methods have given and can give satisfactory results, and that the success of the mortar bed or the monolithic method of construction remains to be demonstrated. This is precisely the attitude taken by the subcommittees of the American Society of Municipal Improvements, which was approved by the society as a whole.

From the various opinions publicly expressed at the meeting and from conversations with various engineers there seems to be little question that so far the experience with the new monolithic pavements has been satisfactory, and *Engineering News* is very glad to record that fact. There were, however, other points brought out in these conversations which are noteworthy in this connection. They are as follows: While it is true that there is often a small air space between the sand cushion and the brick surface the reason is easily explained. The sand cushion must be thoroughly compacted, and it is practically impossible to compact clean dry sand by rolling. It does compact some under the vibration of traffic after the pavement is completed—hence the objection that has been raised to sand cushions. (It was generally agreed that the talk about the sand flowing out from under the pavement is tommy-rot.) If sand is not perfectly clean, if it has a little clay or loam added, it will compress and form a compact cushion much more easily; and the same end may sometimes be accomplished by slightly dampening the sand while rolling, which causes adhesion of the particles. When these details are properly looked after, it was generally conceded just as good brick pavements could be laid on a sand cushion as on a mortar bed.

On the other hand, it seems certain that the omission of the bedding course entirely, as practiced by W. T. Blackburn of the Dunn-Wire-Cut-Lock Brick Co. at Paris, Ill., has great advantages in eliminating construction hazards. There are some possible disadvantages, however, which remain to be disproved. It has been suggested that a monolithic pavement half brick and half concrete, having different rates of expansion, top and bottom, because of the difference in materials, may develop cracks from internal stress. Moreover, when the subsurface conditions are such as to cause cracks in the concrete base, these cracks will probably extend through the brick wearing surface, if this is made monolithic with the base, where the wearing surface might otherwise have been kept intact.

Sewage Treatment and the War

Among the numerous vagaries of the European War, two that are of particular interest to the sanitary engineer may be mentioned. One is that the Royal Commission on Sewage Disposal went out of existence some months ago, without much likelihood that its 17 years of work will ever amount to much beyond the amassing and digesting of data and the early loosening of the shackles of the Local Government Board. The restrictions of this body bound every municipality to the land treatment of sewage, regardless of local conditions against it and of all such advances as the septic tank, contact bed and sprinkling filter as have been made up to about 1900. It is a pity that the other conclusions of the Commission, most of which need Parliamentary action to become effective, are not likely to be acted upon for some time to come, if ever.

The other vagary is that, according to reports from friends of Dr. Karl Imhoff, abroad and here, a large number of Imhoff tanks have been built in the conquered portions of Belgium and France. It may also be mentioned that conditions seem to have been ripe when the war broke out for the voluntary building of a number of Imhoff tanks in England, but these and presumably more rapid progress with activated sludge on a considerably greater scale than has yet taken place have been held up in Great Britain by the war. Meanwhile the use of the Imhoff tank has been spreading on every hand in the United States and Canada, and activated-sludge experiments, some on a large working scale, are being carried on with great zeal and promising results in America.

When the war is over and ordinary municipal activities have been restored throughout Europe there may be some surprising realignment of sewage treatment. Necessary economies will force all the European countries engaged in the war to adopt a rational rather than an ideal sewage-treatment policy, such as has been practiced in Germany for a decade or two. Partial processes, like screening and tank treatment, will doubtless be widely employed, and in many instances nothing more may be feasible for years to come. If the activated-sludge process is shown to be an economic success it bids fair to be adaptable to almost any degree of treatment and thus to find its way to all parts of the world. By the time the war is over, the possibilities of this most interesting and promising method of sewage treatment will probably be determined.

Track Maintenance on Heavy Electric Railways

The problem of the proper relation of the railway track to the equipment and traffic which it carries seems to be developing on interurban electric railways in somewhat the same way as it has developed on steam railways. That is to say, the track construction is often light in relation to the traffic, and the strengthening of the track lags behind the increase in weight and wheel-loads of electric cars and locomotives. Track maintenance also in many cases fails to keep pace with traffic requirements.

It is true that driving-wheel loads are lower on electric railways, and the rotary drive from the motor eliminates the destructive hammer blow experienced from the reciprocating engines of steam locomotives. On the other hand, the low center of gravity of the ordinary electric drive often results in a high lateral pressure or bursting effect upon the rails and fastenings, especially at curves and turnouts. Where the motors are above the axles, as in some locomotives, these conditions may be modified. The advantage of shorter rigid wheel base on electric cars and locomotives is offset to some extent by the use of sharper curves on electric railways.

It has been suggested that for light roadway construction, such as is often found on interurban lines, rails of 75 to 80 lb. per yd. may be even better than those of 85 to 100 lb., owing to the greater flexibility of the former and the consequently wider distribution of the load on the roadbed and proportionately lower stress in the rail. One trouble from such flexibility, however, is that it would probably result in greater and increasing disturbance of the track substructure unless extraordinary attention was paid to maintaining the road in good condition.

One of the difficulties in the equipment of ordinary electric interurban lines is to secure large motor cars that will ride easily at high speeds. The main difficulty lies in the machinery which is carried by the car and the transmission of its power to the axles. But when such a car is propelled over track having low joints and a poor condition of surface and line, it is likely to prove an uncomfortable conveyance for passengers, which will not add to the popularity of the line. Being a motor car, it will, under these conditions, ride much more roughly than if it was simply a train car behind a steam locomotive. And while the effect of the motor car upon the track will be less destructive than that of a steam locomotive, it will be much more destructive than that of a trail car. These conditions indicate that it is highly desirable to have the track of interurban railways maintained in good condition.

On street railways of course very different conditions obtain. For the main lines in large cities the track construction is heavy in relation to the wheel loads (even where interurban cars are carried), but the amount of traffic is very great. On the other hand, track maintenance (which is daily work on open-track construction) is an impossibility, since the track is buried in the paving and can be disturbed only at long intervals. Therefore flexibility of rail and deflection of track are not permissible as on ordinary railways. For these reasons the track must be made very substantial in itself and placed on a rigid foundation, so that it will not only stand the traffic but will be free from such deflection or vibration as would disturb the paving.

It is an unfortunate fact, though, that street railways are often in the same category as other public-service corporations, both private and public, in seeming always to be hacking away at a newly completed pavement for the purpose of replacing or rearranging rails. This condition is peculiarly aggravated at crossovers and curves, mainly because wear is concentrated there.

The wear is concentrated on the railhead and at the joints, and comparatively slight wear at these parts may necessitate the renewal of heavy rails. The wear of the head is aggravated also by the dust and dirt and the grinding by wheels of cars and street vehicles. A renewable railhead for a permanent track construction in paved streets is a desirable feature that has been aimed at for many years, but has not passed the experimental stages for modern street-railway track construction. The excessive wear at special work and on the sharp curves required at street intersections is a condition that can hardly be remedied by maintenance, but here again some form of renewable wearing surface is highly to be desired.

Why Excess Condemnation Was Killed in Two States

The defeat of excess-condemnation constitutional amendments in New Jersey on Oct. 19 and in California on Oct. 26 seems to have been largely due to a lack of knowledge of what excess condemnation really is and to a state of mind which resulted in downing every amendment proposed in the two states.

The strongest real objection to excess condemnation advanced in the arguments which came to the attention of *Engineering News* in connection with these two campaigns was that the power to take more land than is actually needed for a given improvement would afford an opportunity for graft. The graft argument can always be urged until municipal conditions are vastly better than they are now, but it does not prevent material progress in other lines, and will not in this one, when the principles of excess condemnation are better understood than they are at present. More educational work is obviously needed.

The right of excess condemnation now exists, it is reported, in Massachusetts, Connecticut, New York, Maryland, Pennsylvania, Virginia and Ohio, and Wisconsin can purchase excess land at private sale, but not by condemnation. The defeats in New Jersey and California will doubtless prove to be only postponements of the adoption of a measure of public policy that is growing in support among those who understand its meaning and advantages.

Once More, the Coroner

The coroner's office has once more justified itself as the most humorous institution in New York City. Comic papers would give many dollars for just that right combination of the elusive and the absurd which marks the verdict on the first of the recent subway collapses. But why did the jury stop at the Bureau of Combustibles? Why not drag in Henry Hudson? Obviously, if he had never discovered Manhattan Island a house-that-Jack-built deduction would readily show that a new subway would never have been needed and the fatal accident of Sept. 22 would never have occurred.

Letters to the Editor

Local Sections of National Engineering Societies

Sir—In reply to the editorial query in *Engineering News* of Oct. 14 as to the effect of local sections of national engineering societies on the older type of local organizations, permit me to remark that our local society comprises 300 members, observant of the activities of chemical, electrical, mechanical and civil engineers, with proportionate benefits to the local sections and to the national bodies. In our experience the local society, embracing all kinds of engineers, is most successful.

JOHN YOUNGER,
President Buffalo Engineering Society.

Buffalo, N. Y., Oct. 22, 1915.

Information Wanted on Bureaus of Employment

Sir—It is possible that the Western Society of Engineers, 1745 Monadnock Block, Chicago, Ill., may attempt seriously the establishment of an employment bureau for the benefit of technical men and the employers of technical men.

Your active coöperation is desired. We wish to receive from officers and past officers of societies that have made similar attempts the reasons why the attempts failed, if they failed, and what degree of success was encountered. We would like to hear from every man who has any ideas on the subject, and the undersigned will not be appalled if the mails are filled with letters of advice or information. The task if properly attempted is a big one, we know, hence the desire to receive the benefit of experience and information which are certainly available.

ERNEST MCCULLOUGH,
First Vice-President, Western Society of Engineers.

Chicago, Ill., Oct. 27, 1915.

Popolopen Creek Concrete Arch Is Too Costly

Sir—It seems to me unfortunate that the competition for the design of the Popolopen Creek viaduct described in your issue of Oct. 28, 1915, p. 856, was not thrown open to more than one concrete bridge designer. I do not know what were the conditions restricting the concrete design, but assuming the ordinary principles of reinforced-concrete construction, I feel certain that a concrete arch bridge of handsome lines and sufficient strength could be built at this site for much less than the $139,000 estimated for the submitted design, which is nearly *three times as much* as the estimate for the selected steel design. Experience at similar locations has shown that while steel arches of the types submitted are cheaper than a reinforced-concrete arch, no such marked discrepancy exists between the costs of the two types.

CONCRETE ENGINEER.

New York City, Oct. 30, 1915.

More Defective Railway Track

Sir—Referring to your editorial of Oct. 21 in regard to railway-track maintenance, the part of the Interstate Commerce Commission inspector's report quoted is but a repetition of conditions which I found to exist on two different parts of one of the larger railway systems of the East—a system running trains from New York to Chicago and other points as far west as the Mississippi River. The two parts of the system I refer to are 150 mi. apart.

Both are on the main line. At one place I noticed ties cut by the rails, spikes an inch above the rail base, ties laid practically in earth and splashing mud every time a wheel went over a rail-joint. On the other part of the system the track structure is a little better, but it is in such shape that if a train would run much over 30 mi. an hour a rail would be sure to turn over. This last-mentioned piece of road is 40 mi. long and most of the grades are light; yet it takes a train from 1 hr. and 40 min. to 2 hr. to run the distance. Train crews have told me they dare not run over 30 mi. an hour on this stretch of road for fear of spilling a train.

I have not been over the road I refer to since last summer, but it is safe to say that these conditions still exist on this road. And this condition existing on a railroad that does considerable advertising to get the public to use its trains!

There should be someone with authority to see that the railroads are maintained in safe condition.

RALPH C. WOOD.

New York, N. Y., Oct. 22, 1915.

Publicity the Best Protection

Sir—The editorial on dangerous railway track in your issue of Oct. 21, 1915, p. 801, leaves the reader to infer that the only protection to the public from the dangers of such track is inspection by the government (that is to say, the Interstate Commerce Commission), and that its powers need extending. I wish to point out that there is another (and better) protection—namely, publicity.

If the newspapers publish or can publish the fact (not suspicion, but fact) that a certain railway's track is not safe, that railway will quickly be forced to make its track safe, reasonably safe—not perfect, but reasonably safe, or, say, wholly safe and reasonably good. To show that railways can and will make operations safe just for their own interest, consider the fact (and I have not seen it disputed) that the Southern Pacific Ry. killed not one passenger in a year in a train accident. This shows that conditions are not so bad on all railroads, and if they are bad on some roads, then reward the good and punish the bad. Do this by riding on the roads with good records, and not riding on the ones with bad records. This will correct the matter even though such discriminating riders are only 10% of the whole number of passengers.

That governmental regulation and inspection do not wholly prevent accidents is shown by the sinking of the steamboat "Eastland" at Chicago.

steamboat "Eastland" at Chicago. NON-SOCIALIST.

Crushed Limestone Aggregate for Concrete Pavements

Sir—I noticed in *Engineering News* of Oct. 7, 1915, the communication of G. F. Prussing, Lennon, Wis., regarding the use of crushed limestone as coarse aggregate in concrete-road construction, and it strikes me that there is some justification for the attitude taken by the highway commissioner.

I presume at the outset, although it is not so stated, that the concrete road in question is of the one-course type (without a finish coat, the surface being floated to a fairly smooth finish) which seems to be the prevailing type in Wisconsin. If such is the case, then gravel is by all means to be preferred to crushed limestone, owing to its natural ability to better withstand the abrasive forces acting on it.

Crushed limestone if made from rock taken from the main workings of a quarry may be quite hard, but in general, especially in localities (such as Lennon, Wis.) where the main product of the quarries is dimension building stone, the stone sent to the crusher is of inferior quality—strippings or chips more or less disintegrated. Such aggregate may make concrete with a compressive strength high enough to warrant its use in structures not subjected to wear or abrasion, but it should be unreservedly rejected for one-course concrete-road work.

The destructive wear and tear to which a concrete road is subjected cannot be set down in terms of stress, and owing to the great difficulties presented by that all too prevalent trouble in concrete building work, "dusting concrete floors," the profession should draw the conclusion that only the very hardest aggregate should be used in the wearing surfaces of roads, sidewalks and floors.

In 1910 the writer was connected with the design and construction of one of the first reinforced-concrete pavements, which had some unique features as regards wearing surface and expansion joints. This pavement in addition to being reinforced had a wearing course of cement and granite chips, and although subjected to heavy traffic it shows little evidence of wear and stands out in happy contrast when compared with some pavements in which limestone screenings were used in the wearing coat.

The expansion joints which were filled with "pecky cypress" are not protected by metal, but in spite of this no undue wear occurred at the joints owing to the hardness of the granolithic wearing surface.

Quite recently a concrete sidewalk adjacent to a large Chicago department store subjected to much parcel trucking has had to be repaired on account of the excessive wearing at the joints, in some cases so deep as to endanger the safety of pedestrians. The top finish of this walk was composed of limestone screenings and cement. Numerous other examples of the poor wearing qualities of some limestones could be cited.

In concrete-road work it is rather costly to treat the surface to resist abrasion, and therefore unless crushed limestone can be obtained at a very much lower price it will prove more economical in the long run to use a harder material such as gravel, crushed granite or traprock for the coarse aggregate.

Regarding the question of dust in the crushed limestone, in the writer's opinion a small amount on the stones is not objectionable, but if crusher-run stone is used too much dust and fine powder will probably be present to get the best results, using the ordinary proportions of sand and stone. In such a case more cement should be added to the mixture to fill the voids and thereby preserve the strength of the concrete. Where much limestone dust is present a thorough and longer period of mixing is essential owing to the tendency of the dust to "ball up," or form in lumps, when water is added to the batch, and unless broken up these lumps are sources of weakness in the concrete.

ALBERT M. WOLF,
Principal Assistant Engineer, Condron Co.

Chicago, Ill., Oct. 26, 1915.

Elimination of Crushing Tests for Granite Paving Blocks

Sir—I note in *Engineering News* of Oct. 21 some comment on the standard specifications for granite-block pavements recently adopted by the American Society of Municipal Improvements at its Dayton convention and on the conclusions reached as to the efficacy of the crushing test.

May I, without assuming too much of the I-told-you-so attitude, call attention to the conclusions on this subject embodied in my annual report as Chief Engineer of Highways of the Borough of Manhattan for the year 1913? The matter in it on the testing of granite paving blocks was extensively used by the Association of Granite Paving Block Manufacturers in presenting its views to the stone-block paving subcommittee of the American Society of Municipal Improvements and was largely influential in forming the determination reached, which represents a considerable change from the prevalent opinion among those discussing granite block as a paving material several years ago.

The defects in pavements referred to in the report from which you quote were the cause of the elimination from Manhattan specifications, after 1912, of gravel-filled joints.

The point to which I wish to direct attention is that all necessary studies, including a more extensive program of physical testing than has been carried out elsewhere, were made over two years ago and the standards deduced from these studies and experiments were then adopted in the Borough of Manhattan. The entire study is given with considerable detail, including all the results of these experiments in the annual reports of the Borough of Manhattan for the years 1912-1913.

The adoption of certain paving standards by the American Society for Municipal Improvements is of value to this extent, in that it rules out certain undesirable materials which will not come up to its minimum requirements. Materials which do meet its requirements can, however, be found in extensive quantities; but the success or failure of pavements laid with any granite will depend almost entirely on careful visual inspection of materials and construction.

HENRY WELLES DURHAM,
Consulting Engineer.

New York City, Oct. 28, 1915.

Sand versus Mortar Beds for Brick Pavements

By Will P. Blair*

No one can question that brick pavements constructed in accordance with the directions of the National Paving Brick Manufacturers' Association, which provide for a sand cushion immediately underlying the brick, have shown most satisfactory results. Many examples of such streets show but a slight impairment from any cause, regardless of age or traffic. The faulty ones are the direct result of a departure from or a failure to comply with the details of construction generally recognized as essential.

One of the things seldom accomplished is proper compression of the sand cushion. It is so difficult to get it done that many are willing to hazard sufficient resiliency for protection of the pavement by leaving it out altogether. It has but one function, and only one—that is, to relieve the shock due to impact in the use of the pavement and to furnish a uniform support to the overlying monolith. A requirement to fill up and roll and refill for at least three times is a necessity in order to obtain a uniform and sufficient support.

I am well aware that mortar beds under the wearing surface of pavements are neither new nor novel. Their use by past generations was not handed down to us in sufficient detail to pass judgment upon them. Our experience is therefore very limited. In recent years but few mortar beds have been tried under brick and stone pavements.

The writer has observed the behavior of five samples of brick pavements covering a period of 25 yr. In one instance the brick seemed to have been greatly injured from the shock effect. The other examples furnish evidence to the contrary.

Some 25 yr. ago a street constructed in monolithic form in Cincinnati did not prove very satisfactory. In five or six years the shock effect seemed to destroy the pavement. A small section of brick street was laid in like manner in the downtown district of Chicago, to which but little notice was given. About 18 yr. ago the brick gutters on Washington St., Indianapolis, Ind., were laid on mortar. At the same time some of the gutter on Ohio St., Terre Haute, was laid in like manner. The first two examples did not remain long in existence. The second two examples, being in gutters, scarcely afforded a condition of traffic upon which to base judgment.

The most interesting example with which the writer is acquainted is a small alley leading to a freight yard and warehouse in the rear of the Hulman & Co.'s wholesale establishment in Terre Haute. The brick were laid upon the green mortar bed of concrete made with seven parts of coarse aggregate and one part of cement. The brick surface was made smooth by the use of a rammer upon a board placed upon the pavement. The joints were then filled with 1:1 cement-grout filler, as provided in our present specifications. This pavement has been subject to frequent as well as heavy traffic for more than 10 yr. It is in almost perfect condition and shows no impairment whatever either from thermal, traffic, humidity or frost effect.

James E. Howard, Engineer-Physicist of the Interstate Commerce Commission, finds that the resiliency of well-grouted brick pavements on a sand cushion ranges between 0.0003 and 0.0100. Considering it to be a fact that no brick in such pavements have ever suffered serious injury from shock, the question naturally arises, Will injury result from shock in case the pavement slab is doubled in depth? We have in mind a monolithic structure which includes 4 in. of foundation, which structure of course will have less resiliency than the thinner slab.

It is clearly apparent that such pavements can be built with the very decided advantage of assurance that construction details are complied with. They can also be laid with the view of better resisting injury from internal strain, particularly those arising from moisture. My opinion leans toward an expectancy of good results from the monolithic construction. This opinion is strengthened by many minor points of construction aside from those mentioned.

Drainage Pumps at New Orleans

A large part of the damage resulting from the September hurricane at New Orleans was due to the breakdown of the electrically driven drainage pumps through severance of the overhead transmission lines. The first inference apt to be made from this fact is that it would have been better to have had these lines in conduits, where they would have been safe during the storm. Comment upon this is made in a recent report of the hurricane by George G. Earl, General Superintendent of the Sewerage and Water Board of New Orleans. Mr. Earl says:

Following this storm, a general and careful overhauling of the transmission lines will be necessary. The greater part of the troubles on these lines was due to the fact that telegraph, telephone and electric light and other wire lines crossed over same and fell upon them, causing short-circuits, or that trees fell across them tearing them down. The line from Central Power Station to Station 5, however, is in very soft ground and was blown over in many places, and a few poles on other lines, subjected to unusual stresses and so located that satisfactory guy wires could not be used, or where other special conditions existed, were also badly bent over.

We have often had the suggestion that underground cables would avoid line troubles of the character occasioned by this storm. To some extent they would, but the cost of an underground system is absolutely prohibitive, and underground systems, we know from experience, are also subject to troubles of other kinds, and in case of trouble in an underground system following a great storm, where the ground through which it passes is under water, the difficulty of quick location of the trouble and of its prompt repair is even greater than with an overhead system.

Pumping stations, each operated by steam, or other power at each station, is another solution which various critics of the existing system occasionally advise. I know of no other system which would have given a better service during the hurricane or remained in service longer or got back into service more promptly than the system here in use, and especially of none which can be more economically or satisfactorily operated.

*Secretary, National Paving Brick Manufacturers' Association, Cleveland, Ohio.

Choosing Air Compressors for Activated-Sludge Tanks

By Carl H. Nordell*

SYNOPSIS—Reciprocating compressors, turbo-blowers and positive-pressure blowers are considered in detail and the possibility of utilizing the fall of sewage in a shaft to compress air is briefly discussed.

Compressed air as used in the activated-sludge process of sewage treatment is required at pressures that have heretofore been met with rather infrequently. The aërating tanks are 10 to 20 or perhaps 25 ft. deep and call for pressures of 5 to 12 lb. This is debatable ground between three types of machine, so that reciprocating compressors, turbo-blowers or positive-pressure blowers may be employed. A brief discussion of the characteristics of each type will enable the formulation of a guide to the proper choice of a machine for any given set of operating conditions.

The aim of compressor manufacturers is to compress isothermally—without increase of air temperature—but that result is only imperfectly attained. For the small pressures involved in sewage aëration there are not great differences between adiabatic and isothermal working. But if the air speeds are low and the pipe runs are long, the heat of compression will be dissipated and a nearly isothermal volume will be delivered.

The reciprocating compressor is too well known to require an elaborate explanation. It can be obtained in a great variety of types, though in general it is designed to operate at higher pressures than that called for by the work in hand.

The mechanical efficiency of these compressors, as ordinarily measured by comparing the work done in the steam and air cylinders, is usually in the neighborhood of 85 to 90%. The higher the pressures it is necessary to employ the more this figure will be reduced. The older types of compressors are less efficient than the later ones. The introduction of large thin-plate valves has reduced air velocity through ports and cut down the heating at this point. The higher the pressures the hotter are the cylinder walls—even with good cooling systems—and the greater is the reduction of air taken in for compression. Tests on plants in operation show that such losses in compression may perhaps be 25% (besides the 10 or 15% mechanical losses mentioned) for the higher pressures used in aëration.

The first cost of reciprocating compressors is comparatively high, and they are bulky in proportion to their output; but they are designed in great variety, and in the larger sizes are direct-connected to steam, electric or oil-engine drive. They may be had in any capacity from less than 100 cu.ft. per min. to the large blowing engines of from 40,000 to 50,000 cu.ft. per min. High-speed single-stage machines are probably best fitted to this work.

*Engineer of Design, Sewerage Commission, Milwaukee, Wis.

The turbo-blower is a comparatively recent development. It is substantially a turbine pump. The pressure is secured by imparting a high velocity to the air, with a subsequent transformation of the velocity head into pressure head. Water weighs about 800 times as much as air; hence to secure the same pressure rise per stage with a blower as with a pump the velocity would have to be 28 times as great. In consequence the rotative speeds are usually carried as high as safety will permit. The impeller tips are sometimes run at 600 ft. per sec., when as much as 3 to 4 lb. pressure can be secured in a single stage. Ordinarily, however, 2½ lb. is considered the limiting pressure per stage.

These blowers are well adapted to handling large volumes of air. Being high-speed machines, they are compact and comparatively inexpensive for their capacity. The larger units show a very good efficiency, often reaching 75%; but the efficiency falls off with the size. Driven by direct-connected steam turbines, excellent overall economies are secured. The guaranteed steam consumption for units delivering in the neighborhood of 30,000 cu.ft. per min. is as low as 15½ lb. of steam per hour per air horsepower.

The steam-turbine-driven units have a very flexible delivery, even at constant pressure, and by slightly varying the pressure high efficiencies over a large range of deliveries can be obtained.

A complete line of turbo-blowers direct-connected to high-speed motors and delivering from 2,000 to 40,000 cu.ft. per min. has been developed. Variable delivery at constant speed over a fair range, without too great loss in efficiency, can be secured by throttling the discharge and intake.

Positive-pressure blowers operate on the same principle as a rotary pump. Lobed impellers meshing with each other in a manner similar to the teeth of a gear revolve within a casing, sweeping the air before them. The impellers do not quite touch each other or the casing, and there are consequently clearance spaces through which some of the compressed air leaks back. With well-made blowers the clearance is small and the leakage fairly low.

The amount of leakage is constant so far as the speed of the blower is concerned, but varies with the square root of the pressure. Hence these machines become less efficient as the pressure is increased, and this tends to limit their use generally to pressures below 10 lb. The leakage or slip is measured by the number of revolutions of the blower required to make it good. Thus, if the slip is 100 r.p.m. and the speed of the machine is 500, the volumetric efficiency is 400 r.p.m., or 80%. The capacity of the machine is usually stated in terms of the displacement per revolution and the delivery is equal to the displacement multiplied by the rotative speed minus the slip. Obviously the higher the speed, the better is the efficiency.

The losses other than slippage are small. Gears are used to keep the impellers in their proper relation to one another and in most machines drive one of the im-

pellers and thus transmit one half of the power. Probably 5 to 10% would cover all losses outside of slippage.

As the intake port is very large, the air is not heated on entering the blower, and thus a good volumetric efficiency is assured. Efficiencies based upon the power input range from 60 to 85%.

The positive-pressure blowers are comparatively slow-speed machines, ranging from 600 r.p.m. in the small sizes to 100 in the larger. When driven electrically they must be either belted or geared for connection with standard-speed motors. The larger sizes are well suited for direct connection to cross-compound engines, the cranks being fixed upon the impeller shaft. As the speed of these machines is suitable, they can be direct-connected to oil engines of the Diesel type.

The most important single consideration governing the choice of a machine is the volume of air it is to furnish. Probably the least volume that will be employed in practice other than testing-station work will be in the neighborhood of 1,000 cu.ft. per min., which would be ample for the treatment of 1,000,000 gal. daily in tanks 10 ft. deep. This volume at a pressure of 5 lb. could best be supplied by a positive-pressure blower because of its low first cost and good economy under these conditions.

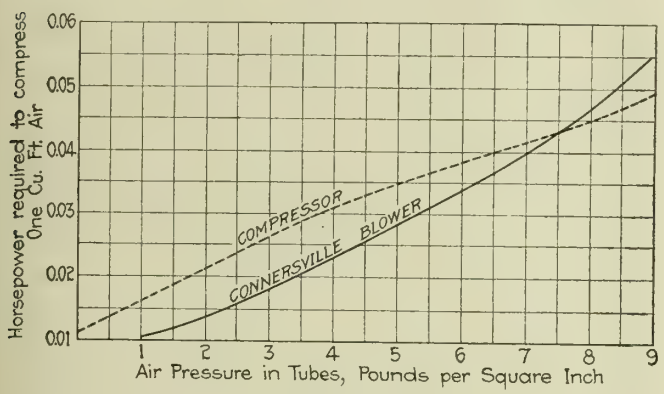


FIG. 1. POWER CONSUMED BY ROTARY AND PISTON AIR COMPRESSORS

From Thorkelson's "Air Compression and Transmission Tests" of machines of 1,500 cu.ft. per min. capacity operating the same tubes of the New York postal service.

A blower of this type and capacity should have an efficiency of 70%, and would make a dependable unit for constant service.

Where conditions favor the building of deeper tanks, so that pressures would rise above 8 or 10 lb., it might allow of the use of reciprocating compressors. Fig. 1 gives the result of tests of the respective merits of positive-pressure blowers and piston compressors; but to obtain the true relative economy of the two types there would have to be taken into consideration capital cost, depreciation and cost of attendance, all of which factors favor the positive-pressure blower.

There is another feature of the positive-pressure blower which might outweigh the smaller power consumption of the piston compressor. The most efficient air distributors so far found are porous tile. The pores of this tile are very minute and consequently may be readily clogged with foreign matter, such as heavy oil, especially if gummy and dirty. The piston compressor must of course use oil in the air cylinder, and there is some danger that it will be carried over to the tile unless it is carefully filtered out. The positive-pressure blower requires no oil in the air cylinders, as the moving parts are without contact and therefore deliver an oil-free blast at all times.

The field of the turbo-blower begins when units of 5,000 cu.ft. per min. capacity can be used. Good efficiencies can then be obtained, and the first cost will probably be about the same as that of the positive-pressure blowers, but the plant will be much more compact and perhaps somewhat lower in maintenance. The turbo-blower has the same advantages of clean blast as the positive-pressure blower.

As the volume of air required increases, the ascendancy of the turbo-blower becomes pronounced. Units of 10,000 to 20,000 cu.ft. per min. capacity are considered large in positive-pressure blowers and very large in reciprocating compressors, while turbo-blowers of more than double this capacity are not at all unusual. When the amount of air used taxes the capacity of the largest positive-pressure blowers, the field is virtually clear for the turbo-blowers, as their superior economy and low first cost have then reached very favorable figures.

Considerations of pressure and volume must sometimes give way to the question of motive power. Electric power is fairly well suited to positive-pressure blowers and piston compressors in the smaller sizes, but in the larger sizes (unless expensive gearing is employed) transmission losses would begin to tell, as direct connection is not feasible. The larger sizes are especially well adapted for direct connection with reciprocating steam engines or oil engines of the Diesel type. Turbo-blowers of any capacity may be driven efficiently by direct-connected high-speed motors, and in sizes where the steam turbine is economical a direct-connected steam-driven unit is an admirable installation from every standpoint. These blowers are not suitable for direct oil-engine drive in any size, as the rotative speeds are too far apart. Therefore where oil or gas engines can be used the field of the other two types is extended considerably, as the excellent economy of the engines will offset the somewhat high cost and allow them to compete.

The type of compressor to be used depends to some extent upon whether a variable or constant delivery is required. It is by no means yet decided whether the amount of air should be increased when the peak of the sewage flow comes along or whether it should be held constant. Experiments at Milwaukee so far go to show that above a certain minimum limit the amount of air per volume of sewage can be varied within a fairly large range without deleterious effects upon the activity of the sludge, provided the general average of aëration is kept up. If it is possible therefore to run the compressor at some constant rate of delivery throughout the day, very favorable conditions are obtained for the use of positive-pressure blowers driven by constant-speed motors, especially in the smaller installations, where it is important to reduce the cost of attendance to a minimum.

But if it is found to be better practice to make the air used per volume of sewage more nearly constant, then the blast delivery must be proportional to the sewage flow. In this case the turbo-blowers will have a great advantage over the positive-pressure blowers, as even when run by constant-speed motors the delivery could be regulated very accurately, either by throttling or by increasing the working head for the periods of low flow. In the larger steam-driven plants the turbo-blowers would also have an advantage, as the delivery of the units could

be varied within wide limits, without serious loss of efficiency.

The positive-pressure blower is not well suited to a variable delivery, as the efficiency falls off with the speed and makes it the best practice to throw units in and out of service to follow the load. This necessitates splitting up the plant into a number of units and results in reduced efficiency.

The diagram, Fig. 2, gives about the economical range for the three types of blowers if the delivery is to be nearly constant, though such a diagram can naturally be only approximate.

There is another type of compressor, which has so far not been mentioned, that possesses peculiar interest in sewage-purification work—the hydraulic compressor, which has been so successfully installed in some mining districts.

This apparatus uses the weight of falling water to compress the air without the application of any intervening machinery. The water is allowed to fall through a shaft

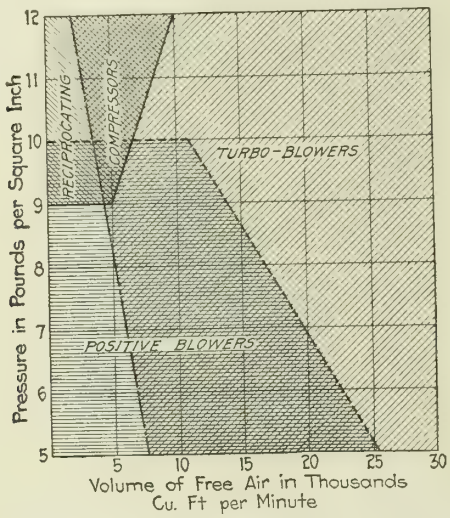


FIG. 2. FIELD FOR RECIPROCATING COMPRESSORS, TURBO-BLOWERS AND POSITIVE BLOWERS

and in doing so sucks in air through a large number of small pipes and entrains it in small bubbles, which it carries to the bottom of the shaft. After descending far enough to secure the required pressure, the mixture of air and water is allowed to flow horizontally, whereupon the air separates out and fills a reservoir, from which it is drawn as needed. Excellent results have been obtained with several installations, notably at Victoria Mine, Mich., and Cobalt, Ont. The former compresses 36,000 cu.ft. per min. to 128-lb. pressure with an efficiency as high as 82%. This remarkable showing is explained in part by the fact that the compression is absolutely isothermal, the water absorbing the heat as rapidly as it is generated.

Perhaps for the exceptional plant, where a considerable fall of sewage is available, a compressor of this type could probably be used with good results. At the same time a certain element of uncertainty exists from the possible fouling of the intake-head pipes. An inexpensive trial installation, however, would show to what degree this might be serious and how it might be obviated.

If the purification can be accomplished with ½ cu.ft. of air per gallon of sewage, as some of the Milwaukee results indicate, then an 88-ft. fall would furnish all the air required at 5-lb. pressure, if 75% efficiency could be obtained. Probably this figure would not be beyond the reach of such a compressor, even though the pressure used is somewhat low for the best results. As the cost of the activated-sludge process lies for the most part in the cost of power, it will be advisable to take advantage of any fall that would furnish even part of the air. Probably an available fall of 10 ft. could be utilized.

Experience with Engine-House Smoke Washer*

By M. D. Franey†

Extensive tests of appliances for preventing smoke led to the erection of a smokeless roundhouse in 1912 at the Englewood terminal of the New York Central lines at Chicago. This house contains 30 stalls, in which from 80 to 100 locomotives are handled each 24 hr. It is situated in a residence district and near an amusement park. Under such circumstances it was difficult for the railway company to obtain permission to build an engine house.

The locomotives west of Buffalo are equipped with two 1¼-in. blowers connected with the steam-jet smoke consumer. With ordinary care there is no excuse for smoke violation after steam has been generated, but the smoke consumer is of very little assistance in building a new fire in a cold locomotive. The handling of smoke due to firing up the engines was the problem that confronted the mechanical officers of the railway in 1910. At that time O. M. Foster, Master Mechanic, conceived the idea of forcing the smoke by means of a fan through a body of water, separating the unconsumed carbon from the gases and permitting the latter to escape through a high stack. D. R. MacBain, Superintendent of Motive Power, approved the plan, and a small plant capable of taking care of one locomotive was built at Elkhart, Ind. The results were such that a larger plant was built at Collinwood, Ohio, to take care of several locomotives, and later (1912) the Englewood plant was constructed. (Described and illustrated in *Engineering News,* May 15, 1913.)

At the Englewood roundhouse is a concrete tank 22x32 ft., partitioned into three basins. Each basin is lined with dressed lumber, set about 1½ in. from the concrete. The space between the concrete and the lining is filled with tar. Wooden pins, instead of nails, are used for fastening the lining, to resist the action of the acids. Fig. 1 is an elevation showing the general arrangement of the apparatus.

The smoke duct, 60 in. in diameter at the center and tapering to 36 in. at the ends, which extends around the house just under the roof and directly above the smoke-stacks of the locomotives, is of "Transite." Near the center of the house an elbow connects into the top of the 60-in. duct and leads down to a 70-in. steel-plate, double-inlet fan, capable of handling 68,000 cu.ft. of 500° gases per minute, at a total static pressure of 14 in. at fan outlet and at a speed of 950 r.p.m. The fan is belt-driven by a 300-hp. motor. A smoke duct leads from the fan to each of the three concrete basins, the

*Read at recent Cincinnati meeting of International Association for the Prevention of Smoke.

†Master Mechanic, Lake Shore and Michigan Southern Ry., Elkhart, Ind.

outlet to each duct coming directly under a set of three hoods whose lower ends are submerged in the tank. The smoke ducts leading from the fan, the hoods and the stack are made of wood pinned together with pegs instead of nails.

An 8-in. hole is provided in each of the partition walls to insure a uniform level of water in the three basins. An overflow pipe maintains a depth of 14 in. of water and prevents the solid matter from escaping into the sewer. A 1¼-in. high-pressure steam jet is located in each of the three ducts, close to the concrete tank, to accelerate and thoroughly mix the gases with the water and prevent them passing through the water in large bubbles.

The telescopic jacks not in use have dampers closed. A locomotive with a fire has a jack fitted to the top of its stack, with the dampers opened. In starting new fires it is necessary to use the house blower slightly, to assist the action of the fan, especially at extreme ends of the house. The carbons and solids are separated from the gases by repeated washings and rise to the top of the water in the tank in the form of a black, foamy scum. The gases pass out through the stack as a white vapor. In handling 80 locomotives per 24 hr., from 8 to 10 bbl. of carbon are obtained from the smoke washer. This has the appearance of lampblack and is thoroughly steam-dried after it is taken from the smoke washer. An analysis of this material is as follows: Moisture, 3.9%; carbon, 82.6%; sulphur, 2.6%; iron oxide, 8.7%; silica, 1.8%; calcium oxide, a trace. The sulphur and sulphuric acids are retained in the water, and the gases that pass out through the stack are practically odorless. The smoke department of the City of Chicago and the near-by residents are pleased with the results.

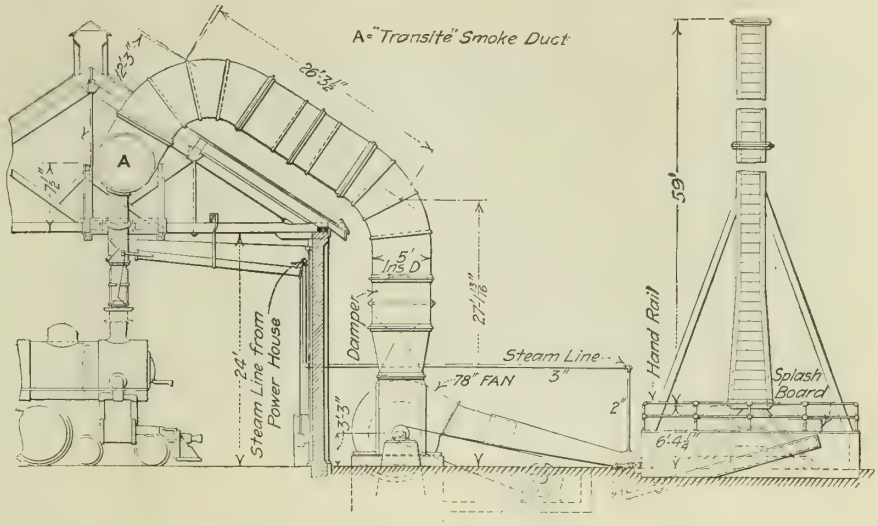


FIG. 1. ELEVATION OF LOCOMOTIVE-SMOKE WASHING PLANT, ENGLEWOOD, CHICAGO

Tank and stack at right, ducts connecting basins with fan, elbow between fan and smoke ducts, and connection between locomotive stack and duct

It is estimated that the cost of such a plant would be from $15,000 to $18,000 where the property conditions are favorable. The Englewood plant being partly experimental, its cost was somewhat greater. The cost of operation of this plant is about as follows:

Water, 18,255 gal. at 7c. per M	$1.28
Coal, 10.86 tons at $1.75 per ton	19.00
Electricity, 3,360 kw.-hr. at $0.0129	43.34
Total	$63.62

The saving from using washer, per day of 24 hr. is as follows:

Fires maintained	$40.80
New fires built	7.11
Reduced electrical cost due to sliding-scale rate	8.52
Total	$56.43

This makes the net cost of operating the washer $7.19 per day of 24 hr. It is expected that we shall be able to find a profitable use for the lampblack reclaimed.

In firing up locomotives at an ordinary engine house in a closely regulated smoke-abatement territory, it is necessary to operate the blower and smoke consumer on the engine. Their action increases the draft, which increases the coal consumption. The blower, steam jet and smoke consumer are also using a large amount of steam, which means increased consumption of water and fuel. We have found at Englewood that where the fires are properly started the draft from the fan is sufficient to draw off the gases from the locomotive without resorting to the blower. This means a decided reduction in the amount of water and fuel used.

Experience has demonstrated that the acids will eat out concrete and metals very rapidly. "Transite" (asbestos lumber) for the smoke ducts appears to be very satisfactory. A wood lining, fastened with wooden pegs and the entire surface coated with tar, has given good service where acids and water are to be resisted. This smoke washer is operated under patents controlled by the American Smoke Washing Co., S K. Dickerson, 5120 Greenwood Ave., Chicago, Ill., secretary.

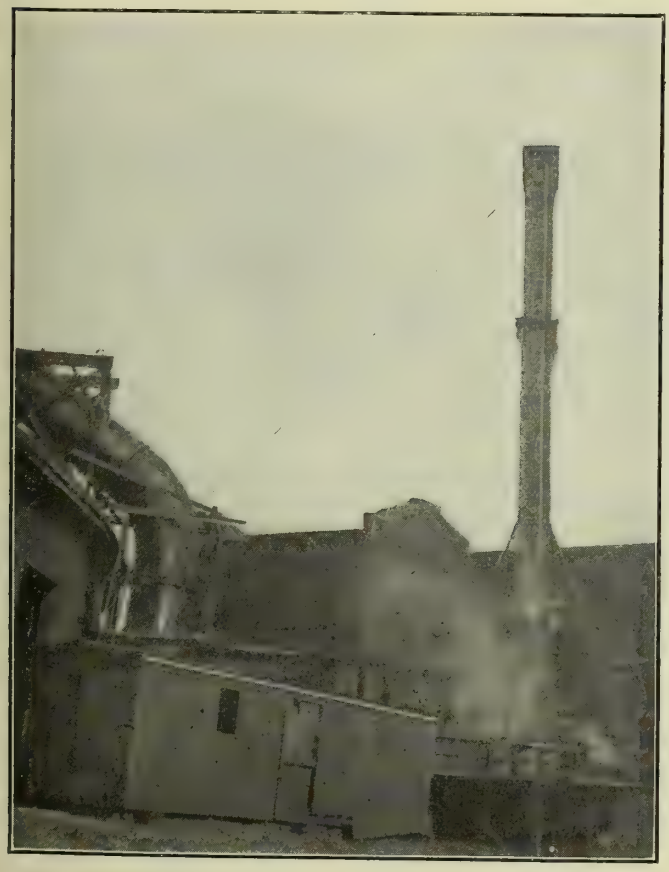


FIG. 2. EXTERIOR VIEW OF ENGLEWOOD WASHER

News of the Engineering World

Point Bridge Completed

The past month saw the completion of the North Side Point Bridge over the Allegheny River at Pittsburgh, Penn., after one of the longest construction periods on record for a bridge of its size. It takes the place of an old toll bridge, which was removed after being declared an obstruction. The chief delay in getting the new bridge was caused by failure to agree on the approaches until well after the main river spans were completed.

The total construction period was 4½ yr., as shown by the following dates:

Substructure	Started	Apr. 5, 1911
	Completed	Sept. 9, 1912
Steel spans	Started	July 23, 1912
	Completed	Nov. 5, 1913
Approaches	Started	Jan. 9, 1914
	Completed	Oct. 1, 1915

The concrete deck covering and paving were done in the period of approach construction, though let as a separate contract.

The Dravo Contracting Co., of Pittsburgh, built the substructure, the American Bridge Co. the two 531-ft. steel spans, and Booth & Flinn the approaches. The latter firm also took the paving contract. The City of Pittsburgh acted through N. S. Sprague, Superintendent, Bureau of Engineering, and T. J. Wilkerson, Division Engineer of Bridges.

Pittsburgh-Lake Erie Canal Has New Directors

Governor Brumbaugh of Pennsylvania has appointed a new Lake Erie and Ohio River canal board to replace the old board which went out of existence last May after reporting on the prospects and design of a canal to connect the Pittsburgh district with Lake Erie. The new board is composed of W. N. Stevenson, W. V. Follansbee, T. P. Sloan, David Jameson, H. C. Ogden and A. E. Adams, all bankers or "business men." The secretary of one of the associations booming the proposed canal in an interview said:

These appointees are eminently satisfactory to all the members of our association in 35 counties in western Pennsylvania, Ohio and West Virginia. I see in them a guarantee of the early construction of the great waterway. The board's first duty will be to complete the estimates of cost made by the last board, which will probably take a couple of months.

When this report has been prepared the canal association will hold a big convention in Pittsburgh of those interested in the project. This will probably be held early in January and, at it the time for holding the bond elections and the amount of money to be asked from each county will be decided. The first of these elections will probably take place next spring, and should they prove successful the canal board will probably start the actual construction of the canal next fall.

The waterway can be built in 5 or 6 yr., making allowances for legal delays, though the actual work would consume only 3 yr. The canal ought to be in operations in 1921 or 1922. At that time the Ohio River will be deepened to Cairo and with the Erie Canal open in New York we will be able to reach 27 states and Canada by water transportation.



NORTH SIDE POINT BRIDGE, PITTSBURGH, SEEN LOOKING NORTH FROM MT. WASHINGTON; SOUTH SIDE POINT BRIDGE AT LEFT



CLAY DUMP CARS, HOPPER AND WAGONS USED IN BUILDING DAMS FOR ASHBY RESERVOIR, FITCHBURG, MASS.

Coroner's Jury Finds Cause of Subway Collapse

The coroner's jury which has been investigating the collapse of the Seventh Ave. subway excavation at New York City on Sept. 22 has arrived at the following verdict:

We find that the said John W. O'Rourke came to his death on the 22d day of September in the subway excavation at 7th Ave. and 24th St. by a fracture of the skull and fractures of the ribs; that death was due primarily to an excessive blast at the northeast heading of the excavation; that, while due care was not exercised in estimating the amount of explosive to be used in this particular blast, the evidence submitted does not show criminal negligence; that the Bureau of Combustibles, Fire Department, City of New York, which has control of all blasting operations, is hereby severely censured for not carrying out, through its inspectors, the powers assigned to it by the Code of Ordinances.

We recommend that at the time of blasting in the subways of Greater New York no traffic of any kind be allowed over any part of temporary structures. We further recommend that the Public Service Commission shall designate the maximum distance to which temporary work shall precede the permanent structure. The jury, in deploring this accident, expresses the hope that it will serve to impress on all contractors and the Public Service Commission the necessity for the utmost caution and care, both in operation and inspecting of all subway work.

It is reported that the district attorney's office is investigating the accident with a view to possible criminal proceedings. This, however, completes the official inquiries into the September subway collapses. No coroner's inquest has been held as yet on the Broadway accident.

Fitchburg Reservoir Completed Long Ahead of Time

A 700,000,000-gal. reservoir formed by two 1,200-ft. earth dams was put under construction for the City of Fitchburg, Mass., on Apr. 15, 1915, and completed Nov. 1, 1915, eight months ahead of the contract time.

The two dams are rolled earth embankments, each with a concrete heart-wall and a spillway. Quicksand at the north dam made it necessary to excavate from 30 to 36 ft. to secure a good foundation. Hardpan and boulders were encountered at the south dam.

Good embankment material was found only one-half mile distant. It was loaded into side-dump cars by steam shovels, hauled over a narrow-gage railway, dumped into hoppers, reloaded into wagons (see view) and rolled with steam rollers. Sand and boulders for crushed stone for the concrete heart-wall were found on the reservoir site. Building the heart-wall preceded and paving the upper slope followed the placing of the embankment. The top and downstream slope of each dam will be covered with top soil and seeded with grass and rye, the latter for temporary protection of the young grass. Part of the reservoir site was heavily wooded, requiring considerable cleaning and grubbing. The construction of 1½ mi. of new highway was necessary.

The reservoir was built for the Board of Water Commissioners of Fitchburg by the E. W. Foley Contracting Corporation, 71 Wall St., New York City, under the direction of Ernest E. Lothrop, City Engineer of Fitchburg, and J. D. Savage, Resident Engineer. Metcalf & Eddy, Boston, Mass., were the Construction Engineers. H. M. Clifford, of the contractors, supplied the information here given.

Utilities Valuation Conference at Philadelphia

A tentative program has been issued by M. L. Cook, Acting Director of the Utilities Bureau, Philadelphia, for a conference on valuation of public utilities to be held in Philadelphia Nov. 10, 11 and 12. (This bureau was organized a year ago to help cities in the study of utility problems and in the adequate presentation of the municipal side of regulation cases, etc.)

All sessions will be held in the roof garden of the Adelphia Hotel. The following general topics are announced for the several sessions:

Reproduction theory, original cost, franchise values, valuing land, depreciation, going value, valuation and the future in utilities. Among the many engineers, utility commissioners and other speakers announced are: Hammond V. Hayes and Leonard Metcalf, Boston; John R. Freeman, Providence; H. P. Gillette, Milo R. Maltbie and Delos F. Wilcox, New York City; M. L. Cooke, Philadelphia; Morris Knowles, Pittsburgh; C. A. Prouty, Washington; R. H. Whelten, Newton D. Baker, Cleveland; C. E. Merriam, E. W. Bemis, Chicago; Halford Erickson, Madison, Wis.; J. E. Allison, St. Louis; Clifford Thorne, Des Moines; and John M. Eshleman, California. A full program may be obtained from M. L. Cooke, City Hall, Philadelphia.

November Election Results

Among the election issues on Nov. 2 of interest to engineers the general constitutional amendments in New York were overwhelmingly defeated, the $27,000,000 New York Barge Canal bond issue was still in doubt at time of going to press, a beginning in state ownership of sources of public water-supply in New Jersey was defeated, most of the large municipal program at Cleveland was approved, and street-railway purchases at Cleveland and at Detroit were voted down. A few particulars regarding these and some other issues follow:

The majority against the New York constitutional amendments was estimated at 375,000, on early returns. The defeat was general, regardless of party or geographical location.

Cleveland's great program of city improvements came through successfully for the major part. All the railway projects were carried, but the proposal to purchase the street railways was defeated. Specifically the voting resulted as follows: *Carried*: Union Station proposal, clearing the way for immediate construction of the new Lake Shore station; Cleveland & Youngstown R.R. franchise, for a freight terminal and downtown passenger station; Cleveland, Akron & Canton Terminal Ry. franchise, for East 55th St. subway; bond issue $1,600,000 for city's share in grade-crossing abolition; bond issue $1,000,000 for new schools; $2,000,000 to carry on sewage-disposal construction already under way; charter amendment fixing minimum daily wage of $2.50 on municipal work. *Defeated*: Proposal that city purchase the street-railway property from the Cleveland Ry. Co.; bond issue $100,000 for public-comfort stations; bond issue $300,000 for opening up Carnegie Ave. extension; bond issue $1,500,000 for deficiencies.

Municipal purchase of the privately owned Detroit United Railway was voted down. Of the total vote of 68,231 only 32,628 voted for purchase, or 8,278 less than the three-fifths needed to carry the proposition. The purchase has long been a local issue and the campaign was a bitter one.

New Jersey voted against a $1,000,000 bond issue to enable the State Water-Supply Commission to buy the "Wharton tract" in South Jersey for use in developing an underground water-supply. This tract was originally acquired by a promoter of one of the many schemes to supply water to Philadelphia before that city finally decided to filter water from the Schuylkill and Delaware rivers.

Commission government was voted on in a number of cities. Salem, Mass., under a system peculiar to the Bay State, having tried the commission plan for two years, voted on its continuance as against a change. The vote stood 3,122 to 2,677 for changing to a mayor and 11 aldermen, the mayor to have large if not absolute veto power. The commission plan was adopted in Bridgeport, Conn., and Watertown, N. Y., while Buffalo, Newburg and Niagara Falls, N. Y., elected commissioners for the first time under the commission plan. A city manager will be chosen by the Niagara Falls Commission; also by a commission at Ashtabula, Ohio, the latter elected under the Hare proportional representation plan.

A Butting Collision on Oct. 19 between a passenger train and a freight train on the Chicago, Rock Island & Pacific Ry. at Agawam, Okla., caused the death of seven persons and probably fatal injuries to two or three others.

Over 2,500 Lin.Ft. of Snowsheds on the Southern Pacific R.R., at Summit, Calif., were destroyed by fire on Oct. 17. The Summit railroad station, a reinforced-concrete structure, was slightly damaged. Through trains were delayed several hours while temporary tracks were laid around the burning sheds.

A Small Grain Elevator Tilted by rotting or settlement of its timber suports on one side, at Starbuck, Man., Canada, on Oct. 22, 1915. The first signs of yielding were noticed 4 or 5 hr. before the building fell off its foundation and came to bearing on the ground several feet to one side of its original position and out of plumb.

An Earth Slide on the Panama R.R., about 2 mi. north of Pedro Miguel, on Oct. 31, temporarily buried about 200 ft. of track and closed the road to traffic during one of its most congested periods. The slide is supposed to have been caused by unusually heavy rains and is particularly unfortunate at this time when the canal is closed to all traffic.

A Fire in a Brick School Building at Peabody, Mass., on Oct. 23 resulted in the death of 21 children. There were 600 children in the school when the fire was discovered. It is stated that every requirement of the law in the way of building construction and fire protection had been complied with and that the loss of life was caused "by the unfortunate place in which the fire started under the main stairway and to the accidental blocking of the main exit." The building was of brick exterior, with wood floors and partitions, and the fire is said to have swept through the three stories in 5 min. There were no fire escapes on the building.

The Scranton-Hallstead Cut-off of the Delaware, Lackawanna & Western R.R. will be opened for passenger traffic on Nov. 7. This line revision, described in "Engineering News," of Aug. 29, 1913, p. 410, is a relocation between Clarks Summit, 7 mi. west of Scranton, and Hallstead, 41 mi. farther west, at the summit of the division. While reducing the mileage only 3 mi., the betterment of line and grade is most marked. Construction was very heavy, particularly in cut and fill and in the erection of the two record-breaking concrete bridges at Tunkhannock and Martin's Creek.

PERSONALS

Mr. R. H. Pinkham, Assistant Supervisor of the Pennsylvania R.R. at Derry, Penn., has been promoted to be Division Engineer of the Renovo division.

Mr. J. K. Sherman, Assistant Engineer of the Pittsburgh division of the Pennsylvania R.R., has been promoted to be Division Engineer of the Zanesville division.

Mr. J. F. Twamley has been elected Second Vice-President and a Member of the Board of the Bath Portland Cement Co. His headquarters will be at 1182 Broadway, New York City.

Mr. V. D. Allen, Building Commissioner of the City of Cleveland, Ohio, has tendered his resignation, to take effect Jan. 1, 1916. Mr. Allen, it is stated, will go into private business.

Mr. Arthur Hastings, recently connected with the Franklin Steel Works, Franklin, Penn., has entered the employ of the Turner Construction Co. as Assistant Engineer in the company's Buffalo, N. Y., office.

Mr. R. G. Jones, Assistant Engineer of the Northern division of the Grand Rapids & Indiana Ry. at Grand Rapids, Iowa, has been promoted to be Division Engineer of the Southern division at Fort Wayne, Ind.

Mr. James Cole Roberts, M. Am. Inst. M. E., of the United States Bureau of Mines, Denver, Colo., has been elected to the Joseph Austin Holmes Professorship of Safety and Efficiency Engineering at the Colorado State School of Mines, Golden, Colo.

Mr. D. W. Cole, M. Am. Soc. C. E., Project Manager of the United States Reclamation Service, Fallon, Nev., has been granted leave of absence—the first in six years. A recent report in another publication, that Mr. Cole has resigned, was in error.

Dr. Charles P. Steinmetz, Past President of the American Institute of Electrical Engineers and Chief Consulting Engineer of the General Electric Co., has been elected President of the Common Council of the City of Schenectady, N. Y., on the Socialist ticket.

Mr. F. C. French, M. Am. Soc. C. E., formerly Designing Engineer of the Anaconda Copper Mining Co., Anaconda, Mont., has become Construction Engineer on the remodeling and enlargement of the plant of the Beaston Copper Co. at Latouche, Alaska.

Mr. William Goldsmith, Assoc. M. Am. Soc. C. E., has resigned as Superintendent of the municipal asphalt plant of the Borough of Manhattan, New York City, to accept a position as Engineer in Charge of Construction of the New Hampton Farms Reformatory.

Mr. Malcolm Lewis, at present connected with the Lederle Laboratories, New York City, and a graduate of the Massachusetts Institute of Technology, has been appointed Sanitary Inspector of the Montclair, N. J., Board of Health, to succeed Lewis O. Taynton, who recently resigned. Last year Mr. Lewis was an assistant instructor in biology at Rutgers College.

Mr. L. E. Yost, formerly Superintendent of the openhearth and blooming-mill departments of the Upson Nut Co., Cleveland, Ohio, has been appointed to a similar position at the new plant of Corrigan, McKinney & Co., of the same city. He will be succeeded by Mr. R. B. Bostwick, Superintendent of openhearth department No. 3 of the Homestead, Penn., works of the Carnegie Steel Co.

Mr. Luciana Selmi, formerly Chief Chemist and Metallurgist of the Otis Steel Co., has become associated with Corrigan, McKinney & Co., Cleveland, Ohio, in charge of the new chemical and physical laboratories being built at the company's plant in connection with the construction of additional steel mills. He is succeeded at the Otis plant by Mr. Frank B. Poto, recently connected with the Youngstown, Ohio, Sheet and Tube Co. and formerly for ten years Chief Chemist of the Buckeye Steel Co., Columbus, Ohio.

Mr. Edward M. Boggs, M. Am. Soc. C. E., Chief Engineer of Docks and Wharves of the San Francisco and Oakland, Calif., Terminal railways, has been appointed Chief Engineer of the Department of Way and Structures, with headquarters at the General Office Building of the company. Mr. Boggs succeeds Mr. George H. Binkley, M. Am. Soc. C. E. Mr. A. W. Macpherson has been appointed Assistant Chief Engineer with the same headquarters. The departments known as the Maintenance-of-Way and Structures and Docks and Wharves have been consolidated and will hereafter be known as the Department of Way and Structures.

Mr. Henry Latimer Collier, for several years past Consulting Engineer of the Yellow Pine Manufacturers' Association at St. Louis, Mo., has opened an office as a consulting and constructing engineer in the Candler Building, Atlanta, Ga. Mr. Collier was graduated from the University of Georgia in 1872. For 10 yr. he served as Commissioner of Public Works of Atlanta and for five years was connected with the United States Department of the Interior as a member of the College of Examiners of Surveys. He will specialize in street and highway pavements and reinforced-concrete construction and the location of disputed land lines and boundaries.

Mr. Louis K. Rourke, M. Am. Soc. C. E., recently Commissioner of Public Works of Boston and formerly Assistant Division Engineer of the Central Division of the Panama Canal, and Mr. Edward C. Sherman, M. Am. Soc. C. E., Consulting Engineer, formerly Division Engineer on the Charles River Dam and Lock at Boston and later Designing Engineer on the Panama Canal, have formed a partnership under the firm name of Rourke & Sherman, with offices at 6 Beacon St., Boston, Mass. They will specialize in the organization, design, construction and operation of public works, including river and harbor improvements, refuse disposal, water-supply, sewerage and pavements, railroad work, and on Spanish-American projects.

OBITUARY

Zenas N. Vaughn, a civil engineer well known in Idaho through his connection with much of the irrigation development in that state, died recently at his home in Boise from injuries received in a runaway accident on a mountain road. Mr. Vaughn was recently engaged in the construction of the Crane Creek Irrigation, Land and Power Co.'s system near Weiser, Idaho.

Thomas Francis Cheyney, a young mining engineer, a graduate of the Case School of Applied Science, disappeared on Aug. 23 from a mining camp where he was employed in the Cobalt silver mining district. No trace was found of him until a few days ago, when his brother, Carl A. Cheyney, of Cleveland, received word that the body had been found on a lonely trail in the Cobalt region, although no details as to the manner of his death were given in the message. Mr. Cheyney was 28 years of age.

Olaf Ridley Pihl, M. Am. Soc. C. E., senior member of the engineering firm of Pihl & Miller, of Pittsburgh, Penn., died suddenly from heart disease on Oct. 14, at the Allegheny General Hospital. He was born in Norway and came to the United States in 1880. Ten years later he became associated with the late William H. Kennedy, M. Am. Soc. C. E., in the Oregon Railroad and Navigation Co., at Portland, Ore., serving there and later at Buffalo, N. Y., as United States Assistant Engineer. He was connected with the Pan-American Exposition, and in 1902 went to Pittsburgh.

ENGINEERING SOCIETIES

COMING MEETINGS

THIRD ANNUAL PENNSYLVANIA WELFARE AND EFFICIENCY CONFERENCE.
Nov. 16-19. Conference in Philadelphia.

NATIONAL MUNICIPAL LEAGUE.
Nov. 17-19. Annual convention, Dayton, Ohio. Secretary, Clinton Rogers Woodruff, 705 North American Building, Philadelphia.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
Nov. 18-19. Annual meeting at Zanesville, Ohio. Secretary, F. E. Sanborn, Columbus, Ohio.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 1-3. Annual convention in Washington, D. C. Executive Secretary, E. C. Kempe, The Octagon, Washington.

AMERICAN ASSOCIATION OF ENGINEERS.
Dec. 10 and 11. Convention in Chicago. Secretary, Arthur Kneisel, 29 South La Salle St., Chicago.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.
Dec. 13-15. Annual meeting in New York. Secretary, Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

SECOND PAN-AMERICAN SCIENTIFIC CONGRESS.
Dec. 27-Jan. 8. Washington, D. C.

American Highway Association—The following officers have been nominated for 1916: President, Fairfax Harrison; vice-president, Logan Waller Page; treasurer, Hon. John Burke; directors, W. T. Beatty, George W. Cooley, Clarence A. Kenyon, James H. MacDonald, E. J. Mehren, Dr. Joseph Hyde Pratt and Henry G. Shirley.

American Road Builders' Association—At a meeting of the directors of the association held in New York City, Oct. 22, it was unanimously resolved not to participate in a proposed International Road Congress to be held in Worcester, Mass., Dec. 14 to 17, 1915. It was also unanimously voted at this meeting to hold the next convention and exhibition during the month of either January or February next, the exact time and place to be left to the executive committee. It is expected that a decision will be reached within the next few days. Cleveland, Ohio and Pittsburgh, Penn., are the two cities whose relative facilities are now being considered by the committee. The decision to hold the annual good-roads show in connection with the convention was made owing to what seems to be a very general demand for it from manufacturers.

Third Pennsylvania Welfare, Efficiency and Engineering Conference—The conference this year, Nov. 16-19, will be of greater scope than those of the preceding years. Among the men who will preside are Dr. John Price Jackson, Commissioner of Labor and Industry; Robert J. Cunningham, State Highway Commissioner; Dr. F. Herbert Snow, Chief, Bureau of Engineering, Public Service Commission, and Farley Gannett, President, Engineers' Society of Pennsylvania. The program includes many subjects of general interest, such as city planning, fire prevention, water-supply, highways and many subjects related to state and municipal government. Coincident with the meeting of the conference the exhibit, which is under the management of the Engineers' Society of Pennsylvania, in conjunction with the officials of the conference, will be held at the car barns of the Harrisburg Railways Co., the use of which has been donated for this purpose.

Appliances and Materials

Bulb Angles and Beams Now Rolled

Years ago the use of bulb angles and bulb beams was quite extensive in shipbuilding construction, and steelmakers of the United States rolled a limited line of both sections such as experience had found suitable. There then followed a tendency in shipbuilding to utilize steel channels in the place of the bulb sections, and for many years the tonnage rolled was extremely limited. Recently, however, the tide has turned again in favor of the bulb-angle and bulb-beam type of construction. In addition, the bulb-angle section has now come into use for strengthening the tops of all steel gondola freight

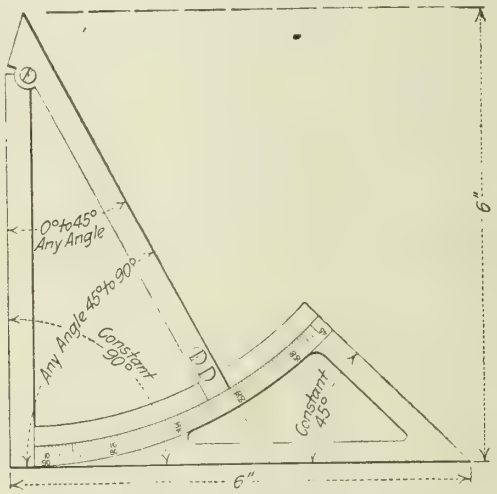
cars and a number of sizes particularly designed for that purpose have come into use. Through the revival in American shipbuilding due to the European War a number of vessels are now under construction to English standards in which the bulb angle is used in floor framing.

The Carnegie Steel Co., of Pittsburgh, now rolls for the first time in this country a fairly complete line of bulb angles to British standards. Orders are being executed as promptly as mill conditions warrant. The company has issued a pamphlet entitled "Bulb Sections," containing tables and data on all profiles now being rolled.

* * *

Universal-Angle Drafting Triangle

A triangle with which lines can be drawn inclined at any angle is now being made by L. F. Hellman, of Indianapolis, Ind. (Box 269, R.R. 26). The design is shown in the accompanying sketch. The device is made of cast aluminum, $\frac{3}{16}$ in.



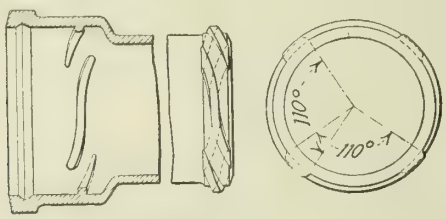
HELLMAN'S UNIVERSAL TRIANGLE

thick, and is smooth on both sides. The base and one side are rigid, but a part of the hypothenuse swings about a friction point. The arc is graduated to half degrees, but quarter degrees can be estimated. Triangles graduated for slope and pitch are also supplied. Only the 6-in. size is made, and this sells for $2.

* * *

Locking Bell-and-Spigot Pipe Joint

Cast-iron pipe has continued to be favored for waste-, vent- and soil-pipe lines on account of reported unfavorable experience with wrought iron and steel. But with the advent of high buildings in cities trouble has developed in the long lines of waste pipes, which are subjected to heavy stress due to sudden and large changes in temperature caused by alternate flushing with hot and cold water. This has loosened the leaded bell-and-spigot joints so that sewer gases have



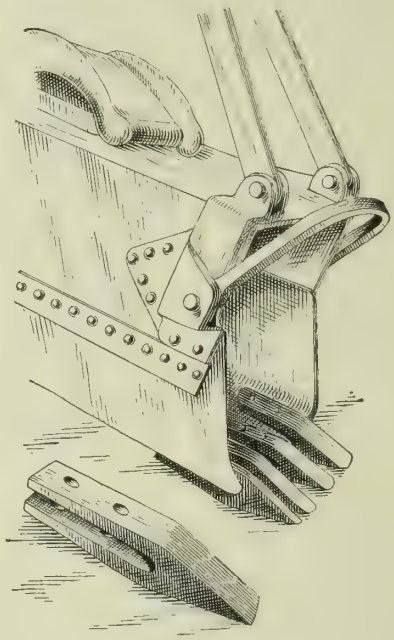
LOCKING BELL-AND-SPIGOT PIPE JOINT

escaped. To meet the need of a locked bell-and-spigot joint the Central Foundry Co., of New York City, has developed the design shown in the accompanying sketch.

The bell end has four helical interior ribs near the inner shoulder. The spigot end has four exterior helical ribs. The spigot is inserted in the bell and given a quarter turn; then oakum is tamped in and the lead poured and calked as usual. There is a groove inside the bell to hold the lead. When it is necessary to cut this pipe to measure on the job, a malleable-iron end ring replaces the spigot end which has been cut off. The pipe is cast so that it engages with the malleable ring. Several lengths of this soil pipe can be jointed on supports and will not sag when the intermediate supports are taken away. If the middle is loaded to collapse, the pipe breaks beyond the joint. Soil pipe in 2- to 6-in. sizes is now made with this joint. The cost is about the same as for the ordinary type.

Easy-Loading Dipper Tooth

An easy-loading style of one-piece tooth for steam-shovel and dredge buckets has been designed and is being manufactured by George P. Chambers, 110 North Madison Ave., La Grange, Ill. The device is shown in the accompanying sketch. The tooth is made in carbon steel for resharp-



CHAMBERS' REVERSIBLE DIPPER TOOTH

ening or manganese steel for especially severe service. The teeth are reversible, so that when worn on one side they may be turned over and reused. It is claimed that a bucket equipped with these teeth loads more material than with any standard tooth, and that particular benefit has been shown in picking up large stones on level ground. These teeth are used at the Dolese and Shepard quarries at Gary, Ill., and by the Brownell Improvement Co., Thornton, Ill.

* * *

Six-Wheel Motor Truck

A six-wheel motor truck, resembling a tractor-trailer outfit, has been designed by the Chicago Pneumatic Tool Co., of Chicago. It is aimed to transfer to the tractor drive wheels only enough load to give the traction necessary for pulling



SIX-WHEEL MOTOR TRUCK

the capacity of the body. A ball race is interposed between tractor and trailer sections. A special connection between the rear-axle supports and the driving truck makes the rear wheels track with the forward wheels. The machine is claimed to turn in a 36-ft. space, even when loaded with 40-ft. lumber.

* * *

Universal Concrete-Culvert Form

A galvanized-steel culvert-form outfit for all sizes and styles, from 15-in. to 6-ft. span, with flat or arched tops, is being made by the Concrete Form Co., of Syracuse, N. Y. This equipment is sold under the trade name of "Whalen Form." It consists of four arch-top sections, 24 in. wide, 27 in. high and 24 ft. long. For culverts wider than 24 in. two lengths are placed parallel and spanned with cover plates. The outfit comprises also two 48x84-in. head-wall forms, one set for wing walls, one parapet box and six 2x3-ft. cover plates.

Engineering News

VOLUME 74 NOVEMBER 11, 1915 NUMBER 20

Ornamental Concrete Elevated Railway, New York City

By Maurice E. Griest*

One of the new rapid-transit lines now being built in New York City passes along the Queens Boulevard, a 200-ft. automobile thoroughfare, for more than three-fourths of a mile. To avoid disfiguring the boulevard—for which a large expenditure had already been made—with a steel elevated railway of the ordinary type, careful study was given to working out a practical type of elevated-railway construction which should be ornamental, and less noisy than a plain open-floor steel structure; and at the same time cheaper than subway construction. The final selection was a new form of structure, a reinforced-concrete arcade or series of vaulted concrete arches.



FIG. 1. COMPLETED STRETCH OF QUEENS BOULEVARD ELEVATED STRUCTURE
Colored tile is to be placed in recessed panels of the face. The station steel in the distance is to be cased in concrete

An ornamental steel structure with columns curving into the longitudinal and cross-girders by sweeping curves was considered. The details were unsatisfactory, however, and no appreciable reduction in noise could be expected. The estimated cost, with open tie floor, was about 1.2 times the cost of a plain elevated structure.

By making the steelwork of plain form and detail, securing the flowing lines by means of a concrete covering or veneer (Fig. 2), fairly satisfactory architectural results could be obtained. But with open floor construction and the ties delivering the impact of the train directly to the concrete covering of the stringers, it seemed doubtful that the concrete would remain intact. This objection was overcome by changing to a through girder construction with solid floor. For the latter design the estimated cost was 1.6 times the cost of a plain steel structure.

Substituting entire reinforced-concrete arch construction for the type just discussed, satisfactory results in point of solidity, grace, beauty, monumental effect and the reduction of noise and vibration were obtained. The estimated cost was about 1.8 times that of a plain steel structure.

The substitution of a subway for the elevated structure would have been highly desirable except that the cost was estimated at four times that of an ordinary elevated structure.[1]

*Assistant Designing Engineer, Public Service Commission for the First District, 154 Nassau St., New York City.

[1]Topographical conditions made it necessary to extend a subway to the east beyond the point where the line leaves the Boulevard, increasing the relative cost for the length on the Boulevard from three times to four times that of the ordinary elevated.

In choosing between these different types the ornamental steel structure was abandoned because of its unsatisfactory detailing. For the remaining types the following tabulation shows the cost ratios:

RELATIVE COSTS OF DIFFERENT TYPES OF STRUCTURE	
Ordinary steel elevated	1.0
Subway	4.0
Concrete-covered steel structure with solid floor	1.6
Concrete arch structure	1.8

Eliminating the subway because of its great excess of cost, it was decided that, the difference of cost between

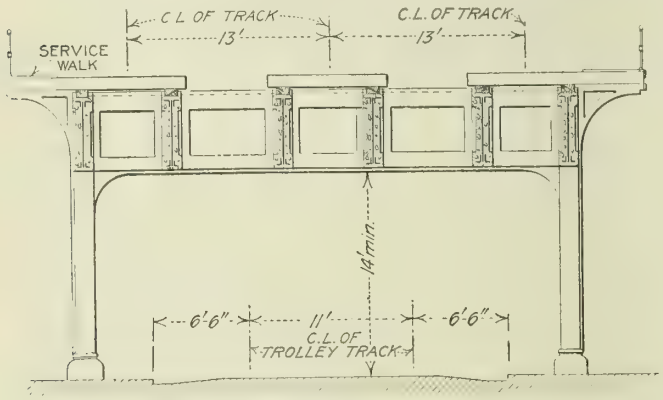


FIG. 2. SECTIONAL SKETCH OF VENEERED STEEL ELEVATED STRUCTURE

the other two types being so slight, the selection of the concrete arch structure was permissible because of the great gain in appearance.

General Description

This concrete-arch elevated railway viaduct with its domed arches supported on columns extends for over ¾ mi. along Queens Boulevard from Hill St. to Gosman Ave., with three stations, Rawson St.-Moore St., Lowery St., and Bliss St.-Carolin St. It carries three tracks, two local and a middle express track.

The elevated structure occupies the middle of the 74-ft parking space forming the central portion of the boulevard. Two trolley tracks occupy the center of the parking space and pass beneath the structure. Solid piers could not be used therefore either at the intermediate supports or at the abutments.

The over-all width of the structure is 44½ ft. A normal span length of 65 ft. was adopted, to fit both the 200-ft. block length and the 60-ft. width of cross-streets. Spans departing from the standard, in some cases down to a length of 52½ ft., were required at stations on account of the longer spans at the mezzanines.

A minimum clearance of 14 ft. over the trolley tracks is required. It was also desired that the height from street to station platforms should not exceed 30 ft., unless elevators or escalators were provided. This meant that the arches must be of very low rise; in fact with the flattest practicable arch the height to station platforms slightly exceeds 30 ft.

The general design of the structure is shown in Fig. 3.

Design of Arch

The ends of the arch are fixed, as the vaulted shape prevents any possibility of hinging. The investigation of stresses was made for a fixed arch by the strict method of elastic calculation, following closely the procedure given in Howe's "Symmetrical Masonry Arches." It was made on the assumption that each longitudinal strip acts independently of every other strip. Later, after the design was completed, the effect of the dome-shape was considered; the stresses were recalculated and proved to be not materially different from those found under the assumption that each longitudinal segment acts independently.

The design was made for a live-load consisting (for each track) of four 30,000-lb. axle loads, spaced 5, 10 and 5 ft.[2] Temperature change was taken as 30° F. rise or fall. Temperature stresses as well as the stresses due to shortening of the arch under load are included in the figures quoted later.

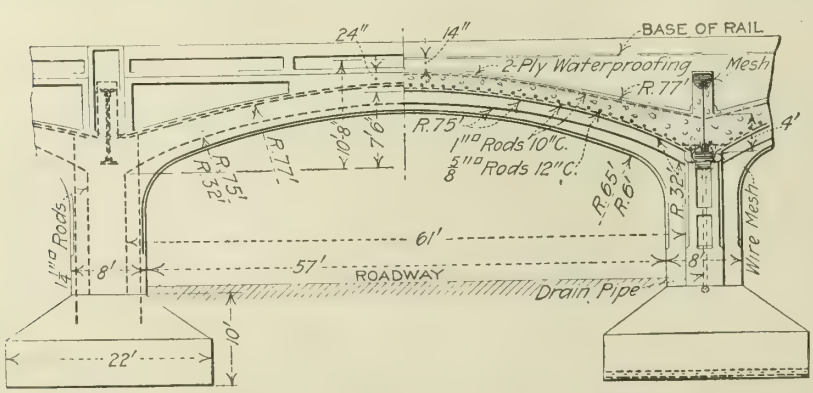
With a 4-ft. longitudinal rise on center line in the trial design and other dimensions as follows:

Span c. to c. of skewbacks	3 ft.
Rise transversely	2 ft. 4 in.
Crown thickness	2 ft.
Haunch thickness	4 ft.
Shape of arch	Circular segmental

The dead- and live-load stresses were found in general to fall within allowable limits, but the temperature stresses were excessive and the combined stresses prohibitive.

After some further rough trials it became evident that the rise of the arch and its flexibility must both be increased in order to reduce temperature stresses. The flexibility was increased by maintaining a constant section from crown to quarter point and increasing the thickness rapidly thence to the haunch. With a three-centered

[2]Dead-load includes weight of ballast at 100 lb. per cu.ft., concrete at 150 lb. per cu.ft., and the track. The stresses for a live-load of 2000 lb. per lin.ft. of track were in all cases less than those for the concentrated loads. The concentrated loads were assumed to distribute over 5 ft.—three ties—longitudinally and 12 ft. transversely. In spite of the use of ballast floor, impact was added, to the amount of 80% of the live-load, as computed from the Public Service Commission's formula: $I = 125 - \frac{1}{8}\sqrt{2000\,L - L^2}$; where L = loaded length of track. The stresses quoted further on include the impact effect.



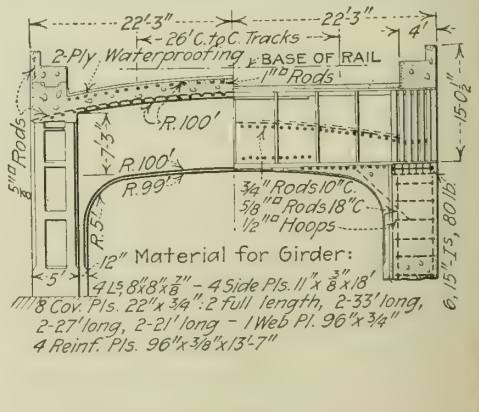


FIG. 3. TYPICAL ARCH SPAN OF QUEENS BOULEVARD ELEVATED STRUCTURE

segmental arch embodying these modifications, and with a longitudinal rise of 6½ ft. and a transverse rise of 18 in., the stresses seemed to come within practicable limits and the design was adopted. The reinforcing used comprises longitudinal rods 1 in. square spaced 10 in. c. to c., top and bottom; and transverse rods ⅝ in. square 18 in. c. to c., bottom only.

The stresses were first computed on the assumption of tension in the concrete, giving the following results:

	Crown		Quarter Point		Haunch	
	Top	Bottom	Top	Bottom	Top	Bottom
Concrete (max.)	+680	+500	+590	+150	+300	+430
Steel (max. comp.)	+10,000	+7,500	+9,000	2,200	+4,500	+6,500
Concrete (min.).	+40	—340	+230	—30	—260	0
Steel (min. compression or max. tension).	+600	—5,000	+3,400	—450	—3,900	0

As under these stresses the concrete would part in tension at the crown and the haunch under a combination of the most unfavorable conditions, the calculation was revised and the arch ring treated as a reinforced-concrete section subject to direct thrust and bending, with the usual assumption that tension is taken up entirely by the steel. On this basis the maximum stresses became:

	Crown		Quarter Point		Haunch	
	Top	Bottom	Top	Bottom	Top	Bottom
Concrete (max.)	+690	+500	+590	+150	+300	+560
Steel (max. comp.)	+10,000	+7,500	+9,000	+2,200	+4,500	+8,500
Concrete (min.).	+40	0	+230	0	0	0
Steel (min. compression or max. tension).	+600	—9,000	+3,400	—450	—7,000	0

All of these stresses are well within the elastic limits of steel and concrete, and, except for the maximum compression of the crown, within the Public Service Commission's working stresses (600 lb. concrete compression). As this case occurred only under the worst condition of load and temperature combination and with a large impact factor added to the live-load stress, it was considered entirely safe and no change was made on account of it.

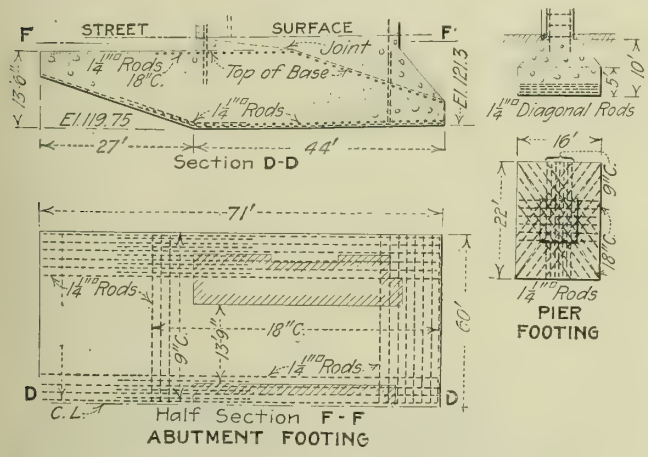


FIG. 4. NORMAL PIER FOOTING AND ABUTMENT FOOTING

Design of Columns

A cross-arch is sprung between the columns for appearance only, as an arch of sufficient strength to support the vertical component of the thrust at the haunch of the longitudinal arch proved entirely impracticable. A steel girder embedded in the concrete carries the load to the columns.

The dead-load thrust of adjacent arches balances at the top of the columns; the abutment of course is designed to resist the full thrust of the arch. The maximum live-load thrust of a single arch (adjacent arches unloaded) was assumed to distribute over *three bents,* so that each column was designed for one-sixth of the total live-load thrust from one arch with three tracks loaded. The highest column governed, and all columns, for appearance, were made of the same section.

A steel column, covered with concrete for architectural effect, was uneconomical, as the steel was concentrated near the center and therefore ineffective in resisting the bending stresses due to horizontal thrust, and the concrete added little strength. Furthermore, in order to prevent shrinkage, temperature and bending cracks, some reinforcement near the concrete faces would be required in any case. The steel columns would have been valuable during erection to support the girders so that they could be erected before any concrete was poured.

Type of Column Used

A concrete column with structural reinforcement in the form of a tower, with the verticals near the corners of the column, was economical. A detail, however, of a grillage to distribute the load of the completed structure over the concrete, and to support the weight of the girder during erection on the tower, proved unsatisfactory.

The only advantage of structural reinforcement over rods (which were used) was the support of the girder during construction. Practically the same results were obtained by pouring the concrete columns to the underside of the grillage, setting the steel, and then proceeding with the casting of the arch. In the end this proved to be an advantage to the contractor, for it was possible to pour the footings and columns while the girders were being detailed and fabricated.[3]

The columns are 5x8 ft. in section, with a rib 4 ft. wide projecting 1 ft. on the inside; they are reinforced with four 1¼-in. square rods at each end and ½-in. square hoops spaced 2 ft. apart vertically. On each side were placed four ⅝-in. square vertical rods to prevent temperature and shrinkage cracks. The reinforcement is proportioned for the bending with both ends of the column fixed.

On the basis of a maximum footing pressure of 2 tons per sq.ft. under direct load only, and a maximum edge pressure of 4 tons per sq.ft. (on sand and gravel), a footing 16 ft. wide and 22 ft. long of reinforced-concrete slab type with diagonal reinforcement was designed, as may be seen in Fig. 4. The original intention was to pour the entire footing as a monolith. This was found to be impracticable, however, so the footing was placed in two pourings, the top of the first lift being toothed in order to take care of horizontal shear.

Stations: Girder Construction and Mezzanine

At stations it was necessary to provide a mezzanine below the track for ticket booths and other facilities. A 65-ft. span was too short to give the required space, and the regular concrete-arch construction did not give sufficient clearance above the street to accommodate a mezzanine. Therefore the arch was replaced with steel girder construction 90 ft. in span.

Two serious problems arose in the station construction. The first was the support of the platforms along the sides of the regular concrete arch spans. In order to occupy as little as possible of the parkway, the structure was not widened, but the platforms were designed to

[3] About 75% of the columns were poured before any structural steel was delivered on the work.

overhang (Fig. 5). The outer edge of the platform was carried by longitudinal girders supported by brackets attached to the cross-girders, thus avoiding putting any additional load on the arches. Expansion in the arches produces no longitudinal movement, while the girders (due to stairways), it was necessary to provide heavy steel columns to support the main cross-girders, which receive all the load; the footings also were enlarged, to 21x26 ft.

The abutments at either end of the concrete structure, where the steel elevated railway adjoins, have to take

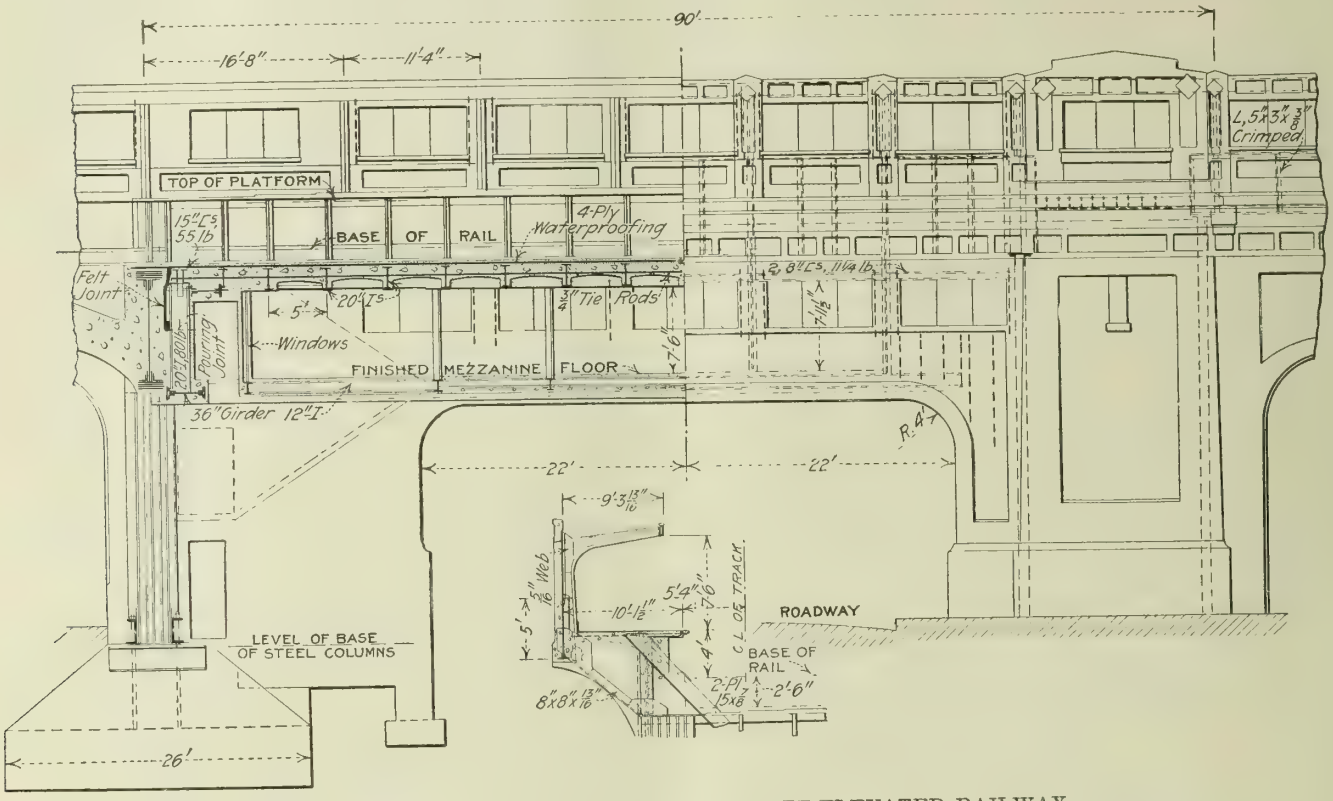


FIG. 5. STATION CONSTRUCTION ON CONCRETE ELEVATED RAILWAY

must expand and contract. The longitudinal girders and canopy columns are covered with concrete, thus maintaining a concrete exterior throughout. To prevent the concrete from cracking, expansion joints in the platforms were provided at the brackets. The expansions were so arranged that the joints in the concrete in general occur at the edge of a panel or pilaster.

The second problem was to provide for the arch thrust at the mezzanine spans. It was necessary to carry this thrust through the steel of the mezzanine and track floors. The average position of the thrust is slightly above the level of the former. The thrust is transmitted to the longitudinal struts by a vertical grillage of 20-in. I-beams attached at the top and bottom to horizontal girders in the track and mezzanine floors. It was first planned to attach the vertical grillage to the main cross-girders which support the longitudinal girders; the details, however, were very cumbersome and the actual stresses indeterminate. To avoid these difficulties the grillage is set clear of the cross-girders and its weight supported from the track floor. The thrust is carried into the beams by the concrete surrounding the grillage. The stress in the struts of the mezzanine floor is about 6000 lb. per sq.in. without temperature, and 14,000 lb. per sq.in. at maximum temperature; the shortening of the struts from the 8000 lb. per sq.in. temperature stress about equals the expansion of the steel due to the change in temperature, so that there will be no appreciable movement from temperature expansion.

Because of the increased load of the station span including the mezzanine, and the reduced section of the columns a maximum arch thrust of 4,088,000 lb. As passage for the trolley cars had to be provided, each abutment is built as a set of three heavy reinforced-concrete piers above ground connected at the top by a heavy reinforced slab to carry the thrust into the piers, and at the bottom by a single massive spread footing. Sufficient tension steel

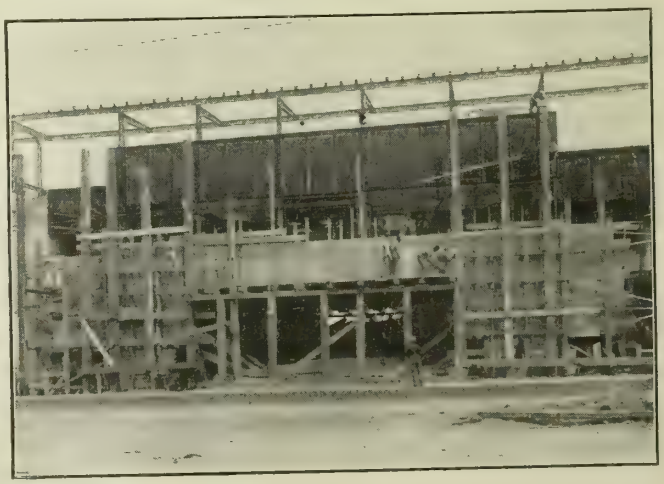


FIG. 6. STATION SPAN WITH FORMS FOR MEZZANINE PARTLY IN PLACE

is provided for the maximum bending stresses due to the arch thrust, and sufficient concrete area to take the shear. The toe of the footing is designed as a cantilever with a maximum toe pressure of 4 tons per sq.ft.

In arranging pouring joints the main objects considered were: (1) To secure stability, by making the joints

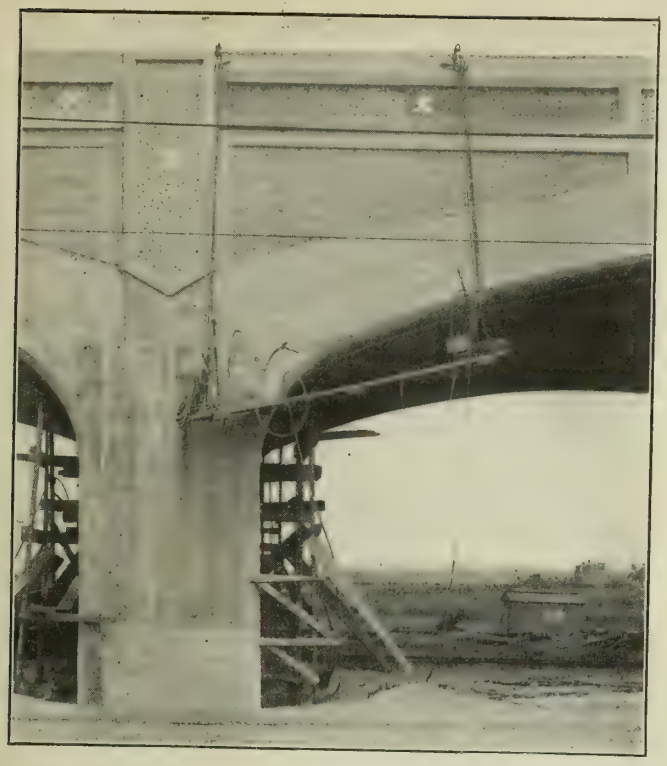


FIG. 7. FACE FINISH, QUEENS BOULEVARD ELEVATED RAILWAY

The arch at the right is tooled; the sunken panel is rough-point, the remainder of the face four-point work; the band around spaces "x" is rubbed. Colored tile is to be set in spaces "x." The arch at the left is untooled, showing the form marks.

normal to the line of strain, or by securing the sections against sliding through the use of dowel rods embedded about 3 ft. in each layer; (2) To arrange the joints where possible so that at the surface they came at edges of panels, etc., so as to be practically invisible.

The ordinary pier footings were divided into two pourings, as previously mentioned. The large footings of the abutments required more divisions. Here the work had to be done in longitudinal sections on account of the cantilever action. The base was, therefore, divided into six longitudinal sections, each containing about 300 cu.yd., equal to the normal daily capacity of the contractor's concreting plant.

The columns were poured in all cases to the underside of the grillage beams under the main cross-girders. In this pouring, skewbacks were molded for both longitudinal and cross arches, as shown in the section in Fig. 8.

The main arch was poured in three sections: first, the middle third, to bring the weight on the forms so that any settlement in them occurred before the arch was finally jointed; second, the haunches and the cross arch on both sides; third, the blocks covering the ends of the cross-girder. These blocks were poured before the arch centers were struck. The spandrel walls of the arch are separated from the arch vault by expansion joints made of a layer of elastic cement; these walls were poured last.

Finish of the Surface

In general the exposed concrete faces were dressed with a four-point tool used in a Boyer air hammer, with points set at the corners of a 1-in. square. Sunken panels on the underside of the ribs and in the spandrel walls are rough-pointed, using a single-point tool in an air hammer. Around the panels in the columns and arch ribs, and at other right-angle corners, a 6-in. draft margin is drawn with parallel cuts $\frac{5}{8}$-in. apart. The band around the colored tile on the face of the structure is rubbed with carborundum brick.

Forms and Plant

Wooden centers and forms were used exclusively on the work. The arch centers, designed by the contractor, are shown in detail in Fig. 8. It should be noted particularly that the lagging was supported on transverse rather than longitudinal trusses. The transverse curvature is uniform for all spans, so that the trusses could be used for any span by respacing them longitudinally.

The concrete was mixed at a central plant consisting of a 1-yd. Chain Belt rotary mixer driven by a 30-hp. a.c. motor. Cement was moved from the cement house to the platform of the mixer by a Robins belt conveyor driven by a 2-hp. a.c. motor, while the sand and gravel were handled with a 1-yd. Hayward clamshell bucket operated by a six-drum 52-hp. Maine Electric Co. hoist. The maximum capacity of the plant was 450 cu.yd. per day; the average capacity, about 300 cu.yd.

The concrete was handled for the most part in 1-yd. bottom-dump buckets and distributed on Koppel side-dump cars rebuilt for the purpose. These cars were moved in 5-car trains by three 24-in.-gage locomotives.

The concrete was handled and the forms moved and reset by two 15-ton Brownhoist locomotive cranes with 70-ft. booms. A derrick-car of 40 tons' capacity was used in setting the cross-girders. The heavy longitudinal girders at the station were handled by two 30-ton stiff-leg

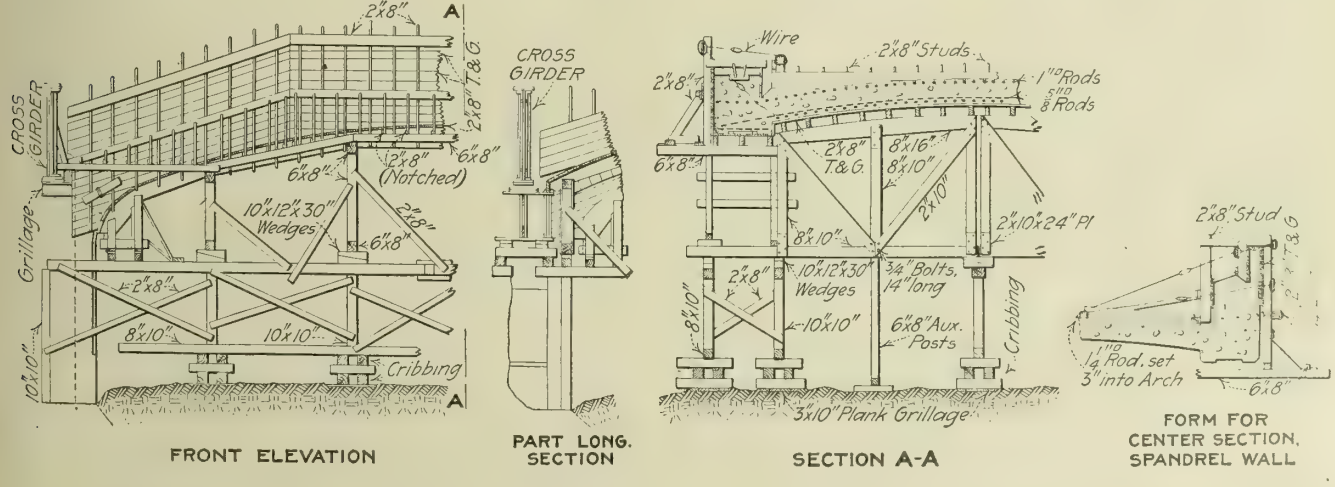


FIG. 8. FORMS FOR ARCH CONCRETING, QUEENS BOULEVARD ELEVATED

derricks. One stiff-leg derrick of the same capacity was used on the superstructure for erecting platform girders and light canopy material.

The plant for finishing the concrete consists of one 50-hp. locomotive boiler and one Ingersoll-Rand straight-line compressor with a capacity of 175 cu.ft. of free air per min. This supplies air for 23 hammers although usually only about 15 are working at one time. The staging for finishing the under side of arches is hung from the spandrel walls.

Progress

The first concrete in the footings was poured on July 1, 1913, and the first arch poured on June 19, 1914. The center of this arch was struck on Aug. 8. The contract provides that the concrete in the arches shall set 28 days before the centers are struck.

The concrete of the arches has all been placed and the concrete covering the steel of the stations is now being poured. About one-half of the surface has been finished.

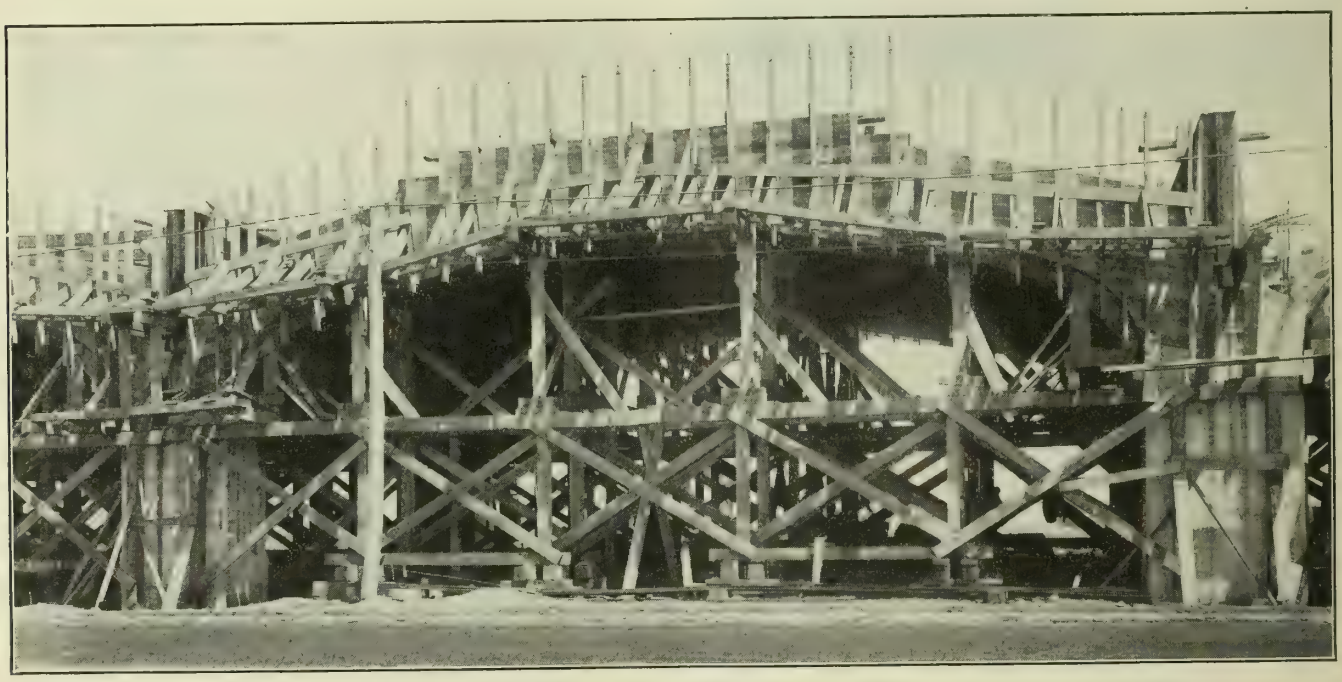


FIG. 9. ONE OF THE ARCHES OF THE QUEENS BOULEVARD WITH THE CENTERS IN PLACE

The daily rate for four-point work is from 75 to 90 sq.ft. per man per 8-hr. day, for rough-point work, about 60 sq.ft. The drafted margin is cut at the rate of about 30 lin.ft. per man per day. The above rates include the time required for shifting staging, etc.

Personnel

The concrete viaduct is a part of the Dual System of rapid transit which is being constructed by the City of New York, acting by the Public Service Commission for the First District. The design was made and the construction supervised by the Commission's engineering staff, Alfred Craven, Chief Engineer; Robert Ridgway, Engineer of Subway Construction; D. L. Turner, Deputy Engineer of Subway Construction. The construction was done under the supervision of John H. Myers, Division Engineer, and Robert H. Jacobs, Senior Assistant Division Engineer. The design was made under the personal supervision of the writer under the general direction of Sverre Dahm, Principal Assistant Engineer in charge of design, and A. I. Raisman, Senior Designing Engineer. The architectural treatment was designed under the direction of Squire J. Vickers, Designing Architect. The E. E. Smith Contracting Co. is the contractor for the elevated line to Corona, which includes the concrete-arch viaduct.

Variable-Speed Pumping Plant for a Drainage District

The pumping plant for the South Quincy Drainage and Levee District, in Adams County, Illinois, is designed to pump the drainage and seepage waters of a drainage district of approximately 6000 acres, to which an additional 4000 acres of hill drainage have to be added. This water is handled by two electrically driven double-suction centrifugal pumps with 36-in. discharge openings. They have a capacity of 60,000 gal. per min., and are operated by two 200-hp. motors. The layout of the plant is shown in Fig. 1. The current is supplied by an 11,000-volt line from the Mississippi River Power Co., which is transformed to 440 volts.

This plant has to pump all water falling in the district, as no sluiceway is provided. The topography of the county is such that many lakes can be drained by an additional 2 ft. of lift, and since these would add about 1000 acres of agricultural land it was considered best to do this. The pumps were built by the American Well Works, of Aurora, Ill., and were installed by the Farrar Pump & Machinery Co., of St. Louis, Mo.

One of the special features of this pumping plant is the chain-drive arrangement. In order to get the greatest efficiency the manufacturer recommended that the pumps be driven at 219 and 244 r.p.m. for different stages of water. To accomplish this change of speed, sprocket wheels of two different sizes are fitted to the motor shaft.

In some other plants of this kind the sprockets are slipped on and off the shaft as required. In this case, however, the two sprockets (with 30 and 27 teeth) are mounted permanently on the motor shaft, while the 59-

tooth sprocket on the pump shaft is arranged to slide longitudinally so that it can carry the chain for either one of the driving sprockets. This arrangement is shown in detail in the drawings in Fig. 2.

and allow the sprocket to be slid along the shaft. With a solid hub bored large enough to have the sprocket slide easily or freely, it was feared that it would be too loose for satisfactory operation. The split hub has a lock nut

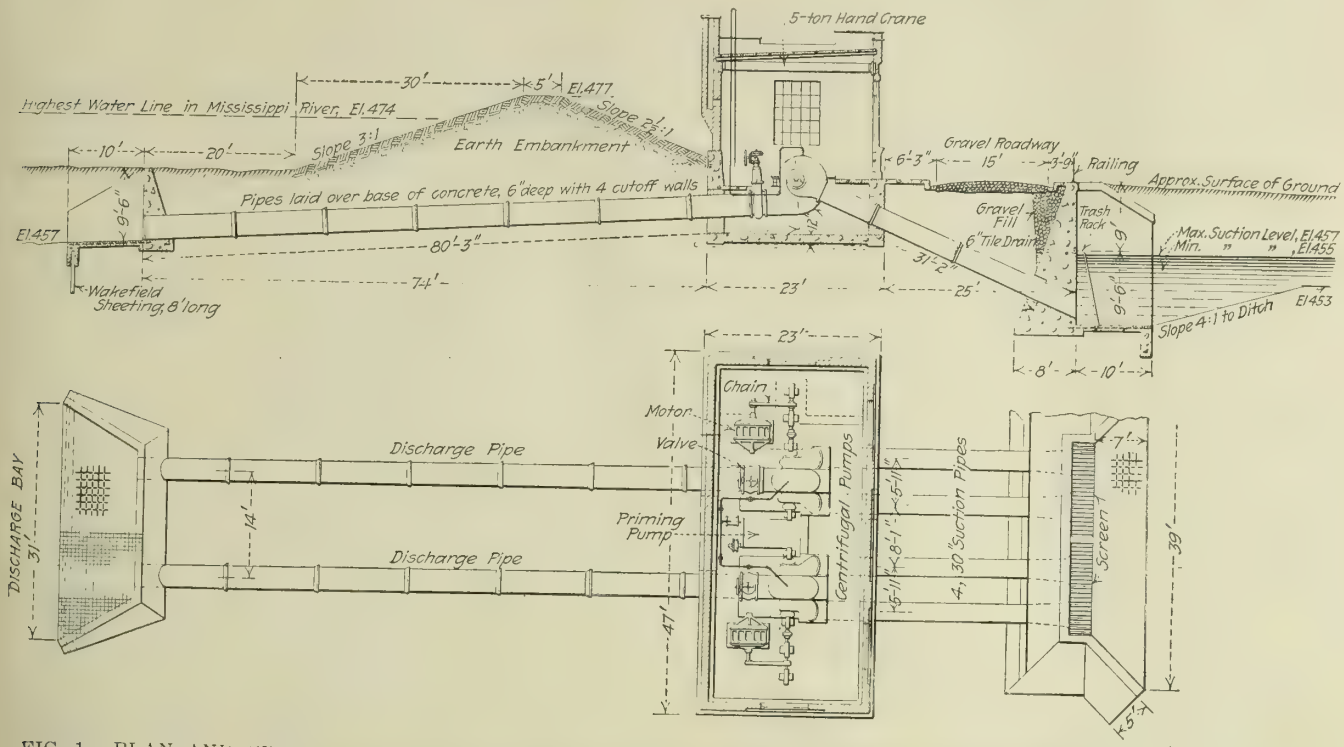


FIG. 1. PLAN AND CROSS-SECTION OF PUMPING PLANT FOR SOUTH QUINCY DRAINAGE AND LEVEE DISTRICT

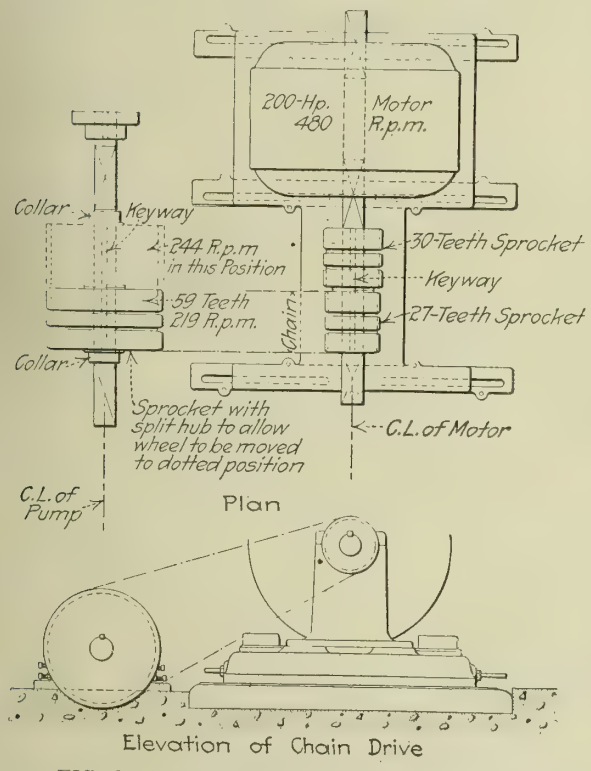


FIG. 2. VARIABLE-SPEED CHAIN DRIVE

The two pinions are fixed permanently to the driving shaft, and the chain is shifted from one to the other as required. The larger sprocket slides on the driven shaft

The larger (driven) sprocket has a split hub. At first it was intended to use a double-width sprocket, but the Morse Engineering Co., of St. Louis, advocated a single sprocket with a split hub. When shifting the chain from one driver sprocket to the other the bolt may be loosened with a key running the full length of the shaft, and is secured permanently in place.

To change the chain from one pinion to another a thin plate is employed, which is inserted under the chain after the center distance is shortened. Then it is easy to push the chain from one sprocket to another. To facilitate the work of shifting the chain, a pulley is fastened to the wall and has two clamps fitting over the chain. The two clamps are fastened close to the small pinion and its upper side. As soon as the chain is pulled out so that its lugs are clear of the sprocket, it is shifted to whichever side desired.

The drainage works and pumping plant for this district were designed by the Edmund T. Perkins Engineering Co., of Chicago. The construction was under A. H. Beitmann, who is in charge of the company's office at Quincy.

The Fees Allowed County Surveyors in Minnesota are based on a law dating back to 1867, when the Government section corners had been recently set and land surveying with a compass and chain, costing altogether less than $50, was more or less profitable. The fee then was $4 per day, and it is the same today, when a surveyor's outfit cost between $500 and $800. For a while this statutory fee was lost sight of and surveyors were able to earn a competence. A few years ago a certain county refused to pay a bill presented by a county surveyor. The case was taken into court and the old law dug up. According to N. Y. Taylor in a paper in the 1915 "Bulletin" of the Minnesota Surveyors' and Engineers' Society, there are few attractions to a county surveyor's office in that state until the old law is changed. A further reform Mr. Taylor proposes is that the notes and plats of all surveys made in a county by any surveyor be recorded by the county surveyor and the fees for the recording be paid by the county through the regular channels. The establishment and perpetuation of corners, as he says, is not a local and personal benefit, but a general and public interest. The conditions met with in Minnesota are by no means confined to that state.

Methods Used in Building the Rogers Pass Tunnel

SYNOPSIS—This 5-mi. double-track tunnel, now well advanced, will be by far the largest tunnel in north America, and is expected to be completed by the end of 1916. It is notable for the entirely new method of tunneling adopted. Intermediate headings are made practicable by driving from each end a pioneer tunnel parallel with, but distant from, the main tunnel and running crosscuts from the drift to the line of the main tunnel. Details are given of the tunneling work, timbering, concrete lining, ventilation and permanent track construction.

The 5-mi. tunnel of the Canadian Pacific Ry. at the Rogers Pass summit of the Rocky Mountains (having its east portal 80.5 mi. west of Field, B. C.) will be by far the longest tunnel on this continent, and will be large enough for a double track. It is being built not only to eliminate the present high-level summit and heavy grades, but also as a part of the extensive double-tracking plan to provide increased facilities for traffic. The tunnel project was described and illustrated in *Engineering News* of Apr. 2, 1914.

The tunnel will be 26,400 ft. long between portals, on tangent, and will have a grade of 0.95% throughout. In section it will be 29 ft. wide at rail level, with vertical sides and semicircular roof. The height will be 21½ ft. from base of rail to crown, or 23 ft. above subgrade. Construction was commenced in September, 1913, and the contract calls for completion within 3½ yr. (by Dec. 3, 1916). This necessitates rapid and steady progress, and for this purpose a novel method of driving the tunnel was devised by the contractors and approved by the railway company's engineers.

Two Pioneer Side Tunnels Employed

To drive this long tunnel from the two ends only would have involved a protracted period of construction, and in order to expedite the work it was highly desirable to attack it at various points by means of intermediate headings. Shafts as used for tunnels at moderate depths were out of the question for this great Rocky Mountain tunnel. Nor were there opportunities for the use of adits (or horizontal shafts), such as have been employed in exceptional cases of side-hill tunnels.

The method devised was to drive from each end a pioneer tunnel or drift parallel with the main tunnel, but about 50 ft. distant from it. From these two drifts lateral drifts or crosscuts are driven to the center line of the tunnel at intervals of 1,400 to 3,000 ft. From each of these points the main tunnel heading is driven, working usually in the upgrade direction. This method gives numerous points of attack on the main tunnel. The drifts serve for the removal of material by the mucking cars, the ventilation of the headings and the placing of pipes and cables clear of the tunnel construction work. The two pioneer

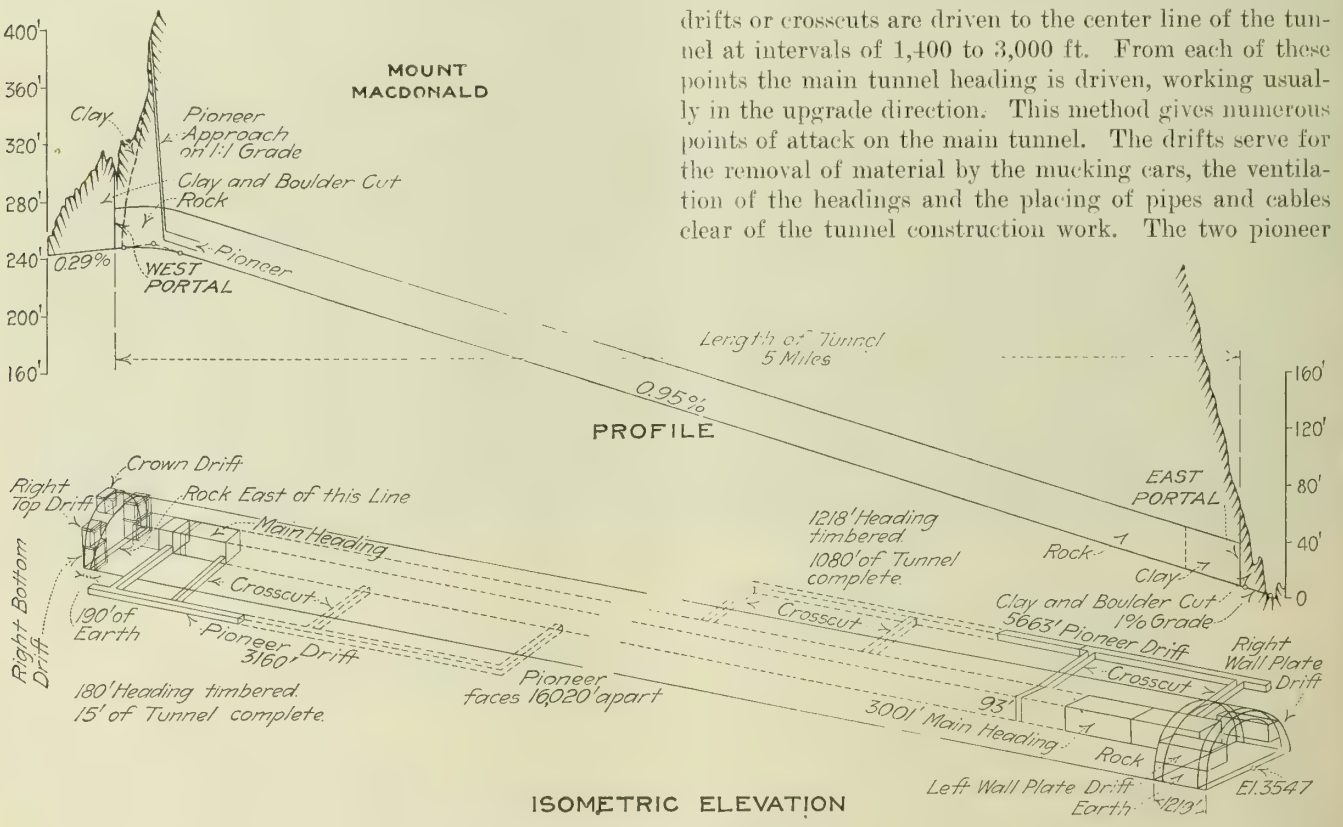


FIG. 1. ISOMETRIC SECTION AND PROFILE OF THE ROGERS PASS TUNNEL, CANADIAN PACIFIC RAILWAY

The tunnel is being driven from intermediate headings reached by crosscuts from two pioneer drifts or tunnels parallel with but 50 ft. distant from the main tunnel, and on opposite sides of the tunnel line

drifts, however, are on opposite sides of the line of the tunnel, the drift at the east end being on the north side and that at the west end on the south side of the tunnel. Thus they cannot be extended to form a continuous passage, and each drift will be somewhat shorter than the half length of the tunnel.

These drifts and crosscuts were intended simply to facilitate the work on the tunnel, and their construction is entirely at the contractors' expense. It was not intended to use them permanently, and in fact if loose ground

is encountered they may be filled with concrete after the completion of the work. There seems to be a possibility, however, that they may be utilized in the ventilating system for the finished tunnel, as noted further on.

The nearest approach to a previous use of this system in driving long tunnels was in the construction of the first Simplon Tunnel in Switzerland. A small drift was run on one side parallel with and a little in advance of the main tunnel, and connected with it by lateral drifts. But in this case the main tunnel was for single-track only, and the parallel drift was intended for use temporarily as a part of the ventilating system and eventually to be enlarged to form a second single-track tunnel. Its enlargement for this purpose to meet the traffic requirements of the Simplon route was begun in 1913 and is now under way. The rate of progress and cost of work on the great Canadian tunnel are considered to have amply justified the driving of the auxiliary construction drifts.

The method of construction is shown clearly in the isometric drawing, Fig. 1. The pioneer drifts and crosscuts are of rectangular section, 8 ft. wide and 6 ft. 6 in. high. The main or central heading, also rectangular, is 11 ft. wide and 9 ft. high. Working from each portal, this main drift is being enlarged to the full tunnel section shown in Fig. 2.

The object aimed at by the novel method adopted for the construction has been attained. This is shown by the fact that the steam shovels (one working at each end) have advanced at the rate of 1,636 ft. per month for the last three months. On July 25 the two pioneer tunnels were stopped when they were 5,202 ft. apart. Crosscuts were made to the center or tunnel headings at these points, and the remaining mile of center heading will be driven and the drilling for enlargement completed before the mucking shovels reach these last crosscuts.

Up to Aug. 19 there had been driven 10,740 ft. of pioneer heading at the east end and 8,870 ft. at the west end. There were 7,366 ft. of main heading driven at the east end and 8,352 ft. at the west end. On that date the most advanced headings were only 4,677 ft., or 0.89 mi. apart. The shovels on the enlargement of the tunnel to full section have advanced 5,612 ft. at the east end and 4,300 ft. at the west end, leaving 16,488 ft. to be covered. Of the concrete lining at the ends about 1,600 ft. has been completed. The progress up to Aug. 1 was given in *Engineering News* of Aug. 12, 1915.

Driving the Drifts and Headings

To save time and excavation the pioneer drifts were started considerably above the grade of the tunnel heading. The drift at the east end starts about 50 ft. above grade and is practically level, so that the first two crosscuts slope down to reach the main heading. From the point where the drift strikes the same elevation as the tunnel it rises with the tunnel grade of 0.95% and the crosscuts are level. The drift at the west end starts about 130 ft. above grade and descends on a sharp incline of 50% grade for 230 ft., which brings it to the elevation of the tunnel heading. Beyond this the drift is on the same grade as the heading and the crosscuts are level. At first the muck cars were hauled up this 50% incline by cables. After the full tunnel section had reached the first crosscut the cars were diverted through this into the tunnel (starting Apr. 29), as described below, thus eliminating the use of this incline.

Drainage of the face of the west pioneer drift (working down grade) is handled by a pump at the face and two intermediate station pumps. It is not expected that much water will be encountered in the rock, but in the loose material at the ends it has been necessary to pack hay behind the timbering of the side-wall drifts to prevent washing in of soil.

The muck from the pioneer drift and the various points on the main heading is hauled in ½-yd. cars through

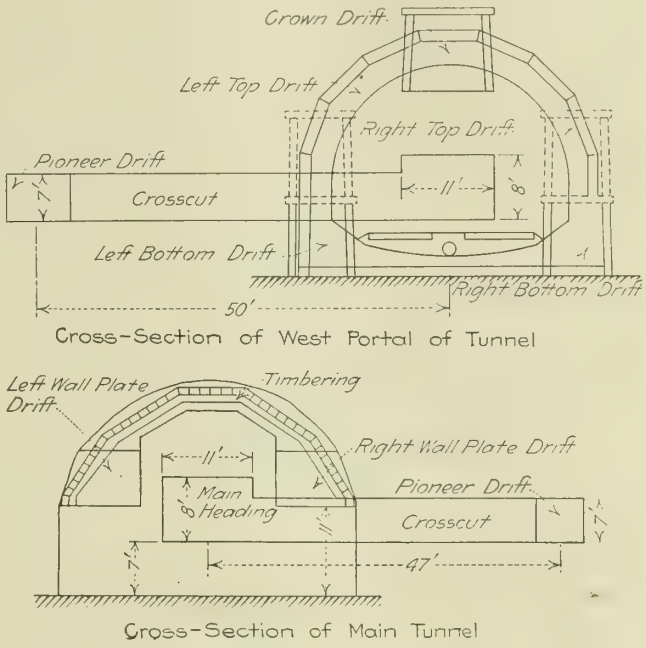


FIG. 2. METHODS OF DRIVING THE ROGERS PASS TUNNEL FROM THE PORTALS

the drift (and crosscuts) to the nearest crosscut which has been reached by the full tunnel section. Here the cars are diverted to enter the tunnel and dump their contents into the 12-yd. standard-gage cars which serve the mucking shovels at the face. The shovels are air-operated machines of about 40 tons with 1- and 1½-yd. buckets.

The ½-yd. cars were at first hauled by mules, but narrow-gage compressed-air locomotives are now used. The larger cars are hauled by 10- and 12-ton compressed-air locomotives working between the face and the sidings for loaded and empty trains. These trains are handled by 40-ton six-wheel steam locomotives between these sidings and the outside dumping places. At the east and west ends the muck is dumped to form the long approach embankments to the tunnel.

Drilling and Power Plant

In driving the pioneer drifts at the east end four Leyner drills are mounted on a bar. These put in about 24 holes 6 ft. deep, 1¼-in. top and 1⅛-in. bottom diameter. Each hole is loaded with from 4 to 8 lb. of 50% dynamite. Three to six rounds are usually fired per day of 24 hr. (three 8-hr. shifts). Similar drills are used in the center bench, drilling rounds of 26 holes 6 ft. apart, or 225 lin.ft. per round. These sections or "rings" are shot off for muck as required.

The compressed-air plant at each end includes two compressors supplying air at 125-lb. pressure for the drills and shovels and one supplying it at 950-lb. pressure for the locomotives. The latter has a capacity of 750 cu.ft. of free air per minute, while the two others have capacities

of 1,000 and 2,000 cu.ft. Each locomotive has storage capacity sufficient for a 1-mi. run with a load, and the 1½-in. high-pressure main is extended into the tunnel, providing air stations about 2,000 ft. apart.

Driving the Portal Headings

For driving the full tunnel section from the portal in the east end two side drifts, 7x8 ft., were driven, with floors about 18 in. below the level of the wall plates for the roof centering. These were connected by a curved crown drift so that the centering could be placed, and the inclosed "core" then removed. The construction is shown in Fig. 2.

For similar work at the west end the two timbered side drifts were at grade and were about 6 ft. wide and 8½ ft. high. Upper-side drifts, 6x7 ft., were driven above

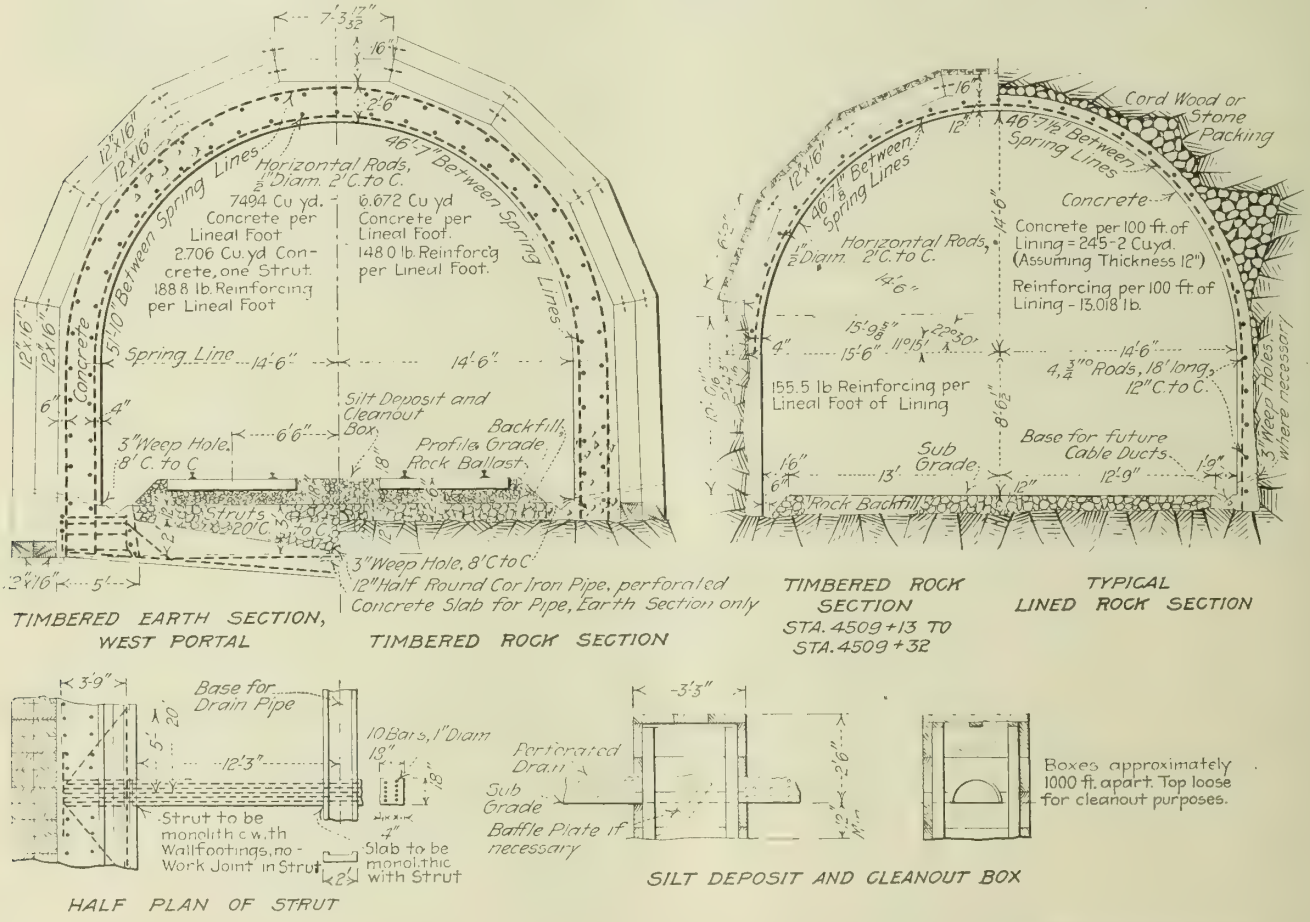


FIG. 3. CROSS-SECTIONS OF THE ROGERS PASS TUNNEL, SHOWING TIMBERING AND CONCRETE LINING

these, the muck being delivered through the roof timbering of the lower drift into cars standing in that drift. A crown drift 8 ft. wide and 9 ft. high was also driven on the center line (Fig. 2). The material between the crown and upper-side drifts was then broken through and the timbering placed outside the line of the future concrete lining.

Timbering and Concrete Lining

With the exception of several hundred feet of clay and glacial drift at each end, the drifts are in solid rock, which is expected to continue throughout the entire length. It is mainly slate, schist and quartzite. No timbering is required in the rock excavation.

For the end portions, which are in loose material and are timbered, a concrete lining is required. This is 30 in. thick and 483 ft. long at the west end and 27 in. thick and 1,288 ft. long at the east end. In addition, on account of the spalling of the rock, some concrete lining may be required in the solid-rock section at the west end. Typical sections of the tunnel, with its timbering and concrete lining, are shown in Fig. 3. The timbering in the glacial drift consists of a semicircular roof arch supported on 12x16-in. posts. The timber sets are usually spaced 18 in. c. to c., but are set close where the material is loose and contains water. The arch has five or seven segments, usually single, but sometimes double.

An interesting feature is that for the lined section in loose material the heavy footings of the side walls are braced by reinforced-concrete struts 20 ft. apart. These are 18 in. wide, 24 in. deep at the ends and 18 in. at the middle. They are formed monolithic with the footings and with the longitudinal concrete slab for the support of the track drain.

The concrete for the tunnel lining is mixed by concrete mixers on the outside and loaded into cars, which are hauled into the mouth of the tunnel by a dinkey. A cable from a hoisting engine hauls the cars up to the work. The concrete is dumped into the forms for the side walls from an elevated track on scaffolding, but is shoveled by hand into the arch form above the level of the scaffolding. Timber forms are being used, as the amount of concrete does not justify steel forms.

For ventilating the working places in the center bench and main tunnel there is a large blower installed in each pioneer drift. This is set up to draw pure air through the drift and discharge it into the center bench through a crosscut ahead of the center-bench drills.

For ventilating the faces of the pioneer drift and advance heading two exhaust fans of the Connersville type (with 12-in. wood-stave pipe) are used, placed usually near a crosscut. From this point the exhaust pipe is carried to within 25 ft. of each face. A gate is provided so that the fan can exhaust from either face as required. Only one of these fans is worked at a time, so that one can be moved while the other is in service. The fan is started at each blast, and the men can return to work in from 15 to 25 min. By opening the 1½-in. air line for the drills the smoke and fumes can be cleared away from the face so that they will be removed by the exhaust.

At the portal of each pioneer drift there has been installed a multivane fan 5 ft. in diameter, which forces air into the drift. This air is diverted into the main tunnel whenever required. For instance, after shooting in the enlargement to full tunnel section the air is turned in at a cross-drift beyond the point of shooting. In this way the smoke and gases are cleared out of the tunnel very rapidly.

The compressed-air pipes, ventilating pipes and telephone lines are laid through the pioneer drifts and crosscuts, so that they are not affected by blasting and do not interfere with the work of the mucking shovels in the full tunnel section. No electric lighting is used. The men carry acetylene lamps and acetylene headlights are applied on the mucking shovels and the locomotives.

Working Force and Staff

The force per 8-hr. shift in the pioneer drift is as follows: Four drillers (4 drills at each end), 2 helpers, 8 to 10 muckers, 1 nipper, 1 driver, 1 shift boss, 1 to 4 mules and about 40 cars.

The force per 8-hr. shift in the advance heading of the main tunnel is as follows: Three drillers (3 drills at each end), 2 helpers, 8 to 10 muckers, 1 nipper, 1 driver, 1 shift boss, 1 mule, and 60 to 80 cars (according to the length of haul). In addition, there is the following force on each 10-hr. shift to cover the two small drifts in each end: One assistant superintendent, 1 walking boss, 2 blacksmiths, 2 blacksmith helpers, 12 laborers, 10 dump men, 6 teamsters, 14 mules, 1 hoistman and 7 pipe-fitters, carpenters, mechanics, etc.

The center bench of the main tunnel is worked in 8-hr. shifts with 7 to 10 drills, 7 to 10 helpers, 5 to 10 muckers, 1 shifter, 1 driver and 1 mule.

The completion of the main tunnel to full section is worked in 10-hr. shifts, with the following force per shift: One driller, 1 helper, 1 to 2 powdermen, 1 engineman and 1 craneman on the mucking shovel, 10 to 12 pit men at the shovel, 1 general foreman, 1 foreman and 12 to 15 laborers for the dump and track work, 2 compressed-air dinkey locomotives with 2 enginemen and 2 brakemen, 1 steam locomotive and 1 engineman, 1 fireman, 1 conductor and 2 car-repair men.

The contractors for the tunnel are Foley Bros., Welch & Stuart, of Winnipeg, and A. C. Dennis is their superintendent. The work is under the direction of John G. Sullivan, Chief Engineer, Canadian Pacific Ry., and W. A. James, Engineer of Construction.

In the finished tunnel the tracks will be spaced 13 ft. c. to c., and will be laid with 85-lb. rails on wood ties embedded in 18 in. of stone ballast. Beneath the ballast will be 12 in. of rock fill, the floor of the excavation being carried down 12 in. below subgrade. A semicircular drain of corrugated iron will be laid in the rock fill beneath the tracks, the pipe being perforated for the admission of water. In general it will be laid on the rock floor, but in the loose material at the ends the pipe will be laid on a concrete slab of channel section, supported by the concrete struts between the footings of the side walls (Fig. 3).

The plans for the tunnel project originally contemplated the introduction of electric traction in the tunnel and over a distance of about 25 mi., and no artificial ventilation was then considered necessary. This feature of the project has been abandoned and a ventilating system is to be installed to avoid possible troubles due to smoke and gas in the 5-mi. bore. The definite plans for this system have not been determined, but possibly it may be found practicable and economical to utilize the construction drifts, with their lateral connections to the tunnel, as part of the permanent ventilating system. These drifts, as described in the foregoing, are outside of and parallel with the tunnel, but do not form a continuous passage.

Interior Temperature Changes in Mass Concrete

In the current *Proceedings* of the American Society of Civil Engineers, C. H. Paul and A. B. Mayhew, of the United States Reclamation Service, in a paper entitled "Temperature Changes in Mass Concrete," have described in detail some experiments made at the Arrowrock Dam in Idaho to determine the temperature changes in the interior of mass concrete as affected by outside temperatures and conditions of setting. The final conclusions of the tests are as follows:

1. Large bodies of concrete deposited rapidly during the summer season develop a temperature of from 90 to 95° within a period of about 30 days, and maintain nearly that temperature for several months.

2. In the case of concrete 1 ft. from an exposed face there is a daily variation in temperature of about 2° when the daily variation in the temperature of the air is about 50°.

3. In the case of concrete 2 ft. from an exposed face there is a daily variation of less than 1° when the daily variation in the temperature of the air is about 50°.

4. In the case of concrete 3.5 ft. from an exposed face, no daily variation in temperature is apparent when the daily variation in the temperature of the air is about 50°.

5. The seasonal variation in the temperature of concrete 3.5 ft. from an exposed face is about 32° when the seasonal variation in the mean daily temperature of the air is about 75°.

6. The seasonal variation in the temperature of concrete 10 ft. from an exposed face is about 12° when the seasonal variation of the mean daily temperature of the air is about 72°.

7. The seasonal variation in the temperature of concrete 20 ft. from an exposed face is very little, and after the effect of "setting heat" has once been overcome, the change in temperature of concrete at that distance from an exposed face is so slight as to be negligible under ordinary conditions.

8. The effect of the "setting heat" in concrete 20 ft. or more from an exposed face is felt for several years after the concrete is placed. Concrete near the center of mass of a large dam probably retains some of this "setting heat" for 5 yr. or more after placing.

9. Contraction joints are desirable in all large concrete structures, whether or not they are to be exposed to wide variations of outside temperature, except possibly when all construction may be carried on during cold weather and when the variation of outside temperatures, after completion, will be slight.

10. Changes in volume due to setting, hardening and seasoning of concrete are more important, ordinarily, except very close to exposed faces, than changes in volume due to the influence of daily or seasonal variations in outside temperatures.

Laying Creosoted Wood-Block on 5 Per Cent. Grades

By J. R. West*

In connection with the Bell St. warehouse of the Port of Seattle there are certain elevated roadways on grades varying from level to 5¼%. Generally these roadways are carried on timber structures, and in order to reduce the dead-load as much as possible it was decided to try creosoted-wood block, although the grades are rather steep for this type of pavement. On the level portions the



FIG. 1. LAYING CREOSOTED WOOD-BLOCK PAVEMENT ON A 5% GRADE

Showing expansion transverse joint and wood-strip joint fillers

blocks were laid with tight joints, but on the grades creosoted-wood spacing strips ½ in. thick and 2½ in. wide were laid in all joints. The blocks were 3 in. depth, which gave a notch ½ in. wide and ½ in. deep between the rows of blocks to afford foothold for horses.

The blocks were cut from sound Douglas-fir lumber containing an average of at least five annual rings per inch, and at no point less than four annual rings per inch; and it was required that the lumber should consist of at least 40% of dense summer wood. Sound knots not over 1½ in. in diameter were permitted, but no knots were allowed to show on the upper surface.

The blocks were required to be air seasoned before being treated. The treating was done by boiling, from 16 to 18 lb. of creosote per cubic foot of wood being forced into the blocks. This amount was then reduced to about 10 lb. by expansion and vacuum. The preservative was a pure coal-tar creosote oil. The pressure was not allowed to run higher than 100 lb. per sq.in., and the oil temperature was about 180° F.

In order to protect the timber structure underneath the pavement from moisture, two layers of Barrett's No. 2 roofing felt mopped with tar were laid as a waterproofing membrane. This membrane was carefully turned up at the edges of the pavement and around the drain inlets, and care was taken to insure thorough waterproofing of the foundation.

The blocks were laid directly on the felt membrane, without sand cushion. This, however, appeared to be a mistake, for the blocks absorbed enough water after the first hard rain to cause a considerable movement at some of the expansion joints, and the blocks being embedded in the tar apparently ruptured the waterproofing membrane at various points, where it was found to leak.

After the blocks were laid and driven tight a joint filler consisting of a dry mixture of one part portland cement and three parts fine sand was used. It was heated to a temperature of about 200° F., spread over the pavement and swept into the joints, the excess being allowed to remain on the surface. Expansion joints 1½ in. wide were placed along the curbs and across the roadways every 80 ft. These were filled to one-half the depth with a high-grade asphalt mixed, while the asphalt was hot, with 20% by weight of portland cement and sand in equal parts. This type of expansion joint has, however, not proved satisfactory, because the sand and cement settled to the bottom and formed a mass so hard that the joints failed entirely to allow compression. It has been necessary to chop out these joints and replace the filler with asphalt. After the joints were partly filled as noted, dry sand was spread over the pavement to a depth of about ½ in. and allowed to remain there. A considerable portion of this sand was worked into the joints by traffic. The remainder was removed after the rainy season had set in, for it acted like a sponge, holding the water and not permitting the blocks to dry out. The pavement was not slippery either before or after the sand was removed; in fact, teamsters who have used this pavement in hauling heavy loads have stated that it was easier to start a load on a 5% grade on this pavement than on a brick pavement.

Outside of the minor difficulties which have developed, and which are not inherent with this type of pavement, the experiment has been very satisfactory and certainly



FIG. 2. FILLING UPPER HALF OF JOINTS WITH HOT SAND AND CEMENT

*Chief Engineer, Port of Seattle, Washington.

demonstrates that a creosoted-wood-block pavement can be used on steeper grades than have been thought safe.

This pavement, including the waterproofing, was laid at a cost of $1.44 per sq.yd. The contractor was the Ferguson Construction Co., of Seattle, and the blocks were furnished by the Pacific Creosoting Co., which has assumed the maintenance of the pavement for a period of five years and has offered many valuable suggestions.

The plans and specifications were drawn and the construction inspected by the engineering organization of the Port of Seattle.

Plans for the Hetch-Hetchy Construction Railroad

The site of the Hetch-Hetchy dam, to be built on the headwaters of the Tuolumne River in California to store water for the future supply of San Francisco, is in a deep valley of the Sierras, at an elevation of nearly 4,000 ft. above sea level and distant nearly 70 mi. from the nearest railway line.

A wagon road exists to the side of the dam, but it has been determined that the amount of material to be handled during construction of the dam will be so large that it will pay to build a railway to the dam site, even though the entire cost of the railway line has to be included in the cost of the dam.

Under direction of City Engineer M. M. O'Shaughnessy surveys have been made and plans and specifications have been prepared for the construction of a railway line 67 mi. in length, and bids for the work are now being advertised for. The line follows the general course of the Tuolumne River most of the way, but as the river runs much of the distance through a narrow cañon with walls nearly vertical, it was not practicable to follow the river closely, and the location is on an elevated bench at some distance from the river.

Location of Road

The railway branches from the Sierra R.R. at an elevation of 935 ft., drops to 589 ft. to cross a valley and then ascends with a somewhat broken profile to a maximum elevation of 5,064 ft., finally dropping down for 6 mi. on a continuous 4% grade to the dam site. Most of the climb going to the dam is made on a 3.4% grade. Adverse grades for all eastbound traffic and for part of the westbound traffic are compensated for curvature at the rate of 0.04 of 1% per degree of curvature.

As the road runs through an exceedingly rough and broken country, is to be operated for freight traffic chiefly and is a construction railroad rather than a permanent line, sharp curvature has been freely used in location. The sharpest curve is 30°, and curves of 18 to 26° are very numerous. It is intended to lay guard rails on curves sharper than 12°.

Notwithstanding the fact that the railway is a construction line, complete detailed specifications have been prepared for the construction. The work involves an estimated quantity of over 1,000,000 cu.yd. of excavation, more than half of it in rock, about 6,700 lin.ft. of corrugated-metal culverts, 40 mi. of fencing, laying 69 mi. of track, including yards and sidings, and nearly 500,000 ft. of lumber in trestles.

An unusual classification is adopted for excavation, the material being classified as granite, solid rock, soft rock and earth, although alternative bids are invited for the entire excavation without classification. The reason why granite and solid rock are classified separately is that the Sierra granite, of which over 160,000 yd. is included in the estimate, is a very much harder rock to drill and break up than the slates, sandstones, shales and other solid rocks occurring along the line. The granite classification includes all masses of granite excavated of 1 cu.yd. or more. The solid rock includes all pieces of rock of 1-cu.ft. or more volume. Soft rock includes all cemented materials that can be removed without blasting.

The roadbed is to be 16 ft. wide at subgrade, and slopes on embankments are specified as 1½ horizontal to 1 vertical. The limit of free haul is 400 ft., and overhaul is paid for at the rate of 1c. per cu.yd. per 100 ft. excess.

Metal Culverts

For galvanized-metal culverts, alternative bids are asked on "pure iron" and on "copper-bearing steel," the first being specified to be 99.81% pure iron and the steel to have between 0.20% and 0.30% of copper. The galvanizing is to be done with not less than 2 oz. of prime spelter per square foot. (1 oz. on each side), to be determined by the lead acetate method. Corrugations are to be spaced between 2½ and 3 in. and ½ to ⅝ in. deep. The longitudinal joints must have a lap of at least 1½ in., with rivets in each outside groove, and the transverse joints are to have rivets not more than 6 in. apart.

Concrete pipe of a 1:2:4 mixture may be used as an alternative to metal pipe.

Details of Trackwork

Ballast of broken stone, of gravel or of selected materials from the excavation may be used, and separate bids are invited for the different classes. The ballast is to be 6 in. deep under the ties, must extend 6 in. beyond their ends and must be level with the top of the ties.

Ties are to be of redwood or cedar, 6x8 in. and 8 ft. long. Rails are to be 60-lb., Am. Soc. C. E. section, of bessemer steel, conforming to the standard specifications of the American Society for Testing Materials as revised in 1914. Tie plates are expected to be used on all ties. Ties are to be spaced 2,880 per mile. Two spikes are to be driven in each tie on the outside of the outer rail on all curves sharper than 8°.

Structures on the Line

Both ballast-deck and open-deck trestles are specified. The ballast rests on a layer of 3x12-in. flooring over the trestle stringers. This flooring is covered by ⅛ in. of approved asphalt roofing, reinforced by an extra asphalt coat of about ½ lb. per sq.ft.

A bridge of 220-ft. span is to be built across the Tuolumne River near Jacksonville, and with three plate-girder spans on the approaches will require about 600,000 lb. of steel. The bridge is to be designed for Cooper's E-35 load.

Eight redwood water tanks of 100,000 gal. each and two steel oil tanks 17x12 ft., to contain fuel oil for the locomotive, are required, as well as station buildings.

The contractor is to complete the entire railway ready for operation within 300 days from the signing of the contract and is to be subject to a penalty of $750 per day for each day's delay in completion over the contract time. No work on Sundays is permitted.

Concrete Pile and Cylinder Foundations at Charleston

SYNOPSIS—Special methods in securing foundations of reinforced-concrete torpedo-boat berth at Charleston, S. C., described in "Engineering News," Nov. 4, 1915. Piles spudded down and cylinder foundations laid in novel manner.

In the construction of the government torpedo-boat berth at Charleston, S. C., foundation difficulties arose because of the subsoil of marl and a tough but plastic clay overlying the marl in the outer half of the site.

The reinforced-concrete piles for the quay wall, 18 in. square and 50 ft. long for the three rows on the river side and 16 in. square by 40 to 45 ft. long for the other two rows, were made nearby on land, in horizontal

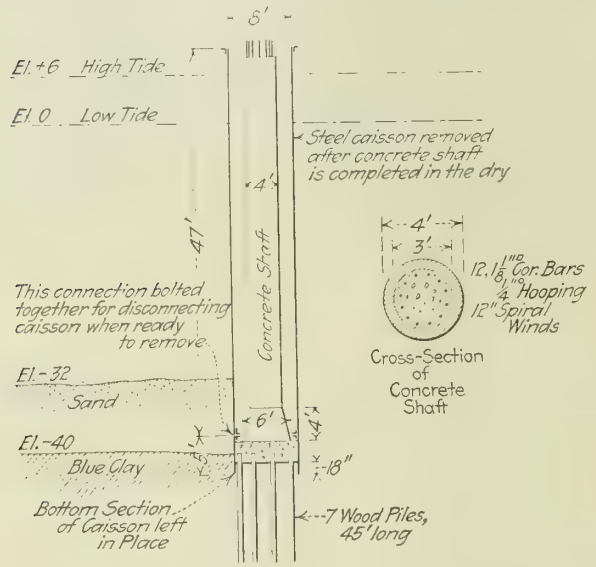


FIG. 1. CYLINDER, COFFER-DAM AND CONCRETE PILE

molds. The reinforcement consists of four longitudinal 1¼-in. square corrugated rods and ¼-in. ties 18 in. on centers. The piles were allowed to set 30 days before being moved. When ready for driving they were picked up by a 15-ton locomotive crane and loaded on a barge, which was towed to the point where the piles were to be driven.

Each pile had a 2-in. jetting pipe molded in it longitudinally for a distance of 17 ft. from the point, with two 30° bends at the upper end to bring the pipe to the face of the pile.

The piles penetrated approximately 10 ft. through soft mud, 15 ft. through stiff blue clay and 15 ft. into marl. Attempts to drive them with a hammer failed. It was impossible to get them down into the marl more than a short distance, even after jetting down four 2-in. holes in advance of the pile. In this difficulty a "spudding" method was adopted.

With the pile standing in the leads of the driving rig at the point where it was to be sunk, hose from a pressure pump was connected to the 2-in. pipe in the pile and the pump started. Then the pile was raised 2 ft. and allowed to drop, and this process was repeated in as rapid succession as possible until the pile was down within 6 in. of the proper depth. The water was then cut off and the last 6 in. spudded down in the same way, but without any water being forced through the jet pipe.

The derrick traveler shown in Fig. 2 was used for driving the piles. Guide-blocks bolted to the front of the forward cross-piece of the traveler frame furnished an upper guide for the piles. As a lower guide a cross-timber just above water level was supported from the traveler frame and braced to it, and sawed through in the way of each pile row so that it could move forward past the piles already driven. Swinging backing-strips were fastened to the timber behind the openings cut in the way of the pile rows, to serve as rear guides. The pile was lifted and dropped by the hoist rope of the derrick, which was fastened to a hook that was clamped to the four reinforcing rods of the piles that extended 18 in. beyond the head of the pile.

Piers Built in Cylinder Coffer-Dams

The concrete piers supporting the causeway and outer pier were built inside 8-ft. cylinder coffer-dams, 42 to 52 ft. long, made of ⅜-in. steel plate. The lower 5-ft. length of the coffer-dam was connected to the remainder by a butt joint fastened by bolts through angle rings riveted on the inside. The bolts were spaced 12 in. on centers, and for additional tightness the joint was calked with oakum. This cylinder was driven into the river bottom until it entered 4 ft. into the blue clay, and the inside was excavated to a short distance above the cutting edge. Then the foundation piles were driven in it, the bottom sealed with concrete, a form set up on the seal concrete and the shaft concrete poured. Finally the coffer-dam cylinder was removed, after unbolting the joint near the bottom. The 5-ft. cutting-edge section was left in the ground as part of the pier.



FIG. 2. DERRICK TRAVELER FOR PILEDRIVING

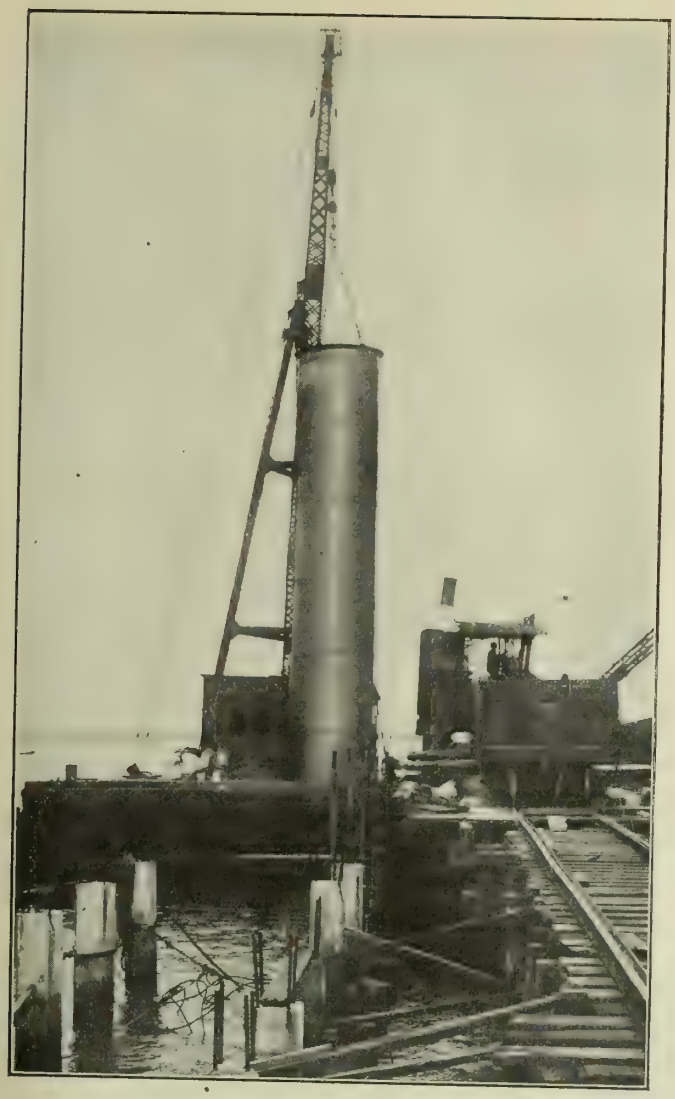


FIG. 3. LOWERING COFFER-DAM CYLINDER TO PLACE

Fig. 3 illustrates the procedure of setting the cylinders. This work was done at slack water, to avoid disturbances from the strong tidal currents. The cylinder, with bottom section attached, was picked up by a 25-ton floating derrick equipped with an 85-ft. steel boom, centered carefully while being held about 15 ft. above the bottom and allowed to drop so as to sink deep into the river mud. When thus placed the cylinder was braced three or more ways with light tackle to guide it during the subsequent driving. A grillage of 24-in. steel I-beams riveted together and with guides for a steam hammer attached was placed over the top, and a No. 1 Vulcan hammer with 5,000-lb. ram falling 42 in. held in these guides would drive the cylinder down to the required grade. The aim was to drive the cutting edge of the bottom section not less than 4 ft. into the clay, or 2 ft. into the marl, which amounts were generally sufficient to seal the bottom against blowing in when the cylinder was pumped dry.

A ¾-yd. orangepeel bucket, operated by the derrick scow, excavated the cylinder to the desired grade. In some cases the driving was resumed after excavation, to get the desired penetration of the cylinder for safety against blowing in of water. After excavating with the orangepeel, in the case of marl bottom the cylinder was pumped dry and the bottom leveled by hand digging, to receive a 3-ft. bottom course of concrete placed in the dry. Where the bottom was clay, the cylinder was pumped out, the bottom leveled by hand digging and the seven piles accurately spotted in the dry. If the clay was very firm, the piles were driven in the dry, but the cylinders were generally filled with water before piledriving was begun. After all the piles were driven, the cylinders were again pumped out, the piles sawed off and the 3-ft. bottom course of concrete placed in the dry.

Difficulties in Sinking Cylinders

The shoreward half of the causeway went through the old berthing pier, built of creosoted piles, and in placing the cylinders for this portion of the causeway the old piles interfered greatly. The ⅜-in. plate of the cylinder buckled easily at the cutting edge when it struck a pile, so that it was necessary to remove the piles before placing the cylinders.

The old piles were so badly eaten by borers and had been driven so deep into the clay that it was found necessary to use dynamite to remove them. For this purpose a 4-in. pipe with a 4-in. tee on top was connected to a 2½-in. fire hose supplied from a pressure pump, and the pipe was jetted down alongside the pile to be removed until its bottom was about 1 ft. below the proposed bottom of the cylinder. Then the water was shut off, the plug of the tee on top of the pipe removed and four or five sticks of 60% dynamite were lowered through the pipe until they rested on the bottom. The pipe was then raised about 10 ft. for protection, a good strain taken on the pile with the derrick and the dynamite exploded. This would break the pile off at the point of the explosion, and the strain from the derrick in connection with the lifting action of the dynamite was sufficient to pull the upper part of the pile. This method of using dynamite 45 ft. below water proved very successful.

Trouble was also caused by logs which had caught in the old piling and had become embedded in the river bottom. Many of these were 18 to 24 in. in diameter and were embedded as much as 15 ft. It was necessary to do considerable dredging with the orangepeel bucket and to shoot off blasts of dynamite under them before they could be removed with the bucket. Here also the dynamite was placed through the 4-in. pipe, as was done in removing piles.

Driving Foundation Piles in Cylinders

When it was decided to drive foundation piles for the concrete cylinder piers where they rested in clay a special floating piledriver was designed, as the piles had to be driven to a top elevation of from 36 to 50 ft. below high water. This driver was built on a 22x70-ft. barge, with the head end cut square; 68-ft. leads were built on the barge, overhanging the end of the barge 8 ft., with the bottom of the leads about 10 ft. above the water line. Extension leads 60 ft. long slid in the fixed leads. They could be lowered down to within 10 ft. of the bottom of one of the cylinders and still leave sufficient of the extension leads between the fixed leads to hold them securely in line. A No. 1 Vulcan hammer slid between the extension leads; to its lower end was fastened a hardwood follower 44 ft. long, with a special steel striking head on top and a 14-in. pipe sleeve at the lower end. Two short pieces of channel attached to the follower 10 ft. above its lower end slid over the extension leads and held it in place.



FIG. 4. EXPANDING STEEL FORM FOR CONCRETING PIER SHAFTS

The procedure in driving the foundation piles was to set them in place to form a ring 6 ft. in diameter and drive them in succession either to grade or to refusal. The piles were 45 ft. long, with 12-in. butt diameter, and had to be driven either so that the head would be embedded 6 in. to 30 in. in the 3-ft. bottom course of concrete or until the piles should take up with a penetration of ½ in. per blow.

The extension-lead driver rig worked very satisfactorily. In one cylinder all seven piles after being spotted were driven to grade in 1 hr. 20 min.

After driving and cutting off the piles the broken-up earth at the bottom of the cylinder was removed by hand digging in the dry, whereupon the 3-ft. bottom course of concrete, engaging the pile heads, was put in place.

The reinforcing cage of the pier shaft, comprising twelve 1⅛-in. square corrugated bars tied together with ¼-in. spiral hooping, of 12-in. pitch, was set directly after the sealing concrete was placed, so as to embed the rods at least 2 ft. in the concrete. This anchored the shaft concrete to the 3-ft. bottom course.

The day after pouring the footing course the top was cleaned of laitance or dirt and the form for the 4-ft. concrete shaft set in place around the reinforcing cage. This form, shown in Fig. 4, was a cylinder built up of $\frac{3}{16}$-in. steel, with conical enlargement at the bottom to form the spread foot of the shaft. The form was made with three vertical bolted joints. By unbolting one of these joints after the shaft concrete had set, the form would expand sufficiently so that it could be lifted off without difficulty.

Concrete for the footing course was run into a 1-yd. bucket from the chute of the concreting tower and the bucket lowered to the bottom of the hole and dumped. The concrete for the shaft, however, was run direct from the chute of the floating concrete plant into the top of the form and allowed to drop inside the form.

Great care was taken to have the form absolutely tight before placing and also to have the inside well oiled. On stripping, the piers were almost always perfectly smooth, an occasional stone pocket being immediately filled with mortar and floated with a wooden float.

Three days after the pier was poured the bolts in one of the vertical seams of the inside form were removed and the form lifted off with the derrick scow. The bolts

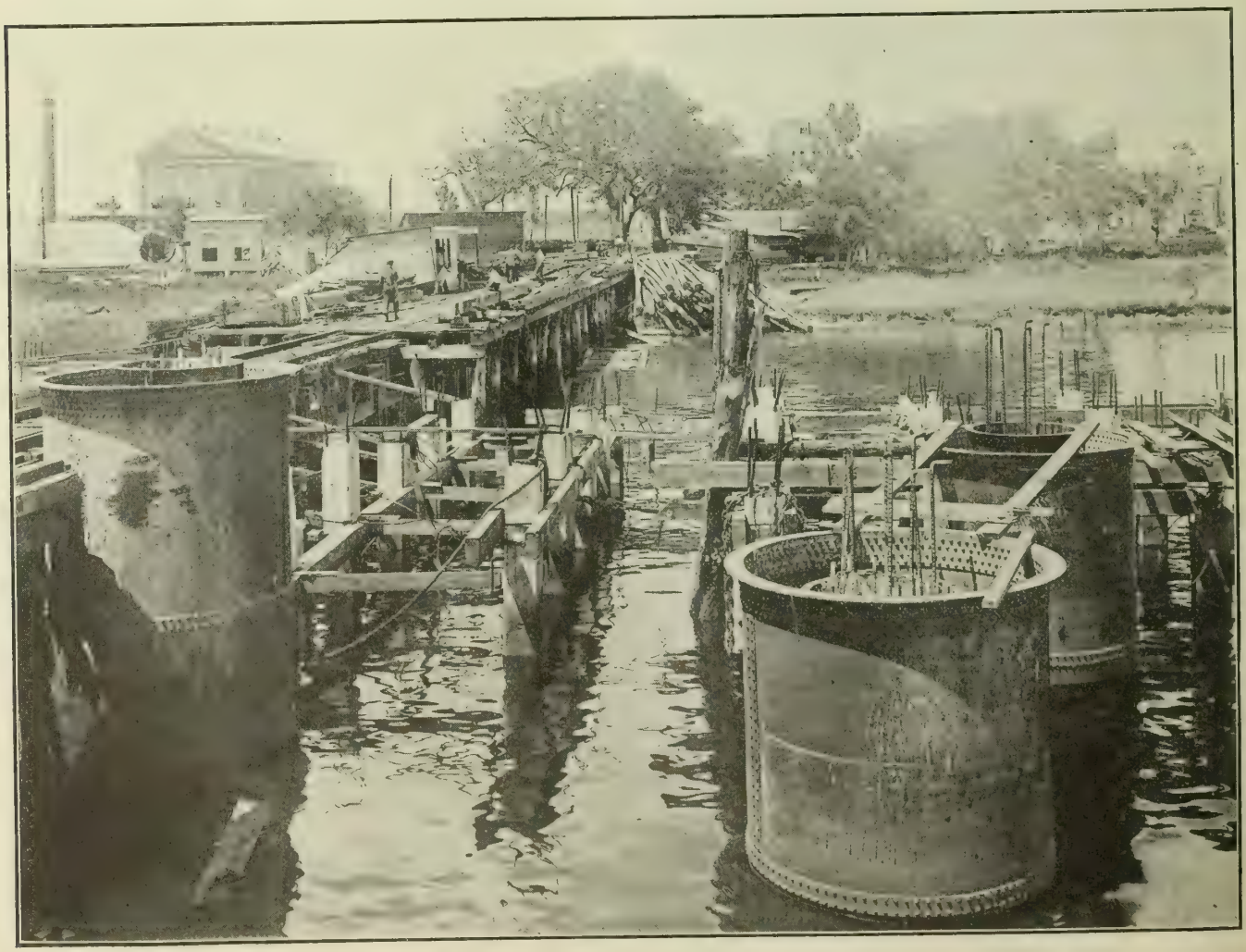


FIG. 5. PIER COFFER-DAMS OF CAUSEWAY

connecting the 8-ft. coffer-dam cylinder to its bottom section were also removed, and after the concrete pier shaft had been inspected the cylinder was hoisted away. However, as the specifications required that the concrete be protected from flowing water for at least 20 days, a square wooden box was lowered over the shaft to serve as a shield.

The work is being done by the Snare & Triest Co., New York City. G. C. Muñoz and G. P. Seeley were superintendents of construction and Captains F. T. Chambers and R. E. Bakenhus represented the Bureau of Yards and Docks, United States Navy Department.

Special Railway Track for Philadelphia Streets

The extensive waterfront improvements to be made at Philadelphia will require the laying of several miles of railway track along the streets to serve the docks and piers. For these lines a special design of rail section and track construction has been approved by the authorities of the city, the Pennsylvania R.R., Baltimore & Ohio R.R. and Philadelphia & Reading R.R. The following information has been secured from W. G. Coughlin, Engineer of Maintenance of Way, Pennsylvania R.R.

The rail (Fig. 1) is of the grooved-girder type, 9 in. high and 5¾ in. wide, weighing 159 lb. per yd. and made in 33-ft. lengths. The guard side of the groove has a flare of 60° and its top is ⅜ in. below the railhead, although the paving is laid level with the railhead. On curves, however, the guard is carried up as high as the head and is made very heavy, as shown by the dotted lines. It will be observed that the guard is narrow and does not

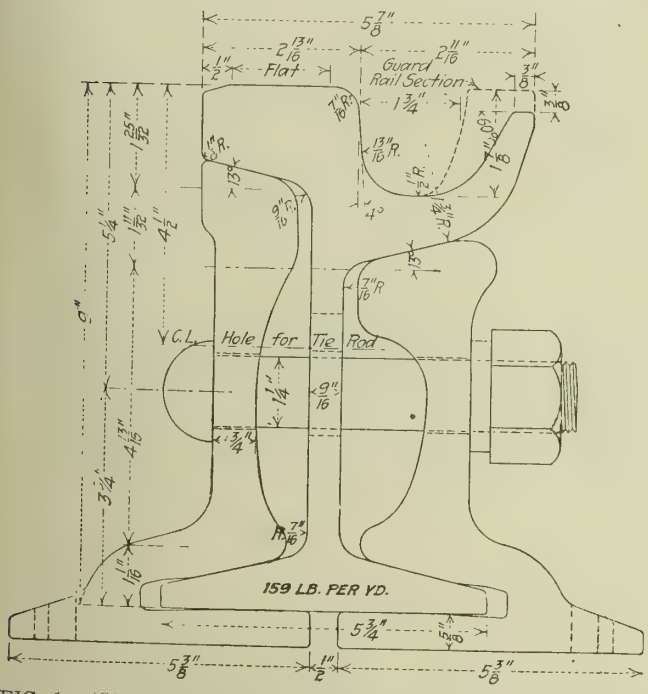


FIG. 1. 150-LB. GROOVED GIRDER RAIL FOR RAILWAYS IN PHILADELPHIA STREETS

have a horizontal outer flange to carry wagon wheels, as in some designs of grooved-girder rails for street railways.

The rail joints are of the Continuous make, with heavy splice bars of special design. The bars are only 26 in. long, with four 1¼-in. bolts spaced 5½ in. for the inner and 7½ in. for the outer bolts. The rails rest on ⅝-in. steel tie-plates 7x10¾ in., which have an outside top shoulder to hold the rail and a bottom rib to secure a hold in the tie. Ordinary ⅝-in. square spikes are used. For each tie-plate there are four spikes, only two of which hold the rail, the others serving to hold the plate tight upon the tie even if the rail spikes work loose. At the

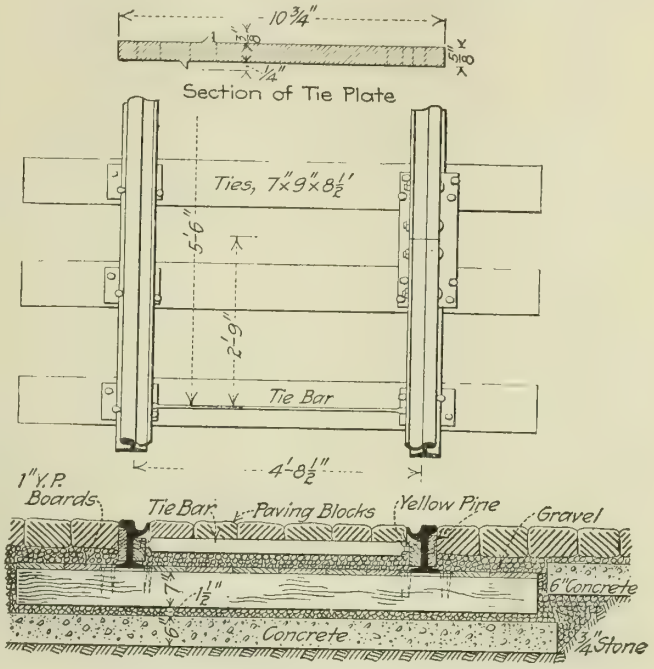


FIG. 2. RAILWAY-TRACK CONSTRUCTION ON PAVED STREETS IN PHILADELPHIA

joints, spikes are driven first in the slots of the splice bars, and after the bars have been drawn tight by the bolts extra spikes are driven through holes in the bars. The details of the trackwork are shown in Fig. 2.

The rails are laid with broken joints, and at intervals of 5 ft. 6 in. they are connected by flat tie bars 2¾x⅜ in., having 1⅛-in. threaded ends which pass through the rails and are secured by square nuts on both sides of the web. The ties are 7x9 in., 8½ ft. long, with 18 ties to a rail length.

The subgrade is 24⅛ in. below top of rail, and on this is a 6-in. concrete base. Stone ballast is laid with a depth of 1½ in. under the ties and is filled in between and around them. An unusual feature is the laying of 1-in. planks on top of the ties to support a 3-in. bed of gravel upon which the stone paving blocks are laid. In the spaces on each side of the rail web are laid yellow-pine fillers, 2x6 in. on the outside and 3x6 in. on the inside. Outside of the track the paving blocks rest on a thinner cushion bed on a 6-in. concrete base.

Home Garbage Disposal at Milwaukee—In every Milwaukee home there will be more or less fire from now on until the warm weather returns. These fires in stove and furnace should do more than give us warmth. There is little or no use for a garbage can in the Milwaukee home that is supplied with a good furnace. If garbage is drained, wrapped in paper and placed on the glowing coals of the furnace, it will be completely and effectively destroyed, and if this is done promptly after each meal and before there is decay there will be no disagreeable odors or nuisance of any kind. This method of destroying garbage has been tried by members of the Health Department for a number of years. None of them reports any trouble. To most of them the method has become a convenience so much greater than the garbage can that they would not think of returning to the can as a receptacle for the winter's accumulation of garbage.—Milwaukee "Health Bulletin."

Pennsylvania R.R. Electrifies Philadelphia District

SYNOPSIS—A 15 to 20% gain in capacity of each suburban passenger line can be secured by changing from steam to electric traction. Single phase selected for possible trunk-line operations. Overhead construction on the Paoli line; changes in signal system and rolling stock.

The Pennsylvania R.R. is now operating the suburban line between Broad St. Station, Philadelphia, and Paoli—the first of its electrified lines in that district. This change and the proposed electrification of the other suburban lines have been undertaken to increase the capacity of the Broad St. Station and relieve congestion.

Change Made to Increase Capacity

This terminal is of a stub-end type, with 16 station tracks approached by six main-line and three yard tracks on an elevated structure. At West Philadelphia the main lines branch off, going north to New York, west to Pittsburgh and south to Washington. The suburban service extends over six different routes, as shown in the sketch, Fig. 1.

All the plans for relief by physical enlargement involved extensive reconstruction and much delay, and therefore the possibilities of electric traction were analyzed. It was found that the change on the Paoli line alone would increase its capacity by about 19%, giving for the station as a whole an increase of about 8%. A similar increase in capacity would result from the electrification of the other suburban routes, and work on the Chestnut Hill line has already commenced.

Although the work done on the Paoli line includes the most expensive part of electrifying the whole district—the Broad St. terminal, with its elaborate yards and restricted property lines—yet there will be sufficient saving in operating cost over steam to pay the interest on the additional investment; that is, the increased capacity will be largely self-sustaining, which would not be the case with physical enlargement.

Alternating-Current System Selected

The 11,000-volt single-phase 25-cycle alternating-current system was selected, power being supplied directly to the train from an overhead catenary-trolley system. The primary factor affecting this choice was the possibility of long-distance operation over the entire suburban division, rather than the requirements of present short suburban electric service. This is in marked contrast to the reasons for the selection of 600-volt direct current for the New York terminal zone some years ago.

Although the possible future electric traction may extend over several railway divisions and cover various classes of service, yet the present installation is for suburban passenger service only and involves about 43 trains each way between Philadelphia and Paoli, west on the main line of the Philadelphia division. From Broad St. Station the main tracks are electrified for 20 mi. A coach yard at West Philadelphia and a coach and repair yard at Paoli have been equipped. A total trackage of 93 mi. is affected.

Electric Power Is Purchased

Power will not be generated by the railway company, but will be purchased from the Philadelphia Electric Co. For the present power will be taken from only one phase of the power company's three-phase generating system. It is planned to supply future electrification from the remaining phases. Current is generated by the electric company at its main station on the east bank of the Schuylkill River and is delivered over four three-conductor armored submarine cables to the railroad company's Arsenal Bridge substation on the westerly bank. Here the current is stepped up from 13,200 volts to 44,000 and is distributed over four single-phase overhead transmission

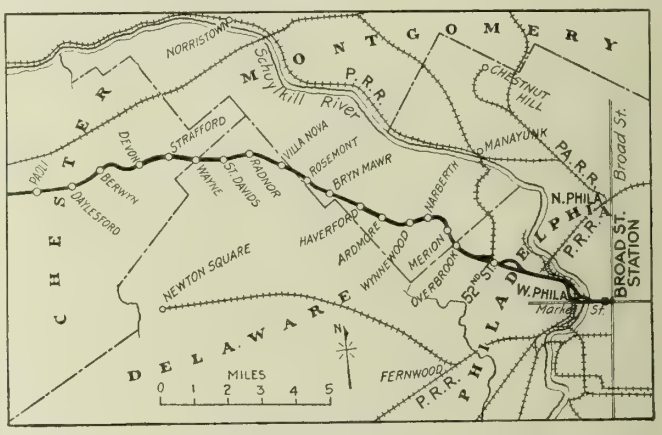


FIG. 1. MAP OF PENNSYLVANIA R.R. SUBURBAN LINES AT PHILADELPHIA

lines, two carried on each side of the track. All four transmission lines go to the West Philadelphia substation (Fig. 1); one pair continues to Bryn Mawr and Paoli and the other will later run to Chestnut Hill. The transmission-line insulators are tested for 250,000 volts puncture and 120,000 volts wet flashover. After erection the transmission lines were tested out at a potential of 66,000 volts to ground—three times working pressure (since the middle of the transformer secondaries is grounded the working potential is 22,000 volts above earth).

The substation equipment is housed in substantial fireproof brick buildings adjacent to the track. Lightning arresters and high-tension feeder section switches are located on the roof. Busbars and switching equipments are on the second floor and transformers on the first. At Arsenal Bridge (Fig. 1) there are three 5,000-kv.-a. step-up transformers and at the three other substations there are two 2,000-kv.-a. step-down units. Space is provided for 100% increase in capacity. In each station there are two small transformers stepping down to 440 and 220 volts for operating circuit-breakers for lighting and miscellaneous purposes. Sixty-cycle power is also provided in all substations to operate circuit-breakers in case of loss of 25-cycle traction power. There are no attendants in the substations, except at West Philadelphia. For the control of the other substations switchboards are provided in nearby signal towers.

The overhead-line construction in many ways resembles that worked out by the same engineers for the Norfolk & Western Ry., Elkhorn grade, as noted in *Engineering News* of June 24, 1915. The principal feature is the tubular-pole cross-catenary bridge supporting the longitudinal catenary and running wires. As shown in Fig. 2, a tubular steel pole is set in concrete foundations on either side of the track and double-guyed away from the track. Between the poles over the tracks are two cross-wires forming the cross-catenary bridge. Where there is no room for back-guying, self-supporting structural-steel posts have been used.

Details of Overhead System

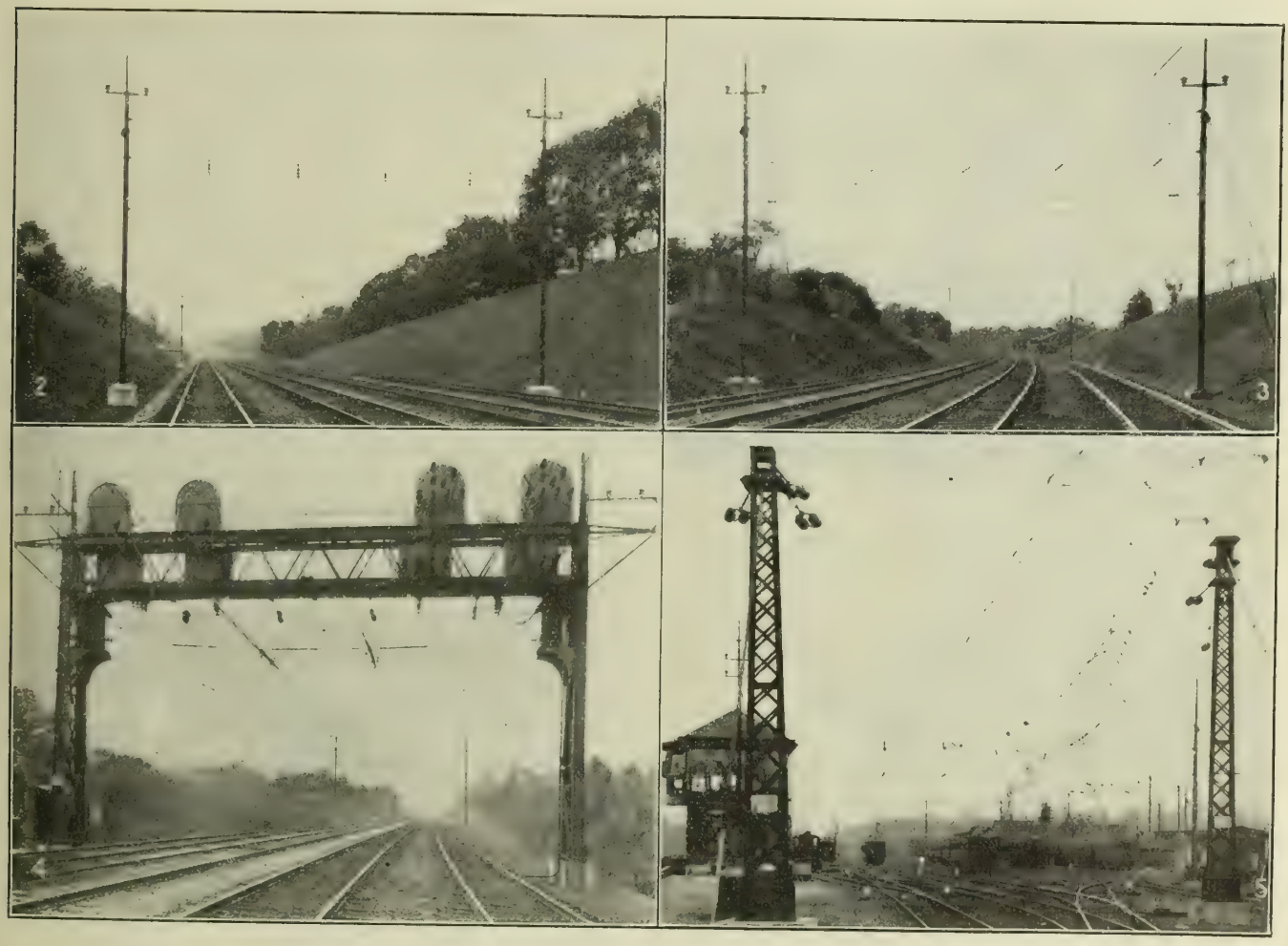
The tubular poles are built up of various lengths, sizes and weights of steel pipe welded together to meet the varying conditions of different locations. The guys are solid-steel rods, with a heavy turnbuckle near the ground end to permit of adjustment. The anchors are of the dead-weight type, consisting of a concrete slab reinforced with old rails. Where the guy rods pass up through the soil they are protected by steel pipe filled with grout. Each steel structure is grounded by connecting to a copper plate buried in coke.

The cross-catenary bridges are about 300 ft. apart on tangents but closer on curves, the spacing depending upon the degree of curvature. The insulators holding the longitudinal wires are over the center of each track, being offset on curves toward the outside.

The cross-wires are of galvanized-steel cable, the upper one usually ¾ in. and the lower one usually ½ in. in diameter. Both are socketed at each end with a turnbuckle at one side. The top and bottom wires are joined by vertical ¾-in. rods and malleable-iron clamps at the points where insulators supporting longitudinal wires are located. The insulators are of the three-disk suspension type. Each disk is 8 in. in diameter.

The main longitudinal messenger is a ½-in. seven-strand double-galvanized steel cable, strung with a sag of 5 ft. in a normal span of 300 ft. Every mile or two this cable is socketed and dead-ended on one of the structural signal bridges spaced about half a mile apart (Fig. 4). The messenger is insulated from the bridge by two or more sets of three-disk suspension insulators.

Every 15 ft. on curved track and 30 ft. on tangent track two wires are supported from the messenger. The top wire—called the auxiliary—is of No. 0 round copper, giving proper current-carrying capacity to the overhead system. The lower wire is a No. 000 grooved bronze alloy ("phono-electric"). Both wires are about 22 ft. above the top of rail, except where they pass under certain highway bridges



FIGS. 2 TO 5. OVERHEAD LINE CONSTRUCTION OF PENNSYLVANIA R.R. AT PHILADELPHIA
Fig. 2—On typical tangent. Fig. 3—On typical curve. Fig. 4—Signal and anchor bridge. Fig. 5—In Paoli yard

Provision Against Corrosion

In the terminal and along the first 5 mi. out, where the steam-locomotive traffic is dense and there is much smoke and corrosive gas, a noncorrodible tube hanger and hanger clips of monel metal and bronze are used. Where

the steam traffic is not dense wrought-iron strap hangers 1 in. wide by $\frac{3}{16}$ in. thick are employed. The main messenger cable is protected from corrosion at brass or monel-metal hanger clips by an inside zinc collar.

On tangents the hangers hold only the auxiliary messenger and the running wire is supported at mid-span. On curves where the two lower wires do not hang directly beneath the messenger both wires are supported at the same point from the hanger. Rigidity is here prevented by the chance for upward swing.

The tension in all cables is selected so that in hot weather there will be no sagging of the running wire, while in cold weather the contraction will not cause stresses beyond the elastic limit.

The running-wire catenary system for each of the four main tracks is separated electrically from the others,

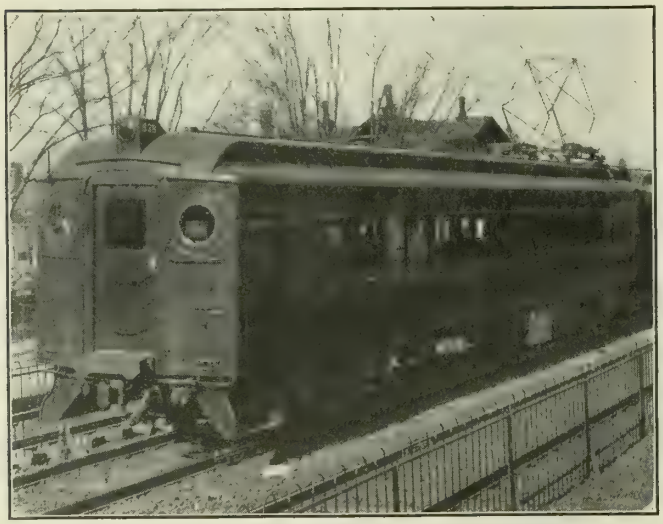


FIG. 6. STEEL MOTOR CAR, PENNSYLVANIA R.R.

and sectionalizing points are provided at all crossovers so that parts of the line may be cut out of service for repair.

Wires Under Highway Bridges

The electrified route is crossed by numerous overhead highway bridges with limited clearance over the track. In such cases where it is impractical to raise the highway bridge, the trolley wires are dipped. The catenary bridges are so located that the highway bridges come in the center of the span and where the vertical height necessary to clear the catenary system is at a minimum. The overhead line is steadied by being held with post-type insulators on brackets on the bridge structure. Transmission lines on either side of the track are also carried down underneath the bridge.

To prevent curious pedestrians from coming in contact with the wires solid wooden fences, either vertical or inclined, and of sufficient height to shut out all view of the wires, have been erected. To protect trainmen general orders have been issued that no men be allowed on top of the cars in the electric zone.

Bonding Rails; Preventing Induction Interference

Each rail of the main-line track is double bonded throughout with No. 0 copper. Through interlockings only one rail of each track is bonded, but all the traction rails are connected together. The bonds have pin-expanded terminals, one being welded and the other soldered on, after the bond has been slipped under the fishplate. At each signal block the track rails are sectionalized by insulating joints. The traction current is led through impedance bonds connected around the insulated joints (allowing the 25-cycle traction current to flow, but preventing the 60-cycle signal current from passing).

Minimum inductive effect of traction currents on adjacent telephone and telegraph wires has been secured in much the same way as on the Norfolk & Western Ry. Series transformers are located about a mile apart along the line and the full traction current is led through the primary windings. The secondary coils are connected across insulated joints in the track so that at this point all returning traction current must pass through the rails. These transformers are shown in place on tower brackets of a signal and anchor bridge in Fig. 4.

Changes in Signal System

Throughout the electrified lines it was necessary to change the existing direct-current signal track circuits to alternating current. For about 15 mi. of four-track line the old form of semaphore signals has been replaced by one with hooded electric lamps arranged in three rows like the semaphore positions of clear, caution and danger. These are shown in Fig. 4. Nearly all the old signal bridges had to be replaced by heavier ones to provide anchorages for the catenary system.

The inductive effect of traction current in the signal circuits is killed by resonant shunts (capacity and resistance in series, adjusted so that they present zero impedance for the 25-cycle current).

Power for the operation of the signals is supplied by the West Philadelphia and Paoli substations. At West Philadelphia there are two 150-kv.-a. motor generators running on the trolley bus and furnishing current at 3,400 volts and 60 cycles over three single-phase feeders. An emergency transformer carried on an outside supply furnishes single-phase, 60-cycle current for signal lighting in emergency.

Throughout the electrified zone, telephone and telegraph wires have been put underground on account of damage from sleet storms. Along the main line these wires are carried in clay conduits or bituminized fiber ducts. To minimize induction disturbances the conduit is located as near the edge of the right-of-way and as far from the tracks as possible. The main signal-power cable is lead-sheathed and carried in a pitch-filled pump log run on top of the main bank of conduits.

Besides the usual telephone facilities between substations and between the power director and train dispatchers, there are permanent telephone boxes on every signal bridge—approximately half a mile apart.

Steel Rolling Stock

The traffic is carried entirely by motor cars. The standard steel suburban coaches have been used without structural changes. This was possible, since the requirements for mounting electric apparatus were considered at the time when the car was introduced. Each car carries two 225-hp. single-phase air-cooled motors, mounted on one truck. The other truck does not drive. Each motor car is complete with one 11,000-volt pantograph trolley, oil circuit-breaker, main transformer, switch group and limit switch, resistance, and two master controllers, one motor-generator set for supplying the control energy, one

control battery, four nine-point train-line receptacles and one train line jumper, one combined blower and compressor unit, and one complete air-brake equipment. All of the main pieces of electrical apparatus are mounted on one end of the car and the air-brake equipment is mounted at the other end. This puts approximately 60% of the total car weight on the driving wheels. The cars are fitted for double-end control and operation.

The motors are connected in series and are started and operated up to about 15 mi. per hr. as repulsion motors with the auxiliary field, armature and main field in series. The running steps for higher speeds place the auxiliary field on one part of the car transformer and the armature and main field on the other portion. Subsequent steps are obtained by increasing the motor voltages. Between the motor shaft and the driving wheels are flexible gears, each made up of a rim, a center and intermediate springs, which equalize the rapidly pulsating torque of the single-phase motor and prevent unpleasant vibration in the car frame.

The air-brake equipment is electro-pneumatic (the Westinghouse U. C., which has been generally adopted by the Pennsylvania R.R.). The application is made simultaneously on all the cars by electrically controlled release, service and emergency sections of a "universal valve" which replaces the "triple valve" of the older air-brake systems. This equipment may be used with either steam or electric traction.

Engineering and Construction

The design and construction described were carried out by Gibbs & Hill, of New York City, as consulting engineers for the railroad company, but in coöperation with the engineering department and officials. All construction except for substation buildings and inspection buildings (which were built under outside contracts) was carried on by specially organized force. The motor-car equipment and important electrical apparatus was furnished by the Westinghouse Electric and Manufacturing Co., but the mounting of the car equipment was carried out by railroad forces under the motive-power department. The signal equipment and changes in telephone and telegraph lines were designed and installed under the direction of the signal and telegraph departments, the equipment being made by the Union Switch and Signal Co. Tubular poles were made by the National Tube Co., structural material by the McClintic-Marshall Co. and Belmont Iron Works; overhead wires by J. E. Roebling's Sons Co., Waclark Wire Co. and Bridgeport Brass Co.

Flat or Adjustable Bearings in Brick Tests—Ordinary flat (rigid) bearings for testing brick in compression are nearly as good as self-adjusting bearings, according to an extended series of tests just reported in the October "Journal" of the Association of Engineering Societies. E. L. Baker and A. F. Suss, students in Washington University, made the tests. The series included about 300 tests. To get comparative values, each brick was first broken in cross-bending and then the two pieces tested in crushing, each by a different method. The bearing surfaces were chipped flat with cold-chisel and hammer, but were not bedded. Two forms of spherical bearing were used—(1) a one-piece bearing, consisting of a rocker shoe the curved surface of which rested on the platen of the testing-machine, while the other (flat) face supported the brick; and (2) a ball-and-socket bearing. The comparison values of crushing strength obtained in the tests are: One-piece spherical bearing to flat-plate bearing, 1.03; ball-and-socket bearing to one-piece bearing, 1.12. The ball-and-socket bearing gave the highest average crushing strength, 9,340 lb. per sq.in. These brick averaged 2,600 lb. per sq.in. in modulus of rupture.

Load Distribution on Concrete Slab Floors

The Highway Department of the State of Ohio (Clinton Cowen, Commissioner) has issued as Bulletin No. 28 a résumé of a long series of tests made to determine the distribution of concentrated loads to the beams and girders under a reinforced-concrete floor slab. The tests were both on laboratory specimens and on the floor of an actual bridge. The pamphlet is too long to abstract here, but as an indication of its contents the summary of the results is given below. The object of the tests was to obtain, if possible, a sufficient knowledge of the distribution of loads through and by concrete floor slabs to enable the designer rationally to proportion the joists of a slab floor, and also the slab itself to carry concentrated loads.

Practically all heavy loads on highway-bridge floors except the dead-load are concentrated on small areas, such as the wheels of a road roller or heavy motor truck. In the design of reinforced-concrete floors, therefore, there are two assumptions which must be made:

(1) In designing the supporting joists or stringers, how much of a concentrated load on the slab is carried by the joist immediately below it and how much is distributed by the slab to other joists? (2) In designing the floor slab itself, what width of slab may be considered as carrying a concentrated load resting upon it?

A satisfactory theoretical solution of these questions is impossible, as it involves the elastic properties of both concrete and steel in flat slabs and beams with multiple supports, and requires so many assumptions that any results thus obtained would be little better than assuming the distribution at once.

The following conclusions regarding the distribution of concentrated loads on a reinforced-concrete slab to the floor joists seem to be warranted by these tests:

1. The percentage of reinforcement has little or no effect upon the load distribution to the joists so long as safe loads on the slab are not exceeded.

2. The amount of load distributed by the slab to other joists than the one immediately under the load increases with the thickness of the slab.

3. The outside joists should be designed for the same total live-load as the intermediate joists.

4. The axle load of a truck may be considered as distributed uniformly over 12 ft. in width of roadway.

5. If the slab has ample grip on the upper flange of the I-beam and is continuous over the floor-beams, and the joists are riveted to the web of the floor-beams, the live-load stress in the joist may be but one-half as great as for a similar load on the bare I-beam supported at its ends.

6. Under these favorable conditions the axle load in a panel of not more than 20 ft. may be assumed as uniformly distributed over two-thirds of the length of the joists considered as simple I-beams supported at the ends. Without these conditions the load may be assumed as uniformly distributed over a length of at least 5 ft.

In a slab of a certain span and indefinite width there is some width symmetrical with the load beyond which a single concentrated load will have no effect. The stresses in this slab will be a maximum under the load and will decrease in each direction from it.

The "effective width" of a slab is that width used in designing over which a single concentrated load may be considered as uniformly distributed on a line down the middle of the slab parallel to the supports.

The tests of slabs seem to warrant the following conclusions:

1. The "effective width" is affected very little by the percentage of transverse reinforcement (parallel to supports).

2. The "effective width" decreases somewhat as the load increases.

3. The "effective width" in percentage of the span decreases as the span increases.

4. The following formula will give a safe value of "effective width" where the total width of slab is greater than $1\frac{1}{3}$ S + 4 ft.: $e = 0.6\,S + 1.7$ ft., where e is effective width in feet and S is the span in feet.

Tests and studies of the same problem are being made by Philadelphia, but so far without results.

Substructure of the Lake St. Bascule Bridge at Chicago

By Hugh E. Young*

SYNOPSIS—Foundation work on one of the heaviest drawbridges ever built, a double-deck double-leaf bascule. Anchor piers in open wells. Steel sheetpile coffer-dam for main piers.

The double-deck double-leaf bascule bridge now being built across the river at Lake St., Chicago, was described by the writer in *Engineering News,* Nov. 4, 1915. The substructure consists of a tailpit and an abutment at each side of the river. The tailpit is a concrete box resting in four cylinder piers carried down to solid rock, the walls of the pit acting as beams. The piers are spaced 34 ft. laterally so as to provide for a possible future double-track subway on Lake St. North of the tailpit are foundation walls for the operators' houses. These rest on pile foundations. The abutments are supported on groups of piles driven on each side of the street, and act as beams, spanning the space that would be occupied by a future subway.

The depth of excavation for the tailpit necessitated special care to protect adjacent buildings and the elevated railway structure. Work did not proceed simultaneously on both sides of the river due to the fact that the scows for delivering material and removing excavated material effectually blocked the channel adjacent to the pier under construction, and it was necessary that one draw be left clear for the passage of the river traffic. Work was started Mar. 30, 1914, by the Fitzsimons & Connell Co., contractors for the subway.

General Method of Working

The general method of conducting the work on the east side was as follows: Excavation was carried down to a general elevation of about 3 ft. above datum, giving about 38 to 40 ft. clear headroom under the elevated structure. A land piledriver was rigged up to clear the elevated structure, and all piles were driven. It was occasionally necessary to dig a hole for the point of the pile, in order to get the butt in under the hammer. By doing this piles about 25 ft. long could be driven.

As the four-story brick building on the north side apparently rested on floating foundation, steel sheeting was driven to protect it. The contractor braced the structure by tying the outside walls together by means of rods connected to timbers on the outside faces. During the excavation a reinforced-concrete wall inclosing the subsidewalk basement of the building on the south side of the street had to be removed. This was broken up by light charges of dynamite without any accident. The foundation piles under the operator's house on the north side of the street were also driven.

The coffer-dam was next constructed. This consisted of a double row of Lackawanna steel sheet-piling for the portion in the river and a single row of steel or wood piling for the portion on land. Where channel clearances permitted, two rows of sheeting were driven about 7 ft. apart; but the rows for the front wall of the coffer-dam were 3 to 5 ft. apart. The two rows were tied together with rods and the space between filled and puddled with clay dredged from the river. The sewer on the north side was diverted through a trough outside of the coffer-dam.

A derrick was then erected on the north side to handle the excavation from the coffer-dam. Its mast was carried by a group of piles near the north support of the rear girders supporting the elevated structure, and the stiff-legs were anchored to the coffer-dam. The derrick hoist was erected on a pile foundation outside the coffer-dam.

As the excavation for the tailpit proceeded the coffer-dam was braced by four horizontal tiers of 12x12-in.



FIG. 1. CONCRETING PLANT AND TOWER

The materials are delivered on scows. The view shows the west end of the old swingbridge, with the columns of the elevated railway approach carried temporarily on a box girder spanning the tail-pit of the new bridge

cross-bracing. One tier of bracing was placed about 18 in. above datum; the others were 6, 13 and 19 ft. below datum. The bracing was supported by means of old piles and partly by suspension rods from the temporary box girders carrying the columns of the elevated approach. The material was loaded into buckets, which were lifted out by the derrick and dumped into a scow alongside the coffer-dam. The excavation was rushed day and night, with men working in three shifts.

When the excavation for the tailpit was practically completed, that for the subpier wells was started. The 8-ft. anchor-pier wells were started first and were dug as open wells, being excavated about 5 ft. at a time and then lined with 3x6-in. tongued-and-grooved maple lagging in

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lengths of 4 ft. 8 in., each length being held in place with two or three rings of 1x4-in. steel. These rings were made in two sections, with a lug bent on the end of each for bolting together. The wells were excavated in this manner to solid limestone rock, the bottom of the well extending 1 ft. into the rock to insure a good bearing.

The material encountered in these wells was blue clay from 20 ft. (where the well started) to about 60 ft. below datum. This ranged from soft clay at the top to very stiff clay at the bottom. From 60 to 75 ft. below datum the material was a mixture of tough blue clay with gravel and boulders; from 75 to 90 ft., a mixture of soft clay and sand; from 95 to 105 ft., gravel and sand. At 105 ft. a water-bearing stratum of sand was encountered, extending to rock at 107 ft. below datum. The quantity of the water was not enough to necessitate an air-lock, the water being removed by a centrifugal pump; but progress was much retarded. It took from Aug. 14 to 28 to excavate these two wells.

Concreting Plant Erected

While these wells were being put down the concreting plant was erected. The mixer plant was placed alongside the dock of the building at the south side of the street, on a pile foundation. In front of the mixer was erected a tower, similar to that shown in Fig. 1 (which is the tower at south side of west coffer-dam), for elevating the concrete to metal chutes that distributed the concrete to the forms. Handling concrete in barrows was unnecessary except for minor parts of the work beyond the reach of the chutes. These chutes were supported from the elevated structure by means of tackle and blocks, and were easily adjusted. Material was delivered to the river plant on scows, being wheeled from the scows in barrows to the mixer hopper.

When the excavation of the wells was completed the concrete filling was started. The concrete was mixed wet and dropped through pipes into the well. The work was inspected at regular intervals during the pouring of the concrete to see that it was being properly filled around the reinforcement and that too much water was not accumulating on top. As the concreting proceeded, the lagging and rings were removed, except for the bottom 15 to 20 ft. of the well. The concreting of the anchor-pier wells was completed on Aug. 31.

Excavation Started

The excavation for the 12-ft. wells for the river pier was started Aug. 31, as soon as the anchor-pier wells were concreted, and proceeded uninterruptedly until Sept. 10, the wells having been carried down to 95.5 ft. below datum. Work was then suspended temporarily, as the contractor encountered some difficulty in getting proper sand for concrete, and decided not to finish the well to rock until the proper materials were available. After a short delay excavation was again started, and rock was reached Sept. 15. Fig. 2 shows the rings and lagging in place, the line of electric lights in the well to illuminate it, and the pump for keeping the well dry.

Concreting was started immediately after the excavation was completed and concrete brought up to 93 ft. below datum, when work was again suspended due to the rejection of the sand by the inspector. This was lake sand from the eastern shore of Lake Michigan, and was finer than that called for in the specifications. After a delay of about a day suitable sand was procured and delivered in cars to a dock a short distance from the bridge, from which place it was brought to the site on scows. The work was then started again, the wells being concreted to the top. The lagging in these wells was left in place from the bottom up to 90.4 and 91.6 ft. below datum for the north and south wells respectively. The wells were completed on Sept. 21.

A bad leak in the south wall of the coffer-dam was noticed on Sept. 14; and it required considerable pumping to keep the water low enough to continue to work. The water entered at the connection of the double row of steel sheeting with the dock, and then through the wood sheeting which forms the part of the coffer-dam on the land. Considerable material was dumped in the river along the dock where the leak started, and finally stopped the leak, on Sept. 24.

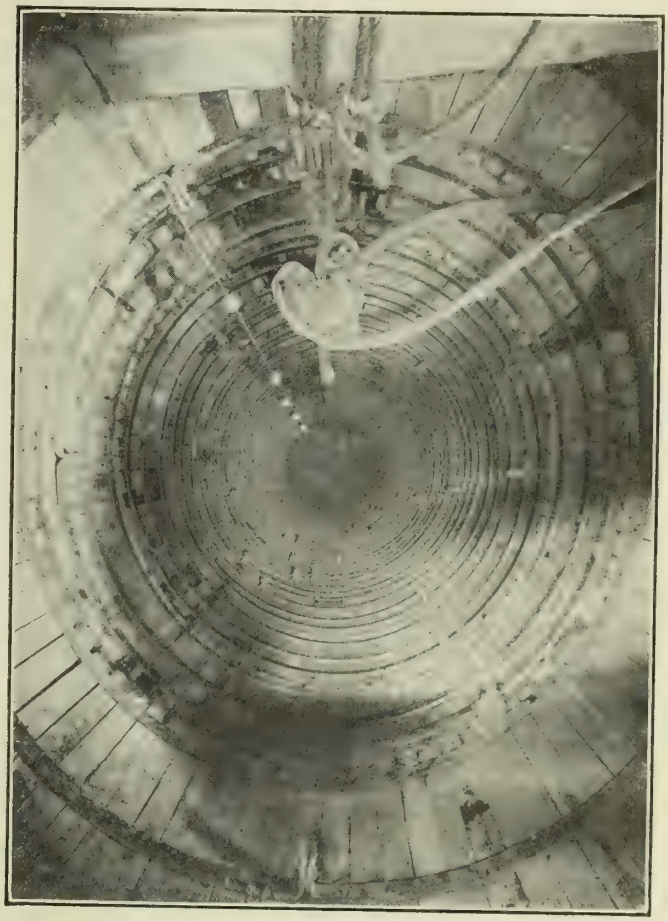


FIG. 2. INTERIOR OF SHAFT FOR ONE OF THE FOUNDATION PIERS

The shaft is 12 ft. in diameter and 107 ft. deep, extending 1 ft. into solid rock. The pump and the electric lights are shown. The shaft is ready to be filled with concrete

Forms for the tailpit proper were prepared at the time the piers were being constructed, and as soon as these piers were finished (Sept. 29) the concreting of the tailpit was started. The floor of the pit, a 5-ft. slab, 62x64 ft., was finished Oct. 3. The construction of the floor requires all piles and other supports for the bracing of the coffer-dam to be cut off above the top of floors, in order to avoid holes in the slab. The bracing is made to hold itself by trussing. The side walls and the river and anchor piers (forming the end walls) of the pit were then brought up to an elevation 1 ft. below datum, and were completed on Oct. 22. The overhanging parts of the side walls were temporarily omitted, so as to clear the piles

under the girders supporting the elevated structure. The outside walls for the operator's house were also brought up to the bottom of the cross walls joining them to the tailpit.

In order to make the pits watertight, a 6-in. layer of cement mortar, made of 1 part portland cement and 2 parts fine aggregate, was placed in the floors and on the outside faces of the walls, up to above datum. The mortar facing on the walls was applied by means of a mortar board, used as a form, which was placed inside the wall forms at the proper distance to give the required thickness of facing, the board being raised as the facing course was carried up with the concrete. The mortar was made in a mechanical mixer, and was delivered in chutes to a box, from which it was carried to the forms in coal scuttles or pails. The concrete was delivered by chutes directly into the forms. From the time the coffer-dam was first pumped out until the concreting was finished the work was carried on continuously, the men working in three shifts, except on Sunday (midnight to midnight), when no work was done.

East and West Abutments

At this stage of the work excavation was started for the west abutment, and the excavation for the east abutment was finished and the forms were constructed. After the concrete in the tailpit had set the girders supporting the elevated structure were shored up on the masonry, as described in the previous article (and shown at *A* in section *CC* of Fig. 3). The piles were cut off so that the overhanging walls and top of the walls under the operator's house could be finished. This work was finished on Nov. 12. The concreting of the east abutment was started Nov. 13 and finished Nov. 25. The concrete plant was then moved to the dock on the west side of the river (Fig. 1). Foundation piles for the west abutment were then driven in the same manner and under the same conditions as those for the east abutment.

The forms for the east tailpit being removed, the space between the coffer-dam and tailpit was filled with water. Under full head of water the pit showed a small leak in the north wall at an elevation of about 1 ft. below datum at the junction of the side wall and overhang. This stopped as soon as silt filtered into the crack, and the pit was then accepted by the city. The coffer-dam was then removed and the channel dredged of all excess material, such as puddling and excavation.

At this same time the west coffer-dam was being constructed and foundation piles for the operator's house were being driven. Excavation was also made for the new portion of the 5-ft. sewer on the west side, and the sewer constructed up to the abutment, where a temporary bulkhead was placed and an outfall constructed under a freight house into the river.

Work on the West Pier

Pumping out of the west coffer-dam started Jan. 11, and as the excavation proceeded the dam was braced as described for the east dam. Excavation for the foundation wells under the west anchor pier was started Jan. 23 and for the river wells Jan. 25. On Jan. 31, due to a rise in the river, the water overflowed the puddle wall of the coffer-dam and partly filled the wells, which were then pumped out. Excavation in the anchor-pier wells was done after the river-pier wells were finished. Water was encountered in the wells at 101 ft. The excavation for the river-pier wells was completed Feb. 7, having been carried to a depth of 109 ft. below datum and 1 ft. into solid rock. Concreting was finished in these wells on Feb. 12, the lagging below 94 ft. and 87.25 ft. below datum being left in place.

The excavation for the north anchor-pier well was completed on Feb. 10 and the south well Feb. 11. They were immediately concreted, work being finished Feb. 15. The lagging was left in place below 82 ft. and 80 ft. below datum for these walls. The tailpit forms were then constructed and concreting commenced Feb. 16. The floor was finished Feb. 20, and by Mar. 6 the walls were brought up to about 1 ft. below datum.

On Mar. 5 a leak developed in the south wall of the coffer-dam adjacent to the building, and this flooded the coffer-dam to river level. This break was repaired and the dam pumped out again.

During the time that excavation for the operator's houses was proceeding the forms for the west abutment were erected and the wall was concreted. This work was started Mar. 12 and finished Mar. 19. The box-girder supports of the elevated structure were then blocked up on the masonry and the overhanging walls and operator's house walls concreted, finishing Mar. 29. As a precaution against freezing the finished work was covered with tarpaulins.

The test of the west pit was made Mar. 31, and the coffer-dam was removed Apr. 2. The plant was then removed, docks were repaired where they had been cut for the coffer-dam, backfilling was placed, the permanent pier protection constructed, and the site cleaned up. The substructure contract was completed Apr. 28, or about 13 months after starting work. The girders supporting the elevated structure on the west side were left in place.

Activities at a War Port

Engineers on this side of the ocean who are concerned in the development of port works in an orderly, and sometimes in a dilatory, fashion will be interested in the feverish activity forced upon the port authorities of Archangel, Russia, in order to make that port equal to the greatly increased trade of the war. United States Commercial Attaché H. D. Baker reports upon this activity as follows:

Information has been received of continued improvement in conditions at Archangel since the time of my visit there early in August. Notwithstanding increasing arrivals of steamers, the goods are shipped out now within a reasonable time after they arrive, and considerable cotton and other merchandise that had accumulated there early this year have now found their way to interior destinations.

It is reported that very good progress has been made during the last month in railway improvements between Vologda and Archangel. It is possible now to run broad-gage cars from any part of Russia direct to Archangel, and for half the distance from Vologda to Archangel the line is double-tracked. The narrow-gage line will be retained, so that it will still be possible to make use of the narrow-gage equipment. Rapid progress is also being made on the line through Lapland between Kandalaksha and Kola. It is expected that it will be possible to run cars over this line after Jan. 1, 1916, so that Kola during the winter season can be substituted for Archangel as a port, there being no heavy ice there as there is at Archangel.

Three cargo ice breakers, one of 2,500-ton capacity and two of 500-ton capacity, will be put on the run for the winter season between Kandalaksha and Sorotskoe, the voyage probably taking about 24 hr. each way. Owing to their limited capacity, the ice breakers will probably be reserved for freight urgently required by the government service.

Erie Flood-Protection Report

One of the highest flood-flow figures on record is given for Mill Creek in a report on the Erie flood of Aug. 3, 1915, by Farley Gannett, Consulting Engineer. He reports to the city authorities that the maximum flow was about 1,000 cu.ft. per sec. per square mile of drainage area. As noted briefly in the news columns of *Engineering News* of Oct. 7, p. 718, he recommends dry-reservoir control to a maximum flow of 6,000 cu.ft. per sec. and channel improvement within the city by concrete lining and conduit.

Magnitude of Flood

The Mill Creek drainage area has been surveyed and found to measure 12.9 sq.mi. (instead of about 17, as stated in *Engineering News* of Aug. 12, 1915). Of the total, 2 sq.mi. lies within the city limits and is largely built over. The drainage area is hilly; the soil is gravel underlain by a gray slate formation, a combination likely to produce a high runoff.

The total fall of the stream from its source is about 500 to 730 ft. above Lake Erie. Within the city its average slope is 1.20 ft. and just above the city for 2 mi. the slope is 1.04 ft. per 100.

The rainfall in the city of Erie on Aug. 3 totaled 5.77 in. within 14 hr., including three separate spells about an hour apart in each of which about 1¼ in. fell in half an hour. It was suspected that higher rainfall occurred in the hill regions south of the city, where the sources of Mill Creek are located. Accidental collection of the rainfall in buckets and other containers, as a careful search disclosed, indicated precipitations of from 7 to 9 in. Mr. Gannett concludes that in the hills the rainfall was about 40% greater than at Erie. It was also more concentrated, starting later and ceasing more abruptly and earlier.

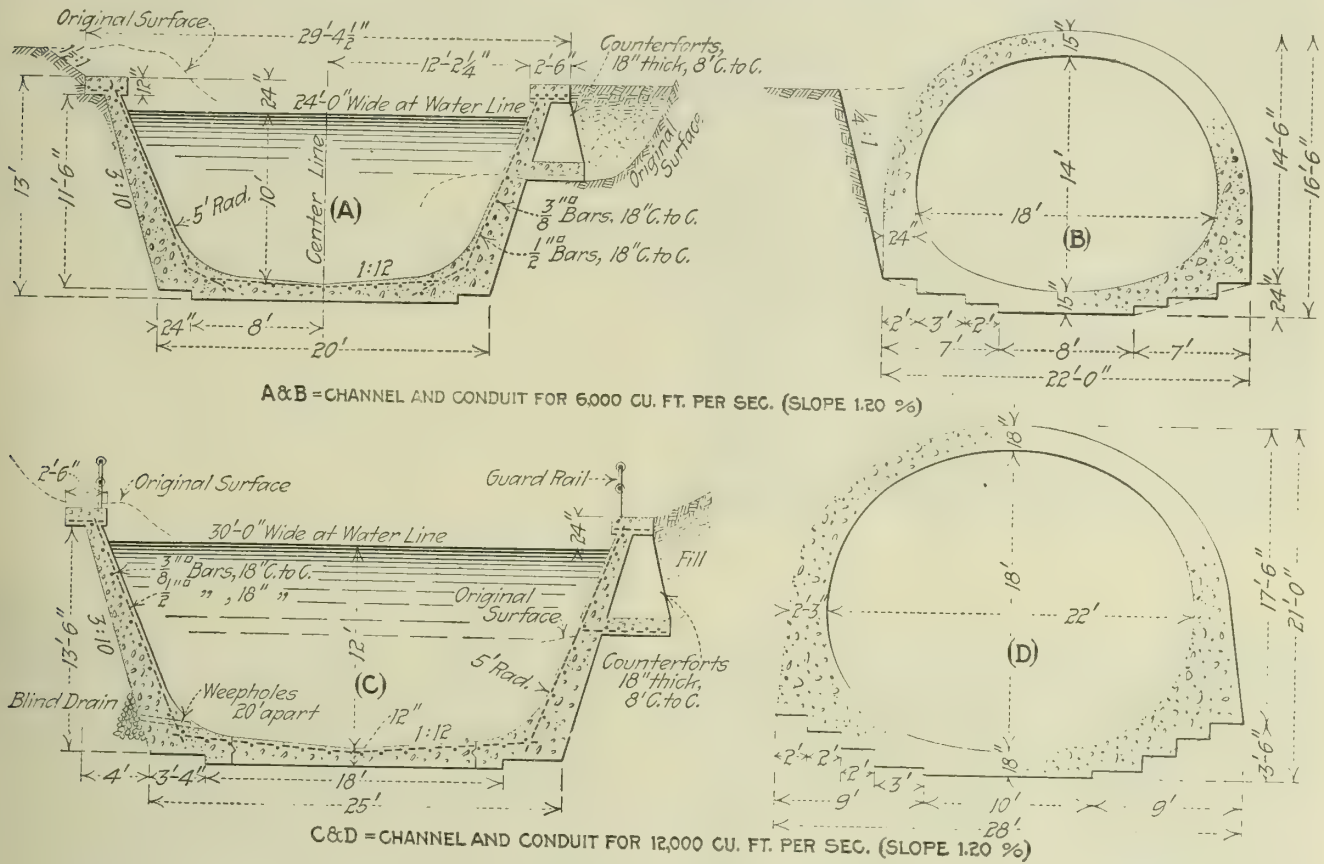
The time required for water to flow from the headwaters of Mill Creek down to the city line ranges from 1 hr. to 2 hr., the shorter period prevailing for the higher flood stages. This means that in the storm of Aug. 3 the water had a favorable opportunity to concentrate, since the successive periods of heavy precipitation were about an hour apart. The flow at 26th St., near the city limits, is estimated at about 11,000 cu.ft. per sec. The drainage area above this point is about 11.1 sq.mi. Mr. Gannett states that this is about nine times the extreme-dry-weather flow of the Ohio River below Pittsburgh, draining 23,000 sq.mi

Greater Flood Possible at Erie

By plotting the precipitations which have occurred at Erie in the last fifteen years and drawing a curve showing the variation of precipitation rates with duration, Mr. Gannett suggests that a rainstorm about 10% heavier than that of Aug. 3 is possible in Erie, even if no broader range of experience is depended on that the last fifteen years' records. This means that a more destructive flood may occur unless protection works are built.

The maximum flood flow assumed for the design of protection work is 12,000 cu.ft. per sec., and the channel-improvement project without storage is designed to carry this flow. In the project with storage the reservoir is designed to pass a flow of 6,000 cu.ft. per sec. and the channel is designed for this quantity.

The channel and conduit designs worked out for the course of the creek through the city are shown in the accompanying drawing, which shows sections to take care of the two flows noted.



A&B = CHANNEL AND CONDUIT FOR 6,000 CU. FT. PER SEC. (SLOPE 1.20 %)

C&D = CHANNEL AND CONDUIT FOR 12,000 CU. FT. PER SEC. (SLOPE 1.20 %)

CHANNELS AND CONDUITS FOR ERIE FLOOD PROTECTION AS SUGGESTED IN THE GANNETT REPORT

Field and Office

Lining Two 5-Ft. Tunnels by Use of Concrete Atomizer

At Rupert, Penn., the Delaware, Lackwanna & Western R.R. has recently completed the lining of two 5-ft. water-power tunnels with concrete sprayed into place by the "concrete atomizer," a machine controlled by Harold P. Brown, 120 Liberty St., New York City, in which a fluid concrete is blown through a nozzle by the force of superheated steam. The machine was described in *Engineering News* of Oct. 14, 1914.



FIG. 1. INTERIOR OF HYDRAULIC TUNNEL NEAR RUPERT, PENN., BEFORE LINING WITH CONCRETE

At Rupert a large flour mill built about 100 yr. ago is supplied with water for power by a pair of masonry tunnels about 5 ft. high passing under the bed of an abandoned canal for a distance of 150 ft. The mortar between the stones had been washed out, leaving a rough, imperfect surface, as shown in Fig. 1, and through these crevices a large leakage found its way to the tailrace. The railroad had purchased the canal many years ago and is under obligation to make all necessary repairs. The rough character of the stonework made troweling of little value and there was not sufficient headroom to permit the use of forms and poured concrete. Furthermore, the location of the tunnel so far below the bottom of the canal made it too expensive a matter to open the trench and repair the masonry from above. The satisfactory work of the atomizer last year on the railroad's Hoboken terminal and in the open cut at Newark, N. J., led to the use of this apparatus for repairing the tunnels.

Since the tunnels were too far from a railroad track to permit the use of steam from a locomotive, as had been done in previous work, a 20-hp. vertical boiler was set up above the tunnel. A superheater located in the bonnet and accessible through the stack (Fig. 2) gave the steam the superheat which the inventor claims produces a waterproof concrete of high density and strength.

It was feared that the small section of the tunnel might make it impossible to use steam in the inclosed

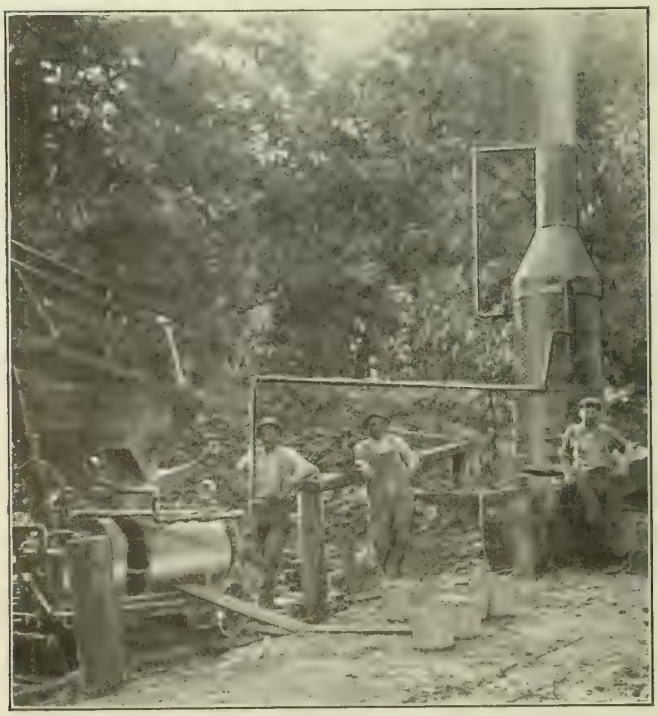


FIG. 2. STEAM BOILER AND CONCRETE ATOMIZER SET UP ABOVE TUNNEL

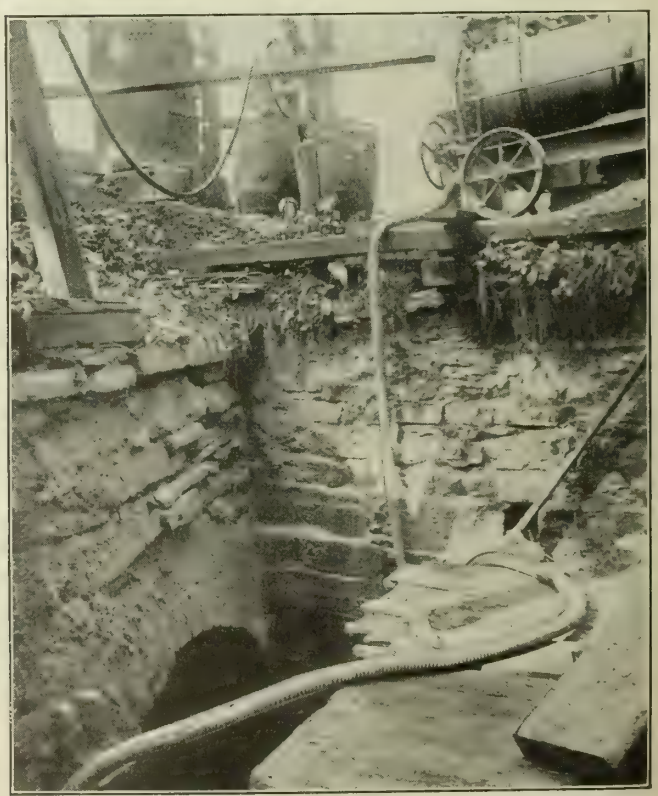


FIG. 3. CONCRETE ATOMIZER WITH DELIVERY PIPE LEADING DOWN INTO TUNNEL

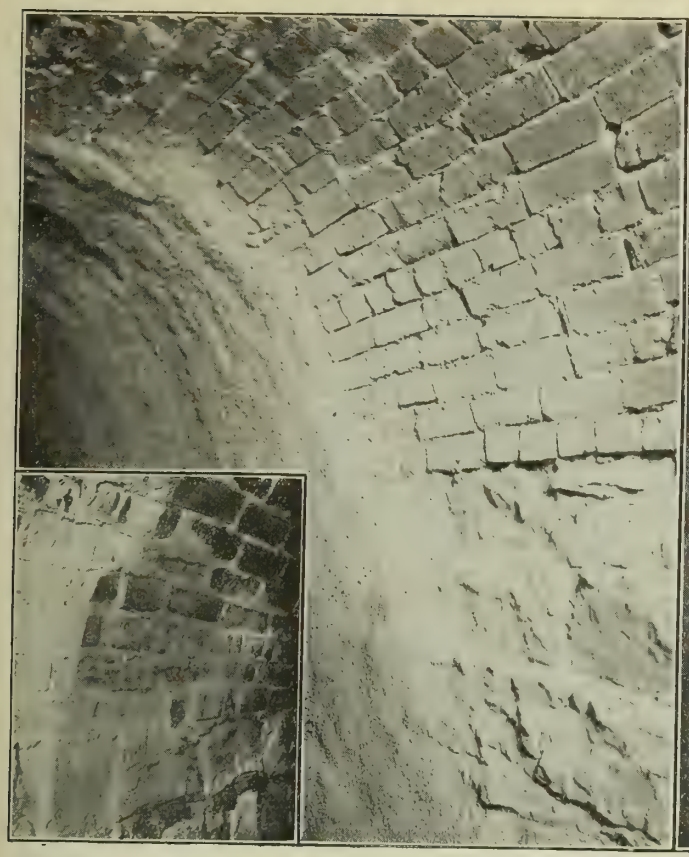


FIG. 1. ORIGINAL CONDITION

FIG. 2. WITH JOINTS CLEANED

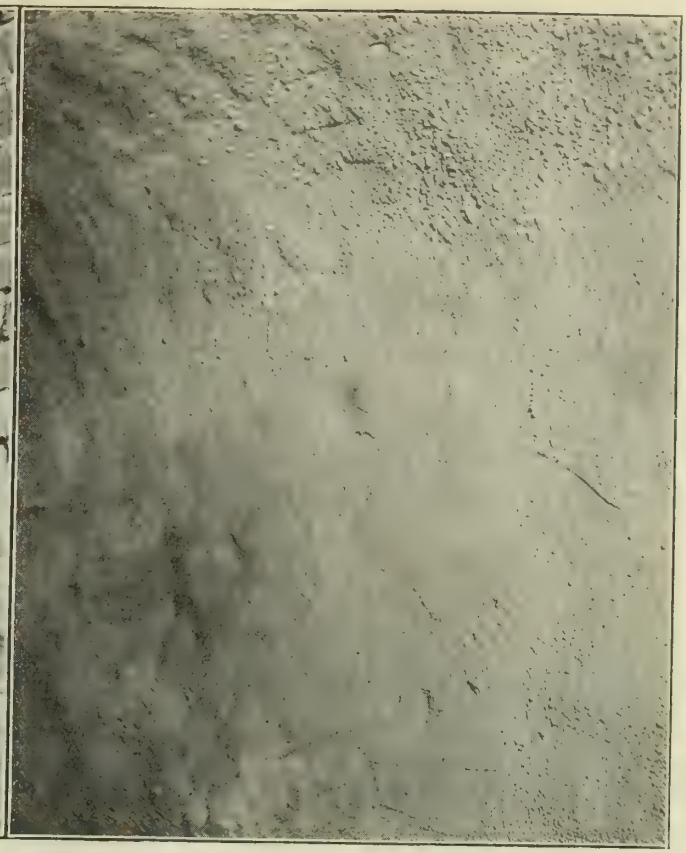


FIG. 3. CEMENT-GUN FINISH AND TROWELED SURFACE

space without forced ventilation and that the exhaust steam and the high temperature would interfere with the work, but no trouble of this kind was encountered.

The stonework was first cleaned by a jet of steam and hot water from the atomizer. This was at once followed by a jetted stream of concrete, which adhered to the sides of the roof of the tunnel and filled all the crevices. For coarse aggregate very small pebbles were used, while sand was used for fine aggregate. The pebbles hammered the concrete into the cracks and crevices so that no troweling was necessary. While the surface formed is not as smooth as is desirable on some work, it is sufficiently smooth for the case at hand. In many places large stone had dropped from the roof and 6 to 8 in. of concrete was required to make the surface level.

The 20-hp. boiler proved to be ample for the work and the proper amount of water in the concrete was easily maintained. No difficulty was found in carrying the concrete several hundred feet from the mixer, and there was but little wear on the hose, probably because the wet cement acts as a lubricant.

Cement Gun for Relining Old Brick and Ashlar Sewers

By L. Chivvis*

The engineers of the City of St. Louis, Mo., have been experimenting to determine the availability of the cement gun for relining old sewers of large diameter, with the intention of purchasing an outfit for municipal use if the results obtained warrant the expense. Theoretically the capacity of rough brick and ashlar sewers could be sufficiently increased by a smooth mortar lining (smooth enough to justify a coefficient n in Kutter's formula of 0.013) to make possible a large saving in the cost of proposed relief sewers. Moreover, the sewers are improved by filling the joints in the old masonry.

Although computations were conclusive, there were several points on which no data could be obtained. For instance, it was not known whether this thin mortar coat would adhere to wet, slimy brick without previous treatment; and if treatment proved necessary, whether a sandblast or a wire-brush abrasive was the best method. Again, since smoothness of surface was the principal object, it was thought advisable to give the gunite a trowel finish, even if the natural film surface was destroyed and the waterproofing qualities impaired. Since the cement gun hitherto has been mainly used to give a weather or waterproof surface, this troweling was objected to by all the companies consulted.

A trial contract was entered into with a Chicago company for the use of a gun, a compressor and two operators. A length of sewer in which were combined both ashlar and brick masonry, and which was small enough so that all parts could be reached without the use of scaffolding, was selected for the experiment. Fig. 1 is a fair representation of the original surface.

In preparing the sewer for the mortar coat, wire brushes were first tried and found wanting. The sandblast failed because of insufficient air. The method finally adopted was to pick and scrape the mortar out of the joints with a tuck-pointer's tool. Many old sewers, however, are too thickly covered with foreign growths to be susceptible to any scarifying method other than the sandblast, and sufficient compressor capacity should be provided to convert the gun into a sand blower where necessary.

*Engineer of Sewer Design, St. Louis, Mo.

The surface obtained with the scraping tools is shown in Fig. 2 and can be compared with the appearance after the untroweled gunite coat had been applied.

As for the advisability of troweling, it is fairly evident that where the sewer is already overcharged the additional capacity obtained by a smooth surface is worth the cost, even though it is necessary to apply a rather wet flush coat before floating. It is estimated that the natural gunite finish will justify a coefficient of 0.015, and that troweling will reduce this to 0.013, both values to include not only the head lost in friction but that lost in eddies due to incoming laterals and manhole shafts. Taking the sewer in question as an example, this two-point decrease is equivalent to a 9% increase in capacity at an additional expense of about 25c. per lin.ft. of sewer. Fig. 3 shows the rather crude results obtained with a sharp-cornered metal float. On any future work wooden floats with rounded corners will be used.

Hitherto little has been said of the added life given an old brick sewer by filling the joints with cement mortar applied under pressure. St. Louis has many miles of such sewers built before the advent of portland cement, which today are in varying stages of decay. In the great majority of cases the damage is confined to the brick joints, which are eroded to depths varying from several inches on the invert to almost nothing around the arch.

In many cases the second stage has been reached where the invert bricks are being washed away as the joint erosion progresses. Fig. 4 shows a case where the entire three rings are gone and the foundation clay is being attacked. The collapse of the sewer will eventually follow, although the life of an apparently unsafe brick arch is remarkable. Fig. 5 shows a case which has been in practically this same condition for over a year.

It is proposed to treat such sewers with a mortar coating of the minimum thickness, troweling where justifiable, and where the invert has disintegrated to a dangerous extent, to flume the flow and reconstruct the invert with vitrified brick up to the point reached by the gunite. On the foregoing work both the gun and compressor are operated on the street, only the nozzleman, one signal man and the surfacers being in the sewer.

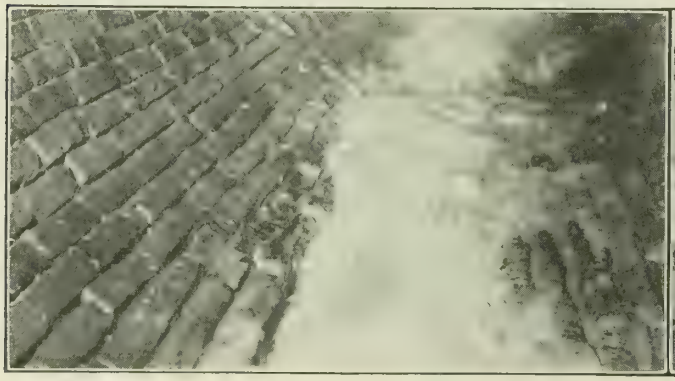


FIG. 4. OLD SEWER WITH BRICK INVERT WEARING OUT

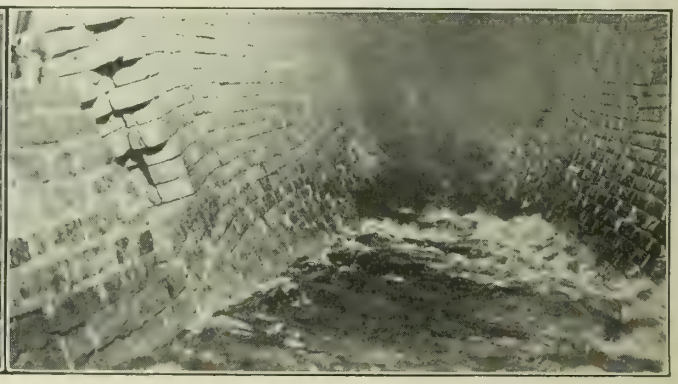


FIG. 5. SEWER WITH BRICK MASONRY ON POINT OF COLLAPSE

Special Treatment of Temporary Wall—The new Essex power station of the Public Service Electric Co., Newark, N. J., is designed for future extension on the land face. The red-brick buildings are closed off here by temporary walls of galvanized corrugated sheet. These have been painted red, and by special selection of colors in several trials they have been made so close a match to the brickwork that at a short distance they appear part of the permanent work.

Aids to Traverse Computations

By Horace Andrews*

Engineering News of May 6, 1915, on page 896, published a query as to a demand for traverse tables for each 10″ of arc. In a reply which was published in abstract Aug. 5, 1915, the writer of this article referred to certain books of tables. As many requests have been received for further details regarding these books, the following fuller notes may be of interest.

Probably the most recent and accurate table of natural sines and natural cosines is that of Prof. W. Jordan (1842-1899), called "Opus Palatinum," after Rheticus. It was issued in a second and corrected edition in 1913. The first edition appeared in 1897. The table gives sines and cosines to seven places of decimals for each 10″ of arc throughout the quadrant. This work, of 270 pages, is published by the Hahnsche Buchhandlung, Hanover and Leipzig, 1913, price 7 marks. A review, in November, 1897, stated that Professor Jordan had in preparation a more extended table, giving all six functions—*sin, cos, tan, cot, sec* and *cosec*—but his death on Apr. 17, 1899, seems to have prevented or delayed its publication.

A similar book to that of Jordan, entitled "Tables Containing the Natural Sines and Cosines to 7 Decimal Figures of All Angles Between 0° and 90° to Every 10″, Etc., by C. L. H. Max Jurisch, Examiner of Diagrams, Cape Colony, Capetown, Michaelis and Braun" (printed by Breitkopf and Härtel, Leipzig), is said to have appeared in 1884, and has been used to some extent in Germany. Sossna publishes, in 1901, a list of errata of this work and points out that these are with one or two exceptions likewise found in the tables of Rheticus and Pitiscus, which were evidently used as a basis by Max Jurisch. Sossna states, in 1896, that he himself had computed a six-place table of natural sines and natural cosines for each 10″, and that he had used as a basis of comparison the 7-place log tables of Dr. C. Bremiker, all discrepancies revealed being invariably traced to errors in the ancient tables of Rheticus (1514-1576) and Pitiscus (1561-1613).

These ancient tables were to 10″ and 10 places of decimals and 10″ and 15 places of decimals respectively. They were published in 1596 and 1613 (see "Encyclopedia Britannica," 11th ed., Vol. 26, p. 328). Despite the errors of these tables—estimated by Sossna as 1,000 in number—it is stated in the encyclopedia article referred

*125 Lancaster St. Albany, N. Y.

to that "they remain to this day the ultimate authority and also formed the data from which Vlacq calculated his logarithms."

The monumental work of Rheticus, which kept computers constantly at work for twelve years, was soon superseded by logarithmic tables. The extending use of computing machines has again revived the use of the natural circular functions, after 300 yr. of dormancy. Confidence in the accuracy of the tables of Jordan is increased by the knowledge of correspondence between Sossna and Jordan, whereby all known errors were eliminated. The few discovered during the 15 yr. of use of Jordan's tables have been corrected in the 1913 edition.

Traverse tables, giving multiples of natural sines and cosines, are well exemplified in "Tafeln zur Berechnung rechtwinkliger Coordinaten im Auftrage des Herrn Finanzministers bearbeitet von C. F. Defert," etc. (second improved edition; Berlin, 1874; Verlag von Julius Springer, Monbijouplatz No. 3, xxx + 97 pp. 9x11½ in.). This gives multiples 10, 20 . . . 90 times *sin* and *cos* for each 1′ of arc, with subtables for decimal parts from 0.00 to 0.99, also tables to be pasted separately on cardboard and used if angles subdividing the minute of arc are employed. For a distance of 1,000 this table gives results to three places of decimals.

Defert's table is, in the opinion of the writer, about of the same degree of convenience and of more agreeable typography than the following, which is equally precise: "Traverse Tables Computed to 4 Places of Decimals for Every Minute of Angle Up to 100 of Distance," etc., by Richard Lloyd Gurden (London, Charles Griffin & Co., Stationers' Hall Court, 1880; 270 pp., 9¼x14 in.). Angles given to seconds of arc are less easily employed with Gurden's tables than with Defert's.

It is evident that a traverse table giving multiples of *sin* and *cos* for each 10″ of arc would be extremely large and inconvenient, while Jordan's *sin* and *cos* tables are primarily designed to be employed with computing machines. With such extensive surveys as those of the United States Geological Survey, which is said to run from 1,000 to 2,500 mi. of traverse lines a year, a computing machine might profitably be employed, but many surveyors will find such infrequent use for multiplying machines that they will prefer tables of products.

There are three of these known to the writer. The earliest is "A. L. Crelle's Rechentafeln" of 1857 (500 pp., 8½x12 in.), which passed through many stereotyped editions, all of which neglected to give multiples of 10, 20 . . . 90, and thus interrupted the use of the tables in an annoying manner. This defect has been rectified by the new edition of 1908, by O. Seeliger. The table is a very valuable help to an engineer for many purposes and gives products of any two numbers under 1,000. Its price is 15 marks.

"Ludwig Zimmerman's Rechentafeln," in its "Grosse Ausgabe" (Liebenwerda, 1896, 205 pp., 7½x10 in.; 5 marks), gives products of any figure of two places by any of 4. Its typography and paper are excellent and its price extremely low. It offers, on its title-page, a sum of 10 marks for any error discovered.

A more recent, extensive and costly work is that of Dr. J. Peters (Berlin, George Reimer, Lützowstrasse, 107; 500 pp., 9x14½ in.; 15 marks; postage 2.80 marks). This work, having the same scope as Zimmerman's, would be preferred by most computers, even at the higher price.

For computing traverses where natural sines and cosines to four places of decimals would suffice, as in all stadia work and in many other cases, the tables of Zimmerman and Peters give excellent results, though the work of a computing machine is more rapid if, as stated to the writer in reference to a well-known American machine, "the new Comptometer permits striking as many digits at once as required, and makes multiplication so fast that the product of 0.9187 × 916.83 is completed easily in 5 sec., far less time than would be required merely to find the page in the table for 0.9187."

The little four-place table of O. Seiffert (Braunschweig, Friedrich Vieweg & Sohn; 33 p., 5x9¼ in.) is to be recommended, as it gives not only natural sines and cosines but also a table of $\sqrt{2}\ sin$ and $\sqrt{2}\ cos$ for the checking of results. A duplicate computation for all traverse work is of course most expedient and in Prussia is required by government regulations.

A more convenient, simple and rapid method of traverse computation was developed by Prof. E. Hammer in "Project for a New Method of Computing the Projections of Traverse Lines" (*Zeitschrift für Vermessungwesen*, June 11, 1908; 16 pp.). Professor Hammer proposed tables giving natural sines and cosines for each 10′ or 20′ of arc, multiplied by numbers from 1 to 250 consecutively (under the supposition of metrical measurements and 250 meters as a maximum length of line), to be supplemented by a graphical table or a slide-rule for the neglected minutes and seconds of arc and the metrical subdivisions to centimeters, or even to millimeters, if thought advisable. Hammer's project has recently been brought to fulfillment by Dr. Artur Grünert in his "Tafeln zur Berechnung der Koordinaten von Polygon und Kleinpunkten" (Stuttgart, Verlag von Konrad Wittwer, 1914; vii + 181 pp.; 7½x10¾ in.; 8.50 marks.) For 10-min. intervals all products of sin and cos up to 300 are contained in this table. The graphical table for subdivisions is, commendably, supplanted by auxiliary tables whereby a double interpolation is secured in a simple manner. In the prospectus of this work the example is given: Sought 81.75 m. × sin 10° 04′ 20″.

From p. 39 of tables, 81 × sin 10° 0′	14.07
From the proportional-part table on the same page, for 75 cm. and tabular difference of 17 (14.24 — 14.07)	0.13
From auxiliary table, for 4′ 20″	0.10
81.75 × 10° 04′ 20″	14.30

Grünert's table is carefully reviewed by K. Ludemann (*Z. für Vermess.*, July 21, 1914) and its use contrasted with Gauss' "Polygonometrische Tafeln," which in Prussia enjoys general esteem and popularity, with the result that Grünert's results are at least as exact as those of Gauss and require only two-thirds the time. The scope of Grünert's tables, 300 m., exceeds Hammer's suggestion of 250 m., yet for use with the foot as a unit of measure they would seem to fail. A similar table for foot measures might well be founded on Grünert's and based on 2-ft. intervals, or less conveniently 3-ft. intervals, up to 1,000 of distance, without expanding the work immoderately. Such a table would be a notable advance upon existing means of traverse computation.

German books not out of print may be ordered from their publishers at the prices quoted, which should be sent by international money order, with an addition of 20% to cover cost of postage. Some of the tables—Crelle's and Peters'—can be had with descriptive matter in English or French.

Dredge Walks Along Over Trench

A "walking dredge" excavated trench on a section of the new aqueduct for the water-supply of Winnipeg, Man., Canada. The dredge was carried on four sleds, one at each corner, with an intermediate sled or pad at each side. The side pads supported a post each, on which the dredge was lifted slightly by means of chains, winches and a hoisting engine. With the weight off the corner pads, the structure is moved forward by chains pulling on the legs, which normally rest on the pads. The lifting and the pulling are continuous during the operation of the dredge, which moves forward, straddling the trench. The speed is about 6 mi. per day. The barnlike structure on top of the machinery house (see view) is the workmen's bunkhouse.



DREDGE "WALKING ALONG" OVER TRENCH. WORKING ON 18-MI. SECTION OF WINNIPEG AQUEDUCT

This dredge was used by the J. H. Tremblay Co., contractors for the westerly 18 mi. of aqueduct. During the past season it was not worked to capacity because of the shallow trench. It is being used at present in replacing the spoil bank as backfill over the aqueduct. James H. Fuertes is consulting engineer on the project. W. G. Chace is Chief Engineer.

Topographic Survey of the City of Dayton, Ohio

By R. H. Randall*

In connection with the design of a comprehensive sewerage system for Dayton, Ohio, by Metcalf & Eddy, Consulting Engineers, Boston, Mass., and F. O. Eichelberger, City Engineer, the city is making a complete topographic survey.

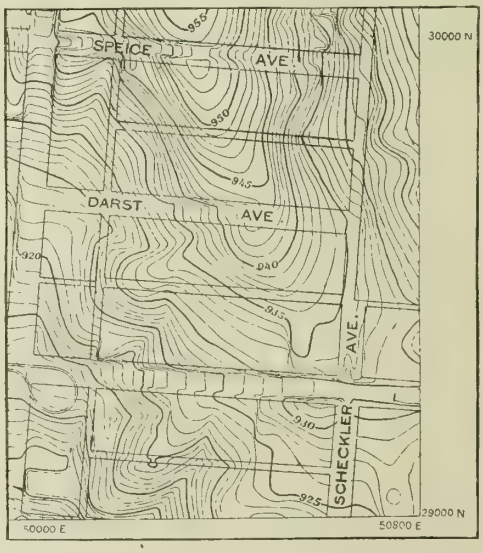
As some portions of the city had already been mapped for flood-prevention purposes at the time of the beginning of the city survey, a scale of 1 in. = 200 ft. was adopted to agree with the previous work. A contour interval of 1 ft. was selected owing to the large areas of flat or gently sloping ground, although the city has an extreme relief of about 250 ft.

The area covered by the survey is approximately 25 sq.mi., and the horizontal control is entirely by primary traverse, no triangulation being undertaken because of the prohibitive cost of such work and the small area involved.

These traverses are run in circuits, so as to form a network of lines covering the entire survey. They are systematically adjusted upon themselves, according to their closure errors, and the coördinates of all stations are computed. The instruments used in running all traverse lines were Bausch & Lomb theodolites reading to minutes, and 100-ft. steel tapes. In all, 61.9 mi. of traverse was run, the average error of all circuits being 1 ft. in 6,197 ft., and the perimeter traverse inclosing the entire net having an error of 1 ft. in 32,884 ft.

The vertical control was run with Bausch & Lomb semi-precise levels and target rods reading to 0.001 ft. In establishing 42 permanent bench marks, 48.5 mi. of levels was run, the average closing error being 0.009 ft. per mile. The entire level net was adjusted by the United States Geological Survey method, based on the closing error and length of circuit. All bench marks are of the standard types used by that organization.

The transit-stadia method of taking topography was tried at the beginning of the topographic work, but soon proved unsuited to work demanding such great detail and accuracy. Plane-tables were then purchased, and the resulting topography has been cheaper in cost and greatly superior in quality to that taken by transit.



PART OF DAYTON TOPOGRAPHIC SHEET
(REDUCED ONE-HALF)

Before going into the field each plane-table sheet has plotted upon it the exact sheet edges and all traverse stations occurring within its area. All plotting is done by

*Engineer in charge of topographic survey.

rectangular coördinates, the origin of coördinates being placed sufficiently southwest of the survey to insure all signs of coördinates being plus. Each map sheet is 27x20.5 in. in size, and is made of the best-quality double-mounted drawing paper, the grain of one of the doubled sheets being at right angles to the other.

Practically all work in open or residential districts is done by compass traverse running between the plotted control points. The horizontal closing error was arbitrarily fixed as 7 ft. on the mapping scale, but both compass and force- and backsight lines generally close with errors not exceeding 4 ft., and these are sometimes caused by the unavoidable changes in the paper due to different degrees of humidity. No limit was set for the vertical closing errors, but in all except very hilly districts these seldom exceed 0.2 ft., and the average is 0.1 ft.

The number of readings per acre averages 9, and ranges from 3 to 30 in various types of topography, the latter number being in quarries, gravel pits, etc.

Two plane-table parties are in the field, each composed of a topographer, recorder and rodman, and from 20 to 90 acres per party is covered in a day. To date the largest week's work for one party has been 0.34 sq. mi.

After the sheet is completed in the field it is returned to the office and inked in three colors—black being used for culture, brown for contours and blue for drainage. All street and alley lines are checked with the city's plat books before inking.

Reproductions in one color—black—are being made by photolithography.

Following are some cost data:

Primary Traverse

	Per Mi.
Field work	$10.08
Office (computing and adjusting)	5.40
Total	$15.48

Semiprecise Levels

Field work	$11.39
Office (computing and adjusting)	2.99
Total	$14.38

Plane-Table Topography

	Per Sq.Mi.
Field work (based upon field time and expenses of 14 sheets)	$288.18
Inking	90.00

Report on Concrete Poles for Electric Railways

The Committee on Power Distribution of the American Electric Railway Association (A. S. Richey, Worcester, Mass., chairman) in its recent report for the San Francisco convention has summarized its tests and experience of several years in the following eight paragraphs:

1. Failure of a pole is always due to stretching of the reinforcing rods on the tension side.

2. A failure is always preceded by the appearance of hair-line cracks in the concrete on the tension side, at rather frequent and regular intervals from the ground line up.

3. It is advantageous to use a high grade of reinforcing steel to secure the maximum tensile strength.

4. Plain round reinforcing rods are essentially as satisfactory as twisted or other rough rods, because in general the rods will elongate before they slip in the concrete.

5. A larger number of small rods is preferable to a smaller number of large rods, as a better distributed reinforcement may be secured for a given amount of steel and a greater bonding contact surface is presented to the concrete.

6. The reinforcement need not be uniform throughout the length of the pole, but may be stepped off as the top of the pole is approached.

7. A pole with uniform reinforcement will break at the ground line, while one with tapered reinforcement will break at some point above the ground, depending on the taper of the reinforcement.

8. A concrete pole has an element of safety in it, as a failure of the pole will not in general allow it to fall to the ground. It is difficult at times to pull over a pole after failure, even though it is inclined at a large angle from the vertical.

The committee presented complete specifications for manufacture of reinforced-concrete poles. The following paragraphs are of interest:

Weights—Variations in weights of poles shall not exceed 5% over or under the weights specified in the order.

Reinforcement—The area of reinforcing rods shall constitute practically 3% of the cross-sectional area) of the pole at the ground line, and shall be made up of 16 reinforcing bars placed as shown. The modulus of elasticity of the reinforcing steel shall be at least 30,000,000.

Pole Attachments—Holes shall be provided in the pole for steps, cross-arms, span-wire attachments, bracket arms and other fixtures.

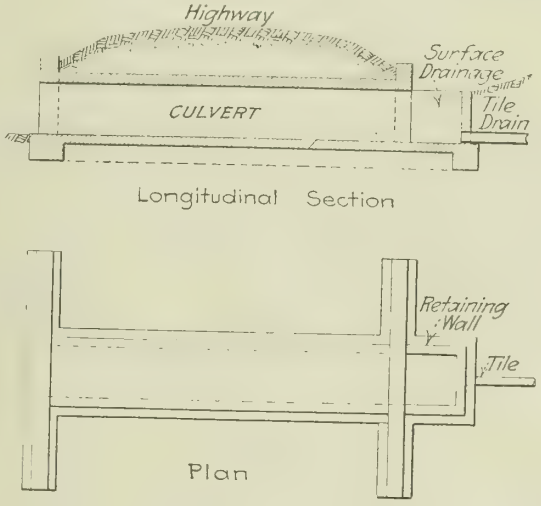
Test—One per cent of the number of poles (minimum of one pole) may be tested to destruction, and 10% of the total number of poles may be tested for deflection with the specified loading, all at the expense of the contractor. Any additional testing that may be required by the company shall be at its expense. The poles to be tested may be selected by the company.

Rejection—The failure of 40% of the poles tested to meet the requirements as herein specified shall be sufficient cause for rejection of the entire order.

Culvert with Ditch Connection

By F. O. Nelson*

The use of reinforced concrete for highway culverts has facilitated the design of a convenient method of retaining the earth at the upper side of the road where (as is frequently the case) the culvert is at the head of a drainage ditch or where it is desirable to fill the ditch above



CONCRETE HIGHWAY CULVERT WITH BASIN FOR DRAINAGE DITCH CONNECTION

this side of the road. The arrangement shown in the accompanying drawing has been found very satisfactory. It serves the interests of the highway and the adjacent landowners, and may be modified to suit individual cases.

The drawing shows a box culvert having wings parallel to the roadway. When the wings are at an angle of about 45° or more with the roadway a straight wall between the outer ends of the wings may be used. A floor for the culvert and for the basin formed by the retaining wall is of course essential to prevent scouring by the water. The area of the basin inclosed by the retaining walls is made equal to the cross-sectional area of the barrel of the cul-

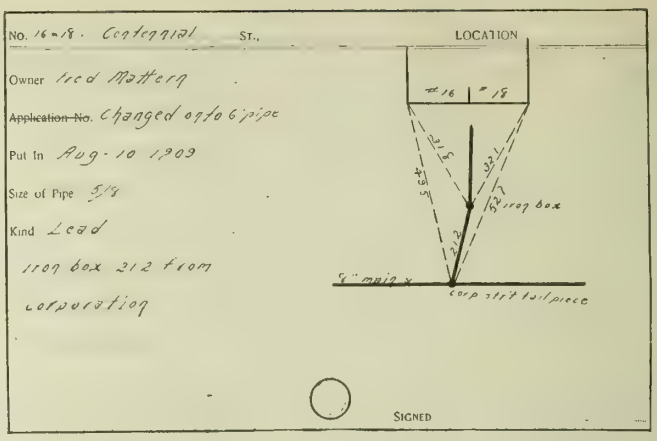
*Drainage Engineer, Toledo, Iowa.

vert. This is ample, but probably not extravagant, for small culverts when the low cost and the reduced chances of being obstructed by drift are considered, though the capacity of the vertical opening is much greater than that of the horizontal opening of equal area.

For tile outlet protection this plan, at very low cost, eliminates the washing around the ends of the bulkhead wall and the undermining, both of which give trouble on steep grades.

NOTES

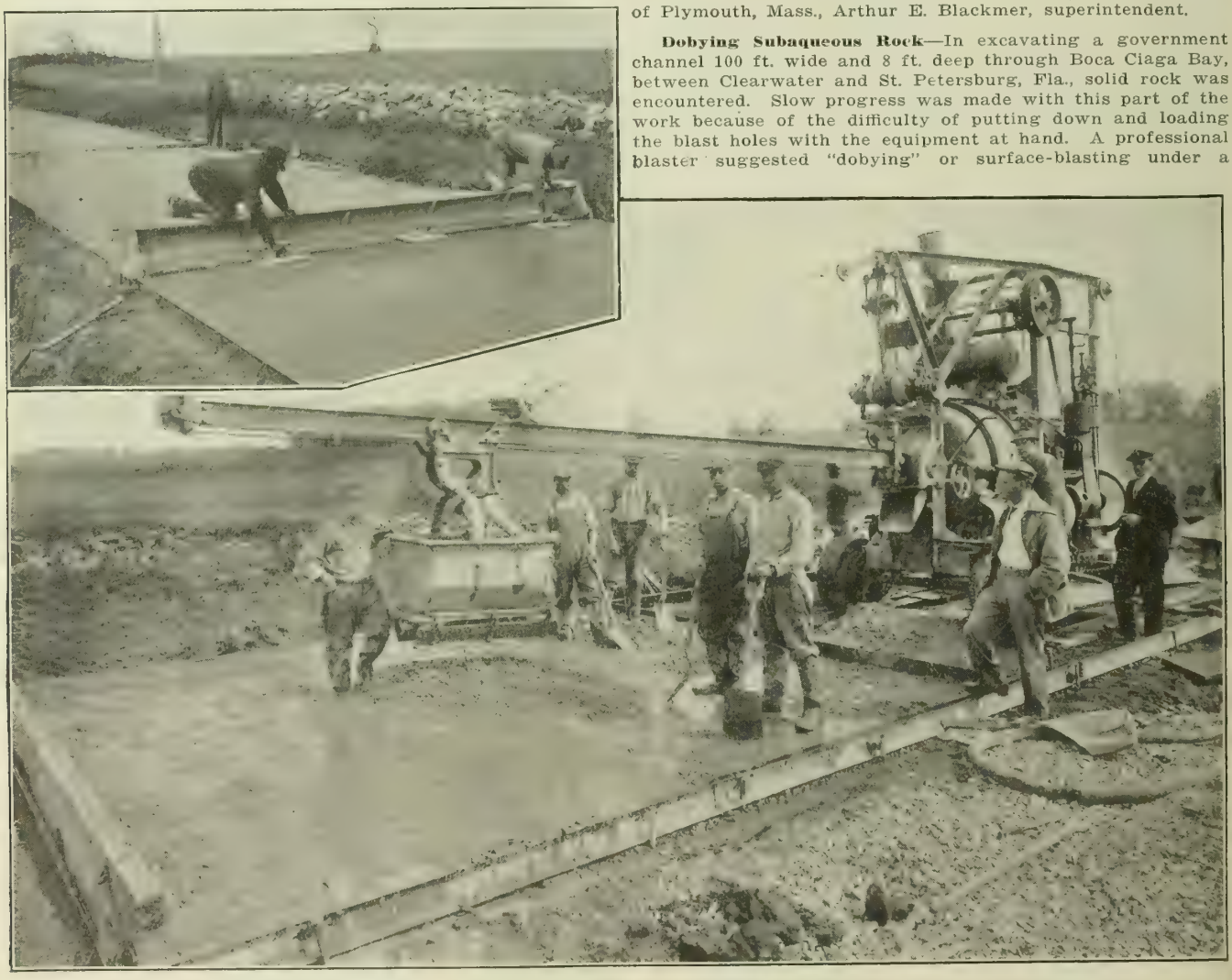
The First Concrete-Paved State Highway in Pennsylvania is now under construction between Easton and Bethlehem. The pavement is 16 ft. wide, 6 in. thick at the edges and 8 in. at the center, and there is a crushed-stone shoulder on each side. The pavement is reinforced with triangular mesh wire



PLYMOUTH, MASS., WATER-WORKS SERVICE RECORD; ABOUT ONE-HALF ACTUAL SIZE

the attention of "Engineering News." The actual size is 4x6 in. (scant). This card is from the records of the water-works of Plymouth, Mass., Arthur E. Blackmer, superintendent.

Dobying Subaqueous Rock—In excavating a government channel 100 ft. wide and 8 ft. deep through Boca Ciaga Bay, between Clearwater and St. Petersburg, Fla., solid rock was encountered. Slow progress was made with this part of the work because of the difficulty of putting down and loading the blast holes with the equipment at hand. A professional blaster suggested "dobying" or surface-blasting under a



CONSTRUCTION OF THE PENNSYLVANIA STATE HIGHWAY BETWEEN EASTON AND BETHLEHEM

and is built in 39½-ft. sections separated by tar-paper expansion joints. The crew and outfit shown in the accompanying views have laid from seven to eight sections (280 to 320 ft.) per 8-hr. day. The work is being done under the direction of the Pennsylvania State Highway Department, which has never had very much money to spend on new construction. The cement was contributed by various cement companies.

Water-Works Service Records—Keeping records of service connections in a card file is quite general in water-works practice, but there is much diversity as regards the size and make-up of the card record. The card shown in the accompanying illustration is one of the neatest which has come to

tamping cap; and instead of using a mud cap the blaster suggested that the water over the rock would serve. The scheme was tried with success. The rock was a soft coral.—"Du Pont Magazine," November, 1915.

Cracks in Walls of Cage-Construction Buildings are ordinarily thought to be impossible. A Pittsburgh building, however, shows a pronounced crack in its rear wall for the full height of the lower story. Local engineers have attributed it to racking effects of wind; but if this were true, the crack should be diagonal or multiple, whereas it is straight and nearly vertical. Whether expansion effects could produce such a crack is a matter of dispute.

Editorials

Recovering the Losses of Defeat

Despite the overwhelming defeat of the revised constitution in New York State on Nov. 2, there is still ample room for improvement through legislative enactment in a number of matters which the new constitution was expected to mend. The engineers who worked together—and separately—to improve the constitution in ways of particular concern to them might well direct their efforts for a few years to come to making the most of the present constitution and to devising individual amendments for submission to the legislature and subsequently to popular vote. Just what direction these efforts should take could best be determined after further study—perhaps by committees or a joint committee of the engineering societies centering in the state. There is good reason to believe that besides study of the sort indicated much educational work should be done to bring home to the people at large such anomalous conditions as the choice of a State Engineer by popular vote, the existence of a medley of 150 overlapping and conflicting departments, commissions and bureaus, issuing 50-yr. bonds to pay for improvements with a life of 5 to 10 yr., and changing the organization and personnel of executive departments charged with the construction and maintenance of great public improvements with every turn of the political weather vane. The remedy of some of these and of many other evils is dependent on neither constitutional amendments nor legislative statutes, but rests simply on sound and strong public opinion. Every engineer in New York State should do his part to make public opinion in these matters sounder and stronger.

Is There a Reaction Against Municipal Ownership?

The rejection of municipal purchase of street railways at Cleveland and Detroit on Nov. 2 is taken in some quarters as a further indication of the same reactionary tendency as was exhibited in the defeat of the proposed new New York constitution on the same date and various constitutional amendments in New Jersey and California during the preceding two weeks. Neither street-railway vote, however, can be taken as a good reading of the municipal-ownership barometer, for local disputes clouded the issues in each city.

In Detroit the city administration, the street-railway commission and political leaders generally favored the purchase. Strange though it sounds, the municipal ownership league opposed it—probably through failure of the ordinance to name a price. The labor vote was against it. The railway company was willing, but apparently not anxious, to sell. In Cleveland the municipal-ownership ordinance created no great activity. It was initiated by the local Socialists, and neither of the leading candidates for mayor openly favored it.

These and other fall elections, as they affected utility companies, showed discordant manifestations that would puzzle the most astute politician. Toledo turned down an ordinance, giving the electric-railway system a 25-yr. franchise, so that in the Ohio city the existing chaos is continued. In Cleveland two suburban electric roads were granted rights for improvements, one of them a subway under the business section, and a new union railway-station project was approved. In Pennsylvania a constitutional amendment was passed allowing Philadelphia to raise its borrowing capacity from 7 to 10% of the assessed valuation, the increase applying only to money for self-sustaining improvements. This makes effective the $6,000,000 appropriation ordinances already passed for the new Philadelphia rapid-transit plans. It is locally expected that the new mayor-elect is more or less hostile to the present (reform) administration's program for the extension of the city's rapid-transit facilities.

Making the Elevated Railway a Thing of Beauty

For some time past the rapid transit field has been dominated by subways. They have a grip on the popular fancy that threatens to bar all future elevated-railway construction. It is true that Philadelphia is going ahead with a rapid-transit program that includes long stretches of elevated railway. But elsewhere the subway is the only type of line considered. Thus, a comprehensive report on Detroit transit, made a few months ago by well-known consulting engineers, discussed street cars and subways exhaustively but ignored elevated railways; even the word "elevated" did not occur in the whole of the bulky report. So also in Cleveland all rapid-transit ideas are based on subways. Broadly, the same is true wherever rapid transit is thought of.

The elevated railway is cheap and efficient. But it has fairly earned the popular dislike. It is noisy and it darkens the street; also, many persons say it is ugly. The noise is the chief objection. Only those who have lived and worked alongside the metallic roar can realize the condition personally, but anyone can gage the effects by noting the depreciated state of property and population within several hundred feet to either side of an elevated railway line.

The ugliness of the elevated-railway structure is a question of taste. Probably no one ever lost a dollar, or ever had his comfort or convenience reduced, by the æsthetic shortcomings of an elevated railway.

Yet the essential motive in the design of the Queens Boulevard elevated structure, described in this issue, seems to have been a purely æsthetic one—to produce an ornamental structure. At the same time a structure of greatly reduced noisiness has been built—having solid floor, massive framework, well-cushioned roadbed, and parapet walls that will confine the spread of noise from the car wheels. It is a fair question whether the adoption of the design was not dependent just as much—or more—on noiselessness as on beauty.

It may be conceded that a very handsome, not to say monumental, structure has been built on Queens Boulevard. The structure is a most valuable object-lesson as to the possibilities in the way of elevated-railway construction. It furnishes a living proof that skill and study can produce a satisfactory elevated structure. Under these circumstances, the subway should not have the exclusive right-of-way in future consideration of rapid transit.

Progress in Foundation Work

Founding a heavy structure on soft bottom has ever been the test of the builder's skill. It is the same today, although the modern builder has the help of a great array of methods and machines for dealing with water, penetrating treacherous ground and forming a solid structure to distribute the superstructure loads. Independent thought and initiative are vital to success in foundation work—today as much as two centuries ago.

The share of the constructor as distinguished from the designer, in this exercise of originality is worth special attention. Reference to the construction of foundations for torpedo-boat berths at Charleston, on another page, will show an interesting example of the demands for original planning on the contractor's part. In that case a novel design was to be built, but standard or ordinary designs are only less likely to require the contractor to devise new methods. This is true of all construction fields, but nowhere more than in the foundation field. Here the integrity and strength of the finished structure depend in large measure on the builder's skill in producing conditions that will realize the various assumptions underlying the design.

Foundation construction is at the same time one of the most difficult and one of the most promising fields of the engineer's activity. The engineering of foundations is by no means as far advanced as other fields of design, on the score of our ignorance of the materials—the soil—if for no other reason. There is ample opportunity for progress, therefore, in the matter of theory and design. But the opportunities for new work on the constructor's side are even greater.

How Electrifying a Railroad Increases Capacity

The substitution of electric traction for steam in the Philadelphia terminal of the Pennsylvania R.R. and out on one of the important lines, as described elsewhere in this issue, is a significant railway development of the moment. One of the early statements in the article is that the change was made to increase the capacity of the Broad St. Station and to relieve congestion. It has become a generally accepted fact that the substitution of electricity for steam does give an appreciable increase in the traffic capacity of a railway terminal or line, but probably few persons not directly engaged in electrification work realize the ways in which this is secured. Comparison of the Pennsylvania's Philadelphia terminal under the old and the new operation demonstrates unusually well by what actions this improvement is secured. The increase in capacity is here effected, for one reason, because motor-car trains replace those hauled by locomotives and shifting of empty trains from one track to another is eliminated. There is also an appreciable gain in capacity due to the more rapid acceleration and to the shorter length of tracks occupied by a string of motor cars than by a train with steam locomotive.

The 8% increase in terminal capacity, as a result of the electrification of one line alone, is notable. The ultimate increase in station capacity when all six suburban lines are electrified will be equally notable, although it is possible that the total increase for the terminal will be slightly under the 40 to 50% which might be expected.

There are many points connected with this installation which are of more than passing interest. For instance, the assurance of the railroad that the savings in operating cost over steam will at least pay the interest on the additional investment will be an eye-opener to many railroad engineers who still fight shy of electric traction because of the additional investment required. Also, the selection here of a high-tension alternating-current system gives food for reflection—bearing in mind that the Pennsylvania's New York terminal, less than a hundred miles away, uses direct current at 600 volts. This alone is a good indication of the progress in alternating-current traction that has been made in recent years. Had the single-phase system been advanced as far as now, it is probable that the direct-current system might not have been employed at New York—remembering the probabilities of an eventual trunk-line service between these cities and beyond.

Buying a Pig in a Poke

The old doctrine of *caveat emptor* is still good law. Let the buyer beware! Let him specify precisely what he wants, and then see that he gets it. This procedure guards him not so much against bad faith—for as a rule there is not a great deal of bad faith in business—but against misunderstandings. The second party cannot know precisely what the first party expects to get unless the qualities desired are so described that they can be measured. What is "a good gray-iron casting?" It depends on the purpose; and if we leave it to the foundryman to judge what kind of casting will suit our purpose we are bound to accept the result of his guess, right or wrong.

The following letter from a reader of *Engineering News* tells the story of a case where the buyer did not specify, but depended on a vague type name:

> Sir—Some time ago a concern in which the writer is interested placed an order with a steel foundry for the following:
>
> Six tray lips, pattern A-1044. . . . These lips are to be of vanadium cast steel 0.35 to 0.45 carbon, annealed. . . . Care should be taken that the metal in the cutting edges is solid and of the best quality. . . .
>
> These castings were shipped direct to a coal dock where they were to be used. Some of them broke within a few hours, and all broke within a comparatively short time after being put in service, and did not give as much service as some ordinary openhearth steel tray lips which had previously been used. Payment of the bills was refused. The steel foundry brought suit for payment, in which the following testimony was developed:
>
> The superintendent of the steel foundry testified that 6½ lb. vanadium (alloy about one-third pure) was placed in each pot of 1,600 lb. steel, which would amount to from 0.15% to 0.16% (calculation shows 0.1354%); that vanadium put into castings varies from 0.05% to 0.15%, sometimes higher if it is ordered higher; also that the amount of ferrovanadium lost in the melt varies a good deal with the temperature of the steel, from nothing up to one-half of one per cent. A chemist stated that he found the vanadium content of the castings to be 0.03% and 0.04%; carbon content, 0.375% and 0.384%. A metallurgist stated that the addition of 6½ lb. of ferrovanadium (33⅓% vanadium) to 1,600 lb. of steel would

be equivalent in round numbers to 0.14% vanadium, and that there would be at least 20%, and possibly 30%, of that lost. The result would be about 0.10% vanadium remaining in the steel. He stated further that there is a recognized "standard vanadium steel," not less than 0.15% of vanadium, and that castings containing only 0.03% and 0.04% would not be castings of "standard vanadium steel," and that the two castings in question showed numerous gas cavities and blowholes. Three other witnesses testified that after the castings were broken they observed numerous holes.

Notwithstanding the foregoing testimony as to the vanadium content and defects of the castings, a decision was given for the plaintiff.

The question now comes up, which interests all purchasers of steel castings of special alloy or otherwise: Is there a standard vanadium-steel casting, and to what extent must full and complete specifications, chemical as well as physical, be given in a simple order when not covered by a term contract in which these elements are fixed? Let the steel foundries come forward and declare themselves. Would all of them, under the circumstances, claim that these were merchantable castings?

Probably no alloy name made up of the names of chemical elements is a proprietary designation, whether nickel steel, carbon steel, manganese steel or vanadium steel. Any alloy of nickel and steel may be called nickel steel. Where practice limits the range of composition it can hardly ever define the composition so closely that detailed specification is unnecessary.

Even simpler names, made up of commonly used words whose meaning any law court might be presumed to know, are made the subject of laboriously developed specifications. "Sound yellow-pine trestle timber" is an example. Experts in timber have thought it worth while to spend years of labor in getting up a satisfactory specification for this material. It is not sufficient that the meaning of each word, "sound," "trestle," etc., is known and can be established before any court or jury.

The activities of the American Society for Testing Materials are a convincing demonstration of the need for specifying the qualities of material. In that society the two materials whose production is most highly standardized—steel rails and portland cement—have given rise to the most active fighting over specifications. And those who did the fighting were not men lacking knowledge of what the trade practices are, but they were manufacturers and buyers of these materials. They recognized that it is impossible to rely on a mere type name or on a fixed trade practice.

The Philadelphia Engineers' Club has mobilized and has started an invasion of Pittsburgh. The *Gazette Times* of the latter city headlines a news item as follows: "Philadelphia Engineers' Club Is Starting Campaign with 1,000,000 Goal." In a four-day expedition the club expects to get 1,000 new members, says the item. At that rate, working 360 days in the year, the club would reach its goal in 11 years and 38 days, due allowance being made for the number of members it already has, without deduction for resignations or deaths. This is exactly the same time that an express train would require to reach the sun, if it started from the earth at a speed of 1,000 mi. per hr. Other analogies are that neither the express train nor the club will reach the goal in question, and also that both the express train and the Philadelphia Engineers' Club are interesting tools of civilization.

Letters to the Editor

Railway-Track Maintenance

Sir—Your editorial in regard to defective railway-track maintenance is timely. There should be some sort of legislation to relieve conditions on some of our railways. The writer is not an advocate of anti-railway laws or regulations, many of which are very inadvisable and contribute nothing to the comfort or safety of the traveling public; but there is a real need for outside regulation of railway-track maintenance, which fact I believe will be admitted by most railway officials themselves.

What are the causes of poor spiking, loose bolts, low joints, wide gage, bad alignment, poor drainage, soft track, bad bridge approaches, weak bridge members and similar examples of defectively maintained track? It is nothing more or less than the lack of track labor to give the proper constant attention which a good-riding railroad track demands. As long as railway management pursues the policy of cutting the maintenance forces to the lowest possible point every time a financial retrenchment is decided upon such bad track conditions will prevail.

Of course it is to be admitted that maintenance is the great "regulatory reservoir" for railway-operating expenses, but if we consider the present practice there seems to be no defined point below which it is dangerous as well as uneconomical to proceed.

The procedure of some of our railroads is to spend money lavishly at times in renewing ties and rail, ballasting track, etc., and then suddenly reduce track forces to the limit, thus losing the effect of the good work that has been done.

The writer has known one railroad west of the Mississippi to reduce track forces on 6-mi. sections to one laborer, besides the foreman, and this in the middle of the summer. The same ratio of reduction applied to the bridge gangs.

Not considering the matter of comfortable riding and risk of injury or death to the public, is such a policy economical to the railroads? It is probable that the expense incident to derailment and wrecks, increased cost of restoring the track to shape after such a "lean" period, loss of traffic due to unsatisfactory freight delivery or uncomfortable traveling conditions will be greater than the saving in maintenance expense.

Derailments at such a time increase to such an extent that engineering parties are kept constantly busy making surveys to determine their causes. The real cause is evident to their chief, but the remedy is unfortunately not in his power to prescribe. It has been suggested that if the section men were organized into labor unions, as are some of their fellow railway employees, such reductions in forces might be made inadvisable.

The writer would propose as a remedy that the railroads be required to maintain a minimum number of laborers on track- and bridge-maintenance work. This number could be figured on the track-mile as a basis, of course making allowance for the number of main and side tracks, or it may be that the train-mile might be a better criterion. Such regulation could be enforced by our state utility commissions and the Interstate Commerce Commission if the proper authority be extended to them. Is not such legislation more pertinent to the needs of the traveler than "full-crew" bills or even two-cent fare laws?

It is certain that it would have, in secret, the unqualified approval of most superintendents and engineers of maintenance, not to mention the roadmasters and supervisors.

G. F. SCHLESINGER,
Assistant Professor of Civil Engineering,
Ohio State University.

Columbus, Ohio, Oct. 25, 1915.

British Engineer Submits an Activated-Sludge Query

Sir—In reading the many interesting articles published in American technical journals concerning the activated-sludge process of sewage treatment I have failed to grasp, or to quite appreciate, the lines upon which American engineers are pursuing their investigations. Little appears to be said about the ideal results which experimenters desire to obtain. To realize what I mean, let us start at the bedrock of the methods used at present. The process has been explained to the writer by stripping the theory of all scientific verbiage and putting it in its naked simplicity.

First of all, in modern plants, sewage is usually treated in a percolating filter, by spreading it evenly over the surface and allowing it to pass through the material to the main underdrainage system. The liquid, in passing through the filter, flows over the surface of the medium, and the more vesicular the character of the latter, the better.

On starting up a new filter the sewage shows but little change after passing through, but as time goes on, a growth shows itself in the body of the filter on what may be termed the stationary framework, and colonies of bacteria accumulate there, which attack the sewage and effect purification or oxidization of the organic matter. These bacteria, being mainly aërobic, an ample supply of air is necessary in order that they may thrive—hence the necessity for adequate ventilation of the underdrainage. That, in brief, is the theory of the percolating filter as it appears to an engineer. Let us take a given volume of the stationary framework from a ripe filter and carefully remove the coating or growth throughout the material. We shall then have a certain volume of what may be termed sludge rich in aërobic bacteria, which may be referred to as the activated sludge of this particular process.

In the new process the active sludge is circulated throughout the sewage in the presence of air, as against the present-day practice of passing sewage in thin *films* over active sludge retained on a stationary framework, as in the case of percolators, for example. The real problem, then, is as follows: To ascertain the most economical method of applying air to sewage with maintenance of complete circulation of the activated sludge, without any formation of dead banks of material. It may be futile, as well as unnecessary, to attempt complete oxidation of a liquid which contains a considerable percentage of grit and garbage. Nevertheless, a plant, no matter how well designed, may fail in its object or become thrown out of gear if the liquid received for treatment by this process is not as near "grit free" as is reasonably practicable. I would therefore suggest to experimenters that more regard be paid to this important point.

Having an adequate volume of grit-free sewage, the next step appears to be the accumulation of activated sludge. To obtain this commodity it is necessary, I believe, to construct a tank or vessel and to pass air under pressure into the body of the liquid in such a way that the suspended particles or solids are constantly in suspension and distributed uniformly throughout the body of the liquid. To bring this about, or rather to produce the activated sludge, may take several weeks of continuous blowing, but once obtained in sufficient quantity we have all we require for experimenting further. The problem may now be said to resolve itself into one of reproducing in a tank the changes which take place in a percolating filter. We have our tank, which represents the walls and floor of the filter. We have our colonies of bacteria and the air necessary to support their life, and all we require to do is to provide means for supporting an even distribution of this life throughout the body of the tank, other than by allowing the bacteria to adhere to a stationary framework such as stone, slate or clinker material.

The engineer has to solve this problem in the most economical manner, and the question is how should it be effected. Compressed air will both insure sufficient agitation and effect the desired result as regards preserving uniform contact and even distribution of the sludge in the liquid. But at what cost?

I will leave the matter there. Perhaps American engineers may consider whether my remarks are worthy of further comment as a lead in the direction of solving the activated-sludge problem and its practical application.

OSWALD J. WILKINSON,
Consulting Engineer to the Manchester Corporation Rivers Committee for Sewage Disposal.
Manchester, England, Oct. 20, 1915.

NOTES AND QUERIES

Is the Jitney Responsible?—Commenting on the suggestion that the good pavements of Los Angeles and the high speeds which good pavements always encourage may explain the large number of automobile accidents in Los Angeles (page 757, "Engineering News." Oct. 14, 1915), a correspondent asks if the extended use of the jitney in the city named may not be the real cause of the large number of automobile accidents there. It is argued that the bus drivers are irresponsible and careless and, besides increasing traffic problems by their numbers, are inconsiderate of pedestrians' rights.

Southern California Rainfall Records—A committee of the Southern California Association of Members of the American Society of Civil Engineers is coöperating with the United States Weather Bureau in establishing rain gages in the mountainous regious of southern California. Six stations have recently been established by William Mulholland along the line of the Los Angeles Aqueduct. The committee desires to know of any records kept by engineers in this territory and seeks all possible coöperation with individuals or firms. G. S. Binkley, 514 Central Building, Los Angeles, is chairman.

Full-Load Secondary Stresses in Elevated-Railway Bents

By L. R. Manville*

SYNOPSIS—Full-load bending of the cross-girder in an elevated-railway bent produces dangerous stresses in the columns. Formula. Amount of stress in New York design. Means of reducing or eliminating the stress.

Secondary stresses have always been more or less ignored by designers in their calculations for proportioning structures. These stresses are difficult and tedious to calculate, and besides, there appears to be a general feeling of doubt as to their importance or even as to their existence. Since engineers in the past have largely neglected them and yet the structures seem to stand the test of time, the same old practices are followed today and the secondary effects passed by.

However, the fact that these structures stand up does not warrant a total disregard of secondary stresses. Very conservative unit-stresses were usually employed in the past, and the resulting large factor of safety provides for many unknown contingencies before actual failure. In structures with good details, much higher unit-stresses could have been employed in design if the secondary stresses had been considered, for one of the main factors of uncertainty would then have been eliminated. A saving of material would even have been effected in many types of structure. In a certain class of structures, however, in which the secondary stresses are abnormally large, the procedure just suggested would not have saved any material even with very high unit-stresses, but it would have produced a more intelligent design; that is, the material would have been placed to much better advantage.

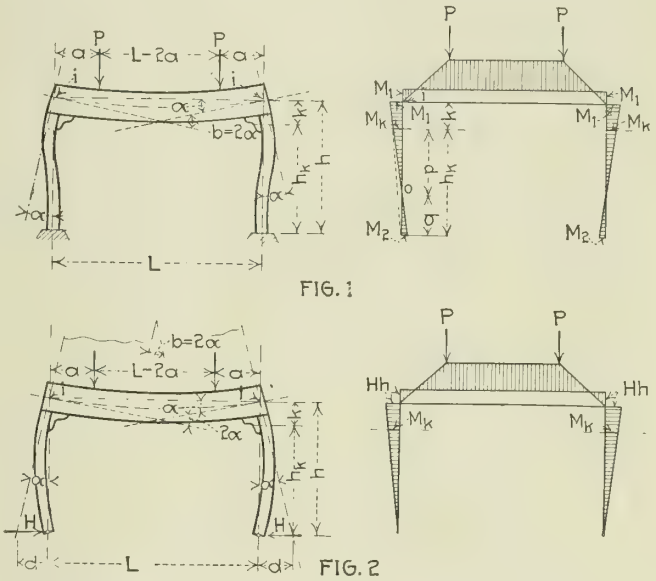
The American Railway Engineering Association has just completed a very extensive and complete investigation of the magnitude and location of secondary stresses in railway bridges. It has gone into the methods of making the calculations and has taken extensometer measurements on the various structures calculated, thus affording an excellent opportunity to verify the accuracy of secondary-stress computations. The report of this work (Vol. 15) demonstrates clearly that secondary stresses are real and that they amount to a considerable portion of the primary stresses. Thus, in structures with fairly good details, the secondary stresses amounted to 50% or more of the primary stresses.

The theory being sound and the stresses real, it is necessary that the designer of any structure of importance should have a clear understanding of the secondary-stress principles. He must also be familiar with the methods of design for reducing these stresses to a minimum; in some cases he must even go to the trouble to calculate the stresses. Few structural failures can be explained without consideration of the stresses other than primary, the latter as a rule being fairly moderate.

*Office of Engineer of Structures, Exterior Zone, New York Central R.R. East of Buffalo, Grand Central Terminal, New York City.

While in the case of trusses the calculation of secondary stresses becomes somewhat involved, yet in the case of plate-girder construction (as used in the ordinary type of elevated-railway structures) the problem is fairly simple, and the writer has worked out equations which can readily be applied by any draftsman by simply substituting easily computed factors.

In a transverse bent with two columns carrying a cross-girder, the columns being effectively connected to the girder with kneebraces, as the transverse girder deflects under vertical loads the joint at the column connection turns and a resulting bend is placed in the column. In other words, the columns produce a restraining effect upon the girder, tending to resist its downward deflec-



FIGS. 1 AND 2. DISTORTION AND MOMENT DIAGRAMS FOR ELEVATED-RAILWAY BENT

Upper sketches for fixed column-base; lower sketches for hinged column-base

tion. To be sure, where the columns are long and slender their resistance to the transverse-girder deflection becomes very small; on the other hand, in the case of short stiff columns the neglect of this secondary bending would mean an error of some 15% in the girder stress. But while the bending of the column tends to reduce the girder stresses, the columns at the same time get large increase of stress due to their lateral bending. Hence the consideration of secondary stresses in such a structure may be confined to the columns, and as the development of the equations to be stated later shows, the secondary bending stress will be a maximum at the top of the column.

Similar bending stresses in the columns, but longitudinal to the structure, would also be found in elevated-railway structures where contraction and expansion are provided for in only every third or fourth bent. The following equations, however, are not intended to cover such cases. The solution of this type of problem is much simpler than the one under consideration in this article.

By making the assumption that the point of counterflexure in the column is at a point one-half the depth of the column, the solution is made easy, and the assumption is no doubt very close to actual conditions after expansion or contraction has taken place.

Secondary Stresses under Full Load

The maximum secondary bending stress per square inch, in columns of transverse bents, occurring at the outer fibers of the columns in the plane of the bent, (at the foot of the bracket) can be expressed by a readily applied equation[1] as follows:

$$f = \frac{P w a (L - a)(3k + 2h_k)}{2 I_1 h^2 k + 2 L I_2 (4k + 2h_k)}$$

In the foregoing equation practically no approximations have been made, and it is believed the solution is exact with all practical conditions considered and provided for. A slight approximation is made in assuming a constant moment of inertia for the transverse girder.

A special feature of considerable importance should be noted in connection with the equation—the effect of the bracket upon the bending curve of the column. The column is considered to remain straight in the depth of the bracket, or for a distance k downward from the top, which is no doubt true in most modern construction, owing to the comparative rigidity of the bracket and column connection.

While at first sight the equation may appear involved, it should be noted from an inspection of the meaning of the notation that all the factors are very easily obtained. The notation (see Figs. 1 and 2) is as follows:

I_1 = Moment of inertia of transverse girder about its neutral axis;
I_2 = Moment of inertia of column about an axis perpendicular to the plane of the bent;
E = Modulus of elasticity;
M_1 = Moment at the intersection of neutral axis of transverse girder with that of column (point i);
M_2 = Moment at foot of column;
M_k = Moment at lowest effective point of bracket;
P = Any symmetrical vertical load on the transverse girder;
h = Height of bent to neutral axis of transverse girder;
h_k = Height to lowest effective point of bracket;
k = Portion of column above bracket (considered rigid; that is, this portion remains a straight line after flexure takes place);
a = Distance of load P from vertical axis of column;
L = Width of bent, c. to c. columns;
α = Angle between vertical and axis of column at point i after distortion;
w = Extreme width of column in plane of bent;
f = Maximum unit secondary bending stress in the column;
H = Horizontal reaction at the foot of the column;
o = Point of counterflexure in column.

General Assumptions—Point of intersection i of the neutral axes of the column and girder remains fixed as to location, but free to turn when vertical loads are applied to the girder.

The right angle between column and girder remains unaltered after flexure.

Moment of inertia of both column and girder is constant. In the equations, the moment of inertia of the columns is only required for the portion below the bracket, where the moment of inertia is constant.

In the foregoing equation the base of the columns is considered restrained. This condition of absolute fixity of the base of columns in most cases of design does not obtain; the inequalities of the masonry work and the "give" in the anchor bolts, etc., tend to relieve the bending at the column top to some extent. A slight "give" in the base would materially relieve the maximum bending at the bracket, the point where the equation just stated furnishes a value for the maximum bending stress in the column. Another extreme condition would be to figure the column base as hinged. With these two conditions before him, the engineer can judge from the details of the bent in question about what bending stresses should be provided for.

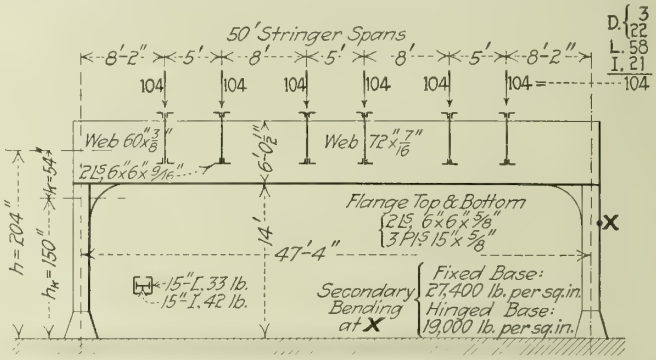


FIG. 3. SECONDARY STRESSES IN NEW YORK ELEVATED BENT

Bent of new city elevated lines. Dimensions and loads taken from article in "Engineering News," May 20, 1915

For the condition of *hinged base,* the maximum unit-stress in the column (at the foot of the bracket) would be

$$f = \frac{H h_k w}{2 I_2}, \quad \text{where} \quad H = \frac{P h}{I_1}\left[\frac{a (L - a)}{\frac{2 h^3_k}{3 I_2} + \frac{h^2 L}{I_1}}\right]$$

Applying these equations to a typical bent such as that used in the design of the New York new rapid-transit lines, the bending stress in the column at the foot of the bracket will run as high as 27,000 lb. per sq.in. for the condition of fixed column-base, and 19,000 lb. per sq.in. for hinged base. Even a mean of these two extremes, or 23,000 lb., is a surprisingly high stress. Under the direct loads considered in this computation, the axial stress in the columns is 9,700 lb. per sq.in., which with the mean of the bending stresses, makes a total of 32,700.

In Fig. 3 is given a typical elevated transverse-bent section, assuming 50-ft. longitudinal spans. Loads and all data are taken from information furnished in the article in *Engineering News,* May 20, 1915, entitled, "Design of Steel Elevated Railways, New York Rapid Transit System."

Summary and Conclusions

A study of the equations affords an opportunity to point out some pertinent facts useful in a design of this type of construction.

The equations show that long and shallow cross-girders, and short stocky columns should be avoided; in the plane

[1]This equation is derived by equating deflection angles at the point of intersection i, Figs. 1 and 2, of column and girder, taking advantage of the fact that the top of the column rotates through the same angle as the end of the transverse girder. All the equations showing the various relations between the unknowns are based upon the two fundamental equations from "Mechanics":

$$\frac{dy}{dx} = \int \frac{Mdx}{EI} = \text{tangent of the angle of deflection}$$

$$y = \int \frac{Mxdx}{EI} = \text{deflection}$$

The integration is done by taking the areas of the moment diagrams. To find a relation between M_1 and M_k the location of the point of counterflexure has to be determined. It should be noted that by assuming the flexural curve of the column straight for a distance k, the value of M_1 is considerably increased and it becomes an important factor in determining the amount of the transverse girder rotation about the point i.

of the bent, at least, the columns should be slender. However, slender columns do not afford lateral rigidity, which makes the stiff column imperative in most cases from a practical viewpoint. In any event *the bending stresses should be figured* and provided for.

In case the stiffness of the column is such that high bending stresses result, the transverse girder should then be made as deep and stiff as consistent with economy, and if possible the span length should be reduced.

A slight bevel on the ends of the transverse girder at the column connection might be made to reduce the column-bending stresses. By making the top of the transverse girder slightly longer than the bottom, a bevel would result at the column connection such that an initial inward bend would be given the columns with no live-load on the transverse girder. Then, as the live-load causes the girder to deflect, the columns would assume their normal vertical position. Only a very small bevel would be required. In the case of the transverse girder of the New York elevated bent, a bevel of 1/8-in. in 6 ft., the depth of the girder, would greatly reduce the bending stresses. To give this bevel the top of the girder should be made 1/4 in. longer than the bottom.

A slight spreading of the column bases during erection would also tend to reduce these bending stresses.

If the bending stresses together with the direct axial stresses are too severe, additional material in the columns might be the best solution. It should be borne in mind, however, that material added to the columns will not reduce essentially the bending stresses, but will reduce the direct axial stresses in proportion to the material added. This method would prove expensive and more or less inefficient.

When secondary stresses are considered, higher unit-stresses might safely be used in design, because one of the elements of uncertainty is eliminated and a reduction in the factor of safety is therefore permissible. It is suggested that unit-stresses at least 25% or even as high as 50% in excess of the ordinary designing unit-stresses be permitted.

American Steel Cars Built for Russian Railways

Probably the most interesting of the car equipment recently ordered in the United States by the Russian Government is the lot of 5,000 general-service steel gondolas being built at McKee's Rock, Penn., by the Pressed Steel Car Co., of Pittsburgh, one of which is shown in the accompanying views.

The rated capacity is 110,000 lb., but a test load of 154,000 lb. was required. The car weighs 46,000 lb. and resembles a common American type. The body is 40 ft. by 9 ft. 6 3/4 in. and 4 ft. 4 in. high. The center sill is continuous from end to end and consists of two 5/16-in. bent plates riveted to a 4-in. rolled T at the top and to 3 1/2x3 1/2-in. angles at the bottom. Malleable-iron center braces are provided at the bolsters and pressed-steel braces at the cross-ties. The end sills are of 3/8-in. pressed steel, reinforced with pressed channels extending between short side sills and center sills and connected to them, and are braced from points at the rear of the buffers with pressed channel-shaped braces in such a manner that the major portion of the buffing shock will be transmitted through these braces into the center sills. The bolsters and cross-ties are pressed diaphragms reinforced with plates and angles.

The bodies have doors on both sides throughout the length, which are operated by a creeping-shaft device and rest directly on the shafts when in the closed position. The chains, which wind on drums, are only employed for lifting the doors and to hold the shaft in place under them when in the closed position, as stops are provided to engage both sides of the doors when they are dropped. The ends are made of 2 1/4-in. planks, reinforced all around with 2 1/2x2 1/2x1/4-in. angles, and are secured with links at the end sill in such a manner that they can be dropped into the car when not required. The sides are made of 1/4-in. steel plates in three lengths, supported by seven pressed-steel side stakes located at bolsters and cross-ties, and are reinforced at the top with 4-in. rolled-steel bulb angles extending the full length. Near the bottom the side sheets are sloped in at an angle of about 60° and have a flange turned out which rests on the end sills, bolsters and cross-ties.

The Russian type of Westinghouse air-brake equipment, with 10-in. cylinder, is being applied. It differs only in detail from the freight-car equipment used in this country. The foundation brake rigging follows standard practice in this country, but involves the use of a tension spring to insure release of the brakeshoes.

The couplings, which are of the hook-and-link type, and buffers are the Russian standard, except that coil springs have been substituted in place of the volute type. Coupler forgings are of special heat-treated steels having elastic limits of 44,000 and 56,000 lb. per sq.in.

Arch-bar trucks, with 6-ft. 3-in. wheel base follow M. C. B. construction in general. Changes are introduced because of the large-diameter wheels—41 5/16 in.—and the 60-in. track gage. The wheels are of rolled steel, with flange and tread similar to the Russian standard, but differing only slightly from the M. C. B.

The completed car stands 8 ft. 11 in. from rail to top of sides and is 44 ft. 4 1/8 in. long over the buffers.



STEEL GONDOLA CAR FOR RUSSIAN IMPERIAL RAILWAY COMMISSION

East River Tunnel Shields

SYNOPSIS—The Flinn-O'Rourke Co. is using shields with sliding platforms but without doors. Compact hydraulic equipment. Gravel-shooting through lining to fill voids around the shell.

Compressed-air work is just beginning in four tunnels under the East River, being built by the Flinn-O'Rourke Co. for two new subway lines of New York City. One pair of tunnels extends from Old Slip, Manhattan, to Clark St., Brooklyn; the other extends from South Ferry to Montague St. The west river-headings of the South Ferry tunnels will not be driven by shields, since they are in rock (these headings will be stopped 1900 ft. out, where rock ends). But as shield work is required in the approaches, the total number of shields is twelve. All of them were built to the design shown in the drawing herewith. The shield structure was designed by the engineering department of the Flinn-O'Rourke Co. The hydraulic equipment was designed and built by the Watson-Stillman Co., of Aldene, N. J.

The tunnels are of moderate diameter (18 ft. and 18 ft. 6 in. respectively). There are only one horizontal and two vertical partitions, making six openings or pockets in the shield. All three partitions are of box construction; the horizontal one is deeper than the vertical partitions on account of receiving hydraulic jacks for sliding platforms.

Main Structure

The main shield ring consists of inner and outer shells spaced apart by seventeen longitudinal I-beams of 24-in. 80-lb. section. These form chambers longitudinal of the ring which contain the jacks for shoving the shield forward. The main or outer shell is a little less than 13 ft. long, of which 5 ft. 9 in. is tail. The length of inner shell, and hence of the jack chambers, is 4 ft. 3 in. The chambers are closed off at front and back by annular plate bulkheads, the back bulkhead having holes for the jack plungers. The vertical and horizontal partitions extend 32 in. forward of the front bulkhead, or within 10 in. of the cutting edge in the lower section of the shield. The front wall of the jack chambers is stiffened by 34 triangular plate-and-angle brackets connecting to the outer shell.

Hood and Sliding Platforms

A permanent hood is fixed to the front edge of the shell. The hood is sectional, to allow replacement of parts or removal in case it is preferred to work without the hood.

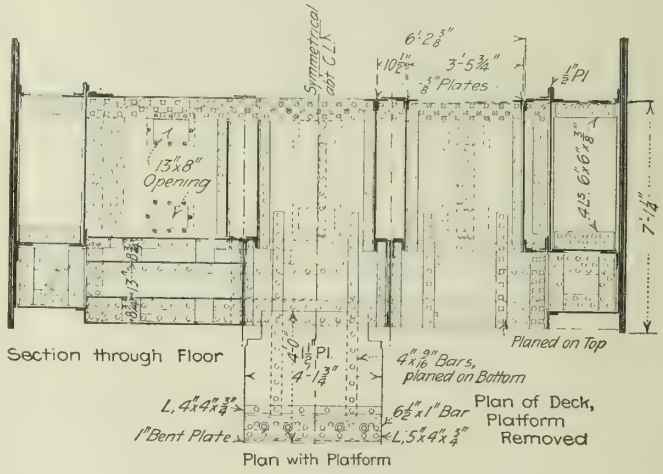


FIG. 1. SHIELD FOR EAST RIVER SUBWAY TUNNELS

Twelve of these shields were ordered by the Flinn-O'Rourke Co., six for the four tunnels now being built at the Old Slip and at South Ferry, and six for their easterly approaches

The hood segments in the upper half of the shield are of steel plate-and-angle construction, and are braced back by large kneebraces to the stiffening brackets of the front of the shield. The segments of the lower half are of cast steel.

Three sliding platforms are provided on the horizontal partition or working deck of the shield. They rest on flat-bar tracks on the upper plate of the deck, and overhang forward with an apron. Under each sliding platform are two hydraulic jacks, seated inside the deck and fastened to the apron of the platform.

The shield is not fitted with doors. The contractors do not expect that doors will be needed, nor do they believe that they would be other than an obstruction. For emergencies in which the pockets must be closed as a matter of safety, stoplog angles are riveted to the vertical partitions at their rear edge.

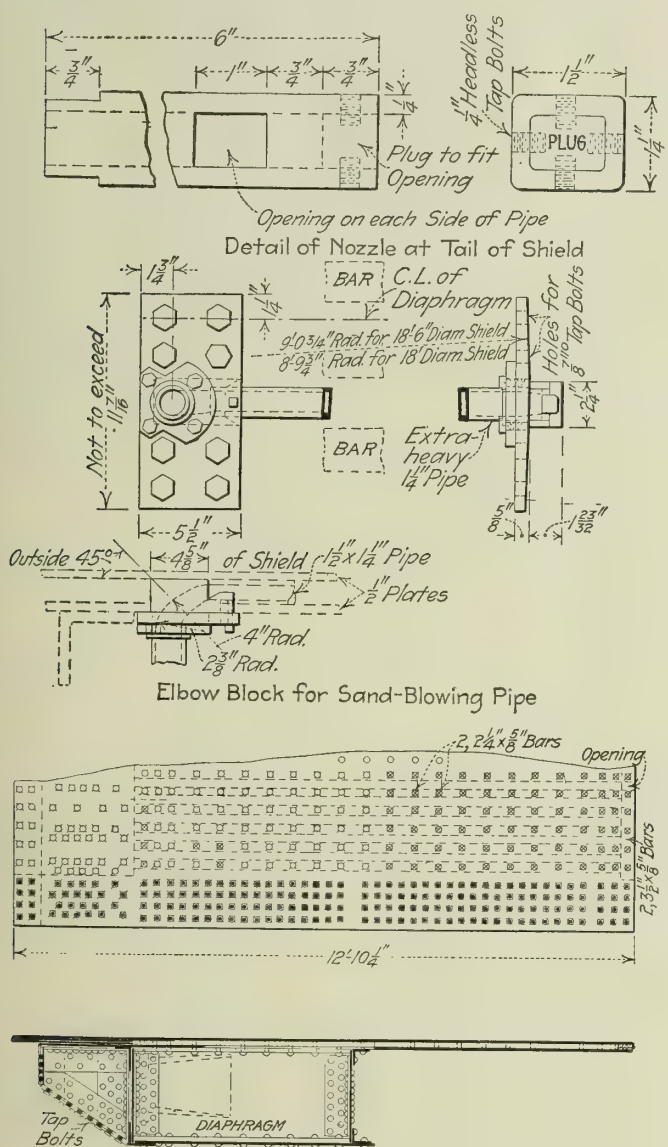


FIG. 2. SAND-BLOWING DEVICE OF FLINN-O'ROURKE SHIELDS

Sand-Shooting to Replace Grouting

A new and radical feature of the work with these shields is a substitute for grouting the void left by the tail of the shield. The scheme was originated by the contractor. As first planned, sand was to be blown out from the tail of the shield by air blast through longitudinal channels in the thickness of the outer shell. How these channels are formed is made clear by the sketch in Fig. 2 of the shield tail. The shell-plate has its outer and inner sheets separated by longitudinal bars, between which are longitudinal spaces. A certain number of these—about 12 in the whole circumference—open at the rear edge of the tail. Each of these channels has a rectangular opening to the inside, just back of the rear diaphragm of the shield, and a cast-iron angle block, as shown in Fig. 2, was set into this hole to connect with a pipe of rectangular section slipped into the rear portion of the channel and terminating just behind the rear edge of the tail. Lateral openings in the end of this pipe formed the nozzles for the sand that was blown through.

The procedure was to blow sand or fine gravel by a sandblast arrangement through these pipes while the shield was shoved forward, and thus fill the void left by the tail of the shield as fast as the void is created. The sand is dried before it goes into the sand-blast tank. By blowing air through the nozzle pipe before opening the sand valve, it was expected that all moisture would be blown out and the sand pipes dried out sufficiently to avoid clogging.

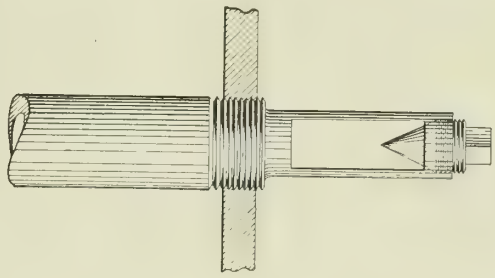


FIG. 2-A. NOZZLE FOR SHOOTING GRAVEL THROUGH GROUTING-HOLES IN CAST-IRON LINING

Within the jack chambers the channels in the tail of the shield are left open on the inside to permit insertion and removal of the sand-blowing pipes.

Gravel-Shooting Through Grout Holes

Actual trials of shooting sand or gravel through the tail of the shield did not prove satisfactory. The first attempts were made with sand. It was found that the sand if perfectly dry would blow out well, but enough moisture remained in the shield passages to cause clogging sooner or later. The idea of using sand had to be abandoned.

Gravel was then used, "birdseye" size being found best. It went in easily, and the operation was in all respects successful so long as the nozzle pipe was intact. The impact, however, wore out the nozzle pipe in a few hours, and then the passage packed full.

A new plan was then resorted to and proved a complete success—shooting in the gravel through the grouting holes in the cast-iron lining at a point just back of the shield. The nozzle sketched in Fig. 2-A is screwed into one of the regular grouting holes (one such hole is provided in every ring segment) and the tip of the nozzle with its lateral openings projects into the space left by the shield tail. A cone-shaped deflector plug at the point of the nozzle deflects the gravel out through the lateral openings. The result is to fill the void space behind the lining thoroughly well.

Some distance back of this point regular grouting with a 1:1 cement-sand grout is done, again using the grouting holes. This fills all remaining voids outside the lining and presumably transforms the gravel into a concrete.

From the relative amounts of gravel and grouting materials that are injected in these two operations it is possible to form an idea of the efficiency with which the gravel shooting is done and the amount of material saved by using gravel instead of grouting with cement. In addition to this, it must be remembered that cement grouting could not be done so close behind the shield as can the gravel shooting, without causing frequent trouble in binding the shield or in flowing forward along the shield shell. The amount of gravel injected per ring (18 in. long) averages in full working about 30 to 40 bags. About the same amount of sand and cement (added together) is used farther back for filling the remaining voids.

Hydraulic Equipment of the Shields

The equipment for shield driving, for shoving the platforms ahead, and for operating the segment erector is shown in Fig. 3. It is seen that the incoming water is led to valve blocks controlling the shield jacks and platform rams and to slide valves controlling the erector.

While 5000 lb. is available for the shield and platform jacks and 2000 lb. for the erector, only one feed line is used, this being connected to either 5000 or 2000-lb. accumulators (in the power stations on the surface), depending on whether it is desired to use the shield jacks or the other apparatus. It is, of course, not required

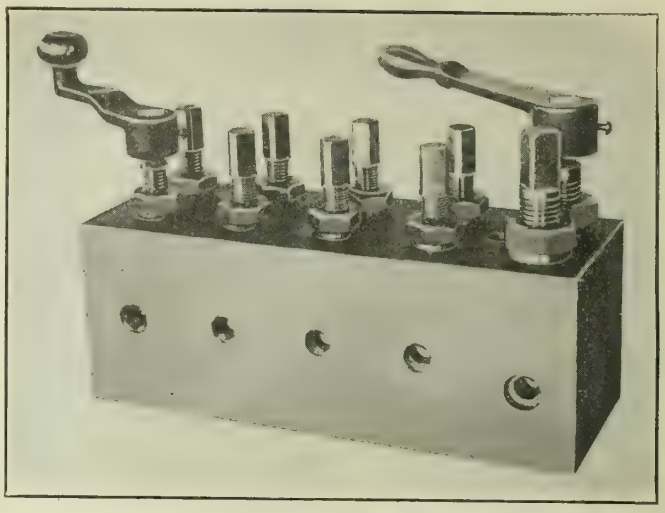


FIG. 4. VALVE BLOCK FOR SHIELD JACKS

that the erector should be worked while the shield is being driven forward.

The feed main coming down from the power station is a 1½-in. XX steel pipe with forged-steel fittings, both being stock material of the makers of the hydraulic equipment. The distribution around the shields is by 1-in. XX steel pipe with forged-steel fittings, and copper tubing from the valve blocks and slide valves. The valve blocks (Fig. 4 shows one) consist of special steel forgings with hydraulic metal bushings, seats and stems controlling the connection of each jack and ram with the pressure supply or release. The jacks can be worked singly or in groups as required to steer the shield. Close to the con-

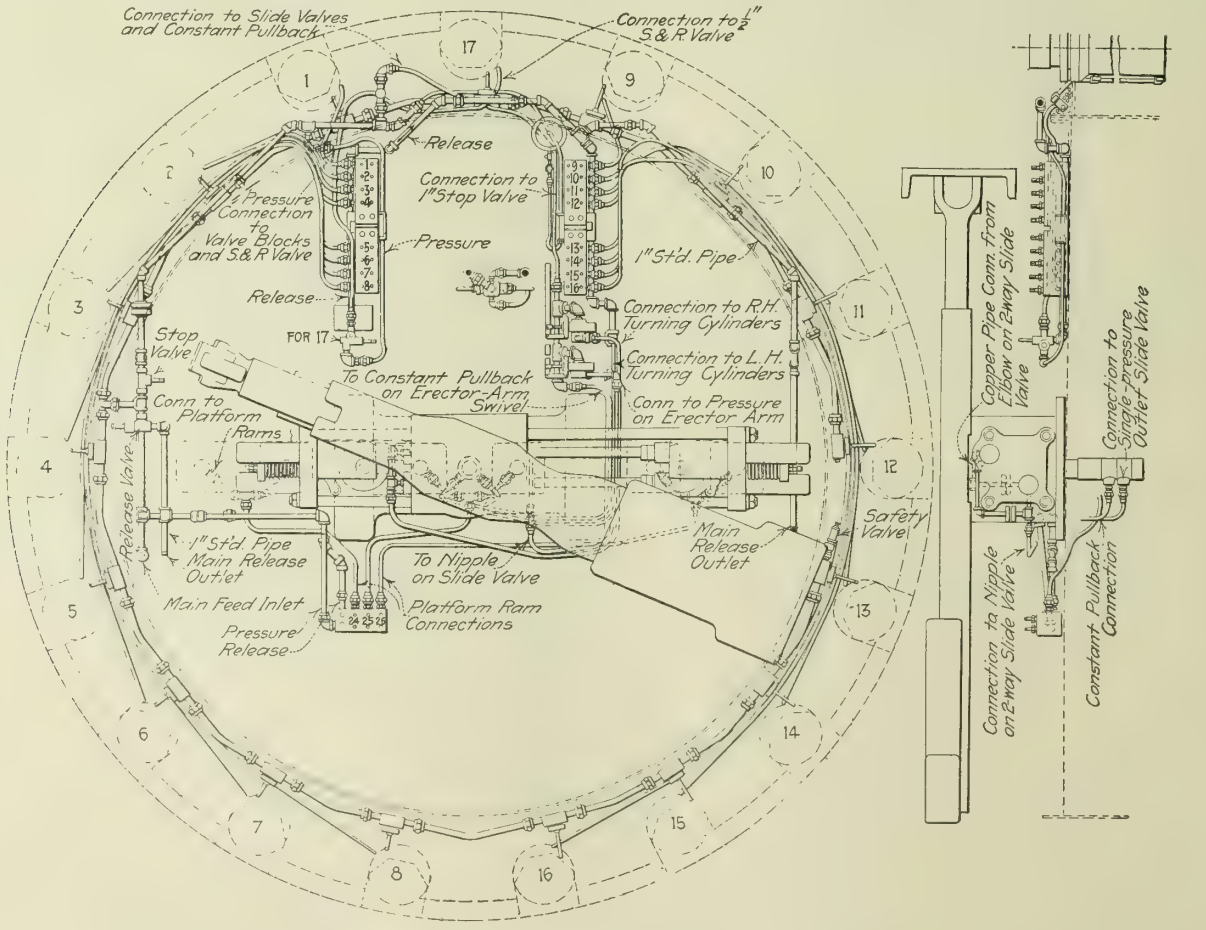


FIG. 3. HYDRAULIC EQUIPMENT FOR EAST RIVER SHIELD JACKS, ERECTOR AND PLATFORM RAMS

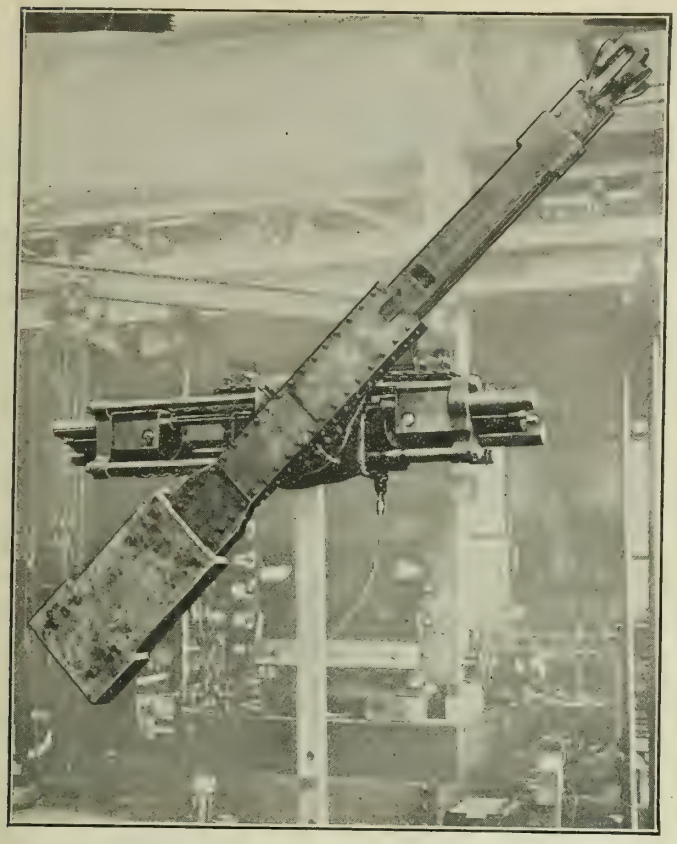


FIG. 5. ERECTOR FOR FLINN-O'ROURKE SHIELDS DESIGNED AND BUILT BY THE WATSON-STILLMAN CO.

nection of the shield piping with the main feed line a connection is taken off, through a stop valve, to the ring line to which the differential side of the shield jacks is connected for reversing.

The jacks are shown in section in the accompanying illustration. The platform rams are 3-in. differential plungers in a cylinder.

The segment erector is shown in its general position on the shield by Fig. 3, and its construction is further seen from Fig. 5. The design is novel because of the small clearances. There are four jacks, two for right-hand and two for left-hand turning. The jacks have hollow fixed rams and movable cylinders. By a specially designed arrangement of chains and sprockets, the horizontal motion of the cylinders is changed to rotary, thus

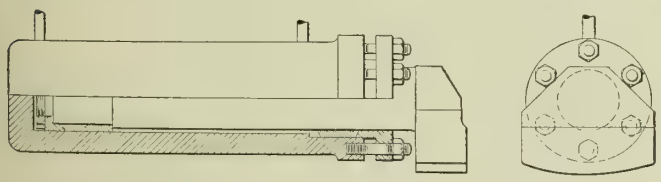


FIG. 6. SECTION THROUGH SHIELD JACK
Design of Watson-Stillman Co.

controlling the movements of the erector arm, being such as to give a little over one revolution.

The ram in the arm of the erector is of simple differential-plunger type, with pressure led to it through a swivel connection in the erector pivot. Connections for control of erector rams are shown in Fig. 3.

The tunneling work is under the management of George H. Flinn, president, and John F. O'Rourke, vice-president, of the contracting company.

Explosive Sewer-Gas Mixtures Studied at Pittsburgh

Joint studies have been made by the United States Bureau of Mines and the City of Pittsburgh, of the causes of explosions in sewers (details of which were published in the September issue of the *Journal of Industrial and Engineering Chemistry* of the American Chemical Society.) One of the largest of the Pittsburgh sewers was taken for the experiment. It is 8 ft. 3 in. wide by 8 ft. 6 in. high and 2,706 ft. long, with six manholes scattered along the length. The ordinary velocity was found by floats to be about 6.5 ft. per sec., and the depth of flow was about 8 in. The flow was 9.6 cu.ft. per sec. and the grade of the line, 0.9%. The temperature of the water was 70° F.

In the first experiment 55 gal. of gasoline (67.5° Bé.) was dumped from a barrel into the first manhole. Samples were collected at the other five manholes—at first 10 min. apart and then ½ hr. and 1 hr. One gallon of gasoline if entirely vaporized produces about 32 cu.ft. at ordinary temperature and pressure. Assuming 1.5% as the low explosive limit of vapor-air mixtures, 55 gal. would produce enough vapor to make explosive the air in 1,900 ft. of 9-ft. sewer—assuming perfect mixture. In this test the gasoline was rapidly carried past each manhole, and only the lighter portion had a chance to evaporate at any one point. The gasoline vapor was heavy, so that mixing was slow. At the second manhole, 553 ft. below the first, 0.89% of gasoline vapor was found in the air 2 min. after introduction; 2.19% was the largest quantity of vapor found in any sample. Only very small proportions were found at any manhole 10 min. after introduction of the gasoline. It was evident that one barrel poured in all at once rendered the air at any particular point explosive for only a few minutes.

In the second test the same quantity of gasoline was allowed to run in at the rate of 5 gal. per min. Some of the gas samples were taken 2 in. above the water and some 2 ft. above. The highest percentage obtained from samples taken 2 ft. above was 0.7%. Thirteen minutes after the inflow of gasoline had ceased in the second manhole, 1.14% of vapor was found 2 in. above the water; 18 min. after the inflow had ceased only a trace was left. At some of the lower manholes the gasoline vapor was not swept out so quickly; at No. 4 manhole in 16 min. the amount was 1.10%, and in 31 min., 0.12%. On ignition of the gasoline vapor at any time within 15 min. after the introduction had ceased, there would have been a rapid propagation of flame along the sewer. The test is cited as showing that 5 gal. per min. introduced continuously will produce a dangerous condition.

A third test was taken with a bulkhead built in the sewer to reproduce the condition of submerged outlet. Gasoline was dumped into the lower end (fifth manhole) at the rate of 5 gal. per min. It was found that dangerous conditions would exist with a small amount of gasoline if the outlet should be submerged by high water. The percentages of gasoline vapor in the upper part of the line gradually increased, disclosing a growing danger where the outlet was submerged for several days, while garages and dry cleaners allowed gasoline to escape.

A fourth test was made with the same conditions as in the third, except that one-half the quantity of gasoline was used (27.5 gal.). The results of analyses were in about the ratio of the quantities of gasoline used.

News of the Engineering World

Activity in Boston Harbor Work

Work has been begun on the construction of the great dry dock at South Boston, the contract for which was recently awarded by the Directors of the Port of Boston to the Holbrook, Cabot & Rollins Corporation. This work will cost approximately $3,000,000. The construction of the bulkhead and filling of flats adjacent to the dry-dock site have been completed under previous contracts.

The dry dock when completed will be the largest in the world. It is to be 1,200 ft. long and 133 ft. wide at the entrance. The foundation is to rest on bedrock and the structure is to be of concrete, with a lining of granite masonry. Plans and specifications for the pumping plant are now in course of preparation.

The United States War Department has approved the new harbor lines in South and East Boston, which include the closing of the old channel northwest of Governor's Island and filling this and adjacent territory comprising approximately 800 acres with material dredged from the harbor and channels. Since June over 300,000 cu.yd. has already been dumped there.

Contracts for dredging and placing 1,500,000 cu.yd. from certain areas adjacent to the present anchorage basin in East Boston are being prepared. It is expected that the areas to be dredged will ultimately become docking places, while the dredged material is to be used for reclaiming about 35 acres adjacent to Jeffries Point.

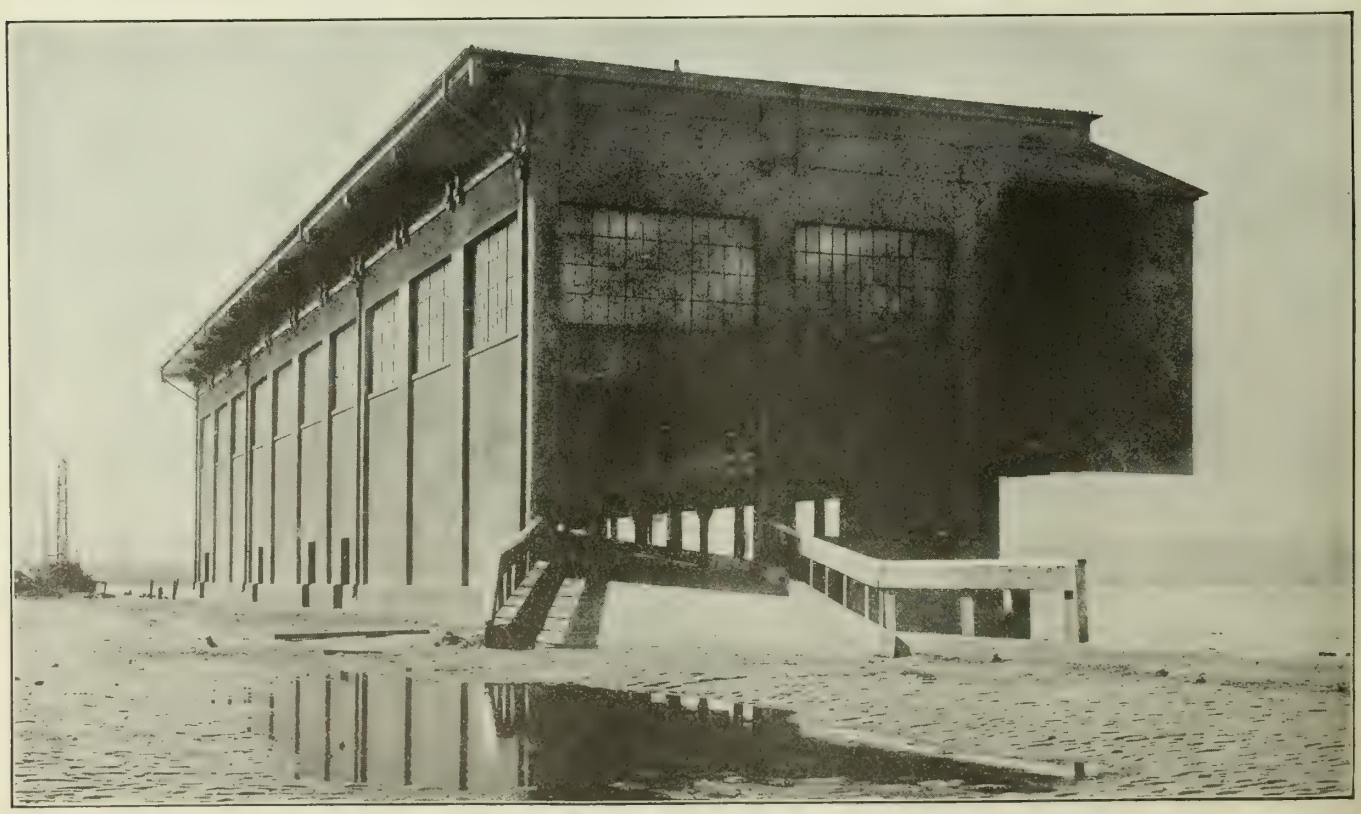
In coöperation with the Boston & Maine, Boston & Albany R.R. and New York, New Haven & Hartford R.R., an investigation is being made by the port directors to determine the volume of freight traffic between North and South Boston, which includes a zone extending from Lowell to Plymouth.

New York City Street-Cleaning Dumping Dock Completed

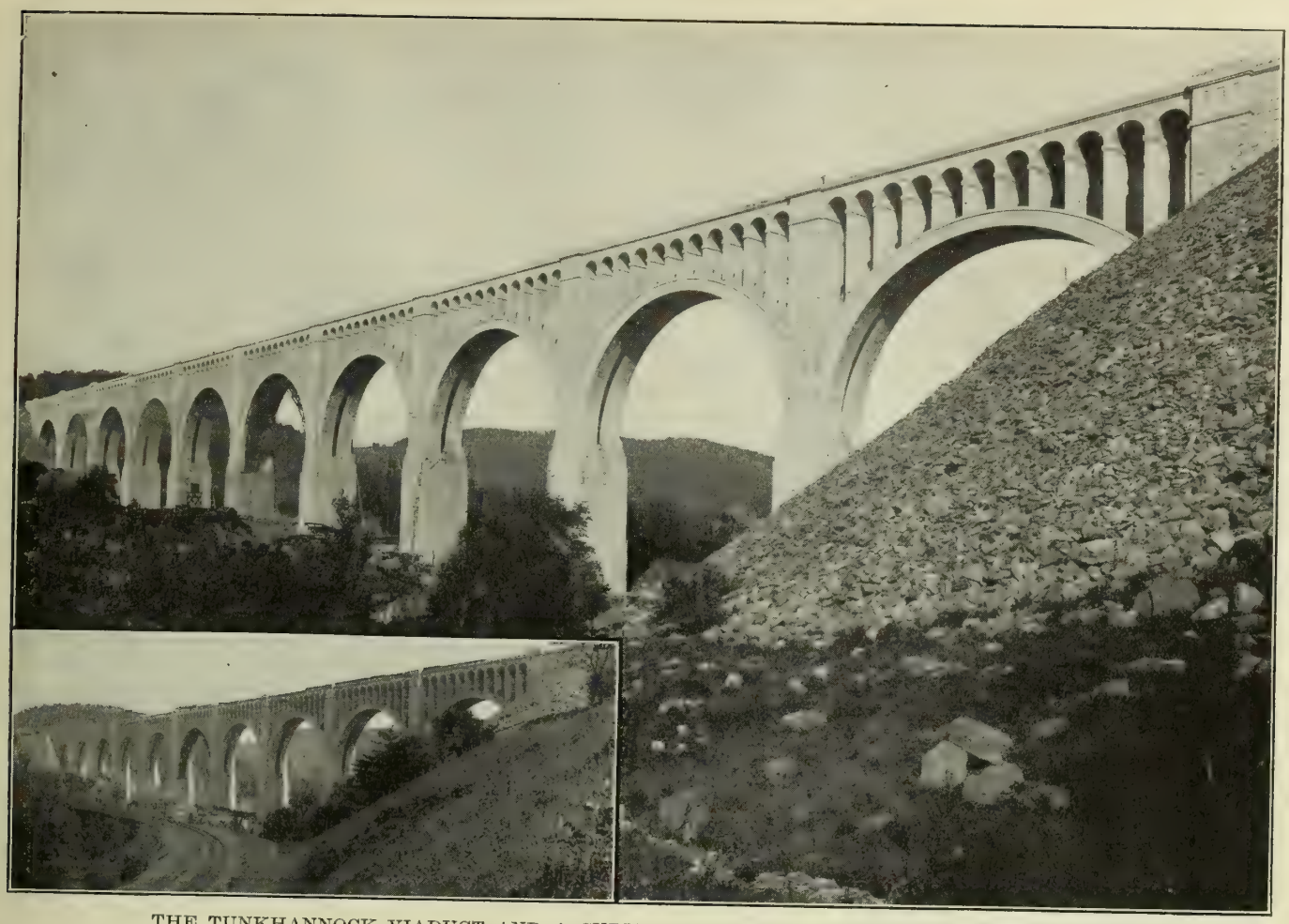
The reinforced-concrete ash-and-refuse dumping board at West 77th St. and North River, New York City, described in detail in *Engineering News* of Jan. 28, 1915, has been completed. The superstructure is steel, with stucco walls, and the roof is of ornamental steel tiles.

Refuse wagons are driven up an incline or ramp and are backed into the part of the shed overhanging the scows. The ashes and refuse fall into the scows through steel chutes, entirely eliminating the dust nuisance, so pronounced in all the old-style open dumps. The chutes are adjustable so that they can be raised and lowered to fit the height of the load on the scows. Each chute has two double-hinged doors swinging back into the chutes so as to give uninterrupted passage to the refuse. Only one door is opened at a time, depending on the position of the chute.

The structure was designed and constructed by the Department of Docks and Ferries under R. A. C. Smith,



NEW YORK CITY STREET-CLEANING DEPARTMENT DUMPING DOCK



THE TUNKHANNOCK VIADUCT AND A CURVE ON THE OLD LACKAWANNA MAIN LINE

Commissioner; R. C. Harrison, First Deputy Commissioner, and C. W. Staniford, Chief Engineer, for the Street Cleaning Department, of which John T. Fetherston is Commissioner.

Summit Cutoff Opened by the Lackawanna R.R.

On Nov. 7 regular passenger trains were sent over the new cutoff line of the Delaware, Lackawanna & Western R.R. between Clark's Summit, Penn., 7 mi. west of Scranton, and Hallstead, Penn., 14 mi. east of Binghamton, N. Y. As described in detail in *Engineering News* of Aug. 28, 1913, this is a 39.6-mi. replacement line, which saves 3.6 mi. between New York and Buffalo, reduces the maximum grade from 1.23% to 0.68% and the total curvature from 3,970° to 1,570°. All of the old 22 grade crossings have been eliminated. The new line for the most part is within sight of the old one, the radical changes noted being possible through heavy cuts and fills and by enormous viaducts. All of this construction was impossible in the early days when the original road was built. The earth excavation for the new line amounted to 5,525,000 cu.yd. and the rock 7,647,000 cu.yd. The concrete placed was 300,000 cu.yd., and 2,360 tons of steel reinforcement was used. Contracts were let in the spring of 1912. The total cost was over $12,000,000.

The most striking feature of the new line is the enormous Tunkhannock viaduct—in point of yardage the largest concrete bridge yet built (see *Engineering News* of June 13, 1912). As shown in the accompanying views, it consists of ten 80-ft. and two 100-ft. arch spans. The maximum height is 240 ft. It contains about 167,000 cu.yd. of concrete and 1,140 tons of reinforcing steel. All foundations were carried to rock.

The Summit cutoff was planned and executed under G. J. Ray, Chief Engineer of the railroad. F. L. Wheaton was engineer of construction and in immediate charge.

Large Power Project Sold

It is unofficially reported that the uncompleted hydroelectric development and aluminum works of the Southern Aluminium Co., near Whitney, N. C., have been taken over by the Aluminum Co. of America. This adds another chapter to the vicissitudes of the Whitney work (see *Engineering News* of June 11, 1914). The Southern Aluminium Co. is a French concern and on the outbreak of war stopped its work on this project. There were under construction a gravity-section concrete dam, 1,350 ft. long and 200 ft. high (maximum), a power house with five 5,200-kw. direct-current generating units (ultimately 16) and an industrial plant and town. The electrical machinery was being built by the General Electric Co., and the general contractor was the Hardaway Contracting Co., of Columbus, Ga. It is reported that the new owner will assume the old contracts and complete the entire development, with only such changes from original plans as are necessary to fit in with the Aluminum company's processes and program.

ENGINEERING SCHOOLS

Akron Municipal University

This institution, in striving to keep its work eminently practical, although of collegiate grade, has installed the coöperative system, with the students distributed for half of their time among the city's industries. In addition much work is done in connection with city departments. For instance, all the city testing is done in the university laboratories. Students recently helped in a survey of pavement conditions. The university physical director is city playground supervisor, and several students are subdirectors. A thorough housing survey was conducted jointly by the university's department of sociology, the local charity organization and the city department of health. Under the city building inspector the municipality has had a corps of competent inspectors (at no expense to the city) who received laboratory credit for their outside work.

Ambridge School of Bridge Engineering

An interesting feature of the work of the Ambridge School is a course in designing and detailing of drawspan machinery being given under F. L. Dudley. About 20 men have been enrolled in the course.

The purpose of this school is to provide an opportunity for young men in the office and shops of the American Bridge Co., Ambridge, Penn., who have not the advantage of a college education. Also, a chance for acquiring a working knowledge of the English language is extended to shop employees of foreign birth. The courses cover mathematics, mechanics, drawing, materials, bridge and building details, drawbridge design, superintendence, shop problems, office practice, English, etc. The school runs from Sept. 16 to May 31. J. E. Banks is principal.

Military Engineering Courses

It is reported that a committee from the association of Land-Grant Colleges and Universities is to appear before the Military Affairs Committees of Congress to ask the establishment of a four-year military engineering course in a number of these schools. This plan provides that each graduate from this course be taken into the United States army as a second lieutenant for one year. At the end of that year he would either be mustered out and placed in a first reserve or reënlisted for further army service.

NEWS NOTES

A 115-Ft. Construction Tower for hoisting building materials on a new structure at Second St. and Second Ave., Minneapolis, Minn., was blown over in a windstorm Nov. 1. Two workmen were seriously injured. The tower was entirely of timber and was guyed with mine wire cables.

A Fire in a Candy Factory in Williamsburg, New York City, Nov. 6, caused the death of nine employees, mostly girls. The building was a five-story brick structure with wood floors. The fire exits were found to be locked. An investigation of the State Factory Inspection Bureau is being made to determine if fire-protection laws have been properly enforced.

A 48-In. Water Main Burst Nov. 6 in Commonwealth Ave., Newton, Mass. The main is a part of the (Boston) Metropolitan Water-Works system, and its failure was probably caused by settlement and weakening after the laying of a new 60-in. main alongside. Nearly 2 hr. elapsed before the water was shut off and considerable damage was done to the boulevard and to the tracks of the Middlesex & Boston Street Ry. Traffic on the four main tracks of the Boston & Albany R.R. paralleling the boulevard was temporarily interrupted.

Ohio River Dam No. 10, near Steubenville, Ohio, was completed on Nov. 4 and the locks were placed in operation on that date.

The Barge Canal Bond Issue, Voted on in New York State Nov. 2, was carried, according to the best information available at the hour of going to press. Complete returns from all but 12 up-state counties show a majority of at least 15,000 in favor.

The Health of Street Sweepers and other employees of the Street Cleaning Department of New York City under Commissioner J. A. Fetherston will be guarded after Jan. 1, 1916, if present plans are carried out. There will be a medical director at $3,000 a year and seven medical inspectors at $1,800 a year to look after the 7,000 employees of the department.

Grade Separation at South Bend, Ind., is to be undertaken on a rather large scale, permission to require this work on the part of the railways having been granted by the state legislature. The city is to pay 25% of the cost of work at the street crossings, and is preparing to raise the necessary funds for this purpose. No plans have been prepared as yet, but the matter will be studied during the winter under the direction of Frederick J. Anderson, City Engineer, with the intention of commencing work next year.

Levee Systems Separately Provided For—At a meeting held at Memphis, Tenn., on Oct. 25, members of Congress from all the Mississippi Valley states and presidents of twenty levee boards decided to ask Congress to make the construction of a levee system a separate project from the usual river and harbor work. It is expected that $10,000,000 will be asked to complete the work. It was decided that the Congressmen should meet in Washington on Nov. 29 for the purpose of formulating a bill to be presented at the next session.

The Vote on Bond Issues at Cincinnati, Ohio, at the election of Nov. 2, resulted in the approval of one only of the four proposed issues. The $1,250,000 bond issue for parks, parkways and playgrounds, which required only a majority vote, was carried, but the other three—for a municipal auditorium ($350,000), high-pressure fire system ($400,000) and street improvements ($1,495,250)—although receiving a majority of votes, did not poll the two-thirds required by the Ohio state law. The referendum on the electric-rate ordinance resulted in the approval of the ordinance.

Sewage Treatment at Toledo, Ohio, is a problem just being taken up, partly at the instance of the Ohio State Board of Health. Both the city and Lucas County are concerned, and will probably coöperate in the investigation. The general scheme is expected to comprise a system of intercepting sewers leading to Imhoff tanks and a filter plant. The first section of the work will be for that part of the city now served by Ten-Mile Creek as an outfall sewer. The city is represented by Herbert McKechnie, City Engineer, and the county has appointed L. A. Boulay as its sanitary engineer in charge of sewage-disposal investigations.

The Chicago Street Railways are facing the problem of having to decide between the conflicting rules of two regulating bodies. The present ordinances, accepted in 1897 and administered under the direction of the Board of Supervising Engineers, forbid the use of trailer cars. The new Illinois Public Utility Commission, after an investigation of the crowded condition of the street cars during the rush hours, has issued an order to the companies to introduce trailer cars. The city authorities hold that the commission has no power to set aside ordinances in this way and the companies state that they will continue to operate according to the requirements of the ordinances as accepted by them and the city in 1897, after years of negotiation.

A Bond Issue of $2,000,000 to pay for construction work has been approved by the Sanitary District of Chicago. The engineers estimate that the completion of the widening of the Chicago River to 200 ft. will cost $1,000,000 and that another $1,000,000 will be required for intercepting sewers in Evanston and the Calumet district and for railway and highway bridges across the Calumet-Sag drainage channel. The finance committee took the position that the cost of such permanent improvements should not be borne entirely by the present generation of taxpayers and that bonds should be issued to mature between 1917 and 1935, the bonds to be for $1,000 each, with 4% interest. After the ordinance for this bond issue had been adopted it was vetoed by the president of the board of trustees, but was passed over his veto with only his own dissenting vote.

PERSONALS

Mr. Thomas A. Edison and Mr. Nikola Tesla have been awarded the Nobel prize for advance in physics.

Mr. William F. Nickel, formerly examiner in the United States Patent Office at Washington, D. C., has opened an office in the Woolworth Building, New York City, where he will practice law, specializing in the law of patents, trademarks and corporations.

Mr. James Forgie, M. Am. Soc. C. E., Consulting Engineer at 84 William St., New York City, recently a member of the firm of Jacobs & Davies, has been awarded the Telford Gold Medal by the (British) Institution of Civil Engineers for his paper, "The Laxaxalpam Aqueduct Tunnels, Mexico."

Mr. Thornton W. Price, formerly designing engineer with the American Bridge Co., and for the past two years in charge of a large part of the work on the Panama Canal coaling stations, has opened offices in the Woolworth Building, New York City, for the practice of structural and mechanical engineering.

Mr. R. L. Baldwin, Assoc. Am. Inst. E. E., for the past two years Appraisal Engineer of the State Utility Commission of Missouri, has become associated with the firm of Burns & McDonnell, Consulting Engineers, Kansas City, Mo. He will have charge of the firm's electrical work and appraisal of electrical and other utilities.

Mr. Chester F. Gailer, Assoc. M. Am. Soc. C. E., formerly Assistant Chief Engineer of the United Railways & Electric Co., of Baltimore, Md., is now associated with the Atlantic Welding Corporation, 30 Church St., New York City, as Chief Engineer. Mr. Gailer will direct the manufacture and installation of the welded rail joints manufactured by this concern and of which he was the original inventor.

Mr. Ralph H. Stearns, Assoc. M. Am. Soc. C. E., of Boston, Mass., formerly Designing Engineer of the Board of Water Commissioners of Hartford, Conn., on that city's Nepaug water-supply project, has been appointed Assistant Engineer of the Water-Supply Board of Providence, R. I. Previous to his connection with the Hartford work Mr. Stearns had considerable to do with the construction of the East Boston and Washington St. tunnels, Boston, and the Catskill Aqueduct work of the Board of Water-Supply of New York City.

Mr. Paul M. Lincoln, Past President of the American Institute of Electrical Engineers, who for many years has been prominently connected with the engineering department of the Westinghouse Electric and Manufacturing Co., has resigned his position with the company in order to devote his time to the manufacture of a maximum-demand electric meter which he has recently invented. Mr. Lincoln was graduated from Ohio State University in 1892. A biography was published in "Engineering News" of Feb. 25, 1915.

The Westinghouse Electric and Manufacturing Co. announces the following changes in its supply department: Messrs. S. A. Chase, formerly Special Representative; T. J. Pace, formerly in charge of the illuminating and rectifier divisions, and Carl G. Schluederberg, M. Am. Inst. E. E., formerly head of switchboard sales, have been appointed Assistants to J. J. Gibson, M. Am. Inst. E. E., Manager of the department. C. E. Stephens, Engineer of Lighting, has been appointed Manager of the illuminating section to succeed Mr. Pace. C. Streamer, formerly head of the order division, succeeds Mr. Schluederberg as Manager of the switchboard section, and A. P. Joseph, Assoc. Am. Inst. E. E., is appointed head of the order section to succeed Mr. Streamer. M. C. Morrow, formerly of the Philadelphia office, is appointed Manager of the appliance section, which is a combination of the former heating, fan motor and ozonizer divisions of the supply department. M. C. Rypinski, M. Am. Inst. E. E., formerly Manager of the detail and supply division of the New York office, becomes Manager of the meter section. W. R. Garret has been made Section Manager of Contracts; J. G. Worker, of stokers, and H. D. Storer, of auxiliaries, in the power department.

OBITUARY

Henry H. W. Sigourney, who practiced civil engineering until his retirement from business some years ago, died at his home in Milton, Mass., on Nov. 3, after a brief illness following a shock, at 82 years of age.

Eben R. Dyer, for the past 50 yr. Superintendent of the Portland Water Co. and the Portland (Me.) Water District, died on Nov. 8. Mr. Dyer was for many years a member of the New England Water-Works Association.

Col. T. Waln-Morgan Draper, Consulting Engineer, of New York City, the builder of the Atlantic & Danville Ry., died in that city on Nov. 8, at 60 years of age. He was a graduate of the Royal Polytechnicum in Munich and the Royal School of Mines in Freiberg, Germany. At the Centennial Exposition, Col. Draper was in charge of the mineralogical collection, after which he spent several years in the West, where he did a considerable amount of mining engineering work. In 1882 he returned to practice his profession in New York City.

Gen. George Miller Sternberg, U. S. A., retired, for a decade Surgeon-General of the United States Army and a former President of the American Public Health Association, died at his home in Washington, D. C., on Nov. 3. He was born in Otsego County, New York, and received his medical degree at the College of Physicians and Surgeons in New York City. During the Civil War and later General Sternberg did much to prevent the spread of cholera and yellow fever. At the outbreak of the Spanish-American War he organized the "typhoid-fever board" and in 1900 the Yellow Fever Commission.

Nathan S. Beardslee, a civil engineer well known in the western part of New York State through his railroad-construction work, died suddenly at his home in Warsaw, N. Y., on Nov. 1, from heart disease. He was born in New Berlin, N. Y., in 1848, and in 1869 joined the engineering corps engaged in constructing the New York, Oswego & Midland Ry. Later he had charge of the laying of the double-track line of the Erie R. R., and did a large amount of other railway location work in New York and in Illinois. He was president of the village of Warsaw for eight years, during which time the water-works system for the village was built, largely through his efforts.

ENGINEERING SOCIETIES

COMING MEETINGS

THIRD ANNUAL PENNSYLVANIA WELFARE AND EFFICIENCY CONFERENCE.
Nov. 16-19. Conference in Philadelphia.

NATIONAL MUNICIPAL LEAGUE.
Nov. 17-19. Annual convention, Dayton, Ohio. Secretary, Clinton Rogers Woodruff, 705 North American Building, Philadelphia.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
Nov. 18-19. Annual meeting at Zanesville, Ohio. Secretary, F. E. Sanborn, Columbus, Ohio.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 1-3. Annual convention in Washington, D. C. Executive Secretary, E. C. Kempe, The Octagon, Washington.

AMERICAN ASSOCIATION OF ENGINEERS.
Dec. 10 and 11. Convention in Chicago. Secretary, Arthur Kneisel, 29 South La Salle St., Chicago.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.
Dec. 13-15. Annual meeting in New York. Secretary, Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

SECOND PAN-AMERICAN SCIENTIFIC CONGRESS.
Dec. 27-Jan. 8. Washington, D. C.

Montana Institute of Municipal Engineers—The annual meeting will be held in Billings, Mont., Jan. 17-19, 1916. The president is C. E. Durland, of Billings, and the secretary is Carl C. Widener, of Bozeman.

National Lime Manufacturers' Association—The annual meeting will be held in Cleveland, Ohio, the first week in February, 1916. Fred K. Irvine, 537 South Dearborn St., Chicago, is secretary.

National Municipal League—The twenty-first annual meeting of the National Municipal League at Dayton, Ohio, Nov. 17-19, will be preceded by the second annual meeting of the City Managers' Association, which lasts three days. The first session of the N. M. L. will be held Wednesday morning, Nov. 17. Sessions of the Ohio Civil Service Association and the Ohio Municipal League will be held simultaneously. Besides the various committee reports, election of officers, etc., one session of the National Municipal League will be held jointly with the City Managers' Association. The subject for discussion will be "Has the City Manager Plan of Government Changed the Concept of City Life?" The conventions will be held at the Hotel Miami. The secretary of the National Municipal League is Clinton Rogers Woodruff, Philadelphia, Penn.

Appliances and Materials

New "Dry" Storage Battery

A new design of "dry" electric storage cell is being put on the market by J. P. Mentzer & Co., Chicago, Ill., the size being the same as the familiar commercial cylindrical "dry battery." The construction is unique. The positive and negative elements are corrugated lead strips, with the active material pasted on, rolled up into cylinders and separated by thin sheets of spongy inert material. In the center is a tube for supplying water, compensating for changes in volume of electrolyte and for venting gases. The container is an improved fiber can.

The manufacturers claim discharge capacities varying from ½ amp. for 40 hr. to 3 amp. for 5 hr. The average e.m.f. is 2 volts. It is intended to displace the ordinary zinc-carbon dry cell, having six times the working capacity and costing less to recharge than the price of a new zinc-carbon unit.

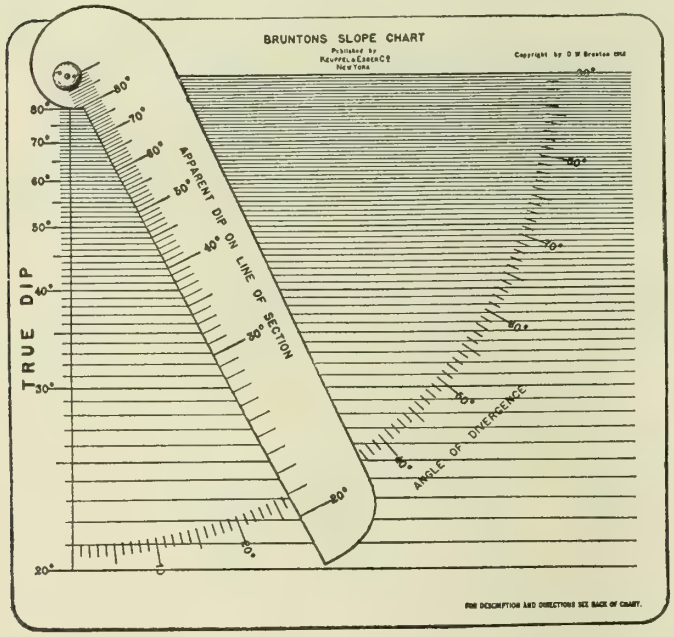
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Chart Solving tan C = cos A tan B

The Brunton slope chart, recently placed on the market by the Keuffel & Esser Co., New York City, is designed to solve mechanically the equation:

$$\tan C = \cos A \tan B,$$

in which C = the apparent dip, A = the angle of divergence and B = the true dip. It is therefore of particular use in the preparation of mining and geological maps, but it may



BRUNTON SLOPE CHART FOR SOLVING EQUATION TAN C = COS A TAN B

be used for giving valley angles in the design of hoppers, ore bins, etc. Such a problem is:

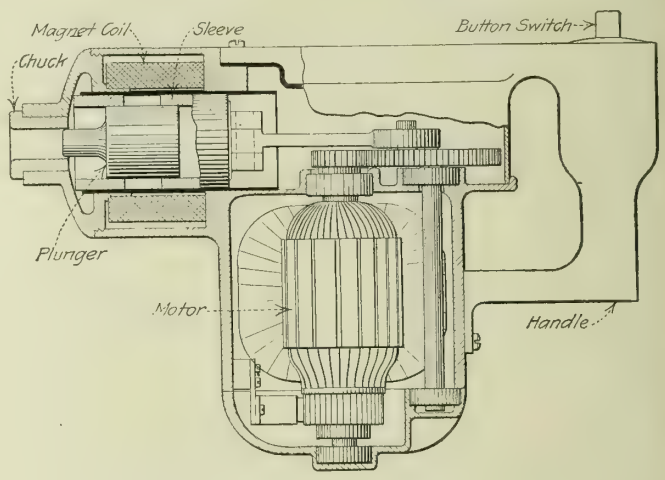
If the sides of a rectangular, hopper-bottomed ore bin have a slope of 50°, what would be the slope of the valley angles in the corners? Answer: As the bin is rectangular, the valleys have a divergence angle of 45° from the sides; consequently, if the graduated edge of the swinging arm is set at 45° divergence, opposite 50° on the true dip, read 40° on the pivoted diagonal arm.

* * *

Electric Hand Hammer and Drill

An interesting design of electric hammer and drill is now being marketed by the Western Electric Co., of Chicago, Ill. The scheme of the design is to throw a heavy plunger against the drill or chisel, there being a magnetic clutch between the motor drive and plunger to prevent transmission of the shock.

Connected to the motor through hardened gears and connecting-rod is a cylindrical sleeve having two relatively thick end sections joined together by a thin center section. This center section is as thin as is consistent with mechanical strength. The plunger which delivers the blow to the drill lies loosely within this cylinder and is not mechanically connected to any part of the mechanism. Outside of the sleeve lies the magnet coil. The coil is stationary, the sleeve moving back and forth within it. The winding is connected in series with the motor. As soon as the circuit is switched on —which is done by a button on the handle—the solenoid creates a magnetic circuit, with the thick sections of the sleeve as the poles and the plunger as the armature. As the sleeve is moved back and forth by the motor, the effect is that of moving the pole faces of the magnet back and forth. The plunger, clutched across the poles, moves with the sleeve, transferring its energy to the drill when it meets it, which it does near the end of the stroke. The plunger is slightly longer than the thin section of the sleeve, which gives it a



WESTERN ELECTRIC DRILL AND HAMMER

certain amount of over-travel and elasticity of connection. Ball bearings are used throughout.

This drill is made in three sizes for 110- or 220-volt direct current. One size weighs 14 lb. and takes 150 watts; the second weighs 25 lb. and uses 220 watts; the third weighs 50 lb. and draws 550 watts. Two sizes—150 and 240 watts—are made with universal motors for direct or alternating current. The prices range from $100 to $165.

* * *

A Double-Ended Squeegee

A new squeegee, with two pieces of split hose bolted to a metal frame, has been put on the market by the Groner-Shontz Co., Canton, Ohio. The advantage over a squeegee with only a single rubber is that when one piece of hose



GRONER-SHONTZ DOUBLE SQUEEGEE

wears out the other can be brought into use by merely changing the handle. When both are worn out new pieces of hose may be substituted by taking the frame apart.

Engineering News

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Indianapolis Flood Protection

SYNOPSIS—About 4½ miles of levee is being built along the White River, through the city. The water slope is faced with concrete, and concrete retaining walls are required at some points. Wood forms and two styles of steel forms are used for the walls. The several plants for earthwork and concreting are described.

The disastrous effects of the 1913 flood in the White River at Indianapolis, Ind., coming as a climax to the results of previous floods, led to a thorough investigation of the situation and the adoption of plans for a costly system of river improvement and flood protection. The work now in progress consists of the construction of a levee for about 4½ mi. along the west bank of the river, extending from 14th St. at Belmont Ave. (above the Emrichsville dam) to the embankment of the Indianapolis Belt R. R. just north of Raymond St.

This is shown in Fig. 1, and it will be seen that the work includes some rectification of the river channel. Plans are being prepared for similar protection to be built along the east bank. Somewhat similar work along Fall Creek, in Indianapolis, was described in *Engineering News*, Dec. 3, 1914.

The levee provides for a considerable increase in width of the river channel at high water, and several bridges will have to be lengthened to give the required waterway. The levee will be incorporated in the boulevard system of the city and will be topped by a broad driveway, with lawn spaces on each side. The top is from 12 to 17 ft. above the original ground level and 4 ft. above the 1913 high-water line. Retaining walls are required at some points, and at the crossing of a group of railways the driveway is depressed through a subway.

A considerable amount of land had to be purchased, and money paid also for damages to abutting property due to its being left below grade by the elevation of street approaches. It will be noticed that just south of Morris St. the levee passes on the outside of a packing company's property. This company did not care to assume any of the expense incidental to changes in its plant.

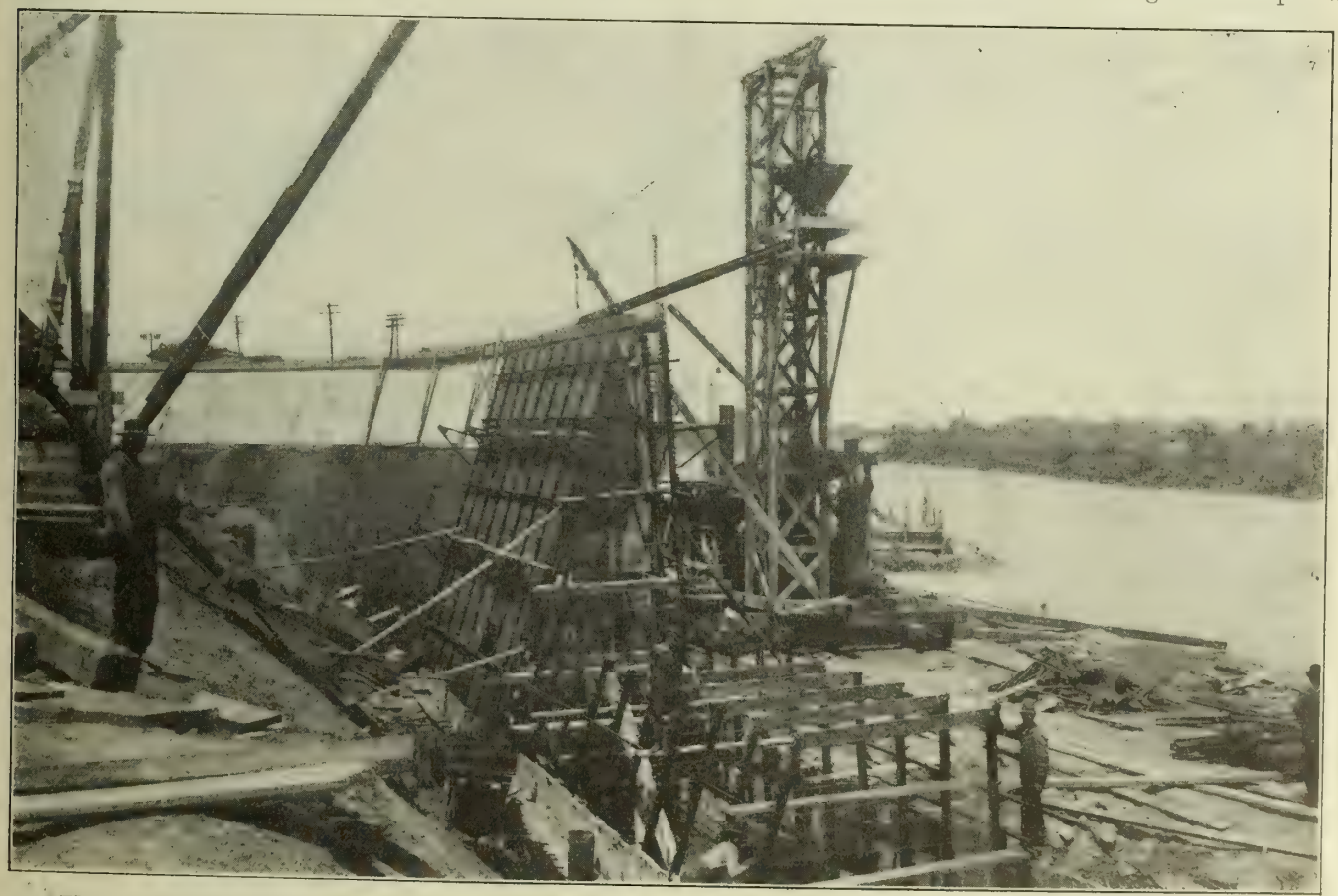


FIG. 1. BUILDING THE CONCRETE RIVER WALL ABOVE THE WASHINGTON ST. BRIDGE AT INDIANAPOLIS

The curved end at the left runs into the fill for the levee. The steel forms are shown erected and partly erected. On the river bank is the traveling concreting plant, with a spout to the forms

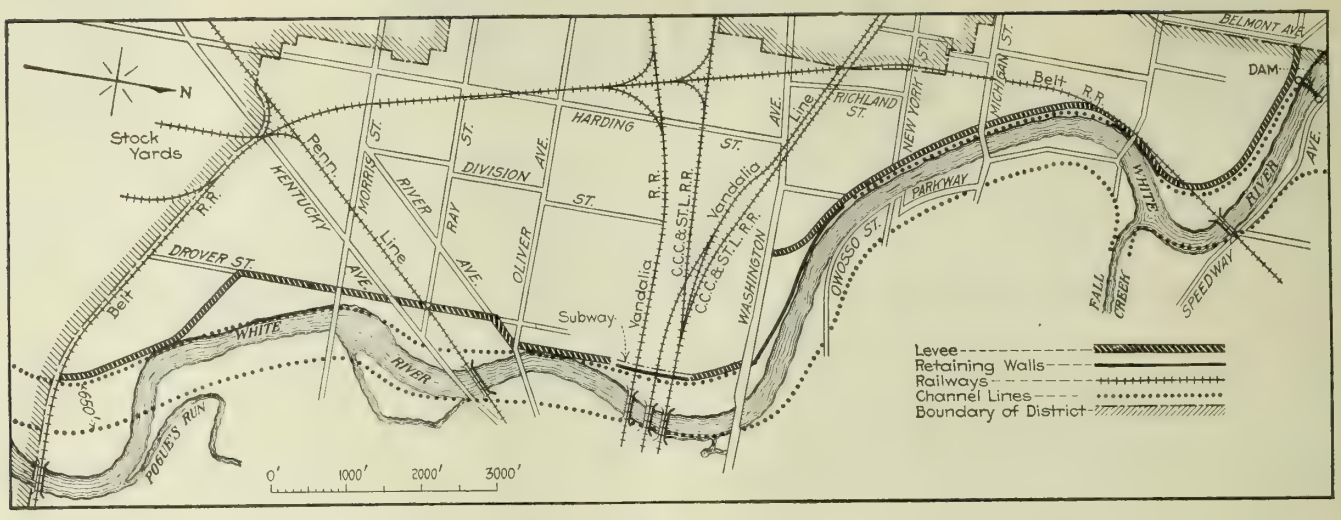


FIG. 2. MAP OF FLOOD-PROTECTION WORK ALONG THE WHITE RIVER THROUGH INDIANAPOLIS, IND.

The work was begun in June, 1915, and the contract calls for its completion by December, 1915. It is under the direction of B. J. T. Jeup, City Engineer, and D. C. Hayne, Assistant City Engineer. The general contract was let to the Marsch, Cleary-White Co., of Chicago, which has sublet some parts of the work as noted later. H. B. Mitchell is Resident Engineer for the company, and W. L. Taylor is Superintendent. The contract covers about 500,000 cu.yd. of fill and 50,000 cu.yd. of concrete. The contract price was not far from $460,000, and the land cost around $655,000.

Description of the Levee Construction

The typical section of the levee may be seen in Fig. 2, which shows also the special section at the subway. The top width is 75 ft. at the upper end of the work and 60 ft. for the part south of the Washington St. bridge. The slopes are 1 on 2½ for the river side and 1 on 1½ for the land side. The water slope is paved with concrete for the entire length of the work.

The roadway is to be finished with 12 in. of gravel, well rolled, and at some future time this will be covered with macadam paving. The lawn spaces and the land slope will be covered with 12 in. of soil, which was removed from the site and stored for this purpose.

The area for the base of the levee was cleared and grubbed, all buildings were removed, and the ground plowed deeply to insure a thorough bond with the fill. The material for the levee was all excavated from the low ground along its river side, no borrow pit being allowed to extend below low-water level.

The contract for all grading from the north end of the work to Washington St. (about 300,000 cu.yd.) has been let to T. A. Kearns, of Chicago. For the main part of this work he is using a 250-ton Lidgerwood dragline excavator with a 100-ft. boom and 4½-yd. bucket. This machine is mounted on four four-wheeled trucks traveling on two tracks. The tracks are built in sections, with longitudinal timbers under the ties. The machinery is all operated by electric motors using city power, a group of transformers being mounted on a wagon that stands a little distance from the excavator.

This excavator built the levee in two operations. It traveled first along the river bank near the toe of the slope, throwing up the main portion of the fill. It then ran along the top of the fill, taking material from the slope on the river side and casting it over to the land side. The material is nearly all gravel, and this wet gravel dumped from a height makes a very compact fill. The specifications require 10% allowance for shrinkage, but the actual shrinkage is much less.

At the lower end of the work on the Kearns contract there is also a 70-ton steam shovel, loading 4-yd. side-dump cars on tracks of 3½-ft. gage. There are three 10-car trains, with three dinkey locomotives, and a spreader car to level the fill. There are about three miles of track. A small Lidgerwood dragline excavator is used to dress the river side of the fill to the proper slope, in readiness for the concrete facing. This machine has a 75-ft. boom and a 1½-yd. bucket and is operated by steam. It runs along the top of the fill.

The work below the Washington St. bridge is being done by the Marsch, Cleary-White Co. Near the bridge it has used a 70-ton steam shovel served by three trains of 4-yd. 4-wheel side-dump cars of 3½-ft. gage, as shown in Fig. 4. Part of the fill made in this way is along the old levee and behind the concrete walls for the subway. Drag scrapers and teams are employed to spread and level the material dumped from the cars. About three miles of track are required, with 60-lb. rails on wood ties.

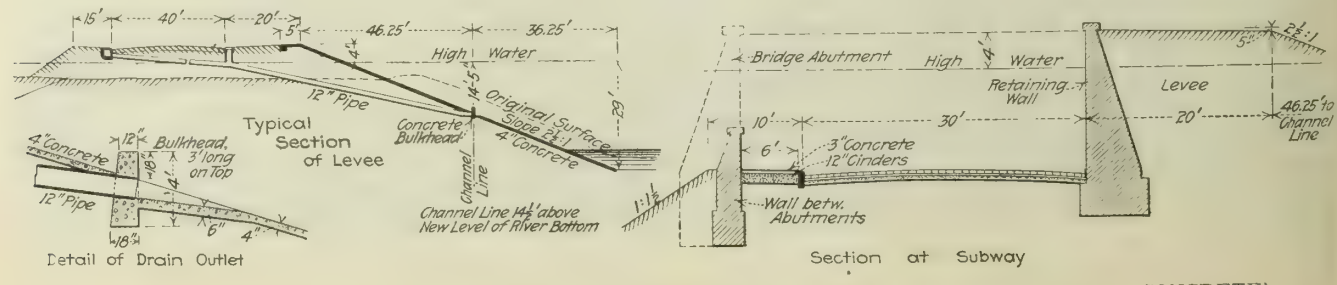


FIG. 3. SECTIONS OF WHITE RIVER LEVEE AT INDIANAPOLIS (RIVER SLOPE FACED WITH CONCRETE)

At the lower end of the work this company has a Monighan dragline excavator, which travels on rollers on a plank runway. This has a 75-ft. boom with 1½-yd. bucket. For a shorter reach, a section of the boom can be removed, making it 60 ft. long, and it can then handle a 2½-yd. bucket. This dragline machine makes the entire fill from the lower level instead of being placed on top of the fill for the finishing work, as on the other contract. It runs first along the edge of the cut or borrow pit, and then close to the toe of the finished fill, scraping the face of the fill to the proper line and slope and casting the material in the rear of the first fill.

All grading is carried on day and night, working two 10-hr. shifts. For the night shift acetylene torches are used.

The various street crossings have inclined approaches of 3 to 4% grade to the level of the levee, and for important streets retaining walls are built on the street lines. At less important streets, however, no walls are used and the fill is extended over the adjacent lots by agreement with property owners. The city pays the cost of raising houses to the new grade. The owners themselves have to undertake the work of bringing their property to grade, but they can arrange to have it done by the city at the time the street grade is changed.

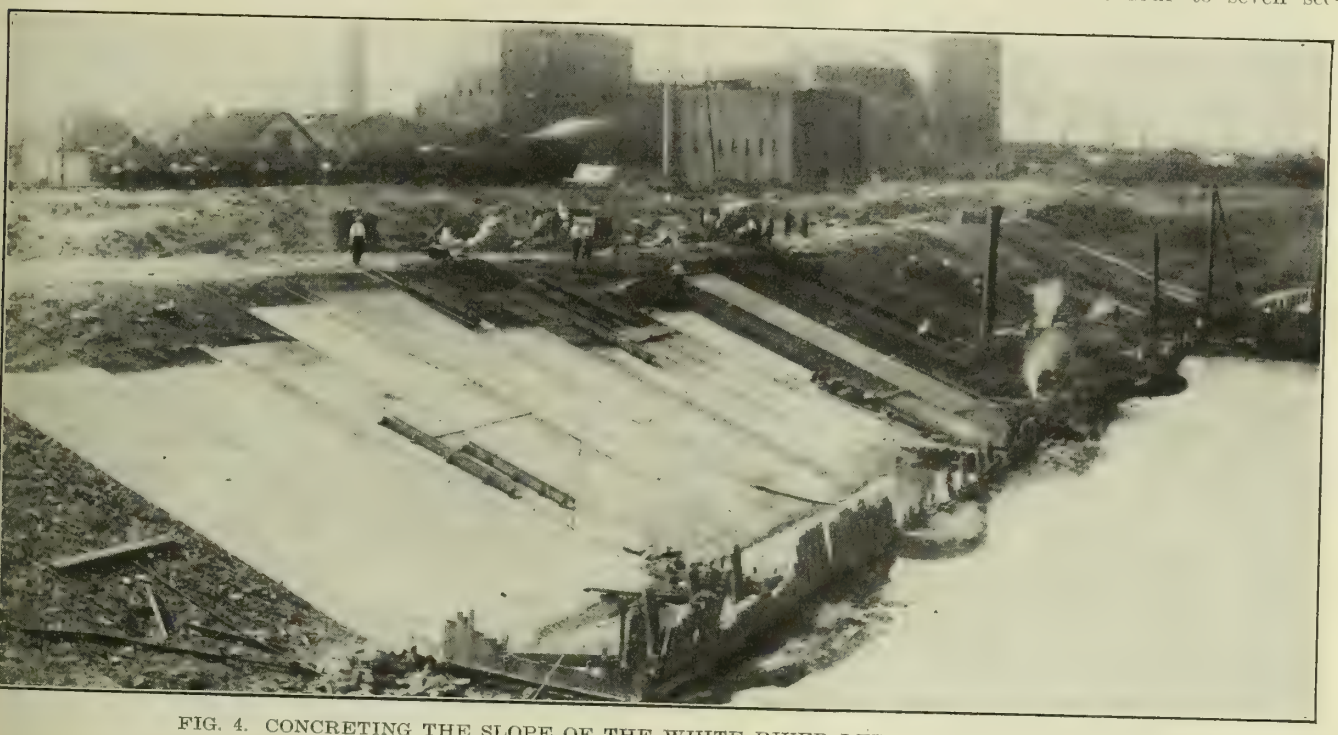


FIG. 4. CONCRETING THE SLOPE OF THE WHITE RIVER LEVEE AT INDIANAPOLIS
The coffer-dam is for placing the concrete on the toe of the slope

Concreting the Water Slope of the Levee

The entire face of the levee on the river side, with a slope of 1 on 2½, will be paved with a 4-in. layer of concrete reinforced by a layer of wire mesh. This work is being done by the Marsch, Cleary-White Co. Most of it is on the new fill, but south of the 10th St. bridge it is partly on the slope of the natural ground, which is at a higher elevation at this point. After the slope has been dressed by the small dragline excavator previously noted, it is trimmed by slip scrapers with mule teams and then finished by hand shovel and tamping to a smooth surface and the exact slope (shown in Fig. 3).

The concrete is laid in strips 15 ft. wide up the slope, being placed in alternate sections, and the sections separated by tar-paper joints. This facing is anchored by a small retaining wall, or curb, at the top (Fig. 1), the reinforcement being bent over into this. There is no anchorage or provision against scour at the toe, as it is expected that the toe of the concrete will be covered by the gravel and silt of the river bed. This work is shown in progress in Fig. 4.

The lower part of the concrete in each section extends from the toe to a few feet above water, leaving a horizontal joint. This is done in order to complete the concrete above water as quickly as possible. For this work a coffer-dam is formed, partly of wood and partly of steel sheeting 11 ft. long, driven by a piledriver scow. The sheeting is held by wales on a row of 18-ft. round piles. This coffer-dam extends over about four to seven sections and is divided by partitions 60 ft. apart. The depth of water in which this work was done varied from 4 to 11 ft. To keep the scow away from the sheeting a horizontal timber was placed through the leads from the deck, with its end resting on the piles. A 2,000-lb. drop-hammer was used.

The water was pumped out by 6-in. centrifugal pumps, supplied with steam from two portable boilers placed on platforms at the foot of the slope. At one point the coffer-dam was built of sandbags instead of piling, as the water was shallow, and this saved the time of driving piles.

The concrete is a 1:2:4 mix, using screened gravel. The wire netting is laid on the face of the slope, and the concrete is then delivered in place by means of steel chutes laid down the slope. For this work there are three gasoline and three steam concrete mixers, of portable size, making 6-ft. batches. These discharge the concrete directly into the chutes, where the men spade it along. It is made sufficiently stiff to stay on the slope. The surface is finished by means of a wooden float.

At intervals of about 350 ft. are concrete outlets for 12-in. pipe drains from the roadway.

At Washington St., the levee swings inland and its surface is inclined so as to bring the roadway level with the street at the intersection. The water front here, therefore, consists of a concrete retaining wall extending for

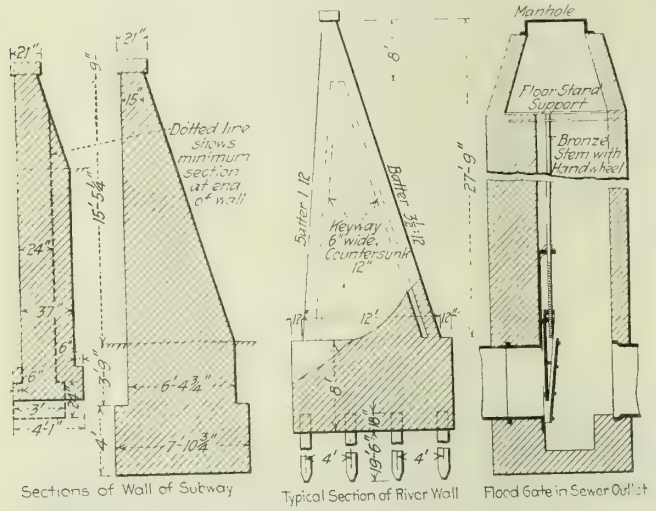


FIG. 5. SECTIONS OF CONCRETE WALLS ON THE WHITE RIVER LEVEE, AND SEWER MANHOLE WITH FLOOD GATE

The two sections at the left are for the wall at the subway, the dotted line showing the minimum section (where wall is covered on both sides). The section at the left is the typical river-front wall. At the right is a special manhole on sewer outlet with flood gate

a length of about 2,300 ft. and forming the wing walls of the new arch bridge. The typical section is shown at the right in Fig. 5. This wall is built on timber piling and will contain about 27,000 cu.yd. of concrete. The subcontractor for the wall is the Kuert Contracting Co., of Indianapolis.

This wall is built in steel forms of the Hydraulic Pressed Steel Co.'s make, shown in Fig. 6. These forms consist of a framing of upright and horizontal bars, fitted with clamps to secure panels, which constitute the face of the form. The main vertical pieces are U-shaped, flared at the wall and having slotted keyways in the back. The form boards, or panels, are 36x36 in., of wood, faced and edged with pressed steel. Clamps of U-shape, held to the vertical pieces by bolts or keys fitting into the keyholes, straddle the vertical piece and are driven home by wedges until they are tight against the backs of the form boards. When these boards are to be removed, the wedges are slacked and the clamps are turned parallel to the upright piece. The forms are kept from spreading by rods with Universal clamps, and until filled with concrete they are spaced apart by wooden temporary struts, held tight by the tie rods. Two men with hammers can erect the forms or remove them. For the curved end of the wall, where it joins the levee, wood forms were used. Tarred felt is laid on the back of the wall.

Gravel is excavated from the river by a dragline cableway and delivered to a washing and screening plant from which the sand and gravel fall to the elevated bins. From these bins the material is dumped into small steel cars which are hauled up a short cable incline to discharge into the hopper of a ½-yd. mixer. The concrete, in turn, is discharged into 1-yd. drop-bottom steel cars, of 24-in. gage, which run out on a trestle to deliver the concrete in place. There is also a steam derrick to handle material and to handle a grab bucket for excavation.

The concrete mix for all walls is 1 : 2½ : 5, and the use of the natural river-gravel mixture for the aggregate is permitted. This is not allowed for the 1 : 2 : 4 concrete for the slope facing. The fine aggregate is specified to range from a ¼-in. screen to a No. 30 sieve. The coarse aggregate is such as will pass a 1½-in. screen and be retained on a ¼-in. screen. The ends of sections of walls are formed with vertical V-shaped keyways 12 in. wide and 4 to 6 in. deep. Concrete surfaces that are to be permanently exposed are rubbed with wood blocks and clear water within 48 hours after the removal of the forms.

Concrete Gravity Retaining Wall

The new channel line approaches so nearly to the power house of the Indianapolis, Terre Haute & Eastern Electric Ry. at 10th St. that there is not room for the full dimensions of the levee. Here a concrete gravity wall will be built, with backfill behind it and the levee slope in front, the wall being covered for its entire length. This wall will be about 950 ft. long, containing about 10,000 cu.yd. The contractors are Hickey Brothers, of St. Louis, Mo.

The section is similar to that of the river wall, Fig. 5. The base of the wall is practically a rectangular block 5 ft. deep and 8 ft. 3 in. to 14 ft. 10 in. wide. It has pockets in the top to bond with the upper portion, which is built separately. This wall has four rows of timber piles 18 ft. below the base and with 18 in. of their heads embedded in the concrete.

The concreting plant is located near 10th St. The materials are brought in on railway cars. Sand and gravel are dumped from these cars into a track hopper, beneath which is a pit for the bucket of a Galion unloader, operated by a gasoline engine. A man beside the track operates a lever for the hopper gate by which the bucket is filled and another lever for starting and stopping the

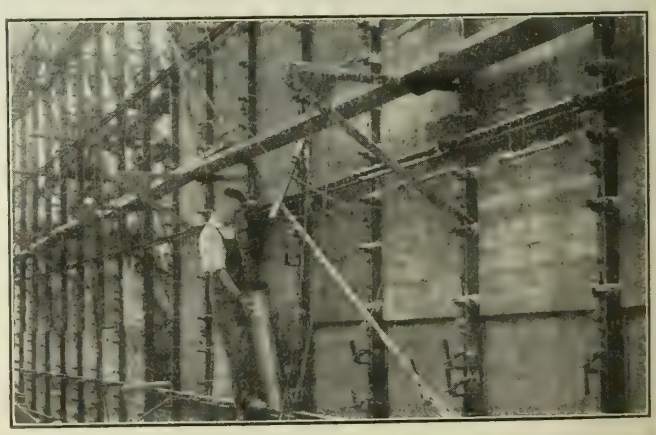


FIG. 6. STEEL FORMS WITH FRAMES AND PANELS FOR CONCRETE RIVER WALL

The bottom panels at the right have been removed to show the smooth surface of the concrete

engine. The bucket travels up an incline to the top of the storage bin.

From this bin the materials are fed to a measuring box containing the amount for a batch of concrete. This is at the ground level and has a drop bottom through which the charge is delivered to the steel-lined charging hopper of a Milwaukee 1-yd. mixer operated by an electric motor.

The cement is stored in a shed at the ground level, and the sacks are emptied into the hopper.

The concrete is discharged into a 1-yd. bucket in an elevator tower, which was 60 ft. high for the work on the lower portion of the wall. From this the concrete was spouted directly into place or into small steel side-dump cars, which were hauled by mules to a chute. For the upper section of the wall the tower was made 150 ft. high, so that the spouting could reach the entire length of the work.

For this upper section of the wall Blaw steel forms are used, in lengths of 30 ft. These are suspended from a traveling frame that straddles the walls and forms and can be moved ahead on rollers. Two derricks, with grab buckets, make the excavation for the lower portion of the wall. These, as well as the pumps, are operated by electricity.

Near Maryland St. the levee crosses three railways, which are at the level of the top of the levee. As the grades could not be raised, the roadway of the levee is depressed about 14 ft. to pass under the tracks, as shown in Fig. 3. A concrete wall (Fig. 5) retains that portion of the levee (20 ft. wide on top) on the river side of this depression. Along a part of the land side is a small retaining wall, extending between the bridge abutments and holding the toe of the railway fills.

The river wall contains about 5,000 cu.yd. and was built in wood forms. The 30-ft. roadway is level for about 500 ft. at the depressed level, and has approach grades of 3%. It will be paved with brick on 2 in. of sand and 6 in. of concrete. There will be one 6-ft. sidewalk, having a 3-in. concrete slab on 12 in. of cinders. The work on this subway was done by the Marsch, Cleary-White Co., but the railways built the bridge abutments.

Selecting Construction Power-Plant System

An Editorial Review

SYNOPSIS—A review of the special features and advantages of different forms of power—steam, electricity, gasoline and compressed air—based upon accumulated experience of numerous contractors and engineers engaged on work of various kinds in different sections of the country, as well as from the manufacturers of machinery. It presents a summary of experiences and opinions and does not attempt to make recommendations or form conclusions.

In purchasing equipment for contracting or other construction work an important consideration is the power to be used. For each job the problem must be dealt with in the light of the conditions affecting that job. Local conditions or features have an important bearing upon the plant and its operation, and may make one form of power or another desirable, quite apart from general considerations. In other cases two or more forms of power may be equally suitable or available, and then the question becomes one of convenience and economy.

The selection will depend to some extent on the location, whether in a city or town or in open country. Other factors to be kept in view are the class of work and the machinery to be used, the character of the labor, the fuel available, the water-supply, the distribution of the construction plant (whether concentrated or scattered), the size of the job, the time it will occupy and the equipment on hand or to be purchased. On construction work the question of fuel consumption may be much less important than reliability and continuous operation of the plant. The cost due to loss of time by an occasional idle crew waiting for repairs to be made is greater than a big saving in cost of fuel. This does not mean that direct waste should be allowed. In fact, an essential for financial success in contracting and for economical construction under any plan—whether by contract or day labor—is the locating and checking of waste and leaks throughout each job.

The forms of power to be considered are steam, gasoline and oil, electricity and compressed air.

Steam power is used so largely and has been employed for so long that the handling of steam-driven machines is well understood. It is natural to expect this power to be held in great favor. Its strong points are its reliability and flexibility, the readiness with which it can be adapted to varying conditions, its ability to stand overloading and hard usage, its successful operation with the smallest and largest machines, the simplicity of making wide speed variations, and the ease of adjustments and repairs. All these are cited by different contractors and engineers as the results of their experience.

Another point in its favor is that it is easy to obtain labor familiar with steam plant, and competent not only to handle it but also to maintain and repair it. In operating such machines as hoists and excavators, experienced men seem to know instinctively just how to apply steam power and how best to work the machine under difficulties. This may not seem important when selecting equipment, but the contractor or the engineer in charge of construction will find it a very important factor in getting the most out of his apparatus.

On the other hand, there are boiler troubles to be expected; the questions of space and weight may enter into consideration; and steam is not adapted for economical distribution from a central boiler plant. The supply of coal to small scattered machines is troublesome and costly, and there is often great waste of fuel at such machines. The fuel consumption, however, may be a relatively unimportant matter. An adequate supply of water, or water of quality suitable for boilers, is occasionally an almost insuperable difficulty. In cities the use of steam may be objectionable, or even prohibitive, on account of the smoke, noise and dirt. Oil, or gasoline and electricity may then be considered.

Electric power has been used with great success for driving such varied machinery as concrete mixers, hoists, pumps, compressors, steam shovels, etc. Some users.

however, consider it less satisfactory than steam for hoists subject to such severe service as those on piledrivers, derricks and locomotive cranes. The torque and overload characteristics of available electric motors range so widely that practically any needs can be met. The motor is not quite so rugged as the steam engine, however, since when it gets stalled there are severe though brief rushes of current which through repetition seriously injure the insulation and reduce the useful life. Electric machinery requires intelligent installation and handling, but some of those who have used various kinds of power are of opinion that under such conditions electricity presents many practical and economic advantages. The power usually is obtained from existing sources of supply, but under special conditions and for very large jobs it may be economical to generate current on the work.

Electric Power Has Important Advantages

A number of contractors doing work in large cities report that they use electric power whenever possible. At ordinary rates it is usually the cheapest, due largely to the elimination of waste which usually occurs with steam or other fuel. The machinery can be started and stopped without any preliminary "warming-up" or stand-by expenses. This equipment is considered also to be more reliable than gasoline and fully as reliable as steam. There has been little trouble from failures or breakdowns to cause high labor cost and other expenses of having a large gang of men disorganized while repairs are being made. In cities the freedom from smoke, dirt and noise is a special advantage, apart from the question of cost.

The power-supply lines in cities are usually numerous and well protected. In many places they are underground. Under such conditions there is not apt to be a complete interruption to the power supply. Not as much can be said for rural districts, if reliance has to be placed on a single transmission or distribution line.

The use of electricity by no means has been confined to cities, however. Electric shovels (mainly of the smaller class) have been used in a number of cases. On the Mesabi iron range the Great Northern Power Co. has sought to develop a field for the use of its current in operating the excavating shovels, but as yet no large-size electrical shovels suited for this work have been reported. Electrically operated suction dredges have been used in several cases, notably at Pearl Harbor, East St. Louis, Cleveland and Minneapolis (see *Engineering News,* June 13, 1912, p. 1105; Aug. 28, 1913, p. 432; Feb. 4 and May 6, 1915, pp. 220 and 889). All the diversified construction work on the Sun River Project of the United States Reclamation Service is being done by electric equipment. Details of this work were presented in *Engineering News,* Oct. 29, 1914, p. 870. Electric rock drills, of both piston and percussion types, are available (see *Engineering News,* Mar. 5, 1914, p. 499; July 30, 1914, p. 249; Sept. 16, 1915, p. 576). One of the great advantages claimed for both is a 90% reduction in power required for a given job.

Electric Plant for a Drainage Contract

A construction plant with semipermanent generating station was proposed for a large land-drainage contract, where the work would last for some years and would call for the regular operation of four or five large excavators. The estimates of first cost and daily cost of operation of this plant did not show a saving over individual steam-operated equipment, but it was figured that the daily output would be greater, thus showing a lower cost per cubic yard of material excavated.

For the efficient and economical operation of this electric plant it was proposed to organize the work as follows: (1) A civil engineer as general superintendent, to have charge of the men operating the excavators and to watch the cost per cubic yard; (2) an electrical engineer as assistant superintendent, to have charge of the electrical equipment and transmission lines and of all labor handling this equipment; (3) a mechanical engineer as assistant superintendent, to have charge of all machinery up to the motor and of all labor engaged upon the machinery.

An interesting example of the use of electric current on construction work is afforded by the Lahontan dam of the United States Reclamation Service (*Engineering News,* April 22, 1915), where a water-power generating plant was installed. Coal would have cost $9 per ton delivered, and a large saving was effected by the use of current costing only about 1c. per kw.hr. Besides the large saving in cost, it was found that the cableways, derricks, shovels, excavators, pumps, conveyors and practically all the construction machinery were operated more conveniently. Breakdowns or delays for repairs were rare. There were no banking and starting of fires and no freezing of pipes. The superintendent states that "when the day's work was done, the switch was thrown and everybody walked off the job knowing that the machine would start in the morning when the switch was thrown on."

Electric Power for City Construction

In many cases power is taken from the trolley wires of street or interurban electric railways; but this is apt to be unsatisfactory because of the great variation in voltage during hours of peak loading or when a number of cars are operating on the line with the machines. This may not be serious for miscellaneous small work done by the railway company's force, but on a large job it is likely to be serious for contractors, some of whom have called attention to this point.

The use of electricity in large cities may also impose special difficulties upon the contractor due to the existence of more than one style of supply. It is stated that in Greater New York, for instance, a contractor wishing to operate his plant by electricity must have several different types of motors on hand. In some sections there is only direct current, but of 220 and 550 volts, while in other districts there is alternating current of three voltages, so that five different motors must be available for each machine. It may be possible to secure convertible direct-current motors and proper transformers, so that only two or three motors would be necessary. In the city the price of current also varies greatly, ranging upward from 1½c. per kw.hr. However, several very favorable replies indicate that this difficulty is not serious.

Field for Gasoline and Oil Power

Gasoline engines have been used extensively for the operation of construction equipment, but mainly for the smaller class of machines, although dredges, shovels and other excavators may be included in the list. They are considered especially suitable for small scattered jobs, whether in the city or the country. These engines are

constant-speed motors, which is an advantage in some cases and a disadvantage in others.

Starting is difficult compared with steam and electric drive. The engines have to be turned over a few times by hand or auxiliary power, while the machine is lightly loaded, and then the load has to be thrown on more or less gradually by a clutch. Starting is so inconvenient that the engine is not stopped for small idle intervals. This throws a heavy burden on the clutch and increases both the maintenance and delays to work. Some shovels employ a stepped-drum hoist so as to get slow speed and large torque while the dipper is in its bank, but high speed and small torque when free of the bank.

Gasoline power is regarded by many contractors as a necessary auxiliary to steam plant and not a real competitor. There are localities where the cost of fuel and good boiler water or the existence of smoke ordinances makes gasoline the only alternative. There is no possibility of distribution of power, as with steam or electricity.

An objection raised by several contractors who have had experience with the engines is that they are liable to frequent stops and breakdowns, causing loss of valuable time and increasing the labor cost by rendering gangs of men idle until repairs are made. One cause of this seems to be the general idea that any laborer can operate a gasoline engine. Experience indicates that for satisfactory work it requires intelligent handling and regular oversight. If the engine is left to a man who simply starts it and then goes about other work, trouble is liable to occur. Difficulty in getting operators who can remedy defects and make repairs, and the delay and expense in getting repair men from the shops are other objections.

Some contractors consider gasoline engines suitable for light machines, but inadvisable for larger machines, and others are doubtful of them for work where it is important that there should be no interruption and where delays or stoppage would be serious, as in pumping out coffer-dams, etc. On the other hand, it is admitted that their use is increasing, and that greater experience with them (alike by builders, users and operators) will result in more satisfactory service.

For small concrete mixers the gasoline engine is lighter and more convenient than a steam engine and boiler. It also requires less attention. Gasoline road rollers are said to show an economy over steam rollers, due largely to the fact that they can work continuously without stoppages and delays for taking coal and water, raising steam, banking fires, cleaning flues, etc. Comparing a certain gasoline roller and two steam rollers operating in the same service, the daily cost of the first averaged $5.14, against $9 and $10.26 for the others. The cost for fuel, oil and waste averaged $1.14 for the gasoline machine and $1.34 and $2.21 for the steam machines. A high item of expense for the latter was the teaming of coal to the rollers, which averaged $3.69 and $4.07 per day.

Gasoline shovels are considered less speedy and reliable than those operated by steam, while for contractors' locomotives it has been suggested that a cheap but efficient variable-speed transmission is needed to make the machines satisfactory. Reliable and efficient hydraulic transmissions are available, but makers of gasoline engines for contractors' service have kept away from such apparatus. The machinery concern which is brave enough to undertake to apply these—or some simpler devices—to its work, it is reported, should reap a good reward.

Gasoline engines are used extensively in the construction work of the United States Reclamation Service, especially on the smaller jobs in desert country which are so scattered that the distribution of coal would be inconvenient and expensive, while electricity would be out of the question. Until within the past two or three years steam was considered as being the more reliable, and is still used for some of the concrete mixers, which work in a cloud of dust and cement. But for pumps, elevators, hoists, etc., the gasoline engines have been found very satisfactory.

Attention must be given to the fuel. In most cases it is common gasoline, but kerosene and distillate have been used with success. Often the engines are started on higher grade fuel and changed over after a few minutes. In one case "motor spirit" was substituted for gasoline because of its lower cost, but it caused excessive deposits of carbon in the engine, with consequent irregular sparking and combustion and frequent delays of 15 min. or more. The expense due to idle labor was so much greater than the saving in fuel that the best grade of gasoline was used for the remainder of the work. Engines working on distillate have been employed to operate drag-scrapers. Oil engines are successful for stationary plants, pumping engines, etc., but are felt to be generally too heavy for portable plants. Some notable designs of dredges with internal-combustion engines were described in *Engineering News*, Sept. 12, 1912, p. 468, and Jan. 28, 1915, p. 173.

Compressed Air

The use of compressed-air power is limited usually to special kinds of apparatus, and it is only rarely that it is distributed over a wide area to serve the various machines employed on a construction job. Such a case would be where a large supply of air at suitable pressure was necessary for special work. Considering power distribution alone, air is more efficient than steam, due to the lack of heat losses. The generation of compressed air is of course inefficient. Compressed air is in general use for rock drills, and it has been applied also to hoists, pumps and other machinery. Pumping water from deep wells is one of its most successful applications—both in temporary and permanent plants. The efficiency is rather low, but the investment charges and upkeep are low. On steel bridge and building construction some compressed-air power for riveters, hand hammers, etc., is required, whatever other power there may be—for instance, at the Quebec Bridge (see *Engineering News* of Oct. 14, 1915).

For tunneling, compressed-air drills and shovels are largely used because of the freedom from noxious gases and heat. In recent years systems for mixing and placing concrete behind tunnel forms by compressed-air carrier systems has come into considerable use (see *Engineering News* of Dec. 31, 1914, p. 1296, for work done in New York City, and Jan. 21, 1915, p. 123, for an installation at Montreal).

The Inflammability of Gasoline and air mixtures has been recently redetermined by G. A. Burrell and H. T. Boyt, of the United States Bureau of Mines, and their results are reported in Technical Paper 115, just issued. With gasoline having a specific gravity of 73° Bé., the limits between which the gasoline and air mixtures were inflammable were found to be 1.4% and 6.4% of gasoline vapor. When the initial temperature was increased before ignition the low limit was reduced to 1.02%. The range for complete combustion of mixtures was narrow and found to lie between about 1.5% and 2.5% of gasoline.

Subaqueous Rock Excavation—I

By Charles C. Phelps*

SYNOPSIS—Review of the development of American practice in excavating rock under water. First of a series. Design, equipment and use of drill barges for nontidal waters.

In spite of the great advances in 50 years of American practice in subaqueous rock excavation, there has been no single review of its progress or any complete presentation of the methods and apparatus developed. That lack it is hoped to supply in some measure by this and two subsequent articles, for the accumulated experience of one of the largest makers of subaqueous rock-drilling equipment has been made available. Of course there are some matters which might have been better treated had the files of all the manufacturers and contractors been open for use.

Economics of Subaqueous Work

Of the best-known methods of excavating rock under water—breaking by impact and dredging the débris, drilling and shooting before dredging and simple dredging without previous work—drilling, shooting and dredging is the scheme most extensively employed. Therefore the other procedures will be briefly dismissed here to take up the practices in this line alone, for this work is truly an art in itself.

It appears to be still an open question (according to the General Report of the 12th International Navigation Congress, 1912, "High-Powered Dredgers and Means of Removing Rock Under Water") whether it is more economical in the softer rocks, such as corals, soft limestone, tufas, etc., to build large dredgers of great power to excavate without blasting or to use a lighter and less costly dredger, loosening or breaking the material by the use of explosives. In using powerful machines without blasting there is always great strain and wear on both hull and machinery with consequent depreciation. The question then is whether this depreciation costs more than the drilling or blasting or whether the increased quantities that would be dredged in the same period of time when the material has been broken up by explosives would compensate for the cost of drilling and blasting.

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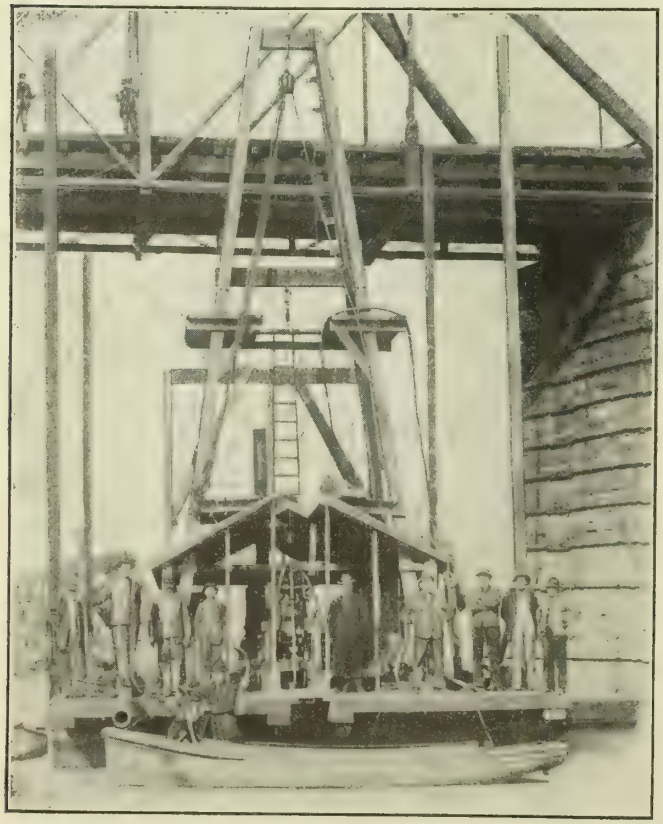


FIG. 1. BARGE WITH CORE DRILL

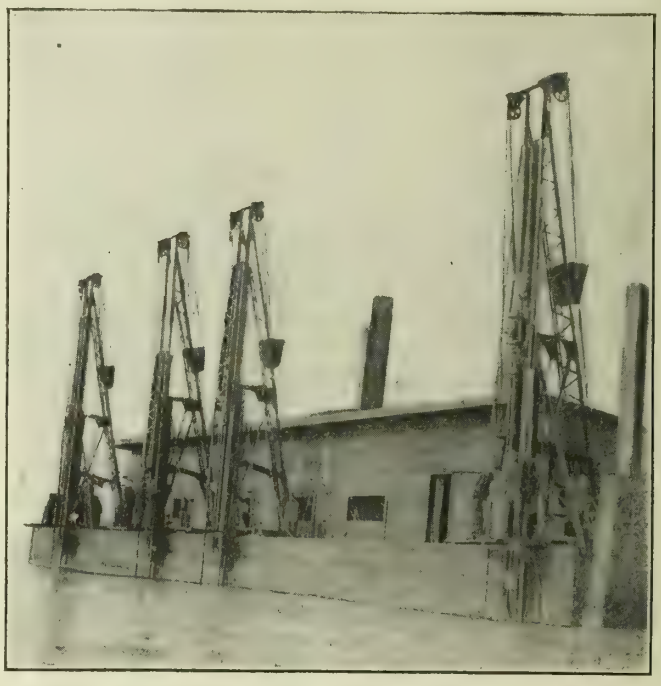


FIG. 2. DRILL BARGE "HURRICANE"

From a great amount of data available (reviewed in the report cited already) it would appear that drilling and blasting by the American method are the most rapid and economical means of preparing the harder rocks for dredging where the depth of rock to be removed is greater than 2 ft. When the rock to be removed is less than 2 ft. in depth the impact breaker attains greater economy as a means of loosening the rock. This depth of 2 ft. may be increased in thinly stratified rock or in rock that shatters easily.

Early Methods of Excavation

In the early days the usual methods were to lower explosives on the surface of the rock and attempt to fracture it by "surface blasting." The surface blast has very little effect on a ledge, but it can break up boulders and jagged projections of rock in a fairly satisfactory manner. Later a form of drop bar was introduced, by means of which holes were drilled and charges inserted in the regular way. This process was very slow and correspondingly expensive. Still another form consisted of a very heavy cast-iron bar



FIG. 3. BUFFALO DREDGING CO.'S "NO. 5"

tipped with a sharp steel point, which was alternately raised and allowed to drop on the rock. The bars used in this method weigh many tons. In operation the sharp point strikes the rock with great force and breaks off a certain amount with each blow. We occasionally hear of this system being used abroad even today, but in America it has been abandoned almost entirely for drilling and shooting.

Diving is scarcely ever necessary nowadays owing to the fact that wherever required both the drilling and charging can be done through submarine tubes, which serve very efficiently as guides. In the early days it was necessary to send a diver down to guide the bit until the hole was started, but through long experience the drill runners have acquired a highly developed "sense of feeling," which, added to the more adequate means now at their disposal, makes it possible to carry on all the operations from above the surface. Improvements in the drilling apparatus and in the methods of controlling it—especially the more recent methods of steam control—have greatly broadened the field of subaqueous excavation and lessened the cost of operations.

There are four distinct methods of subaqueous rock drilling in extensive use today, as follows: (1) From a floating drill barge, equipped with movable towers on which the drills are mounted; (2) from a floating boat equipped with submarine drilling frames, which carry the drills and which can be lowered to the rock bottom; (3) from a platform adjusted so that it can be raised above the wash of the waves, and equipped with tripod drills; (4) from a floating raft or pontoon equipped with tripod drills.

The later developments in submarine-rock excavation may be said to comprise refinements rather than changes of method, the four systems being those in vogue today. Even with such a variety of methods practically every job involves special problems peculiar to itself, so that much ingenuity is frequently demanded of the engineer in charge, as well as the crew.

Rock Drilling in Nontidal Waters

In studying operations on inland rivers and lakes and in sea harbors where there is little difference in tide levels, it is seen that much of the information to be recorded is equally applicable to other fields.

Before undertaking subaqueous rock excavation it is sometimes necessary to do a certain amount of prospecting to determine the character, order, thickness and extent of materials below the bed of the channel. With such information at hand the contractor is in a better position to figure the probable cost of rock removal and the engineer in charge is better able to plan the work.

The core drill is the most convenient and efficient drill for work of this class, as it extracts a core which is a perfect record of the strata to be penetrated. It has been successfully used for making soundings for bridge, wharf and dam foundations and for channels. Fig. 1 shows a prospecting barge with calyx drill used by the C. B. & Q. R.R.

In inland waters, waves, strong currents and the possibility of floods are occasional difficulties encountered and the likelihood of severe storms, extremely low temperatures, danger from ice packs, and the limitation of working space due to density of navigation are special considerations that might have to be taken into serious consideration in choosing equipment.

The various depths of the water over the area to be excavated and the depth, width and length of the finished channel must also be taken into consideration in planning. Other factors are the nature of the rock bottom, whether it is composed of sandstone, limestone, shale, flint, etc., or a combination of these materials, and its degree of hardness. It has also to be determined whether the rock is homogeneous or stratified, and if the latter, whether the material is solid or loose. The nature of the bottom mud or sand covering is a matter of no small importance.



FIG. 4. GOVERNMENT DRILL BARGE FOR MISSISSIPPI RIVER WORK

For work in nontidal waters the drills are mounted on barges of various types, and in designing and using drill boats the direction of the water currents, and even the direction of the prevailing winds, are matters that are too often left out of consideration until experience has taught that it pays to offer the least resistance to these elements.

When the above-mentioned conditions are fully known then the method of drilling, the sizes and lengths of starting and bottoming steel, the kinds of bits, sizes of drilling machines, etc., can be determined, as well as the best means of penetrating the overburden, should there be any.

Spacing, Depth and Diameters of Drill Holes

The most economical spacing and diameters of the holes depend on a number of factors, such as the hardness of the rock, its stratification and the required depth of the channel, as well as the equipment available on the boat. As a rule it pays to drill large holes and fewer of them, permitting the use of heavy charges. The diameters of the starter bits depend on the depth of hole to be drilled, and for a channel of any depth usually range from 4½ to 6 in.

The most economical spacing and charging may be based largely on the experience of the engineer on the ground, but are best determined by actual trial. It is customary to drill the rock directly to depth rather than to remove it in two or more layers. It is usually necessary, however, to drill the holes a little below grade, to make sure that the dredging will be done to specified depth. In perfectly homogeneous rock the depth below pay grade ought to be about half the distance between holes. In practice, however, the rock is seldom perfectly homogeneous, and therefore this rule usually has to be modified considerably, as it is cheaper to go a little below grade in the beginning than to "sandpaper" the bottom after dredging. The dip of the river bed, stratification of the rock, seams, embedded stones or pebbles, boulders and the grain of the rock, all affect very materially the proper depth.

Many of the most important subaqueous drilling operations in this country have been for improving the waterways of the Great Lakes. This work has required the heaviest of equipment and the present apparatus has been gradually evolved. Formerly only one or two drills

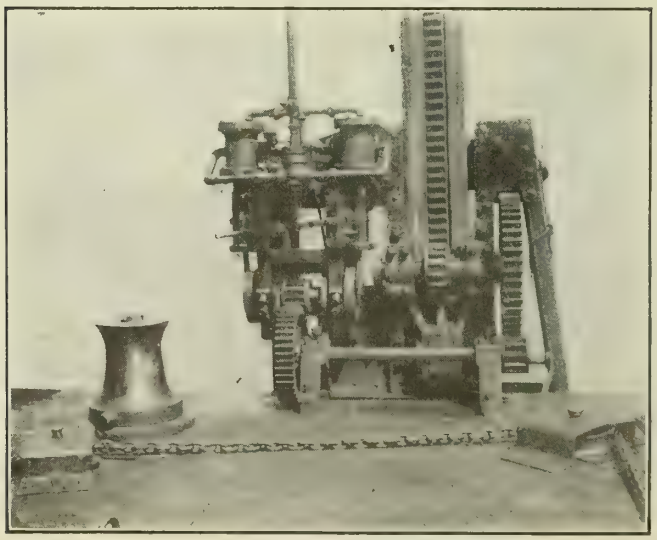


FIG. 5. SPUD HOIST ON "HURRICANE"

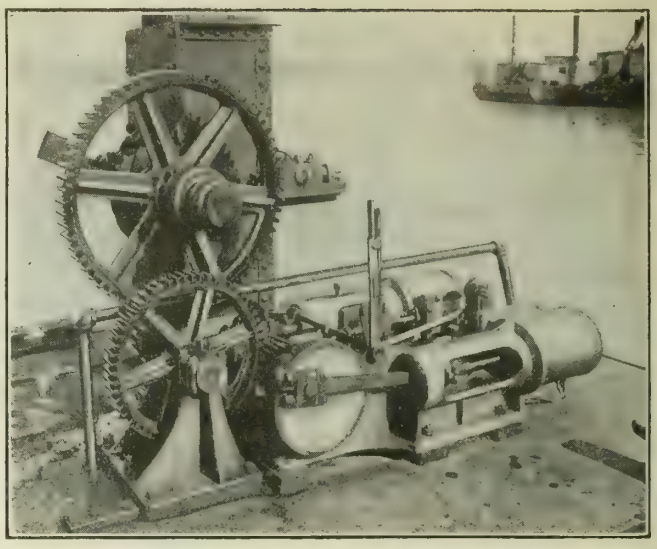


FIG. 6. SPUD HOIST ON MISSISSIPPI BARGE

were mounted on each barge, and the boats were often but little more than makeshifts—old scows, etc. As the art of submarine drilling progressed, boats particularly adapted to such service were developed, the largest of them having as many as five or six drills.

The drill barge is anchored by four spuds, or mooring posts, of a size that will support a fraction of the weight of the boat and insure it against shifting. The drills are usually mounted on steel or wooden guide towers, secured to one side of the barge. Many of these boats are built almost entirely of steel. While they are made in a great variety of sizes, in recent years they have been more or less standardized, so that it is probably safe to state that the length seldom exceeds 150 ft. and the width usually ranges from 35 to 40 ft., while the depth is usually 6½ or 7 ft.

The boats contain all the necessary machinery for operating the spuds, drills and anchors and have a sufficient coal capacity for a run of several days. The boiler, pumps, winch engines for shifting position, the coal bunkers, sharpening apparatus and all auxiliary equipment are usually placed on the barge opposite the drills, thus balancing and making the outfit self-contained.

Evolution of Drill Barges

It may be of interest to review briefly the history of this type of boat. The pioneer in the modern drill-scow method of submarine rock excavation and constructor of the drill scow substantially as it stands today was C. F. Dunbar, of Buffalo, N. Y. About 1866 Mr. Dunbar undertook the removal of rock from the channels at the harbor of Erie, on Lake Erie. He drilled and blasted a portion of the rock through the ice, in winter time, and when there was no ice, used a raft for the purpose. All the drilling was done by hand. The average depth of the excavation in the rock was about 6 ft. In 1872 Mr. Dunbar undertook further excavation at the harbor of Port Colborne, on Lake Erie. An attempt to drill by hand failed, because the rock was found to be so hard that three men could drill only about 1 ft. in a day. During the following winter he converted an old 50-ft. dredge into a drilling scow, which was very similar in its main features to the boats used today. This boat employed spuds at the corners and two steam drills mounted in towers arranged for both longitudinal and vertical feed. The

drilling machines were raised and lowered by a hand-operated windlass and the towers were moved along the track with the aid of crowbars. The boat was enabled to drill ten holes, spaced 5 ft. apart at one setting of the scow. The drill feed was 9 ft. Some seven or eight years later Mr. Dunbar improved his boat by the addition of a hydraulic ram with which to move the drills both vertically and horizontally, and by the use of a steam pump to force water into the drill holes for the purpose of keeping them free of cuttings and débris.

Handling Drill Boats

The barge is anchored by means of cables, anchor chains or spuds, or a combination of these means, depending on local conditions. In very swift currents chains have been found more advantageous as breasting lines than wire cables, as they are less severe on the breasting gear while shifting position. The greater weight of the chain permits an amount of spring or elasticity that would be absent with the lighter cable.

In operation the barge is brought into approximate place, anchors are dropped and winches used to move the barge into exact position. The heavy spuds are dropped to the bottom after the boat is properly located over the work. The barge is then lifted until a sufficient fraction of its weight is supported by the spuds so as to insure holding it in a fixed position. Usually a lift of 5 or 6 in. is sufficient to hold the barge steady. These spuds are made either of structural steel or of timber and have the lower end fitted with a steel point or iron shoe intended to penetrate the surface.

The drills are mounted in wooden or structural-iron towers and have effective feeds of various lengths up to about 25 ft. At first the drills were raised and lowered by hand-operated windlasses, but later a hydraulic lift cylinder connected to the backing of the drill became the common means of raising the machine in the guides, the down feed being accomplished by gravity. With later types, steam hoisting engines have been adopted and are considered by many to be more satisfactory. They certainly require less power and enable boats working in colder climates to remain in operation for a longer season, steam-driven machinery not being so easily subject to trouble from freezing as hydraulic machinery.

The drill towers rest on rails running the length of the barge and fastened to the deck. There are the necessary means for clamping the towers in different positions along the rails. Each has vertical guides on which slides a heavy cast-iron saddle, to which the drill is bolted. In the steam type, ropes or cables, passing over one or more sheaves on top of the tower, connect this saddle with the drum of the hoisting engine. The drill-feed regulation is controlled by a brake lever on the hoisting engine operated by foot. By this means the feed can be regulated to a nicety, and it also insures rapid handling when the steel must be lifted from the hole. Engines for this purpose are also built with throttle reverse.

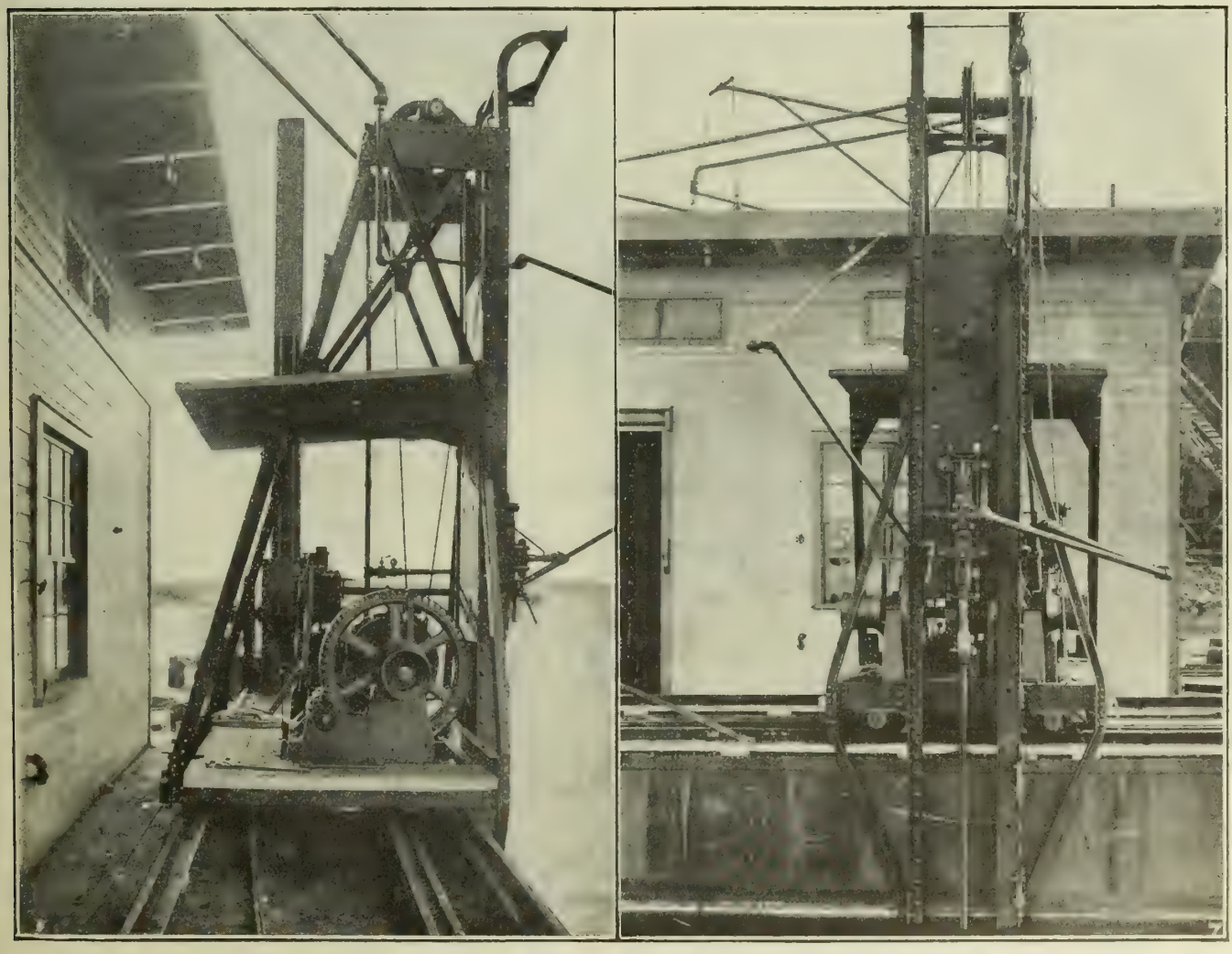


FIG. 7. FRONT AND SIDE VIEW OF DRILL TOWERS ON MISSISSIPPI BOAT

When this type of engine is employed it is advisable to employ a balanced-throttle valve, so that the engine can be turned a small amount in either direction when desired, by applying slight pressure on the valve by hand.

Fig. 7 shows the construction of a drill tower on the boat illustrated in Fig. 4. The drills on this boat are not

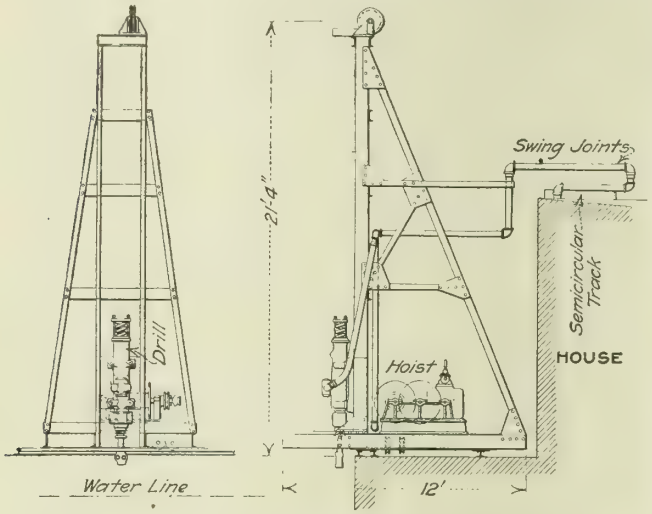


FIG. 8. WAGON TOWER USED ON MOHAWK RIVER DRILL BARGE

of very large size, having only 4¼-in. cylinders, and the tower illustrated is therefore of relatively small size. The views, however, serve to illustrate clearly the principle of operation, irrespective of the size of the plant. In some cases a regular drill-wagon tower has been adapted as a mounting for a small submarine drill. This type (Fig. 8) was used for work on the Mohawk River, where the depth of cut was moderate.

The towers are moved along the rails in a number of different ways. One method for shifting employs a separate wheel on the hoisting engine which engages with a chain secured to the deck at either end of the drill-tower runway. The chain wheel is connected to the hoisting engine by means of a jaw clutch, the chain passing over guide wheels in the base of the tower. This is an efficient and rapid means of moving the frame in either direction. Fig. 7 shows how a rack on the deck engaging a cog wheel on the drill frame is utilized for the same purpose.

In the older system of hydraulic control a hydraulic cylinder is used instead of the hoisting engine (see Fig. 9). The supply pump for this is located in the deck house and the water pipes leading to the tower are arranged in very much the same manner as described later for steam control. The same sizes of drills, and operated by steam in the same way, are used whether steam or hydraulic control is employed for the drill towers.

Piping Arrangements for Drills

The movements of the drill tower along the deck and of the drill up and down in the guides necessitate flexible steam and hydraulic connections, so that the pipes will automatically adjust themselves to any position of the tower. A variety of methods is in common use, such as short lengths of hose, telescopic pipes, or arrangements of swing-jointed pipes (Fig. 10). Any one of these arrangements provides for the vertical as well as horizontal movement of the drill. The controlling valve for the steam is located within convenient reach of the operator.



FIG. 9. HYDRAULIC THROTTLE CONTROL ON DRILL BARGE

By locating the main steam pipe inside of the deck house it is protected from the weather. The branch pipes may extend through the deck-house roof, as shown in Fig. 10. In that view the pipe lines are arranged in pairs. One

PERFORMANCE OF THREE DRILL BARGES ON DETROIT RIVER IMPROVEMENT

Boat	Spacing of Holes	Average Total Depths of Holes, Ft.	Depth Drilled Below Pay Grade, Ft.	Holes per Shot	Charge per Hole	Av. No. Holes Drilled per Shift	Lin Ft. Drilled per Shift	Depth per Drill, per Hr., Inc. Delays, Ft.	Speed, Ft. per Hr., Inc. Setting, Cutting and Loading	Ratio Cutting to Total Time	Ratio, Moving Boat on Range to Total Time	Ratio Idle (Not Inc. Moving) to Total Time	Av. Cu. Yd. Pay Rock per Shift
1*	5 ft. on deck; 4½-ft. move-over	9½	3	650	12 20-oz., 60% sticks	52	510 (average)	9.3 (average)	16.8	0.669	0.091	0.24	280
2†	5x5 ft.	12.1	3	228	20 20-oz., 60% sticks	32½	390	8 9	13.4	0.588	0.013	0.399	270
3‡	5x5 ft.	12½	2½	396	17 18-oz., 60% sticks	25	310	7 1	14	0.512	0 028	0 46	232

* Buffalo Dredging Co.'s all-steel boat No. 5—138x31¼x6½ ft.; steel house 19x110 ft.; four spuds with 6x8-in. steam engines; two steam capstans; two Scotch boilers, 90-lb. gage pressure; pump, blower, forge, steam hammer, anvil, bench, vise, acetylene plant, etc.; five Ingersoll-Rand 5½x8-in. drills; drill feed, 19 ft.; Dake steam hoisting engine; 2-in. x 34-ft. steels; 3½-in. bit gage; ½-in. waterjet; crew of 5 drillers, 4 helpers, 2 blasters, foreman, fireman, smith and 2 smith's helpers; 10-hr. day shifts and 12-hr. night shifts.

† Dunbar & Sullivan's "Hurricane" (Fig. 2)—All-steel, 100 ft. long; four spuds with engines; two steam windlasses; two Scotch boilers, 90-lb. gage pressure; three pumps, blower, forge, anvil, bench, vise, dynamo, etc.; two Ingersoll-Rand 5½x5½-in. and two Ingersoll-Rand 5½x6½ drills; 19-ft. drill feed; hydraulic - ram hoist; 1¼-in. x 35½-ft. steels; 3½-in. bit gage; ½-in. waterjet; crew of 4 drillers, 4 helpers, foreman, fireman, powderman, smith and 2 smith's helpers; two shifts of 11 hr. each.

‡ M. Sullivan's all-steel boat "Destroyer"—110x33½ ft.; four spuds and engines; two steam capstans; Scotch boiler for 100-lb. gage pressure; two pumps, blower, forge, anvil, bench, vise, dynamo, etc.; four Ingersoll-Rand 6½x9-in. drills; 19-ft. drill feed; hydraulic-ram hoist; 2½ and 2¼-in. by 36¾-ft. steels; 4 and 4½-in. bit gage; ½-in. 150-lb. waterjet; crew of 4 drillers, 4 helpers, foreman, fireman, blaster, smith and 2 smith's helpers; two shifts of 11 hr. each.

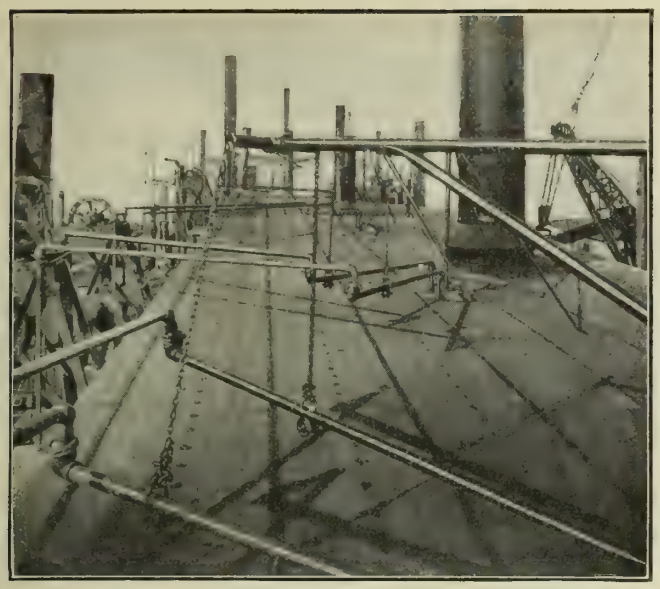


FIG. 10. FEED PIPES AND SWING JOINTS, MISSISSIPPI DRILL BARGE

supplies steam to both hoisting engine and drill. There are three swing joints between the deck-house roof and tower and three more between the hoisting engine and drill. The second pipe supplies water under high pressure for the washout jet and is similarly equipped with swing joints. The movement of the swing joints is facilitated by swinging-crane adjustment (Fig. 10) or by a guide track bent into a semicircle upon which the jointed pipe slides. The steam pipes should be protected by nonconductive material as far as practicable so as to reduce the loss of heat by radiation.

Drill-Barge Performance Records

The boats employed on the Livingstone improvement of the Detroit River are representative of the types under discussion. Therefore some figures are appended from the records of three typical examples of the many boats employed on this job. (See Dana & Saunders' "Rock Drilling," Wiley & Sons, New York.) The three boats were owned by different contractors. The channel cut was 23 ft. deep, 300 ft. wide and was on the 18,250-ft. long section of the job known as Section 3. The rock is a hard limestone having 1 to 2 ft. of sand overburden. The work was divided into three strips, each 100 ft. in width, and each of the boats referred to was employed on a part of one of these strips.

Subsequent Notes

The later articles on subaqueous drilling will discuss (1) drills and drilling machinery, (2) work in tidal waters with submarine frames, (3) drilling from platforms raised above the waves, and (4) the use of drill pontoons in shallow waters. Indebtedness is acknowledged to the sources of information already indicated. In addition special acknowledgment should be made to Charles C. Hansen, of Phillipsburg, N. J., who furnished much of the detailed information.

Protecting the Water-Supply of Caracas—The government of Venezuela has appropriated about $16,000 for the purchase of two farms situated upon one of the watersheds that supply Caracas. According to United States Consul Homer Brett, of La Guaira, these farms will be depopulated and reforested as a part of an effort to improve the water supply and decrease the high death rate of Caracas.

Lead and Tar Paints Compared on Minidoka Project*

By Barry Dibble†

The painting of the penstocks and draft tubes of the Minidoka turbine installation has been a source of considerable trouble. Several trials were made before anything was found which would withstand the action of the water.

The shop paint was of red lead, or iron oxide, and oil. A further coat of red lead and oil was applied on the job, after assembling and riveting the pipes. After two years' service an examination showed that this paint had practically disappeared. After considerable study and experiment, with unsatisfactory results, the following formula for red-lead paint, obtained from one of the largest paint manufacturers in the country, was adopted, the lampblack being used as a hardener for the surface:

First Coat—30 lb. red lead per gallon of linseed oil, using one-third boiled and two-thirds raw oil.

Second Coat—Same as above, with 4 oz. of lampblack per gallon.

Third coat—Same as above, with 4 lb. of lampblack to the gallon.

Paint was applied according to this formula during the winter 1912-13. After part of this work was done the chief electrical engineer suggested that we try the material used on the Los Angeles Aqueduct (see article on San Fernando Siphon, *Engineering News,* May 21, 1914), and in accordance with his instructions we ordered water-gas tar for the first coat and coal-gas tar for the second and third coats. This was applied to penstock and draft tube No. 1.

At the end of the 1913 season the red-lead paints applied according to the above formula showed decided deterioration where in contact with water, while the tar was in very good shape, except for slight rust spots around some of the rivets, where cleaning evidently had not been properly done. At the end of the 1914 season the lead paint had almost entirely disappeared where exposed to water and the tar paint was in good condition on the penstocks, but was apparently getting rather thin on the outside of the draft tube. Where the red lead does not come in contact with the water, as is the case on the upper part of the exterior of the draft tubes, it shows no deterioration and is now in excellent condition.

During the fall of 1914 the parts exposed to water on all the draft tubes were scraped, cleaned and repainted with water-gas and coal-gas tar. There was a considerable variation in the condition on the different tubes, due to the fact that some had two coats of lead and some three, and also due to the fact that in some cases the weather was cold when the paint was applied, and it therefore may not have set sufficiently before being submerged in the water. The tar paint on draft tube No. 1 would, under ordinary circumstances, have gone a much longer time without renewing, but it was thought advisable to go over it in order to determine what condition the tar coating was in, and also to find out what was the condition of the iron underneath.

Cleaning was done by means of steel scrapers and brushes. With the lead paint the iron pitted badly, and it was necessary thoroughly to clean out the loose scale

*From United States Reclamation Record, September, 1915.

†Engineer in charge of power and pumping stations, Minidoka Project.

before attempting to repaint the metal. The rivet heads particularly presented a serious difficulty with these scrapers, and we found it very slow to do a good job cleaning around them. After finishing this work on the draft tubes, a special brush was made up which could be fitted over the rivet heads and revolved in a breast-drill frame. This worked satisfactorily, and it materially reduced the cost of cleaning the penstocks.

The men working on this scraping were affected by lead poisoning, and precautions had to be taken to make their work intermittent. Even at that it was necessary for some of them to lay off for a considerable time to overcome the effects of the lead dust. After thoroughly scraping the iron, it was brushed down with scratch brushes, to remove the loose scale, but no attempt was made to get off all the dust prior to applying the water-gas tar.

In scraping draft tube No. 1 we found an excellent adherence between the metal and the tar paint, which had been on 1½ yr. at that time. Where it was scraped down to the metal it left a bright surface. On one patch, of about 1 sq.yd., apparently the iron had not been well cleaned before applying the paint, as it was in a place difficult to reach, and here scale had formed on the iron, but this was the only place the iron had not been protected from the water. Altogether, the results with the tar have been most satisfactory.

There was quite a variation in the consistency of the water-gas tar purchased at different times. As ordinarily obtained, it was necessary, in the cool weather during which we painted, to mix a little gasoline with it. Usually the mixture was about 1 qt. of gasoline to from 3 to 5 gal. of tar. This tar was then spread on carefully with a brush in the same manner as ordinary oil paint, working it carefully into all pits and around rivets. One gallon of tar covered about 30 sq.yd. with one coat. The cost was about 15c. per gal., about one-half of which was freight charge from Chicago to Minidoka.

The tar is rather slow in setting even if the weather is warm. It hardens when the thermometer drops, but when the weather warms up will become sticky even after a considerable period. As most of our work was done in cool weather, it was possible to apply the second coat within 10 to 14 days. In only one case (No. 4 draft tube) were we able to get a third coat on prior to the time when the weather turned so bad that it was impossible to do outside work. It does not appear to affect the tar to put it into the water before it is thoroughly hardened.

The Reclamation Service is now testing this tar coating on a number of structures, both earth covered and exposed to the weather, under different conditions as to extremes of temperature, alkali action, etc.

Reinforcing Details of Delco Building, Dayton, Ohio

A carefully planned factory design, a flat-slab floor system containing new elements, and some interesting reinforcement details are found in the new Delco Building being erected in Dayton, Ohio. Schenck & Williams, of Dayton, are the architects. Nelson J. Bell is the structural engineer for the architects. A. Bentley & Sons Co., Dayton, Ohio, is the contractor.

The building is 423x93 ft. over all, extending between First and Second St. and facing on Race St. The general scheme involves a future extension to the next street east by the construction of a duplicate building plus a 22-ft. connecting bay. The completed building will be 423x203 ft. over all, with an interior court 61x237 ft. Features of the layout are: Clear floor areas without partitions; maximum sash area with windows extending up to the ceiling (spandrel beams above the floor, bottom flush with ceiling); the omission of a

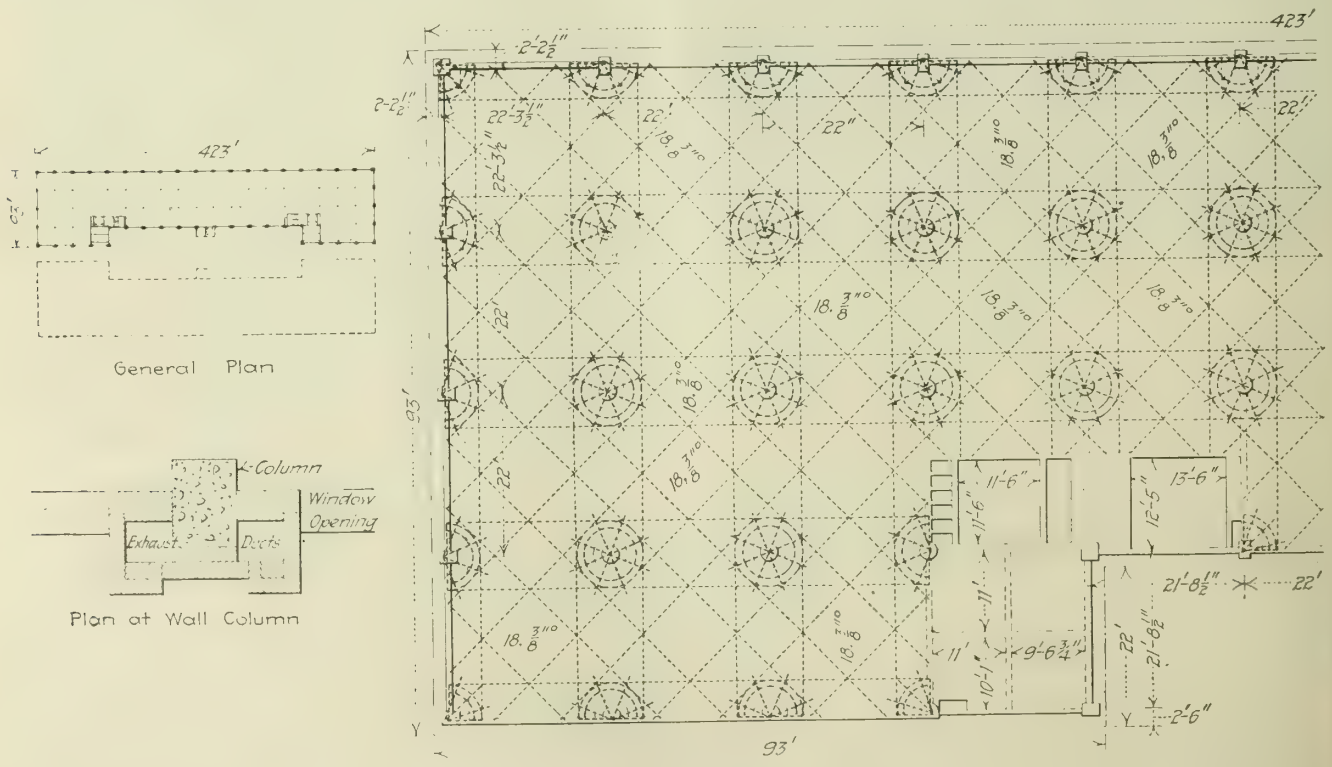


FIG. 1. FLOOR ARRANGEMENT AND FLAT-SLAB REINFORCEMENT OF NEW DELCO FACTORY BUILDING, DAYTON

basement on the theory that a floor above ground where it gets natural light is worth more than a floor below ground; and an original arrangement of the blast heating and ventilating system, with vertical heat ducts rising from plenum chambers in the center of the building and vertical vent ducts at all the wall columns.

Structurally the floors represent a flat-slab system similar to those heretofore in general use, but differing from them in some details. The column heads, like the columns, are circular and contain ring rods as well as radial rods. The radial rods do not bend down into the columns, but cross at the center (note bend in middle, in Fig. 2). Bands of rods extend in four ways, in the directions of the column rows and in the two diagonal directions.

The radial rods will be supported on little bent-iron chairs, as sketched by a detail in Fig. 2. The belt rods will be kept up off the floor-forms by pieces of cross-rods.

A feature of the ceilings is the enormous number of ceiling inserts for attaching shaft-hangers and the like. The inserts are to be placed 18 in. apart in both directions, making approximately 14,000 per floor. In the present Delco Building (just north, across First St.) the inserts are spaced 2 ft. apart both ways, and it is claimed that for the conditions peculiar to the plant they have been found insufficient, so that a closer spacing was adopted for the new building.

The ceilings are flush and level with the tops of the windows. The beams around the elevator wells and stair-shafts project below the ceiling, but all of these are flush with the shaft walls. Both spandrel beams and cornice are above slab level. A novel form of assembled reinforcement is used for all beams, as shown by the sketch in Fig. 2. The straight and the bent-up girder rods are connected from each quarter point to the end by a zigzag of stirrup-bar looping, which, however, is wrapped around both rods so as to make the assemblage a unit. This looping is bent before assemblage, and is then slipped over the main rods and jammed fast.

As the spandrel beams had to connect to the columns, it was necessary to place the vent ducts (at exterior columns only) outside the window line, as indicated by the enlarged section in Fig. 1. This has the advantage of giving deep vertical reveals and thus favoring the architectural development of the exterior, but it meant that the basement retaining-wall had to be set out from 1 to 2 ft. The wall, as shown by a detail sketch in Fig. 2, occurs only at the heater and fan room space. Under the rest of the building there is no basement except the heat tunnels and the plenum chambers, but the concrete forming the ground-floor surface is laid directly on the natural ground. Here the inclosure walls reaching up to the first-story window sills have the same general shape and detailing as the basement retaining-wall sketched.

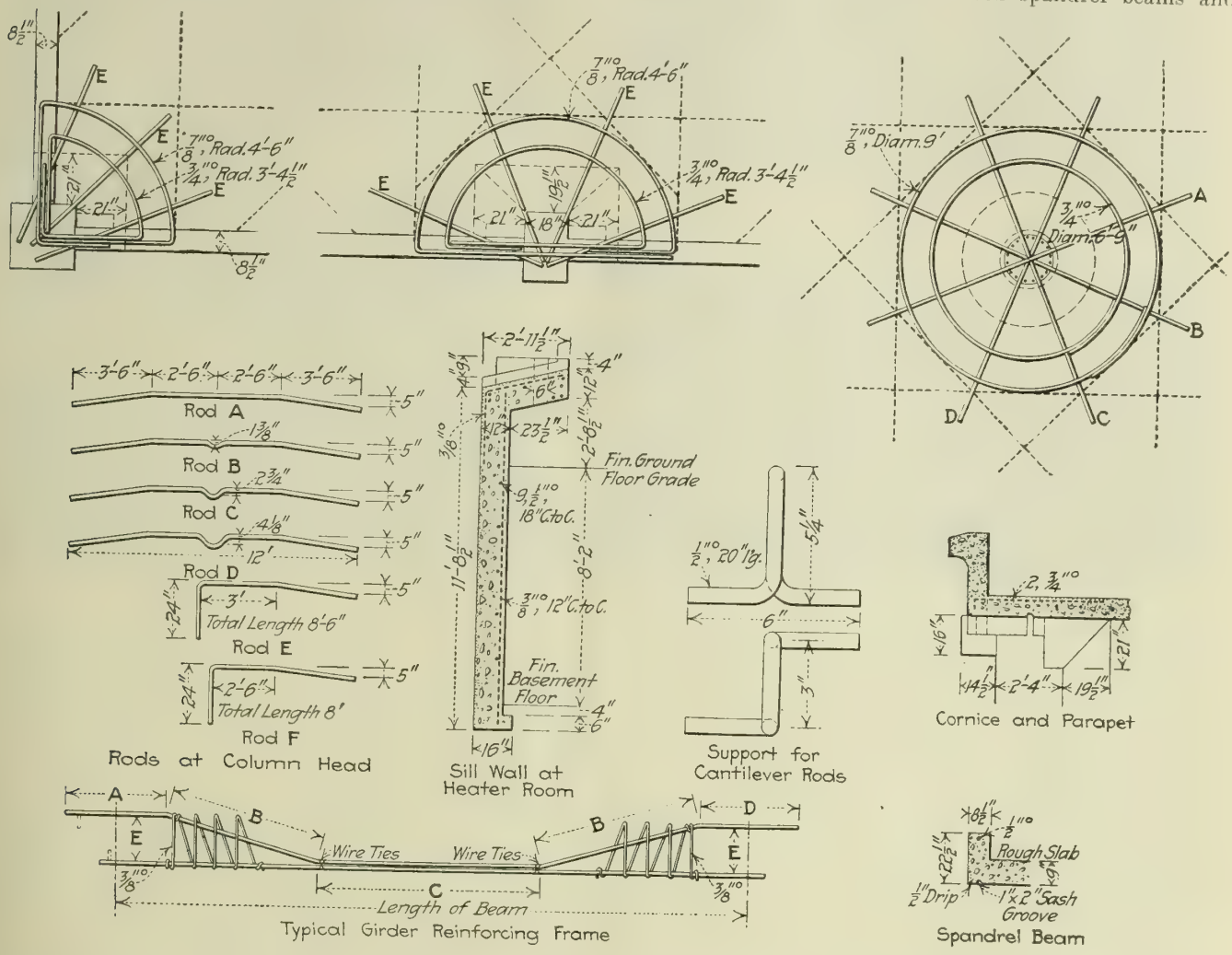


FIG. 2. DETAILS OF REINFORCEMENT IN COLUMN HEAD AND GIRDERS; SILL AND CORNICE SECTIONS

Rebuilding a Burned Oil Tank

By C. P. Bowie*

SYNOPSIS—A 30,000-bbl. petroleum tank was set on fire by lightning. The fire burned for over 11 hr. The damage done to the tank is described and also methods adopted for its reconstruction.

If one has ever watched a mass of crude petroleum in process of combustion, he cannot but be impressed by the extreme ferocity with which it burns and the consequent intensity of the heat generated. It is therefore interesting to note just what the results of such a severe test might be on the shell of an ordinary steel tank, such as is used for storage, and it is the purpose of this article to describe, as nearly as possible, the actual condition in which such a structure, having passed through a fire, was found to be when the flames had burned themselves out and the metal cooled sufficiently to permit of examination; also the work required and method pursued to reconstruct the tank.

On the afternoon of Dec. 10, 1914, the vicinity of the Associated Pipe Line Co.'s Levis pumping station, situated in the San Joaquin Valley, California, about 40 mi. northwest of Fresno, was visited by an electrical storm of comparatively short duration and what seemed not unusual intensity. After an especially heavy clap of thunder immediately following a vivid flash of lightning the roof of the storage tank was seen to be a mass of flames. Already great clouds of inky black smoke were soaring skyward.

The tank had a capacity of 30,000 bbl. and was about one-third filled with oil of 16° Bé. gravity. It was situated at a distance of about 300 ft. from the pumphouse and was entirely surrounded by a levee 6 ft. in height, 4 ft. wide on the top, 16 ft. wide at the base, and at such distance from the tank as to impound about one and one-third the contents of that structure.

Steam was immediately turned into the tank through the smothering line, but the wooden roof burned so rapidly that the attempt to extinguish the flames by this method was ineffectual. The 6-in. bleeder in the bottom of the tank was then opened and oil allowed to run out into the surrounding basin. This was done to prevent the water on the bottom of the tank forming steam bubbles and causing the oil to boil over. The pumps were run at full capacity, drawing oil from the tank as long as was deemed expedient. The machinery was then shut down, the station being bypassed so as not to tie up the system, and the doomed tank was left to its fate. No attempt whatever was made to fight the fire with water, and fortunately the rain accompanying the thunder storm was of short duration. Therefore the metal that remained intact when the fire was over and that might be used in reconstruction could be allowed to air-cool on the passing of the flames and not be injured by sudden chilling.

The fire started at 3:55 p.m. on the 10th and burned itself out at 3 a.m. on the 11th, having lasted 11 hr. 5 min.; by the morning of the 14th the metal had cooled sufficiently to permit of examination.

The tank was 86 ft. in diameter and 30 ft. in height. The shell was composed of six rings of steel plate, each ring containing 24 sheets approximately 5 ft. 3 in. by 11 ft. 6 in. The roof and roof supports were made of wood, with a waterproof covering of ordinary roofing paper.

A review of the specifications reveals the following facts:

Part	Dimensions	Diameter of Rivets, In. Seam Vertical	Seam Horizontal	Rows of Rivets Seam Vertical	Seam Horizontal
1st ring	14 lb. per sq.ft.	⅞	⅞	Double	Single
2nd ring	12 lb. per sq.ft.	⅞	⅞	Double	Single
3rd ring	11 lb. per sq.ft.	⅞	⅞	Double	Single
4th ring	10 lb. per sq.ft.	⅞	⅞	Double	Single
5th ring	8 lb. per sq.ft.	⅞	⅞	Double	Single
6th ring	8 lb. per sq.ft.	⅞	⅞	Single	Single
Bottom sketch plates	No. 4 gage		⅞		Single
Bottom rectangular plates	No. 6 gage		⅞		Single
Top angle	3x3x⅜-in.		⅞		Single
Bottom angle	4x4x½-in.		¾		Single

The manhead in the bottom ring was 20 in. in diameter, of ½-in. plate with welded seam and closed by ½-in. flat plate and ¾-in. bolts. The tank had four 8-in. pressed-steel flanges secured to the shell with ¾-in. rivets. The bottom had one 6-in. flange with ½-in. rivet. An iron ladder was riveted to the shell from ground to top. All rivets over $\frac{7}{16}$-in. were driven hot, and all were driven on the outside of the tank except for the bottom.

As will be seen in the accompanying views, the heat of the burning oil curled the shell of the tank inward so that when the fire had passed, the top angle iron and in places a large part of the top course rested on the bottom of the tank. The deformation began near the top of the second ring (counting from the bottom upward) and extended to the top of the tank. The photograph of Fig. 6 was taken from a point inside the tank near the center, looking toward the shell. In the foreground of the picture can be seen the remains of the swing (or suction) pipe, the winch box and the iron ladder. The inspecting engineer's report on material and work

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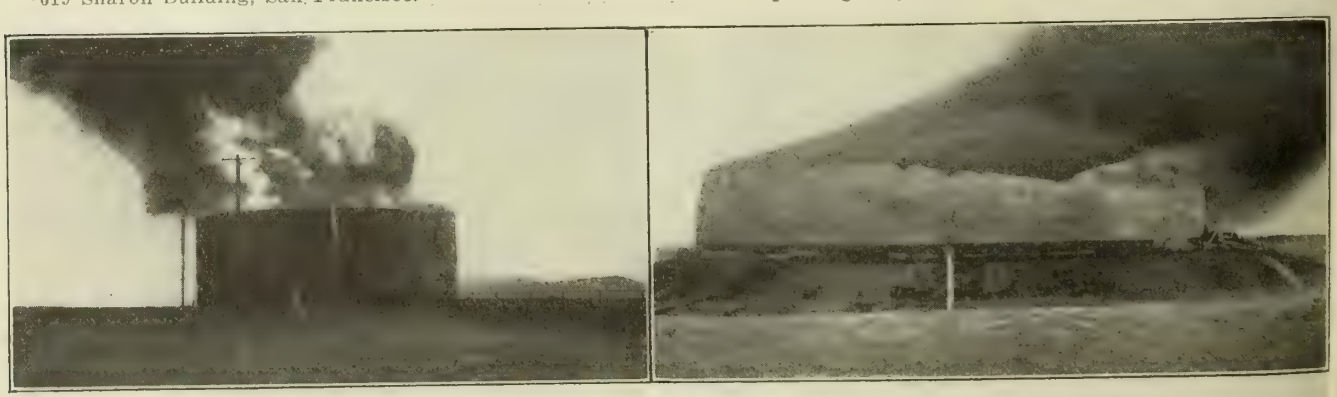
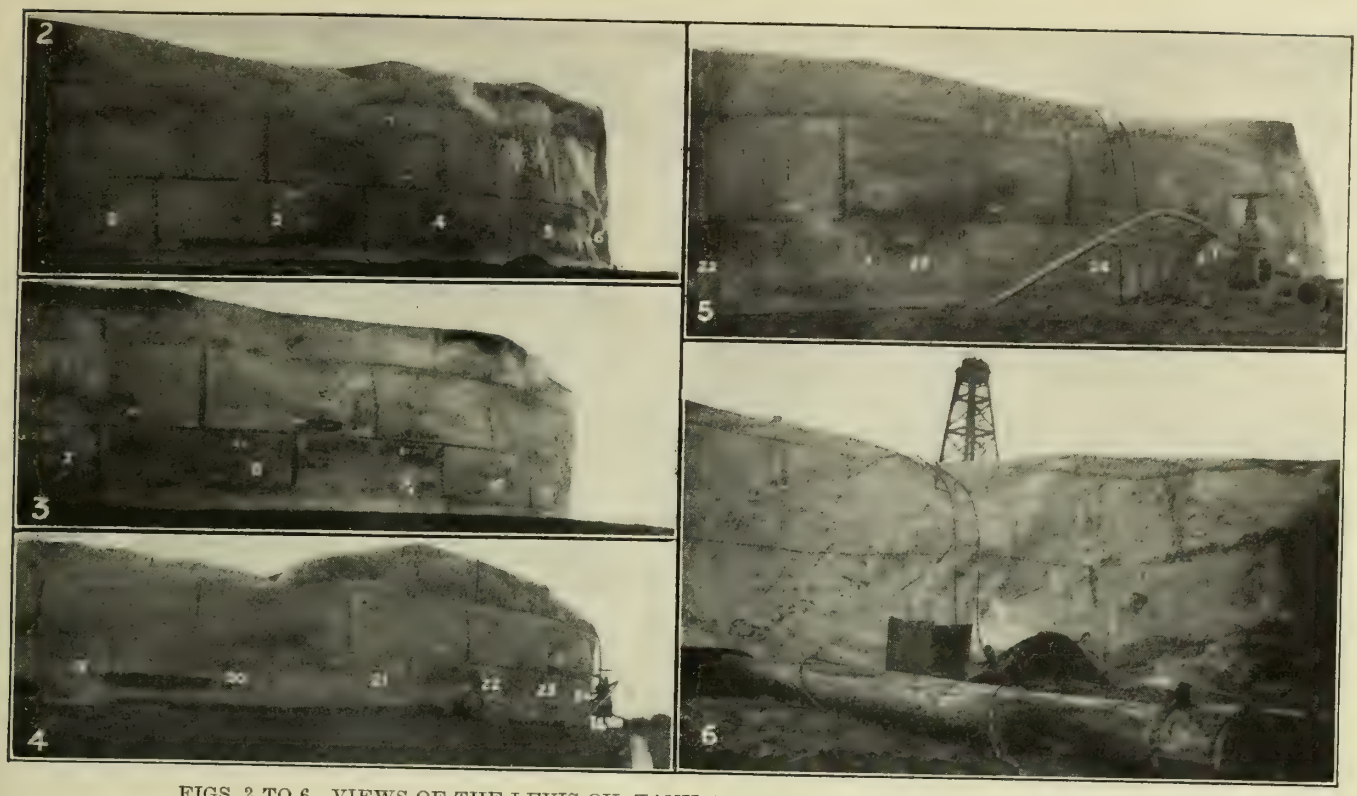


FIG. 1. LEVIS OIL TANK, NORTH OF FRESNO, CALIF., AT BEGINNING AND END OF FIRE



FIGS. 2 TO 6. VIEWS OF THE LEVIS OIL TANK AFTER ITS DESTRUCTION BY FIRE

Figs. 2 and 3—Outside of shell; numbering corresponds to inspecting engineer's report. Fig. 4—Suction-nozzle valve, suction pipe and manhead. Fig. 5—Tank ladder and suction-nozzle valve. Fig. 6—Interior of shell, top course resting on bottom sheets

required for reconstruction showed that the tank bottom was badly warped, but that the bottom angle iron and angle-iron shoes were in good condition. The engineer recommended cutting the bottom sheets apart, reriveting and calking. Sheets 1 to 17 in the first course (counting from the bottom up and from the 18-in. nozzle toward the manhole) were good. Sheets 18 and 19 were warped, but could be straightened and used. Nos. 20 to 24 were good. In course 2 sheets 1 to 15 (counting the same way) were fairly good and 16 to 18 were badly warped, but all could be straightened. Sheet 19 was so highly heated and buckled that it was thrown out. Nos. 20 to 24 were fairly straight. All the sheets in courses 3 to 6 were damaged beyond repair. The 18-in. nozzle and 8-in. flanges could be cut off, reriveted and calked. The swing pipe and all fittings, a 45° flange on the shell and a 4-in. pipe and strainer, were entirely useless. The ladder could be used, though badly bent and burned in two at the top.

The work of reconstruction was done under contract by the Llewellyn Iron Works, of Los Angeles. The material in the four upper rings of the tank was cut into strips of convenient size, lifted over the remaining portions of the shell and discarded. It was the intention to do this work with air tools, but on account of heavy rains the compressor was so greatly delayed in arriving that the cutting was done by hand. The rivet heads were cut off and the remainder punched through. Where it was not practical to follow along the seams the plates were cut.

The sheets of the two lower rings and the bottom were then entirely cut apart. Of the bottom only a few plates required to be straightened. In the first course 12 plates and in the second course six plates required reworking. This was done by placing the sheets on a heavy wooden form made of 4x12-in. pine planking placed on edge and hewn, in the case of the side plates, concave to conform with the circumference of the tank shell. The plates to be straightened were bolted to this form and hammered with sledges, a flatter being interposed in order to avoid injury to the plates.

Some plates were replaced in the bottom and a few more in courses 1 and 2 than recommended by the inspecting engineer. Otherwise the specifications for reconstruction were framed essentially along the lines of his suggestions. All the old sheets were rebeveled before being calked. The 18-in. valve on the suction and the 8-in. valve on the filling line, both of which were on the outside of the tank near the bottom, were practically unharmed and required only to be overhauled and repacked before being put back into place. It was a matter of frequent comment among those connected with the work of reconstruction how remarkably well the rivet holes in the worked-over plates matched, there being in most cases practically no necessity for reaming.

The tank, when completed and given a fresh coat of paint, was to all appearances wholly new and in as good condition as it was before the fire. In fact, had it not been for the baked and discolored appearance of the ground upon which the structure stands and the abundance of cinders and ashes strewn in its basin, one would not suspect that any part of the present shell had passed through the flames.

No laboratory tests were made on the sheets. All sheets requiring straightening, however, were inspected for cracks, etc. No plates were found injured by the straightening. Previous experience of an affiliated company had shown that metal that had cooled slowly and that was not actually oxidized by the flames or warped beyond possibility of reworking was of sufficient strength.

The saving of this reconstruction over discarding all the old material was about $1,200.

Engineering Literature

Library Files of Periodicals

Sir—An editorial in *Engineering News* of Oct. 21 (p. 788) calls attention to the important catalog of technical periodicals issued by the Library of the Engineering Societies and to the great amount of information to be found in periodical literature.

From this catalog the following statistics have been compiled: There are 956 periodicals complete in some one of the seven New York libraries covered by that catalog; 43 periodicals are not complete in any one library, but the parts missing in one are to be found in some other library in the city; 1,067 are incomplete in all libraries. The total number of periodicals is 2,066 and the number of sets 4,236. In those sets there are 3,086 part volumes and 43,109 whole volumes, a total of 46,169 lacking.

If it were desired to complete at least one set of every periodical, it would be necessary to procure 1,290 part volumes and 11,000 whole volumes—a total of 12,290.

Evidently there are large gaps in the collections of New York City, nor will other cities fare much better. Even old libraries lack many volumes. For instance, the Library of the Royal Society of London, whose catalog of periodicals published in 1912 contains 1,811 titles, shows 240 part volumes and 842 whole volumes lacking.

Every librarian knows how hard it is to fill gaps in sets. A clearing library for technical and scientific periodicals would prove of great value. Such a library, supported by all other libraries, could purchase from second-hand dealers, publishers of periodicals and private persons sets both complete and incomplete and receive from the libraries all duplicate sets or parts of sets. In case it were found that additional volumes of periodicals could not be procured and were needed by a number of libraries, they could be reproduced by some inexpensive process by the clearing library.

Here is a fine opportunity for someone wishing to devote money for a useful purpose. It is very well to establish libraries of all sorts, but libraries will be of little use to workers if needed publications are not available.

A. Fanti,
Librarian, United States Bureau of Standards.

Washington, D. C., Oct. 30, 1915.

Books for the Practical Man

By Antonio Llano*

Of the many calamities that the unschooled practical man is heir to, few are so harmful or so disgraceful (not, of course, to him) as the imposition constantly practiced on him by publishers of worse than worthless books claiming to teach, in simple style which his untrained mind can readily comprehend, all the mathematics that he needs. The authors of such books, being ignorant, would be better occupied in learning than in teaching; a little education would enable them to accomplish their purpose, which is exclusively to add a few dollars to their sorry income, with more credit to their reputation and less injury to others. It is charitable to assume that, themselves afflicted with the blindness they would cure in their companions, they act in good faith, and that the deception they perpetrate on their customers arises from their own self-deception. But this charity cannot be extended to the publishers, whose duty it is to have competent experts as critics and advisers. They ought to be unqualifiedly condemned for publishing books which may justly be characterized as impostures—a character all the more blamable as these books are intended for men at once ignorant and poor.

I shall illustrate this disgraceful situation by reference to a book on mathematics that claims to be "practical." The author, who does not understand that the letters used in algebraic expressions are convenient symbols to represent numbers, teaches the student that a letter is a sort of abbreviation for the name of "some object or thing." "In arithmetic," he says, "we would say, if one hat costs 5 cents, 10 hats cost 50 cents. In algebra we would say, if one a costs 5 cents, then $10a$ cost 50 cents, a being used to represent 'hat.'" He further illustrates by saying that if a man has 5 tables and 10 chairs, he may write a for *tables* and b for *chairs* and say that his stock is $5a + 10b$. This is algebraic addition. In arithmetic, he continues, we cannot multiply one table by one chair, for arithmetic can give us no "conception as to the appearance of the object" that would result from so strange an operation. But "in algebra all this is simplified"; all we have to do is to write a for *chair* and b for *table,* and then "the expression ab represents in its entirety the multiplication of a chair by a table."

The student is practically given to understand that the constant 3.1416 is an experimental coefficient; for, according to the author, this number is found by "comparison between the lengths of the diameter and circumference of a circle made with the utmost care." Perhaps the author, not knowing how to write, did not intend to convey this idea, but he does convey it. I saw once a similar statement, though more explicit, made by one of the many "practical and theoretical, long-experienced instructors" (young girls just out or not yet out of school) of a notoriously and deservedly unhappy correspondence-instruction concern. In answering an inquiry, this "expert," who "taught" many branches of engineering, said very knowingly and concisely: "The number 3.1416, like many others used in practical formulas, is an empirical constant."

In the book under consideration the student learns further that "an equation is the expression of the equality of two things"; that "a polygon bounded by four sides is called a quadrangle"; that "the addition of two right angles makes a straight line;" that "two triangles are seen to be equal if one side and the angle opposite to it of the one are equal to one side and the corresponding angle of the other"; that the logarithm of 0.0438 is writ-

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ten —2.6415, although "the —2 does not carry its negativity to the mantissa"; that, with the directrix or some other line to the left of the vertex as the axis of y, the equation of a parabola is of the form $y^2 = ax$; that the integral of $\sin x\, dx$ is $+\cos x$; that the integral $\frac{dx}{x}$ is the *common* logarithm of x (and, that there may be no doubt, this is illustrated by numerical examples); that all equations of a degree higher than the second "represent a large variety of curves called cubic curves"; that a differential is an inconceivably small quantity, "less than one millionth or one billionth"; that a differential is the same thing as a rate; that g is a rate and therefore a differential, which may be called dx; that in this case $dx = 32$ ft. per sec., and therefore 32 ft. is an inconceivably small quantity; and many other curious things, after which comes the awful declaration that "the student may not understand at first the theories herein treated of."

The style of the book is wretched; a mixture of crudity, which the author mistakes for simplicity, and fustian, which he mistakes for learning. Rhetoric in general, and grammar in particular, are conspicuously missing in his equipment, and this, although affording something more for the educated reader to laugh at and therefore enjoy, greatly increases the difficulties of the would-be learner.

Let it not be thought that I have devoted too much attention and space to a worthless book. For that book is typical of a large class of abominable publications that affect the education and means of subsistence of perhaps hundreds of thousands of men. They possess great importance and deserve attention, just as injurious patent medicines concocted by quacks possess importance and deserve attention.

To write a good textbook of any kind is exceedingly difficult. To write a good elementary textbook for beginners is so difficult that the number of such books we have can perhaps be counted on the fingers. It is not true that if a man knows a subject he is competent to teach it or to write on it. Especially is this the case with technical subjects; for our technical men are as a rule lacking in that general culture and scholarship without which a person, however well he may know his specialty, cannot write well. And when a man having but a smattering of the subject and no general education attempts so arduous and so delicate a task, the results cannot fail to be disastrous—disastrous literarily, scientifically and pedagogically, and disastrous likewise mentally and financially to buyers, who lose at the same time their money and their hope, and gain nothing.

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A classified "List of Periodical Publications Relating to Municipal Affairs," compiled by Mabel L. Conat, of the Detroit Public Library, fills 13 pages of "Special Libraries" for October, published by the Special Libraries Association, Indianapolis, Ind.

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A large industrial map of Pittsburgh and vicinity was recently completed by the Pittsburgh Development Commission under the direction of George H. Lehman, chief engineer of the Flood Commission and of the Lake Erie & Ohio River Ship Canal. The map is 6x4 ft., is printed in four colors and has a scale of 4 in. per mile. It is based on data furnished by the United States Geological Survey, but was compiled largely by original fieldwork. It shows not only all streets, parks, roads, railways and street-car lines, but also indicates every manufacturing plant which has railway connections.

REVIEWS AND NOTES

New Edition of Kent's Boilers

Reviewed by W. S. Finlay, Jr.*

STEAM-BOILER ECONOMY: A Treatise on the Theory and Practice of Fuel Economy in the Operation of Steam Boilers—By William Kent, author of the "Mechanical Engineer's Pocket-Book." Second edition, revised and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xvii + 717; 244 illustrations. $4.50, net.

In prefacing his second edition of "Steam-Boiler Economy," William Kent has briefly summarized certain particular points along which marked progress has been made in the science since the publication of the first edition in 1901. With these improvements as bases of discussion, much valuable matter has been added to the work, the development of fourteen years furnishing ample opportunities for revision.

Undoubtedly, so far as the college student is concerned, much will have been accomplished in supplying him with the essentials of that generally neglected end of the modern power plant, and if studied with sufficient care and vigorously applied in practical ways, the book should carry the student into professional life with a very satisfactory foundation in this department of his work.

For the engineer in practice the book can be of value only in so far as it may supply him with a source of reference for everyday application to design or operation. With this as the controlling idea, the following comments are submitted:

Passing over a general but necessary introduction covering fundamentals, there has been given a fairly comprehensive analysis of the subject of fuels and combustion, followed by opportunities for application in tabulated data, which include abstracts of reports by the United States Geological Survey and the Bureau of Mines. This latter, with the matter upon coal fields and miscellaneous fuels, is naturally of value for general information and may be used for reference, as therein have been collected and reduced to a practical size the essentials of unwieldy reports.

Proceeding to the actual study of the working unit itself, in considering the grate and furnace, much matter that was contained in the first edition pertaining to systems and methods that are now practically obsolete has been retained, and from the very fact that so much space is given to them, an impression is conveyed that exaggerates their importance. Particular reference is had to flat grates and hand fires, whose value the author himself discounts in recording instances of their replacement by stokers to increase efficiency and capacity. Numerous examples of stokers and fuel-oil burners have been detailed, as also types of furnaces, the design of the latter being generally controlled by the stoker or burner installed.

The introduction of new material in the edition on boiler design has added greatly to the value of the work. In interpolating, however, much of this has had the

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effect of breaking up the sequence and making unnecessary repetitions. Elements of boiler design have been added and are well handled in the short space allotted.

Appliances conducive to economy in the boiler room are also briefly summarized. The chapter on analysis of boiler troubles has been practically entirely retained from the first edition, and although the subject matter is elementary, still in the amount of importance given to grate surfaces, flat grates, etc., much of it is really out of date and replete with troubles not now generally met with.

The balance of the book, on boiler testing, etc., is practically standard and includes results of recent research work of value in pointing out the type of data obtained and the methods employed.

As a whole, the new edition, with intimate acquaintance, will hold the place of its predecessor as a source of reference to the worker. The value of the book would have been greater had the old matter been completely eliminated or revised and the work entirely rebuilt with a view to maintaining careful sequence in analysis and grouping. Such information as is given should relate only to the best present practice, at the same time directing attention to the trend of development in the science.

Building and Maintaining Track

ELEMENTS OF RAILROAD TRACK AND CONSTRUCTION—By Winter L. Wilson, Professor of Railroad Engineering, Lehigh University. Second edition, revised and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. vi + 396; 210 illustrations. $2.50 net.

TRAMWAY TRACK CONSTRUCTION AND MAINTENANCE—By R. Bickerstaffe Holt, M. I. Mech. E., Highways and Permanent Way Engineer, City of Leeds. London: Tramway and Railway World Offices. New York: D. Van Nostrand Co. Cloth; 6x10 in.; pp. xv + 249; 150 illustrations. 10/6. $4.50 net.

The book by Professor Wilson gives a comprehensive but summarized review of track construction and maintenance. In this way a great number of subjects are dealt with briefly and generally, except that the matter relating to turnouts goes into formulas and mathematical analyses. With such summarized treatment there are necessarily many omissions, and the subjects are not always covered very clearly.

The "bridge" rail is defined as a rail supported on intermittent supports. In point of fact it is what in this country is more commonly called the U-rail. The name relates to its form of section, and the early bridge rails were carried on continuous stringers. It is said to date back to 1844, but this should be 1834. Under "cresoting" no mention is made of the full-cell and empty-cell systems of treatment. The location of gravity yards is said to depend on the topography, but in point of fact the topography is more often made to suit the requirements, and the largest gravity yard in existence is located in flat prairie country.

The chapter on railroad construction, which belongs logically at the beginning of the book instead of at the end, deals with field parties and their work, grades and profiles, cuts and fills, trestles and culverts. An extraordinary feature is the entire omission of anything relating to curves, either in railway construction or track work, except that a rule is given for widening gage on curves. There is no mention of the wear of rails on curves and the compensation of grades for curvature. The matter on organization of maintenance-of-way forces is not very clear. It seems to assume that the organization is the same on all roads, and the distinction between departmental and divisional organization is not explained. The index is decidedly weak.

The foregoing points are mentioned to indicate the limitations of the book. It does not qualify as a work of reference; but the author states that the aim is "to present a few of the fundamental principles in such manner that the inexperienced engineering student can form a general idea of the subject." It should serve this purpose very well, though it would seem that a smaller and cheaper book would suffice. The author considers that the larger books on the subject are not suitable for classroom work, but such works are used in this way with satisfactory results. However, the student may gather a good general idea of railway work, and a little practical experience will soon extend his knowledge and modify his impressions on various points.

The book on "Tramway Track" deals, as its name implies, with foreign (and mainly British) practice. The use of a concrete base is almost universal, but in many cases it has caused trouble because of insufficient strength and improper construction. Hand mixing only is referred to, and this method is probably the cause of much of the defective concrete mentioned. It seems strange that in these days such large jobs of concreting should be handled in this way.

Track is shown with and without cross-ties. Grooved rails only are considered, including the Romapac rail with renewable head. Mention is made, however, of a T-rail and guard-rail construction in Amsterdam, Holland, which requires four rails for each track. A curious feature in construction is that rails are laid usually with the base 1 to 2 in. above the concrete, the space being filled with stone chips (mixed with cement or pitch) or with longitudinal planks. There is danger of raising the rails while tamping this loose packing, and the author ascribes the majority of track-maintenance troubles to defective packing.

Considerable space is devoted to track-construction methods, including the welding of joints. The manufacture, wear and corrosion of rails are dealt with, but rail corrugation is not discussed, although machines for grinding corrugated rails are described. Curves, turnouts and special work are treated at some length. The paving materials considered are ordinary and smooth-dressed granite blocks and wood blocks.

An interesting feature of the book is the way in which the author points out the weaknesses and defects of some of the devices and methods described.

From a mechanical point of view the book is made unnecessarily bulky by the use of unusually large type, wide margins and waste spaces. In this respect it compares unfavorably with Professor Wilson's book, previously mentioned. The latter is lighter (little more than half the weight), smaller and handier, although it contains much more matter and is printed in large, clear type.

MANUAL OF SURVEYING FOR FIELD AND OFFICE—By Raymond E. Davis, C. E., Instructor in Civil Engineering, University of Illinois. New York and London: McGraw-Hill Book Co., Inc. Leather; 4x7 in.; pp. xv+395; 54 text illustrations. $2.50, net.

Like many similar surveying manuals by college instructors, this one is designed primarily for the use of college students. It is more practical than some others; among points emphasizing this are considerable informa-

tion on the precision of measurements and statements of the errors allowed in practice, methods of checking, some very useful tables and an excellent index. In fact, it has much more of the surveyor's fieldbook make-up than of the lecture-form notes for specific elementary problems, which is quite characteristic of some other works of similar nature.

Engineering Thermodynamics

REVIEWED BY C. R. RICHARDS*

A TEXTBOOK OF ENGINEERING THERMODYNAMICS—By Charles Edward Lucke, Professor of Mechanical Engineering, Columbia University, and John J. Flather, Professor of Mechanical Engineering, University of Minnesota. An Abridgment of "Engineering Thermodynamics," by Charles Edward Lucke. New York: McGraw-Hill Book Co., Inc. Cloth, 6x9 in.; pp. xxiv + 688; 189 illustrations. $5, net.

HANDBOOK OF THERMODYNAMICS TABLES AND DIAGRAMS. A Selection of Tables and Diagrams from "Engineering Thermodynamics," by Charles Edward Lucke. Arranged and Amplified by John J. Flather. Cloth, 6x9 in.; pp. xvi + 238; 82 charts. $1.50, net.

These two books are made up from Lucke's "Engineering Thermodynamics," reviewed by the writer in *Engineering News* for Sept. 18, 1913. The first of these volumes contains the text and the second the various tables and charts from the original book.

While the textbook is styled an abridgment of the earlier work on "Engineering Thermodynamics," a rather careful comparison of the two volumes fails to disclose any radical changes in the subject-matter presented. In some of the chapters the original text has been slightly abridged, but the omissions are unimportant and do not seriously impair the usefulness of the book for general reference or for use in the classroom. The reduction in the number of pages in the new, as compared with the older, volume has resulted largely through a decrease in the size of the cuts used and a more compact setting of the numerous formulas presented.

The original volume is divided into three parts containing six chapters. The new volume retains the three major divisions, but the number of chapters is increased to nineteen, an arrangement which will doubtless commend itself to the teacher.

The handbook of tables and charts will be a valuable addition to the reference library of every engineer, whether for use with or without the text, for it contains a large amount of information which is not generally accessible, together with many graphical charts for the solution of problems in engineering involving thermodynamics.

TRATTATO DI COSTRUZIONI ANTISISMICHE. Preceduto da un Corso di Sismologia—By F. Masciari-Genoese. Milan, Italy: Ulrico Hoepli, Editore Libraio Della Real Casa. Paper; 7x10 in.; pp. xxviii + 1,004; 900 text figures. 24 Lire.

Earthquake-proof construction is already of wide interest, and is bound to have still wider spread. However, very little is known about the subject. That a 1,000-page treatise under the title "Earthquake-Proof Structures" should take an important place in our literature would be quite natural under these circumstances. But the book under review is a complete disappointment. What it contains of practical interest is found in about 100 pages, in the second half, where are described methods of building walls, foundations and a few other structural elements in such a way as to offer greatest resistance to earthquake destruction. Even this treatment is of little direct value because of its *ex cathedra* presentation of certain methods or details, without stating which constructions have been used in practice and which have given good or bad results. The publisher has provided at the end of the book two ruled blank pages headed "Annotazioni," perhaps anticipating the reader's desire to add information to the scant amount given by the author.

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Heating and Ventilating

HEATING AND VENTILATING BUILDINGS: A Manual for Heating Engineers and Architects—By Rolla C. Carpenter, M. Am. Soc. M. E., Professor of Experimental Engineering, Cornell University. Sixth edition, revised and rewritten. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xiv + 598; 290 illustrations. $3.50, net.

Carpenter's treatise long ago won a position as a leading manual for the layout and installation of heating and ventilating systems, but the "revision and enlargement" (which in the book trade is different from "revision and rewriting") which has marked each of the previous editions has not and obviously could not have kept the book thoroughly modern in all details for over 20 yr. The present extensive rewriting and rearrangement gives the text a new lease of life and very largely restores it to its old usefulness.

That does not mean that the revision has been thoroughgoing all through, for a careful reading of the book and comparisons with earlier editions show many lapses in the sections of minor importance to designers. For instance, the chapter on electrical heating remains largely as it was in 1902, both as to cited facts and data. Now at least some mention of the significant installations made in recent years in some Western irrigation power districts would be worth while. The most amusing failure to modernize the text is on page 241, where statistics on boiler explosions *up to 1893* are tabulated. In view of the painstaking studies of insurance companies and power journals, this is inexcusable. There are numerous other failures to bring the book up to date, but fortunately they relate to comparatively minor points so far as detail design is concerned.

There has been considerable condensation of various sections in order to provide space for new material. As a result the book is about the same size as the more recent reprints, though twice as large as the earlier edition. A very extensive rearrangement is seen. Some topics are grouped by complete systems instead of common parts. For instance, there are chapters on the design of gravity-steam, pumped-return and hot-water systems, containing what was before scattered under piping and design. This leaves the chapters on pipes and fittings, radiators and boilers largely descriptive. Revision in a reverse direction is seen where the subjects coming under flow of fluids are now bunched instead of being discussed separately in sections on water, steam and air.

The book starts out with a discussion of the nature and properties of heat, principles of ventilation and the amount of heat required for comfort. The heat given off by radiating surfaces and the flow of fluids are the subjects of intermediate chapters before the descriptions of apparatus are presented. The latter include the chapters on pipe and fittings, radiators, boilers, fittings and appliances, etc. After this are given the general layout and the detailed proportioning of parts for various steam-heating systems. A section on mechanical ventilators is logically introduced before hot-blast work is taken up.

The latter part of the book deals with electric heating, automatic temperature regulators and the special problems of schoolhouses, shops and greenhouses. Appended to all this are contract and specification suggestions, state laws on heating and ventilating and air conditioning. There is a bibliography extending from 1815 to 1895. An attempt has been made to bring the latter up to date by appending eight titles from 1902 to 1915. There are tables of standard weights and measures, pressure conversion, properties of gases, mathematical quantities (mensuration), logarithms, strength of materials, properties of air, relative humidities, properties of saturated steam, calorific value of fuels, etc.

Mechanical Drawing

REVIEWED BY CHARLES W. REINHARDT*

MECHANICAL DRAWING FOR COLLEGES AND UNIVERSITIES—By James D. Phillips, Professor of Drawing and Dean of the College of Engineering, and Herbert D. Orth, Instructor in Drawing in the University of Wisconsin. Chicago and New York: Scott, Foresman & Co. Cloth; 6x9 in.; pp. 283; 295 illustrations. $1.75 net.

This volume is for use in university classes and is complete in itself. It cannot be said that the authors have slighted their subjects in any particular, as in some instances it appears that self-evident details of instruction have been presented at too great length. However, the book as a whole is well arranged and illustrated.

The illustrations present a pleasing departure from the prevalent style of "wax-engravings." They are directly reproduced in facsimile from well-executed originals. Quite a number of freehand sketches illustrate certain positions of the hands and principles involved. A mild protest might perhaps be made against the excessive finish and shading represented in Figs. 158 and 161.

The chapter on "Lettering" illustrates in considerable detail on about 50 separate practice plates the principles of the upright and inclined one-stroke style of Gothic lettering which for the past 20 years has almost universally been adopted.

A uniquely arranged Table of Contents, or "Outline," is one of the features of the volume. The book is ably written, with subjects attractively presented, and the general make-up is a model of neatness.

MASONRY AS APPLIED TO CIVIL ENGINEERING: Being a Practical Treatise on the Design and Construction of Engineering Works in Stone and Heavy Concrete—Adapted for the Use of Students and Those Engaged in the Practice of the Profession by F. Noel Taylor, author of "A Manual of Civil-Engineering Practice." New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. xi + 230; 212 illustrations.

In brief and fairly clear terms this book gives the details of the British practice in masonry construction. It is local in its application and can benefit an American engineer only in so far as it may show him some new way of performing a fairly familiar act. The wonder is that the practices in the two countries, which at one time must have been precisely alike, should have grown so far apart.

YEARBOOK OF THE UNITED STATES DEPARTMENT OF AGRICULTURE, 1914. Washington, D. C. Cloth; 6x9 in.; pp. 715; illustrated.

Among the articles of interest to engineers in this well-known annual publication are the following: Clean Water and How to Get It on the Farm; Retail Public Markets; State Management of Public Roads; The Economy of Farm Drainage; the Preparation of Fertilizer from Municipal Waste. The author of the last-named article sees little hope of recovering fertilizing material from sewage and urges the adoption of garbage-reduction processes instead of incineration, in order that the valuable material contained in the garbage may not be entirely lost.

Factory Power-Plant Practice

PREVENTING LOSSES IN FACTORY POWER PLANTS—By David Moffat Myers. New York: The Engineering Magazine Co. (Works Management Library.) Cloth; 5x8 in.; pp. xvi + 560; 68 illustrations. $3.

Mr. Myers discusses modern power-plant practice, particularly for owners and managers of industrial works. This has necessitated a somewhat dilute treatment of matters which mechanical engineers are apt to review very concisely. It also results in emphasis on the accuracy with which today we may study energy phenomena.

After introductory remarks, the thermal losses in a boiler and engine plant are shown by a typical steam-balance sheet. This, with a pictorial diagram, gives an illustration of the cycle through which steam passes in a factory plant.

The next large step, and the one which leads to the real purpose of the book, is the presentation of a general plan for investigating the economy of a factory power system. This gives a list of the important items of information which will be disclosed by tests on the boiler plant, steam piping, engines and heating system. Four succeeding chapters take up in detail the path of an engineer-investigator in each of these divisions of a plant. Naturally, no attempt has been made to teach the plant owner to be his own expert—the aim seems to be rather to inform him as to what he may expect to have shown him, to a greater or less degree, by a properly qualified man.

One of the most important chapters in the whole book is entitled "The Human Factor." Here are disclosed the vast amount of fuel which can be wasted by improper firing of the boilers and the great advantages and economy that result through cutting down the working hours to a reasonable time, ventilating the boiler rooms, making the wages depend in part on eliminating waste of fuel, and from educating the men in regard to the economies which are possible. This chapter also has appended to it a plea for greater attention to safety in the engine and boiler rooms. Some of the more important safety devices and methods which have been installed are noted.

The following chapter describes systems installed by the author for increasing the efficiency of boiler plants, for finding what the efficiency actually is and for rewarding the employees. The rest of the book consists in what are virtually a series of appendices on subjects of interest to the works owner. First of these is a discussion of boiler tests as made by engineers today. The second takes up combustion reactions and losses. A third one presents the so-called "surface combustion" developed by Professor Bone in England and Professor Lucke in this country, involving flameless combustion of gaseous fuels and high-efficiency high-capacity absorption apparatus. A short chapter on natural gas tells what results may be expected with its use in different kinds of plants. One of the most interesting sections of the book is that on waste fuels—showing what has been accomplished in utilizing wood waste, tan bark, sugar-cane refuse, anthracite culm, etc.

*Reinhardt-Winters-Cahill Co., technical illustrators, Times Building, New York City.

A few pages give descriptions of such new types of prime movers as the "Locomobile," the "Unaflow" engine, and the Diesel motor. At the end of the book a couple of reports, made by the author to power-plant owners, on the improvement of their systems are reprinted as showing the typical form and substance of such investigations.

Conquest of Yellow Fever at Havana and Panama

SANITATION IN PANAMA—By William Crawford Gorgas, Chief Sanitary Officer, Panama Canal; Surgeon General, U. S. A.; Major General, U. S. A. New York and London: D. Appleton & Co. Cloth; 5x8 in.; pp. 298; illustrated. $2, net.

The first half of this interesting and inspiring book is devoted almost wholly to yellow fever and its conquest, with particular reference to experiments and practices at Havana. The second half deals chiefly with the conquest of yellow fever at Panama. There is also something about the suppression of malaria at Havana, more about the control of that disease at Panama, and all through the volume the mosquitos—stegomyia and anopheles—that spread yellow fever and malaria receive due attention. In the half of the volume dealing with Panama there are chapters on measures against plague, leprosy, the hospitals, a sanitarium, the quarantine system and the sanitary department, all under the direction of the author.

As may be inferred from the foregoing remarks, the volume is first and chiefly a popular account of the discovery of the causes of yellow fever and of the utilization of that discovery by Colonel Gorgas to rid Havana and Panama of the disease. The title is very misleading, both because so much of the book has nothing to do with Panama and because only a part of the sanitary work at Panama is more than barely mentioned. The style is rambling—interestingly so; there is considerable but no tiresome repetition, and those who wish details of how Colonel Gorgas accomplished such marvels in Cuba and on the Isthmus must pick them up here and there as they lie scattered through the narrative. Nevertheless, the book is one to be thankful for. It doubtless fulfills the exact object of the author and will be read by and inspire hundreds of people that would give scant or no attention to a more scientific account of what Colonel Gorgas and others did to make the construction of the Canal possible without the needless sacrifice of a hundred thousand or more lives.

Revised Edition of Hutte

"HUTTE": DES INGENIEURS TASCHENBUCH—Herausgegeben vom Akademischen Verein Hütte, E. V. 22nd edition. (In Three Volumes.) Berlin: Wilhelm Ernst & Sohn. 5x8 in.; pp. 1,084, 1,077 and 1,109; 4,700 illustrations. Linen, 18 Marks; leather, 21 Marks.

Further improvement in many details, but no change in subdivision or treatment, marks the twenty-second edition of this widely used engineers' handbook. Following only four years after the previous edition, which represented extensive change, it is the more notable for being issued in the midst of war—the date of completed revision is April, 1915.

Among the revised or rewritten sections are those on measuring instruments used in testing, materials of construction, steam turbines, pumps, blowers, shipbuilding, foundations, reinforced concrete, railways and bridges. The new edition is thus considerably more than a mere reissue. With the changes goes an increase in number of pages. Each of the three volumes now is as bulky as the single volume which 10 or a dozen years ago formed the entire handbook.

Continuing the innovation made in the last edition, Vol. III is so planned as to cover all subjects of civil-engineering practice. It is thus adapted for separate use. The revision concerned itself particularly with this volume.

Study of Ore Dressing

REVIEWED BY F. W. TRAPHAGEN*

THE THEORY AND PRACTICE OF ORE DRESSING—By Edward S. Wiard, S. B., Member, Min. and Met. Soc. of America. First Edition. New York and London: McGraw-Hill Book Co, Inc. Cloth; 6x9 in.; pp. 426; 254 text illustrations. $4, net.

Mr. Wiard has made an important contribution to metallurgy—a field not very well covered by existing books, Dr. Richard's classic standing almost alone.

Using his extensive practice as a basis, Mr. Wiard has brought together an extremely valuable mass of material. This he has made the subject of analytical study and the conclusions reached have wide bearing on current practice. The theoretical considerations are well handled and the precautions suggested to operators, with accompanying advice, will well repay careful reading. The book has a pleasing make-up and is comparatively free from typographical errors.

Can Farmers Learn Surveying?

COMPASS SURVEYING AND THE SIMPLIFIED CALCULATION OF FARM AREAS—By Charles Mitchell Thomas, Civil Engineer and Surveyor. Wytheville, Va.: The Author. Cloth; 6x8 in.; pp. vi + 92; charts. $2.

The author has set himself an almost impossible task. As he describes it: "If you own a farm or if you are thinking of buying one, it will be a great source of satisfaction to you if you know how to calculate its area, so that you will not have to take another's word for it." He attempts to teach the real-estate agent and the farmer the familiar double-meridian-distance method of computing an area from a metes-and-bounds decription. This is a large order. He makes it more formidable by teaching also the principles and practice of compass surveying, with auxiliary remarks on magnetic declination and on adverse possession.

The most striking features of the text are the language and style employed. They represent the author's effort to fit his words and argument to the intelligence of his reader. Unusual similes and methods of explaining difficult conceptions abound, and so also does a rich Virginian vocabulary not lacking in charm.

Engineering News confesses itself unable to judge whether the book will succeed in instructing the farmer; and, what is more, it does not believe in making every man his own surveyor or engineer. But the book recommends itself unreservedly to every college teacher of surveying as a helpful and suggestive contribution to the art of teaching the subject to unprepared minds. Beyond this, there is sound sense in a remark contained in an advertising circular that reached us with the book: "If you happen not to be interested, give your boy or girl a chance; perhaps they can catch on to the calculation even quicker than you."

*Professor of Metallurgy and Ore Dressing, Colorado School of Mines, Golden, Colo.

A statement on page 26 may prove somewhat misleading. The author says: "When there is no fence on the line to be surveyed, and one corner can't be seen from another, a deed giving metes and bounds of the tract is required." This statement may be considered in several different ways; but in any event the reader should be acquainted more fully with the fact that a deed of the kind described may be useful even when one corner can be seen from another.

Power and Heating Plants

POWER HEATING AND VENTILATION: A Treatise for Designing and Constructing Engineers, Architects and Students. (In Three Parts, Each Complete in Itself)—By Charles L. Hubbard, Consulting Engineer. Part III, Combined Power and Heating Plants. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. x + 408; 220 illustrations. $3, net.

The third volume of the new edition of Hubbard's "Power, Heating and Ventilation" series is now in hand, completing the set. The high standards of the previous volumes are maintained—even exceeded. As already noted (Feb. 11, 1915) the preceding volumes cover elementary heat phenomena, use of fuels, design and construction of boilers, furnaces, engines, etc., elementary theory of heating systems, design of heating equipment and estimates for heat losses from structures.

A large part of the present text is also given to boilers, engines, turbines, auxiliaries, piping, etc., and at first examination it might be thought to go back over the ground of the first two volumes. Careful comparison, however, shows that it deals with the proper selection and installation of such machinery rather than the design and construction of the individual pieces themselves, as is done in the earlier volumes. This book therefore supplements rather than duplicates its fellows. The arrangement follows a logical sequence of plant design, and indeed is a guide manual of combined power- and heating-plant design for special buildings.

Some of the minor shortcomings of the earlier volumes noted have been corrected in this text. Style has been kept clear, and the statements and data are definite. Little more could be asked. This volume, involving a departure from the scope of the original Hubbard treatise, is to be considered a first edition, and it is so marked.

The book starts out by describing the heating and ventilating schemes found in office buildings, theaters, banks, department stores, courthouses and other public buildings, hotels, hospitals, shops and mills. Practice is described concisely over a great range of structures. The author in his previous volumes has shown his ability to make original constructive suggestions for the improvement of inherited practice, and it is to be regretted that he did not turn his attention to that end upon some fields where complaint is rife. The opportunity exists notably in theater ventilation, where it is common to supply air under the chairs and to draw it out overhead, the street dust and smell immediately contaminating the fresh supply.

There are chapters on steam and hot-water heating and hot-blast heating and ventilating. This part of the book gives a notable collection of data on practice. So far, as will be realized from these remarks, the text is devoted to special heating and ventilating. Nearly 40% of the volume is thus passed through before combined heating and power plants are arrived at. In the rest of the book practice in central-station steam- and hot-water distributing systems is described. The combined power and heating requirements of the special buildings already enumerated are reviewed and summarized in tabular form.

PRACTICAL TRACK WORK—By Kenneth L. Van Auken. Chicago, Ill.: Railway Educational Press, 14 East Jackson Boulevard. Cloth; 5x8 in.; pp. 216; illustrated. $1.50.

Track work and the tool equipment required are dealt with here, but the book does not cover the design of track material or the work of maintenance-of-way. It begins with organization and equipment of the section forces, and then takes up tracklaying, double-tracking and relaying track. Curves, switch work, surfacing and general work on the track complete this portion of the book, covering 150 pages. The balance includes tables of useful information and a 36-page glossary of track terms. The book is written for the section foreman and sectionman. It will be useful also to the young engineer commencing his practical experience in the track department, although he will need other books to inform him as to the engineering features of track and maintenance-of-way.

AMERICAN SCHOOL BUILDING STANDARDS—By Wilbur T. Mills, Architect. Columbus, Ohio: Franklin Educational Publishing Co. Second edition. Flexible leather; 5x8 in.; pp. 616; illustrated. $5.

This is largely a compilation from various sources "modified by conclusions as experience and the most recent authorities approve." There is an introductory chapter on selecting an architect for public-school design, which contains information on architectural competitions and how they should be carried out. Other chapters present the general character of the building, cost of school buildings, ventilation, and a valuable collection of laws in the various states governing plan, construction, fire protection, sanitation and furnishings of public-school buildings. About half the book is a collection of typical floor plans and halftone engravings of recent school architecture.

The latest engineering society to establish a monthly publication is the Civil Engineers' Society of St. Paul, which issued the *Bulletin* for the first time in November. P. H. Sackett is editor pro tem.

An extended study of "Rainfall in New England," including a large collection of statistics of rainfall for places in New England and southeastern New York, fills 202 pages of the *Journal* of the New England Water Works Association for September, 1915. (Tremont Temple, Boston, Mass., $1 a number.)

A valuation of the property of the Queens County Water Co. (Borough of Queens) for the purpose of adjusting water rates is the subject of an interesting report of 177 pages made by Delos F. Wilcox, Deputy Commissioner of the Department of Water-Supply, Gas and Electricity, New York City.

One of the most interesting commercial pamphlets issued in recent months is Bulletin 13E of the engineering department of the National Lamp Works (General Electric Co.), "Multiple Mazda Lamps." The present types of tungsten-filament lamps for 105- to 125- and 220- to 250-volt circuits are described. The notes on operat-

ing characteristics, color quality, temperatures, efficiencies, use, etc., will be found intelligible to any engineer. New gas-filled types are briefly presented.

NEW PUBLICATIONS

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor, the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

AGRICULTURAL DRAWING AND THE DESIGN OF FARM STRUCTURES—By Thomas E. French, Professor of Engineering Drawing, and Frederick W. Ives, Assistant Professor of Agricultural Engineering, in the Ohio State University. New York: McGraw-Hill Book Co., Inc. Cloth; 8x11 in.; pp. viii + 130; 182 illustrations. $1.25 net.

AIR BRAKES: References to Books and Magazine Articles—Pittsburgh, Penn.: Carnegie Library. [Reprinted from the Monthly Bulletin, July, 1915.] Paper; 6x9 in.; pp. 55.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS—Transactions, Vol. VII. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. 308; illustrated. $3 net.

ECONOMIC CYCLES: THEIR LAW AND CAUSE—By Henry Ludwell Moore, Professor of Political Economy in Columbia University. New York: The Macmillan Co. Cloth; 6x9 in.; pp. viii + 149; 27 illustrations. $2.

THE ELASTICITY AND RESISTANCE OF THE MATERIALS OF ENGINEERING—By William H. Burr, M. Am. Soc. C. E., Professor of Civil Engineering in Columbia University. Seventh edition, thoroughly revised. Cloth; 6x9 in.; pp. xix + 928; illustrated. $5.50 net.

ELEMENTS OF HIGHWAY ENGINEERING—By Arthur H. Blanchard, M. Am. Soc. C. E., Professor in charge of the Graduate Course in Highway Engineering in Columbia University. New York: John Wiley & Sons, Inc. Cloth; 6x9 in.; pp. xii + 514; 202 illustrations. $2.50 net.

THE ELEMENTS OF MECHANICS OF MATERIALS: A Text for Students in Engineering Courses—By C. E. Houghton, Associate Professor of Mechanical Engineering in New York University. Second edition, revised and enlarged. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. viii + 216; illustrated. $2 net.

ENGINEERING GEOLOGY—By Heinrich Ries, Professor of Economic Geology in Cornell University, and Thomas L. Watson, Professor of Economic Geology in the University of Virginia and State Geologist of Virginia. Second edition, enlarged. New York: John Wiley & Sons, Inc. Cloth; 6x9 in.; pp. xxvii + 722; 249 text illustrations and 104 plates. $4 net.

THE EXPERIENCE GRADING AND RATING SCHEDULE, Designed to Be a United States Standard for Measuring Fire-Insurance Costs Based Upon Combined Experience Averages—By E. G. Richards. To which is added by permission the "Standard Classification of Occupancy Hazards and Loss Report Form" of the National Board of Fire Underwriters. New York (76 William St.): The Board. Cloth; 6x9 in.; pp. 104.

GENERAL SPECIFICATIONS FOR CONCRETE WORK as Applied to Building Construction—By Wilbur J. Watson, M. Am. Soc. C. E. Second edition. New York: McGraw-Hill Book Co., Inc. Paper; 8x11 in.; pp. 56; illustrated. $1 net.

GUIDE TO THE REPORTS, EVIDENCE AND APPENDICES OF THE ROYAL COMMISSION ON SEWAGE DISPOSAL (of England)—By G. Bertram Kershaw, M. Am. Soc. C. E., Engineer to the Commission. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. 178. $2 net.

A table of contents of the ten reports in 30 volumes, together with separate indexes of names, places and subjects of the present volume. The Guide promises to be a time saver to those having occasion to refer to the various reports of the commission.

HOW TO MAKE LOW-PRESSURE TRANSFORMERS—By F. E. Austin. Second edition, with additions. Hanover, N. H. (Box 441): The Author. Linen; 5x7 in.; pp. 17; 4 illustrations. 40c.

INVENTORS AND MONEY-MAKERS: Lectures on Some Relations Between Economics and Psychology Delivered at Brown University in Connection with the Celebration of the 150th Anniversary of the Foundation of the University—By F. W. Taussig, Henry Lee Professor of Economics in Harvard University. New York: The Macmillan Co. Cloth; 5x8 in.; pp. ix + 135. $1.

IOWA STATE HIGHWAY COMMISSION—First Annual Report, 1913-1914. Ames, Iowa: The Commission. Cloth; 6x9 in.; pp. 351; illustrated.

JAHRBUCH DER TECHNISCHEN ZEITSCHRIFTEN-LITERATUR, Ausgabe, 1915 — Herausgegeben von Heinrich Rieser. Vienna, Austria: Verlag für Fachliteratur, Gesellschaft m.b. H. Paper; 6x9 in.; pp. 98. 4 marks.

LEHRBUCH DER EISENHÜTTENKUNDE Verfasst für den Unterricht, den Betrieb und das Entwerfen von Eisenhüttenanlagen—By Bernhard Osann, Professor an der Königlichen Bergakademie in Clausthal. Erster Band, Roheisenerzeugung. Leipzig, Germany: Verlag von Wilhelm Engelmann. Paper; 7x10 in.; pp. xiii + 668; 407 illustrations, 17 tables. 29 marks. Bound in linen, 30.50 marks.

MACHINE DESIGN—By Albert W. Smith, Director of Sibley College, Cornell University, and Guido H. Marx, Professor of Machine Design, Leland Stanford Junior University. Fourth edition, revised and enlarged. New York: John Wiley & Sons, Inc. Cloth; 6x9 in.; pp. xii + 500; 278 illustrations, 31 tables. $3 net.

MUNICIPAL FREEDOM: A Study of the Commission Government—By Oswald Ryan, formerly of the Department of Government, Harvard University. With an Introduction by A. Lawrence Lowell, President of Harvard University. Garden City, N. Y.: Doubleday, Page & Co. [The American Books.] Cloth; 5x8 in.; pp. xvi + 233. 60c. net.

NOTES ON HEATING AND VENTILATION—By John R. Allen, M. Am. Soc. M. E., Professor of Mechanical Engineering in the University of Michigan. Third edition. Chicago, Ill.: Domestic Engineering Co. Cloth; 6x9 in.; pp. vi + 227; 84 illustrations. $2.50.

PLANE ANALYTIC GEOMETRY, With Introductory Chapters on Differential Calculus—By Maxime Bôcher, Professor of Mathematics in Harvard University. New York: Henry Holt & Co. Cloth; 5x8 in.; pp. xiii + 235; 75 illustrations. $1.60.

PROCEEDINGS OF INTERNATIONAL IRRIGATION CONGRESS—Held at Calgary, Alta., Canada, Oct. 5-9, 1914. Spokane, Wash.: Arthur Hooker, Secretary. Paper; 6x9 in.; pp. 402; illustrated.

RAILWAY REGULATION: An Analysis of the Underlying Problems in Railway Economics from the Standpoint of Government Regulation—By I. Leo Sharfman, Professor of Political Economy, University of Michigan. Chicago: La Salle Extension University. Flexible leather; 6x9 in.; pp. vi + 230. $2 postpaid.

REGULATION OF RAILROADS AND PUBLIC UTILITIES IN WISCONSIN—By Fred L. Holmes. New York: D. Appleton & Co. Cloth; 6x9 in.; pp. xi + 375. $2 net.

RETURN AS TO WATER UNDERTAKINGS IN ENGLAND AND WALES—Local Government Board; H. C. Monro, Secretary. London: Wyman & Sons, Ltd.; T. Fisher Unwin's Foreign Agencies. Paper; 8x13 in.; pp. 599. 5/1.

RIVINGTON'S NOTES ON BUILDING CONSTRUCTION: A Book of Reference for Architects and Builders and a Textbook for Students (in two volumes)—Edited by W. Noble Twelvetrees. New edition, entirely rewritten. New York: Longmans, Green & Co. Cloth; 6x9 in. Part I, pp. 306; 484 illustrations. Part II, pp. 332; 395 illustrations. $2.25 each.

SAFETY IN STONE QUARRYING—By Oliver Bowles. Washington, D. C.: Superintendent of Documents. Technical Paper 111 of the Bureau of Mines. Paper; 6x9 in.; pp. 48; illustrated. 10c.

SIMPLIFIED REINFORCED-CONCRETE MATHEMATICS: Derivation of Simple, Universal Formulas and Application of Same to Beams, Columns and Arches with Nomographic Computing Device—By Melvin D. Casler, Assoc. M. Am. Soc. C. E. New York: D. Van Nostrand Co. Cloth; 5x8 in.; pp. vi + 66; illustrated. $1 net.

STEEL SHEET PILING: Tables and Data on the Properties and Uses of Sections Manufactured by the Carnegie Steel Co., Pittsburgh, Penn. Paper; 5x8 in.; pp. 96; illustrated.

A good little monograph, now in its tenth edition, well worth a place in every engineer's library. If it contains some points that appear doubtful or debatable, it need only be remembered that the subject of sheeting is rich in debatable matters, and the engineer is therefore likely to be prepared for differences of view.

THE THEORY OF MACHINES—By Robert F. McKay, Lecturer in Theory of Machines and Machine Design at the City and Guilds (Engineering) College, London. New York: Longmans, Green & Co. Cloth; 6x9 in.; pp. viii + 440; 407 text illustratons. $4.20 net.

UNITED STATES GEOLOGICAL SURVEY PUBLICATIONS—Washington, D. C. Paper; 6x9 in.; illustrated.

Water-Supply Papers—No. 340-L, Stream-Gaging Stations and Publications Relating to Water Resources, 1885-1913; Part XII, North Pacific Slope Drainage Basins. Compiled by B. D. Wood. Pp. 147-195. No. 371, Equipment for Current-Meter Gaging Stations. By G. J. Lyon. Pp. 64. No. 375-F, Conditions Requiring the Use of Automatic Gages in Obtaining Records of Stream Flow. By C. H. Pierce. Pp. 131-139.

Mineral Resources of the United States, 1914, Part II—No. 17, The Gypsum Industry in 1914. By G. F. Loughlin. Pp. 261-270. No. 28, Statistics of the Clay-Working Industries in the United States in 1914. By Jefferson Middleton. Pp. 455-548.

Bulletin No. 621-A, Field Apparatus for Determining Ash in Coal. By C. E. Lesher. Pp. 12.

WHAT SCIENTIFIC MANAGEMENT MEANS TO AMERICA'S INDUSTRIAL POSITION—By Frank B. Gilbreth and Lillian Moller Gilbreth. [Reprinted from "The Annals" of the American Academy of Political and Social Science, Philadelphia, September, 1915, Publication No. 935.] Providence, R. I. (77 Brown St.): Frank B. Gilbreth. Paper; 7x10 in.; pp. 9.

WIRE-DRAG WORK ON THE ATLANTIC COAST—By N. H. Heck and J. H. Hawley, Assistants. Special Publication No. 29. Washington, D. C.: United States Coast and Geodetic Survey. Paper; 9x12 in.; pp. 24; 8 illustrations. 10c.

WIRELESS TELEGRAPHY—By Dr. J. Zenneck, Professor of Physics at the Technical High School of Munich. Translated from the German by A. E. Seelig. New York: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xx + 443; 469 illustrations. $4 net.

THE YEAR-BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY, 1915—New York: The Marconi Publishing Corporation. Cloth; 6x9 in.; pp. 800; illustrated. $1.50.

Field and Office

Wire and Rock Mattress to Protect Bridge Pier

By J. H. Fisk*

In the spring of 1914 the north pier of a two-span steel highway bridge over the Grand River at a point about 12 mi. west of Grand Junction, Colo., was found to be undermined. The pier was one of the steel-tube type and rested on a concrete footing. Leaning against the pier was a rotted log structure built to protect the pier from the thrust of the rock and earth fill serving as an approach to the bridge. The depth of water at the base of the pier was 7 ft. and soundings showed that approximately one-half the area of the base of the concrete footing was unsupported, allowing the pier to lean against the bridge, a condition plainly shown by the buckling of the bottom chords of the north span.

Plans were hurriedly made by the writer to jack up the bridge and carry the footing of the pier down to a safe foundation. But on account of the shortness of the time before the spring rise, and also the rapid erosion of the river bank above the bridge, this idea was abandoned and plans were drawn for stopping the undermining of the pier and preventing the bank of the river from further erosion.

The river carries at this point from 3,000 sec.-ft. at low water to possibly 50,000 sec.-ft. at high water. The north bank was formed by a precipitous layer of sandy adobe about 8 ft. thick rising from a point 2 or 3 ft. above low water and underlain by a stratum of sand and gravel of unknown thickness, but exposed by the action of the water to an average depth of 7 ft. To secure permanent protection it was considered necessary to riprap the river bank for a distance of 750 ft., commencing at the pier and extending up the river to the mouth of a bayou entering at that point.

After rejecting numerous suggestions, including rock-filled log cribs, brush and pile forms of protection, it was decided to reduce the river bank to a slope of 1:1 and cover it with a mattress made of woven wire fencing and stone, carrying the outer toe of this mattress well into the deepest part of the river.

The specifications were intended to insure the use of stone that would not disintegrate in water and of such dimensions that it could not pass through the meshes of the wire, and covered the wire to be used, not specifying the particular make, but limiting the greatest dimensions of mesh and the least diameter of wire.

Under water the mattress was formed by laying stone-filled wire bags, 3 ft. in diameter, side by side and securely tied together, with their bottoms resting on the river bed at the deepest point and their tops coming out at the edge of the water far enough to permit of fastening to the portion of mattress laid on the bank above water. The mattress above water was 11 ft. wide and was formed by laying strips of wire fencing parallel with the river bank, commencing at the tops of the submerged sacks and wiring all strips securely together, with tie wires spaced not over 6 in. apart. Strips of fencing cut 18 in. wide were then set up vertically and wired transversely to those already laid, forming compartments 54 in. wide, 18 in. deep and 16 ft. long, which were then filled with stone. A covering of wire similar to that which formed the bottom of the compartments was then laid over the entire surface and securely wired to the transverse strips, the whole being firmly tied to the upper ends of the submerged sacks.

The placing of the sacks under water was accomplished by the use of light scaffolding which rested at point of deepest water, nowhere over 15 ft. from the bank.

The work was commenced at the lower end of the pier and carried upstream, a sack being sunk into place with tie wires attached and held temporarily by fastening to the scaffolding. When full, it was allowed to fall into place, the tie wires being slipped through the meshes of the next succeeding sack as it was lowered to its position.

Careful inspection, after the passage of two spring floods, has failed to disclose any sign of failure in the wire and the protection has successfully prevented any further erosion.

The work was done by contract in 13 days and required 1,200 cu.yd. of loose stone and 1,018 rods of woven-wire fencing 3 ft. wide. Suitable stone was found ½ mi. distant. The contract was awarded to the low bidder at $2,839, on which a fair profit was realized.

*Engineer, Arkansas Valley Irrigation Co., Dodge City, Kan.

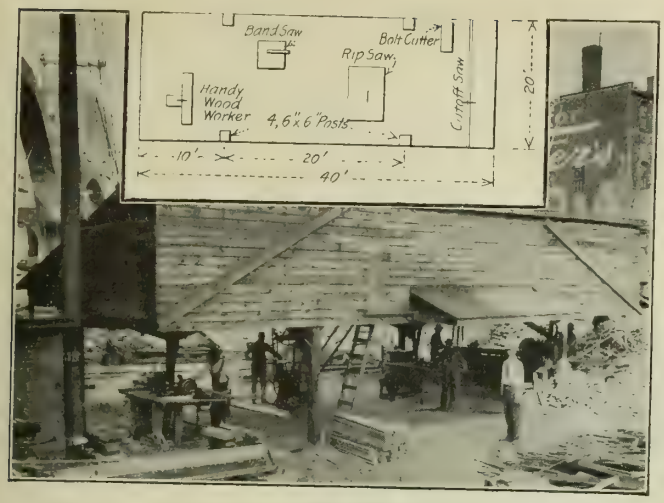
Sawmill for Form Construction

By Harold E. Ketchum*

On large concrete construction an efficient sawmill is essential. The Detroit-Superior high-level bridge in Cleveland, a double-deck reinforced-concrete arch bridge 2,800 ft. long, requires a large amount of formwork. Cableways command the site of the bridge, so that forms of any size can be built at the mill and set in place. The sawmill was designed to allow the greatest freedom in handling lumber through the various saws.

The roof is supported on four 6x6 posts, there being no walls or other obstructions. The posts are placed 10 ft. from the corners of the building, the ends of the roof being carried as cantilevers and the center trussed with light bracing. The sawmill itself is 20x40 ft. in plan, with a plank floor level with the surrounding ground. The following machines are being used: An 18-in. swing cutoff saw, a 16-in. ripsaw, a 36-in. bandsaw, a bolt-threading machine and a handy woodworker. The latter, a boring and saw tool operated by an individual motor on the upper part of the frame of the machine, with 12-in. saw, has proved accurate and economical, especially on light cutoff work. The other machines are driven through belts and countershafts by a 15-hp. alternating-current motor placed 8 ft. above the floor.

*Superintendent, Hunkin-Conkey Construction Co., Cleveland, Ohio.



SAWMILL FOR FORMS; DETROIT-SUPERIOR BRIDGE
Dimensions and machinery location

Lumber is received on cars and piled to the south of the mill. It passes north through the saws to benches, where the forms are assembled. The forms are placed north of the benches, directly under the cableways, and taken away as required.

The Detroit-Superior bridge is being built for Cuyahoga County, for which K. D. Cowen is resident engineer. The Hunkin-Conkey Construction Co. has the contract.

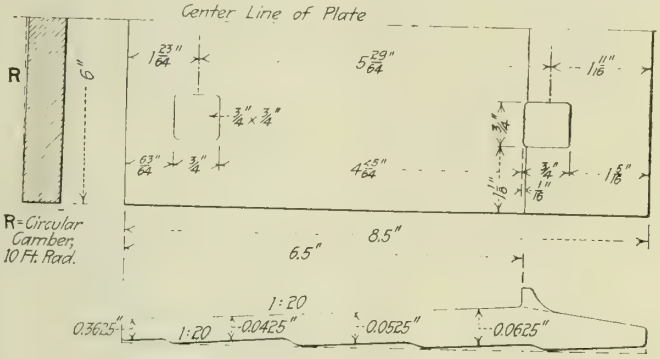
Stone-Unloading Plant for Concrete-Road Contract

The two views show a plant for unloading broken stone from railway cars in use by the Williams & Little Co., general contractors, of Cleveland, Ohio, on a concrete-road contract near Perry, Ohio. Hopper-bottom cars bring the stone in on a main-line siding and dump it into the boot of a conveyor, which carries it to the bins. An oscillating plate in the pit insures the free flow of the stone to the buckets of the conveyor without the need of any hand shaking or scraping.

The bins are provided with two sets of chutes—one short set for feeding to wagons and one longer one for leading to the motor trucks which cannot get close to the framework. The trucks or carts take the stone as needed to the job.

Tie-Plate with Inclined Face

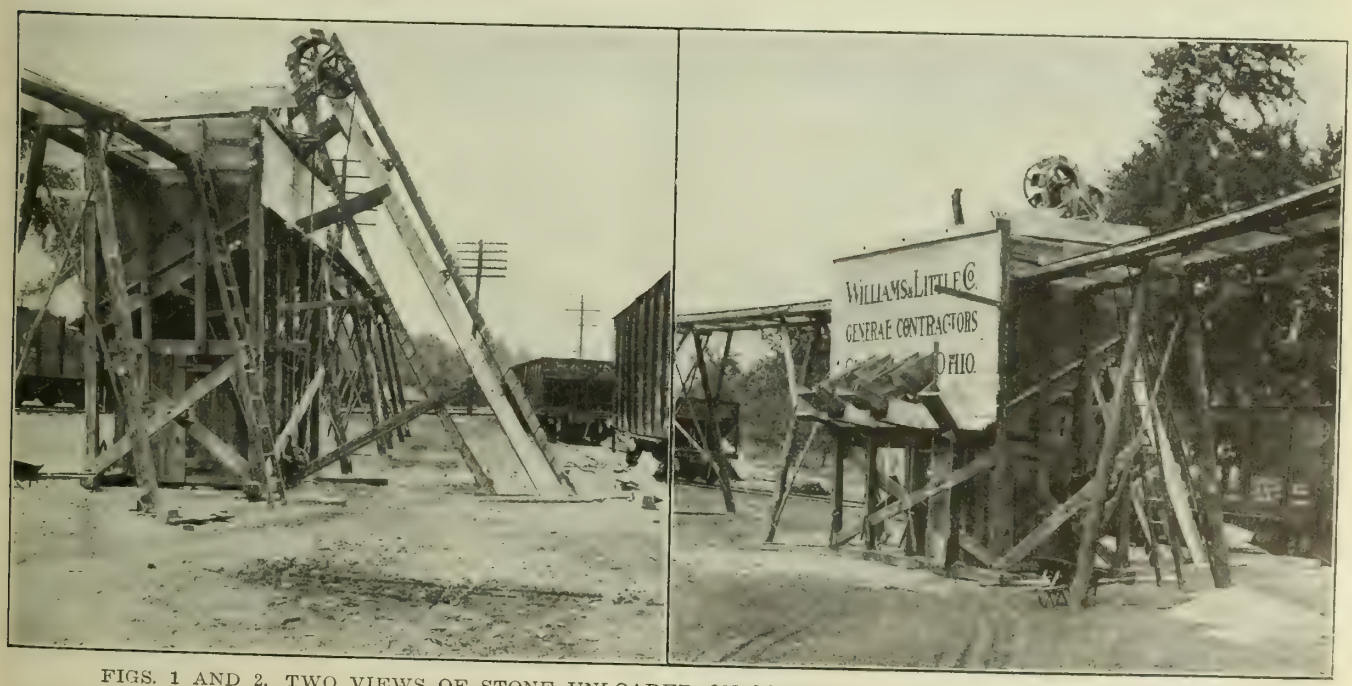
A tie-plate which gives the rail an inward inclination, so that it is practically at a right angle with the coned surface of the wheels, is being tried on several railways. The drawing shows the tie-plates as used on the New York, Ontario & Western Ry. It is 8½x6 in., with the bearing surface or rail seat inclined 1 in 20 and having a shoulder to engage the outer edge of the rail base. The



TIE-PLATE WITH INCLINED FACE; NEW YORK, ONTARIO & WESTERN RY.

bottom of the plate has the same slope, but is stepped to give an increasing thickness from the edge. Longitudinally with the rail the plate is given a circular camber of 10-ft. radius. There are four spike holes.

This inclining of the rail is general practice on foreign railways, but has not been given much attention in this country. It is claimed that it will give increased stability to the track, with a reduction in maintenance work. The tie-plate illustrated is the invention of John Lundie, 52 Broadway, New York, N. Y.



FIGS. 1 AND 2. TWO VIEWS OF STONE UNLOADER ON CONCRETE-ROAD JOB NEAR PERRY, OHIO

Sinking Foundations Through Steel and Concrete

A 16-story loft building is being constructed on the site of the old Hoffman House and Albemarle Hotel, 24th St. and Broadway, New York City. The last extension of the Hoffman House, built only 10 yr. ago, was founded on concrete piers carried down to rock in open pits held by steel sheeting. This sheeting, of the Friestedt type, was cut off at grade by electric arc and left in the ground. Thus the ground is filled with concrete, steel grillage girders of the cantilever footings, and steel sheeting; since the new column locations do not match the old ones, the new piers have to be sunk through the miscellaneous materials mentioned. Naturally the work is tedious and expensive. The Thompson-Starrett Co., which built the extension, is also constructing the new building and is therefore in the position of cutting through its own substantial construction of 10 yr. ago.

In cutting out the concrete incasement of the grillage and cantilever girders the only tools used are bull points, mauls, sledges and wedges. The bull points are 1½-in. octagon steel. The slowest part of the work is chopping the concrete (or grout) out of the pockets, such as the space between pairs of girders where cement mortar had been poured in to fill the space. In such cases, after laying bare the outside of one of the girders the girder is cut through with oxygen flame (see view, Fig. 1, taken after complete removal of one girder section and interior concrete), wedged out to get it loose from the inside concrete as far as possible and then this inside concrete chopped out bit by bit with the bull points.

Some of the 48-in. plate girders which, set in pairs side by side, formed the main cantilever girders for the north wall footings are rather difficult objects to cut, because they have three web plates in the end section—a

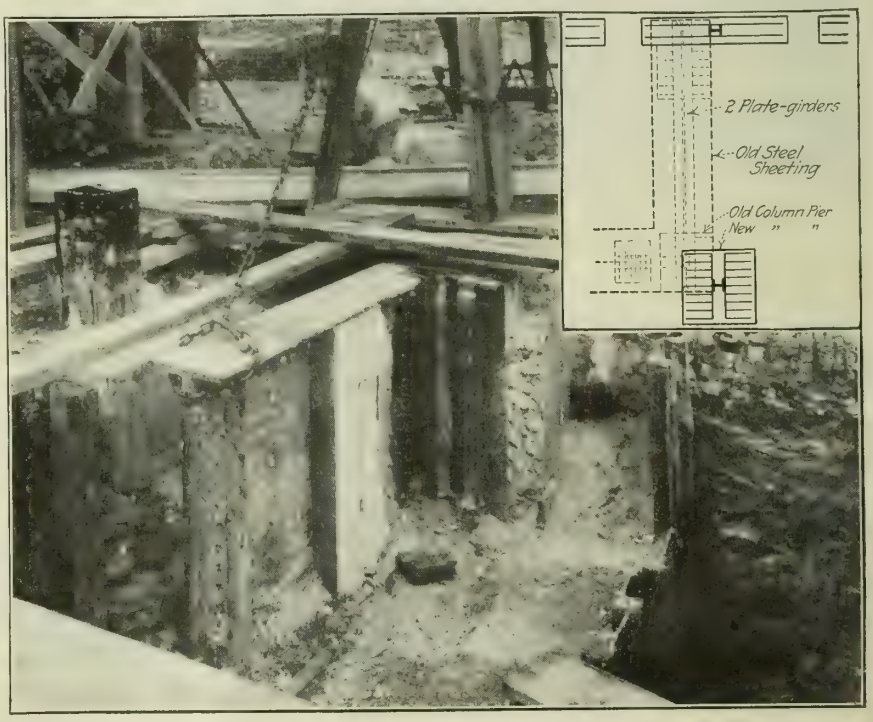


FIG. 1. CUTTING THROUGH CONCRETE-CASED PAIR OF PLATE GIRDERS IN OLD CANTILEVER FOOTING
The cut through triple web and flanges consumed about 125 cu.ft. Blaugas and 200 cu.ft oxygen

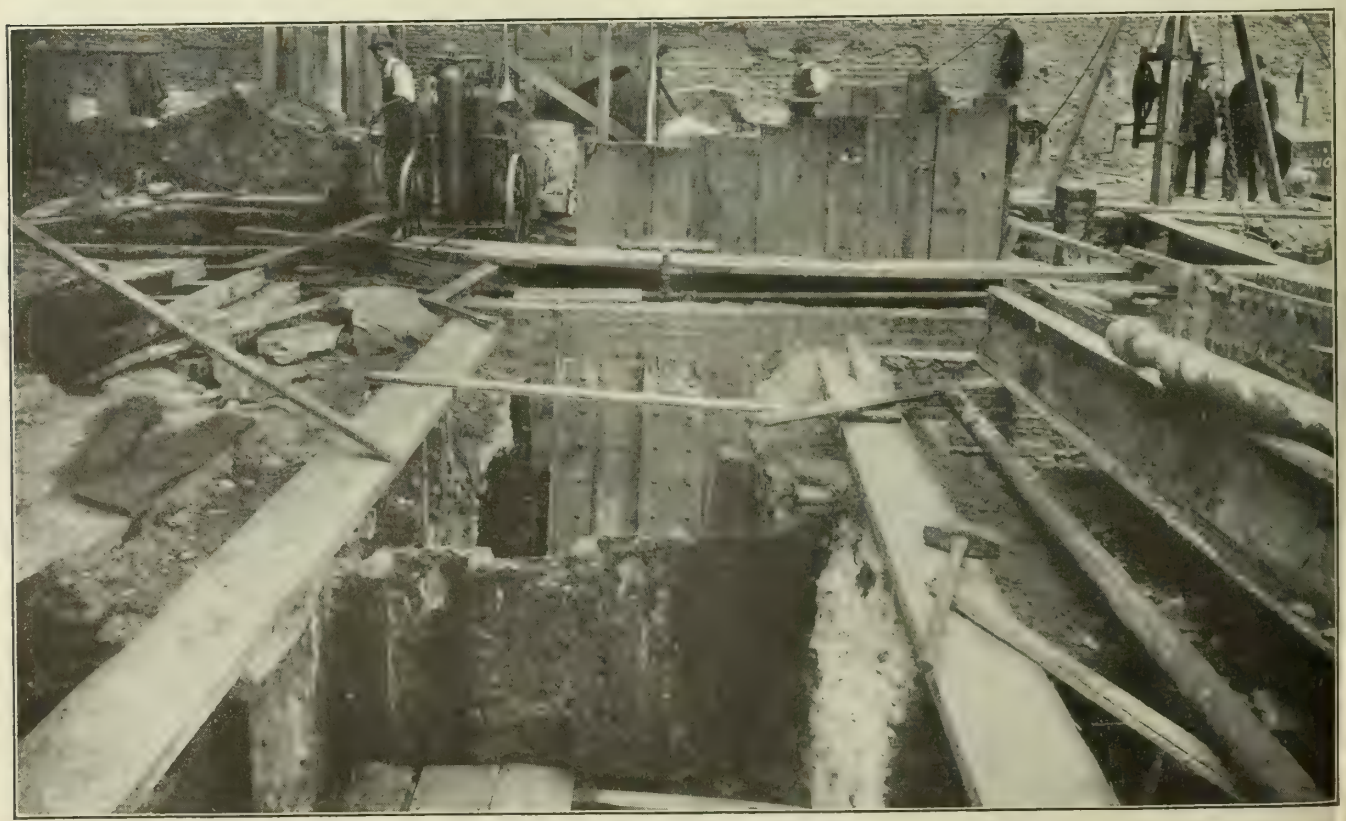


FIG. 2. OLD STEEL SHEETING, CONCRETE AND GIRDERS WHICH NEW FOUNDATION PITS MUST PENETRATE

regular central web plate and two reinforcing webs spaced about ¾ in. away from the central web. This cut (Fig. 1) required about 200 cu.ft. of oxygen and about 125 ft. of Blau gas. When the webs were cut through about a quart of water ran out, although the soil surrounding this footing is entirely dry and has been so for years. The water may have come from the combustion of the gas.

Wherever the old sheetpiling comes within the new foundation pits it is laid bare and cut out in sections. The torch will cut about 8 ft. per hour of the piling. At one point, where the piling was driven close on the outlines of the pier and the concrete fills it completely, the builders expect to leave in the old pier and sheeting and concrete around it for the remaining area of the new pier.

The new piers are being put down by open excavation, the pits being sheeted as soon as they get down low enough to require a platform. Rock is nowhere over 25 ft. below cellar bottom, and except for a few feet just over the rock the ground is dry.

A. G. Moulton is superintendent for the contractors.

How Concrete Lamp-Posts Are Made for Lincoln Park

By George T. Donoghue*

Concrete lamp-posts are being used extensively on the boulevards of the Lincoln Park system in Chicago. They were first used in 1907. During the past year 133 were installed, making a total of 947 now in service. They were designed by John Hamilton, of the firm of Perkins, Fellows & Hamilton architects, of Chicago. The design is copyrighted.

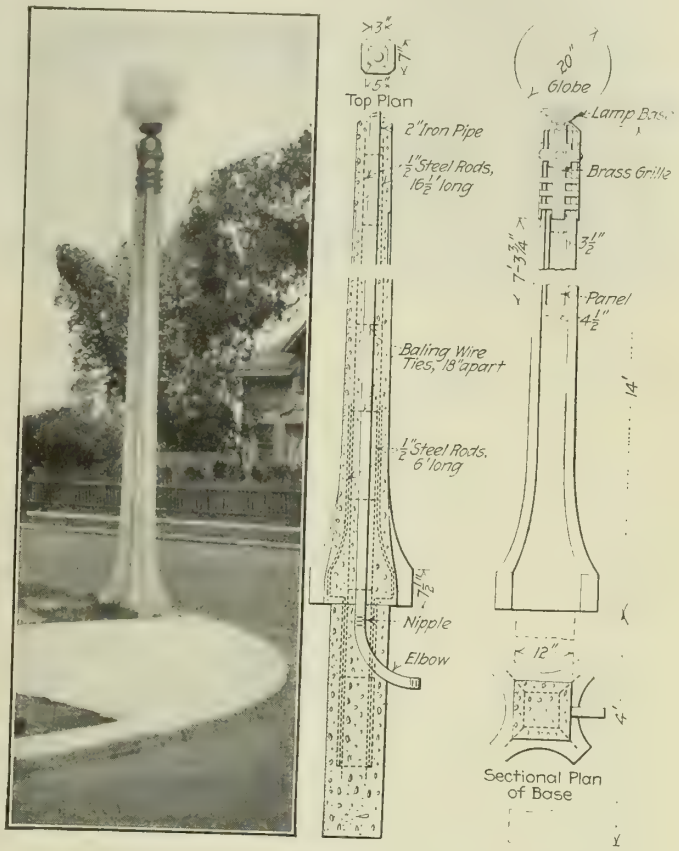
The body of the post is composed of very dry concrete—1 part cement, 1.5 parts torpedo sand and 2.5 parts of ½- to ¾-in. limestone. The surface dressing above ground consists of ½ in. of 1 : 1 : 1½ mortar composed of cement, torpedo sand and fine red granite screenings. To this mortar is added 5 lb. of mica for each post. The mold for the portion of the post above ground is of cast iron. It consists of a base and two sides and resembles a trough. This is bolted to a wooden form (also in the shape of a trough) for the portion of the post that is below the ground.

To prevent sticking, the mold is given a light coat of cheap machine oil before the concrete is put in. The bottom of the iron trough and about 2 in. on each side are coated with the surface mortar. Dry concrete to form the body of the post is then introduced and a reinforcing bar placed in each corner. The sides are then lined a little higher with mortar and more concrete is added. At the center a 2-in. cast-iron pipe is placed to carry the electric-light wires. The sides are again lined with mortar and the entire trough is almost filled with concrete, a reinforcing rod being placed in each upper corner.

The top is then covered with the surface mortar, leaving the mold a little more than full, the top or lid of the mold being then put on and bolted firmly into place. This forces the concrete into all lines and corners of the mold. The portion of the post below ground receives no surface dressing.

The post is allowed to remain in the mold 24 hr., after which the top and the sides are removed so that curing can proceed more rapidly. The bottom mold is usually removed after 48 hr., but sometimes it is necessary to wait 72 hr. Complete drying of a post takes about 120 hr.

When the post is completely dry the surface is quickly brushed with muriatic acid. This removes all the cement on the outer surface and gives an effect resembling natural granite. As soon as the post has been completely covered with acid it is drenched with water and brushed over with a broom to prevent the acid from attacking the cement in the body of the post. About 2 gal. of acid is used for each post. The posts when finished weigh 2,000 lb. The cost of manufacture varies from $16 to $19 each. Union cement finishers are used in doing this work. The posts are built under the direction of Philip Zimmer, master mechanic.



CONCRETE LAMP-POST OF THE LINCOLN PARK COMMISSION IN CHICAGO

In erecting these posts a hand-power derrick mounted upon a large wagon is used. The post is set in a prepared hole and concrete 12 in. thick is placed around the base.

*Chief Engineer, Commissioners of Lincoln Park, Chicago.

Concrete "Atomizer" Repairs Brick Railway Tunnel Arch—The Chicago Great Western Ry. tunnel at Winston, Ill., a 2,600-ft. single-track tunnel on 1% grade, showed serious destruction of the arch brickwork by water and locomotive exhaust. The lower layer of the arch and part of the second layer had been destroyed. The tunnel was very wet, and near the east end water flowed freely from the roof. The arch was repaired by H. P. Brown with the concrete "atomizer," which put on a surface layer of 1:3:2 concrete made with ½-in. gravel. Just ahead of the spray work, men with pneumatic hammers and a hose cleaned off the surface of the arch. The nozzle car, set behind the materials car in the work train, carried on two longitudinal rails a truck supporting the nozzle journaled to swing in a transverse plane, so that in one spotting of the train a 10-ft. length of arch could be covered. The sprayed concrete, applied in several layers, adhered perfectly, even where water was coming through the brickwork. The air pressure used here was 80 lb. A mechanically operated trowel arm was tried for finishing the surface, but it worked only where the track was in the center of the tunnel. High-pressure steam jetting gave a troweled effect.



FIG. 1. OLD CUTTER HEAD



FIGS. 2 AND 3. TWO VIEWS OF NEW CUTTER HEAD

Special Cutter Head on Dredge Working in Hard Material

By J. H. Gandolfo*

In building the new coal-storage dock at San Juan, Porto Rico, for the Porto Rico Coal Co. it was necessary to excavate about 70,000 cu.yd. of material for the slip and channel approaches. For this purpose a suction dredge is in use, with a 50-ft. arm carrying the cutter head, a 12-in. centrifugal pump driven by a 200-hp. motor and 12-in. suction and discharge pipe. The first cutting head provided was fitted with six cast-iron blades, bolted to six arms radiating from the operating shaft, and had an extra set of manganese-steel blades.

All dredging is to be completed to a minimum depth of 24 ft. The top 10 ft. consisted of soft mud, full of manglaris roots, and the remainder is a tough yellow clay, alternating with patches of a tough white sand that has enough clay mixed with it to prevent it from disintegrating in the water. In addition, occasional pockets of a hard coral are encountered. Both the clay and sand become very hard on exposure to the air.

At the beginning of operations a cut for the full depth necessary was taken out, in order to test the equipment. It was soon realized that the cutter head at first provided would not be able to handle the hard material. On account of the arms supporting the blades and the closeness of the blades, the head was constantly blocked with both the clay and sand. Fig. 1 is a front view of the old cutter head clogged with material so hard and tenacious that to clear the head it was necessary to pry the material out with bars.

After several consultations, the contractors designed the cutter head shown in Figs. 2 and 3. It is 42 in. in diameter at the larger end, has five blades, with a supporting ring at the rear, and is carried at the front on a central shaft. The front end of this shaft may be noted in Fig. 3, which also shows the opening to the suction pipe between the blades. The head is of cast steel.

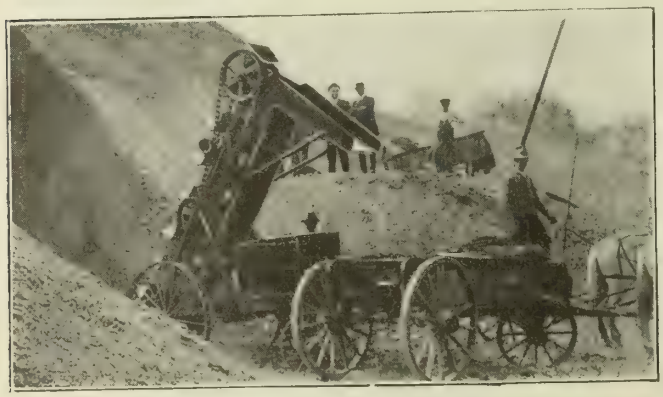
This cutter head has given entire satisfaction on the work. Because of the wide space between the blades leading to the suction pipe it rarely becomes clogged. It is also successful in breaking up the beds of coral small enough to pass through the discharge pipe.

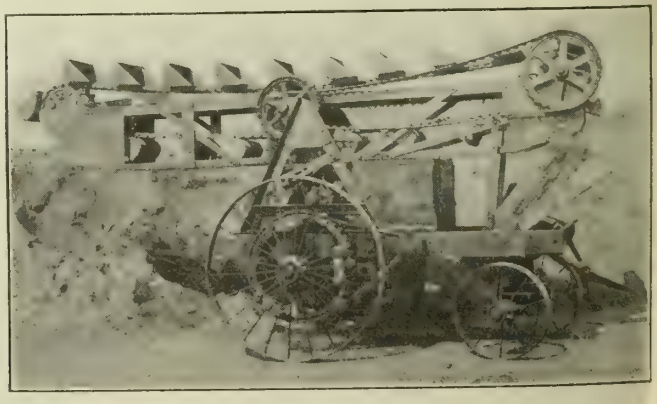
The Moody Engineering Co., of New York, is the engineer for this work, and John Monks & Sons the contractor, with E. D. Buel as superintendent.

*Resident Engineer, Moody Engineering Co., San Juan, P. R.

Wagon Loader Handles 10,000 Yd. of Traprock

The Park Department of New York City has been using a gasoline wagon loader for handling run-of-crusher traprock used in road repair. This machine, working pretty steadily throughout the summer at Van Cortlandt Park, loaded 10,000 yd. into horse-drawn wagons and tractor-trains.





GASOLINE WAGON LOADER HANDLING TRAP IN VAN CORTLANDT PARK, NEW YORK CITY

Left—Loading traprock into wagons. Right—Elevator raised in position for transportation, so as to clear gateways, trestles and wires

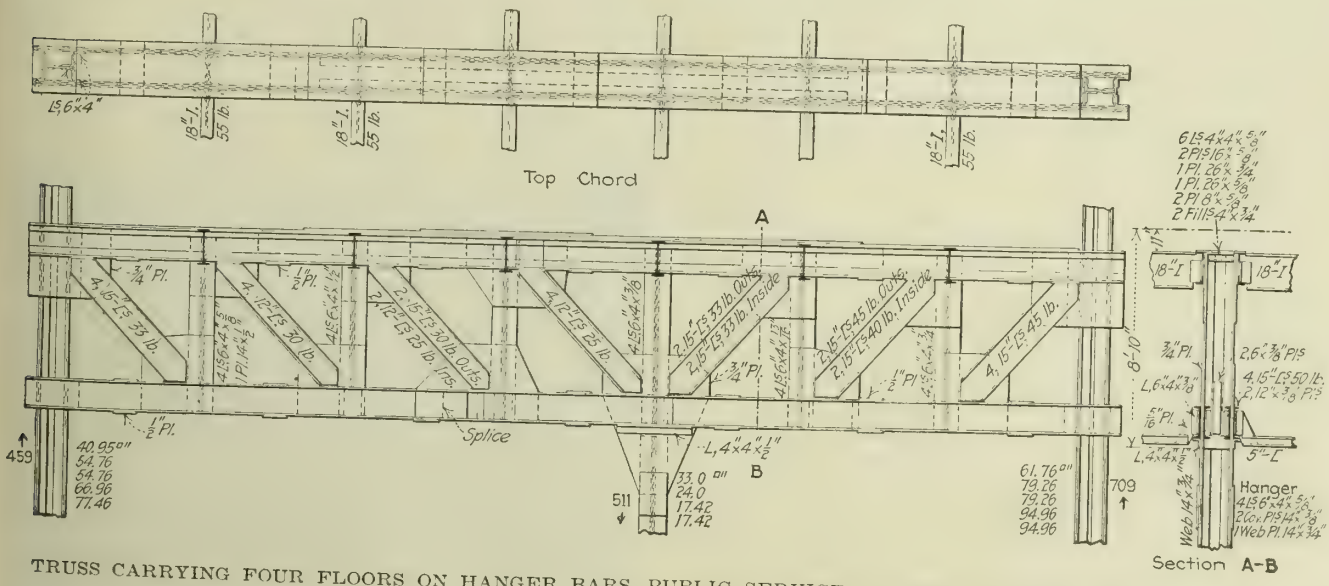
The gasoline engine of the loader is being rebuilt at the present time, this making its second thorough overhauling since purchase. The engine was 6 hp. and found to be rather light for such continuous heavy work. The Park Department, however, appears to be well satisfied with the performance of the machine and intends to put it to work on a 375,000-yd. pile of traprock just as soon as the engine is ready for service. This rock is situated below the Park reservoir and was intended for use in connection with a filter plant. When the filter project was abandoned the rock was turned over to the Park Department for road repair.

The wagon loader was built by the George Haiss Manufacturing Co., 141st St. and Rider Ave., New York City. It cost the Park Department $700 and weighed 4,250 lb. Except for the motive power, the machine is exactly the same as the electric loader manufactured by this company.

Columns Over Clearways in Newark Terminal

In the design of the Public Service Ry. terminal and office building in Newark, N. J., described in *Engineering News* of Oct. 28, 1915, it was necessary in two places to support two lines of columns over clear spaces. One of these was at the front, where a line came down over the subway leading from the building. Clearance was limited. Here a triple girder, spanning 36 ft. and weighing 33 tons, was used. Each of the three component girders has a 48x3/8-in. web and 8x6x5/16-in. flange angles. The outer webs have only outer flange angles, and 12x7/8-in. plates were used on the inner face to make up. Each flange of the composite girder has four 34-in. cover plates, totaling 3¼ in. in thickness, riveted to all four flange angles.

The second place where clear space was required was in the auditorium of the building. A Pratt truss in the 8-ft. roof space above the eighth story carries a line of hanger bars replacing the columns for four stories below. The design of this truss and the areas of end columns and hangers are shown in the accompanying sketch.

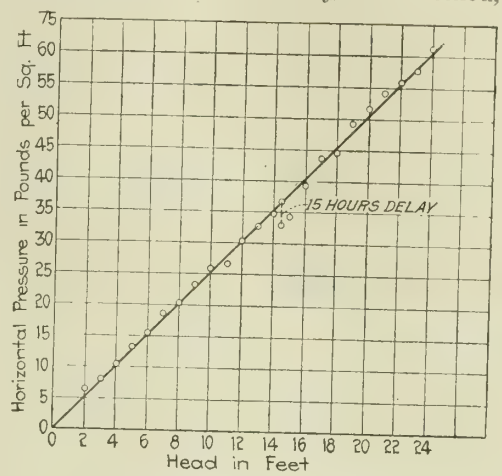


TRUSS CARRYING FOUR FLOORS ON HANGER BARS, PUBLIC SERVICE RAILWAY TERMINAL, NEWARK, N. J.

Pressure of Cottonseed

By W. M. Eliot*

Some designers of cottonseed warehouses use the results of tests made on wheat, with a correction for the difference in weight of the two materials, to obtain the horizontal pressure. They cannot have much confidence in the results secured by this method, as the conditions are unlike in nearly every respect. The tests on wheat have usually been made in relatively deep bins; cottonseed is stored in shallow ones. The angle of repose of cottonseed varies, but any of it will stand at a much steeper slope than will wheat. Wheat will flow through an orifice under any appreciable head, while the seed will not. Wheat is stored just as it falls from the conveyor; cottonseed is usually tramped to secure greater storage, thereby increasing the horizontal pressure.



HORIZONTAL PRESSURE OF LOOSE COTTONSEED UNDER INCREASING HEADS

Weight of loose seed = 22.4 lb. per cu.ft.
Weight of packed seed = 33.6 lb. per cu.ft.
Angle of repose of seed = 38° 40′.
Equation of curve,

$$P = \frac{5}{2} H$$

As the available experimental data were limited, the writer undertook to make some tests of the horizontal

*713 North Lancaster Ave., Dallas, Tex.

pressure as measured in a working cottonseed bin. The side of the rectangular tunnel through the center of the building extended only 1 ft. above the top of the vertical 3x4-ft. pressure door at which the measurements were made, and as the nearest wall was 25 ft. away, the side-wall friction was negligible. The conveyor opening was 35 ft. above the center of the door and 8 ft. to one side. The pressure of the seed was measured just as it fell, without any further packing. The average head on the door was obtained by measuring the vertical distance from the center of the door to the line of the sloping seed.

The pressure was transferred through levers to a platform balance scale. No system of spring scales or pressure diaphragms could be used, as the slightest movement of the door would cause a marked change in the pressure. When the door was removed at the completion of the test, the seed remained nearly vertical, less than a cubic foot falling down.

By referring to the diagram, it will be noticed that a considerable break in the pressure occurs when the filling is delayed, but that this loss is soon fully recovered. Since the whole mass of seed is in a constant state of readjustment while the head is being increased, it is the writer's opinion that as soon as the set acquired during the intermission is broken, the pressure becomes the same as if no delay had occurred. Although the pressure on a wall decreases with time, it would seem that nothing is gained by partly filling a building and allowing the seed to set.

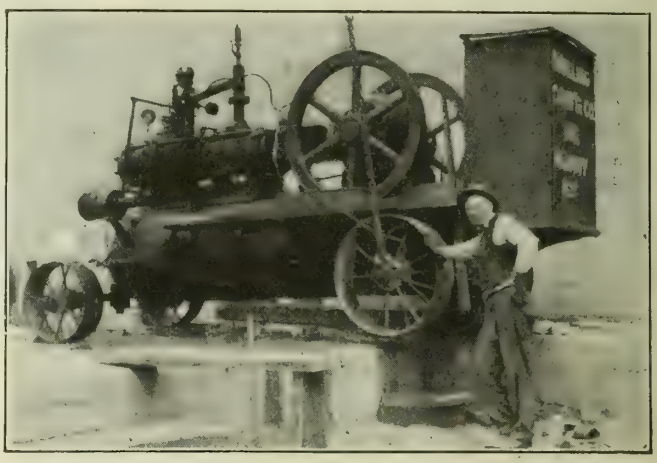
One way of designing a wall to retain cottonseed is to allow for the pressure of the loose seed and the effect of tramping, when such packing is not permitted nearer than 10 or 12 ft., depending on the height of the wall. Another method is to make the wall much stronger so as to resist the pressure when tramping is permitted next to it. The latter is more fool-proof, but the former is probably the better practice, as more seed can be stored in that way for each dollar invested.

This test was made with the coöperation of J. H. Brillhart, Chief Engineer, Mosher Manufacturing Co., Dallas, Tex.

NOTES

Good Performance of a Ditching Dredge was made by a 2-yd. dredge working on Joint Ditch No. 17 in Emmet and Palo Alto Counties, Iowa. This ditch drains the eastern half of Swan Lake and the adjacent lands. The main ditch from the junction of the laterals was 17½ mi. long and 5 to 15 ft. deep. The bottom width was from 18 to 24 ft., with slopes of 1½:1 In places the bottom was very hard. The dredge was operated until Jan. 1, 1915, and then was frozen in until Mar. 1 The frost was 18 in. deep in March and some zero weather was encountered. There was 959,000 cu.yd. to be excavated in the contract, and the work was finished Oct. 15. The dredge was operated double shift, time for repairs being only on Sundays after the boiler work was attended to, and no labor was employed except the regular crews of four men on each shift. In the final month, Sept. 15 to Oct. 15, the dredge cut a ditch 38 ft. wide on top, 24 ft. wide on the bottom and 6 ft. deep, 21,180 ft. long (or 4 mi.) in 26 working days. There were no breakdowns during the month and the dredge quit in good working condition. Considering that the work was in the country and that all repair work was handled by the operating crews, it is natural that the steady work with double shift would cause wear and tear that would bring delays at the close of the work.—H. B. Whitney, Contractor, Emmetsburg, Iowa.

The Importance of Portable Equipment for contractors is emphasized by a report of the Drilling Contracting Co., 35 State St., Albany, N. Y., on a portable air-compressor outfit used by the concern on its New York State Barge Canal work. The machine has been put on cars only four times, yet it has been set up on all of the eight locks below Fort Edward on the Champlain Canal, on all the 22 locks of the Erie Canal between Waterford and Oneida Lake, and on the

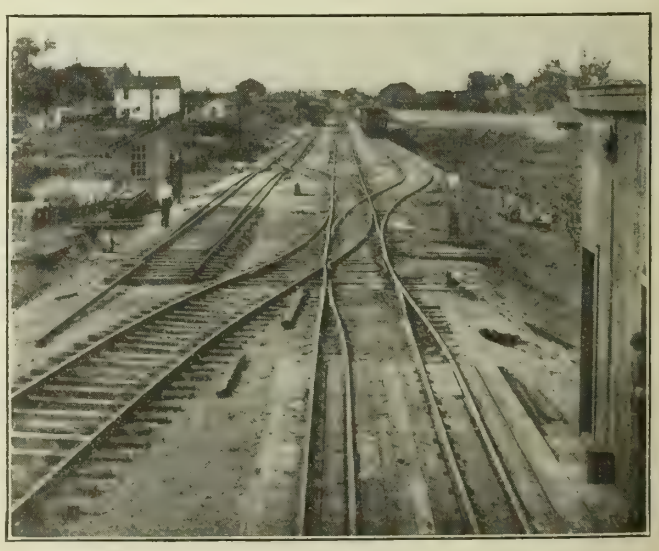


PORTABLE COMPRESSOR OF DRILLING CONTRACTING CO. OF ALBANY

locks at Fulton, Minnetto and Oswego of the Oswego Canal. It is at present working on the four locks of the Cayuga and Seneca Canal. The company reports that it has become so much a matter of routine to sling the portable outfit around by cranes that it requires only about 15 min. to get drills running after placing the compressor on a new site. The photograph shows this compressor going into position at Lock 3 on the Cayuga and Seneca Canal. The unit is run at times 24 hr. a day, with only a 10-min. stop for examination of journals and wristpin connections. The machine was furnished by the Chicago Pneumatic Drill Co.

A Turnout Within a Turnout—An unusual piece of temporary trackwork is shown by the view. In order to make extensive repairs to a set of "light" railroad track scales it was necessary to remove the dead and running rails, but at the same time maintain the empty-car traffic normally passing over these scales and without tying up the loaded-car traffic passing over the "heavy" scales.

The desired result was obtained by cutting the "light" track at one point and connecting by turnout to the "heavy"



A COMPLICATED TEMPORARY TURNOUT ARRANGEMENT

track. Empty cars were weighed on the "heavy" scales and by a back-up movement were passed over the temporary connection and to the storage yard beyond. For this information I am indebted to H. C. Finch, general manager of the Genesee & Wyoming R.R., Retsof, N. Y.—J. R. Taft, New York.

Editorials

Maladministration Responsible for Late Factory Fires

The fire question has come very much to the fore in the last week. The destruction of the Bethlehem and the Roebling shops may be passed over here. The real matter of concern is the series of terribly fatal fires in city factories, of which Pittsburgh furnished one three weeks ago and New York another ten days later. The two dozen victims of these fires were a needless sacrifice. There is no instruction in the details of the disasters, nothing to be learned from them that will help in saving other lives in the future. In both cases the victims were penned up in firetraps—a commonplace word in our modern language, but how appropriate to the working-places and the buildings which were burned!

Let it be emphasized that the art of fire-protection—and this is an engineering study—long ago reached the point of recognizing clearly the inevitableness of such fires as those in Pittsburgh and New York. Combustible buildings, conditions that encourage rather than prevent the start and spread of fire, lack of means of exit, absence of fire warnings and fire-fighting means, and all the other elements that mean death soon after the first chance flame springs up, have time and again been observed in their disastrous action and marked down as things that must be eliminated if even reasonable safety is to be attained. But between this knowledge and its full utilization there stands, in some states and cities, a wall of administrative incompetence and neglect that is horrifying.

No more grotesque characterization of this administrative failure has ever been given than was supplied by the state inspecting board of New York in the inquest on the fire of Nov. 6. The board's inspectors testified that they inspect factories of six stories and more and factories of four stories and less, but no *five-story factories.* The board never made regulations for five-story factories! For months it has gravely discussed, in a dozen different board meetings, says the chairman, the question of making such regulations. And once, when they had a public hearing on this weighty question, representatives of manufacturers' interests came to protest, saying that it would be a crime and a useless expense to extend the fire rules to five-story factories! And even today the board has no rules for this class.

But the cause of this particular fire lies farther back even than the wonderful board. It goes back to the Triangle shirtwaist fire of evil memory. Tremendous excitement among the public and the authorities of city and state was aroused by that fire; yet when, long afterward, Harris and Blanck, the operators of the factory, came into court under indictment for keeping their employees locked in, they were acquitted. The encouraging lesson—that the most necessary laws may be violated with impunity—was not lost on their successors.

Another interesting example illustrates a different phase of the subject. Some years ago a great new department store was to be built. Department-store crowds and the large open floor areas—which it has never been possible to restrict by legal limitation—need ample stairway provision for quick escape in case of fire. The stairway requirements of the law are none too ample. But in this particular case the owner did not want to provide as many stairways as the law requires. All the technical officials who had to pass on the case insisted on the full legal provision of stairs. But there were some high officials—nontechnical men; in short, politicians—who were also interviewed. The final result, no matter how it was brought about, was that fewer stairs were put in than the plain reading of the law requires.

A department store of the present-day type constitutes a large fire danger. Good luck has kept fire away, and for fifteen years there has been no department-store conflagration. When it comes, it may, by chance, seize on the store with inadequate stairs.

Inadequacy of laws or their absence and maladministration make illusory, in a large measure, the public's protection from fire danger. Engineers are concerned with this situation to the extent that they can influence current thought toward reform.

Two Tunnels to Make One

One way of doing a thing well is to do it twice. Ordinarily this is an uneconomical procedure, but the builders of the Rogers Pass tunnel claim that it is economical in their case. They had a long tunnel to dig, and so they started by excavating a second tunnel, a useless tunnel, first, and from it they proceeded to attack the main tunnel itself.

To describe the striking, iconoclastic method of the "pioneer heading" in the above terms is likely to seem belittling and unfair. The work was carried on in highly successful and expeditious style. Record-breaking rates of advance were made, greater at least than any prior performance on the western continent. No untoward incidents interfered with smooth progress. So the work merits congratulations and praise. That fact however does not bar the question whether the second-tunnel scheme was an essential factor, or whether the same or even better results would have been attained without it.

Comparison with the Simplon tunnel is invited, because there the parallel-heading method was also used—in fact it was originated by the Simplon engineers. Two reasons in coöperation made a sound basis for the method there: First, the prospects were that great heat and large water-flows would be encountered, which would call for drainage and ventilation capacity almost impossible to secure in a single heading; and second, if for purposes of ventilation and drainage a second heading were driven along with the main heading, it could be used later for the second tunnel which would shortly be needed to provide double track, and so the parallel heading would involve hardly any dead expense.

There has been much difference of opinion in Switzerland among tunneling experts as to whether the Simplon experience justifies the existence of the parallel-tunnel method of construction. In the later Loetschberg tunnel, which is shorter than the Simplon but still much longer than the Rogers Pass, the method was not used; and although this is a double-track tunnel there is no ground for assuming that the greater width had anything to do with the selection of the driving method. The conclusion is probably conservative that for the Simplon itself the parallel-tunnel method was a vitally important device, making possible the successful handling of great springs of water, oppressive heat, and swelling rock; but that it established no valid precedent for other tunneling operations.

It is pertinent to remark that none of the critical conditions of the Simplon were present in the Rogers Pass problem—neither much water and heat, or unsound rock. Moreover, the builders of the latter say directly that, despite the outward similarity, their method has no relation to the Simplon method. They were aiming at speed of advance.

This reduces the case to a simple question, which, it may be hoped, the Rogers Pass engineers will answer in due time: Wherein does the supposed gain of speed or convenience by the parallel-heading method lie? It cannot lie in the heading advance itself, since the main heading should get along just as fast as a parallel heading, in respect to work at the face, and since no difficulty has been found elsewhere in passing the heading muck through the break-up and enlargement work in the rear. To cite only one case of proof: the Loetschberg headings, while break-up work was proceeding very actively at numerous points back of the face, were uninterruptedly driven forward at a very much faster rate than Rogers Pass has been able to report, so that the Loetschberg or standard method cannot be materially inferior to the Rogers Pass method in regard to muck disposal.

Drainage was not a factor at Rogers Pass, it appears, for if it were the pioneer headings would have been driven on an up-slope, to drain. Ventilation, however, may have had important bearing, and a clear statement of how much account was taken of ventilation in adopting the tunneling method will be a most desirable thing.

Another World Record Broken

Engineering News owes a mild apology. Success always overcomes carping criticism, and the Philadelphia Engineers' Club has recorded a sweeping success. The club's campaigners did not go after a million members, as a jealous Pittsburgh newspaper said—see *Engineering News* of last week—but only after a modest thousand. "Modest" is true only in contrast, however, as there is nothing small about the project of gathering in 1,000 new ones in four days. It means, says the local mathematician, 250 per day, or in the 14-hr. working day 18 members per hour. Every 3 min. 20 sec. a new candidate was to be signed, sealed and delivered. That is real ambition.

But what did they do? They not only made good but they had 67% to spare! No less than 1,776 persons not previously members of the Philadelphia Engineers' Club were convinced by the earnest arguments of the membership solicitors.

To convert this phenomenal achievement into a permanent triumph will call for further work, harder than the efforts of the whirlwind campaign. The club must now "deliver the goods," to speak in worldly phrase. Recent Philadelphia history teaches us how hard it is, after the newly awakened sleeper has "hit the sawdust trail," to keep him awake. Let the club put forth its efforts to this end. Let it show that members can be not only secured but also retained.

Low-Cost Reinforced-Concrete Water-Works Conduit

Engineers may well be set to thinking by the low unit cost of the 27 mi. of 42-in. reinforced-concrete pipe for the new water-supply of Victoria, B. C., described elsewhere in this issue. The cost was not much over the bid for wood-stave pipe and only a little more than half the bid for riveted-steel pipe. It should be noted, however, that the pipe was laid on the hydraulic grade line, in a rough and heavily timbered country, with local cement and with sand and gravel readily available. It may be mentioned that the carrying capacity of the pipe exceeds the estimated capacity by a considerable percentage. What the life of the conduit will be as compared with wood and how water-tight it will prove after the test of service are interesting subjects for speculation. Instead of evil, *Engineering News* prefers to prophesy a long life, and a useful one, for this concrete conduit—which, by the way, has below it 11 mi. of 36-in. riveted-steel pipe under pressure, conveying the same water, and thus affording some chance for comparing the two materials.

Sidelights on the Philadelphia Valuation Conference

The recent three days' discussion at Philadelphia of appraisals, values and depreciation of public-utility properties (noted elsewhere in this issue) was of peculiar interest as disclosing the tendencies of responsible men connected with the public side of utility regulation the country over. There were represented, of course, all shades of opinion. The utilities themselves were not unrepresented, even though the conference was held under the auspices of the Utilities Bureau, which aims to be the organization of the public side nearest approaching the various well-known associations of utility companies and men. The utilities might have been more largely represented had they not, as there is reason to believe, been afraid of giving the impression of trying to strangle coöperation among public bodies and public men. It was evident throughout all the discussions (and it likewise has been evident in recent meetings of utility-corporation men) that equity to both public and corporation was the goal. Of course there were inevitable differences as to just what constituted real equity and how it was to be approached—differences arising from somewhat antagonistic viewpoints. But the spirit of equity seemed generally to dominate. A few years ago this was not wholly true on either side of the case, and its development is an encouraging evidence of the benefits of state regulation.

One idea accepted by the gathering was that the introduction of the term "value" had been unfortunate.

All parties, except possibly one prominent railroad attorney, who stood firmly on the bedrock of Supreme Court decisions as fixing the law of the land, were seeking to find as a rate basis not the economist's market value of plant and business (which depends on rates) but an equitable worth on which the utilities should turn—as one speaker put it, "a basis of compensation for the sacrifice of the investor." Reproduction cost of property and business under present conditions was assailed as the basis of rates; but as single elements tending to show the earning worth which a commission might equitably establish, reproduction under present and under historical conditions was finally accepted. Thus it may be seen how advantageous it is to clear away some mutual misconceptions of terms which in the past have caused needless controversies.

A heart throb of approval and sigh of regret will be evoked from every engineer in the public service who reads the following words from a recent report by M. L. Cooke, Director of Public Works of Philadelphia: "With the exception of a very few positions, the men in this bureau are not well enough paid. The whole salary schedule should be revised, and upward." Some might say that the best and only way to remedy this deplorable state of underpay is well-conceived publicity work. That the author of the report believes in publicity no one who knows him and his work can doubt. But he urges other means just here—means, too, quite within the reach of every engineer, but too commonly overlooked and neglected. To quote again: "It has always been a personal theory of mine that the way to get one's salary increased is to study to do better work and to have the salary increase come as a byproduct." Not only better work, but also more of it, might well be the study of many engineers in both public and private service who are more inclined to form a new mutual-admiration and raise-our-pay society than to strive every day to do their best, be their salary high or low. When maximum output and perfect quality have been secured it will be found that many barriers to effective and desirable publicity have been broken down—and the way paved to higher salaries.

Letters to the Editor

Sand-Cement and Mortar Beds for Paving—A Difference

Sir—The relative merits of sand and mortar beds under brick and block pavement continue to be a matter of active discussion. I notice that writers on the subject in referring to mortar beds seem to have in mind two quite different kinds of material. The one is a so-called mortar made of sand and cement mixed with only sufficient water to dampen it, resulting in a pulverulent mass that can be handled and gaged like damp sand; the other is a true and quite soft mortar.

The former has been more or less used as a substitute for sand alone for a long time; the latter is a comparatively new substitute for the common sand cushion. The writer has always meant this latter in speaking of mortar beds. The difference between the two is not alone in the quantity of water used in making it up. The merely dampened mixture of sand and cement is inferior to the real mortar. It does not set up into a mass of anything like the same hardness and strength as the true mortar. This was proved by the writer in experiments made over twenty years ago. The results of the tests have been mislaid and I cannot give the exact figures.

The experiments may easily be repeated and the statement verified by making up cubes of the two mixtures, using the same ratio of sand and cement and crushing them after the usual period of setting; or the striking difference in hardness between this so-called mortar and the concrete in the foundation may usually be observed in cutting through a pavement several years old.

It will sometimes be difficult to tell in places whether the cushion was so-called "mortar" or ordinary sand. This is partly because block pavements with close joints, even where the joints are not filled with impervious material, may not permit sufficient water to reach the cushion to complete the setting process for a long time, and the jar of travel over the pavement may break up the incipient setting, leaving, in places at least, only the equivalent of a sand cushion. Furthermore, tests will show that the dampened sand and cement, so frequently called mortar, if first compacted into a mold and then kept saturated with water will never attain the hardness and strength of the same composition well mixed with sufficient water to make a true mortar.

In order that results and experience may be properly compared, it should always be noted in reports of mortar beds whether real mortar or a moistened mixture of sand and cement (which might be designated as semi-mortar) is used; also, whether the mortar bed is applied before or after the foundation concrete has set. Unless the former method is followed, the effect of monolithic construction may not be fully attained.

New York City, Nov. 11, 1915. S. Whinery.

Colleges and the Development of National Resources

Sir—The German Government testing stations in technical colleges have contributed greatly to German industrial efficiency. Why cannot the United States Government so utilize the brains and equipment of the Land Grant Colleges? To this end your readers' coöperation is solicited in connection with a proposed bill for "mechanic-arts experimentation."

By the terms of the proposed bill there will be established under the direction of the land-grant college in each state a department to be known as a "mechanic-arts experiment station" for the purpose of conducting original researches, verifying experiments and compiling data in the mechanic arts and in their application to the

improvement of conditions of the rural and industrial classes of the United States; also for conducting researches, investigations and experiments in connection with the production, transportation, extraction and manufacture of substances utilized in the application of mechanic arts to industrial pursuits, and such other researches or experiments bearing directly on the various industries of the United States as may in each case be deemed advisable, having due regard for the varying conditions and needs of the respective states.

For the purpose of carrying out the requirements of the proposed bill the Federal Government will be asked to appropriate a sum of $15,000 per annum to each state. In order to secure uniformity of methods and results, some department of the United States Government will be designated as coördinator, to act in the same relation to the proposed mechanic-arts experiment stations as that now existing between the Department of Agriculture and the agricultural experiment stations.

In several states, including Illinois and Iowa, appropriations by state legislatures for research in mechanic arts have been occasioned by the demand from the industrial interests of the states for scientific experimentation relating to mechanic arts. That these appropriations were well utilized is evidenced by the fact that about 150 bulletins were published by these two stations within the past 10 yr., the largest portion of which is among the most authoritative literature on the subjects treated.

The land-grant colleges of about 15 other states maintain definite organizations for carrying on research in mechanic arts, but have no support from their states or from other sources for such investigations.

Experiment stations in the mechanic arts will also cooperate with the agricultural experiment stations in solving engineering problems which are intimately related to the industry of agriculture. Such problems include flood protection, drainage and irrigation, water-supply, sewage disposal and farm sanitation, rural architecture and road building. The proposed Federal aid for systematic experimentation in mechanic arts is analogous to the aid provided in the Hatch Act of 1887 and is for the purpose of paralleling the excellent work which has been carried on by agricultural experiment stations.

The Hatch Act and the proposed bill are alike supplementary to and in full accord with the Morrill Acts of 1862 and 1890.

A. A. Potter, Secretary,
Land Grant College Engineering Association.
Manhattan, Kan., Oct. 26, 1915.

NOTES AND QUERIES

Queens Boulevard Concrete Elevated Structure—By accidental omission the article published Nov. 11 on the concrete arch elevated structure on Queens Boulevard, New York City, failed to state that Noble & Woodard, consulting engineers to the Public Service Commission, were consulted in reference to the design.

Smooth Railway Crossings—A correspondent in South Carolina asks to be informed about the financial benefit to a railroad or street-railway of "automatically operated, perfectly smooth crossings." The only such crossings that the editors have been informed of are used by the Pacific Electric Co., in Los Angeles, and are made by the Cobb Shockless Crossing Co. (described in "Engineering News" of June 10, 1915, p. 1151). Where two tracks cross, the rails not in use are depressed so as to have a continuous rail surface for the approaching car or train. The financial benefits have not yet been disclosed.

Sooke Lake Water-Supply for Victoria, B. C.*

By C. H. Rust†

A new $2,500,000 gravity water-supply for Victoria, B. C., has recently been provided, consisting of the raising of Sooke Lake 12 ft., the building of a 38-in. conduit and a storage reservoir of 136,000,000-gal. (Imp.) capacity. The upper 27.3 mi. of the supply conduit is of reinforced-concrete lock-joint pipe and the lower 10.75 mi., below the storage reservoir, is of riveted steel pipe. The original contract, which provided for 40-in. instead of 42-in. concrete pipe, was abandoned. Under the new contract 42-in. pipe was used, for reasons stated farther on.

Victoria has a population of about 50,000. The daily consumption of water in the summer is 80 Imp. gal. per capita; in winter, 50. All services are metered.

From 1873 to 1913 the city procured its water-supply from Elk Lake, about 5 mi. northeast of the city. The capacity of Elk Lake being only about 2,500,000 Imp. gal. a day, the city was compelled to procure a more ample supply. It was decided to bring water from Sooke Lake, which drains an uninhabited forest area of 31½ sq.mi. The lake is about 4 mi. in length, and its maximum area at 555 ft. above sea level is 978 acres. It was decided to construct a dam at the foot of the lake and raise the level 12 ft., increasing the area to 1,180 acres.

It is proposed ultimately to utilize the Leach River watershed, with an area of about 31 sq.mi. the water from which can be turned into Sooke Lake by constructing a 5-mi. conduit. If it should be necessary, the dam at Sooke Lake can be raised to a height of 45 ft., giving a reservoir storage of 17,358,000,000 Imp. gal. The scheme which has now been completed gives a reservoir capacity of 5,555,000,000 Imp. gal.

The contract for the new supply called for the clearing of the land around Sooke Lake 15 ft. above low water and the construction of a dam, with screen house, intakes, etc., at the foot of the lake; 27 mi. of 40-in. concrete pipe and 27 mi. of 2-ft. gage railway track; a telephone line; the clearing of a reservoir site at Humpback, 12 mi. from the city, and the erection there of a dam, screen house, valve chamber, venturi meters, etc., and the building of 11 mi. of 36-in. steel pipe leading to the city reservoir. The contract for all this work was awarded to the Westholme Lumber Co., of Victoria. The following were some of the figures: Earth excavation, from 60c. to $1.50; rock excavation, from $1.75 to $7.50, the former being the price on the concrete pipe line. The prices for clearing land around the lake ranged from $150 to $250 per acre.

For the pipe line from Sooke Lake to Humpback Reservoir bids were received on three classes of pipe. The bids of the successful contractor for pipe laid and installed were: Wood-stave pipe, $2.47 per foot; riveted-steel pipe, $5.50 per foot; reinforced-concrete pipe, $2.53 per foot. It was finally decided to use the concrete pipe.

On the pressure line from Humpback Reservoir to the city, tenders were invited for three kinds of steel pipe.

*Slightly condensed and rearranged from a paper read before the American Society of Municipal Improvements, Dayton, Ohio, October, 1915.

†City Engineer, Victoria, B. C.

The prices bid by the contractors were: Lap-welded, $7 per foot, laid and connected; riveted-steel plate, $\frac{5}{16}$ in. thick, $5.25; $\frac{3}{8}$ in. thick, $6.25; lock-bar pipe, $6.80. It was decided to use riveted-steel pipe.

The contractors commenced work early in 1912, but the progress made was not at all satisfactory, and in April, 1913, they abandoned their contract. The writer, as Water Commissioner, recommended to the Council that the work be proceeded with by day labor. This was approved and the city immediately put on a large force of men at various camps. The laborers were paid $2.75 per day for 8 hr., $1 a day being deducted for their maintenance. Free medical attendance was supplied by the City Medical Health Officer.

The city completed the clearing of the land at Sooke Lake, carried out the construction of the dam, headworks, etc., at the foot of the lake and built the dam at Humpback.

It was considered advisable to call for tenders for the conduit. The contract for the construction of the concrete pipe was awarded to the Pacific Lock-Joint Co., and in place of 40-in. pipe, the contractor, having the necessary forms on hand, agreed to construct 42-in. pipe for the same price, its tender being $2.29 per foot, including laying and installation, but not transportation.

The concrete pipe had a shell 3 in. thick and was made in 4-ft. lengths, except the pipe used for siphons, which was more heavily reinforced and had a 4-in. shell.

The city awarded the contract for the fabrication and laying of the riveted-steel pipe to the Burrard Engineering Co., of Vancouver, at the following prices: $\frac{5}{16}$ in., $5.50 per foot; $\frac{3}{8}$ in., $6.25 per foot; but the city carried out by day labor the necessary excavating and backfilling. This line is 56,677 ft. long and was built and laid in six months.

For the construction of the concrete-pipe line a right-of-way 100 ft. wide was secured. All trees on this strip were cut down and any tall trees outside this area, which might in falling damage the pipe, were removed. The concrete pipe is not covered except immediately in the vicinity of the Humpback Reservoir, where it was thought slides might occur. Open standpipes are located 2,000 ft. apart on the conduit line, and each of the six inverted siphons has a waste outlet at the bottom controlled by a 6-in. gate valve. The deepest siphon is 600 ft. in length and has a maximum head of 90 ft. The whole of the concrete pipe line, which is 144,040 ft. long, was constructed on a grade of 1 ft. in 1,000 ft. The first pipe was made Apr. 20, 1914, and the pipe line was finished May 20, 1915.

The Humpback storage reservoir, about 11 mi. from the city, was formed by building a 60-ft. concrete dam across the valley of a small stream. It has a storage capacity of 136,000,000 Imp. gal. and floods an area of 33½ acres, originally covered with a very thick forest. A portion of the reservoir site had black soil of peaty nature. It was decided to cover this with a 6-in. layer of clean gravel.

The water flows into this reservoir from the concrete pipe line over a series of steps. There is also a 24-in. bypass to the pressure line. During the summer of 1915, owing to algæ in the reservoir, the water was sent to the city through this bypass.

Because of the great pressure, it was decided instead of delivering the water direct to the city to permit it to overflow into Smith's Hill Reservoir, situated within the city and having a capacity of about 15,000,000 Imp. gal., which acts as a pressure regulator.

To protect the watershed of Sooke Lake from any possible danger of pollution, the city purchased the whole area of about 15,000 acres for $12 per acre. It expects ultimately, if it so desires, to more than compensate itself for this outlay by disposing of the very large amount of valuable timber which is on the watershed.

The abandonment of the work by the contractor, the Westholme Lumber Co., led to a protracted litigation. The company entered suit against the city, claiming $500,000 damages. The suit was heard in Victoria last winter, and the judge hearing the case was assisted by two assessors, who were civil engineers. The case lasted six weeks and a verdict was given for the city, but the company has appealed and no doubt the case will be prolonged for some time before final decision.

The system was completed and put into use on June 2, 1915. No fatal accidents occurred during construction.

The original contract called for the delivery of 16,000,000 Imp. gal. per 24 hr. through a 40-in. pipe. The maximum flow through the 42-in. pipe actually built, as determined by test, was 22,400,000 Imp. gal. in 24 hr.

One accident has occurred to the concrete pipe line. During a forest fire a tree came down the side of the mountain and broke one pipe and cracked six more. Repairs to the two breaks, however, were quickly made.

The contractors for the concrete pipe line agreed to maintain the pipe for a period of one year. At present there is a leakage in the 27 mi. of about 500,000 Imp. gal. per 24 hr. It is expected that these leaks will be entirely eliminated when the necessary repairs are made.

The following is the actual cost of work by the city:

Sooke Lake Dam

	Per Cu.Yd.
Earth excavation	$1.42
Rock excavation	4.24
Concrete in foundation of dam	15.68

All the cement had to be shipped by rail and hauled by teams about 10 mi. over very rough roads. The gravel and cement were procured from the upper end of the lake and had to be towed to the foot of the lake. This involved the placing of a tug in the lake, which had to be transported from Victoria over the mountain, and the construction of scows.

Concrete Pipe Line

	Per Lin.Ft.
Pipe	$2.32
Concrete trestles for pipe line	.18
Railroad	.53
Transportation	.33
Total	$3.36

Telephone Line

Per mile	$426

Steel Pipe Line

Contract price for $\frac{5}{16}$-in. pipe, per lin.ft.	$5.50
Contract price for $\frac{3}{8}$-in. pipe, per lin.ft.	6.25
Earth excavation, day's work, per cu.yd.	1.32
Backfilling, day's work, per cu.yd.	.55

Humpback Reservoir

Earth excavation, per cu.yd.	$2.09
Rock excavation, per cu.yd.	12.78
Clearing, per acre	605.00
Placing gravel in bottom, per cu.yd.	2.48
Concrete foundations for dam, per cu.yd.	9.00
Concrete in dam, per cu.yd.	10.05

These prices include plant, tools, equipment, supplies, bookkeeping, etc.

Wynn Meredith, of the firm of Sanderson & Porter, New York, was engineer for the work. He was represented on the ground during the progress of the work by Boyd Ehle.

The entire cost of construction, including engineering, etc., was $2,037,176, and the cost of land, including right-of-way for pipe lines, site for Humpback reservoir, land adjoining Sooke Lake and the Sooke Lake drainage area, in all amounted to approximately $540,000.

Making a Road Up the Palisades

SYNOPSIS—Building a road to carry heavy traffic on an easy grade up the steep slopes of the Palisades at New York City. The road is brick-paved, and is guarded by a heavy parapet wall with novel coping.

On the west bank of the Hudson River, opposite New York City, rises the long range of trap-rock precipices known as the Palisades. Their summits are 400 to 500 ft. above the river, and the cliffs themselves have a height of 50 to 100 ft. From their foot, a steep rock-strewn slope well forested extends to the river. These cliffs and the slope below them to the river were made a public park by joint action of the New York and New Jersey legislatures fifteen years ago, and were placed under jurisdiction of an interstate commission, a body that is unique in being, so far as is known, the only example of an organization empowered to carry out a public work by the joint authority of two states.

From the first it has been planned to build a driveway through the park along the west shore of the river, and this projected road was long ago christened the Henry Hudson Drive. It is planned to have this driveway eventually extend and complete a through highway along the west bank of the Hudson from New York to Albany.

The first section of this drive, known as the "Englewood Approach," was completed and opened in June, 1915. It consists of a roadway starting from the top of the cliffs at Englewood and pursuing a zigzag course down a steep slope to the river, where a ferry to Dyckman St., New York City, has been established. The new road becomes the best avenue for through automobile travel to New England, where it is desired to avoid the crowded streets of downtown New York. The easy grades of the new highway tend to make it the favorite route for most of the pleasure travel between New York City and New Jersey.

The new roadway across the Palisades Park follows the general route of an old road built seventy-five years or more ago, which took advantage of a natural break in the cliffs. The old road was a very narrow sidehill cutting, supported on the lower side by rough stone walls which, while they had only a shallow footing and were only one course thick—a mere veneer for the earth backing, in fact—had stood up surprisingly well.

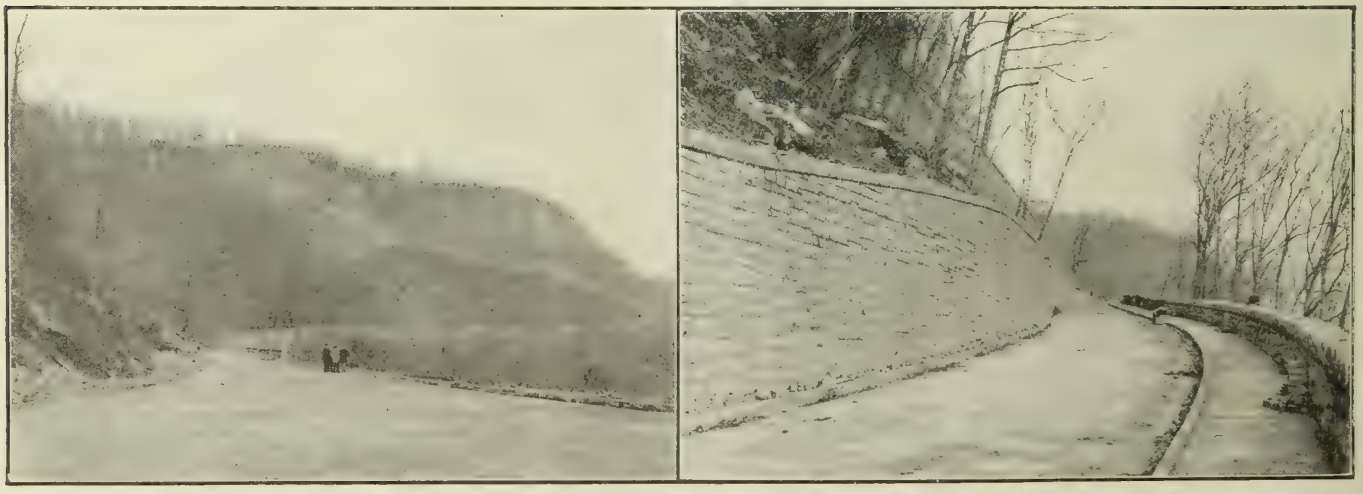
In order to make a roadway wide enough to carry the expected traffic, it was necessary to cut much farther into the steep slope, and support the fill on the lower side by a high and substantial retaining wall. On the upper side also, along the lower section of the road, it was eventually found necessary to hold the caving earth and disintegrating shale of the bank by a substantial wall. The lower wall was built of dry rubble; the upper one of dressed stone laid in cement. All these walls were built of the trap rock obtained in excavating the cliffs above.

A Road Down a Cliff

On the middle section of the roadway the old road passed along a narrow ledge half way down the face of the vertical cliff, nearly a hundred feet in height. The necessary widening of the roadway, therefore, meant either very high wall work to support the lower side or the excavation of a great amount of rock from the high cliff. The former plan was followed on the lower section, and as the road ascended and the height of the cliff above it became lower, the width was gained wholly by excavation.

The accompanying topographical map with the general view gives a good idea of the route followed by the new roadway. It may be noted that very heavy excavation was required at the two "loops," or hairpin turns, to obtain sufficient width to enable vehicles to turn safely without interference between the ascending and descending streams of traffic. The grade of the roadway is about 8%. This has proved very satisfactory for automobiles.

The lower side of the roadway is protected for the whole distance by a very heavy parapet of trap-rock masonry. The coping for this parapet is of massive blocks roughly dressed and rounded, and harmonizing with the general rough and wild character of the landscape. The blocks are so heavy and substantial that they are not likely to be lifted off and cast down the slope by mischief makers, and they form a surface too rough to permit anyone to walk along their tops.



FIGS. 1 AND 2. TWO VIEWS OF THE ENGLEWOOD APPROACH; HENRY HUDSON DRIVE, PALISADES PARK

Fig. 1—Looking up the Englewood Approach from the lower end. Taken in the winter of 1914 when the leaves were off; in summer the roadway is nearly hidden. Fig. 2—On the lower section looking toward the first loop. The retaining wall on the upper side of the roadway meets and unites with the wall on the lower side of the upper roadway



FIGS. 3 AND 4. CONSTRUCTION VIEWS ON THE ENGLEWOOD APPROACH OF THE HENRY HUDSON DRIVE
Fig. 3—Winter view during construction; from lower loop looking down lower roadway and up the upper roadway.
Fig. 4—Heavy rock excavation to increase width of road

Much study was given to the selection of the paving for the roadway. It was appreciated that a very heavy traffic was to be expected, for the road will soon become the chief avenue between New York City and a large section of the suburbs in northern New Jersey. Granite and scoriæ blocks were considered, but it was realized that a very large proportion of the traffic would be motor-driven, and it was desired to secure as smooth a pavement as possible. The final decision of the commission, therefore, was to use paving brick of the "hillside" pattern, having a bevel on one side to afford a toe hold to horses. The brick were furnished by the Mack Co., and were inspected at the kiln by the Pittsburgh Testing Laboratory. They are laid on a 5-in. concrete foundation with a 1½-in. sand cushion, the joints being grouted. At the numerous curves "dutchmen," or V-shaped sections, were laid at intervals to keep the courses square with the axis of the road.

Lighting and Draining Englewood Approach

The roadway is lighted by tungsten series incandescent lamps, placed in porcelain globes carried on low standards set on the parapet wall. The current for the lamps is carried in underground cables, laid in ducts beneath the paving. The roadway drainage is also carried in a pipe sewer beneath the paving, with catch basins at intervals.

A difficult problem was presented by a 6-in. cast-iron sewer pipe which carried the sewage from a few houses on the plateau at the top of the cliffs. This pipe extended down the face of the precipice some 40 ft. in height beside the roadway and was an eyesore that it was desired to remove. Various plans were canvassed for diverting the pipe to other locations, but all were found very expensive. It was then proposed to bore a well in the cliff back of the face, drift in at the foot and drop a pipe with screwed joints down the well to connect with the pipe crossing then built underneath the roadway. Various kinds of well-drilling outfits were investigated, and it was concluded that the ordinary artesian-well sinking outfit would be the most economical. The contract to sink the well was let for a lump sum of $1,000, and the contractor decided to use the chilled-shot method of boring. He made good progress in the solid rock, but the trap of the Palisades is full of fissures and seams, and when these were encountered the shot were lost and boring was suspended. The boring was finally completed, but with greater outlay in time and money than had been anticipated.

Conduct of the Construction Work

While the Palisades Interstate Park Commission now has its own offices and engineering staff, at the time the road described was undertaken, Watson G. Clark, of Tenafly, N. J., was placed in charge of the work as chief engineer. Surveys, plans and specifications were prepared by Mr. Clark, bids were advertised for, and the contract was let to the lowest bidder, the Miles-Tighe Contracting Co., on a unit-price basis.

The largest item of cost in the work is the excavation, for which the contract price was $1.65 per cu.yd. for rock,

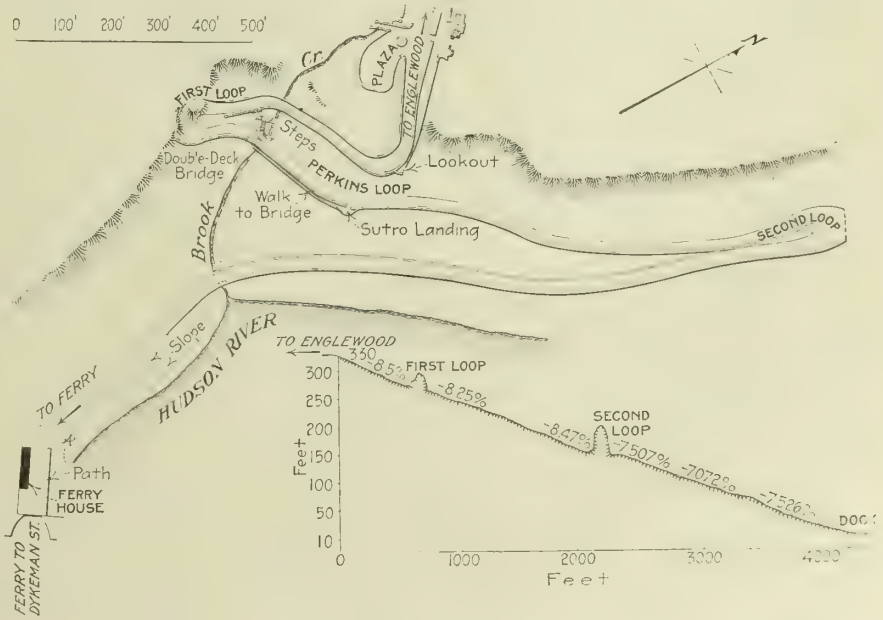


FIG. 5. PLAN AND PROFILE, ENGLEWOOD APPROACH TO THE HENRY HUDSON DRIVE; PALISADES INTERSTATE PARK

and 68c. for earth. Nearly 39,000 cu.yd. of rock and nearly 26,000 cu.yd. of earth were removed. The masonry walls cost about $57,000, in which the largest items were 7,900 cu.yd. of dry rubble at $2 per cu.yd., 80,000 cu.ft. of parapet wall at 40c. per cu.ft. for two-faced wall and 30c. per cu.ft. for one-faced.

Structural concrete at $12 per cu.yd. accounted for nearly $50,000 of the cost. It proved necessary to use a great deal of concrete in leveling up the footings for the retaining wall and filling openings in the high cliffs to support the roadway on the lower side. The brick paving cost about $41,000, there being over 12,000 sq.yd.

The total cost of the roadway, about 4,000 ft. in length, including engineering and inspection, will be over $300,000. This includes the electric-lighting equipment already referred to and also the construction of a large paved plaza at the summit, where those who come there to see the view may park automobiles.

The work of construction has been supervised by a committee of the commission, of which Abram De Ronde was the first chairman. Upon his retirement from the commission, he was succeeded by Col. E. A. Stevens, and he in turn by Charles Whiting Baker.

Use of Water in the Modesto Irrigation District

By Kenneth A. Heron*

During the season of 1914 the writer conducted a series of irrigation investigations in the Modesto Irrigation District. Records of canal flow and irrigation methods were kept in such detail that it is believed they may be of value as illustrating irrigation practice in central California.

To record the canal flow during the season, gaging stations were established on all the principal canals and laterals and readings made daily and twice a day by the ditch tenders and water distributors. For the purpose of observing irrigation methods 15 representative tracts, ranging from 20 to 80 acres in size, were selected and complete records of the manner of using water and of the crop obtained were kept.

As 86% of the 46,000 acres in cultivation in the district is in alfalfa, the tracts selected were in this crop, and records on these fields consisted of soil report, depth of ground-water measurements, time of starting and ending each irrigation, irrigation head, amount of water applied at each irrigation and during the season and crop report.

Systems of Checking Land for Water Distribution

Two methods of checking land are in general use—the square- and strip-check systems. The square check is better adapted to areas having little slope and to the harder soils upon which it is necessary at times to let water stand one or two hours several inches deep in checks until the soil is saturated. Checks are ordinarily laid out so as to contain an acre and are either level or sloping slightly away from the box on the lateral. Borders or levees about 12 in. high and 10 or 12 ft. wide on the base surround each check. The land the levees occupy is not wasted, but is seeded and cropped exactly as the rest of the check; and while water seldom reaches the top of the levees, the soil subirrigates so that in looking over a well-laid-out and irrigated field of alfalfa the location of the levees is only distinguished by the apparently higher growth on them. The strip-check system is generally acknowledged the best method of laying out the land where the slope is sufficient. Checks 60 ft. wide and 300 ft. long, with a fall of 0.3 to 0.4 ft., give the best results. The old contour-check system is no longer used, and lands that were checked in that manner years ago are being rechecked to conform to one of the other systems that have supplanted it.

Size of Irrigation Head

An irrigator is allowed the use of a 20-sec.-ft. head for 20 min. on each acre of land he irrigates. This amount spread evenly over his land would cover it to a depth of 6½ in. This head is turned into two or three checks at a time, and in the case of the ordinary sandy soil of the district is allowed to run into a check until it lacks 50 ft. or so of reaching the low end. It is then shut off and turned into another check. The application of too much water results in its piling up in the lower end of the check, and the water and hot sun kill the alfalfa.

While the time is usually strictly adhered to, the size of the irrigation head varies somewhat, and ditch tenders and the water distributor endeavor so to adjust the size of the head that the farmer will obtain 20 sec.-ft. at his field, and an amount equal to the transmission loss in the lateral (depending on its length) is added at the headgate.

During the season 66 irrigation heads were measured. The largest amounted to 40.9 sec.-ft. and the smallest to 10.50 sec.-ft. Only the largest ranches can use a head of more than 20 sec.-ft., and then it is divided into two heads. The average head in use on the 15 tracts during the season was 19.32 sec.-ft.

Amount of Water Applied Per Irrigation

The amount of water applied to the land varied on different fields and at different times of the year. As a rule, the first irrigation was the heaviest. The late summer irrigations, however, usually took a large amount of water where it was available, not so much because the land required it, but because the farmers endeavored to "store" enough in the top soil to carry them through until the winter rains. Some fields were irrigated six times during the season, while others received water only three times. The average number of irrigations received by the 15 fields was 4.4. The lightest irrigation of the season was on a tract of young alfalfa and amounted to a depth of 0.25 ft. Water amounting to a depth of 1.55 ft. was used to irrigate another tract of older growth in a sandier location. The larger number of fields used a depth of 0.55 ft. or less for each irrigation, and the average amount of water applied at each irrigation on the entire number of tracts, was 0.65 acre-ft. per acre.

When raising alfalfa, irrigators prefer to irrigate a week or so before the hay is cut or just as soon as it is removed from the field. The average time between cuttings is about 32 days, and this represents the average period between irrigations for the season. In the harder soils, however, irrigation must be more frequent, and one field irrigated at 21-day intervals suffered severely for water between irrigations. On the other hand, where

*Irrigation Engineer, Lakeview, Ore.

the ground water was close to the surface and the crop subirrigated, fields went unirrigated 40 or 50 days without apparent damage to the crop.

The amount of water applied to the fields under observation during the season varied from a total depth of 1.55 ft. on a field of young alfalfa planted in a hard soil to a depth of 6.73 ft. on another field, perhaps the sandiest in the district. These two represent extremes. The larger number of fields used from 2.5 to 3 acre-ft. per acre in four or five irrigations. The average amount used on the 15 fields was 2.84 acre-ft. per acre.

Irrigation Head and Volume per Irrigation

It is the general opinion of irrigators—which was substantiated by experiment and measurements—that a large irrigation head is more economical than a small one. One of the tracts under observation used 2.49 acre-ft. per acre during the season. This field was thoroughly irrigated each time and used heads of from 24.1 to 40.9 sec.-ft. Another irrigator who constantly utilized a head of from 10 to 12 sec.-ft. used over 6.50 acre-ft. per acre in six irrigations.

While a difference in soil of the two tracts was held responsible for some of this large difference, the larger part of it was charged to the small field laterals and boxes on the latter tract, which fed water into the checks so slowly that the upper ends were saturated to an unnecessary depth before water reached the lower ends. Measurements of depth of saturation in checks in this and other fields showed that the use of a small head invariably resulted in a much deeper saturation of the soil in the high end of the check than occurred in the low end. On the other hand, the larger head spread more rapidly over the check and resulted in a more even penetration of the water.

One of the best producing tracts in the district (partly subirrigated) cropped 8.50 tons of alfalfa between April and October. Other ranches were not so fortunate, and yields as low as 1.35 tons per acre were measured. Four to 6 tons per acre represented a general yield, and the average number of tons per acre cut from the tracts under observation was 5.4. This is believed to represent a fair average for the entire neighboring district and this part of the state.

Transmission Losses in Canals and Laterals

The main supply canal which heads on Tuolumne River at La Grange is 44.7 mi. in length. Discharge measurements were made daily during the season on the upper 34.2 mi. The lower 10.5 mi. is classed as a main lateral, and the loss in the canal shown in the accompanying table is determined from the daily measurements mentioned on the upper portion of the canal. There are 96 mi. of main laterals in the district. These take water from the main canal at points below the twenty-second mile and are eight in number. The shortest is 7.3 mi. and the longest 17.1 mi. The capacity of these laterals runs from 2 to 10 irrigation heads. Measurements were made daily for seepage losses on 14 mi. of these laterals, and periodically during the season on the remainder. From all these measurements it was estimated that 16% of the water entering the main laterals is lost in transmission to the heads of the private laterals.

There are 1,600 mi. of private laterals in the district, mostly of one-head capacity. They are not continuously in use, nor are all in use at one time. The "run" in each is usually from one hour to several days during the month. The losses were determined as follows: When the system was working under normal conditions, ditch tenders reported the mileage of laterals in operation at a given time. In this way it was found that, as a rule, about 31.2 mi. of private laterals were in continuous operation during the season.

Numerous measurements were made on laterals of this type to determine seepage losses. It was found that the average loss per mile was 1.35 sec.-ft. The average length of a private lateral is 1.64 mi. It was estimated from this that 10% of the water taken into the heads of private laterals was lost in invisible seepage and evaporation between the farm and the head of the private laterals. The figures in the accompanying table correspond to this.

TRANSMISSION LOSSES IN CANALS AND LATERALS IN THE MODESTO IRRIGATION DISTRICT, SEASON OF 1914

Month	Mean Flow of Intake Main Canal, Sec.-Ft.	Transmission Loss in Main Canal, Sec.-Ft.	Transmission Loss in Main Laterals, Sec.-Ft.	Transmission Loss in Private Laterals, Sec.-Ft.	Flow Reaching Fields, Sec.-Ft.	Per Cent. of Intake Capacity Reaching Fields
April.....	416.9	96.9	51.2	26.9	*161.9	38.8
May.....	629.5	101.8	84.5	46.3	396.9	63.0
June.....	670.6	121.6	87.8	46.1	415.1	61.9
July.....	583.2	113.0	75.2	39.5	355.5	61.0
August...	400.0	108.0	46.7	24.5	220.8	55.2
Average	540.0	108.3	69.1	36.6	310.0	57.4
Per cent..	100.0	20.1	12.8	6.8	57.4	

* Estimated 80 sec.-ft. wasted on account of wet weather.

Operating losses are caused by (a) accidents to the main canal, which necessitate its being shut down for repairs; (b) losses due to changing the flow from one lateral or headgate to another; (c) accidents to laterals and leakage from structures. From careful records during the season it was estimated that operating losses for any year would be close to 5% of the intake flow of the main canal if it were in continuous operation during the season.

Amount of Drainage from Irrigated Land

Six years ago a drainage canal extending from east to west through the district was built. Ground water stands at from 4 to 7 ft. below the surface of about 15,000 acres tributary to this canal. Although this land was irrigated with more than 2 acre-ft. per acre during the season, the flow of the drain averaged only 3 sec.-ft. during this time. It was estimated that less than 2% of the irrigation water reached the drain canal.

A Minnesota State Park with an unusual history is the Jay Cooke Park on the St. Louis River, 18 mi. northwest of Duluth. An area of 2,200 acres of wild land on the banks of the river has been given to the State of Minnesota for a public park by the heirs of Jay Cooke, the famous banker of Civil War times. The gift carries the stipulation that the state shall add 4,000 acres of adjoining land to the gift. At this point the St. Louis River is very turbulent, falling about 400 ft. in 5 mi., and the scenery is rugged and picturesque. The park is 7 mi. above the hydro-electric power plant of the Great Northern Power Co. The interesting history of this bit of country concerns the Duluth & Winnipeg Ry., an early northwestern project in which Jay Cooke was heavily interested. A roadbed had been graded through this section of the St. Louis valley, in spite of great physical obstacles, when the panic of 1873 caused the collapse of the project. Subsequently work was resumed and rails were laid on a portion of the work, when a disastrous accident led to its final abandonment. In the 40 yr. since, the roadbed has become overgrown with brush, but it is estimated that a few thousand dollars will convert the old railway right-of-way into a fine boulevard. There are trestles wanting across some ravines, but in these instances the boulevard will detour around on the hillsides.

Valuation Discussed at Philadelphia

The "Valuation Conference" held at Philadelphia on Nov. 10, 11 and 12 under the auspices of the Utilities Bureau (the year-old intercity organization for joint support in utility cases) was a notable convention in point of attendance and flow of pertinent discussion. Three sessions a day were scheduled, and the attendance at each was about 150. Men representing municipalities and commissions from various parts of the country were present. There were a few utility men present, but by no means as many as had been invited. The papers of greatest engineering interest are briefly reviewed in the appended paragraphs. The whole proceedings will be made available by the Utilities Bureau in the January issue of its official organ, *Utilities Magazine.*

Reproduction Basis of Worth Attacked

Lieutenant-Governor J. M. Eshleman of California, former president of the State Railroad Commission, presented the idea of "threat price"—the maximum at which a monopoly could induce a purchaser to buy, or the minimum that the public could force a company to make. Competition, it was held, acted to keep down the natural excess of threat price over cost. Reproduction cost (for present conditions) was a threat value which the utilities would establish as the limit on which the public would pay rather than build new. Fanciful and impossible assumptions about starting a business new under present conditions were held to be a serious bar to the use of reproduction cost of development ("going value"). Reproduction cost on historical grounds, it was admitted, was of value as secondary evidence of investment in the absence of original data.

H. F. French, attorney, of Baltimore, held up the true aim of valuation as the location of a middle ground between confiscation by the public or extortion by the utility. Reproduction-cost methods did not secure that medium and always worked in favor of utility. The reproduction method of appraising intangibles was ridiculed because of unreal assumptions necessary. The recent Supreme Court decision in the Des Moines gas case—where the 15% allowance for overhead items was allowed, but no addition was made for "going value"—was cited as ruling out reproduction estimates of intangible elements associated with physical plant.

Morris Knowles, consulting engineer, of Pittsburgh, held that the Des Moines case did not close the way for introduction of going value by reproduction-cost methods, since the court had only stated that the method of valuation in the case (by giving 15% overhead allowance) had duly included this element. He pointed to a danger in confusion of the terms "cost" and "value." There was a cost of reproduction which could be found and which might influence the final determination of value. He had found that the accounts of a utility never showed the entire investment of time, thought and interest, all of which, as the Wisconsin Commission had recognized, properly entered true cost. The reproduction method of estimating intangibles was a check on that element. The assailed assumptions about starting a new business, in his experience, had led to the actual reproduction costs which any company would have to stand if it were to repeat today what it had accomplished in earlier years.

In the paper on "How to Get Rid of the Reproduction-Cost Theory" G. W. Anderson, attorney, of Boston, formerly a member of the Massachusetts Public Service Commission, held that the investors should have a return only on what they furnished. The Massachusetts commission had ruled that investment honestly and prudently made was to be taken as the rate basis. Mr. Anderson urged that legislators should incorporate the investment basis in their codes.

In the discussion F. W. Stevens, Valuation Counsel, New York Central Lines, and former member of the Public Service Commission for the Second District, State of New York, claimed that the first introduction of the reproduction-cost theory was made by "the late Secretary of State" in the famous Smyth vs. Ames case. At that time it gave a value lower than the investment which the railroads had made; now it was attacked because it gave a value higher than the investment.

Frederic P. Stearns, consulting engineer, of Boston, approved of the introduction of investment as a basis for future plants and present extensions, but cited injustices which might result by its use against old companies. Equities could be maintained by using reproduction cost under historical conditions.

E. W. Bemis, Board of Supervising Engineers, Chicago, described how the general rise of land values in the United States had produced an unearned increment in railway real estate "of startling size." The capital charges on this increment, if distributed over rates, he believed would necessitate a serious increase.

Appraisals; Short-Cut Valuation

C. L. Pillsbury, Chief Engineer of Valuation Bureau, District of Columbia, in the paper entitled "Making and Maintenance of Price Inventories," urged the standardization of inventories. The details of the inventory he would arrange in accordance with the purpose for which it was to be used; for instance, in a rate case he would value only property used and useful. He urged the continuance of inventories once established, the maintenance being done by the operating company with a permanent valuation staff under some outside direction and supervision.

Under the title "Valuation by Approximation" George G. Morse, Appraiser, Associated Factory Mutual Fire Insurance Companies, of Boston, described the inexpensive appraisals which are being made on insured factory property. His claim was that detailed appraisals were no more accurate because of the estimates for waste, contingencies, depreciation, length of life, etc. The insurance company's valuations were not dragged into court, although in two cases members of the appraisal staff had applied these methods outside and supported them in court. The manufacturing plant was first divided into buildings and machinery, the buildings being considered as empty structures. Everything which could be removed without altering the building was classed under machinery—including elevators, piping, wiring, etc. Machinery in turn was divided into machines, shafting, belting, piping, wiring, furniture and miscellaneous equipment. Unit-cost figures were based on replacing from today's markets.

Buildings were valued on the basis of square feet of floor area under normal conditions, and taking into account the effect of length, width and type of construction. All fixed machines were completely inventoried, but with

only such description as is necessary to determine the value—less than a dozen words if possible. By such a plan fixed machinery was listed in an incredibly short time. Standard machines were appraised from price lists, special machines by records or estimates.

The value of buildings and fixed machines usually amounted to more than half the total of a plant. Therefore it is inconsistent to spend a long time listing the minor items in detail. In this end certain "short-cut" methods have been devised. For shafting, an average price per linear foot was taken. Belt lengths were estimated by eye. For sprinklers and steam- and hot-water heating systems a few cents per square foot of floor area were allowed. Wiring was taken per light or per horsepower of motors. Furniture and apparatus were assumed to be a certain amount per main machine unit.

In arriving at depreciation 5 to 10% per annum was deducted. Buildings were held at a stationary value for a considerable time. Shafting was taken at 100%. In machinery only the parts which bore wear and tear were depreciated; an equilibrium value of 33% frequently resulted in machinery well maintained. Throughout the work a plant was considered as a going concern, with the machinery, no matter how antiquated, turning out salable products.

Valuation of Lands Debated

"Principles Applied in Valuing Lands" was the title of a paper by Hammond V. Hayes, consulting engineer, of Boston. In presenting the appraisal of land for commissions or courts he would work out both an original cost and a reproduction estimate. Both of these were divided into two parts—the probable price which a company paid for land and the cost of condemnation, damages, purchase, etc. The direct-purchase element in both original-cost and reproduction estimates would be arrived at by the familiar sales-comparison method, taking in the one case transactions at the time of purchase and in the other case the present moment. The difference in the price actually or probably paid by the company and the normal market value at the time of purchase would reveal the excess cost borne by a utility. By further studies the trend of this ratio from early days might be established.

The discussion on land valuation was prolonged and largely dealt with law and economics. A. E. Helm, Counsel of the Kansas Public Utilities Commission, urged the use of land cost rather than appreciated value in rate basis. He held that the railways were agents of the public in maintaining highways and service and that therefore they had to hold in trust for the public any increment which their property acquired. J. M. Eshleman reported that the California Railroad Commission had seen danger in accepting the agency theory; it was possible to organize utilities in California today so that they became agents and escaped regulation. He believed that a "condition of servitude" existed which allowed different canons of valuation of public-utility property. For instance, in railway-condemnation cases the right-of-way had a smaller value than nearby land, because it was necessarily devoted to one specific purpose. Such an effect took away the unearned increments.

M. R. Maltbie revived a theory which he had proposed while a member of the New York Public Service Commission. He would admit the unearned increment of land, but each annual increment he would have entered in the annual income, offsetting in part the year's depreciation of plant or tending to lower the rates.

F. W. Stevens, Valuation Counsel of the New York Central Lines, reviewed the decisions of the Supreme Court, contending that the court had always interpreted value as being the economist's "market value." In spite of the apparent reasoning in a circle which sprung from the fact that this value depended on rates, he held that there was no escape from the dictum of the court until the law had been changed.

The Place of Franchise Values

"Franchise Values" were discussed by Delos F. Wilcox, Deputy Commissioner, Department of Water Supply, Gas and Electricity, New York City. A franchise he held gives life to a physical property and must be valued on that basis. The appraiser, however, must not see double—must not duplicate his allowances by piling franchise value upon going value. For taxation, franchise value was not determined by either actual cost or reproduction estimates, the most widely accepted method being on net earnings over and above operating expenses, depreciation, taxes and a fair return on physical property. In rate cases it was held to be reasonably well settled in the courts that a separate and distinct value for a corporation's franchises at one cost need not be considered except where contract relations may require it. Where a separate franchise value may be introduced, based on actual cost, it is to be depreciated in proportion to its age where its life is limited. In condemnation proceedings cost or reproduction figures of a franchise are immaterial and present worth of its prospective earning power is the real criterion. Future rates enter as a doubtful element.

Depreciation Discussions

"Court Decisions on Depreciation" was presented by J. H. Goetz, Counsel, Public Service Commission of the First District of New York. The importance of the present treatment of depreciation he illustrated by quoting recent statements made before the Interstate Commerce Commission that a deduction for depreciation from the value of railroads in the country would diminish their value by about $3,000,000,000. He held that the importance of distinguishing between the various purposes for which depreciation was considered had not yet been grasped. Regulating bodies were not confined to narrow questions but were concerned with the rights of investors and the development of enterprises.

Halford Erickson, in a paper entitled "Depreciation and Its Relation to Fair Value," outlined the necessity and the difficulties of measuring depreciation, citing the entrance of cost and salvage values and probable useful life. He argued for the establishment of actual depreciation reserves from which funds could be secured for making renewals of plants. He held that the sinking-fund method of providing additions to this reserve was the most efficient scheme. He held that the amount that the customers would have to pay to cover depreciation was actually less than with any repayment-of-capital method. He favored use of full value of plant in rate basis, except where the reserves provided by the customers had been paid out to the investors.

The concluding sessions of the conference were devoted to financial aspects of valuation, constitutional protection, opinion testimony and outlook for the future.

News of the Engineering World

Steel-Frame Building Burned

The steel frame of the wire shop at the John A. Roebling's Sons Co. plant, Trenton, N. J., was wrecked very thoroughly by the fire of Nov. 11. The picture herewith shows that brick walls and steel columns and beams did not contribute materially to making the building fire-resistant with respect to interior fire. While the walls offer a considerable degree of protection against exterior fire, the steel frame could not be of service in this respect and therefore is in no way superior to wood frame.

While the facts shown by the picture have long been known, they are interesting because they form the main basis for the development of the sprinklered "mill-construction system," with slow-burning main frame and reliance on fire-doors, sprinklers and alarms.

A Local Engineering Society of Record Membership

(Contributed)

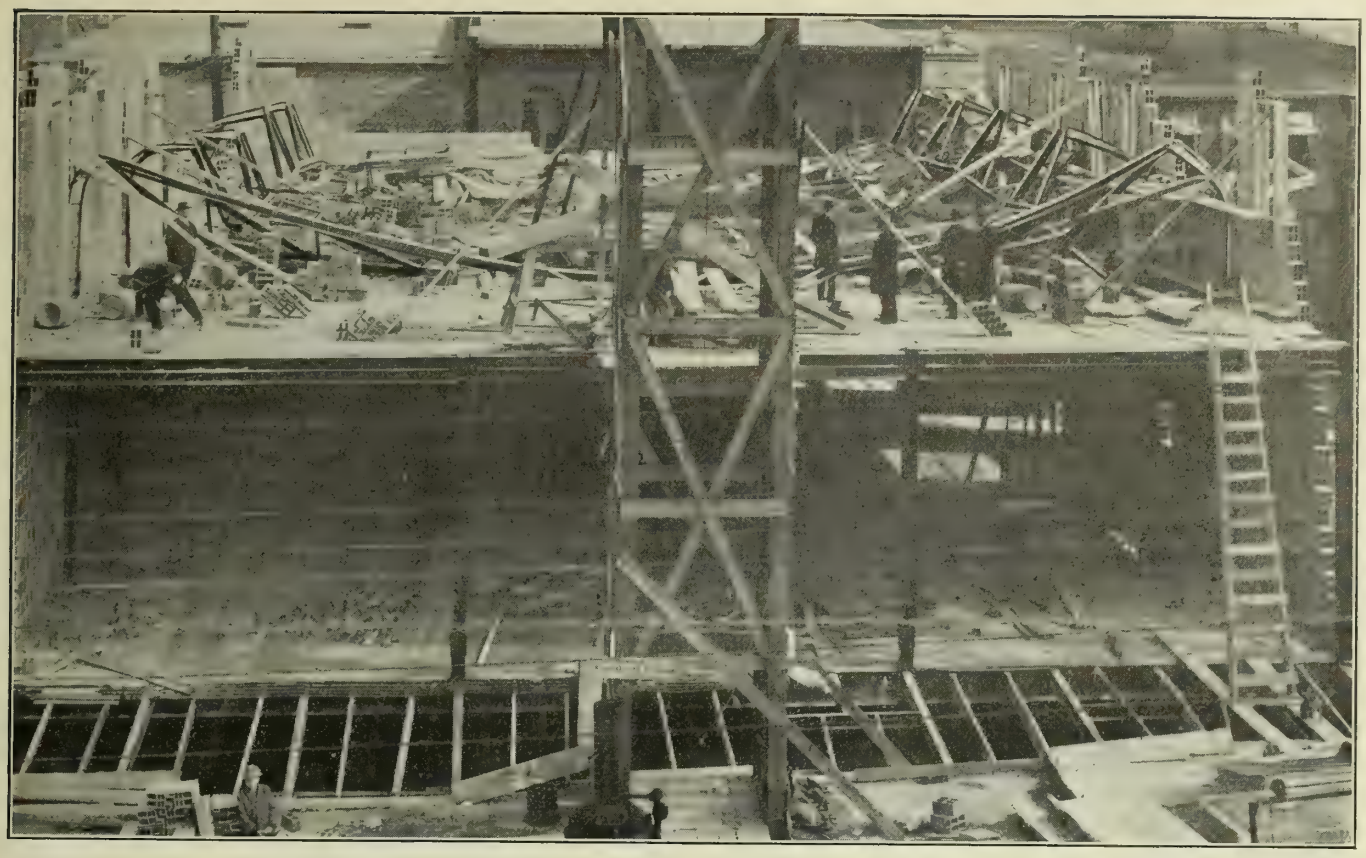
The result of the recent campaign of the Engineers' Club of Philadelphia is that the membership grew in five days from 551 to 2,127, far exceeding the most sanguine expectations. Briefly, the campaign organization consisted of a general chairman, a chairman in charge of the campaign teams, leaders of two divisions—each consisting of 13 teams—under so-called captaincies. These two divisions were pitted against each other in friendly rivalry for a handsome trophy in the form of a silver cup, on which the membership of the winning division was to be inscribed, and which was to be deposited at the club as a permanent memento of the occasion. In point of fact the activities of both divisions were so nearly balanced and the results so close—the winning division reporting 840 and the losing division 830—that the leader of the winners proposed, with the enthusiastic approval of all present, that the names of the members of both divisions should be inscribed on the trophy.

Contrary to expectations, the returns increased steadily day by day, numbering 670 on the last day. A careful revision of the returns shows that the application of the same individual has been reported in many instances in duplicate, and in a few cases in triplicate and quadruplicate by various teams, so that the reported total accessions of 1,670 represent in reality only 1,576 new members. A detailed analysis of the old and new membership is as follows:

	Old Membership	Accessions	Present Membership
Honorary members	4	0	4
Active members, resident	400	1,380	1,780
Active members, nonresident	123	94	217
Junior members	24	102	126
Summary	551	1,576	2,127



FIRE RUINS OF ROEBLING WIRE SHOP, SHOWING GENERAL WRECK OF STEEL FRAME WITH WOOD FLOORS



FRONT VIEW OF PIERCE BUILDING, OSWEGO, N. Y., WITH OVERTURNED ROOF-TRUSSES LYING ON SECOND FLOOR

Among the new members is Thomas A. Edison. No less than 200 applications were received after the campaign had closed, making the total 1,776.

The club was originally organized by a small group of leading engineers of this city in the fall of 1877, and some years ago acquired its own home in the club house which it now occupies. By increasing the membership above 1,500 a previously arranged sliding scale of dues goes into effect, which reduces the yearly dues of active members from $35 to $15, at the same time increasing the income of the club.

Overturning Roof Truss Causes Collapse of Roof

The roof of a two-story building under construction in Oswego, N. Y., for H. D. Pierce fell on Oct. 22, 1915, while it was being concreted. One man was killed. The owner was superintending the work, having a few weeks before taken over the supervision from the architect, L. L. Cope. The plans had been approved by the city. According to the best evidence now at hand, the roof would have been sufficiently strong if the trusses had been fully braced during construction. The trusses turned over, twisting the columns with them. They had been guyed to hold them in place until completion of the roof, but it is reported that some time before the accident one of the guy wires was removed.

The building is 66x100 ft. in plan and comprises steel framework, 8-in. hollow-tile walls and concrete floors and roof. The roof was carried by trusses 16 ft. 5 in. apart. At the time of the collapse a panel of roof concrete was being placed. It is thought that the collapse was due to lack of bracing of the steel roof framing. A brisk west wind (20 to 25 mi. per hr.) was blowing at the time of the accident, and this may have helped start the collapse, as the roof fell toward the east, or rear, of the building.

The second floor of the building, on which the wreckage fell, seems to have remained uninjured. The walls were damaged only where the columns were wrenched out of place when the trusses fell.

A Big Railway Peak Load

The peaks of traffic on the New York, New Haven & Hartford R.R. due to the Yale football games at New Haven and to the Thanksgiving recess in New England colleges and female seminaries have long been notable. But the record of Nov. 13, the day of the Yale-Princeton game, establishes a new high-water mark in this tide of travel. In 4 hr. 20,232 passengers were unloaded at New Haven—13,277 from New York and 6,955 from Boston and other points. They came in 22 regular and 23 special trains. When the tide turned, 19,678 passengers were carried out of New Haven between 5 and 7 p.m.—in 22 regular and 20 special trains.

There were no mishaps; 32 trains were on time, 14 arrived ahead of schedule and the rest were only a few minutes late. All New York traffic was handled by electric traction. The operating and traffic departments of the company had been at work for weeks perfecting the plans and devising safeguards against mishaps. A 20-page pamphlet was issued as a guide for the employees; special telephones were installed at various points in yards and terminals to facilitate the movement of trains; officers of the traffic, operating, engineering and mechanical departments were stationed at different points

on the route to look after matters pertaining to their respective departments in case their help was needed. The crowd was extremely well ordered, which helped to make the work considerably easier and more pleasant.

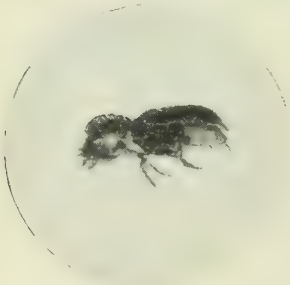
Bugs Bore into Leaded Cables

EDITORIAL CORRESPONDENCE

A widely published press dispatch recently announced the discovery by Albert Schuler, of Santa Barbara, Calif., of a bug which eats lead. At a recent meeting of telephone engineers at San Francisco, Mr. Schuler, who is manager of the Home Telephone System of Santa Barbara, reported the discovery of this strange bug and gave an account of its depredations, which in the newspapers was reported to be the real cause of so-called electrolysis.

Probably most engineers who read the newpaper story at once placed it in the same class with the famous and far-traveled hoax about "the worm that eats steel rails" which was perpetrated a quarter of a century ago and still reappears at intervals.

One of the editors of *Engineering News,* however, has since visited Santa Barbara and has seen the bugs, a number of which are held in captivity in lead boxes with glass covers, to see how long it will take them to bore their way to freedom. The bug is a slender black beetle, with hard wing covers, about ¼ in. long and of innocent and placid demeanor. Perhaps the reported alias of the marauder should be placed on record to aid in the detection of other members of the guild—*Sinoxylon declive.*



PLUMBI TEREBRA
CALIFORNIENSIS
Alias Sinoxylon
declive

It is stated that what the bug does is to light on a lead-covered telephone cable and bore a tiny round hole through the lead sheath and the paper insulation down to the copper. Possibly he (the bug) believes the cable to be part of a tree or vine into which he is accustomed to bore holes, and so he proceeds to bore through the lead as he would through the bark. One entomologist gives concealment as the motive. Any engineer familiar with the rate at which the *Teredo novalis* can drive his boring apparatus through hard wood will see nothing impossible in a beetle boring into a lead cable covering.

The accompanying view is reproduced from the only photograph the bug has ever had taken, and indicates, not very clearly, the two scoops on the prow with which he bores. Why the bug should want to bore holes is as yet an unexplained mystery, as it seems wellnigh impossible that he could derive a high degree of nutrition from the lead, even if it did not make him sick. It is possible, however, that the boring process is preliminary to egg depositing, in which case the foregoing account is all wrong as to the bug's sex and apologies are due to her.

The lead borer has been heard of in South Bend, Ind., Rockford, Ill., in Omaha, Tacoma, Portland, San Diego, in Florida and far away Australia. Numbers of them have been found in old lead foil of tea packages and it is suspected that the family is of Oriental extraction. Quarantine is being considered to check the menace.

Two Warehouses Were Burned on Pier 34, Baltimore & Ohio R.R., Baltimore, Md., Oct. 28. The loss is estimated at $400,000. The cause of the fire is unknown.

A Collision on the Central R.R. of New Jersey on Nov. 9 between two freight trains caused the death of two trainmen and injuries to four others. One train was stalled on a heavy grade about 3 mi. from Newark, N. J., and in backing down collided with an upbound train.

A Fire in the Bethlehem Steel Co.'s Plant at South Bethlehem, Penn., on Nov. 10 destroyed one of its machine shops. The loss is estimated at about $1,500,000. The building was of so-called fireproof construction with brick walls and a steel floor system. The cause of the fire was said by the company to have been a short circuit, which ignited a small quantity of oil in a part of the building used to manufacture field guns.

The Geology of the Hetch Hetchy Aqueduct district in the Sierra Nevada Mountains will be determined by L. W. Stocker, who has been assigned by the United States Geological Survey to carry out that task in coöperation with M. M. O'Shaughnessy, City Engineer of San Francisco.

Unnecessary Air-Duct Menaces Safety of Tunnel—The Boston Transit Commission is removing the ventilation duct from the East Boston Tunnel. The only statement which has been made on the matter is that "the air duct is unnecessary and its removal will, in the opinion of the engineers, increase the safety of the tunnel."

Lightning Rods Protect Ohio Buildings—State Fire Marshal B. Buckley has reported that no buildings in the State of Ohio protected by lightning rods were fired by lightning during the past summer-storm season (three months ending Sept. 1). But there were 68 fires from lightning on unrodded buildings, causing a loss of $91,163.

A Motor-Bus Feeder Service for the municipal railway line of Portland, Ore., has been inaugurated. The City Council recently approved a contract with one F. M. Peterson for the operation of motor buses between 13th Ave. West and Nickerson St. and Ballard Ave. and Market St. The contractor receives 3c. for each adult carried and 1.5c. for each school pupil. The city will receive 2c. and 1c. respectively. The contractor is required to furnish an indemnity bond and has the right to extend his route to 20th Ave. and West 65th St.

An Engineer Arbitrator Will Be Selected from a list of 15 engineers of national reputation to arbitrate on the value of the physical property of the Spring Valley Water Co. in the rate cases pending in the Federal Court. The names will be selected by M. M. O'Shaughnessy, City Engineer of San Francisco, and the choice will be made from them by the city and the company. It is expected that this procedure will save large sums of money that would have to be paid for expert witnesses on the two sides had testimony been taken before a master in chancery.

The Dredging in Boston Harbor, referred to in the article in "Engineering News" of last week, page 956, amounting to 1,500,000 cu.yd., is now ready for contract letting. Proposals for the work will be received on Nov. 24. Prices for dipper dredging in Boston harbor have recently been as low as 11⅛c. per cu.yd., and offers of 2c. per cu.yd. for depositing the material within the harbor limits have been made by several dredging companies. Robert E. Barrett is acting chief engineer for the Directors of the Port of Boston. The time limit for receiving bids is Nov. 24.

Sewage-Treatment Works for Lexington, Ky., were authorized by a 4 to 1 popular vote on Nov. 2, which approved a $300,000 bond issue for that purpose. At the same time $50,000 of storm-sewer bonds were authorized. It is expected that construction will be started right away, in accordance with a scheme outlined by the Solomon-Norcross Co., consulting engineers, Atlanta, Ga., in a report to the City Commission of Lexington dated Oct. 9, 1915. The scheme includes coarse screens, grit chambers, two-story settling tanks, sludge beds, sprinkling filters and a laboratory. The estimated cost of outfall sewers and a disposal plant to treat 3,000,000 gal. of sewage a day is $270,000, plus $30,000 for land, legal and engineering expenses.

Plans for Straightening Turkey Creek, Kansas City, Kan., are taking definite shape. The proposed channel will be approximately 1,700 ft. long, consisting largely of vertical retaining walls 66 ft. apart at the top in the widest point of the channel. The channel is designed to carry about 25,000 sec.-ft.—a flow somewhat greater than that of the flood of Sept. 7, 1904, which was the largest on record. In some places the bottom as well as the sides of the channel will be con-

crete lined, making it practically a flume. The estimated cost of the project is between $300,000 and $700,000. The proposed work has been approved by the City of Rosedale, the City Council and the Mayor of Kansas City, and all that remains to be done before starting construction is to obtain court condemnation proceedings.

PERSONALS

Mr. Edward S. Larned has resigned as New England States Manager of Sales of the Lehigh Portland Cement Co., of Allentown, Penn.

Mr. Walter N. Polakov, M. Am. Soc. M. E., has resigned as Superintendent of Power Plants of the New York, New Haven & Hartford R.R. to engage in private practice.

Mr. Thomas W. Connette, Assistant Superintendent of Transportation of the Buffalo (N. Y.) city lines of the International Ry., has been made Superintendent of Transportation.

Mr. P. H. Anthony, of the C. D. Cooley Co., architects and engineers, of Pittsburgh, Penn., is now located at the company's newly opened Western office in the Waldheim Building, Kansas City, Mo. He will devote his time especially to the territory west of the Mississippi River.

Col. Herbert Deakyne, Corps of Engineers, U. S. A., who for the past four years has been in charge of the Missouri River improvement work between the mouth of the river and Sioux City, has been relieved from duty. Col. James F. MacIndoe, who has been located in the Philippine Islands, will succeed him.

Dr. S. S. Goldwater has resigned as Commissioner of Health of the City of New York and will resume the superintendency of Mt. Sinai Hospital, in that city. Dr. Haven Emerson, Deputy Commissioner and Sanitary Superintendent of Health, will succeed Dr. S. S. Goldwater as Commissioner of Health of the City of New York.

Mr. Frank R. Judd, Assoc. M. Am. Soc. C. E., formerly Chief Draftsman of the bridge and building department of the Illinois Central R.R., has been appointed Engineer of Buildings of that road. He was born in Hamilton, Ont., in 1882. Mr. Judd attended the Chicago Manual Traing School for three years and immediately afterward, in 1899, entered the service of the Illinois Central as a draftsman.

Mr. Henry U. Mudge, formerly President of the Chicago, Rock Island & Pacific Ry., has been elected President of the Denver & Rio Grande R.R., with headquarters in Denver, Colo. He succeeds Mr. Arthur Coppell, of New York City, who has been serving temporarily as President. Mr. Mudge was born in 1856 at Minden, Mich. He entered the service of the Atchison, Topeka & Santa Fé Ry. at the age of 16 as a water boy, and had risen to the position of General Manager when he left that road in 1905 to become Second Vice-President of the Chicago, Rock Island & Pacific. Mr. Mudge has been President of the American Railway Association during the past year.

OBITUARY

William J. Smith, one of the promoters of the first cable-car line in Kansas City, Mo., died at his home in that city on Nov. 8, at 79 years of age. Mr. Smith was born in New York City and was educated at the Irving Institute, Tarrytown, N. Y.

Wirt du Vivier Tassin, formerly Chief Chemist and Assistant Curator of the Division of Mineralogy of the United States National Museum, died in Washington, D. C., on Nov. 2, at the age of 46. He was born in Fort Whipple, Va., and was a graduate of Cornell and Harvard universities. He was special agent of the United States Geological Survey at the World's Fair at Chicago, and in 1893 received his appointment at the Museum, where he remained until 1909. Since then Mr. Tassin had engaged in private practice as a consulting metallurgist and chemical engineer.

James F. DeVoy, Assistant Superintendent of Motive Power of the Chicago, Milwaukee & St. Paul Ry., died at his home in Milwaukee, Wis., on Nov. 5. He was born in Ithaca, N. Y., in 1866, and was graduated from Cornell University as an honor student in mechanical engineering. For seven years following his graduation Mr. DeVoy was employed in the mechanical department of the New York Central & Hudson River R.R., and afterward by the American Locomotive Co. He had been in the service of the Chicago, Milwaukee & St. Paul Ry. for the past 15 years. At the time of his death he was a member of the executive committee of the American Railway Master Mechanics' Association and past president of the Western Railway Club.

William Frederick Allen, Assoc. M. Am. Soc. C. E., General Secretary of the American Railway Association and Editor and Manager of the "Official Railway Guide," died on Nov. 9 from a stroke of apoplexy, at his home in South Orange, N. J. He was born at Bordentown, N. J., in 1846 and received his education at the Protestant Episcopal Academy and the Bordentown Model School. He was first employed as a surveyor on the old Camden & Amboy (N. J.) R.R. In 1868 he became Engineer of the West Jersey R.R. Mr. Allen was an expert on the standardizing of railroad time. In 1875 he was made General Secretary and Treasurer of the General Time Convention, which was composed of the principal trunk-line railways and was represented by their general managers and superintendents. The following year he was elected Secretary of the Southern Time Convention, consisting of the leading Southern railway lines. These conventions were consolidated in 1886 and from them the American Railway Association developed.

ENGINEERING SOCIETIES

COMING MEETINGS

THIRD ANNUAL PENNSYLVANIA WELFARE AND EFFICIENCY CONFERENCE.
Nov. 16-19. Conference in Philadelphia.

NATIONAL MUNICIPAL LEAGUE.
Nov. 17-19. Annual convention, Dayton, Ohio. Secretary, Clinton Rogers Woodruff, 705 North American Building, Philadelphia.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
Nov. 18-19. Annual meeting at Zanesville, Ohio. Secretary, F. E. Sanborn, Columbus, Ohio.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 1-3. Annual convention in Washington, D. C. Executive Secretary, E. C. Kempe, The Octagon, Washington.

AMERICAN ASSOCIATION OF ENGINEERS.
Dec. 10 and 11. Convention in Chicago. Secretary, Arthur Kneisel, 29 South La Salle St., Chicago.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.
Dec. 13-15. Annual meeting in New York. Secretary, Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

SECOND PAN-AMERICAN SCIENTIFIC CONGRESS.
Dec. 27-Jan. 8. Washington, D. C.

Montana Institute of Municipal Engineers—The annual meeting will be held in Billings, Mont., Jan. 17-19, 1916. The president is C. E. Durland, of Billings, and the secretary is Carl C. Widener, of Bozeman.

National Lime Manufacturers' Association—The annual meeting will be held in Cleveland, Ohio, the first week in February, 1916. Fred K. Irvine, 537 South Dearborn St., Chicago, is secretary.

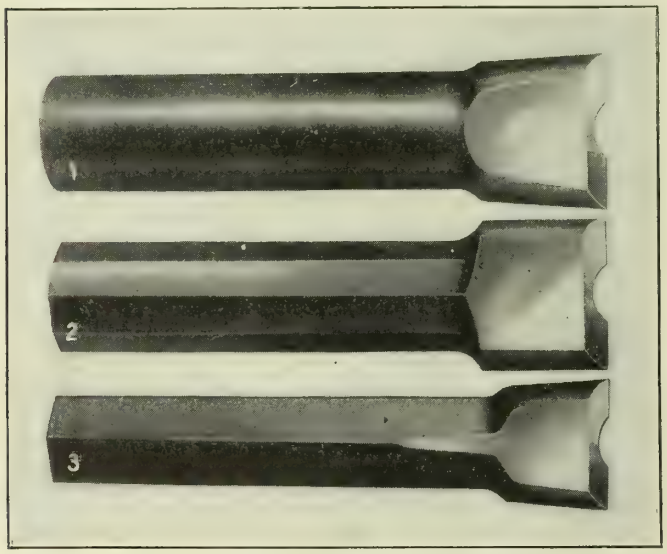
International Road Congress—Although the title of this road meeting is rather misleading, there is every evidence that the congress to be held in Worcester, Mass, Dec. 14-17, will be the largest affair of its kind ever held in New England, and it will be primarily a meeting of New England highway officials. The president of the congress is Hon. J. Lewis Ellsworth, former Secretary of the Massachusetts State Board of Agriculture, and the advisory board includes the following: George W. Tillson, Consulting Engineer of Brooklyn, N. Y.; W. A. McLean, Chief Engineer of Highways and Commissioner of Ontario Public Roads and Highways, Toronto, Ont.; Irving W. Patterson, Chief Engineer, Rhode Island State Board of Public Roads; Frederic E. Everett, State Engineer of New Hampshire; Charles J. Bennett, State Highway Commissioner of Connecticut; Stoddard B. Bates, State Highway Commissioner of Vermont; William D. Sohier, Chairman of the Massachusetts State Highway Commission; Philip J. Deering, Chairman of the Maine State Highway Commission, and Frederick H. Clark, President of the Massachusetts Highway Association. The Program Committee is composed of Harold Parker, former Chairman of the Massachusetts Highway Commission, now President of the Hassam Paving Co., of Worcester; E. L. Powers, Editor of "Good Roads," New York; A. W. Dean, Chief Engineer, Massachusetts Highway Commission, and John H. Brownell, Chairman of the Convention Committee of the Worcester Chamber of Commerce, under whose auspices the congress is to be held. There is to be a governors' day, when the Hon. David I. Walsh, Governor of Masschusetts, will preside; a roadbuilders' day under the auspices of the Massachusetts Highway Association, a mayors' day, when Mayor Wright of Worcester will preside, and an auto-

mobile day, when automobile manufacturers will be heard. There will be an exhibition of road machinery. The headquarters of the congress will be at the Bancroft Hotel and the exhibition will be held in an adjoining auditorium.

Appliances and Materials

An Improvement in Drill Bits

An improved type of drill bit, known as the "Carr bit," is being made by the Ingersoll-Rand Co., 11 Broadway, New York City. Three forms are shown in the accompanying views. This bit, while designed primarily for overcoming certain difficulties in drilling rock, has been found to meet satisfactorily not only these special conditions, but the ordinary conditions as well. The Carr bit has but a single cutting edge and is uniform and symmetrical in shape. A transverse recess is formed across the center of the bit. With hollow steel this recess is tapered until it runs into the original hole through the steel; with solid steel the recess extends back about ½ in. from the face. This recess tends to act as a pilot and reduces the cutting or contact surface with the rock to a minimum. The thickness of the bit is made equal to the short diameter of the steel and the length equal to the bit gage. Hollow drill-steel bits are conical in shape and have a 5° taper on a side. Solid steels have straight parallel cylindrical sides. The advantages claimed for this bit are many. It holds its gage better, thereby increasing the depth to which



CARR BITS FOR ROCK DRILLING

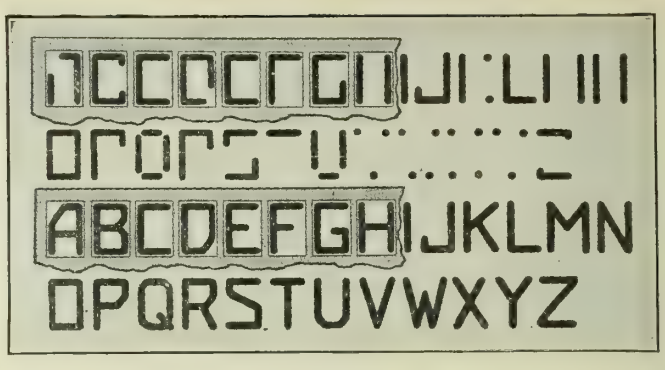
1—For Leyner water type. 2—For piston drill. 3—For large sizes of automatic hand drills

a hole may be drilled with a single steel. It drills a round hole and therefore rotates easily. It does not require more than $\frac{1}{16}$-in. variation in the gage of bits on successive lengths of steel. The bit, being simple in form, is easily made. The idea of drilling a hole the same size from the collar down to the bottom originated with the inventor from a discovery that a drill bit cuts a margin of clearance for itself; and to insure the drilling of a round hole, the shape of the bit was made such that it would be impossible for it to go down if the hole were not round. The loss of gage was overcome by providing the long shoulders curved concentric with the axis of the bit. Rapid cutting speed was assured by forming the transverse recess in the center of the bit, reducing the area of contact.

* * *

Lettering Templets for Draftsmen

Lettering templets of transparent celluloid are now a regular product of the Keuffel & Esser Co., New York City. What is known as the "Simplex" templet consists of a strip with two rows of different-sized perforations uniformly spaced. This is placed on a cardboard guide, which raises the half of the templet in use away from the drawing and thus prevents blotting. A pencil or a special hollow glass pen, held perpendicularly, is used for lettering. Lines which do not conform to edges of the templet, such as the oblique and cross lines in K R and A, are drawn in freehand without shifting the templet. The first perforation at the left of the templet is wider than the others, so that it can be used for



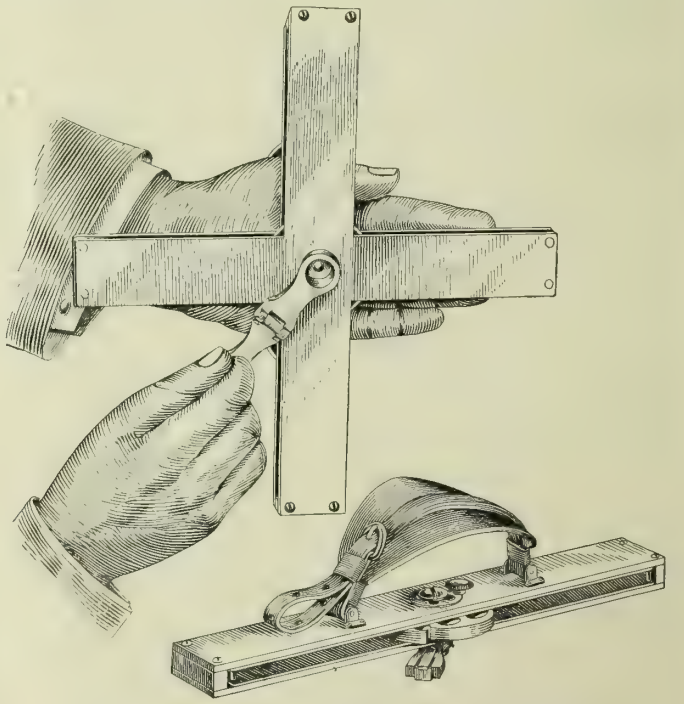
TRANSPARENT LETTERING TEMPLET FOR DRAFTSMEN

such leters as M and W. The sketch shows the different steps in using the templet. The templets come in sets of two, three and five, for both vertical and slanting letters. List prices range from $1.25 to $4 per set.

* * *

Folding Reel for Steel Tapes

A four-arm reel for steel tapes made of nickel-plated steel and so constructed that it may be folded and carried in the pocket, is a recent addition to surveyors' equipment of the Keuffel & Esser Co., New York. This reel is especially



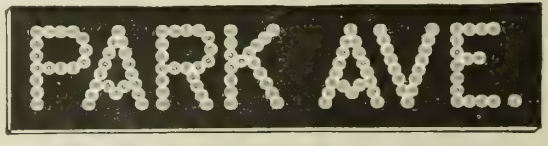
FOUR-ARM FOLDING REEL FOR STEEL TAPES

designed for tapes of over 100 ft., which ordinarily are not carried on reels, and is made in three sizes for tapes ¼ in. wide, 100 to 500 ft. long. Hitherto most folding reels have been of the three-arm type. The list price is $3.40 each.

* * *

Drilled-Letter Highway Sings

Highway direction or warning signs and street-name signs made of heavy "pure-iron" sheets, with the letters or figures drilled about ⅛ in. into the metal, are being manufactured by the Indestructible Sign Co., Columbus, Ohio.



HIGHWAY OR STREET SIGN WITH DRILLED LETTERS

The drilling takes the place of etching and, giving a sharper, cleaner edge, is claimed to make a more durable sign. The method of manufacture is patented. Any material—iron, steel, wood, brass or copper—may be used in the same way.

Engineering News

VOLUME 74 NOVEMBER 25, 1915 NUMBER 22

Goethals on Panama Slides

Report of George W. Goethals, Governor of the Panama Canal, to the Secretary of War; with Selected Illustrations

SYNOPSIS—Present great slides on east and west banks at Culebra involve about ten million cubic yards, of which a million yards per month is being dredged out. Dredging is the only feasible method of attack. Prior slides at other points, including the Cucaracha slide, are discussed. Report written under date Oct. 26, 1915, at Balboa Heights, Canal Zone.

The following report is submitted on the slides which have closed the Panama Canal to navigation. On account of the importance of the subject, I deem it advisable to make a comprehensive report, even at the expense of repetition of the matter contained in previous documents on the subject.

The slides which developed during the construction period were of three distinct types. The first were due to the moving of material from the sides of the prism or cutting, when these were left by the excavation at a steeper slope than that at which the material would remain at rest.

In those of the second type porous material mixed with clay, small rock and spalls, overlay smooth surfaces of rock or other impermeable substances, harder than the overlying mass, which sloped toward the axis of the canal. In excavating the prism through these sections, the removal of the lateral support, combined with the effects of the water permeating through to the underlying inclined strata, resulted in the sliding of the material into the excavated area, the rains assisting and accelerating the movement.

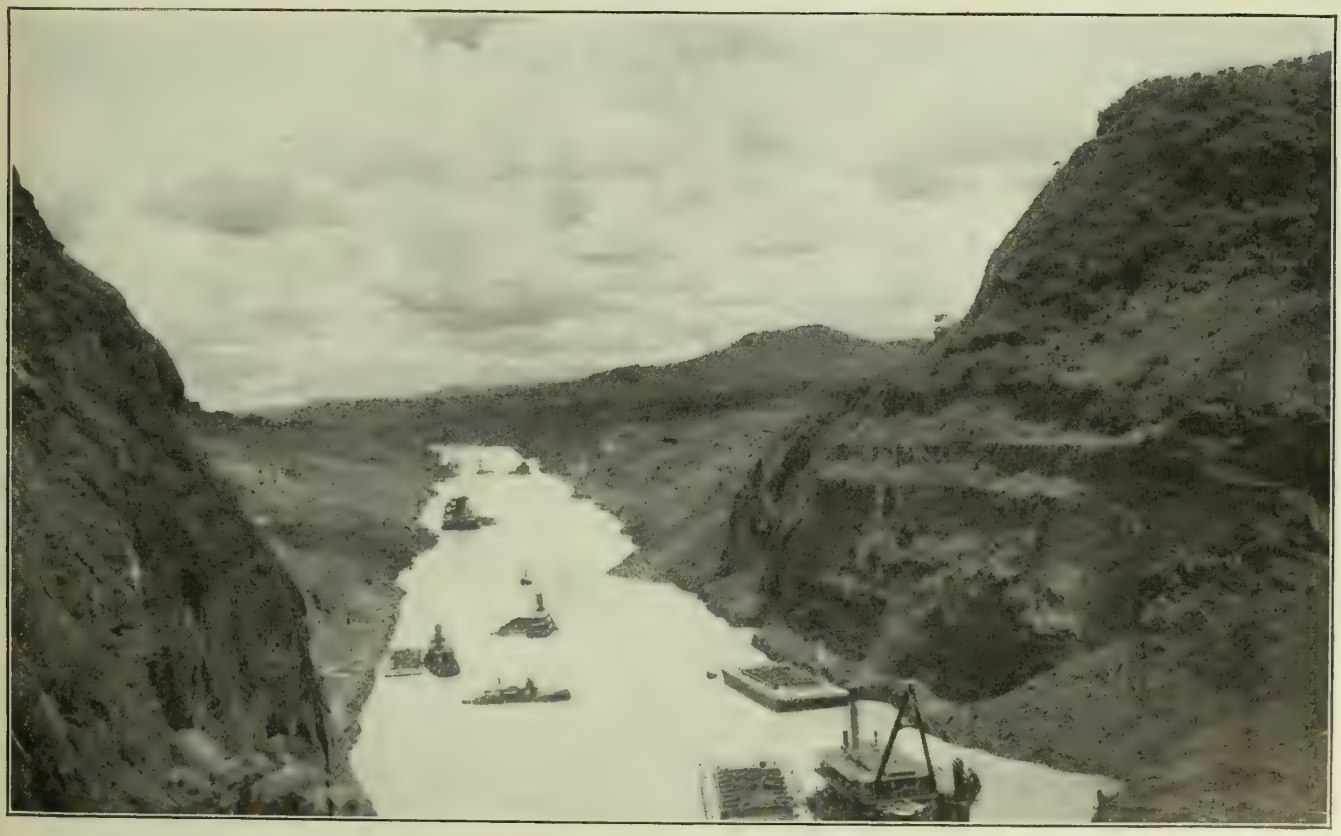


FIG. 1. VIEW NORTH BETWEEN CONTRACTORS HILL (LEFT) AND GOLD HILL (RIGHT) SHOWING CULEBRA REGION

Small slides on both banks caused by admission of water to canal. The great slides came later

The slides of the third class were designated "breaks," and were of two kinds, best described by the localities—those in the vicinity of Culebra and those at or near La Pita Point. In the former the first manifestation was a crack in the surface of the ground, generally parallel to the axis of the canal, with the ends running to the edge of the prism. This cracking was followed by a depression on the side of the crack away from the cut and a movement of the mass between the crack and the canal into the excavated area. The sinking movement on the top was accompanied by an upheaving of the bottom of the canal prism.

The cause of these movements was attributed to the poor quality of the underlying rock, which was intersected by vertical seams or seams sloping toward the canal. As the material was excavated not only was the lateral support removed, but the load distribution was changed to an extent that caused the rupture of the underlying weaker strata. After the break the movement into the cut was like an ordinary slide of the first and second classes, though the cause was entirely different.

The breaks in the vicinity of La Pita Point consisted of the moving or pushing out and a subsequent settling down of sections of rock masses which formed the banks. Three such breaks occurred and were due undoubtedly to water pressure from the Obispo or East diversion channel. This source of trouble has been relieved by turning the waters of the channel into the cut.

The first class of slides gave relatively but little trouble, even during the construction period, and ceased when the material assumed its natural slope. In anticipation of other possible movements of this kind, slopes which seemed too steep have been flattened.

Considerable difficulty was experienced with slides of the second class, and the most notable example was the one at Cucaracha, just south of Gold Hill (Fig. 2). The only method of handling them was to allow the material to enter the prism and remove it from below, for the adjacent ground did not lend itself to handling the material in any other way, and attempts to hold the banks by piling, rock covering or drainage failed. The slide of this class at Cucaracha consisted of clay mixed with rock and rock spalls moving into the cut, the movement resembling the action of a glacier.

History of the Cucaracha Slide

The sliding began during the operations of the French company, and continued to cause trouble until the early part of 1912, when it became quiescent. The material in moving left exposed a mass of rock, which the geologist assured us was of ample strength to hold back the clay and other material remaining on the hillside above it. The indications were that the future trouble in this locality would be limited in extent and caused by small masses of clay washed down by rains or from the usual erosive action to be anticipated in this climate.



FIG. 2. THE GREAT CUCARACHA SLIDE OF 1913, CAUSED BY FAILURE OF ROCK KNOLL.
Nearly 4,700,000 yd. was dug out; 1,000,000 yd. more sluiced off the hillside

These expectations and predictions were not realized, however, for on Jan. 20, 1913, following a few days after a rock movement from the south face of Gold Hill, the rock support broke at some part of its structure near or below the bottom level of the canal and a mass of clay and rock moved into the cut, completely filling the prism across its entire width and up to a bench that existed along the west face at the 69-ft. level (see Fig. 2).

The length of the canal blocked by this earth movement was approximately 1,600 ft., and the quantity of material to be removed was estimated at 2,000,000 cu.yd. The slide was attacked by steam shovels located on the 69-ft. level on the west side and on the bottom, or the 40-ft., level. As the excavation proceeded the material broke away from the higher elevations on the face of the hillside and moved down into the prism.

An examination of the top of the hill indicated that there were large masses of clayey material remaining that would eventually move into the cut. The topography of the country lent itself admirably to sluicing operations, by which a large part of the material near the top could be washed into a valley to the east. A sluicing plant was available, and steps were taken to draw off to the east side of the ridge as much of the clay as could be reached by the nozzles of the sluicing plant and thus relieve the situation in the prism itself. This was successfully accomplished.

The balance of the cut, some 8½ mi., was nearing completion; steam shovels were concentrated at Cucaracha slide and as many were worked as available space permitted. In February eight of them removed 168,677 cu.yd.; six shovels working in March and April removed 203,030 and 204,308 cu.yd. respectively; but these were dry-season months. The rainy season reduced the output of the six shovels in May to 148,000 cu.yd. and in June to 124,844 cu.yd. The expectation of reaching the bottom at this time had not been realized. Difficulty was experienced in maintaining tracks, not only at the slide but on the dumps, due to the character of the material that was handled. The cost of removing 921,000 and 808,000 cu.yd. during the last two months respectively from the entire length of the cut, including Cucaracha, was 62 and 66c. per cu.yd. respectively. With Cucaracha alone remaining, the difficulties and cost would be increased.

There was a dredging fleet available capable of handling larger quantities of material than the shovels. The dredges could work 24 hr. a day, while the shovels could not work to exceed 12 hr.; the excavation could proceed without delays due to upset of steam shovels and disarrangement of tracks; the material could be dumped in the Gatun Lake; so that all indications pointed to dredging as the best means, both as to time and money. This course was taken.

The steam shovels operating at Cucaracha slide from Jan. 20, 1913, to Sept. 11, 1913, removed a total of 1,139,708 cu.yd., or an average of 142,463.4 cu.yd. per month. The dredging operations began on Oct. 23, 1913, and up to Aug. 3, 1914, on which date the first boat went through the canal, the dredges removed 2,767,080 cu.yd., or an average of 286,239.78 cu.yd. per month. The cost of the steam-shovel work at Cucaracha was not separated from the remainder of the work in the cut, but the total of 8,225,989 cu.yd. removed during the period under consideration was done at an average cost of 65c. per cu.yd., while the cost of the dredging averaged 44c. per cu.yd. Active operations at Cucaracha slide ceased on Oct. 14, 1914, on which date the total amount removed by steam shovels and dredges since Jan. 20, 1913, was 4,679,238 cu.yd. In addition, upward of

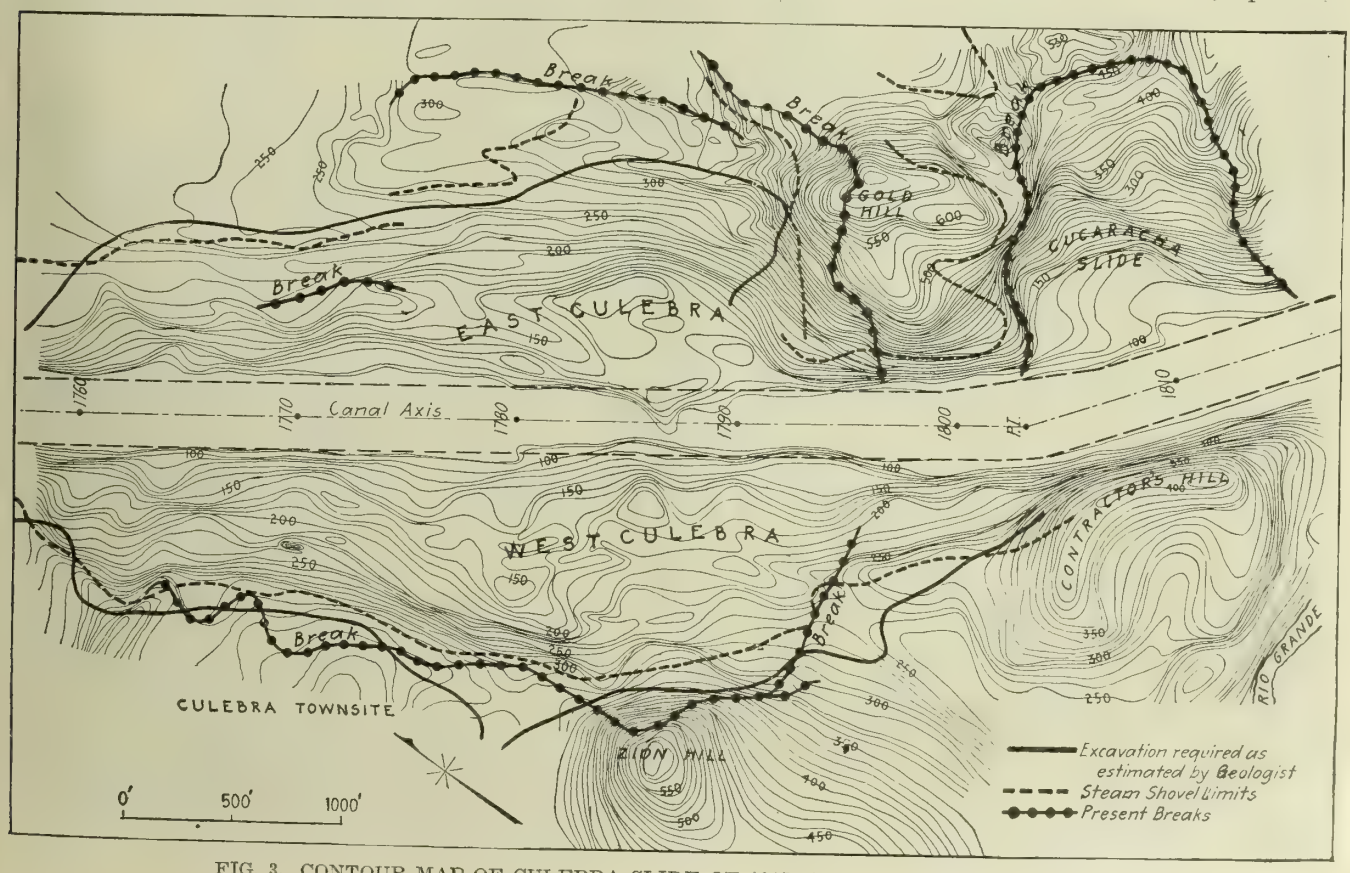


FIG. 3. CONTOUR MAP OF CULEBRA SLIDE OF 1915, AND LOCATION OF BREAKS

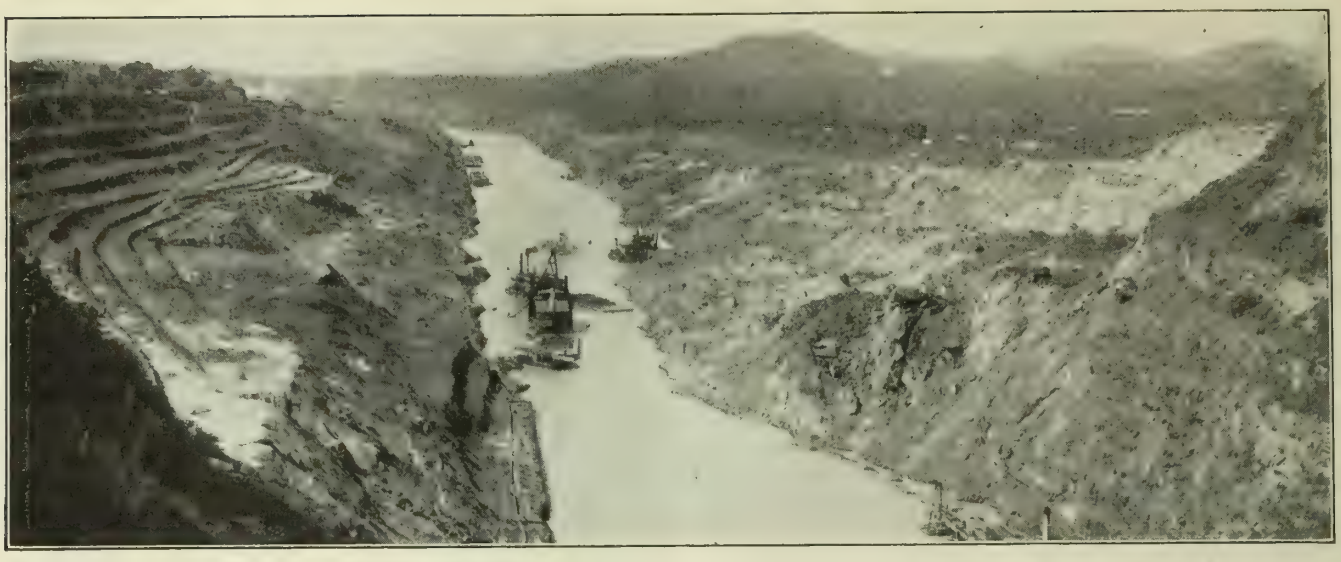


FIG. 4. THE CULEBRA SLIDE IN AN EARLY STAGE; SLIDE FROM EAST SIDE ONLY, OCTOBER, 1914

1,000,000 cu.yd. which would have gone into the cut was removed by sluicing, at a cost of 20c. per cu.yd.

The first break in the vicinity of Culebra occurred near the old Panama R.R. station in 1907, and affected but a few hundred feet. Subsequently, as the depth of the excavation increased, the breaks became more extensive, both in length and quantities of material involved; furthermore, they occurred in both the east and west banks, until the upward movement along the bottom of the excavated area affected a length of 2,000 ft. north of Gold Hill. As the cause was the unequal distribution of the pressure exerted by the adjacent banks, it followed that by reducing the height of these banks, the movements would cease or be reduced. Opposition developed to this method on the ground that more material would be removed than was necessary; that by allowing the material that broke off to move into the cut, the minimum amount would be handled, and the material left to itself would assume its natural slope.

Culebra Slides; Their Recent History

Two breaks occurred in rather rapid succession at Culebra in the latter part of 1910. As usual, each completely overturned the tracks at the bottom of the excavation, interrupted drainage and seriously delayed operations in the prism. The latter one of the two breaks

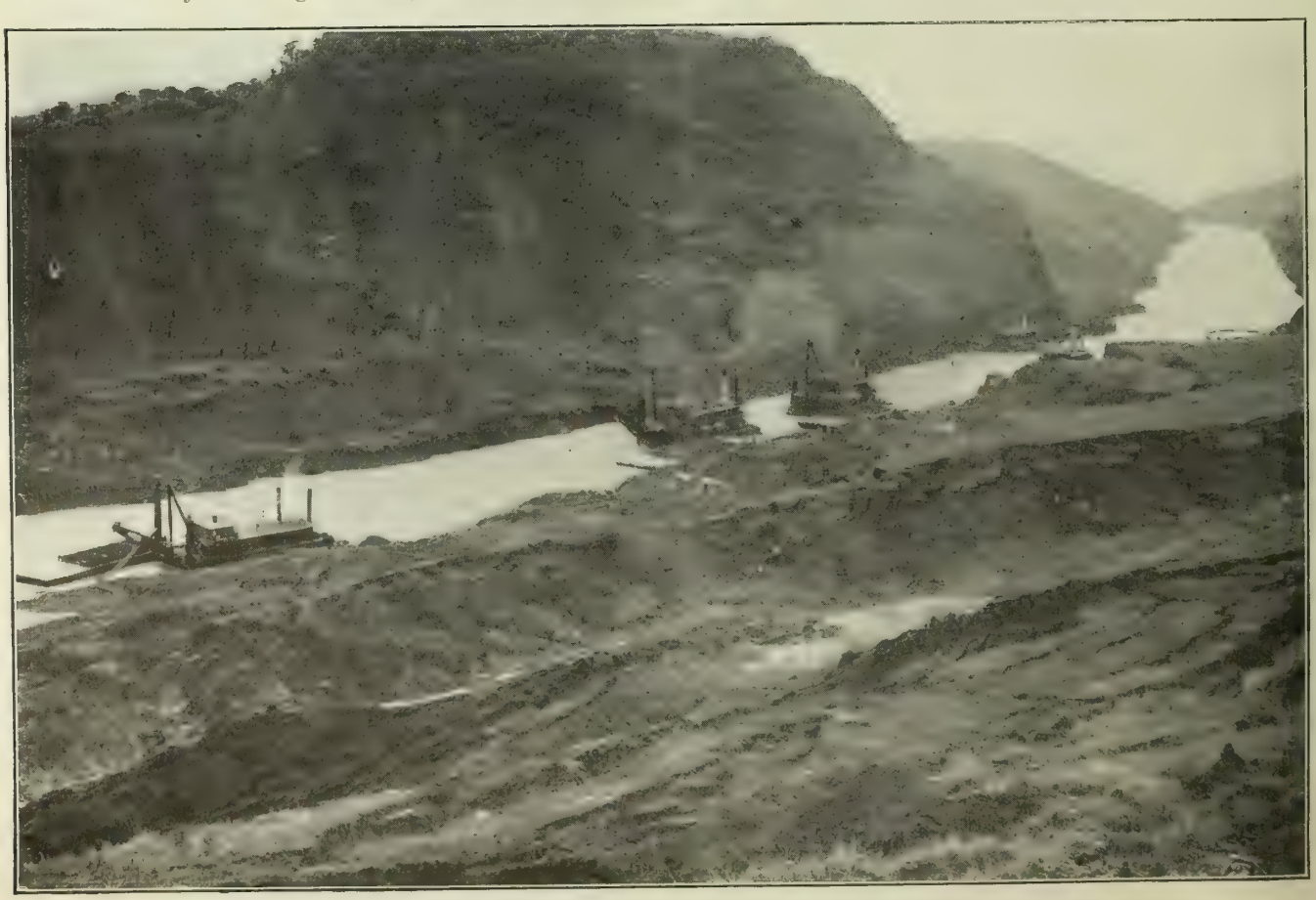


FIG. 6. WAVE OF SLIDING MATERIAL MOVING INTO CANAL PRISM FROM WEST BANK

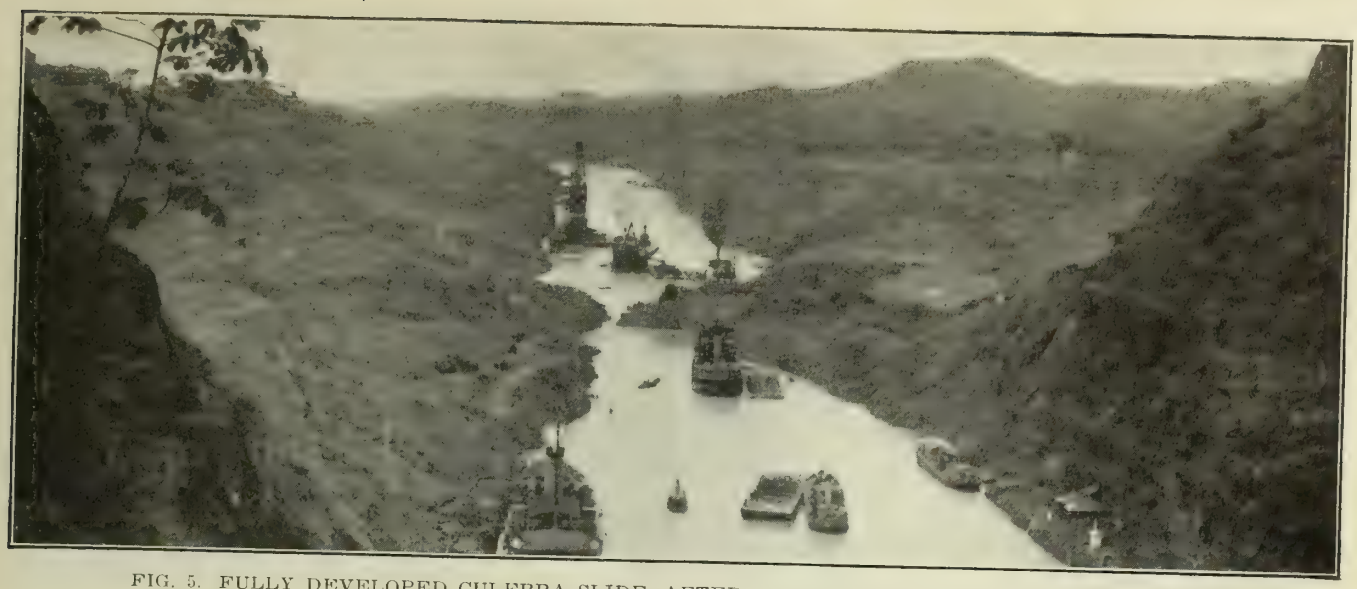


FIG. 5. FULLY DEVELOPED CULEBRA SLIDE, AFTER AUGUST, 1915, WHEN BOTH BANKS SLID

determined the change in plan, and in January, 1911, the reduction of the height of the adjacent banks on either side of Gaillard Cut in the vicinity of Culebra, was directed and begun. This work continued until December, 1913, at which time 6,533,924 cu.yd. had been removed from the east bank and 8,797,990 cu.yd. from the west bank, resulting in slopes varying from 1 on 1.5 to 1 on 6.5 for the east side and 1 on 2.46 to 1 on 4.35 for the west side, in benches (Fig. 10).

The result of this method of procedure was that when the operations in the cut in the vicinity of Culebra were completed, prior to the admission of water, the breaks in the banks and the upward movement of the bottom had ceased entirely.

Early in 1911 a geologist was employed in connection with the earth movements and proposed maximum and minimum lines for lightening the banks, together with suggested slopes. In the map (Fig. 3) are shown with heavy black lines the maximum probable limits of the earth movement on the two sides, as predicted by him. The map also shows by broken black lines the areas over which the banks were lightened by excavation, and when the shovels were removed the benches within the areas marked by broken lines were all intact, the shovels having



FIG. 7. BROKEN-UP CONDITION OF THE SLIDE MASSES; POOR SURFACE FOR STEAM-SHOVEL WORK

dug so as to remove all evidences of cracks. So far as could be foreseen satisfactory slopes had been secured.

In the early part of 1914 small cracks had developed on some of the upper benches on the west side and similar effects were noted on the east side. During the dry season the surface of the ground in this country cracks as the result of drying out and in some instances these cracks are of considerable depth and extent. Whether those found on the benches were the ordinary dry-season cracks or the result of structural weakness was not known, though they resembled the former. To guard against emergencies, however, the shovels were returned and worked on the east bank, reducing the slope still more, until Apr. 1, 1914; and on the west bank the shovels continued until June 14, 1914.

Suspicious Cracks at Zion Hill and on East Side

A crack had existed for some years at the foot of Zion Hill, southwest of Culebra; the hill was pronounced as geologically secure against any movement, and when the material had been cut away from this bank, the slope of the excavation extended to the crack or the limit marked as the maximum limit by the geologist.

On the east side, toward the end of the dry season of 1913 a crack was found north of Gold Hill, parallel to the cut, about 1,300 ft. back from the face. It was not connected with the slope of the prism at either end. There were no cracks or breaks between it and the cut proper. There was apparently a slight settlement on the side of the crack nearest the cut, but none with the marked indications of a probable break. Steps, however, were taken to lighten the banks between the crack and the cut by sluicing away the high ground and by steam-shovel operations. There were no indications of movement, and apparently the work done toward lightening the banks had been effective. It appeared, so far as could be determined, that equilibrium had been secured.

Great Slide Begins in 1914

Subsequent to turning in the water there were small slides on the east bank, north of Gold Hill, and also on the west side, but they were small, the material was easily removed and they were typical of Class 1 slides.

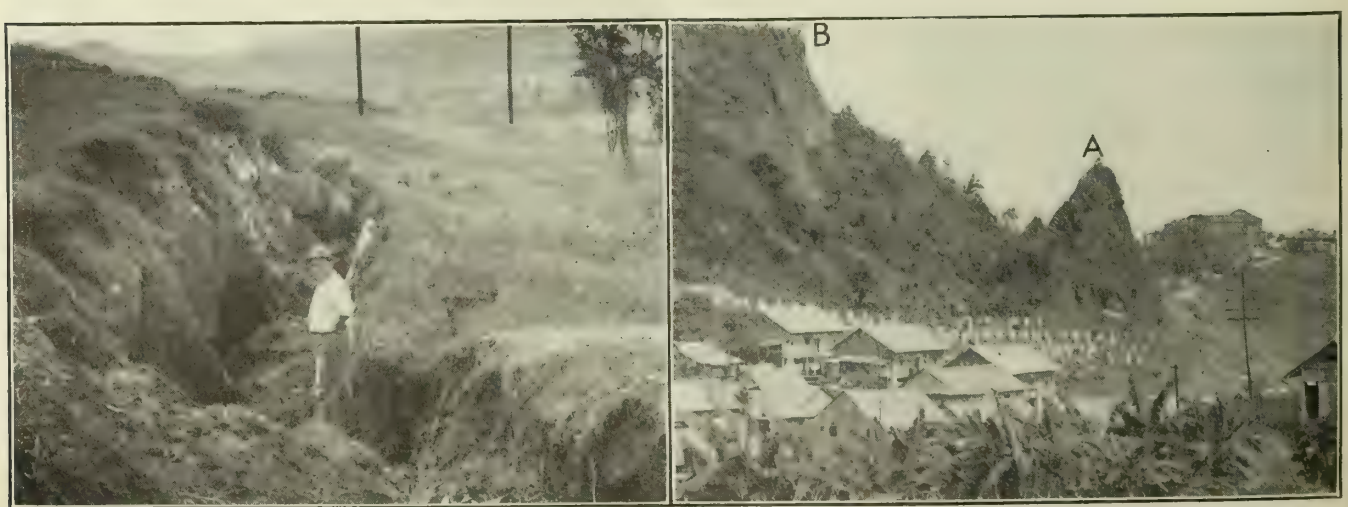
No change occurred until Oct. 14, 1914, when, without warning, a section of the east bank settled vertically 20 ft. This section measured 2,000 ft. along the prism face and extended back about 1,000 ft. from the axis of the canal, generally along an irregular curved line. The bank was from 300 to 350 ft. above sea level, and the extension of the ground eastward was relatively flat country. In the settlement, the upper portion that broke away remained practically parallel to its original position, and the benches which formed the upper part of the slide had not changed their relative positions, though they were badly broken up, while the lower strata were squeezed out across the canal. Subsequently the broken mass moved into the cut (Fig. 4), and until August, 1915, the dredges were able to keep up with the movement, when the movement on the west bank occurred.

A crack was found on the slope of Zion Hill in June, 1914, but observation made upon it showed no movement until subsequent to the break on the east side, when a gradual but general breaking up of the west bank began (Fig. 8). Subsequently the cracks on Zion Hill extended to El. 480, the limit of the present break. The movement into the cut from the west bank occurred early in August, 1915, when a section of Zion Hill broke away and settled down (Fig. 9).

Some Features of the Slide Mass

The break is generally along a curve. The movements from the two sides are toward the central portion of the inclosed area, and at this central portion is the main obstruction to the channel. In coming into the cut the mass on the east side is breaking up into waves, which move down to the prism in succession. One now occupies part of the channel (Fig. 6) and another is forming up the slope of the hill. On the west bank this wave effect is also evident. Here the bank was pushed forward horizontally, the benches in some portions still maintaining their relative position with respect to each other, but the ground in their rear has settled, forming sinkholes on the side away from the prism.

When the break of Oct. 14, 1914, occurred it was evident that the large mass of material that had broken away must be handled by the dredges. Turning any part of the material away from the prism by sluicing operations was not possible on account of the natural lay of the ground, and in fact all material that could be handled by that method had been removed when the



FIGS. 8 AND 9. SLIDE EFFECTS AT ZION HILL, ON WEST BANK AT CULEBRA, IN 1914 AND 1915

Fig. 8—Enlargement of crack on slope of hill in 1914, after break on east side. Fig. 9—Piece "A" of Zion Hill slipped off "B" in August, 1915



FIG. 10. BANK REDUCTION AT CULEBRA—A SLIDE-PREVENTIVE MEASURE ONLY PARTLY SUCCESSFUL
This steam-shovel terracing was done in 1910 to 1914, taking 6½ million cu.yd. from the east bank (right) and nearly 9 million from the west bank. This was prior to admission of water into the canal

sluicing plant was installed on this bank. Steam shovels and trains could not operate on any portion of the broken mass (Fig. 7).

There remained a stretch between this and the limiting crack to the east, but this ground was in such condition that before preparations could be completed for beginning work it would be broken up so that steam shovels could effect nothing. Subsequent developments have verified this.

No further cracks or indications of a further extension eastward have occurred, and judging from past experience the existing cracks will limit the fracture, which is about 1,300 ft. from the edge of the prism.

Similar investigations and considerations on the west bank show there is no possibility of handling the material to advantage by steam shovels. The configuration of the ground is such that all material in the present movement will be taken away long before the area involved could be reached. Like the east side, sluicing could only throw the material into the prism; similarly, it is believed that the limits of the break have been reached.

The conclusion reached, therefore, is that the only method is to remove the material as it comes into the cut, by the dredges. These are handling nearly 1,000,000 cu.yd. per month, at a cost of less than 30c. per cu.yd. When the break occurred in October, 1914, and the subsequent breaking up of the west bank became evident, it was decided to augment the dredging fleet by another 15-yd. dipper dredge and three 1,000-yd. barges. The latter are in service. The dredge arrived last week and will be ready for use within two weeks.

Volume of the Culebra Slide

As to the amounts involved, it is difficult to make predictions. As noted above, when Cucaracha broke loose in 1913 it was estimated that 2,000,000 cu.yd. was involved. Upward of 4,000,000 cu.yd. was taken out of the prism before the slide was entirely removed, in addition to 1,000,000 yd. washed away by the sluicing plant. In the present instance, estimating that the material must be removed from a slope extending from the bottom of the canal, reference 40, on the outward limits of the prism, up to the farthest limits of the breaks, on the theory that all the material above these planes will move into the cut, it is estimated that 7,000,000 cu. yd. will have to be removed before the slides are entirely done away with. If we assume a surface parallel to the existing one starting from El. 40, the estimated quantity is 13,000,000 cu.yd. The resulting surface will be irregular, and perhaps the more correct estimate will be between these two limits, or 10,000,000 cu.yd.

While the foregoing amounts are the estimates of what will have to be handled before all moving material is removed, it is not to be assumed that the canal will be closed to navigation for this length of time; on the contrary, all efforts are being directed toward securing a channel. The estimated amount in the canal within the limits of the prism was about 500,000 cu.yd. when the prediction was made that the canal would probably be opened by Nov. 1, 1915, and the dredges could easily handle this amount within the time limit; but in view of the wave movements and the difficulty of breaking through the central obstruction, it was not deemed wise to make any further predictions until the moving mass was in such shape that we had a channel through it which we felt reasonably sure could be maintained. To this end the dredges are operating to cut a channel wider than the full prism width, which will enable the maintenance of a channel more easily than heretofore. On Oct. 6 the length of the channel that was blocked was 1,300 ft.; this length has been reduced since then to 700 ft.; but due to the continued movement we have been unable to break through the closure in the vicinity of Sta. 1,787, which is now about 100 ft. in length. When this is accomplished the lower waves can be more easily removed and more reliable predictions made than are now possible.

The Mexican Railway; 1873 and 1915

SYNOPSIS—The location of surveys for this first railway in Mexico was made by American engineers in the face of great difficulties. Some interesting information as to these surveys, and also as to present conditions, is given in this article.

The Mexican Railway, connecting the City of Mexico with the Atlantic port of Vera Cruz, has been brought to notice in this country very conspicuously during the recent troubles in Mexico and especially during the American occupation of Vera Cruz in 1914. It was the first railway in Mexico and is an engineering work of considerable interest, partly on account of the difficulties of location and construction and partly from the fact of its having been located by American engineers. For the reasons cited it is interesting to present the following particulars of the early history of this road, condensed from information furnished by William R. Eastman, of

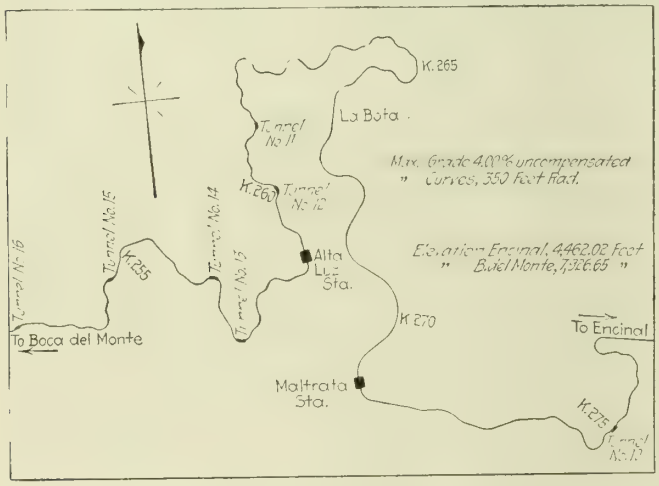


FIG. 1. LOCATION OF THE MEXICAN RY. AT MALTRATA TO MAINTAIN A GRADE OF 4 PER CENT.

Albany, N. Y., who was a transitman on the survey made in 1858 and made the difficult location at Maltrata, mentioned later. The length of the line is 264 mi.

History of the Railway

The Mexican Railway was opened Jan. 1, 1873. It had been built at great cost and represented the planning and working and vexatious delays of many years. Concessions for a railway to Vera Cruz were granted in 1837 and 1842, but notwithstanding large appropriations by the government, only 11½ mi. were built by November, 1850. The first 15 mi. extended from Vera Cruz through Tejeria to San Juan and were operated in 1858. In 1854 a line was built from Mexico to the suburb of Guadalupe (3 mi.). This was wholly of American construction. The rails and other material and the parts of the locomotive were hauled 260 mi. from the coast. In 1857 a new concession was obtained by Don Antonio Escandon, who paid $1,000,000 to the national treasury and at once entered upon the undertaking.

The broad table-land of Mexico is about 8,000 ft. above sea level. This great elevation is reached within 100 mi. from the coast, the ascent gradually growing steeper. At 95 mi. the line has risen 5,500 ft. In the next five or six miles the mountain rises 2,500 ft. higher to the Cumbres or sharp edge of the table-land, which stretches in a nearly level plain for 400 mi. To ascend this abrupt mountain wall was the railway locators' problem. There were difficulties also from deep and steep ravines, or barrancas, and a line of small hills, the Chiquihuites.

An eminent and experienced American engineer, Col. Andrew Talcott, was engaged. He was a graduate of West Point and had rendered conspicuous service in the United States Army. A surveying party of some 30 men was recruited in New York. The chief assistants were M. E. Lyons, of Reading, Penn., and R. B. Gorsuch, of New York. The latter had had experience in Mexico in the building of the experimental railway to Guadalupe; he was the first secretary of the American Society of Civil Engineers. Camp equipment, instruments, etc., were shipped from New York.

The main party left New Orleans by steamer on Jan. 1, 1858, and landed at Vera Cruz four days later. A camp was established at Tejeria, 9 mi. from the city. Three working parties were organized—one headquarters party to explore the country on horseback and two field parties. From Vera Cruz there were two main highways. One was by way of Jalapa, and had been chosen by General Scott with the American army in 1847. The other road, somewhat more direct, passed through Orizaba, climbed the mountain pass at Aculcingo and joined the Jalapa road at San Marcos; thence to Puebla and Mexico. This was the route taken by Cortez and his Spaniards. It was the regular stage route in 1858 and was adopted as the base of the survey. In many respects this was a remarkable road, built probably by the Spaniards 200 or 300 years ago.

As the disturbed political and military conditions seriously embarrassed the work, the force was reduced, keeping only one field party to examine the most critical point on the line—the abrupt ascent of the Cumbres. The road climbed the pass at Aculcingo by a series of ten or twelve extended zigzags. The railway could not do that. The attempted line of survey became hopelessly involved in a tangle of hills, and after a month's work the result was failure. Then attention was devoted to another pass, up from Maltrata, and on the farther side of which a long mountain spur thrust out for miles into the lower country. There was no carriage road in the Maltrata pass and the zigzag turns for trails were even more numerous than at Aculcingo, but hope was fixed on that prolonged spur of the mountain. After climbing to Boca del Monte, 7,922 ft., the transit was set for a down grade of 200 ft. to the mile, and with only this as a guide the mountain side was explored. No account was taken of curves, bridges or tunnels. The chopping out of the path was slow. Straight lines and their angles were carefully measured and noted. The leveling instrument was close behind.

At one point the cliff is so precipitous that it seems to hang above Maltrata, 2,000 ft. below. After winding on till the located line resembled the outline of a boot with the leg resting along the valley (Fig. 1), and after 11 mi. of sharp descent, the level of the village was reached. But this was not the end. The drainage of the valley is

through a narrow rocky gorge down which the line turns and twists until, in the valley of Encinal, it reaches level country. In 18½ mi. the descent is 3,000 ft. The average fall is 165 ft. to the mile, but many miles are on a grade of 200 ft. or more.

The crossing of the deep ravine of the Barranca de Metlac was a problem. A straight line across was only 1,400 ft., but the cost of a bridge would have been enormous and the American type of steel viaduct had not been developed. The line descends on a narrow shelf for a mile or more upstream till it reaches a broader part of the ravine and then makes an almost semicircular turn, with a bridge about 100 ft. above the water, and ascends by a similar shelf on the farther side. The river crossing at which the line reverses is shown in Fig. 2. The Chiquihuites range of hills is passed by a considerable detour away from the line of the highway.

In September, after a little more than eight months in the country, the party returned to New York, the line of survey was plotted and the report made. But for a long time nothing more was done. A new grant from the government was made in 1861. The French entered Mexico in 1862, and to facilitate their movements they contracted with Escandon to build portions of the railway. It was extended over the open country to Paso del Macho, 48 mi. from Vera Cruz. It was also carried from Mexico to Puebla. During this foreign regime 133 mi. were constructed. Still more liberal contracts were made with the republican government in 1867 and 1868.

The cost of construction was found to be unusual and extreme. The government insisted that the road should be built from both terminals simultaneously, making it necessary to haul heavy material, machinery and equipment hundreds of miles over rough mountain roads in order to build back from the capital. The work of construction of the mountain division (still under the supervision of Colonel Talcott) was taken up in earnest in 1864. But Escandon was compelled to seek outside pecuniary help, and it was an English company which (in 1872) finished the railway.

In spite of the great cost, the railway has such important traffic that good profits have been paid, at least up to the past year. The road is under English management, and the impression is common that the English built it. The fact is that the survey, the location and the plan of construction were American throughout.

Present Conditions on the Mexican Railway

Information supplementing the early history given has been furnished to *Engineering News* by W. T. Ingram, Resident Engineer. The main line and some of the branches are of standard gage, and the company owns 130 mi. of branch lines of 36-, 30- and 24-in. gage. Practically the whole of the main line and the standard-gage branches is laid with steel ties spaced 16 to the 30-ft. rail.

The rails on the mountain division are 82-lb. per yd., but are being changed to 85-lb. 40-ft. T-rails of the British standard section. On the rest of the line there are 62- to 85-lb. rails. The maintenance-of-way department is mostly under the care of Mexican roadmasters and supervisors, and all the labor is Mexican.

During 1909 and 1910 nearly $500,000 (gold) was expended in renewing bridge girders and in eliminating a number of bridges and viaducts by means of fills supported on the downhill side by massive stone retaining walls. The curious bridge at Soledad, shown in Fig. 3, has two independent steel superstructures on one set of

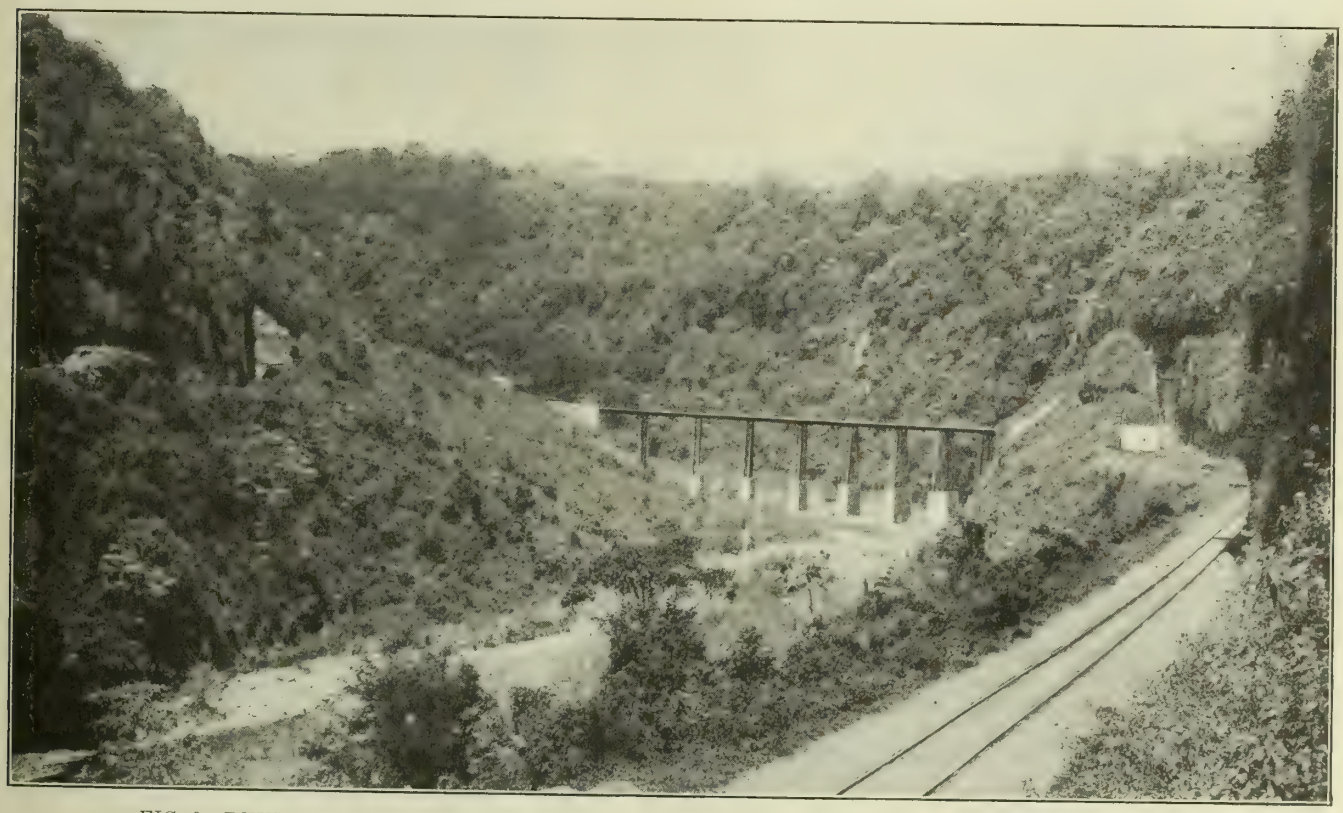


FIG. 2. DEVELOPMENT AND REVERSING CURVE AT THE CROSSING OF THE METLAC RIVER

The line on the left (entering the tunnel) descends from the high ground on a grade of 3%. It crosses the river by a bridge on a curve of 324 ft. radius, and ascends the opposite side of the valley (in the foreground) on a grade of 2½%

piers. The lower structure has through-truss spans for a roadway. The sides of the piers are carried up above the trusses and support transverse plate girders, between which are framed the plate-girder spans for the railway. Since 1908 large amounts have been spent for new rails, steel ties, ballasting, water service, fuel-oil installations, etc. The total issued capital of the company amounts to $41,557,400.

Locomotives and Operation

The operation of the 4% grade between Orizaba and Esperanza is interesting from the use of locomotives of the Fairlie duplex double-boiler type. The latest of these engines, built by the Vulcan Iron Works, England, have six 48-in. driving wheels under each end, with a wheel-base of 9 ft. 3 in. for each group and 35 ft. 6 in. for the entire engine. The weight is about 153 net tons in working order, with a tractive power of 59,134 lb. The four cylinders are 19x25 in.

The boiler is a single structure having two barrels 4 ft. 9½ in. diameter, set back to back, each with a fire-box 5 ft. 4 11/16 in. by 4 ft. 6¾ in. While there are two independent fireboxes, there is no division above the crown-sheets, so that water circulates freely between the two barrels and there is an ample depth of water over the crown-sheets when the engine is on the steep grade. The train load for one engine on the 4% grade is 340 metric tons. Mr. Ingram states that these engines are very satisfactory. The whole weight is available for adhesion, and with the short rigid wheel-base they can traverse sharp curves safely and with a minimum of tire wear. The articulation of the underframes and the supports of the boilers provide for free movement longitudinally and vertically. The fuel economy is fully 20% less than for two ordinary engines of practically the same dimensions.

All freight trains are handled with two engines, one at each end. Trains of 680 tons are hauled at an average speed of 10 mi. per hr. This is considered good performance on a continuous grade of 4%, not compensated for curvature, and having curves of 350-ft. radius, many of which are reverse curves and are so short that frequently a train will be on three curves at once. Since 1909 all engines have used petroleum-oil fuel from Tuxpam. It is stored in tanks of 50,000 bbl. capacity, and



FIG. 3. DOUBLE BRIDGE AT SOLEDAD; MEXICAN RY.
The lower bridge, with truss spans, is for a highway

the service tanks for supplying the locomotives are of 500-bbl. capacity (Fig. 4).

Commenting upon the operation of the line during the present revolutionary troubles in Mexico, Mr. Ingram states as follows:

It is very gratifying to be able to record that notwithstanding the fact that Mexico has been in the throes of a severe revolution for the past four years, no more serious damage has been done than to destroy track, burn buildings and decks of unimportant bridges, wreck engines and cars by running them wild down mountain grades, etc. While this has involved heavy outlay for repairs, it has not kept the railway out of service for long continuous periods. At least one important bridge missed destruction by a narrow

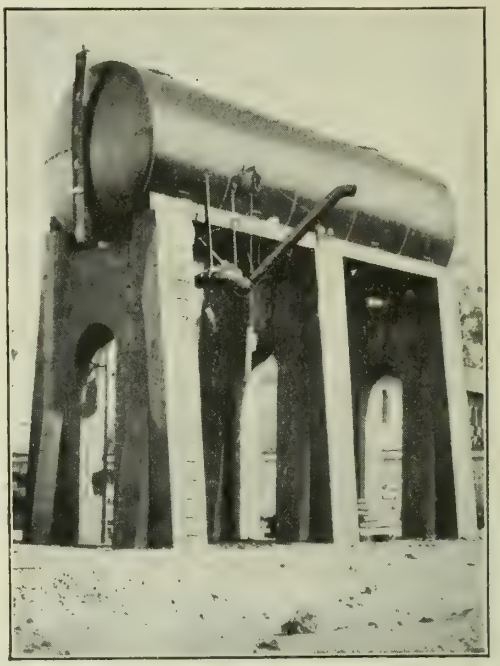


FIG. 4. OIL-FUEL STATION FOR SUPPLYING LOCOMOTIVES; MEXICAN RY.

margin. This is the Soledad Bridge, 27 mi. from Vera Cruz and carrying both the railway and the highway across the Jamapa River [Fig. 3]. On Apr. 22, 1914, while the United States expeditionary forces were taking possession of Vera Cruz, the bridge was mined and would undoubtedly have been entirely destroyed had any attempt been made to start up country.

Tests of a Proportional Weir

A proportional weir of the Rettger type (as described in *Engineering News* of June 25, 1914, p. 1409) corrected for finite length of crest was subjected to very careful tests on a large scale during the past year by E. W. Doebler and F. H. Rayfield, students at Cornell University. The hydraulic testing plant at Cornell permits of obtaining a large supply of water and of measuring discharge volume accurately by means of a calibrated standpipe 6 ft. in diameter by 60 ft. high. The methods of making the test were in all respects such as would secure a high degree of precision. Only the results will be stated here.

The Rettger type of weir, whose sides have the equation l^2h = constant, would be of infinite length at the crest if the curve were continued. For practical use the crest length must be limited to some length L, at which point the height from weir crest to curve of side is H. The roughly triangular areas outside of the side lines of the weir lost by limiting the crest length to the length L have an area equal to LH. By adding this same area LH just below the theoretical crest—in other words, moving the crest down a height H—the same total area of discharge is secured as with the theoretical Rettger weir, although the head on the small added area is slightly altered. This correction was made in the weirs tested, as indicated by the dotted line in Fig. 3.

Two weirs were tested, both 3.5 ft. long on crest, but one having $H = 0.10$ ft., the other 0.01 ft. Fig. 2 shows weir *A* discharging under 1-ft. head of water. A few feet below the weir crest the flow strikes diverters, which lead it into the measuring standpipe. Both weirs were cut out of sheets of galvanized iron and carefully handfiled down to the plotted curve, filing perpendicular to the sheet.

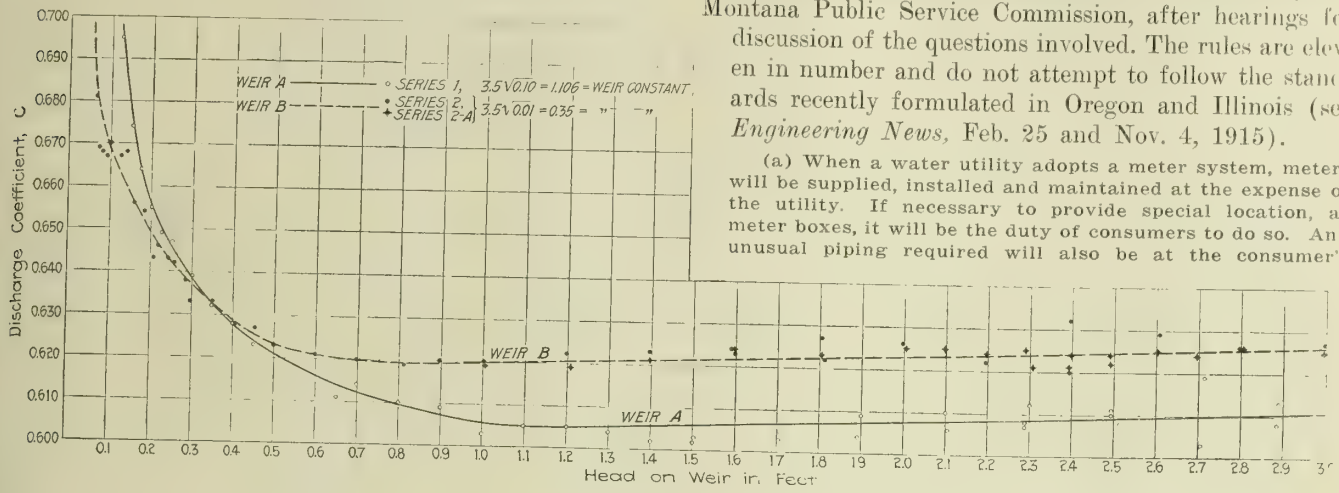


FIG. 1. DISCHARGE COEFFICIENTS FOUND BY TEST OF TWO RETTGER WEIRS

The results are shown by the plotted points and curves in Fig. 1, which give the computed discharge coefficients for various heads on the weir. According to the theory of the Rettger type of weir, the coefficient should be constant. For the higher head (above 1 ft.) the coefficients of the smaller weir are about 2.4% higher than for the larger weir. The gradual increase in coefficient as the head increases was found to be not due to the velocity of approach above the weir. Probably the manner of correcting for finite length of weir is responsible.

Logarithmic plotting between head and discharge gives:

Weir A, $Q = 8.47\ h$;

Weir B, $Q = 2.74\ h$.

The tests noted were made under Prof. E. W. Schoder.

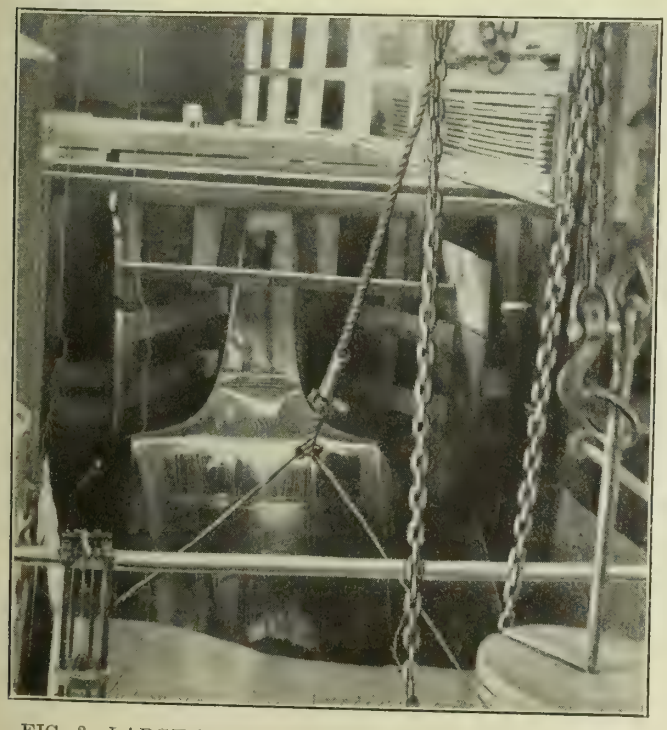


FIG. 2. LARGE WEIR (WEIR A) UNDER 1-FT. HEAD

Water-Works Rules Issued by Montana Commission

Rules and regulations governing and standardizing water-works service in Montana have been issued by the Montana Public Service Commission, after hearings for discussion of the questions involved. The rules are eleven in number and do not attempt to follow the standards recently formulated in Oregon and Illinois (see *Engineering News*, Feb. 25 and Nov. 4, 1915).

(a) When a water utility adopts a meter system, meters will be supplied, installed and maintained at the expense of the utility. If necessary to provide special location, as meter boxes, it will be the duty of consumers to do so. Any unusual piping required will also be at the consumer's expense. Meters which have been installed at consumer's expense will be taken over by the utility at the pro rata value based on length of service and present condition.

(b) If the utility requires a meter deposit, the consumer will receive interest thereon at the rate of 6% per annum.

(c) A utility may protect itself by reasonable minimum charge based on the size of the meter and consumption.

(d) The utility at its own expense must tap the main and furnish the corporation cock, the clamp (when necessary) and any other material used or labor furnished in connection with the tapping of the main. Any other material used or labor furnished in connection with the installation of the service pipe or curb box to the property line of the consumer shall be billed against the consumer at actual cost.

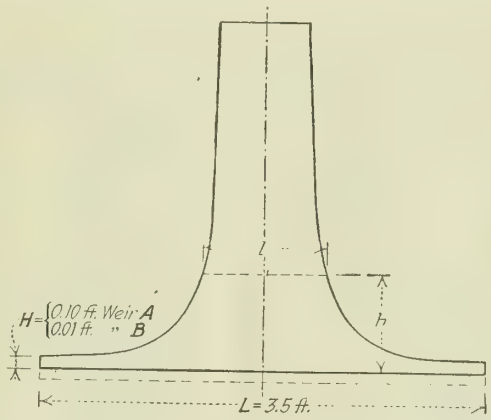


FIG. 3. SKETCH OF THE CORRECTED RETTGER WEIR

(e) Unless under conditions where it is not possible to do so, the utility must notify the consumer prior to shutting the water off.

(f) When the water has been shut off for cause, the utility shall not charge the consumer a greater sum than $1 for turning it on. This must not be indicated in the schedule as a "penalty," but is presumed to simply reimburse the utility.

(g) Should the consumer, not the owner of the property, desire service and tender the utility a deposit to guarantee payment of bills for a period not less than the customary billing period of the utility, and in no event less than one month, the utility must accept such deposit and render the service applied for.

(h) A consumer must not add additional fixtures without the consent of the utility, under flat rates.

(i) Consumers must not without the consent of the utility supply water to others.

(j) When the water has been shut off, it should not be turned on except by the utility or by its direction.

(k) The commission will not authorize fines or penalties.

Subaqueous Rock Excavation—II

By Charles C. Phelps*

SYNOPSIS—Continuation of a review of American practice in removing underwater rock. Notes on the equipment of drill barges for nontidal waters.

In a previous article (*Engineering News,* Nov. 18, 1915) the general development of the American method of excavating rock under water (drilling and shooting) was sketched and the use of drill barges for nontidal waters outlined. The notes on barge equipment are continued in these paragraphs. While the descriptions of drills and accessories and working methods apply particularly to barges for nontidal waters, yet it is obvious that this apparatus and these practices have a broader application to all subaqueous drilling.

Barge Drills and Accessories; Drilling and Charging Practices

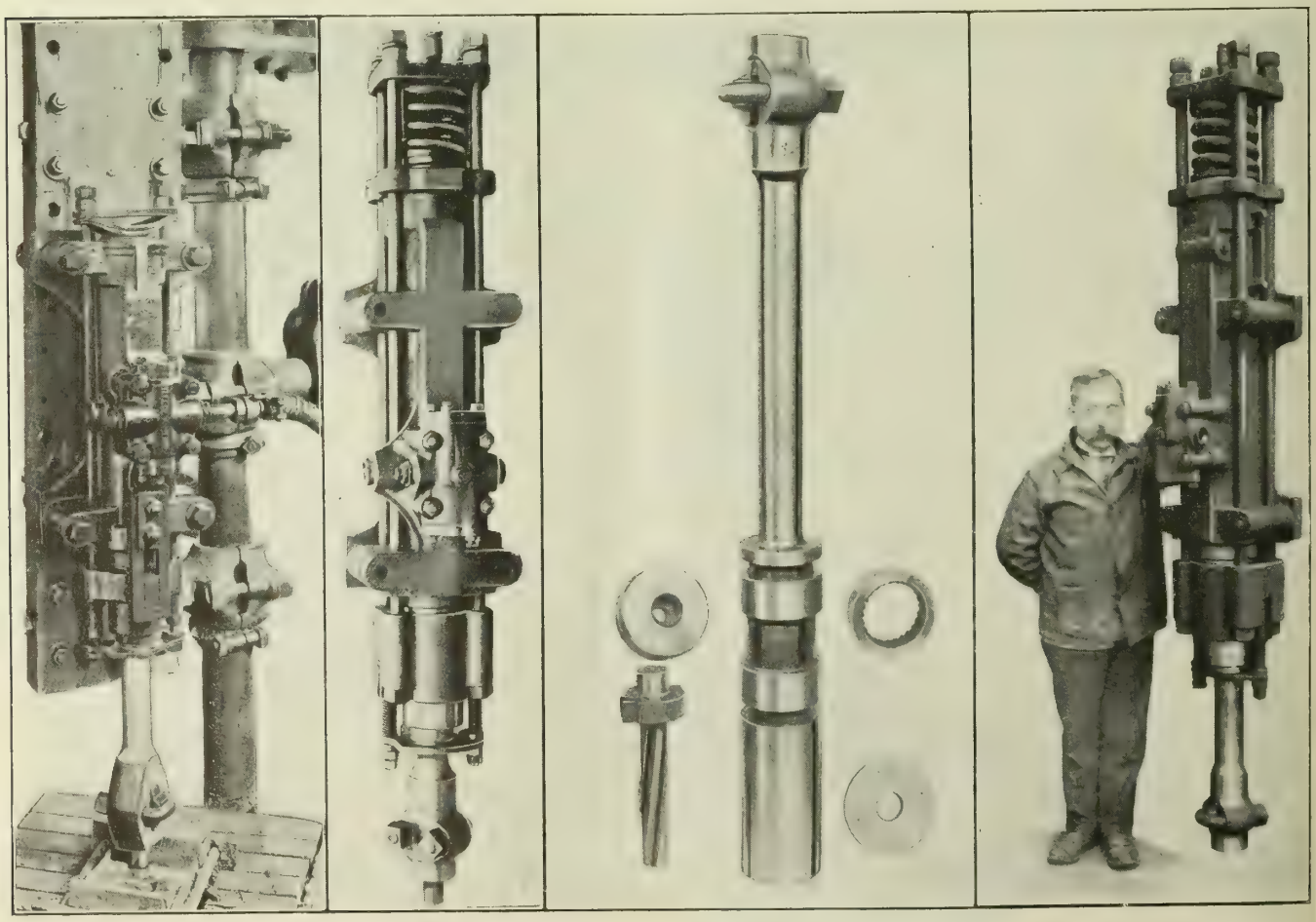
The steels used for subaqueous work are exceptionally long, and large-diameter bits are usually employed. The distance between drill and rock is necessarily much greater than on land. With these extremely severe conditions it is necessary that equipment of the heaviest type be employed. It is particularly desirable to have the bearing surfaces of the drilling machine as liberal as possible and spaced as far apart as practical in order to counteract effectively any buckling or glancing tendencies of the drill steel. The wear on a submarine drill is very severe and for that reason the packings and bushings should be made of the best materials and be easily replaceable.

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Light and Heavy Submarine Drill Types

In Fig. 12 is shown one of the lightest types of drills used for this class of work. Four of them are employed on the boat shown in Fig. 4. They have a cylinder diameter of 4¼ in. and a stroke of 8 in., and will handle steels 25 or 30 ft. in length and of about 1½-in. diameter. Their normal speed is about 400 strokes per minute. The valve action is of the standard "Sergeant" type consisting of a main pressure-thrown valve of the balanced spool type, which in turn is controlled by an auxiliary valve thrown by the piston. This type of valve automatically admits of a wide variation of stroke to meet the varying conditions imposed.

Fig. 13 shows a type which is probably in most extensive use for general submarine work. It has a cylinder diameter of 5½ in. and a piston stroke of 8 in. For extra-heavy work, where the depth of water is excessive or where larger holes must be drilled, the drill shown



FIGS. 12 TO 15. THREE TYPES OF SUBMARINE ROCK DRILLS

FIG. 12—Light design. Fig. 13—Standard weight. Fig. 14—Piston, rifle bar, rotation washer and ratchet of extra heavy drill. Fig. 15—Extra heavy drill

in Fig. 15 is also used to some extent. It has a 6½-in. cylinder and a 9-in. stroke. Both of the last-mentioned machines will handle steels 2¼ in. in diameter and 40 or 50 ft. in length. Both operate at a speed of approximately 250 strokes per minute.

Any considerable increase in the length of steel used necessitates increasing the cross-section so as to diminish the buckling tendency of a long steel. Consequently the weight of a long steel becomes very great, often as much as 400 or 500 lb. The light drill shown in Fig. 13 might be sufficiently heavy to operate steels of a given bit diameter in drilling to a moderate depth, but it might become necessary to employ a drill of the heavier type for the same diameter of hole put down to a greater depth, due to the increased power required to reciprocate the heavier steel. When the operating conditions are known it is a simple matter to find the proper type and size of drill.

Drill-Cylinder Supports

In all of these sizes the cylinder is arranged for bolting directly to a saddle (Fig. 16) which travels in the drill-frame guides. The cylinder is provided with double pads to fit the saddle, as shown by Fig. 15. These bosses are extended over the outside of the cylinder so as to be easily accessible and to insure secure bolting to the saddle.

The valve motions of the drills illustrated in Figs. 13 and 14 are exhaust-thrown, with an outside adjustment for the valve. This makes it possible to run the machine either at a long or short stroke, and the adjustment is under perfect control of the operator. The value of the variable stroke is particularly apparent when starting holes and when working in caving, seamy or broken ground, while the quick return "mucks" the hole well.

In the heavier types four through bolts connect the front-head and back-head plates. Between the back-head plate and back head is placed a heavy single-spiral spring. By tightening up the nuts on the through bolts to the desired amount, the front head and back head are made tight with the cylinder. The spring is then in compression, however, having ample reserve deflection, so that if the piston should strike the front head occasionally—either from improper attention of the operator or when it is required to back the steel out of a tight hole—the drill will not be damaged, but the hammering shock will be absorbed by the spring.

Submarine drills operating on drill barges fitted with modern equipment have given results in speed and economy of operation that compare favorably with drilling and blasting operations on land. As a matter of fact, drills of the submarine type with power-operated feeds, and mounted on self-propelled carriages, are being employed for land operations with remarkable success.

Handling the Steels

Small-size steels may be manipulated by hand, but a hoist of some kind is necessary for handling the longer and heavy pieces usually found on drill boats when removing dull steels from the chuck and inserting sharp ones. Frequently an extra sheave is mounted on top of the tower over which the rope for the drill steel passes. Cranes and overhead tracks are both employed extensively for conveying the steels to and from the smith's shop.

It is wasteful of the drill's and operator's time to stop the drill to measure the depth of the hole. A mark may be made on the steel corresponding with the depth from the surface of the water to the bottom of the hole, or the drill feed cable or rod may be marked so that the drill can be stopped without delay when the desired depth is reached. A convenient way of marking the steel is to lay off a scale of feet and inches on one guide of each drill frame, starting at the water line of the vessel, when

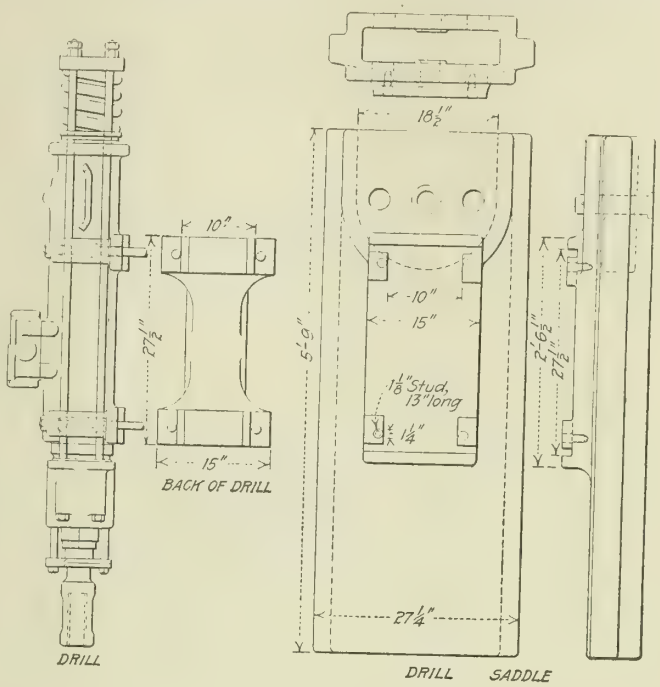


FIG. 16. SUBMARINE-DRILL SADDLE

raised on the spud anchors, and running upward. With the bit touching the surface of the water, the desired depth of cut can then be marked directly on the steel.

Power Supply for Submarine Work

While submarine-drilling work has been performed with both steam and compressed-air equipments, the former have advantages that greatly outweigh the benefits of operating by means of air. As a result, steam is almost universally used. The steam pressures employed generally range between 90 and 100 lb.

In selecting a boiler for this service, full allowance must be made, in addition to that consumed by the drills, for steam for the auxiliary apparatus, such as pumps, hoists, dynamo engines for lighting service, etc. Reduced efficiency and capacity, due to soot or scale in the boiler after continued use, must be foreseen. In determining upon the type and size of boilers for submarine drilling it must be remembered that the service is almost continuous and there is very little opportunity to clean the boilers.

In locations where the cost of boiler water or coal is excessively high it might pay to exhaust the drills to condensers, although it would probably not be worth while under ordinary conditions. One notable instance where a condenser was employed to advantage was in the drilling of a channel in St. Georges Harbor, Bermuda, during 1913 and 1914. Practically all the fresh water in Bermuda is rain water caught and stored in tanks and sold at various prices up to $4.50 per ton. The condenser in this case consisted of 160 ft. of 2-in. galvanized-iron pipe bolted under the bottom of the scow. Even in the summer, when the temperature of the sea water was about 75° F. a vacuum of 22 in. was easily maintained. The two

Type H-9 Ingersoll-Rand drills and the auxiliary equipment were operated with steam from a boiler carrying 60 lb. gage pressure, the condenser increasing the effective pressure to about 70 lb. The water consumption amounted to only about 1½ tons per week for each drill and its auxiliary apparatus. In addition to the water saving and reduction in coal consumption, the noise and inconvenience of the exhaust steam were eliminated and pure boiler-feed water was assured. Practically no cylinder oil was used for internal lubrication, so there was no trouble from oil accumulating in the boiler.

Drilling and Charging Aids; the Submarine Tube

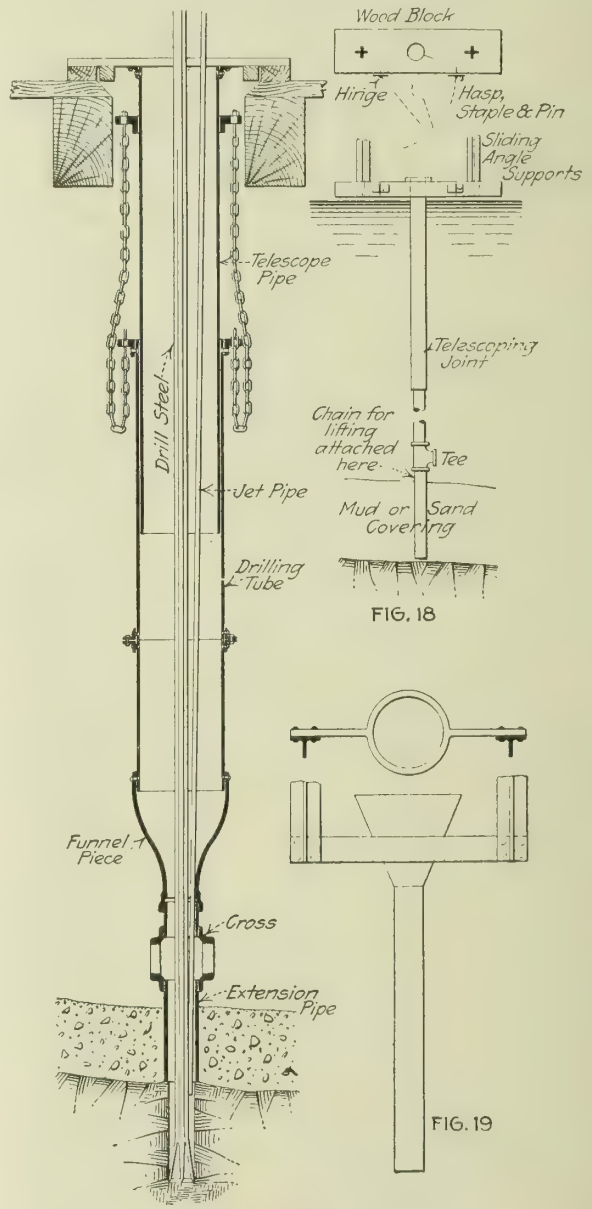
In almost all subaqueous operations the drilling is done through any overburden that may be deposited on top of the rock. If this overburden is not prevented from getting into the drill hole, the drilling progress is liable to be very slow, or perhaps even entirely interrupted. Likewise, in drilling a range of holes where the longitudinal axis of the boat is more or less parallel with the direction of flow of a swift current, the débris that is washed out of the upstream holes by the jet or blown loose by blasts may drift down upon the drills which are working farther down stream, clogging them and often increasing the time necessary for drilling, cleaning and charging. To overcome these difficulties the submarine drilling and charging tube has been devised. The drill is run to the top of the guide and a protecting guide tube is lowered and driven, with the assistance of a water jet, down through the overburden to the rock. One of the commonest forms of drilling tube is shown in Fig. 17. It consists of a telescopic tube of large diameter. To the bottom end is connected an extension pipe slightly larger than the drill hole required. The extension pipe sinks down to and rests upon the solid rock and the drill steel passes through the tubes. Near the bottom of the tube, but far enough up to clear the overburden, a "cross" connects the large telescopic pipe and extension pipe. Sometimes a tee is used instead of a cross. This cross gives an opening on either side of the pipe, through which the cuttings are discharged. The telescoping construction accommodates different depths of water, as the top of the tube is generally held a little above the surface of the water. Where this tube is used in connection with barge or submarine-frame drilling the top of the tube may be bolted to a platform overhanging the side of the boat or to a crosshead arranged to travel vertically so that the drill steel will enter it easily and be in line with it. When work at a hole has been completed, the lower section of the tube can be raised by the chain so as to clear the rock prior to setting off the charge.

These submarine tubes are also made in other forms. Fig. 18 shows an arrangement in which the tube is bolted to a crosshead which slides in guides, so that the apparatus can easily be raised and lowered by the hoisting engine, or by hand if counterweighted.

Where the depth of water is nearly uniform the telescopic construction is not as necessary, in which case a stiff tube, built up of any desired number of sections, may be used without serious difficulty.

A similar device that works satisfactorily in locations where the water is not too deep and the layer of overburden not too thick is known as a sand pipe (Fig. 19). It is simply a large cast-iron funnel, the one shown being about 5 ft. in length and large enough to accommodate the charging stick. The sand pipe rests in position in a cast-iron support of the shape shown in Fig. 19, which rests on top of the overburden. The ends of this casting are riveted to the ends of two T-bars that slide in guides or are otherwise arranged for raising and lowering.

The sand pipe is allowed to slide down into the overburden before a hole is started. It works its way to the bottom by its own weight. Like the drilling tube, it



FIGS. 17 TO 19. SUBMARINE DRILLING AND CHARGING TUBES AND ACCESSORIES

Fig. 17—Telescopic tube. Fig. 18—Tube and crosshead in guides. Fig. 19—Sand tube

prevents sand from getting into the hole when it has once been emptied of sand by the washout jet.

The sand pipe and its support are raised and lowered by cables, usually counterweighted. If the sand layer is deeper than the spigot of the funnel, the end of the sand pipe will of course not rest on the rock. This may add to the difficulty of keeping the hole clean. However, the device will aid in this respect, and in any event will serve perfectly as a guide for the steel and the charging stick, so that the hole is kept relatively clean.

After a bit has once started a hole, the complete drilling is generally accomplished without interruption. If there were no sand pipe or drill tube, as soon as the steel was raised sand and small stones would fall into the hole and cause trouble and delay. These devices are of great assistance in charging, as it is very easy to locate the large funnel opening. Without some form of guide the charging is often very difficult, especially in swift currents, because the charger, in moving around the edge of the drilled hole, often causes a slide of sand and stones into the hole, necessitating redrilling.

In all subaqueous drilling operations it is necessary to get rid of the cuttings from the bottom of the drill hole, so that the steel will not bind and every blow be delivered against clean, solid rock. In most cases this is accomplished by means of a jet pipe placed in the hole alongside the drill steel and kept far enough from the bottom so that the bit part of the steel will not touch it on the up stroke. The jet pipe is handled from the deck of the barge or platform by means of the overhead rigging when the size of the equipment warrants it, but in shallow water and for the smaller holes it is more usual to manipulate it by hand. Various sizes of jets have been employed, but probably a ⅜- or ½-in. pipe is most suitable for the purpose, and a stream of water, usually under 100 to 150 lb. pressure, is forced through the jet pipe, effectively washing out the cuttings from the bottom of the hole.

Besides its main function, the jet serves the very useful purpose of assisting the submarine drilling tube, or sand pipe, to settle rapidly through the overburden and down to the rock bottom.

Loading the Drilled Hole

The loading of the holes is done most conveniently by means of a loading tube, also known as a loading stick, illustrated in Fig. 20. The bottom of the loading tube has a slightly smaller outside diameter than the hole drilled and serves as an envelope for the dynamite sticks. This large tube or envelope for the dynamite sticks is manipulated by means of a small pipe inserted in the upper end. The complete length of pipe depends on the depth of water and depth of hole drilled. Through this tube passes a still smaller pipe or rod and extends into the larger pipe at the bottom. To the end of this last rod is attached a wooden piston which fits fairly tight into the large tube. The charge is inserted in the cavity in the large tube, with the plunger up, and the pin is slipped into the hole provided for that purpose in the small rod.

The blaster inserts one stick of dynamite after another in the charging tube, shoving them up into place until the pipe will accommodate only one more stick. This stick has a piece of wire or rope around it or a small wedge is inserted to keep the sticks from falling. The loaded charger is lowered into the cleaned hole with the aid of the hoist and the hole charged. In deep holes the above foregoing operation may have to be repeated one or more times.

The fuse wires are carried through the slot cut in the large bottom tube. The loaded charging stick is then inserted in the drilled hole and lowered to the bottom. The advantage of the drilling tube or sand pipe for rapidly guiding the loading stick into the hole will now be more apparent. When the stick is in the correct position, the pin is released, the inner rod is pressed downward and at the same time the outer tube pulled up, leaving the charge in the hole with the fuse wires ready for exploding. When the required number of holes have been drilled and charged the wires are connected to the electric battery or firing machine and the charge is then ready to be set off.

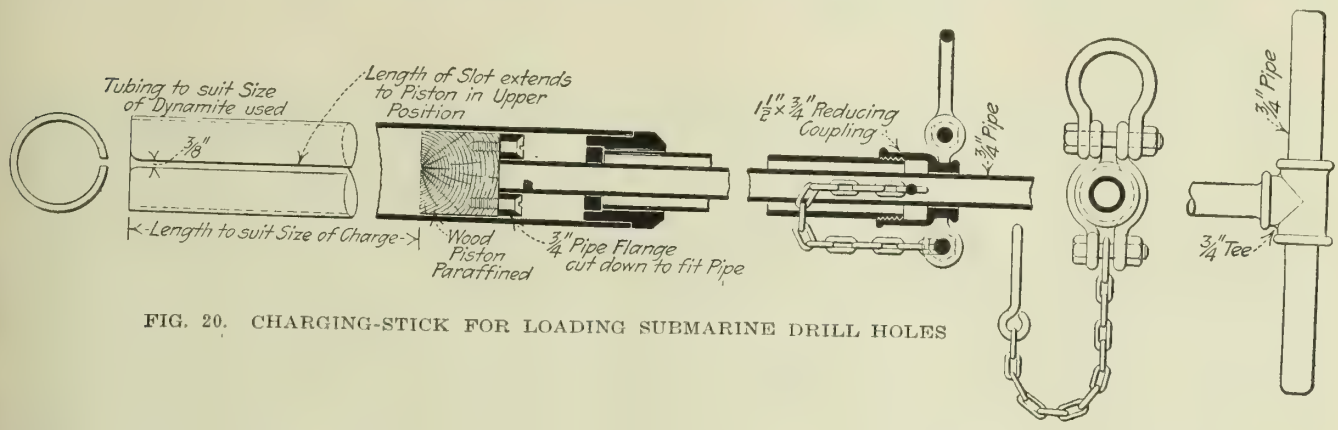


FIG. 20. CHARGING-STICK FOR LOADING SUBMARINE DRILL HOLES

The charging tube is manipulated by hand, usually with the assistance of block and tackle. Instead of the rod and wooden piston previously mentioned, an older method employs a long wooden pole, which is used in ramming the powder out of the charger and into the hole.

On many boats a signaling system is used in connection with charging. When a hole has been completed, the drill runner rings a bell or blows a whistle the proper number of times to notify the blaster which frame is ready to load. A steam whistle attached to each drill feed is convenient on a large boat.

The holes may be shot singly, in single rows or in a battery of rows. These methods are known as "single-hole," "range" and "field" blasting respectively. There are advantages in each method. However, it is generally believed that the breaking effect is much weaker when the holes are shot separately. Nevertheless, in cold-weather operations single-hole blasting is employed almost exclusively, as any delay would chill the dynamite and so weaken its action, if not actually prevent its detonation. This method also has the advantage of greater simplicity, as the holes are usually shot as soon as drilling is completed. In field blasting sometimes only a few of the holes, say every fourth or fifth hole, are exploded di-

rectly by the battery, the detonators and powder charges in the other holes being set off by the shock of these explosions. Nitrogelatin is more suitable for subaqueous work than nitroglycerin, as the water has a tendency to replace the latter substance in dynamite.

The inexperienced operator should use every caution to be at a safe distance when setting off the charge. However, many operators consider it safe to set off the charge without removing the drill boat or platform if the water is not too shallow, if too many holes are not set off simultaneously and if the individual charges are not too heavy. Such a procedure should never be attempted, however, until experience has taught the range of safety, as otherwise a broken spud or even more serious damage may result.

When the barge must be moved prior to blasting, the spuds are drawn up and the barge is shifted by winding in and paying out on opposite anchor ropes until it is clear of the charged holes. After blasting, the barge is brought back by means of the winches and a new series of holes is drilled.

Another method of working across a wide channel is to swing the boat on one spud by means of the current after the completion of each range, working diagonally across the channel from range to range.

One method of measuring the distance from range to range, so as quickly to locate the boat in each new position, is by means of wires stretched from the ends of the boat to two poles, either inserted in drilled holes in the channel or erected on shore. Surveyors' transits mounted on the shore are also sometimes employed in locating the ranges.

Sharpening Steels for Subaqueous Work

Where the sizes of bits do not exceed 3¾ in. it will often pay to install a sharpening machine; however, for the larger-size bits generally used for subaqueous work it is more usual to employ hand methods of sharpening. As the efficiency of the cutting bit greatly influences the speed and cost of the drilling operations, it is advisable to procure the services of a skilled blacksmith to do this work.

In dressing the bit care must be taken not to overheat it or to work while too hot. The proper temper should be determined by experiment and rigidly adhered to. After forging the bit should be allowed to cool thoroughly and then be reheated for tempering. It should never be sharpened and tempered on the same heat. Plenty of metal should be left back of the cutting edges, not only to provide ample strength but also to maintain the gage for as deep a cut as possible. Whatever style of bit is adopted, it is of the greatest importance that it be made as nearly symmetrical as possible.

Removing the Shattered Rock

Rock that has been coarsely broken is most economically dredged by the elevator type or the dipper type of dredger. Where the rock is well shattered and where the depth of each breaking is limited to 2 or 3 ft., as is usually the case with rock breakers, the elevator dredger, because of its ability to dredge closer to a given grade, is more effective. Where the rock is broken in large pieces as usually occurs with the drilling and blasting method, and where the depth of the cut is more than 3 ft., the dipper dredge will demonstrate superior economy. This does not apply to excavations in depths of 35 ft. or more, as the dipper dredgers, owing to limitations of mechanical design, lose their effectiveness beyond certain depths. (See General Report, 12th International Congress of Navigation, Philadelphia, 1912, on the subject of "High Powered Dredgers and Means of Removing Rock Under Water.")

Modern powerful dipper dredges carry buckets of from 5- to 15-cu.yd. capacity. The dredge is maneuvered so that the face of the excavation is always in front of the bucket, which is operated from the bottom of the face upward.

Dipper Dredges Cut Cost of Drilling

When the majority of rock to be removed lies in large masses, as in extensive channel improvements, the bottoms of all the drill holes are kept approximately on the same level. When these holes are charged with dynamite and exploded, the rock at a certain level above the bottom of the hole will be broken into small pieces, and above this elevation the pieces will be larger. The dredge bucket enters the mass of broken rock at the level where the rock is most shattered and is hoisted up under the larger and heavier pieces. Ability of the dredge to handle large masses permits of spacing the drill holes farther apart, thus lowering the average feet of drilling per cubic yard of excavation and also the unit amount of explosive.

Elevator or ladder dredges, owing to the small size of their buckets, require the rock to be broken into smaller pieces. If the pieces are too large they are rolled in front of or fall behind the buckets or are forced to the side of the channel. To remove these large stones entails the extra cost of divers or the employment of a grab dredger.

The grab, orange-peel or clamshell dredgers have not proved economical in removing large masses of rock for the reason that the surface of the rock must be thoroughly broken up to permit the bucket edges to penetrate. To obtain this condition entails the use of unnecessarily great quantities of explosive. Even where the rock is well broken there is still great uncertainty, as the amount lifted each time the grab is hoisted is dependent on the chance of dropping on material arranged in such form that the grab may catch a good load. The grab has not the positive manner of working of either the dipper or elevator dredger.

It is on small, disconnected ledges of rock that the grab dredge, because of its comparatively small cost of construction, may be employed to advantage.

Electrification of Railway Terminals in Chicago is impracticable for financial reasons, according to advance statements regarding the comprehensive work of the Chicago Terminal Electrification Commission on electrification and smoke abatement. The cost is estimated at $290,000,000 for 3,356 mi. of track which would have to be included in a complete system. This is for the terminal system as a whole, with electric service extended to points 15 to 20 mi. distant. Of this amount $188,000,000 is said to be the direct cost and $102,000,000 the cost of changes and betterments in connection with the work. The committee has not considered the practicability of electrification for individual roads. As far as the smoke problem is concerned, railway locomotives are said to be a minor factor, and a permanent commission is proposed to study this problem. One conclusion reached is that the complete elimination of steam locomotives is not necessary as a means of smoke abatement. A second finding is that no existing contact system is well adapted to some of the Chicago trackage. A third point is that the longer electrification is delayed the more the technical difficulties will be reduced through developments of the art.

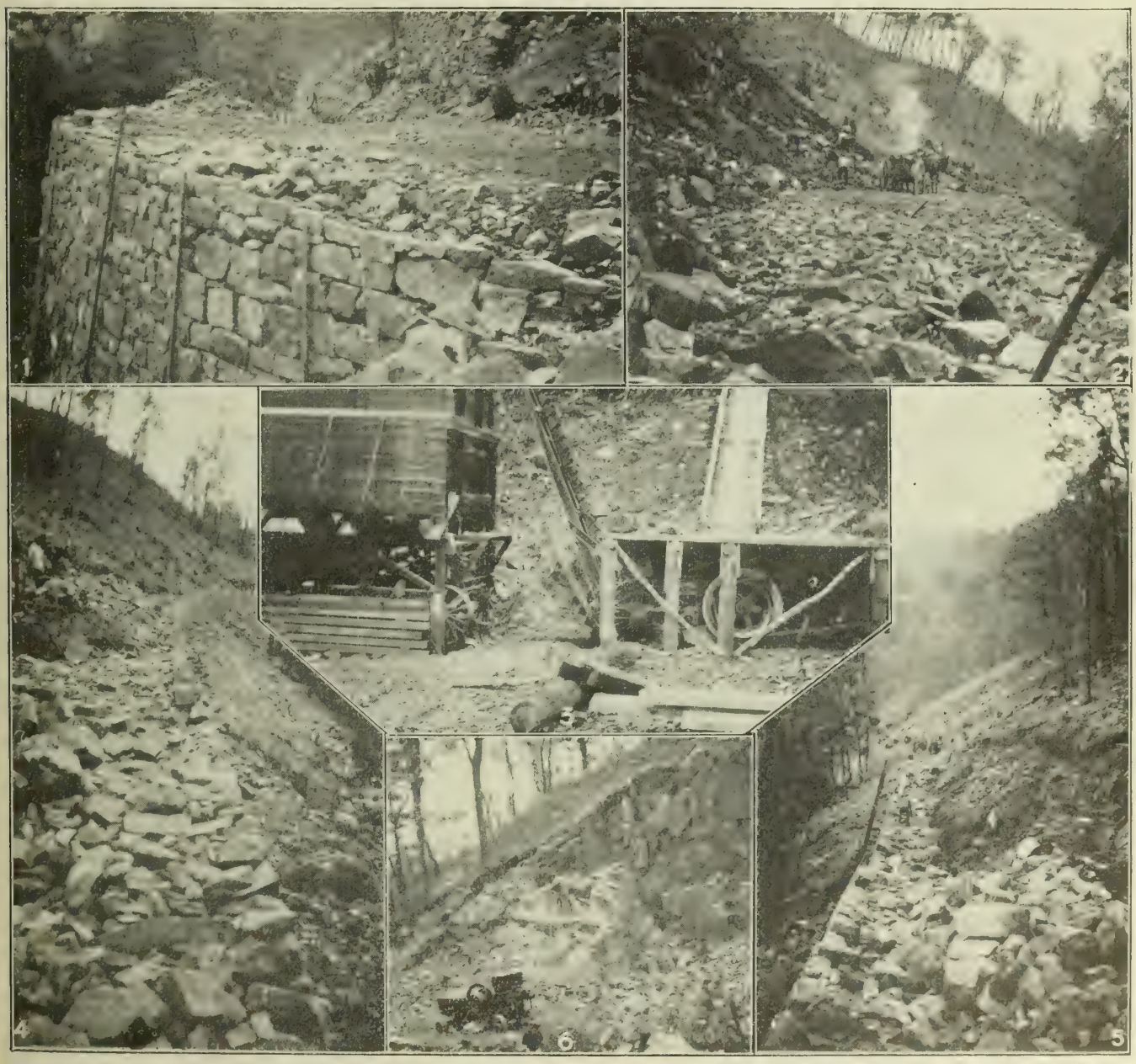
Alpine Roadbuilding in the Hudson River Valley

Northwest of the town of Nyack, Rockland County, N. Y., a 3-mi. section of state road is under construction amid such picturesque surroundings that photographs of the mules working in paths on the sides of the hills have been exhibited as pseudo-Alpine scenes. The road here is half or three-quarters of a mile back from the Hudson River, gradually climbing up the face of the hills which border the river valley. The road cuts through this divide at about the middle point of this contract section—a very happy arrangement, as will be shown.

The side-hill slope averages probably about 45°, but is steeper in many places. It is about the angle of repose for a great mass of traprock fragments that cover the hill sides, while the hills themselves are largely composed of solid trap, with a rather light surfacing of earth. The old road follows the foot of this steep slope to a natural gulch, where a "hairpin" curve, so called, practically doubles the road back on itself—what would be a switchback in railway terms.

The plans and cross-sections for this stretch of highway made the roadbuilding look like a fairly rugged proposition; and to pass along the old road and look up at the survey center line on the mountain side probably did not detract from the preconceived ideas that the road was one of extreme difficulty to build. The estimated quantities in round numbers were 12,500 cu.yd. of earth excavation, 5,000 cu.yd. of rock excavation, 1,500 cu.yd. of dry-laid walls and 250 cu.yd. of mortar-laid masonry. Bidders were comparatively few and prices were high.

The successful bidder was the Brady-Oltarsh Construction Co., New York City, and the contract prices were: Earth excavation, 40c. per cu.yd.; rock excavation, $1.50 per cu.yd.; dry wall masonry, $4 per cu.yd.; telford base for pavement (in place), $1.45 per cu.yd.; foundation course for a penetration bituminous-macadam pavement, $2.50 per cu.yd.; surfacing stone, $2.75 per cu.yd. The time allowed for completion is 140 working days.



FIGS. 1 TO 6. BUILDING A MOUNTAIN ROAD THROUGH A SECTION OF THE HUDSON RIVER VALLEY, NEW YORK

So much ingenuity has been used by the contractors that instead of an extremely difficult job it turns out to be one of comparative simplicity. Work was begun at the "hump" in the middle of the contract. The object of this is to have no uphill hauling. A mule path was first dug along the mountain side, on the outer line of the projected road, and the dry-masonry retaining wall started. The stones for the walls were within easy reach, as the views show. The wall building and excavation were carried on alternately. The wall was built up a little and then the fill was widened a little by excavating into the mountain side. In some places it was merely necessary to start a small slide from above and the fill made itself. Meantime some of the rock was hauled back to the beginning of the contract section to make the telford foundation.

At a convenient place on the old road, about 25 or 30 ft. (vertically) below the new location, a portable stone-crushing plant has been erected (Fig. 3). A wooden chute leads to the crusher platform from the edge of the retaining wall above. The stone excavated from the road bed or picked off the mountain side is brought to the mouth of the chute, sent through the crusher and hauled to the pavement by 7-ton motor trucks. The whole lay-out is a study in conservation of material, equipment and effort.

A steam road roller is about the only heavy equipment on the job. Single-mule stone boats are used for handling the heavy stones to wall or crusher. A small portable gasoline-engine air compressor operating a small hammer drill (Fig. 6) is being used for rock excavation. This has been found by experience on this job to do the work of four hand drillers.

The roadbed construction is substantially the same as that designed for the Storm King road, described in *Engineering News* of Oct. 14, 1915, p. 724. The retaining walls are dry masonry with a 5-ft. top wall of masonry laid in cement mortar. The dry walls are laid with a face batter of 1 on 6, and a base width of one-half the height. The road is officially known as County Highway No. 1295. The plans and specifications were prepared by the State Highway Department. H. Eltinge Breed is First Deputy Commissioner in charge of design and construction and B. H. Waite is Division Engineer.

Is a Part Stronger Than the Whole?

By R. Fleming*

The object of this article is to throw light on the question whether a structure or a member may sometimes be strengthened by cutting away part of it—a question which in some form often confronts the structural engineer.

Case 1—In a group of buildings now being finished there are many eccentric connections. The detail shown by Fig. 1 is used several times.

According to accepted rules the shear on the lower rivet is 3,000 lb. due to the direct pull of the rod, plus 1,800 lb. due to rotation about the center of gravity of the four resisting rivets. This equals 4,800 lb., which exceeds the allowable shear of 4,000 lb. on a rivet. If the plate were cut along the dotted line or the upper rivet knocked out, there would be no tendency to rotation and the shear on the remaining three rivets would be 4,000 lb. each. Shall the erector go over the work and knock out the upper rivet? In this particular detail it could be done, but in other places, where the connection is made eccentric to take a strut, it would be difficult to make a change. What shall be done?

Case 2—This case is largely hypothetical, but well illustrates the point. The architect's design of a building called for some 12x12-in. wooden columns 20 ft. long resting on a 24x24-in. cast-iron base. According to the formula used the columns were good for a load of 115,200 lb., equivalent to 800 lb. per sq.in. of cross-section. The contractor happened to have on hand some 12x16-in. timbers and used them as shown in Fig. 2.

For such a column, according to the Rankine formula for eccentric loading, the stress varies from 150 to 1,050 lb. per sq.in. If the timber were sawed along the dotted line, there would be no bending and the allowable stress

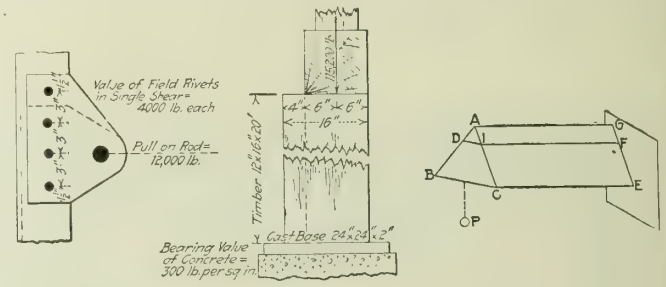


Fig. 1 Fig. 2 Fig. 3

Fig. 1—Eccentric connection. Are three rivets stronger than four? Fig. 2—Post on eccentric base-block. Fig. 3—The triangular beam—Emerson's paradox. Reproduction of Emerson's Fig. 15, Pl. XI

of 800 lb. per sq.in. would not be exceeded. Shall this sawing be done?

Case 3—Three years ago an engineer designed the foundations for a 36-story building in New York City. The footings consisted of distributing girders resting on a concrete caisson 6 ft. wide, about 50 ft. deep, running through about 10 ft. of hardpan to rock. The column center was 2 ft. from one edge of the caisson, thus making the load eccentric. For this reason the design was condemned. Had the caisson been 4 ft. wide, there would have been no criticism. But a pneumatic caisson cannot be built 4 ft. wide. At least 6 ft. is required to give a practical working-chamber underneath. The question was purely whether a 4-ft. wall was weakened by adding 2 ft. to one side. The two engineers that had final authority in the matter decided it was. Were they correct in their decision?

Johnson concludes the article, "Weakening Effects of Eccentric Loading," in his book, "The Materials of Construction," with: "Hence we may say that the addition of material on one side of a member subjected to a direct stress symmetrically placed weakens it until the added material has exceeded twice the original thickness of the member, the maximum weakening occurring when the added material is one-half the original thickness, when the enlarged member is only three-fourths as strong as the original member." The mathematics of the article is simple and perfectly correct, but is the conclusion always true?

In the *Proceedings of the Engineers' Club of Philadelphia* for October, 1891, there is a communication from Prof H. W. Spangler, "Rupture Under Tension Unsymmetrically Applied," in which he quotes a letter from the president of the club: "The original investigation of the

*American Bridge Co., 30 Church St., New York City.

strength of a flat bar of increasing width to one side of the line of strain and the discovery that the weakest section in such a bar is 1.5 times the width of the section subject to uniform stress should be credited to Mr. Carl G. Barth. . . . It was surprising to be told that as the bar widened, it at first grew weaker and then stronger . . . but an investigation of the problem showed that it yielded readily to the following analysis, which confirms the statement and shows how easily structures may be weakened by an abundance of badly disposed material."

The *Home Study Magazine*[1] for September, 1897, has an article, "Eccentric Loads—Some Surprising Facts—Gaining Strength by Removing Material," by Carl G. Barth, closing with: "We now draw the rather astonishing conclusion that more or less strength is always gained by the removal of the eccentric portion of an eccentrically loaded rectangular section, so long as such removal involves less than two-thirds of the total section."

The idea of a part being stronger than the whole is by no means new. Emerson's "The Principles of Mechanics"[2] was regarded as an authority in England 150 years ago. Near the close of the section on "The strength of beams in timber" are the few lines stating what is known as "Emerson's paradox." They read: "Let AE (Fig. 15, Pl. XI) be a beam in form of a triangular prism, and if $AD = {}^1/_9\ AB$, and $AI = {}^1/_9\ AC$, and the part $ADIF$ be cut away parallel to the base, the remaining beam $DICEF$ will bear a greater weight P, than the whole $ABCEG$, or the part will be stronger than the whole, which is a paradox in mechanics." See Fig. 3.

Emerson gives no proof of his statement, but follows it with the sentence: "And upon the same principles an infinite number of questions of like kind may be resolved, which are curious enough and of great use in the common affairs of life."

In the *Philosophical Transactions of the Royal Society of London* for the year 1818 there is a paper, "Account of Experiments on the Strength of Materials. By George Rennie, Jun., Esq." A portion records "experiments made on the transverse strain of cast bars, the ends loose, June 8, 1817." An interesting extract is: "The paradoxical experiment of Emerson was tried, which states that by cutting off a portion of an equilateral triangle (see page 111 of Emerson's 'Mechanics') the bar is stronger than before, that is a part stronger than the whole. The ends were loose at 2 ft. 8 in. apart as before. The edge from which the part was intercepted was lowermost, the weight was applied on the part above, it broke with 1,129 lb., whereas in the other case it bore only 840 lb."

A name well-known in engineering science is that of Hodgkinson. The *Report of the Seventh Meeting of the British Association for the Advancement of Science* (held at Liverpool, September, 1837), being Vol. VI of the British Association Reports, includes a paper, "On the relative Strength and other mechanical Properties of Cast Iron obtained by Hot and Cold Blast. By Eaton Hodgkinson, Esq." Experiments 8 and 9 for Transverse Strength were with cast bars, the section of which was an isosceles triangle, the base being 1.43 in. and each side 2 in. Experiment 10 was with a bar same as in 8 and 9 but with one-tenth the depth taken off the vertex. In all cases the bars were cast 5 ft. long and were supported on props 4 ft. 6 in. apart. The vertex was downward. Hodgkinson writes: "The breaking weights of the whole triangle, in the hot blast were 672 and 812 lb., mean 742 lb. and of the frustum 782 lb. In the cold-blast iron the whole triangle was broken with 815 lb. and the frustum with 677. The difference in the transverse strength of the hot- and cold-blast Carron irons, No. 2, is very small, the ratio between them being 99 to 100. We may therefore assume their strengths to be the same, and taking an arithmetical mean between all the strengths we have strength of triangle 766 lb., strength of frustum 702 lb. The frustum is therefore weaker than the triangle."

Coming now to Saint-Venant, "the foremost of modern elasticians," we find that his "Résumé des Leçons . . . par Navier," Paris, 1864, devotes 100 pages to "Rupture par Flexion." Professor Pearson thus comments on this portion of the book:[3] "This practically deals with the formula for the maximum moment, $M_0 = \frac{T_0\, w\, K^2}{h}$ . . . Saint-Venant holds that if T_0 be the stress at which enervation commences, we have in reality a condition for the safety of a permanent structure. . . . On pp. 95-101 our author treats of 'Emerson's paradox' or the existence of 'useless fibers.' In other words, the expression $\frac{w K^2}{h}$ can be occasionally increased by cutting away projecting portions of w. We have the cases of beams of square, triangular and circular cross-sections fully treated, as well as that of the *croix d'equerre*. The elastic failure of such outer fibers does not, however, denote that the truncated section possesses greater strength than the complete section as Emerson argued from the formula, Rennie confirmed and Hodgkinson refuted by experiment. Saint-Venant very aptly terms them *fibres inutiles*."

Quoting once more from Professor Pearson[4] (referring to the Hodgkinson experiments): "Here it seems to me that theoretically the triangle would certainly show rupture at a less load than the frustum, but it does not follow because the vertex of the triangular prism was ruptured that the triangle itself would break at a *less* load than the frustum." It is clear that in theory a crack should not extend down into the part that would stand the stress alone. Some think[5] that in actual practice if a crack ever started it would continue past the critical point and sever the beam.

In conclusion, the writer recognizes with Saint-Venant and Professor Pearson a distinction between rupture and strength. The fallacy in Barth's analysis of the tension in a flat bar with an eccentric pull is the premise, "Since the bar is only as strong as the outside fibers. . . ." Returning to the three instances cited in the beginning of this article: It is not believed that the wooden column in Case 2 will be strengthened by cutting off a part of it, or that the concrete caisson in Case 3 was weakened by adding 2 ft. to one side. And Case 1 in which he has been particularly interested remains as it was detailed and erected—no field rivets were knocked out.

[1] The "Home Study Magazine" was one of the many predecessors of "Power." It was published from 1896 to 1898.

[2] William Emerson (1701-1782) was the author of a number of mathematical treatises. The first edition of the "Mechanics" was published in 1754, the second in 1758, and many subsequent editions were called for. The writer has seen London editions bearing dates as late as 1827 and 1836.

[3] "A History of the Theory of Elasticity and of the Strength of Materials." Todhunter and Pearson, Vol. II, page 114.

[4] Todhunter and Pearson, Vol. I, page 515.

[5] "Engineering News," Vol. 62, page 439 (Oct. 21, 1909).

Connecticut Shipping Terminal at New London

By W. E. Clarke*

SYNOPSIS—A 1,000-ft. pier, 200 ft. wide, being built by the State of Connecticut at a cost of $1,000,000. Article outlines the alternative designs which were prepared and describes the design now being executed, which is a fill inside of masonry bulkheads, with ouiside deck made up of precast concrete slabs resting on creosoted timber piles. Specially designed for a commercial life of 25 years.

In 1911 the Legislature of the State of Connecticut appropriated $1,000,000 to be used for the construction of a steamship terminal at New London. Field operations were begun in August, 1912; wash borings were taken, and a detailed survey was made to determine the material under the foundation of the structure.

It was understood, first, that a complete unit of a steamship terminal should be constructed with the $1,000,000 available; that it should consist of a pier, shed, warehouse, track connections and a storage yard; that these factors should be so balanced and equipped that all classes of freight might be handled; secondly, that the type of construction adopted should be such that the money expended would earn a maximum rate of interest as a direct investment.

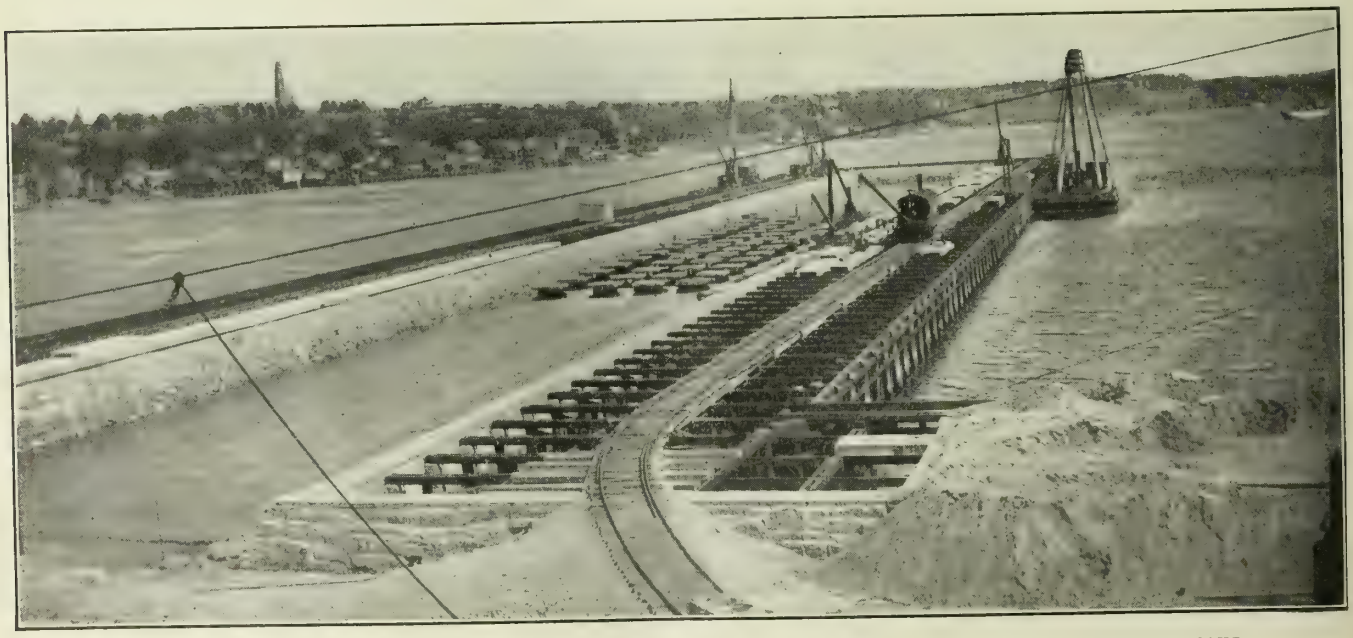


FIG. 1. RECENT VIEW OF NEW SHIPPING PIER UNDER CONSTRUCTION AT NEW LONDON, CONN.

Commercial Life of Terminal Unit

The commercial life of the unit was assumed to be 25 yr. This assumption was based on the belief that even though the unit was built to meet the maximum requirements of the present time, 25 yr. would so change the equipment used in transportation that an entirely new structure would be necessary. This period is the commercial life of the unit. The commercial life may be further defined by saying that it has ended in a given structure when that structure cannot be used without an annual loss due to obsolescence and age great enough to pay the prevailing interest on a sum sufficiently large to replace the structure by a new one for the same business.

This statement becomes interesting at this time to show the relation of the first cost, interest rate, maintenance and depreciation. Let

R = Income from handling goods;
I = Original investment;
r = Rate of interest on the original investment, and maintenance increments;
M = Annual maintenance and depreciation.

For the first year's operation R should equal $Ir + M$. For public property the value of R should be made such that r shall equal only the prevailing rate of interest. If 25 yr. is the assumed commercial life of the structure, there would be no advantage in building any part of it to last a longer period. The annual cost, $Ir + M$, is the first term of a progression in which 25 is the number of terms and $1 + r$ is the ratio. The serial sum of this maintenance and interest is for $r = 0.05$,

$$\frac{(Ir + M)(1.05^{25} - 1)}{(1.05 - 1)} \qquad (1)$$

Expression (1) reduces to

$$2.4\,I + 48\,M \qquad (2)$$

The total cost of a structure for the period of 25 yr. will then be (2) plus the initial cost I, or

$$3.4\,I + 48\,M \qquad (3)$$

Of two structures having equal facilities for operation, the one that will make expression (3) the smaller is the more economical type of construction to be used.

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To further illustrate assume that a wood wharf structure costs \$1.50 per sq.ft.; that a steel one covered with concrete and assumed to be permanent costs \$4 per sq.ft.; that depreciation and maintenance on the former is \$0.10 per year, and on the latter, \$0.00. By substituting in the expression (3), the economic advantage of the former is as 9.91 is to 13.60. That is, the cost of each square foot of the timber wharf 25 yr. hence is \$9.91, whereas the cost of each square foot of permanent construction would be \$13.60. There is an advantage of the concrete construction in insurance against fire and a point in favor of the wood construction in this case based on the assumption that there would be no maintenance for the concrete-steel construction which, of course, would not be literally true.

If in (1) r is made 0.04, (2) will become $1.66\,I + 41.50\,M$, and (3) will become $2.66\,I + 41.50\,M$. That is, the cost of one square foot at the end of 25 yr. would be \$8.14 for the wood construction and \$10.64 for the permanent construction. The effect of the change in interest in this case from 5 to 4% illustrates the general principle that with a fixed economic advantage the lower the rate of interest the more permanent the type of construction feasible.

Since even the substructure of a pier is more or less complicated, in order to find the most economic design, it has been necessary to make preliminary designs and estimates of several different types. These were known as schemes A, B, C, D and E.

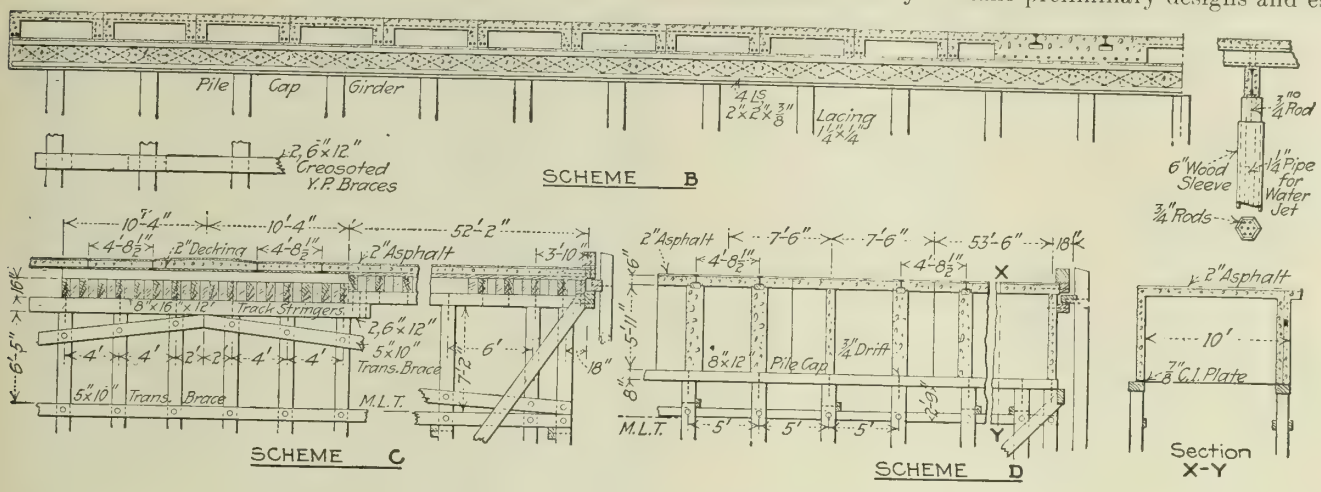


FIG. 2. ALTERNATE DESIGNS FOR NEW LONDON STATE PIER
None of them was accepted

Alternative Designs; Steel-Cylinder Type

The foundation of the site of the proposed structure is sand, gravel and boulders. In some places the material is light. It required 30 to 40 ft. of penetration of a 13-in. pile to bear 20 tons as given by the *Engineering News* formula. This uncertainty of the foundation made the adoption of a complete filled pier with deep retaining walls out of the question. For the purpose of computation for the different schemes shown, a pier 125 ft. wide and 1,000 ft. long, with two bulkhead sections, has been assumed.

The subfoundation for the pier known as Scheme A consisted of steel cylinders 4.5 ft. in diameter driven as an open caisson over nine piles which are cut off at the

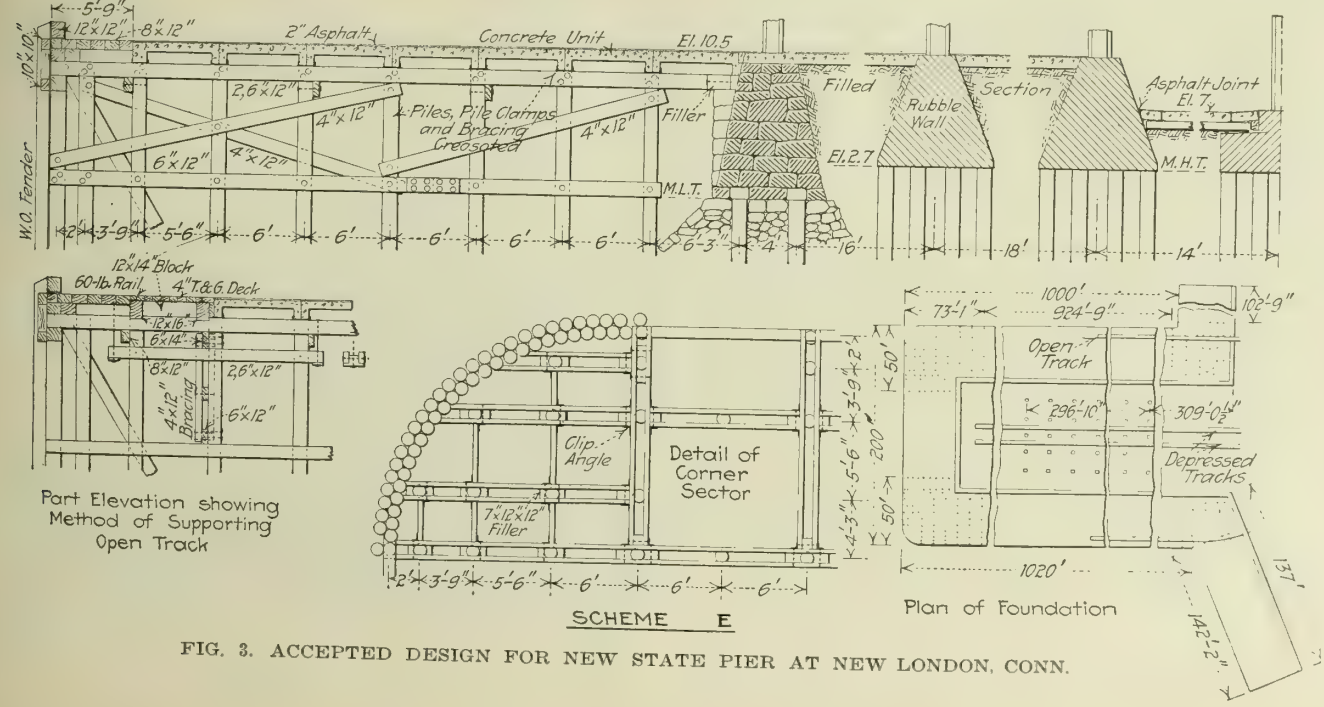


FIG. 3. ACCEPTED DESIGN FOR NEW STATE PIER AT NEW LONDON, CONN.

elevation of the harbor bottom. Concrete is then to be deposited around these piles with a drop bucket, from 2 to 12 ft., and allowed to set; after which the water is pumped out of the caisson and the remaining space filled with concrete. The top of the caisson is at elevation 3 ft. above mean low tide. A stone cap is placed on top of the concrete pier and the steel floor system placed directly on this cap. The range of tide at New London is about 3 ft. A stone cap was used in preference to concrete, as it would better resist the action of sea water during the winter months. All steel is protected with a covering of concrete.

The only questionable element in this type of construction is the concrete that is poured around the pile tops to seal the caisson. In soft soil it would be necessary to make this section sufficiently deep to balance the total hydrostatic head. This would require 15 ft. of concrete Because of the method of pouring this concrete, the strength of it would be in doubt. In addition to this there is a possibility, if not a probability, that the boulders that exist in the soil on the proposed site would make trouble in keeping the piles in clusters close enough to permit the cylinders to pass over their tops. Since these piers are designed to retain the total load of 240 tons, it is necessary to bring this with steel girders to the pier, greatly increasing the cost of the steelwork over what it would be for spans of one-half or one-third those given. In spite of the uncertainty and extra cost of the type of construction mentioned, many engineers have used it during the last few years, doubtless believing the disadvantages less than for those of many other types that might have been used under like circumstances. For the comparison of all schemes shown, r is assumed to be 0.05. The estimated cost per square foot is $3.25 for Scheme A. This design is not shown in the accompanying sketches.

The maintenance is assumed as follows: Asphalt surface, $0.01 per sq.ft. per yr.; fender system, $0.01; concrete, etc., $0.004; total, $0.024. Inserting these quantities in (3), the cost for the period of 25 yr. is found to be $12.20.

Creosoted-Pile Substructure

The next type investigated, shown as Scheme D, contemplated the use of creosoted piles driven in bents 10 ft. apart with piles 5 ft. on centers. These were cut off at 3 ft. above mean low water and capped with a timber and a cast-iron bearing plate. Obviously, the cap mentioned and some of the piles, at least once during the period of 26 yr., would need to be replaced. The replacement of timberwork beneath a solid-concrete deck is difficult and very expensive. To overcome this difficulty a box unit of concrete was used, to be precast and cured in the yard and set on the cast-iron bearing plates by means of a derrick lighter. Pipe sleeves are inserted at the four corners to receive eye-bolts for making fast to the unit. The joints between these units are to be calked with oakum and the whole surface covered with 2 in. of asphalt. At any time it is desired to repair the woodwork of the substructure it will only be necessary to remove the asphalt and lift as many units as required, replacing the timberwork from the top. In cases where the creosoted piling is long, the 8 ft. of piling saved would be of advantage in getting low prices. A disadvantage is the fact that whatever bracing of the bents is necessary would have to be done at mean low tide or under water



FIG. 4. CONCRETE GIRDERS ON NEW LONDON PIER CAST IN PAPER SHEETING

with a consequent increased cost of maintenance work. The first cost of this pier is $1.78 per sq.ft. The maintenance is estimated as follows: Asphalt, $0.01; fender system, $0.01; track and woodwork, $0.02; total, $0.04. This gives $7.97 as the cost of the structure at the end of the 25-yr. period.

All-Concrete and Standard Timber Types

The next type of structure investigated (Scheme B) was a complete concrete pier, concrete pile bents spaced 15 ft. apart with a concrete girder cap tying the piles



FIG. 5. TESTS OF REINFORCED-CONCRETE SLABS FOR NEW LONDON PIER

together and a concrete U-section deck, showing in Fig. 2. It was thought that one of the principal disadvantages of this type would be the action of the sea water on the piles around high tide. To overcome this action a wood sleeve is provided, lined and attached as shown. The reinforcement used in the concrete cap is structural steel tied to the concrete pile with a bolt. On the cap rest concrete unit sections for a floor system. The legs of the units are tied to the pile cap at each bearing, by means of bolts through the legs of angles and extending into the units as bond rods. The floor units are to be cast in alternate sections on a checkerboard plan to overcome the effect of expansion and contraction due to congealing of the concrete and to temperature changes. A spring-fender system of timber is placed on the outer edge of pier to absorb as much as possible of the shock due to the rolling of ships, etc.

The cost of this pier, as estimated and given, is $1.88 per sq.ft. The maintenance is as follows: Asphalt, $0.01; fender system, $0.01; tracks and concrete protection, $0.01; total, $0.03. This would give $7.65 for the cost of the structure per square foot 25 yr. hence.

Scheme C is a standard type of timber construction with a concrete deck and asphalt pavement. It involves no extraordinary feature of design. The estimated cost is $1.83 per sq.ft. for installation.

The maintenance could be rated as follows: Asphalt, $0.01; fender system, $0.01; bracing and piles, $0.013; caps and stringers, $0.03; floor plank, $0.02; total, $0.083. This would give $10.20 per sq.ft. as the cost 25 yr. hence, and it is highly probable that the maintenance charges would exceed even those given.

Type of Pier Under Construction

As a result of the foregoing computations and estimates, another type was made, shown at Scheme E, which involves some of the construction of all the other types. This design was adopted and is now building. The width of the pier is made 200 ft. instead of 125. The central core 100 ft. in width is a filled section. This fill carries two central tracks, water-piping foundations for a warehouse, etc. Increasing the width of the pier makes it possible to put a large warehouse on the central section for time storage, thereby saving to a certain extent the usual cost of transporting goods from the warehouse to the pier. The method of construction has been to first drive the piles shown as bearing piles in Fig. 3. These inclose the filled area. Riprap is then placed around these piles to the elevation of mean low tide, which is the cutoff of the piles.

The stones indicated as channel stones were placed and 2-ply "Paroid" paper pressed in between them, forming a channel directly over the top of the piles. In the channel thus formed, a reinforced-concrete girder was made containing about 1% of steel in the bottom and anchored to the piles with bond rods drifted into them (Fig. 4). These girders were put in at low tide. The paper was sufficiently strong to prevent any loss of cement. This method of forming the foundation of the wall is somewhat of an innovation, but it has worked out satisfactorily and is believed to be preferable to a wood or stone platform or grill because it insures a bearing on each pile whether it is in good alignment, cut off exactly level or not. The piles were cut off with a circular saw attached to a framework operating from the platform above.

The deck of the platform outside of the rubble wall is composed of precast sections of reinforced concrete. It will be seen from Fig. 3 that the cross-section of these units is that of the letter U. They are for the most part 22.83 ft. long, 6 ft. wide and weigh about 7 tons. They are laid to break joints, each one to rest on three supports, but not reinforced to be continuous over the middle support. Cast-iron plates are placed on top of the piles and pile clamps for the legs of the unit sections to rest on. The corrugated section of the floor thus formed allows air to circulate around the pile clamps, thereby lessening the danger of dry rot. The unit sections are not fastened to the timberwork and are laid with a slight clearance at the edges and ends, leaving joints to be filled with a mastic. This arrangement was made to add to the nonrigidity of the structure, so as to obviate, as far as practicable, damage to boats in rolling against the edge of the pier. The outer edge of the pier is of timber construction, having a solid fender system such as used in New York Harbor.

Slip Details; Progress of Work

The slips are 150 ft. wide on either side of the pier and have a depth of 33 ft. at mean low tide. A heavy cast-iron bit has been designed, having two posts tipped back from the face of the pier to prevent, as far as practicable, the hitch from slipping up and off. Fig. 4 shows the column foundations for the warehouse, also the depressed tracks on the center of the pier. The photograph, Fig. 1, shows the state of completion of the work about June 1, 1915. The rubble masonry wall is nearly completed. Some of the unit floor sections can be seen as placed in their final position.

The cost per square foot of the structure is $1.38. The maintenance (the items referring to timberwork being corrected in the ratio of the platform or timber section to the filled section) may be estimated as follows: Asphalt, $0.01; fender system, $0.0056 ($0.01 \frac{1}{2}\frac{2}{1}$); bracing and piles, $0.0033 ($0.006 \frac{1}{2}\frac{2}{1}$); tracks and concrete deck, $0.005; total, $0.0239.

The total area of the pier is 221,000 sq.ft. The total cost for the 25-yr. period, on the basis previously computed for the other sections, is $5.85.

Tests of the Unit Floor Slabs

The concrete used for the floor units is a 1:2:4 mix. The sand used is from Long Island; the stone, local gravel or crushed trap rock. A unit made November, 1914, with gravel aggregate, local sand and Alsen cement, was tested to destruction. The sand ranged from very fine to gravel ½ in. in diameter. The stone was crushed cobbles ranging from crusher dust to stone 2½ in. in diameter. The unit was supported on three carefully placed supports similar to the pile caps, leaving two equal spans. A load was applied at the middle of these spans. The loads were applied in separate increments by placing units as shown in Fig. 5.

1. Total load, 52,349 lb.; stress in concrete, $c = 242$ lb. per sq.in. (computed); stress in steel, $s = 10{,}340$ lb. per sq.in. (computed). There were no cracks in the unit. It was acting as a continuous beam under this load.

2. Total load, 65,925 lb.; $c = 323$, $s = 13{,}830$. There were no cracks in the unit.

3. Total load, 79,170 lb.; $c = 391$, $s = 16{,}700$. The tensile strength of the concrete over the middle support

dropped a few minutes after this load was applied. For the rest of the loads the unit acts as two simple beams.

4. Total load, 92,821 lb.; $c = 729$, $s = 31{,}100$. Small diagonal cracks appeared leading from the point of application of the loads.

5. Total load, 109,922 lb. A short time after this load was applied, the tension steel pulled through the leg, rupturing it. The unit failed by lack of bond on the rods near the supports. This perhaps would have been greater had the leg of the unit been thicker. There were two rods, 1 sq.in. each, in a 7-in. leg. The bond on the rods computed as 151 lb. at rupture. The shear through the legs computed at 78 lb. The equivalent uniform load on the unit would have been about 1,600 lb. per sq.ft.

Engineers and Contractors Engaged

This work is being carried out under the supervision of the Rivers, Harbors and Bridges Commission of the state. William T. Donnelly, of 35 Battery Place, N. Y., was employed as consulting engineer of the project. W. E. Clarke, formerly construction engineer for the United Fruit Co., located at Bocas del Toro, Panama, was employed as resident engineer and is in charge of the work.

The T. A. Scott Co., of New London, has the general contract, and the New England Construction Co., of Springfield, Mass., has the subcontract for the masonry.

The compilation of the material and studies presented here were made by G. L. Bilderbeck, Assistant Engineer, under the direction of the writer.

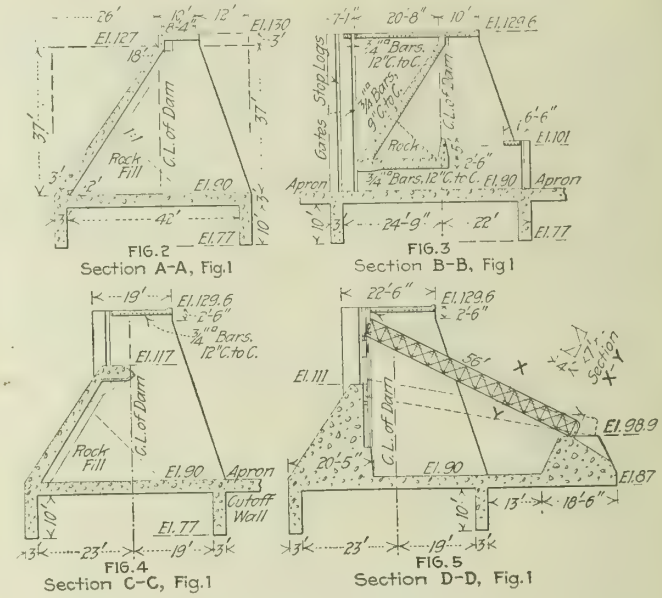
$101,000 Hollow Concrete Dam, St. Francis River

The $400,000 water-storage and regulation scheme proposed by the Quebec Streams Commission for the St. Francis River in the Province of Quebec was briefly noted in *Engineering News* of Sept. 2, 1915, p. 457. Contract for the storage dam has recently been let to Madden & Co., of Quebec, for $101,000.

The regulation scheme briefly comprises a large storage dam at the outlet of Lake St. Francis and the purchase of about 4 sq.mi. of land to be flooded and power rights now held by individuals on Lake St. Francis and Lake Aylmer (just below). By raising the water level of Lake St. Francis 27 ft. the storage capacity will be increased by 438 sq.mi.-ft., making it feasible to regulate for a constant discharge of 600 sec.-ft., which is an increase of 500 sec.-ft. over the present minimum.

The total fall along the river is about 900 ft., so that about 41,000 hp.-yr. additional is possible; but only 200 ft. available head is now utilized, so that the increase of power from the scheme will be about 6,000 hp.-yr. The present power users will be charged a sum per horsepower of increased capacity sufficient to cover the investment and maintenance of the storage scheme.

The dam itself, some typical sections of which are shown in the accompanying sketches, is to be of a hollow type, with reinforced floor slabs supporting a series of



FIGS. 2 TO 5. SECTIONS THROUGH THE ST. FRANCIS DAM

Fig. 2—Through typical panel. Fig. 3—Through sluices. Fig. 4—Through spillway. Fig. 5—Through log slide

buttresses, which in turn on the upstream side carry a deck slab, flat on the outside face and arched on the inside (15-ft. radius). The buttresses also carry a concrete roadway.

The buttresses are 5 ft. thick and are on 20-ft. centers generally. In the gate section the buttress faces are vertical and have stop-log and gate grooves, as shown in Fig. 2. At the log sluice also the buttresses have a vertical face and show stop-log and log-slide grooves. The deck is carried on seats. The deck slab has the slope of the buttress faces, except for a vertical top section. At the log sluice a solid wall replaces the deck slab, as shown in the section, Fig. 5.

The floor slab varies in thickness from 15 to 36 in. The reinforcement is of ¾-in. square twisted steel bars bent so as to be 3 in. above the bottom of the slab at buttresses and 3 in. below the top of the floor between buttresses. The inner corner between the deck and floor will be filled with rock and faced with mortar. The two cutoff walls will be 3 ft. thick and 10 ft. high. At the end panels they are joined and run as a bulkhead into the banks. Cutoff walls and floor are monolithic. For floors, buttresses, aprons, etc., the concrete will be a 1:2½:5 mix, and for the deck slab and arches a 1:2:4 mix.

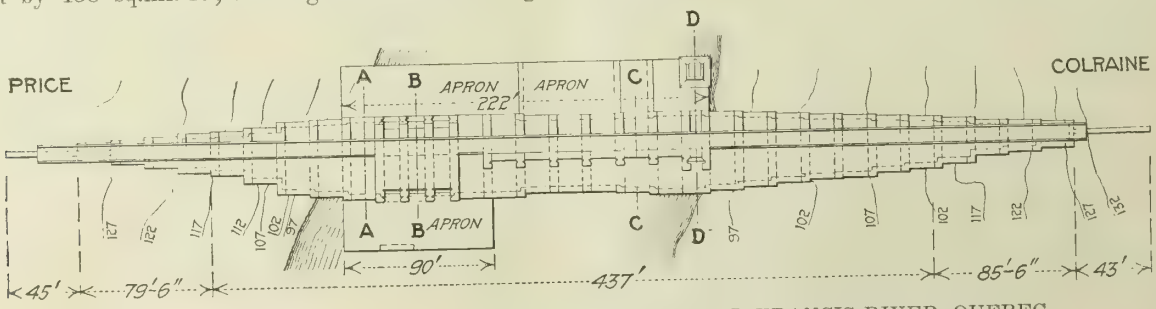


FIG. 1. PLAN OF HOLLOW CONCRETE STORAGE DAM, ST. FRANCIS RIVER, QUEBEC

The river bed at the site of the dam shows stiff clay, with small boulders and gravel. Solid rock was found at 14 to 48 ft. During construction the river will be diverted through a cut channel and the bed excavated for foundations in hardpan (2 ft. before natural bottom).

The work is being done under the direction of the Quebec Streams Commission, Hon. S. N. Parent, Chairman; O. Lefebvre, Chief Engineer, and Arthur Amos, Hydraulic Engineer.

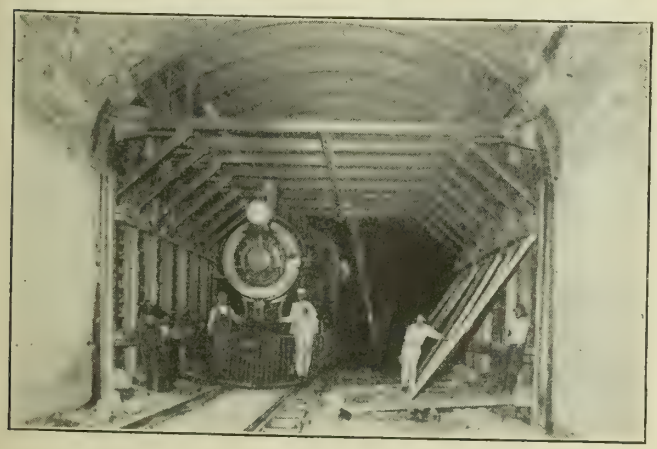
Lining a Railway Tunnel by Compressed Air

The concrete lining of the double-track Diana tunnel on the Louisville & Nashville R.R. has been placed by the pneumatic system. The tunnel is on the new line to Birmingham, Ala. (*Engineering News,* Feb. 5, 1914). It is 1,520 ft. long, in limestone and shale, and required timbering throughout. For about 300 ft. at the north end this timbering had to be removed in advance of the concrete, but for the remainder of the distance the tunnel section was large enough for the lining. Traffic was handled on one track.

Steel forms of the Blaw type were used, with steel plates for the side walls and 2½x5½-in. pine lagging for the arch. The sides were stiffened by vertical I-beams, against which were two lines of horizontal timbers secured to the rock by anchor bolts. Struts from the I-beams carried transverse members, on which were mounted jacks supporting the arch ribs. There were two sections of the forms, each 35 ft. long, traveling on rails. The sides of the forms abutted against the footings, which were built in advance of the forms.

The mixer plant was in the approach cut, about 75 ft. from the portal, working first at the south end and then at the north end. Spoil from the tunnel was crushed to form the coarse aggregate. Sand and cement were delivered by cars and hauled up incline tracks to the top of the material bins. The materials were supplied to a measuring hopper, which delivered 10-ft. batches to the mixer chamber beneath.

An 8-in. steel pipe was laid along the subgrade from the mixer to the forms and then turned vertically, ending in a Y with two 8-in. branches. These branches led into the crown of the arch for about 20 ft., each ending in an elbow at the side wall, with a 9-ft. length of 8-in. hose.



PLACING CONCRETE LINING IN A TUNNEL UNDER RAILWAY TRAFFIC

The arch ribs are carried by jacks on the horizontal beams. The diagonal line in the rear is the concrete pipe to the arch

Men with ropes pulled the hose to and fro to secure even distribution of the concrete. The concrete was deposited on one side till the wall was 2 to 6 ft. high; then it was diverted to the other side, in order to balance the pressure on the forms.

For concreting the arch, the hose, elbows and one branch pipe were removed and a short piece of hose attached to the remaining pipe. When the concrete reached the end of the hose, this was removed and the concrete blown in directly from the pipe. The forms were left in place for sixty days at first, but afterward the time was reduced to four days.

Where the temporary timbering was removed the cavities were filled with a packing of 75% limestone screenings and 25% sand, blown in by compressed air.

The work was done in 41 sections of 35 ft., containing about 250 cu.yd. each. The concreting of a section averaged 24 hr., with a minimum of 15 hr. The distance for conveying the concrete by compressed air averaged 400 ft., with a maximum of 925 ft. The force consisted of 13 men for concreting and 10 for constructing the footings and shifting the forms.

The work was done by the Meacham Contracting Co., of Hopkinsville, Ky., using the McMichael pneumatic plant supplied by the Concrete Mixing and Placing Co., of Chicago. It was under the supervision of H. C. Williams, Chief Engineer of Construction, Louisville & Nashville R.R. George B. Bryson was Resident Engineer.

Oakland Municipal Garage

The City of Oakland, Calif., has a municipal garage, established in 1913, which has the care of all motor cars owned and operated by the city except those used by the fire and police departments. There were 18 cars when the garage was started and there are 40 cars now. Operating costs have been made the subject of considerable study and are presented in the 1915 annual report of the Commissioner of Streets.

The functions of the garage have been increased from mere daily care and minor repairs to the full duties of a repair garage, requiring a modern machine shop and an increase in the number of machinists, but resulting in a lower cost per mile in the upkeep of the machines. The garage does ordinary repairing, thorough overhauling once in each 12 or 18 months, body building, upholstering and even the making of parts and rebuilding of entire cars.

A complete check is kept on the use of the machines by an "in-and-out" register. Complete check is kept on the handling of the machines by the "efficiency marking system on auto drivers"; and the segregated cost against each machine gives a complete check on operation.

The table shows the analyzed cost data. These records are kept for the double purpose of checking the efficiency of the garage, car and driver and to serve as a basis for apportioning the cost among the various departments of the municipal government. Comparison with garage-operating costs elsewhere shows these to be unusually low.

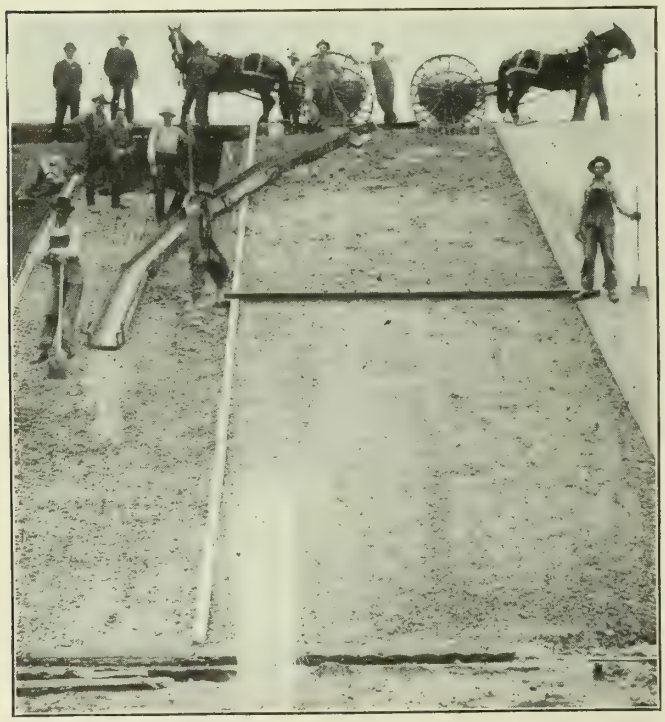
COST OF OPERATING MOTOR CARS, OAKLAND, CALIF.

	1913-14	1914-15
Maintenance cost	$17,541.34	$20,101.78
Number of cars	35	40
Average miles per car	6,683	7,066
Average cost per car	$501.17	$502.54
Average cost per mile	.075	.071
Average miles per gallon gasoline	.....	13.78

Field and Office

Placing Monolithic Lining on Reservoir Bank

Many engineers in the Northwest have contended that the climate is so equable as not to call for expansion joints in reservoirs. L. D. Kelsey, City Engineer of Aberdeen, Wash., had the courage to construct a 7,250,000-gal. reinforced-concrete reservoir without expansion joints. The reservoir is 160 ft. square on the bottom, has slopes of 1 on 2 and a depth of about 25 ft. from the bottom to the top of the embankment. The embankment had to be made by a fill of sand and clay and was settled as the dirt was placed by keeping water from a hose running upon it. This fill was allowed to stand over winter. When the slope and the top were dressed off in the spring the fill was found to be thoroughly compacted, and careful levels showed that no settlement had occurred.



PLACING REINFORCED-CONCRETE RESERVOIR LINING, ABERDEEN, WASH.

The lining of both the bottom and slopes was 6 in. thick, with a toe at the bottom and a parapet at the top of the slope. The lining consisted of a 5-in. concrete base, using one sack of cement to 5 cu.ft. of concrete, and a 1-in. top of 1 part of cement and 2½ parts of sand. The reinforcing (see view) placed at the middle of this 6-in. slab was No. 28 triangular mesh, lapped 4 in. The joints between days' work were made by thoroughly wetting the old surface and dusting with dry cement before the new concrete was placed. The concrete was kept wet one week after placing.

No cracks have appeared except slight hair cracks at the joints between days' work, and no leakage of any noticeable amount has occurred.

Contract Plans for Sewer Work at Columbus, Ohio

The method used in presenting data on the construction plans of the new south-side storm sewer at Columbus, Ohio, appears to have many advantages. Roughly, there is a main storm sewer 6,700 ft. long, of concrete construction, varying in diameter from 108 to 120 in., with a system of connecting laterals varying in size from 12-in. pipe to 72-in. concrete, comprising an area of about 1 sq.mi.

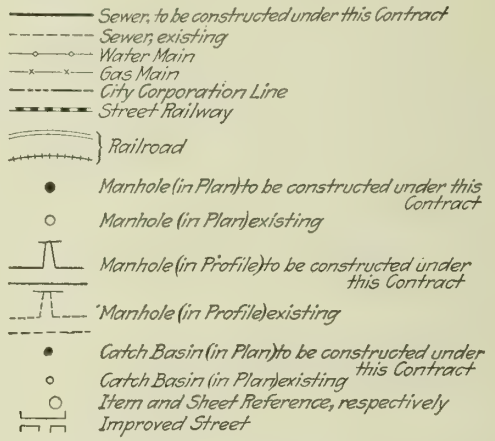


FIG. 1. SYMBOLS USED ON STANDARD SEWER PLANS OF COLUMBUS, OHIO

There are 12 sheets of standard plans, 14x39 in. each. Blueprints of these are folded to 7½x5 in., to just fit the pocket, the title coming in the lower right-hand corner, so that by pressing back the corner of the outside fold the title of each sheet is always exposed. Sheet 1

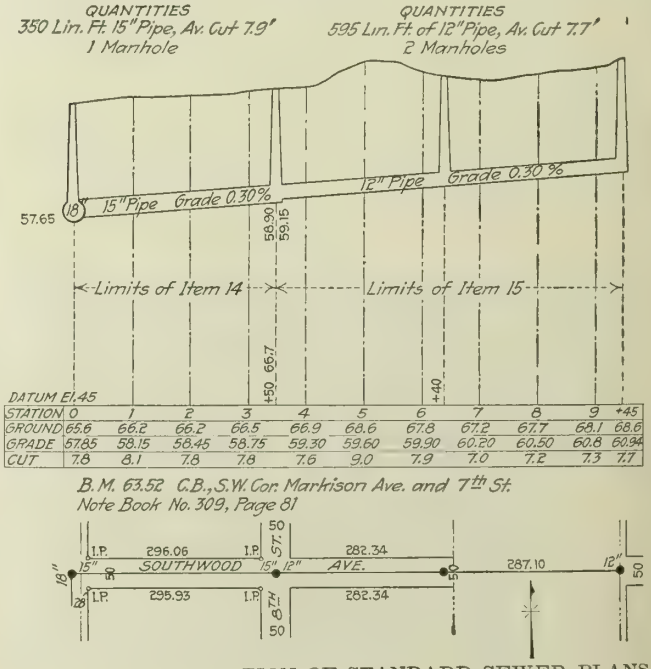


FIG. 2. TYPICAL PORTION OF STANDARD SEWER PLANS OF THE CITY OF COLUMBUS, OHIO

is an index plan of the whole system, showing the size of the various sewers and the sheet number where the details of each section are to be found. Besides these, Sheet 1 contains a list and description of the 52 items of the contract and a list of the items on which alternate bids will be received. The symbols shown in Fig. 1 are used on this plan.

Other sheets, with the exception of Sheet 10, show plans, profiles and details of itemized sections of the different sewers. Sheet 10 shows the standard cross-sections of all sewers. Fig. 2 is a good example of the method in which detail data are presented, which seems to be a particularly handy form for the estimator. Separate bids were received on each of the 52 items and on the alternate designs for the same item.

The City Engineer of Columbus, under whose supervision the plans were prepared, is Henry Maetzel, with W. J. Weaver engineer in charge, and the contractor is the J. C. Carland Co., Toledo, Ohio.

Joints for Wrought-Iron and Steel Pipe*

By R. S. Lord†

The joints in use on wrought pipe have until recent years been threaded. Many different shapes have been used for making the couplings, with some variation in the threads cut. A few varieties will be noted.

Threaded-Joint Pipe Couplings

The standard pipe coupling, Fig. 1, has a comparatively short body with threads out to the extreme edge and is not intended for heavy pressures or difficult conditions. The line-pipe coupling, Fig. 2, is larger and heavier and, in addition to its long bearing of threads, has an overhanging extension, which is intended as a convenience for calking in case of leakage, as well as a reinforcing section. This feature is emphasized in the air-line coupling, Fig. 3, in which the recess for lead is large enough to permit thorough calking. This leading feature is used because of the fact that it is impossible in diameters 4 in. and larger to make screw joints that will hold high pressure of air and gas without probability of leakage.

The inserted joint, Fig. 4, is used in casing where a common collar would obstruct the passage within a larger casing. The flush joint, Fig. 5, is used in the same way where external smoothness is more important than strength. Neither shape is used in pipe lines.

Flanges are rarely used on wrought pipe, except in steam piping and for connections to valves and fittings. In large diameters it is difficult to make the thread in a flange tight; peening the end of the pipe for the purpose of stopping leakage is a common practice. The modern Van Stone joint is an improvement in flanges. It is made by belling out the end of the pipe at right angles to the axis of the pipe. The flanges, without thread but machined to the curve of the bell, are of course put on the pipe before the end is expanded. The gaskets are inserted between the ends of the pipe rather than between the cast flanges.

In the early days of the natural-gas business, engineers, realizing the weakness of large screw couplings, turned to lead for sealing joints. The Kimberley joint, Fig. 6, was a heavy forged collar with ample lead space for calking, but without provision for locking. The Converse joint, Fig. 7, was made by locking wrought pipes in a cast-iron hub by means of projecting rivets on the pipe made to engage in slots inside the hub. When locked the joints were leaded. This joint was in common use for large pipe lines 25 years ago; most of them now have rubber clamped against the lead to stop leakage, or the lines have been relaid with a rubber-sealed joint. The McKee coupling was somewhat like the Converse; the lock was made by a series of rivets set in spiral lines, inserted in spiral grooves, and leaded.

The Matheson joint, Fig. 8, is of bell-and-spigot design, the bell being formed by expanding one end of the pipe sufficiently to inclose the spigot end and the necessary lead space. This joint is in common use for water lines in the West, where freight rates run up the cost of cast iron. When used for gas lines, rubber is usually clamped on to insure tightness as well as rigidity.

Rubber-Packed Pipe Couplings

Rubber-packed couplings have opened a great field for inventors. While many differences in detail are to be noted in the different couplings, they seem to divide readily into two general classes—those intended to be packed by the pressure of fluid carried and those packed by force applied externally, working against the pressure within.

From 1891 to 1905 all Dresser couplings (one of the earliest) were made with cast-iron sleeves, or center rings, as they are commonly called. The first followers, or end rings, were of cast iron, but the change to malleable iron was made quite early. Where cast-iron center rings overlapped the rubbers and the end rings merely served to crowd the rubbers forward into the recesses under the center rings, this proved to be too much of a strain on the latter.

The Dayton coupling, Fig. 10, changed the faces of the center rings and rubbers so that they met on a slope, tending to drive the rubber down against the pipe. The Hammon coupler, Fig. 11, placed the rubber under the projecting edge of the center and the compression was applied by crowding the rubbers forward into the stuffing-box, thus putting the heaviest strain of the compressed rubber on the center ring. The most radical change in the early Hammon coupling was the eccentric feature, which made it fit equally well whether the pipes were laid in a straight line or at an angle up to 10° or 12°. The eccentric features of this coupling required an excess of material and increased the cost, but it still has many friends who, on account of its convenience, will use no other.

In the Custer type (1905) the center ring was made of steel, and the change of material was soon made by other manufacturers. The Custer coupling, Fig. 12, shows a center ring with outwardly flaring bell-shaped rubber recesses and an enlarged interior, giving great room to swing at a sharp angle, if properly controlled, so that an equal pressure can be maintained on the rubbers. In order to maintain this pressure on the rubber, it is necessary to have an end ring with broad face to close the opening, without much clearance. Rubber has

*From a paper before the Engineers' Society of Western Pennsylvania.

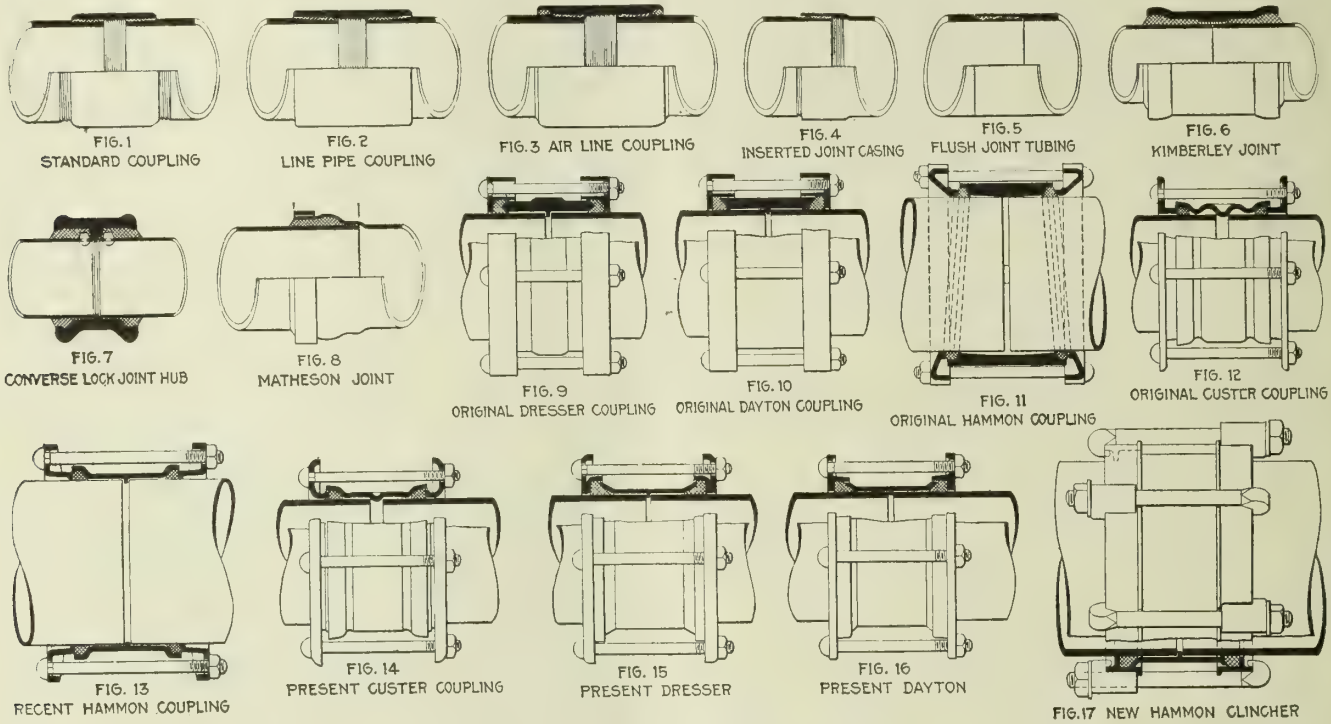
†Vice-President, Hope Engineering and Supply Co., Mt. Vernon, Ohio.

a habit of escaping from pressure by crawling through an opening, and the original Custer couplings were weak along this line.

From the beginning of the steel-center-ring business, the dividing stops or lugs have differed. Neither Custer nor Dayton made a square stop by which the rings could be squared up against the ends of the pipe, and the tendency to slip a lug past the edge of the pipe often made it difficult to shape up the joint as it should be.

Dresser adopted a ridge running entirely around the interior of the center ring, making a square stop that lined up the rings very satisfactorily. This method is now used by Dayton. Hammon has always used square detachable lugs forming a perfect stop to line up the pipe; they can be removed by hammering if it is desirable to use the ring as a sleeve.

An entirely new coupling is being made by the Hammon company and is largely the invention of H. D. Hildebrand. The new design, Fig. 17, is made close down to the pipe and the bolts have a hook at the head end and a clip at the nut end. The pull is as direct against the gasket as it is possible to get it. The strength of the ring is made in the direction of this pull of the bolts so that it cannot be bent between the bolts. The shallow depth in radial lines will permit of better adjustment to irregular pipe than can be obtained where the usual wide flange is used. In addition there is the saving of more than half the labor of bolting up, since these bolts hook on and are tightened immediately.



COUPLINGS FOR STEEL AND WROUGHT-IRON PIPE

Improvements in Rubber-Packed Couplings

In the evolution of steel end rings very different designs have been used. It has been found difficult to get sufficient stiffness in a forged ring to resist the tendency to lean forward unduly under the heavy pull of the bolts. It is impossible to rib up and strengthen a forging, as is done in a malleable casting; consequently, when the center ring incloses the gasket, preventing any bursting strain from coming on the end ring, malleable iron is a better material for a stiff gland than steel. For this reason Hammon has manifested a preference for malleable end rings, Fig. 13, wide on the face against the gasket and sufficiently rigid to resist the bolting strain.

Custer has cut steel rings out of plate, Fig. 14, pressing them into cup shape. Dresser uses steel plate, but presses it so that the gaskets can be inclosed and a ring obtained that stands up well against the bolts. Dayton uses a special rolled shape resembling a T-bar, Fig. 16, which also incloses the gaskets. The standards of the various manufacturers as made at the beginning of this year will pack an ordinary pipe line very satisfactorily.

The Advantages of Plain-End Pipe

The plain-end pipe is the easiest line to join together and has the tightest joint known. The pipes themselves are simple, are not likely to be damaged seriously in handling and are easily cut into short lengths if that becomes necessary. The unbroken film of mill scale over them helps against corrosion, making a thin plain-end line as durable as a heavy screwed line with its deep-cut threads and tong scars. With a good coating of preservative paint, it is possible to insure long life with much lighter than standard pipe.

The joints, when properly constructed and anchored, are capable of making bends up to 5° without danger of leakage. This absolutely tight condition insured by a good gasket is perhaps the strongest point in favor of such a line, but the fact that it can give and take under change of temperature or settlement without making a break puts it in a class by itself.

As to strength, repeated tests of various modern couplings have shown them to be in all cases stronger than the pipe itself, although made of the same thickness of material. In the one point of rigidity, it must depend upon some method of anchorage, such as a covering of earth in the ditch or, if exposed on a bridge, a secure

fastening to the bridge itself. It would be unwise to recommend plain-end pipe for exposed lines carrying heavy pressures without anchorage, as slight deflections quickly upset the balance of pressures and the line will most surely be forced apart.

The most vital point in a plain-end coupling is of course the gasket. Under conditions of air, water or dry gas carried in a line, the rubber will doubtless last as long as the pipe itself and no better packing can be devised. In recent years gasoline has come to be a common thing in natural-gas lines. Common rubber cannot long resist gasoline, but fortunately rubber compounders have come to the rescue with new compounds.

While natural gas has been the particular field of plain-end pipe, it has been used to some extent on artificial gas, air, water and oil lines, and the demand in these fields seems likely to increase. It is a most convenient line for carrying air for quarries and mines, the saving in power through the elimination of leakage making it especially valuable. If the improved gaskets stand as well against drip oil as they do against gasoline, they will open a wide door to the artificial-gas business. Some manufacturers are making such claims for their material, and the case is likely to be proven soon.

Within the past year the City of Pittsburgh has laid several plain-end water lines on bridges, among them being two 16-in. mains across the new Bloomfield Bridge and two 24-in. across the new Point Bridge, the latter bridge being the first place where the bolts were clipped over the end rings. The success of these lines leads to the hope that the demand for such water lines will multiply rapidly.

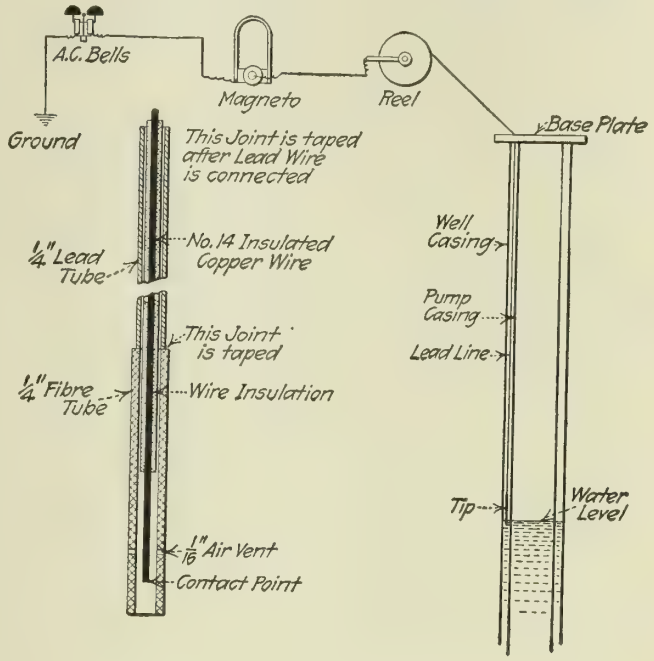
Measuring Well-Water Levels Under Difficulties

By H. W. Keith*

The writer was at one time confronted with the problem of ascertaining the draw-down and refill curves of a deep well of small diameter operated by a plunger type of pump. The well, being slightly out of plumb at several points, had clearances between the well and pump casings at these points too small to allow the use of the "air-line" method. To overcome this difficulty, a portable apparatus which requires only 3/8-in. clearance or less was devised by the writer. It comprises an electric circuit, which is completed when the water level is reached, with a hand magneto and a bell.

The tip, as shown in the sketch, is a piece of No. 14 insulated copper wire, inclosed on one end by a lead tube for weight and on the other end by a fiber tube, the insulation here being stripped back about 1½ in. to form a contact point. An air vent is drilled out about 1½ in. above the contact point. The tip is given a good coat of shellac, after the joint between the lead and fiber tubes has been firmly taped. The end of the tip, as shown in the sketch, is connected to the leading wire, a small rubber-covered flexible cable, the length of which is governed by the depth of the water plane, and this is graduated in 5-ft. intervals.

A case, about 9x9x18 in. and divided into two equal compartments, contains the apparatus. In an upper compartment are placed a set of alternating-current bells and a hand magneto; in the lower part is the reel for the lead wire. In making the reel a steel axle is used, one end of the sounding cable being soldered to it and a constant connection obtained through the bearing of the axle. This bearing, the magneto and the bells are connected in series, as shown in the sketch. The other side of the bells is connected to a metal plate which forms the bottom of the case and is used to obtain a ground



ELECTRIC WELL-SOUNDING OUTFIT

connection. In operation, the case is rested on a good ground connection; the tip, with lead wire, is dropped down the well and the magneto operated. When the tip reaches the water level, the circuit is completed and the bell rings.

The writer has tested a number of pumping plants, using this apparatus, and has found that not only could he follow the water level very accurately, but that in many cases it was the only medium by which the water level could be ascertained.

*1811 32d St., San Diego, Calif.

Fire Damage to Steel Viaduct and Method of Repair

Judgment based on inspection was the criterion used to determine where steel had been injured by heating in the lumber-yard fire which on May 25, 1914, wrecked the Nickel Plate viaduct across the Cuyahoga River in Cleveland (illustrated in *Engineering News* of June 4, 1914, p. 1269). The main girders on a length of 450 ft. of the viaduct had acquired a permanent sag from the fire. The spans were 60 ft. and 30 ft. In the 60-ft. spans, when the sag exceeded ½ in. below horizontal (or about 1 in. total, the girders originally having 5/8-in. camber) the girder was considered sufficiently damaged to be taken out. These girders all had their webs somewhat buckled, but none badly enough to be dangerous. The 30-ft. girders, on the other hand, were condemned mainly for buckling of web.

The girders within the length affected by fire showed extensive buckling of plates, local distortion of flanges, a slight degree of sagging, and in the case of one 30-ft. tower span complete lateral buckling which stopped just

short of collapse. The spans had crowded together when expanded by the heat and forced the viaduct out of line, and subsequently on cooling they did not return to place, but drew apart at the expansion joint. That there was a considerable amount of endwise compression of the girders is shown by the fact that all of them were shortened

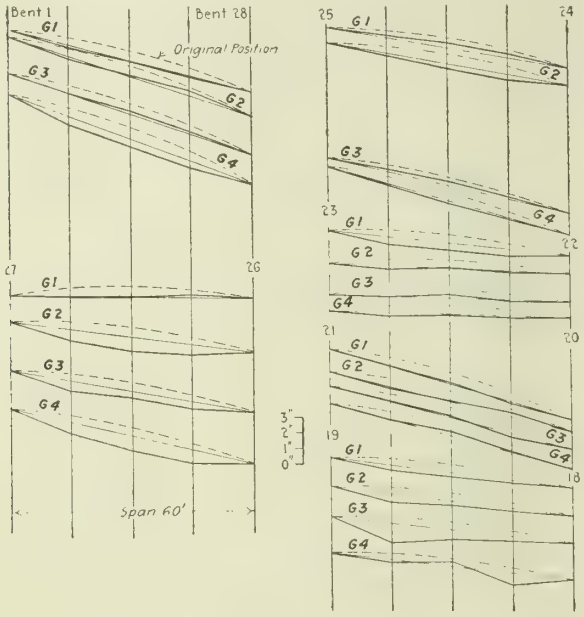


FIG. 1. PROFILES OF 60-FT. GIRDERS, NICKEL PLATE VIADUCT, SHOWING DEFLECTIONS CAUSED BY FIRE

slightly, in so far as check measurements could be made. The 30-ft. girders were shortened more in proportion to their length than the 60-ft. girders, and this resulted in drawing the tops of the towers together. The 60-ft. girders were shortened on the average ⅛ in. to ⅜ in. The track forms a 3° curve on the viaduct, and the structure was pushed 8 to 9 in. out of line at the middle of the curve.

The amount of damage from web buckling was determined by judgment on inspection. Flange damage was estimated by the sag or deflection of the girders, as already mentioned. The diagram Fig. 1 gives a plot of the measured deflections of the 60-ft. spans, the dotted lines indicating the original cambered position of the girders. The sag below horizontal averages ¼ to ½ in., but in one case amounted to 1⅛ in., or a total deflection of over 1½ in. It was decided on the showing of this plot to retain all the 60-ft. girders except the one which had maximum deflection and to replace most of the 30-ft. spans.

The drawing Fig. 4 shows the replacements. The same drawing shows by a detail sketch the replacement work in one of the towers, this being selected as representative of the work done on five towers.

Pier and Tower Repair

In connection with the tower work the renewal of pedestal caps was an important operation. The sandstone caps had generally been destroyed by the heat. They were replaced by precast concrete cap blocks slipped under the tower legs after jacking up the leg, or, where the column was renewed, setting the cap after removing the old column and just before setting the new.

Where the columns were damaged, but were not removed, the effective column length was reduced by putting in struts at middle of the story height, as can be seen in the sketch in Fig. 4.

There was great difficulty in pulling the distortion out of the towers. It was attempted to square up the towers after the new columns were in and riveted up, but

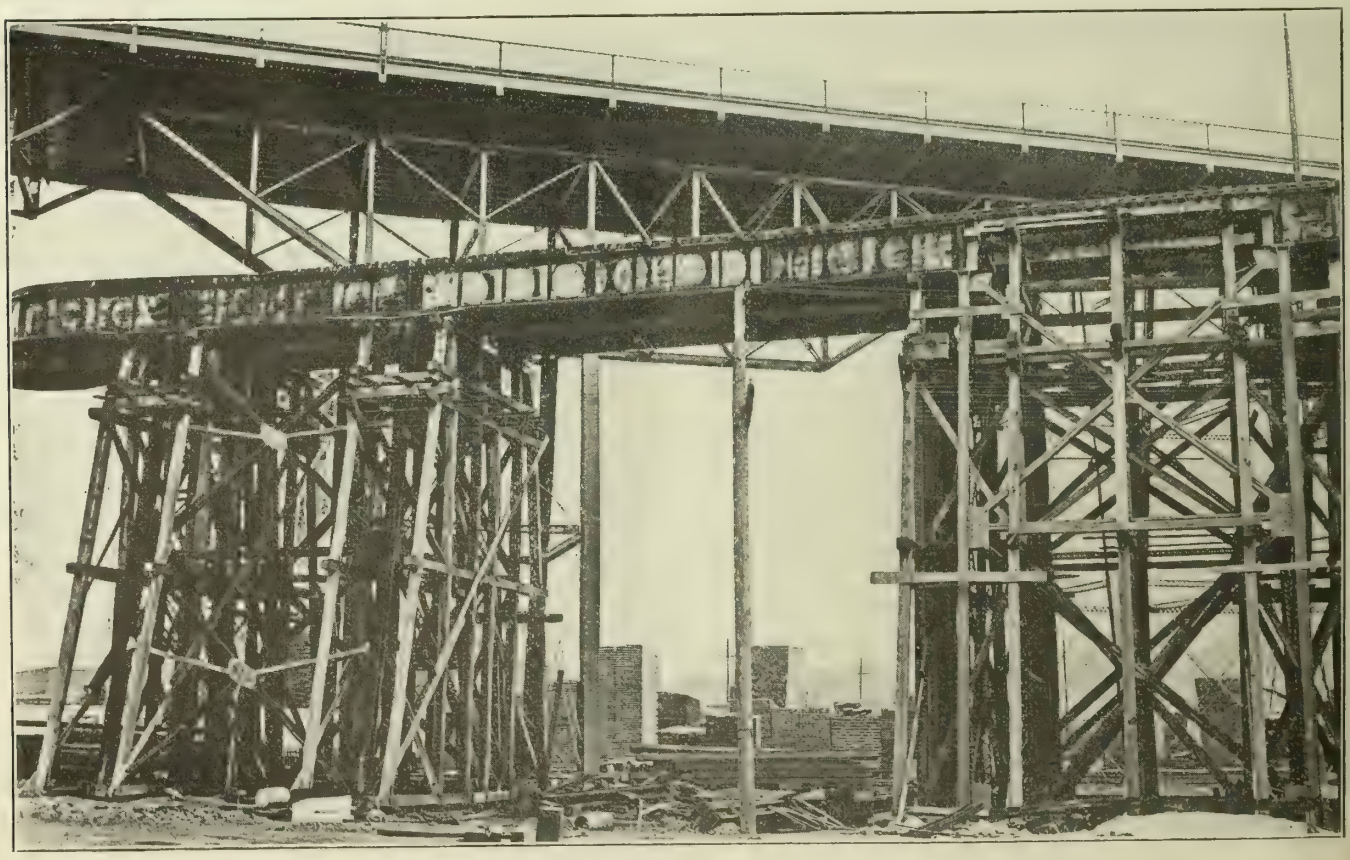
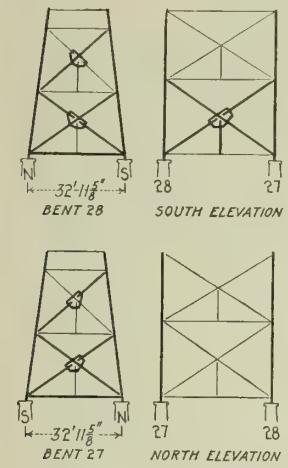


FIG. 2. PART OF WRECKED NICKEL PLATE VIADUCT RESTORED ON TIMBER BENTS

not always with success, and some diagonals had to be cut and shortened. The main purpose of the squaring up was to get the viaduct back into line. It was necessary to leave the column footings off the center marks both longitudinally and transversely in order to get the tops of the towers to approximately correct position. In the whole fire-stricken part of the viaduct very few loose rivets were found, which differed from expectations. A curious phenomenon, however, was that many of the rivets through girders and shoe plates were sheared off. This defect could be discovered only by close inspection, as superficially the rivets appeared to be sound.



Typical Tower Replacements.

The successful and efficient handling of the reconstruction work was due to the close coöperation of E. E. Hart, Chief Engineer, and George H. Tinker, Bridge Engineer, of the railway company, and the officials of the King Bridge Co., who carried out the work. The construction forces, both in clearing the wreckage and opening traffic and in the subsequent reconstruction, worked solely with a view to the urgent railway requirements.

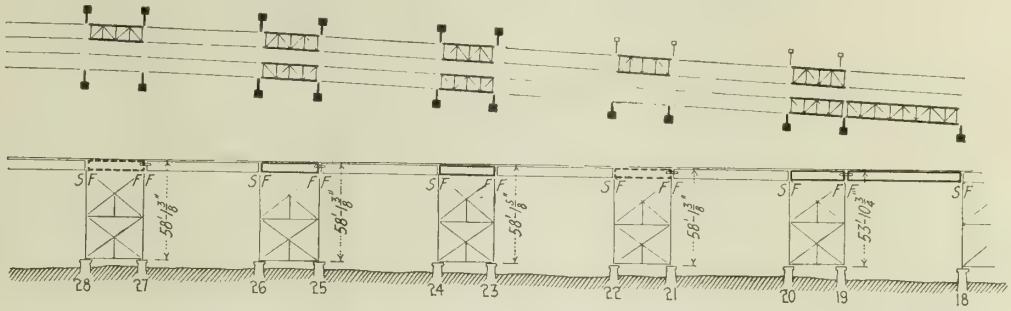
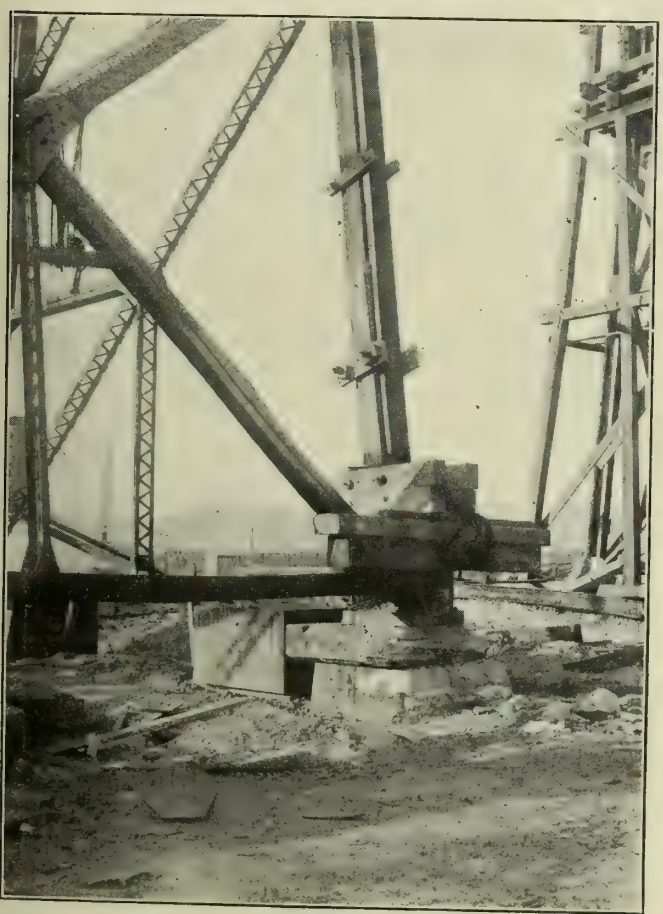


FIG. 4. NICKEL PLATE VIADUCT REPLACEMENTS AFTER LUMBER-YARD FIRE

There was an unusual amount of steel cutting required for clearing the wreckage of the city viaduct that had fallen over the tracks; 5,000 cu.ft. of acetylene and 15,000 cu.ft. of oxygen were used. The price paid the contractor for this clearing was $9.50 per ton loaded on cars, railroad weight.

Just after the fire an unusual factor was the caustic nature of the water in pools on the ground. Enough lye had been dissolved from the ashes to make the water uncomfortable and damaging in contact with skin. The wreckers and erectors soon learned to avoid these pools.


FIG. 3. ONE OF THE UNDERPINNING OPERATIONS IN RESTORING NICKEL PLATE VIADUCT
Blocking on tower leg, ready for jacking-timbers. New precast concrete block pedestal cap is at left of base

NOTES

Handling Bulk Cement On A Road Contract—On a concrete-road job about 10 mi. long in Lake County, Ohio, the contractor, the Williams & Little Co., of Cleveland, Ohio, is using cement in bulk, and A. E. Williams of the firm has devised some special methods of handling the cement from car to mixer. When a car of bulk cement is opened on the siding, it is partly emptied by hand, using lime scoops to pour the cement down chutes to cement-tight wagon boxes, which are so placed that the top is at the car-floor level. When a narrow lane has thus been opened in the car from door to door, an unloading buggy is introduced and is filled by forcing its lip into the cement face as far as possible and topping off by using a specially designed hoe. This buggy then completes the filling of the wagon boxes. The wagons are then driven to portable cement-storage boxes, which are located at intervals along the road ahead of the mixer and are moved ahead from time to time as the concreting work passes them. The cement is unloaded into these boxes by use of lime scoops and chutes in a manner similar to the car-unloading process. The boxes are so designed that unloading can be done with equal rapidity whether full or nearly empty. From the portable boxes the cement is handled by scoops into barrows graded to batch proportions and the barrows are wheeled to the mixer.

Diagrams for Determining Pavement Crowns—For using the same formula to determine the crown of pavements (where the curbs are at different elevations) given by Charles W. Barber in "Engineering News," of Sept. 9, 1915, page 509, William A. Lyon, of the City Engineer's Office at Syracuse, N. Y., uses a chart, which eliminates computations. The practice there is to make the pavement cross-section parabolic, with the rate of transverse grade d independent of the longitudinal grade. The crown is made equal to $1/_{60}$ of the street width on a street with opposite curbs level, and where the street is laterally inclined the crown is taken as $1/_{60}$ of the width of a theoretical street, the half width of which is the horizontal distance from the lower gutter to the crown point. Expressed algebraically, $C = \frac{W + 2X}{60}$. Two formulas have been used for computing the crown shift X. The first, $X = \frac{15\,Wh}{2\,W - 30\,h}$, has recently been discarded in favor of $X = 15\,h$. The latter formula gives a slightly greater shift under ordinary conditions than the first.

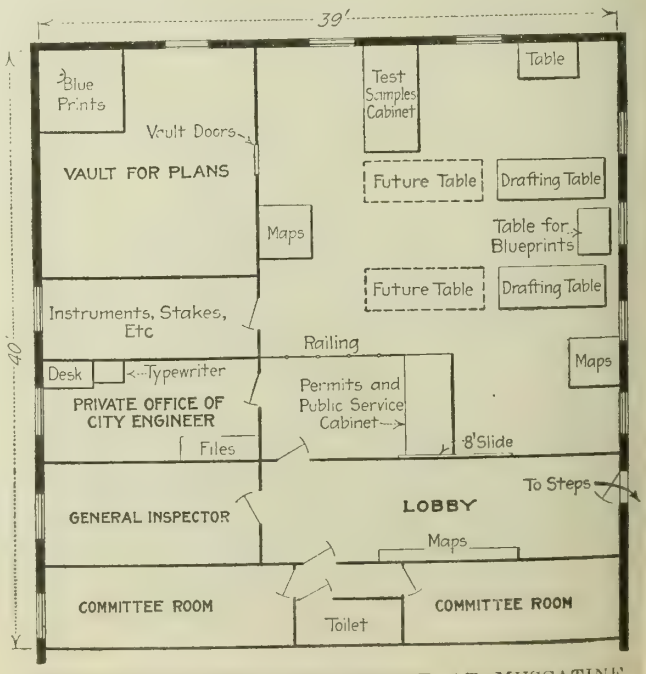


SHOW-WINDOWS IN THIS SIDEWALK SHED KEEP BUSINESS ALIVE

Sidewalk Shed with Show Windows—The builder's sidewalk shed illustrated herewith is probably the most elaborate one ever constructed. It was built recently in front of the New England Building, Cleveland, Ohio, the first story of which is occupied by a large book store. The building is being changed into an arcade, the book store to occupy one side, and it was important that during the rebuilding the book business should be disturbed as little as possible. The shed is developed in arcade outline, with some pretence to æsthetic effect. It stands on the outer half of the sidewalk. The inner wall of the shed is formed into show windows or display cases facing the passageway, taking the place of the store-front show windows, which are put out of service in the reconstruction. As the passage is rather dark, the illuminated show windows afford effective display. The space between the inner wall of the shed and the building front is used for the contractor's purposes, except that two inclosed walks go through it, leading from the sidewalk shed into the store.

Roof Planking Jointed with Gasoline-Driven Saw—The rig described herewith is being used for sawing the boards or sheathing on a large circular roof over an oil-storage reservoir. On account of the rafters all converging toward the center of the roof, it was necessary to nail the roofing in place with the ends of the boards overlapping and then saw through both boards to make the joint come on top of the rafters. Power is furnished by a 4-hp. gas engine belt-connected to a 10-in. circular saw and mounted on a two-wheel truck having Ford automobile wheels fitted with ball bearings and rubber tires to help take care of the vibration of the engine and to make the rig easy to move about over the roof. The engine, a 4-hp. throttle-governed high-speed gas engine built by the Cushman Motor Works, of Lincoln, Neb., has given satisfaction because of its light weight and the ease with which it is operated. A similar rig operated by electric power was described in the "Proceedings" of the American Society of Civil Engineers for August, 1915, page 1340. The gas-engine rig is superior to that one, because electric power is not always available and there are no electric wires to drag around. The machine is operated by two men and weighs complete but 240 lb. This includes the water-cooling tank. Its cost fitted to operate was $192.—E. D. Cole, Supt. of Constr.

An Uptodate City-Engineering Office is included in the interior arrangement of the new $125,000 city hall just completed in Muscatine, Iowa. Before the final plans of the building were approved City Engineer C. H. Young inspected the layout of engineering departments of a number of cities with a population of from 15,000 to 100,000. From the data thus gained the layout shown in the accompanying plan was made and accepted. The department is on the main floor of the city hall. Mr. Young was seen in his new office on Nov. 3, in the midst of moving, and expressed satisfaction over the new quarters.



CITY-ENGINEERING DEPARTMENT AT MUSCATINE

Editorials

The Culebra Slides at Panama

A masterpiece in technical reporting of facts is Governor Goethals' account of the Panama Canal slide situation. His statement carries clear conviction that the long chain of earth movements which mark the history of the canal has been handled in a capable, deliberately judging manner. Moreover, it inspires a fair degree of confidence in an early ending of serious slide trouble for the canal. The present two immense slips at Culebra, in the light of Governor Goethals' review, represent part of the final adjustment of the ground to its new slope and water conditions. Just as the thorough job of excavation done to clean up the Cucaracha slide of two years ago produced a result that upon a year's test of the permanent water conditions appears to be stable, so the removal of the present Culebra slides promises to bring quiet in this region also.

But in the matter of such earth movements as these, any definite prediction is little else than barefaced guesswork. Clays of landslip proclivities not only defy calculation, but are free from all regularity or habit of behavior by which guessing could be guided. Their performance inclines toward the unexpected. Brief reference to the nature of landslips will show convincingly that they form poor subjects for prediction and prophecy.

The classification of Panama slips given by Governor Goethals in the present report furnishes a good basis for such reference. His classification does not fall very far short of covering landslips in general. It is by no means the least valuable feature of the report.

First and simplest are slips of the kind discussed in the ordinary retaining-wall theory. These, however complex they may become, both as to physical facts and as to theory, are always of small size.

Second are the slides of the ship-launching type, where a natural slip-plane exists, on which the superincumbent mass begins to slide, under critical conditions of lubrication. Such slides are not exactly rare. They are slow-moving, and may be very large and exert enormous downhill pressure on an obstacle. Governor Goethals says that the great Cucaracha slide was of this type.

Third are slips of the plastic-flow kind, a rare and highly unmanageable type. They are represented in the remarkable series of slips in valleys of the St. Lawrence River tributaries in Quebec—most notable of them the last, the slip which overwhelmed the village of Notre Dame de Salette in the Lièvre valley in 1908. They are also represented in the recent subsidence of a large cement plant at Hudson, N. Y., as well as in the tipping of the Transcona grain elevator two years ago. According to the description of the Culebra slides, these too are of the plastic-flow type.

In these latter slips a clay-like subsoil becomes suddenly plastic—not to say semiliquid—under certain conditions of moisture and pressure. The Quebec slides, as reviewed in *Engineering News* of May 27, 1909, show the characteristic phenomena most clearly. In a typical instance, a flat river terrace, up to 60 ft. high above water, developed surface cracks, and soon afterward a large section of the bank subsided suddenly, the material below bursting out from the bank while the upper strata in part dropped nearly vertically. The Quebec slides include one or two bottle-shaped slides, where the failure area was very narrow at the river bank, while back of the bank it spread laterally like a dock basin, and the material squeezed out by the subsidence flowed out through the narrow bottleneck break of the bank.

Practically nothing is known as to the particular soil qualities responsible for the plastic-flow slips. We do not even know that notorious landslip soils differ in any way from normal clays or silt soils. We do not know whether sand mixtures play a part. The necessary careful laboratory attack on the problem is still to come.

But that high moisture content plays a determining part is well recognized. All but one of the Quebec landslips occurred in the months of March to May, and the one exception came in October after several days of rain.

Similarly, we know well that pressure is a vital factor. In the Transcona elevator case, for instance, how clear is the picture of sudden breakdown of the subsoil, crushed under its normal load! The same soil carried the same load for a long time, with no yielding; but when some slight change in its nature—no doubt due to an increase of water content—occurred, quite suddenly the bed of clay failed, flowed away laterally against the counter pressure of the surrounding soil and destroyed the support of the building. Only because we call this a foundation failure is it any different from the landslips.

The compressive loads which caused the flows seem to have been such as occur under very moderate depths of overburden—sometimes as low as 30 ft., which would hardly exceed 1½ tons per sq.ft. or such as may be caused by a not unusual surface load, as the weight of the Transcona elevator, or of the stone storage pile of the Knickerbocker cement plant.

Considering the time just prior to any one of these slides, it is obvious that not only was there no warning, but every assurance could be drawn from long-continued permanence of conditions that the soil was stable. In the Quebec valleys, for instance, farms and villages existed many years on and near the ground which ultimately subsided and flowed out. Any prediction, certainly, would be for continued stability and quiet. The slip of course disproved it, and just as surely would make any future prediction in the same region valueless. As said earlier, predictions are guesswork.

At Culebra, while the plastic-flow character is evident from the description—and Governor Goethals himself makes a clear distinction between the Culebra or "break" type and the other slips at Panama—the situation is somewhat different, and by no means equally hopeless, from the predicting viewpoint. The flows that occurred there were relatively slow movements. The soils that crushed out under the superincumbent weight did not fail

as suddenly or completely; they have no such narrow critical range as exhibited in other slides of this type. Adjustment should therefore be easier, and the permanence of the result should be more dependable.

The toe abutment of the slope is no more being cut away by canal-prism excavation. Water being already in the canal, there will be no further rise of ground-water. Moreover, the movement of the sliding ground relieved the soil stresses in large part, and with continuance of flow during excavation of the slide toe a full opportunity is given for complete relief. Adjustment to the present saturation level may therefore be expected to be complete. Subsequent reduction of load by surface excavation, as a protective measure, is likely then to have greater effect than did the prior steam-shovel terracing in the same region, which consumed millions of dollars.

Removal of the slide, says Governor Goethals' report, is going on at the rate of 1,000,000 yd. per month. The total earth to be excavated—only a small part of which is in the canal—is 10,000,000 yd. If the worst comes to the worst, if all the material slips into the prism, the canal will be closed a long time. The indications are in any event that the closure will continue a number of months.

The citizen as stockholder in the canal enterprise should accept this fact without complaint. Indeed, since the adjustment slip occurred so soon after the opening of the canal, he may feel fortunate in having the slip occur at this time, and under circumstances where the best method of removal can be applied systematically and thoroughly.

Co-operation or Amalgamation of Local Engineering Societies

"Do local chapters of national engineering societies tend to disintegrate the older type of local societies without commensurate benefit to the members of the local chapters?" This question was put in a brief editorial note in *Engineering News* of Oct. 14, 1915. Primarily to help solve this problem of possible conflict, the Cleveland Engineering Society devoted its November meeting to an open discussion of the relations between the different local associations of engineers and an inquiry as to whether coöperation, affiliation or amalgamation is what the situation calls for. It was the first step toward the formation of an intersociety committee or council, which will attempt to solve the problem.

It seemed to be the unanimous opinion of this meeting that collective effort—coöperation—was desirable, at least so far as concerned local affairs. The main question, then, is, How is coöperation to be brought about? The matter of whether local chapters of the national engineering societies are necessary when there is a strong local engineering society already in the field was apparently not considered. There is a rapidly growing tendency to establish local chapters of the national societies, and no one disputed their real need. There is evidently a useful field for all.

Should these local chapters merely coöperate through representation in a general council, should they also affiliate to the extent of using the same quarters, library, etc., or should they amalgamate and be merely sections or divisions of the local engineering society? If all the members of the local chapters could be induced to join the local engineering society, amalgamation would undoubtedly be the best solution. The recent experience of the Engineers Club of Philadelphia in increasing its membership fourfold shows what may be done in this direction by active campaigning.

The only arguments put forward at the Cleveland meeting for maintaining the local identity of the national engineering societies were that the papers and discussions would be of restricted interest and that certain discussions would be devoted to the affairs of the parent societies, and should of course be limited to members of those societies. To these the local society, with subdivisions or sections, presents no obstacles.

The real obstacles to the formation of a single united local engineering society are natural indifference, narrowness, clannishness, and perhaps the parsimony of individuals. It is generally a question of whether the local member of the national engineering society feels that he will derive enough additional benefit to pay him for joining the local engineering society. To belong to a local chapter of the parent society usually costs little or nothing additional. It is plain that a local society which will include all the local members of the national engineering societies is a sheer impossibility.

Should the established local engineering society, with its clubrooms and library, invite the affiliation of the local chapters to the extent of sharing its quarters and facilities with the members of the local chapters? If this were done, these chapter members would enjoy practically all those privileges at cut rates. Obviously that is unjust to the regular members of the local society and would remove all but philanthropic motives for active membership. Frankly, would the local society gain enough in influence and prestige to pay for carrying all these deadheads?

If it is considered necessary to preserve the individuality of the national society chapters, but one logical course is left. That is for local chapters and the local society to coöperate on an equitable basis, just as do the national engineering societies (with the well-known exception of the American Society of Civil Engineers) in New York City. They could erect and share a building or meeting rooms, could have a common library, a general council, and if desirable have general meetings for discussion and action on local affairs—at the same time preserving their organizations as individual societies and paying the costs in proportion to the use they make of the common plant and equipment.

At first glance this looks like the extinction of the local engineering society, but it would not necessarily follow. If the local society can maintain a live organization, if it can offer its members something that the local chapters do not, if its subjects of discussion are of broad and general interest—in short, if it is a real factor in both engineering and community affairs—the local engineering society will not only survive but flourish. It will never include *all* the members of the local chapters, but it will include the livest and most influential members in those chapters and a host of other engineers who do not belong to any of the national societies.

Mere members are not all that is desirable. A small but active, interested and energetic membership generally accomplishes more than a large membership lumbered up with the deadwood of the many who are indifferent and inactive. Circumstances induce and perhaps neces-

sitate this condition of affairs to a greater or less extent in the national engineering societies, but it is a condition which can and should be guarded against in the local engineering society.

It must be admitted that the really live local society is at present the exception rather than the rule, yet it is not improbable that the competition or conflict between the local society and the local chapters of the national societies may actually end in developing the local society, compelling it to broaden its activities or to succumb.

If the local society lives up to its opportunity, it will become the leader in the broad field of public usefulness and be a power in forming the public policy of its community in engineering and technical affairs. In this field the local chapters of the national engineering societies, both individually and collectively, are handicapped rather than aided by the ties which hold them to the national bodies. In this way the local society will attract to its membership, without concessions, the most desirable home members of the national societies, and it will become of indispensable assistance to all broad-minded, public-spirited engineers, whom we all hope to see the men of affairs of the future.

Eccentric-Loading Questions

A tendency toward iconoclasm is a good sign. It means healthily active thought, especially when it concerns the structural field, where strict rule of calculation usually governs. In this light it is a welcome fact that a bit of radical dissent is voiced in the article on another page which seeks to overthrow settled beliefs on eccentric loading of structural members. Though at the start the author tries to appeal to preconceived notions by his ingenious title, "Is a Part Stronger Than the Whole?" yet he proceeds to make a strong and honest statement. He does not argue, but his illustrative examples have the force of argument.

However, it is important to recognize that the practical effect of the author's statements is little less than a complete ignoring of load eccentricity. This is a questionable proceeding, to put it mildly. True, there are cases—not a few, in fact—where the theoretical eccentricity is largely unreal. The diagonal brace whose connection plate is made eccentric by a single rivet will probably adjust itself to the loading with much lower overstress than the calculation indicates. A post set on an eccentric base block may crush down in such a way as to produce a fairly uniform base reaction. But under other conditions such a post may have a highly nonuniform reaction, and the post thereby be subjected to bending, which undoubtedly reduces the load-carrying capacity.

At bottom, the author's query is simply this: Does the stress in the extreme fiber measure the tax on the piece? When the stress is tensile, is there any danger in initial cracks at the tensile extreme fiber? The author implies that there is not. Take a beam which has a narrow rib below its bottom flange, so proportioned that the beam would have a lesser extreme fiber stress if the rib were cut away; the claim is that when the projecting rib tears, the tear will stop at the main flange. The trouble with this statement is that it ignores the dangerous character of tension cracks and their great liability to extend progressively even at low stress. Broadly, a crack in a stressed piece of material is a sure forerunner of ultimate breakdown.

The author's argument is also misleading whenever adverse deflections are produced by nonuniformity of stress. In the case of a column, for instance, any one-sidedness of bearing means a deflection, and this increases the edge stress at the weak section of the column still further. The excess stress is not imaginary and is not harmless.

The essential warning, however, relates to the following: In steelwork we do not always deal with tough, ductile material. Local excess of stress, bending, eccentric loading, and initial cracks have a very different meaning for brittle or unsound steel than for normal steel. There are some structures standing today that have excessively high edge stresses at certain points. Usually the material is ductile and yields slightly, thereby relieving the local excess. But not all structural steel is ductile; some is brittle, and breaks rather than yield. The collapse of the Orpheum Theater should be remembered, where brittle plates failed at a point where high local bending existed.

Common-sense is called for in dealing with problems in eccentric stress. For instance, the question whether a column foundation resting on rock but carrying the column off center can distort enough to put any bending into the column is readily decided by the engineer's common-sense judgment. The entire subject calls less for definite rule than for the use of caution and common-sense together.

Ownership of Water Services

A favorite subject for discussion at water-works conventions for several decades has been who should own the service pipes. The question has come up again where so many questions both old and new are arising daily—before a state public-service commission. As no universal practice has yet been reached, and as light seems to be desired, an opportunity is afforded to point out anew what most water-works superintendents believe—namely, that service pipes, like the meters at their house ends, should be considered as a part of the water-works plant and supplied, laid, paid for and maintained by the city or company that owns the works.

Coming now to the case in point. The Montana Public Service Commission, as noted elsewhere in this issue, preliminary to issuing service regulations, asked the water utilities of the state why they should not own and care for the services.

The answer seems to have been that in Butte, for instance, the company would have to take over the 9,500 service lines now owned by the property holders at an added annual expense of $28,500 ($19,000 annual offset to depreciation and $9,500 for maintenance), and that it did not dare ask the consumers each to pay the $3 extra, to say nothing of $3 interest on eventual investment.

Nevertheless, the water consumers are actually giving up that $6. They are not paying it out year by year in cold cash, but each consumer is losing the interest on his $50 investment; he sees—or might see if he were wise enough—his $50 gradually wasting away, and he feels—or will soon feel—the need of expending another $50 for a new service line. In addition, he is paying out in real coin an average, say, of a dollar a year for repairs.

Those figures of investment and cost are predicated on individual action. As one of the Montana commissioners

in a dissenting opinion ably pointed out, the company, by centralized management and expert labor, could cut the first and annual costs of service lines by a third of what the individuals now pay. The company admits this is the case with meters and desires to keep the purchase and maintenance of such devices entirely in its own hands—as is quite proper. If the company owned the services, the rates might be raised to bring in $4 a year more revenue from each service line, and still the consumers would save $2 a year each.

Why should the water company fear to tell the users that fact and assume responsibility for the entire plant?

The language of the decision leaves possible the future readjustment of such matters in Montana. No valuations of these water-works have been made, apparently, and no scrutiny of rates as to their reasonableness. Probably if the commission should find the charges in any case unduly high by an amount about equal to the annual cost of the service lines under efficient company administration, taking the lines over from the individuals would be required in place of lowering the rate.

The experienced water-works man does not need to be told that utility ownership and maintenance of services are not only mutually advantageous to the utility and the consumer as a matter of finance, but are also necessary as a preventive of troublesome leaks or waste.

Cement for Pipe Joints

The use of portland cement for the joints of cast-iron water mains in southern California cities was described years ago in the columns of *Engineering News,* but has probably been forgotten by most of its readers. As stated in an article elsewhere in this issue, this innovation was not an isolated experiment to be tried and forgotten, as so many experiments are, but has become standard practice in a number of these cities and is defended not merely as a cheap substitute for the lead joint but as a better and more secure joint.

Why should the cement joint be absolutely watertight against an internal pressure of 100 lb. per sq.in. or more, while the cement joint for sewer pipes in practically universal use be exceedingly apt to leak under the ordinary pressure of ground water?

The answer to this question is probably to be sought in the manner in which the cement joint for water mains is made up—with a cement paste containing barely enough water to moisten it, packed into the pipe bell with a calking tool and hammered home as if it were lead.

It is common knowledge that the strength of a cement briquette is greatly affected by the packing of the cement in the briquette mold; but we recall no tests made to determine how strong a briquette could be produced by compressing a very dry paste under repeated hammer blows. The long experience with the cement water-pipe joint now available indicates that such cement is not only very strong but about as impermeable as metal.

The New Haven railroad bridge noted on page 1053 of this issue is described by the New York *Times,* Nov. 21, as follows: "The new bridge will have a capacity for eight tracks. Four tracks will be built immediately on the main structure and two on the superstructure, leaving room for two more on the superstructure when needed." Thus is a remarkable bridge accounted for.

Letters to the Editor

Waterproofing the Newark Terminal

Sir—The statement is made in the article in *Engineering News* of Oct. 28, describing the Newark Terminal, that "the waterproofing is unique in building construction because of its extent (500,000 sq.ft.) and because of its evident completeness." My recollection is that there was a larger area than this (about 56,000 sq.yd.) covered in the construction of the Boston South Terminal Station built nearly 20 yr. ago, which was designed to resist an upward water pressure of 500 lb. per sq.ft. and which has successfully served the purpose for which it was designed.

In the construction of the Boston Terminal 10 layers of felt and pitch were used. It would be interesting to know how the single layer of muslin used at Newark compares in cost, assuming it to be equally effective, as this will afford at least some measure by which progress in the art of waterproofing may be judged, although the conditions in Boston were probably more difficult than those in Newark.

F. Lavis.

50 Church St., New York City, Nov. 5, 1915.

[The designer of the waterproofing system used in the Newark Terminal has offered the following information.—Editor.]

Sir—Concerning the waterproofing at the Newark Terminal of the Public Service Ry., I beg to say that the cost was 16½c. per sq.ft. A portion of the structure was designed to withstand a maximum upward pressure of 950 lb., the normal upward water pressure being about 450 lb.

Oscar Sheffield,
Chief Engineer, Masonry Waterproofing Co.
307 Herkimer St., Brooklyn, N. Y.

Comparing Triple-Expansion and Centrifugal Pumps

Sir—In G. H. Gibson's article, "How Low Fixed Charges Favor Centrifugal Pumps," appearing in *Engineering News* of Nov. 4, 1915, I find there is an error as regards the cost of the Holly pump at Bissells Point. The price which he names was for two pumping units, instead of one. The cost of the unit referred to, including suction and discharge piping with two hydraulically operated gate valves, together with the bonus, was $103,953.

In making comparisons between the duties of pumps it should be stated how the heads on the units are measured. It is customary, in order to facilitate making a shop test, to measure the suction head or lift near the inlet flange and the discharge head near the outlet flange of a cen-

trifugal pump; then an allowance for difference between the velocity heads at these two points is made. In order that the shop test may be conducted without installing the auxiliaries to be furnished with the unit, it is also customary not to charge the steam used by the auxiliaries against the unit.

The auxiliaries (air pump, boiler-feed pump and air compressor) were an integral part of the Holly pump and were charged against it. The boiler-feed pump was required to deliver its full capacity against 200 lb. pressure, and this required over 4,500,000 ft.-lb. of work per hour. The friction losses in the suction pipe, gate valve and condenser were charged against the Holly pump. This was equivalent to a 2-ft. head.

There should be charged against a centrifugal pump the cost of the necessary increase in boiler capacity due to its lower duty. When a new building is required for a pumping station, the greater cost of the building necessary for the triple-expansion over that of the centrifugal should be charged to the triple. GEORGE M. PEEK,

Engineer in Charge of Construction.

St. Louis Water-Works, Nov. 8, 1915.

[Mr. Gibson has made the appended statement concerning Mr. Peek's correction and comments.—Editor.]

Sir—While the error regarding the cost of the Holly pump pointed out by Mr. Peek is regrettable, the De Laval pump still retains a considerable advantage in lower total annual cost per water horsepower, as will be seen after revising the figures in the last table of my article to take into account the correct price of the Holly pump:

	Centrifugal Unit	Reciprocating Unit
Cost of buildings and foundations, assumed	$20,000.00	$80,000.00
Cost of boilers, settings and stack assumed as $30 per nominal boiler horsepower	16,371.00	10,503.00
Annual interest, maintenance and depreciation charges on pumps and buildings	5,130.00	13,980.00
Annual interest, maintenance and depreciation charges on boilers	1,849.00	1,188.00
Total interest, repairs, maintenance and depreciation charges	6,979.00	15,168.00
Annual fuel cost of steam, at 13c. per 1,000,000 B.t.u., based on full load 24 hr. per day, 365 days per year	22,030.00	14,540.00
Total annual cost per water horsepower, exclusive of attendance and supplies, assuming 100% load factor	23.11	27.63

For 66.6% load factor, or full-load operation 16 hr. daily, the annual cost per water horsepower becomes $34.80 for the Holly pump, as against $25.90 for the De Laval pump.

The duty of the De Laval pump was calculated from the total head overcome by the pump—that is, the discharge head measured at the delivery nozzle plus the suction head at the suction nozzle, both corrected to the center line of the pump. As the two nozzles are of the same size, no correction for velocity was necessary.

Mr. Peek states that auxiliaries of the Holly pump, including air pump, boiler-feed pump and air compressor, are integral parts of the main unit and are operated by it. The air pump for the De Laval unit (of the common flywheel type) and the condensate pump (of the duplex type) are independent of the main unit, but the steam consumed by them was charged against the latter in figuring the duties stated in my article. At the same time, the exhaust from these units was delivered at atmospheric pressure to an open feed-water heater, instead of passing to the main condenser, and at least 80% of the heat represented by the live steam consumed by them was returned to the boilers in the feed water, raising the latter approximately 20° F. in temperature, with a fuel saving of nearly 2%. As the final temperature was still only 102° F., the exhaust of the independent boiler-feed pump can be utilized in the same way and the fuel cost for its operation will be practically negligible.

A turbine-driven boiler-feed pump would use not to exceed 600 lb. of steam per hour. If the pumping outfit were credited with heat returned in the condensate—as should be the case—the total net steam consumption charged to boiler feeding would not be more than the equivalent of approximately 90 lb. of steam per hour, which represents less than 0.5% in duty.

The larger boiler equipment required by the De Laval pump is fully taken into account in my article, where the nominal horsepower capacities of the boilers, upon which interest, depreciation, repairs, etc., are figured, are in each case based upon the respective steam consumptions in actual test, 30 lb. of steam per hour being taken as a boiler horsepower.

Figures were not at hand covering the costs of buildings and foundations and the cost of attendance in each case, so that the comparison of the two pumps is necessarily incomplete; but it is believed that the inclusion of these items would have resulted in a showing still more favorable to the steam-turbine-driven centrifugal pump.

GEORGE H. GIBSON.

Tribune Building, New York City, Nov. 15, 1915.

Popolopen Viaduct Design

Sir—I agree with "Concrete Engineer," whose letter on the Popolopen Creek viaduct was published on page 901 of *Engineering News* of Nov. 4, 1915. It would appear that the steel design might have been decided upon at first and an estimate on a concrete design asked for to stop comment. A concrete bridge to fit the location could have been designed and built for a very little more than the steel structure, unless foundations were very difficult.

I think a concrete bridge would have fitted the landscape better than the steel design. It was a pity there was only one competitor who submitted a design in concrete. ANOTHER CONCRETE ENGINEER.

Nashua, N. H., Nov. 6, 1915.

NOTES AND QUERIES

The Reinforcement of the Concrete Pavement under construction between Easton and Bethlehem, Penn., noted in "Engineering News" of Nov. 11, page 944, is not triangular-mesh wire but diamond-mesh wire made by the Trussed Concrete Steel Co., Detroit, Mich.

Deflection of Concrete Beams—A reader inquires what simple formula for deflection gives results which check with measurements on concrete beams. He says that the formulas published in some of the standard books are too complicated for practical use and do not give assurance of fitting the facts.

Offered to the Most Worthy Library—A complete file of "Engineering News" for about 15 yr., partly bound, is in the possession of N. S. Reeder, 24 Broad St., New York City, and is offered free to the most deserving applicant—schools, societies, libraries or individuals being given preference in that order.

Rebuilding Piers and Abutments, Black River Bridge

By Edward U. Smith*

The Wheeling & Lake Erie R.R. has recently completed rebuilding a girder bridge across the east branch of Black River on its Toledo division in Ohio, which required strengthening the substructure. The footings of the two river piers were enlarged in an original and effective way. Reinforced-concrete slab abutments were also built, as the old bridge, a curious combination of girders and timber trestle, had no abutments.

Thorough inspection of the piers showed that they were supported on oak piling and timber grillage, which were found to be in as good condition as when placed, 15 yr.

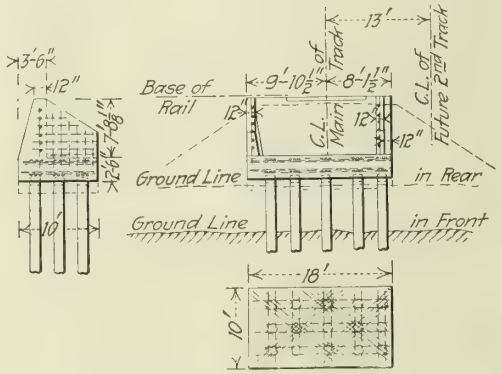
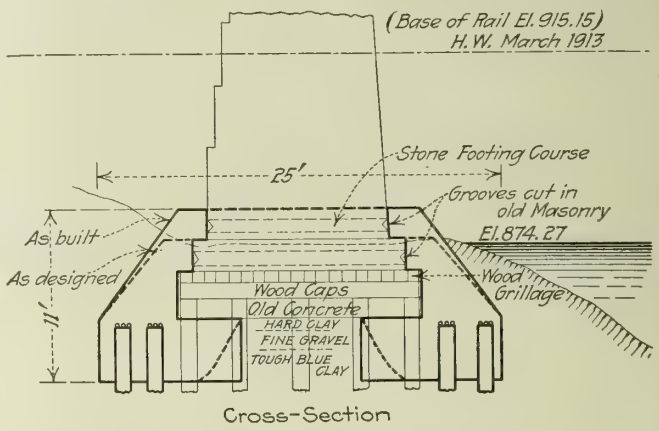


FIG. 1. NEW ABUTMENT OF BLACK RIVER BRIDGE

ago. The grillage beams were 24 in. on center, the spaces filled with concrete, making a concrete thickness of 3 ft. The top of the first course was at normal water level and the bottom of footing was about 4½ ft. below water. The stream is about 7 ft. deep. It was planned to substitute a new and complete plate-girder superstructure designed for heavier loading (Cooper's E-60), and this necessitated strengthening the pier foundations, although the pier shafts were adequate. It also meant building abutments to carry the end-span plate girders.

The plan adopted for reconstructing the pier footings was to drive two rows of mixed oak piling around and to a level below the bottom of the old footing, place a ring of concrete on top of the new piles and bring it up to the third course of stone, thus incasing the foundation and enlarging its bearing area, besides carrying the foundation deep enough to prevent future damage from scour. While the new concrete would not normally take the whole load of the pier, it was so designed as to be



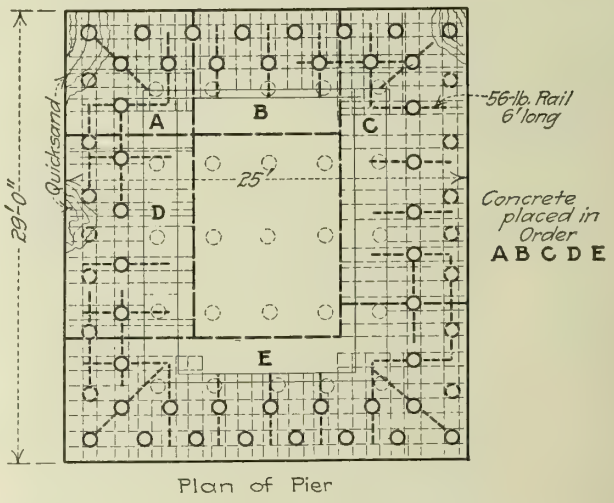


FIG. 4. PIER-FOOTING REINFORCEMENT

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FIGS. 2 AND 3. ENLARGING PIER FOOTINGS OF BLACK RIVER BRIDGE, W. & L. E. R.R.



FIG. 5. CONCRETE PILES FOR WEST ABUTMENT

safe for the entire load if a slight settlement of the old work should take place.

In making the excavation (in the manner shown by the view Fig. 3) a bed of quicksand was struck. This made the work difficult, but called for no changes of method, and the reconstruction of the footing was successfully carried through. As shown by the drawing (Fig. 4) the concrete was carried up higher than originally intended. Radial reinforcement in the lower portion of the new footing concrete enables the extended footing to act as a corbel.

The abutments (Fig. 6) were designed as reinforced-concrete slabs carried on concrete piles. The piles chosen were those of the Great Lakes Dredge and Dock Co. They were octagonal, 16 in. by 40 ft., of uniform section, with cast-steel point and eight ½-in. vertical rods. They were driven by company forces, at a cost of 15c. per lin.ft. The work was done with an Ohio locomotive crane handling a 3-ton Vulcan steam hammer, which made 85 blows per minute. The piles were driven to refusal, most of them going down the full 40 ft., through gravel, clay and quicksand.

The slab over the piles, 10x18 ft., was made 36 in. thick for the east abutment and 54 in. thick for the west abutment. It has bands of reinforcing rods in both directions over the pile heads and also diagonal bands in two directions. The design of the slab was governed by punching shear, which required a thickness of 7½ in. over the piles.

The slab and back-wall reinforcement was arranged with a view to adding a future second track. The wing-wall which later will be between tracks and will serve as brace to the back-wall is straight, while the other is flared.

Steel was erected by a derrick car reaching out from the abutment end as shown in Fig. 7, picking up the girders from a point alongside the track (Fig. 6). The King Bridge Co., Cleveland, Ohio, fabricated the new steel, and the Ferro Construction Co., Chicago, erected it as subcontractor for the King Bridge Co.

After the girders were in place the abutments were backfilled with granulated slag. At the west end, where the piles projected several feet above the natural slope, the slag was rammed around and between the piles. At the east end the slope was such that it was necessary to excavate for the slab, so that only backfill had to be placed.

Cement Instead of Lead for Pipe Joints

The use of portland cement for making the joints of cast-iron water mains has become common in southern California cities. The practice appears to have originated in the water department of Long Beach, Calif., about ten years ago and the success there obtained has caused a number of other cities to adopt the same plan. The superintendent of the Long Beach water-works, Clark Shaw, declares that the cement joint is not merely cheaper than the ordinary lead joint, but is tighter and more permanent.

The method of making the joint is as follows: After the pipes are connected, a ring of dry jute is inserted in the bottom of the bell and the bell filled with neat cement paste. It is essential that this paste be mixed with only enough water to moisten it, but not enough to make it soft. After the bell is filled with the paste it is packed with a long calking tool, like that used for calking a lead joint. If the paste is of the right consistency it should pack under the tool until it is almost as hard as lead. (For an editorial discussion see page 1044).



FIGS. 6 AND 7. PLACING SUPERSTRUCTURE GIRDERS OF BLACK RIVER BRIDGE

After the first calking, the joint is refilled with paste, which is again packed solid with the calking iron; this is repeated a third time. The joint is then neatly rounded off with a collar of 1 : 1 cement and sand. The cement is allowed to set for 48 hr. before water pressure is turned on the pipe. In case of necessity, however, water may be turned into the pipe within 24 hr. The only lead joints now used in Long Beach are in pipe which has to be put in service as soon as it is laid. The pipe used has the standard hub and spigot. A line of pipe 6,400 ft. long was recently laid with cement joints and not a single leak was found when it was tested.

When it is necessary to take up pipe laid with the cement joint, a section of the cement on top, about 60° wide, is chipped out to the bottom of the bell, and the joint is then readily broken. This work is much more easily done than unjointing pipe having lead joints.

An important advantage of the cement-jointed pipe is that the conductivity of the line for electric currents is much reduced, as there is cement insulation at every joint. Liability of damage to the line by electrolysis is greatly reduced, although if one joint or only a few were made with cement there might be corrosion at these points.

A comparison of costs of the material required for a 4-in. pipe joint shows that with lead at 5½c. per lb. the material for a lead joint cost 29c., and the material for a cement joint 3½c. At the present high prices of lead the difference is much greater, and on larger sizes of pipe the large saving possible makes the change one which is well worth the attention of water-works engineers. There is also much less expense for labor in the cement joint than for the lead joint, and the work is simpler.

Alternate Specifications for Public Work Are Legal

By Daniel T. Pierce*

No little attention is being given to the subject of alternate specifications and bidding from the viewpoint of public policy. The reason why this subject is always more or less alive is that the common requirement that a low bid under a general specification must be accepted is productive of so much poor construction. Recourse is had to an increasing extent to alternate specifications, separate divisions of which may describe entirely different materials or types of construction or different kinds of the same type of materials, the authorities reserving the right to accept the lowest bid under any division of the specification.

The alternate specifications avoid the undesirability of "open specifications," which confer a monopoly upon mere cheapness; of "closed specifications," which may be considered objectionable because they may create monopoly, and enable the purchaser to consider quality as well as price. While this is conceded, there is raised from time to time the objection that alternate specifications are not legal under statutory requirements that public contracts must be awarded to the lowest bidder. The following review of decisions on this point shows that the legality of the alternate specification has been upheld under a variety of conditions in at least nine states.

*Executive Assistant, Barber Asphalt Paving Co., Philadelphia, Penn.

The case of the City of Connersville vs. Merrill, an Indiana case (42 Northeastern, 1112), arose under an Indiana statute requiring sidewalk-improvement contracts to be let upon competitive bidding to the lowest responsible bidder, and provided that such improvements could be made pursuant to an ordinance which was required to state "the kind, size and location of the proposed improvement."

The City Council adopted a sidewalk-improvement ordinance which provided that certain sidewalks "should be made of either free or limestone flagging or of artificial cement stone as the Common Council might determine on receipt of bids therefor." Separate bids were received for the different materials specified and a contract was awarded on one of such bids. The validity of the contract was called in question by an abutting property owner. The court held that the contract was valid.

> There was no uncertainty in the material to be used, so far as the bidders were concerned. Thus bidders were put upon an equality, and the city and the property owners had the benefit of competition on each brand or special kind of the general material to be used. They were invited to submit bids for the improvement on three different kinds of material. The bids were made on this basis, and the lowest and best bid for either kind of improvement—that is to say, the lowest bid for artificial cement stone was accepted.

The case of Dixey vs. Atlantic City, a New Jersey case (58 Atlantic, 370), likewise upholds the principle of alternative specifications. Atlantic City advertised for bids for paving certain streets with vitrified blocks. The Delaware River Quarry and Construction Co. submitted a bid specifying various separate prices for the work, according to the particular type or brand of block to be used. One item of this bid was accepted and a contract let pursuant thereto. Certain taxpayers filed a suit calling in question the validity of the contract on the ground that the successful bidder had no right to submit alternative bids, as this would be in violation of the statute requiring competitive bidding. The court held the contract valid, declaring:

> The bid of the successful bidder gave the city the advantage of knowing just what were high and what were low-priced blocks, and we think the specifications did not limit bidders to naming blocks of only one price, but permitted them to bid for different kinds of blocks at different prices, and if they were able to furnish more than one kind of block at the same price, they might do that, also submitting samples and the information as to manufacturer required.

Case of the Philadelphia Filtration Plant

In the case of Parker vs. City of Philadelphia, a Pennsylvania case (69 Atlantic, 670), alternate specifications were again upheld. Philadelphia advertised for bids for a filtration plant. One item of the specifications called for controllers to measure the output from the filters. Six different types of controllers were specified, leaving it to the city to determine, after the receipt of bids, which type should be adopted. Alternative bids were requested and submitted upon several different types. A taxpayer sought to impeach the validity of the contract, but the court held the contract legal. A part of the decision follows:

> Where the thing to be furnished can be manufactured by anyone in precise conformity to certain and specific requirements of the specifications, or purchased in an open market at a standard price, there is no valid reason for asking for alternative bids; but where the thing is protected by a patent or cannot be bought in an open market, and any one of a number of particular kinds fully complies with the established standard, the interest of a municipality will be best served by asking for bids for any or all. The field is equally

open to each bidder; the power of a monopoly in the thing is broken. The general custom of long standing has been to require bidders in certain classes of public work to furnish samples of the articles they proposed to furnish in order that the quality of the sample may be taken into consideration in awarding the contract, thus bringing into competition both the price and the quality of the thing to be furnished.

Farther on in the opinion it continues as follows:

We are of the opinion that under our law specifications for alternative bids are not per se unlawful.

Cases Involving Various Types of Pavement

The case of Ex Parte City of Paducah, a Kentucky case (89 Southwestern, 302), is one where the city adopted specifications and advertised for bids for the improvement of a street. The specifications provided that the street should be improved with vitrified brick, bitulithic or bituminous macadam. Alternative bids were requested and submitted on these several types of pavement. The court held the contract for bitulithic valid, saying:

Nor are the ordinances objectionable for the reason contended for by counsel for the city, on account of different materials being mentioned therein with which the streets were to be constructed. It is obviously good policy, and to the best interest of the public, that ordinances of this nature should be so framed as to bring about competition in the bidding of such work.

The case of Campbell vs. Southern Bitulithic Co., a Kentucky case (106 Southwestern, 1189), arose when the City of Ashland adopted specifications for paving with vitrified brick or bitulithic pavement, as might be determined after receipt of bids. Alternative bids were advertised for and received upon both types of pavement. The brick bids were lower than the bitulithic bids. A contract was awarded to the lowest responsible bidder on bitulithic. A suit was brought to enjoin the performance of the contract on the ground that the contract was let in violation of the statute requiring such contracts to be let upon competitive bidding to the lowest bidder. The court held the contract valid and quoted with approval the Paducah case cited above.

In the case of Emmeret vs. Elyria, an Ohio case (78 Northwestern, 269), the city required paving contracts to be let upon competitive bidding and provided that improvement ordinances should contain a statement of the general nature of the improvement and the character of the materials thereof. The city adopted an ordinance and advertised for bids for paving a certain street with brick or asphalt or other material as might thereafter be determined. After receipt of alternative bids a contract was awarded for asphalt. A property owner sought to enjoin the performance of the contract, but the court upheld it.

It appears from the finding of facts that council determined that the paving material should be asphalt, brick or other material, as might thereafter be determined. This meets the requirements of the statute. Prior to the adoption of the present code it was provided, as to some cities, that the kind of materials should not be determined until after bids had been received, the reason being that it promoted competition and tended to prevent collusion among bidders.

State of Michigan vs. City of Detroit

The case of Attorney-General vs. City of Detroit, a Michigan case (26 Michigan, 263), arose when the City of Detroit adopted specifications and advertised for bids to pave certain streets. The specifications and advertisement called for alternative bids upon several kinds of wood and stone pavement. After the receipt of alternative bids a contract was awarded for the Ballard wooden-block pavement. The validity of the contract was questioned by the attorney-general in this case, but the court held the contract valid in an elaborate opinion by Judge Cooley. This case is the earliest and may probably be regarded as the leading case on the right of municipalities to adopt alternative specifications.

Baltimore Paving Specifications Upheld

In the case of Mayor of Baltimore vs. Flack, a Maryland case (64 Atlantic, 702), the city advertised for bids for the improvement of certain streets with asphalt, vitrified brick or bitulithic, as might be determined after receipt of bids. Alternative bids were submitted upon the several types of pavement and a contract was awarded to the lowest responsible bidder on bitulithic. Property owners sought to enjoin the performance of the contract on the ground that alternative bidding was not permissible under the Maryland statute which required an award to the lowest responsible bidder. The court held the contract valid in an elaborate and carefully considered opinion, containing these statements:

Thus competition was invited and secured both as to materials and as to price, and the contract was awarded to the lowest responsible bidder on the material selected, though there was another bidder whose price was lower on a different material. Were this method of procedure and this action in violation of Sections 14 and 15 of the charter? There are two kinds of competition—the one, competition between different things which will equally answer the same general purpose; and the other, competition between the prices bid respectively upon each of those distinct things. What difference is there, or can there be, looking solely to the extent of that authority, between selecting the kind of pavement before bids are asked for and selecting the kind of pavement after the bids have been received and opened, upon distinct sets of specifications descriptive of wholly different kinds of pavements, but all of which are suited to the same general purpose? Manifestly, none whatever; though in some particulars, not touching the power itself, but affecting the ultimate result in other ways, there may be a difference between the two methods. Thus by the selection of the materials or the kind of pavement, after the bids have been received, combinations between bidders to inflate prices may be in a great measure avoided, since it is altogether improbable that parties who compete for the adoption of their respective materials will all ask exorbitant prices, as each party will most likely strive by depressing prices to secure the contract. As in such an instance no bidder knows in advance which kind of pavement will be selected, each is in reality stimulated to propose terms which in order to secure him the contract will produce the best results so far as the public are concerned.

New York Decisions on Use of Patented Materials

We now come to the case of Warren Brothers Co. vs. New York City (190 New York Reports, 299). This shows that the general principle set forth in the foregoing has likewise been followed in New York State. In this case the Court of Appeals reversed the Appellate Division, which had held to the contrary. Section 1554 of the New York Charter provided as follows:

Except for repairs, no patented pavement shall be laid and no patented article shall be advertised for, contracted for or purchased, except under such circumstances that there can be a fair and reasonable opportunity for competition, the conditions to secure which shall be prescribed by the Board of Estimate and Apportionment.

Under this section bids were asked for asphalt blocks, sheet asphalt and bitulithic. The question in the case was whether under such circumstances, where bids were asked for three different kinds of pavement, there could be a fair and reasonable opportunity for competition within the meaning of the charter provision just quoted. The Court of Appeals reversed the Appellate Division and held that there could be fair and reasonable opportunity for competition.

We are of opinion that the scheme devised by the Board of Estimate and Apportionment permitting the owners of patented and unpatented pavements to join in bidding for contracts to lay the same under section 1554 of the charter is, under all the circumstances, feasible, workable and affords a fair and reasonable opportunity for competition under said section.

The case of Warren Brothers Co. vs. City of New York was likewise cited with approval and followed by the Appellate Division in New York in the case of Holly vs. City of New York (128 N. Y. App. Div. Reps., 502), where bids were taken on four different types of pipe. We quote from this decision as follows:

Bids were advertised for four types of pipe on what we can only conclude were equal terms, and if it be assumed that type D is a patented article and the subject of monopoly, the conditions were similar to those approved by the court in the case just cited, except that the conditions were not prescribed by the Board of Estimate and Apportionment, which I do not think enters into the question in the present case, for the reasons already stated. That case related to bids for patented pavements, and the court said: "The dictates of public policy under the circumstances here presented would seem to require that the owners of patented and unpatented pavements should bid on equal terms."

The foregoing cases show that the rule is general that alternative specifications calling for two or more materials of a different kind or quality are not invalid because bids are taken under statutes requiring the contract to be let to the lowest responsible bidder. On the contrary, the courts have held that by taking alternative bids on different kinds and qualities, not only is competition secured in price, but is likewise secured in quality and prevents collusion.

Fifty-Ton Testing Machine Built in College Shop

By Curtis C. Myers*

Conditions often arise in making investigations where it is desirable to use special testing machines for a short time in order to secure data for reports which are being worked up by a committee. It is often impossible to invest the requisite money for permanent equipment and yet the data are necessary for a convincing report.

This condition arose recently with a committee of the Engineers' Club of Cincinnati when it was desired to make some reinforced-concrete T-beams 10 ft. long by 42 in. wide and 12 in. deep.

A testing machine was wanted which would fill the following requirements:

(1) A portable testing machine of 100,000 lb. capacity which may be used under a hatchway where an overhead crane was available for handling the beams. It was not desirable to locate the machine permanently in this position, as it was on a driveway which was used frequently. (2) A machine which would not require a pit in the floor to accommonate the weighing or loading mechanism. (3) A machine which could be built in a repair shop having ordinary shop equipment. (4) A machine not to cost over $250. This limit made necessary a design free from castings or other details which would be costly.

The transverse testing machines on the market do not meet all those requirements, as the large size require a permanent location and a pit for their loading mechanism, and their capacity is not great enough for a 42-in. beam. The machine here described was built for $245 and has given satisfaction. It was built almost wholly of scrap material, as the structural members were picked up in local junk yards, with the exception of the heavy 6-in. I-beams for the main weighing levers. The weighing mechanism was made of a discarded long-beam briquette-testing machine and the loading was accomplished with a 70-ton screw jack. The weighing mechanism could be replaced by a platform scale and the jack could be a hydraulic jack, with perhaps a little more compactness.

The machine was designed for a safe load of 100,000 lb., but was loaded to 146,000 lb. in the tests with no failure. After calibration a load of 150,000 lb. was applied and accurately measured.

While designed for beam testing, the machine may be used to test columns up to 8 ft. long and also for other compression tests, like concrete culverts. If desired, tension tests of limited range might be made.

Method of Construction

The machine was built in the University of Cincinnati repair shop by one of the students. There was no serious trouble encountered in the building, which could not be handled in any ordinary repair shop with limited equipment. The main I-beams were used as found and but few extra holes were drilled in them. It was appreciated that longer beams could have been used so that the machine would have more range simply by moving the weighing end. The short beams were cut to length by an oxyacetylene torch, this method proving cheaper than drilling. All members were bolted together, as there were no facilities for riveting. In addition, bolts were desirable in order to permit dismantling in case of storage.

The general details are shown in Fig. 1. The wheels were discarded mixer drum rollers. The main transverse I-beams have webs stiffened with angles, and a 32-in. 70-lb. rail is bolted to the top of the highest of these beams. This rail acts as one of the knife edges for supporting the beam to be tested. The tension rods were made of discarded bridge rods and the heads were welded on of the same material. The plates holding these rods were made 1½ in. thick, and they proved heavy enough.

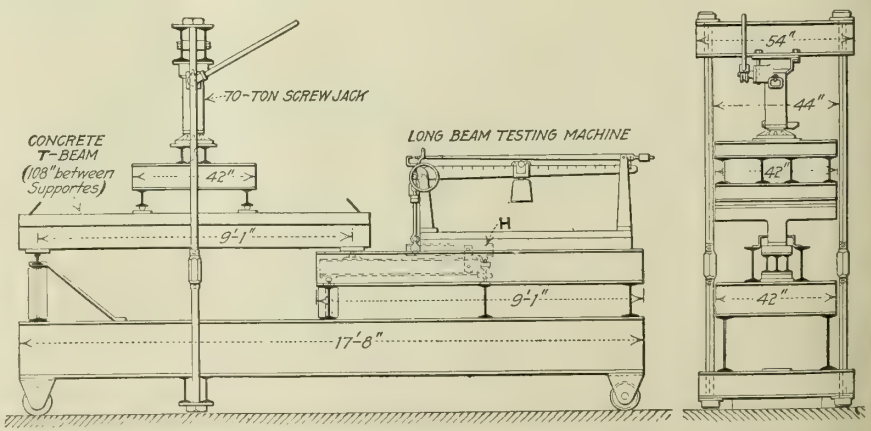


FIG. 1. DETAILS OF 100,000-LB. TESTING MACHINE BUILT IN SHOP OF UNIVERSITY OF CINCINNATI

*In charge of Cement Laboratory, University of Cincinnati, Cincinnati, Ohio.

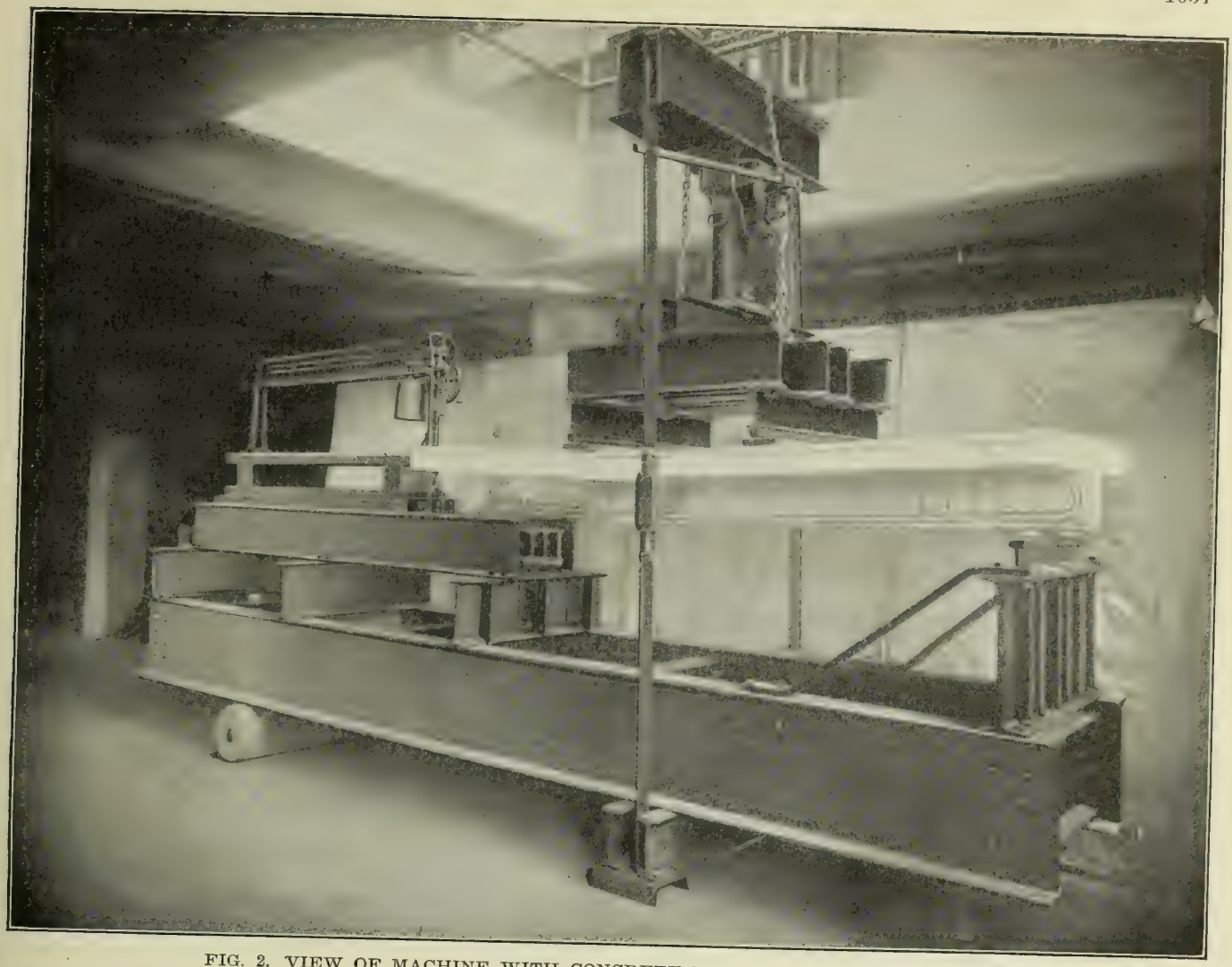


FIG. 2. VIEW OF MACHINE WITH CONCRETE BEAM IN COMPRESSION TEST

The knife edges and bearings were made of tool steel hardened in fish oil, and the temper was not so high as to cause any trouble from breaking the edges, which were rounded slightly with an oil stone. The 1¼-in. pins through the links and the links themselves were case-hardened, and both gave satisfactory service.

The ball-bearing screw jack was bolted to its bed plate and fastened with clamps and U-bolts to the top plate. This arrangement made possible the handling of the whole upper portion by the overhead crane. The long-beam testing machine was connected to the lever *H* by an eye-bolt fastened into a clevis with hardened bearings. The adjustment at the top end was made by two bolts which connected to a second clevis on the end of the scale beam.

Operation of the Machine

The method of operation when a beam was to be tested was as follows: The two tension rods were screwed out of the turnbuckles and a crane lifted the whole top part up and to one side. The beam was then lifted by means of eye-bars in the ends. Bearing plates were now adjusted on the knife edges and the beam placed in position. The top header was set on the beam and the turnbuckles were adjusted. This operation of taking off the top portion, adjusting the beam and assembling the machine took about 20 min. All the beams tested were reinforced, and there was no trouble from sudden failures. If a beam failed suddenly there would be danger of the whole top portion dropping down, and this would have to be provided for by some kind of a buffer to restrain the header. Then after the rods were screwed back into the turnbuckles a platform was placed in position and two men easily applied the load as wanted. The cost of the machine is as follows:

Old material	$68.90
New material	21.40
Bolts	11.20
Welding rods	11.00
Oxyacetylene cutting	7.00
Labor	125.50
Total	$245.00

The First Commercial Oil-Burning Tug in New York Harbor is the "Mexpet," which went into service this summer. It is owned by the Mexican Petroleum Co. and is used for handling oil tankers and ocean vessels docking at the company's pier to fill its bunkers with fuel oil. The tug is 112 ft. overall and has a beam of 24½ ft. The hold is 14 ft. deep. The rudder is unusually large for ease in short turning. The boat has one Scotch boiler 14½ ft. in diameter by 12 ft. long, with three corrugated suspension furnaces 48 in. in diameter. The pressure carried is 165 lb. per sq.in. The mechanical fuel-oil firing system of W. A. White is employed, there being two oil pumps and two heaters. The main engine is an inverted compound with 18- and 38-in. cylinders and a 26-in. stroke. In service the "Mexpet" has evaporated 16.4 lb. of water per pound of oil from and at 212° F. Oil is sprayed at from 240° to 280° F. under 40- to 80-lb. pressure. The engine horsepower ranges from 650 to 750, and a speed of 10 knots has been developed. Ninety tons of fuel oil is carried, sufficient for 10 days' run. A crew of 10 men is required.

News of the Engineering World

Important Stream-Pollution Decisions in New Jersey

The right of the State Department of Health of New Jersey to compel a municipality on the Delaware River to cease polluting that stream by sewage, notwithstanding the fact that it is an interstate river and being polluted by Pennsylvania municipalities, was affirmed by the Court of Errors and Appeals in a decision handed down on Nov. 15 in the long-pending suit between the state and Phillipsburg. The court also held valid the transfer to the State Board of Health of 1908 of the powers of the State Sewage Commission created in 1900. (The board was succeeded in turn by the present department on July 1, 1915.)

Another important decision rendered by the same court on the same day was one that materially affects Newark and other municipalities taking water from the Passaic River for municipal purposes. This suit was brought by dyeing concerns in Paterson, who sued, as riparian owners, for damages for the diversion of water from the river. The court held that a riparian owner who was polluting the stream to the injury of the people of the state could not collect substantial damages for diversion of water for public use.

The Maltrata Railway Accident

A railway accident which in number of casualties is one of the worst on record occurred Oct. 5 on the Mexican Ry. Details have been secured with difficulty. This railway is described elsewhere in this issue. The accident occurred on the Maltrata incline (between Orizaba and Boca del Monte), where the line makes an ascent of 4,000 ft. in 25 mi., with a general grade of 4% and some stretches of 5%. The alignment is very crooked and has numerous 16° curves, as shown by the plan in another column.

The accident was near Alta Luz, at tunnel No. 13, about 8 mi. west of Maltrata. The tunnel is 1 mi. distant from and 1,600 ft. above Alta Luz. The morning passenger train from Vera Cruz to Mexico was ascending the grade, hauled by a Fairlie duplex locomotive. In the tunnel the coupling to the engine gave way and the engine ran ahead, the separation of the air hose setting the brakes on the cars. The engineman did not at once realize what had happened, but after running a short distance he stopped and backed up, apparently without taking proper precautions. The tunnel is on a sharp curve, and in the darkness he miscalculated the position of the train and bumped into it with such force as to start it down the grade, the air brakes being in some way released.

The train is said to have run about 4 mi. in 2 min. before it was derailed, and then ran off the roadbed and plunged down the side of the mountain. Attempts were made to set the handbrakes, but with the panic and the crowding of passengers upon the platforms the brakemen were not able to reach the brake handles. Nearly all those on the train were killed or injured. The number of casualties is estimated at 300, a great majority of these being fatal. All the passengers who jumped from the train were killed. The bodies were collected and cremated at the side of the track, thus obliterating all traces of the dead as well as concealing the actual numbers. The only foreigners killed were a Frenchman and his wife, but their two children were unhurt.

The engineman and train crew were Mexicans. We are informed that the road has for some time been in the hands of the Carranza forces, the English management having no voice in its operation and the operation being of a haphazard character. The local papers and the brief dispatches sent out minimized the severity of the accident, but the foregoing particulars have been secured from a reliable source.

Death of Col. Francis G. Ward

Col. Francis G. Ward, for the last fifteen years Commissioner of Public Works of Buffalo, N. Y., died Nov. 16 at his home in that city. He had been ill for over a year.

He was born Mar. 8, 1856, in Cayuga County, New York, and was a lineal descendant of Col. John Ward, a soldier of the American revolution. He was educated at private schools in this country and in France and studied engineering at L'Ecole des Ponts et Chausses in Paris.

In 1875 Mr. Ward went to Buffalo as agent for the Laflin & Rand Powder Co. Two years later he entered the service of the New York Central & Hudson River R.R. as a yardmaster, being subsequently promoted to the positions of dispatcher and assistant superintendent of the Grand Central Terminal, New York City.

After ten years of varied experience in railway work in this country he received the appointment of superintendent of the Panama R.R. and for two years lived on the Isthmus of Panama. In 1887 he was transferred to Paris as manager of the general offices of the Panama R.R.

His work at Panama and in Paris attracted the attention of the French Government, and in 1888 he was employed to take charge of important surveys for proposed railways in Asiatic Turkey. Subsequently he had charge of dock construction in Algiers.

Mr. Ward returned to Buffalo in 1890, and after an unsuccessful venture in the soap business he began his public career as the chief of the city bureau of water in 1896. His service here was interrupted at the outbreak of the Spanish-American War, when he went to Cuba as Lieutenant-Colonel of the 202d New York Volunteers.

In 1900 the Buffalo city charter was changed so as to place the department of public works under a single commissioner, and Colonel Ward was elected to that office. He was reëlected for two- and four-year terms through

five successive city administrations—a remarkable record in an elective municipal office.

The department of public works being the largest city bureau, employing about 3,000 persons, has been a continual target for the city politicians, and Colonel Ward's organization was from time to time made the subject of much criticism and many investigations. The fact that he was continuously retained in office by popular election is sufficient vindication of the work he accomplished.

All his activities were not devoted to the narrow field of technical work. He was a linguist of unusual ability and could read and talk most of the European languages, and was a diligent student of history and philosophy.

He is survived by a widow, two sons and two married daughters.

Seattle City Engineer Reports on Cedar Lake Reservoir

City Engineer A. H. Dimock of Seattle, Wash., has submitted under date of Nov. 8, 1915, a report of his studies to find some means by which to render the Cedar Lake storage reservoir of the Seattle water-supply and power development available for use. As described in *Engineering News* of Jan. 21, and Apr. 15, 1915, the great concrete dam (160 ft. high and 795 ft. long on the crest) recently completed at a cost of $1,500,000 is practically useless because of the leakage under a moranial bank into which one end of the dam projects.

Analyses of samples of materials taken from various depths in pits sunk through the leaky bank show that it is composed largely of coarse sand and gravel with a few intervening strata of finer materials. The level of the water in these pits fluctuates with the water level of the reservoir, eliminating all doubt of the porosity of the material.

Experiments have been made to see whether or not a silting process could be devised which would utilize nearby soil; but the only material available for silt is a fine sand and surface soil, with which it was found impracticable to make an impervious mixture.

Two methods are proposed to reduce the leakage to a reasonable amount. One is the construction of a curtain wall (see *Engineering News* of Apr. 15, 1915); but this method Mr. Dimock is inclined to consider impracticable. The other method is to cover the porous area with a mat or layer of impervious material, a mixture of the local sand and gravel with some other material, the nature of which is not disclosed. Experiments, however, have convinced the city engineer that it is practicable to make such a mixture.

If this method is adopted it is proposed as a preliminary to remove all logs, stumps and other débris from the reservoir bottom, smooth off all slopes to 3 on 1 and utilize the excavated material to fill the old river channel. This work would be done under one contract, and if filling the river bed stopped the leakage, the second contract for covering the reservoir bottom would not be entered into. There is about 150 acres to be treated, and the cost of clearing and smoothing the slopes is estimated at $300,000. The cost of the impervious coating is stated to "amount to a considerable sum of money."

Mr. Dimock recommends caution, and he believes the scheme should be tried out on 10 or 15 acres before proceeding further. He believes that "it is entirely feasible and practicable to secure a reservoir which will retain the impounded water." In view of the unusual problems and the large interests involved, he has asked to be authorized to secure such expert advice and assistance as may be necessary to work out the details.

New Haven Road to Build New Thames River Bridge

A new Thames River bridge is to be built at New London, Conn., by the New York, New Haven & Hartford R.R. The present bridge, which consists of five spans (150 ft., 310 ft., 503-ft. draw span, 310 ft. and 150 ft.), was built in 1888-89 and originally was a two-track structure. In 1908, owing to increased train weights, it was necessary to limit the use of the bridge to single-track operation. The bridge is on the main line of the railway between New York City and Providence and Boston, so that the reduced capacity of the structure has seriously hampered the efficiency of the whole line. The new bridge is to have a substructure capable of carrying four tracks with the heaviest known loading; but the superstructure to be first built will be for two tracks only. It will also be a five-span structure with an electrically operated bascule lift span. There are to be three spans of 330 ft., one of 185 ft. and one of 212 ft. The new bridge is to be 185 ft. upstream from the present structure, which is to be presented to the State of Connecticut for a highway bridge. The four piers for the new bridge will require foundations ranging from 75 to 142 ft. deep. The piers are to be of concrete, with masonry facing between high and low water; three will be constructed by open-well dredging and a pneumatic caisson will be used for the fourth. The extreme dimensions of the piers are 42x98 ft. About 48,000 cu.yd. of concrete will be required. The superstructure will contain 5,000 tons of steel. The work includes two bridge approaches of 1,300 and 1,600 ft. respectively. Contracts have not yet been let, but it is assumed that the work will be completed in 1917. The plans have been prepared by the engineering department of the New York, New Haven & Hartford R.R., under the direction of Edward Gagel, Chief Engineer; I. D. Waterman, Construction Engineer, and W. H. Moore, Bridge Engineer. The following are the consulting engineers: Gustav Lindenthal, E. H. McHenry, Ralph Mojeski and J. P. Snow. The estimated cost is $2,500,000.

Irrigation by Los Angeles Aqueduct Water

Further progress in making ready to utilize the surplus water of the Los Angeles Aqueduct will result from the approval by the California Supreme Court of the procedure for the formation of the Los Angeles Water District No. 3. This district comprises 77,000 acres of land in the San Fernando Valley, which has recently been annexed to Los Angeles for the purpose of securing the use of the water named. The district proposes to issue $2,600,000 of 6% bonds, half of which it intends to put on sale shortly.

The recently enacted "County Water District Law," under which the district previously named was organized, has itself been approved by the State Supreme Court.

The law provides that upon petition to the Board of Supervisors of the County from territory that is partly or wholly unincorporated, the supervisors shall proceed with the organization of a water district, either for domestic- or irrigation-water service, and that after the district is organized the county officials shall act as the officers of the district, collecting the taxes of the district for interest and principal on the bonds, the same as regular county taxes, and eliminating entirely the local district officers, who in years gone by have caused much trouble in irrigation districts.

The law further provides that when all of the territory so served shall become annexed to a city having a municipal water-works, these county irrigation district works shall automatically become a portion of the municipal water-works. The city officials are then substituted in place of the county officials, and the taxes for interest and principal on the bonds are collected as a portion of the regular city taxes. These bonds, therefore, are quasi-county or municipal bonds and should have a market value about the same as school, county or city bonds.

In the case of the district under consideration it is expected that eventually the irrigated area will be built up and all the water formerly used for irrigation will be required for domestic and other municipal purposes.

Court Decision Adverse to Luten Bridge Patents

A decision against the validity of seven patents on reinforced-concrete bridge construction issued to Daniel B. Luten was handed down Nov. 18 by Judge R. E. Lewis in the United States District Court at Denver, Colo. In the case decided, Daniel B. Luten sued Washburn and others for infringement of the following patents: Nos. 852,970; 853,183; 853,202; 853,203, dated May 7, 1907; 933,771, dated Sept. 14, 1909; 979,776, dated Dec. 27, 1910, was 989,272, dated Apr. 11, 1911.

Washburn was a contractor who built a 30-ft. span reinforced-concrete bridge for a Colorado county. The county joined in the defense of the suit for infringement and employed Prof. M. S. Ketchum as expert in the case. Among numerous patents cited to the court by the expert as anticipating the alleged inventions of Luten was a patent to Coignet, No. 88,457, issued in 1869, containing the following claim: "The introduction in the body of artificial stones or in the body of artificial stone monolithic structures made of agglomerated stone paste of skeletons or metallic framework, linked or arranged so as to strength the same."

The expert for the complainant disclaimed that the patents in the suit embodied anything beyond placing the steel in a new way that produced better results in a more efficient form.

Judge Lewis in his decision declared that in placing the steel in position to conform to certain mechanical principles, in the patents in suit, Luten had in each instance made application of mere mechanical skill and that what he did was in no sense the work of inventive genius.

The judge refused to consider as binding the previous decisions rendered in favor of the Luten patents, holding that the evidence showed that in all these decisions the cases for the defense had not been adequately presented.

The Joint Sewage-Disposal Project for Pasadena, South Pasadena and Alhambra, Calif., has progressed as far as the purchase, on Nov. 10, of 600 acres of land for a disposal site at a reported cost of $150,000.

A Highway Engineer is to be engaged by the State Highway Commission of Florida at its meeting on Dec. 1, at which time the work of the commission will be organized. The chairman is W. J. Hillman, of Live Oak, Fla.

A 600-Mile Oil Line is contemplated to run between Casper, Wyo., and Omaha, Neb. Governor Kendrick, of Wyoming, has appointed a committee to decide upon the feasibility of the project, which is expected not to exceed in cost $3,000,000.

A Car Ferry for the Canadian Northern Ry. is to be operated between Vancouver, B. C., and Patrica Bay on Vancouver Island. From the latter point a railway will be built to the City of Victoria, a distance of 16 mi. Two car-ferry steamers have been ordered for this service, which will enable passengers to travel to and from the Port of Victoria without change of cars.

A Saving of $100,000 per Year by cooling the water used in the condensing tanks of the garbage plants of the Pacific Reduction Co. in Los Angeles is announced in the annual report of Homer Hamlin, City Engineer. The city furnishes the water for this reduction plant, and the supply needed has been cut down by the installation of cooling tower and 18x22x10-ft. storage reservoir. The cooling tower is 4 ft. wide, 100 ft. long and 36 ft. above ground.

Erie Adopts Flood-Prevention Plan—The City Council of Erie, Penn., has adopted formally the flood-prevention plan recommended by Farley Gannett, as reported Nov. 11, 1915, p. 937. The channel of Mill Creek through the city will be converted into a horseshoe-shaped reinforced-concrete conduit 22x18 ft., with a flow capacity of 12,000 cu.ft. per sec. This is slightly more than the peak flow of the Aug. 3 flood. No storage is to be provided on the stream. The total cost will be $900,000. Work can be started without a referendum vote.

Recovering Benzol from Coal Gas is a feature of the byproduct coke-oven gas plant of the Citizens Gas Co., of Indianapolis, Ind. This step was taken owing to the necessity of scrubbing the gas to remove naphthalene, which caused trouble by clogging the mains. By scrubbing the gas the light oil is recovered and carries with it the objectionable naphthalene. By refining the light oil, benzol is obtained, and at the present time is commanding a high price. A complete refining plant for this purpose has been installed, and though a considerable percentage of the benzol must be returned to the gas for enrichment, there is a certain amount available for sale.

A Conference of Iowa Sewage-Works Operators was held at Ames, Iowa, Nov. 2 and 3, under the coöperative auspices of the Engineering Division of Iowa State College and the Iowa State Board of Health. Over twenty operators were in attendance, besides representatives of the college and of the board, several men from outside the state and a number of engineering students. The 21 topics on the carefully arranged program were designed to give a bird's-eye view not merely of the various methods of sewage treatment, but also of the elements of each method and of the best way of meeting operating problems. Mimeographed notes on the work of the conference were distributed to those present. Visits were made to three sewage works—those of the college, the city and Nevada, Iowa.

Cracks in a Reservoir Lining at Aberdeen, Wash., have been investigated by R. H. Thomson, consulting engineer, Seattle. Mr. Thomson states that the cracks are not due to any fault in the reinforced-concrete lining (built without expansion joints, as described on page 1034 of this issue), but are caused by movement of the earth fill, which forms half the depth of the reservoir at the place where the cracks have occurred. Of the few cracks in the lining, Mr. Thomson states that the widest is probably ¼ in. across at the surface; and that L. D. Kelsey, city engineer, has taken needful measures by making "insurance applications" in the form of burlap strips soaked with asphalt to prevent leakage into the embankment. Subsequent advices from C. E. Fowler, consulting engineer, Seattle, indicate that the earth fill slid on the rock beneath it.

The Eugenia Falls Plant of the Ontario Hydro-Electric System was officially opened on Nov. 18 by Mayor J. McQuaker, of Owen Sound, in the presence of the representatives of 12 municipalities in the neighborhood and the members of the Hydro-Electric Commission. The gathering was addressed by Sir Adam Beck, the chairman of the commission, who reviewed

the work done in the development of the Eugenia Falls system, which was begun in July, 1914, and completed in 14 months. A steel and concrete dam had been constructed 50 ft. high and half a mile in length on the Beaver River, with several smaller dams, which will impound a reserve supply of water insuring a steady production all the year round of 8,000 hp. The storage basin covers an area of 1,700 acres. This plant represents an expenditure of $596,000, and the transmission lines supplying the municipalities require a further outlay of $475,000. At present about 4,000 hp. will be supplied from the Eugenia Falls development to 12 municipalities, the principal of which are Owen Sound, Mount Forest, Orangeville, Medford, Kincardine and Grand Valley; but ultimately the output will be doubled and the number of towns and villages supplied increased to 24. When the northern district is supplied from Eugenia Falls and other plants in that section it is proposed to connect the district with the Niagara Falls system.

PERSONALS

Mr. Leonard Funk has been appointed Commissioner of Public Works of the City of Spokane, Wash.

Mr. Frank H. Ciutz, Municipal Engineer of Chambersburg, Penn., has resigned to accept a position in the city service of Philadelphia.

Mr. S. C. Odell, of Columbia, S. C., has been appointed Manager of Terminals of the Jacksonville, Fla., Municipal Docks, now approaching completion.

Mr. N. H. Bogue, formerly Assistant Engineer of the North Coast Ry., has been appointed Chief Engineer of the Oregon, California & Eastern Ry., a projected west coast railway, of which Mr. Robert E. Strahorn is President.

Mr. Thomas C. Shedd, Jun. Am. Soc. M. E., Instructor in Mechanical Engineering at Brown University, has resigned to accept a position with the Phoenix Bridge Co. at Philadelphia. He will be succeeded by Mr. Frank C. Blake.

Mr. Richard A. Hart, Assoc. M. Am. Soc. C. E., Supervising Drainage Engineer of the United States Department of Agriculture at Salt Lake City, has been appointed to take charge of the newly created branch office of the United States Office of Public Roads and Rural Engineering at Berkeley, Calif.

Prof. John C. Tracy, Professor of Structural Engineering in Sheffield Scientific School, Yale University, has been appointed to succeed the late A. J. Du Bois as head of the Department of Civil Engineering. Professor Tracy was graduated from Sheffield in 1890 and received the degree of Civil Engineer in 1892, at which time he was made an Assistant, and in 1894 an Instructor. He was appointed Assistant Professor of Structural Engineering in 1902 and Professor of Structural Engineering in 1915.

OBITUARY

Edwin Thomas Munger, General Superintendent of the Hudson & Manhattan R.R. for several years, died on Nov. 14 at his home in Paterson, N. J., at 44 years of age. He was born in Menomonie, Wis., and was graduated from the University of Wisconsin. Previous to his connection with the Hudson & Manhattan R.R. he was General Superintendent of the Metropolitan Elevated R.R. of Chicago.

Theodore Landsberg, formerly Professor of Bridge and Structural Engineering at the Darmstadt Technical College, Germany, died on Oct. 20, at the age of 68. During the time of his professorship—1880 to 1908—he made a prominent name as a leading student and investigator of structural subjects, among them influence lines and the analysis of framed domes. He received the honorary degree of doctor of engineering some years ago.

Dr. A. Veeder, a member of the American Public Health Association, and a writer on water-supply, garbage disposal and similar subjects, died at his home in Lyons, N. Y., on Nov. 16. He was born in Ashtabula, Ohio, in 1848, and was graduated from Union College in 1870. He received his medical degree from the University of Buffalo several years later. For several years Dr. Veeder was Principal of the Ives Seminary, Antwerp, N. Y. He had practiced medicine for the last 30 years in Lyons.

ENGINEERING SOCIETIES

COMING MEETINGS

THIRD ANNUAL PENNSYLVANIA WELFARE AND EFFICIENCY CONFERENCE.
Nov. 16-19. Conference in Philadelphia.

NATIONAL MUNICIPAL LEAGUE.
Nov. 17-19. Annual convention, Dayton, Ohio. Secretary, Clinton Rogers Woodruff, 705 North American Building, Philadelphia.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
Nov. 18-19. Annual meeting at Zanesville, Ohio. Secretary, F. E. Sanborn, Columbus, Ohio.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 1-3. Annual convention in Washington, D. C. Executive Secretary, E. C. Kempe, The Octagon, Washington.

AMERICAN ASSOCIATION OF ENGINEERS.
Dec. 10 and 11. Convention in Chicago. Secretary, Arthur Kneisel, 29 South La Salle St., Chicago.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.
Dec. 13-15. Annual meeting in New York. Secretary, Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

SECOND PAN-AMERICAN SCIENTIFIC CONGRESS.
Dec. 27-Jan. 8. Washington, D. C.

MONTANA INSTITUTE OF MUNICIPAL ENGINEERS.
Jan. 17-19. Annual meeting at Billings, Mont. Secy., C. C. Widener, Bozeman, Mont.

NINTH CHICAGO CEMENT SHOW.
Feb. 12-19. First Infantry Armory and Coliseum. Secy., R. F. Hall, 208 South La Salle St., Chicago.

SECOND NATIONAL CONFERENCE ON CONCRETE ROAD BUILDING.
Feb. 15-8. At Chicago. Secy., J. P. Beck, 208 South La Salle St., Chicago.

Engineers' Society of Western Pennsylvania announces that twice a month lists of positions open and men available will be published in its notices of meetings. The service is free and coöperation is solicited.

The Second National Exposition of Chemical Industry will be held at the Grand Central Palace, New York City, in the week of Sept. 25, 1916. The first exposition, recently held in New York City, was sufficiently successful to warrant repetition.

American Road Builders' Association—The next annual convention will be held at Pittsburgh, Penn., Feb. 22-25, 1916. In order to supply the necessary facilities, the Pittsburgh City Council recently appropriated ample funds to put Mechanical Hall of the Exposition Building in shape for this convention. It has been decided to hold the annual conventions hereafter either in January or February.

The Society of Constructors of Federal Buildings will hold its seventh annual convention at Washington, D. C., Jan. 3 to 6, 1916. It is intended to have an exhibition of building materials and appliances, an exhibition of photographs of hoisting equipment, etc. There will also be an exhibit of photographs of United States public buildings, showing the different styles of architecture that have been in vogue. Information as to the convention and the exhibits may be obtained from Irving D. Porter, 3128 Mt. Pleasant St., Washington, D. C., or from Charles Reed Marsh, secretary, Brattleboro, Vt.

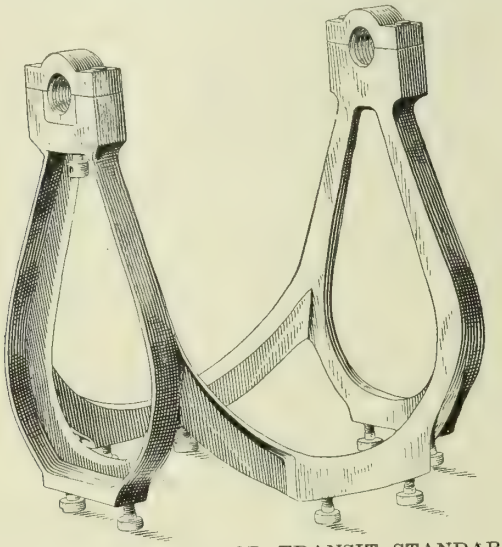
Atlantic Deeper-Waterways Association—At the eighth annual convention of the association, adjourned on Nov. 12, the following officers were elected: President, J. Hampton Moore, of Philadelphia; vice-presidents, J. H. Small, North Carolina, and W. S. Bennett, New York; F. W. Donnelly, New Jersey, and J. H. Preston, Maryland; delegates-at-large, J. Charles Linthicum, Maryland, and Frank F. Crane, Massachusetts. W. H. Schoff, Pennsylvania, was reëlected secretary-treasurer. Under a change in the constitution four vice-presidents-at-large and two delegates-at-large are elected.

The American Civic Association will hold its eleventh annual convention at the New Willard Hotel, Washington, D. C., Dec. 28 to 31. The convention will be held in conjunction with the Second Pan-American Scientific Congress. The program will include addresses and discussions relating to city, town and country planning; to residential and garden-suburb development; to national and state parks; to Niagara Falls preservation; to the abatement of the billboard nuisance. The Scientific Congress will treat the scientific aspects of several of the topics just mentioned. The secretary of the association is Richard B. Watrous, Union Trust Building, Washington D. C.

Appliances and Materials

One-Piece Trussed Transit Standards

A new line of precise transits is being introduced by W. & L. E. Gurley, Troy, N. Y. The principal features of the new instruments are the standards and the lower plate castings. The standards are cast in one piece, as shown in the accompanying sketch; the casting is of bronze and of angle cross-section. It is fastened to the plate casting by eight



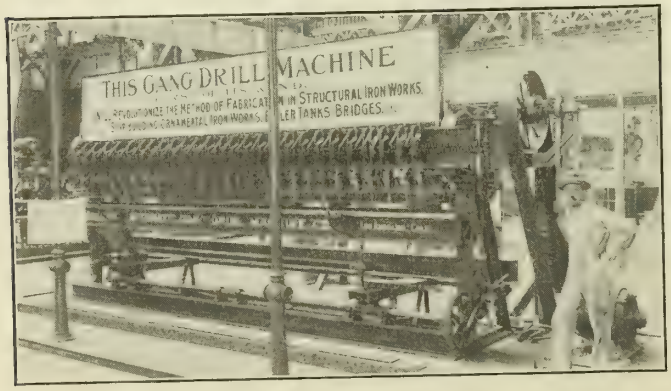
ONE-PIECE CASTING FOR TRANSIT STANDARDS

fillister-headed screws instead of four screws, as in the usual type of transit standard. The plate castings have 24 to 26 radial ribs to give rigidity. The new instrument, with a 6.7-in. horizontal circle, weighs 18½ lb., or 29½ lb. with the tripod. The list price is $220. The same construction is also used for an instrument with a 6.25-in. horizontal circle, which is made in two weights—16½ and 27½ lb. The list price is the same.

* * *

Gang Drilling Machine for Structural Steel

There is in the Machinery Building at the Panama-Pacific Exposition a new gang drill which is claimed to bore a larger number of holes than any such drill hitherto made. A front view of the machine is shown herewith. The drills are rotated by two sprocket chains, which engage with sprocket wheels mounted on the spindles of each alternate drill head. This enables the drill spindles to be brought very close together without requiring the driving sprocket to be of very small diameter. Each drill head may be moved independently of the other and is clamped to the horizontal slide by a hand lever. The frame which carries the drill heads is stationary and the table on which the plate or other material to be drilled is placed is raised by automatic mechanism to give any desired feed. The drills can be spaced as accurately as in any gang drilling machine, and provision is made for automatic feed of cooling and lubricating liquid. In the present machine the closest spacing possible is about 3 in., but with slight alterations in design it will be possible to reduce this. The chuck takes standard sizes of twist drills and is arranged to permit their quick removal from the machine.



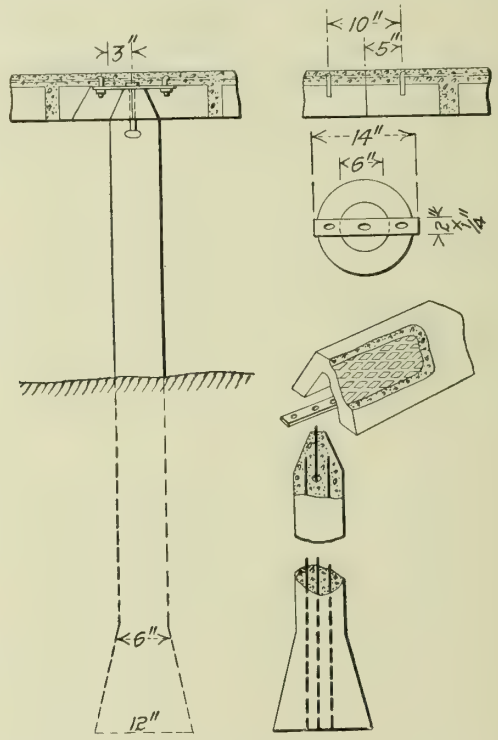
HILL GANG DRILL FOR STRUCTURAL WORK

The inventor of the machine is Aaron Hill, of Los Angeles, and the first machine was built at shops in that city. The machine is being placed upon the market by the Hunt Engineering and Sales Agency, Baker-Detwiler Building, Los Angeles, Calif.

* * *

Patented Concrete Guard Rail

A reinforced-concrete guard rail for use on highways has been patented by H. E. Dillon, Construction Engineer, Olean, N. Y., who manufactures the steel-unit reinforcement and the special forms for molding the rail and posts. The rail itself is of inverted V-shape cross-section and is reinforced with diamond-mesh wire cloth. It is made in 8-ft. lengths and is connected to the posts by slotted iron strips attached to the under side of the rail. Through these strips bolts in the top of the posts are passed and held by nuts. While the forms are in sections, the rail may be cast monolithic if desired. The posts are round, 6 in. in diameter, spread at the



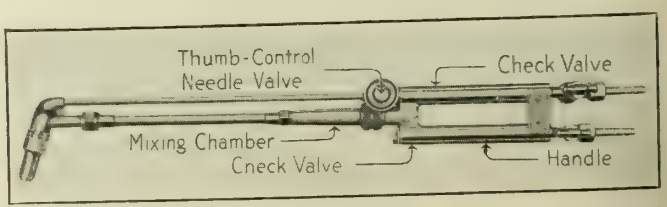
DILLON REINFORCED-CONCRETE GUARD RAIL

base to 12 in. The tops of the posts are tapered to avoid frost damage to the rail and to give it a firm bearing under all conditions. The reinforcement forms a framework which would stand of itself, thus providing the completed structure with considerable strength against shock. The inventor claims that this rail may be erected in place at approximately the cost of a first-class wooden guard rail.

* * *

Oxyacetylene Welding and Cutting Outfits

A newly improved line of cutting and welding outfits, designed by A. J. Fausek, is being made by the Modern Engineering Co., St. Charles and 14th St., St. Louis, Mo. They are variously arranged for concerns all the way from small smiths and manufacturers up to the largest railways, welders and wreckers. The important item, besides hose, gages, etc., is the torch—which is shown in the view as fitted for cut-



FAUSEK OXYACETYLENE TORCH FITTED FOR CUTTING

ting. Patent check-valves prevent flow from one gas line to the other. The handle is a one-piece light-alloy casting. To attach the cutter, the welding arm and tip are removed from the mixing chamber, and the cutting head, with its oxygen-control valve and conduit, is put on. The tank-hose connections are not disturbed.

Engineering News

VOLUME 74 DECEMBER 2, 1915 NUMBER 23

Piecemeal Erection of a Bridge on the Boston & Maine R.R.

By K. W. Lemcke*

The Boston & Maine R.R. crosses the Hudson River just east of Mechanicsville, N. Y., by a double-track bridge consisting of nine deck-truss spans, each about 130 ft. long. At the west end is a double-track deck-girder span across the Stillwater Road. The truss spans of the old structure, built in 1878, consisted of double-intersection Pratt trusses of eight panels, having Phœnix compression members. In 1893 these spans were strengthened by the addition of a center truss.

The new structure, which has recently been completed, is similar to the old one, except that the truss spans are of six panels of the single-intersection Warren type. The new structure is much the heavier. The alignment and grade remain the same and the old piers are used for the new structure. Fig. 3 is a general view of the bridge as seen from the west bank of the river.

Conditions at the Site

Just north of the bridge site the Hoosick River empties into the Hudson, while half a mile below is the West Virginia Pulp and Paper Co.'s dam, built for power purposes. The normal depth of water at the bridge site is from 12 to 14 ft. The main current flows between piers 8 and 9. The river bottom varies from rock overlain by sand to a bare rock floor, and is fairly uniform and level.

Traffic was maintained at all times. There was an average of about 20 trains over the structure per working day of 8 hr. Material storage room was limited to a narrow strip of ground on each side of the track. There was a very sharp curve at each end of the bridge.

Falsework Used in Erection

The general method of erection adopted was to falsework the old structure and, with traffic on one track, remove one side of a span and place the new steel and deck, then to transfer traffic and complete the opposite side of the span. This process was repeated span by span.

As all river spans were alike and the river bottom fairly level, a standard form of falsework bent was used, except the falsework for the girder spans, at the land ends, around the piers and at the east abutment of the river spans. The standard form of bent was of two stories, each being made of two half bents spliced at the center. The lower story had eight 10x12 plumb legs about 25 ft. long, caps and sills of two 10x12's 20 ft. long spliced at the center by 4x10 scabs, and bracing of 3x10's bolted on.

*36 Fuller Terrace, Orange, N. J.

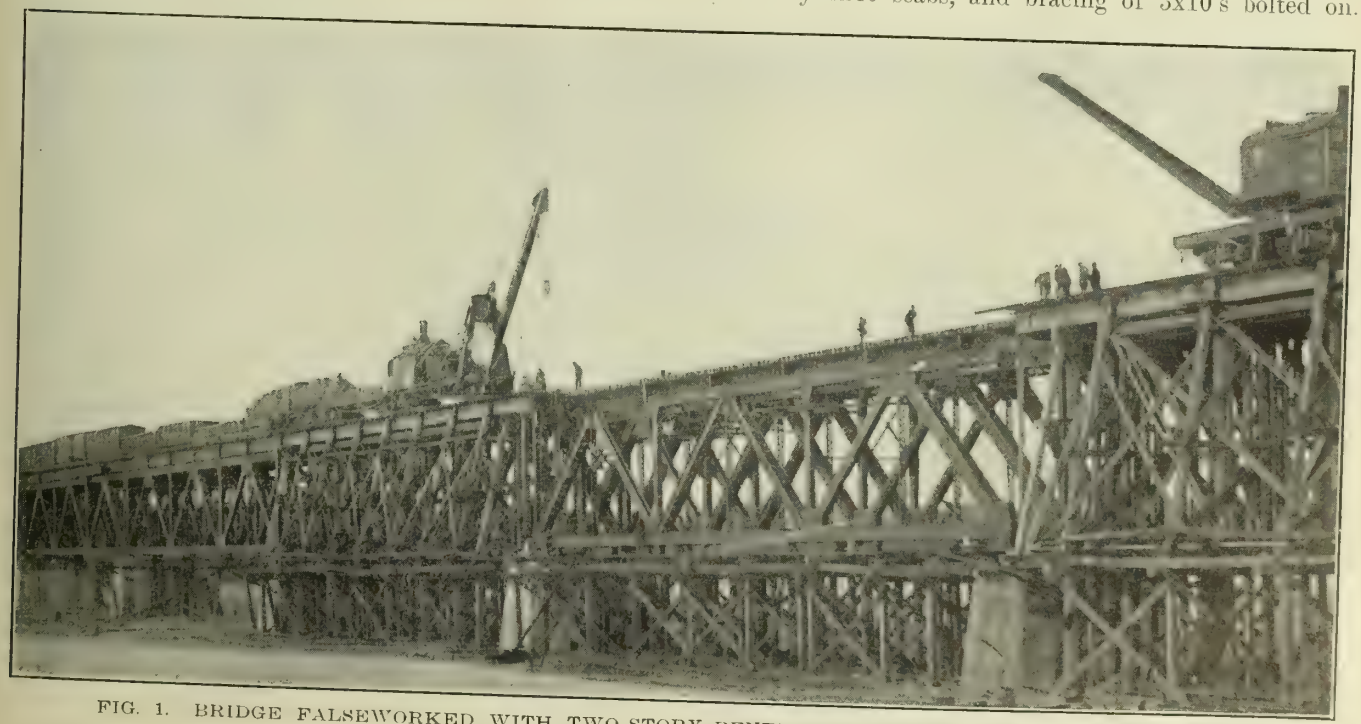
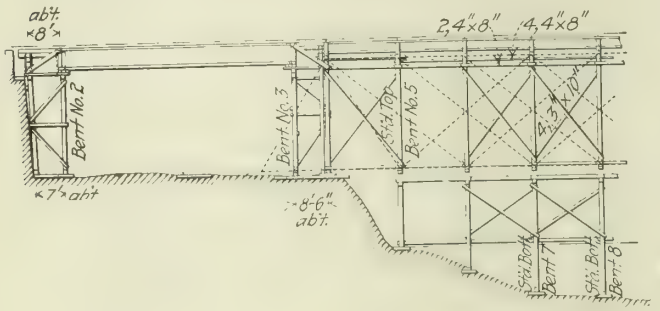


FIG. 1. BRIDGE FALSEWORKED WITH TWO-STORY BENTS; STEEL ERECTION GOING FORWARD

The upper story consisted of six plumb legs and two batter legs, 10x12, on 10x10 sills, spliced at the middle by 3x10's. The batter legs were connected to the ends of the floor-beams of the old structure by hardwood scabs



The contract required that the old structure be removed and loaded on cars, the wrought iron and cast iron to be loaded in separate cars. The old steelwork was cut up with oxyacetylene flame for loading.

Erection was started at the west end of the structure, with a locomotive crane placing falsework and a wooden derrick car to follow up for removing the old and placing the new structure. After a few months' work a second crane was placed on the job and was used in the yard to feed the derrick car, load old material and bring up and lay the new ties.

On account of having to clear the piers for alterations to the masonry, sufficient falsework lumber was bought to falsework completely at one time either the girder spans and two truss spans or three truss spans. It was

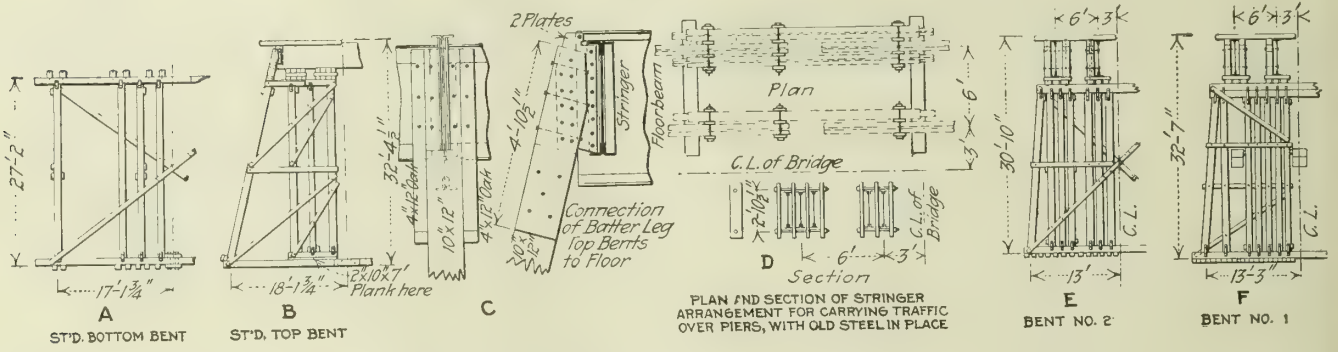


FIG. 2. DESIGN OF FALSEWORK USED IN REMOVAL OF OLD BRIDGE STEEL AND ERECTION OF NEW

and steel plates bolted to the floor-beams, rivets in the stringer connections being knocked out for this purpose. As the bents were placed at the panel points of the old structure, the caps were made of two separate 10x10's. The transverse braces were 3x10-in. and 2x10-in. planks.

The inequalities in the river bottom were taken up by shoes bolted to the sills of the lower bents and by blocking between upper-story and lower-story bents. Between the two stories 10x12-in. stringers were placed, and later when the old steel and top-story falsework were removed the blocking to support the new steel was laid on these stringers. The old floor system was blocked up from the top of the top-story bents by means of 4x8-in. stringers. The falsework was braced between piers by 6x8-in. horizontal sash and 3x10-in. bracing.

Erection Methods and Plant

All piers and abutments were made of stone masonry; the river piers had been jacketed with concrete. In order to distribute the reactions from increased load, I-beam grillages were embedded in the masonry. As the grade remained the same and the distance from top of masonry to base of rail was practically the same for the new as for the old structure, the old masonry had to be cut down to receive the grillages.

This operation necessitated spanning the piers and abutments so that they could be cleared and cut down for placing grillages. This was done in the case of the river piers by placing bents each side of the piers and using steel stringers from the old structure. For the east abutment an extra bent was used, while for the west abutment and pier 9 the girder spans were set east about 8 ft. on special bents after the end panel of span No. 9 had been removed, the abutment being spanned by timber stringers.

framed in a yard just north of the bridge site and close to the river bank. When sufficient falsework had been placed and the necessary portion of span No. 9 had been removed, the derrick car, assisted by the falsework crane, set the old girder spans east 8 ft., their ends being supported on special bents of falsework. This cleared pier 9 and the west abutment. The change was made between trains.

Starting from the east end, the derrick car then removed one side of span 9, taking out at one time two panels of steel and the top falsework. Two panels of the new steel were then set on blocking on the lower-story falsework. The derrick car backed up westward and repeated the process until the old span was removed and the new one put in place. As soon as pier 9 had been cut down, the grillage beams, shoes, etc., were placed. As the masonry was removed in courses, it could not be accurately cut to grade. The grillages were concreted in at the proper elevation, being temporarily supported on rails or struts taken from the old structure, with plate liners or pieces of Phœnix columns (cut to correct length) set under them. The one exception to this procedure was the grillage at pier 9, which was hung from timber beams until concreted in place.

After one track of span 9 had been completed and the ties laid, the old girder span was removed and loaded on cars by the derrick car and falsework crane and run back on a siding. The girder spans were shipped riveted up complete, and all ties for a new span were placed while in the yard at the site. The derrick car and falsework crane set the span; the steel bent supporting the east end had previously been set.

Ties for the truss spans were framed in the yard and piled up by panels. As the ties were framed so as to remove some of the camber in the span, the daps in them

were of different depths. These ties were loaded on a flat car and run out and set from the main track by the falsework crane or the yard crane.

The yard crane later assembled by panels the floor system of the truss spans, and during the period when there was danger from ice, set most of the floor system. The falsework crane assisted in removing the old steel from the piers and placed the grillages, shoes, end floor-beams, stringers and batter and plumb end-posts of the new spans.

After the river had frozen over, the falsework bents on being removed by the derrick car were snaked along on the ice by the falsework crane for erection in new position. For several spans, holes for the falsework bents had to be cut through ice 18 in. thick.

Materials and plant for concreting were placed on two flat-cars, which were loaded in the west yard. The cars were run on the bridge between trains and placed on the dead track. The concrete was placed by means of a long chute let down between the cross-ties. Wire mesh was placed in the concrete to assist in bonding it and to prevent it from spalling off. Owing to traffic and working conditions, considerable of the concreting had to be done at night. When it was necessary to concrete during freezing weather the materials were heated by means of a steam line, the steam being supplied by one of the cranes.

Work was started the second week in August, 1914, and all steel had been erected by the middle of February, 1915. The steel was fabricated and erected by the bridge and construction department of the Pennsylvania Steel Co., Steelton, Penn., for whom J. F. Ritter is Superintendent of Erection and H. E. Trout, Engineer in Charge in the field. The writer was associated with the design of the falsework in the office and did the engineering in the field.

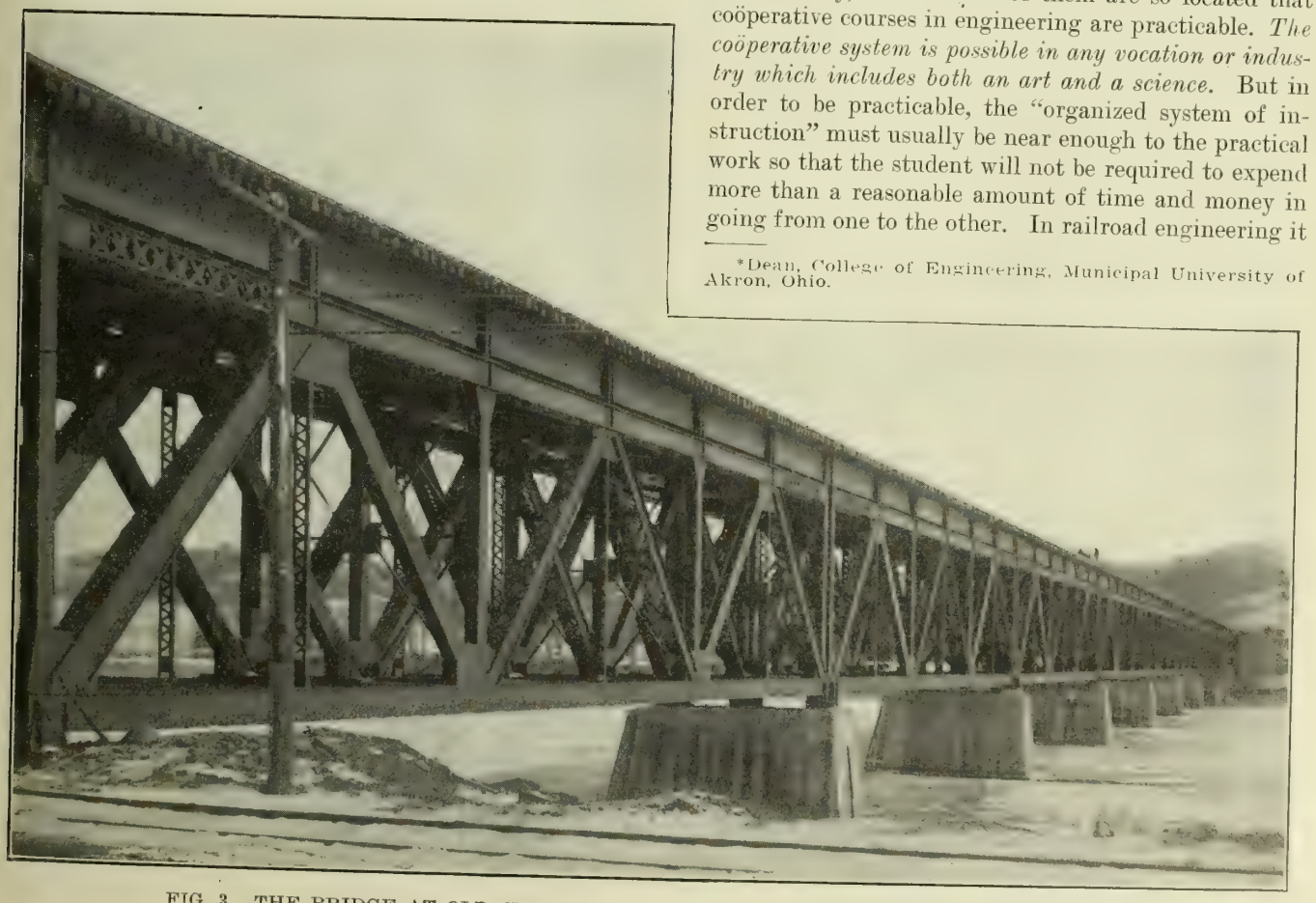


FIG. 3. THE BRIDGE AT OLD CROSSING ON B. & M. R.R., AT MECHANICSVILLE, N. Y.

Co-operative Technical Schools Meet Present Needs

By Fred E. Ayer*

A review of the files of the leading engineering magazines shows that practically every subject in the engineering-school curriculum and the method by which it is taught have been attacked by practicing engineers. Many advantageous changes have resulted. So many of the deficiencies in engineering education are overcome by the co-operative system that a few hints on starting such a course ought to be of interest.

What Is the Coöperative System?

Herman Schneider, Dean of the College of Engineering, University of Cincinnati, has well stated the fundamental idea thus:

> The practice of engineering cannot be learned in a university; it can be learned only where engineering is practiced—namely, in the shop or field. The theory underlying the practice may be obtained outside of the university, but can be best obtained in an organized system of instruction under skilled teachers.

In this system the students are grouped in pairs and spend alternate periods at work in the industries and at school in the engineering college (*American Machinist*, July 28, 1910; see also *Engineering News*, July 9, 1908).

Where Are Coöperative Courses Possible?

Although there are over 600 colleges and universities in this country, less than 50 of them are so located that coöperative courses in engineering are practicable. *The coöperative system is possible in any vocation or industry which includes both an art and a science.* But in order to be practicable, the "organized system of instruction" must usually be near enough to the practical work so that the student will not be required to expend more than a reasonable amount of time and money in going from one to the other. In railroad engineering it

*Dean, College of Engineering, Municipal University of Akron, Ohio.

has been found practicable to have the student work as far away from the college as he can travel between Saturday night and Monday morning, since his fare costs him nothing. By making the alternating periods long it is practicable in many cases to carry on the system even though college and work are widely separated.

It is easy to understand how a factory can coöperate to advantage with the engineering school, but the application of the system to civil engineering is not so apparent. The mechanical engineer manufactures his product in a factory and ships it to the consumer, while the civil engineer must usually build his product on the site of its future use. Therefore any organization engaged more or less continuously in work requiring the services of civil engineers offers an opportunity for coöperative students.

The Industries Will Coöperate

A railroad is an organization which suggests itself at once. But when the attempt was first made in Cincinnati to coöperate with the railroads there, none of the chief engineers would believe that college students could be induced to work as laborers on the section gangs and associate with the foreigners employed there. Soon after this attempt had failed, D. C. Buell, at that time in charge of the Educational Bureau of the Union Pacific R.R., consented to try some of the civil-engineering students during the summer. Eight boys were taken to Omaha, and they worked there as section hands all summer, part of the time in the yard section and the remaining time in an extra gang on main-line work. After this demonstration there was no difficulty in placing them at home. One and in some cases two years can be spent profitably on track work, including yard, main-line and extra-gang work. The remainder of the time is divided among the signal corps, carpenter and bridge-repair gangs and the engineering corps. Some time is spent in the office in clerical work to acquaint the student with the accounting and cost-keeping methods of the department.

The majority of cities having shops enough to make a coöperative course in mechanical engineering possible also have enough construction work going on to provide employment for a number of civil-engineering students. The first year or two can be spent to advantage in a structural-iron works and the following years at such construction work as is available in the vicinity. It is evident that the sequence of work in construction cannot be planned with the same definiteness as in a factory, yet experience shows that the men are promoted about as fast as their capabilities warrant. Since construction work stops in cold weather, it is better to work these students continuously during the summer and let them take the college work given to the other students in the summer term in alternate periods during the cold months.

At present the civil-engineering students in Akron are employed on the railroad, on a $1,000,000 building being erected by the B. F. Goodrich Co. and on the sewage- and garbage-disposal plants being built for the city.

Again, in selecting an industry care must be taken to see that the work offers educational opportunities. A machine shop doing general repair work, even though it employs a small force and has limited equipment, is usually a far better place for a student in mechanical engineering to work in than a big manufacturing plant in which the work is done by automatic machinery Many educators believe that strict precautions are necessary to prevent employers from exploiting students. In the nine years that the writer has been engaged in this work, less than 3% of the firms employing coöperative students have persisted in treating them unfairly. Since the "organized system of instruction" is in the business of education, it should take the initiative in starting the new system. However, in several instances this first step has been taken by the manufacturers themselves.

Of course it is necessary to know, in a general way, what kinds of work the student will get in his progress through the shop, but at first it is not essential, and often it is not possible, to outline a specific course of four months in one department, six months in another, etc. In practically every case such a course can be satisfactorily agreed upon by the institution and the employer as the latter gets more experience with student labor. Sometimes employers hesitate to coöperate for fear the system will not be satisfactory and they will be obliged to retain the students at least one school year. Hence, it is safe for the educator to agree to remove the students whenever the employer is not satisfied with their work. Such occasions seldom arise, and usually no difficulty is experienced in placing the students with some other firm.

A common wage scale is very desirable if the employers can be prevailed upon to agree to it. When the course is started there are usually so few students involved in any one organization that the employer classifies them under one of the rates already established. A common scale can be agreed upon later when there are enough students involved to make such a procedure worth the consideration of the employer.

The solicitor must be qualified to go into an industry and point out the specific places in which student help could be utilized profitably. If an institution contemplates starting coöperative courses, those teachers who have a practical knowledge of the art involved and who have thoroughly familiarized themselves with the system can make the necessary investigations to see if the system is possible. Of course one experienced in such work can make the survey much quicker, and most institutions at present operating these courses would doubtless be glad to send a man, making no charge except expenses.

If the system is to survive long, the students must be commercially profitable to the employer. A number of firms may be willing to enter into the scheme and a few remain in it from a philanthropic standpoint, but permanent success cannot be achieved in this manner.

Also, the successful operation of the system is much more difficult than that of the regular engineering courses and requires constant and careful attention to details.

The Coördination Department

The coördination department is essential to the successful operation of the system. Its functions may be classified under two general heads—educational and business. Its educational features are described in the catalogs of the institutions using the coöperative system and, briefly, include all the college work necessary to supplement the outside training by explaining that part of the work which the foreman has not time to explain and also the exemplification of the theory of each course as found in the student's practical work.

Under the second head come all the business details incident to smooth operation—such as soliciting places of employment, furnishing students for such places, planning

courses in the shops, adjusting difficulties with the employers, etc. It must be remembered that the employer is a business man and expects to have all these details attended to promptly and in a businesslike manner.

The coördinator will find that many difficulties with foremen can be avoided if he gets well acquainted with them and calls on them often enough to keep thoroughly in touch with each student, so that he can rectify bad tendencies in the student before any trouble arises. It should be the aim of the coördinator to see that the students cause no more trouble in the shop than any other employees, and less if possible. Time is well spent in explaining the system carefully to the man directly in charge of the students. The student's foreman and his fellow-workmen have considerable respect for the boy who is willing to work as they do in order to get an education. And the general attitude of the foreman and workmen is a potent factor in the success or failure of the system.

Educational Advantages of Coöperative System

The educational advantages of the system have been fully described, but a few of the secondary results and conclusions are new and interesting. One good result of the system has been to bring more forcibly to the attention of the colleges of engineering the fact that there is a *science* of engineering and that most of the subjects in the curriculum are tools used in its development. This enforces teaching specific applications of the various subjects and develops the ability of the student to use in the solution of his problems not only the limited knowledge he is able to retain but also that which can be found in library, laboratory and shop.

This system has also done much in correcting some of the erroneous ideas resulting from the misuse of the terms "practical" and "theoretical." The student who is taught theory through its constant application to real engineering problems and who daily coördinates his shop work with his college training soon realizes that "the theory that will not work out in practice" is a mighty poor theory from an engineer's standpoint.

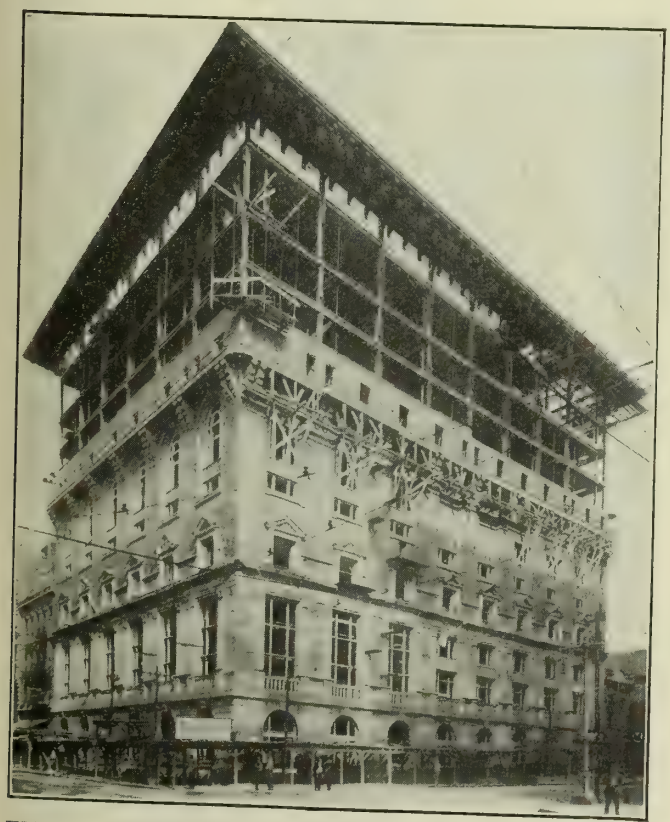


FIG 1. ORNAMENTAL CORNICE OF 10-FT. CANTILEVER CONSTRUCTION ON THE MISSOURI ATHLETIC ASSOCIATION BUILDING, ST. LOUIS, MO.
The completed roof is shown beneath the lowest points of the cornice

Cantilever-Frame Cornice

An ornamental copper cornice about 10 ft. wide and 8 ft. deep, carried by steel cantilever framing, is a structural and architectural feature of the new club building for the Missouri Athletic Association at St. Louis, Mo. Fig.

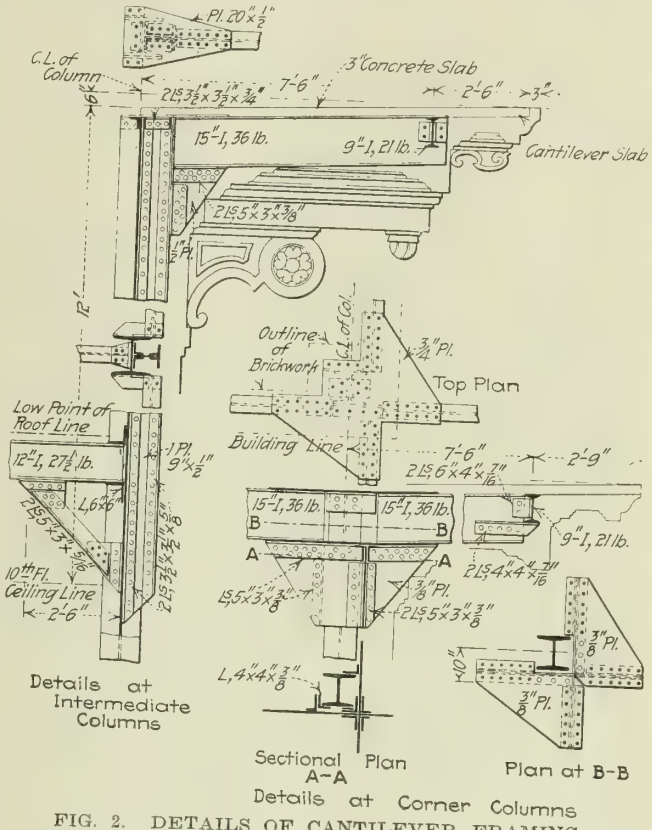


FIG. 2. DETAILS OF CANTILEVER FRAMING FOR CORNICE

1 is a striking view of the cornice, erected in advance of the exterior walls (Sept. 18, 1915). The completed roof is shown below the bottom of the ornamental brackets of the cornice.

The building is 10 stories high, of steel-frame construction. The columns are of heavy H-beams, and the outer columns are carried above the roof to the top of the cornice. To the web of each of these outer columns is riveted a built-up H-column having a bracket support for a cantilever 15-in. I-beam 7½ ft. long, which is secured also by a top plate riveted to the top of the column. The outer ends of the cantilevers are connected by a line of 9-in. I-beams. The construction is shown in Fig. 2.

Upon the steel framing, and extending 2½ ft. beyond it, is a 3-in. concrete slab. The ornamental copper cornice projects 3 in. beyond this, making a total cantilever length of 10 ft. 3 in. from center of column. Special construction is required for the corner columns, as shown.

The W. M. Sutherland Building and Contracting Co., of St. Louis, is the general contractor for the building. G. F. A. Brueggeman and William B. Ittner, of St. Louis, are the associated architects.

Subaqueous Rock Excavation--III

By Charles C. Phelps*

SYNOPSIS—A submarine frame is used in tidal waters supported independent of the drill boat. Lighter drills are necessary than when drilling from a barge. In shallow rough waters, tripod drills are mounted on raised platforms or special pontoons.

Where tidal changes are measured in inches rather than in feet the simple barge method of drilling is often employed. Where drilling must be carried on under conditions affected by a considerable rise and fall of tide, the problem requires a different solution. Drill barges like those described in previous articles have been employed successfully for this work where the spudding engines have been so adjusted as to keep a definite weight on each spud, so that when the tide rose the barge was lifted and when it fell the barge was lowered automatically.

However, this system is difficult and even hazardous where the tide movements are considerable, as there is danger of wrecking the drilling apparatus in case the steel should become stuck when the drill is on top of the frame and the tide is falling. In such a case something would have to give away, either the drill steel or the frame. Moreover, serious strains might be placed on the spuds or barge hull should trouble develop with the power or spudding engines. Another difficulty under such circumstances is that the operator finds it hard to get used to feeding his drills at different rates, depending on whether the tide is rising or falling.

Drilling in Tidal and Shallow Waters

In places where the tide differences are over a few feet and the work is exposed to wave action, the apparatus shown in Fig. 21 has been found more advantageous. This equipment is variously known as the submarine drill frame, the Sanford Ross frame and the auto-screw frame. Each drill and its frame are mounted directly on a spud, the latter being placed on the rock bottom with its top flexibly attached to the barge. Under certain difficult conditions the spuds are sometimes guyed to kedge anchors. Thus the drill support is unaffected by the tide, but remains fixed and may be held absolutely in line during the drilling operations. This method of drilling was developed by P. Sanford Ross, of Jersey City, one of the principal pioneers in the development of submarine work along the Atlantic Coast.

Prior to the introduction of this method, work was carried on in waters affected by tide and wave motion only under the greatest difficulties. This type of drill plant has been used extensively in many harbor improvements, notably in the Pacific approaches to the Panama Canal, where the tide variations approximate 24 ft.

Submarine Drill Frame

The drill is mounted on a long frame or shell. The feed screw is operated by means of a separate engine on top of the frame. The frame is bolted to a heavy wooden spud, which is usually provided with an iron shoe on the bottom. When the drilling is done through a tube, the latter is usually attached rigidly to the spud and rests on the bottom, thus helping to support the spud. The location of the drill and frame on the spud is of course determined by the depth of the water and the rise and fall of the tide, and will remain a definite distance from the rock irrespective of the tide. The spud, with the drill and frame attached, is handled by a derrick boat and placed by it in the various positions desired for drilling the holes. Whether the spud is guyed to supports on the derrick boat or to separate kedge anchors, the boat is allowed to rise and fall with the tide. The man who operates the drill is stationed in a cage attached to the drill frame and has complete control of the operation of the machine. The boilers which supply the steam for the drills are located on the derrick boat and are connected to the drills by means of rubber steam hose. The changing and sharpening of the drill steels are done on the derrick boat, where the rest of the crew are stationed to assist in the operations.

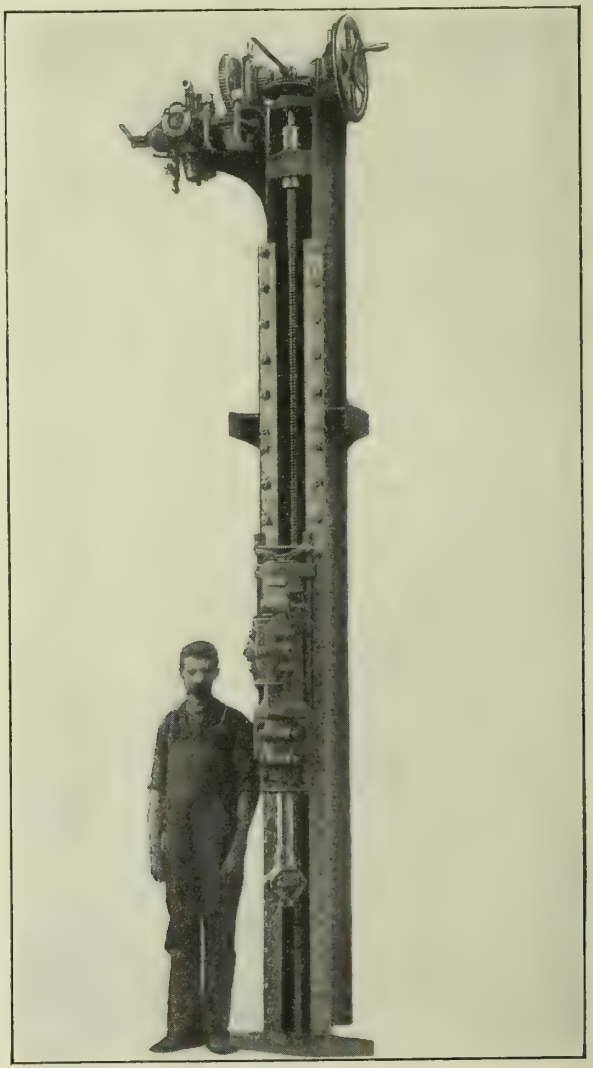


FIG. 21. SUBMARINE DRILLING FRAME FOR TIDAL WATERS

Structural steel spuds are also used as mountings for the submarine drills, as illustrated in Figs. 24 to 27,

*Ingersoll-Rand Co., 11 Broadway, New York City.



FIG. 22. SANFORD ROSS DRILLING BOAT WITH TWO SUBMARINE FRAMES

which show the method of drilling rock at Oak Point in the East River, New York City. The spuds are housed in movable guides overhanging the side of the vessel, as shown in Figs. 25 and 26. These guides are suspended from a track 15 ft. above the deck and can be traversed fore and aft a distance of 70 ft. by means of trolleys and ropes connected with a hoisting engine. Each steel spud is 43½ ft. long and has a 7x12-in. closed rectangular cross-section. Projecting guide flanges engage the sliding submarine-drill mounting (see Fig. 26). Wire rope, hauled in by a hoisting engine, passes from a point on the traveling frame down and around a sheave near the foot of the drill spud, then around another sheave on the traveling frame and thence to the hoisting engine. With this arrangement the spud can be quickly raised and lowered to any position. The drill is traversed vertically by means of a vertical screw with an effective feed of more than 10 ft., and is operated by an engine near the top of the drill spud.

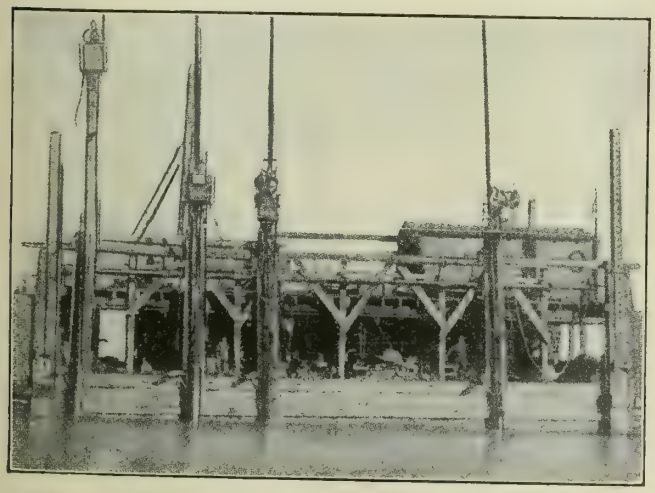


FIG. 23. DRILL BOAT OF ATLANTIC COAST CONTRACTING CO.
With four steel submarine frames and four anchor spuds

Fig. 27 also shows the form of drilling tube used on the boat illustrated in Figs. 23 and 24. This tube is 4 in. in diameter and 20 ft. in length, which is sufficient to keep the top of the tube above the surface of the water. As the largest bit is 3½ in., this allows sufficient clearance. To the foot of the spud is attached a 6-in. pipe 8 ft. in length, which serves as a guide for the drilling tube. Both tubes are split their entire length with a slot about ½ in. wide, to permit raising the tubes without disturbing the firing wires connected with the charged hole. Both pipes normally rest on the surface of the rock to assist in starting the drill and to facilitate changing bits without losing the hole. The pipe also prevents mud from entering the hole and the slot permits the cuttings to be discharged.

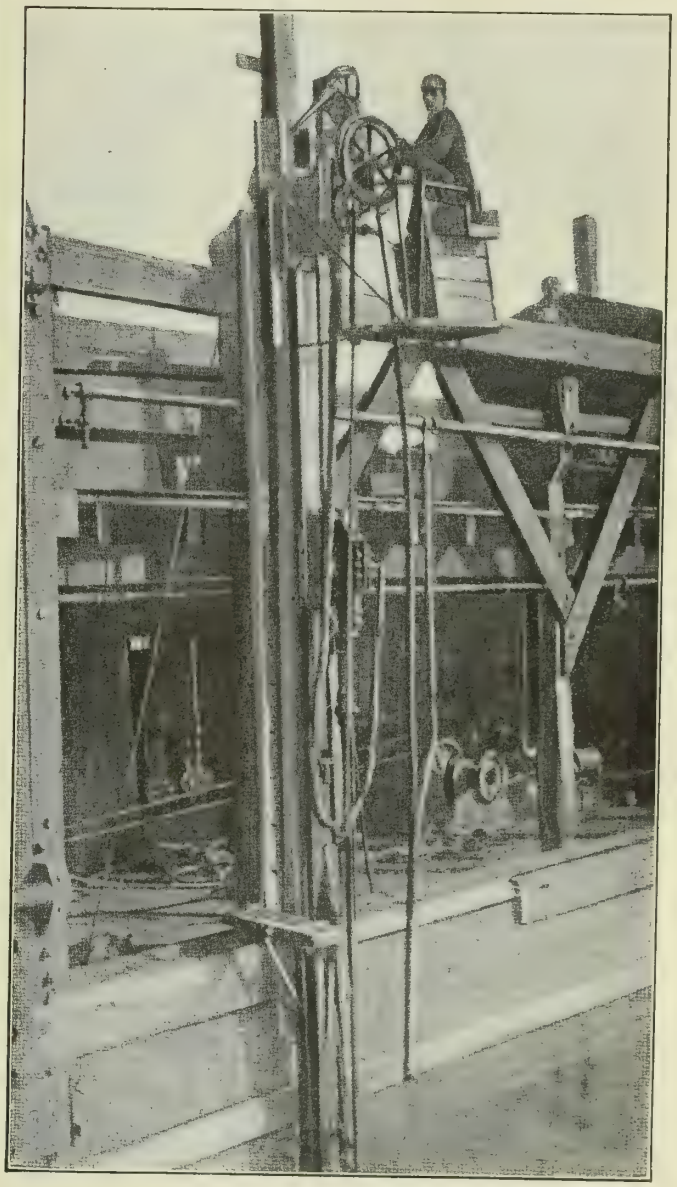


FIG. 24. SUBMARINE FRAME ON DRILL BARGE OF ATLANTIC COAST CO.

The vessel described in the foregoing is self-adjusting to the variations of level due to waves or tide without affecting the operation of the drills. This is accomplished

by the automatic regulation of the pressure on the spud engines, which operate through rack-and-pinion motion four yellow pine spuds (14x14 in.x50 ft.) at the corners of the boat. As these engines are kept under a constant steam pressure, any increase in the load due to falling tide will cause the engines to overhaul against the steam pressure, and any decrease in the load due to rising tide will cause the engines to start up because of the steam pressure. Thus a delicate balance is maintained and the height of the boat above flotation is maintained constant. In this case the tide variations are from 5 to 7 ft.

The Drill

The drilling machine used with a submarine frame has the usual shell omitted, the frame taking the place of the shell. In fact, the frame resembles somewhat an elongated and enlarged drill shell having suitable guides in which the drill slides. The Sanford Ross frame is made of cast iron, with stiffening webs and flanges. Inside the frame is a feed screw, with an effective feed of 10 ft. or more, fitting the regular feed nut at the back of the drill. This screw hangs from the top of the frame and is geared to a small three-cylinder steam engine (Fig. 28), the speed of which is under perfect control of the operator. A handwheel is also provided, so that the drill can be raised or lowered either automatically or by hand, and by either method it may be fed down fast or slow, depending on the rate of cutting.

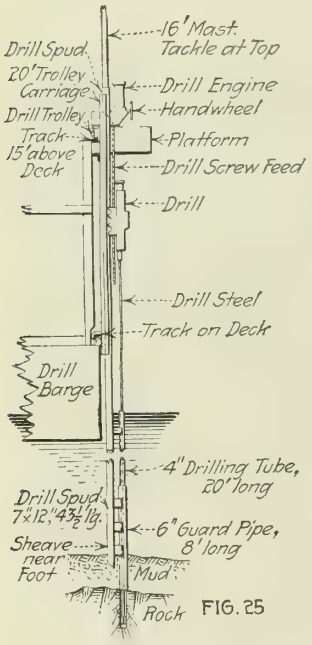


FIG. 25

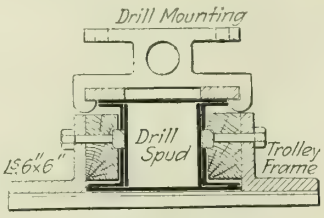


FIG. 26

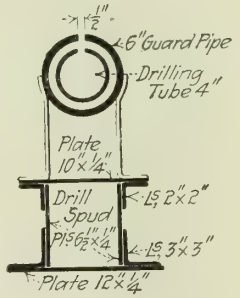


FIG. 27

FIGS. 25 TO 27. SUBMARINE FRAME DETAILS; ATLANTIC COAST CO.

Fig. 25—Drill spud and guide. Fig. 26—Sliding-drill mounting and trolley guide frame. Fig. 27—Spud foot and drilling tube

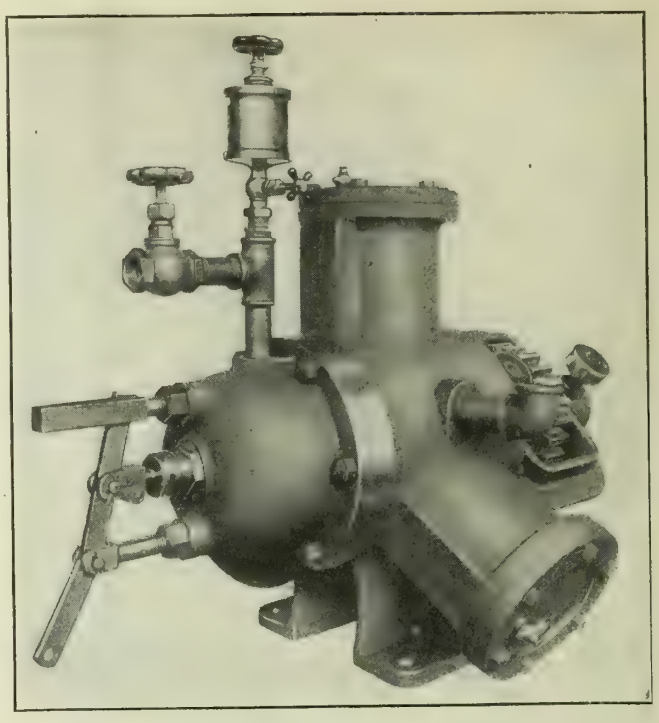


FIG. 28. THREE-CYLINDER STEAM ENGINE FOR OPERATING FRAME FEED SCREW

A drill commonly employed for this class of service has a 5½-in. cylinder diameter and 8-in. stroke. It is similar to the medium-weight drill previously described and illustrated in Fig. 13, with the exception of the mounting, lighter construction and a few minor differences. A heavier drill than this mounted on a submarine drilling frame would be too topheavy for the spud and hard to manage.

The submarine-frame method has been used successfully where all other principles have failed. Work with it is not as rapid as with the large drill boats described in the previous articles, but for changing tidal conditions it gives about as rapid a drilling method as has been devised. The accompanying tabulated data will give an idea of the performance of boats of the Sanford Ross type. For further data see "Rock Drilling," by Dana and Saunders.

Drilling in Shallow Water from a Raised Platform

In shallow water, with swift current or rough water, the drilling is frequently best carried on from a raised platform. W. L. Saunders was the originator of this system, having first employed it in the early 80's for the removal of ledges of rock in New York Harbor.

The Saunders method is probably the simplest means of drilling in shallow water, especially where swift currents, waves, high winds, considerable tide or a combination of these is encountered. It has the advantage of

TYPICAL RESULTS OF SUBMARINE-FRAME METHOD OF SUBAQUEOUS ROCK EXCAVATION

Boat	Location	Rock	Average Depths (Ft.) of Holes (Total) During Observation	Depth Drilled Below Pay Grade (Ft.)	Charge per Hole	Average Coal Consumption (Tons per Shift per Drill)	Holes Drilled per Boat Shift	Lin.Ft. Drilled per Shift per Boat	Average Depth (Ft.) per Drill per Hr., Inc. Delays	Cu.Yd. Pay Rock per Shift per Boat	Low-Water Channel Depth, Ft.	Spacing of Holes, Ft.
Eastern Dredging Co.[1]	Lovejoys Narrows, Kennebec River, Me.	Slate and flint	5	3¾	20 lb., 60% cartridges 2½x16 in	1¼	8	40	2	7.4	18	5x4
Atlantic Coast Contracting Co.[2]	East River above Hell Gate, N. Y.	Gneiss, quartz, mica schist and granite	7	3			Holes of various depths		2.25		29	4x4

[1] Boat fitted with Sanford Ross frames and Ingersoll-Rand drills. A shift crew comprised 2 drillers, 2 helpers, 1 blaster, 1 smith and 1 smith's helper; one 10-hr. shift per day

[2] Wooden boat 95x28x8 ft. with structural-steel drilling frames and Ingersoll-Rand Drills. Shift crew of 4 drillers, 4 helpers, 1 fireman, 1 engineer, 1 smith, 1 smith's helper, 1 machinist, 1 captain; two 10-hr. shifts per day.

low initial cost, although the equipment must necessarily be lighter and of smaller capacity than that used on drill boats. Pontoons of air-tight barrels are generally employed to float the platform, Fig. 30, into position. It is supported on four timber spuds as in deep-water drilling, but is usually lifted clear of the water during work. The platform is built with slots over which tripod drills are set in much the same manner as on land. The platform is made of timbers, trussed to insure rigidity, and the spuds are of sufficient length to reach bottom at high water and raise the staging above the wash of the waves. The slots are spaced according to the required location of the drill holes and run practically the full width of the platform. A pipe or beam, which may be shifted, is supported on a timber frame, from which are suspended blocks and tackle or small chain hoists for raising and moving the drills, steels and tubes. A hand winch on the staging is employed for raising the platform or for lifting the spuds.

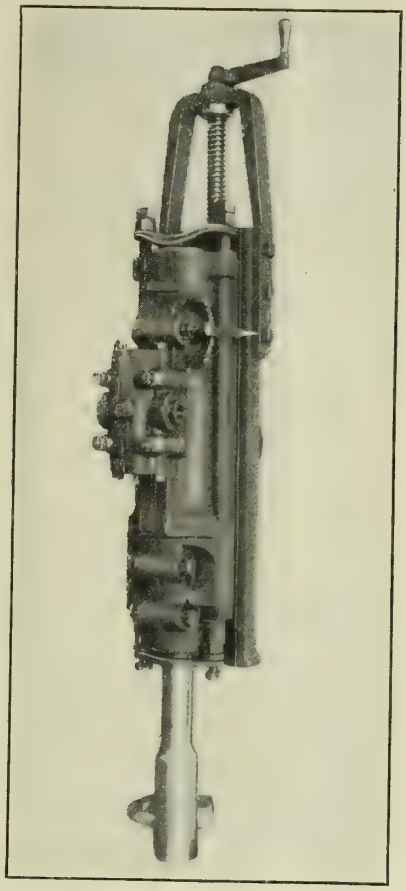


FIG. 29. DRILL FOR SUBMARINE FRAME (IN SHORT GUIDE FRAME)

A regular tripod drill is used, with the tripod legs mounted in a wooden A-frame which can be moved along the deck to the desired location. The A-frame (Fig. 31) is made of heavy oak timbers and has metal plates with holes for the tripod points to rest in. It is smooth and level on the bottom, with the edges and corners rounded so that it will easily slide along the platform. By means of heavy pins projecting from the sides one man with a crowbar can shift the heaviest drill. Staples are sometimes used for securing the frame to the platform.

Drills and Steels for Platform Work

The steels employed in the platform and floating-raft methods of drilling are the same as those used for land drilling, and the variations in length depend on the feed of the drill shell, which is usually 30 in., although a 48-in. feed is not uncommon. Long steels are preferable, but by employing an extension piece having a regular chuck with a U-bolt on each end (Fig. 31) and extension steels, ordinary steels may be used for this kind of work.

The sizes of drills used for this method are usually smaller than those for the other kinds of submarine work described previously, cylinder diameters between 3¼ and 5½ in. being the more usual sizes.

Telescopic drilling tubes, as previously illustrated, are the most convenient means of overcoming difficulties with mud or sand covering. These tubes may be easily arranged to slide in ways along the platform slots. Both drilling and charging are done through these tubes. A waterjet is invaluable for keeping the drill holes free. This method admits of "single-hole" blasting without removing the platform, provided proper care is taken not to set off a hole too close to a spud or where the rock surface is too close to the platform.

In the barge method the steam boiler is usually located right on the barge, but in the platform method it is customary to accompany the platform with a scow upon which the boiler, auxiliaries, stock of steels and blacksmith's outfit for sharpening the steels are located. The scow is moored alongside the platform and connected to it with a gangplank.

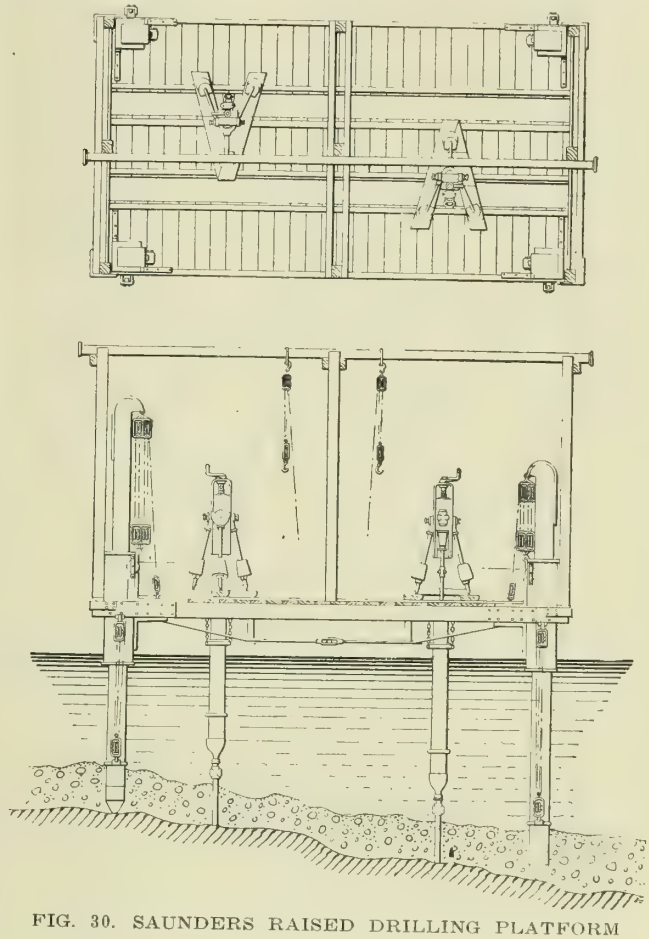


FIG. 30. SAUNDERS RAISED DRILLING PLATFORM

No recent data are available covering the raised platform method, but, as the drilling conditions described in the following paragraphs are somewhat similar to those of the platform method, the figures convey some idea of the results to be expected from the Saunders method.

Drilling in Shallow Water from Floating Pontoons

The manipulation of the drills by the fourth method is practically the same as with the Saunders system, but the rafts or pontoons are not raised from the water. This method is practicable only in shallow inland waters, where the water level does not change appreciably.

An interesting and thoroughly representative example of the use of pontoons for subaqueous drilling is referred to in the "Professional Memoirs" of the Corps of Engi-

neers, United States Army, September-October, 1913. The United States Government cut a channel through Tuscumbia Bar in the Tennessee River, about 2 mi. long by 150 ft. wide by 5 ft. deep at extreme low water.

The type of drill floats finally adopted for this work consisted of 13 pontoons, 1x5x25 ft., put together so as to leave a clearance of 1 ft. between pontoons. This made the overall dimensions 25x77 ft. There were three of these units in operation and attached to each was a drill

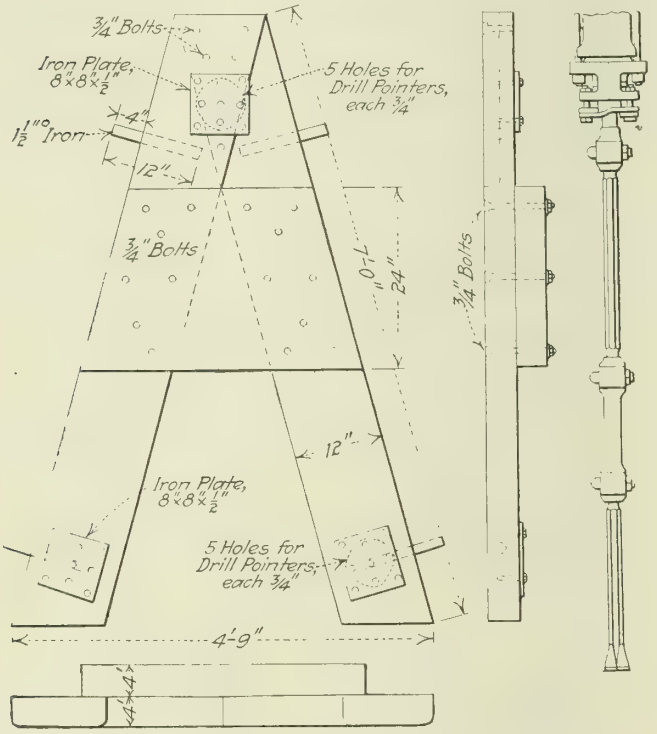


FIG. 31. DRILL BASE FRAME AND EXTENSION CHUCK

tender. Each float carried, upon A-frames, eight steam-operated 3¼x6½-in. tripod drills. At one setting of a float, holes could be drilled halfway across the channel.

To prevent the holes from filling with gravel and silt, the drilling was done through a pipe 3 or 4 in. in diameter (Fig. 33). From three to five drill bits were used in putting down each hole, depending on the depth of rock. The spacing was 4x6 ft. and the holes were put down to a depth of 9 ft. below low water. The spacing adopted at first was greater and the holes were not drilled so deep, but under those conditions the rock was

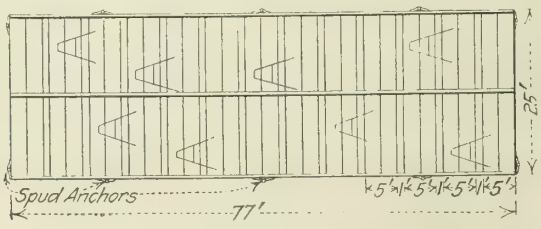


FIG. 32. PLAN OF DRILL FLOAT USED AT TUSCUMBIA BAR, TENNESSEE RIVER

often thrown out in large chunks, necessitating subsequent blasting with "mud caps."

The drilling rafts used at Tuscumbia Bar were floated into position, with the pontoons pointing in the direction of the current flow and the spuds lowered to prevent movement. Fig. 34 shows how the drills were managed. Under favorable conditions it required almost an entire day, with a double crew, to drill out, load and detonate all the charges for one setting of the drilling float.

During the first season the steels were sharpened by hand, but during the second season a compressed air sharpener was installed on one of the boats, and a blacksmith and helper kept all the steels for the 24 drills in good condition.

The Tuscumbia records may be summed up as follows: Holes per shot, 72, using three batteries simultaneously;

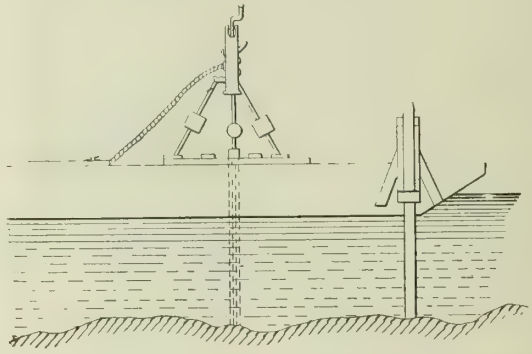


FIG. 33. ELEVATION OF ONE END OF TUSCUMBIA BAR FLOATS

charge per hole, 6 to 10 sticks of 80% gelatine dynamite; linear feet drilled per day per float, 432; average depth per drill per hour, 3.3 ft.; average rock excavated per day per float, 380 cu.yd. These figures were based on a 16-hr. day (two shifts). The depth of holes ranged from 3 to 8 ft., with the average about 6 ft. Steels were used in 2-ft. changes, with bits ranging from 1¾- to 2½-in. gage and steel diameters from 1¼ to 1½ in.

At Buck Island Shoals, about 3 mi. below Tuscumbia Bar, similar methods were used in drilling soft oölitic limestone. This rock cost about one-half as much to drill per linear foot as the hard blue flint-limestone rock at Tuscumbia Bar.

Special Schemes Often Needed

Although the more usual methods of subaqueous drilling have been outlined in this and the two previous articles many occasions have arisen in which none of these methods were suitable to meet special conditions. Cases have been encountered both on the sea and on inland waters where, on account of the difficulty of handling vessels, it became necessary to mount derricks on ledges of rock and operate the drilling machines suspended by chains from them.

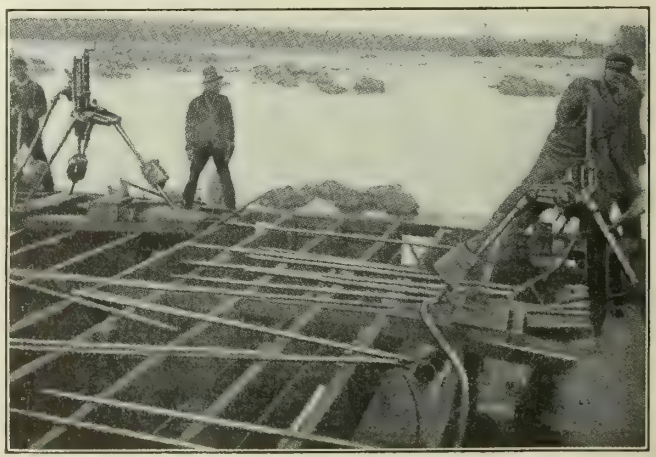


FIG. 34. FLOAT AND BLASTED CHANNEL, TUSCUMBIA BAR, TENNESSEE RIVER

In a very recent case in England it was desired to remove 7 ft. from the face of a massive concrete wall about 60 ft. in height, forming a dock with 54 ft. below water. It was decided to put in a row of closely spaced holes, each drilled to the full depth. An ordinary submarine drill mounted on a drill wagon (the first expedient considered) was not thoroughly practicable on account of the extreme depth of holes. For these exceptional conditions a portable core drill, extracting a 2½-in. core, was found to be a much more satisfactory outfit.

While constructing the sewer outfall of Manchester, Mass., during the latter part of 1914, two small ledges were encountered in the trench at a depth of about 16 ft. at low tide. A hand hammer drill was purchased and was operated by a diver—a decidedly novel method of using this type of drill. The drill was operated by steam, the exhaust of which at first caused annoyance to the diver. This was easily remedied by bringing the exhaust to the surface through a length of common garden hose.

Rules for Efficiency Ratings: Municipal Civil Service

The Bureau of Civil Service of the City of St. Paul, Minn., has recently adopted a new set of rules and regulations, some of the most interesting features of which relate to the manner in which it is proposed to rate employees for efficiency, character and conduct.

While efficiency records have become recognized essentials in large organizations under civil service, there is quite a variety of methods employed in arriving at them. The St. Paul rules and regulations are evidently designed to eliminate, as far as possible, the personal equation (or perhaps bias) of the officer primarily responsible for the ratings and are therefore unusually elaborate.

The factors used in rating the efficiency, character and conduct of employees are under the following heads: (1) Quality of work; (2) attendance; (3) discipline.

Grading for Quality of Work

In fixing a numerical value for quality of work, reasons are to be given for any exceptionally low or high marks. The following is the system of numerals used and the character of work to which they refer: Above 85, exceptional; between 85 and 80, very good; between 80 and 75, good; between 75 and 70, fair; below 70, poor.

The subfactors used in marking the quality of work are uniform for all positions having duties of the same general character and of substantially similar authority, importance and responsibility. The definitions and weights of the subfactors that are used in marking the quality of work are as follows:

(*A*) Ability—ability to perform the duties of the positions, physical ability, general health, endurance, technical ability, special knowledge, mechanical skill, neatness of work, originality, resourcefulness, initiative, ability to direct work and to manage men, executive ability, sense of order, system, judgment, discretion, tact.

(*I*) Industry—Alertness, promptness, speed, industry, perseverance, energy, diligence, willingness to work, quantity of work.

(*R*) Reliability—Certainty of action, sobriety, health, accuracy, exactness, freedom from errors, truthfulness, attention to duty, faithfulness.

The following are the weights of subfactors to be used in arriving at efficiency, character and conduct markings for engineering employees:

	(A)	(I)	(R)
Drafting and detailing	0.4	0.4	0.2
Field and construction	0.4	0.3	0.3
Designing and estimating	0.5	0.2	0.3
Executive, specialized supervision, expert	0.5	0.2	0.3

Attendance and Discipline Demerits

No positive marks are given for attendance or discipline, but demerits are charged for infractions of regularly prescribed rules and regulations and for other delinquencies. In all deductions five demerits equal one point in efficiency, character and conduct markings for quality of work as follows:

Attendance—Tardiness; three demerits are given for more than five minutes and not exceeding one hour, and five for more than an hour. Absence without leave brings five demerits for each day. Absence without leave for three days or less in any month is investigated by the head of the department or bureau. Absence without leave for four days in any three months is cause for investigation by the Civil Service Bureau and for suspension.

Absence with leave not exceeding 15 days brings half a demerit for each day of the period; one demerit for each day in excess of the 15 days. The penalty, however, does not extend for more than a period of one month. Absence on sick leave not exceeding 30 days receives half a demerit for each day. No efficiency, character and conduct credit is allowed for overtime.

Discipline—The mark for discipline is obtained by penalties for laxity in observation or violation of established rules and regulations, failure to report, incivility, objectionable deportment or manner, inebriety, indolence, lack of personal neatness and improper habits.

If suspension is imposed for disciplinary purposes the demerits are as follows: For suspension of one day ten demerits are given. For a suspension of more than one day and less than seven working days, 15 demerits. For more than six and less than 13 working days, 25 demerits. For more than 12 and less than 28 working days, 40 demerits. When demerits are so awarded there are no additional demerits under "attendance" for the suspension period.

The total demerits reported with any individual efficiency, character and conduct report are added and the sum divided by five and the result subtracted from the marking for quality of work. The remainder is entered on the report as the net efficiency, character and conduct mark.

All net-efficiency markings are entered from the reports upon a card record. The card is subdivided by departments, the departments by payrolls, the payrolls by alphabetical arrangement of the names. The reports are then filed alphabetically by departments and chronologically within departments. Markings are not entered finally until after investigation or until approved by the examiner.

A Large Tidal Lock which will give access to the new harbor at Chemulpo, Korea, is being built in accordance with competitive plans prepared by Henry Goldmark, consulting engineer, New York City, for the McClintic-Marshall Co., of Pittsburgh, Penn., the successful bidders on the entire equipment. Mr. Goldmark has been appointed to take charge of the construction in the United States of the lock gates, sluice valves, operating machinery and electrical equipment.

Pumping California Crude Oil

By C. P. Bowie*

SYNOPSIS—For pumping the lighter California oil through pipe lines it is heated and thus rendered fluid enough so that it will flow readily. The author describes from his own experience the method by which engineers proceed to lay out the pipe lines and pumping stations so that the maximum amount of oil may be transported.

The crude petroleum produced from the California oil fields is a dark-colored, thick, viscous liquid, emitting, especially when first drawn from the wells, a strong odor of sulphur. The product from different fields and different wells varies in gravity between 12° and 38° Bé. Most of the present-day production lies between 14° and 28° Bé., or between 0.9722 and 0.8861 specific gravity. The wells from which it is produced vary in depth from 200 to 4,000 ft.; the lighter oils being usually found in the deeper wells. In the Kern River field, which lies in the southeasterly end of the San Joaquin Valley near the city of Bakersfield in Kern County, and which was one of the first inland fields to be extensively developed, the producing sands are seldom found at a depth greater than 1,300 ft.

The Rifled System of Oil Pumping

Fully 80% of the oil in this field is of a gravity heavier than 15° Bé. The difficulty in moving this viscous material through pipe lines, especially in cold weather, has given rise to the invention and development of a process of pumping known, locally, as the "Rifled System," the like of which, so far as I am able to determine, exists in no other country in the world.

This system was invented by J. D. Isaacs, now Consulting Engineer of the Southern Pacific R.R., and Prof. Buckner Speed, of the University of California, and has been successfully used for the past eight years by the Associated Pipe Line Co. in transporting oil from the Kern River field to Port Costa, a town on San Francisco Bay 26 mi. east of Oakland and 283 mi. distant from the oil field.

This system[1] consists in pumping cold oil of from 13 to 15° Bé., together with about 10% by volume of water, through an 8-in. pipe that is corrugated spirally, or "rifled." The rifles are put into the pipe as it is made by running each length with a twisting motion through a set of rolls consisting essentially of wheels, about ¼ in. wide, which push indentations into the pipe from the outside. The rifles make one complete revolution in 10 ft. of length of pipe and give to the interior much the same appearance as the inside of a gun barrel.

In operation water is forced into the pipe along its inner periphery through an injection nozzle surrounding the pump discharge and at a distance of about 10 ft. from the pump. Since the pipe is already filled with oil, the water being injected in this manner forms a film between the core of oil and the walls of the pipe itself. As the mass moves forward the rifles give to it a whirling motion and because of the greater specific gravity of the water, the centrifugal force produced holds the film of water in place, thus keeping the oil from coming in contact with the pipe and consequently greatly reducing the frictional resistance.

The Hot-Oil Pumping System Described

Experience, however, has shown that the rifled-line system of pumping is limited to oils of a gravity not lighter than 15° Bé. Oils of higher gravity will form an emulsion with the water and produce a mixture that is not only very difficult to pump and often expensive to separate into its integral parts on arrival at the terminal,



FIG. 1. A TYPICAL PUMPING STATION ON A CALIFORNIA OIL PIPE LINE

but that also may greatly reduce the oil contents of the line, since at each pumping station it becomes necessary to add water to the mixture in order that the free water in the pipe may be kept up to the necessary 10%. While this system works satisfactorily with some grades of heavy oils, it is not likely that it will ever be used in fields which produce light as well as heavy oils, for the reason that when light oil can be obtained it is always possible, by mixing the low-gravity with the higher-gravity, to obtain a product that can be successfully pumped by what is known as the "hot-oil process."

This system of transporting the oil consists in pumping it dry, that is, without the addition of water, and of heating it at the initial and each succeeding station to such a degree of temperature that the gravity may be raised sufficiently to produce a fluidity commensurate with that necessary to secure the required velocity of flow, maintaining at the same time a pressure at the pumps within the limit of their design. While the methods pursued in designing a "hot-oil" system would in many respects apply to a "rifled" system, the following discussion assumes that the oils to be transported will be heated to the required temperatures and pumped without the addition of water.

Fixing Location for Oil-Pipe Line

In preparing the surveys for a pipe line, the work proceeds in much the same manner as the preliminary survey for a railroad. The engineers should first make a reconnaissance of the country through which the proposed line is to pass, for the purpose of noting its more promi-

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[1]A paper by Mr. Isaacs describing this process in detail was published in "Engineering News," June 7, 1906, p. 640.

nent features and acquiring a general knowledge of the topography in order that he may select the most suitable route. Due consideration should be given to the prospects of securing a suitable water-supply for the various pumping stations. Excessively hilly country should be avoided because, even though it offers the shortest route for the line, it may require the building of expensive roads to carry on the construction and may make the cost of maintenance and operation high.

The floors of old lake beds, where the soils contain a high percentage of alkaline salts, may also well be avoided when possible, since through such territory depreciation of the pipe from corrosion is very rapid, and expense and more or less elaborate coverings must be resorted to, which at best afford probably only temporary protection.

A route along the bank of a stream is seldom a desirable one, especially where the flow is torrential during the wet season. Such streams may change their course very rapidly during times of high water and destroy considerable sections of the line by undermining it. Detours from an otherwise desirable location may also be necessary on account of inability to secure right-of-way. This last objection to an alignment can, however, generally be overcome by condemnation proceedings or by compromise, and it is therefore usually unnecessary for the engineer, in his preliminary work at least, to give this phase of the procedure more than passing consideration.

When the route has thus been gone over in a general way, a transit line is run to which is tied in all section corners, monuments, etc., marking land surveys, also all adjacent buildings or other structures, and upon which is carefully noted all intersections with streams, railroads, wagon roads, streets, fence lines, pipe lines, power lines and whatever else crosses the proposed route. Stakes marked with the engineering station are set at intervals of 100 ft. or less, where necessary.

Immediately following the transit party come the levelman and rodman. Ground elevations are taken at each engineering station and at such intermediate points as are warranted by stream crossings or other changes in the topography.

As the field work progresses an alignment map and profile is made in the field office. This should be kept as nearly uptodate as possible in order that any errors in the instrument work may be discovered and the necessary corrections made in the field while the camp outfit is still in the vicinity. The field map and profile being only a rough copy, often made hurriedly and under the extreme of adverse conditions, it is usually advisable to prepare at least a new profile of the line in the office at headquarters when the field work is complete.

For convenience it is well to plot on this profile, beneath the ground elevations, a second line, called the "power profile," which represents the ground elevations divided by 2.3, or the static head in feet reduced to pressure in pounds per square inch.

The Pumping-Machinery Installation

In determining the number of pumping stations required for a system, it is usual to assume 800 lb. per sq.in. as an allowable maximum working pressure on the pumps. This figure is, however, only arbitrary, since 700 lb. or 600 lb. maximum pressure could be used if desired. Nearly all the trunk lines operating at the present time are composed of 8-in. pipe that is guaranteed by the makers to withstand a test pressure of 1,200 lb. per sq.in. and a working pressure of 800 lb. per sq.in., in view of which the pump manufacturers have been required to guarantee their machinery also for 800 lb. working pressure. So it is that this figure has become sort of a standard by which to design pumping systems and 8 in. the size of pipe to which other lines are referred.

Fluid Friction of the Oil in the Pipes

Regarding the flow of California crude oil through pipe lines, an amazingly small amount of reliable information is available. So many varying quantities enter into the problem of pumping by the hot-oil process, each one of which may prove to be an influential factor, that it is difficult to predict with any reasonable degree of assurance as to accuracy just what the results will be for any given hypothesis.

In the case of water we have a fluid whose gravity is practically constant and whose viscosity remains unchanged within the ranges of temperature maintained during its flow from one position to the other. The flow of oil, however, is influenced very largely by viscosity, and the viscosity factor depends not only on the gravity of the oil and the temperature at which it is pumped, but apparently also on its chemical constituents. This latter seems exemplified by the fact that a very decided variation in flow will often be noted in two days' run of a pumping station, although so far as can be determined, the gravity and the temperature of the oil remain unchanged, as well as atmospheric conditions.

Another reason for this dearth of knowledge is the fact that pipe lines now in operation, from which reliable data could be obtained, are practically all of one size and engaged in pumping, as nearly as possible, a maximum quantity of oil each day.

Within the knowledge of the writer the most reliable data at hand relate to oils from 16 to 28° Bé. and are limited to pipe lines from 12 to 20 miles in length. Between these limits reasonably accurate results can be obtained for lines from 4 to 10 in. in diameter by the use of the following formula:

$$Q = C\sqrt{\frac{P}{Le}}$$

Where

Q is the quantity of oil in barrels per hour;

C is a constant;

P is the initial pump pressure (plus or minus the static head between terminals) in pounds per square inch;

L is the length of line;

e is a factor dependent upon the size of the pipe used.

For values of C use the following:

Gravity of Oil	Outgoing Temp.	Value of C
16° B.	142° F.	160
18° B.	136° F.	167
20° B.	130° F.	174
22° B.	125° F.	183
24° B.	119° F.	192
26° B.	113° F.	202
28° B.	107° F.	213

For values of e:

4-In. Pipe	6-In. Pipe	8-In. Pipe	10-In. Pipe
32.00	4.20	1.00	0.333

These figures are based on the assumption that the pipe line between stations is buried in dry ground to a depth of at least 2 ft. and that wherever the pipe passes over trestles of any considerable length it will be protected

against loss of heat by radiation, either by boxings filled with earth or bulrushes, or by wrapping the pipe with successive layers of building paper or other insulating materials.

Even were the temperature factor the only variable affecting the flow of the oil, it is obvious that one cannot hope to obtain exact results from the use of a formula, and no such claim is made for the one here given. It has, however, been found by repeated experiments that the figures are conservative and that between the limits as stated they can generally be depended upon to give results within a reasonable degree of accuracy—more often too small than too large.

The outgoing temperatures given, under values of C, for the various gravities of oil are an average of those which experience has shown to give the best results when pumping oil of that particular gravity.

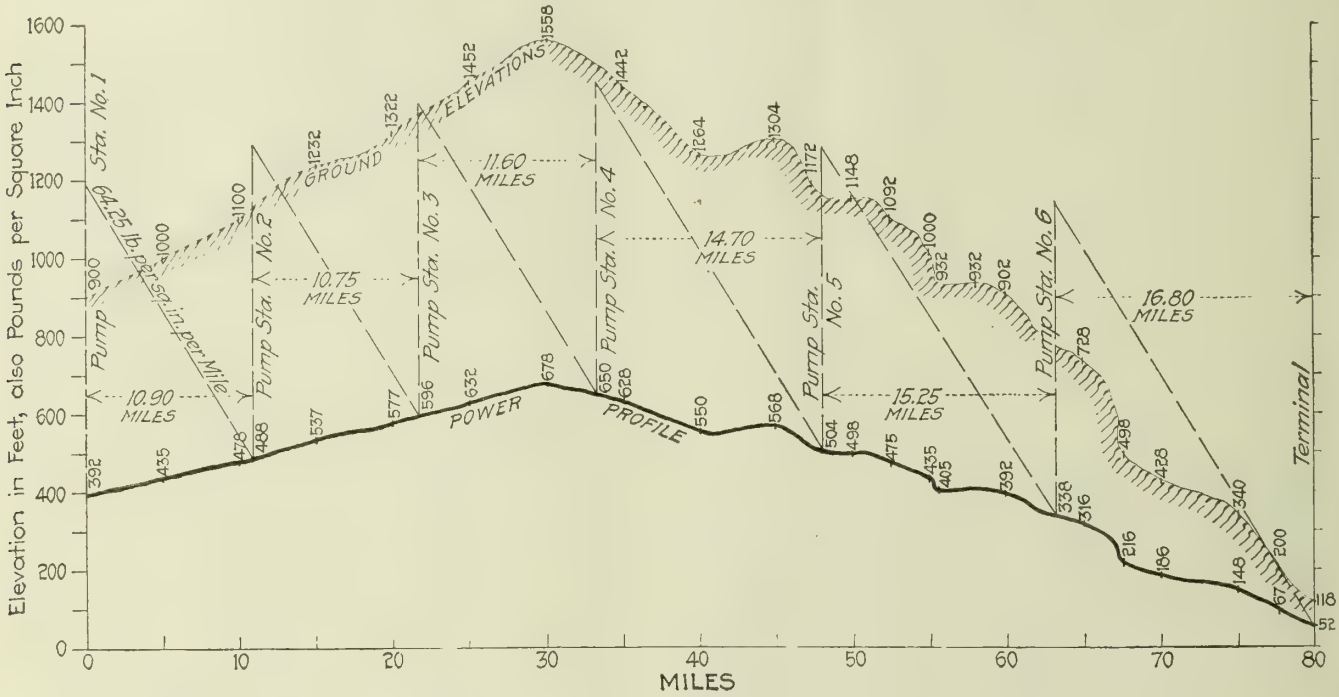


FIG. 2. GROUND PROFILE AND POWER PROFILE FOR AN 8-IN. OIL PIPE LINE, 80 MILES LONG, TO DELIVER 30,000 BBL. PER DAY OF 16° B. OIL. MAXIMUM LINE PRESSURE, 800 LB. PER SQ.IN.

A Typical Problem in Pipe-Line Design

Returning to the power profile reproduced herewith, suppose that we were called upon to design a system that will deliver 30,000 bbl. per day of oil of a gravity of 16° Bé. or higher, through an 8-in. pipe line, with a maximum working pressure on the pumps of 800 lb. per sq.in. We would design the system for 16° Bé. oil, since this would present the worst conditions and a line which would successfully deliver the required amount of this gravity of oil would easily live up to expectations with lighter oils.

From the formula it can be determined that a line of 8-in. pipe (on level ground) 13.1 miles in length will deliver 30,000 bbl. of 16° Bé. oil per day of 24 hr. with a working pressure at the pumps of 800 lb. per sq.in.; which is to say that to insure this delivery we must have an available head to overcome friction of 61 lb. per sq.in. per mile and must therefore lay out our hydraulic grade line with this end in view. Suppose that the proposed system is to be 80 miles in length with the initial station of sufficient height above the terminal to afford a static head of 340 lb. per sq.in. Then we must have a number of pumping stations which, multiplied by 800, the product added to 340 (had the terminal been lower than the initial point by the same amount we would have subtracted the 340) and the result divided by 80 will give a friction head per mile of at least 61 lb. per sq.in. By trial we see that five stations give 54.2 lb. per sq.in. per mile and six stations 64.2 lb. per sq.in. per mile. We must therefore use six pumping stations and in doing so could reasonably expect that our system would, in case of emergency, be capable of delivering a little more of the lowest-gravity oil than the requirement.

Plotting the Grade Line for Pipe

In plotting the grade line, it is more convenient to use the power profile than the ground elevations, since the points on the vertical scale representing pressures at pumping stations will by this method usually fall within the bounds of the profile sheet. To locate the pumping stations, begin at the sources of the line and lay off on the vertical scale a point representing 800 lb. plus the static head as shown on the power profile. Then on the vertical scale, at some convenient distance out from the source—say ten miles—plot the point which represents the pressure at this position on the line; which will be 642 lb. less than the first point plotted. A line drawn through these two points and produced to cut the power profile will locate on it the theoretical position where the pressure in the line becomes zero, or in other words where we will have to place another pumping station. Plotting on the vertical scale above this intersection a point representing 800 lb. plus the static head, we proceed as before, continuing until we reach the end of the line. As a check on the accuracy of the work, the last diagonal line, or gradient, should cut the terminal point of the profile.

It may happen that a pumping station so located will fall on ground the nature of which, because of swamps

or extreme roughness, presents physical characteristics undesirable for the erection of tanks and buildings. In such a case it is better to choose a pumping-station site opposite the one located, to the right or left of the line and make a detour to include it, than to move backward or forward a half-mile or more, thus causing a weak link in the system. If a detour is necessary the profile should be replotted and all the stations relocated.

Heating Stations Sometimes Necessary

If the contour of the country traversed between any two stations is such that the hydraulic grade line follows closely along the power profile without cutting it, the distance between stations may become so great that the loss of heat from radiation will materially retard the flow, and in order to keep the system up to capacity will require a line pressure at the pumps in excess of the safe maximum allowable amount. In this case it would be necessary to put in a heating station.

Such a station consists essentially of a bypass from the main line through which the oil can be passed into a manifold and thence into a number of smaller pipes, usually 4 in. in diameter. The latter traverse the gas flues of a furnace where the temperature of the oil is raised the desired amount, before returning again to a manifold and thence into the main line. The source of the heat is supplied by oil drawn from the line itself. The pressure is sufficiently reduced by means of a reducing valve and fuel oil is passed through coils arranged on the inner face of the firebox, where it is highly heated, and thence sprayed into the furnace, being so finely atomized that it burns with an even and almost noiseless flame, in which combustion is complete.

It may sometimes happen that the hydraulic gradient will cut the power profile at a certain point and then pass on well above it for a considerable distance before a definite intersection is reached. Where this is the case, the trench for that portion of the line which lies above the diagonal should be excavated well below the gradient; or, if this is impossible or too expensive, a detour should be run out on lower ground. It is always poor policy to lay any of the pipe above the hydraulic grade line, since the remainder of the line acts merely as a channel to deliver the flow, which will result in a remarkably large diminution of discharge.

The Value of Accurate Planning

One of the chief faults of pipe-line systems that have heretofore been constructed in California has been that too little heed was given to accurately surveying the proposed line and then making a detailed study of the profile with a view to locating the pumping stations at such positions that, as nearly as possible, a constant friction head might be maintained throughout the system for any desired working pressure. Where the pipe passes over high mountain ranges this is of course impossible with low working pressures, since on the upgrade side of the range there will always be required a certain amount of pressure to overcome static head. However, as the limiting capacity for which the system is designed is approached, there can be no excuse for not being able to deliver, with a constant working pressure throughout, approximately the same amount of oil at each pumping station.

Engineers engaged in the design and construction of oil-transportation systems will do well to hold paramount in their minds the fact that, after all, barrels per day delivered is the bread and butter of the system and that no effort should be spared to the end that the given quantity may be delivered with, as nearly as possible, an equal wear and tear on each station from beginning to end of the line.

The truth of the old adage that no chain is stronger than its weakest link is nowhere better exemplified than in oil pipe-line systems. If nine pumping stations have a daily capacity of 30,000 bbl. and the tenth of only 25,000 bbl., then the whole line has but a 25,000-bbl. capacity and whatever of time and money has been expended on bringing the nine stations to the greater capacity is wasted until the tenth can be strengthened.

Acknowledgment is made to E. G. Brua, Assoc. M. Am. Soc. C. E., for his kindly criticism and helpful suggestions in the preparation of this paper.

Civil-Service Examination for Water-Works Engineer

The City of St. Paul, Minn., recently conducted an examination for a water-works designing and construction engineer (salary $250 per month). The examination was open only to citizens of St. Paul, and of the four who took the examination not one passed. It was an unassembled examination—the application form, experience paper and question sheets were sent to the applicants, and the answers were written by them in their own homes or offices.

SPECIAL SUBJECT (WEIGHT 50)

Question 1. Describe in detail the most important engineering structure you have actually designed and which has been constructed in accordance with your design, stating the location, date of design and date of subsequent construction, preference to be given to water-works structures, such as reservoirs, filtration plants, etc.

Question 2. Describe some of the most important pieces of construction work, not to exceed five, which you have actually superintended, stating the date, period of time the construction was in progress and the approximate cost of the completed work.

SUBJECT: MATHEMATICS AND REPORT (WEIGHT 30)

Question 1. A water-works contemplates purchasing a pumping engine having a capacity of 15,000,000 gal. per 24 hr. Under the following operating conditions, what type of pump would be most economical to buy: Suction head, 8 ft.; discharge head, 170 ft. (includes friction in discharge line); steam pressure, 125 lb.; superheat, 0°; temperature of feed water, 190° F.; return tubular boilers, hand fired; coal contains 14,000 B.t.u.; cost $5 per ton (2,000 lb.), delivered?

This unit will be used to operate in conjunction with others in the same station during six months of the year—May, June, July, August, September and October.

Assume that a triple-expansion, vertical flywheel engine will cost $100 per water horsepower and having a guaranteed duty of 150,000,000 ft.-lb. per 1,000 lb. of dry steam; that a steam turbine geared to a centrifugal pump would cost $30 per water horsepower and have a guaranteed duty of 120,000,000 ft.-lb. per 1,000 lb. of dry steam. Assume that no additional boiler capacity will be required. Assume that foundations and revision of the building will cost $25,000 in case of a triple-expansion, vertical flywheel engine and $1,000 in case of a steam turbine and centrifugal pump.

The pump is to be purchased from the sale of 30-yr. bonds, bearing 4½% interest. This must be taken into account in your conclusions.

Assume that attendance and supplies would be the same for any type of equipment, estimating it to be $2,000 per yr.

Are there any other considerations which you would take into account in selecting the pump? If so, mention them, and give reasons for your answer.

Show the details of all calculations and the method of arriving at your result.

SUBJECT: EXPERIENCE (WEIGHT 20)

This subject is rated from the answers submitted by the applicant to the questions contained in the experience blanks.

Cause and Prevention of Storm Erosion on Gulf Coast

By Gerald O. Case*

SYNOPSIS—The recent hurricane on the Gulf coast not only caused serious damage to structures, as noted lately in an issue of "Engineering News," but also tore out large sections of beach and shore, with consequent destruction of property. Mr. Case made a personal inspection of many miles of the coast and reports here the results of his investigations. They apply not only to this particular shore line but to many others of a similar conformation.

Hurricanes are known to have periodically ravaged the Gulf coast for the past 150 yr., and they have not only caused many deaths and great losses to shipping interests, but have also done millions of dollars' worth of damage by injuring growing crops, destroying timber areas near the coast, killing livestock and damaging houses and business properties by wind action and flooding. A large amount of preventable damage has also been done by wave action and currents eroding the coast. The erosion has resulted in the loss of a considerable amount of land

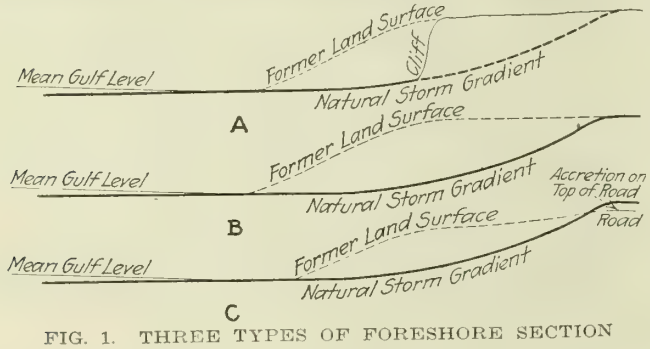


FIG. 1. THREE TYPES OF FORESHORE SECTION

and the destruction of houses, and a large amount of damage has been done to the coast roads and railway tracks, and unless prompt and effective measures are taken to prevent further erosion it will be impossible, at a reasonable cost, to maintain two of the most beautiful coast roads in the United States—those between Biloxi and Pass Christian and Bay St. Louis and Waveland, Miss. In the past no recorded study has been made of the causes of erosion on this part of the coast and the best means of preventing it.

Topography of Coast Line

The coast line of Mississippi is to a great extent sheltered by an outlying chain of sandy islands. The land abutting on the shore line is generally about 10 to 15 ft. above mean Gulf level. The soil is mostly sand and consequently easily eroded by wave action. In many places there are slightly depressed areas a short distance behind the shore line, which at times results in a considerable seepage of water through the sand ridge to the Gulf.

Mississippi Sound is essentially a naturally protected bay and one which under ordinary circumstances would be classified as an area subject to accretion and not erosion. As a rule erosion takes place at headlands and projecting parts of the coast and accretion occurs in sheltered bays and estuaries, and there is strong evidence to show that below mean-high-water level the Mississippi Sound is no exception to this general rule, the erosion caused by hurricanes being confined to the storm foreshore (area between mean-high-water level and the landward limit of the storm tide) above mean Gulf level. Below ordinary high-water level accretion takes place to a large extent through the action of vegetation which grows on the sea bed and arrests and consolidates sediment carried in suspension in the currents, and to the action of certain mollusks, chiefly oysters, which dwell on the bottom and contribute their share to the rising surface. On the east side of several accumulations of oyster shells projecting out into the sound and on the east side of Gulfport harbor land is being gradually reclaimed by salt-loving grasses accumulating material.

Record of September Storm of 1915

The first hurricane of which there appears to be any authoritative record was that of 1772. Other severe storms—each of which has continued the erosion caused by its predecessors—occurred in 1819, 1856, 1860, 1893, 1901, 1906, 1909 and 1915.

Although the erosion is confined to the areas above mean Gulf level, and there are often periods of several years when no appreciable erosion takes place, yet the net result, considered over the long period of time is that greater erosion takes place on the Mississippi coast than on many exposed coasts subject every winter to the undermining action of waves and currents. One reason for this is that although the storms on the Mississippi coast which cause erosion occur infrequently compared with storms causing erosion on the open Atlantic coast, yet when they do occur they are exceptionally severe. Another reason is that on the open coast the foreshore eroded during winter is in many cases repaired again by the forces of nature during the summer months. On the Mississippi coast the water falls back from the area eroded as soon as the storm subsides, and owing to the small range of tide is only covered by water during the time when the destructive forces are at work, and there is therefore no chance of nature assisting to repair the damage.

The hurricanes on the Gulf of Mexico practically always occur between the middle of August and the beginning of October. That of Sept. 29, 1915, as usual originated in the area known as the "doldrums" and approached the Gulf coast from a southeasterly direction. The center of the storm struck the coast at New Orleans, and altogether 300 mi. of the coast was more or less affected by the storm. Information supplied to the writer by the Weather Bureau at New Orleans showed that the maximum wind velocities were recorded at Burrwood, La., and were as follows:

Velocity, Miles	Periods in Minutes
124	5
116	19
108	60
106	60
96	60

The maximum wind velocity recorded at New Orleans for a 5-min. period was 88 mi. per hr.; the previous high-

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FIG. 2. RAILROAD DAMAGE NEAR BILOXI



FIG. 3. EROSION OF SHORE NEAR GULFPORT



FIG. 4. CONCRETE WALL WRECKED AT BAY ST. LOUIS



FIG. 5. ANOTHER VIEW OF BAY ST. LOUIS WALL



FIG. 6. TIMBER BULKHEAD DESTROYED, BAY ST. LOUIS



FIG. 7. SHORE EROSION NEAR MISSISSIPPI CITY



FIG. 8. WRECKED SEA WALL NEAR GULFPORT



FIG. 9. NO EROSION ON GRASSED FORESHORE

est velocity recorded was 66 mi. per hr. during the hurricane of 1909. The maximum rise of tide above mean Gulf level took place about 50 mi. east of the storm center, where the rise was approximately 20 ft. At Biloxi, Miss., the rise was about 9.75 ft.; at Pass Christian, Miss., 10.2, and at Bay St. Louis, Miss., between 10 and 11 ft. As soon as the wind turned round toward the southwest the water immediately began to fall. The figures indicate that the rises of tide were at least 1 ft. above those recorded during the 1909 hurricane.

If we can take as reliable the information handed down to present residents of Pass Christian as to places reached by the tide during the hurricane of 1819, it would appear that during that storm the tide rose about 1 ft. higher than it did on Sept. 29 last.

The amount of the rise of the tide is of course largely dependent on the contour of the coast, the maximum rise taking place at or near the heads of confined bays, where the water naturally piles up. During the last hurricane the maximum recorded rise was at the east end of the Mississippi Sound, where the water was confined and unable to escape to southward.

As the water rises very rapidly, at first the lower part of the foreshore is subject to breaking waves for a comparatively short time compared with the upper part.

No reliable information was obtained as to the height of the waves during the hurricane, but owing to the existence of the outlying chain of sandy islands the height must have been small compared with the height of storm waves on the open coast.

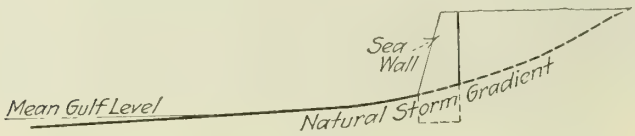


FIG. 10

FIG. 10. POOR LOCATION OF SEA WALL

The height of waves, as is well known, depends on the "fetch," or distance, of open sea across which the wind blows before reaching the coast. Stevenson's formula for this height of waves is: $h = 1.5 \sqrt{f}$, where f is the "fetch." Between Bay St. Louis and Biloxi the distance between the outlying islands and the shore, measured diagonally across, is nowhere more than about 14 mi. Using the foregoing formula, it would appear that the wave height was probably not more than about 5 ft. 6 in.

Damage to Foreshores

The illustrations give a good idea of the erosion caused by the hurricane. In many places between Biloxi and Waveland from 10 to 50 ft. of land was washed away and the fine shell road which formerly existed along this part of the coast has been breached in numerous places and will probably cost from $200,000 to $300,000 to replace. The line of the Louisville & Nashville Ry. was badly damaged, notably at Chef Menteur and Rigolets. At the former place 319 ft. of track was destroyed and at the latter about 900 ft., causing the direct train service on the coast line between Mobile and New Orleans to be suspended for about a month. The coast line of the Gulfport & Mississippi Traction Co. was also wrecked most of the way between Biloxi and Pass Christian, a distance of over 20 mi. This line previous to the storm was in front of the coast road.

Although very serious and extensive erosion took place over a length of more than 30 mi. of the Mississippi coast, the amount of erosion was by no means uniform, and in some places little or no erosion happened.

A careful examination of the local conditions showed that the outlying islands have a considerable influence in protecting the coast. The east beach at Biloxi, which is largely sheltered by Deer Island, suffered much less than the west shore, which is less protected. It was also noticed in several places that where accumulations of oyster shells project into the Sound, the erosion was more marked in the leeward (westward) side than on the east side. At Gulfport harbor the difference between the erosion on the east and west sides of the harbor was particularly noticeable; and while little damage was done on the east side, where natural accumulation has been taking place below mean-high-water level, on the west side there was severe erosion.

Various Influences at Work

It was also apparent that the gradient of the storm foreshore had a very powerful influence in determining the amount of erosion taking place. Where there was a gradually sloping surface extending some distance back of ordinary high-water line the storm waves had their energy gradually abstracted as they moved inland and were unable to exert any force capable of doing serious damage. On the other hand, it was most noticeable that wherever the land rose more or less steeply from the ordinary high-water line, or where there was a ridge or cliff which the waves were able to hit with considerable force, large masses of material were torn out.

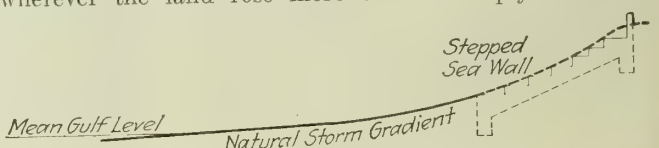


FIG. 11

FIG. 11. PROPER LOCATION OF SEA WALL

During storms, material in suspension and floating débris greatly assist the waves in their work of erosion. Stones, pieces of timber, etc., are hurled by the waves with great force against the shore or cliff and materially assist in the work of disintegration.

It may be stated as a general rule that on any coast where there is a considerable range of tide the foreshore has its natural inclination of repose, and it is undoubtedly equally true that the storm foreshore also has a natural inclination of repose, the gradient depending on the height of the storm tide, the height of waves, etc. Wherever, therefore, the gradient was too steep or there was a steep bank, the hurricane employed its energy in carving out a natural storm gradient; and in places where the gradient was too flat—as was the case in places where the waves broke over the coast road—the tendency was for material to be deposited (see Fig. 1).

Although a small amount of material eroded by direct wave impact was deposited on the road to build up the gradient (Fig. 1), by far the greater part of it was transported to the sea bed and permanently lost to the land. The strong onshore winds which blow during hurricanes pile up the water on the land margin, and would pile it up still higher but for the fact that this action is in part compensated for by an undertow seaward. Material stirred into suspension by wave action is thus transported to the bed of the Sound and permanently lost to the land. When the water subsides after the storm,

large quantities of material in suspension are also moved away and when the storm ceases are deposited in quiet water.

On the north side of the railway trestle at Bay St. Louis the reinforced-concrete vertical wall recently constructed successfully withstood the storm, while on the south side it was demolished. That this part of the wall was destroyed was no doubt partly due to the fact that it had not been backed up. It was, however, subjected to the full force of the storm and would in the writer's opinion have been badly damaged even if it had been backed up, a vertical wall being entirely unsuitable for such a situation.

It was also noticed that in many places between Biloxi and Waveland drainage water from the land, flowing across the storm foreshore, and seepage through the sandy soil increased the amount of erosion. Where a stream of water had cut a gully across the foreshore, material was moved in by oblique waves from the neighboring shore to fill in the hollow. This material was in turn moved away to the bed of the Gulf by the seaward flowing stream of water.

The hurricanes usually come from a southeasterly direction, and the waves formed thereby do not strike the shore at right angles to the main direction of the coastline but obliquely, and such oblique waves cause littoral drift (the alongshore movement of material) to take place. Owing to the inequality in the amount of shelter afforded to the coast by the outlying islands, to projections into the Sound—such as at Gulfport harbor pier—and to the varying contour of the coastline, the amount of such drift is not everywhere the same, and as a result localized erosion takes place.

On the Mississippi coast it is impossible to build up the storm foreshore to a natural inclination of repose and prevent further loss of material by constructing groins, as is successfully done on exposed coasts and where the range of tide is much greater. There is no supply of littoral drift on the Mississippi coast except the material moved alongshore during storms. In some places it might be possible to collect material during the storms, but it would be at the expense of the neighboring shore. As it is impracticable to protect the coast by "active defenses," it is necessary to adopt "passive" measures; that is, the object of the work must be to hold the material already there and to prevent further losses. This can undoubtedly be accomplished at a moderate cost by a sea wall, or facing to the upper part of the storm foreshore, thus substituting for the sand a durable material. In places where there is a tendency toward erosion by littoral drift, short groins may be built from the toe of the concrete work out to ordinary low-water line for the purpose of preventing the wall being undermined by alongshore movement of material already there.

The investigations of the writer seem to show conclusively that the storm waves tend to cut out a gradient of repose up which the waves will harmlessly roll, their energy being gradually abstracted by friction on the bottom. If instead of the natural gradient we have a vertical cliff or a sea wall halfway up the natural gradient, as shown in Fig. 10, it is obvious that this obstruction will be reached by the waves before their energy is abstracted; they will hit the obstruction and their impact will tend to destroy it. It is therefore obvious that it is a bad policy to construct on the foreshore a vertical sea wall, as not only would it have to be made very strong successfully to withstand the blows of the waves, but the rebound therefrom will scour out material from the front of the wall and tend to undermine it.

As has already been noted, little erosion took place during the last hurricane in places where there was an approximately natural sloping gradient. If the storm foreshore in such places had been covered with a thick matting of vegetation there would have been practically no erosion. It is impossible, however, to maintain such a covering of vegetation, as in the case of a zone which is occasionally flooded with salt water the conditions are not good for land plants; and if the shore is bare, material will be washed away by the undertow with every storm. The gradient will also be altered somewhat according to the height of storm tide, waves, etc., of each storm.

If, however, a gradually sloping sea wall is built to form a continuation of the natural storm gradient (Fig. 11), protection will be obtained, and such a structure will not be subjected to the blows of waves which a vertical wall would have to withstand. A stepped wall has advantages over a vertical sea wall, as the velocity of the uprush of the waves is considerably checked and the backwash, instead of flowing down with gradually accelerated velocity, has its velocity diminished as it pours from step to step. In places where there is a tendency for material to be scoured out from the lower part of storm foreshore owing to inequalities in the amount of littoral drift or other causes, it can be prevented by building low groins from the wall to low-water line of ordinary tides.

Immediate Protection Necessary

It has already been pointed out that the outlying islands shelter the Mississippi coast. It is therefore important that in the event of their being rapidly eroded and the possibility of their being washed away, it would be advisable to take steps to prevent their destruction. While there is some evidence of erosion of the seaward faces, there is also evidence of accretion at the landward faces, and there is no indication that they will be demolished within the next century. It would, however, be very desirable to have an accurate survey made from time to time, so that, if found necessary, steps could be taken later on to prevent further erosion of their sea faces.

The problem of protecting the coast from storm erosion is one of vital importance to the inhabitants of the coast towns of Mississippi. Not only is it impossible to maintain a road along the water front without protection works, but the property values have decreased in consequence of the liability to serious erosion. The towns are unlikely to develop as they should do if erosion continues, and a large expenditure is incurred after every storm in clearing up débris, repairing the road, sidewalks, etc. In fact, it may be stated that the prosperity and development of the Mississippi coast are dependent on protection being obtained against storm damages.

While the writer is of the opinion that the Mississippi coast can now be permanently protected at a moderate cost, there is little doubt that any serious delay in starting the work would very materially increase the cost and that if another hurricane attacked the coast before the work was carried out, the cost of subsequently building protection works sufficiently far seaward to enable a road to be maintained in front of the existing houses would be very expensive.

Making Concrete Tight; Tacoma and Seattle Water-Works

By C. E. Fowler*

SYNOPSIS—At Tacoma, repairing a leaky reservoir lining, with leakage precautions at the joints only; waterproofing the concrete and giving particular attention to the joints at another reservoir; waterproofing concrete for a settling well, an 85-in. reinforced-concrete conduit and liquid-chlorine-treatment tanks. At Seattle the concrete slabs of two reservoirs were not waterproofed, but the joints were asphalted and were supported on concrete ribs. Subsequent leakage was stopped by replacing some of the asphalt with a harder grade of material; some joints were repoured with lead.

The leakage in the Alaska St. distributing reservoir in Tacoma, Wash., recently became so serious that extensive repairs had to be made. The reservoir was originally built in 1895 with a capacity of 3,500,000 gal., but in 1908 it was enlarged by the addition of another section with a capacity of 7,500,000 gal., leaving a dividing wall between, making the whole reservoir about 200x300 ft. in plan and 20 ft. deep.

This new part, where the leakage occurred, was lined with concrete slabs approximately 25 ft. square and 6 in. thick, laid directly on the ground. The joints between the slabs averaged about ⅝ in. thick and had straight sides. The joints were not calked and were filled with tar and pitch of ordinary quality. Part of the leakage occurred through these joints, but a great part, which was so bad as to wash out the dirt underneath, was through defective slabs.

The superintendent of the water department, P. S. Savidge, recommended that the defective concrete be replaced and membrane waterproofing used, at a total cost of $7,500, but the City Commission ordered it repaired at a cost of about $2,000.

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FIG. 1. SETTLING WELL AND BRIDGE ABUTMENT



FIG. 2. PORTION OF 85-IN. REINFORCED-CONCRETE PIPE, TACOMA WATER-WORKS

The defective slabs were removed, and some of them were found to have a thickness of only 2 in.! Four lines of 6-in. drain tile were put in across the reservoir, at a minimum depth of 18 in. The tile were laid on a 2x4-in. timber, the trenches backfilled with gravel and the four lines connected up to empty into a sump.

The new concrete slabs were laid and all the joints calked with oakum and poured with S grade of Floatine. Over the joints strips of burlap 10 in. wide have been laid in Floatine and painted over with two coats of asphaltum. These repairs have been carefully executed and the leakage has practically stopped.

The McMillan storage reservoir of the Tacoma Green River gravity water system is located about 18 mi. from Tacoma and is 350 ft. wide by 1,390 ft. long, with a central dividing wall.

The slabs in this reservoir were 6 in. thick and had joints ¼ in. at the bottom and ¾ in. at the top. These joints were supported on ribs 6 in. thick and 8 in. wide, with a layer of tar paper on top. The joints were then filled with refined asphaltum, specified to be pliable between freezing temperatures and 200° F., and not sticky at 120° F. This reservoir has not leaked since it was built in 1911, but the slabs were all waterproofed by adding 10% of hydrate of lime.

Three other pieces of work which were constructed on this system by waterproofing the concrete are worthy of notice, one being a settling well, which also acted as a

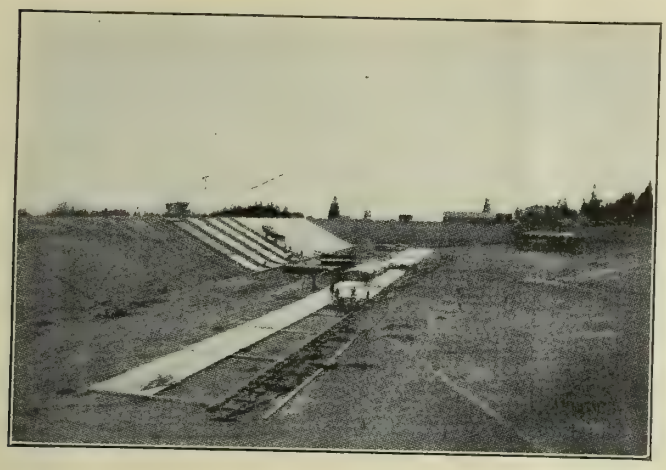


FIG. 3. PLACING BOTTOM IN GREEN LAKE RESERVOIR

bridge abutment (Fig. 1). This abutment was waterproofed by using 8% of hydrate of lime and has not leaked.

The 85-in. reinforced-concrete pipe between the tunnels at the headworks was not waterproofed further than to allow 5% of clay to be used in the sand and gravel making the concrete, and this has not leaked through the 12-in. walls (Fig. 2). The reinforcement was triangular mesh, lapped between sections, alternate sections being placed and the others filled in two days later. While fine hair cracks appeared at the junction of sections, nothing more than a slight seepage occurred. Approximately every 200 ft. telescopic metal expansion rings were introduced, packed with oakum and red lead, and no trouble occurred by leakage.

When the Green River system was completed the water was somewhat impure and a chlorine gas plant, manufactured by the Electro Bleaching Gas Co., was installed, using a tank 11 ft. in diameter and of 5,000 gal. capacity. This tank was built with Hyrib reinforcing, the sides being 3 in. thick and the base 6 in. thick. The sides were of plastered construction, 1 in. inside and 2 in. outside, and 3% of Medusa compound was used, resulting in a perfectly tight tank.

The two Green Lake reservoirs in Seattle, one of 65,000,000 and the other of 75,000,000 gal. capacity, were concrete lined by the writer from plans by R. H. Thompson, then city engineer. The 12x32-ft. slabs (Fig. 3) had a 1 to 8 concrete base and a 1 to 1½ mortar top, the base being from 6 to 8 in. thick and the top 1 in. thick. The joints were ⅜ in. wide at the bottom and ⅝ in. wide at the top, and were formed by a wedge-shaped board form soaked in oil. Underneath the joint was a rib 4 in. thick by 8 in. wide, with an asphalt-saturated wool-felt strip on top. These joints were poured with a special grade of asphalt of the Obispo brand, which met practically the same specified requirements as already given for the McMillan reservoir.

When water was turned in, this asphalt proved to be too soft. Serious leakage occurred and a large part of the filler was melted out and replaced by a harder grade of asphalt, which had originally been recommended by the asphalt company. Some of the joints were repoured with lead. Since these repairs were made no serious leakage has occurred. No waterproofing was used in the slabs and even the Sylvester alum wash which had been specified was not used.

Water-Supplies and Health in Massachusetts

By Arthur L. Gammage*

The relation between the character of public water-supplies and health is perhaps more readily studied in Massachusetts than in any other American state because of the long series of water analyses and the mortality statistics that are available for the cities and towns of the state. Moreover, the waters of Massachusetts show a wide variation in mineral and organic contents, and there is also a considerable variation in local death rates. From a somewhat extended study of the water analyses and the mortality statistics of the commonwealth the author has chosen for presentation here some highly interesting data on the relation between hardness and color and public health, the latter as reflected in the typhoid and general death rates. The data are for the ten years 1904 to 1913 and are presented separately for ground waters and for surface waters.

Relation Between Water Hardness and Health

It has been a much-disputed question whether a hard water or a soft water is the more beneficial to health. Various English, French and Austrian commissions have given opinions, some one way, some another. The general consensus of opinion today seems to be that in similar class towns and cities, having like principal sanitary conditions, the death rate is not raised or lowered by the softness or hardness of the water.

In Massachusetts the hardness in water ranges from 4 to 150 parts per 1,000,000. The study of this relationship has been undertaken for hard, medium and soft waters, taking the medium waters to equal in hardness the average hardness for each group of the two studies—ground and surface waters. The results of this study are summarized in Table 1.

TABLE 1. RELATION BETWEEN WATER HARDNESS, TYPHOID AND TOTAL DEATH RATES IN MASSACHUSETTS

Ground Waters—34 Cities and Towns	Average Hardness, Parts per 1,000,000	Death Rates per 1,000 Typhoid	Total
Softest	17	0.08	14.18
Medium	29	0.14	15.71
Hardest	71	0.11	14.12
Surface Waters—39 Cities and Towns			
Softest	5.7	0.115	14.99
Medium	17	0.10	13.85
Hardest	41	0.14	14.98

Neither in the individual results nor in the group results is there enough consistency to say that hard waters are more destructive of life than soft waters.

Color of Waters and Health in Massachusetts

In the groupings to show by contrast the effect of low colored waters and low typhoid on total death rates, the different waters are given in the order of ground waters, metropolitan waters and surface waters. The metropolitan surface waters are supplied to the suburbs of Boston as well as to the city itself, and special care in many directions has been taken to give this district a safe water and one protected to the utmost by storage and sanitary regulations. The color records are considered fairly representative for the period covered, and as in New England turbidity or suspended matter generally in water is small, color may be taken to represent æsthetic appearance, aside from taste, and sometimes including taste.

*With Robert Spurr Weston, 14 Beacon St., Boston, Mass.

TABLE 2. COLOR OF GROUND WATERS AND TYPHOID AND GENERAL DEATH RATES IN MASSACHUSETTS

City or Town	Color	Death Rate per 1,000 Typhoid	Total
Newburyport	20	0.33	18.94
Lowell	24	0.13	18.77
Hingham	19	0.10	17.72
Grafton	18	0.14	17.45
Fairhaven	39	0.05	17.31
Amesbury	20	0.22	16.95
Milford	27	0.20	16.59
Marblehead	24	0.06	16.58
Middleboro	27	0.09	16.35
Needham	2	0.00	16.35
Methuen	24	0.24	16.07
Natick	0	0.13	15.84
Chelmsford	15	0.10	15.72
Framingham	8	0.13	15.61
Mansfield	0	0.12	15.08
Winchendon	11	0.19	14.92
Braintree	13	0.11	14.89
Woburn	2	0.07	14.86
Dedham	4	0.03	14.72
Easton	0	0.08	14.62
Webster	4	0.07	14.34
Reading	26	0.09	13.94
Franklin	2	0.02	13.25
Adams	2	0.19	13.21
South Hadley	18	0.06	13.18
North Attleboro	0	0.07	12.96
Monson	0	0.10	12.78
Attleboro	4	0.06	12.62
Westboro	9	0.06	12.07
Norwood	15	0.07	11.09
Bridgewater	21	0.01	10.96
Walpole	0	0.00	10.75
Wellesley	0	0.02	10.04
Average		0.12	16.16
	Below 0.12		14.54
Less than 22			14.63
Less than 22	Below 0.12		13.66
Less than 10			13.88
Less than 10	Below 0.12		13.49

TABLE 3. COLOR, TYPHOID AND TOTAL DEATH RATES IN THREE GROUND-WATER-SUPPLY CITIES

	Color	Death Rate per 1,000 Typhoid	Total
Brookline	21	0.05	11.33
Newton	9	0.06	11.75
Waltham	11	0.19	13.18
Average		0.10	12.02

Average of places below average typhoid death rate, 11.44.

TABLE 4. TYPHOID AND GENERAL DEATH RATES FOR MASSACHUSETTS METROPOLITAN CITIES

City or Town	Death Rate per 1,000 Typhoid	Total
Stoneham	0.08	17.81
Boston	0.15	15.83
Arlington	0.10	14.70
Swampscott	0.06	14.57
Lexington	0.06	14.39
Revere	0.11	13.80
Chelsea	0.16	13.78
Somerville	0.11	13.15
Melrose	0.08	13.05
Malden	0.12	12.75
Winthrop	0.10	12.47
Quincy	0.07	12.39
Medford	0.07	12.07
Everett	0.10	11.84
Milton	0.07	11.25
Watertown	0.04	10.54
Average	0.11	12.94
Less than 0.11		12.59

In the metropolitan zone (Table 3), although not included in the metropolitan water district, are three ground-water-supply cities or towns which are comparable in population, geographical position and industries with the metropolitan suburban cities and towns, rather than with the ground waters or surface waters scattered all over the state.

Complete records of the quality of waters supplied to the different metropolitan cities are not available. Table 4, with color not given, shows that the suburbs of Boston have a lower average death rate than the city itself.

Nearly all unpurified surface waters have some odor. Although they are much improved by natural storage, still at times many ponds and reservoirs are deteriorated by the growth of organisms, which either in their growth or their decomposition give to the water objectionable odors and tastes. In general, the organic matter in a water will be less with less color, and hence there is less liable to be objectionable odor and taste in the lower colored waters. With the surface waters of Massachusetts

TABLE 5. COLOR, TYPHOID AND GENERAL DEATH RATES FOR MASSACHUSETTS SURFACE-WATER SUPPLIES

City or Town	Color	Death Rate per 1,000 Typhoid	Total
Fall River	26	0.14	18.83
Holyoke	24	0.10	18.01
Montague	9	0.14	17.90
Hingham	26	0.10	17.72
Salem	34	0.17	17.37
New Bedford	38	0.19	17.17
Ipswich	29	0.29	17.01
Plymouth	4	0.17	16.96
Milford	27	0.20	16.59
Chicopee	34	0.06	16.48
Pittsfield	26	0.21	16.31
Athol	41	0.11	16.22
Weymouth	56	0.07	16.16
Lawrence	34	0.19	16.02
Amherst	32	0.25	15.65
Abington	15	0.12	15.61
Palmer	29	0.09	15.57
Springfield	26	0.21	15.49
Worcester	24	0.09	15.36
Haverhill	28	0.14	15.31
Westfield	33	0.16	15.18
Taunton	26	0.16	15.13
Cambridge	29	0.10	15.09
Andover	20	0.15	15.08
Peabody	22	0.19	14.95
Spencer	13	0.08	14.67
Northbridge	31	0.11	14.62
Rockland	15	0.12	14.61
North Adams	20	0.20	14.49
Great Barrington	13	0.08	14.44
Gardner	15	0.12	14.42
Greenfield	11	0.07	14.41
Leominster	32	0.09	14.37
Gloucester	35	0.10	14.30
Beverly	34	0.19	14.22
Southbridge	39	0.13	14.11
Easthampton	20	0.08	13.96
Marlboro	31	0.07	13.91
Wakefield	26	0.10	13.56
Fitchburg	20	0.12	13.50
West Springfield	20	0.04	13.39
Northampton	23	0.10	13.32
Adams	2	0.19	13.21
North Andover	21	0.05	13.20
South Hadley	18	0.06	13.18
Lynn	48	0.15	13.16
Maynard	18	0.08	13.04
Danvers	48	0.12	12.70
Whitman	18	0.02	12.09
Brockton	18	0.10	11.79
Hudson	26	0.07	11.67
Norwood	20	0.07	11.09
Winchester	20	0.00	10.54
Concord	8	0.06	10.45
Average		0.14	15.41
	Less than 0.14		14.61
Less than 22			13.76
Less than 22	Less than 0.14		13.11

(see Table 5), as well as the ground waters, the color will represent to a good degree of accuracy the agreeable acceptance of that water by the consuming public.

The surface waters of Massachusetts have not reached a state of purification by storage or other means where more than one town could be put in a class of waters of color less than 10 parts per 1,000,000 and a typhoid rate of under 0.14 per 1,000.

Dividing the whole number of places previously using ground waters, metropolitan waters or surface waters into two groups—one having a death rate less than 15.87, the average for the whole state for the 10-yr. period used, and the other a death rate of over 15.87 per 1,000—we find about two-thirds of the waters having a color of less than 22 have a death rate below 15.87, while about two-thirds of the cities the death rate of which is over 15.87 have a color of over 22.

In general, a color above 22 on the platinum scale begins to be noticeable to the consumer, and this point has been taken as the separating line to determine the effect of appearance of water on the death rate, as well as to determine whether the good-appearing waters and their corresponding cities and towns of the state are the best protected from a sanitary standpoint, taking the typhoid death rate over a period of 10 yr. as the indicator.

From a different standpoint, that of the high-death-rate cities and low-death-rate cities, which are those whose average for 10 yr. is below the state average, a critical examination has been made to find whether good appearance

held sway in the contest for low death rates or whether sanitary protection as measured by the typhoid death rate was sufficient to determine low death rates for places so improving their water-supplies. Table 2 shows these figures for places supplied with ground water.

The ground waters and surface waters of the lowest typhoid death rate have the lowest total death rates, and the difference is at least several times the average typhoid death rate for that class of waters.

In the case of the metropolitan waters, the towns and cities of low average typhoid death rate have a lower total death rate than the average. However, the metropolitan authorities would strenuously object to rating the sanitary quality of the water in the different cities by the typhoid death rate, and I would rather attribute it to collective and individual sanitation than accident when it includes about one-half the metropolitan suburban population in the low typhoid death rates.

Even more remarkable than the lower death rates with lower typhoid rates is the observation of the lower death rate with lower colored waters, and especially with the lower colored waters of the low typhoid death rates. This condition exists in the case of both surface waters and ground waters and in group combination of the two classes of waters.

It must be remembered that comparatively few Massachusetts cities have installed water-purification plants and that both mechanical filters and water disinfection by hypochlorite or by liquid chlorine treatment are notable for their absence.

Financing County Roadbuilding in Illinois

Vermilion County, Illinois, voted $1,500,000 of bonds at the election in November, 1914, for 174 mi. of paved roads to be constructed during the years 1916 and 1917. According to information furnished by P. C. McArdle, Superintending Engineer (Assistant Chief State Highway Engineer), Danville, Ill., this system of country highways reaches every city and village in the county. It comprises two main roads north and south and five roads east and west (see accompanying map).

For construction purposes the system has been divided into nine divisions of approximately 19 mi. each. It is the purpose of the county to let all the work by contract to the lowest responsible bidder early in the spring of 1916, after the supreme court decision on the validity of the bonds, which is expected at the December term of court. The circuit court of the county has already sustained the issue.

The county road-improvement committee at Danville, Ill., through its Superintending Engineer, P. C. McArdle, is preparing plans, specifications and estimates of cost. These plans should be in readiness by about Feb. 1, 1916. The designs and specifications follow almost exactly those of the Illinois State Highway Department. Included in these contracts will be grading, drainage, small culverts, farm entrances and a pavement 10 ft. wide of brick or concrete, with 3-ft. gravel or macadam shoulders.

The bonds bear interest at 4% and are issued serially; $75,000 worth are retired each year. The actual amounts, including interest, the cost per $100 of assessed valuation and the approximate cost per acre on farm lands, are shown in the table.

STATISTICS OF PROPOSED COUNTY BOND ISSUE, VERMILION COUNTY, ILLINOIS

Year of Payment	Payments of Principal and Interest as Fixed by Supervisors	Approximate Direct Tax Required on Each $100 of 1913 Assessed Valuation	Approximate Cost per Acre on Farm Lands (Average Assessed Value per Acre, $30.63)
1	$95,000	$0.26¼	$0.08
2	112,000	.30⅞	.09½
3	129,000	.35½	.10⅞
4	126,000	.34¾	.10⅝
5	123,000	.34	.10½
6	120,000	.33	.10⅛
7	117,000	.32¼	.09⅞
8	114,000	.31½	.09⅔
9	111,000	.30⅝	.09½
10	108,000	.29¾	.09⅛
11	105,000	.29	.08⅞
12	102,000	.28⅛	.08⅝
13	99,000	.27⅓	.08½
14	96,000	.26½	.08⅛
15	93,000	.25⅝	.07⅞
16	90,000	.24⅞	.07⅝
17	87,000	.24	.07½
18	84,000	.23⅛	.07⅛
19	81,000	.22⅓	.06⅞
20	78,000	.21½	.06⅔
General average per year	$103,500	$0.28½	$0.08¾



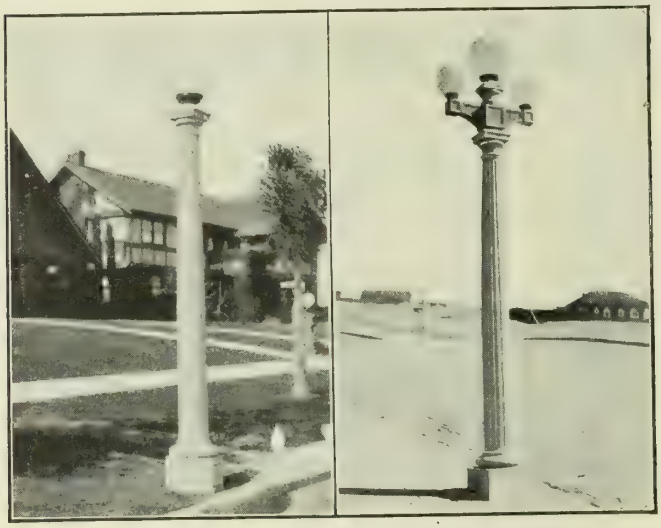
MAP OF VERMILION COUNTY, ILL., SHOWING PROPOSED ROAD SYSTEM

By reference to the map it will be noted that the county is traversed by eight railroads (four east and west and four north and south) and by one interurban electric line. The roads to be improved are divided with regard to present railroad sidings into divisions, so that the average haul does not exceed 3 mi. The county is comparatively level, and contractors' hauling by industrial railways should prove eminently satisfactory, except in a few instances.

Concrete Lighting Standards Made Attractive

By L. W. R. Allison*

A new and attractive design of reinforced-concrete lighting standards is being used in many of the southern California cities and towns, good examples of which are shown in the accompanying views. The standard is made by centrifugal molding, and in completed form closely resembles cut and polished stone or marble. The surface



FIGS. 1 AND 2. CONCRETE LAMP STANDARDS

is hard, smooth and impervious to moisture. This column is produced in designs patterned after the classic types of Greek and Roman architecture. A single-lamp standard of Doric column model, with octagonal base, is illustrated in Fig. 1, and a three-light standard with the same shaft on a square base is shown in Fig. 2. These reinforced-concrete posts are cast in three distinct parts—shaft, base and cap. A sectional view of a typical lighting standard is shown in Fig. 3, with base, shaft and capital erected in place and securely anchored to the concrete foundation by twisted steel reinforcing rods. A line of sherardized conduit is run through the hollow center from top to bottom and provision made for a cutout box. The size of the cored center varies for different types of posts.

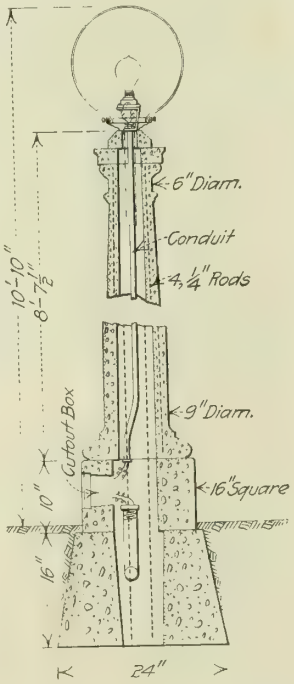


FIG. 3. COLUMN SECTION

In making these standards a wooden or metal mold of desired dimensions and exterior outline is made in two or more parts. When steel reinforcement is required, this is built up and placed in the mold, properly supported from the walls on radial lines. The sections of the mold are securely fastened and the necessary mixture of gravel, sand and cement is poured in at the end. The mold with contents is then rotated about its axis at such a speed as will hold the wet concrete against the walls. This depends on the diameter. In about 30 min. the preliminary set is attained and the mold and column are placed aside for 24 hr. Final curing is done out of the mold in the open air, the concrete being kept well moistened.

While at first it might seem that the larger particles of the aggregate would be forced to the outside and cause a rough surface, actual work shows that all voids are filled, securing a hard and smooth exterior, such as cannot be obtained by tamping. The similarity of the finished surface to polished stone has resulted in the local trade name "marbelite." A recent test for absorption as compared with well-tamped concrete of like mixture showed that the surface of the whirled concrete absorbed less than one-half the moisture taken up by the tamped product in the same period of time.

This centrifugal process of manufacture is effectively employed for a variety of concrete products, such as ornamental columns, poles, piles, etc. The attractive open-shelter railway station, shown in Fig. 4, as erected at one of the Los Angeles beach resorts, on the line of the Pacific Electric Ry., has posts made like the lighting standards described.

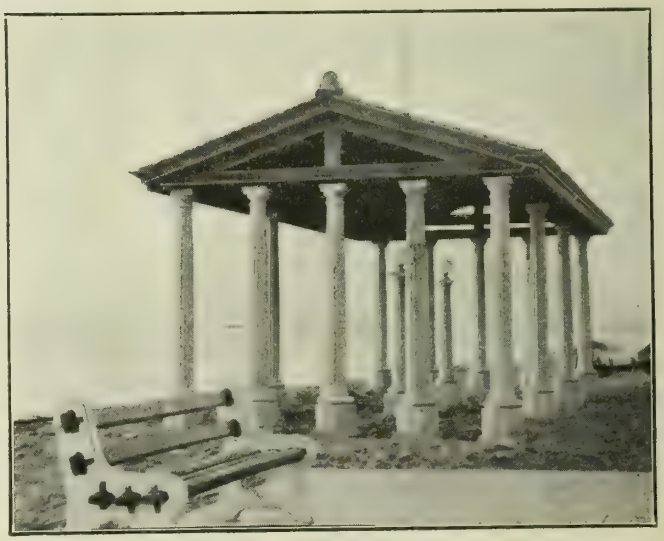


FIG. 4. RAILWAY SHELTER WITH CENTRIFUGALLY MOLDED POSTS

*170 Roseville Ave., Newark, N. J.

Progress of Santa Barbara Water-Supply Project

By K. Q. Volk*

A possible serious bar to the water-supply project of Santa Barbara, Calif., has been removed in an unexpected way. California has an obnoxious riparian law which in the past has substantially interfered with the development of the state. Under it, riparian owners on a stream can object to diversions of water at points on the stream above them. The California courts in some instances have ruled that no water whatever could be taken out of a drainage basin, but of late the California Supreme Court has shown a tendency to relieve the situation and has given two decisions to the effect that waters may be

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diverted out of drainage basins for beneficial uses, provided there is no substantial damage to lower owners.

In developing an additional water-supply for the City of Santa Barbara it became necessary to seek it from a distant mountain drainage basin. A tunnel 19,600 ft. in length has been driven through the Coast Range, which is known as the Santa Ynez Mountains, to the Santa Ynez River. This river, above the upper portal of the tunnel, drains 208 sq.mi. of rough mountain country and flows in a westerly direction, discharging into the Pacific Ocean 68 mi. west of Santa Barbara. The City of Santa Barbara is not in the drainage basin of the Santa Ynez River. It is a portion of the plan to erect a concrete dam 180 ft. high above bedrock and develop a storage capacity of 16,000 acre-ft. This reservoir will be filled by the winter flood waters, which would otherwise flow into the Pacific Ocean.

The lower riparian owners on the Santa Ynez sought to enjoin the City of Santa Barbara from continuing the construction of the dam which had been started and petitioned for the closing of the tunnel so that water could not be diverted to the city.

There were two principal plaintiffs against the city and approximately a dozen interveners, who also were objecting. The case came to trial on Oct. 7, 1915, at Santa Barbara and developed an amusing situation. Neither one of the plaintiffs appeared to press the suit, and all of the interveners expressed a willingness to accept judgment in accordance with the answer of the defendent City of Santa Barbara to the plaintiffs' complaint. This involved the diversion of an equivalent continuous flow of 13 cu.ft. per sec. of water from the reservoir site. It was conceded by all who appeared that Santa Barbara had the right to impound and divert flood waters, but it was contended that it did not have the right to divert the normal flow of the river.

The legal features of the case were handled by W. P. Butcher, City Attorney for Santa Barbara, assisted by George Gould and W. B. Matthews, of Los Angeles. The engineering offices of J. B. Lippincott, of Los Angeles, prepared the engineering data.

The case is important, as it indicates the changing opinion that has developed in California relative to riparian rights.

California Examination for Construction Engineer

The following problems and questions were submitted to candidates for the position of construction engineer for the State of California in an examination recently held at San Francisco:

Specifications for Construction (Time 3 hr.; no reference books allowed)—Select one of the most important pieces of engineering construction with which you have been identified and write complete specifications covering the materials and the incorporation into the work of the three principal items estimated for payment under the contract.

Conditions Determining Types of Construction (Time 4 hr.; no reference books allowed)—Select one of the most important pieces of engineering construction with which you have been connected during the past five years and write a description of the conditions governing the selection of the type of work built, describing briefly what that type was, illustrating by pencil drawings and demonstrating why this type was best adapted for the site and conditions of use. Any difficulties which arose during construction should be described, and suggestions should be made as to alternate designs which might have been applicable and economical.

Supervision of Construction (Time 3 hr.; no reference books allowed)—From memory of actual conditions write a complete monthly progress and cost report, addressed to a hypothetical superior officer, recounting in detail the progress made during a typical month on some piece of engineering construction with which you have been connected in a responsible capacity. A cost report should be incorporated as part of the monthly report, and should give in detail the cost of the various items entering into the contract, as well as giving the total number of men and teams, number of days worked and the supplies, materials and machinery used.

Materials of Construction (Time 4 hr.; hand books or reference books may be used; take one of the seven problems.)

Problem I—Make a design for a two-span wooden highway bridge, having a roadway 18 ft. wide in the clear and spanning a canal 40 ft. wide at top of banks and 10 ft. deep. Water in the canal is 6 ft. deep. A single-framed trestle bent is allowed in the middle of the stream, and wooden mud-sills are permissible. The uniform live-load is 100 lb. per sq.ft., and maximum live-load is due to a 15-ton traction engine having two-thirds of its weight upon one axle, the distance between axles being 12 ft. Show all details with dimensions. Make bill of materials, together with estimate of cost of materials only, if lumber costs $26 per 1,000 ft., board measure, and nails $3.50 per 100 lb. delivered at the site of the work. Show computations.

Problem II—In building a large masonry dam, rectangular steel towers 50 ft. high and 25x50 ft. in plan were erected on the dam foundation for the purpose of each carrying two 10-ton capacity stiff-legged derricks having 50-ft. booms. Each derrick had its hoisting engine mounted on top of the tower. The total load to be provided for, both live and dead, is 40 tons. Design a tower with riveted connections, showing the dimensions of all main members, and give details of bracing, connections, etc. Show computations.

Problem III—A small city proposes to build a circular water-supply tank of reinforced concrete on top of a hill, where the foundations will be upon a firm gravel. Inside dimensions of the tank are to be 30 ft. diam. and to hold water 20 ft. deep. No roof will be required.

(a) State proportions of concrete for foundation and walls.
(b) Give all required computations.
(c) Sketch details of design with dimensions, and give sizes and spacing of the steel reinforcement required.
(d) Specify briefly the principal requirements governing the making and placing of the concrete.

Problem IV—A crossing of a single-track railway over a highway requires abutments of first-class granite ashler laid in cement mortar. Both the abutment foundations and the railway embankment are composed of a medium-fine grade of sand, and the former will always be wet. The embankment is 24 ft. high, 14 ft. wide on top and with 1½ on 1 side slopes. Maximum load on top of one abutment equals 100 tons. Sketch design for one abutment, showing:

(a) Details of foundation.
(b) Dimensions and arrangement of courses and widths of face joints.
(c) Bridge seat, assuming a through plate-girder bridge.

Problem V—A highway embankment crossing a watercourse has such a height that the maximum load, both live and dead, on the culvert may be considered uniformly distributed at the rate of 1,500 lb. per sq.ft. For this condition design a triple-arch, plain concrete culvert 100 ft. long, each arch to have a clear span of 18 ft. and a rise of 4 ft. Piers are to be 5 ft. in height from culvert floor to arch springing line. The maximum allowable pressure on the foundation is to be 3.5 tons per sq.ft.; maximum velocity of water in culvert, 6 ft. per sec.

(a) Show cross-section of culvert.
(b) Show end elevation of parapet, etc.
(c) Compute cost of the concrete alone if the latter costs $12 per cu.yd. in place.
(d) State proportions of concrete to be used and what precautions should be taken to secure good work.

Problem VI—Farm land worth $200 per acre, and located in river bottom subject to flooding, is to be protected from overflow by a levee which must resist a rise of 20 ft. in water level above the normal elevation. The river banks are covered with trees and brush, and fine sand and sediment are the only materials available for building the levees.

(a) Design a satisfactory levee, indicating all details.
(b) Specify in detail how it should be constructed and how it should be protected from erosion. The river channel at ordinary water stages is 600 ft. wide and is navigable for large craft.

Problem VII—Smithville is a farming center having a population of about 5,000. It is located 10 mi. from any railroad, the nearest station being at Jonesville (population 20,000). At present no good road exists between the two cities, but one is to be constructed, which when completed will be the principal outlet of Smithville.

Between the two cities there is a ridge about 2,000 ft. high, with precipitous sides, and there is a ravine 50 ft. deep and ¼ mi. wide. The stream at the bottom of the ravine drains about 4 mi. of hilly land and, at the site of the proposed road, has a fall of 5 ft. per 1,000.

Near Jonesville the soil is very sandy, but at Smithville there is a top soil of from 1 to 2 ft. of black loam underlaid by yellow clay. The ridge is of gravel, hardpan and ledge rock. The other features and conditions are the same as those usually encountered in the construction of a road.

(a) Outline briefly all steps necessary from the time the road is proposed until it has been thrown open to traffic.
(b) Draw an imaginary plan, scale 1 in. equals ½ mi., and a profile of appropriate scale to accompany the same. Give sketches of proposed structures. Draw also several typical sections showing present surface and proposed section and pavement.
(c) Dicuss briefly the type of construction, kinds and sizes of structures and why chosen.
(d) Write brief specifications for the work and for the materials to be used.
(e) Make a detailed estimate of the quantities and costs.

Field and Office

Moving a 30-In. Gas Main

By Raymond J. Van Wagner*

To use the open-cut method of construction for 2,000 ft. of the Lexington Ave. subway in Whitlock Ave., Borough of the Bronx, New York City, it was found necessary to change the location of 1,500 ft. of 30-in. gas main.

About 1,450 ft. of the whole 2,000 ft. of this main was on a curve of 1,200-ft. radius, and the remaining 550 ft. was on a tangent. The new location was approximately parallel to the old. To economize, as much of the old pipe as possible would have to be used; and as the service could



FIG. 1. A 450-FT. LENGTH OF GAS MAIN ROLLED INTO NEW LOCATION

be interrupted for only a limited period, the pipe to be re-used would have to be moved quickly.

It was finally decided to lay new pipe on the curved portion of the pipe line, and to roll the remaining pipe from the old location to the new. As there was a slight change of direction in the 550-ft. length to be moved, it was decided to roll the pipe in 450- and 100-ft. sections.

The new location was just outside of the neat line of the subway, and the regular excavation for the subway was widened to include the excavation for the new pipe line. At the same time the existing pipe line was uncovered. The subgrade for the new position of the pipe was graded, and bed blocks were set to line and grade. Pieces of 12x12-in. timber were then laid across the cut, one timber to every second length of pipe, and the pipe was notched at the desired breaking points.

After all new pipe was in position on the curve, two cables were placed around the 450-ft. length of old pipe, dividing it into three equal parts. These cables were anchored in position on the bank over the new location, passed around the pipe and back to blocks placed near the anchored end, then returned across the cut to other blocks. The hauling was done by fastening the ends of the lines to two locomotives on the tracks of an industrial railway parallel to the pipe line.

The gas was cut off and the pipe broken at the notched points. At a given signal both locomotives started pulling, and the pipe rolled over the timber supports to its new position. Fig. 1 shows the 400-ft. length immediately after rolling into position. The actual time of rolling was 25 sec. By repeating these operations the 100-ft. length was put in place in 30 sec. Fig. 2 shows the pipe at the start and Fig. 3 shows it rolling into place.

To allow clearance for the steam shovel and to allow for erection of steel, etc., the lower end of the pipe, which will rest on the subway roof when completed, was by-passed on overhead cables supported on two towers placed outside of the neat subway line.

The pipe was restored to service after a delay of only 6 hr., which was well within the time limit. Very little calking was required, as the joints held fast.

The work was done under the personal direction of John H. Hagerty, of Rodgers & Hagerty, contractors for this section of the subway work.

*Assistant Engineer, Public Service Commission, 1372 Zerega Ave., New York City.



FIG. 2. CABLES PLACED FOR ROLLING 100-FT. SECTION



FIG. 3. ROLLING 100-FT. LENGTH OF GAS MAIN

Sand-Puddle Foundation for Heavy Aqueduct

A novel scheme was employed for obtaining firm bearing for the large concrete conduit now being constructed for the Greater Winnipeg Water District, Canada. The trench bottom at some points was too soft at the elevation of the invert to carry the conduit. In these places all the soft material was removed and an artificial bottom was prepared by flooding the trench with water to a depth of a foot or two and dumping sand or gravel into the trench. This material was cast or worked so that it settled into the water, so that the water level was maintained always higher than the top of the fill. These foundation fills in cuts are carried up a few inches higher than the required elevation; then the water is pumped or drained out of the trench in such a way that it passes down through the sand or gravel instead of flowing off over the surface.

This method has resulted in a bottom so tight and hard that the invert can be laid on it almost as soon as the water has drained out. In fact, the material was so tightly packed that it was necessary to use picks and mattocks to trim for receiving the invert. The accompanying view shows one of the soft-bottom trenches with the water standing in it and a load of gravel being dumped. The material for these foundation fills was obtained, for the most part, from the gravel plant of the water district and contained so much sand that had there not been this use for it the material would have had to be wasted.



DUMPING GRAVEL FOR TRENCH BOTTOM TO CARRY AQUEDUCT

Concrete Mixing and Placing, Ford Building, Buffalo

In the construction of the automobile assembling and sales building for the Ford Co. at Buffalo, N. Y., some interesting methods were used in the concrete work. The architect is Albert Kahn, of Detroit. The Turner Construction Co., of Buffalo, has the general contract. H. E. Plumer is the company's engineer and W. T. Baker is its superintendent.

The building is about 435x100 ft. in plan, four stories high, with a deep basement under one end. The first floor is at the street level (Main St.), and the basement floor is level with the depressed tracks of the New York Central R.R. The rock cut was widened to give space for spur tracks and a loading platform. The floors and roof are of flat-slab construction. The columns and their flaring capitals are octagonal, so that it was a simple matter to make the forms of wood, there being no curved surfaces. The walls are faced with brick and terra cotta on the outside.

The layout of the construction plant is shown in Fig. 1. The supply track, concrete mixer and concrete elevator

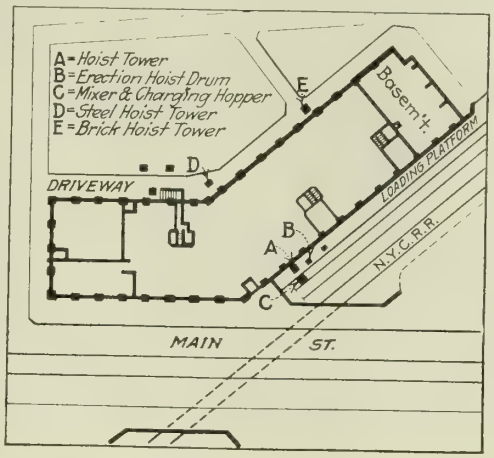


FIG. 1. PLAN OF CONSTRUCTION PLANT FOR THE FORD BUILDING AT BUFFALO, N. Y.

tower are at the lower (railway) level. On the other side of the building are three hoisting towers at the upper (street) level. One of these is for the reinforcing steel and the others are for the brick.

Mixing and Conveying Plant

Materials are delivered on cars and the cement is stored under the Main St. bridge. Sand and gravel are unloaded by hand into 1-yd. portable hoppers or bins standing beside the cars (Fig. 2). Thence the material is discharged by gravity into wheeled carts of 6 cu.ft. capacity for delivery to the stock pile or the mixer.

A ⅔-yd. mixer is used, set in a pit so that it can be charged by gravity from the carts at the track level. It delivers the concrete into a ¾-yd. self-dumping elevator bucket in a tower 90 ft. high, operated by a 40-hp. motor and friction hoist. This bucket discharges into a short chute at the floor or roof level as required, the concrete flowing to a hopper with a gate, from which it is delivered to the 6-ft. carts to be wheeled to the forms. The mixer and hoist are operated by a 40-hp. electric motor.

Floor Construction

In order to complete the building as rapidly as possible the forms for the floor were made in panels approximately 5x12 ft. When these panels are placed there is a loose board built in between each two form panels. After the floor has been concreted, and before any of the forms have been disturbed, a secondary set of shores is placed under these loose boards so that the floor is still properly supported after removal of the forms. These secondary shores are allowed to stand under the second floor until the roof has been concreted, and in no case are they removed in less than 24 to 28 days.

In order to give proper grade to the floors, strips of Norway pine are used, 2x6-in., dressed on four sides. These are supported on edge, so that the lower edge is level with the finished floor. They are supported by ½-in. eyebolts 18 in. long. The eye is 2 in. in diameter and fitted down against the upper edge of the strip. There is

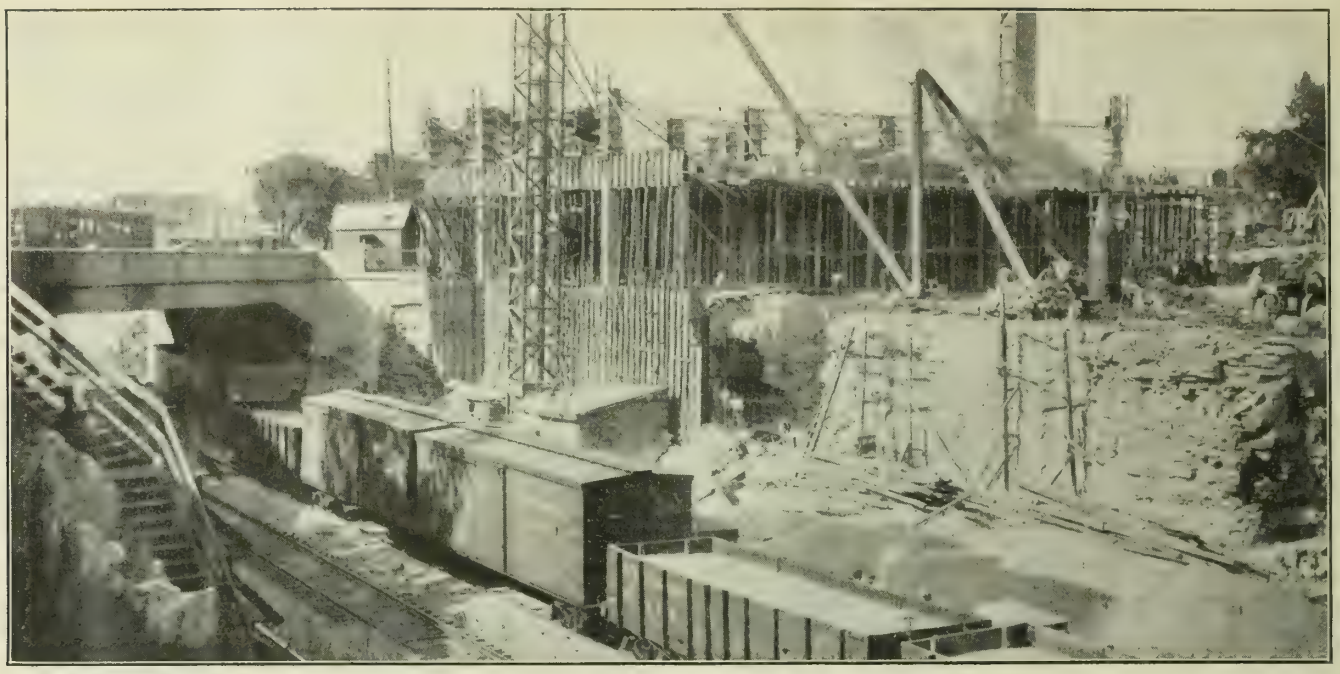


FIG. 2. CONCRETE SUPPLY AND MIXING PLANT

The cars are on the supply track, and materials are wheeled to a hopper discharging into a mixer below the ground level. At the right is the rock excavation for the basement. The tower at the left is for elevating the concrete. The other is for hoisting steel rods, being sheathed on one side, so that the rods will not catch in the bracing

a nut directly on the lower edge of the strip and two nuts on top of and underneath the floor forms. By loosening or tightening these two lower nuts the strip can be set to any height. These strips are set as soon as the steel is in place and are leveled with the aid of an instrument.

In order to grade the floor between the strips a 2x10-in. plank is notched on each end so that its bottom edge will be flush with the bottom edge of the 2x6-in. strip. After the floor has been set off with a straight-edge the nuts under the bottom of the floor form are removed and a hook inserted in the eye of the eyebolt to pull out these strips. This leaves only the bolt holes to fill up before floating the floor. After this floating, the floor hardener is applied and the floor finished in the usual manner.

Methods of Handling Steel

The steel bars for reinforcement vary in length from 6 to 60 ft., and it was desired to hoist these to the various floors with as little chance of bending as possible. It was decided to build a tower of such height that the long bars could be hoisted on end clear of the floor and lowered to the floor. For that reason the tower used for hoisting steel is approximately 125 ft. high. This hoist is operated by a 40-hp. motor and friction drum, which were later used for the second brick hoist.

The steel was hoisted for the entire job and placed on the various floors as soon as the first section of the building was up. This permitted the use of the steel laborers to good advantage at a time when progress is slow, while starting the second section, and also allowed the use of the hoisting drum as soon as work was ready for the brick on the second section. This tower is sheathed on one side with 1-in. sheathing to prevent the rods from catching on the braces.

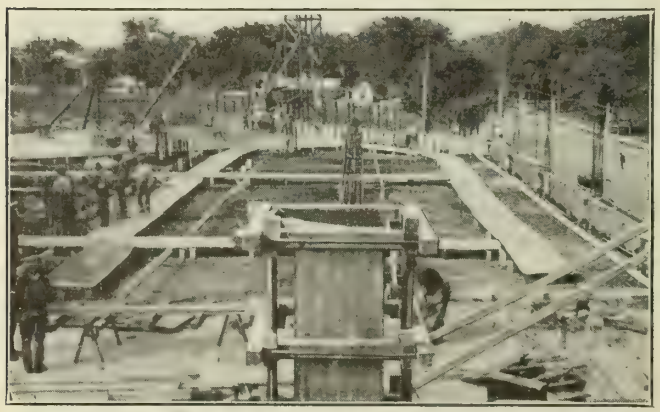


FIG. 3. CONCRETING THE FIRST FLOOR OF THE FORD BUILDING

The elevator tower is at the rear, with its bucket delivering concrete to wheeled carts which are operated on the wide runways

Force Employed

The force has averaged about as follows: Forty carpenters, 35 bricklayers, 8 cement finishers, 10 steel laborers, 25 carpenter helpers, 50 concrete laborers, 28 brick laborers and 25 general laborers. Each of these gangs is under the direct supervision of a foreman, and in the cases of the bricklayer and carpenter gangs the foreman has one assistant.

The carpenters are mostly men who have worked for the firm on similar work before. They work in pairs, a new man always being paired with an experienced man. The bricklayer gang is divided into three sections—the first to lay the terra cotta, the second to lay face brick and the third to lay common brick. About 50% of the concrete gang are men who have worked for the firm before. The remainder are the quicker and better class of general labor. The average is from 36 to 40 yd. of concrete per hour with this gang, with a record of 425 yd. in 9½ hr.

Right-Angle Offsets by standing on the survey line with arms extended so as to be in alignment, then looking directly to the front, quickly bringing both arms forward and sighting over the hands, will give points within 1.5 ft. in 60 ft. This figure is the average obtained in a large number of tests by W. W. Gruber, Cincinnati, Ohio. The opportunity for these tests was the need for using the method extensively for short offsets from a railway survey line to fences, creeks, roads, etc., where greater accuracy was not required.

Laying Wood-Stave Pipe to Replace Steel Pipe

Twenty-two years ago a wrought-iron penstock pipe supplying power water for the mill of the Flory Milling Co., Bangor, Penn., was laid in the channel of Martin's Creek, practically the whole length being exposed to the water. In its service since then the pipe rusted full of holes, and this summer its condition became so bad that immediate replacement was imperative. Cast-iron, sheet-iron and wood pipe were considered for the new pipe, and wood-stave pipe was adopted. A 36-in. pipe, 3,000 ft. long, is being put in. Most of it will be covered.

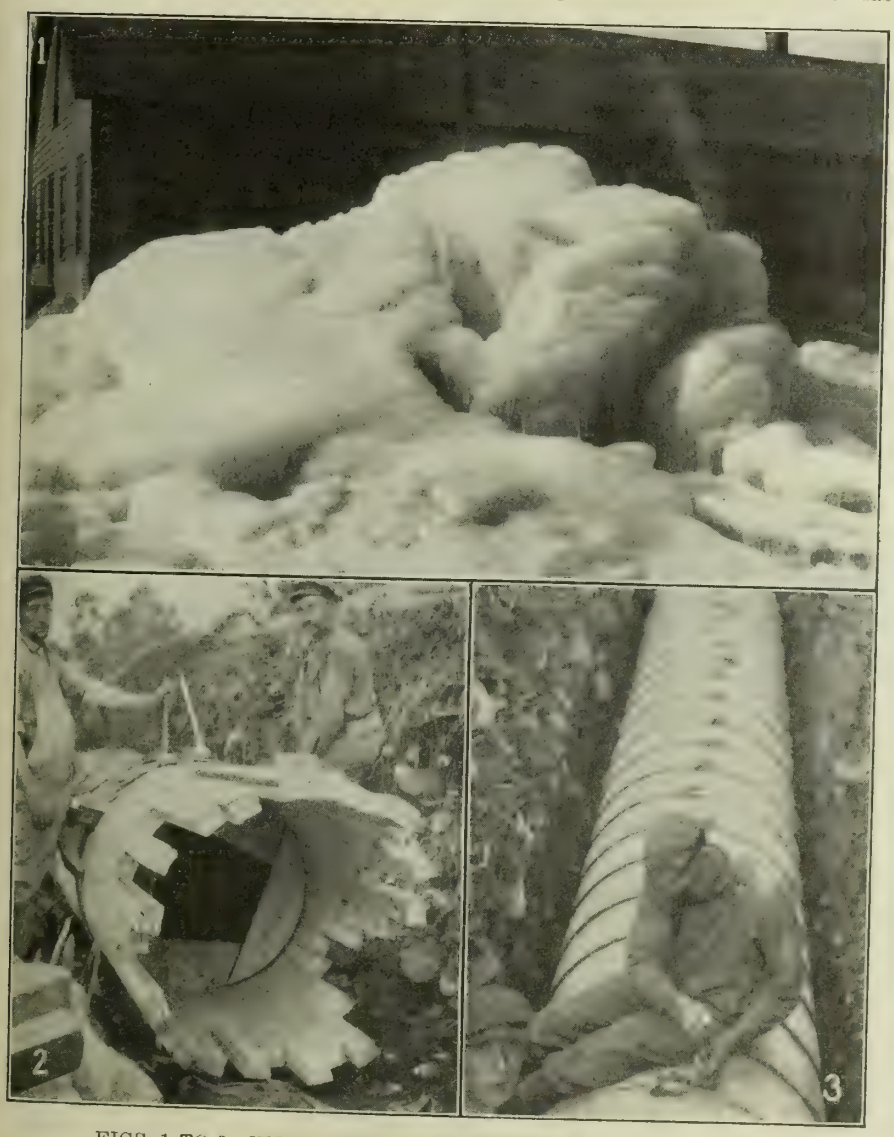
The 3-in. white-pine staves for the pipe, 4 in. wide, are milled by the Fitzgerald-Speer Co., of Pen Argyl, Penn. They are made of selected log run from West Virginia, grading about No. 2 barn and better. The inner and outer faces are milled to the radius of the pipe, so that an entirely smooth inner surface is obtained. The side faces are tongued and grooved. The ends are cut square and have a saw cut 1 in. deep parallel to the outer face of the stave, in which a ⅛-in. iron tongue plate is placed in assembling the pipe.

Staves are delivered daily at the trench fresh from the mill, as it was found that when left exposed over night they absorbed a certain amount of moisture and were harder to work.

The pipe is built right in the ditch. It is bedded on the earth, without concrete supports, and after completion it is covered. The staves are furnished in various lengths from 2 ft. up; joints are staggered throughout, and at the same time the odd lengths give perfect freedom to cut out any pieces of unsatisfactory quality. The banding is ⅝-in. round iron, with both ends threaded, the nuts engaging a cast lug. The bands are spaced about 12 in. apart. They are painted one coat of asphalt before applying.

The labor of building the pipe is six men and boys at a combined labor cost of about $15 a day, who build and lay complete 100 ft. of pipe per day. This makes the cost of laying about 15c. per ft.

E. A. Speer, of the Fitzgerald-Speer Co., worked out the design and manner of building the pipe. Milton Flory, president of the Flory Milling Co., is superintending the work personally.



FIGS. 1 TO 3. WOOD-STAVE PIPE WORK IN BANGOR, PENN.
Fig. 1—The 22-yr.-old iron pipe in winter; note stream of water spouting through the ice. Fig. 2—Assembling 36-in. wood-stave pipe in trench. Fig. 3—Tightening bands

Gasoline Dinkeys Haul Concrete

The practice of using gasoline dinkeys for hauling cars of concrete has become widespread. It is successfully employed on at least three construction jobs now under way in the United States and Canada and was used in placing the concrete piers of the Scioto-ville bridge of the Chesapeake & Ohio Northern Ry. These dinkeys are used in the construction of the large concrete conduit of the Greater Winnipeg water-supply, on the Harrisburg (Penn.) bridge of the Cumberland Valley R.R. and on the Little Scioto viaduct of the Chesapeake & Ohio Northern Ry.

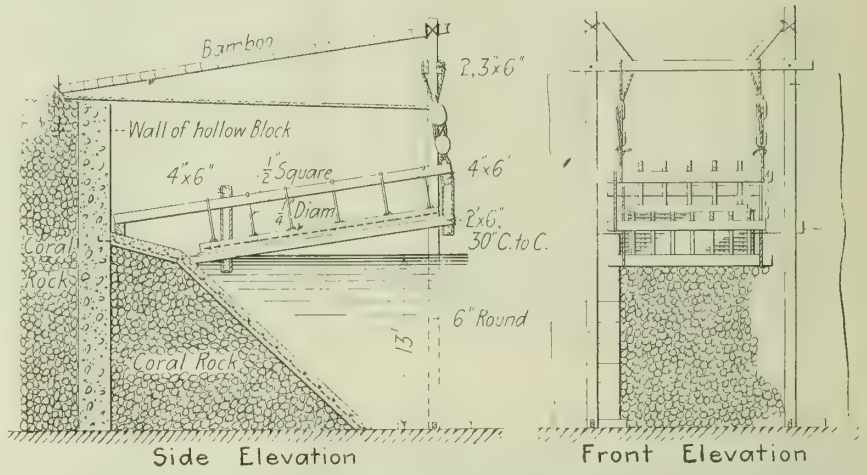
Reports from these jobs show special satisfaction with dinkey transportation of concrete. The method is fast and no report of segregation of the materials has come from any quarter. In fact, James H. Fuertes, consulting engineer of the Greater Winnipeg Water District, expressly states that there is no segregation of the materials in the cars and that no difficulties have been encountered with this method of transportation. The concrete on the various jobs is moved either in small steel dump cars or in buckets carried on flat cars. The distance of transportation varies up to about ½ mi. At the C. & O. N. job concrete is moved from a central mixing plant to several structures within a distance of 3,500 ft. along the line. Dump-cars are used, tipping into a hopper at the point of delivery. At Harrisburg bottom-dumping buckets are used, seated on small flat-cars holding two buckets. These are run on a work-trestle built alongside the bridge and are lifted off by a locomotive crane.

Decorating a City Bridge with Structural-Steel Portals

The most pretentious bridge portals in the United States are those recently applied to the Smithfield bridge across the Monongahela River in Pittsburgh. The old bridge, built in 1883, had cast-iron portals. It was at first a two-truss single-roadway bridge, but in 1890 the east (right-hand) truss was added, making a second roadway. As this roadway was narrower than the first one, and required specially narrow street cars, it was widened in 1911 by moving the east truss 4 ft. farther eastward. At this time the old cast-iron portals were removed. They had proved a nuisance, incidentally, because they made it impossible to paint the end-posts, and considerable rusting occurred at certain points in these posts. Some strengthening was needed here, and this has been accomplished by filling the end-posts with concrete, rammed under the top plate and bearing at the bottom on new upper-bearing castings, which were placed in sections inside the posts and over the pins. The new structural-steel portals built around the end-posts were also filled with concrete. These portals were designed by Stanley L. Roush, architect in the office of N. S. Sprague, Superintendent, Bureau of Engineering, Department of Public Works of the city. The Des Moines Bridge and Iron Co. fabricated the steelwork. The Thomas Lane Co. was contractor.

Placing Cast Concrete Slabs on Underwater Revetments

In repairing the Calumpang dike in the Province of Batangas, P. I., the design called for the placing of a reinforced-concrete slab protection on a rock fill to be deposited outside the existing hollow concrete wall dike. This rock fill extended only a foot or so above water level, so that most of the slab protection had to be laid under water. For this somewhat novel condition a special method of construction was devised in which slab sections were molded above water and after setting lowered to place. It is described in the "Quarterly Bulletin" of the Philippine Bureau of Public Works.



METHOD USED IN PHILIPPINE ISLANDS IN PLACING SUBAQUEOUS CONCRETE SLAB REVETMENT



NEW SOUTH PORTAL OF SMITHFIELD ST. BRIDGE OVER MONONGAHELA RIVER, PITTSBURGH

An ornamental structural-steel portal, replacing old cast-iron portals. The oldest part of the bridge dates from 1883

The rock fill was first dumped outside the old dike and shaped to its proper section. Its above-water surface was then covered with a mat of concrete slabs cast in place in 3x4½-ft. squares and provided with reinforcement which protruded with hooked ends a few inches below the lower edge of the slab. After these slabs had set, the rig shown in the sketch was set up. This rig consisted of a bridge supported at its shore end on blocks on the cast slabs and at its outer end slung by block and tackle from braced posts. From the upper chord of this bridge was hung a solid floor, on which was cast the reinforced-concrete slab with protruding hooks, by means of which the hardened slab was hung directly to the upper chord of the bridge.

After these slabs had reached a sufficient set, the lower floor was unslung and removed and the slab lowered into place, the slab pivoting at its upper end around the hook in the above-water slab 6 ft. for that purpose. Divers then cast off the supporting slings and the rig was moved to the next slab. Joints between the slabs were filled by concrete deposited through a tremie.

Table of Angular Deflections in Decimals of Feet

The accompanying table is self-explanatory. It has proved of great value in at least one engineering office, according to C. H. Eiffert, Assistant Engineer, Windes & Marsh, Engineers-Contractors, Winnetka, Ill., who computed it. The table gives deflections in decimals of feet for every minute of angle up to one degree. It is most commonly used in running random lines and is very useful for correction of bearings or obtaining offsets for given deflections. The table is designed to be in two parts, divided between 700 and 800, each half just fitting an ordinary field notebook.

ANGULAR DEFLECTIONS IN DECIMALS OF FEET

Min.	100	200	300	400	500	600	700	800	900	1000	660	1320	2640	5280	Min.
1	0.029	0.058	0.087	0.116	0.145	0.175	0.204	0.233	0.262	0.291	0,20	0.40	0 79	1.51	1
2	0.058	0.116	0.175	0.233	0.291	0.349	0.407	0.465	0.524	0.582	0.40	0.79	1 51	3.04	2
3	0.087	0.175	0.262	0.349	0.436	0.524	0.611	0.698	0.785	0.873	0.59	1.12	2.31	4.62	3
4	0.116	0.233	0.349	0.465	0.582	0.698	0.815	0.931	1.047	1.164	0.79	1.52	3.04	6.14	4
5	0.145	0.291	0.436	0.582	0.727	0.873	1.018	1.164	1.309	1.455	0.99	1.91	3.83	7.66	5
6	0.175	0.349	0.524	0.698	0.873	1.047	1.222	1.396	1.571	1.746	1.19	2.31	4.62	9.24	6
7	0.204	0.407	0.611	0.815	1.018	1.222	1.425	1.629	1.833	2.040	1.32	2.71	5.41	10.76	7
8	0.233	0.465	0.698	0.931	1 164	1.396	1.629	1.862	2.094	2.330	1.52	3 10	6.14	12.28	8
9	0.262	0.524	0.785	1.047	1.309	1.571	1.833	2.094	2.355	2.620	1.72	3.43	6.93	13.86	9
10	0.291	0.582	0.873	1.164	1.455	1.746	1.837	2.328	2.619	2.910	1.91	3.83	7.66	15.38	10
11	0.320	0.640	0.960	1.280	1.600	1.920	2.290	2.560	2.880	3.200	2.11	4.22	8.45	16.90	11
12	0.349	0.698	1.047	1.396	1.746	2.142	2.491	2.792	3.141	3 490	2.31	4.62	9.24	18 41	12
13	0.378	0.756	1.135	1.513	1.890	2.268	2.696	3.026	3.405	3.780	2.51	5.02	9.97	19.93	13
14	0.407	0.815	1.222	1.629	2.035	2.445	2.852	3.258	3.666	4.070	2.71	5.35	10.76	21.52	14
15	0.436	0.873	1.309	1.746	2.180	2.619	3.055	3.492	3.927	4.360	2 90	5.74	11.48	23.03	15
16	0.465	0.931	1.396	1.862	2.325	2.893	3.358	3.724	4.188	4.652	3.10	6.14	12.28	24.55	16
17	0.495	0.989	1.484	1.978	2.475	3.067	3.562	3.956	4.452	4.950	3.30	6.53	13.07	26.14	17
18	0.524	1.047	1.571	2.094	2.620	3.141	3.665	4.188	4.713	5.240	3.43	6.93	13 86	27.65	18
19	0.553	1.105	1.658	2.210	2.765	3.315	3.868	4.420	4.974	5.530	3.63	7.33	14.59	29.17	19
20	0.582	1.164	1.746	2.328	2.910	3.492	4.074	4.656	5.238	5.820	3.83	7.66	15.38	30.76	20
21	0.611	1.222	1.833	2.444	3.055	3.666	4.277	4 888	5.499	6.110	4.03	8.05	16.10	32.27	21
22	0.640	1.280	1.920	2.560	3.200	3.840	4.480	5.120	5.760	6.400	4.22	8.45	16 90	33.79	22
23	0.669	1.338	2.007	2.676	3.345	4.014	4.683	5.352	6.021	6.690	4.42	8.84	17.69	35.31	23
24	0.698	1.396	2.094	2.792	3.490	4.188	4.886	5.584	6.282	6.980	4.62	9.24	18.41	36.83	24
25	0.727	1.455	2.181	2.910	3.635	4.365	5.092	5.820	6.543	7.270	4.82	9.57	19.21	38.41	25
26	0.756	1.513	2.268	3.026	3.780	4.539	5.295	6.052	6.804	7.560	5.02	9 97	19 93	39.93	26
27	0.785	1.571	2.355	3.142	3.925	4.713	5.498	6.284	7.065	7.850	5.21	10.36	20.72	41 45	27
28	0.815	1.629	2.445	3.258	4.075	4.887	5.702	6.516	7.335	8.150	5.41	10 76	21.52	43.03	28
29	0.844	1.687	2.532	3.374	4.220	5.061	5.905	6.748	7.596	8.440	5.54	11 15	22 31	44 55	29
30	0.873	1.746	2.619	3.492	4.365	5.238	6.111	6.984	7.857	8.730	5.74	11 55	23.03	46.07	30
31	0.902	1.804	2.706	3.608	4.510	5.412	6.314	7.216	8 118	9 020	5.94	11 88	23.83	47 65	31
32	0.931	1 862	2.793	3.724	4.655	5.586	6.517	7.448	8.379	9.310	6.14	12.28	24.55	49.17	32
33	0.960	1.920	2.880	3.840	4.800	5.760	6.720	7.680	8.640	9.600	6.34	12.67	25.34	50 69	33
34	0.989	1.978	2.967	3.956	4.945	5.934	6.923	7.912	8.901	9.890	6.53	13.07	26.14	52 21	34
35	1.018	2 036	3.054	4.072	5.090	6.108	7.126	8.144	9.162	10 180	6.73	13.46	26.86	53 72	35
36	1.047	2 094	3.141	4.188	5.235	6.282	7.329	8.276	9 423	10.470	6.93	13.79	27.65	55.31	36
37	1.076	2.152	3.228	4.304	5.380	6.456	7.532	8.608	9.684	10.760	7.13	14.19	28.38	56.83	37
38	1.105	2.210	3.315	4.420	5.525	6.630	7.735	8.840	9 945	11.050	7 33	14.59	29.17	58 31	38
39	1.135	2.270	3.405	4.540	5.675	6.810	7.945	9.080	10.215	11.350	7 52	14 98	29.96	59 93	39
40	1.164	2.328	3.492	4.656	5.820	6.984	8.148	9.312	10.476	11.640	7 66	15.38	30.76	61.45	40
41	1.193	2.386	3.582	4.772	5.965	7.158	8.351	9 544	10.746	11 930	7 85	15.77	31.48	62.96	41
42	1.222	2.444	3.666	4.888	6.110	7.332	8.554	9.776	10 998	12 220	8 05	16 10	32.27	64.55	42
43	1.251	2.502	3.753	5.004	6.255	7.506	8.757	10 008	11 259	12.510	8 25	16.50	33 00	66.07	43
44	1.280	2.560	3.840	5.120	6.400	7.680	8 960	10.240	11.520	12.800	8.45	16.90	33.79	67.58	44
45	1.309	2.618	3.927	5.236	6.545	7.854	9 163	10.472	11.781	13 090	8 65	17.29	34 58	69 12	45
46	1.338	2.676	4.014	5.352	6.690	8.028	9 366	10.704	12.042	13 380	8 84	17.69	35 31	70.65	46
47	1.367	2.734	4.101	5.468	6.835	8.202	9 569	10.936	12.303	13.670	9.04	18 02	36 10	72 18	47
48	1.396	2.792	4.188	5.584	6.980	8.376	9.772	11.168	12.564	13.960	9.24	18 41	36.83	73 71	48
49	1.425	2.850	4.275	5.700	7.125	8 550	9.975	11.400	12.825	14 250	9.43	18 81	37 62	75.24	49
50	1.455	2.910	4.365	5.820	7.275	8.730	10.185	11.640	13.095	14.550	9.64	19.21	38 41	76 82	50
51	1.484	2.958	4.452	5.916	7.420	8 904	10 388	11.832	13 356	14.840	9.77	19 60	39 20	78.36	51
52	1.513	3.026	4.539	6.052	7.565	9.078	10 591	12.104	13.617	15.130	9.97	19.99	39.93	79.89	52
53	1.542	3.084	4.626	6.168	7.710	9.252	10 794	12.336	13 878	15 420	10 16	20.33	40.72	81 42	53
54	1.571	3.142	4.713	6.284	7.855	9.426	10 997	12 568	14 139	15 710	10 36	20 72	41 45	82 95	54
55	1.600	3.200	4.800	6.400	8.000	9.600	11.200	12.800	14 400	16 000	10 56	21 12	42 21	84.48	55
56	1.629	3.258	4.887	6.516	8.145	9.774	11.403	13.032	14.661	16 290	10.76	21 52	43 03	86 01	56
57	1.658	3.316	4.974	6.632	8 290	9.948	11 606	13.364	14.922	16 580	10 96	21.91	43 76	87.54	57
58	1.687	3.374	5.061	6.748	8.435	10 122	11.809	13.496	15.183	16.870	11 15	22.24	44.55	89 07	58
59	1.716	3.432	5.148	6.864	8.580	10 296	12.012	13 728	15.444	17.160	11 35	22.64	45.28	90.60	59
60	1.746	3.492	5 238	6.984	8 730	10 476	12.222	13 968	15 714	17 460	11 55	23 03	46 07	92 19	60

NOTES

Tin Speaking Tube Over Form Ties furnishes an easy means of removing the tie-rods used in concreting the piers of the Cumberland Valley R.R. bridge over the Susquehanna River at Harrisburg. The tube is cheap, and while it is not tight enough to keep out all mortar from the concrete, yet the rods are easily pulled out when the forms are stripped.

Concrete Cylinders as Form Spacers are being used on the reinforced-concrete walls of the new cotton terminal buildings under construction at Atlanta, Ga. These cylinders are cast in quantities. The molds for them are of such size as to make the cylinders 4 in. in diameter and 8 or 12 in. long. An opening is left through the axis of the cylinder to permit the entry of the wall-form tie-rods. After the wall has set, the rods are loosened and removed and the cylinders allowed to remain as a part of the wall.

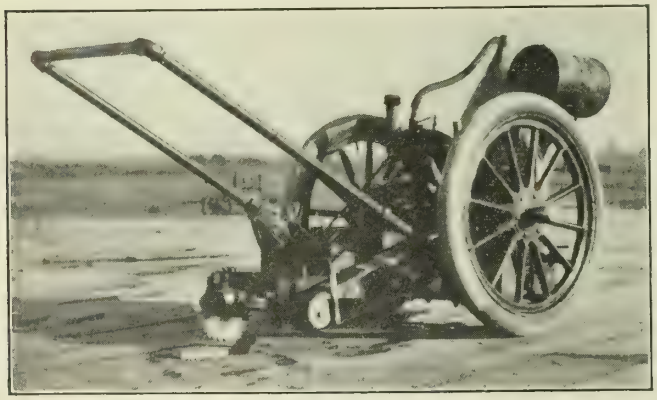
Dump Trestles for Sidehill Cuts—A novel method of disposing of material from sidehill cuts on the Pacific extension of the Canadian Northern Ry., recently opened to traffic, is illustrated herewith. For some distance through and beyond Yellow Head Pass the line is parallel with, but at higher elevation than, the Grand Trunk Pacific Ry. To deliver spoil clear of the latter line, timber trestles were built across it, carrying a dump-car track and having a dumping chute at the farther end. At the point shown, 32 mi. west of the summit, six of these chutes were required in a



DUMP TRESTLES ON THE CANADIAN NORTHERN RY.
These deliver the spoil from sidehill cuts clear of the Grand Trunk Pacific Ry. beneath

distance of 4,000 ft., the two lines being so close together. Three of these are shown, and they are on both sides of the tunnel, the west portal of which appears in the view. Over the six chutes about 307,270 cu.yd. of material was dumped, mostly rock. This work was under the direction of M. H. MacLeod, General Manager and Chief Engineer of the Canadian Northern Ry.

The Gasoline Saw used for jointing roof plank on a circular reservoir, as described in our issue of No. 25, is shown in the photograph herewith, sent by the Allinson & Cole Con-



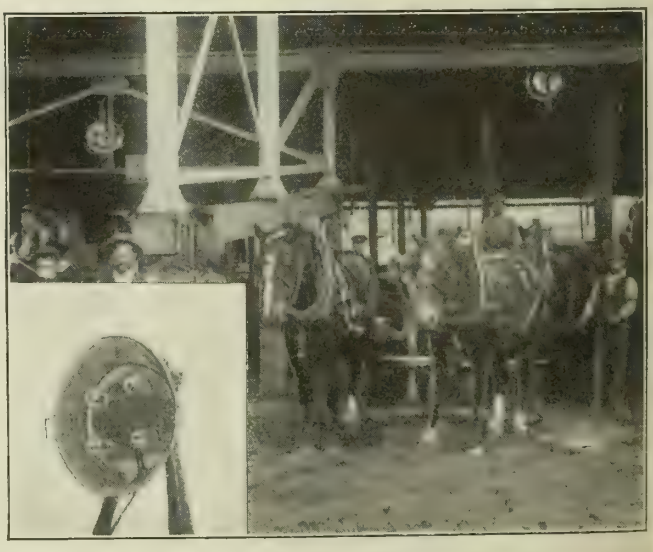
GASOLINE SAW USED FOR JOINTING ROOF PLANK OF CIRCULAR RESERVOIR

struction Co. The advantage of the rig over a motor-driven saw previously used was its being self-contained, free of wires or cables.

Portable Concreting Plants are used on two contract sections of a large water conduit for the Greater Winnipeg water-supply, now under construction in Canada. The concrete mixer is installed upon a car which runs on a track laid along one side of the trench. Each contractor is required by the specifications to provide a 300-ft. platform along the railway of the Water District, and upon this platform the District delivers the gravel and sand. A stiffleg derrick mounted on trucks on a broad-gage track, equipped with a 16-cu.ft. bottom-dump bucket, handles the materials to the mixer. The sand and gravel are shoveled from the platform into the buckets. Then either the derrick is moved to the mixer or the concreting car is run back to a point opposite the derrick. James H. Fuertes, consulting engineer for the District, states that considerable difficulty has been experienced with these plants owing to the breaking of the truck wheels. Ordinary cast-iron wheels have not given satisfactory service, and experiments with different grades of chilled cast-iron, semi-steel and other materials have not yet brought forward a wheel that will stand the work. The trucks probably will be replaced by others carrying more wheels.

Stair Treads of Concrete-Filled Channels are used in a new water-works plant at Crewe, Va. Each tread is a 10-in. 15-lb. channel with flanges turned up, carried by the stair strings by means of $1\frac{3}{4} \times 1\frac{3}{4} \times \frac{3}{16}$ seat angles. The strings also are 10-in. 15-lb. channels, flanges turned out. The treads are simply filled with concrete to the level of the top of the flanges, making a simple and satisfactory tread with protected edge. Anderson & Christie, of Charlotte, N. C., are the engineers of the station.

Homemade Reflectors for Electric Lights on construction work were recently noted on two jobs as far apart as Southern California and Long Island, New York. These reflectors are made of bright new dishpans, with four or more sockets for incandescent lamps roughly riveted to the bottom. As



HOMEMADE REFLECTORS FOR INCANDESCENT LIGHTS

long as they stay bright the dishpans are about as cheap and effective as any reflector that can be had; and as the life of a reflector on a construction contract is likely to be short, these dishpans probably stay bright as long as they are recognizable as reflectors.

Editorials

Broad Patent Principles and Reinforced Concrete

The decision of Judge Lewis in the United States District Court at Denver on the Luten concrete bridge patents, noted in full on another page, is important not so much because of its special application to the bridge or to the patents in question but because it lays down with commendable lucidity a principle long contended for by engineers but rarely, and then reluctantly, admitted by lawyers and the courts. This principle is that the arrangement of metal parts in a body of reinforced concrete to resist the stresses which are set up involves merely mechanical design and not *invention.*

It is an accepted principle of patent law that in order to be patentable an invention must embody something else than mere mechanical design. It is indeed difficult to draw the line between design and invention or to lay down any hard and fast rule by which to distinguish between them. This much can be said, however: That if a structure involves nothing more than skilled proportioning of parts to resist the stresses to which they are subjected the courts are not likely to sustain a patent upon it. Simply to describe and spread upon the patent records a combination of parts never used before does not give a man the right to a monopoly of that particular combination and power to collect damages from anyone else who may desire to use it. In order that a patent shall be valid it must cover an actual invention. What the Germans call "a new technical effect" must be produced.

It follows, then, in the opinion of Judge Lewis that as the essence of patentability is invention and not the adaptation of known design, patents involving the arrangement of reinforcement in concrete are not valid, mainly because fifty-odd years ago Francois Coignet described the reinforcement in concrete as "a metallic framework linked or arranged so as to strengthen the same."

In the few reinforced-concrete patent suits that have hitherto come to a regular trial, the judges as a rule have not been able to follow the general principle to its specific instance. They have, indeed, been overwhelmed with the apparent novelty of reinforced concrete and have been ready to accept its manifold variations as absolutely novel structural effects demanding the extraordinary skill of the inventor rather than the art of the designer. These decisions engineers have constantly resented and the demands for royalties have been consistently regarded as impositions, not because of a wish to deprive the so-called inventor of the profit of his thought, but because of a feeling that the inventor was capitalizing for his own benefit the accrued knowledge of the profession.

In its narrow application the Lewis decision, if upheld in the higher courts, will measurably clear the reinforced-concrete patent situation. It will sweep aside the numerous annoying patents in which a clever engineer has had recorded in the files of the Patent Office various distributions of reinforcing rods in so many arrangements that it is practically impossible to reinforce a structure without imitating one of them. It will perhaps call to the attention of less analytical judges that because an engineer shows in his patent drawings a retaining wall with the reinforcing rods clearly outlined in its section he has not improved on the idea of a predecessor who many years before showed that same wall without the rods therein specifically indicated.

In its broader sense, however, the decision should have a far-reaching effect on all structural patents, for it should serve to emphasize the fact that any structure which a competent engineer would naturally arrive at through the orderly development of the principles of design cannot be held as an invention. It would prevent, for instance, the patenting of a fish-bellied, separately cast reinforced-concrete T-beam for a bridge girder, because an engineer of ordinary accomplishments would soon come to the conclusion in the course of his design of a separately cast concrete girder that material could be saved by reducing the depths at the ends. Yet such a girder has been patented, and royalties are being demanded for its infringement.

Especially noteworthy, also, in Judge Lewis' decision is his reference to the prior decisions in favor of the Luten patents in suit. It has become the custom in patent cases—a custom for which there is much to be said—to allow decisions in favor of a patent in one judicial circuit practically to control the decision in other circuits. In the present case it was urged on behalf of the patents in suit that decisions in favor of Luten had been rendered in fourteen other suits involving the validity of these patents. Concerning these decisions, however, Judge Lewis says:

> In all of those cases the decrees and judgments offered in evidence show that they were had either pro confesso or by agreement, and if not by agreement, it is admitted that no defense was in fact made. . . . Experience has given me the impression that it has become a favored method to follow that practice for the principal purpose of thus building a basis on which to attempt to sustain a patent when it is later seriously contested.

At the present time royalties are being demanded on account of some other patents on reinforced-concrete construction on the basis of prior decisions sustaining the validity of the patents. In view of the foregoing statement by Judge Lewis, it is probable that there will be a very careful overhauling of the records in these cases, and it may well be that the courts will be more inclined to investigate these prior decisions than has been the case hitherto.

Engineering-Society Cleavage

Why cannot there be a single engineering society for all America? One answer is that there is altogether too much cleavage in the profession, both vertical and horizontal. The vertical cleavage follows both professional and geographical lines. Although lateral pressure tends to close up the breaks here and there, constant and seemingly irresistible forces continually open up new gaps,

resulting in brand-new societies or at the least the formation of sections and subsections in old ones. As to horizontal cleavage, this is in evidence at the organization of every society that has classes or grades of membership. In the course of time the class or grade consciousness increases to such an extent that new societies are formed from both the higher and the lower strata. Notable examples of horizontal cleavage and the beginning of separate existence are the American Institute of Consulting Engineers, formed a few years ago to further the interests of super-engineers, and several recently organized societies for the uplift of subclass engineers.

The onlooker can find much to interest him in studying these engineering-society cleavages. He sees no end to the breaks and separations, but in them all, regardless of occupational or geographical divisions and class or caste distinctions, there can always be seen the weaknesses and foibles as well as the nobler elements of human nature.

Let us take the super-engineers, as best fitted by their elevated position to be exposed to view. Hours of discussion have been devoted by them to the pros and cons of disciplining some member against whom complaint of unprofessional conduct has been lodged. In these discussions there has been a tendency to a sharp division—horizontal or vertical, as one may choose to call it—into two portions, one party ready to excuse or palliate an alleged ethical offense, the other uncompromisingly refusing to do so.

Or, again, take the super-engineer's recent division—be it horizontal or vertical—over the ethics of serving as consulting engineer for a company or project in which the consultant has a proprietary interest. This subject has agitated the super-engineers for more than a year. True, the question was brought up by would-be members—mining engineers—who in seeking admission to the super-engineer's society found that its code of ethics forbade the practice just mentioned. The question having been referred to the proper committee, a report was submitted in September, 1914, to the effect that the rules of the society ought not to be modified "to suit the convenience of any particular branch of the profession," since "to do so would mean the loss of what has been gained by us during the years" the rules have been in effect. What the membership at large or those at the meeting thought of this conclusion each reader may infer for himself from the statement that the "report was ordered filed."

The question would not stay down. In April, 1915, a letter reached the secretary stating "why mining engineers could not subscribe" to the rules. This letter was sent to all the super-engineers. The result was evidence of cleavage—horizontal or vertical—but by only nine members. These nine "favored amendment" of the rules. The majority of the committee held fast to the rules. A minority was "unable to agree" that the rules ought to remain unchanged, but thought it "inexpedient to submit a minority report at this time."

All of which shows that the super-engineers are still human beings, subject to much the same laws of cleavage as cause the sub-engineers to subdivide into various classes or strata. Until these cleavage forces cease acting there will be not one but an ever-increasing number of engineering societies—a condition not without its compensations, although a change in some of the cleavage lines would be wholesome.

Trains on Steep Grades

The terrible railway accident on the Mexican railway in which some 300 people were killed and injured, as noted last week, seems to have been due largely to careless operation of the line under semi-military control. A careful engineman finding his train detached on a 4% grade would surely have realized that the brakes would hold the cars and would have ascertained the position of the train before backing up at such speed as to strike the train and drive it downhill.

While this railway has been notably free from accidents, consideration may well be given to the protection of traffic on its long, steep and winding stretch of line. No such action can be expected, however, until Mexico is in a more settled condition and railway operation again on a normal basis. Catch sidings at intervals and guard rails on the curves might be provided, but an accident might easily occur between the sidings, or the speed prove too great for the guard rails to be effective. Emergency chain couplings to the engine, normally slack, might also be used. Probably the most effective mechanical preventive of runaways would be brakes so adjusted that they will hold, and at least prevent a detached car or train from attaining dangerous speed. In the case of descending trains, practically all reliance must be placed on the brakes.

The Laborer's Wage and the City Engineer's Salary

If the service of day laborers is worth $2.50 a day to a city, how much should the city engineer be paid? The question has just arisen at Aberdeen, Wash. That enterprising city is about to spend $400,000 for a new water-supply. On a night when the City Council was taking action to further the project an ordinance was passed establishing $2.50 as a minimum wage for city laborers and for laborers on municipal contract work. Another ordinance was passed raising the salary of the city engineer, on account of the extra work in sight, from $175 to $250 a month. The worthy mayor promptly announced that he would veto the salary-increase ordinance. Among the dire results predicted if the salary increase stands are that taxpayers would "be more critical of the engineer and condemn him more in case of small mistakes"; "dissatisfaction among his helpers"; some "will begin to believe that the $400,000 voted by the people is a sort of 'pork barrel' from which everyone has a right to grab and get a big handful"; right-of-way owners "will want more for their property than it is actually worth"; "to increase the engineer's salary at this time would be harmful to the economic building of the system."

The mayor graciously or justly remarks that no one in Aberdeen "is giving more time to the city and thinking more about its projects" than the city engineer; but he adds that the "water project is demanding sacrifices from everybody," including taxpayers, city engineer, city attorney, councilmen and practically every city official. Finally, the mayor believes that the opportunity the project affords the city engineer "to display his real mettle" will partly compensate him "for a smaller salary than might be allowed him somewhere else."

The mayor is not recorded as saying a word against $2.50 a day as a minimum for laborers. That price may

or may not be excessive in Aberdeen. But is not the engineer as well as the laborer worthy of his hire, minimum wage and all?

Justice to the Aberdeen council makes it necessary to say that the vote in favor of the minimum wage for the laborers appears to have been 7 to 5, while that for giving the city engineer $3,000 instead of $2,100 a year was 10 to 2. If the mayor vetoes the salary increase there would therefore seem to be an excellent chance that the council will muster the necessary two-thirds vote to override the veto. If so, it seems perfectly safe to say that instead of the dire results predicted by the mayor the small sum involved will prove to be money well invested.

Since the foregoing paragraphs were written, news has come across the continent that shows the council lacked the backbone credited to it, since it repealed the salary-increase ordinance before the mayor vetoed it. No word has come that the laborer's minimum-wage ordinance has been repealed.

A Way To Pay for Good Roads

Missouri is one of the few states which has not yet embarked on an extensive state-road building program, and so the people of that state are still listening to the old familiar good-roads arguments. That farmers' hauling costs may be reduced from 30 or 40c. to 5c. per ton-mile by good roads is an argument as old as the good-roads movement, but Fred D. Gardner in a recent address before the Implement, Vehicle and Hardware Association of St. Louis put forth another argument, the proof of which may be more easily demonstrated. He would assess every owner of a motor vehicle $10 per year for five years, thus providing an estimated fund of $5,000,000 for road improvement. He claims—and he is a transcontinental motor tourist—that each motor-vehicle owner would save at least $50 a year in tires by the introduction of smooth, hard roads.

The wear and tear on automobile bodies and tires because of rough roads ought to be much more demonstrable to good-roads propagandists than the reduction of farm hauling costs. The farmer argument has been overworked. Why not face the issue thus squarely and ask those who want good roads most to share the cost directly, at least in proportion to their actual saving by the improvements? Of course the howl from the automobile owners, both individually and in associations, will be louder than their present "good-roads" clamor, but perhaps they could be made to see the light.

Acres of Tracing Cloth and Hogsheads of Ink

A large-sized filing cabinet will be needed by the Valuation Division of the Interstate Commerce Commission at Washington, D. C. The law requires every steam-railway carrier to file with the commission maps and profiles of its entire system. The maps are of standard size, 23x55 in. inside the border lines, on scales of 100, 200 or 400 ft. = 1 in. The profiles are 10x55 in. inside the borders and on a scale of 20 ft. = 1 in. vertical and 400 ft. = 1 in. horizontal.

It is estimated, according to F. C. Sheperd in a paper presented before the Boston Society of Civil Engineers, that the Boston & Maine R.R. will have to file about 3,000 maps and 750 profiles. The Boston & Maine R.R. comprises 2,300 mi. of track. There is about 370,000 mi. of track in the United States, and computing the number of maps required by the same ratio as on the Boston & Maine, we have 484,000 maps and 121,000 profiles.

These Government file maps must be on tracing cloth, which will require about 537,000 sq.yd. (4,840,000 sq. ft.) of plain tracing cloth and 67,000 sq.yd. (600,000 sq.ft.) of profile tracing cloth (Plate A). As the railways will very likely not want to file the originals with the Government, tracing-cloth copies of the originals will have to be made, doubling the consumption of tracing cloth to 1,000,000 sq.yd. and 130,000 sq.yd. respectively—a total of 1,130,000 sq.yd.

Engineering News is informed from reliable sources that ordinary tracings require about one quart of black drawing ink to every 100 sq.yd. of tracing cloth, so for these railway-valuation maps about 11,300 quarts of drawing ink will apparently be the quantity required.

Letters to the Editor

How To Light Blasting Fuses

Sir—I have noticed some discussion by T. R. Martin and others in the last numbers of *Engineering News* on the best way to light the ordinary safety blasting fuse. I have had my share of nervous thrills in trying to light a stubborn fuse with others burning beside me and have found that the best way to "spit" a number of fuses is to use a short piece of the blasting fuse itself.

Notch the short piece along one side, every inch or so in length, open the notches so that the powder is exposed and light the short piece. At every notch the powder will spit such a strong flame that it will be a very stubborn fuse indeed that will not be lighted instantly by it.

Wenatchee, Wash., Oct. 26, 1915. F. J. Sharkey.

Sewer Gaging at Seattle in the Light of St. Louis Gagings

Sir—In connection with the article on sewer gaging in Seattle published in your issue of Oct. 28, I wish from our experience in St. Louis to offer a few comments and suggestions.

The sewer-gaging work in St. Louis was started in 1910 and has been kept up carefully and on an extended scale since that time. We now have in the sewers about 20 gages of the Bristol and Foxboro types. We are also using about six tipping-bucket rain gages, besides a number of standard gages.

Our first installation of the Bristol gages was similar to that described by Mr. Silliman, and we experienced

all of the troubles that he has described, and some others. We found that our "moisture-proof" cases were not moisture-proof when installed in the sewer manholes, and at the end of the first year these cases were set on posts back of the curb line, the air tube being carried under the pavement into the sewer.

We found that the accumulation of rubbish on the bulbs when supported in the center of the sewer was so great as practically to destroy the value of the records and in our present work the bulbs are installed in wooden boxes bolted to the side of the sewer and set high above the ordinary flow of sewage. In fact, we have found that the results from light rains are of so little value that in most cases the bulbs are installed just below the spring lines of the sewer. These boxes are in the shape of flat triangles, with the long side against the sewer wall, and have a coarse wire mesh on top and bottom.

We also had a great deal of trouble with the regulation of the clocks on these gages, particularly in the earlier years, and even now it is sometimes necessary to prorate an error of several minutes throughout the 48-hr. run. Owing to the large number of gages in use and to the fact that we could only keep two trained observers on this work, we have found it advisable and entirely satisfactory to allow the instruments to run around twice, and have never had a case where we were not able to identify the lines to their proper days.

In studying the Seattle charts I have noticed two eccentricities which might be explained by some of the experiences that we have had. Their chart from May 27 shows the peak of the flow at about 2:33 p.m., while there is no reason whatever for its occurrence before 2:43 p.m. Here I would suggest that there was probably some trouble with clock regulations.

Their chart for Nov. 10 and 11 shows an almost instantaneous rise at 12:30 midnight, which the rainfall could not possibly account for. From similar experiences I would like to ask Mr. Silliman whether it is not possible that the first rush of the water, bringing down a large amount of débris, may not temporarily have created a dam against his sewer bulb.

I do not think Mr. Silliman's definition of the percentage of runoff is clear; or at least according to my reading of it, the factor described is not one usually used.

I think Mr. Silliman is in error in describing the district gaged as a 20-min. district. The district is of a very peculiar shape, and I believe that if sewers were being designed for it, it would be found that the maximum discharge would result from the heaviest 15-min. rain falling on the body of the district and ignoring the two long tongues.

By inspection of these figures for running time the total drainage area seems to be divided about as follows:

	Per Cent.
Within 5-min. time	12
From 5- to 10-min. time	45
From 10- to 15-min. time	35
From 15- to 18-min. time	8

The times are for flow through the sewer only.

As all of his grades are apparently very steep, the time of flow to the inlet should not be over 5 min. It should therefore be apparent that for the first 5 min. after the beginning of the rain there should be practically no runoff; for the second 5 min., only from about 12% of the area; that for an intense precipitation lasting only 5 min. the maximum flow should occur about 15 min. after the beginning of the rain; for an intense precipitation approximately uniform for 10 min. the maximum flow should occur 20 min. after the beginning of the rain and that the same would be true for a uniform precipitation for a 15-min. duration.

Referring again to the records given, the storm of Nov. 10 and 11 was uniform for 15 min.; but from the chart it appears that the peak did not occur until 30 min. after the beginning of the rain. This is not only not in accord with the conclusions drawn by Mr. Silliman, but it is so unusual that it seems advisable to ask how the 0.08 in. of rainfall between 12:35 and 1 a.m. was distributed. The record for Oct. 30 gives one 5-min. period of very intense precipitation and the peak occurs apparently about 8 min. from the beginning of this period. Here again I should look for clock trouble, as we know that it is impossible that the water from a large proportion of the drainage area could reach the gage in that time.

The rain of June 6 is continuous for 20 min., and as would be expected, the peak occurs 25 min. after the beginning of the rain. This is again divergent from the conclusions which Mr. Silliman draws. The gage on May 27 shows the peak occurring at the end of the first 5 min. of precipitation, when it is obvious that no more than 15 or 20% of the drainage area could be tributary.

I should not have thought of questioning the accuracy of the observations in Seattle were it not that the wide divergence in results is so nearly paralleled in my own experience, and further that in my work more detailed and continued study had not offered explanation of the inconsistencies.

As an example, we had three gages on one tangent of a 9-ft. sewer. The upper two were about 800 ft. apart, with practically the same drainage area. The lowest gage was 400 ft. below the middle one and a 3x4-ft. sewer entered about 100 ft. above it. The middle gage consistently through all records showed stages that indicated flows of from 70 to 95% of those at the upper one, while the lower often indicated discharges so large as to be out of all proportion to the increase in area. The installation of additional gages indicates that there must be an acceleration on this tangent, and hence a lowering of stage until the tributary mentioned is reached, when the stream is so badly broken up that something similar to the hydraulic jump occurs.

Additional study is being made to determine characteristic velocities at one of the upper gages, from which it is expected all the records can be corrected within reasonable limits.

This study is also bringing out the fact that the flow in sewers does not occur with the precision and propriety that our formulas are wont to assume. It also has indicated clearly the necessity of careful attention to the small details of curves and intersections.

In conclusion, I am of the opinion that Mr. Silliman has made a mistake in attempting to make any deductions from four records of a single gage, and I cannot find that the records published would warrant either the conclusion which he has apparently reached or any others in so far as the time of occurrence of the maximum flow is concerned.

W. W. Horner,
Engineer in Charge Sewer Design.

St. Louis, Mo., Nov. 3, 1915.

[Mr. Silliman's reply to Mr. Horner's letter follows.—Editor.]

Sir—I have read Mr. Horner's letter with interest and profit. My impressions from his letter are that Mr. Horner concedes that there is some truth in my deductions, when, in order to justify his deductions, he shortens the running time of the district to 15 min.

The running time, as shown on the plat of the district, was calculated by using Kutter's constants, $n = 0.013$ for pipe sewers and $n = 0.015$ for brick sewers.

Many of the sewers in this district are more than 20 yr. old. The intercepting sewer was constructed in 1894. In all the velocity measurements that I have made I have not found an old sewer that had more than 90% of its calculated velocity, using the foregoing constants. Some ran as low as 75% of the calculated velocity.

Nothing could be farther from the truth than Mr. Horner's assumption that my deductions were made from "four records of a single gage." If I could get the money I would purchase several more gages, but could not hope to rival the St. Louis layout of "twenty gages and six tipping-bucket rain gages."

My deductions were based not only on the records from the First Avenue Intercepting Sewer District for the year 1914, but included the results shown by the records of the sewage flow in two large drainage districts. One of these districts had at the time the gagings were taken an area of approximately 2,000 acres above the point where the gage was installed. The time of running from the recording gage to the farthest-removed storm-water inlet on the main sewer that did not have storm-water overflows was calculated to be 48 min. From the recorded flow of seven storms, occurring on Mar. 22 and 28, Apr. 2, 4, 14, 26 and 27, 1914, the average time interval from the end of the 10-min. period having the maximum rate of precipitation to the time of maximum flow in the sewer at the recording gage is 27 min., which is 3 min. more than one-half the running time.

The other drainage area from which we have records of the sewage flow has a sewered area of approximately 7,000 acres above where the recording gage was installed. The distance from the recording gage to the farthest-removed storm-water inlet is 9.25 mi. The calculated time of running from the recording gage to this inlet is 2 hr. 40 min. The records show that in four storms, occurring on Oct. 16, Oct. 30, Nov. 12 and Dec. 30, 1914, the maximum flow was recorded at the average time for the four storms of 1 hr. 37 min., after the hour having the greatest rate of precipitation. The rate of precipitation was practically uniform throughout the hour for these storms, except in the fourth, when 72% of the fall occurred in 10 min. The maximum flow occurred 1 hr. 43 min. after this 10-min. period.

These records seem to me to justify my deductions regarding the time of maximum flow in a sewer after the period having the greatest rate of precipitation.

In the September, 1913, *Journal* of the Western Society of Engineers is a paper entitled "Rainfall and Its Runoff into Sewers," by Samuel A. Greely. In the discussion of this paper by Mr. Horner on page 703, Fig. 9—"Graph of a St. Louis Sewer-Flow Determination"—he gives the time of concentration of the district from which he took his record as 26 min. The rainstorm begins at 8 a.m.; the maximum rate of precipitation occurs from 8:05 a.m. to 8:10 a.m.; the maximum flow in the sewer occurs at 8:15 a.m., a time interval from the beginning of the storm which is approximately one-half the time of concentration given.

Another point raised by Mr. Horner is clock trouble. The man who takes the records from the recording gage in the First Avenue Sewer has always reported that there was no error in the timing of the gage clockwork. In the other recording gage, at the end of one year of service the clock was losing about 3 min. in 48 hr. At that time it was regulated, and no appreciable error can be detected at the present time.

For the record in which Mr. Horner insists damming occurred, the record shows that within 1 hr. after the rainfall stopped, the depth of flow in the sewer was the same as that when the storm began. What became of the dam?

A study of the meteorological conditions on the day of each storm and for a period of several days before each storm affords a rational explanation of the variations in storm-water runoff shown.

HENRY D. SILLIMAN,
Assistant District Engineer.

Seattle, Wash., Nov. 18, 1915.

Treated Ties on the Southern Pacific Ry.

Sir—In an editorial entitled "Treated Ties Are Little Used," in your issue of Oct. 14, it is indicated that the Baltimore & Ohio R.R. had treated ties in its tracks to the approximate total of about 7% of the whole, and that probably few roads could make so good a showing of treated ties compared to the total number used in renewals.

The Pacific System of the Southern Pacific Co., containing about 7,000 mi. of road, has for approximately 18 yr. made an extensive use of treated ties in renewals. During the fiscal year ended June 30, 1915, tie renewals were divided as follows: Treated ties, 1,730,259 = 75%; untreated ties, 575,658 = 25%; total ties renewed, 2,305,917.

The percentage of all kinds of ties in all tracks at the close of the fiscal year was as follows: Treated fir, 61.80%; untreated fir, 16.76%; untreated redwood, 20.88%; untreated cedar, 0.56%. The untreated fir ties are largely accounted for by reason of their application to heavy curvature or for heavy yard and switching service, where mechanical wear determines the life before the untreated tie decays. Redwood ties, on account of their decay-resisting qualities, do not require treatment.

It will be seen therefore that this company has long maintained a policy of treating practically all ties used in renewals that required it, or where any advantage would accrue to the company by so doing.

J. Q. BARLOW,
Assistant Chief Engineer, Southern Pacific Co.

San Francisco, Calif., Nov. 8, 1915.

[The figures of the untreated ties used in renewals on the Baltimore & Ohio R.R. in the year ended June 30, 1915, are not at hand, but the number of treated ties used was about 50% of the total estimated as desirable for treatment. On the Southern Pacific Ry. they were 75% of the total renewals.—Editor.]

Six Concrete-Bridge Patents Void on Broad Grounds

The Luten suit against Weld County, Colorado, for infringement of concrete bridge patents was decided against the patents by District Judge Robert E. Lewis of the Colorado Federal district court, at Denver, Nov. 13, 1915, in a decision remarkable for its scope. If upheld, it is likely to affect most reinforced-concrete patents. It declares the alleged inventions nonpatentable at the time of application. The earliest patents on reinforced concrete cover a combination of concrete and a metal skeleton so placed as to strengthen it; and by mechanics the points of greatest stress in a structure can be determined.

Besides giving this broad ground for declaring the patents invalid, Judge Lewis says that several of the patents represent mere exercise of mechanical skill and others are completely anticipated by prior patents.

The complete text of the opinion which follows is accompanied by sketches, copied by *Engineering News* from the patent drawings, showing the particular point involved in each patent under litigation.

It is of interest to note that the particular claims under litigation are only a small part of the total claims under each patent. Indeed, in the six patents which finally were considered the total claims in each were 51, 35, 23, 22, 3 and 4 respectively.

Daniel B. Luten, Complainant, vs. George Washburn et al., Defendants.

Weld County through its codefendant, Washburn, constructed a reinforced-concrete bridge having one span of about 30 ft. across what is known as Sheep Draw on one of the public highways within that county; and thereafter the complainant brought his bill, in which he alleges that the defendants in so doing had been guilty of infringement of each of seven patents theretofore issued to him. The patents on which the suit is based are set up in the bill by the complainant thus, viz.:

1. Letters Patent No. 852,970, issued on May 7, 1907, for certain new and useful improvements in bridges or arches of concrete or other analogous material, application for which was filed by complainant, as he alleges, on Feb. 13, 1905.

2. Letters Patent No. 853,183, issued May 7, 1907, for new and useful improvements in concrete or similar arches, application for which was filed by complainant, as he alleges, on June 24, 1905.

3. Letters Patent No. 853,202, issued May 7, 1907, for certain new and useful improvements in arch structures, application for which was filed by complainant, as he alleges, on July 25, 1904.

4. Letters Patent No. 853,203, issued May 7, 1907, for certain new and useful improvements in arches, application for which was filed by complainant, as he alleges, on July 25, 1904.

5. Letters Patent No. 933,771, issued Sept. 14, 1909, for certain new and useful improvements in concrete bridges, application for which was filed by complainant, as he alleges, on Mar. 29, 1909.

6. Letters Patent No. 979,776, issued Dec. 27, 1910, for certain new and useful improvements in reinforced structures, application for which was filed by complainant, as he alleges, on July 23, 1904.

7. Letters Patent No. 989,272, issued Apr. 11, 1911, for certain new and useful improvements in reinforced structures, application for which was filed by complainant, as he alleges, on Dec. 9, 1908.

The answer pleads the general issue as to each patent; it also denies invention as to each patent; denies that complainant was the original and first inventor as to each; and sets up anticipation in other named patents and also description in named printed publications more than two years prior to complainant's several applications, and that each includes and covers matters of public and common knowledge and in public use for more than two years prior to the applications and more than two years prior to the supposed discovery by complainant. The answer also specifically denies infringement.

The relief sought is injunction against further alleged threatened infringement and for profits and damages.

The bill also sets up adjudications in favor of complainant in fourteen separate suits or actions which he brought in other jurisdictions, in which the validity of one or more of these patents was involved in each of said suits or actions. But in all of those cases the decrees and judgments offered in evidence show that they were had either pro confesso or by agreement, and if not by agreement, it is admitted that no defense was in fact made. Experience has caused me to feel that such proceedings ought to be given but scarce, if any, weight. I will go so far as to say that experience has given me the impression that it has become a favored method to follow that practice for the principal purpose of thus building a basis on which to attempt to sustain a patent when it is later seriously contested, and I have of late declined to

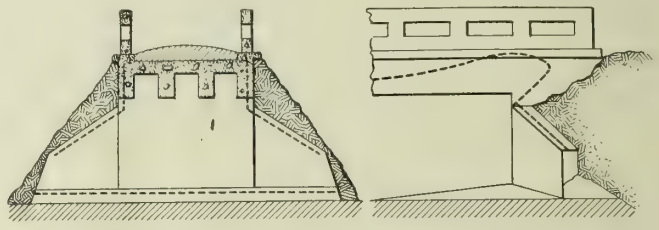


FIG. 1. ILLUSTRATING CLAIM FROM PATENT 852,970

enter such decrees if, after inquiry as to the true facts, I could appropriately avoid doing so.

At the trial the complainant did not introduce patent No. 933,771, but relied on the other six.

A. The claims under patent No. 852,970, on which reliance is placed to establish that defendants' bridge was an infringement, relate only to the wings and abutments of the bridge, and consist in the binding together of each wing to each abutment, and the abutments and the two wings at either

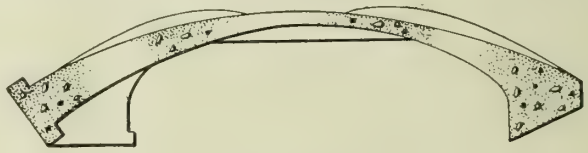


FIG. 2. ILLUSTRATING CLAIM FROM PATENT 853,183

end of the bridge by reinforcing rods extending into and through them.

B. The claims under patent No. 853,183, on which reliance is placed to establish that defendants' bridge was an infringement, relate to the formation at the juncture of the outer rib or girder of the bridge at each of its ends with the abutments—i.e., an arched kneebrace set in the under angle formed by the girder and abutment as distinguished from the triangular kneebraces under the inner girders; and also in the structure having two outer ribs or girders projecting both

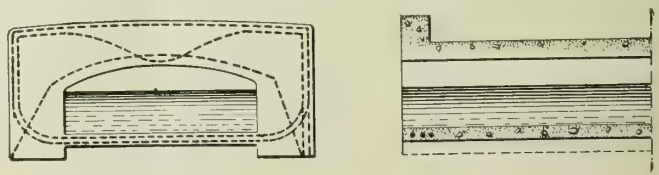


FIG. 3. ILLUSTRATING CLAIM FROM PATENT 853,202

above and below and with a roadway between the upper ribs or girders, with reinforcing members in the lower ribs.

C. The claims under patent No. 853,202, on which reliance is placed to establish that defendants' bridge was an infringement, relate to a bridge spandrel or retaining wall of concrete with reinforcing members near the stream and roadway surfaces, to the extension of such spandrel or girder across the abutment and cantilevered on the abutment with tension members extending across the abutment near the upper surfaces of the spandrel or girder, to longitudinal reinforcing tension members near the lower surface of said spandrel or girder, said tension members having upward extensions toward the ends of the girders, and to reinforcing tension members embedded near the lower surfaces of said spandrels or girders and having a plurality of shear members extending upwardly and inclined toward the ends of the girders, and tension members embedded near the upper surfaces of the girders and over the abutment.

D. The claims under patent No. 853,203, on which reliance is placed to establish that defendants' bridge was an infringement, relate to the reinforcing members in said bridge transverse to the roadway and extending upward into the wall or

spandrel near its back face, reinforcing members embedded transverse to the roadway and extending upward into the wall or spandrel and having such transverse members overlapping other reinforcing members embedded into wall or railing.

E. The claims under patent No. 979,776, on which reliance is placed to establish that defendants' bridge was an infringement, relate to reinforcing members in the girders in said

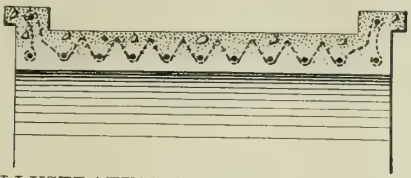


FIG. 4. ILLUSTRATING CLAIM FROM PATENT 853,203

concrete bridge comprising a lower horizontal tension rod and upper and lower shearing rods, each having a central horizontal part, inclined parts extending outwardly from opposite ends of the central parts, and the horizontal parts extending outwardly from the ends of said inclined parts, the central horizontal part of the lower shearing rod being longer than that of the upper shearing rod, and the horizontal ends of the upper shearing rod being longer than those of the lower shearing rod.

F. The claims under patent No. 989,272, on which reliance is placed to establish that defendants' bridge was an infringement, relate to the use of embedded tension members reinforcing the concrete abutment and the outer concrete rib or girder continuously adjacent the surfaces opposite the kneebrace, and extending away from said opposite surface of the transverse member intermediate its middle and the kneebrace and other tension members embedded longitudinally through the kneebrace.

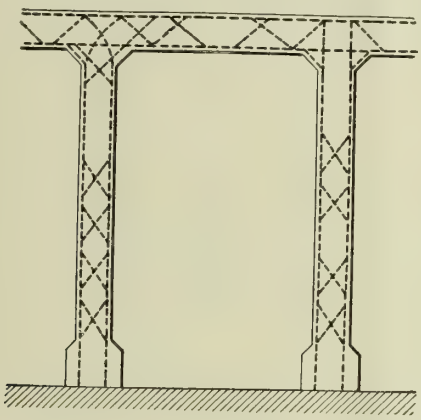


FIG. 5. ILLUSTRATING CLAIM FROM PATENT 979,776

On consideration of prior patents and publications introduced by the defendants to meet the separate and several claims, I am unable to rid myself of the firm belief and conclusion that each and all of complainant's claims were nonpatentable at the time he made his several applications, and also at the two times prior to applications when he claims he first, within two years prior to such applications, made practical use of the claimed inventions in those two instances. The prior patents as anticipations and the prior patents and publications as showing the then state of the art lead to the clear conviction that complainant in each instance only then made application of mere mechanical knowledge and skill, and that what he did is in no sense a demonstration of inventive genius. This is also the opinion of the defendants' expert witness.

The complainant as a witness disclaimed that his patents, or any of them, embodied anything beyond or more than placing "the steel in a new way that produces better results in a more efficient form. Now, in a concrete bridge the greatest efficiency is always secured by resisting tension or pull with steel rods. That has been established for half a century; not perhaps with curved tension members, but the basic idea is very old. There is no question about that." But none of complainant's patents in its specification, including drawings and in the claims, gives any specific direction as to just where any of the reinforcing members should be placed. This I suppose would in each instance depend upon the maximum load to be carried, the length of the spans and other elements which involve mechanics only, and would necessarily, I assume, be worked out in determining the amount of compression and tension under the established formulas in statics. In a general way the points of greatest stress can be roughly approximated without the use of mathematical tables, but this is centuries old—that is, it is open to common observation, and the fundamental purpose of reinforcing concrete was to strengthen the structure at these points; such a discovery in Luten's day is no evidence of inventive genius.

A bridge girder, for instance, is commonly known to be in compression on its upper side and in tension on its lower side; hence the greatest necessity for them through the latter region, and if carried continuously through and anchored in the outer face or foot of the abutment, it is but adding the element of suspension in bridge construction, which is old. This but illustrates. The same applies to the other points relied upon in Luten's patents.

The earliest patent relied upon in anticipation against all of the claims is that issued to Francois Coignet in 1869 (No. 88,547), described in the specification as being improvements in artificial stone, monolithic structures and artificial stone articles, in which the second claim reads: "The introduction, in the body of artificial stones, or in the body of artificial stone monolithic structures, made of agglomerated artificial stone paste, of skeletons, or metallic framework, linked or arranged so as to strengthen the same." That issued to Hinckley (No. 623,904), Apr. 25, 1899, expressly shows the application of tensile strength by carrying the rod continuously well into the abutments, and also the reinforcement of the spandrel or upper girder against outward thrust from the roadway by rods carried upward into it.

The publications cited against each of the patents are voluminous, and both foreign and domestic, and include drawings and plans with description of the same, in which the reinforcing members have been placed both in bridge and other structures so as to meet the strain where it falls in each instance. These publications so cited are too extensive for review and discussion here.

Two patents to Coignet, both issued in 1869, and the one issued to Hinckley, issued in 1899, are cited against all of complainant's patents. A number of other patents are cited by the defendant, some against one of the complainant's patents and some against another. They will not be applied in detail. They consist of one to Cunningham, 1907, four to Parmley, three in 1902 and one in 1904; two to Hennebique issued in 1898, in which the reinforcing bars in beams or girders are shown continuous as one rod in their lower longitudinal part, upwardly deflected part and longitudinal part in the upper surface, and in the specification he says: "It is possible to construct girders resistant in all their parts in a perfect manner to the effects of tension, the effects of compression, the breaking effects and the bending effects, while reducing to a minimum the quantity of iron employed and suppressing or dispensing with iron in the part under compression." There as here, the tension rod in all of its parts rests in the one perpendicular plane. And also patent issued to Sission and Wetmore (No. 124,453) in March, 1872. Hennebique appears to have completely covered all that was inventive in Luten's so-called truss or shearing rod patent, No. 979,776.

I see nothing more than mechanical skill in tying the wings and abutments together, the circular kneebrace in the outer girder with a reinforcing member, binding it to the adjacent abutment and girder and in carrying the transverse member in the roadway into the outer side of the upper spandrel or girder and upward and over the longitudinal reinforcing member in that girder. In view of the Coignet letters and of the prior state of the art as evidenced by his patent and the publications introduced as above noted, he made specific claim to a "metallic framework linked or arranged so as to strengthen the same."

The views above expressed make it unnecessary to consider the defense of noninfringement of some of the claims.

The authorities relied upon will not be cited, but briefs in which they have been noted will be placed with the files.

It is ordered that the bill be dismissed at complainant's costs.

ROBERT E. LEWIS,
District Judge.

(Endorsed) 6,129. United States District Court, District of Colorado. Daniel B. Luten vs. George Washburn et al. Opinion, Lewis, District Judge; Filed Nov. 13, 1915.

A Civic Center in Honolulu is being agitated by many citizens. At present Capitol Square has in its center the executive building, and contains also the archives building and a wooden structure known as the Bungalow. It is proposed to raze the latter and to erect in its place a three-story building for the use of the various land departments. In the same square a commission building will be erected to house the many commissions that are a part of the government of the territory. With the executive building as a nucleus, the civic center as proposed would cover several city blocks.

Activated-Sludge Experiments at Urbana, Ill.

One of the most complete of the many experimental activated-sludge plants for the treatment of sewage in the United States, Canada and England is at Urbana, Ill., where it is being operated by Edward Bartow and F. W. Mohlman, of the State Water Survey, University of Illinois. The plant consists of four reinforced-concrete tanks, with the necessary pump and compressed-air supply. Two papers on the design and operation of these tanks were presented before the American Chemical Society, at Seattle, Wash., in September, 1915, by Messrs. Bartow and Mohlman, but were not made available to the technical press until Dec. 1. They extend the information on the Urbana experiments published in *Engineering News* of Apr. 1 and July 22, 1915. Liberal extracts from the two papers follow:

Description of the Four Tanks

Each tank is 3 ft. 2 in. square, giving an area of 10 sq.ft., and is 8 ft. 5 in. in depth above 1½-in. Filtros plates, which are used for diffusing the air. In two tanks there are 9 plates, each 12 in. square, covering the entire floor. In the third tank there are 3 plates, covering one-third the area of the floor, forming the bottom of a central trough. The remainder of the bottom slopes to the plates at an angle of 45°. In the fourth tank is a single plate in the center covering one-ninth the area, with the bottom sloping to it at an angle of 45° from all sides. Below the plates is an air space 4 in. deep. A petcock is provided to relieve the air pressure when draining the tank and to prevent air bubbles from rising and stirring up the sludge. The air obtained from the university compressed-air plant at a pressure of 80 lb. is reduced by a pressure-reducing valve to 8 lb. and is further regulated by a hand-operated valve before passing through meters on each tank. The pressure under which it enters the tank is sufficient only to overcome the pressure of the sewage, equivalent to about 8 in. of mercury or a little less than 4 lb. per sq.in.

Two outlets for the effluent are respectively 2 ft. 6 in. and 5 ft. 7 in. above the porous plates. A tank can be filled in 6 min. and drained to the lower outlet in 8 min.

Review of the Operating Results

Experience has shown that a lower floating outlet would be preferable. A fixed outlet is objectionable because sludge is at times drawn out with the effluent. In fact, no accurate data have been obtained concerning the quantity of sludge formed, because we have been unable to determine how much has been lost with the effluent. In order to prevent this loss, a floating outlet made of 2-in. pipe connected together with loose joints, has been placed in tank C. The effluent flows to the outlet through a screen of copper wire of about 16 mesh, which is fastened on both sides of an iron frame 1 ft. square. With this arrangement no sludge has been lost, and we expect to obtain accurate data concerning the amount of sludge formed from the sewage.

The amount of sludge must be determined by weight on the dry basis, for it has been noted that its volume and rate of settling vary with the amount of air applied. If an unusually large amount of air has been applied, the sludge will settle more slowly and will occupy a much greater volume, even after prolonged settlement, than it does when less air has been applied.

Tanks A and B were filled with the same kind of sewage on May 5, 1915. The sewage in tank A was aërated continuously. The sewage in tank B was aërated 23 hr., allowed to settle, the supernatant liquid withdrawn and tank refilled with fresh sewage in 1 hr. This cycle was repeated daily. Determinations of the amount of sludge and of the degree of purification were made daily.

At the end of 10 days, after 1 hr. settling in Imhoff cones, 1% of the volume in tank A consisted of sludge, while about 10% of the volume in tank B was sludge. The effluents from tank A, which had been aërated 10 days, and from tank B, which had been aërated one day, were equally stable, while that from tank B was clearer.

Tank B was continued in operation, changing the sewage every 24 hr.; after 15 days nitrification was complete. Then the sewage was changed every 12 hr. Nitrification was again complete after 8 days. Then the sewage was changed every 6 hr. Many of the effluents with the 6-hr. cycle were putrescible, and it is necessary at intervals to aërate for longer periods. This comparison indicates, however, that sludge may be satisfactorily activated by changing the sewage before nitrification is completed and that the sewage may be changed at frequent intervals.

Tank A was therefore cleaned and fresh sewage added every 12 hr. Stable effluents were obtained in 7 days. Complete nitrification occurred in 18 days, after which the sewage was changed every 6 hr. The effluents obtained from the tanks during this 6-hr. cycle were not all stable, yet the average improvement was so great that the conclusion is reached that activated sludge may be built up by changing sewage at frequent intervals without complete nitrification of each dose of fresh sewage. A considerable degree of purification is also obtained from the beginning of the operation, and the time for building up adequate sludge for the process is cut down very materially. A later experiment with tank C showed that satisfactory activated sludge could be built upon a 6-hr. cycle.

Diffusion Area That Is Required

Tank C, with 3 sq.ft. of Filtros blocks, gave some stable effluents after 5 days. Tank D, with only 1 sq.ft. of diffusion area, did not give stable effluents in 18 days. The sludge from C was of good appearance, while that from D was not as flocculent and at times had a septic odor. During the comparative experiment an average of 450 cu.ft. of air per 400 gal. of sewage was used with tank C and of 360 cu.ft. of air per 400 gal. of sewage with tank D. The amount of air given tank D was always sufficient to keep the sludge mixed with the sewage. In fact, the sewage in tank D was agitated much more violently than that in tank C. We have concluded that 1 sq.ft. of Filtros plate per 10 sq.ft. of floor area is hardly sufficient.

We have noted that it is quite essential that the plates be as nearly as possible at the same level. A variation of ¼ in. in level will cause uneven air distribution. The distribution seems to become more uniform the longer the plates are used.

The quality of the effluents has usually depended more on the strength of the raw sewage than upon any other variable. The tanks, when operating on a 6-hr. cycle, were filled at 9 a.m., 3 p.m., 9 p.m. and 3 a.m. The strength

of the raw sewage, estimated by the free ammonia values, averages for the 9-a.m. sewage between 20 and 35 parts per million; for the 3-a.m. sewage, between 3 and 12 parts. Nearly all of the 3-a.m. sewages have given stable effluents, but the strong morning sewages have quite frequently given putrescible effluents. Unless the sludge is in good condition and well nitrified, a strong sewage cannot always be purified in 4½ hr. even by increasing the air to 800 cu.ft. per 400 gal. In the normal working of the plant the sludge will usually regain its "activity" if 800 cu.ft. of air is applied for several periods after the strong sewage has been added.

At times, however, with a succession of strong sewages, it is necessary to increase the time of aëration in order to obtain good effluents. When strong sewages are to be treated, a definite cycle of operation cannot be established without provision for longer aëration of the sewage or separate aëration of the sludge. In order to keep the sludge in its most active state, complete nitrification of such sewage is necessary. Effluents are usually stable if 50% of the free ammonia is removed and 2 to 3 parts per million of nitrogen as nitrates are present. A completely nitrified effluent is neither necessary nor economical.

The greatest efficiency in air consumption will be obtained when enough air is used to make the sewage nonputrescible and to keep the sludge activated.

Fertilizer Value of Activated Sludge

The sludge obtained in the process is flocculent, resembling a freshly formed precipitate of ferrous-ferric hydroxide. It separates easily from the clarified water and, after 1 hr. settling, contains from 96 to 98% of moisture. On further standing, about one-half of this water can be removed. The remaining material can be dried by filter pressing or dried on beds of sand and evaporated over steam baths.

The disposal of the sludge can be most easily accomplished if it has manurial value. That activated sludge has manurial value is shown by its chemical composition, by its reaction with various soils and by its effect on the growth of plants. Specimens of sludge obtained at the experimental plant have varied in nitrogen content from 3.5 to 6.4%. The lower values were obtained during periods of high water. Street wash was getting into the sanitary sewers, and since no grit chamber was provided to remove the grit, the nitrogen value of the sludge was greatly lowered. The tests of the fertilizer value have been made on the richer specimens which were first obtained.

Through the courtesy of Paul Rudnick, chief chemist, Armour & Co., Chicago, the availablity, according to the alkaline-permanganate method as used by the New England States, was shown to be below 44.7%. The sludge would be classed as an inferior ammoniate, but the availability according to the neutral-permanganate method, which has been adopted by the Southeastern States, was shown to be 89.0% and would therefore be classed as satisfactory.

Tests have been made by Prof. C. B. Lipman (University of California Bulletin 251, 1915) in which a fertilizer and a soil are incubated for a month. The results obtained were reported by him (in part) as follows:

> The activated sludge used contained 6.2% total nitrogen and no nitrate. The hundred grams of soil in every case contained nitrate in milligrams of nitrogen as follows: Anaheim soil, 1.0; Davis soil, 0.3; Oakley soil, 0.1.
>
> The amounts of nitrate produced in one month's incubation from the soil's own nitrogen and from the nitrogen of the sludge mixed with the soil in the ratio of one part of sludge per hundred of soil is, in milligrams of nitrate, as follows: Anaheim without sludge, 6; Anaheim with sludge, 10; Davis soil without sludge, 4.2; Davis soil with sludge, 14; Oakley soil without sludge, 2.2; Oakley soil with sludge, 4.
>
> These figures indicate that the general tendency is to make available the nitrogen of sludge in type soils at about the same rate that nitrogen is transformed into nitrate in such organic nitrogenous fertilizers as fish guano. While it seems to hold a medium position, it nevertheless resembles much more closely in its general characteristics, so far as available nitrogen is concerned, the so-called high-grade organic nitrogenous fertilizers, dried blood and high-grade tankage, etc., rather than the low-grade nitrogenous fertilizers, steamed bone meal, cottonseed meal, garbage tankage, etc.

Although the chemical tests and the nitrification tests with soils indicate that the activated sludge has a high fertilizer value, the final test must be its effect on plant growth. Pot cultures, using wheat, were started in March, 1915, under the general direction of Prof. C. G. Hopkins and with the assistance of J. C. Anderson.

[There follows a detailed account of the results of culture experiments with wheat, lettuce and radishes, as summarized in the concluding sentence of the paper, given just below.]

These pot cultures [wheat] and gardening experiments [lettuce and radishes] show that the nitrogen in activated sludge is in a very available form and that activated sludge is valuable as a fertilizer.

River Improvements at Memphis

The formation of a sandbar covering approximately 40 acres in front of the levee at Memphis, Tenn., has interfered seriously with river traffic at that point and has led to a study of plans for relief. A channel with a maximum depth of 6 ft. and wide enough for the passage of a steamboat is being kept open by the continuous operations of two Government dredges. In the present condition of the river it is not considered feasible to attempt its complete removal by ordinary means.

The city is now considering cutting a 50-ft. channel from Wolf River, which empties into the Mississippi on the Tennessee side at a considerable distance below the bar, so that it will provide a current directly against the bar and scour it away. The land through which the cut would be made is owned by the city and the cost of excavation is estimated at $150,000. This plan was first suggested by Maj. E. M. Markham a year ago, when the formation of the bar was first noticed. Telegrams were recently sent to the War Department asking for immediate relief, but there is little that can be done by the Government at the present time.

The city sewers discharge opposite the bar and the low stage prevents the sewage from being carried off. To eliminate this evil, the city engineering staff is preparing plans for the construction of a new sewer along the wharf to carry the sewage to a less dangerous point.

Col. C. McD. Townsend, Corps of Engineers, U. S. A., President of the Mississippi River Commission, recently announced that the Commission had authorized the immediate appropriation of $75,000 to begin removal of "Mud Island," a 40-acre bar in the Mississippi, directly in front of the Memphis wharf, and which threatens to close the local harbor. It was said that Congress will be asked for $75,000 to complete the work.

Canadian Northern Ry. Opened to the Pacific Coast

SYNOPSIS—Brief description of the physical characteristics of the newest (third) Canadian transcontinental railway. Also gives for comparison the profiles of the Canadian Pacific and Grand Trunk Pacific railways.

The third Canadian transcontinental railway was put in operation on Nov. 22, when the Canadian Northern Ry. ran the first train on its Pacific line from Edmonton to Vancouver, B. C. The second transcontinental line was the Grand Trunk Pacific Ry., opened Sept. 1, 1914, and described in *Engineering News* of Aug. 5, 1915. The first of the transcontinental lines was the Canadian Pacific Ry., opened June, 1886.

The western ends of the three lines are shown in Fig. 1 The Canadian Pacific Ry. runs practically west from Winnipeg, but both of the other and newer lines run northwest from that point in order to develop new territory which had been considered far beyond the probability of settlement when the first line was built. By doing this they were able to get through the barrier of the Rocky Mountains by a pass at a much lower elevation than that adopted by the Canadian Pacific. This is the Yellowhead Pass, and was suggested at one time for the original location of the latter road, but was then rejected as being too far north for a commercial route.

From Edmonton the two newer lines are in close proximity, and through the mountains they are parallel and closely adjacent. When clear of the pass, however, they diverge sharply. The Grand Trunk Pacific continues practically northwest to Prince Rupert, a new city and port not far south of the Alaska boundary. One of the earlier routes proposed for the Canadian Northern was partly along the same general line, following down the North Fork of the Fraser River to the main river and thence south and southwest to a new terminal and port on Bute Inlet, opposite the middle of Vancouver Island.

The adopted route of the Canadian Northern Ry. follows the valley of the Athabasca and Miette Rivers to the summit of the Yellowhead Pass. West from that point it runs along Yellowhead Lake, down the Fraser River (North Fork) for 40 mi. and across the head of Cranberry Lake, beyond which it rises to the Albreda Summit at an elevation of 2,861 ft., or 850 ft. lower than that of the Yellowhead Pass. The line runs down the Albreda River till it strikes the North Thompson, which it follows to Kamloops, then the Thompson River to Lytton and the Fraser River to the coast. From Kamloops the new line practically parallels the Canadian Pacific Ry.

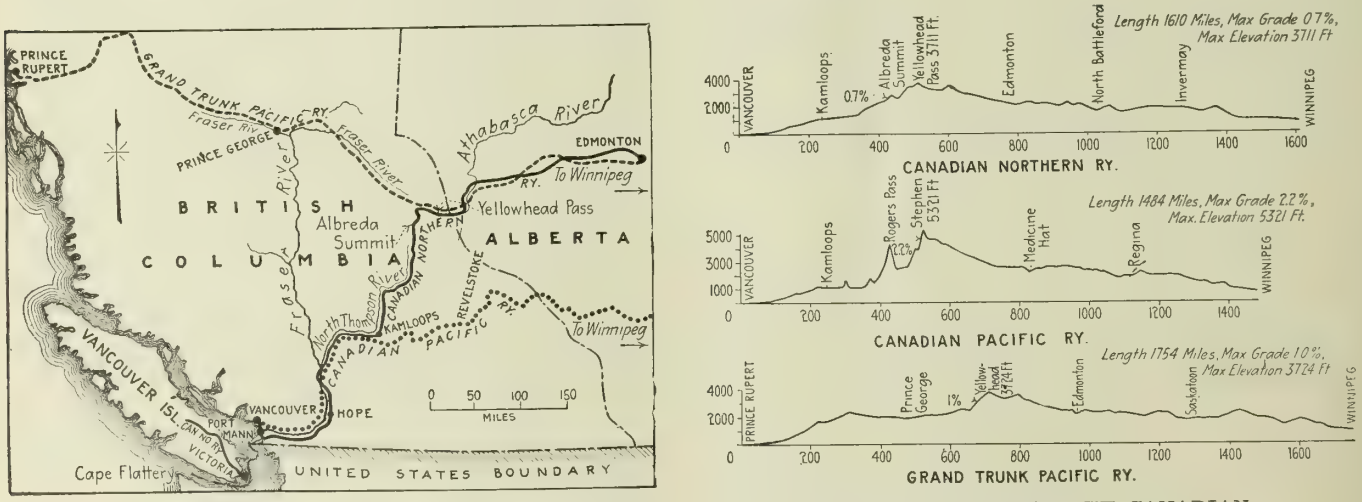
The railway company has established a new city and port at Port Mann, but the line runs beyond this to the older port of Vancouver. From the latter terminal a car ferry will transfer trains to Patricia Bay on Vancouver Island, whence the Canadian Northern has a line to Victoria, the port used by most of the Canadian ocean steamers in the Pacific service. Thus passengers will be able to take train to and from Victoria, instead of using the transfer steamers across the Sound to Vancouver.

PACIFIC COAST SECTION OF THREE CANADIAN TRANSCONTINENTAL RAILWAYS

Railway	Winnipeg To	Miles	Max. Elevation, Ft.	Max. Grade
Canadian Northern...	Vancouver	1,610	3,711	0.7%
Grand Trunk Pacific..	Prince Rupert	1,754	3,724	1.0%
Canadian Pacific.....	Vancouver	1,484	5,321	2.2%*

*Reduced from the original grade of 4.2%.

An interesting comparison of the profiles and operating conditions of the three lines from Winnipeg to the Pacific Coast is shown in Fig. 2, and their main features are given in the table. There is a remarkable difference between the maximum grades of 0.7 and 1% on the new lines and the 4.2% grades of the original location of the Canadian Pacific Ry.; although within recent years the last-mentioned grades have been reduced to 2.2%. The maximum grade of 0.7% on the Canadian Northern Ry. occurs on only one engine division, the remainder of the line having maximum grades of only 0.4 and 0.5%.



FIGS. 1 AND 2. MAP AND PROFILES OF THE PACIFIC COAST SECTIONS OF THREE CANADIAN TRANSCONTINENTAL RAILWAYS

Three views of the characteristic construction on the Canadian Northern Ry., about 40 mi. west of the summit, are shown in Fig. 3. At *A* is a heavy rock cut in a steep



FIG. 3. HEAVY CONSTRUCTION WORK NEAR YELLOWHEAD PASS; CANADIAN NORTHERN RY.

mountain slope. At *B* is a solid rock cut, from which about 43,557 yd. was taken out. At *C* is another rock cut where a heavy concrete retaining wall was required to support the outer side of the roadbed.

The last rail of the Pacific section was laid in January, at a point about 200 mi. from Vancouver. The eastern sections of the new line have been described in *Engineering News* of Apr. 5, 1906; Nov. 9, 1911; June 27, 1912, and July 10, 1913. The bridge over the Thompson River at Kamloops, with a cable-lift drawspan, was described Feb. 26, 1914.

The construction of this new line into the great northwest territory and down to the Pacific Coast has been due to the enterprise of Sir William Mackenzie, president, and Sir Donald Mann, vice-president, of the Canadian Northern Ry. M. H. MacLeod is General Manager and Chief Engineer of the lines west of Winnipeg.

Jacksonville Municipal Docks Nearing Completion

The first stage of the large municipal dock system started by the City of Jacksonville, Fla., over a year ago is now approaching completion. Practically all the filling work has been done, and the pier structures are in such shape that it will be possible to dock boats at them by the beginning of the new year. A manager of terminals has been appointed and the cotton warehouse and compresses are about ready. All that remains to be done is the securing of business to justify the project.

The site of the docks is a tract of 135 acres lying along the St. Johns River at almost the northerly boundary of the city, about 1¼ mi. from the nearest railway and considerably farther from the business center of the town. At present there is nothing in this immediate vicinity but some isolated plants. The work consisted in filling in the site about 6 ft. above mean water with characteristic Florida white sand dredged from the river and building two piers (one with sheds), the connecting railway to the trunk-line roads and a cotton warehouse with compresses.

The filling was all done with hydraulic dredges, about 1,250,000 cu.yd. of sand being moved. The two piers are similar, each 1,000 ft. long and 260 ft. wide, with an intermediate 260-ft. slip. At present the bottom in the slip and off the pier ends is dredged to a 35-ft. depth; but the outer faces of the piers remain at their original lower depth. The St. Johns River has now only about 28-ft. depth to its mouth, but the Federal government has a 35-ft. project under way.

Each pier structure is a central 200-ft. filled section, retained by Lackawanna steel sheetpiles tied together by rods across the 200-ft. width, with a 30-ft. timber-pile wharf section outside. On the fill will be two one-story steel sheds, each 73 ft. wide, with space between and on either side for sunken railway tracks leading down from the ladder on the onshore fill.

The tracks from this ladder lead back 6,800 ft. over a right-of-way wide enough for the erection of warehouses or factories to the main interchange yard at the trunk-line railway connection. It is the intention of the city to control the movement of all trains inside of this connecting point.

The cotton warehouse comprises a one-story reinforced-concrete building alongside the tracks and two cotton compresses, one to be operated hydraulically and the other by steam.

The cost of the work, about $1,500,000 to date, was defrayed by a bond issue of the City of Jacksonville. The design and construction have been under the direction of an elected body of 15 men known as the Board of Port Commissioners, with Fred W. Bruce as chief engineer.

There are also under construction at Jacksonville the new privately owned docks at Commodore Point, which were described in *Engineering News*, Oct. 21, 1915, p. 772. This system is located about 2 mi. upstream from the municipal docks but nearer the city's business center.

News of the Engineering World

Export Freight Clogs New York Railway Terminals

The unprecedented movement in export freight has caused such a congestion in the railway terminals in the New York City district that several of the railway companies have declared a partial or complete embargo on further receipt of freight for foreign transport. The Delaware, Lackawanna & Western R.R. has placed such an embargo on the export freight from all of its lines, the Pennsylvania R.R. has placed a similar bar on export flour and lumber at New York and on export grain at Philadelphia and Baltimore, and the Baltimore & Ohio R.R. has prohibited iron and steel articles for export through New York. It is reported that 17,000 carloads of freight are held up in and around New York awaiting vessels.

While the terminal facilities at New York are not sufficient to care for the present influx of freight, the real cause of the congestion is the lack of ships to carry it.

Southern Waterways Projects

Conventions of three Southern waterways associations were held recently for the purpose of arranging to bring their projects to the attention of Congress at its coming session.

The Tennessee River Improvement Association, which met at Chattanooga Nov. 15 and 16, adopted resolutions asking Congress to provide for the development of power at Muscle Shoals and the establishment of a plant for electrical nitrogen fixation for fertilizer and military use. Government engineers already have plans for this development, it is stated, and the cost was estimated at $16,000,000. The immediate completion of locks and dams at Caney Creek and the selection of one of alternative plans already provided for the improvement of the middle section of the river, with a preference for lock-and-dam construction above channel work, were urged as part of the memorial. The river carried 50,000 cars of freight during the past year, it was stated.

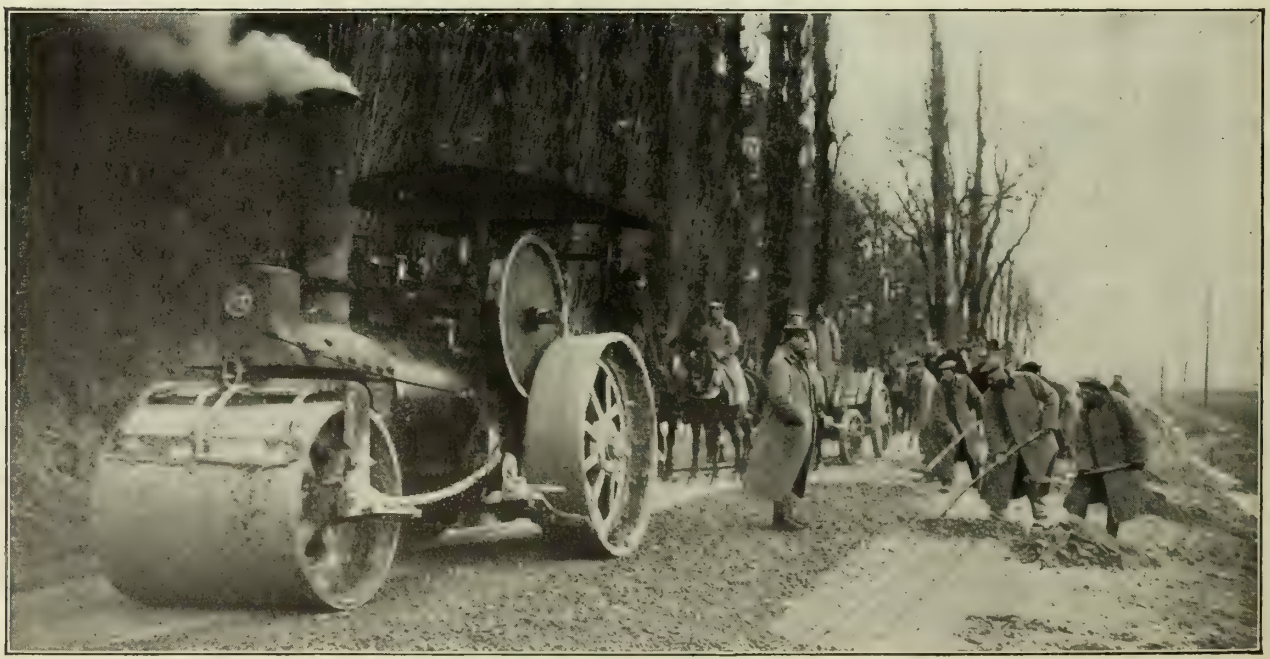
The Arkansas River Development Association met at Little Rock, Ark., and decided to ask for $10,000,000 for the building of a system of dikes, revetments, wing dikes and jetties from the mouth of the Arkansas to the Tulsa District. With an improved river, it was stated, more than 500,000 tons of freight annually could be hauled.

The Cumberland River Improvement Association met at Nashville on Nov. 23 and asked Congress to provide for the construction of locks and dams already planned and to build other necessary works.

The Mississippi River Levee Association will present to Congress a series of photographs of the river. John A. Fox, secretary of the Association, and John K. Milton, photographer of the Illinois Central R.R., are taking a 1,000-mi. trip along the river for this purpose.

Wartime Road Building

The accompanying view is from a photograph recently sent from Europe to illustrate one phase of engineering work in connection with the great war. It shows a party of German military resurfacing a macadam road in northern France. The picture is interesting as showing that the roads at least will not be destroyed by the war, for the only reason, however, that keeping them in prime condition is a military necessity.



WARTIME ROAD IMPROVEMENT IN EUROPE

Municipal Dock for St. Louis, Mo.

Progress is being made on the municipal dock project for St. Louis. Plans for the first section of the dock have been approved by the Board of Public Service, of which E. R. Kinsey is President, and an ordinance authorizing the construction of the dock at a cost of $285,000 has been introduced in the Board of Aldermen. The estimated cost of the dock alone is $255,000, and of equipment $30,000.

The first unit of the dock will be 300 ft. long out of a total length of 1,200 ft. The plans call for a reinforced-concrete structure, including both piling and decks. The dock will be open underneath and riprapped. Provision is made for diagonal pile fenders extending back from each end of the dock and also for a certain amount of levee paving. A railroad track will run down the center of the dock. A steel frame warehouse will be built in back of this track and a crane will run between the track and the water side. The dock will be equipped with two traveling cranes for transferring material between either boats and cars, or between boats and the warehouse. The warehouse and platforms will be equipped with electric trucks, and possibly with tiering machines. The estimated cost of the other three sections of the dock, which will not be put under construction until this section is completed, is $155,000.

The track mentioned above will connect directly with the municipal railway which the city took over from the terminal company at the expiration of its franchise this year. The city now has through tracks extending from a point south of the municipal bridge to the northern city limits.

In connection with this dock enterprise it may be mentioned that after a recent brief promotion campaign by the St. Louis newspapers shippers of that city have guaranteed over 160,000 tons of freight for the proposed Mississippi River barge line out of St. Louis.

An Explosion and Fire in the pumping station at Manchester, Mass., on the night of Nov. 23, wrecked the building, putting the plant out of commission and causing damage estimated at $10,000. The pumping station was one-story high, built of brick with concrete floor, and it housed a 250-hp. producer-gas engine, which was used to pump water from Gravelly Pond to the water tower. The accident will not interfere with the town's water-supply, as there is an independent system of artesian wells that will serve until the plant can be replaced.

A Health-Insurance Act for introduction in the various state legislatures of the country has been drafted in tentative form by a committee of the American Association for Labor Legislation (131 East 23d St., New York City). The bill provides that all manual workers and others earning less than $100 a month shall be insured against sickness, half the estimated cost of the insurance to be paid by the employers. An explanatory pamphlet may be obtained by addressing the association.

A State Health Association has been planned for Connecticut. The movement was started at a complimentary dinner to Prof. C.-E. A. Winslow in New Haven on Nov. 18. It was voted to have Dr. E. J. Root, of Hartford, Chairman of the State Board of Health, name a committee of four to perfect the plans. The purpose of the organization is to promote concerted and uniform action among health associations, and otherwise assist in the improvement of health conditions throughout the state.

Experimental Activated-Sludge Plants are being built at Chicago by Sulzberger & Sons Co. and by Armour Co. It is stated that at a recent conference of engineers and chemists representing the Chicago packing-house interests much enthusiasm was shown for the activated-sludge process, and that some even went so far as to declare that this is the only process of sewage treatment brought to their attention which gives promise of satisfactorily treating the liquid wastes from the packing houses and at the same time recovering the valuable material which they contain.

A Dexter Brackett Memorial Prize was the recommendation of the committee of the New England Water-Works Association, adopted at the Nov. 10 meeting held in Boston. A bronze medal to be known as a Dexter Brackett Medal is to be awarded annually for the most meritorious paper presented to the association. Enough members have already guaranteed a sufficient sum to assure the success of the plan. It was voted at the meeting that the same committee (Frederic P. Stearns, Allen Hazen and Alfred D. Flinn) be requested to draft a letter to be sent to the entire membership, offering each an opportunity to subscribe.

The Ship-Canal Route Across New Jersey surveyed by the Federal Government a few years ago is to be permanently marked by the New Jersey Board of Commerce and Navigation. A survey party is now engaged in placing monuments along the center line. The canal is to extend from Bordentown, on the Delaware River, to Morgan, on Raritan Bay—about 33 mi. The State is to purchase the right-of-way for the canal, according to a resolution of the New Jersey Legislature in 1911. The type of canal recommended by a special board of army engineers was a sea-level canal of 25 ft. depth and 125 ft. bottom width. The estimate of cost was $45,000,000.

The Boundary Line between the states of Ohio and Michigan has been fixed after a dispute dating back to 1837. The disagreement has involved the jurisdiction of a point of land jutting out into Lake Erie, about three miles from Toledo, known as Point Place, a summer suburb of Toledo. The terminus of the Ohio-Michigan line on the point has been established by federal government surveyors and a monument erected. Here on Nov. 24, standing in their respective states, the governors of Michigan and Ohio shook hands across the line, made speeches and otherwise celebrated the event. The engineering societies of the two states took a prominent part in bringing about a settlement of the dispute.

The Law Prohibiting Alien Labor on Public Works in New York State was upheld by the United States Supreme Court on Nov. 29, thus affirming decisions of the New York Court of Appeals and the Court of Special Sessions of New York City. The cases arose in connection with New York subway contracts, the suspension of which was threatened until the legislature amended the law to permit the employment of aliens when citizens were not available. The Supreme Court declared in effect that New York State may "control the construction of its own works and the distribution of its own moneys," and may exercise the same control over cities. It also held that the legislation was beyond Federal control and that it did not violate the provisions of the treaty between the United States and Italy.

The Water-Works Reservoir at Aberdeen, Wash., settlement in one of the banks of which was noted in "Engineering News," Nov. 25, 1915, p. 1054, should not be filled to a depth of more than 10 ft., according to recommendations by R. H. Thomson, Consulting Engineer, Seattle, Wash. Mr. Thomson states that the embankment has settled from 2½ to 3 in. and that some of the support to the slope wall has given away and several small cracks opened in the coping of the reservoir. He recommends that careful measurements of the settlement in the embankment be kept and also in the filled ground to the north of it. Next summer, Mr. Thomson states, it may be desirable to build a heavy concrete wall across the toe of the embankment north of the reservoir, and it may be necessary to terrace the slope to prevent further sliding. If the wall is built it should be carried to rock.

Parkersburg Suspension Bridge—The new suspension bridge over the Ohio River being built by the Parkersburg-Ohio Bridge Co. at Parkersburg, W. Va., is progressing favorably. The bridge consists of a suspension structure 1,425 ft. long (main span, 775 ft.; side spans, 275 and 375 ft.), a 200-ft. simple span at the Parkersburg end, and approaches, the total length being 2,850 ft. It will carry two interurban tracks and a roadway. Work began Mar. 15, 1915, on the piers. By July 1 the substructure was completed, 13,000 cu.yd. of concrete having been placed; the contractor was the Dravo Contracting Co., of Pittsburgh, Penn. At the present time the suspension cables have been built up and wrapped, and erection of the stiffening trusses and floor system is under way. The American Bridge Co. is fabricating the steelwork; the Pittsburgh Construction Co. is doing the erection. Herman Laub is Consulting Engineer to the owners.

Panama Slide Excavation—Excavation of the Culebra slides is going on at the rate of about 250,000 cu.yd. per week. In October the total amount taken from the slides was 872,-

952 cu.yd., according to the "Canal Record." Elsewhere in Gaillard Cut about 200,000 cu.yd. was excavated, making the total excavation for the month 1,079,663 cu.yd., which is 27,000 yd. higher than the September excavation, 88,000 yd. higher than the August excavation and 387,000 yd. higher than the July excavation. The new 15-yd. dipper dredge "Cascadas" was completed on Oct. 30 and started to work on Oct. 31. A remarkable record was made in assembling the dredge, the entire work being completed in a little over seven working days. This compares with 14 days for the "Paraiso" and 30 days for the "Gamboa." Work was facilitated by using picked men and by the ability of the 250-ton crane "Ajax" to handle the heavy parts. The new dredge has not yet worked into good condition, according to last reports of the "Canal Record." In the week ended Nov. 9 it excavated 38,235 cu.yd., as compared with 60,325 for the "Paraiso' and 73,155 cu.yd. for the "Gamboa," both of which are also 15-yd. dipper dredges, though they are slightly narrower in the beam and have only two boilers in place of three of the "Cascadas."

PERSONALS

Mr. Thomas E. Donnelly has been appointed Commissioner of Public Works of the City of Cincinnati, Ohio.

Mr. B. H. Rader has been appointed Western Sales Manager of the Lehigh Portland Cement Co., Chicago, Ill.

Mr. Harold M. Scott has been appointed Assistant Secretary of the Lehigh Portland Cement Co., with headquarters at Chicago, Ill.

Mr. A. Q. Dufour will be in charge of the new branch office of the Jeffrey Manufacturing Co., Columbus, Ohio, in the M. & M. Building, Milwaukee, Wis.

Mr. Claude E. Cox, recently Assistant Valuation Engineer of the Chicago, Milwaukee & St. Paul Ry., at Chicago, has been appointed Engineer of Estimates of the Chicago Union Station Co.

Mr. Ray Palmer, Assoc. Am. Inst. E. E., formerly Commissioner of Gas and Electricity of Chicago, has been elected Vice-President and General Manager of the New York & Queens Electric Light and Power Co., Long Island City, N. Y.

Mr. Elihu C. Church, M. Am. Soc. M. E., Consulting Engineer, and former Secretary of the Department of Water Supply, Gas and Electricity of the City of New York, has been appointed Deputy Warden of Sing Sing State Prison, Ossining, N. Y.

Messrs. William Cooper Proctor, E. W. Edwards, William A. Hopkins, Edward H. Dornette and Christian Schott, all prominent in the civic and commercial life of Cincinnati, have been selected members of the new Rapid Transit Commission of that city.

Mr. C. W. Reinhardt, formerly chief draftsman with "Engineering News," has severed his connection with the Reinhardt-Winters-Cahill Co., Technical Illustrators, Times Building, New York, and has opened an office at 9 Church St., New York City.

Mr. J. P. Hickey has been made Manager of the Standard Engineering and Construction Co., 442 Montgomery St., San Francisco. Mr. William Reinhardt, Assoc. M. Am. Soc. C. E., formerly Assistant City Engineer of San Francisco, is also associated with the company.

Mr. W. N. Royall has resigned as General Manager of the Atlantic Coast Line Ry. on account of ill health. He will be succeeded by P. R. Albright, Assistant General Manager. Mr. J. C. Bland, Superintendent of the Third Division, at Jacksonville, will become Assistant General Manager.

Mr. Elliott H. Whitlock, M. Am. Soc. M. E., Consulting Engineer, has been appointed General Superintendent of the Sandusky Portland Cement Co., with headquarters in the Engineers Building, Cleveland, Ohio. Mr. Whitlock was formerly associated with the National Carbon Co.

Mr. J. H. Weed, Maintenance-of-Way Inspector of the St. Louis & San Francisco R.R., has been appointed Roadmaster of the River and Cape division of the road. Messrs. C. R. Gray, Jr., and H. R. Irvine, Maintenance-of-Way Inspectors have been appointed Roadmasters of the Western division.

Capt. William S. Smith, Engineering Officer at the Philadelphia Navy Yard, has been attached to the Bureaus of Construction and Repair, Steam Engineering and Ordnance, of the Navy Department, Washington, to pass upon suggestions now being received in great numbers concerning the development of the naval service.

Mr. A. H. Markwart, Assoc. M. Am. Soc. C. E., of the firm of Galloway & Markwart, has received an appointment from the Panama Pacific Exposition Co. to superintend the removal of the Exposition buildings under the Director of Works. Mr. Markwart has been Assistant Director of Works of the Exposition, and had much to do with the design and construction of the buildings.

Mr. Carl M. Bernegau, Vice-President and Treasurer of Keuffel & Esser Co., was given a dinner by the firm on Nov. 16, attended by about 500 employees, in celebration of the 25th anniversary of his connection with the company. Mr. Bernegau came to this country from Germany in 1890 and entered the employ of the company in the capacity of bookkeeper.

Mr. E. F. Cykler, Jun. Am. Soc., C. E., formerly Chief Assistant Engineer for H. J. Brunnier, Consulting Engineer, of San Francisco, has been appointed Chief Engineer of the Lord-Young Engineering Co., Ltd. Mr. Cykler's headquarters will be in the Pantheon Building, Honolulu, T. H., in which city and Hilo the company at present has underway about $800,000 worth of work.

Mr. Jacobus Kappeyne, who has been in the Valuation Bureau of the Public Utilities Commission of the District of Columbia, at Washington, D. C., has been appointed Engineer of the Commission. He succeeds Mr. H. C. Eddy, who has been asked to make an electrolysis survey of the District in conjunction with the work of the Commission. Previous to his work in Washington, Mr. Kappeyne did important work in New York for the Public Service Commission in the valuation of street railways.

Mr. Leon S. Moisseiff, M. Am. Soc. C. E., has opened an office for the practice of consulting civil engineering at 69 Wall St., New York City. Mr. Moisseiff has until recently been connected with the Department of Bridges of the City of New York, as Chief of the Division of Design. His more important work includes the design of the Manhattan bridge, the Queensboro bridge (before its modification), the proposed Henry Hudson Memorial Bridge, and also the planning and execution of the work of strengthening the Williamsburg bridge.

Dr. Ernest Fox Nichols has resigned as President of Dartmouth College to accept the chair of physics at Yale University. In their statement announcing Dr. Nichols' retirement from the Presidency, the Trustees said "In seven years he will have made what might well be considered a lifetime's contribution to the well-being of Dartmouth. By unremitting labor he has accomplished a monumental task. Hence he has earned the right to return to his first and chosen field of activity where large honors still await him." Previous to his presidency at Dartmouth, Dr. Nichols held professorships at Colgate University, Dartmouth and Columbia University.

Mr. E. A. Howard, for the last 15 years Land and Industrial Commissioner of the Chicago, Burlington & Quincy R.R., has been appointed Vice-President of the road in charge of all lands and industrial affairs of the company. He is also Chairman of the Joint Board for the construction of the new Union Railroad Station at Chicago. For several years Mr. Howard was Indian Commissioner in Arizona during President Cleveland's administration, and later was a national bank examiner. On entering the railroad business in the Northwest he was associated with Mr. James J. Hill in the construction and extension of railroads through several Rocky Mountain states and to the Pacific Coast.

OBITUARY

Gustave Reinberg, Vice-President of the McKiernan-Terry Drill Co., New York City, died at his home in that city Nov. 22, in his 58th year.

J. B. Wilson, formerly County Engineer and City Engineer at Walla Walla, Wash., at the time the city water system was installed, died Nov. 13 at Montour, Idaho. For the past four years Mr. Wilson had been engineer for a company which was developing an irrigation project on the Payette River.

Charles Abbott Locke, M. Am. Soc. C. E., died at his home in Nashville, Tenn., Nov. 5. He was born near Summerville, Tenn. His first large engineering work was in 1885, when he was placed in direct charge of improvement work on the Cumberland River. After leaving the service of the government, he engaged in consulting work, during which he did much geological prospecting in the South. As advisor to Philadelphia interests he helped to develop the cement industry of Virginia. Mr. Locke was also advisor to the Louisville & Nashville R.R. in connection with the development of the phosphate fields of Tennessee. Mr. Locke retired from practice a number of years ago.

Herbert Merrill Wheeler, Engineer of Electrical Distribution of the Chicago Surface Lines, died in that city Nov. 5. He was born in Shawano, Wis., in 1876 and at the age of 20 graduated in electrical engineering from the University of Minnesota. For several years he was in the employ of the Fort Wayne Electric Corporation and the North Chicago Street R.R. Co., and one time was instructor of mathematics at Lewis Institute, Chicago. He was appointed Electrical Engineer of the Chicago Railways Co., on its organization in 1907, afterward becoming Assistant Chief Engineer. When the street railway system of Chicago was taken over by the Chicago surface lines, in 1914, he was appointed to the position which he held until his death.

Alexander Beith McDonald, M. Inst. C. E., for 25 years City Engineer of Glasgow, Scotland, died at his home in that city Oct. 31. Mr. McDonald had been in the service of the Glasgow Corporation for 45 years, and retired from the position of City Engineer on a pension last year. He was born in Stirling, Scotland, 68 years ago and was a graduate of the Stirling High School. After graduation he was apprenticed with Smith & Wharrie, Civil Engineers, of Glasgow, and ultimately became Senior Assistant of the firm. While engaged in practical work he studied engineering at the Glasgow University, and finally received an appointment on the engineering staff of the Glasgow Corporation under John Carrick, who held the offices of City Architect and Master of Works. One of the greatest pieces of engineering work for which Mr. McDonald was responsible during his connection with the Corporation was the Glasgow Main Drainage Scheme.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 7-10. Annual convention in New York. Secy., Calvin W. Rice, 29 W. 39th St., New York City.

AMERICAN ASSOCIATION OF ENGINEERS.
Dec. 10 and 11. Convention in Chicago. Secy., Arthur Kneisel, 29 South La Salle St., Chicago.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.
Dec. 13-15. Annual meeting in New York. Secy., Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

SECOND PAN-AMERICAN SCIENTIFIC CONGRESS.
Dec. 27-Jan. 8. Washington, D. C.

AMERICAN CIVIC ASSOCIATION.
Dec. 28-31. Annual convention in Washington, D. C. Secy., R. B. Watrous, Union Trust Bldg., Washington, D. C.

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 3-6. Seventh annual convention in Washington, D. C. Secy., C. R. Marsh, Brattleboro, Vt.

MONTANA INSTITUTE OF MUNICIPAL ENGINEERS.
Jan. 17-19. Annual meeting at Billings, Mont. Secy., C. C. Widener, Bozeman, Mont.

NATIONAL DRAINAGE CONGRESS.
Jan. 19-21. Annual meeting, Cairo, Ill. Vice-Pres., Edmund T. Perkins, First National Bank Bldg., Chicago.

ILLINOIS CHAPTER: AMERICAN WATER-WORKS ASSOCIATION.
Jan. 25-27. Annual meeting, University of Illinois, Urbana. Secy., Dr. Edward Bartow, Urbana, Ill.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 26-28. Annual meeting, University of Illinois, Urbana, Ill. Secy., E. E. R. Tratman, Wheaton, Ill.

NINTH CHICAGO CEMENT SHOW.
Feb. 12-19. First Infantry Armory and Coliseum. Secy., R. F. Hall, 208 South La Salle St., Chicago.

SECOND NATIONAL CONFERENCE ON CONCRETE ROAD BUILDING.
Feb. 15-18. At Chicago. Secy., J. P. Beck, 208 South La Salle St., Chicago.

AMERICAN ROAD BUILDERS' ASSOCIATION.
Feb. 22-25. Annual convention in Pittsburgh. Secy., E. L. Powers, 150 Nassau St., New York City.

The Western States Reclamation Convention is in session at San Francisco, Calif. It is proposed that at a later date an Eastern conference will be held.

Iowa Section of the American Water-Works Association—The first annual meeting of this section is being held Dec. 3 to 4, at the State University of Iowa, Iowa City.

The New England Water-Works Association holds its December meeting at the Hotel Brunswick, Boston, on Dec. 8. The papers to be presented are: "Causes of Explosions of Domestic Boilers"; "Some Water-Works Experiences," and "The Middleboro, Mass., Reinforced-Concrete Tower Tank." Members and guests are requested to register at once.

Boston's New High-Pressure Water-Works for fire service can now be used in case of emergency, states Edward S. Murphy, Commissioner of Public Works, by connecting fireboats with the 6 mi. of mains already laid. It is hoped that a site for the pumping station may soon be found that will be acceptable to the United States engineer officers.

American Society of Mechanical Engineers—The annual convention will be held in New York City Dec. 7 to 10. Dr. John Brashear, president of the society, will make the opening address on Tuesday evening, Dec. 7. The nominations for officers are: President, D. S. Jacobus; vice-presidents, Wm. B. Jackson, J. Sellers Bancroft, Julian Kennedy; managers, John H. Barr, John A. Stevens, H. deB. Parsons; treasurer, Wm. H. Wiley.

The Kansas Good-Roads Association, assisted by the Kansas Good-Roads Federation, will hold its fifteenth annual meeting at Arkansas City, Kan., on Dec. 9 and 10. The program will include papers and addresses on methods of construction, on financial matters and procedure, on the attitude of the state toward road improvements and on the best methods of supervision. Much road work is now being considered for the coming year and this meeting should be well attended.

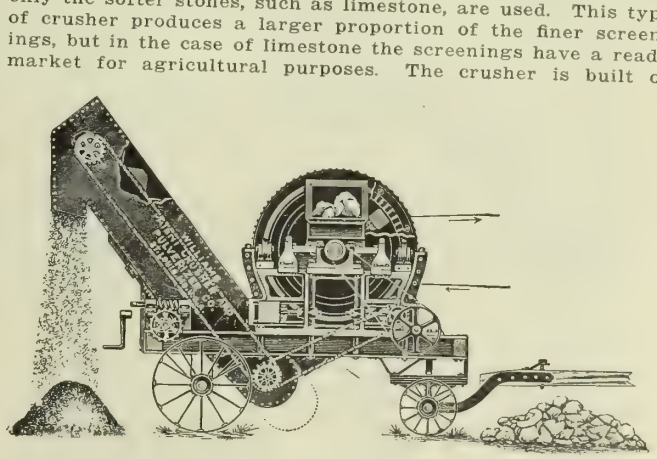
Washington Society of Engineers—The tenth anniversary of the organization of the society was celebrated on Nov. 23, 1915, by a dinner, to which the members of the Naval Consulting Board of the United States were invited as special guests. The main address was by W. L. Saunders, of the board, who spoke on the necessity for military preparedness being assured by a preliminary industrial preparedness. George R. Putnam, Commissioner of Lighthouses, is president of the society.

American Association of Engineers—The Chicago Chapter recently held a meeting at which a set of by-laws was adopted. The following 14 standing committees are provided for: By-Laws, Meetings, Program, Entertainment, Initiation, Finance, Inspection Trips, Publicity, Articles for Publication, Membership, Visiting, Grievances, Local Legislation and Employment, and Information. Chapters are being formed at Springfield, Ill., Minneapolis and Indanapolis. There will be no initiation fee until 500 members have been obtained, after which an initiation fee of $2 will be charged, the fee to increase with each 500 new members. Junior membership will soon be instituted.

Appliances and Materials

Chain-Hammer Crusher for Road Work

Chain-hammer crushers and pulverizers made by the Williams Patent Crusher and Pulverizer Co., St. Louis, Mo., have been used for ore and for agricultural limestone for a number of years, and quite recently this type of crusher has been proved adaptable to macadam-road work, especially where only the softer stones, such as limestone, are used. This type of crusher produces a larger proportion of the finer screenings, but in the case of limestone the screenings have a ready market for agricultural purposes. The crusher is built of



CHAIN-HAMMER STONE CRUSHER FOR ROADBUILDING

two simple elements—a revolving cylinder with hammers attached to the chains, the reach of which is adjustable, and a revolving cylindrical screen. A belt drive operates both parts: the hammers revolve in one direction and the screen in the opposite direction. The only change necessary to convert an agricultural limestone crusher to road purposes is to replace the fine screen with a coarser one. The elevator

attachment shown in the illustration may be thrown out of gear and the product discharged on the ground if desired. An 8- to 10-hp. chain-hammer crusher with a cylinder 30 in. in diameter and 24 in. long is claimed to crush 5 to 6 tons of road-surfacing material an hour. The weight of the outfit (exclusive of power) is about 5,000 lb.

* * *

New Heavy-Duty Edison Storage Battery

A new design of the nickel-iron alkaline electric-storage battery developed by Thomas A. Edison has been produced for the heavy service of electric locomotives, submarine vessels and electric station emergency service. The reactions employed remain the same as in the smaller cells which have been made for some time by the Edison Storage Battery Co., of Orange, N. J. The positive element consists of alternate layers of nickel hydrate and metallic-nickel flakes packed in small perforated steel tubes. Twenty of these are clamped in a subgrid which is welded into a main-grid frame of steel. The negative material is iron oxide and mercury packed in flat, perforated, rectangular pockets of nickel-plated steel—16 to a main grid. The main grids of both positive and negative plates are three subgrids wide and five or six high. In assembling the plates, hard-rubber strips are secured between adjacent grids. Plates of like polarity are bolted together at neck terminals; hard rubber spacers hold the plates rigid and prevent their touching each other or the steel container. Each pair of subgrids is rated to give 15.6 watt-hr. on a 4.4-amp. discharge rate. The potential is 1 volt.

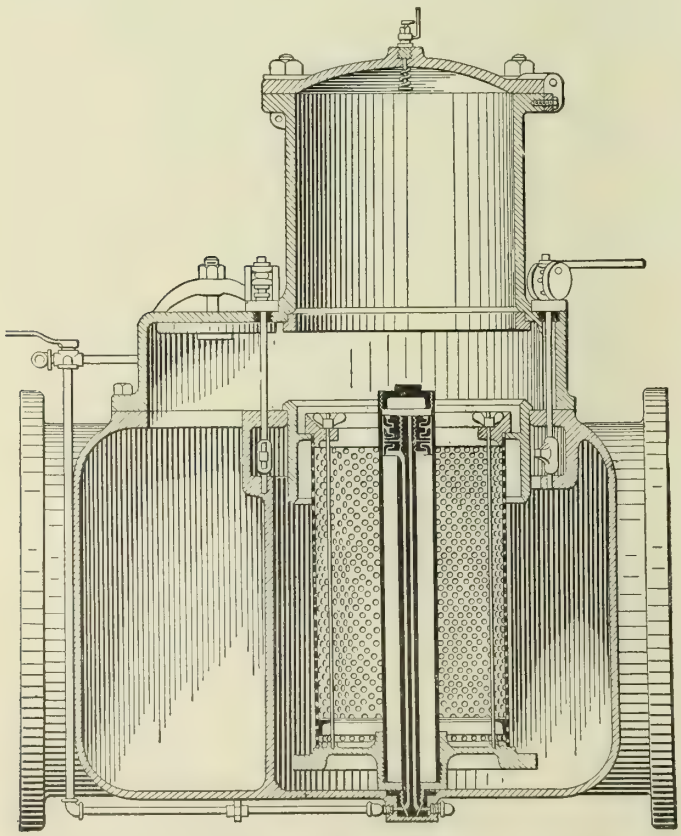
* * *

Multiple-Basket Condenser Strainers

A development of the multiple-basket type condensing-water strainer built for several years by the Lagonda Manufacturing Co., Springfield, Ohio, is shown in the sketch. The improvement is in the substitution of an air- or water-pressure cylinder for the handwheel and screw stem formerly employed in raising and lowering the baskets.

The straining basket is rigidly supported on a circular base or disk, which also serves as a valve seat when the basket is raised. Attached to the disk is a cylinder of small diameter, the whole moving freely up and down on a piston and piston rod rigidly connected to the strainer body. The piston rod is provided with two conduits, communicating with the upper and lower sides of the piston and connected as shown through a four-way control valve to the pump or compressor supply. When pressure is applied to the top of the piston, the basket is raised to the cleaning chamber. The basket support, or lower valve seat, engages the sliding-valve collar of the strainer, carrying it up with the basket, completely to close the cleaning chamber or bonnet. For assurance against possible leakage or chance lowering of the disk while a basket is removed, there is supplied a cam-lever locking device on either side of the strainer bonnets, as shown. In the flange cap a petcock is provided for relieving any pressure in the cleaning chamber, so that the hinged flange cap can be easily unbolted and opened for the quick removal of the basket. With the basket reinserted and the flange cap bolted down, the basket is lowered into position by releasing the locking device and throwing the handle of the four-way control valve.

This design of automatically operated strainers is especialy suited for power plants and large pumping stations, where the rapidity and ease with which the baskets can be removed and cleaned is essential.

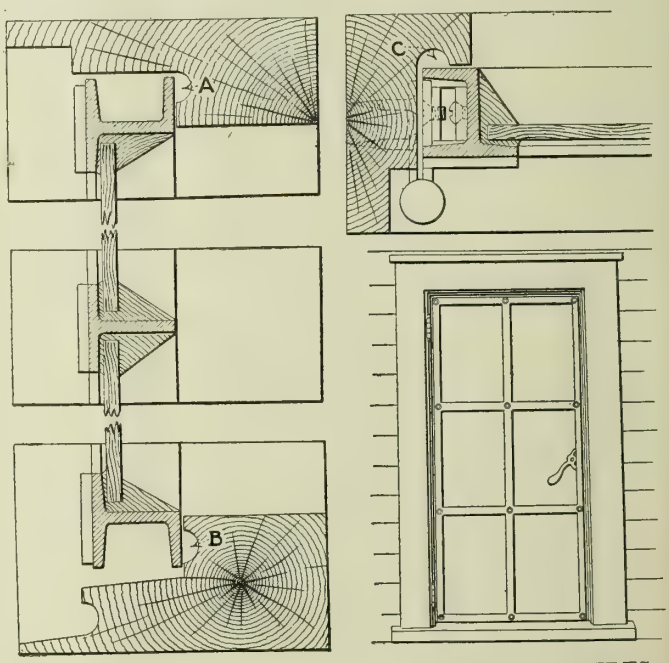


SECTION THROUGH NEW LAGONDA STRAINER

* * *

Steel Casement for Wood Frames

A steel casement for use in wood-frame structures has been designed by E. J. Zahner, of the Zahner Metal Sash and Door Co., Canton, Ohio. It is reported that there has been a large demand for such a casement to eliminate the warping, twisting and binding of wood casements during wet weather.



STEEL CASEMENT FOR WOOD-FRAME STRUCTURES

The construction is shown in the accompanying sketch. The members are electrically welded. This style is furnished in widths up to 2 ft. and in heights up to 5 ft., with any desired arrangement of lights. The construction, as shown, is claimed to be moderately weatherproof and to be wind-tight with felt strips at A, B and C.

* * *

New Line of Batch Concrete Mixers

After several years' experience in the manufacture of continuous concrete mixers the Eureka Machine Co., Lansing, Mich., has placed a batch mixer on the market. The chief aim in the new design is compactness. The whole machine is mounted on a frame of 5-in. steel channels with steel wheels; a double conical drum, made of boiler plate, is driven by a centrally placed gear and has a power loading device. There are two sets of operating levers, which make it possible to manipulate the drum or loader from either side of the machine. The batch capacity is about 5 cu.ft. The power is supplied by a 3½-hp. vertical gasoline engine. The weight complete is 2,800 lb.

* * *

Electric-Light Unit for Construction Work

The "Little Wonder" portable electric-lighting plant consists of a 1½-hp. gasoline engine directly connected to a ½-kw. dynamo, both mounted on a bedplate. The complete unit, including fuel and water tanks, is 31x13 in., 26½ in. high, with a weight of 260 lb. The current produced, 500 watts, is sufficient for twenty-five 18-cp. tungsten lamps. The power is sufficient to operate small electric drills, pumps, grinders, fans, etc., having motors not over ½ hp. The plant is designed particularly for lighting and cooking purposes in country residences, churches, farms, etc., but is applicable also for use in camps and on construction work. It is manufactured by the Swartz Electric Co., Indianapolis, Ind.

Engineering News

VOLUME 74 DECEMBER 9, 1915 NUMBER 24

Record-Breaking Plate Girders for Nickel Plate R.R.

The largest plate girders built in modern times are being made for the double-track skew crossing of the Nickel Plate over the four-track roadbed of the Illinois Central R.R. at 79th St., Chicago, described in *Engineering News* of Oct. 28, 1915. The work is part of the Grand Crossing grade separation.

The bridge has three lines of girders. The girders of the middle line, which carry the heaviest load, are made deeper than the others—10 ft. 10 in. b. to b. of angles as against 9 ft. 8¼ in. for the outer girders. On account of the sharp skew, five spans are required. The normal span length is 125 ft. 8$\frac{11}{16}$ in. c. to c.; but the end spans contain girders of 130 ft. 6½ in. c. to c. length (131 ft. 9 in. o. to o.) The latter, however, are lighter than the 125-ft. girders of the middle line, which weigh 130½ tons.

The 130-ft. girders are the longest single-span plate girders in use. Heavier girders were used by the New York, New Haven and Hartford R.R. in grade-crossing elimination at Worcester, Mass., two years ago. These are up to 122 ft. long, and the heaviest weighs 170 tons, which is 40 tons more than the Nickel Plate girders.

Structurally, two highly individual features of the bridge are the method of support at the abutments and the method of providing for expansion of the bridge. Longitudinally the five spans are continuously coupled so that they expand as a unit—an arrangement frequently adopted in modern bridge practice.

Ordinary masonry bearings at the abutments would have made the girders of the end spans several feet longer than the clear opening, and as the end spans are the longest the extra length was specially objectionable here, increasing the section and weight of the girders considerably. To avoid this, steel columns are set in the abutment to carry the girder end, the masonry serving merely as earth wall. This construction makes the end support practically identical with the intermediate supports, except that the columns are lighter and are braced by the concrete instead of by diagonals. The layout is shown in Fig. 3.

Structure Expands from Middle Span

The bearings on the two middle bents are fixed. Apparently the expansion in the single 125-ft. length between these bents did not require consideration. The other two bents and the two abutment bearings are expansion bearings. Longitudinal stability of the middle or fixed span is given only by the fixity of the columns on their footings. The railway clearance below does not permit of introducing kneebracing, and the middle span is not framed into the columns but rests on top of the columns, as do the other spans.

The type of expansion bearing is unusual and interesting. No rollers or segments are used. The shoe itself, however, is a rocker shoe to allow for deflection of the girders without canting of the bearing plate.

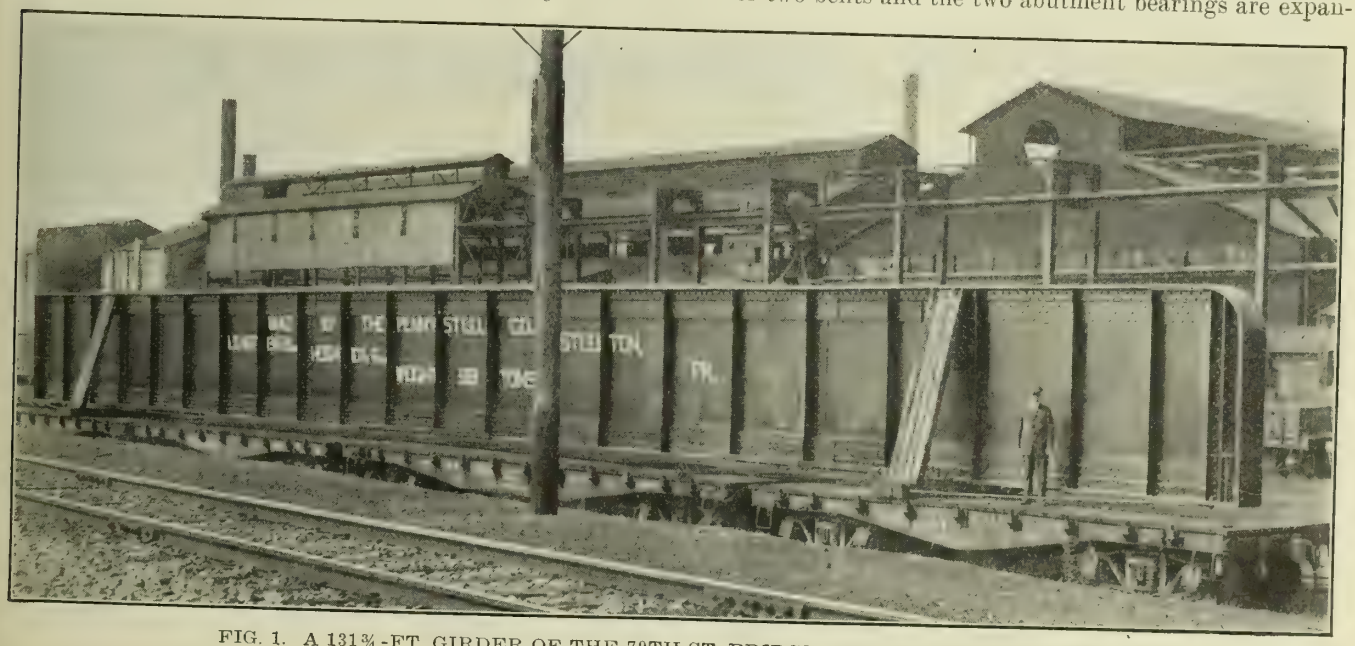


FIG. 1. A 131¾-FT. GIRDER OF THE 79TH ST. BRIDGE, ON CARS FOR SHIPMENT

The rocking seat of the shoe is not made by a pin, as usual, but by the shaping of the two halves of the shoe in the solid metal. The lower shoe plate is a steel casting the upper surface of which carries two semicylindrical convexities, each giving the effect of a half pin laid on the plate, one for either of the two spans meeting at the shoe. The girder is seated on this half pin by means of a forged shoe plate bolted to the girder, in which a concave half cylinder is milled. As the concave half cylinder is shorter than the width of the forging, an adequate lateral guiding effect is secured without further attachment.

At the four fixed bearings the lower shoe plate is riveted to the cap plate of the column. At the expansion point it seats on a 1-in. phosphor-bronze slide-plate dropped into a pocket in the column cap, and the shoe plate itself is loosely connected to the cap by means of bolts going through slotted holes.

The make-up of the girders follows standard practice generally. The flanges are made up of a single pair of angles and up to six cover plates, supplemented by a pair of side plates below the angles. Ordinary stiffeners are crimped over the flange angles, but the load-carrying stiffeners over the shoes are left straight and have fillers over the web. The difference in the shaping of the abutment ends and the intermediate ends of the girders is shown by the details in Fig. 3.

A remarkable feature of the girders is that the flange angles are in one piece for the full length, thus eliminating the necessity of splicing the heavy sections. They are 8x8x1⅛-in. angles. These long angles were rolled by the Pennsylvania Steel Co., Steelton, Penn., which is fabricating the girders and will also erect them. The 129½x¾-in. web-plates (planed from 130-in.) were rolled by the Lukens Iron and Steel Co., Coatesville, Penn.

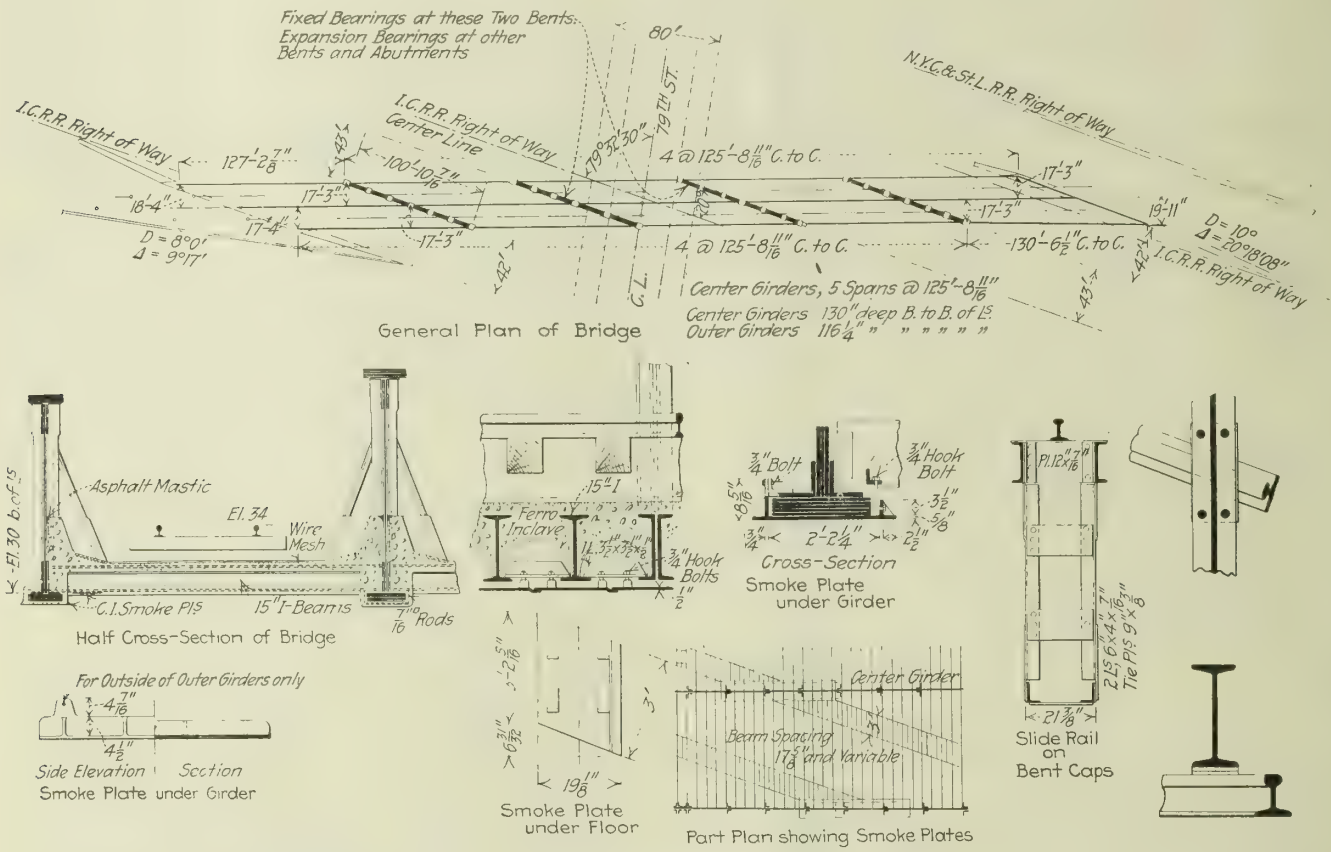


FIG. 2. LOCATION PLAN AND SECTION AND SMOKE-PROTECTION DETAILS, 79TH ST. BRIDGE OF N. Y. C. & ST. L. RY. AT CHICAGO

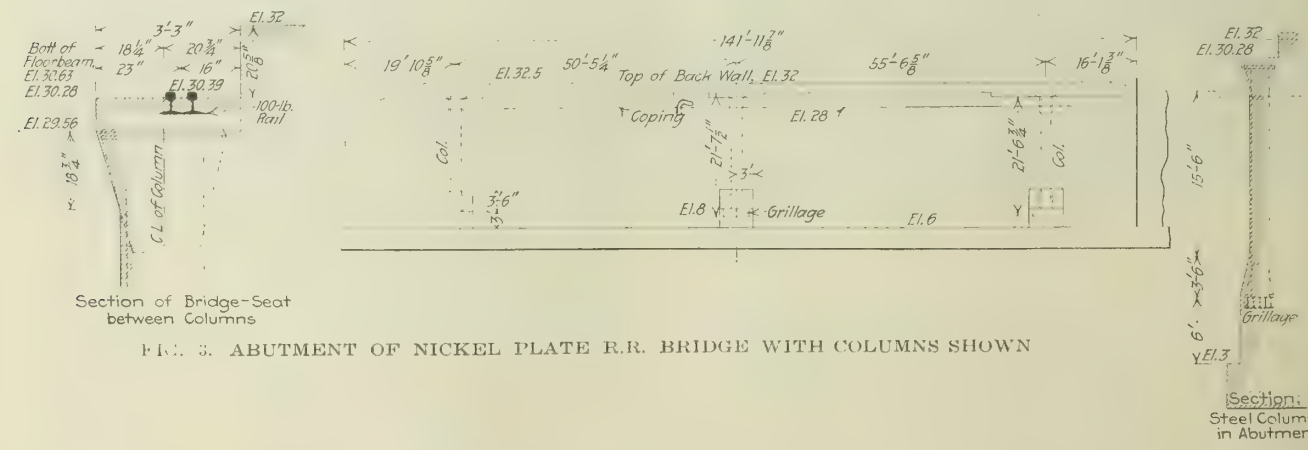


FIG. 3. ABUTMENT OF NICKEL PLATE R.R. BRIDGE WITH COLUMNS SHOWN

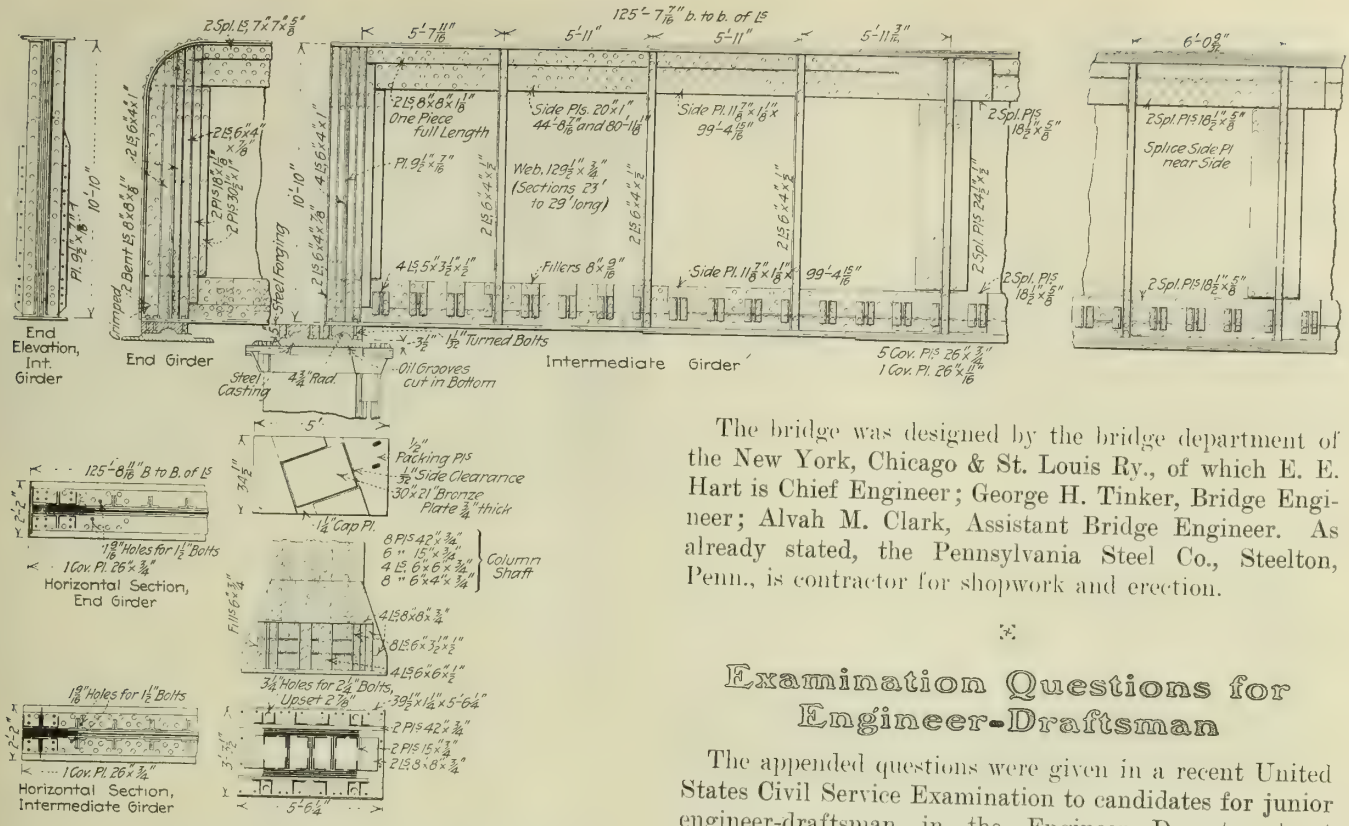


FIG. 4. GIRDER, COLUMN AND ROCKER SHOES, 79TH ST. BRIDGE

The floor (see Fig. 2) is solid, composed of concrete arches on ferro-inclave bent to half-cylinder shape, spanning an average of 18 in. between transverse joists spanning from outer to center girders. The regular joists are 15-in. I-beams, but at each girder stiffener ease of erection made it preferable to use two 15-in. channels.

At the abutment and on the cap girders of the bents the joists are supported by a slide rail, the construction and arrangement of which are shown by sketches in Figs. 2 and 3. At the abutments this support is necessary, but at the intermediate supports it is used solely to improve the deflection conditions and therefore the riding qualities of the track

The bridge floor will carry a regular ballast and tie roadbed. The concrete of the floor is carried up along the side of the girders half way to the top flange, thus making the floor a continuous concrete trough. The trough is drained by pipes directly through the floor, discharging between the Illinois Central tracks. The concrete at its upper edge against the webs of the girders is sealed by a longitudinal strip of asphalt mastic placed in a triangular pocket between concrete and steel.

To shield the bridge against smoke gases and blast action from the Illinois Central trains below, the underside of the floor will be protected with a cement-gun coating, applied after slipping Mitchell-Tappen metal caging over the joist flanges. In addition there will be cast-iron blast plates 3 ft. wide hung directly over the center line of each Illinois Central track. The construction of this cast-iron protection is shown by several sketches in Fig. 2. Cement mortar will be packed behind these smoke plates, covering the angles and bolts which hold the plates and avoiding the formation of any pockets.

The columns will be incased in a concrete wall to a point about 5 ft. above top of rail (Illinois Central).

The bridge was designed by the bridge department of the New York, Chicago & St. Louis Ry., of which E. E. Hart is Chief Engineer; George H. Tinker, Bridge Engineer; Alvah M. Clark, Assistant Bridge Engineer. As already stated, the Pennsylvania Steel Co., Steelton, Penn., is contractor for shopwork and erection.

Examination Questions for Engineer-Draftsman

The appended questions were given in a recent United States Civil Service Examination to candidates for junior engineer-draftsman in the Engineer Department at Large. Applicants were required to have had at least a high-school education and five years' experience as a draftsman. For the examinations familiarity was necessary with calculations, structural details, structural shop practice, reinforced concrete and in making drawings from data.

Use of a structural handbook was permitted. The general subjects and relative weights were: (A) Computations, materials and structural details, 35; (B) drawing and design, 40; (C) training and experience, 25. The time allowed was 7½ hr.

QUESTIONS ON MATERIALS AND COMPUTATIONS

Answer four of the following:

1. Explain in detail two methods of calculating quantities of material dredged.

2. Show a neat pen-and-ink section of a reinforced-concrete beam 10x15 in. by 20 ft. span. Give all dimensions. Make necessary assumptions and calculate safe load per foot of beam.

3. A wall 500 ft. long, 30 ft. high, 3 ft. wide on top and 12 ft. at base is built of 1:3:6 concrete. Specify the number of barrels of cement required and cubic yards of sand and gravel, making no allowance for waste.

4. (a) Calculate the least thickness of metal in a 16-in. c.-i. water pipe under a static head of 150 ft. Allow safe unit stress of 3,000 lb. in metal. (b) A screw has a 1¼-in. pitch; the lever arm is 20 in. and the load is 800 lb. Assuming efficiency as 60%, find the power necessary to move the load.

5. Select a steel column of two channels and two cover-plates riveted to their flanges. The column is of square section and 20 ft. long. The total load on the column is 200,000 lb. Find the least weight of column per foot, using a safety factor of 4.

6. (a) Give a specimen page of level note book showing field notes. (b) State the precautions to be taken in measuring over rough country with a tape.

QUESTIONS IN DRAWING AND DESIGN

Answer two of the following:

1. Determine graphically the stresses in the members of a given roof truss.

2. A sketch showing two water mains of unequal size intersecting at 60°; required to develop the intersection area.

3. Make a sketch of a wharf 120x30 ft. in plan. Draw a pen-and-ink section. Make a bill of material and estimate cost.

Bypass Around Leaky Tunnel in Catskill Aqueduct

By Charles A. Hirschberg*

SYNOPSIS—Driving a bypass tunnel 400 ft. below leaky Moodna tunnel of Catskill Aqueduct. Two 8-in. holes were drilled through 50-ft. concrete plug in surface shaft—one hole for hoisting purposes, the other for chuting concrete for lining of tunnel. Drilling methods.

Driving a shaft and tunnel supplementary to the Moodna pressure tunnel, which connects with the Catskill Aqueduct tunnel under the Hudson River at Cornwall, N. Y., to stop leakage from a damaged section, is practically the last chapter of the gigantic water-supply project of New York City. The work itself is complete now, two months in advance of the time specified by the Board of Water Supply of New York City. There remains only the work incident to tearing out track, cleaning up and sealing the damaged and leaky section. The actual driving and concrete lining of the tunnel and connecting shaft have been finished some time; in fact, the majority of the surface equipment has been boxed and shipped to other work.

The original work was carried on through two shafts, known as No. 7 and No. 8, shown in the profile, Fig. 1. No. 8 shaft formed the connection between the siphon under the river and the main water-supply tunnel and had been permanently sealed. No. 7 shaft was driven as an access shaft and was left open to permit operation of the aqueduct. The cracks which developed in the old tunnel are located near Shaft 8 and extend part way toward Shaft 7.

When it was decided to replace the damaged section the plan adopted was to drive a new tunnel section parallel to the old, but located 400 ft. below it. To save time and expense the contractor was required to utilize Shaft 7 (8 ft. 8 in. in diameter) for handling all materials. This necessitated sinking a supplementary shaft (designated No. 7A), 17 ft. in diameter and 400 ft. deep, from a point within the old tunnel and driving a new tunnel 17 ft. in diameter and 900 ft. long. The latter formed the new connection between the siphon and the main water tunnel. A concrete lining reduced both shaft and tunnel to approximately 14 ft. 2 in. in diameter.

Provision for Handling Materials

The contract was awarded to the Oscar Daniels Co., New York, and the work of installing equipment began in the latter part of November, 1914. Active work on Shaft 7A was not started until Jan. 2, 1915. The time intervening was devoted to installation of the surface plant, placing guides and apparatus for operating a cage in Shaft 7 and driving a dome or upraise over the location of Shaft 7A for hoisting headframe purposes. Preliminary work also included the installation of a platform at a point in Shaft 8 where the new tunnel was to be started.

It was at first thought feasible also to utilize Shaft 8 for handling materials directly from the new tunnel to the surface. This shaft, however, had been sealed at the top by a concrete dome and also by a concrete plug 50 ft. thick and 30 ft. above the old tunnel, so that the idea of using this shaft was abandoned. Blasting operations for the removal of the 50-ft. plug would have endangered the shaft lining. The concrete dome, however, was removed, and the novel idea was conceived of utilizing the portion of Shaft 8 between the new and old tunnel levels by drilling two 8-in. holes through the plug with a core drill. One hole was used for passing the hoist cable from the surface for handling a cage and the other for chuting concrete for the tunnel and shaft lining.

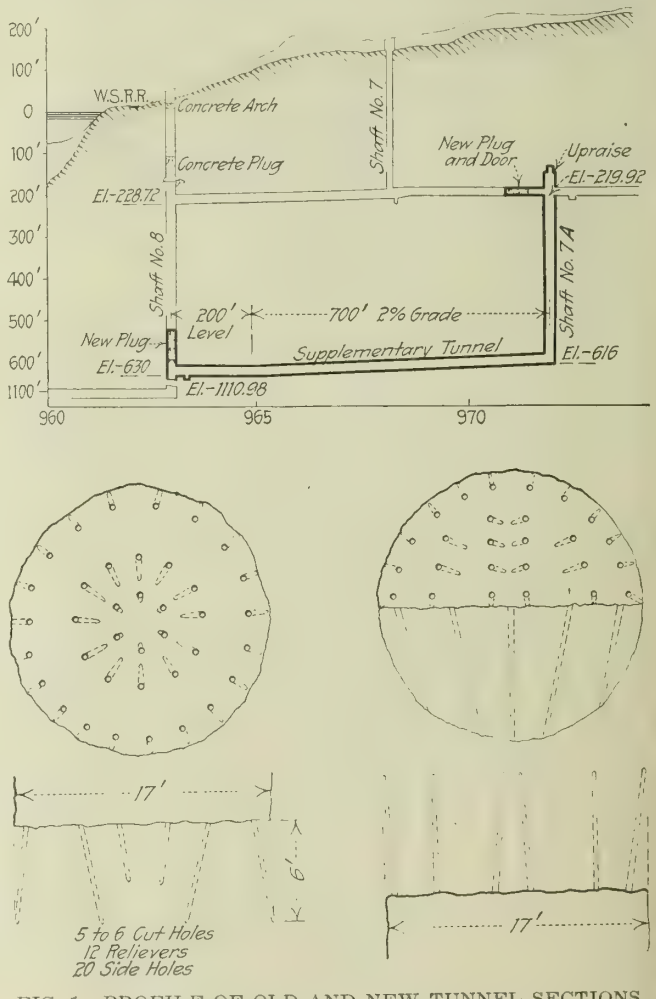


FIG. 1. PROFILE OF OLD AND NEW TUNNEL SECTIONS, WITH DIAGRAMS OF DRILLING ROUNDS

The tunnel work was prosecuted entirely from Shaft 8. The first round was blasted on Feb. 6, 1915, and the last or breaking-through round on May 20. Driving the tunnel and sinking the shaft were completed at about the same time.

Driving an Upraise

Fig. 2 is a view looking up into the dome or upraise in Shaft 7A. Work in this upraise, which was 17 ft. in diameter and 31 ft. high, was necessarily slow, owing to the need for continual building of temporary staging,

*Ingersoll-Rand Co., New York City.

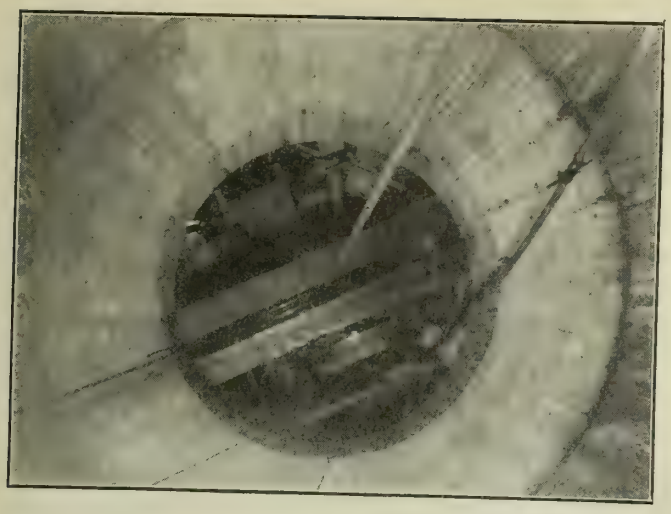


FIG. 2. LOOKING UP INTO DOME OVER NEW SHAFT 7A

which had to be torn out prior to blasting each round. Work was started on Dec. 31, 1914, and was completed Jan. 17, 1915. Three stope drills were employed for the drilling. The dome was concreted to form a setting for the hoisting headframe with its sheaves and to eliminate danger incident to rock sloughing off.

Sinking Shaft No. 7A

In Fig. 1 is a diagram of the drilling round in the shaft. This round consisted approximately of 38 holes. For drilling the shaft as many as six heavy hand hammer drills (Ingersoll-Rand Co. "Jackhamers," Bull Moose size) were employed at one time. The day was divided into one 8-hr. drilling shift and two 8-hr. mucking shifts. All holes were started 2 in. and bottomed 1⅝ in. 1¼ in. powder. The first round in the shaft was blasted on Jan. 22, 1915, and the entire sinking of 400 ft. was completed in 76 rounds, giving an average advance per round of 5.26 ft. After sinking 306 ft., drilling was stopped for 26 days to do concreting, and was resumed again on Apr. 20. In portions of the shaft it was necessary to employ temporary steel lining.

All hoisting in Shaft 7A was handled by bucket, except in the case of the spoil, when the transferable bodies of the 2-ton steel cars were used.

Driving the Supplementary Tunnel

The supplementary tunnel, 17 ft. in diameter and 900 ft. long, was driven by the usual heading-and-bench method. The round (in Fig. 1) consisted of 26 to 28 holes in the heading and five holes in the bench.

Work in the tunnel was started from a platform placed in Shaft 8. The first round was blasted on Feb. 6 and holed through on May 20, during which time 206 rounds were drilled, blasted and mucked, giving an average advance of 4.37 ft. per round. The drilling and mucking may be said to have proceeded simultaneously. The first drilling crew worked from 8 a.m. to 4 p.m. and the second from 8 p.m. to 4 a.m., while the first and second mucking crews worked from 4 p.m. to 12 midnight and from 4 a.m. to 12 noon. Holes in the heading averaged from 7 to 8 ft. deep, and from 6 to 8 ft. deep in the bench. All holes were started 2 in. and bottomed 1⅝ in. Changes of steel averaged 24 in. Four No. 18 Leyner-Ingersoll water drills on two columns were employed in drilling the heading. Two drills of the same type set up on tripods drilled the bench. Each machine was manned by two men. About 150 lb. of 1¼-in. "gelatin" was consumed per blast in the tunnel and 90 to 100 lb. in the shaft.

Air was furnished by two 1,200-ft. motor-driven Imperial air compressors, a pressure of 90 lb. being maintained at the drills. The air was conveyed both to the tunnel and the shaft by means of two 4-in. air lines. Water for the drills was taken from the leakage in the tunnel. All haulage was performed by storage-battery locomotives. Lining the tunnel started after holing through, Blaw steel forms being used. The smoothness of the concrete lining of this work is a feature worthy of note.

Engineers and Contractors

D. E. Baxter and C. L. Ostenfeldt supervised the work for the Oscar Daniels Co., S. A. Knowles being Superintendent. The engineers of the Board of Water Supply were George J. F. Carey, Field Engineer, and W. B. Hoke, Section Engineer. Ralph M. Wheeler, Department Engineer of the Northern Aqueduct, was in charge for

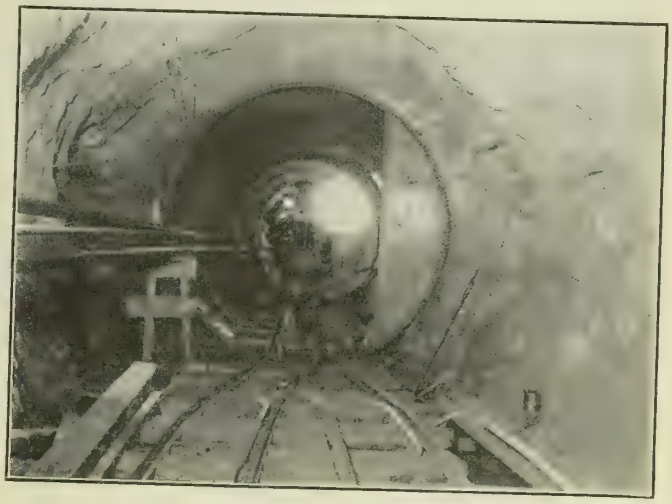


FIG. 3. WHERE WORK WAS STARTED ON SHAFT 7A

Note steel forms at point where old tunnel section is to be plugged by a concrete wall fitted with bronze door

the Board of Water Supply under the direction of Alfred D. Flinn, Deputy Chief Engineer, and J. Waldo Smith, Chief Engineer.

A description of the circumstances which led to this repair work, that is the leakage which started the trouble and the then proposed methods of repair, was published in *Engineering News*, Nov. 5, 1914, p. 954.

The Field for Automatic Stream Gages in obtaining records of stream flow is discussed by C. H. Pierce, Hydrographer, U. S. Geological Survey, in the recently published Water-Supply Paper No. 375F. The necessity for automatic height gages has long been recognized, but determination of the proper field for them was not started until 1912. The problem was how to determine whether the conditions at a gaging station were such that two readings a day from an ordinary staff or chain gage gave satisfactory results and what conditions required an automatic gage. The conditions requiring the use of an automatic gage are summarized as follows: (1) regulation of the stream by power development, (2) operation of canals and ditches for irrigation, (3) large and rapid fluctuations due to run-off variations caused by rain or melting ice and snow, (4) inaccessibility of stations or lack of reliable observer, (5) continuous record needed for legal purposes, (6) human fallibility of gage observers. The total number of stations maintained by the Geological Survey in 1913-14 was 1,741, of which 325 stations were equipped with automatic gages.

Gravel Roads of New Hampshire; Patrol Maintenance

SYNOPSIS—Motor tourists during the past summer have generally praised the plain gravel roads of New Hampshire as being ideal. An investigation by one of the editors confirmed this view and led to some conclusions as to how the state highway authorities accomplished such results. Those conclusions, briefly stated, are an efficient patrol system of maintenance and a willingness to spend sufficient money and time and trouble on plain gravel roads to secure results. The patrol system, the most powerful contributing cause, is described in some detail.

The popularity of the White Mountains in New Hampshire for automobile touring has steadily increased during the last few years, and during the recent summer this traffic was extraordinarily heavy. On many main trunk roads automobile traffic averaged from 800 to 1,000 cars a day, and on the Sunday before Labor Day an unofficial count of 1,500 cars was made on the road through Crawford Notch. Even under this excessive traffic, plain gravel roads have stood up remarkably well, and their almost perfect condition all through the season has elicited universal praise and admiration from touring parties, as well as exploded previous theories as to the possible traffic a gravel road could economically carry.

New Hampshire is a sparsely settled agricultural state with a population of less than half a million and with only one city of over 75,000 (Manchester). A considerable share of the state's prosperity depends on tourist travel to and from the White Mountains, and to attract and hold this traffic good trunk-line highways are absolutely essential.

The problem of building and maintaining over 1,000 mi. of such roads with any sum of money which the financial condition of the state justified was a hard one, and to the late S. Percy Hooker, State Superintendent of Highways, who solved that problem in a very economical manner, great credit is due. The record of these gravel roads has amply justified Mr. Hooker's prediction that they would prove ideal for the conditions to be met. Mr. Hooker's policy has been ably continued by Frederic E. Everett, the present Commissioner.

Needless to say, the excellence of these roads was not attained, nor is it maintained, by accident; nor yet is it by any means due to extraordinarily good material. It is the result of a carefully worked out policy to concentrate on gravel-road construction, of good construction and of thoroughgoing and really efficient maintenance; and possibly, to some extent, it is due to topographic and climatic conditions.

General Road Plan of New Hampshire

As this article deals chiefly with the most important of these causes—maintenance—the general road policy of the state will be touched upon only briefly. Essentially, there are three main trunk highways north and south, the length of the state, and two main trunk highways east and west through the southern and northern parts of the state respectively, each built by coöperation between the state and the towns and by special appropriations. There are a few miles of state-built roads in wilderness sections of the state and there are numerous state-aid roads where the state has assisted the towns to build and maintain roads on important routes. The cost of building the 550 mi. of trunk line highways has averaged $4,000 per mi., including grading, drainage and culverts.

As to methods of construction, little needs to be said. It would be merely a rehearsal of first principles, with which every highway student is familiar, the practice of which, however, requires a large amount of rare good judgment and horse-sense. On these New Hampshire roads just as much attention has been paid to foundation and drainage as if the wearing surface was to be $15,000 a mile asphaltic concrete. The usual width of finished roadway is 21 ft., with a thickness of 10½ in. of gravel in the center and 3 in. at the sides. For compacting the gravel, corrugated, sectional, horse-drawn rollers are generally used.

The total appropriations for road maintenance from all sources have averaged about $250,000 per annum for the past three years, and with this sum the State Highway Department has improved and maintained about 1,000 mi. of gravel roads, or at an average annual cost of $250 per mi. (ranged from $119 to $850). It is not possible in many cases to draw any distinctive line between new construction and improvement (or maintenance), because there are instances where the original road needs little more than surfacing material, and the constant addition of new surfacing material is one of the prime requisites in gravel-road maintenance.

Patrol Maintenance One Secret of Fine Gravel Roads in New Hampshire

Starting with well-built gravel or dirt and gravel roads, the problem is to maintain them under severe motor-vehicle traffic. The successful method as demonstrated in New Hampshire has two prime essentials—honest, efficient and decently paid patrolmen and a willingness to spend $200, $300 per mi. per yr., or even more in an exceptional case, on plain gravel-road maintenance. It is in the latter essential that most highway departments fail; for while they show willingness to spend $600 to $1,000 per mi. per yr. to maintain bituminous roads, they generally balk at regularly spending $200 per mi. per yr. on dirt or gravel roads.

Patrolmen are local men, appointed on the recommendation of the selectmen of their towns. They are intelligent natives, not the ordinary type of laborer. Each patrolman is required to provide himself with the following equipment: Horse, dump cart, chain, shovel, pick, iron bar, hoe, rake, ax and brush hook. Any other necessary equipment (on exceptional sections tar kettles, etc.) is furnished by the state. The patrolman is expected to spend his whole working day of 9 hr., six days a week, on the job during the working season. His pay ranges from $3 to $3.50 per day.

In brief, the patrolman's duties are to frequently patrol his section and see that the road is clear of stones, broken

glass or anything of a foreign nature; to see that the ditches and shoulders are cleaned, the culverts clear and bushes cut, and to pay particular attention to the cleaning of the culverts and ditches after each rain. He is to patch any ruts and holes that may appear and drag the road after every rainstorm or shower or whenever the road surface is damp.

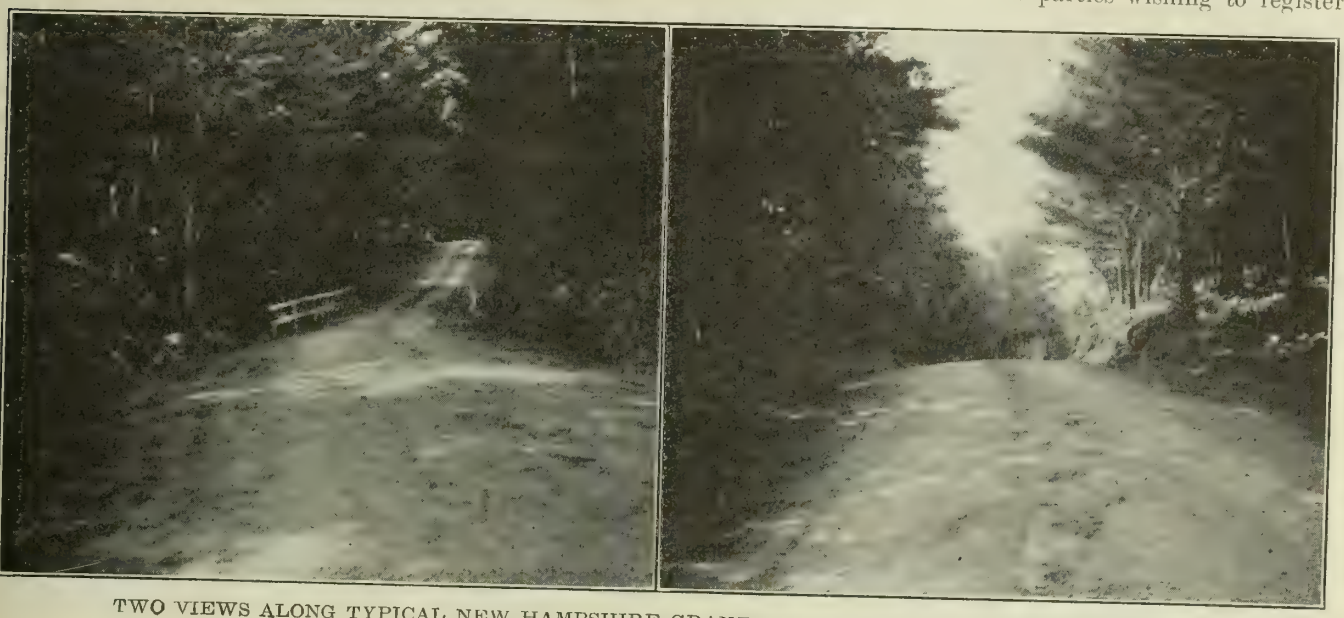
When necessary, a patrolman may hire, upon written consent of the division engineer, such assistants as he needs, but for each patrol section only a limited sum is ordinarily available each year—generally $1,000 or $1,200; and it is in the interest of all parties concerned (the state, the town and the patrolman) to make this money go as far as possible. If a patrolman spends a part of his allotment in hiring assistants, he has so much less for his own labor and for materials, which he also purchases out of his allotment—that is to say, his working season will be shorter. By good judgment on the part of the patrolman and division engineer this system works out admirably, and it makes the patrolman's job more than that of a day laborer, and thus it requires and develops a higher grade of intelligence and workmanship.

The patrolman makes daily postcard reports of his own time, assistants' time, material, work done and weather conditions. As the towns pay part of the maintenance costs, the patrolman must keep a record of his work in each town. Upon the authorization of the division engineer, the patrolman makes purchases of such material as is necessary for his work. Where small quantities are purchased at a time, bills are not sent in every week, as otherwise required, but a total bill is rendered at the end of each quarter—May 28, Aug. 28 and Nov. 27. The patrolman pays these bills, sending receipts promptly to the highway office, and at the end of the quarter he is reimbursed by the state.

There is no hourly allowance for overtime nor docking for short time. The patrolman is left largely to his own devices, but when he takes a day or a part of a day off he records the same and is paid only for the time he actually works. The working time of the patrolman is made up weekly from his daily post-card reports, and an order is sent him for presentation to the selectmen of the town or towns in which his section is, who give him a warrant on the town treasurer to cover his own pay, assistants' pay and material accounts. In cases of emergency, material may be purchased or assistants hired upon telephone order from the division engineer.

Every patrolman is provided by the state highway department with two cart signs with his number painted on them. He is also provided with a staff having a sign on top, which he carries on his cart; or when he is compelled to leave his section of road to go to a gravel pit, or for any other purpose, he leaves his staff in an upright position beside the road just at the point where he has left it, so that he may be found if necessary.

Each patrolman is provided with complaint blanks which he is to furnish to all parties wishing to register a "kick" in connection with the highway work. These complaints the patrolman is required to send to the division engineer. The patrolman is also expected to report all accidents which occur on his section of road and to take ordinary precautions on his own initiative to prevent accidents. He is also required to report any dangerous place or conditions on the roads or bridges of the town or towns which are not under his supervision, but he is to do this through the division engineer, and is particularly cautioned against criticizing the town authorities, and is urged to assist the town road authorities in every possible way in solving their problems.



TWO VIEWS ALONG TYPICAL NEW HAMPSHIRE GRAVEL ROADS, SHOWING TIMBERED SLOPES

A system of supervising and assisting patrolmen by having three of the most experienced men act as part-time foremen, traveling over the various patrol sections and giving instruction and advice, has been tried and proved fairly successful in one division, but the scheme of organization for the coming season is somewhat different. It is planned to have one experienced man give his whole time as inspector or foreman of patrolmen. The object is not so much that of checking the work of the patrolmen as to give them the benefit of the advice and experience of the inspector in solving their particular problems.

The state's highway patrolmen are all deputy fire wardens of the state forestry department and are furnished with badges and instructions in connection with these duties. In this work the patrolmen are governed by instructions from the forestry department, but report all

fires and work done as deputy fire wardens on the daily cards sent to the division engineer. When necessary, special written reports are made by letter.

Specific Instructions for Guiding Work of Patrolmen

The following instructions, while they may not contain any new points, are more specific than are usually found in highway literature and have the advantage of being founded on successful experience. They are taken from a book of instructions for patrolmen by C. W. Brooks, one of the state highway division engineers.

In dragging a road surface, the surface must be moist enough so that the drag blade will move the material from the high places and deposit it in the ruts and hollows. A road should not be dragged when too wet so that the first vehicle passing over the road will make ruts in the mud and destroy the patrolman's work; neither should it be dragged when too dry, as then the loose material will not pack down. Patrolmen should experiment with the different sections of their road so as to learn under what conditions the best results are obtained from dragging.

As a general rule the best time to drag is after a rain, when the road surface is moist. A gravel road that dries out rapidly should be dragged during a light rain, while a hardpan or soft road can be dragged a day or two later.

The best results can be obtained when a patrolman rides his drag. The use of a pair of front wheels is discouraged, as is also the use of what is known as a "bush drag." Experience has proved that the double-blade one-horse plank drag does the best work, and all patrolmen should study their drag and its various hitches and angles. When it does not work well the trouble is generally with the operator and not with the drag.

It is better to drag a mile of road several times and get it in good condition than to try and drag 2 or 3 mi. and not finish any part of it.

When the weather is unsuitable for dragging, as during a dry spell, all patrolmen should cart all the new material possible in order to fill up all ruts and holes and resurface worn sections. Carting is essential during dry periods and should never be neglected. Whenever a patrolman is in doubt as to what to do next, the general rule is to cart new material, for all roads are constantly wearing out under travel and it is necessary that the surface be continually renewed to take the place of the old material that is thrown out as mud or blown away as dust. Do not be afraid that you will do too much carting.

As a general rule, plan your work so as to begin at the far end of your section the first of the week and work toward home, commencing each day where you left off the night before. Give your entire section equal care and attention.

Save all the sods, leaves, rubbish, stone and refuse that you clean off your road and dump this waste material in places where the bank is steep, so that by flattening the side slope there will be no need of a guard rail; or dump the material back of a present guard rail, so that later this guard rail can be removed.

All brush after cutting must be removed from the sides of the road or placed in small piles and burned. Under no condition should a patrolman dump brush off the side of his section where there is danger of it being set on fire by the traveling public.

In cutting brush, all trees 4 in. or over in diameter should be left for shade purposes unless ordered removed by the division engineer. August is the best month for general brush-cutting.

Find out the location of all suitable surfacing material on your section and arrange with the owners to sell it to you.

If you have a large stone or log to get out of your road have a load of earth in your cart or dumped near by before removing the obstruction, so as to quickly backfill the hole and not inconvenience travel any more than necessary.

Never dump any material directly on your road or in a hole or rut. Always dump on a dumping board or shovel the material out of the cart. If for future use, the material can be dumped in piles on the shoulders or side of the road and then when needed shoveled on the road surface.

One dragging in the spring is worth two in the summer. Never try to drag all the road at one time. Take a certain section first and put it in shape, dragging two or more trips if necessary.

Make the most of the weather conditions and drag when the surface of the road is wet, after a rain, so your drag can move material. Don't drag a soft section when it is so wet that the first vehicle will rut it. First fill the holes and ruts with material and then drag as the surface dries out.

Clayey sections should be kept well crowned up to shed water, and sandy sections should be as flat as possible to hold the rain water. The reason is that a clay road is best when dry, while a sand road is best when damp.

Every patrolman is expected to work on rainy days and should provide himself with suitable coat and boots to keep dry. On days when it is raining very hard he may patrol his section in a light wagon and see that all ditches, culverts and waterways are free and carrying off the water, and at this time he should locate and mark all places in the road where water is collecting so that he can fill them as soon as the rain stops. On all other rainy days the patrolman is expected to use his regular cart and outfit, and every patrolman should have material dumped in small piles along the side of his section, so that on a rainy day he can at once fill all holes and ruts in which water is collected.

The very best work on any road can be done when the road surface is wet, both in filling holes and ruts with new material and also in dragging the road as the surface dries out.

Possible Influence of Climate and Topography

The recent summer has been a particularly wet one, but where proper drainage is provided water can do little harm to a well-compacted gravel road. The rain has assisted materially in protecting against the one great enemy of gravel roads subjected to dense automobile traffic, which is the dust nuisance. The roads were frequently dragged and kept well shaped and free from the slightest indication of a rut, so that the automobile traffic instead of injuring the roads actually aided a great deal in forming a smooth, hard, thoroughly compacted surface, every bit as smooth and even as one of bituminous macadam.

Another favorable element is that many miles of New Hampshire roads are through wooded country, where dense forests line both sides of the highway and give shade to the road surface and prevent its rapid drying out. Moreover, the surrounding forests probably assist in keeping the soil of the whole locality in a more moist condition than that in an open country.

Unless gravel roads have an opportunity to become thoroughly compacted before a dry season sets in, it is always harder to maintain them in good condition and prevent dust. In some instances the use of an oil dust layer has proved beneficial, the oil in these instances being a nonasphaltic oil—a dust layer pure and simple—for then the character of the road is not changed. It may still be dragged, shaped and maintained as a gravel road. On the other hand, if an asphaltic or tar binder and grits are applied, the surface becomes a bituminous macadam to all practical purposes, and its maintenance becomes the well-known patching process, which is much more complicated than the maintenance of a plain gravel road, and lends itself much less readily to the patrol system of maintenance.

Perhaps a combination of climatic and topographic conditions—the fact that the northern part of the state lies between the seacoast and a mountain range and is well forested—brings in another element which materially assists in keeping the roads of that section of the state in prime condition during the summer months. This is the heavy dew which falls nightly in sufficient amount to dampen the road surface. Dragging in the early morning after a heavy dew is equivalent to dragging after a light rain, and with this frequent dragging the roads may be kept in almost perfect condition.

Pile-and-Mat Foundation for Power House in Marsh

SYNOPSIS—To carry Essex Station on Passaic River marsh, the full area had to be piled at minimum spacing. Unreinforced-concrete mat caps the piles; pile-heads peeled where surrounded by concrete.

A difficult foundation problem was presented at the Essex power station, a large new generating station which the Public Service Electric Co., Newark, N. J., is building on the bank of the Passaic River in the extreme southeast of the city, in the tidal marsh of Newark Bay. The soil is very soft, peaty and alluvial marsh ground to a depth of about 35 ft., to which depth the foundation necessarily had to go. Piles were the logical solution. But with very heavy concentrations of load it seemed impracticable to provide isolated pile groups. Apart from the cost of the footings, the weight of the station is very large—approximately 2 tons average weight per square foot over the entire area, but by no means uniformly distributed—so that sufficient pile capacity could be obtained only by covering the whole area with piling.

Under these conditions recourse was had to a concrete slab or mat over the whole site, supported by piles driven



FIGS. 1 TO 3. FOUNDING A LARGE ELECTRIC POWER STATION ON SOFT MARSH

Upper view—Original condition, August, 1914. Lower views—A section of piled ground inside of coffer-dam, and the finished boiler-house foundation

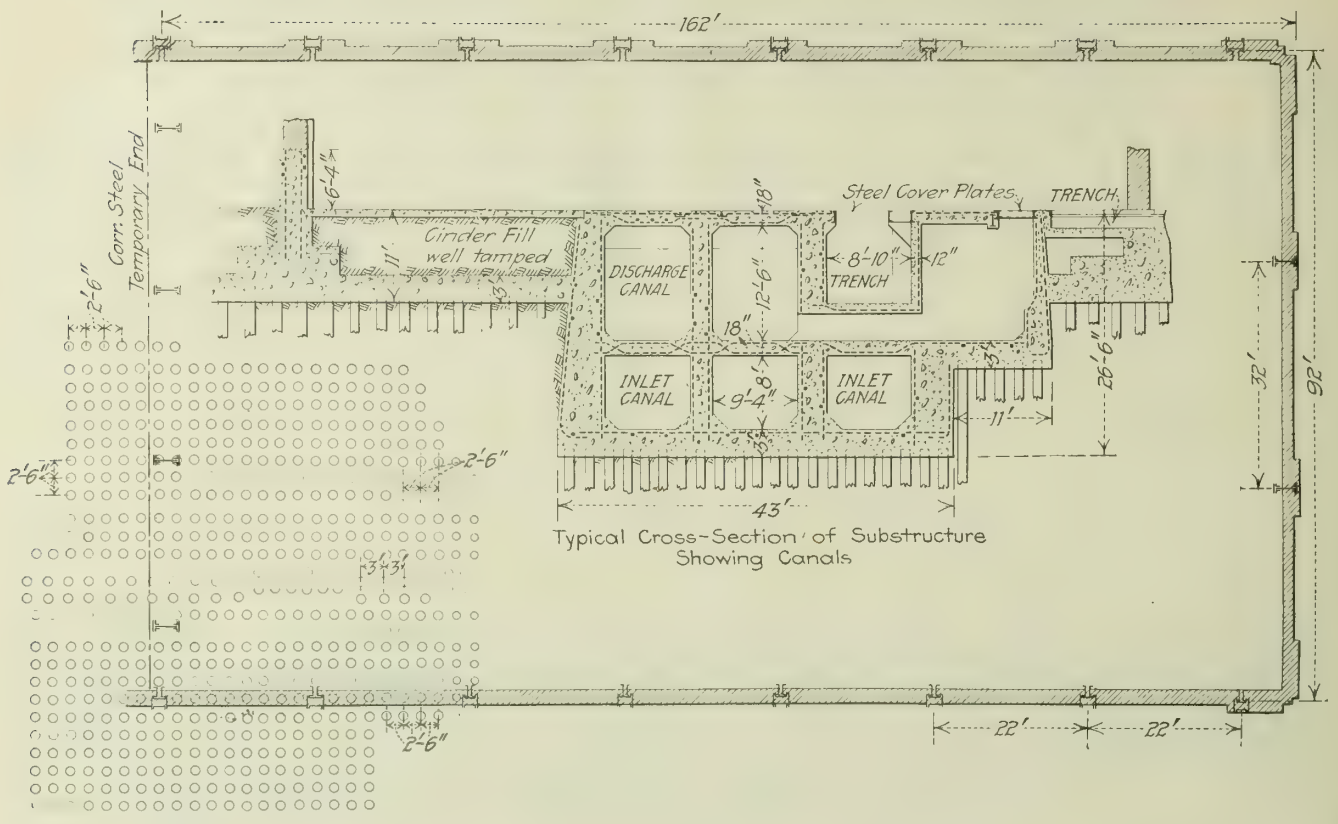


FIG. 4. DETAILS OF TURBINE-HOUSE FOUNDATION FOR ESSEX POWER STATION NEAR NEWARK, N. J.

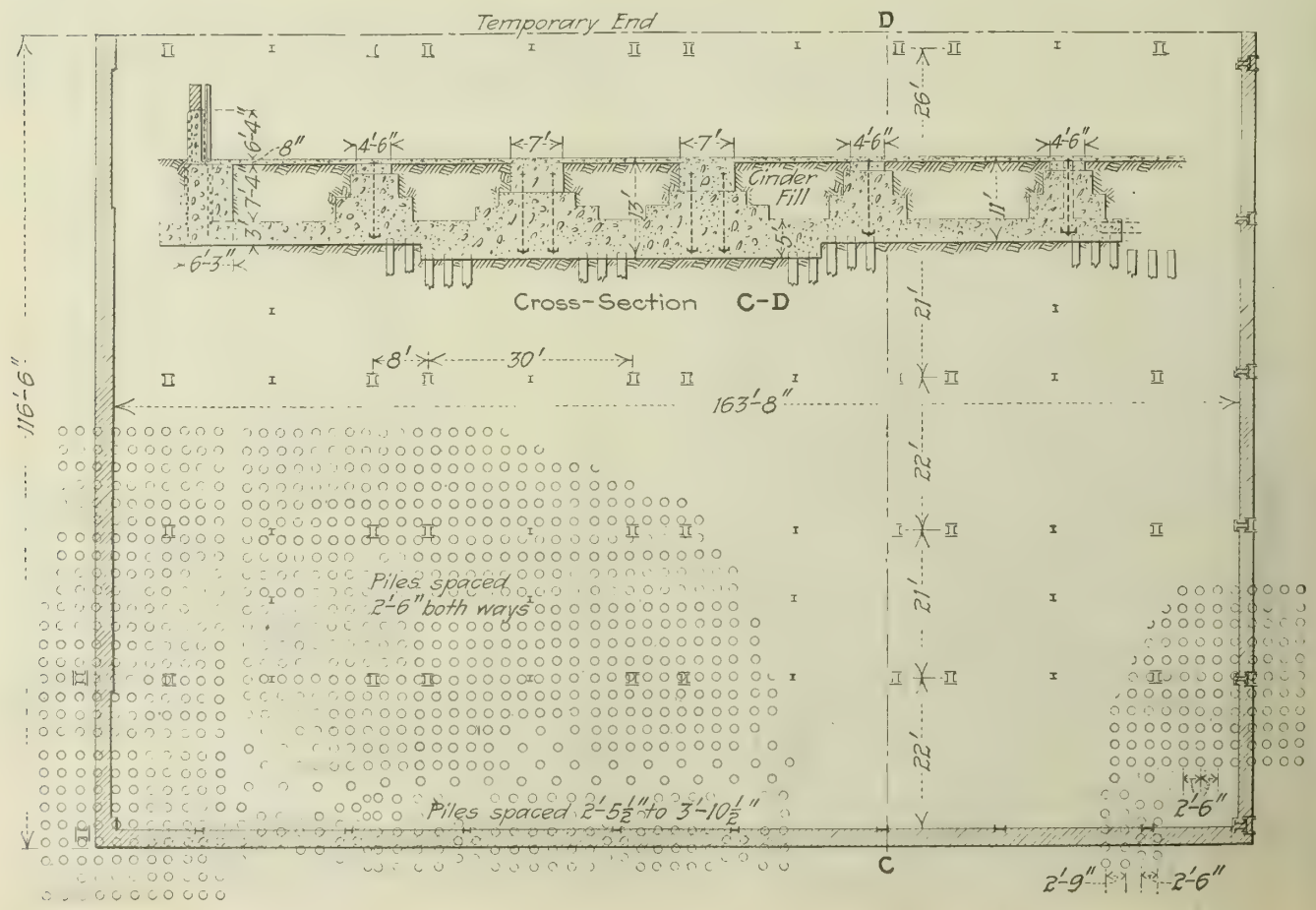


FIG. 5. BOILER-HOUSE PILING AND FOUNDATION MAT, ESSEX STATION

all over at substantially minimum spacing. There is no steel reinforcement in the mat of the boiler house or turbine room (except under the canals). In the switch house the 15-in. mat between column piers is reinforced and has no piles under it. The latter arrangement was selected, as the column loading did not require piles over the whole area, and the 15-in. mat ties the structure together, as

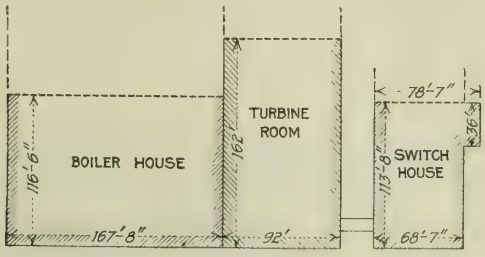


FIG. 6. KEY PLAN OF PLANT

there is a complete system of piling around and under the outside walls.

The boiler-house and turbine-house foundations, with complete piling and with uniform mat on which are supported stepped footings and piers for the columns, are shown in Figs. 4 and 5.

Piles are spaced 30 in. on centers, minimum spacing; there are about 9,000 in all under the entire group of buildings. They were driven after excavating to below low water behind a pile-and-earth bulkhead coffer-dam. The space between piles was refilled with cinders and earth to the desired bottom of the mat, 9 in. below cutoff. The tops of the piles were then peeled to give a clean contact with the mat concrete.

The mat in the boiler house is 36 in. thick, thickened under the stack columns up to 5 ft. in order to distribute the load over the required number of piles, but maintaining a uniform elevation of bottom over the remaining area. Thus there is ordinarily 27 in. of concrete over the pile tops except under the stable columns.

The concrete was placed in sections about 20 to 40 ft. square, as conditions permitted. No attempt was made to form vertical construction joints. A single curb timber of 6x6 was placed along the free edge of a section, its top flush with the intended top of the concrete, while below this curb the concrete was allowed to taper off outward at its own slope. Thus a long flat-sloping bond surface was produced, with a 6-in. rabbet or gain at its upper edge. The latter feature avoided the formation of a feather-edge joint on the surface of the mat.

The top of the mat is 7½ ft. below the column bases. Concrete piers are built on it to support the bases. Under several rows of columns in the turbine house and the switch house these piers are connected to form a continuous wall, which assists in the load distribution. Concrete floor surfacing will be laid on a cinder fill placed between walls and piers.

The Essex station was planned and designed by the engineering organization of the company, under N. A. Carle, Chief Engineer, Linde & Griffith, of Newark, N. J., were the contractors for the foundation.

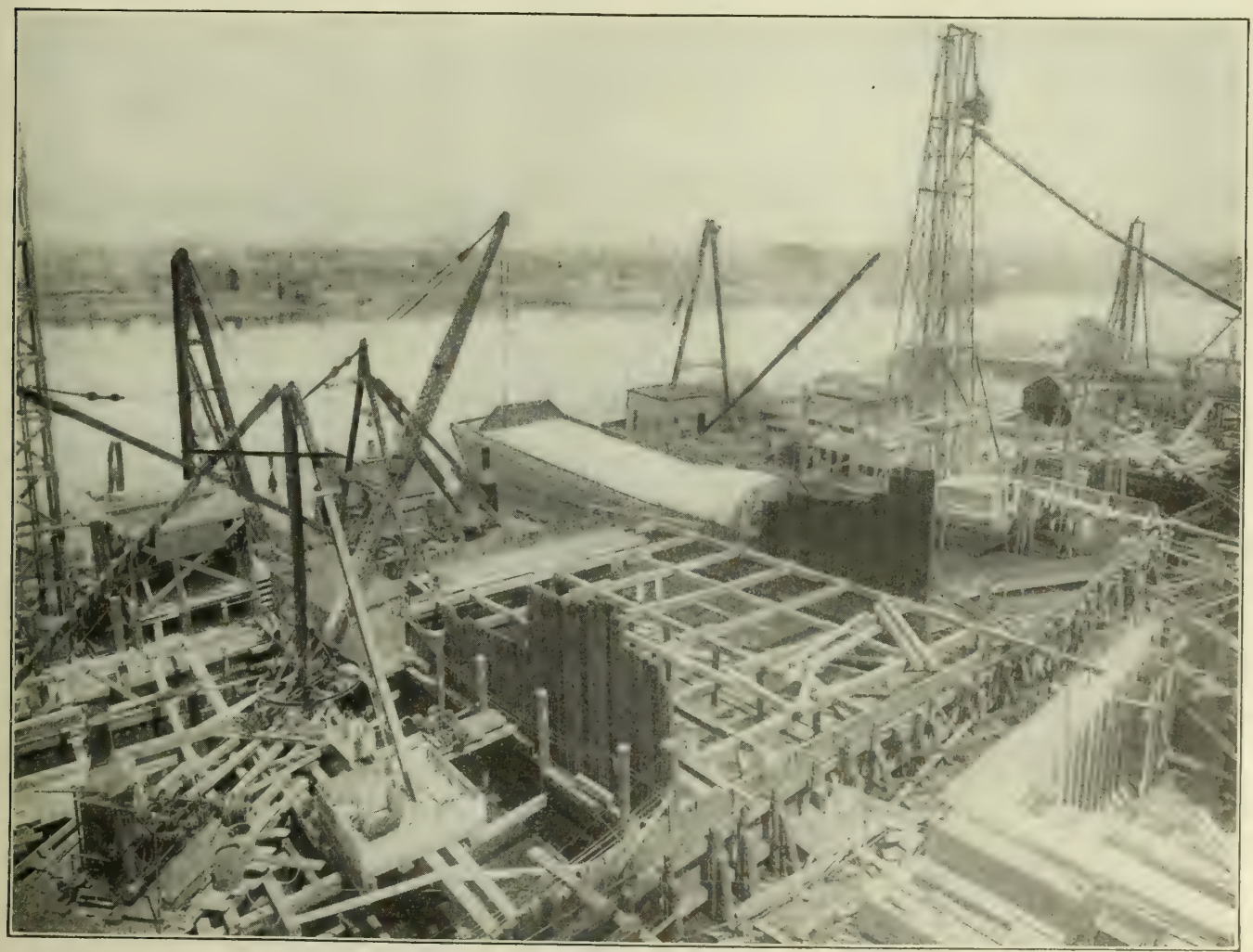


FIG. 7. FOUNDATION CONSTRUCTION PLANT ON ESSEX STATION (VIEW TOWARD TUNNEL FOUNDATIONS, MAY 11, 1915)

New Methods in Building Concrete Cottages

By C. E. Drayer*

A development of experimental work continued over a number of months is represented in the building of the concrete cottages shown in Figs. 1 and 2. D. S. Humphrey, of the Humphrey Co., owner of Euclid Beach Park, a summer resort on the Lake Erie shore near Cleveland, Ohio, was the chief factor in the development. He originated the concrete conveyor (Fig. 5), which is one of the striking features of the work. This is a distinct innovation in concreting methods.

The motive was the demand for summer cottages at a reasonable rent, but with modern conveniences, which required a durable but low-cost type of construction. The final answer, after considering various methods of building, was the monolithic poured-concrete house.

At first several concrete cottages with sloping roofs were put up. It was found, however, that the pitch roof was difficult and expensive to build and more difficult to keep in shape. Cracks would develop. Then the flat roof with earth covering was hit upon, and it has proved satisfactory.

The foundation of the cottage is a reinforced-concrete slab resting on the surface of the ground, which serves as a floor. Walls, partitions and roof are of reinforced concrete 4 in. thick. A parapet is built above the roof, partly to give a finished appearance, but also to retain the earth which is spread over the roof to keep off the sun's rays.

After the general shape of the cottage was worked out there was need to find a form which would allow full control of placing the concrete in the narrow walls. There was also need to devise a method of mixing and conveying for continuous supply of concrete of the proper consistency.

Wood forms had been tried, but were unsatisfactory both because of the difficulty in placing concrete and because of the expense of taking them down and setting them up again. A set of steel forms manufactured by the Hydraulic Pressed Steel Co. was then tried and found to be satisfactory. They are composed of pressed steel studs, with removable form plates fastened to them by U-clamps. In Fig. 3 all studding except that of the parapet

*1801 East 93rd St., Cleveland, Ohio.

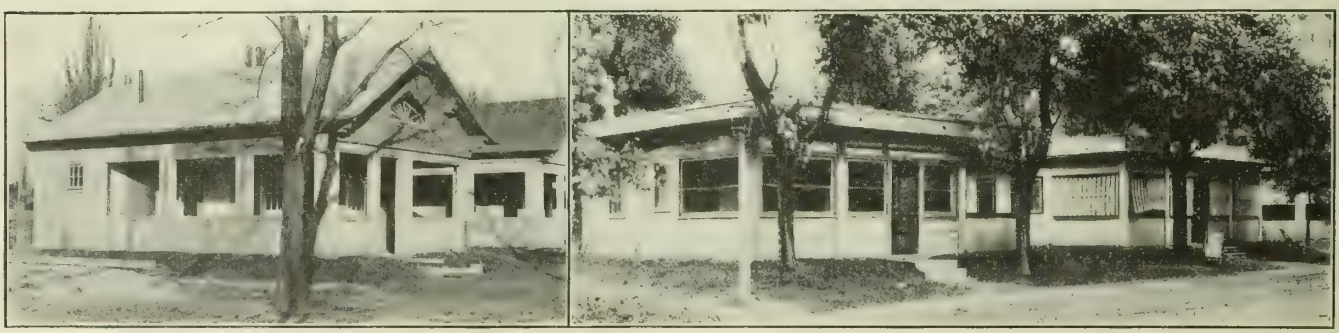


Fig. 1—Early design, with pitch roof Fig. 2—Final design, earth fill on flat roof

FIGS. 1 AND 2. CONCRETE COTTAGES AT EUCLID BEACH, A SUMMER RESORT NEAR CLEVELAND, OHIO

Designed to meet demand for low-cost durable beach cottages

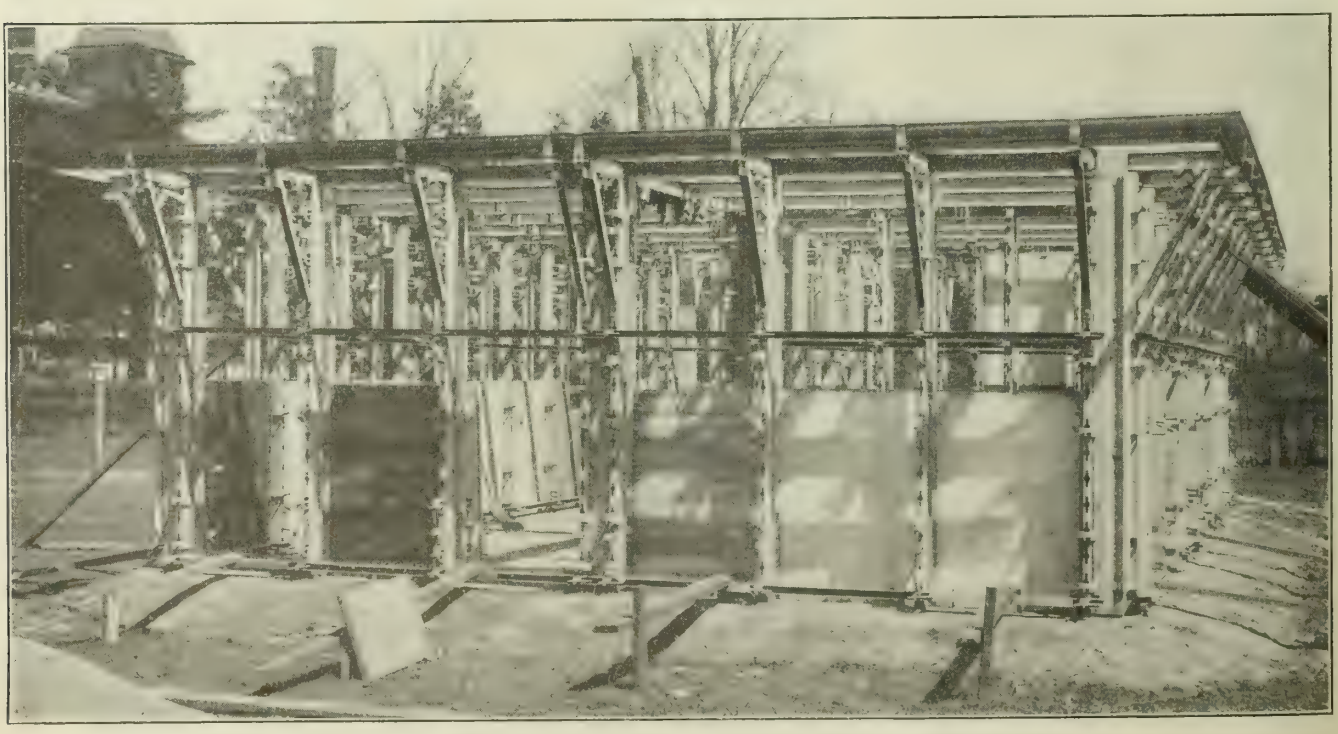


FIG. 3. STEEL STUDS AND PART OF FORMS FOR CONCRETE COTTAGE

is in place, with a few of the form boards attached. These forms consist of 1¾-in. tongued-and-grooved boards, with a pressed-steel plate on the face toward the concrete. The forms are held securely to the studs by wedge clamps, which are tightened with a hammer. Bolts fitting into keyhole slots in the backs of the studs hold the clamps securely in place.

The concrete is mixed by a continuous mixer, which discharges into a trough-shaped conveyor inclined upward and leading to a hopper above the roof of the cottage. A sprocket chain with steel scraper blades attached pushes the concrete up the conveyor trough into the hopper, from which a spout distributes the concrete to the forms. By swinging the conveyor and the spout, concrete is placed anywhere in the building. Mixer and conveyor are run by a small gasoline engine. About 4 hr. is required to pour one cottage, which contains about 50 cu.yd. concrete. A typical cottage is 35x21 ft., according to the plan, Fig. 4.

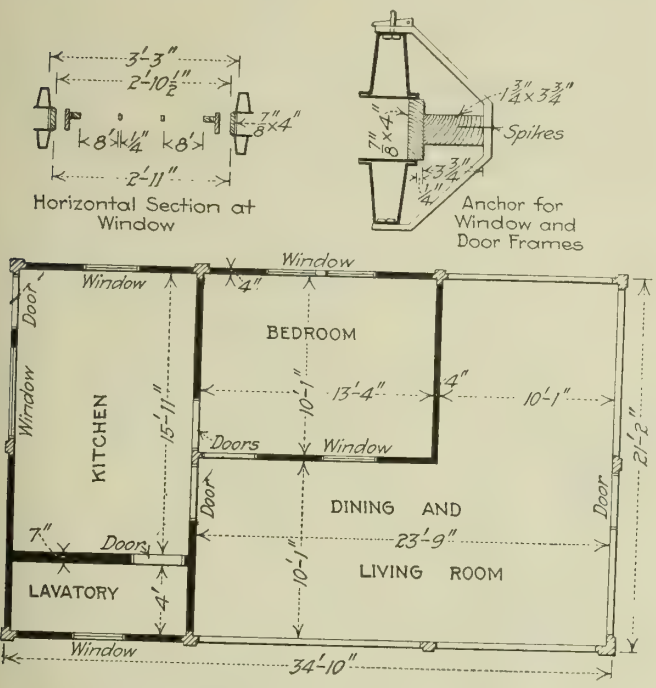


FIG. 4. CONCRETE COTTAGE BUILT WITH PRESSED STEEL FORMS

The interior face of the concrete is rubbed as soon as the forms are removed and later painted with a concrete paint. The exterior is bush-hammered, except the trim, which is rubbed till a smooth surface is gained.



FIG. 5. RAISING CONCRETE TO FORMS BY SCRAPER CONVEYOR FROM CONCRETE MIXER

The cost of the forms must be distributed over about 50 cottages in order that the part borne by each may be low enough to make them economical. It is expected that, with a gang working continuously, the concrete cottage with plumbing, electric wiring, screens, awnings, etc., can be built for about $600 under this community system, where a great number of similar buildings are built in the same locality.

Use of Electricity in North American Cities

An interesting table showing the per-capita consumption of electric power in Winnipeg as compared with other large cities in Canada and the United States has been made by H. E. M. Kensit, of the Dominion Water Power Branch, in connection with a study of power questions in western Canada. Only 20 cities were covered, as sufficiently complete data were not returned in response to inquiries of a larger list.

The high per-capita figures for power consumption in Winnipeg are due to the low cost of electricity and the high cost of coal and gas.

The quoted figures are given as only approximate, although believed to be substantially correct. Care was taken to cover all sources of public electric supply for each city, including street and elevated railways. In each case the load and output for the city and district are taken, but the population shown in the accompanying table is the estimated 1914 figure within the city limits.

ELECTRIC CENTRAL-STATION LOADS IN AMERICAN AND CANADIAN CITIES, 1914

	Estimated Population, 1914	Connected Load, Kw. Total	Connected Load, Kw. Per Capita	Peak Load, Kw. Total	Peak Load, Kw. Per Capita	Output, Kw.-Hr. Generated Total	Output, Kw.-Hr. Generated Per Capita	Figures Include
Atlanta, Ga.	199,740	88,000	0.440	44,320	0.222	145,684,803	730	Georgia Ry. & Pwr. Co.
Buffalo, N. Y.	457,900	137,872	0.310	67,424	0.147	302,220,107	660	Buffalo Gen. Elec. Co.; Cataract Pwr. & Condt. Co.
Chicago, Ill.	2,436,000	852,000	0.350	344,500	0.142	1,280,962,600	527	Commonwealth Edn. Co.; Str. Ry. Cos.; Sanitary Dist.
Columbus, Ohio	213,900	49,309	0.230	19,471	0.091	70,283,250	329	Columbus Ry., Pwr. & Lgt. Co.; Muncpl. Dept.
Detroit, Mich.	583,000			87,800	0.150	329,395,900	565	Edn. Illuminating Co.; Muncpl. Dept.
Louisville, Ky.	232,350	97,000	0.417	28,200	0.122	100,692,219	433	Louisville Gas & Elec. Co.; Str. Rys.
Milwaukee, Wis.	420,000			46,924	0.112	170,889,000	406	Wisconsin Edn. Co.; Commonwealth Pwr. Co.
Minneapolis and St. Paul	601,900	144,778	0.240	91,655	0.152	270,168,475	450	Minneapolis Gen. Elec. Co.; Consumers Pwr. Co.; Twin City Rapid Trans. Co.
Nashville and Chattanooga.	179,590	60,843	0.338	20,200	0.113	71,401,500	398	Nashville Ry. & Lgt. Co.
Philadelphia	1,671,000	202,086	0.121	82,078	0.490	275,711,745	165	Phil. Elec. Co.; Str. Rys.
Pittsburgh	572,700			71,000	0.124	316,500,000	553	Duquesne Lgt. Co.; Penn. Lgt. & Pwr. Co.
Portland, Ore.	314,000			47,775	0.152	199,166,000	634	Portland Ry. Lgt. & Pwr. Co.; N. W. Elec. Co.
Providence, R. I.	249,000	82,060	0.330	39,700	0.160	113,286,600	455	Narragansett Elec. Lgt. Co.; Rhode Island Co.
Rochester, N. Y.	248,000	68,177	0.274	29,813	0.120	123,850,785	500	Rochester Ry. & Lgt. Co.
St. Louis, Mo.	740,400			92,176	0.125	319,151,753	430	Union Elec. Lgt. & Pwr. Co.; Elec. Co. of Mo.; United Rys. Co.; Laclede Gas Lgt. Co.
Toledo, Ohio	187,250	60,315	0.322	23,965	0.128	91,996,426	491	Toledo Rys. & Lgt. Co.
Montreal, Que.	570,500	222,000	0.384	65,000	0.113	300,000,000	520	Montreal Lgt., Heat & Pwr. Co.
Toronto, Ont.	468,000	178,677	0.382	64,064	0.137	250,240,500	535	Elec. Lgt. Co.; St. Ry. Co.; Ont. Hydro-Electric System.
Vancouver, B. C.	186,400	61,290	0.330	34,300	0.184	124,884,565	668	B. C. Elec. Trac. Co.
Winnipeg, Man.	226,000	136,000	0.600	43,300	0.191	167,765,000	740	Winnipeg Elec. Ry. Co.; City Lgt. & Pwr. Dept.

Halifax Ocean Terminals

SYNOPSIS—Largest harbor work now in progress in North America. Contracts let total $7,000,000. Project to cost $30,000,000. Involves 6 mi. of new railway through virgin territory, 2,000-ft. landing quay, six piers and berths, all in deep water; complete railway and wharf intercommunication and modern freight equipment. Remarkable quay-wall construction of 60-ton concrete blocks stacked up to make 60-ft. wall.

The Dominion of Canada through its Department of Railways and Canals is now engaged at Halifax, Nova Scotia, in the construction of one of the largest port developments in the world—a development which comprises not only an entirely new location of the ocean terminals of a port now over 150 yr. old but also the radical revision of the railway entrance to the city. The scheme is of much more than local or even provincial importance, inasmuch as it is part of the transcontinental railway enlargements fathered by the Dominion Government and a bid for the transatlantic trade centering not only around interior Canada but the great northwest section of the United States. Started in 1913, it has been consistently carried forward even during the financial stress of the past year and has now reached a substantial advance in actual construction. Contracts already let total over $7,000,000. It is estimated that the finished scheme will cost four times that amount. The city of Halifax, the largest city in Nova Scotia, is located on the east coast of that peninsula, in a harbor of exceptional natural advantages. Direct passage is offered ocean steamers from the open sea through a wide bay entrance to deep-water berths protected by islands and promontories from the force of wind and waves and faced by a basin of ample space for maneuvering. Although quite far north, it is ice-free the year round. Furthermore, it is the port in North America nearest to Europe. Its location on the continent is not so advantageous, inasmuch as while it is on the Nova Scotia peninsula, "the long wharf of Canada," all railway connections must go north to the neck of that peninsula to reach the mainland. It has, however, an old-established railway which is tied up to the various Canadian transcontinental lines.

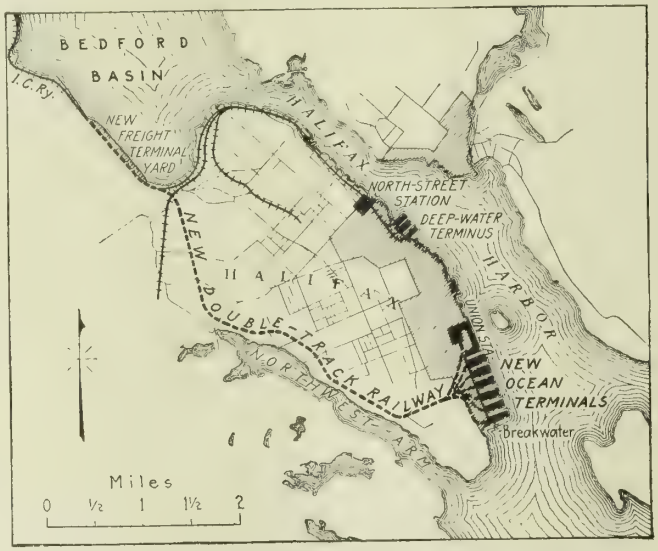


FIG. 1. MAP OF HALIFAX, NOVA SCOTIA, SHOWING LOCATION OF THE NEW DEEP-WATER TERMINALS

The city was founded in 1759 and had only a provincial importance until the beginning of the railway era, when for a time it promised to monopolize the trade of eastern Canada. The more orderly development of other Atlantic and St. Lawrence ports, and particularly their greater attention to transshipment and transportation necessities, soon caused them to surpass Halifax, and for many years it progressed but little as a port.

The defect at Halifax lay in poor railway connections, and more especially in inadequate and faultily located terminals. The main part of the city is situated on the east shore, about midway down a peninsula about 5 mi. long and 2 mi. broad, making out into the bay. This peninsula, particularly the northern section, rises rather abruptly from the shore, the rise continuing back to the neck. In consequence the early railway builders took advantage of the low level on the bay shore to bring the tracks to a point about halfway down the shore line. Since the construction of the road, over 50 yr. ago, the city has grown southward, so that at present the center of business is a long way from the terminals, and, more important, the shore south of the terminal has become crowded with private wharves, warehouses and factories, the removal of which to permit a southerly extension of the railway would be most costly.

For many years the ocean terminals have been in the congested districts just south of the railway passenger station, and in 1910, in an effort to improve conditions, the government undertook the reconstruction of this section, starting with the building of Pier 2, the large reinforced-concrete pier described in *Engineering News* of June 24, 1915. It was felt, however, that such provisions were only makeshifts and that some radical revision of the whole harbor must be made if the port were to be developed to meet the national needs anticipated in the Canadian transcontinental and transoceanic trade expansion consequent on the rapid development of this vast country. To provide for this expansion the Intercolonial Ry. has been greatly improved and will be double-tracked with revised grades from Moncton to Halifax.

The Intercolonial Ry. now entering Halifax and its connecting line, the National Transcontinental Ry., both of which are under government control form a continuous line from Halifax to Winnipeg under one management. At the same time the privately owned railways of Canada are being extended with a vigor comparable to the best progress made at a similar stage in the development of the United States. It has therefore naturally become a part of the Dominion's economic policy to develop an entirely Canadian control of the expanding trade between its people and Europe and to supplant the present partial control of existing trade by United States railways and ports, dictated entirely by present superior economic advantages.

Halifax seems to have at least three dominant advantages to further this policy. It is the nearest port to Eu-

rope open all the year round and at all times, and should therefore be most desirable for transatlantic mail and passenger routes. It is a safe and easily accessible summer and winter port for Canada, thereby differing from the St. Lawrence cities. It is an all-year port of call for shipping between Europe and North America. The last-cited circumstance is considered a most important factor, as it promises to guarantee a sure and constant outlet to trade even though the port is not established as a terminal. The accepted path of transoceanic steamers bound for United States ports would be lengthened only from 20 to 50 mi. in calling at Halifax.

As a result of these considerations the government in 1912 decided to establish at Halifax a new deep-water terminal which should furnish safe and accessible landing facilities for vessels of the largest and most modern type and communicating railway terminals for passengers and freight located in the most desirable situation with regard to city population and industries.

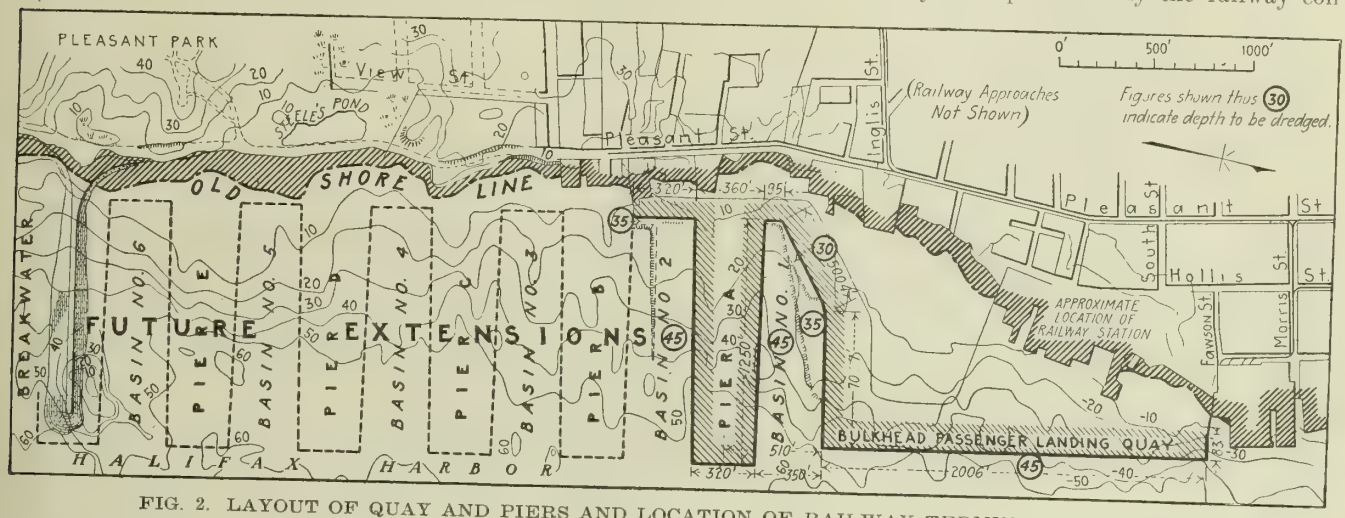


FIG. 2. LAYOUT OF QUAY AND PIERS AND LOCATION OF RAILWAY TERMINAL AT HALIFAX

An extended study of the harbor was made and designs were outlined at four different places—two at Dartmouth on the opposite side of the bay, one an extension of the old terminals near the station and one, which was adopted, near the south end of the peninsula. The Dartmouth schemes across the bay from Halifax were abandoned mainly because of the isolation of the sites, it being assumed from previous experience at other ports that it is difficult to establish new terminals removed from existing business centers. The extension of the present terminals was rejected largely because of the poor approaches along the narrow shore level and the expensive dislocation of the business district which would be required. The southerly plan was adopted because it did not have the disadvantages noted in the foregoing and in addition had several decided advantages, which can be enumerated as follows:

(1) A location convenient to the center of the city; (2) utilization of a part of the city waterfront hitherto little developed, and largely unoccupied; (3) comparatively small effect on assessment value and taxation; (4) turning space in front of the terminals sufficiently large to permit the maneuvering of the largest ships; (5) convenience of the topography for a railway-terminal location; (6) sufficient depth of water to care for any ship now in existence or in contemplation; (7) room for a large freight yard; (8) possibility of extension at small cost.

The location of the new deep-water terminal is shown in Fig. 1 and the layout in Fig. 2. It consists of a landing quay 2,006 ft. long and six piers with six berthing basins, all physically connected with a passenger and freight terminal approached by a double-track railway, which enters the city across the neck of the peninsula and connects with the piers through the point at the south end of the city. At the piers full equipment is to be provided in the way of warehouses, elevators and railway-terminal facilities, while on the shore of Bedford Basin, just before the railway makes its new detour back of the city, is to be built a large freight yard. A depth of 45 ft. of water is to be provided at all berths except two which will have 30 and 35 ft. respectively.

The whole project, from freight yard to terminal, is in territory not now in commercial use, so that business can be transferred from the old to the new location without interference or delay. At present only the railway connection, the landing quay, Pier A and the breakwater are under construction. In immediate prospect, however, is the erection of an elaborate terminal building which will house under one roof the required facilities for steamship- and railway-passenger service.

The total area to be used for the terminal will be about 260½ acres, of which 198½ will be land and 62 in water. The bulkhead landing quay, as stated, is 2,006 ft. long, will have a minimum of 45 ft. of water alongside and will carry for its full length a passenger and freight building, the ground floor of which is to be used for freight and the second floor for passengers, baggage, mail and express, connecting through a large concourse to the new Union passenger station for all the railways. On the north side of Basin No. 1 are berths for two ships, one 700 ft. long, with a minimum depth of 35 ft. of water and the other 500 ft. long with 30 ft. of water and each provided with double-story freight sheds 100 ft. wide, with three tracks at the back and one along the front of the quay. The five piers and basins (which have not as yet been started) will each be 1,250 ft. long and each from 320 to 360 ft. wide. The basins will be dredged to give a minimum depth of 45 ft. at low-water level. There will be four berths to each pier and each berth will be provided with two-story sheds and ample track connections. The layout of the station and terminal tracks is not yet complete.

At the extreme southern, or seaward, side of the piers a paved rubble-mound breakwater is being built along with the first unit of the docks. The breakwater will extend eastward from the shore into the harbor for a distance

of about 1,500 ft. and will be built out to and upon an isolated ledge of rock which is at present in places very close to the surface of the water. When required by demands of business, a quay wall can be built along the inner side of the breakwater, which will itself then compose the centering for a new pier.

The landing quay and the piers are to be of earth and rock fill behind concrete walls of novel construction. The design was selected after careful study of the requirements, which may be outlined as follows:

(1) The great depth of water (45 ft.) to be provided at low water; (2) the varying levels of the present bottom of the harbor, particularly of the rock surface; (3) the dip in the strata and the irregular nature of the rock and its broken and laminated character; (4) the impracticability of cofferdamming on account of the exposure, great depth of water and danger of leakage through the rock; (5) the effect of the frequent ground swell and wind and waves on any staging and floating plants, difficulty in securing good bottom for piles and anchors, great length of spuds required for dredging with scows and the regulation of the plant to the rise and fall of the tide; (6) the low range of the tide and consequent difficulty in securing bracing for either temporary or permanent works; (7) necessity for practically a vertical-face wall on a wharf to suit the modern midship section; (8) necessity for protecting the face of the walls against disintegration from frost or sea water and the action of ships; (9) avoidance of taking out any more rock from under water than is absolutely necessary and having to replace it with concrete; (10) reduction of diver and expensive subaqueous work to a minimum; (11) necessity for rapid construction.



FIG. 3. LOOKING NORTHEAST ACROSS HALIFAX HARBOR FROM SHORE END OF FUTURE PIER A

Quay-Wall and Pier Construction

The quay-wall method of construction consists in placing on a prepared bottom, in 30 to 60 ft. of water, stacks of hollow reinforced-concrete blocks fitting one on top of the other to form the required height and joined together laterally to form the continuous wall. After setting these blocks, their cells, which line up vertically, are to be completely filled with concrete for the first 5 ft. and above that each stack is to have its face cells and the middle line of transverse cells filled with concrete, the remainder of the other cells to be filled with stone riprap and sand so that in effect the completed wall will be a retaining wall with a concrete base and a concrete face strengthened with solid counterforts. Topping the wall above low water will be a granite-faced wall in the intertidal space and up to and including the coping, as a protection against the frost and sea-water action which might damage the concrete. The shed and warehouse structures will have their forward columns supported directly on the wall and their rear columns on pedestals footing on concrete-pile clusters driven through the fill which will be placed after the wall is completed.

The advantages of this method are that all the concrete is mixed with fresh water, molded in air, and allowed thoroughly to mature before coming in contact with sea water and placed so that it will not be subject to frost action. The mass concrete that is deposited under water is placed under conditions as nearly ideal as possible. The design of the walls obviates the necessity of using expensive temporary staging or floating cranes. Expensive foundations for the front row of the shed column are unnecessary. Settlement, expansion and contraction are provided for by means of the short sections and the leeway afforded by the reinforced-concrete guides.

While cellular concrete blocks for subaqueous wall construction are not new, in no other work have they been developed to such magnitude as at Halifax, nor has the method of placing and filling them ever been used before. At the present over 1,100 out of the 3,634 blocks required have been cast and are in storage at the site (see

Fig. 7), but the placing has only just started, the view in Fig. 8 showing the first block being swung into place on Sept. 25. The method in which the blocks are intended to be laid—which in the limited practice so far offered has proved very successful—can be outlined. The process of laying is also sketched in Fig. 6.

Placing the Concrete Blocks in Wall

The details of a typical block are given in Fig. 5. As shown in the general elevation, this block is only typical of those in the main part of the shaft, there being special shapes and sizes for the base blocks and for the top blocks. The block shown, however, is sufficiently typical for purposes of description. It is 31 ft. wide, the width



FIG. 4. LOOKING SOUTHEAST ACROSS HALIFAX HARBOR FROM SHORE END OF FUTURE PIER A

of the completed wall; 4 ft. high and 22 ft. long, and weighs 60 tons. It is reinforced not only against its loads as a part of the wall but against handling stresses. The walls are solid except for the triangular openings shown (provided so as to insure a good bond with the fluid concrete placed in the cells) and also vertical circular openings for grouting, as afterward described. On each side are provided triangular vertical openings which serve as grooves to engage the square guide posts used in setting the blocks. These posts are in appearance the same as reinforced-concrete piles and are cast in a similar manner. Great care is taken in getting plane surfaces and truly right-angled edges in the blocks, for upon these features depends the verticality of the finished wall.

The surface of the bottom, upon which the lowest block is laid, is prepared by dredging, or where already low, by filling up to the required grade with mass concrete or a rubble mound. The final leveling is made in the chamber of a diving bell, to be described in a later article. Inside of this bell the subsurface is cleaned up and where necessary at the back or front brought to proper elevation by filling holes or depressions with concrete, and then low concrete pedestals each about 5x6 ft. footing on solid rock (or concrete or rubble fill) are laid, with tops finished to true grade about 3 in. above the surrounding bottom. These pedestals are located at back and front at the junctions of stacks of blocks. The first block is then picked up with special tongs slung from a traveling crane, the jaws of the tongs fitting into specially prepared openings in the bottom of the block. With the crane running on a standard gage track and standing with outriggers set on an already completed stack (see Fig. 6), the block is lowered overboard, effort being made to keep it lightly engaged against the vertical guide posts which have been plumbed and fastened into the corresponding grooves in the last stack already set. After the block is lowered to bearing on the pedestals, the succeeding blocks of the stack are placed until the stack is complete. The sealing concrete for the two bottom risers is then placed by bottom-dump buckets from a floating concrete mixer or delivered from the molding yard concrete mixer by flat cars running on the standard gage track behind the crane, and then the filling of the proper cells with concrete to the top of the stack is completed. After this filling is finished, grout is forced into the vertical 10-in. holes, which, matching up, form a continuous well through the stack. It is expected that this grouting will fill any voids left where the bearing of the blocks is not perfect or the concrete filling has left holes. Finally the remaining cells are filled with rubble gravel and sand.

The placing of the blocks has from the first been attended with the greatest success. The guide and key posts which are carefully plumbed for each stack automatically bring the blocks into true position without the

assistance of a diver whose services are required only for inspection and to see that all is clean and clear for the bottom blocks and mass concrete of each stack. No difficulty is found in keeping the stacks vertical or in securing good alignment. The tendency to "creep" longitudinally or to get out of line is corrected by using different combinations of the three standard sizes of posts provided. The variation in levels between the highest and lowest corners of the top blocks of the stacks as set does not average more than ½ in. Blocks for about 500 ft. of wall have already been set with a 150-ton standard-gage steam locomotive wrecking crane which travels out on ordinary railway track laid on stringers resting on the stacks of empty blocks and extended by stack lengths of 22 ft. as the block setting proceeds. The same crane is used for lifting the blocks from the molding platforms to standard flat cars on which the blocks are transported out to the wall head. As many as two stacks each of nine blocks have been set in one working day and an average per day of one stack of blocks loaded from the yard and set in the wall is easily maintained.

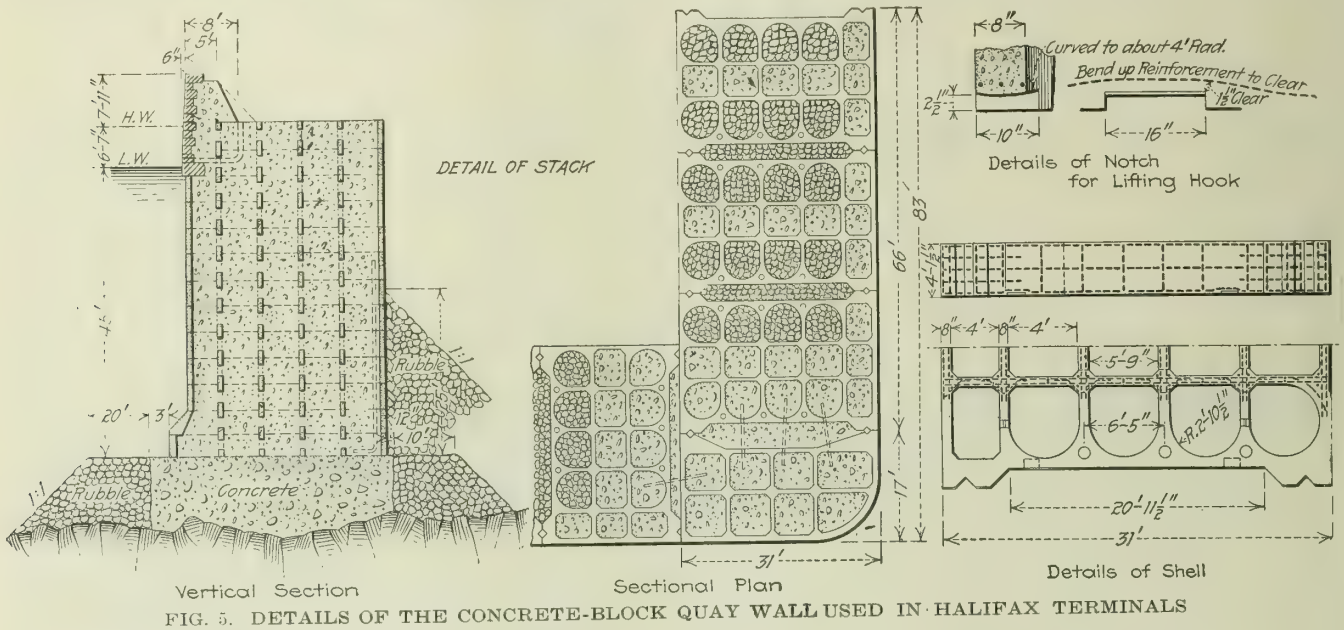


FIG. 5. DETAILS OF THE CONCRETE-BLOCK QUAY WALL USED IN HALIFAX TERMINALS

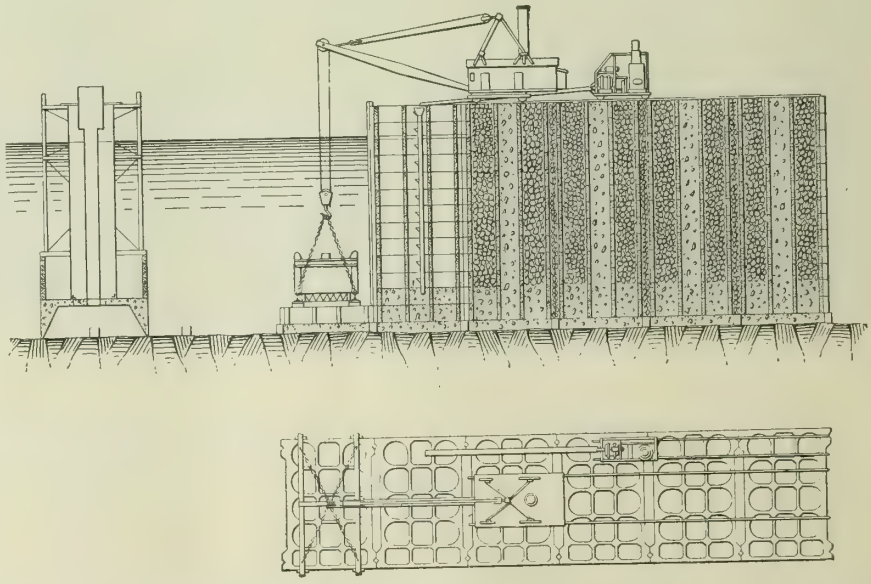


FIG. 6. SKETCH SHOWING METHOD OF LAYING BLOCKS IN QUAY WALL

As the map in Fig. 1 shows, the new railway entrance leaves the old main line at the lower end of Bedford Basin and continues down the west side of the city to the terminals, a distance of about 6 mi. Except for the freight yard along the shore of the Basin and the four-track approach to the terminal yards, the line will be two-track. On account of the topography and the short length of the new line, it was impossible to balance the cuts and fills, so most of the work is in cut, the spoil being carried north to make the freight yard and south to the breakwater and back fill of the quay and pier walls. The total excavation is about 1¾ million cubic yards and the deepest cut about 60 ft.

Some difficulty was experienced in locating the line because the Northwest Arm, along which it runs, is a beautifully wooded section highly desirable as a residential, park and recreation district. On this account the line was kept well back from the water, and all crossings of streets leading to the water side district are to be carried above grade on handsome reinforced concrete arch bridges.

Subaqueous Excavation

The landing quay and piers were located to fit as closely as possible to the natural shore line so that excavating below water for the required depths would be at a minimum. However, it is necessary to dredge about 250,000 cu.yd. of the rock bottom to attain the desired low-water depths (maximum 45 ft.), and this spoil is used mainly in filling in behind the walls. This excavation for the most part is in fairly hard rock which requires blasting before dredging; but in some low areas the rock lies at a depth of from 50 to 90 ft. and it is necessary to dredge out the overlying mud. In these sections a granite rubble mound is deposited to form a foundation for the quay-wall blocks.

The railway connection to the terminals and the details of the contract work which comprise the block-making,

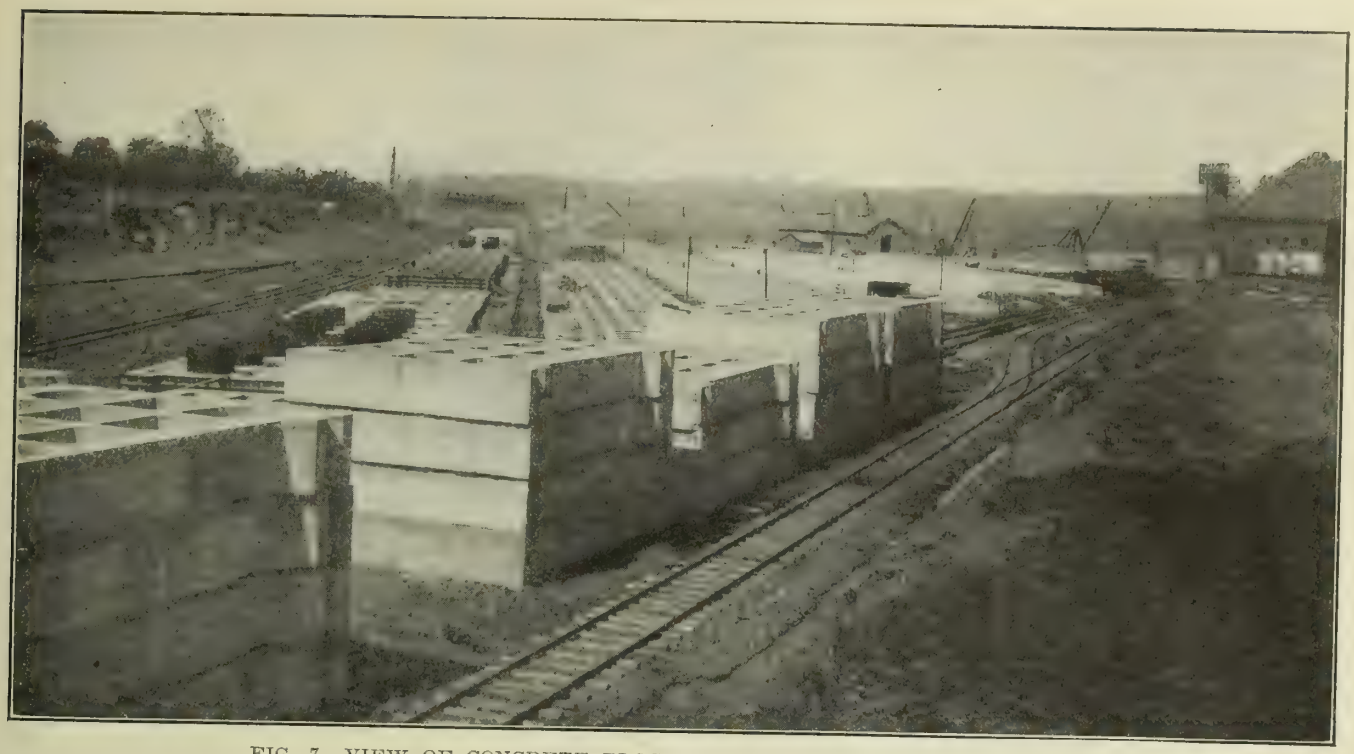


FIG. 7. VIEW OF CONCRETE BLOCKS IN STORAGE IN HALIFAX YARD

dredging, diving-bell methods, quarrying, etc., will be described in later articles.

The deep-water terminals at Halifax are being built by the Department of Railways and Canals, under the direction of the Minister, Hon. Frank Cochrane, and under the direct personal supervision of F. P. Gutelius, General Manager of the Canadian Government Railways. Design and construction are in immediate charge of James McGregor as Superintending Engineer, with F. W. Cowie, of Montreal, as Consulting Engineer on the dock works and C. B. Brown, Chief Engineer of the Canadian Government Railways, as Consulting Engineer on the railway works. A. C. Brown is Resident Engineer on the dock works, R. H. Smith is Resident Engineer on the railway works and J. J. Macdonald is Office Engineer. The railway grading contract is held by the Cook Construction Co., Ltd., and Wheaton Bros., with Andrew Wheaton and I. J. Bowes in charge, and the dock contract by Foley Bros., Welch, Stewart & Fauquier, with J. P. Porter and R. B. Porter in charge of operations representing the company and J. W. Roland as their Chief Engineer.



FIG. 8. SETTING THE FIRST BLOCK IN THE HALIFAX QUAY WALL, SEPT. 25, 1915

British Cement Specification

In a new edition of the British Standard Specification for Portland Cement (obtainable from the Engineering Standards Committee, 28 Victoria St., Westminster, London, S. W.) some changes in the fineness and strength provisions are made. The new fineness clauses allow a maximum residue of 14% through a 180-mesh sieve and 1% through a 76-mesh. The maximum tensile strengths for seven days have been raised to 450 lb. per sq.in. for neat cement and 200 lb. per sq.in. for 1 : 3 mortar.

The growth of tensile strength required at 28 days both for neat cement and cement and sand is now obtained by means of a formula in place of the fixed percentages which have been specified hitherto. The formula gives a progressive increase instead of the somewhat irregular steps of the method previously adopted, but has the effect of requiring a somewhat increased percentage of growth on the higher seven-day figures.

The clauses dealing with the preparation of the briquettes have been amplified, the procedure being described in greater detail than has previously been the case. Ramming and hammering are expressly prohibited, but the wording of these clauses still leaves scope for wide differences of opinion as to the quantity of water to be used and the precise methods of filling the molds. In the test for final setting time the Vicat needle is provided with a fixed metal circular cutting edge set ½ mm. back from the point, with the idea that this will clear the scum which sometimes forms on the surface of the pat.

Buffalo Barge Canal Terminal

The New York Barge Canal will terminate at Buffalo, N. Y., in the old Erie Basin, which is being deepened and improved for the purpose. The basin extends north along the shore line from the mouth of the Buffalo River to the new Black Rock channel and is formed by the old New York State breakwater, of stone masonry. There were originally three piers running from the inner side of the breakwater, and the depth of water was about 9 to 14 ft. Of late years the basin has become obstructed by a number of sunken vessels and scows.

The work of adapting the basin for the Barge Canal terminal consists of building two piers out from the shore, deepening the entire area to 23 ft. of water, removing the old piers at the breakwater, and removing about 400 ft. of the south end of the breakwater in order to give an outlet to Lake Erie.

The plan of the terminal basin is shown in Fig. 1. The work is under the direction of Frank M. Williams, State Engineer. L. D. Brownell was formerly Resident Engineer and E. H. Anderson is Assistant Engineer in Charge. H. S. Kerbaugh, Inc., of Buffalo, has the contract.

Deepening the Basin

The depth of water was from 3 to 12 ft., with rock at a depth of 15 to 25 ft.; but rock excavation was required over nearly the entire area. The material above the rock was mainly sand and clay, with some hardpan. The loose material (860,000 cu.yd.) was removed with a large dipper dredge having a 50-ft. steel boom and a bucket of 7-cu.ft. capacity. The wrecked vessels were mainly removed by means of a derrick boat 181x36 ft., having at each end a stiff-leg derrick of 75 tons' capacity, with 53-ft. mast and 83-ft. boom.

For rock drilling, two drill boats are employed, one having five and the other four drill frames. These drill 3½-in. holes to a depth of about 26 ft. below water. Each hole is charged with about 50 lb. of 60% dynamite, the cartridges being put down through a 2¼-in. pipe in the drill hole. The shattered rock (280,000 cu. yd.) is removed by the dredges and either loaded into scows or deposited directly at the site for the new piers.

Construction of the Piers

The two piers will be used for the transfer of freight between the canal boats and railway cars or lake vessels. They will be diagonal to the shore line, as shown in Fig. 1, with lengths (on the longest side) of 576 ft. and 397 ft. Both will be 150 ft. wide. Between them will be a slip 250 ft. wide. The sides and ends will be formed of rock-filled timber cribs resting on a bed of broken rock and surmounted by concrete walls 8½ ft. high, having their tops 6½ ft. above water level. This construction is shown in Fig. 2. The space between the two lines of cribs will be filled with dredged material, the rock being deposited against the cribs and the loose material in the central portion.

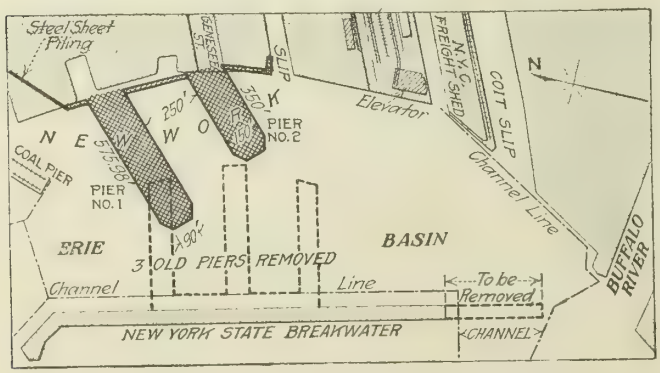


FIG. 1. PLAN OF THE TERMINAL FOR THE NEW YORK STATE BARGE CANAL AT BUFFALO, N. Y.

The bulkhead walls at the shore line will be of similar construction. A line of steel sheetpiling will extend from the north end of the bulkhead to form one side of a 280-ft. slip along the coal pier of the Philadelphia & Reading R.R., as shown.

The cribs, Fig. 3, are 20 ft. wide and 20 ft. high, built in lengths of 100 ft. They are of 12x12-in. timbers, with planking on the bottom course to retain the rock fill. The timbers are put together with horizontal 1¼-in. screw bolts, 26½ in. long, and vertical 1-in. button-head drift bolts, 22 and 30 in. long. The drift bolts are

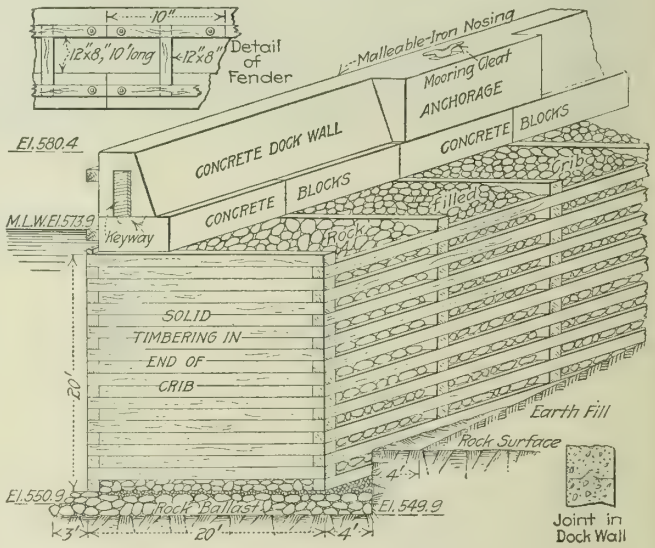


FIG. 2. CRIB AND CONCRETE WALL CONSTRUCTION FOR PIERS AND BULKHEADS

slightly inclined, as shown, and are driven in $\frac{15}{16}$-in. bored holes.

The 100-ft. cribs are built at the edge of the water on a tilting platform, which turns on trunnions. This is counterweighted to stand normally level, so that there will be no danger of its tilting while the crib is being built. When a crib is completed to about two-thirds its full height it is launched by hitching a tackle from an overhead frame to the rear of the platform. This is done so that it will not be too heavy for handling, the remaining timbers being added while the crib is floating. Some rock is placed for ballast and the crib then towed to place and sunk by filling with rock from a derrick scow. Dredged material is added to make a solid fill.

Concrete Dock Walls

The concrete walls forming the faces of the piers and the bulkheads are built up of a bottom course of concrete blocks and an upper course of monolithic construction. This is shown in Figs. 2 and 4. The lower course consists of flat blocks 10x6 ft., 3 ft. thick, with recesses in the top and ends and weighing about 15 tons each. In each block are three loops or stirrups of 1-in. bars for the hoisting slings. These blocks rest directly on the

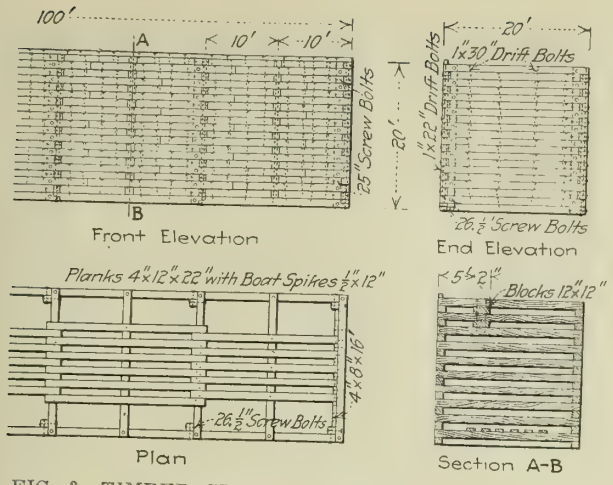


FIG. 3. TIMBER CRIBS FOR PIERS AND BULKHEADS

top timbers of the crib, at its outer face, but are set back about 12 in. from the edge.

The upper part of the wall is poured in place, in lengths of about 40 ft. Its joints are made to correspond with those of the concrete blocks below. The ends of the sections are connected by vertical keys and keyways of triangular section, and the keys are painted with asphalt. This part of the work is 5½ ft. high, 4 ft. 10 in. wide on the base and 3 ft. on top, the water face being vertical. At intervals it is made wider in order to carry the cast-iron mooring cleats. The concrete mix will be 1:2½:5, with Niagara River gravel for the coarse aggregate.

The upper edge of the wall is protected against wear by a continuous rounded nosing of malleable iron. Along the face of the wall is a fender of two lines of 12x8-in. timbers, with posts of the same size 10 ft. apart. The timbers are secured to the wall by bolts in iron tubes embedded in the concrete.

Operating Results of the Palo Alto Refuse Incinerator

The incinerator put in operation by the City of Palo Alto, Calif., Jan. 7, 1914, described in detail in *Engineering News*, Mar. 4, 1915, p. 432, and May 27, 1915, p. 1040, has a daily capacity of 30 tons of mixed refuse, garbage, etc. The incinerator is of the Dundon high-temperature type, with a single cell, a level drying hearth, forced draft, a combustion and supplementary combustion chamber, a boiler, and air and water heaters. The furnace has two grates and a total grate area of 33 sq.ft. There is special machinery for handling refuse, dead animals, ashes and clinkers. The plant cost about $18,000.

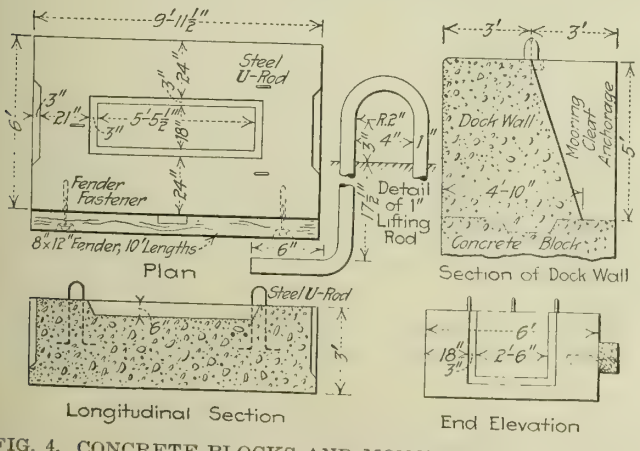


FIG. 4. CONCRETE BLOCKS AND MONOLITHIC CONCRETE WALL, BUFFALO BARGE CANAL TERMINAL.

The total amount of refuse burned in the year ending June 30, 1915, was 1,871.66 tons. The weight of residual clinker, ash, etc., was 449.74 tons. The average amount of refuse burned per hr. was 0.75 ton, and the average burned per sq.ft. of grate area was 45 lb. per hr. The amount of water evaporated per lb. of refuse (boiler pressure 140 lb.) was 0.09 lb., which is exceptionally low because the boiler was operated only a small part of the time. Ordinarily the water evaporation at 140 lb. boiler pressure is about 0.25 lb. per lb. of refuse. The average composition of the refuse was 1,044 lb. of water, 401 lb. of combustible matter and 555 lb. of non-combustible matter per ton of refuse. The population of Palo Alto is about 5,500.

OPERATING COST DATA OF PALO ALTO REFUSE INCINERATOR

Credits		
Receipts from refuse collection charges		$3,051.00
Sale of steam to power plant		84.62
Sale of junk		19.85
Receipts from cremating 9 horses, 3 cows, 19 dogs		23.00
Miscellaneous receipts		25.23
		$3,203.70
Debits		
Cost of operation:		
Destructor plant wages	$1,487.30	
Power	70.92	
Fuel	26.62	
Supplies	9.50	
Maintenance	11.00	
		$1,605.34
Cost of collection:		
Refuse collectors' wages	$2,404.90	
Wagons	12.00	
Teams	10.00	
Repairs	41.45	
		2,468.35
General expense:		
Salaries	$385.00	
Printing and stationery	194.95	
Sundries	74.65	
		654.60
Bond interest		893.09
Depreciation		700.13
		$6,321.51
Loss in operation		$3,117.81

Under the method of collection in force in 1914-15 a direct charge was made for garbage and refuse collections, varying from 15c. per month for collections once a month to $1.75 per month for daily collections. This resulted in a deficit of about $110 per month, and since July 1, 1915, the following schedule of collection charges has been in force:

Removal of garbage twice per month	$0.25 per mo.
Removal of garbage once per week	.50 per mo.
Removal of garbage twice per week	.80 per mo.
Removal of garbage three times per week	1.25 per mo.
Removal of garbage six times per week	2.50 per mo.

The refuse to be removed is not limited to garbage, but includes all forms of waste matter and tree trimmings, which are taken care of by the garbage collectors without extra compensation.

A sanitary inspector is appointed whose duty it is to examine all premises not less than once a month and report any violations of the collection ordinance to the health officer. According to the ordinance the garbage is to be collected at least once per month.

Recovery of Byproducts from the Pickling Liquor of tinplate and galvanized-wire plants is announced from Pittsburgh as an early probability. Experiments appear to show that both acids and pigments may be obtained from the pickle. Different colors or tints would be produced by subjecting the solids to varying degrees of heat.

Freight Yard at Birmingham

SYNOPSIS—This new yard is of the gravity switching type. It takes the place of four old yards and is designed for future enlargement. It includes engine terminal facilities. Some of the special features of the plant are described.

To meet the requirements of increasing traffic at Birmingham, Ala., the Southern Ry. has built (at North Birmingham) a freight yard and engine terminal representing an expenditure of about $661,000. This has been named the Finley yard, in honor of the late president of the railway. It supersedes four old yards in the same district and was designed to provide for the probable needs of the next 25 yr., separate units to be built as required. The present unit includes a receiving yard, gravity classification yard, storage yard and repair tracks, roundhouse, sewers and water-supply system, coal-, cinder- and sand-handling plants, and lighting and compressed-air facilities. The freight yards have a total capacity of about 2,000 cars. The plan and the profile are shown in Fig. 3 and some of the special features are described below.



FIG. 1. CINDER PITS AND CINDER-HANDLING PLANT IN THE FINLEY YARD

Freight Yards

The receiving yard consists of eight tracks (45 cars each) and two running tracks, the former laid 12½ ft. c. to c., the latter 15 ft. c. to c. The grade is level for about half the length, and then ascends at 0.5% toward the switching hump. The classification yard has 16 tracks (47 cars each) and two running tracks, spaced as previously mentioned. The grade is mainly 0.25%.

There are five caboose tracks (173 caboose cars), two repair tracks of 74 cars' capacity, ten local freight and storage tracks (53 cars each) and a six-track coal-storage yard (35 cars). The coal-storage tracks descend at 1%, so that cars are run to and from the hopper by gravity.

Switching Hump

In building humps or inclines for gravity switching, the Southern Ry. fixes the grades by actual tests, cars being run over the hump and the grades adjusted to meet the local conditions. This is done not only in new yards, but also in old yards when new scales are installed. The grades for the hump at the Finley yard are shown in Fig. 3. The grade ascending from the receiving yard is 1.7%. The descent commences with a short starting grade, followed by 0.6% over the scales, 3.8% to the foot of the hump, 0.89% along the ladder and 0.35% through the classification tracks. Vertical curves, 20 to 50 ft. long, are used at all grade intersections. A concrete subway eliminates the necessity of employees crossing the hump tracks.

150-Ton Track Scale

The track scale on the hump track is of the suspension-bearing type, 150 tons' capacity, in four sections. It is 54 ft. long, with a live weighing surface of 50 ft., and has an automatic weight recorder with a device which prevents a weight being recorded when more than one car is on the scale. The main and extension levers are of cast iron, the fifth lever is of cast steel and all pivots and bearing steels are of special alloy.

The scale is installed in an open pit, as shown in Fig. 2, having concrete abutments and two intermediate piers on each side to support the dead platform. The platform stringers support the dead rails by malleable-iron castings the thickness of the timber deck. The live rails are supported by short sections of I-beams which rest on the weigh-bridge girders and project between the floor-beams to the platform surface.

The weigh-bridge is maintained on the 0.6% grade by means of adjustable wedge blocks. Lateral movement is checked by adjustable side buffers and longitudinal movement by buffers on the ends of the girders and just clearing steel plates in the abutments. The live and approach rails are connected by Bohannan-Dugger easer joints, which prevent excessive impact and reduce the vibration of the scale mechanism. This mechanism is protected by a timber deck and dirt shields.

A special feature is an interlocking device for the switch above the scale. This prevents unauthorized use of the scale (as for the passage of engines); it prevents cars being run on the scale before the weigh-master has had time to adjust it, and it places the responsibility for weighing and care of scales. Two interlocking levers are fitted in the scale house, the door of which must be

closed before either lever can be operated. The door being closed, the throw of the first lever locks the door and unlocks the lever controlling the switch. The throw of the latter then locks the door-controlling lever. Before the weigh-master can open the door to leave the scale house he must close and lock the switch by throwing the second lever.

The track at the lower end of the scale is equipped with a spring switch. For night work there are two electric headlights so mounted on posts that their rays intersect 4 ft. above the rail and directly in front of the scale beams. General lighting of the scale and upper part of cars is furnished by a 40-watt cluster of lamps on the front of the scale house.

When a train having both weigh and nonweigh cars is being passed over the hump the foreman of the switching crew notifies the weigh-master of the approach of each weigh car by means of an electric bell in the scale house, operated by a push-button at the hump.

Engine Terminal Facilities

The roundhouse, 92 ft. wide, is of reinforced concrete, with a roof slab of concrete and hollow tile covered with tar and gravel roofing. There are 25 engine pits, with one truck-wheel drop-pit and one driving-wheel drop-pit. The windows are of wire-glass and metal sash, each window having an area of 284 ft. (58% of the panel area). The floor is of creosoted-wood blocks on 5 in. of concrete. The turntable is 90 ft. long, motor-operated, in a concrete pit.

The ash-handling plant is of special interest and is shown in Fig. 1. There are four ashpits, 160 ft. long, arranged in pairs, each pair equipped with an electric overhead traveling crane. The cranes have a span of 46 ft. 8 in., supported by steel runways on bents 20 ft. 6 in. c. to c., with a clearance of 16 ft. over the tracks. They handle 1½-yd. grab buckets. Each crane is operated by one man. The pits are of plain concrete, 4x4 ft., with track rails fastened to inverted channels secured to the top of the walls by U-bolts. The bottoms are sloped for drainage and are protected from damage by the grab buckets by means of two rails embedded at the surface of the concrete.

The coaling station (of reinforced concrete) has a capacity of 1,000 tons, of which 60 tons is held in four



FIG. 2. TRACK SCALE WITH OPEN PIT ON THE SWITCHING HUMP IN THE FINLEY YARD

15-ton scale pockets, fed from the main bin above. Coal is dumped from hopper-bottom cars into a track hopper and elevated to the storage pocket by a motor-driven elevator of the chain-and-bucket type at the rate of about 100 tons per hr. Locomotives on either of four tracks are supplied with coal from the scale pockets. The scales are fitted with type-registering beams, enabling the operator to determine the amount of coal taken by each engine.

The sand-storage and drying building, of reinforced concrete, has a capacity of 100 cu.yd. of wet sand. From the track hopper the sand is elevated to the storage bin by a motor-driven belt-and-bucket elevator. It is fed by gravity to three stove driers under the bin and the dry sand is delivered to a steel drum, from which it is conveyed by compressed-air to a storage tank in the monitor of the coaling station. From there it flows by gravity to spouts at the coaling tracks. A motor-driven compressor is located in the drying room. Sand is delivered to the wet bin at about 35 tons per hr. and dried at the rate of about 1 ton per hr.

Air-Brake Testing Equipment

Facilities have been installed for testing the brakes on trains made up for departure. A motor-driven compressor, with a capacity of 1,000 cu. ft. of free air per minute (at 100 lb. pressure and 150 r.p.m.) delivers air to a receiver 54 in. in diameter and 12 ft. long, located above ground and about 50 ft. from the compressor house.

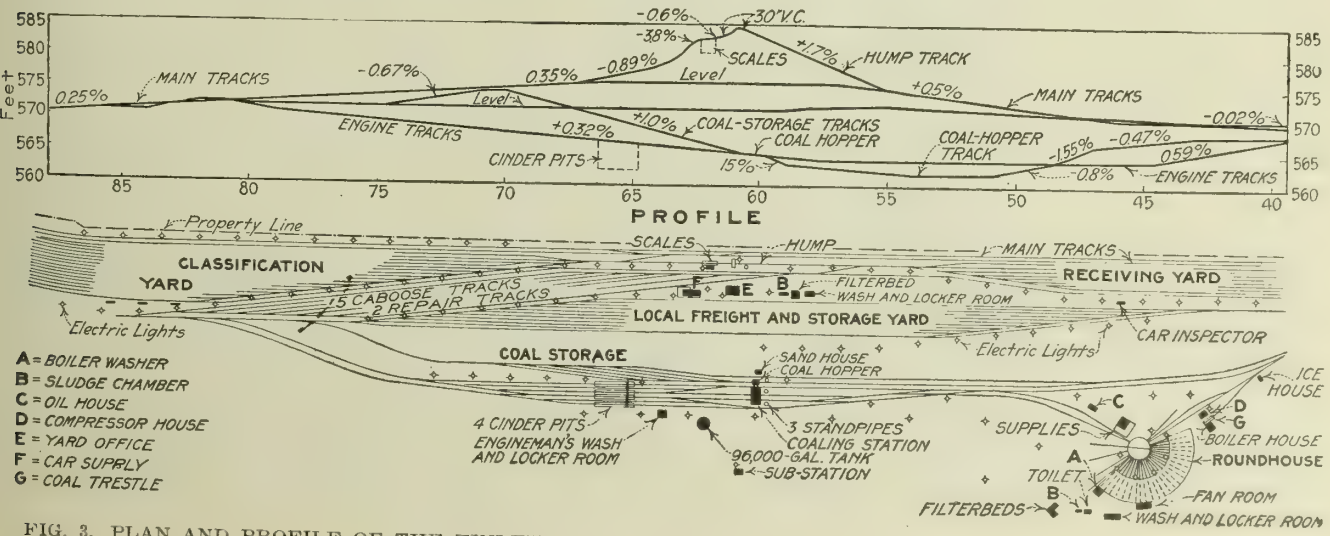


FIG. 3. PLAN AND PROFILE OF THE FINLEY FREIGHT YARD AND ENGINE TERMINAL OF THE SOUTHERN RY. AT NORTH BIRMINGHAM, ALA.

A 2½-in. wrought-iron main is laid in a creosoted-wood box so as to be readily accessible, and from this 1¼-in. lines are run to the center of each yard track at about the clearance point. Each is connected to an angle cock and standard hose coupling inside a reinforced-concrete service box, which is flush with the tops of the ties.

The distance from the air compressor along the 2½-in. main to the farthest service box is about 6,550 ft. There are 38 outlets, one at each end of 15 tracks in the classification yard and one at the west end of each of the 8 tracks in the local freight and storage yard. Condensation reservoirs, 24 in. diameter and 36 in. long, equipped with drain cocks, are placed in concrete pits at the lowest points in the main pipe line. The compressor also supplies air to the roundhouse.

Electric Light, Sewers and Water-Supply

The entire yard is lighted by 130 nitrogen lamps of 400 cp., located as indicated on the plan, Fig. 3. Some of the poles carry electric horns for audible signals to the switchmen. Current is purchased from a local company.

The local water company furnishes water for yard and fire protection purposes, the railway company installing the pipe lines on its property and having two elevated tanks, of 96,000 and 48,000 gal. A circulating high-pressure main for fire protection takes water directly from the water company's mains. There are two sewage-treatment plants, one near the roundhouse and the other near the yard office. Each consists of settling tanks and intermittent slow sand filter beds. The yard has a complete drainage system.

The terminal was built under the direction of B. Herman, Chief Engineer of Maintenance-of-Way and Structures, and T. H. Gatlin, Assistant Chief Engineer of Maintenance-of-Way and Structures.

Home Examination for Assistant Building Inspector

An unusual civil-service examination for assistant building inspector was held in Madison on Aug. 28 by the Industrial Commission of Wisconsin (Sydney G. Williams, Building Inspector). Each candidate wrote his answer in his home, without supervision. Accompanying the list of questions were the following instructions:

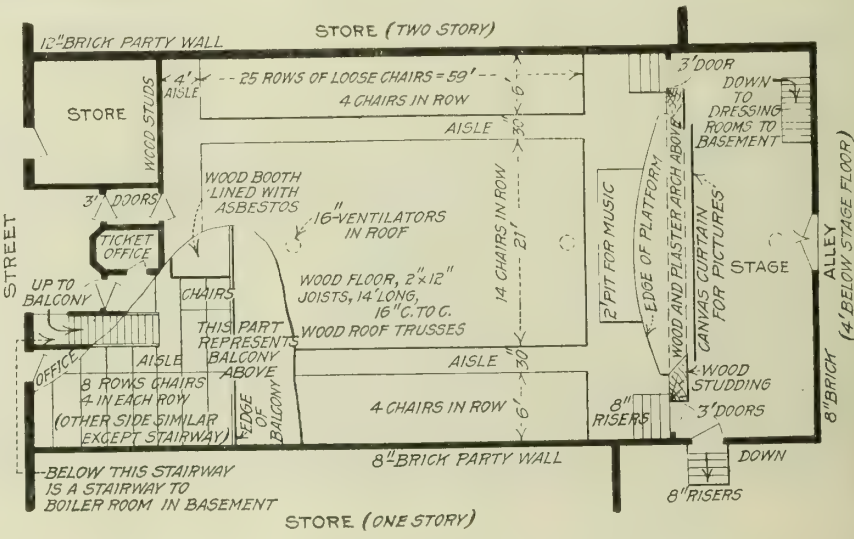
The questions are of such a nature that the answers can be written in 4 hr. You are permitted to consult any books or other printed matter that you desire, including the state-building code, of which a copy has been sent you, provided you note in connection with each question all books or other references which you consulted. You are not expected to have an exact knowledge of the requirements of the present state building code, but rather to answer the questions according to what you understand to be standard practice. You are also permitted to consult other persons if you desire, but you are advised not to rely on such information but to answer the questions on the basis of your own experience and judgment. You will note in connection with each question all persons whom you consulted.

The eight persons who passed the examination were assembled for an oral examination, which was designed to indicate the personality and judgment of the candidates. Written and oral examinations were given equal weight, and the three with the highest averages were appointed at a salary of $1,500 per year.

The method of examination was adopted, it is stated, because it is cheaper for both state and candidate, it enables the candidate to take the examination without the knowledge of his employer and it more closely approximates working conditions. The Wisconsin Civil Service Commission has employed the same general method in the selection of a supervisor of apprentices. The questions asked follow:

1. Discuss the purpose and methods of fire-resisting construction. What safeguards against fire would you employ in (1) a five-story reinforced-concrete hotel; (2) a three-story furniture factory, of mill construction, 100x150 ft.?

2. (a) Suppose you are sent to inspect a theater built some years ago in a town of 5,000 people, you find the theater to be as shown on the accompanying plan. What would you do? Suppose the manager of the theater says your requirements are unreasonable; that he has run the theater for 15 years and never had a fire; that he would have to go out of business rather than make the changes which you ask. What will you do then?



THEATER PLAN TO BE INSPECTED BY CANDIDATES

(b) Let the same plan now represent the plan for a new theater, sent to you for approval. What changes, if any, would you require?

3. What are the main points of danger to workmen on new buildings? What would you (as state inspector) do to prevent accidents on a large building having a steel frame, concrete floors and brick wall?

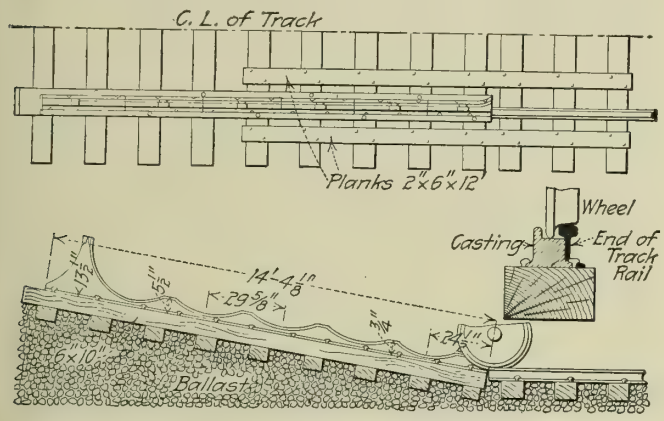
4. Design either (1) a reinforced-concrete floor over a school boiler room, 14x20 ft., the room above being a class room; or (2) a wood-joist floor for the auditorium of a church, 40x60 ft. in plan, one row of columns being permitted in the basement.

5. If ordered to inspect a three-story, twelve-family tenement house, what sanitary features would you investigate? What standards would you require?

Marketed Production of Phosphate Rock in the United States in 1914 was 2,734,043 long tons, valued at $9,608,041, according to W. C. Phalen, of the United States Geological Survey. There has been a decrease since 1913 amounting in quantity to 337,178 tons or 12%, and in value to 19%. The production of phosphate rock has been steadily increasing for many years, with an occasional exception, until 1914, when a diminished output is recorded, caused chiefly by conditions outside the country. Stocks on hand at the close of 1914 showed a decrease for the entire country amounting to 9%. In 1914 Florida, the leading state in the production of phosphate rock, marketed 2,138,891 tons, or 78% of the entire production of the United States. The Florida phosphate rock consists of hard rock, land pebble and river pebble. Exports amounted to 964,114 tons.

Car-Stop of Novel Design for Use in Yard Tracks

A car-stop which catches the wheels of cars instead of acting as a bumper has been applied by a number of railways, especially on stub tracks ending at streets or other points where it would be dangerous for a car to overrun the track. In the past a large number of very serious accidents have occurred at just such locations where the ordinary bumper had been installed.



CAR-STOP FOR YARD TRACKS

As shown in the accompanying drawing, it consists of two sets of castings forming a 15-ft. continuation of the track rails and having a series of concave depressions to engage the wheels. These castings are placed on 6x10-in. stringers, inclined to give a rise of 24 to 30 in. at the rear end. It would take very high speed to drive a car to the end of this device, and the raised end would then keep it from over-running. The depressions are about 29 in. c. to c., with a drop of 3¼ in. for the first two and 5½ in. for the others.

The car wheels ride on their flanges on the car-stop and the brakeshoes and rigging are carried clear of the ridges as shown in the section in the accompanying drawing.

The device is made by the Saunders Car Stopper and Equipment Co., 113 North 2nd St., St. Louis, Mo. The Southern Railway Supply Co., St. Louis, is sales agent.

Aerodynamic Experiments Made in M. I. T. Tunnel

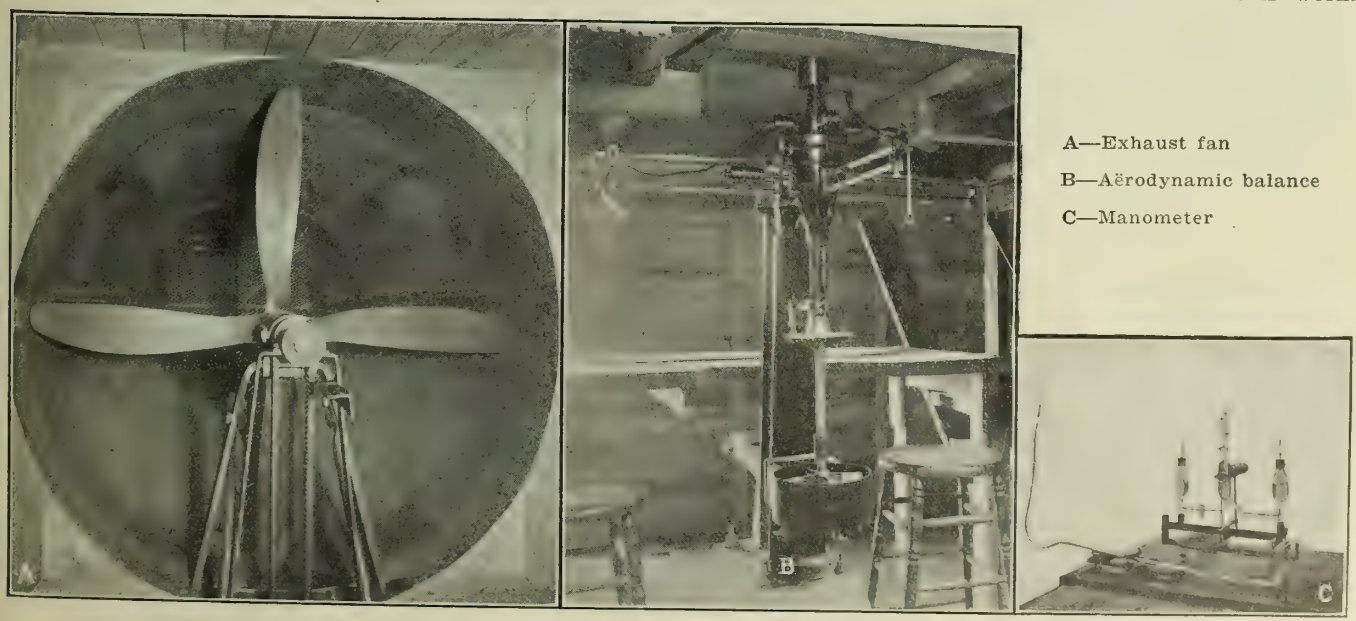
An aërodynamic laboratory for the study of the characteristics of air currents has been constructed and is the first building completed in the new group of the Massachusetts Institute of Technology at Cambridge, Mass. The laboratory consists of an inexpensive structure housing a wooden tunnel 4 ft. square and about 40 ft. long, through which air is drawn by means of a four-blade wooden propeller 7 ft. in diameter, revolved by a 25-hp. electric motor with chain drive. The flow velocities obtainable are as high as 35 mi. per hr.

The portion of the tunnel next to the fan is built of a sheet-metal cylinder, which diminishes in size toward the connection with the wood section. A wire grating is located just within the tube to catch any objects which might be drawn toward the fan, thus protecting the latter from injury. The mouth of the tunnel, at the opposite end from the fan, is fitted with horizontal tubes 12 in. long, to give direction to the air after it enters the tunnel.

Midway of the tunnel are planes for objects on which tests are to be made, and beneath this is located a balance which weighs three components—the forward push of the air on an object, the lift and the twist of air currents at varying velocities. This apparatus was manufactured in England on the pattern of one now in use at the National Physical Station at Teddington and was exhibited at the Royal Academy, London, before being sent to America. It is the only machine of its kind in this country. The accompanying views illustrate some of the details.

Pressure gages for tests of air pressures on objects in various relations under varying velocities can be placed at different locations in the tunnel, and experiments are being made with propeller blades for aëroplanes to determine their most efficient shapes.

The courses in aërodynamics at the Institute of Technology are given by the Department of Naval Architecture and Marine Engineering. The laboratory equipment and instruction are in charge of Lieut. J. C. Hunsaker, U. S. N., who was detailed for this work.



A—Exhaust fan
B—Aërodynamic balance
C—Manometer

AERODYNAMIC LABORATORY APPARATUS AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE

Field and Office

Transferring Paving Materials from Cars to Pavement

During the summer and fall of this year a 6.1-mi. brick-paved country road was constructed from New Lexington toward Somerset, Ohio, under unusual conditions. The contractors succeeded in doing away with practically all hauling problems by building an extension of the Pennsylvania Lines alongside the roadway and bringing cement and brick direct from the manufactory to the job.

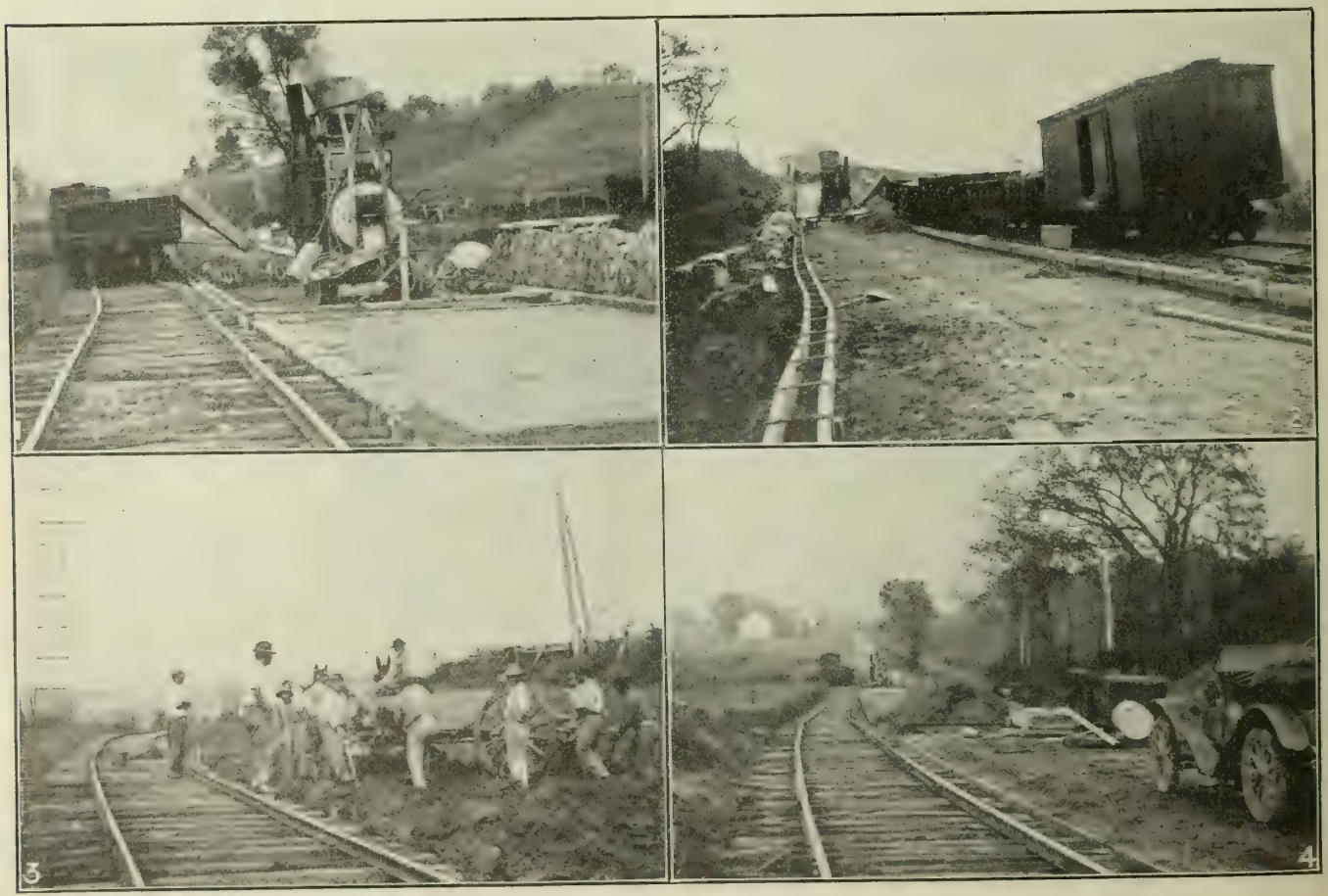
The pavement begins about 600 ft. from the union station of the Pennsylvania Lines and the Toledo & Ohio Central R.R. at New Lexington. Here the contractors' railway connects with the side tracks of the Pennsylvania Lines, and in the intervening 600 ft. between the main line and the beginning of the pavement a siding was built to accommodate three or four cars. This served as the contractors' sorting yard.

The new pavement follows the line of the old road. The soil is heavy clay. Before deciding on the construction methods the contractors came to the conclusion that teaming or motor-truck hauling was out of the question, and it was then that the decision was made to build a standard-gage construction railway.

The design called for a brick pavement 16 ft. wide with 5-ft. earth shoulders. It was determined to begin grading at once (last winter), and for this purpose a steam shovel was employed. As soon as pavement work could be begun in the spring, the whole force was employed laying track on the left-hand shoulder of the roadway. Old discarded ties and second-hand 60-lb. rails were used. When about ¾ mi. of track had been laid the paving work commenced.

The roadbed was finished to subgrade by hand shoveling and carting (Fig. 3), then rolled and the concrete base laid to the end of the track. The supply train for this stage of the work consisted of a box-car of cement on the forward end, a gondola car of sand and two gondola cars of gravel (Fig. 2). These were kept abreast or somewhat ahead of the Koehring paving mixer. The cement, sand and gravel were unloaded into wheelbarrows, the cement in bags and the sand and gravel through wooden chutes. One car of gravel was so spotted that this material could generally be discharged directly into the mixer hopper. Water for the mixer was pumped from small streams crossing the road and piped alongside the pavement on the right-hand side. A valve for a hose connection was placed about every 300 ft. on this pipe line.

It required considerable ingenuity to handle the cars correctly, for the contractor had but one locomotive (45-ton Shay geared), and a 6½% grade near the begin-



TRANSFERRING PAVING MATERIALS DIRECT FROM CARS TO PAVEMENT; ROAD AT NEW LEXINGTON, OHIO

ning of his track prevented hauling more than one car at a time on this part of the line, and there were no sidings other than the one at the beginning of the track. The four cars of material made about one day's work (600 ft. of 4-in. concrete base), so that cars could be shifted at night or out of working hours.

When the base was constructed to the end of the completed track, five or six carloads of brick were brought up and distributed at proper intervals. About this number of car loads was laid in a day. The brick were shipped in gondola cars, and to unload them, a shelf was hung by brackets to the side of the car. Two or three men in the car laid the bricks on this shelf. On the ground below, a two-step bench was laid parallel to the car. This permitted the men below easily to reach the brick on the shelf and to transfer them to the pavers. Fig. 1 shows a pile of brick at the side of the roadway, but this was the exception; they were unloaded during a wet spell to release a car.

The grouting was not done until the brick had been laid up to the end of the completed base. Then a grouting car was run over the line. This was a steel gondola. The sand and cement were mixed in the bottom of the car and transferred to a grout box on the pavement by a chute. The grouting was carried on continuously, the same crew working successively at the different operations.

The specifications did not limit the amount of brick laid before grouting the joints. The wording is: "Soon after the pavement has been properly compacted and surfaced, and before any dirt or other foreign material has entered the joints, they shall be filled with 1:1 portland cement grout."

When the pavement was completed, another ¾-mi. section of track was laid. Whenever possible the track construction work was done at times when the crew could not be employed on paving work. About five men were required as a permanent track gang, for, on account of frequent rains and subsequent washouts, the track required constant attention. Prompt and efficient operation of this little railway prevented the accumulation of demurrage charges, so that this item did not enter the cost.

The cost of the railway line on this job may be roughly estimated as follows: Rails, about $1,500 per mi.; ties (5c. for old ones, 30c. for new), about $1,000 per mi.; labor for track construction, about $550 per mi., and labor for removing track, about $550 per mi. The locomotive cost $4,500; but this could be considered a permanent investment. It is estimated that the cost of handling material was between 10c. and 15c. per ton-mile.

Aside from the economy in this particular case, it would have been nearly impossible to have hauled heavy loads on the soft shoulders and subgrade of the roadway. Moreover, no special outfit (except the locomotive) was required for hauling, and no special crew was employed on hauling work. When not moving the construction train there was always plenty of work for the locomotive, such as switching, spotting cars, etc. The variety of work to be done made it possible to keep the construction gang busy even during an exceptionally rainy summer, when on many days no paving work could be done.

The road was constructed under specifications of the Ohio State Highway Department, Clinton Cowen, Commissioner. The contractors were Swank & MacIntyre.

Mixer Supplies Three Jobs; Gasoline Dinkey Haulage

By H. B. Watters*

Gasoline dinkeys haul concrete cars at a speed of 40 to 50 mi. per hr. on long hauls from the mixing plant to the Little Scioto Viaduct on the new Chesapeake & Ohio Northern Ry. now building in Ohio. The mixing plant is located near where the line crosses over the main track and a siding of the Baltimore & Ohio Southwestern R.R., about 1 mi. east of Sciotoville, Ohio, and supplies concrete for the abutments of this crossing (3,800 cu.yd.), for a 20-ft. concrete arch (containing 1,000 yd.) for a highway undercrossing located about 1,000 ft. from the mixer and for the piers and abutments of the 1,080-ft. viaduct over the Little Scioto River. The viaduct footings contain about 6,000 yd. of concrete and are located 3,500 ft. north of the mixer.



GENERAL VIEW OF LIGON MIXING PLANT NEAR SCIOTOVILLE, OHIO

The accompanying view was taken from a trestle thrown across the B. & O. S. W. Ry. on about the grade line of the new railway. At no point are the materials handled by hand, except in the case of the cement when it goes into the mixer. The gravel and sand are shipped to the site on the B. & O. and are unloaded by derrick

*Resident Engineer, Chesapeake & Ohio Northern Ry., Sciotoville, Ohio.

into hoppers placed directly above the mixer. The mixer is charged from the hoppers and the concrete is dumped into 1-yd. cars and taken to the viaduct and to the highway crossing by the gasoline dinkeys. The concrete is deposited in the forms by derricks or chutes. On the long hauls the concrete trains consist of three 1-yd. cars. C. Y. Ligon & Co. are subcontractors under Rinehart & Dennis. M. J. Caples is in general charge of the work for the C. & O. N. Ry. W. Michel is Chief Engineer. The writer is engineer on Residency No. 1.

20-Ton Derrick with Roller-Bearing Mast

The large steel guy derricks which are used so generally in the erection of steel buildings and bridges frequently give trouble in swinging because of the friction on the bearing which forms the foot of the mast, and which is generally a ball working in a hemispherical socket in the shoe. The swinging is done usually by hand power applied to a lever on the mast. In some cases a bullwheel and a cable have been employed, but the distance to the hoisting engine is so great that it is difficult to have the various signals promptly obeyed, especially as the engineman has also to operate the hoisting and luffing cables.

To eliminate this difficulty in erecting the steel framing for the William Penn Hotel at Pittsburgh, derricks with roller-bearing turntables for the shoe and head of the mast were designed by the Bergendahl-Knight Co., of Chicago, which had the contract for the erection. The derrick thus equipped was turned by one man, although ordinarily three or four men would be required with a derrick carrying a load. The derricks and bearings were built by the American Bridge Co. The bearings can be applied to old derricks.

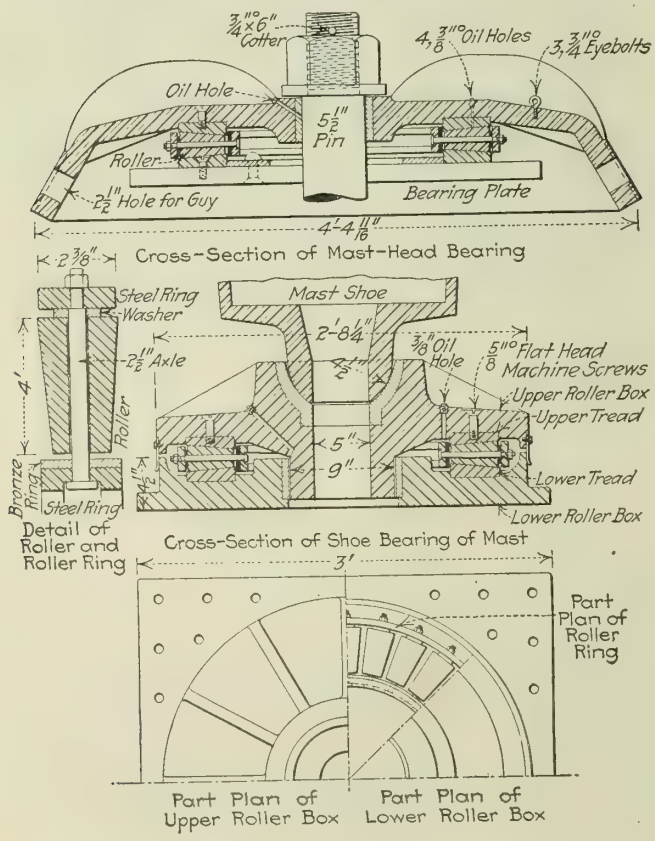


FIG. 1. ROLLER BEARINGS FOR SHOE AND MAST-HEAD OF 20-TON DERRICK

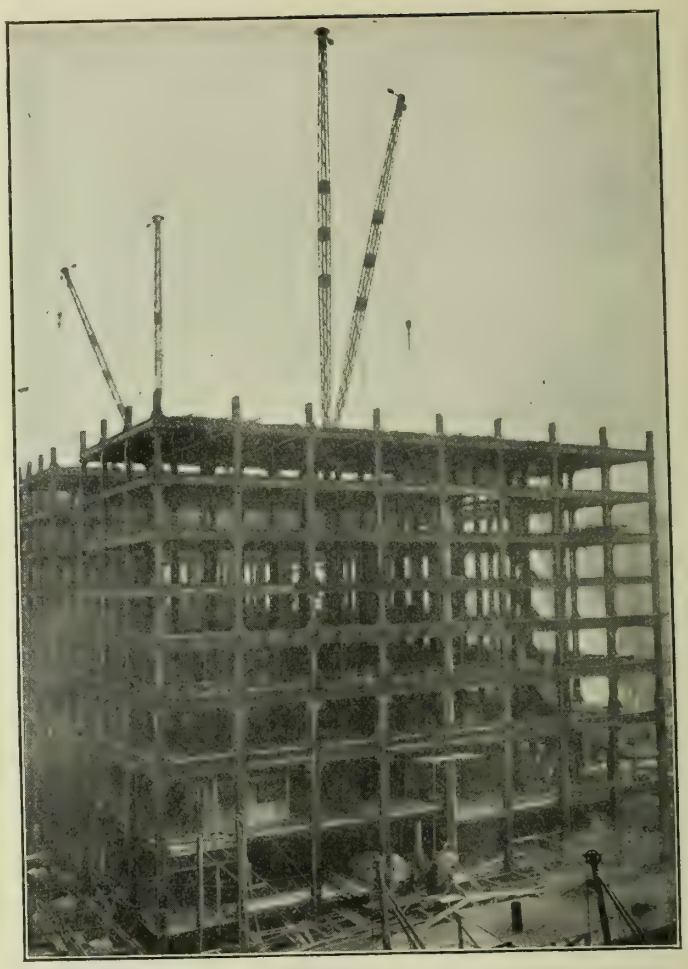


FIG. 2. TWO 20-TON ROLLER-BEARING GUY DERRICKS, WILLIAM PENN HOTEL, PITTSBURGH (101-FT. MAST, 90-FT. BOOM)

Roller Bearings for Derrick Mast

The mast bearings are shown in Fig. 1. The foot of the mast has the usual hemispherical foot, so that pressure on the roller bearing is centralized even if the mast is not exactly vertical. This bearing consists of two plates or roller boxes, with a live-ring of rollers between. The foot of the mast rests in a hemispherical bushing in the upper roller box, which has a stem fitted into a bushed socket in the lower box. This prevents any rocking of the upper box and keeps the two boxes concentric.

The roller boxes are steel castings (annealed) and have attached to them the tapered treads of tool steel. Between these are the 28 conical rollers, which are of die steel. The roller axles are carried in two forged-steel rings, with a bronze ring on the inner side and a bronze washer on the outer end of each roller. The roller boxes form an annular oil chamber, retaining oil up to the level of the axles, so that the rollers move in an oil bath. The opening between the outside edges of the two boxes is closed by a steel band which is secured to the upper box by screws. This excludes dirt. The design is very compact, as the bearing is only 3 ft. square on the base and 12 in. high.

The masthead bearing is of similar construction. The hood to which the guys are attached has a bushed bearing for the 5½-in. mast pin, and this hood forms the upper roller box, with the roller tread secured to it by screws.

The lower tread is carried by a 36-in. bearing plate bolted to a similar plate forming the cap of the mast. The rollers run in oil, as previously described. The hood has eight 2½-in. holes for the guys.

Other Features of the Derrick

The derrick has a mast 101 ft. high and a boom 88 ft. long, giving a horizontal reach of 90 ft. Both pieces have two 14-ft. removable sections (the four sections being interchangeable), and the splices for these are made with splice plates on four sides.

The mast and boom, Fig. 3, are of box lattice construction, with four chord angles, 4x4 in. for the former and

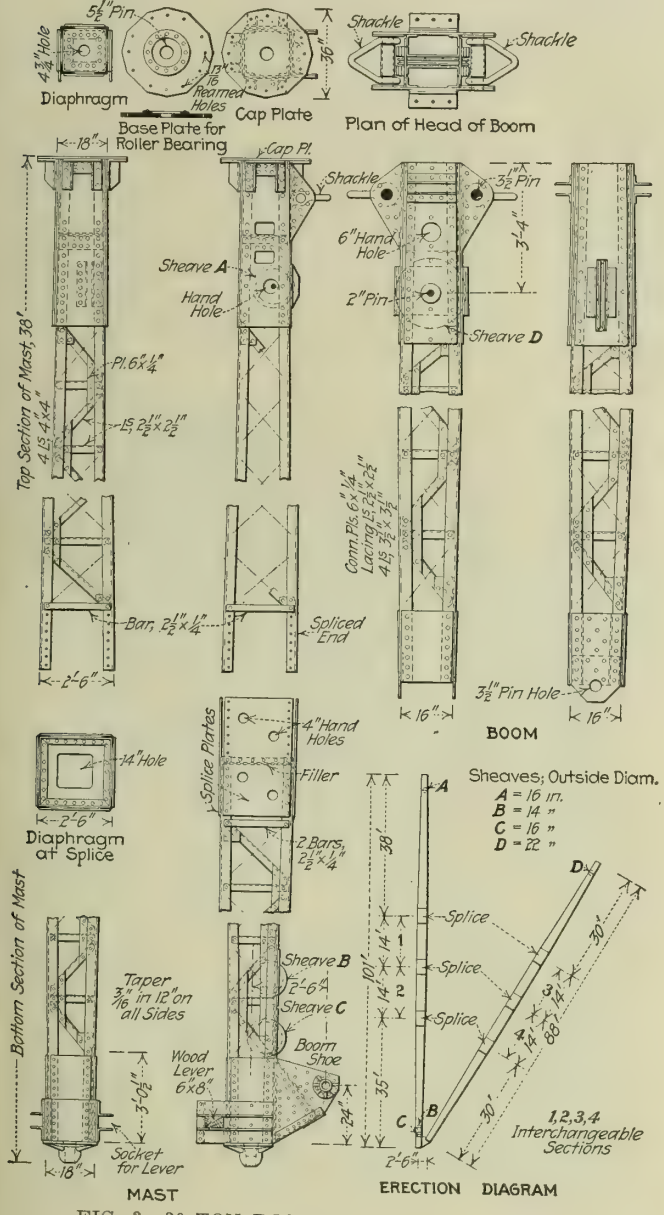


FIG. 3. 20-TON ROLLER-BEARING DERRICK

3½x3½ in. for the latter. The lacing angles are 2½x2½ in., with gusset-plate connections. A special feature of the design is the use of horizontal ties, which serve very conveniently as ladders for the use of the riggers. Across one side of the shoe of the mast is a pair of angles, between which is fitted the 6x8-in. oak lever for swinging the derrick.

The boom has its foot seated on a 3½-in. pin in the mast shoe and can be raised to a vertical position against the mast. Its head has a 22-in. sheave for the hoisting cable and two shackles for the attachment of the blocks for the luffing and hoisting tackle. The mast has two sheaves at the bottom, one for the ⅝-in. hoisting cable running to the head of the boom and the other for the ⅝-in. luffing cable, which runs over another sheave at the head of the mast.

The steel erection on the William Penn Hotel was done with two 20-ton derricks (one old and one new), as shown in Fig. 2. Both of these were equipped with the roller bearings described. On this work each derrick was served by a 50-hp. electric hoist installed in the basement. The two derricks erected about 9,000 tons of steel.

Two New Methods in Backfilling

Two novel schemes were employed to backfill a heavy reinforced-concrete river wall which is being built in Cedar Rapids, Iowa. In order to lay the foundations it was necessary to construct a coffer-dam in front of the site of the wall. This was of earth, and it is this earth that is being used to backfill the completed wall.

The Cedar Rapids river wall between the bridges at First, Second and Third St. was constructed by Frank K. Hahn, a local contractor. The work is carried on under the supervision of the River Front Improvement Commission, of Cedar Rapids, for which M. L. Fox is inspector.

A Homemade Ladder Conveyor

The muck is being elevated from the coffer-dam to the top of the wall by a ladder conveyor (see Fig. 1), made on the job by the contractor. Materials for its con-

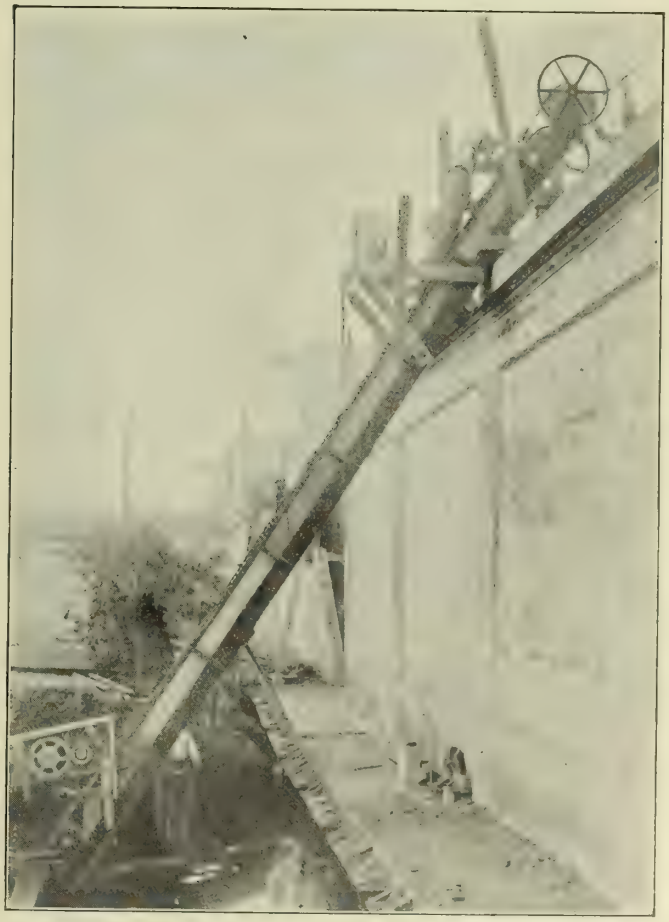


FIG. 1. HOMEMADE LADDER CONVEYOR IN POSITION FOR BACKFILLING

struction were obtained from the Link-Belt Co. and from the Quaker Oats Co., whose plant is in the city. The buckets are wide strips of metal which slide up a plank at an angle of about 60° with the plank and empty as they go over the sprockets at the top. A gang of men at the bottom of the conveyor fills the buckets by shovel. The material is mucky and does not readily empty from the buckets. Any muck which adheres to the

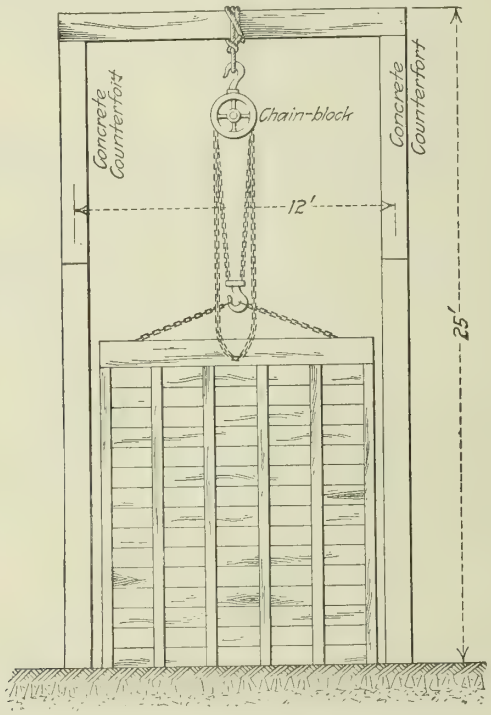


FIG. 2. WOOD APRON FOR RETAINING 6-IN. COBBLE BACKING DURING BACKFILLING

buckets as they go over the sprocket falls in a short chute, which delivers the muck on the upper section of the inclined plank in front of the ascending buckets. Thus all the muck which rises to the top of the conveyor eventually goes into the backfill.

Wood Apron Holds Cobble Backing

A wood apron, used in laying up loose-stone drainage backing at the land side of the river wall, is shown in the accompanying sketch. As the backfilling continues, the 6-in. cobble backing is carried up behind the wood apron. This apron is suspended between two counterforts, from timber beams laid across the tops of the counterforts. The apron is raised by a chain-block as the work proceeds. The stones for the drainage backing are transported in wheelbarrows along the top of the wall to a point above the apron, where they are dumped.

Load Test on Concrete Joists; Unexpected Results

By J. H. Byrd*

Load tests of a concrete-joist floor were made on two school buildings recently constructed in Kansas City, Mo., both of which have a wing to the plan shown by the drawing. The joists span 37 ft. clear between walls of common brick, 18 in. thick. The joists are spaced 28 in. on centers.

*Structural Engineer, Finance Building, Kansas City, Mo.

The design live-load on the floors was 90 lb. per sq.ft. The dead-load, consisting of concrete floor and plaster ceiling at 20 lb., slab 43 lb., metal pan and lath 2 lb. per sq.ft., and joist 131 lb. per lin.ft., totaled 120 lb. per sq.ft. The total live- and dead-load for which the floor was designed is 210 lb. per sq.ft., or 490 lb. per lin.ft. of joist, equivalent to a total load on each joist of about 18,000 lb. The test load was 180 lb. per sq.ft., making at time of test a total load on each joist of 25,900 lb.

In design the unit stresses adopted were: Concrete, 750 lb.; high-carbon steel, 18,000 lb. A moment factor of $\frac{1}{10}$ was assumed.

The test load was applied 51 days after concrete was poured. Six joists were loaded, a surface area of 14x37 ft. Sand was used as load. A cubic foot was weighed carefully and found to weigh 85 lb. (loose). A bin 14x37 ft. was made on the floor and 2 ft. of sand placed over the entire area, in four layers, to produce weights of 50 lb., 100 lb., 150 lb. and 180 lb. per sq.ft. The final weight probably exceeded 180 lb., due to packing by laborers in spreading the different layers.

Idlers were attached to each joist at midspan and deflection readings could be made at all times.

The allowable deflection for each load (test and dead added) was calculated by the formula

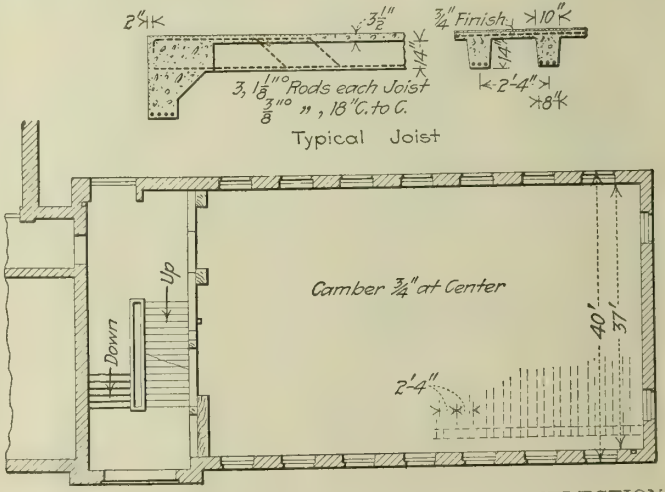
$$D = \frac{c_1}{E_s} \times \frac{Wl^3}{b\,d^3} \times \frac{n}{i^3},$$

in which $n = 10$, $E_s = 30{,}000{,}000$.

If the deflection at any time had reached the calculated amount, no further load would have been applied.

Extensometer readings were also made on the steel to measure the actual elongation, and from these to calculate the stress.

The results of the readings up to the final load need not be stated. For the final load of about 26,000 lb. per joist



PLAN OF FLOOR THAT GAVE VERY SMALL DEFLECTION

the calculated deflection was 1.3 in.; the actual deflection was $\frac{1}{16}$ in. for three joists and $\frac{1}{32}$ in. for the other three.

The extensometer failed to show any movement of the needle, except by a reading glass, which showed too small a variation to record. A movement of one space ($\frac{1}{16}$ in.) would have indicated a stress of 300 lb. per sq.in. in the reinforcing steel.

Two points of design probably produced the small deflection shown. The first is the large belt of concrete at the walls, forming a deep and rather strong beam in the horizontal plane; in loading the center 14 ft.

of the floor, any thrust due to elongation would be resisted by this beam, fixed at the ends by the slab not loaded. The second point is the ¾-in. camber, forming an arch. In order that this arch may straighten out, a movement at the end is necessary, and the beam resists this movement. The arch action also would relieve the tension in the steel, probably accounting for the low unit stress in the steel.

Smith, Rea & Lovitt, of Kansas City, were the architects, and the author was structural engineer.

Large-Sized Soft Stone for Bituminous Macadam

The usual specifications for bituminous-macadam pavements limit the size of the stones composing the surfacing material to a maximum that will pass a 2½-in. ring. These specifications have given satisfaction with trap rock and granite, but with softer varieties of rock such as limestone there is a tendency for the stone to powder and crush under the roller and to wear under traffic, which makes a larger-sized aggregate desirable.

To meet these conditions the Ohio State Highway Department (Clinton Cowen, Commissioner) has been experimenting with the use of a surfacing stone that will



SURFACING AN OHIO STATE ROAD WITH 4-IN. STONE

pass a 4-in. ring and be retained on a 2½-in. ring. The voids in this material are partly filled with sand, stone dust and chips, although thorough rolling ordinarily breaks up enough of the material to make a fairly compact layer.

The method of construction is to spread and harrow the stone as for a waterbound macadam road. As soon as the stone is partly compacted, stone chips and stone dust are spread into the voids with shovels. Rolling and the application of screenings are continued until the layer of stone is thoroughly compacted and the voids sufficiently filled so that the amount of bituminous material to be used will produce a dense mixture. The bituminous binder is applied by the penetration method with any approved form of apparatus.

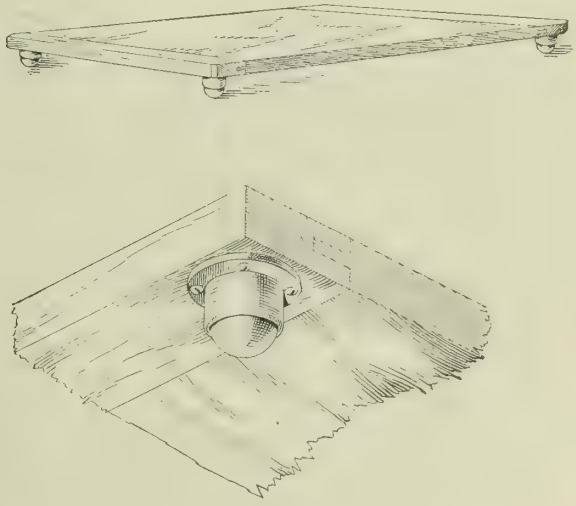
For pouring by hand, common sprinkling pots with the seams and connections riveted instead of soldered and with the holes in the nose punched to approximately ⅕ in. diameter are used. By filling the pots to nearly the same level each time and by taking care to cover about the same area with each potful, a uniform distribution is secured.

After the application of the bituminous binder the surface of the pavement is spread with screened washed gravel ¼ to 1 in. in size. After rolling the gravel in, a seal coat of the same bituminous material is applied and more gravel is added, followed by more rolling. A total application of about 2 gal. per sq.yd. for a 3-in. depth of rolled stone gives excellent results. Washed gravel instead of limestone chips is used, as the available gravel is usually harder and tougher than ordinary limestone and the cost is about the same. A finer gravel, ¼ in. to ⅝ in., is preferable for the seal coat. For a 4-in. road the amount of bituminous binder required is about 2¼ gal. per sq.yd.

According to A. H. Hinkle, Deputy State Highway Commissioner in charge of maintenance, from whom the foregoing information was obtained, these pavements have given much better satisfaction than the older ones that were constructed with the 2½-in. stone as aggregate.

NOTES

Ball-Bearing Drawing Board for Freehand Work—In making freehand drawings the board must be turned and shifted frequently to accommodate the hand to different curves and lines. I provided my board with four ball casters, as sketched,



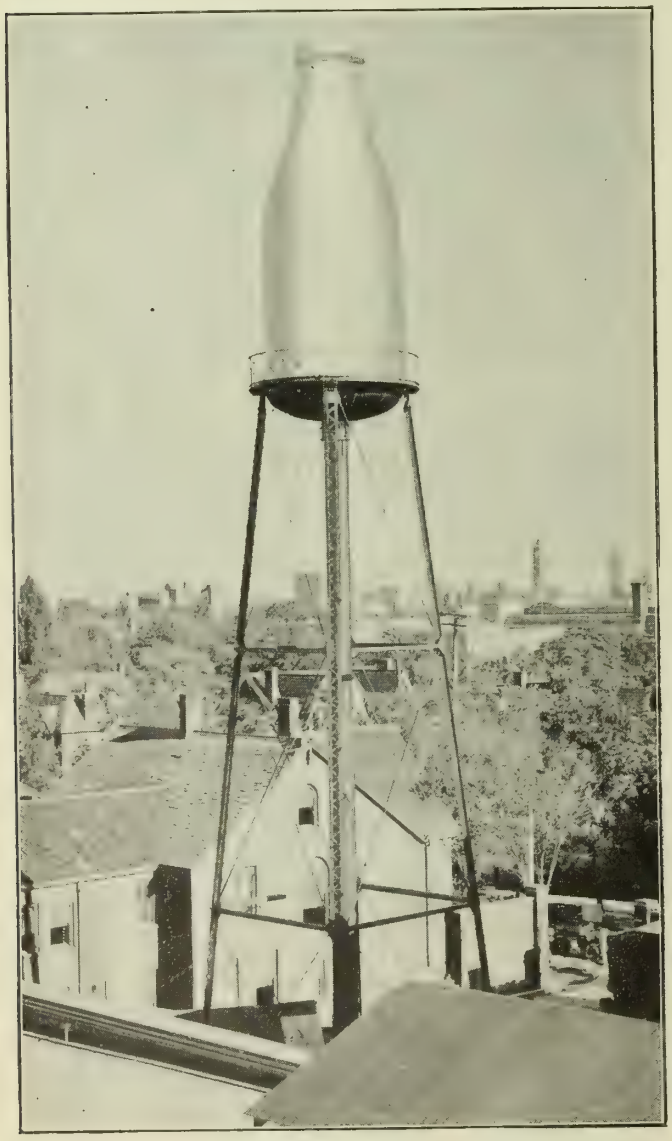
DRAWING BOARD WITH CASTERS FOR FREEHAND WORK

to facilitate this turning and shifting. The casters are a standard article, readily bought anywhere. I found this board very valuable for freehand work.—E. Schwartz, Brooklyn, N. Y.

Iron Washers as Form Spacers—To carry lighting-wire conduits the proper distance above the floor forms, ordinary iron washers are being used on the concrete buildings for the new cotton terminals at Atlanta, Ga. These washers are merely strung along the conduits at intervals and allowed to rest as they will on the forms.

A 75,000-Ton Blast was recently made in the limestone quarry of H. Frazier, Fort Spring, W. Va.—that amount of stone being thrown down by a single explosion. Some notes on the blast are given in the "Du Pont Magazine" for December. The height of the quarry face varies from 15 to 175 ft. Early in September thirteen 6-in. drill holes were put down 125 ft., extending 5 ft. below the quarry floor. There were also two short holes—72 and 85 ft. deep. The holes were about 15 ft. apart. In each hole was loaded about 500 lb. of 60% blasting gelatin and from 150 to 600 lb. of quarry powder. In each hole was a line of countered cordeau carrying one electric blasting cap. In 10 holes the charges were split near the center, with from 10 to 20 ft. of clay stemming between the charges and 20 ft. of clay stemming on the top charge. In the five holes which were loaded solid there was 30 ft. of clay stemming on top. About 50% of the stone thrown down was broken to one-man size. None was thrown over 100 yd. from the face. The total charge of explosives was 13,500 lb. The volume of loose rock was 60,500 cu.yd. The cost of explosive and blasting supplies was $16,040. The cost of drilling and loading was $820. The total cost of bringing down the rock was 3.3c. per ton.

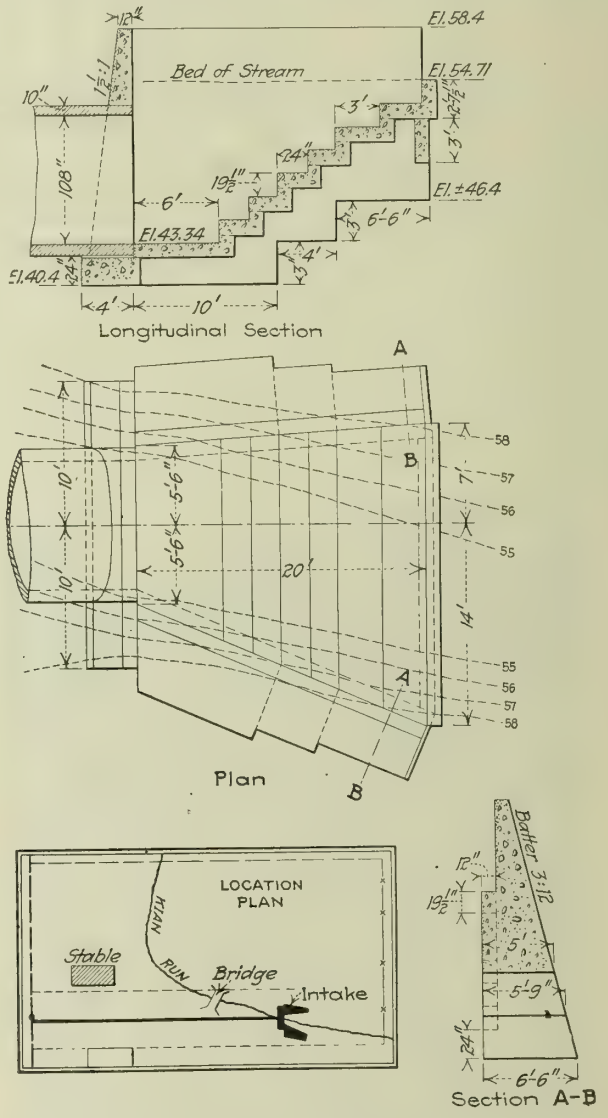
A Milk-Bottle Water Tank—The City Dairy Co., of Toronto, Ont., Canada, has at its plant a huge milk bottle, 70 ft. above ground, which is not a milk bottle at all, but an elevated tank for fire protection. This novel tank has just been



WATER TANK ADVERTISES BUSINESS OF CANADIAN DAIRY

completed by the Canadian Chicago Bridge and Iron Works, of Bridgeburg, Ont., and Chicago, Ill. The bottle is 13 ft. in diameter and 39 ft. 9 in. high and thus its top is about 105 ft. above ground. The exterior is painted white to carry out the idea of a milk bottle more perfectly. The bottle shape is formed by the steel plating of the tank itself; the rivet lines show plainly although they disappear in making the reproduction from the photograph in the cut herewith. The tank bottom is of the now much used ellipsoidal form. The tower is a standard four-post steel tower. Ellipsoid, tower and gallery being painted a different color from the bottle, in contrast with the white, heighten the illusion.

A Sewer Intake on a Running Stream forms the head end of the south-side storm sewer at Columbus, Ohio. One of the chief purposes of the sewer is to intercept a creek known as Kian Run, which now meanders through the southern part of the city, and to conduct it in a direction practically at right angles to its former course by a shortcut to the Scioto



STORM-SEWER INTAKE TO INTERCEPT KIAN RUN, COLUMBUS, OHIO

River. The intake opens into a 108-in. circular concrete sewer. The details of the intake are shown in the accompanying illustration. All concrete for the intake is 1: 2½: 5 mix, broken stone or gravel. Tongue joints 4x8 in. are placed at the junctions of the head and wing walls. The lump-sum contract price for this intake is $750. Henry Maetzel is City Engineer of Columbus, and the contractor is the J. C. Carland Co., Toledo, Ohio.

Nineteen-Year-Old Paint—Nineteen years ago Frank C. Hooper, manager of the North River Garnet Co., North River, Warren County, N. Y., became convinced that painting the wooden buildings of his plant every couple of years could be eliminated by a change of paint, reports "Graphite"—the house organ of the Dixon Crucible Co., of Jersey City. Therefore Mr. Hooper made the experiment of using a silica-graphite paint on the mill, outbuildings and a few workmen's cottages. To relieve the dark appearance of the natural graphite gray, the trimming coats were lightened with white lead. The surfaces are reported in "excellent condition" today, although no repainting has been done, and five of the cottages were moved to another plant 5 mi. away.

Editorials

Economy in Gravel Roads

Assuming the cost of a modern country-road pavement of the so-called "permanent" type at $15,000 a mile (conservative) and supposing this to be paid for by 20-yr. bonds at 4½%, the annual charges for interest on and redemption of the bonds amount to about $1,150 per annum. It is safe to assume that even the most "permanent" type of country-road pavement will require repairs and maintenance of at least $50 per mile per year, or in round figures we have a minimum of $1,200 per mile per year as the cost of the improved road.

Assuming that a good gravel road may be built for $4,000 per mile (which has been the average cost of New Hampshire roads), the annual charges for interest on and redemption of bonds (if the roads are built by bond issues) at the end of 20 yr. would amount to about $310. Therefore it is theoretically economical to spend nearly $900 per mile per year for the maintenance of gravel roads if for that sum the roads can be maintained in a condition equal to a pavement in the $15,000-a-mile class.

No one of course believes that a gravel road can everywhere be used as a substitute for a pavement, no matter how much money is spent for maintenance. But under favorable conditions it is more economical to spend a considerable sum on gravel-road maintenance than to invest large sums in pavement construction. The experience of New Hampshire and Vermont has proved this and has demonstrated that a properly cared for gravel road has a much larger capacity for motor-vehicle traffic than has been the generally accepted theory. An article on another page describes the maintenance of gravel roads by the State Highway Department of New Hampshire, where at an annual cost of from $250 to $600 a mile plain gravel roads have been kept in perfect condition under a motor-vehicle traffic of from 800 to 1,000 cars a day.

Even the most enthusiastic gravel-road advocate recognizes that gravel roads will not stand up under exceptionally dense or heavy traffic. There are plenty of roads in New Hampshire near the larger cities and towns where some form of pavement has been found most economical. Moreover, it must be borne in mind that the New Hampshire roads carry a dense traffic only during a part of the year; but on the other hand they are under patrol maintenance only for about the same length of time each year. They are good roads all the year round and exceptionally fine motoring roads in the summer.

Similar conditions exist in other localities. In a great many cases the severe traffic is only during the summer season, and to build an expensive pavement to take care of summer tourist traffic is not economical when half the amount of annual interest charges on such an investment would keep a gravel road in splendid condition.

The plain gravel roads of New Hampshire and Vermont are object lessons in economical roadbuilding and maintenance, and the traffic they are carrying is a convincing refutation of some elaborately worked out theories as to the wearing qualities of plain gravel roads.

Another Novel Quay Wall

The quay wall for the new deep-water terminals at Halifax, described on another page of this issue, is a remarkable structure both in size and design. Retaining walls 60 ft. in height are scarce enough in land structures where every opportunity for construction in the open is afforded. In sea walls they are even more rare. The Halifax design, however, is unique, and in these days of increasing novelty in pier and quay-wall design that is saying a good deal.

As pointed out in the article, the combination of a rock bottom with no overlying earth and the great depth required eliminated all but two types of wall, the cyclopean block, either of cast concrete or masonry, and the hollow reinforced-concrete caisson which could be cast in dry dock or on marine railway and floated to place, there to be sunk and filled with concrete or rock. The former method is time-honored; it is, however, most expensive and involves many difficulties in the placing and effective joining of the blocks. The latter method, of somewhat recent origin, has had a great vogue and almost unbroken success. For so extensive a work as that at Halifax it would require an enormous plant or else an unduly long time, for the construction of one of these big hollow boxes is an engineering operation of magnitude requiring considerable space, material and plant. Furthermore, the founding of such a box on a rock bottom, even though that bottom has been prepared by diver or in diving bell, is a ticklish undertaking. With the removable wooden bottom, as introduced in the Ontario entrance to the Welland Canal, this difficulty is reduced from what it is in the older solid-bottom caissons, but that method even is better adapted to the soft bottom where a preparatory foundation of riprap can be laid.

In lieu of these two alternatives the Canadian Government engineers have devised a new scheme that is a judicious combination of the benefits of the separate block and the hollow box and is sufficiently novel probably to insure its patentability, if its inventors so desired. The general method of deposition of the separate block is combined with the shape and method of manufacture of the hollow box. On paper the scheme appears formidable; in fact, some of the contractors contemplating the work were scared by its possible complications. In practice, on the contrary, it is working out in admirable fashion, and in the limited progress so far made has reflected credit on both its designers and executors.

Hoarded Water Rights Freed by Morris Canal Decision

The monopoly of the available sources of public water-supply for a considerable portion of northeastern New Jersey which has been attempted with more or less success for three decades now seems to have met a serious check but one which would have been much more beneficial to

the public interests had it come years ago. The check comes from the decision of the United States Supreme Court on Nov. 15 in Morris Canal and Banking Co. and Lehigh Valley R.R. Co. vs. New Jersey State Board of Assessors. The possible liberation of hoarded water rights is not obvious, for primarily the case involved the right of New Jersey to tax the Morris Canal, which stretches across the state. To see the further effects of the decision, a little of the history of the case must be set forth.

When the Morris Canal and Banking Co. was chartered in 1824 it was exempted from state and local taxation so long as its property was used for "canal navigation." In 1871 the company was authorized to lease its property and franchises, but no mention was made of the taxation-exemption grant from the state. A few weeks later the canal company leased its canal and accessories and sold its personal property to the Lehigh Valley Railroad Co. In 1884 and subsequent years the legislature provided for the taxation of railroads and canals. The state tax on the canal property for the year 1906 was contested by the owners on the ground of the exemption clause in the charter of 1824, but the contention was denied by the New Jersey Court of Errors and Appeals. This decision is now upheld by the United States Supreme Court, which points out that the statute of 1871 did not authorize the transfer of exemption from taxation, and adds: " . . . as clearly pointed out in the Rochester case, Rochester Railway Co. vs. Rochester, 205 U. S. 236, an exemption from taxation does not pass under a valid lease or sale of corporate property together with appurtenances and franchises."

The original rights were granted for navigation; but under color of rights to water for that purpose, the attempted water monopoly has been selling water rights and water itself for municipal purposes and declaring "hands off" to all others who claimed or sought a right to certain waters. Had such a decision as this been handed down in 1885 instead of 1915 it might have had a material bearing upon the Newark, Jersey City and other water-supply contracts; particularly on the long controversy over the Jersey City contract. Even now the decision may have a material bearing upon the efforts of the State Water-Supply Commission and the State Conservation Commission to control some of the potable waters of the state.

Also, beyond guaranteeing to the state hundreds of thousands of dollars in taxes and aiding it regain a control of its potable waters which it should not and need not ever have lost, the decision will doubtless hasten an equitable settlement of the long contest over the abandonment of the Morris Canal. This will mean much to the state and to the municipalities and townships through which the canal extends and may contribute materially to success in converting the canal into a water parkway, advocated with much earnestness for several years past.

Finally, the broader bearing of this decision should not be overlooked. Taken with the Rochester decision already mentioned, it may aid other states and perhaps scores of cities to regain control of water-supplies and waterfronts granted explicitly for beneficial public use and which should revert to the state when not used for the purpose of the grant, but which have been diverted to quite other purposes, to the enrichment of private and the robbery of public interests.

The Panama-Pacific Exposition Comes to an End

At midnight on Dec. 4, the Panama-Pacific Exposition closed its gates for the last time, having been open to the public for 288 days. It has been widely advertised that the Exposition has yielded a profit of $2,000,000; but this means only that the receipts from paid admissions, concessions, etc., exceeded the running expenses of the fair by that amount during the time it was open. The cost of creating the fair—grounds, buildings and all—was to the Exposition company about $17,000,000. When to this are added the amounts spent by exhibitors, concessionaires and others, the current statement of $50,000,000 as the total outlay on the Exposition is probably not excessive.

The total number of admissions is stated to have reached 17,000,000 on Nov. 19; but this included apparently the daily admissions on passes of several thousand attendants and employees. Allowing for this and for the fact that most of those who visited the Exposition went on the grounds from three to a dozen times or more, it is probable that not more than two million different persons visited the Exposition.

That it was worth a great deal to have such a wonderful display of art and architecture and constructive genius as the Exposition spread before two million or more people, every visitor who had the privilege of seeing it will agree. The exhibits themselves were creditable, but what every visitor to the Exposition will longest remember was its success as an artistic creation. The buildings at San Francisco in their proportions, their decoration and particularly in their coloring and their night illumination surpassed even the well-remembered successes at the Chicago Exposition of 1894 and the St. Louis Exposition of 1904.

The toast sent by President Wilson for the exercises at the close of the Exposition declared that "in its conception and successful accomplishment the Exposition gave striking evidence of the practical genius and artistic taste of America." The engineering profession may well take pride in the fact that the Exposition was the creation of engineers, and its success was the greatest demonstration ever made that a competent engineering executive can so direct the work of artists, architects and constructors as to produce a finished masterpiece.

United States Supreme Court on Invention and Design

Attention was called in these columns last week to the difference between the work of the inventor and the work of the designer in connection with a court decision recently rendered on certain reinforced-concrete patents. It will be of interest to many to read an authoritative opinion on this question from the highest court in the land. A correspondent has sent an extract from an opinion rendered by the Supreme Court of the United States, delivered by the late Justice Bradley, in the case of the Atlantic Works vs. Brady, 107 United States, 192. The extract is as follows:

> The process of development in manufacture creates a constant demand for new appliances, which the skill of ordinary head workmen and engineers is generally adequate to devise, and which indeed are the natural and proper outgrowth of such development. Each step forward prepares

the way for the next, and each is usually taken by spontaneous trials and attempts in a hundred different places. To grant a single party a monopoly of every slight advance made, except where the exercise of invention somewhat above the ordinary mechanical or engineering skill is distinctly shown, is unjust in principle and injurious in its consequences.

The design of the patent laws is to reward those who make some substantial discovery or invention which adds to our knowledge and makes a step in advance in the useful arts. Such inventors are worthy of all favor. It was never the object of those laws to grant a monopoly for every trifling device, every shadow of a shade of an idea which would naturally and spontaneously occur to any skilled mechanic or operator in the ordinary progress of manufacture.

Such an indiscriminate creation of exclusive privileges tends rather to obstruct than to stimulate invention. It creates a class of speculative schemers who make it their business to watch the advancing wave of improvement and gather its foam in the form of patented monopolies, which enable them to lay a heavy tax upon the industry of the country, without contributing anything to the real advancement of the arts. It embarrasses the honest pursuit of business with fears and apprehensions of concealed liens and unknown liabilities to lawsuits and vexatious accountings for profits made in good faith.

It may freely be conceded that this rule, laid down by the Supreme Court in this and other decisions, has often been trangressed, not only by the Patent Office in the granting of patents, but by the lower courts in adjudicating them. It will not do, however, to blame too seriously the judges who have erred in sustaining patents on trivial combinations and assemblages involving no real invention but merely an attempt to monopolize some next step in mechanical or engineering progress. For such prostitution of the patent system, patent attorneys and patent experts are probably even more at fault than the judges themselves. There is little wonder that the judges, with only laymen's knowledge of technical matters and unable to secure the advice of unbiased experts, are often mystified by the great mass of technical details which are presented to them by the attorneys and experts on opposite sides. It has often happened, moreover, that in a patent case each side is desirous of sustaining the patents in controversy, and there is no one to present the side of the public, which is interested in having patents annulled if they create a monopoly in what should be public property.

It is quite possible that the investigation which has been ordered by a Senate committee may lead to radical reforms in the granting of patents and in patent litigation.

Contrasts in Port Development

The current export-freight congestion in New York and, in a lesser degree, in other Atlantic ports makes of especial interest the very elaborate port improvement at Halifax now being made by the Canadian Government. While the main cause of the present congestion is of course scarcity of ships, there is no disputing the fact that a secondary influence is the primitive terminal facilities available at most American ports. The Halifax improvement will make it without doubt the most modern port development on this continent; its design and execution leave very little to criticize. When completed it ought to bring down terminal costs to somewhere near their proper relation to transportation costs, in contrast to the usual condition in most of our ports.

In contrast, too, to the situation in American ports, the problem at Halifax is being worked out in its entirety under one directive head, subject only to the vicissitudes of future political change in the national government, whereas in the United States the management of a port is likely to be entirely changed every time a change occurs in the city government. One need only note the past history of port-improvement projects in Boston or view with a prophetic eye the coming port policy of Philadelphia to understand the contrast. The much-heralded Port Commission appointed by the New York City Board of Estimate and Apportionment is as yet only a name because the same Board has omitted to appropriate any funds for the Commission to work with.

And yet, notwithstanding their excellent design and construction it is within the possibilities that these great Halifax terminals may find as little use as some of the loudly exploited municipal piers at minor ports of the United States. The most efficient terminal in the world cannot create commerce, and it remains to be seen whether the influence of the Canadian Government plus the low terminal charges at Halifax will be sufficient to offset the long railway hauls from manufacturing and farming centers to that port. It is quite possible that Montreal and Quebec in the summer and Portland, Boston and New York in the winter will continue to get most of the Canadian export business.

Letters to the Editor

Origin of Compressed-Air Tunnel Ventilation

Sir—In the mammoth workings of the famous Comstock Lode, at Virginia City, Nev., were initiated many of the practices that have been developed into systems. The nature of the rock in that locality and the great depth of the workings generated extreme temperatures when the rock was exposed to the air. This made it necessary to introduce quickly into the faces of the extreme workings fresh, cold air in sufficient volume to sustain the almost naked and sweat-smothered miners working in short shifts or reliefs.

Power rock drills driven by compressed air were first extensively used in mining and tunneling in the Comstock Lode. True, such machines had been employed in the Hoosac Tunnel in Massachusetts and in another driven in Pennsylvania, but they were so heavy and cumbersome, requiring ponderous carriages for their mounting, and mechanically were so defective that as economical factors in tunneling they had given little if any advantage over hand drilling. Later they were modified and made more adaptable, and their practical worth was first demonstrated in the Sutro Tunnel driven to tap the Comstock Lode at depth to drain it of water and permit transportation of the ores to the mills near the tunnel's mouth.

Smaller machine drills adapted to the mine drifts came to be quite generally used in the workings of that lode, and the compressed air with which they were driven, exhausting from them into the extreme headings and expanding to four or five times its volume and thus being rendered very cold, supplied the miners with ample fresh, cold air and a ready and admirable means of ventilating the workings.

From this Comstock Lode practice has developed the system of tunnel ventilation by compressed air now generally employed. But its growth was slow and roundabout. In fact the resumption of this local practice with compressed air and its development in large tunnel work were taken up many years later, after steam exhausted from power drills had proved to be more or less a success in such work.

Steam-exhaust ventilation was first demonstrated by a Colorado miner whose name I do not recall. With one power drill driven by steam, he ran a small mine tunnel 1,000 ft. into a mountain and ventilated it by utilizing the exhaust steam from his machine in the following manner:

Near his steam boiler, at the mouth of the tunnel, he set up a wooden box chimney connected at the bottom to a similar horizontal box which ran in near the face of the heading. Into the end of this flue he set up a wide-mouthed funnel, which was removed before blasting. By opening a ¼-in. steam jet in the chimney after a blast, he caused a strong suction to draw the foul air into the inner end of his ventilating box. This in no long time so cleared the extreme heading that he went in, set up his funnel and machine and went to drilling, carrying the exhaust steam through a hose into the funnel. The exhaust was sufficient to maintain the draft, and the live-steam jet in the chimney was shut off. This device kept his tunnel filled with a flow of fresh air and his heading comfortably cool. This worthy adventurer took righteous pleasure in writing me of his success with steam against my expressed belief that he could not make it work successfully in tunneling.

Years later, on one of the several railway tunnels that were undertaken on the South Penn Ry. to run between Harrisburg and Pittsburgh, the contractors started using steam for driving the drills until air compressors could be built and installed. On getting in a distance, the steam from the machines uncomfortably raised the temperature. The Colorado miner's device recurred to my mind, and it was introduced, where some seven drills were in operation. It ventilated the tunnel while it was being driven in some 800 ft.

Years after the South Penn work, the Croton Aqueduct Tunnel for the supply of water to New York City was underway. This 36-mi. tunnel was the longest that had ever been undertaken. In the center of every 3,000 ft. section a shaft was sunk to grade, and tunnels were driven north and south from this, each 1,500 ft., until they met opposite headings. Extensive ventilation was necessary, and this was foreseen to be very expensive unless some method other than by the usual exhaust fans or blowers could be devised.

I had equipped half of the tunnel, under contract with Brown, Howard & Co., with Ingersoll drills, air compressors, boilers, etc., and was in constant consultation with D. D. McBean, of that firm, the manager of the work. When the matter of ventilation came up, Mr. McBean was in no way disposed to go into the large expense of equipment with known appliances if this could be obviated—and he was not the man to permit difficulties of any nature to prevent the employment of simple and effective means. On his hearing of the success of compressed air in the Comstock heading and steam exhaust in the Colorado mine and the South Penn Ry. tunnel, he decided to try them in his work on the Croton Aqueduct Tunnel. They were successfully adapted. This was the first development and use of the since well-known system of compressed-air ventilation for large tunneling operations. The features of this system and its details have become too well known to warrant mention here.

Up to that time, as president of the Ingersoll Rock Drill Co., I had furnished the mechanical equipment for seven-eighths of the railway and other large tunnels that had been made using power drills, and was therefore in a position to know what appliances had been tried or used. To the best of my knowledge this is the history of the rise and development of this system of tunnel ventilation. F. M. Pierce.

Point Loma, Calif., Nov. 11, 1915.

Track Maintenance

Sir—The insufficiency of track forces is given by Mr. Schlesinger in your issue of Nov. 11 as the cause of defective track. But no track force can maintain good track with rotten ties, insufficient ballast, light and worn rails and old or defective fastenings, especially when these conditions occur on track with at least moderately heavy traffic. The accident reports of the Interstate Commerce Commission inspectors indicate the existence of track of this kind, although of course it is exceptional.

Railway.

A Sewage-Disposal Problem

Sir—I have bene asked to assist in the design of a plant for the disposal of sewage consisting of house waste from some 50 to 70 persons and the liquid waste from stables sheltering about 700 head of cattle. It has been assumed that the sewage from the domestic buildings and stables may be satisfactorily treated by customary methods, selected, however, to suit the composition of the sewage. As the problem seems to be unusual, the experience of others with similar problems, if such there be, would be appreciated. Unusual.

Cowstables, Dec. 1, 1915.

[The problem presented seems to be properly characterized as unusual, but as announced two or three thousand years ago, there is nothing really new under the sun. Information regarding how similar problems have been met and solved would be of interest to many readers and of practical value to a considerable number besides the inquirer.—Editor.]

The Influence of Manufacturing Industries upon the growth of population is illustrated by a census just taken of two villages in the suburbs of Detroit. St. Clair Heights, Mich., has a population of 6,853, an increase of 447% since 1910. Highland Park, Mich., has a population of 27,155, an increase of 559% since 1910. The remarkable growth of these villages is chiefly owing to the automobile manufacturing industry in and near them.

Chicago Smoke Abatement and Railway Electrification

A brief summary from an advance statement concerning the report of the Chicago Railway Electrification Commission was printed in *Engineering News,* Nov. 25, p. 1024. The complete report of the commission was submitted on Dec. 1. As previously announced, the commission finds that the electrification of Chicago railways as a whole, while an engineering possibility, would involve an enormous cost wholly beyond the means of the railway companies to raise.

Five years ago the Chicago City Council passed an ordinance requiring the railways after a certain date to use some other motive power than steam locomotives to operate their trains within the city limits of Chicago. Public opinion was in a confused state concerning this ordinance, and with a view to determining the facts in the case the Chicago Association of Commerce appointed a commission of 17 citizens to investigate the whole subject and report. A large engineering organization was created headed by the late Horace G. Burt, former president of the Union Pacific R.R. After Mr. Burt's death in May, 1913, he was succeeded by Dr. W. F. M. Goss, Dean of the Engineering School of the University of Illinois.

Air Pollution and Smoke Prevention

A vast amount of matter has been published concerning the causes and effects of smoke in cities. The commission's investigations showed that nearly all this published matter is of very doubtful reliability, being based on general impressions rather than scientific data. The commission found, for example, that greater harm to the health of city dwellers is done by the invisible products of combustion, such as sulphurous gas and fine mineral dust, than by the visible smoke. While two-thirds of the pollution of Chicago air is due to the combustion of coal, the other third is due to dust, gases, etc., from other sources, so that even if all combustion of coal were eliminated, considerable pollution of the air would remain. The smoke polluting the air of Chicago is found to proceed from the following sources:

	Per Cent.
Metallurgical furnaces and other manufacturing processes using fuel	64.26
High-pressure steam-power plants	19.34
Low-pressure steam-power plants and domestic heating	8.6
Railway locomotives	7.47

The locomotives, however, because their smoke is discharged near the ground, produce a somewhat larger proportion of the visible smoke, a little over 20% according to the figures of the commission.

It is evident from the above that if the steam locomotives were immediately done away with in Chicago, and other sources of air pollution allowed to continue unabated, the effect would hardly be noticeable by the general public.

Railway Electrification

In order to eliminate steam locomotives in Chicago it will be necessary to electrify the lines of 38 steam railway companies owning a total of 3,476 mi. of track, of which nearly half is main-line track. This mileage of electrified steam-railway line would be twice as great as the mileage of all the electrified steam lines in the entire United States and would be even greater, by about 15%, than the mileage of all the electrified lines in the world. The number of electric locomotives required would be about 2½ times the entire number now existing in the world.

The commission gave much attention to the selection of the best system for electrification, recognizing that if electrification were to be undertaken the system should be made uniform for all lines. The commission finally selected the overhead contact system using a single-phase current at 11,000 volts as on the whole the cheapest and most desirable. The commission recognized that there are objections to this system on account of danger to employees and also inductive interference with telephone and telegraph wires; but the difficulties are on the whole less than would be experienced were direct current used, either from a third rail or from an overhead wire.

The commission's estimate of the total cost of electrification showed a minimum of $178,127,000. A number of the railways entering Chicago, however, have taken this estimate and find that in order to operate their lines economically under the electrified plan it would be necessary to extend the electrification considerably farther than was assumed by the commission and also to make a large immediate outlay for track elevation and other improvements. These changes increased the estimate made by the commission by something over 50%. Applying this proportion to the commission's estimate as a whole, the final probable cost of electrification would be in round numbers $275,000,000.

The commission estimated that electrification would produce some gain in the railway earnings and some reduction in the operating expenses together sufficient to increase the net revenues of the railways by $2,336,000. Deducting this amount from the interest and depreciation charges on the cost of electrification, there is left an annual deficit of $14,600,000.

Railway Finances at Low Ebb

While some of the Chicago railways are in financial position to assume their share of the cost of electrification, most of the railway companies would find it absolutely impossible. In fact several companies are now in receivers' hands. The city could not share to any large extent in the expense of the work, since its margin of indebtedness under the state constitution would not permit it. If it were attempted to pay the cost of electrification by a tax upon the traffic passing through Chicago it would be a serious handicap to the business of the city in competition with other commercial centers. Moreover, were Chicago to require its steam railways to electrify their terminals, there is no doubt that numerous other cities might and would make similar demands.

It is especially to be noted that the commission's conclusions relate only to the electrification of the Chicago railways as a whole. It did not separately investigate the relative economy of electric operation for suburban service. There is a strong feeling in Chicago that some of its suburban steam lines, notably the Illinois Central, should be electrified not only for the relief from smoke and dust of the densely populated sections of the city through which the line runs, but because of the gain the company would make by reduced operating expenses and increased traffic. The commission held, however, that such investigations were the business of individual roads to make and that its duty was to deal with the problem presented by the proposed sweeping municipal legislation compelling electrification of the entire railway system of the city in order to abate the smoke nuisance.

Construction of Washington St. Arch Bridge at Indianapolis

SYNOPSIS—The plant and methods of construction for the foundations and superstructure of a new seven-span reinforced-concrete bridge across the White River are described in detail. Work is progressing from both ends with a very successful plant.

The new Washington St. Bridge over the White River at Indianapolis, Ind., is a reinforced-concrete arch structure with two spans of 106 ft., two of 112 ft., two of 117 ft. and a central span of 120 ft. The contract awarded by Marion County in 1914 was for a five-span bridge, but in July, 1915, the city gave a contract for two additional spans at the west end, in order to provide for the widening of the river in connection with the flood-protection work on the west bank. The present west end pier, therefore, is braced by temporary concrete buttresses to resist the arch thrust. The total length will be 844 ft.

The bridge washed out by the flood of 1913 had five plate-girder deck spans on concrete piers at right angles to the street and skew with the stream. The new bridge has the piers parallel with the stream and at about 60° with the street line. The piers are carried down 15 ft. below low water, except that the second pier from the east end, which is in the middle of the main channel, is carried down 25 ft. All the piers are on 25-ft. timber piles. The arrangement of the construction plant is shown on the accompanying drawing.

Foundation Work

The river bed is mainly gravel, but at the bridge site there is the débris of the old bridge piers, with large stones and masses of concrete which had to be removed in advance of the coffer-dam work. This clearing was done with a large stiff-leg derrick of timber construction and handling an orange-peel or clamshell bucket as required. The derrick travels on a track of 30-ft. gage and has a two-wheel (tandem) truck under each corner. At the middle of each side is another truck with a roller instead of wheels, this providing against deflection of the sills under load. The derrick clears the site of the pier, handles material, places filling outside the coffer-dam and does the dredging within the coffer-dams. A similar derrick is making the excavation for the two west spans. They are 15-ton machines with 60-ft. booms; but one has the boom spliced to a 75-ft. length. They were built by the American Hoist and Derrick Co.

Before commencing to drive the sheetpiling, the site for each pier is examined by a diver to see that all débris has been cleared away. This is a rather difficult task, owing to the muddy water.

The coffer-dams are about 30x115 ft., made of timber sheetpiles, 6x12 in., 25 ft. long. Each pile has two 2-in. yellow-pine splines nailed along one edge to form a dovetail groove and a single dovetail spline on the other edge. To secure the splines firmly, larger nails are used near the bottom, the holes being bored, so as not to split the wood in driving these large nails. The piles were driven with a Vulcan steam hammer slung from the derrick, a cast-iron cap being placed on the head of the pile. The entire set of piles was driven first to a depth of about 15 ft., when they began to drive hard. The inclosed space was then pumped out and the piles readily driven to full depth, the side pressure of the sand being reduced by lowering the head of water. The penetration is about 10 ft. below the base of the pier footing. At first this was only about 6 ft., but it proved insufficient and led to some blowouts. No other accidents occurred to the coffer-dams.

The wood sheetpiling was used because of its economy, easy driving and satisfactory closure. The piles can be pulled and used again, and when no longer available for sheeting are used for caps and falsework timbering. After the completion of the sheeting, dredged material was filled around the outside by the fixed derrick and by a floating derrick, both with clamshell buckets. The usual interior bracing was placed as the water was pumped out.

In driving the foundation piles, work was commenced at the middle of the pier and progressed outward. These piles were driven by a heavier Vulcan steam hammer. A water jet was used for both sheetpiles and foundation piles.

Arch Falsework and Forms

The arch falsework is of the special Luten design, in which piles carry caps transverse to the arch, and upon each line of caps are three rows of struts to the arch form, radiating in fan shape. Each strut is built up of two planks forming a column of T-section, the planks being fastened together only by wire ties wrapped around them. When the time comes to strike the centers, the wire ties are cut, when the struts resolve themselves into simple planks, which buckle under the load and are readily removed.

The ribs of the arch form are also of special and simple design. Each rib is made of 2x12-in. planks lapped and spiked over the posts (so that no cutting to shape is required), and upon them is nailed a separate 2-in. strip having its top cut to the curve of the arch. When the centering is removed the planks are ready for use again, and only the curved strips are waste. The forms are all of wood, shiplapped, and coated with paraffin on the face.

The spandrels do not rest upon the barrel of the arch but are placed against its side, forming the face of the arch and eliminating any horizontal joint. This arch ring is anchored to the arch proper. The top of the vertical joint is painted with an asphaltic waterproof coating. No outside bracing is required for the spandrel form, the form being secured by wire ties to anchors projecting from the side and back of the main arch. Another feature of the formwork is that the coping is built separately upon the spandrel. This permits the form to be set absolutely true to line, and the projection of the coping hides any slight bulges which may have occurred in the line of the spandrel.

Where the spandrel wall abuts against the pier it is made with a vertical V-groove in the end. In the form the open side of the groove is closed by a plank, forming

a triangular channel, which extends down to the pier and through the arch, so as to take care of drainage. This channel begins about 12 in. below the coping; thus there is no opportunity for dirt to fall into it.

Concreting 45 Hr. Continuously

Each pier is built as a monolith from 6 in. below low water to the bottom of the pier coping. The coping is poured next and then the skewback for the two arches. Each arch is poured complete, the 1,150 yd. of concrete being placed in about 45 hr., working 10-hr. shifts (two days and two nights). About the same speed was made at each end, using one large mixer with elevator tower and chutes at the west end and two smaller mixers with dump cars at the east end.

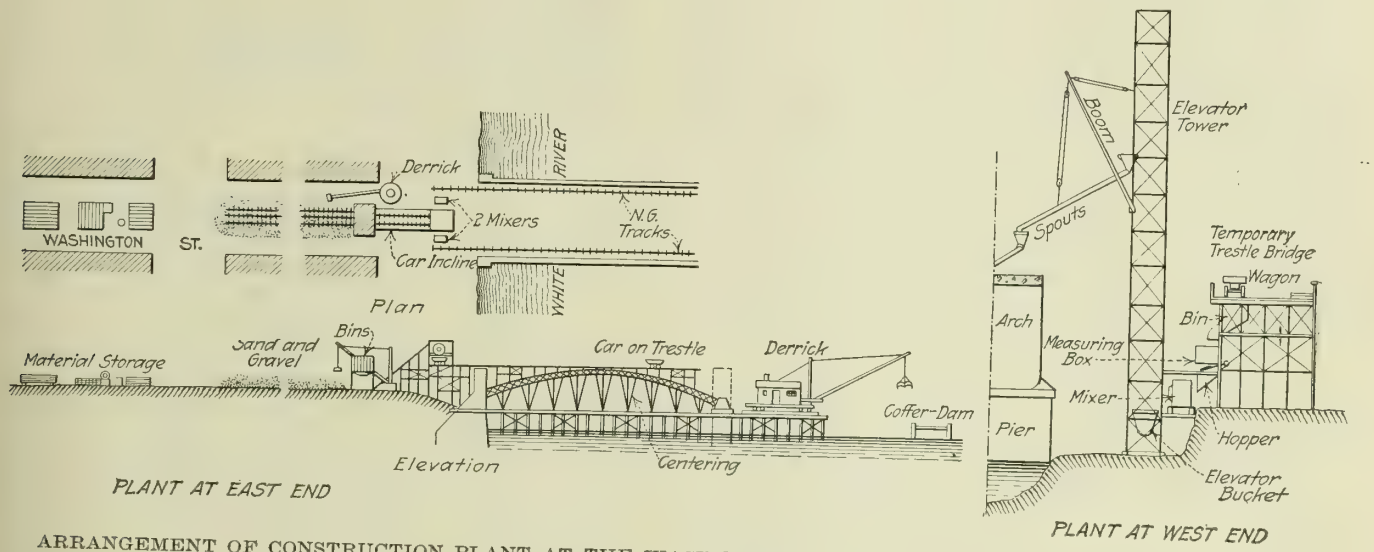
Drainage of the fill over the arch is provided for by pipes embedded in the piers and emerging below low-water line. They are galvanized-iron pipes placed in an inclined position so that there is no bend between the inlet and the outlet. This permits them to be cleaned out readily.

The concreting is being worked from both ends with two plants, but after the completion of the east end arch, with its abutment and pier, all the work will be done from the plant at the west end.

cars on tracks just below them and running out over the arch.

At the west-end plant the mixer is placed on the river bank, below and at the side of the street. The storage bins are below the deck of the temporary trestle bridge. Dump wagons deliver sand and gravel over gratings in the street surface. The bins have gates over a measuring-box with a hinged bottom, which falls when unlatched (and is then closed by a counterweighted lever), dropping the contents through a steel hopper to the charging side of the ¾-yd. Smith mixer. The cement (from sacks) is dropped into the same hopper.

The concrete is discharged into a 1-yd. bucket in an elevator tower and dumped into the hopper of an Insley steel spouting system. The first spout is suspended from a 50-ft. boom on the tower, and the boom (with spout and hopper) is raised or lowered to the desired elevation by



ARRANGEMENT OF CONSTRUCTION PLANT AT THE WASHINGTON ST. BRIDGE OVER THE WHITE RIVER AT INDIANAPOLIS, IND., SHOWING CONCRETING PLANTS AT BOTH ENDS

Not drawn to scale

East-End Concreting Plant

As two blocks of Washington St. are closed to traffic, the center of the street is utilized for storing construction material. In the farther block are reinforcing rods, timber, etc. In the block next the bridge, sand and gravel are deposited by wagons on each side of the street-car space, and between these stock piles are three narrow-gage industrial tracks for steel dump cars. At the end of the street are three elevated bins over the tracks, and material is loaded into these by a stiffleg derrick operating a clamshell bucket. The material is dumped by the cars within reach of the derrick.

From the bins the material is loaded by gravity into the cars, which are hauled by cable up a two-track incline and dump into two ½-yd. Smith mixers, one on each side. The mixers in turn dump the concrete into similar means of a hand crab. The tower is 124 ft. high and carries 300 ft. of spouting, which gives a horizontal reach of about 250 ft. This plant can place about 400 yd. per day in one 10-hr. shift, and has made a record of 422 yd. placed in 11 hr.

The construction plant includes also a floating derrick (for dredging, etc.) and a hand-power bending machine for the steel rods. For the timber work there is a carpenter shop having a ripsaw, cutoff saw and grinder. Another shed is used for molding the balustrades. All the derricks, concreting plants, etc., are operated by steam, except that one mixer at each end has an electric motor.

Concrete and Surface Finish

The concrete is 1:2:4 mix, made with river sand and gravel, the maximum size of aggregate being 1½ in. This material is dredged from the river by a dragline cableway with a 1-yd. Shearer-Mayer bucket. The gravel is washed and screened and delivered to bins, from which it is loaded by gravity into the dump wagons. This washing plant has a capacity of about 125 cu.yd. of gravel per day. The reinforcement is of deformed bars; but only a relatively small proportion of steel is required.

The face treatment of the bridge is simple and effective. Large panels are formed on the spandrels and

upper parts of the piers, but these are in the same plane with the rest of the work, so that the only form construction required is the nailing of V-strips for grooves outlining the panels. The panels are bush-hammered by hand and the remainder of the surface is rubbed with carborundum blocks while wetted with a thin cement grout applied by whitewash brushes.

The parapet has balustrades which are molded in a shed near the work, using a Pettyjohn mold. Each has a rod projecting from the bottom and engaging a groove in the coping, this groove being afterward filled with mortar. Upon the balustrades rests a cap, but this is not anchored to them and is free to move longitudinally with contraction and expansion movements, without disturbing the balustrade.

Engineers and Contractors

The bridge was designed by Daniel B. Luten, consulting engineer, of Indianapolis. He also designed and patented several of the construction features, including the T-beam arch struts, the arch reinforcement and the spandrel arrangement. The contractor for the entire work is the National Concrete Co., of Indianapolis. The work is under the direction of Charles E. Cheney, County Engineer, and B. J. T. Jeup, City Engineer. The total cost will be nearly $500,000.

Combined Fire and Load Tests of Building Columns

Testing the strength of building columns under conflagration conditions has hitherto been impossible because there has not been a machine built in which fire and load could be applied at the same time. Realizing the necessity of information on this subject, a joint body, formed of the Associated Factory Mutual Fire Insurance Companies, the National Board of Fire Underwriters and the United States Bureau of Standards, has had designed and built a testing machine in which full-sized building columns can be tested to destruction under end load and at the same time subjected to temperatures equaling those of a general conflagration.

This machine has been set up in the Underwriters' Laboratory in Chicago, and a series of fire tests of building columns has been outlined. A prospectus of the series has just been issued. Herewith is given an abstract of this prospectus, together with a detail drawing of the machine. Engineers and insurance experts interested in the subject have been asked for suggestions and criticisms of the prospectus and it is expected that as soon as these criticisms have been digested the tests will be initiated. Any information regarding the work not included in this abstract can be obtained by writing to the Underwriters' Laboratory, 207 East Ohio St., Chicago, Ill.

General Plan of Investigation

The object of this investigation is to ascertain the ultimate fire resistance of centrally loaded columns used in the interior of buildings, under conditions approximating those of service; to ascertain the fire-retardant value of the column protection provided by the various materials and methods commonly employed in protecting columns against fire; to obtain full and accurate data that will serve as a basis for the classification of column protection for various classes of buildings, and to furnish data for guidance in the determination of proper test conditions for heavier columns, and special tests to ascertain the effect of the application of fire streams to columns while in a highly heated condition.

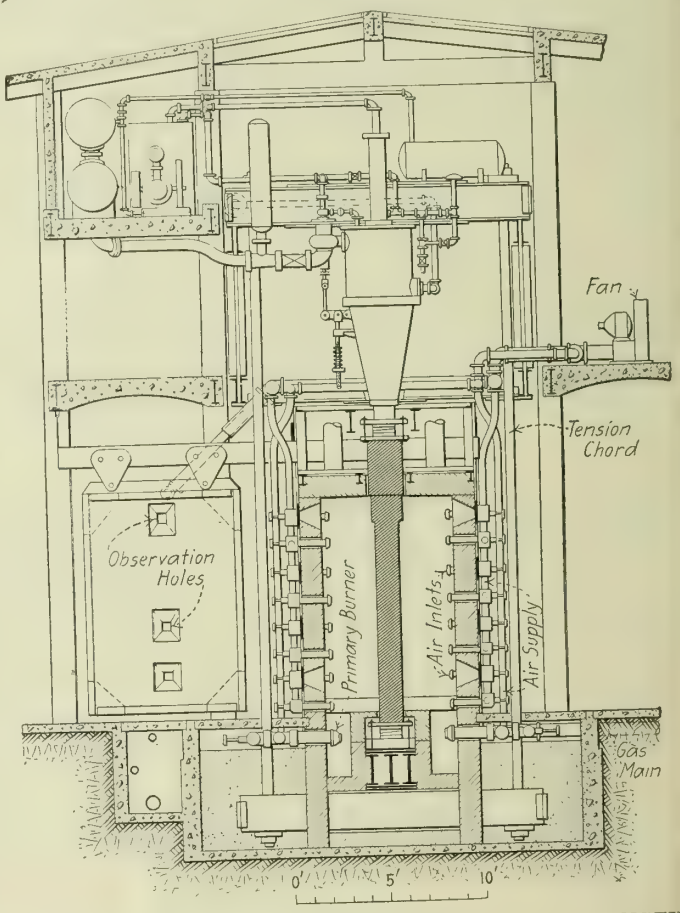
Test columns consisting of the types of columns commonly employed in building construction, specially designed for the test apparatus and for safe rated loads of approximately 50 tons, have been secured.

It is proposed to protect these columns, except one of each type, by various methods commonly employed in fireproofing building columns, and to allow them to season under proper conditions for a period of six months before they are tested.

It is proposed to make supplementary standard tests to ascertain the quality of the materials employed in the construction of the test columns.

It is proposed to subject each of the columns to its safe rated load and to temperatures increasing at a predetermined rate until failure, or until the column has withstood the temperature conditions in excess of 8 hr.

It is proposed to measure and record at regular intervals during the test the temperatures in the furnace and at various



SECTION THROUGH MACHINE FOR TESTING STRENGTH AND FIRE RESISTANCE

points on the surface of the structural portion of the column, the deformation and deflection of the column near the middle, and to record the results of observations relative to the effects of fire on the column and on the column protection.

It is proposed to make careful examinations after the test and a record of the condition of the column and column protection.

It is proposed to make photographic records of the column before and after the test and after the column protection has been removed.

It is proposed to make a supplementary series of tests upon additional test columns to determine the effect of the application of fire streams to columns while in a highly heated condition.

Description of Proposed Test Columns

The types of columns to be tested include rolled-steel sections, built-up steel sections, round cast-iron sections, steel pipe filled with concrete, and vertically reinforced and hooped concrete columns, to which it is proposed to add several wooden columns. At least one of each of the sections is to be unprotected; others are to be partially protected by concrete, and others completely protected by various thicknesses of concrete, clay tile, gypsum blocks and plaster on metal lath, in accordance with the methods commonly employed in practice.

The test columns, with the exceptions noted, are 15 ft. 8 in. long between bearings. The upper 3 ft. is made of extra-heavy section to serve as a medium for the free transmission of the load from the ram through the roof of the furnace to the heated portion of the column. The extra-heavy section is assumed to establish an effective length of 12 ft. 8 in. as a basis for calculating the safe rated load of the column. The pipe columns and two of the cast-iron columns are approximately 12 ft. 6 in. in length and provided with square end bearings.

The test columns are provided with two brackets near the top to simulate the details used for beam and girder supports and conditions affecting the application of fireproofing at these points.

The materials used in the construction of the test columns and protective coverings are to be obtained from various sources and from various sections of the country, and are to be selected with a view of obtaining those representative of their respective classes.

Columns partly protected by filling the reëntrant portions with concrete are introduced as a type made necessary where space limitations prevent the use of full protection. Besides giving information on the merits of this type of protection as compared with unprotected steel, cast-iron and wooden columns, it is also thought that they will give further data on the influence of type of steel section on fire resistance. The concrete aggregates are the same as those used in the tests of the fully protected columns of the corresponding sections.

APPARATUS TO BE USED

The apparatus to be used in the tests is specially designed for the purpose, and consists of a carriage and traveling crane for handling the test samples, a furnace in which the columns are subjected to fire, a hydraulic ram and restraining frame by means of which the loads are applied to the columns, the apparatus for measuring the temperatures of the furnace and the test samples, the apparatus for measuring the deformation of the test samples and a flexible nozzle by means of which streams of water are supplied in the fire-stream tests.

DETAILS OF TEST FURNACE

The test furnace, which is shown herewith, consists of a combustion chamber 7 ft. square and 12 ft. high, exclusive of two shallow pits to receive falling material and carry off the water during the fire-stream tests. The sides are formed by two stationary brick walls and two movable brick walls in steel panels suspended from overhead beams by trolleys. The top of the furnace consists of heavy fireclay blocks supported by a steel frame, and is partly removable to permit the installation of the test columns. The bottom is formed by the fireproofing on the steel bearing plate and restraining frame of the loading apparatus. The products of combustion are carried off through four 13-in. flues extending from the furnace through the roof of the building. Each side of the furnace is provided with mica-glazed observation holes, so arranged near the top, middle and bottom that all parts of the test column can be observed. Observation galleries outside the furnace afford access to the upper observation holes.

The furnace is heated by means of eight 6-in. specially designed blast burners, extending in at the corners and the middle of the sides and arranged so that they discharge horizontally toward the center of the combustion chamber at the bottom. The burners are supplied with gas through mixing tubes connected to circulating mains located in a shallow pit under the floor outside of the furnace. Each burner is provided with valves for regulating the gas and air.

The additional air necessary to complete combustion and distribute the fire is supplied by secondary air inlets extending through each side of the furnace at regular intervals toward the top, each inlet being provided with a regulating valve.

Gas is supplied to the furnace through a 6-in. pipe connected to the street main. Air is supplied to the burners and to the secondary inlets by means of an electrically driven blower capable of maintaining uniform air pressure.

TEMPERATURE AND DEFORMATION MEASUREMENTS

The temperatures within the furnace are indicated by means of thermocouples inserted through the walls near the top, middle and bottom. The temperatures at the surface of the structural portion of the test column are indicated by thermocouples placed at the same levels as the furnace couples.

The deformation and deflection of the column during test is to be taken by measuring the movements of protected wires attached near the middle of the column. One end of each wire is attached to the column and the other is weighted and passed over an idler at a point outside of the furnace and as far from the column as the room conditions permit. The movement is measured at an intermediate point on the wires, and the true movement at the point of attachment to the columns calculated from the established ratio of distances.

LOADING APPARATUS

The apparatus to be employed in applying the loads to the columns during the fire and fire-and-water tests consists essentially of a hydro-pneumatic ram, the pumps and tanks supplying the pressure, restraining frames and pressure-indicating, controlling and recording apparatus.

The ram has a rated capacity of approximately 256 tons and is bolted to the under side of the heavy steel beams forming the top of the restraining frame in such a manner that it will engage the top plate of the test column when in position. The column transfers the compression to the beams, constituting the bottom of the frame, which complete the action by transferring the stresses back to the top through steel tension chords forming the sides of the frame. The framing supporting the restraining frame at the top is also designed to aid in supporting laterally the lower end of the ram and resist any racking set up by eccentricity of the loads when the test columns are deformed in the tests.

The ram is designed to automatically maintain the load on the test column and develop characteristic deformation at the point of failure. In case of sudden complete failure, the loss of the load is judged to be immaterial, inasmuch as the load at which the column fails is known. In case of gradual failure, such as can be expected in the majority of cases, the ram is capable of maintaining the load until characteristic deformation of the column is secured. In case of sudden but incomplete failure of the test column, some loss in the load may take place, but this will be automatically recorded and is not considered important, inasmuch as the full load throughout the complete period of deformation would probably only increase the rate of deformation, the characteristics of which have already been observed.

The ram is connected by a 6-in. pipe to steel tanks in which the operating water and air pressures are stored, and is provided with a controlling valve that can be set to automatically shut off the pressure after any predetermined downward movement of the plunger less than 24 in. has taken place. It is also designed to absorb the impacts and withstand the pressures in case of the failure of the automatic controlling valve. A separate lifting cylinder and pressure tank by means of which the plunger of the ram can be independently raised and lowered is attached to the ram. Water and air pressures as high as 500 lb. per sq.in. are supplied by an electrically driven pump and compressor. The pumps and tanks are equipped with the necessary pressure gages and the ram with pressure-recording apparatus. The connections are provided with the valves necessary for the manual control of the loading apparatus.

Adjustable bearings are provided at the top and bottom of the test columns to insure the central application of the loads.

METHOD OF CONDUCTING TESTS

After being allowed to season for six months, the column is to be placed in the furnace and the top and bottom bearings adjusted for even distribution of load. The connections are then made with the instruments for measuring heat and deformation and the furnace closed and readings on all instruments taken. After applying the safe rated load, readings are again taken for deformation and deflection.

The gas is then lighted and gas and air gradually turned on to establish the predetermined temperature rise in the furnace. This is proposed to be made uniform for all tests and to be such that a temperature of approximately 1,500° F. is attained in 30 min., 1,700° F. in 1 hr., and 2,000° F. in 4 hr., beyond this point the temperatures being very slowly increased to a maximum of 2,300° F.

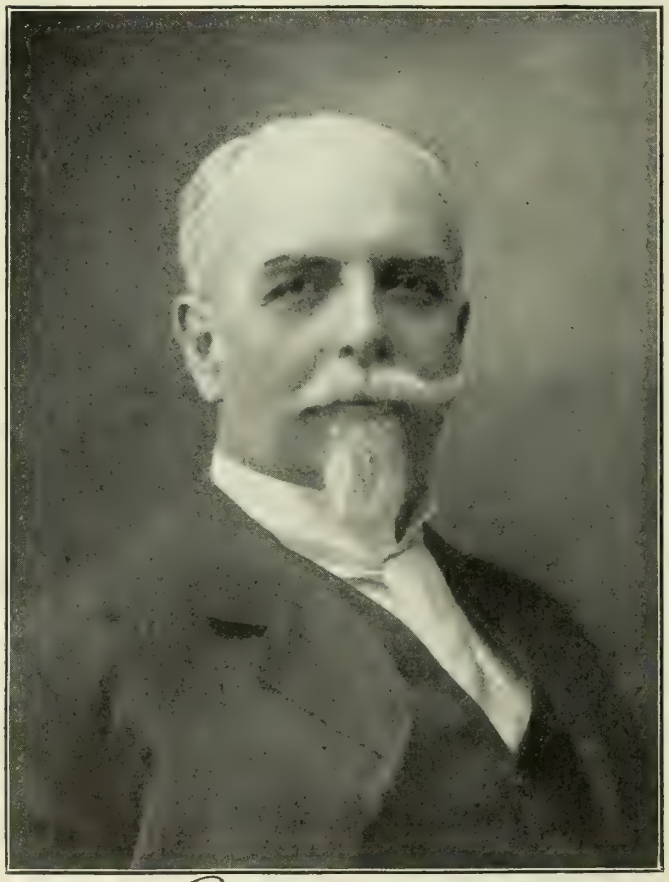
Readings on gages for load, on column and furnace thermocouples for temperature and on deformation and deflection instruments are to be taken in regular order at five-minute intervals up to a point near failure, the load being maintained as nearly constant as possible during the whole test. Observations of the visible effects of the fire on the column and its protection are to be made at regular intervals during the progress of the test.

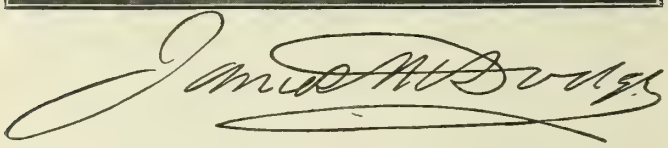
After failure, the furnace doors are to be opened and the column allowed to cool. Photographs and notes are to be made showing the general condition of the column after test. The covering is to be then removed, and constituent materials examined for deterioration due to fire.

Street Railway Given to City.—It is reported that the street-railway system in San Angelo, Tex., has been offered to the municipality as a Christmas present. The authorities are undecided whether to accept it or not, as it is unprofitable. The line is 5 mi. long and has six motor cars, one work car and a power station; the value is placed at $100,000.

James Mapes Dodge

James M. Dodge, Chairman of the Board of Directors of the Link-Belt Co., Philadelphia, Penn., died at his residence in Germantown, Philadelphia, on Saturday, Dec. 4, aged 63 years. Mr. Dodge was a native of New Jersey. His maternal grandfather, James J. Mapes, was an eminent chemist and scientist. His mother, Mary Mapes Dodge, was widely known through her editorship for many years of the juvenile magazine, *St. Nicholas*. Mr. Dodge was for three years a student at





Cornell University; then he spent a year at Rutgers College, New Jersey, where he took a special course in chemistry. His early engineering work was in the field of shipbuilding. Starting in as an ordinary workman at the famous old shipyards of John Roach, at Chester, Penn., he became at the end of three years superintendent of erection.

In Chicago about 1880 Mr. Dodge became acquainted with William D. Ewart about the time that the latter had invented and patented a new type of sprocket-chain transmission, using separable links. Mr. Dodge joined Ewart and his associates in the commercial development of this invention, and it determined his future business career.

At the time of the Ewart invention the sprocket wheel and chain, although an old device for the transmission of motion, was hardly used in machine construction or engineering. Mr. Dodge's inventive genius found full scope in the new industry in the development of various devices intended to utilize the chain transmission. The application of chain transmission to large power installations led to the formation, in 1888, of the Link-Belt Engineering Co., where under Mr. Dodge's direction a strong engineering and scientific organization was built up.

In 1889 Mr. Dodge brought out his now well-known system of anthracite coal storage, using the Link-Belt conveyor to deliver the coal in great conical piles. A separate organization, the Dodge Coal Storage Co., was formed to exploit this invention. The extent of Mr. Dodge's original work may be judged by the fact that he took out over a hundred United States patents on his inventions.

Mr. Dodge was among the best-known members of the American Society of Mechanical Engineers. He joined the society in 1884, only four years after its organization. He was elected one of the managers of the society in 1891, was a vice-president in 1902 and was elected to the presidency in 1903. Mr. Dodge also took great interest in the Engineers Club of Philadelphia and in the Franklin Institute and was vice-president of the latter organization.

A Year of Activated Sludge at Milwaukee, Wis.*

By George W. Fuller†

During the past year, and in fact for many years, there has been in the field of sewage disposal no step in advance so notable in many ways as that associated with the use of activated sludge.

In point of correctness as to theory this process seems to rest on a sound basis. What its shortcomings may be from an operating standpoint in actual practice, and what its operating costs and indeed its total costs may involve for plants of different sizes and for widely varying local conditions, are all propositions upon which further data are needed before arriving at final conclusions.

The activated-sludge process has many points of similarity to the filtration of sewage in filter beds, in that it offers an opportunity for the sewage to come in contact with surfaces suitably prepared as to biological growths, promoting nitrification and other bio-chemical changes. In a sense, it is a reversal of the filtration process in that the purifying medium is moved up and down through a tank of sewage, rather than the liquid moved through a bed of stone, each particle of which is surrounded with films containing bacterial growths and the products of bacterial growths, all of suitable physical and biological character.

About two weeks ago I visited the Milwaukee sewage-testing station, noted the activated-sludge investigations there and discussed them with Messrs. Hatton and Copeland and other members of the technical staff. The following tentative deductions regarding this process may be drawn at this time, which marks a transitional stage between the strictly experimental work at Milwaukee and numerous places elsewhere, and the actual operation at Milwaukee of a plant on a working scale:

1. Having secured an adequate quantity of properly activated sludge, it is necessary in its utilization to ap-

*Slightly condensed from a paper read before the New Jersey Sanitary Association, Lakewood, N. J., Dec. 3, 1915.

†Consulting Engineer, 170 Broadway, New York City.

ply a certain minimum quantity of air. This quantity must be at least sufficient to effect a thorough commingling of the activated sludge with the sewage to be treated by it.

2. When the sludge is properly activated and adequately commingled with the sewage to be treated, a period of two hours or less is sufficient to bring about substantially complete clarification through the attachment of the fine colloidal particles to the more or less gelatinous surfaces of the activated sludge. This is the only process besides intermittent sand filtration that seems practicably capable of thorough clarification.

Bacterial Removal

3. With the removal of colloidal matters there are also eliminated the great majority of the bacteria, and with a period of aëration of from 2 to 3 hr. the removal of bacteria may be expected to approach 96 to 99%, or substantially as high an efficiency as may be expected with sand filters.

4. It appears that the Milwaukee sewage may be well clarified and well freed of bacteria, after sedimentation, but without the establishment of nitrification. Such an effluent will not remain nonputrescible for more than say four or five days.

5. Still further improvement in the quality of the effluent of the activated-sludge method is brought about by the nitrification and other oxidation processes characteristic of activated sludge, and more or less resembling the action effected by the ripened films surrounding the solid medium of sewage filters.

6. Nitrification to the point of securing complete stability may be effected within certain limits by applying air in greater quantities per volume of sewage treated or by a prolongation of the time during which the activated sludge is brought in contact with the sewage to be treated and with the rate of application of air sufficient to bring about a commingling of the activated sludge throughout the liquid to be treated. At Milwaukee it is stated that nitrification increases in a roughly proportional way to the duration and intensity of the aëration, although there are apparently some exceptions to these general rules. Incidentally, mention may be made of the fact that the application of this process may be adjusted to different degrees of stability of effluent, of which there will doubtless be variations in individual viewpoints, just as is the case in deciding upon the best depth of sprinkling filters.

7. The duration and intensity of aëration ought to be adjusted to the sewage flow for those portions of the day when the volume and strength of the sewage are greatest. Then for those portions of the day when the sewage is weaker and less in volume the result will be a higher degree of nitrification than that which would be decided upon as suitable for the maximum load as to strength and volume.

8. The indications are that the beneficial effect of activated sludge may be lost in varying degrees and in a variety of ways, of which mention may be made of the following:

A. Excessive aëration may break up the particles of activated sludge so as to reduce materially the adequacy of the spongy gelatinous surface for removing colloids. Perhaps this may be made clearer by saying that the inner surfaces of disintegrated portions of activated sludge may themselves under some circumstances utilize a portion of the gelatinous activated material, and thus reduce the quantity available for the withdrawal of colloids of the sewage to be treated.

B. Fine mineral suspended matter, say from street washings and present in the effluent of a grit chamber, may saturate the gelatinous surfaces of the activated sludge so as to preclude normal action by the latter upon the colloids of the sewage.

C. The activation of the sludge may be carried to a point where it is "burnt up," or where the material within or underneath the gelatinous surfaces of the sludge particles no longer stimulates a continuous bacterial growth along normal lines.

D. Inadequate or insufficient aëration might cause a temporary breakdown of the process, the correction of which would require more or less re-activation of the sludge at hand. This feature in practice will need attention, as complete activation of the sludge seems to require a month or more of frequent if not continuous aëration.

9. It is believed at Milwaukee that the activated-sludge process will prove markedly successful in removing with great promptness the odoriferous compounds found in sewage, and if this should prove generally true it is believed that the marked practical benefit will justify costs in excess of methods of treatment not capable of freedom from odor.

10. Data are not yet available to show what may be expected during the winter months as to diminished performance of the process due to low temperature of the sewage, other things being equal. A somewhat more intense application of air or a longer period of treatment or a somewhat lessened degree of stability of the effluent in various combinations may make the problem appear more simple than is thought to be the case by some observers at present. Keen interest will be felt in the outcome of the Milwaukee experiences during the coming winter with its new plant capable of treating 1,600,000 gal. of sewage daily.

Drying of the Sludge

11. The surplus sludge removed from the sedimentation tanks into which the sewage passes after it leaves the aërating tank apparently will dry quickly, and it is free of offensive odors as removed and dried. This does not necessarily mean that it will not ultimately decompose and produce foul odors if allowed to accumulate in bulk. Preparation of this sludge for use as fertilizer seems to be a proposition necessitating considerable careful study, and it yet remains to be seen whether the sludge can be sold for enough money to pay for its own treatment. The practical outcome of sludge disposal in this process must depend upon data to be secured in the future.

12. Although it is not the purpose of this discussion to go into the question of costs of the complete process based on present data, it may perhaps not be amiss to point out, in a process where the cost of power and attendance will vary much under local conditions and depend upon the size of the plant, that the method may work out admirably for a plant of 50,000,000-gal. capacity, and even for one of 5,000,000-gal., whereas it may prove markedly expensive for a plant of say 500,000-gal. daily capacity.

News of the Engineering World

Activated-Sludge Treatment for Packing-House Wastes

The treatment of stockyards' sewage and industrial wastes before discharge into the Chicago River is being forced upon the attention of the meat-packing firms, and has been under consideration by these firms and the Sanitary District of Chicago for some time. The District made a report on the subject about a year ago, but since then the activated-sludge process has come to the front. As this process promises a byproduct of considerable fertilizing value and is otherwise promising, several of the large packers began to conduct a series of experiments with it.

After successful experiments with small tanks, Armour & Co. have now an experimental activated-sludge plant with a tank of 20,000-gal. capacity, which is worked on the continuous-process method. This was put in service early in November, 1915, and has given excellent results. Morris & Co. and Swift & Co. have plants of the same general character, and the latter is said to intend building a 500,000-gal. plant. Sulzberger & Sons Co. is reported as experimenting with both the activated-sludge and electrolytic processes.

These experiments are independent of but in relation with the investigations which have been carried on for some time by the Sanitary District of Chicago regarding the activated-sludge process for treatment of trade-waste products at the stockyards. The District recently appropriated $10,000 for further experiments, and is building a plant to handle 150,000 gal. per day. A committee of five members appointed by the packers represents them in discussions of the problem with the Sanitary District authorities.

Supreme Court Decision on Asphalt-Paving Guarantee

Certain streets in St. Paul, Minn., were paved with sheet asphalt by the Barber Asphalt Paving Co. under a 10-yr. guarantee or maintenance clause. During six years of the maintenance period the asphalt company made repairs at the request of the city. It was then discovered that the defects were caused chiefly by leakage from gas mains, poor construction of the street-railway tracks and other causes beyond the power of the contractor to prevent. On subsequent work of a similar nature the contractor demanded payment for repairs, and on refusal by the city brought suit.

The maintenance clauses in the contract were indefinite, and the contractor contended that they should be interpreted to cover only repairs made necessary by defective material or poor workmanship, while the city contended the maintenance clauses were so broad that they covered such repairs as those under question. The United States Circuit Court upheld the city's contention, and stated:

> If the gas company was negligent in permitting gas to escape, which caused injury to the pavement, it might be liable to the plaintiff . . . But even if there had been some ambiguity in the language used in the contracts, the construction placed upon them by both parties during all that time, from 1901 until the institution of this suit in November, 1912, that these repairs had to be made by the paving company at its own expense, would effectually remove the ambiguity. The law is well settled that, if there is any doubt or ambiguity in a contract arising from the words employed, it is effectually removed by the practical construction continuously put upon it by the parties for so long a period as was done in this case.

The case was taken to the United States Circuit Court of Appeals, where the decision was upheld, and subsequently a petition for a writ of certiorari was made by the plaintiff to the United States Supreme Court, which was refused.

The decision establishes that if a contractor makes paving repairs for any considerable time and afterward claims that these are not covered by his maintenance obligation, the courts will construe his having made repairs without objection as evidence that this is his own interpretation of the maintenance clauses, and that they are accordingly binding. On this point only is the decision of importance, for it opens the way to making the gas company responsible for the repairs even though the city is not.

Lackawanna R.R. to Have New Coal Pier at Buffalo

The Delaware, Lackawanna & Western R.R. has just started at North Pier in Buffalo, N. Y., the construction of a new coal pier and dumper with a capacity of 300 cars per day.

At the present time there is in use at this point an ordinary coal trestle having a capacity of about 5,000 tons. The trestle has been in use for a number of years and has about reached a point where it requires rebuilding. In addition to this, the United States Government objected to the fact that boats had to lie in the channel of the Buffalo River while loading. After considerable discussion between the officers of the railroad company and the United States War Department, the railroad company was finally required to excavate a slip entirely on its own property and parallel to the face of the present dock. In order to do this, it became necessary to cut back the entire frontage for a width of 90 ft., which gives room to put in a slip 66 ft. wide and to build an outer protection pier 24 ft. wide.

It is intended to put in a timber crib below the water line and a concrete retaining wall above the water line, along the inner side of the proposed slip. It is also intended to build the protection pier entirely of reinforced concrete, using the floating reinforced-concrete caisson method similar to that devised for the Lake Ontario entrance to the Welland Ship Canal, described in *Engineering News*, June 10, 1915. A marine railway will

be built at some point adjacent to the site of the proposed protection pier, on which to build necessary caissons. These caissons will be in sections of about 100 ft. in length, are to be fitted with pipes and valves so that they can be filled with water and sunk, and they will have movable wooden floors and necessary cross walls. The ends are to have keys for keeping adjacent sections in line with each other. After the boxes are sunk in place they will be filled with stone or other material. It is intended to dredge the channel out to a depth of 23 ft. below mean water, and the caissons will be made 23 ft. in width.

For handling the coal it is intended to put in a car dumper having a capacity of 75 tons. The matter of handling the screenings and the handling of coal from box-cars have not as yet been fully decided. There is handled during the season of navigation at this point from 1,600,000 to 1,800,000 tons of coal.

Dredging is already under way and the contract for the car dumper has been let to the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, and it is the understanding that the car dumper is to be in operation by the first of June, 1916. George J. Ray is chief engineer of the railroad company.

Commission of Scientists to Study Panama Slides

A commission of scientists has been selected by the President to visit the Panama Canal and to investigate and report on the slide situation. The men were nominated by the National Academy of Sciences at the request of President Wilson. It is reported that they will sail for Panama on Dec. 11 to be gone about four weeks. The personnel of the commission is as follows:

C. R. Van Hise, President of University of Wisconsin, Chairman.
George F. Becker, U. S. Geological Survey.
Arthur L. Day, Geophysical Laboratory, Carnegie Institute.
J. F. Hayford, Dean, College of Engineering, Northwestern University.
Harry Fielding Reid, Professor, Johns Hopkins University.
Charles D. Walcott, President, Smithsonian Institution.
J. C. Branner, President, Leland Stanford, Jr., University.
Arthur P. Davis, Chief Engineer, United States Reclamation Service.
H. L. Abbot, Brigadier General, U. S. A., retired.
R. C. Carpenter, Professor, Cornell University.
John R. Freeman, Consulting Engineer.

Extensive Railway Improvements at Elizabeth, N. J., are projected by the Pennsylvania R.R. and the Central R.R. of New Jersey. Plans have been prepared by R. W. Creuzbaur Consulting Engineer for the City of Elizabeth.

The Demolition of the Panama-Pacific Exposition Buildings was begun Dec. 6. Nothing east of the Fine Arts Palace will be retained. It is probable that the yacht harbor and possible that the Fine Arts Building may be kept. A marine boulevard may be constructed.

The Contract for Constructing the Hetch Hetchy R.R. for use in developing the Hetch Hetchy water-supply by San Francisco, Calif., was awarded on Dec. 6 to F. Rolandi, 550 Montgomery St., San Francisco, for $1,543,081. This was the lowest of five bids, the details of which are given in the construction news pages of this issue. A description of the railroad project was printed in "Engineering News" of Nov. 11, 1915, p. 925.

The Chicago Subway Project has made another step, the City Council having passed an ordinance for the appointment of a committee of three engineers to investigate and report upon the matter. One member is to be a Chicago man, and the others are to be men familiar with conditions at New York, Boston and Philadelphia.

A New Reinforced-Concrete Stadium to seat 5,000 persons will be started soon at the University of Wisconsin. It will be completed in time for the games of next fall. An appropriation of $20,000 has been made by the State Legislature for the erection of the first section of the new stadium. This section will be semicircular in form and will contain 40 rows of seats. It will be built in such a way that it can be extended around the two sides and perhaps in the future be made into a stand inclosing a field.

The St. Paul Union Station Plan as submitted by the United railways to the city and Federal government ("Engineering News," Mar. 11, 1915, p. 488) has been withdrawn in its entirety, following the rejection of the harbor details of the scheme by the Chief of Engineers, U. S. A. The plans were drawn under an Act of Congress providing for the bettering of river navigation and river transportation facilities at St. Paul, the harbor line and river being moved a maximum of 400 ft. for 6,000 lin.ft. The United States engineers declined to appove the plans on grounds which to the railroad companies seemed fundamental, and new plans will now be drawn which will not require the approval of the Federal government. This will mean the selection of a new site and the purchase of grounds.

The Proposed New Jersey Ship Canal, which is to run between the Delaware River and Raritan Bay, is to be surveyed during the coming winter under authority from the State of New Jersey. The surveys will be in charge of W. F. K. Griffith under the direction of B. F. Cresson, Jr., Chief Engineer of the Department of Commerce and Navigation of the state. The route for this canal has already been surveyed from Bordentown to Jamesburg, so that the work remaining is for the section between Jamesburg and Morgan, the latter being the terminal point in Raritan Bay. This route is one investigated some years ago by the U. S. Army engineers and is included in the Inland Waterways scheme now being advocated as a measure of military preparedness.

Blowout Delays East River Tunnel Work—A blowout in the south tunnel, west end, of the pair of rapid-transit tunnels which the Flinn-O'Rourke Co. is driving from Old Slip, New York, under the East River, filled the tunnel at the shield with water and stopped work until clay cover was placed on the river bottom to seal the demoralized ground. The accident happened Nov. 30. The south shield was partly under the riverfront bulkhead wall, which here is a concrete-block wall on bagged concrete on rock. The tunnel crown is 4 to 5 ft. above rock, which is at El. 28. Just outside the bulkhead, in the slip, the earth cover over the shield is about 14 ft. Air leaking along the shield from the tail, since the cutting-edge began going through the wall foundation, rose up in the slip and loosened the ground. When the cutting-edge was about 8 ft. out from the wall, the rear half of the shield being under the wall, the sheeted earth face at the top of the shield gave way just after a blast in the rock portion of the face below. A leak to the river bottom developed, which brought in water as the air pressure dropped from 14 lb. to 11 lb. The inflow was slow, but attempts to plug the leak with bagged sawdust did not succeed, and in 20 min. the shield was submerged, the upper part of the tunnel slope still holding 11 lb. air.

PERSONALS

Mr. William B. Bartholomew has been elected Director of Highways and Mr. Thomas J. Roth, Director of Public Property, of the City of Allentown, Penn.

Mr. Oliver S. Kelsey, Lock Haven, Penn., has been appointed by Gov. M. G. Brumbaugh a member of the Pennsylvania Water Supply Commission to succeed B. F. Focht, congressman-elect, resigned.

Mr. George R. Henderson, M. Am. Soc. M. E., has severed his connection with the Baldwin Locomotive Works and opened

an office for the practice of consulting engineering at 1321 Walnut St., Philadelphia, Penn.

Mr. Charles Boettcher, of Denver, Colo., has been elected President of the Denver & Salt Lake R.R. He succeeds Mr. Newman Erb, of New York, who has been President since the reorganization of the road two years ago.

Mr. R. P. Black, M. Am. Soc. C. E., formerly Engineer of Maintenance of Way of the Kanawha & Michigan Ry., at Charleston, W. Va., has opened an office in Atlanta, Ga., as a construction engineer. Mr. Blank is also President and Treasurer of the Spencer Turbine Cleaning Co., of Atlanta.

Mr. W. B. Saunders, M. Am. Soc. C. E., Consulting Engineer, of Minneapolis, Minn., and recently with the Great Falls Power Co., Great Falls, Mont., has been appointed Engineer of the Montana State Office of Railroads and Public Service Commissioners, with headquarters at Helena, Mont.

Mayor-elect Harry L. Davis, of Cleveland, Ohio, has appointed Mr. Fielder Sanders, former county judge, Director of Traction Service; Mr. Thomas Farrell, formerly Secretary of of State Federation of Labor, has been appointed Director of Public Utilities, and Mr. Alex Bernstein, for six years a member of the City Council, has been appointed Director of Service.

Mr. Edward N. Lake, Fellow, Am. Inst. E. E., formerly in charge of the Chicago office of the Stone & Webster Engineering Corporation, of Boston, has become a partner in the firm of Krehbiel & Co., Engineers and Constructors, with offices in the Marquette Bldg., Chicago. The business will be continued under the present firm name. Mr. Lake will be Treasurer and Manager, and Mr. Krehbiel will continue as President.

Mr. W. Thomas Wooley, City Engineer of Syracuse, N. Y., has accepted a similar appointment with the City of Schenectady, N. Y., effective Jan. 1. Previous to his present position, Mr. Wooley was City Engineer and Architect of Schenectady, and prior to that Engineer of the Public Improvement Commission at Hoosick Falls, N. Y., and City Engineer of Auburn, N. Y. He is a graduate in civil engineering of Rensselaer Polytechnic Institute.

Mr. Charles W. Okey, Assoc. M. Am. Soc. C. E., Engineer, Division of Drainage Investigations of the Office of Experiment Stations, U. S. Department of Agriculture, has assumed charge of the consolidated field offices at New Orleans for the states of Texas, Arkansas, Louisiana, Mississippi, Florida and part of Alabama. Since July 1, 1915, the drainage work has been under the Office of Public Roads and Rural Engineering, Department of Agriculture; the various field offices have been consolidated and established at Berkeley, Calif., Denver, Colo., and New Orleans, La., in addition to the central office at Washington. Mr. Okey will continue to give special attention to land drainage by pumps in all sections of the country.

The Pressed Steel Car Co., Pittsburgh, Penn., announces the following changes, to take effect immediately: Messrs. N. S. Reeder, M. Am. Soc. M. E., has been elected Vice-President, with headquarters at New York; J. B. Rider elected Vice-President, with headquarters at Pittsburgh. He will continue to perform the duties of General Manager in Charge of Operations; J. F. MacEnulty, formerly General Sales Manager, elected Second Vice-President, with headquarters at New York; C. E. Postlethwaite, formerly Manager of Sales, Central District, Pittsburgh, appointed General Sales Manager of the Pressed Steel Car Co. and the Western Steel Car and Foundry Co., with headquarters at New York; H. P. Hoffstot appointed Assistant Sales Manager, Central District, with headquarters at Pittsburgh.

Mr. C. J. Larsen, Assoc. Am. Inst. E. E., Electrical Engineer, with headquarters at 227 Federal Square, Harrisburg, Penn., has been appointed to make a survey of the facilities of the independent telephone companies of eastern Pennsylvania with a view to bringing about a standardization of operating methods, improvement in central-office equipments, inspection of toll lines and adoption of long-distance routes between connecting companies. This work is being undertaken under the direction of the service committee of the Independent Telephone Companies of Pennsylvania, Maryland and Virginia, which includes Messrs. E. M. Prisk, Consolidated Telephone Co., Hazleton, Penn.; H. M. Tracy, Cumberland Valley Telephone Co., Harrisburg, Penn.; A. J. Ulrich, Keystone Telephone Co., Philadelphia, Penn.

Mr. Edward E. McCall, Chairman of the Public Service Commission, First District, New York, has been removed by Governor Whitman on the ground that he has violated the law by holding stock in a public-utility corporation. Mr. McCall is charged with holding 387 shares of stock in the Kings County Electric Light and Power Co., Brooklyn, N. Y. He contended that he transferred these shares to his wife when he was appointed Public Service Commissioner, but Governor Whitman held that there was no evidence of the transfer, and is reported to have said that he "did not believe a transfer within the meaning of the law was ever made." The commissioners are appointed for six-year terms, and Mr. McCall had served about half his term. Previous to his appointment as a member of the Public Service Commission he was a Supreme Court Justice.

OBITUARY

Archibald Colter, contractor, and for many years Superintendent of the Cincinnati Street Cleaning Department, died at his home in that city Nov. 24 from apoplexy. He was 65 years old.

Col. W. P. Rend, President of the Rend Coal Co., of Chicago, died suddenly at the age of 75 in that city Nov. 30. Col. Rend shipped the first train load of coal out of Columbus on the Hocking Valley R.R. 40 years ago and made a fortune in the coal and oil business. He was a native of Ireland and served in the Civil War.

James I. Ayer, M. Am. Inst. E. E., General Manager of the Simplex Electric Heating Co., Cambridge, Mass., and formerly President of the National Electric Light Association, died Nov. 27 at 61 years of age. Mr. Ayer invented many electrical appliances and had charge of the installation of the municipal lighting plant at St. Louis, Mo.

Frederick Warren Dodge, Founder and President of the F. W. Dodge Co., of New York City, died at his home in that city Nov. 10. He was born in Melrose, Mass., in 1864 and was educated in the public schools of Newton, Mass. Mr. Dodge founded the F. W. Dodge Co. in Boston in 1891, and the following year he opened a branch office in New York. In 1896 he formed a partnership with Clinton W. Sweet, publisher of the "Arichitectural Record," the "Record and Guide" and "Sweet's Catalog." Shortly afterward the head office of the company was transferred to New York City. In 1912 Mr. Dodge purchased Mr. Sweet's interest in the company, and at the time of his death controlled some sixteen publishing enterprises in New York and elsewhere.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 7-10. Annual convention in New York. Secy., Calvin W. Rice, 29 W. 39th St., New York City.

AMERICAN ASSOCIATION OF ENGINEERS.
Dec. 10 and 11. Convention in Chicago. Secy., Arthur Kneisel, 29 South La Salle St., Chicago.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.
Dec. 13-15. Annual meeting in New York. Secy., Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

SECOND PAN-AMERICAN SCIENTIFIC CONGRESS.
Dec. 27-Jan. 8. Washington, D. C.

OKLAHOMA SOCIETY OF ENGINEERS.
Dec. 28. Annual meeting in Oklahoma City. Secy., H. V. Hinckley, Oklahoma City.

AMERICAN CIVIC ASSOCIATION.
Dec. 28-31. Annual convention in Washington, D. C. Secy., R. B. Watrous, Union Trust Bldg., Washington, D. C.

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 3-6. Seventh annual convention in Washington, D. C. Secy., C. R. Marsh, Brattleboro, Vt.

MONTANA INSTITUTE OF MUNICIPAL ENGINEERS.
Jan. 17-19. Annual meeting at Billings, Mont. Secy., C. C. Widener, Bozeman, Mont.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 19-20. Annual meeting in New York City. Secy., C. W. Hunt.

NATIONAL DRAINAGE CONGRESS.
Jan. 19-21. Annual meeting, Cairo, Ill. Vice-Pres., Edmund T. Perkins, First National Bank Bldg., Chicago.

ILLINOIS CHAPTER: AMERICAN WATER-WORKS ASSOCIATION.
Jan. 25-27. Annual meeting, University of Illinois, Urbana. Secy., Dr. Edward Bartow, Urbana, Ill.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 26-28. Annual meeting, University of Illinois, Urbana, Ill. Secy., E. E. R. Tratman, Wheaton, Ill.

NINTH CHICAGO CEMENT SHOW.
Feb. 12-19. First Infantry Armory and Coliseum. Secy., R. F. Hall, 208 South La Salle St., Chicago.

AMERICAN CONCRETE INSTITUTE.
Feb. 14-17. Annual convention in Chicago. Secy., John M. Goodell, 1418 Walnut St., Philadelphia.

SECOND NATIONAL CONFERENCE ON CONCRETE ROAD BUILDING.
Feb. 15-18. At Chicago. Secy., J. P. Beck, 208 South La Salle St., Chicago.

AMERICAN ROAD BUILDERS' ASSOCIATION.
Feb. 22-25. Annual convention in Pittsburgh. Secy., E. L. Powers, 150 Nassau St., New York City.

Brooklyn Engineers' Club—At the annual meeting held on Dec. 9 at 8:30 p.m., the following officers were elected: President, Ernest M. Van Norden; treasurer, Harry E. Funk; directors, Bernt Berger and Carroll S. Dunphe; secretary, Joseph Strachan, 117 Remsen St.

American Concrete Institute—The annual convention will be held in Chicago, Feb. 14-17, 1916, the exact location of the meetings to be announced later. The Nominating Committee has filed a ticket for the coming election, with Leonard C. Wason, of Boston, continued as president and H. C. Turner, of New York, as vice-president.

The Engineers' Club of St. Louis will hold its annual dinner on Jan. 26 in conjunction with the Associated Engineering Societies of St. Louis. Elmer L. Corthell will be the guest of the evening. At a recent meeting of the Engineers' Club it was voted to devote one meeting a month to military engineering. Major Willing, Corps of Engineers, U. S. A., will give a series of four lectures before the Club.

American Road Builders' Association—The thirteenth annual convention of the American Road Builders' Association, scheduled to be held in Pittsburgh in the week of Feb. 22, has been postponed to the week of Feb. 28, the closing day being Mar. 3. The Sixth American Good Roads Congress will be held coincidently and under the auspices of the association, as will also the Seventh National Good Roads Show of Machinery and Materials. The technical sessions will commence on Tuesday morning, Feb. 29, continuing on Wednesday, Thursday and Friday.

New Jersey Sanitary Association—The activated-sludge process of sewage treatment was the leading engineering feature of the fifty-first annual meeting of this Association, held at Lakewood, N. J., Dec. 3 and 4, 1915. The discussion was opened by W. T. Carpenter, chemist, Brooklyn Sewage-Experiment Station, New York City, who reviewed the work done at Brooklyn and elsewhere. (See "Engineering News," Apr. 1, July 1, July 15, 22 and 29, and Dec. 2, 1915.) The discussion of this paper was opened by Geo. W. Fuller, New York City, whose deductions from personal observations at the Milwaukee sewage-experiment plant are printed elsewhere in this issue. M. N. Baker, of the editorial staff of "Engineering News," characterized the process as most promising and perhaps revolutionary, provided it proves to be economically feasible. Federal experiments with small sewage-treatment plants at Washington, D. C., were outlined by Leslie C. Frank, Sanitary Engineer, United States Public Health Service. Imhoff tanks for domestic sewage appear to need steeper sloping sides than those for city sewage. Both scum formation and boiling occurred in the Imhoff tanks in July, but might perhaps be obviated by changes in design. The tank effluent created no nuisance on sand filters. Chester H. Wigley, Chief, Bureau of Engineering, New Jersey State Department of Health, opened the discussion. He said engineers do not favor Imhoff tanks for small plants because they require more attention than do the old-style tanks. In a paper on "The United States Public Health Service and the Shellfish Problem," Surgeon H. S. Cumming stated that more study of the subjet is needed and the studies should partake more of a practical sanitary survey than of the laboratory. This point was endorsed by R. B. Fitz-Randolph, Assistant Director, New Jersey Department of Health, who stated that since oyster protection was undertaken four years ago conditions had been greatly improved so that now there are few oyster areas subject to pollution in New Jersey.

International Road Congress—The program of the so-called International Road Congress, to be held at the Hotel Bancroft, Worcester, Mass., Dec. 14-17, includes the following papers:

Tuesday, Dec. 14—"The Development of Improved Highways in Canada and What It Means to the Dominion," by Hon. W. A. McLean, Department of Public Works, Toronto, Ont.; "What the United States Is Doing for the Good Roads Movement," by Logan Waller Page, Director of the United States Office of Public Roads and Rural Engineering.

Wednesday, Dec. 15—"History of Highway Development in Massachusetts," by Wm. E. McClintock, Treasurer of the Winnisimmett Co., Chelsea, Mass.; "Brick Roads," by Will P. Blair, Secretary of the National Paving Brick Manufacturers' Association; "The Merits of Natural Asphalt Roads," by Clifford Richardson, Consulting Engineer, Barber Asphalt Co.; "The Merits of Refined Asphalt Roads," by Leroy M. Law, Chemist, United States Asphalt Refining Co.; "City Pavements," by Geo. W. Tillson, Consulting Engineer of the Borough of Brooklyn, N. Y.; "Selections of Type for Road Surfaces," by W. W. Crosby, Consulting Engineer, Baltimore, Md.; "The Necessity of Scientifically Trained Engineers in Highway Construction," by Dr. Ira N. Hollis, President of Worcester Polytechnic Institute; "Concrete Bridges vs. Steel and Wood," by J. R. Worcester, Consulting Engineer, Boston, Mass.

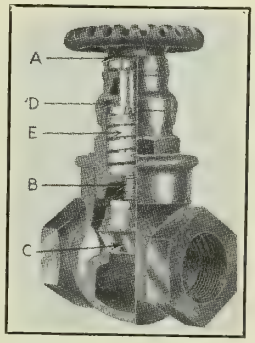
Thursday, Dec. 16—"The Selection of Materials for Highway Construction," by Dr. Joseph Hyde Pratt, State Geologist, North Carolina; "Financing City Streets," by Nelson P. Lewis, Chief Engineer of Board of Estimate and Apportionment, New York City; "Providence and Her Highway Department," by Joseph W. Gainer, Mayor of Providence; "Milwaukee County Concrete Roads," by Herbert R. Kuelling, Highway Commissioner; "Boston's Experience with Various Types of Street Paving," by James M. Curley, Mayor of Boston; "Precautions Adopted by Dominion Cities Against Extreme Climatic Changes in Building and Maintaining Streets," by Thomas Cote, Commissioner of Streets, Montreal; "The Organization of Highway Departments," by W. H. Connell, Chief of Bureau of Highways and Street Cleaning of Philadelphia.

Friday, Dec. 17—"The Automobile and Its Relation to Good Roads," by George C. Diehl, Buffalo, N. Y.; "The Type of Pavements Now Being Laid in New York State Highways," by Edwin Duffy, Commissioner of New York State Highway Department; "Improved Granite Pavements," by Henry Welles Durham, New York City; "The Ideal Road for the Motorist," by Lewis D. Speare, Cambridge, Mass.; "The Interest of the National Chamber of Commerce in the Good Roads Movement," by John H. Fahey, Boston, Mass.; "Canada as a Country for Motorists," by W. H. Danderand, Montreal; "Relation of Motor Trucks to Permanent Highways," by Wm. R. Smith, President, Lane Construction Co., Meriden, Conn.

Appliances and Materials

High-Pressure Valve with Cast-Iron Spring

Two special features of the high-pressure valve shown herewith are the entire absence of packing and the use of a cast-iron spring. This application of cast iron is novel. The springs, which are made under the Knudsen patent, have no temper, so that heat does not affect them. Test springs show no change in tension or resilience after having been in regular use for three years.



HIGH - PRESSURE UNPACKED VALVE

The nonrising handle swivels on the shoulder A and is independent of the main valve stem. A square socket in the handle turns a shank, the lower end of which fits over a square head on the main threaded spindle B. This head moves up and down in the recess of the shank as the valve C opens and closes. Between the rigid and revolving shoulers at D is a grooved ring of bearing metal, which forms a constant seat and prevents the steam or water from rising above it. The purpose of the spring E is to maintain a tight contact between the shoulders and the grooved ring. The spring was tested to 10,000,000 deflections in a machine and showed no set, calipering the same before as after the test. Many of the valves are in use.

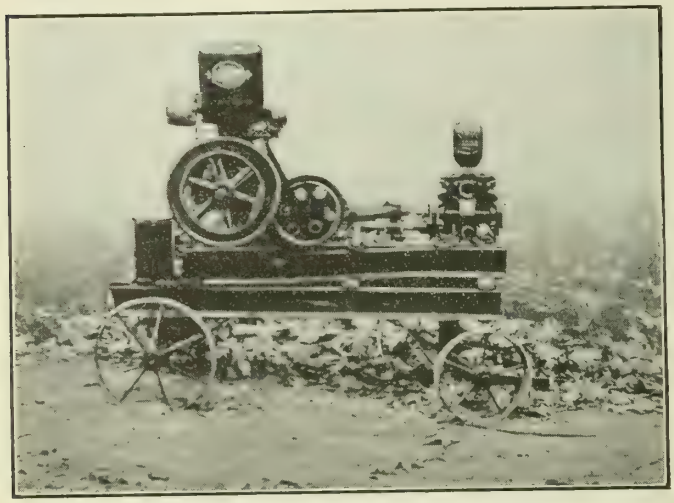
The valve is for use with high-pressure steam, water, gas and air, and also for ammonia. It is manufactured by the Universal Valve Co., 910 South Michigan Ave., Chicago, which has also the sole right to make the springs previously described.

* * *

Small Pumping Unit for Contractors

A small portable pumping unit of a very serviceable type for construction work is shown in the illustration. It is so light and compact that it may be drawn on hard road by a

single man, although of course it is not intended to be so hauled generally. The unit is designed on lines similar to those of the larger units which the maker, the Novo Engine Co., of Lansing, Mich., has been manufacturing for some time past, known as Type U pumping outfits. The unit pictured consists of a single-cylinder gasoline engine geared to the



SMALL PORTABLE PUMPING UNIT FOR CONTRACTOR'S USE ON CONSTRUCTION WORK

crankshaft of a small piston pump especially designed for high pressures. The following table gives the specifications for these small outfits:

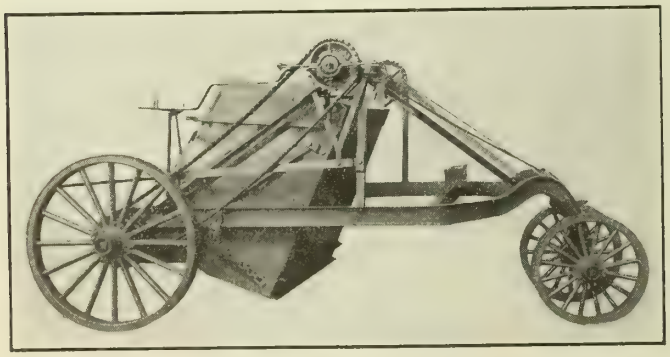
No.	Hp.	Pump Cyl. Diam., In.	Pump Stroke, In.	Suct. and Disch., In.	Cap., Gal. per Hr.	Pressure, Lb.	Bare Wt., Lb.	Shipping Wt., Lb.
61	Jr.	2	5	1	400	155	370	445
62	1½	2	5	1	400	230	415	490
63	1½	3	5	1¼	900	100	425	525
64	2½	3	5	1¼	1,000	150	590	700
65	2½	4	5	1½	1,800	85	640	750
66	4	4	5	1½	1,400	180	790	915
67	4	5	5	2	2,200	115	940	1,150
68	6	5	5	2	2,200	170	1,240	1,500

The smallest size of pumping outfit is claimed to deliver 400 gal. per min. against a head of 50 ft. through 5,000 ft. of 1-in. pipe or 15,000 ft. of 1½-in. pipe. Against a head of 300 ft. it is claimed to deliver 400 gal. per min. through 600 ft. of 1-in. pipe or 2,000 ft. of 1½-in. pipe.

* * *

Four-Wheel Scraper for Snow Removal

Wheel scraper-excavators of the "Maney" four-wheel type, made by the Baker Manufacturing Co., Springfield, Ill., are proving a practical device on road and street grading, railway excavation, quarry stripping, etc. These have been made with scraper-bucket or pan capacities of ½ and 1 cu.yd. A new scraper of the same type, especially designed for handling snow, is now on the market. It has a pan capacity of 4



MANEY FOUR-WHEEL SNOW SCRAPER

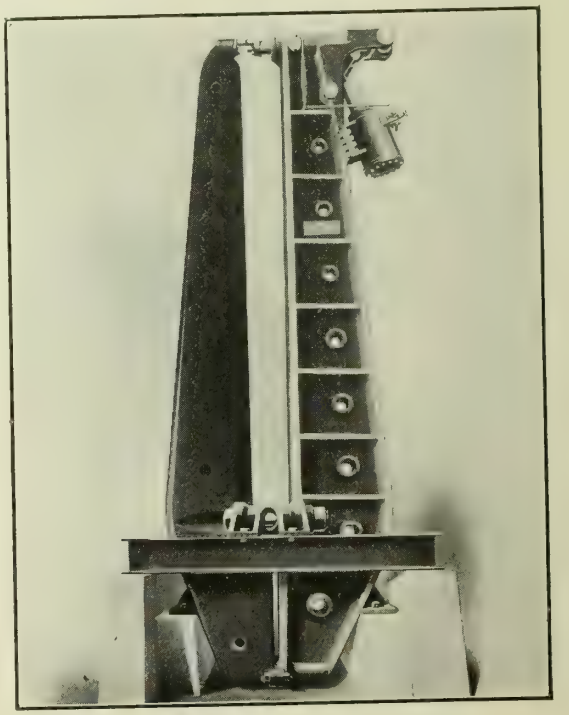
cu.yd. and can be easily handled by two horses. The illustration shows the scraper in carrying position. A lever on the right-hand side of the machine (shown in illustration) throws out the spool clutches and allows the pan to drop into loading position. A movement of the lever in the opposite direction stops the pan at any point. The pan turns and swings about an axis at one edge of the pan, which is suspended by chains to the scraper frame. A foot-lever throws in the rear wheel clutches, and the chain-driven windlass winds up chains attached to the two upper corners of the pan, raising it to the carrying position shown in the illustration. A second hand-lever stops the raising of the pan at any elevation, or an automatic device stops the windlass at any desired point. The dumping lever is operated by the driver's left hand and arm and raises the end gate, permitting the snow to slide out between the rear wheels.

The Baker Manufacturing Co. also makes a snow plow that may be attached to the front of any motor truck and a four-wheel trailer plow to be attached to the rear of the truck by an offset hitch. The plows and wheel scraper are designed to be used in conjunction, the plows pushing the snow into winrows and the scraper loading and hauling it away with little or no expenditure of hand labor.

* * *

Largest Pneumatic Riveter

What is claimed to be the largest pneumatic riveter yet constructed has recently been completed by the Hanna Engineering Works, 2059 Elston Ave., Chicago. The machine, shown in the accompanying view, weighs 40 tons, has a reach of 21 ft. and can exert a pressure of 100 tons on the rivet die with air at 100 lb. per sq.in. It is intended to replace troublesome hydraulic machines for high-pressure steam-tight work. The riveting movement is accomplished by a combination of toggles, levers and guide links until proper pressure is reached, when further travel of the die is



LARGEST PNEUMATIC RIVETER

made by a simple lever movement. The total cylinder travel is 22 in. and the die movement 5¾ in. The toggle action goes with the first 11-in. cylinder travel and 4¾ in. of die movement.

* * *

Extra-Strong Road Grader

A road grader especially constructed for hauling with tractors or steam road rollers has recently been placed on the market by the Western Wheeled Scraper Co., Aurora, Ill. Heavy Z-bars are used for the main frame and all rigid connections are made with ¾-in. rivets instead of bolts. The front wheels are 34 in. in diameter, made of steel with staggered spokes, and the rear wheels are 44 in. in diameter. The grader blade is not rigidly attached to the blade beams but has a lateral play of 22 in. in either direction. This adjustment of the blade is automatic and is controlled by the position of heavy stay chains. It is designed to bring the point of greatest resistance on the cutting edge in line with the direction of draft and thus prevent the tremendous leverage and strain which rack most tractor-drawn machines. An 18-in. extension is provided for each end of the blade. This is of special shape for cutting new or cleaning out old ditches, undermining embankments or filling in old ditches. With this attachment the machine will cut to a maximum of 4 ft. outside of the wheels. This grader is known as No. 10. It weighs 6,400 lb. and is 18 ft. over all.

Engineering News

VOLUME 74 DECEMBER 16, 1915 NUMBER 25

Replacing Water-Main Bridge with Concrete Arch

In the City of Washington there is now being built a long-span concrete arch bridge which is interesting not only for its structure and appearance but also because it incloses one of the unique bridges of this country—the old water-main arch which for many years carried the entire water-supply of the city across Rock Creek on the line of Pennsylvania Ave. This arch, which is shown in Fig. 1, was built in the early fifties of the last century as the main line of the Washington Aqueduct, and until the construction of the tunnels to the reservoirs on the north and east of the city, it conveyed all the water to the principal section of the city. Since these reservoirs were built the mains have been used only to take back filtered water from the plant east of the city to that section lying west of Rock Creek valley. While primarily intended for an aqueduct, the creek crossing was also utilized as a highway bridge and for many years formed the only connection between the two parts of the city.

As shown in Figs. 1 and 2, the old bridge consisted of two 4-ft. mains made up of flanged cast-iron pipe arched to a 200-ft. span and carrying through the medium of some very peculiar wrought-iron bracing a timber floor forming a 26-ft. highway. The pipes were special castings of 2-in. metal with heavy bolted flanges covered with the ornamental bands shown in the view. The spandrel frame was mostly of wrought-iron I-beams. In all the years this pipe has been in service its leakage has been practically negligible.

The demands of traffic required a new bridge. At the same time it was felt desirable to conserve the old water-main arch, mainly for carrying an emergency raw-water supply from the river in case the filtration plant



FIG. 1. OLD COMBINATION WATER-MAIN AND HIGHWAY BRIDGE ACROSS ROCK CREEK AT WASHINGTON, D. C.

or its connecting tunnels were ever put out of service. Consequently, a design for a new bridge was prepared which utilized the old abutments and concealed—though it did not support—the old arch. In this bridge, which is now under construction, the pipe arch remains self-supporting.

The right-hand half of the elevation in Fig. 2 shows the new bridge, and the other drawings in that figure illustrate the way in which the old main is cared for. The new arch is of reinforced concrete, with a 204-ft. clear span and 31-ft. rise. On account of conditions dictated by the present topography and the proposed location of a new parkway which passes under the bridge, each new arch rib has a separate abutment block, which is carried to solid rock through the masonry of the old abutment. The showing faces and balustrade of the new bridge are of cut granite.

The pipe arches in the old bridge were connected by a thorough system of counterbraces, which interfered somewhat with the layout of the new bridge. It was felt, however, that some cross-bracing of the pipes was necessary, so the bracing shown in detail in Fig. 2 was adopted. All the old bracing was removed and new struts were fitted into bands placed around the pipes.

In construction, all of the old bridge except the pipes was removed and the new concrete poured into forms

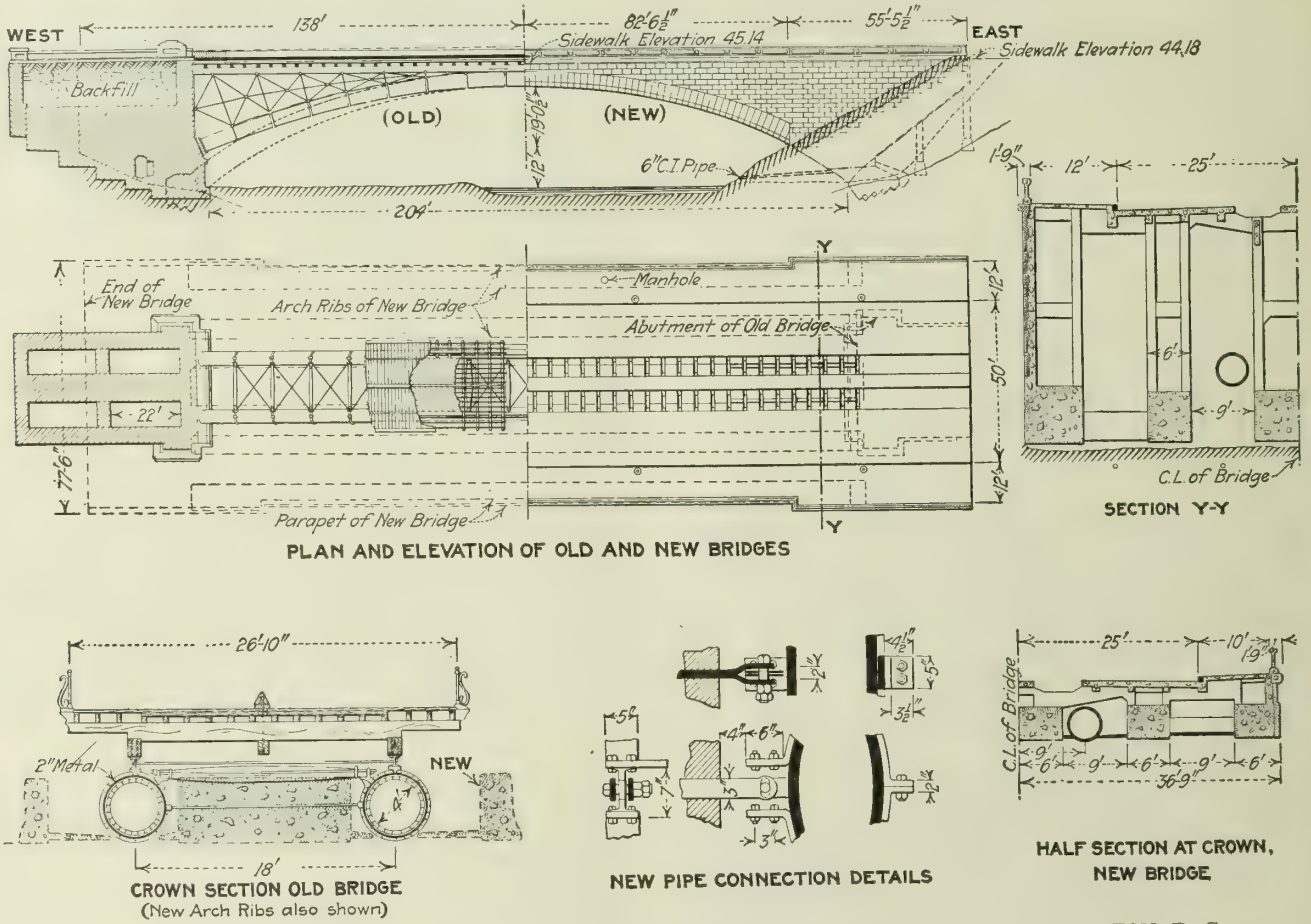


FIG. 2. DETAILS OF NEW AND OLD PENNSYLVANIA AVE. ROCK CREEK BRIDGES, WASHINGTON, D. C.

it was not possible to clear the arch to the old abutments, which were utilized also for the new abutments; a false abutment face was therefore built in front of the real abutment on each side. Thus the showing arch is only of 164-ft. span and 19-ft. rise.

The new arch is made up of five ribs dimensioned as shown in Fig. 2 and spaced so as just to avoid the water mains of the old arch. In elevation the new arch is curved so as to conceal the pipes, and the five ribs are connected by an intrados shell which not only serves as cross-bracing but also completely covers the pipes except for a very short distance near the crown where the lower surface of the pipes comes too near the intrados of the concrete arch. For this short length the pipe will be painted to resemble the concrete.

The roadway of the new arch, carried on reinforced-concrete spandrel columns and girders, is 70 ft. wide, and provides a 50-ft. roadway with space for two car tracks and two 10-ft. sidewalks. As shown in the plan resting on regular timber centers footing in the creek bed and valley.

The bridge was designed and is being built, under the direction of David E. McComb, Engineer of Bridges of the District of Columbia, by the Hardaway Construction Co., of Columbus, Ga. Its total cost will be about $125,000. It will be used both for a highway and street railway crossing.

The Expenses of the Sanitary District of Chicago for the year 1914 amounted to $7,316,200. Of this total, $2,325,348 was for construction work (exclusive of land), $1,706,000 for retiring bonds, and $1,508,605 for the electrical department. The largest item in construction work was $1,322,051 for the Calumet-Sag channel. The receipts for the year were $6,581,437, of which $5,088,874 was in taxes. With a balance of $1,313,117 on hand at the end of 1913, the total receipts for 1914 were $7,894,554, leaving a balance of $578,355. For the whole period of the existence of the Sanitary District of Chicago, to the end of 1914, the financial operations have been as follows: Expenditures, $76,555,179; receipts, $80,642,472; balance (including money due from the city, etc.), $4,087,293.

Automatic Pumps in Boston Prevent Sewer Flooding*

By E. S. Dorr†

A section of the South End in Boston has remained without a complete system of drainage for the past 50 years. This area comprises several blocks in the vicinity of Albany St. and Union Park. The territory contains about 190 acres laid out on the alleyway plan. The streets are below high tide, and the cellars are below high-water level in the main sewers. The sewers are built on a combined scheme delivering dry-weather flow into the East Side intercepting sewer in Albany St. and storm flow into South Bay. The interceptor can carry away only a small fraction of the storm runoff, and when a long-continued rain coincides with a high spring tide, the district is badly flooded.

The peculiar conditions in this district trace back to the existence of old tide-mill ponds here. One pond was used as a receiving basin to take the discharge from the other pond at periods of high water. This basin became a huge storage reservoir protected from high tides and afforded a low outlet for sewers that were built to drain the land made by filling the flats. In time the basin became a gigantic cesspool so that arrangements had to be made to drain it. Filling in the basin itself to accommodate the crowding districts began about 1860. The plan was adopted of turning the drainage of the district into South Bay and building the main sewers large enough to afford some storage at high tide. The sewer system was adequate to discharge the storm water of heavy rains at low tide, and the storage capacity was sufficient for short, violent showers at high tide, but when a heavy rain lasted over a high tide, the storm water and sewage ran back into the low basements, yards and alleys until the next low tide. Some assistance was rendered by the connection with the intercepting sewer mentioned, but flooding was not prevented.

It was long realized that nothing effective could be done except by pumping, but in the older days this required a steam station (particularly difficult and expensive to maintain on account of the intermittent character of service), but with the development of centrifugal pumps, electric motors and automatic electric control the problem was taken up again by the City Sewer Division.

The district was already completely sewered. Only those portions of the district which suffered most were to be reached by a low-level system of sewers connecting to the pumping station. A new main sewer for the flooded district was required, and this was secured by rebuilding the Union Park St. line, an old wooden sewer in rotten condition. This was built of a peculiar section—it might be called a sewer with a horizontal septum. One sewer was superimposed on the other, the top one taking flow from street surfaces and parts of the districts high enough to drain by gravity, while the lower one cared for all those areas that would not drain at high tide, and it connected with the pumping station. The top sewer was built at the same elevation as the old line which it replaced. It discharges its dry-weather flow into the interceptor through a sump and regulator. When the interceptor is full, the storm flow goes through an overflow outlet to the South Bay, operating in all respects like the old line. The low-level section underneath the top sewer also connects with the interceptor and discharges dry-weather flow into it as long as the interceptor will receive it. When it begins to be backflooded, a tide gate closes and diverts the flow over weirs into the pump wells of the pumping station, whereupon the pumps start up automatically and eject the flow into South Bay through an outlet conduit separate from the overflow outlet of the sewer.

The station has three 36-in. and one 26-in. centrifugal pumps, giving a total capacity of 105,000 gal. per min. against a head of 13½ ft. It is the largest automatic station in the world. One 36-in. pump is regarded as a spare unit, making the normal capacity of the station 75,000 gal. per min. Each 36-in. pump is driven by a 150-hp. constant-speed induction motor taking three-phase 60-cycle current at 440 volts. The 26-in. pump has a 75-hp. motor, making the total power required for the station 525 hp. Each motor is thrown into operation by a float-actuated switch set for a fixed elevation of the sewage in the pump well.

The foundations for the station presented a problem, the underlying material for 37.5 ft. being a soft silt except for a few feet of gravel, clay and ash filling on top. There was a substratum of 3.5 ft. of stiff blue clay and under this a soft clay or silt to hard bottom at 80 ft. depth. As the pit for the substructure was sheeted with 6-in. grooved and splined Georgia pine driven to the clay stratum and as the foundation was to be a raft of reinforced concrete 3 ft. thick, it was finally determined to drive 25-ft. piles to bear a load of 8 tons each. The concrete was mixed with integral waterproofing (liquid). The treatment has been successful; a few small leaks developed, but were stopped.

The capacity of the station is not only ample, but has some surplus, since the limits of ultimate extension of the pumping system are indeterminate.

Just after the station was put in operation a phenomenal rain gave a fair test. One 26- and one 36-in. pump were called into action. The tide was falling, however, and the maximum test is yet to come with a rising tide and such a rain.

The contract price of the machinery was $35,856. The building, including substructure, cost $50,000. The total cost of the project, sewers and all, is about $400,000. Extensions in sight may add $125,000.

*From a paper before the Boston Society of Civil Engineers, Nov. 3, 1915.

†Former Chief Engineer, Division of Sewers, Boston, Mass.

A 62-Ton Traveling Stiff-Leg Derrick for the new harbor works at Valparaiso, Chile, will place massive concrete blocks and will handle a grab bucket with the auxiliary hoist. It can hoist 62 tons at a 60-ft. radius with a speed of 10 ft. per min. For 10-ton loads the speed is 50 ft. per min. with the main hoist or 60 ft. with the auxiliary hoist (single rope). The swinging is done at 190 ft. per min. (at the hook), and the traveling speed is 40 ft. per min. The foot of the box-girder mast has a ball-bearing with 50 balls 2 in. diameter in two rings. The boom, stiff-legs and sills are of box-lattice construction. For hoisting, topping and traveling there is a 10½x16-in. engine controlled by a hydraulic brake having oil cylinders. The 8x10-in. swinging engine is controlled by a foot lever. Steam is supplied by a vertical boiler. The mast is seated on a bedplate carried between two six-wheel trucks, and there is an eight-wheel truck under the heel of each stiff leg. These trucks have 30-in. wheels and are on tracks of 5 ft. 6 in. gage. For work with the boom at right angles to the rails there are two tracks 60 ft. c. to c., but where the boom works parallel with the rails there are three tracks 35 ft. c. to c. of the outer tracks. This machine was built by Joseph Booth & Bros., of Rodley, England, for S. Pearson & Sons.

Ballasted Timber Floor for the Sibley Bridge

Solid floors with ballasted tracks are not generally used on large railway bridges, and this construction is therefore a rather notable feature of the reconstructed bridge of the Atchison, Topeka & Santa Fé Ry. crossing the Missouri River at Sibley, Mo.

The Sibley bridge was built in 1887. In 1914-15 the superstructure was renewed in order to provide for the heavier loading of modern locomotives and trains. The new bridge is designed for Cooper's E-60 loading, while the loading for the old bridge was equivalent to Cooper's E-24. This part of the railway is double track, but the two tracks are gauntleted across the bridge, as the original pneumatic caissons were too short to permit of widening the piers to carry a double-track superstructure. The bridge comprises three through-truss channel spans of 396 ft., a deck truss span of 247 ft., two deck truss spans of 172 ft. 6 in., three plate-girder spans of 80 and 100 ft. at the west and an east approach viaduct about 2,000 ft. in length.

The floor on the through-truss spans, Fig. 1, has a close deck of timbers, 4x8 in., laid flat, with every fifth timber secured to the track stringers by hook bolts. The timbers are 16 and 18 ft. long. The ends of the timbers rest upon I-beam jack stringers. Upon this deck is a bed of stone ballast, 6 in. thick at the ends of the span and 8¼ in. at the middle. This is held in place by a 6x10-in. curb timber at one side and by a raised plank walk at the other side. The walk is covered with 3 in. of stone screenings. The curb is held by straps secured to it and to the floor by lagscrews. Blocking is required around the gussets connecting the floor-beams and truss posts.

On the deck truss spans, Fig. 2, the floor timbers also rest upon the track stringers, while their ends are carried by 6x10-in. timbers laid along the chords. All the floor timbers are 18 ft. long, their ends carrying the walk, which has curbs to hold the screenings in place.

The floor on the girder spans and viaduct is of rather different construction, as shown in Fig. 3. The transverse timbers are 8x8 in., laid directly upon the girders,

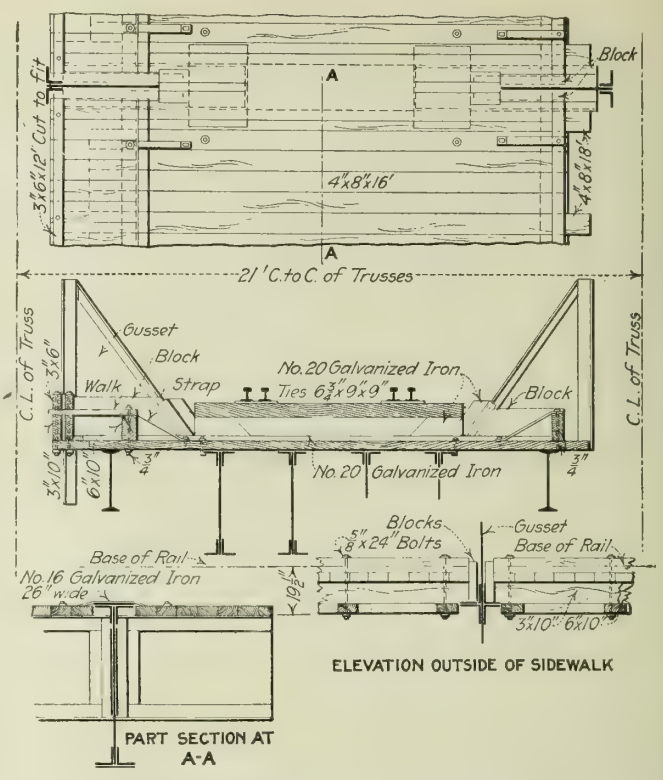


FIG. 1. SOLID FLOOR AND BALLASTED TRACK ON THE 396-FT. THROUGH-TRUSS SPANS OF THE SIBLEY BRIDGE

being bored out on the under side to fit the rivet heads. The curbs or guard timbers are 6x10 in. The floor timbers are 14 ft. long, except that every sixth timber is 16 ft. and set in 6 in. from one end of the other timbers, so as to give a projection of 2 ft. 6 in. to carry a continuous walk of three planks. This walk is covered with 3 in. of stone screenings between the guard timber and an outer curb, 2x6 in. A hand railing runs along this walk.

At intervals on the approach there are handcar platforms. Each has four timbers, 6x8 in., 24 ft. long (forming long deck timbers). The outer ends of these are supported by inclined struts footed upon the bottom chord of the girder. Across these are 3x6-in. joists carrying a floor of 2x6-in. planks, on which is a 3-in. layer of stone ballast.

All the timber is creosoted pine. Where it has to be cut for framing, the surfaces are given two coats of a hot solution composed of 1 part creosote oil and 3 parts heavy road oil.

The track on all the spans has two pairs of 90-lb. rails (gauntleted 7 in. over gage lines) on ½-in. tie-plates, long enough to carry both rails. The ties are 9x6¾ in., 9 ft. long, spaced 18 in. c. to c. The depth of stone ballast is 6 to 6¾ in. on the 8x8-in. floor of the deck spans and viaduct and 8¼ in. on the 4x8-in. floor of the truss spans. The weight of track, ballast and deck is about 2,100 lb. per lin.ft. on all spans.

It is of interest to compare the economy of the ballasted deck with that of the ordinary open deck. After

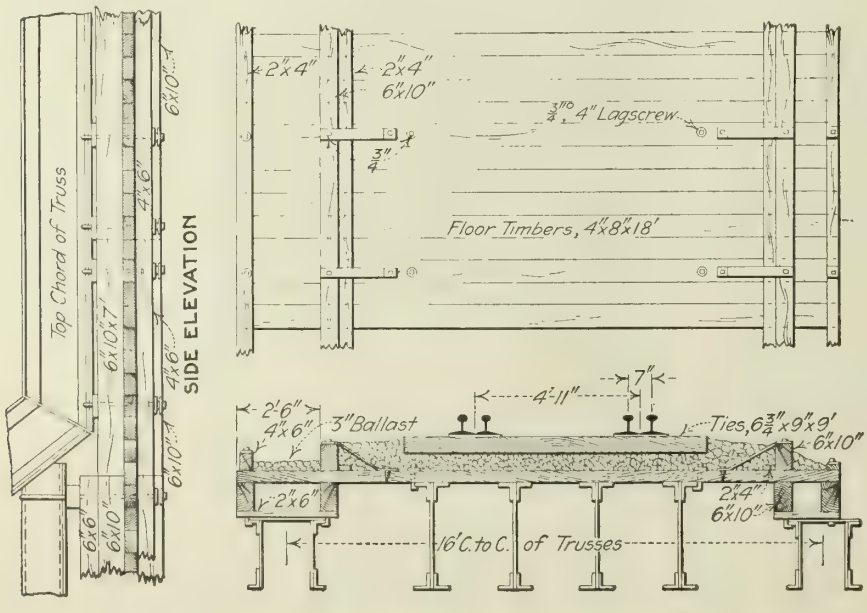


FIG. 2. SOLID FLOOR ON DECK TRUSS SPANS OF THE SIBLEY BRIDGE

taking into account the interest on the increased cost of the ballasted deck and the cost of lining and surfacing track, the total annual maintenance charge for this

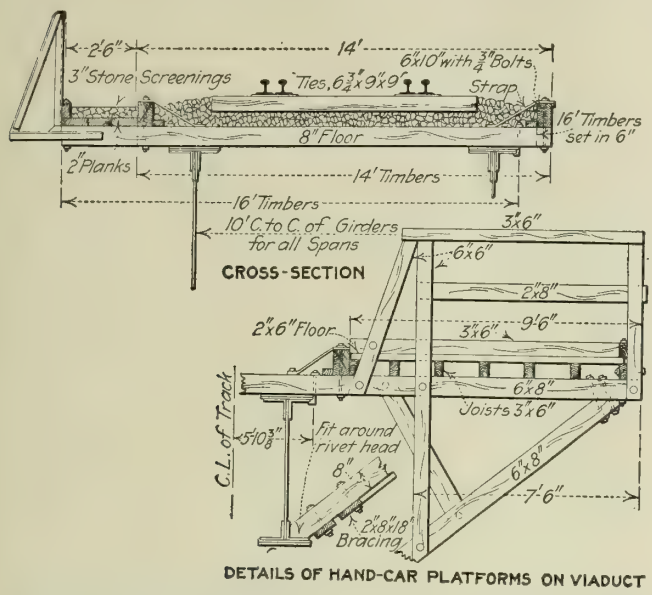


FIG. 3. SOLID FLOOR ON GIRDER SPANS AND VIADUCT APPROACH OF THE SIBLEY BRIDGE

construction shows a very good margin of profit over that for the open-deck construction on the old bridge.

The bridge (with its solid floor) was designed by A. F. Robinson, Bridge Engineer, Atchison, Topeka & Santa Fé Ry. system.

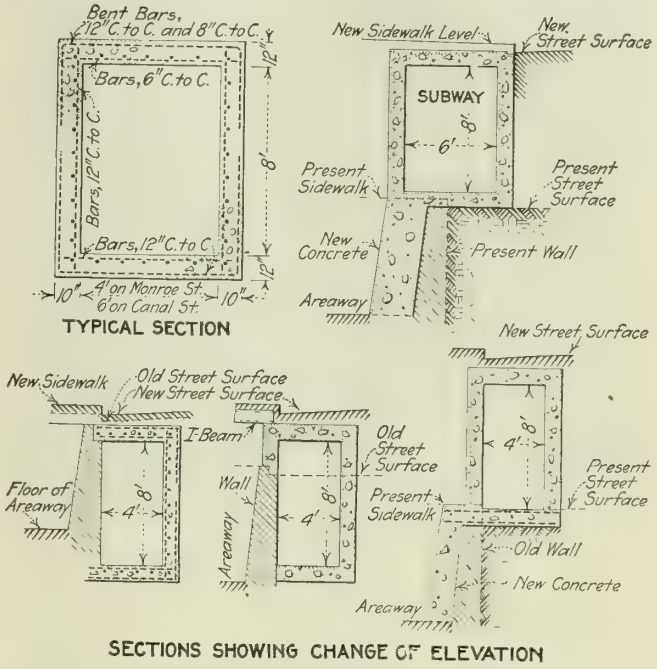
Chicago's Public-Utility Subway

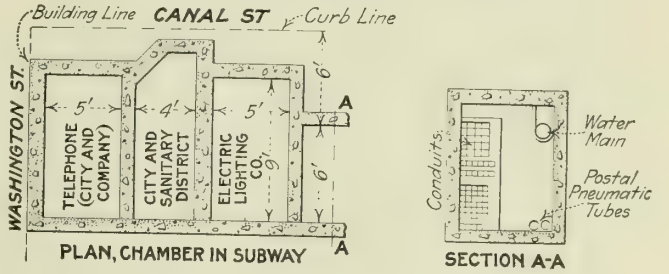
A utility-service subway is now being constructed at Chicago as one of the auxiliary works for the new union railway station at Canal and Adams St. It is of rectangular section, 4 and 6 ft. wide inside and 8 ft. in clear height, as shown in the drawing herewith. It is of reinforced concrete, with 10-in. sides and 12-in. roof and floor, the latter having a fall of 1 in. at the center for drainage. The reinforcement consists of ½-in. deformed bars. The subway will contain water pipes (suspended from the roof), pneumatic mail tubes and electric conduits. The latter will provide for the city's lighting, bridge operating and fire- and police-alarm services, the telephone and electric-light companies and the services of the Sanitary District of Chicago.

The subway is about four blocks in length and is in the roadway, with one side adjacent to the curb line. A curious feature in the construction is that part of the work is built above the present street grade. This is due to the fact that the construction of the new station will involve raising the grade of adjacent streets. In this way one side of the subway is built on the existing walls at the curb line (for sub-sidewalk areas). These walls are faced with ½-in. cement mortar when they form the side of the subway, and are strengthened by concrete on the rear side where necessary. Some of the typical sections of this part of the work are shown in the drawing. Manholes are provided at intervals. At Washington and Canal St. there will be a vault for the various utilities, as shown in the lower section of the drawing.

Part of the work was built in the open, a steam-operated portable concrete mixer being placed in the street and concrete distributed by wheeled carts on buggies. Where the subway runs along the side of the Chicago & Northwestern Ry. terminal, the concrete was obtained from a plant erected for work on the union station, being spouted across the street to a hopper from which the buggies were filled. The crossing of Madison St., with its heavy traffic, was effected by tunneling under the roadway, timbers being placed to support the street-car tracks.

The cost is paid mainly by the Union Station Co., but the city pays for a portion of it and the plans are approved jointly by Thomas Rodd, Chief Engineer of the





UTILITY-SERVICE SUBWAY IN CHICAGO

company, and John Ericson, City Engineer. The construction is under the direction of A. J. Hammond, Assistant Engineer for the Union Station Co. The contractor is the W. J. Newman Co., of Chicago, which is doing the work in connection with other work auxiliary to the building of the new station.

Six-Wheel Motor Trucks and motor buses are suggested by John Riekie, writing in "The Engineer," of London, as a means of reducing the destructive effects of such vehicles upon the public roads. He disapproves of the twin-wheel (or broad wheel with two separate tires) now commonly used, as he considers it destructive to both the tires and the road, since under certain conditions of surface each tire may have to carry 50% more load than that for which it is designed. Instead of the six tires on four wheels he would have them on six wheels, while for very heavy loads he prefers eight wheels. The springs could be connected by equalizing levers, as in railway practice, so as to give an equal distribution of the load upon the wheels. No plans are given, but it is stated that such a wheel arrangement can be designed without difficulty, and that part or all of the wheels could be driven, coupled or steered.

Experimental Concrete Roadway, Sacramento, California

By A. J. Cleary*

To test the permanency of concrete pavement under ordinary traffic, to investigate its adaptability to local climatic conditions and to determine the most economic design, a 3,000-ft. stretch of experimental pavement was laid on the county road between Sacramento and Riverbank, Calif., in September, 1912. Climatic conditions in this section show less fluctuation than in Eastern states, the extreme temperatures ordinarily being between 35 and 100° F.

On the road selected traffic conditions are such as would be expected on any country thoroughfare leading into a large city. Farm wagons traveling loaded in both directions, motor trucks, light horse-drawn vehicles and automobiles all use the road in numbers which constitute "medium" traffic. About 100 heavy wagons is an average for most days.

Construction Methods of Experimental Pavement

The pavement has a uniform width of 18 ft., with a crown of 3 in., sloping to the sides at a uniform rate of $\frac{1}{3}$ in. per ft. For half the length of the roadway the subgrade below the westerly portion is a heavy clay loam, while the easterly end was laid over an existing macadam road. All of the subgrade, after being trimmed, was thoroughly compacted by sprinkling and rolling with an 8-ton steam roller. To prevent the absorption of water from the concrete the subgrade was again well moistened just before placing the concrete.

Portland cement which complied with the standard tests prescribed by the American Society of Civil Engineers was used throughout. Two varieties of local sand —one sharp, coarse and well graded, from the Yuba River; the other fine and interspersed with mica, from the Sacramento River—were used.

Six of the sections tested had a thickness of 6 in.; two were 5 in. and three 4 in. thick. On four sections a light wire-mesh reinforcement was used. This had a sectional area of 0.1 of 1% to 1% of the cross-sectional area of the concrete. Its function was not to withstand shrinkage stresses but rather to bind the concrete.

Four types of expansion joints were tried—plain joints, oiled, spaced at 10, 20, 30 and 40 ft. respectively; joints of tar paper; ¼-in. joints filled with bitumen, and ⅜-in. joints with edges protected by soft steel plates, and one section had no expansion joints. Joints of the first three types were laid diagonally in some places and at right angles to the axis of the road in others. The metal-protected joints were laid at right angles to the roadway.

The pavement surface was of six varieties—(a) roughened with wire brooms; (b) pitted with embossed tamper; (c) checkered, grooved pattern, checks 6 in. square; (d) plain concrete surface; (e) sanded surface; (f) surface covered with a $\frac{3}{16}$-in. coat of bitumen and fine rock screenings.

The sections of experimental pavement run from east to west. The condition of each section in September of the present year is briefly described as follows:

Section 0—Length, 600 ft.; thickness, 6 in.; mixture, 1:2:5; reinforcement, none; expansion joints of oiled paper and plain oiled joint; surface grooved with tampers. This section is in excellent condition, shows no evidence of disintegration, cracking or chipping at the expansion joint. It is the best-appearing section on the entire road.

Section 1—Length, 200 ft.; thickness, 6 in.; mixture, 1:2½:6; reinforcement, none; expansion joints, ¼-in. spaces filled with bitumen and screenings; surface oiled and sanded. Over one-half of the surface carpet is worn off in patches. The exposed concrete surface is in good condition and no cracks can be seen. The section would have been better had no oil been placed upon the surface.

Section 2—Length, 200 ft.; thickness, 6 in.; mixture, 1:3:6; reinforcement, No. 12 wire mesh; expansion joints, ¼-in. spaces filled with bitumen and screenings; surface, ⅜ in. thick, of bitumen and screenings. About half the asphalt surface has been worn off and the exposed concrete shows no signs of deterioration, nor any variation in wear. No cracks appear in the entire section.

Section 3—Length, 300 ft.; thickness, 6 in.; mixture, 1:2½:5½; reinforcement, none; expansion joints, ¼-in. spaces filled with bitumen and screenings; surface, ⅜ in., bitumen and screenings. About half the bituminous surface has been worn off and the concrete surface shows signs of wear. Several of the expansion joints are cracked at the edge and exposed; one especially poor spot is shown in Fig. 2. Transverse cracks appear across the surface, which is somewhat uneven. Evidently the poor



FIG. 1. SECTION 6 OF THE EXPERIMENTAL CONCRETE ROAD, RIVERBANK, LOOKING WEST

*Assistant City Engineer, San Francisco, Calif.

condition of the pavement is due to the lack of sufficient cement in the concrete.

Section 4—Length, 275 ft.; thickness, 6 in.; mixture, 1:2½:6; reinforcement, none; diagonal expansion joints filled with a single thickness of tarred paper. This section is in good condition, the only defect being that several of the expansion joints are badly chipped.

Section 5—Length, 247 ft.; thickness, 4 in.; mixture, 1:2:4; reinforcement, No. 7 triangular mesh; oiled expansion joints; surface roughened with grooved tampers. This entire section is in good condition except for the slight settlement adjoining a culvert, where the subsoil apparently was insufficiently tamped.

Section 6—Length, 250 ft.; thickness, 4 in.; mixture, 1:2:4½; reinforcement, none; expansion joints, partly tarred paper and the remainder oiled; surface broomed. Fig. 1 shows the general condition of this section. Longitudinal cracks extend throughout practically the entire length, and many transverse cracks have appeared. The surface is badly disintegrated and the expansion joints badly fractured. Some of the surface was later covered with oil, which has almost entirely worn off. This section



FIG. 2. SECTION 3 OF THE EXPERIMENTAL CONCRETE ROAD, RIVERBANK, YOLO COUNTY, CALIF.

is at the beginning of the westerly half of the road, where the foundation is clay and loam.

Section 7—Length, 250 ft.; thickness, 6 in.; mixture, 1:2:5; reinforcement, none; expansion joints, oiled; surface roughened with grooved tampers and oiled. The oil covering is worn off in large patches throughout the entire section, exposing a clean concrete surface. There are several longitudinal cracks, one of which is 1 in. wide.

Section 8—Length, 260 ft.; thickness, 5 in.; mixture, 1:2½:6; reinforcement, triangular mesh; expansion joints, double thickness of tarred paper; surface broomed. This entire section presents a badly worn appearance, all parts being considerably chipped at the joints. Longitudinal and transverse cracks are frequent and the concrete is uneven, indicating rapid wear.

Section 9—Length, 270 ft.; thickness, 5 in.; mixture, 1:2½:5; reinforcement, none; expansion joints, ⅜-in. spaces 30 ft. apart, protected by soft-metal plates; surface roughened with grooved tampers. The tendency of the metal plates in this section has been to settle unevenly, causing depressions in the adjoining concrete surface, which is worn along one side of the road. Longi-

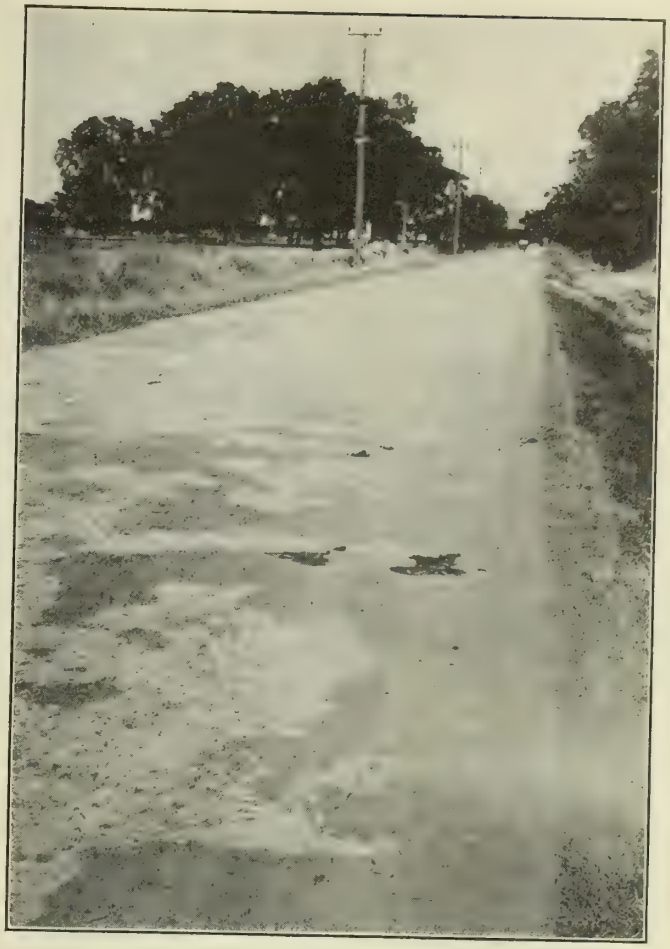


FIG. 3. SECTION 9 OF THE EXPERIMENTAL CONCRETE ROAD, RIVERBANK, LOOKING WEST

tudinal and transverse cracks are quite frequent (Fig. 3).

Section 10—Length, 217 ft.; thickness, 4 in.; mixture, 1:2:5¼; reinforcement, No. 12 wire mesh; no expansion joints; surface checkered. This section is in fair condition, very few cracks being seen.

Conclusions Drawn from Experiments

From the foregoing the effects of lean mixtures and poor foundation material, or the two together, are readily apparent. A thin bituminous carpet has proved unsatisfactory. Metal expansion joints appear inferior to a plain joint, either oiled or filled with tarred paper, transverse or diagonal. Joints should not be spaced at intervals greater than 20 ft.

It will be noted that the three 6-in. pavements (Sections 3, 4 and 7) which show deterioration are all lean mixtures and none have reinforcement. On the other hand, Section 1, constructed of an equally lean mixture and not reinforced, has stood up remarkably well. The two sections (5 and 10) of reinforced 4-in. pavement have shown quite remarkable wearing qualities, but the unreinforced section of 4-in. pavement (6) has practically all gone to pieces. This and Section 5 were both made with the poorer, or Sacramento River, sand. Sections 8 and 9, of 5-in. pavement, appear to have suffered about the same, although one is reinforced, while the other is not.

The road was constructed under the direction of Haviland, Dozier & Tibbetts, Consulting Engineers, of San Francisco. Its condition was examined for *Engineering News* in September, 1915, by H. Armstrong, Assistant Engineer, California Reclamation Bureau.

Chicago & Northwestern Ry. Valuation Methods

SYNOPSIS—This article outlines the methods of preparing and recording the mass of detailed information upon which the valuation of railway property is to be based. It gives a summary of the instructions prepared by one large railway system, but is illustrative of the methods employed by railways in general.

Railway valuation is being carried out on a large scale by the railways and the Interstate Commerce Commission, and the railways have to collect a vast amount of information from which the cost of work and the value of property may be determined. This article is a condensed compilation of the instructions issued to engineers preparing such information on the Chicago & Northwestern Ry. The field practice and organization for the work of this road were described in *Engineering News* of Oct. 28.

The work preparatory to valuation includes the examination of all structures and property, the preparation of maps and drawings and the investigation of plans and records; also the compilation and filing of all old and new data in form available for use when the actual determination of values is commenced. All this work is under the direction of a valuation committee, which includes William H. Finley, Chief Engineer, and George W. Hand, Valuation Engineer.

GENERAL INSTRUCTIONS TO ENGINEERS

The field work will consist of a complete chain survey of all property, level notes where necessary to determine grading quantities, and descriptions of bridges, buildings and other structures. The notes from these surveys will be used to compute the quantities of the various elements of property, to arrive at their value and also for the purpose of plotting. They must contain such measurements as are necessary to admit of resolving all elements of material into commercial units and of describing their character, and also must contain data as to the correct location and position of each object, so that it may be correctly shown on maps. Every page of the notes must be signed and dated. Notebooks must show names and positions of all persons in the party.

Six notebooks will be used on each survey, one for each of the following: Main-line chaining, main-line auxiliary notes, levels, side tracks, buildings and bridges.

The main-line chaining notes will be of first importance and will be the basis of other notes. The right-hand page will be for a sketch illustrating the topography of the line (approximately ½ in. to 100 ft.). The left-hand page will show the stationing. The auxiliary main-line notes include such details as the weight, brand and date of rails, kind and number of ties, kind and amount of ballast, number of track fastenings, tie-plates, etc.

CHAINING THE LINE

All tapes must be compared and checked. The party taking notes must be supplied with blueprint alignment maps and must have complete information as to the location of the zero point of chaining, also the pluses to all permanent points, land lines, monuments, etc., so that the chaining may be checked with the original chaining used on existing maps and records. Any apparent discrepancies must be investigated, and whenever this rechaining varies from the original by 10 ft. or more, an equation will be made and the original chaining resumed. These equations will not be introduced in the chaining within the limits of station grounds.

All chaining must refer to the original center line as located, and great care must be exercised in taking pluses to lines crossing the center line diagonally that the plus given is to the point where the original center line intersects the other line. In all double-track districts the original center line may be the present center between tracks or the center line of either of the present tracks. It frequently changes from one to the other, and oftentimes is neither of these lines, but a line at varying distances from the present center between tracks. The location of this line can be ascertained by reference to the record maps or by retracing on the ground, and the party making this rechaining must be thoroughly informed about this before proceeding with the work.

When chaining along the rail on curves, corrections should be made to conform to the distance along the center line. These corrections must be made with such frequency as to avoid an accumulated error of 1 ft. or more, and all errors must be eliminated at the end of each curve. The difference between the distance along the rail and along the center of the track is 0.04 ft. per 100-ft. station for each degree of curvature. The difference between the distances along the center of either track and along the center line between tracks, for tracks spaced 13 ft. c. to c., is 0.11 ft. per 100-ft. station for each degree of curvature.

In chaining on grades where the amount and length of grade would introduce error greater than the probable error from other causes unavoidable, corrections should be made. This correction per 100-ft. station is equal to the per cent. of grade squared and divided by 200. This for a 1% grade equals 0.005 ft. per station. For 1 mi. the correction would be 0.26 ft. For a 5% grade the correction per station is 0.125 ft. per station and 6.6 ft. for 1 mi. The correction per 100 ft. is the amount each station should be lengthened to give the true distance along a horizontal line.

CONDITION OF PROPERTY

Notes will be taken on the physical condition of each structure, judged from the standpoint of the amount of maintenance bestowed upon it. Field inspectors will note structures above the average as "first class," those in average condition as "good" and those below the average as "fair." No other classes will be shown, but a statement should be made as to any special conditions and what is their effect on the condition of the structure.

All buildings, bridges, crossings, cattle guards, whistle posts, signals, etc., should be noted, so that they can be referred to in the auxiliary notes by pluses and the page stated on which they are shown in these notes.

GRADING ALONG THE LINE

These notes will show width of roadway at subgrade, classification of excavation and side slopes. This information is to be used with the profile in computing the quantity of each classification of grading, so that where two or more classifications exist, the notes must show the proper proportion of each class. Where conditions are such that extraordinary settlement would occur, inspectors should state the nature of the formation and make an estimate of how much settlement would take place. Careful examination should be made and notes taken of all work, such as riprapping and other protection work. Notes should be taken to show how earth could be hauled where excavation from the cuts would have to be wasted and borrow made for fills, and where earth for fills would have to be borrowed from adjacent cuts and hauled out instead of being borrowed at the side, as would ordinarily be done if conditions would permit. This will enable a proper estimate of overhaul to be made. Notes should be made of location and size of ditches, also all channel changes.

CLASSIFICATION OF MATERIALS

In addition to measurements necessary for computing the quantities of grading, notes and measurements must be made of conditions relative to the geological characteristics of cuts and fills, upon which the cost of grading depends. Primarily materials will be classified as solid rock, loose rock and earth. On account of various characteristics, however, there are wide differences in the prices for these items in different parts of the country. Other materials, such as hardpan, quicksand, cemented gravel, gumbo, etc., will require further variations in the prices. The information called for in the following paragraphs is therefore essential in establishing proper unit prices for grading.

The assistant engineer in charge of each party will personally make the necessary observations for obtaining this information. It should be recorded in the main-line auxiliary notebooks under the heading of "Grading." He must sign and date all such notes.

Where two or more kinds of material are found in the same cross-section the field notes must clearly set forth

the data necessary for computing each separately, or for approximating the percentage of each classification when accurate measurements are impossible. The character of the material from which each cut or extensive borrow-pit was made should be noted.

Where two or more formations occur in strata, as, for instance, clay loam on top of blue clay, state that the top (4 ft., for example) is heavy clay loam and the remainder tough blue clay. Sufficient examination should be made to ascertain the correct depth of the overlying loam, for in most cases it will appear to be deeper than it was in reality, owing to the fact that it has fallen down over the surface of the cut and covered part of the underlying strata.

Special materials employed in constructing the roadbed, particularly at places where the banks have been widened or the grades raised, and materials which have been applied originally as ballast, but which have settled below subgrade, and material exceptionally employed in raising track under traffic should be determined and shown separately from the ordinary materials deposited in the customary manner in normal construction.

Care should be exercised to discover all evidences of hard material, such as hardpan, cemented gravel and indurated clay; also other material difficult to handle, such as gumbo or marl. If material resembles any one of these, but is not definitely known to be such, it may be stated that it resembles hardpan or gumbo, etc.

Where boulders are prominent, it is to be presumed that they were encountered in making the cuts, and sufficient note should be made to admit of classifying a certain amount of material in the cut as rock to allow for them. For example, make a notation: "Classify the cut as 2% loose rock, 1% solid rock on account of boulders."

Where rock is encountered, especially solid rock, it should be generally classified as sandstone, limestone, slate, shale, granite, basalt or by some other easily defined classification. Rock that cannot be readily classified geologically by inspection should be generally described as to appearances, hardness, density, etc. The general structural characteristics should be noted, so as to afford some idea as to whether it would be comparatively expensive to excavate for that particular kind of rock. Note whether stratified rock is in thick or thin strata; note the color of the rock and state whether sandstone appears to be a soft or a hard variety. Note whether rock is dense or porous, and whether it has the appearance of cleavage, so far as these things are visible on inspection.

Precautions should be taken to note evidence of wet cuts, the presence of quicksand or other conditions that would make excavation more difficult. Where such conditions are observed, close attention should be paid to requirements, such as blind drains, extra-deep ballast, subsequent heavy ditching and the condition of adjoining fills, to discover evidences of extraordinary settlement, sloughing of material or mud slides.

The present condition of side slopes should be noted, stating whether they have been badly eroded or not. If cuts are badly gullied, note the average depth of gully. Note whether side slopes are protected by vegetation or are bare. Such information is essential in estimating the cost of solidification of the roadbed, which expense depends greatly on the manner in which the exposed slopes withstand the action of the elements.

In all places where extra work appears to have been necessary to make the fill, the situation should be carefully studied. It should be remembered that when every possible thing is discovered, there will still be little actual evidence of expense often necessary on account of heavy settlement, slipping of material, washouts, etc., so that the slightest indication of anything of this sort should be thoroughly investigated. Instead of taking a few yards of riprap for what it appears to be, and going on without further investigation, it should be looked upon as evidence of a bad place where perhaps ten times as much stone is covered up as can be seen, and likewise as a clue to many other special things that may have been done. A complete investigation should then be made of the situation.

For main track, show the length, weight and brand of rail and (when available) the date of rolling. Classify rail as "first class," "good" or "fair" with reference to the density of traffic and speed of trains. Notes should be taken of crossing frogs, stating whether alloy steel is used. Main-track switches are to be included, but siding and spur-track switches (and crossovers on double track) are shown in the "Siding" notes. The notes on fastenings include form of joint, length of splice bars, number of bolts, tie-plates, rail braces, etc.

For ties, the notes must show the kind of tie and number per rail, also pluses for the beginning and ending of each kind of tie; also the general condition and the percentage of ties renewed each year. Note the position and length of space occupied by bridges, switches or railway crossings, so that allowance may be made in computing ties. For each bridge (except with ballasted floor) show the number and size of ties and feet board measure.

TRESTLES. Division NORTHERN IOWA Bridge No. 1035 File No. 6-21 14

Station EAGLE GROVE Year Reported 1907-15 Date Comp May 1915 Order No. GEO.12768.
Sub-Division 10 Vol and Page 1-22 4-35 Date Insp 7-11-15 Est No
Section 32 Map Corrected 9-15

REMARKS

Location	Type	DATE Super St	DATE Sub St	Total Length	Span Length	No of Spans	Grade + or -	Alignment	No of Tracks
1735-22	Pile Bridge	1915	1915	65'	13'	5	-.51	Tang.	1

STRINGERS Kind	No	Dimensions	TIES No	Kind	Size	GUARD RAILS No	Kind	Size	FLOORING Kind	Amt	CAPS Size	Kind
Fir	6	8"x 16"	62	Fir	8"x 8"-10'	2		4"x 10"65 Lin.ft Floor & Hand Rail			14"x14"-14'	

PILE BENTS No Bents	No Piles Each	Avg Height	PILING Lin Ft	Kind	FRAME BENTS No Bents	No Posts Each	Size of Posts	Avg Ht Bents	Size of Sills	Total Ft B M Framing	Cu Yds Masonry
4	5	15'	540	Cedar	2	5	12"x 12"	12'	14"x14"-14'	1963	
									Sway Bracing =	577 Ft. B.M.	

WATER STATIONS. Division EASTERN File No. 5-25 28 -1

Station YORK Year Reported 1909-10-14 Date Compl. 1913 Order No. GMB 11671
Sub-Division 8 Vol. and Page 2-67 to 69 Date Insp. 7-11-14 Est. No.
Section 15 Map Corrected 1915 Total Cost $4376.00

REMARKS

TANK Dimensions	Matrl.	Capacity	No of Spouts	SUPPORTS Kind	Ht	No. Posts	Size Posts	FOUNDATION Kind	Amount	WATER SUPPLY Type	Dimensions
16'x 24'	Wood	48606	1	Steel	16'	4		Masonry	70 Cy.	Well	5"x 40'

ENGINE Kind	Capacity	PUMP Kind	Size	WINDMILL Kind	Diam	Make	TOWER Kind	Ht.	BOILER Dimn.	Type	Size and Length Piping
F.M.& Co.		U.S.W.E.	4x12	Wood	20'	U.S.	Wood	50'			758'of 2'
Jack of all Trades	4 H.P.	Myers 8" Head	Bulldozer								8'of 3"

PUMP HOUSE Kind	Dimn.	Kind Floor	Kind Roof	PENSTOCKS Size	Make	Length and Size Supply Pipe
Frame	6'x 8'	Concrete				
Height to E. = 6'			Shingle		1 Standard Hog	Pump Pit 8'x 12'
Height to G. = 8'					Sprinkler	Brick Lined

CARD-INDEX RECORDS FOR VALUATION; CHICAGO & NORTHWESTERN RY.
Each card is 5x8 in. The upper card gives the record of a trestle and the lower card gives the record of a water station

Show pluses at beginning and end of each kind or depth of ballast used. Give depth in inches below bottom of ties for all material except earth. Show location and extent of all bridge openings, so that allowance may be made. The general condition of ballast should be noted. Two standard depths are used—12 in. and 6 in. deep under ties. Under ordinary circumstances depths will be shown as 6 in. or 12 in., not taking into consideration slight variations due to a few years' wear or a small surplus due to recent reballasting. Note should be made where the depth is much below 6 in. or in excess of 12 in.

On older lines that show evidences of having had several successive applications of ballast, full notes should be taken of the conditions. A track that was originally ballasted with 6 in. of gravel, then again in a few years with 6 to 12 in. more gravel and finally with 12 in. of stone or slag is entirely different from one that has merely 12 in. of stone or slag on top of the subgrade. The notes must show these different conditions. Where such conditions extend over an entire line or over several miles without very much variation it will suffice to describe them in the first mile and refer to this for each succeeding mile.

An examination of the depth of the entire accumulation of material deposited for ballast purposes must be made by test holes, with such frequency and in such places as may be necessary. The digging of these holes will be covered by special arrangement and instructions. This examination need not necessarily be made simultaneously with the rest of the field inspection, but the ballast notes will not be considered complete until the tests are made and the results recorded.

A similar condition, but resulting from other causes and occurring locally rather than generally, is the repeated raising of the track at places where the roadbed has settled considerably, so that there are accumulations of 2 ft. or more of ballast material in excess of the normal amount. The notes should reveal such conditions, and test pits must be made as described in the foregoing.

BRIDGES, TRESTLES AND CULVERTS

The information required from field inspection is intended only to supplement existing plans and records in computing the cost of bridges. There are plans of the foundations and superstructures of most (but not all) permanent bridges and arches. There are standards from which stone and concrete box culverts and pile trestles are built. Where no plans exist, special inspections will be made at another time by a party especially organized for the purpose. The regular inspection parties are only required to take such notes as are here outlined.

For steel bridges note type of spans, as I-beam, deck plate girder, through plate girder, shelf-angle girder, through riveted truss, pony pin-connected truss, deck pin-connected truss; also special description as to ballasted floor, etc. State whether span is square or skew. The length of each span is required. For pin-connected trusses the length is c. to c. of end pins in the bottom chords, and for other types it is from out to out. For trusses having pin bearings the length is c. to c. of bearing pins. The total length of the bridge is the distance face to face of back walls.

Give the number and location of piers and abutments and state whether masonry, concrete or pile. Where possible, ascertain whether foundation is concrete or stone.

Get complete details of overhead highway bridges—type, length, width, kind of floor, size of members, etc. In making sketches do not show anything conventionally, but show correct position and relation of the various members.

For culverts, state kind, size of opening, length and kind of material. Measure and show kind of material in head walls of boxes, arches and pipes. State if culverts have no head walls.

For pile-and-timber trestles show number and length of spans, and note especially if span lengths vary. Note whether standard type or modified; give details of latter. Get full details of sway bracing, floor and hand rails and number and kind of piles. Length of piles will be obtained from division records and personal knowledge or estimates of bridge foremen. [Trestle records are shown in the accompanying cut.]

In addition, full details must be obtained in the field regarding all forms of protection work, such as drainage provisions back of abutments. Inquiry should be made as to the knowledge of the division forces concerning dikes, fire protection, ice breakers, riprap, wing dams, bank protection, levees, etc. Ascertain, if possible, whether abutments and arches have been waterproofed.

Note any evidence that would throw any light on the condition under which the foundations were put down. Note especially whether sheetpiling or coffer-dams would be requied. Get all details possible regarding kind of material excavated from foundation pits, and whether wet or dry. For pipe culverts, observe whether grillages would be required.

The records in the valuation office include the following: Original copy of field notes; card records of all structures and quantities; profiles (1 in. to 400 ft. horizontal and 1 in. to 20 ft. vertical scale); maps showing alignment and right-of-way (1 in. to 400 ft.); station terminal and yard maps (1 in. to 100 ft.); mass diagrams showing distribution of grading quantities and how quantity of overhaul is developed; detail and working plans of structures; copies of all valuation reports compiled and furnished to Federal, state or other government authorities.

The notebooks are filed in sets according to a filing system based upon the geography of the road. The operating division is the major unit of the system. A number is assigned to each line of the division and to each station, and each item filed has a number to designate its division and station.

Card Record of Physical Property

The card record constitutes the permanent office record of the physical property. It covers completely all descriptions and data required for valuation purposes. It includes the location, kind, type, size and quantities of material in each structure or item of property; also information relative to date of construction, actual cost, drawing and order numbers, references to field notes, record of book and page of valuation report in which item was reported, etc. [The cut on p. 1161 shows the cards for records of trestles and water stations. Other cards were given in *Engineering News* of Oct. 28, 1915.]

The system of filing these cards is upon the same basis as that described for the notebooks. Three groups of items are made to facilitate the arrangement and handling of information. The first comprises all the main-line items, covering the grading, main tracks, fence, signal apparatus, telephone and telegraph lines, etc. The second group comprises bridges, trestles and culverts. The third group comprises station, terminal and yard facilities, consisting principally of side tracks and building accessories. Each of these groups is filed separately and is filed by divisions, lines and stations, as described in the foregoing.

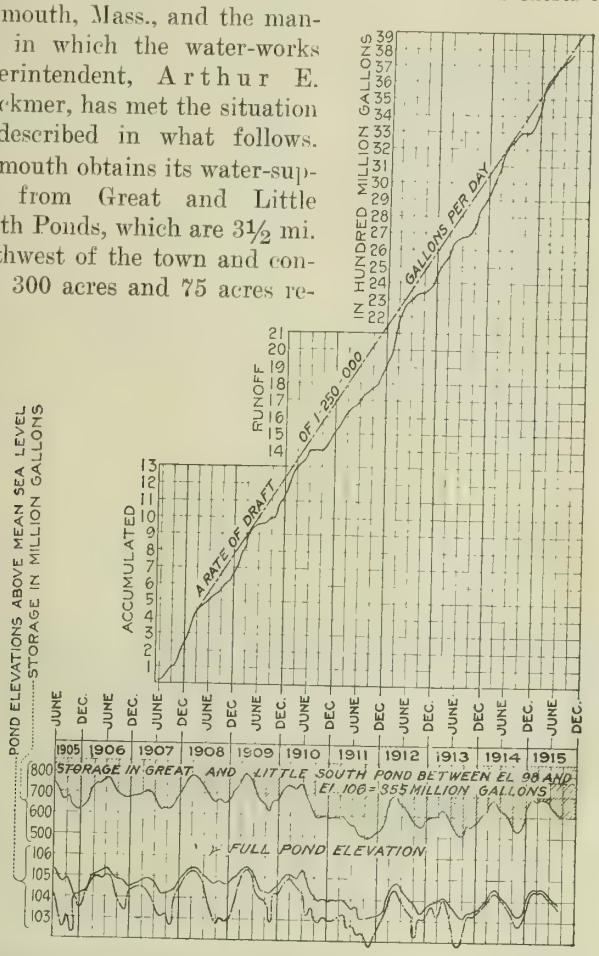
Guide cards showing station numbers are inserted in such a way as to divide main-line items and bridges into sections corresponding to the sections of the road between stations. In addition, bridge-number cards are inserted as guides at every even 100 numbers. All station items at any one station are filed under a guide card giving the name and number of the station. The information is filed in sequence corresponding to the location of stations on the line. The cards are 5 in. high and 8 in. long, and are filed in card-index cabinets of the ordinary type. Each drawer holds about 1,000 cards and will accommodate record cards for about 150 to 250 mi.

A separate card is made for each form of property, and each card is given a form number to facilitate arranging the files. The back of the card is left blank for additional information and special data or sketches.

The Forest Area of Japan is decreasing at the rate of 1,000,000 acres per year, to provide lumber and firewood and to make way for additional rice cultivation. The present forest area is about 45,000,000 acres. Considerable revenue accrues to the government through the sale of timber. In 1914 the budget estimated this revenue at $5,359,845. The expenditures for upkeep, supervision and reforestation were estimated at $2,326,811. The government is devoting a great deal of attention at the present time to reforestation.

Warning the Public Against Overdrawing a Reservoir

To convince the lay public of a small city or town that at the prevailing rate of water consumption the city supply is being slowly but surely depleted, while there is still plenty of water in sight, is not an easy task. Yet it is obviously the duty of an efficient water-works manager to warn against a possible water shortage and to present his arguments in such form that they will be readily understood. Such a condition of affairs exists in Plymouth, Mass., and the manner in which the water-works superintendent, Arthur E. Blackmer, has met the situation is described in what follows. Plymouth obtains its water-supply from Great and Little South Ponds, which are 3½ mi. southwest of the town and contain 300 acres and 75 acres respectively. These two ponds are about 500 ft. apart and are connected by an open channel, consisting of a 12x5-ft. concrete flume about 150 ft. long and 350 ft. of ditch.



DIAGRAMS SHOWING CONDITION OF WATER-SUPPLY OF PLYMOUTH, MASS.

Upper—Accumulated run-off diagram, showing permanent depletion of water-supply. Center—Storage depletion diagram, showing an overdraft on available water-supply. Lower—Diagram showing heights of water in Great and Little South Ponds, Plymouth, Mass., water-works

These ponds have no streams running into them and apparently are fed from springs, but when they reach elevation 106 ft. above mean low water of the sea they waste over a stone sill, the elevation of which was established by the courts when these ponds were first taken as a water-supply. The gatehouse is situated on the north shore of Little South Pond and water is taken through 100 ft. of 30-in. pipe which branches into an 18- and a 16-in. pipe.

About one-half the total consumption comes by gravity through the 16-in. pipe line to a distributing reservoir in the center of the town and the remainder flows by gravity from the pond through the 18-in. pipe line about 7,500 ft. to a pumping station, from which it is pumped to a high-service distributing reservoir in the rear of the pumping station at an elevation of 165 ft.

On the 16-in. gravity line is a venturi meter with a chart recorder, and the quantity of water pumped is measured by plunger displacement. (A venturi meter is now being installed to check the plunger-displacement.)

A careful survey of Great and Little South Ponds has been made, with soundings sufficient to locate the 5- and 10-ft. contours of the bottom. These data make possible the calculation of a table of storage volumes (Table 1).

TABLE 1. VOL[illegible] IN GREAT SOUTH AND LITTLE SOUTH PON[illegible] FOR EACH FOOT IN DEPTH

	Elevation	Great So. Pond 1,000,000 Gal.	Little So. Pond 1,000,000 Gal.
Full pond	106		
	105	97.7	21.7
	104	94.2	21.3
	103	91.3	20.6
	102	88.5	20.0
	101	85.6	19.4
	100	82.9	18.8
	99	80.1	18.1
	98	77.4	17.4
	97	75.0	16.7
	96	72.6	16.0
		845.3	190.0

A gage is set in the concrete culvert at Great South Pond and a record is kept of the elevation of Great and Little South Ponds. The lower diagram in the accompanying figure shows pond elevations, the elevation of Little South Pond being in dotted lines and of Great South Pond in full lines. The middle curve is a storage-depletion diagram and is constructed as follows: Between grade 106, or full pond, and grade 98, which is 3 ft. above the bottom of the 30-in. intake pipe, is a storage volume of 855,000,000 gal. in Great and Little South Ponds. From the diagram of pond heights and the table of storage volumes, it is a simple matter to compute the available storage at the end of each month, thus furnishing the data for drawing the storage-depletion curve.

The accompanying runoff curve is constructed as follows: The total quantity of water withdrawn each month from the two water-supply ponds, excluding seepage and evaporation, passes through the venturi meter on the gravity system or through the pumps. The sum of these two quantities is the total draft from the watershed, for a glance at the diagram of pond heights shows that no water has been wasted over the spillway during the period covered by this record.

The total consumption for each month is added algebraically to the monthly change in the storage volume of the ponds, and the sum of these two quantities is called the watershed yield for that month.

The curve of accumulated runoff is the sum of these monthly quantities since records have been kept. On this runoff diagram a dotted line has been drawn for a uniform draft 1,250,000 gal. per day. The average daily draft from the watershed (equivalent to the daily average consumption) is shown in Table 2.

TABLE 2. [illegible]ERAGE YEARLY CONSUMPTION OF WATER, PLYMOUTH, MASS.

Year	Av. Daily Consumption, Gal.
1908	1,220,000
1909	1,267,000
1910	1,251,000
1911	1,310,000
1912	1,371,000
1913	1,307,000
1914	1,383,000

Mr. Blackmer concludes from these data that the safe daily yield of the watershed does not exceed 1,250,000 gal. per day, and with the help of these charts he is endeavoring to bring this fact home to the public.

Brick and Concrete Hillside Pavements in Birmingham

The newer residence section of the City of Birmingham, Ala., is in a very hilly district where street grades are of necessity high. In order to facilitate the movement of horse-drawn traffic, which found it nearly impossible to use some of the streets, especially in wet or icy weather, the city engineering department has put in a number of short stretches of special paving ridged to guarantee a horse's foothold. Two types, one of brick and one of concrete, have been used.

The details of the concrete pavement are shown in Fig. 2. The street is laid in three sections between curbs—a central asphaltic, or cement concrete, smooth section for motor traffic, a narrow corrugated, or stepped, concrete section on the right-hand side going up for ascending horse-drawn vehicles, and a similar wide corrugated section on the left for descending horse-drawn vehicles, the whole street being laid on a solid concrete base. The uphill section is left narrow because vehicles will hardly try to pass on a stiff upgrade. The steps are formed between transverse iron bars, 1½ in. by $\frac{3}{16}$ in. in section, the tread of the step being screeded from the top of a lower bar to ½ in. below the top of the next higher bar. The bars are held in place by longitudinal ¼-in. rods passing through and wired to each bar.

The base concrete, which is 5½ in. thick at the steps and 4 in. at the center, is a 1:3:6 mixture using local slag as coarse aggregate. The finished coat to the steps is a 1:1½ concrete, using a crushed stone graded from $\frac{1}{16}$ in. to ½ in. as aggregate.

This pavement has been laid on four separate stretches of street, all of short length, on grades varying from 10 to 22%. It has been down about 18 months and has shown excellent wear, although of course the traffic over it is not great. It is found that dirt tends to collect in the corners against the exposed bars, not enough to defeat the purpose of the steps, but sufficient to form a cushion against excessive wear at those points. The cost of the pavement was about $1.75 per cu.yd., including about 8 in. of grading.

The brick pavement is shown in the view in Fig. 1. This is laid in a concrete base with grouted joints and differs from an ordinary grouted brick pavement only in the type of brick. These are the regulation 3½ in. width and 9 in. length but are formed so as to be 3½ in. deep at one end and 4 in. deep at the other, so that when laid with bottoms level there is a ½-in. lift at each brick, which is continuous across the street from curb to curb. The bricks were burnt at Birmingham, only a slight rearrangement of the regular dies being required.

Three streets have been paved with this brick on grades from 10 to 18%. The cost of the pavement was about $2.10 per sq.yd., but this price should be reduced when once the dies are prepared.

Both types of pavement have proved much easier for horse-drawn traffic, which can now go where hitherto it has been impossible. The roughness is hardly per-

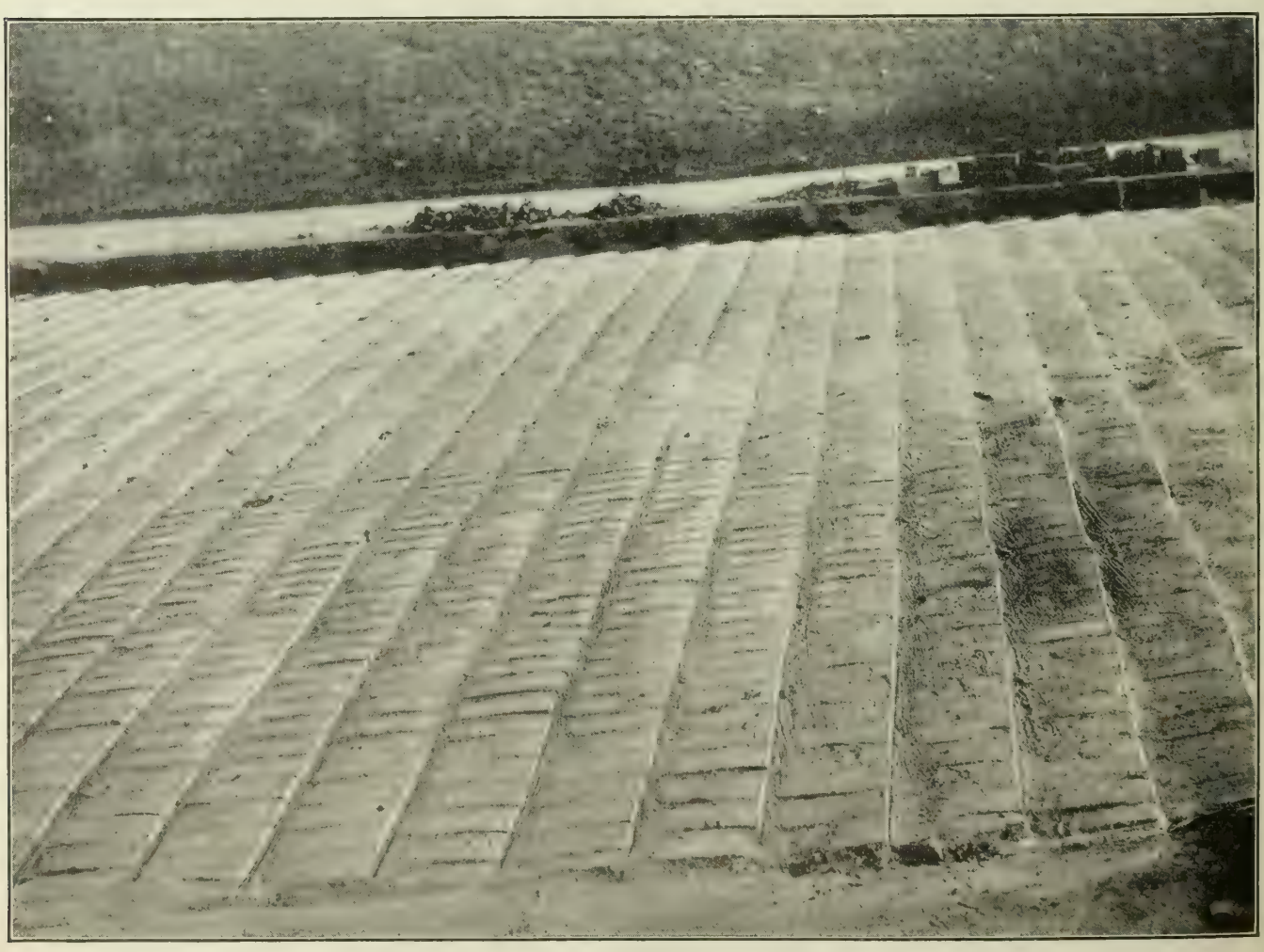


FIG. 1. HILLSIDE BRICK PAVEMENT AT BIRMINGHAM, ALA.

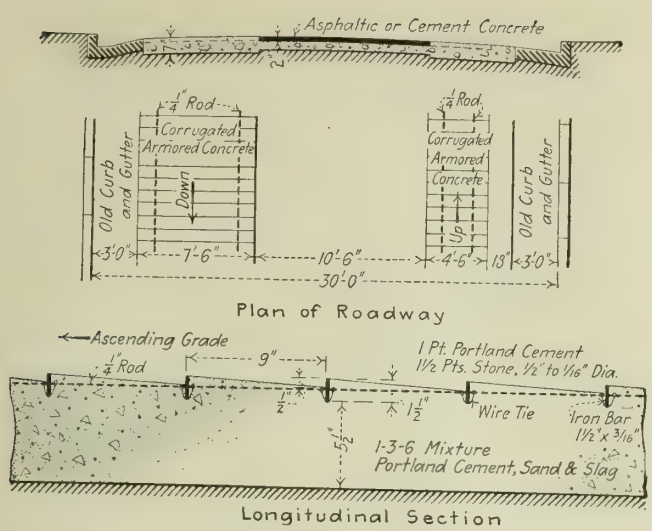


FIG. 2. CONCRETE STEPPED PAVEMENT FOR HILLSIDE STREETS, BIRMINGHAM, ALA.

ceptible to an occupant of a motor vehicle, and such traffic has not been deterred from using the streets.

These pavements were devised and placed under the direction of J. D. Webb, Assistant City Engineer in Charge of Construction. Julian Kendrick is City Engineer of Birmingham.

Contracts for Land Drainage

The following interesting suggestions for improvements in the letting of contracts for land-drainage work are from a report on "Drainage in the Southern Section of Michigan," by A. D. Morehouse, Drainage Engineer, Department of Agriculture, Washington, D. C.:

Advertising and Letting Contracts

In all drainage work amounting to over $5,000 or $10,000 the law should stipulate that publication of the "notice of letting" and of the receiving of bids for the work be made for not less than three or four weeks in one or more engineering or contracting journals of general circulation, in addition to the county papers. This would give the widest possible circulation of the notice among contractors and thus secure the best bids. It would obviate the necessity of personally notifying contractors, as is attempted at present by a number of drain commissioners. It would also prevent favoritism being shown in such notification.

Should the farmer wish to bid, which now seems rarely to be the case, he should be compelled to enter into fair and open competition with responsible bidders and to take his chances with them. In order to secure the lowest bids the work should usually be let as an entirety or in such large sections that it will pay responsible contractors to attend the lettings and bid on the work. The best results are often secured by receiving sealed bids. The method of letting drainage work should be left to the decision of the drainage commissioner. Even though open bids are received, sealed bids should be accepted and placed, unopened, in view of the other bidders, to be opened after the lowest open bid has been received. The contract should then be let to the lowest responsible bidder.

A practice much to be condemned is that of changing the specifications of tile or open ditchwork at the time of the letting. This is decidedly unfair to the contractors who have attended in good faith and who by the change may be prevented from bidding. It is also a dangerous procedure on account of the liability of doing, on the impulse of the moment, that which may be eminently unwise from an engineering or economical standpoint.

A case in point is that of the changing of a ditch from a specified bottom width of 10 ft. to a bottom width of 4 ft. This change, besides being presumably unwarranted from an engineering standpoint, prevented a dredge contractor who had secured the contract for the adjacent short section from bidding successfully on the section in question, to which he was practically entitled and which he would have secured had the size not been changed.

Postponing the Award of Contract

Another questionable method sometimes used is for the commissioner, after receiving a fair low bid, to offer such bidder a still lower price and, upon his refusal, to adjourn the "letting" in the expectation of receiving from him a lower bid. This procedure is occasionally even repeated the second time.

The other responsible bidders have by this time grown cold in the matter and do not attend. The original low bidder (who in one case was about completing a contiguous job) is then by force of circumstances usually obliged to take the job at a still greater reduction in price than was offered him at the second "letting." Such experiences are not conducive to securing bids from responsible contractors. The law should provide against delaying the award or changing the specifications.

Practically all bids requested are for the price per rod of ditch, so that in comparatively few cases could even the approximate yardage be obtained. In this class of work it is far more logical, and a nearly universal custom, to make all estimates and computations on a basis of cubic yards. It is very difficult to make any changes in dimensions of the ditch or to provide for any extra work under the price-per-rod system; and the yardage not being known (even approximately) the contractors find themselves largely in the dark in their bidding. This often causes much loss to the contractor, or much trouble to the drain commissioner in forcing an irresponsible contractor to live up to his contract.

The Steam Boiler Code adopted by the American Society of Mechanical Engineers is to be pressed for general adoption in the legislatures of the several states by the American Uniform Boiler Law Society, an organization formed of representatives of the principal trade and technical organizations that coöperated with the American Society of Mechanical Engineers in the drafting of the code. The code has already been accepted and put in force by the officials in charge of steam-boiler inspection in the states of Ohio and Indiana and the cities of Detroit and Chicago, while the state authorities of Pennsylvania, Wisconsin and California have signified their acceptance of the code and will put it in force later. This winter bills for the adoption of the code are to be introduced in the legislatures of Georgia, Kentucky, Louisiana, Massachusetts, New York, New Jersey, Rhode Island, South Carolina and Virginia. The committee of the Uniform Boiler Law Society promoting the legal adoption of the A. S. M. E. code has as its chairman Thomas E. Durban, of Erie, Penn. Among the other members are E. R. Fish, of the American Boiler Manufacturers Association; I. Harter, Jr., representing the water-tube boiler manufacturers; John H. Wynne, representing the locomotive manufacturers; Walter Plehn, representing the steam-shovel manufacturers, and H. M. Covell, representing the hoisting-engine manufacturers.

Grandstand for the Chicago Automobile Speedway

The Maywood automobile speedway near Chicago, which was described in *Engineering News* of Sept. 9, 1915, page 488, provides seating accommodations for about 100,000 persons in the grandstand and bleachers. These structures are of wood, but the grandstand has a steel roof on steel columns, which serve also to support the deck and seats. Both structures are designed to carry safely a load of 200 lb. per sq.ft., with allowance for the movements of crowds.

The grandstand is 2,250 ft. long and seats 60,000 persons. A general view of it is given in Fig. 1. Fig. 2 shows the typical character of the construction (but without the roof). It has six-post bents spaced 12 ft. c. to c., with longitudinal bracing in alternate panels both front and back. The posts, 8x12 in., carry 8x16-in. stringers. On these are laid 2x14-in. joists, arranged in pairs and inclined about 1 on 2. Upon these are the tiers of seats, with 30-in. tread and 13-in. rise, the width being sufficient to allow chair seats (with backs) being fastened to them. At the gangways are intermediate steps to form convenient stairways.

The architects' original design provided for a roof having timber trusses supported on three lines of columns. In view of the time which would have been required to build these trusses the design was changed to a steel roof, but still with three lines of columns. The front row of posts being objectionable, the contractor's engineers prepared a design for a two-column roof, with trusses extending as cantilevers over the front part of the grandstand. This was approved and the roof was built according to this design, as illustrated in Figs. 1 and 3.

The details are shown in Figs. 4 and 5. Each column is composed of an I-beam and two channels, with batten plates over the flanges of the latter. The trusses are built up of angles. The rear posts are braced by diagonal members (Fig. 3), and longitudinal diagonal bracing is provided in alternate panels. The steel bents are spaced 24 ft. c. to c., and their columns form part of the alternate bents of the structure supporting the deck and seats of the grandstand. The corresponding timber posts

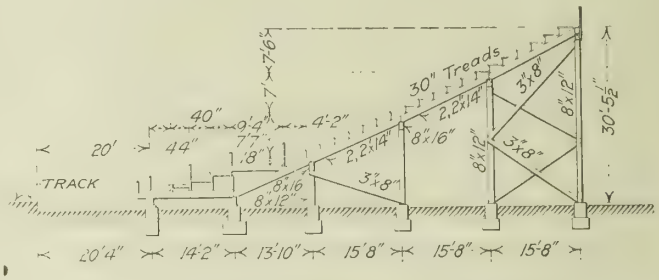


FIG. 2. TYPICAL SECTION OF GRANDSTAND

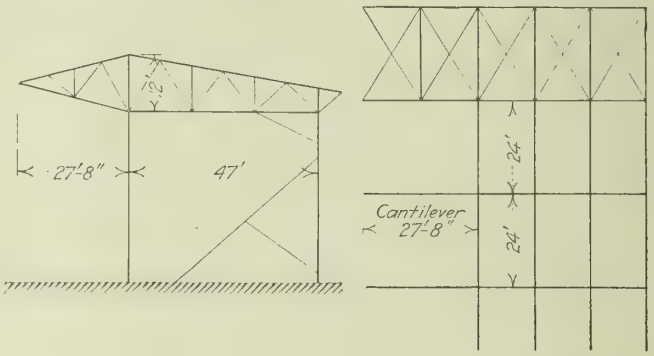


FIG. 3. DIAGRAM OF STEEL ROOF FOR GRANDSTAND

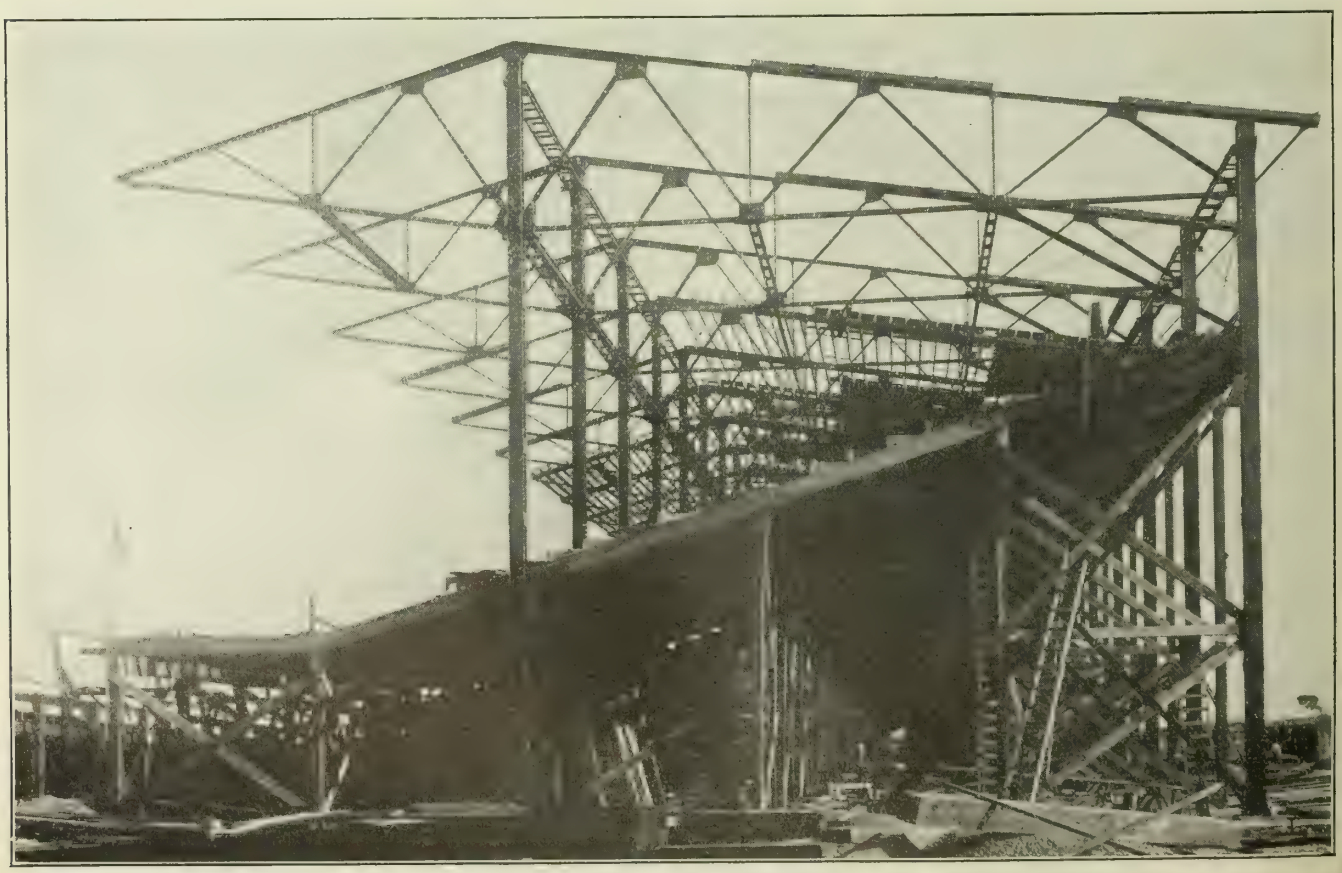


FIG. 1. STEEL ROOF FOR TIMBER GRANDSTAND AT THE MAYWOOD AUTOMOBILE SPEEDWAY

are omitted in these bents, the floor joists being carried by angle brackets on the posts, as shown.

The trusses are 74 ft. 8 in. long and 12 ft. deep, cantilevered 27 ft. 8 in. beyond the inner columns. Longitudinal struts are placed between the columns. These are pairs of channels with top and bottom batten plates. Diagonal rods for wind bracing are placed in the plane of the top chords of the trusses. The timber joists of the roof are laid across the trusses and secured to angle brackets on the top chords. They are covered with plank sheathing and a felt and composition roofing.

The roof as built was designed by the Shank Co., of Chicago, the general contractor for the Speedway. Frederick Grim was Chief Engineer and Alfred H. Marshall, Principal Assistant Engineer. The steel was fabricated by the Hansell-Elcock Co., of Chicago. It was erected by the general contractor, a stiff-leg derrick with a 50-ft. boom being used for this work. Each column was handled complete, but the trusses were erected in two sections.

A 20-ft. open space or safety zone is left between the grandstand and the track. A heavy guard timber on posts is built along the edge of the track, and there is also a high screen of netting (shown at the left in Fig. 1) to catch tires which may be thrown from the wheels of the cars in races.

When this track was opened the fastest time ever made on a continuous track was made, but this speed was afterward bettered in the new motor speedway at Sheepshead Bay in the Borough of Brooklyn, New York City.

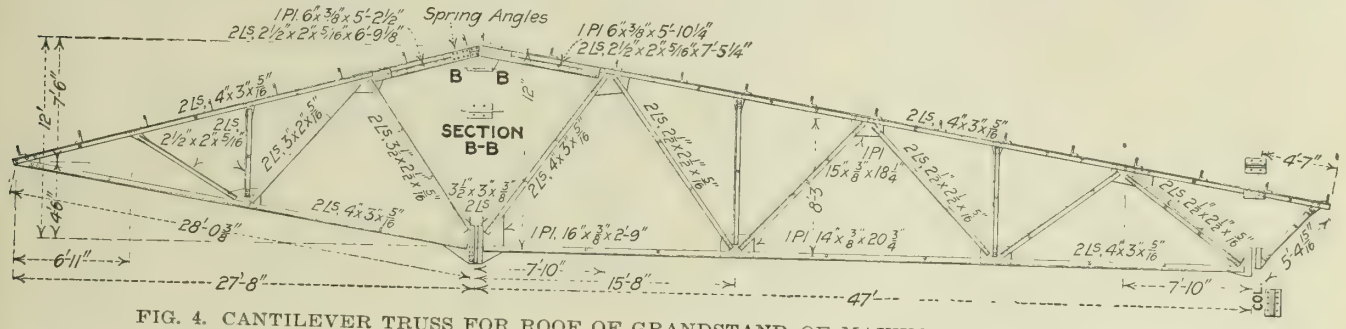


FIG. 4. CANTILEVER TRUSS FOR ROOF OF GRANDSTAND OF MAYWOOD MOTOR SPEEDWAY

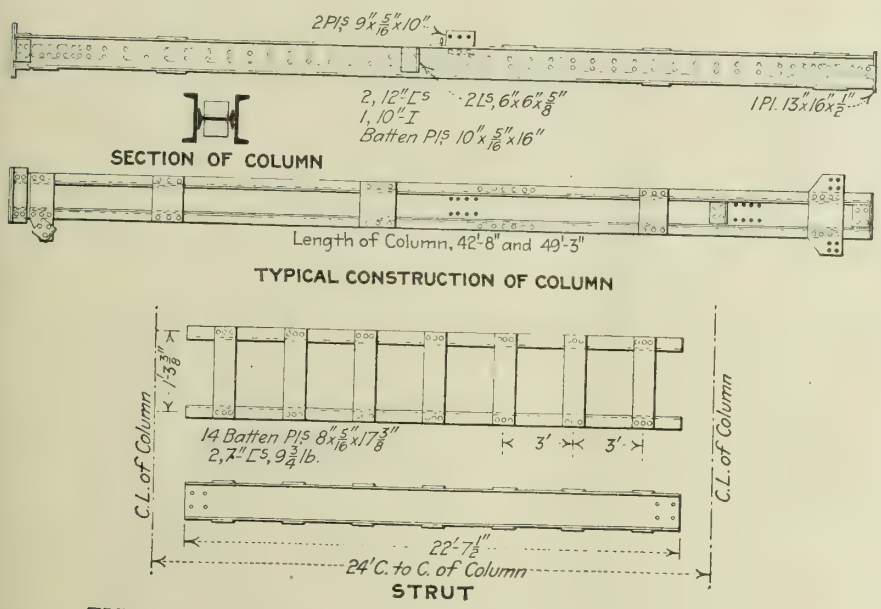


FIG. 5. COLUMNS AND STRUTS FOR ROOF OF GRANDSTAND

Hints on the Use of the Tremie

In the October *Proceedings* of the American Society of Civil Engineers, Clement E. Chase, of Pittsburgh, Penn., in an article on the Cherry St. Bridge at Toledo, Ohio, makes some valuable suggestions as to the use of the tremie in depositing concrete.

Tremie work, though practiced for years, is far from being standardized, and as it is on the details of the construction and the handling of the tube that success depends, the methods used at Cherry St. may be of interest.

The tremie pipe consisted of flanged sections of 12-in. spiral, riveted pipe, which were bolted together to make up the various lengths required. The top section was short and was riveted to a pyramidal hopper of ¼-in. sheet steel, stiffened with angles and having a capacity of about 1 cu.yd. The edges of this hopper rested on a timber frame, suspended from the derrick by slings at the four corners. The discharge pipe from the floating mixer was self-supporting, and was simply held in place over the hopper by lines, in such a way that its weight did not have to be lifted when the tube was raised. A signalman, usually accompanied by the inspector, "rode" the hopper and gave directions to the hoisting engineman.

Three things which must be most guarded against in tremie work, under conditions such as those at Toledo, are, first, the "plugging" of the pipe; second, the loss of the charge; and third, allowing the concrete to drop through water as it leaves the pipe. The first causes serious delay, disturbance of the concrete already placed, and danger to derrick and tremie from efforts to start the concrete flowing, and, usually, in the end, loss of the charge, thus making it necessary to refill the tremie. It can be avoided by using a quite wet mix, with small aggregate where possible, and by having the pipe hoisted enough to start the charge moving just as the hopper starts to fill, instead of after it is full. There does not seem to be any advantage in having a pipe larger than that used on this work.

The second trouble causes serious washing of the last of the concrete in the pipe, for, as the column of concrete nears the bottom, the water rushes up through it to fill the tube. Also, refilling the tremie always causes more or less washing out of the cement. Loss of charge can only be avoided by good team work between the signalman and derrickman. The lowering of the pipe to stop the flow must be started in time, so that the pipe will be completely sealed, at least when the concrete has lowered in the tube to about the water level. The pipe should be lowered gently so as not to disturb the concrete already deposited. To reduce washing in filling the tremie, a cement sack, loosely filled with straw, will act as a plunger and force the water before it as the weight of the concrete forces it through the tube. The sack will usually float to the surface after passing through the pipe.

The third trouble will cause loss of cement from the charge and churning of the deposited concrete. The pipe must be "picked," or lifted, just enough to start the flow, which will rarely bring the lower end out of the soft concrete previously deposited. A concrete with a small aggregate is handled much more easily than one with the larger sized stone.

Engineering Literature

Sewage Disposal Up To Date

Reviewed by John H. Gregory*

AMERICAN SEWERAGE PRACTICE; Vol. III, Disposal of Sewage—By Leonard Metcalf and Harrison P. Eddy. New York: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xiii + 851; 230 illustrations. $6, net.

The final volume of this notable work on American sewerage practice is devoted to the disposal of sewage and contains a fund of valuable information on this most important branch of the subject. Together with the preceding volumes, which treat respectively of the design and construction of sewers, these three books give the most complete and uptodate information on the subject of American sewerage practice.

In Chapter I, which is mainly historical, the authors trace the developments in the art of sewage treatment from the earliest steps taken in England, about the middle of the last century, down to the present time, and discuss briefly the successive steps taken in developing the art not only in England, but also in the United States and Germany.

The meaning of chemical analyses is discussed at more or less length in Chapter II, and, as the authors state, the effort is made in this chapter to explain, for the benefit of engineers, lawyers and others who lack a knowledge of chemistry adequate to a full understanding of the results of these analyses, the general method of analysis, the meaning of the technical terms used and the interpretation of the results obtained.

Two chapters, 70 pages, are devoted to bacteria and their relation to the problem of sewage disposal, and to plankton. The authors present an interesting discussion of these two subjects and include a brief but especially good discussion of typhoid fever, with just enough tables and statistics for the reader to get a good idea of the close relation between typhoid fever and sewage disposal.

The composition of sewage is taken up in Chapter V. In addition to the detail discussion of the subject the authors have assembled here numerous tables giving the analysis of the sewage of various cities in the United States as well as in England and on the continent of Europe.

One chapter is devoted to a brief exposition of the theories of sewage disposal, in which the authors discuss the disposal of sewage by dilution and the treatment of sewage by grit chambers, screens, plain sedimentation, septic tanks, Travis hydrolytic tanks, Imhoff tanks, tanks with colloiders, chemical precipitation, activated sludge, contact beds, trickling filters, sand filters, broad irrigation and disinfection. This chapter, in effect, serves as a well-prepared introduction to the subsequent chapters which discuss more at length and in greater detail the several methods of treatment just mentioned.

In the chapter on the disposal of sewage by dilution, various phases of the question are considered, as the influence of suspended matter, the aëration of sewage-laden waters, the self-purification of natural waters, the conditions for successful disposal by dilution, the basic information necessary for planning dilution projects, tides, and the effect of the character of the water receiving sewage. Throughout the discussion numerous examples are cited to illustrate the principles involved.

To the subject of grit chambers 22 pages are devoted. Descriptions are given of different types of grit chambers in use in this country and abroad. The chapter well illustrates the wide diversity of views held by engineers at the present time on the design of grit chambers, due perhaps in a large measure to the lack of accurate information on the results of operating such devices.

Chapter IX treats of racks, cages and screens. Descriptions are given of numerous installations. While the reader can gain much by a study of this chapter its value would be increased if the relative advantages and disadvantages of the different types were discussed more at length, and if more space was given to the minor details of design and construction which play such an important part in the convenience of operation.

In the chapter on sedimentation, straining and aëration the authors touch briefly on the theory of sedimentation and then take up more in detail the discussion of horizontal- and vertical-flow tanks, the design of such tanks and the action of strainers or roughing filters. Aëration and activated sludge are also discussed, and a résumé of the experiments made at Lawrence, Mass., Manchester, England, and by the Illinois State Water Survey is given. The Milwaukee experiments are but briefly referred to. In a later edition of the book a much more extended discussion of activated sludge will be welcomed.

Chapter XI deals with tanks for sludge digestion, and under this head the authors take up successively the septic tank, the Travis tank, the Imhoff tank and the Lethbridge tank, the latter a type of tank somewhat similar to the Imhoff tank. The treatment of the Imhoff tank is especially good, but more space could to advantage be given to a discussion of the details of Imhoff tanks. Convenience of operation is one of the prime requisites for success in sewage-treatment works, and the necessity for well-designed details cannot be too strongly emphasized

To the chapter on chemical precipitation the authors devote 19 pages, but additional information on the subject is found in some of the other chapters of the book. The chemicals ordinarily used are first described, and then the preparation of the chemicals and their mixing with the sewage are taken up. Data are given on the volume of sludge produced. The chapter ends with some practical suggestions on the design of precipitation tanks.

The handling and disposal of sludge are well treated in Chapter XIII. After describing the character and composition of sludge, the authors discuss the removal of sludge from tanks, sludge pumping and pressing, the drying of sludge by centrifugal machines and on drying beds, and the disposal of sludge at sea, in lagoons and trenches and by burning.

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Contact beds are next taken up, and various phases of the construction and operation of such beds are discussed. The nature and depth of material used in building contact beds are described and data are given on the rate of operation, on multiple contact and on the maturing and loss of capacity of the beds. Dibdin slate beds are also briefly referred to. The chapter closes with data on the cost of constructing and operating contact beds.

The longest and most interesting chapter in the book is that on trickling filters. After treating of the character, size and depth of filtering material, the authors devote considerable space to a detailed discussion of the application of sewage to the filter. Under-drainage, ventilation, construction and operation are among the other subjects taken up.

A good discussion of intermittent sand filters will be found in Chapter XVI. After describing the materials used in, and the construction of, such filters some especially valuable information is given on the operation of sewage filter beds and on their maintenance in winter. The chapter closes with figures on the cost of construction and operation.

In the chapter on irrigation and the agricultural utilization of sewage and sludge, the use of sludge as a fertilizer is first taken up, following which are descriptions of the experiences obtained with the operation of sewage farms in England, Germany, France and the United States.

Automatic apparatus for dosing intermittent sand filters, contact beds and trickling filters are illustrated and described in Chapter XVIII, and special forms of dosing tanks used for dosing trickling filters are briefly referred to.

Chapter XIX deals with the disinfection of sewage and sewage effluents, and while chemicals other than hypochlorite of lime and liquid chlorine are referred to, the authors' discussion relates largely to disinfection by means of these two. After describing the several chemicals used, there then follows a general and detailed discussion of the subject of disinfection with frequent references to the results secured by the application of disinfectants, as shown by experimental investigations and at certain works where careful operation records have been kept.

The last chapter in the book is devoted to the disposal of sewage from residences and institutions. The arrangement, construction and operation of several small works are described. A table of considerable interest has been included at the end of the chapter, in which the per capita sewage flow from nearly twenty different institutions is given. The appendix contains a number of convenient conversion tables.

While the idea might possibly be gained from the title of the book that the subject matter was confined to the disposal of sewage from the standpoint of American practice only, such is not the case, and the reader will find much valuable information on sewage disposal as practiced in Europe, especially in England.

The book is well printed, is uniform in appearance with the two preceding volumes and is well illustrated with many carefully prepared drawings and halftones, although the illustrations relatively are not as numerous as in the earlier volumes.

[Vols. I and II of this work were reviewed by Mr. Gregory in *Engineering News* of Feb. 11 and Mar. 18, 1915, pages 260 and 532.—Editor.]

Truly Practical Mathematics

REVIEWED BY LEON S. MOISSEIFF*

A TEXTBOOK ON PRACTICAL MATHEMATICS FOR ADVANCED TECHNICAL STUDENTS—By H. Leslie Mann, Lecturer in Advanced Practical Mathematics, The Woolwich Polytechnic. New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. xi + 487; 149 illustrations. $2.10, net.

The practicing engineer frequently meets a ready formula which he would like to deduce and check to satisfy himself of the validity of the assumptions on which the formula has been built and of the correctness of its derivation. In his scientific studies the engineer also encounters many an equation he would like to establish or to solve, and especially in analyzing the conditions of new problems he requires the concentration and definiteness of the mathematical symbol. He then is thrown back on his old mathematical knowledge and not infrequently finds it rusty, and himself awkward in handling the old tools. In such times the engineer will be grateful to find at hand a work which in a short and concise manner presents methods of treating problems similar to his. Mr. Mann's "Practical Mathematics" is such a book. While the author calls it a textbook, it is by no means what its name implies. It does not teach mathematics; it rather presumes a knowledge of it. It does better; it reminds one of what he has forgotten. It consists practically of methods to solve problems stated in as few words as possible.

The book is divided into three sections, covering 25 chapters. These sections are algebra and trigonometry, the differential and integral calculus, and their application to concrete examples. The algebraic section treats of the means of handling equations and fractions for purposes of integration, of trigonometric functions and of complete quantities. The calculus section treats of the method of series and the integration of various expressions. The third section, comprising about 250 pages, or more than half of the book, deals with the application of mathematics to geometry, mechanics and physics. Each chapter concludes with a number of examples for exercise, and an appendix gives the answers.

The book has a thoroughly practical aspect, and it is evident that an experienced and practical mind has written it. The reader, or rather the user, of the book will be grateful to the author for its production.

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PURCHASING; Its Economic Aspects and Proper Methods—By H. B. Twyford, Otis Elevator Co. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. xvi + 236; 121 illustrations. $3, net.

The chapters in Mr. Twyford's book which deal broadly with purchasing are most interesting. Of special value should be the description, including forms, of the mechanical process of buying goods—that is, placing the requisition and order, and methods of following up shipments. In the last section the author discusses in four chapters purchasing for railway construction, manufacturing and construction companies, for construction and operation in widely separated localities, and purchasing for a small manufacturing establishment.

Of peculiar interest is Mr. Twyford's statement that personal contact between buyer and seller is not the potent factor it once was. He aptly likens this condition to the dying out of personal combat in war. If the author's conception of scientific purchasing ever becomes general, then a mail order will give as satisfactory a result as an expensive (both in time and money) personal transaction.

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Purchasing will be greatly simplified when the selling price is recognized to be cost plus a reasonable profit—16% according to this book.

River Control and Improvement

Reviewed by W. H. Bixby*

THE REGULATION OF RIVERS—By J. L. Van Ornum, M. Am. Soc. C. E., Professor of Civil Engineering, Washington University, and Consulting Civil Engineer. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. x + 393; 99 illustrations. $4, net.

This book covers a sphere of work about which there are but few recognized textbooks by American writers, and which up to the present time has been directed and executed principally by the United States Army Corps of Engineers and their many civil-engineer assistants. The need of a good comprehensive textbook on this topic has long been recognized by the engineering profession. The author of this book has the great advantage, so seldom realized, of having combined actual field practice in the government service on some of our largest rivers with subsequent careful study as a professor of civil engineering in one of our best universities located near large rivers and within easy reach of officials still engaged in such work. Accordingly his offering to the engineering profession represents an uptodate presentation of his subject and the best and latest methods.

The book deals with the great need of full utilization of our inland-navigation resources, their commercial considerations, the general phenomena of rivers—including especially their water flow—river surveys, river improvement in general, the principles and best methods of river regulation and of current control, dredging, bank protection, levees, etc.

The author's discussion of the commercial considerations affecting waterways and railways is remarkably valuable for its broad point of view. It well shows why railroad development has recently far exceeded waterway development in the United States; at the same time it points out how valuable to the country would be a fuller and better-standardized waterway development well provided with efficient terminals and with connections combining joint use of both boats and railways, all based upon sound economic principles of coördination and coöperation instead of upon commercial warfare between railways and waterways.

Under the head of "General Phenomena" the author's exposition of the complex question of the effect of forests and reservoirs upon navigation is one of the best résumés yet published, showing how completely any engineering decision on this subject must be dependent upon the individual surrounding circumstances.

In other chapters his discussion of the principles of river regulation by dredging, channel contraction, bank protection and levees is equally uptodate and shows how necessary it is that such work should be carried on under a carefully studied project directed towards a final accomplishment of a complete protection of the channel and banks by gradual steps each based upon the most immediate needs and upon true economical considerations. His discussion is supplemented by brief descriptions of some of the United States, European and Asiatic rivers, and of the methods by which they have been controlled and improved, all largely based upon published reports of the Chief of Engineers, United States Army, of the International Association of Navigation Congresses (whose last meeting was at Philadelphia in 1912) and of foreign engineers—to whom he gives due credit—checked up by personal experience and in some cases by personal inspections.

The question of the relative disadvantages and advantages of cutoffs is not discussed as fully as might seem desirable and possible, but is limited to the statements of a few facts illustrating the limitations of their use.

The book, as shown by its title, is restricted to a consideration of the "regulation of rivers," so it does not include any description of the dams, locks and side canals which belong to river canalization; but pertinent to its subject, it contains a due amount of description and illustration of bank-heads, spur-dikes, submerged sills, training walls, bank revetments, hydraulic dredges and levees.

The modern hydraulic engineer has begun to realize the usefulness of small-scale models by which in the laboratory he can test his theories and secure a definite and reliable indication of what his proposed constructions will probably effect when actually constructed in the waterway itself. Several pages of this book are devoted to showing how such models have already been employed in England, France and Germany (where they have been used far more extensively than in the United States), how useful they may be and how they should be constructed in order to give the most useful and most reliable indications of probable results in the full-sized waterway.

The book, with its excellent index, should be of great use and value to the modern hydraulic engineer when called upon to undertake work of river control and improvement.

SURVEYING AND FIELD WORK: A Practical Textbook on Surveying, Leveling and Setting-Out, Intended for the Use of Students in Technical Schools and Colleges and as a Work of Reference for Surveyors, Engineers and Architects—By James Williamson, Assoc. M. Inst. C. E. [The Glasgow Textbooks.] New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. xxii + 363; 271 illustrations. $3, net.

In general, surveying textbooks of British origin are not of particular value to American students; not merely because we have a number of excellent American texts, but because English surveying instruments, methods and terms generally strike the American engineer as somewhat antiquated. This book, however, has at least one great advantage—it is written in clear and concise language. It is an excellent elementary text on surveying, notwithstanding its English character, and should find a welcome place in engineering libraries.

A BIBLIOGRAPHY OF MUNICIPAL GOVERNMENT IN THE UNITED STATES—By William Bennett Munro, Professor of Municipal Government. Harvard University. Cambridge, Mass.: Harvard University Press. Cloth; 6x9 in.; pp. xiii + 472. $2.50, net.

A useful bibliography, selective rather than inclusive, with very brief critical notes where thought necessary, is here presented in dignified form. Half the references are to publications not more than five years old, and more than three-fourths to books and articles of a date later than 1905. The main divisions are: General Works; Political Machinery and Direct Legislation; Municipal Organization; City Planning and Public Improvements; Utilities, Sanitation and Public Health;

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Safety; Education and General Betterment; Finance. Under each of these heads are various subheads, the total of subheads being 76. An index, subject and author combined, adds materially to the value of the book.

Internal-Combustion Engines

REVIEWED BY H. E. LONGWELL*

INTERNAL COMBUSTION ENGINES. Theory and Design: A Textbook on Gas and Oil Engines for Engineers and Students in Engineering—By Robert L. Streeter, Assistant Professor of Mechanical Engineering, Russell Sage Foundation, Rensselaer Polytechnic Institute. New York and London: McGraw-Hill Book Co., Inc. Cloth; 7x10 in.; pp. xi + 418; 240 text illustrations and drawings. $4, net.

This is a conventional textbook on internal-combustion engines—not appreciably better or worse than the average of its predecessors; and unless history fails to repeat itself, it probably will not suffer seriously by comparison with its inevitable successors.

The opening chapter is painfully elementary. The author states that it is written for the benefit of the many students who have a working knowledge of mechanics and thermodynamics, but who are not at all familiar with the details of gas engines, or the names and functions of the various parts.

It requires a lively imagination to picture an individual presenting himself for instruction in gas-engine design who does not know that "the base plate on which the engine is fixed and the cylinder bolted is of cast-iron usually," or that the valves "admit fresh gas into the cylinder at the proper time, and allow the exhaust gases to escape"; or that "the force on the reciprocating gas-engine piston is transmitted to the revolving crank-shaft through a connecting-rod and crank." If there be such a one, it is safe to say that mechanical engineering is far from being his real vocation.

Much of the information in this introductory chapter is rather "sketchy" in character, especially the part dealing with the advantages of compression. For example, the fact that "the particles of gas are pressed more firmly together" is not a very scientific reason why the combustion temperature should be higher than if the gas had not been compressed.

It is strange that writers avoid the simple, common-sense reason why compression is advantageous; that is, that in an engine working on the Otto cycle a higher compression means a smaller clearance volume and consequently a more complete expansion of the exploded charge. The efficiency is a function of the ratio of compression for no other reason that that the ratio of compression is incidentally the same as the ratio of expansion.

The method of calculating the cylinder dimensions is interesting as a mathematical diversion, but hardly what one would term simple or direct. According to the author's method, the designer may not say what the stroke—and consequently the piston speed—*shall* be; he must find out by calculation what it *will* be. The m.e.p. is the last thing determined and is calculated from the horsepower speed, and piston diameter and stroke. The more sensible method is to compute the m.e.p. first and then proceed to determine the cylinder dimensions in the same way that one would go about designing a steam engine. From the data in the book the m.e.p. can be calculated directly without traversing the tortuous route outlined by the author.

The method of checking the calculations is original and amusing. The m.e.p. of a 75-hp. engine, for example, is computed, and the check consists in computing the m.e.p. of a 1-hp. engine the piston displacement of which is one seventy-fifth as great. Naturally if the results do not agree there must be an error in one or the other of the computations, and we have two sets of calculations to check instead of one.

In general, the book is of the usual character, with chapters on fuels and combustion, ignition, carburetion, governing, cost of power, general descriptions of various commercial types of engines, details of design, etc. The theoretical part is, as in most books on the subject, far too elaborate, and the practical part rather superficial. It seems to be largely a compilation from existing sources, and displays no particular originality in the selection or arrangement of the material. The errors in the text that are apparent from even a casual inspection indicate that the proof-sheets did not have the careful correction that one has the right to expect in books of a technical nature.

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Factory Safety and Sanitation

REVIEWED BY C. E. CARSON*

THE MODERN FACTORY: Safety, Sanitation and Welfare—By George M. Price, Director, Joint Board of Sanitary Control in the Cloak, Suit and Skirt and the Dress and Waist Industries, New York City; formerly Director of Investigation, New York State Factory Commission. New York: John Wiley & Sons. London: Chapman & Hall. Cloth; 6x9 in.; pp. xx + 574; 257 illustrations. $4, net.

The short title that appears on the outside of the cover, "The Modern Factory," gives an erroneous impression, since the book deals entirely with safety, sanitation and welfare work. The only exception is the first chapter, which gives a historical summary of the rise and development of the factory system, and this chapter might very well have been omitted.

The second chapter discusses in a general way the working conditions of different industries. Other chapters take up factory fire prevention, accident prevention, factory lighting, factory sanitation, welfare work, factory ventilation, dusty trades, industrial poisons and fumes, factory legislation and factory inspection. Among the safety devices described in Chapter IV is the familiar one for a punch press. It is without doubt safe, because the operator must use both hands to trip the press. But from the production manager's viewpoint this type of device would be prohibitively slow. Safety on this job may be better attained by spending more money in the construction of the die and providing a gravity feed.

The book as a whole shows experience and careful preparation. It will be a valuable asset to the library of any large manufacturing establishment that has, or contemplates having, a department of safety, welfare and sanitation.

PIPE COUPLINGS. By R. S. Lord, Vice-President, Hope Engineering and Supply Co., Mt. Vernon, Ohio. [Reprinted from "Proceedings of the Engineering Society of Pennsylvania," Vol. 31, pp. 417-37 (June, 1915).] Address the author.

A useful and interesting review of couplings, or joints, for wrought-iron and steel pipes, with more particular reference to pipe lines for oil and natural gas, but with mention of water mains. Among the special joints figured are the Kimberly, Converse, Matheson, Dresser, Dayton, Hammon and Custer. Good words are said for

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plain-end pipe rather than those with hub and spigot. Mention is made of several plain-end water mains, 16 and 24 in. in diameter, laid across bridges in Pittsburgh; and it is added that plans have recently been considered "for a very large water-piping system likely to be constructed in this way."

Water-Purification Plants and Their Operation

Reviewed by Robert Spurr Weston*

WATER-PURIFICATION PLANTS AND THEIR OPERATION —By Milton F. Stein, Assoc. M. Am. Soc. C. E., Assistant Engineer, Cleveland Filtration Plant. New York: John Wiley & Sons, Inc. Cloth; 6x9 in.; pp. viii + 258; 95 illustrations, 11 charts. $2.50, net.

The object of the author, who is Assistant Engineer for the new Cleveland filtration plant, was the preparation of a compendium of special and general information primarily for the nontechnical operator of small plants, but also for those graduate chemists who fail to grasp the practical details of operation when first assuming charge of water-purification works.

The work is divided into the following chapters: Water and Its Impurities; Types of Water-Purification Plants; Physical and Chemical Tests; Bacterial Tests; Interpretation of Tests; Coagulation and Sterilization; Water Softening; Sedimentation; Filtration and General Operation. There are in addition 11 graphs for computing the results of the various determinations, the amounts of chemicals to be applied to various waters, the cost of coagulating chemicals and the strengths of chemical solutions. In the appendix are directions for the analysis of coagulants and for the preparation of standard analytical solutions, as well as specifications for chemicals used in water purification, and a weir table.

Rarely has so much useful information been brought into so small a compass. Especially worthy is the nontechnical description of the character of water and its impurities. In this the composition of water as affected by the geological conditions encountered by circulating meteoric water and the classification which these conditions make necessary are clearly elucidated. The author evidently believes in the method adopted in the best law schools, for he teaches by cases and illustrates by many examples. Some minor criticisms might be made of this portion of the book. Subterranean waters from gravel beds are not "usually" but sometimes high in iron, and *Crenothrix* is one of several iron bacteria found in ferruginous waters. But this chapter will bear reading by the most experienced.

Very wisely the author has given examples of typical water-purification plants, illustrated by perspective drawings that show clearly the general arrangements and methods of operation. The theory of filtration is discussed clearly and sanely and with due regard to modern theories of colloids. Some will be in doubt, however, whether the coagulum in water passing a rapid filter forms a porous blanket that strains the water, or films about the sand grains that remove suspended matter and bacteria by attraction and absorption.

The statement that slow filters will remove 25% of the color from water is rather low; 40% would be nearer.

The physical and chemical tests described are based on the standard methods of the American Public Health Association, abridged for purification-plant use by untrained workers. The principal tests are clearly outlined and well illustrated by examples and cuts. The user should bear in mind, however, that not all bacteria which ferment dextrose and lactose with the production of gas are *B. Coli*. No methods for the determination of dissolved oxygen, or carbonaceous or nitrogenous matter are given.

The terms alum, aluminum sulphate, and sulphate of alumina are used indiscriminately to describe one of the important chemicals used. The trade name of this is sulphate of alumina; it contains aluminum sulphate but is really a basic complex salt. Alum, which is a double sulphate of a monovalent and a trivalent element, is rarely used for water purification, except in household filters.

The book contains much that will help the filter operator and suggest construction details to the designer. Typical data of operation and cost are given and rather precise directions for operation. The author also includes forms for recording the results of operation. It is to be hoped that in future editions it will be possible to modify these forms so that they will be more like those recently adopted by the New England Water-Works Association.

The charts which accompany the volume are ingenious and should be helpful to the operator. They are not so simple but that a cross reference in each case to the page where they are described would be a convenience.

Generally the work is to be commended because of its clear style and choice of illustrative material. The author's experience evidently has been confined chiefly to hard and turbid waters. This probably explains why so little space has been given to the purification of soft colored waters or to the peculiar problems connected therewith. The fact that the author has confined himself to known facts within his experience explains both the excellence and the incompleteness of the book. Reading it critically the reviewer finds it instructive, dependable and within its field valuable.

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Centrifugal Pumps Concisely and Clearly Treated

CENTRIFUGAL PUMPS—By R. L. Daugherty, Assistant Professor of Hydraulics, Sibley College, Cornell University; author of "Hydraulic Turbines." New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. x + 192; 111 illustrations. $2, net.

In this small volume Prof. Daugherty has made another fine contribution to engineering literature. He has produced a text conspicuously above the average in conciseness and clearness, infusing into it a peculiar quality of sustained interest and readability for anyone who is in the least interested in this complicated subject. These are indeed the same characteristics which mark the earlier companion volume to this one—Prof. Daugherty's "Hydraulic Turbines" (reviewed by H. E. Longwell in *Engineering News*, Nov. 13, 1913).

Mathematics is not spared in developing the theory of the many centrifugal-pump actions, but the mathematical discussion is not unnecessarily protracted and is easily followed. A commendable phase in these sections is the translation of mathematical expressions wherever possible into physical pictures. Comparison of theory with actual constructions and actions is made at each important step, and the reasons for departures in practice are generally well disclosed. Unusual coöperation with many pump makers must have been secured to make this possible. The commercial features set forth are skillfully handled. What schemes the Goulds, De Laval, Worthington, Wood,

Morris, Southwark, Chicago, Platt, Alberger, Allis-Chalmers, McEwen and other companies have used and what has been accomplished have been recorded, but always for some definite end and with complete absence of any intimation of advertising. This alone is an important accomplishment. All through the book are references to the somewhat parallel matters of hydraulic-turbine design, the development in the theory of those machines being employed where applicable—with frequent notes on the service and structural differences which prevent the centrifugal pump from being merely a reversed turbine.

The book first classifies centrifugal pumps and describes typical ones. Then there is a transitional chapter on installation and operation before the first installment of general theory. Head, power, efficiency and discharge characteristics of various designs are described and reasons for peculiar actions presented. Another transitional chapter, on disk friction, leads into a discussion of factors affecting efficiency. The latter part of the book briefly but adequately compares the advantages of centrifugal and reciprocating units, outlines the fields of service for the several designs of centrifugals, reviews some general theoretical laws, describes pump testing, adds some cost data, tells how a pump designer approaches his problem and finally appends some complete test data obtained by the author.

Direct-Current Machinery

Reviewed by Charles F. Scott*

PRINCIPLES OF DIRECT-CURRENT MACHINES—By Alexander S. Langsdorf, F. Am. Inst. E. E., Professor of Electrical Engineering and Dean of the Schools of Engineering and Architecture, Washington University. [Electrical Engineering Texts.] New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xxiii + 404; 313 illustrations. $3 net.

The appearance of this book is noteworthy, as it is the first one issued in a series of books to be known as the Electrical Engineering Texts, outlined by a committee of professors and engineers formed in 1909. Prof. H. E. Clifford is Chairman and Consulting Editor, and the members are Professors M. C. Beebe, E. J. Berg, G. W. Patterson and H. J. Ryan and Messrs. P. M. Lincoln, H. H. Norris, Elihu Thomson and W. D. Weaver. The aim is "a well-considered, carefully written series, each volume of which shall treat only of its subject matter proper, and in a manner that is uniform with the treatment in other volumes." The present book is of interest not only on its own account, but as indicating the educational and technical standards and the method of treatment to be anticipated in the volumes which are to follow.

The preface proposes "a reasonably complete treatment of the fundamental principles that underlie the design and operation of all types of direct-current machinery." Armature windings and commutation receive especial attention, comprehensive rules covering windings and an unusually extensive treatment of commutation being presented. The operating characteristics of generators and motors include new material, elucidated by the use of three-dimensional diagrams.

The book requires a knowledge of calculus, a preliminary grounding in physics and electrical engineering, and the ability to interpret rather intricate graphical diagrams. The preface states that the book has been prepared for junior and senior students. Granting that the junior student is prepared to take up this book as a text, the question may be raised whether all students should go into the subjects treated in this book as thoroughly as the book requires. It is an excellent and comprehensive reference book, but it may be too specialized for the average student. Few engineers, aside from designers, need to know very much about commutation, for example. For each designer there are a thousand who need to know the operating characteristics of motors; not merely the magnetic and electrical characteristics, but the mechanical performance, so that a machine tool or a fan or a hoist with its particular requirements as to speed adjustments and torque can be adequately supplied with suitable motor and control apparatus. If the present book is one of many in which the subjects receive uniform treatment, will the series not call for an amount of time and lead to a degree of specialization which the student can ill afford?

The preface asserts an effort to give prominence to the physical concepts by presenting the physical facts of the various problems and refers particularly to the last section in the book as an example of this procedure. The section is a ten-page description with graphical and mathematical analysis of a certain automobile lighting regenerator. There are some 40 equations, many of which require two lines across the page and employ a special list of symbols. The machine described is out of date, as later models do not serve as motors as well as generators; furthermore, the series winding is omitted, "experience having shown that its effects contributed little or nothing of value." The student is wise if he observes that it is "experience," that is, the intelligent dealing with physical things, and not mathematical analysis of an intricate order, which indicates what can be done. After "experience has shown that the series field can be omitted" then the post mortem examination discovers that "the analytical reason for this fact is clear from the form of equation (30)." Equation (30) contains 46 symbols.

It is well to be able to make mathematical investigations and it is well to be able to travel through those which have been made, but all students cannot afford the time for exercises of this kind, and the student who expects to specialize on automobile generators is apt to get the mistaken idea that the designing and building and testing of such apparatus are based on intricate mathematics. Inventors who devise ingenious machines do not usually begin with equations of the third degree.

The book brings together much excellent material in concise and intelligent form. It is a treatise and a valuable reference book. Its suitability as a textbook will be decided differently by different teachers, depending upon their point of view as to what the student should study.

OVERCROWDING AND DEFECTIVE HOUSING IN THE RURAL DISTRICTS—By Dr. Harvey D. Bashore, Inspector for Pennsylvania Department of Health; author of "The Sanitation of a Country House," "The Sanitation of Recreation Camps and Parks," "Outlines of Practical Sanitation.' New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. xi + 92; illustrated. $1, net.

The deplorable living conditions existing in many country districts are pictured by text and halftones. Land overcrowding, house overcrowding, defective buildings and overcrowded and defective school buildings are the main topics considered. The author states that the "observa-

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tions noted" were made mostly "in a typical rural farming community, inhabited by native-born Americans." Many engineers could testify to the existence of similar unhappy and unhealthful conditions in various parts of America.

Internal-Combustion Engine Valve Gears

Reviewed by John J. Flather*

VALVES AND VALVE GEARS: Vol. II, Gasoline, Gas and Oil Engines—By Franklin DeRonde Furman, M. Am. Soc. M. E., Professor of Mechanism and Machine Design, Stevens Institute of Technology. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xi + 190; 216 illustrations. $2, net.

This work is a still further development of the book noted in these columns Mar. 14, 1912, which is now published in two volumes. The first volume of the present edition, reviewed here July 15, 1915, related to the valves and valve gears used in reciprocating engines and steam turbines. The second volume treats of the various types of valves and valve gears used in gasoline, gas and oil engines. In this volume, as in its predecessors, the subject is treated chiefly from the kinematic standpoint with a view to the actual layout of valve gears and the control of the gasoline, gas or oil. This constitutes a continuation of the subject as presented in Volume 1, but as the title implies, it relates solely to internal-combustion engines and has been prepared to meet the requirements of varying courses of study and also to satisfy the needs of those who are interested only in internal-combustion engines. The method of treatment is similar to that presented under the discussion of valves and valve gears for steam engines and steam turbines. The selection and arrangement of the material is most excellent, but it is hoped that in the next edition of the work the author will follow his previous practice and present numerous working problems under each division. The general scope of the work may be obtained from the section headings: General Characteristics of Internal-Combustion Engines; Commercial Applications of Various Forms of Valves and Valve Gears to Gasoline Engines; Aëroplane Engines; The Gas Engine; Oil Engines; Diesel Oil Engines; Comparison of Prime Movers.

The book is very rich in material of general interest to the engineer who desires to obtain a knowledge of the various types of internal-combustion engines. The first portion gives a very general although brief discussion of gasoline, gas and oil engines. It also includes a discussion of fuel and fuel apparatus, such as gas producers and the different types of carburetors and mixers. The various methods of ignition employed in practice are also given considerable attention.

In the commercial application of the several forms of valve and valve gears to gasoline engines, the principal types are discussed more in detail and their distinguishing characteristics pointed out. In connection with this phase of the work an interesting method of using sinusoidal diagrams in laying out the sleeve valve of the Knight engine is particularly worthy of note.

Under aëroplane engines the more important types are presented, and their construction and valve mechanisms are clearly shown by means of an excellent series of drawings and diagrams. Of particular interest are the kinematic analysis of the 7-cylinder Gnome revolving radial engine and the comparison of its mechanism with that of the well-known Whitworth quick-return motion.

The rest of the book is devoted to a consideration of gas and oil engines, including a review of the early types of gas engines and their cycles. Methods of speed control and ignition are presented for engines operating under various conditions, and considerable attention is given to the slow-combustion Diesel oil engine. This consists of a comprehensive description of the different types of this form of oil engine, which is now coming into such general favor for marine as well as stationary service. Valve mechanisms and timing diagrams of both the four-stroke and two-stroke engines are given kinematically, and various methods of control are discussed.

The book concludes with a brief comparison of prime movers in which a very good table is presented, showing the approximate rating of the various prime movers in general use, based on the thermal efficiency and cost of fuel per b.hp.

This book is more than a treatise on valves and valve gears of gas, gasoline and oil engines—it comprises a very comprehensive and satisfactory treatment of the internal-combustion engine, and, like its predecessor, it will appeal equally to the teacher of machine design and to the student of engineering.

Landscape Architecture and Gardening Explained

THE ART OF LANDSCAPE ARCHITECTURE; Its Development and Its Application to Modern Landscape Gardening—By Samuel Parsons, author of "Landscape Gardening." New York and London: G. P. Putnam's Sons. Cloth; 6x9 in.; pp. xxi + 347; 57 illustrations. $3.50, net.

DESIGN IN LANDSCAPE GARDENING—By Ralph Rodney Root, Assistant Professor of Landscape Gardening, in charge of Professional Courses, University of Illinois, and Charles Fabens Kelley, Assistant Professor of Art, Head of Department of Art, Ohio State University. New York: The Century Co. Cloth; 6x9 in.; pp. 278; 65 illustrations. $2, postpaid.

Books on gardening, landscape gardening and landscape artitecture have rapidly multiplied in the last two decades, but the two now under consideration are unique, each in its own way, and deserve a place in the library of the student, the collector and the professional man.

Taking up first the volume by the well-known writer and practitioner, Mr. Parsons, it may be noted that he has marshaled in masterful sequence extracts from the writings both of the great authorities on the art of landscape architecture and of many lovers of landscapes. These extracts, combined now with the author's comments on the quotations and again with his own remarks to which some of the quotations give emphasis, serve to show what landscape architecture is and how it may be attained.

Among the writers drawn from most frequently by Mr. Parsons is Prince Herman von Pückler-Muskau, a German prince who wrote in 1834 and who practiced on his own estate what he so eloquently taught in his book.

The author deals in succession with the principles of his art, the laying out of estates, enclosures, location of buildings, grass spaces, roads and paths, water, islands, rocks, grading, plantations, maintenance, gardens and public parks. These are treated in the fashion already indicated. In a final chapter the author tells in his own language and from his broad and varied experience what trees and shrubs may be chosen from for various purposes. A bibliography of perhaps 150 titles and a rather brief index close the volume. It should be added

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that the illustrations, mostly full-page halftone views, are well chosen, are truly illustrative and include a good majority of American subjects—many being views in Central Park, New York, with which the author has been connected.

The second of the volumes before us has two unusual characteristics for a book on landscape gardening—brevity and as nearly a scientific presentation of the principles of landscape design as could be expected of a book dealing with an art.

Professors Root and Kelley first give thumb-nail sketches of architecture, sculpture, painting, agriculture, horticulture and engineering as elements of landscape work. The principles of landscape design, of color and of planting are next presented. A series of problems—like an American home, school grounds and a golf course—are then discussed. Garden design is the last topic. There is a good and extensive index.

The illustrations include diagrams as well as halftones and run freely to foreign examples.

The book promises to be useful to all who wish to inform themselves in the principles and to make a modest beginning in the practice of landscape design. It can scarcely fail to interest any not too old in their own esteem to learn something from every earnest attempt to present an old but ever new subject.

Production of Pig Iron

REVIEWED BY RICHARD MOLDENKE*

LEHRBUCH DER EISENHÜTTENKUNDE Verfasst für den Unterricht, den Betrieb und das Entwerfen von Eisenhüttenanlagen—By Bernhard Osann, Professor an der Königlichen Bergakademie in Clausthal. Erster Band, Roheisenerzeugung. Leipzig, Germany: Verlag von Wilhelm Engelmann. Paper; 7x10 in.; pp. xiii + 668; 407 illustrations, 17 tables. 29 marks. Bound in linen, 30.50 marks.

The first volume of Prof. Bernard Osann's *magnum-opus* is before us. It is entitled (translated) "A Treatise on the Metallurgy of Iron" and deals with the production of pig iron. With usual German thoroughness this book forms, without question, the most complete compendium of blast-furnace literature in print, and should be in the library of every iron and steel producer and metallurgist.

Since every phase of the blast-furnace problem is very carefully detailed, one finds the history of the development, the necessary instructions for making the installation calculations and the latest types of construction illustrated. Hence the book becomes not only a reference volume for the student, but a vade mecum of the blast-furnace superintendent and engineer.

After covering the history of iron and the accompanying statistics, the author discusses the principles of combustion, the fuels that are available in the blast furnace and the ores of iron and their distribution. A series of chapters are devoted to the preliminary preparation of ores for smelting, such as their roasting, briquetting, sintering. Manganese is also included in these discussions, and the chemistry of limestone is ventilated.

The construction of the blast furnace, the refractories used, accessory details, blowing engines, with full calculations, cover over 100 pages of the book; and a very interesting exposition of the dry-blast problem, with reasons for its practical failure in the exceedingly economical mode of running furnaces in Germany, is appended.

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Next comes the blast-furnace stove, with about 100 pages of hot-blast description and data. The furnace hoist, ore- and coke-handling machinery, furnace gases and the necessary cleaning apparatus, and finally the blast-furnace gas engine, its construction, heat economy, development, etc., constitute another large section of the volume.

The metallurgy of the blast-furnace process is next discussed. Temperature, heat balance, the nature of the pig iron produced, calculation of burden and slags made and the nature of the latter precede the operation of the furnace itself. This is gone into fully and the many troubles the furnaceman experiences are explained and advised upon. The recovery of values from the blast furnace is discussed, and directions are given for the operation of the stack for the different grades of pig metal required by the trade.

Pig iron from the electric furnace is given attention. Cost calculations, and the detailed plans of a blast-furnace installation complete the volume.

One cannot help agreeing with the author that the study of the metallurgy of iron is somewhat like that of medicine. One cannot duplicate the happenings of the furnace or the human system in the laboratory, nor can one see very much of what is actually going on within them; hence the necessity for constant study to enlarge the range of understanding, so that the results in practical operation may be more and more reliable and subject to more accurate prediction.

The book is cordially commended to the attention of the American iron industry and the hope is expressed that an English translation and the subsequent parts may soon follow.

Commission-Manager Plan

THE CITY MANAGER: A New Profession—By Harry Aubrey Toulmin, Jr., author of "Social Historians." New York and London: D. Appleton & Co. [National Municipal League Series.] Cloth; 5x8 in.; pp. xi + 310. $1.50, net.

The city-manager plan is so new and is so closely associated with the commission-plan of government, both in theory and practice, that it is not surprising to find this book consisting largely of an exposition of commission government and its advantages. In fact, the portion of the contents relating solely to the city manager and his work would make little more than a respectable pamphlet. The book is nevertheless useful. Its usefulness and effectiveness are increased by its interesting character and the enthusiasm of the author.

For concrete illustrations the author draws chiefly upon Dayton, Ohio, with frequent excursions to Springfield and a number of references to two or three other cities. Unlike many writers, Mr. Toulmin gives due credit to Staunton, Va., for taking the lead in appointing a city manager. In view of this and of the further fact that, as the author brings out, Staunton appointed a city manager because it lacked authority to adopt commission government, it is a bit surprising that almost no attention is given to the possibility of the employment of a city manager by other cities that lack either the legal power or the official or popular desire to adopt the commission plan. The fact is that a number of other cities have employed a manager by intent, and in others a masterful city engineer or commissioner of public works has become manager and achieved notable results.

It is a pity that the author should have been so full of Dayton and Springfield in particular and the commission plan in general as to have nearly ignored the majority of the cities actually under the manager plan and wholly ignored those which have utilized it without the official stamp of the name or endorsement of propagandists of the simon-pure city-manager plan. Some of the space now filled by repetitions and by "results" that are little but local self-congratulatory categories of activities might well have given place to broader, more thoughtful and more discriminating reviews of city-manager experience and approximations outside of Ohio.

The foregoing remarks are not designed to belittle the book but rather to point out how it may readily be improved upon, either by the author of the next book on this subject or by the present author, should he have the courage and energy to attempt a thorough rewriting of this volume, with liberal cutting at a number of places and a moderate but painstaking expansion at others.

A conspicuous service rendered by the author is his clear-cut and forceful exposition of the inherent and crippling weakness of the commission plan, in that it attempts to select administrative officers by popular vote. Having rendered this service, it is hard to see how the same man can condone, if not uphold, that provision of the Dayton charter which makes the city manager subject to popular recall. A broader field of vision, such as is to be expected in a book in the National Municipal League Series, might have prevented this inconsistency.

Surveying for the Self-Tutored

Reviewed by A. W. Bedell*

PRACTICAL SURVEYING for Surveyors' Assistants, Vocational and High Schools—By Ernest McCullough, M. Am. Soc. C. E., author of "Engineering Work in Towns and Cities," "The Business of Contracting" and "Engineering as a Vocation." New York: D. Van Nostrand Co. Cloth; 5x8 in.; pp. ix + 42; 229 illustrations. $2 net.

The purpose of this book, the author says in his preface, is to meet the needs of students whose mathematical preparation does not extend beyond simple arithmetic. It is intended to be used as a text in high schools or vocational schools and for self-tutored men who wish to become surveyors.

Instruments for field and office, and their use, are described in detail. The chapter on chain surveying gives almost all possible ways of making linear measurements, with many geometrical and practical problems. Leveling and grading are described, and a page is introduced showing signals for communication at long range. Under compass surveying are given the use of the instrument in the field, notes on attraction and variation (a complete isogonic chart is found in the front of the book), balancing errors, computing lost courses and areas and plotting the map. Trigonometry is treated in simple language in one chapter, giving both the regular and graphic solutions of plane triangles, with problems; and the use of logarithms is explained. The transit and its parts are described in some detail, together with traverses and a little on stadia work. Some useful pages are copied from the Ainsworth manual on meridian observations. The chapter on surveying laws is well written and is more thorough than would be expected in a book of this scope. The author truly says that "much of the litigation over land lines would be eliminated if the lawyer could be prevented from interfering with the surveyor," and that much of this interference is due to the fact that the average lawyer does not recognize such a thing as "the error." The chapter on engineering surveying covers, in a descriptive way, surveys for various kinds of construction. In the appendix the simplest uses of algebra are explained.

As may be expected in a new edition, there are a few unimportant errors. The book is illustrated in detail with clear sketches, and the language throughout can be easily understood. There are several tables scattered throughout the book, including squares and roots, traverse tables, natural and logarithmic functions, stadia reduction and lengths of a degree at different latitudes. Some of the tables, however, are incomplete for anything but instruction.

This is not in any sense a reference book. It is suitable only for those with little surveying experience and small mathematical knowledge, being an elementary parallel of Tracy or Johnson; but it is very thorough in its field. No one who is starting out to learn surveying will make a mistake in choosing this book as a guide.

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DIELECTRIC PHENOMENA IN HIGH VOLTAGE ENGINEERING—By F. W. Peek, Jr. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xv + 265; 190 illustrations. $3, net.

The high-tension studies of the author in the laboratories of the General Electric Co. have become widely known to the electrical-engineering profession through his many papers before the American Institute of Electrical Engineers. These researches into the failure of materials under extreme electrical stress are now collected in concise form and related order, giving a most useful volume for designer or student—a text the merit of which is parallel with the recognized worth of the work described.

ROLLING-LIFT BASCULE BRIDGES—Their Inception, Development, and Use. Chicago, Ill.: The Scherzer Rolling Lift Bridge Co. Paper; 6x9 in.; pp. 38; illustrated.

The 20 yr. of history and development of this type of bascule bridge are reviewed briefly and interestingly. The bridge was invented by the late William Scherzer to meet the peculiar conditions for a railway bridge across the Chicago River, where the close proximity of two swing spans prevented the use of another swing span between them. That bridge was opened in 1895 and is still in use. Since then there have been interesting developments, especially in simplifying the operating machinery and in adapting the bridge to meet various local conditions. At home and abroad there are now some 200 of these bridges for railway and highway service, with spans ranging from 29 ft. to 310 ft.

The book business of the Myron C. Clark Publishing Co., 608 South Dearborn St., Chicago, Ill., has been taken over by the Clark Book Co., Inc., a new concern with offices at 27 William St., New York City. The list of books taken over will be extended in the near future by several volumes on economic subjects.

Under the title "Some Important Engineering Features of the Canadian-Pacific Railway" a number of articles describing recent railway, bridge and irrigation construction activities of this railway have been reprinted by "The Canadian Engineer" of Toronto. The articles are well illustrated by halftones and line drawings.

NEW PUBLICATIONS

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor, the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

AUSTRALIAN REPORTS—Paper; 8x13 in.; illustrated.
Annual Report of the Sludge-Abatement Board of Victoria for 1914. Pp. 26. Annual Report of the Chief Mining Inspector on Dredge, Mining and Hydraulic Sluicing in Victoria for 1914. Pp. 16. Melbourne, Victoria: Department of Mines and Forests. Report on Commonwealth Demography, 1914 and Previous Years. Pp. 262. Melbourne: Commonwealth Bureau of Census and Statistics. Annual Report of the South Australian Railways Commissioner for 1914-15. Pp. 52. Adelaide, N. S. W. Annual Report of the Commissioner of Queensland Railways for Year Ended June 30, 1915. Pp. 145. Brisbane, Queensland.

AUTOGENOUS WELDING AND CUTTING—By Theodore Kautny. Translated by the Author and James F. Whiteford, M. Am. Soc. M. E. New York: McGraw-Hill Book Co. Cloth; 5x8 in.; pp. xiv + 157; 130 illustrations. $1, net.

BEITRAG ZUR BERECHNUNG VON MASTFUNDAMENTEN—Von. Dr.-Ing. H. Frölich. Berlin, Germany: Wilhelm Ernst & Sohn. Paper; 7x10 in.; pp. 60; 61 text figures. 2.60 marks.

THE BUILDING ESTIMATOR'S REFERENCE BOOK: A Practical and Thoroughly Reliable Reference Book for Contractors and Estimators Engaged in Estimating the Cost of and Constructing All Classes of Modern Buildings, etc.—By Frank R. Walker. Chicago, Ill. (30 North Michigan Ave.): The Author. Flexible leather; 4x7 in.; pp. v + 612; illustrated. $10.

BULLETINS, UNITED STATES DEPARTMENT OF AGRICULTURE—Washington, D. C. Paper; 6x9 in.; illustrated.
No. 300, Excavating Machinery Used in Land Drainage—By D. L. Yarnell, Drainage Engineer. Pp. 39. No. 304, Land Drainage by Means of Pumps—By S. M. Woodward, Drainage Engineer (revised with special reference to the Upper Mississippi Valley by C. W. Okey, Senior Drainage Engineer). Pp. 60.
Copies at 15c. each may be procured from the Superintendent of Documents, Washington, D. C.

CANADIAN IRRIGATION REPORT FOR 1914 (Ottawa, Ont.)—Part VII, Annual Report, Department of the Interior. Paper; 7x10 in.; pp. 222; illustrated.

CANADIAN SOCIETY OF CIVIL ENGINEERS—Transactions, Vol. XXIX; Part I, January to June, 1915. Montreal, Canada (176 Mansfield St.): C. H. McLeod, Secretary. Paper; 6x9 in.; pp. 379; illustrated.

CIVIL SERVICE BOARD, CITY OF OAKLAND, CALIF.: A Report and Review of Civil Service Operation from Organization of the Board on Sept. 5, 1911, to June 30, 1915. Including Rules and Regulations, and Sample Examinations. Oakland, Calif.: Frank Colbourn, Secretary of Board. Paper; 6x9 in.; pp. 242.

COAL MINING IN ILLINOIS—By S. O. Andros. Bulletin 13. Urbana, Ill.: Coal Mining Investigations, University of Illinois. Paper; 6x9 in.; pp. 250; illustrated.

COMPARATIVE RAILWAY STATISTICS, UNITED STATES AND FOREIGN COUNTRIES, 1912—Washington, D. C.: Bureau of Railway Economics. Bulletin No. 83. Paper; 6x9 in.; pp. 78.

THE CONSTRUCTION OF THE PANAMA CANAL—By William L. Sibert, Brigadier-General, U. S. A., formerly Member of the Isthmian Canal Commission and in charge of the building of the Gatun Locks and Dam and of the channel from Gatun to the Atlantic Ocean, and John F. Stevens, formerly Chief Engineer and Member of the Isthmian Canal Commission. New York: D. Appleton & Co. Cloth; 5x8 in.; pp. x + 339; 23 illustrations. $2, net.

THE CORROSION OF IRON: A Summary of Causes and Preventive Measures—By C. L. Wilson. New York: The Engineering Magazine Co. [Works Management Library.] Cloth; 5x8 in.; pp. vi + 178. $2.

THE DETHRIDGE METER—By V. M. Cone, Irrigation Engineer, United States Office of Public Roads and Rural Engineering. Fort Collins, Colo.: Experiment Station, Colorado Agricultural College. Bulletin 215. Paper; 6x9 in.; pp. 11; illustrated.

ENGINEERING THERMODYNAMICS—By James Ambrose Moyer, Professor, and James Park Calderwood, Associate Professor, of Mechanical Engineering, Pennsylvania State College. New York: John Wiley & Sons. Cloth; 6x9 in.; pp. viii + 203; 71 illustrations. $2, net.

FORD METHODS AND THE FORD SHOPS—By Horace Lucien Arnold and Fay Leone Faurote. New York: The Engineering Magazine Co. [Works Management Library.] Cloth; 7x10 in.; pp. x + 440; illustrated. $5.

GENESIS OF THE CENTRIFUGAL PUMP—By Albert E. Guy. [Reprinted from the Proceedings of the Colorado Scientific Society, Vol. XI, pp. 49-102.] Denver, Colo.: The Society. Paper; 7x10 in.; illustrated.

THE HURRICANE OF SEPT. 29, 1915, AND SUBSEQUENT HEAVY RAINFALLS: Report of George G. Earl, General Superintendent, to Sewerage and Water Board of New Orleans, La. Paper; 6x9 in.; pp. 18.

IOWA STATE DEPARTMENT OF FINANCE AND MUNICIPAL ACCOUNTS (Des Moines, Iowa)—Annual Report for 1914-15. Cloth; 6x9 in.; pp. 276.

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PRACTICAL FORGING AND ART SMITHING—By Thomas F. Googerty. Milwaukee, Wis.: The Bruce Publishing Co. Cloth; 5x8 in.; pp. 144; 90 illustrations. $1, net.

THE PRINCIPLES OF DYNAMO ELECTRIC MACHINERY—By Benjamin F. Bailey, Professor of Electrical Engineering, University of Michigan. New York: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xv + 311; 222 illustrations. $3, net.

PRINCIPLES OF LOCOMOTIVE OPERATION AND TRAIN CONTROL—By Arthur Julius Wood, M. Am. Soc. M. E., Associate Professor in Charge of Railroad Mechanical Engineering, Pennsylvania State College. New York: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. ix + 271; 117 illustrations. $3, net.

REPORT ON THE CLIMATIC AND SOIL CONDITIONS in the Canadian Pacific Railway Company's Irrigation Project, Western Section (near Calgary, Alta.)—Ottawa, Ont.: Irrigation Branch, Department of the Interior, Canada. Bulletin No. 3. Paper; 7x10 in.; pp. 24.

RULES AND INFORMATION PERTAINING TO ELECTRIC SERVICE, METERS, WIRING AND MOTORS—Commonwealth Edison Co., Chicago, Ill. Paper; 5x7 in.; pp. 86, illustrated.

SAFETY ENGINEERING APPLIED TO SCAFFOLDS—The Travelers Insurance Co., Hartford, Conn. Cloth; 6x9 in.; pp. vi + 354; 127 illustrations. $3.

SCIENTIFIC MANAGEMENT AND LABOR — By Robert Franklin Hoxie, Associate Professor of Political Economy, University of Chicago; Special Investigator of Scientific Management for the United States Commission on Industrial Relations. New York: D. Appleton & Co. Cloth; 5x8 in.; pp. x + 302; $1.50, net.

SOCIALIZED GERMANY—By Frederic C. Howe, author of "The City: the Hope of Democracy"; "The British City. the Beginnings of Democracy," etc. New York: Charles Scribner's Sons. Cloth; 5x8 in.; pp. x + 342. $1.50, net.

TECHNICAL PAPERS, UNITED STATES BUREAU OF MINES—Washington, D. C. Paper; 6x9 in.; illustrated.
No. 116, Miners' Wash and Change Houses—By Joseph H. White. Pp. 27. 10c. No. 124, Accidents at Metallurgical Works in the United States During 1913 and 1914. Pp. 28. 5c.
Copies may be procured from the Superinendent of Documents, Washington, D. C.

THEORETICAL ELEMENTS OF ELECTRICAL ENGINEERING—By Charles Proteus Steinmetz. Fourth edition, thoroughly revised and entirely reset. New York: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xiii + 368; 194 illustrations; $3, net.

UNITED STATES GEOLOGICAL SURVEY PUBLICATIONS—Washington, D. C. Paper; 6x9 in.; illustrated.
Water Supply Papers—No. 352, Surface Water Supply of the United States, 1913; Part II, South Atlantic and Eastern Gulf of Mexico Basins. Pp. 84. No. 355, Surface Water Supply of the United States for Year Ending Sept. 30, 1913; Part V, Hudson Bay Basins and Upper Mississippi River. Pp. 181. No. 370, Surface Water Supply of Oregon, 1878-1910—By F. F. Henshaw and H. J. Dean. Pp. 829. No. 376, Profile Surveys in Chelan and Methow River Basins, Washington. Pp. 8. No. 377, Profile Surveys in Spokane River Basin, Washington and John Day River Basin, Oregon. Pp. 7. No. 378, Profile Surveys in 1914 on Middle Fork of Willamette River and White River, Oregon. Pp. 8. No. 379, Profile Surveys in 1914 in Umpqua River Basin, Oregon. Pp. 7. No. 388, Surface Water Supply of the United States, 1914; Part VIII, Western Gulf of Mexico Basins. Pp. 124.
Mineral Resources of the United States, 1914; Part II—No. 22, The Production of Asphalt, Related Bitumens and Bituminous Rock. By John D. Northrop. Pp. 347-362. No. 23, The Production of Lime. By G. F. Loughlin. Pp. 363-373. No. 24, The Production of Peat. By Charles A. Davis. Pp. 375-385. No. 25, The Manufacture of Coke. By C. E. Lesher. Pp. 387-442.
Bulletins—No. 615, Rhode Island Coal. By George H. Ashley. Pp. 62. No. 622, Mineral Resources of Alaska; Report on Progress of Investigations in 1914. By Alfred H. Brooks and Others. Pp. 373.
Professional Paper No. 95-G—Preliminary Report on the Diffusion of Solids. By C. E. Van Orstrand and F. P. Dewey. Pp. 14; 9x12 in.

WATER POWER ENGINEERING: The Theory, Investigation and Development of Water Powers—By Daniel W. Mead, M. Am. Soc. C. E., Professor of Hydraulic and Sanitary Engineering, University of Wisconsin. Second edition New York: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xvii + 843; 430 illustrations. $5, net.

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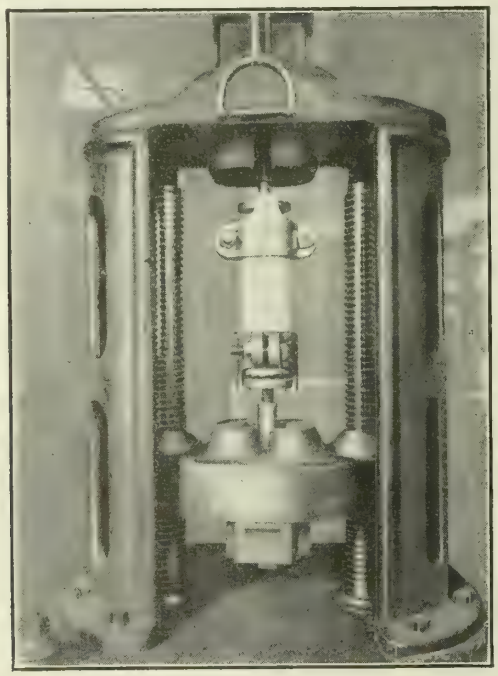
Field and Office

Special Grips for Large-Size Concrete Tensile Tests

By Charles M. Montgomery*

A simple and inexpensive set of grips for making tensile tests on fairly large concrete specimens, either drill cores or cast cylinders, is shown in the view.

Two sets of malleable-iron clamps made for use with 3-in. Knox hose couplings were procured and the lips



TENSION GRIPS FOR CONCRETE CYLINDERS

sawed off. The ends of the concrete specimens—in this case drill cores—were wrapped around with a layer of heavy web cut from a cotton hose to protect the concrete from direct contact with the metal clamps, and the clamps adjusted and loosely bolted in place.

Two heavy malleable-iron flanges 4 in. in diameter tapped for ½-in. pipe were reamed and threaded for a 1-in. U. S. Standard bolt. A section of 1-in. bolt, 2½ in. long, threaded over all, was then screwed into each flange and the end peened to prevent turning. One of these was placed between each of the clamps and the clamps bolted up tight, and the other end of the bolt threaded into a pipe attached to the heads of a testing machine.

*Inspector in charge of physical tests, Board of Water-Supply, City of New York.

A 38-Ft. Cobblestone Arch Raised and Moved

The Kress House Moving Co., of Los Angeles, Calif., carried out a unique piece of work recently when, in order to make room for widening the street, it moved a 38-ft. stone arch spanning a cemetery entrance. This arch, with its abutment piers, flanking sidewalk arches, etc., forms a piece of cobblestone masonry 105 ft. long. The portion moved is a 90-ft. length of the structure. The moving was made necessary by a change in the street alignment just at the entrance, which, beginning about opposite the right-hand main abutment (Fig. 1), amounted to a shift of about 6 ft. at the extreme left end.

To judge of the dimensions of the masonry structure, the following figures will serve: Span of main arch, 38 ft.; sidewalk arches, 7 ft.; section of main arch, 30x36 in.; main abutment piers, 6 ft. diameter at bottom, 4 ft. at top, 18 ft. high; sidewalk abutment piers, 4 ft. thick at bottom, 3 ft. at top, 15 ft. high. There is no reinforcement in the masonry.

Two 20x20-in. timbers 60 ft. long formed the main base or support for the structure in moving. They were placed on either side, stretching along arch piers and the wing wall, and the weight of the piers was transferred to them by steel needles of I-beams and rails. The main arch was carried by two 24-ft. lengths of plank laid against the intrados and supported by A-frames resting on the main timbers. Similar A-frames carried the left-hand sidewalk arch—the right-hand sidewalk arch, not being included in the section to be moved, had been cut loose alongside the main pier. When supports and needles were in position, the main timbers were jacked up to take the load and to bring runways into position. The moving was done by jacks pushing horizontally against the timbers.

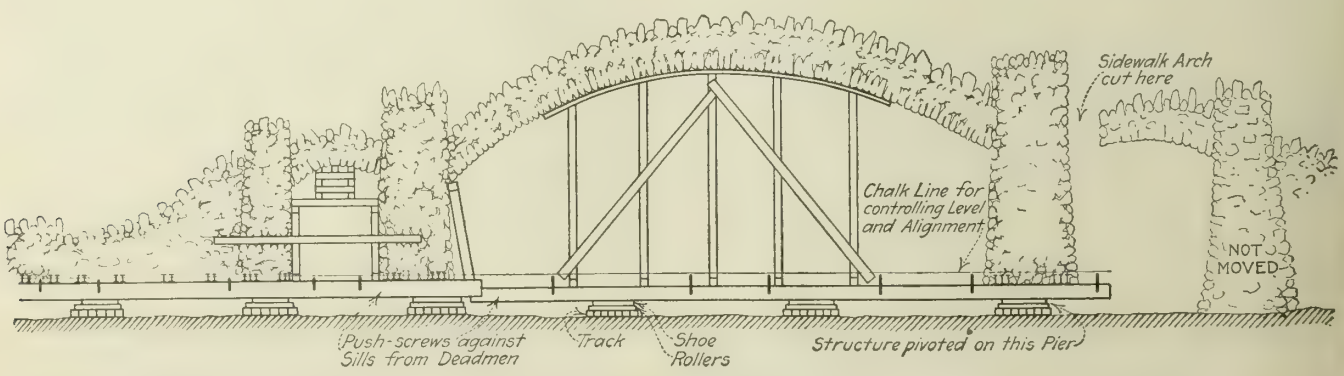


FIG. 1. SKETCH OF SHORING OF ARCH AND WALL, WITH ROLLER SUPPORT FOR MOVING

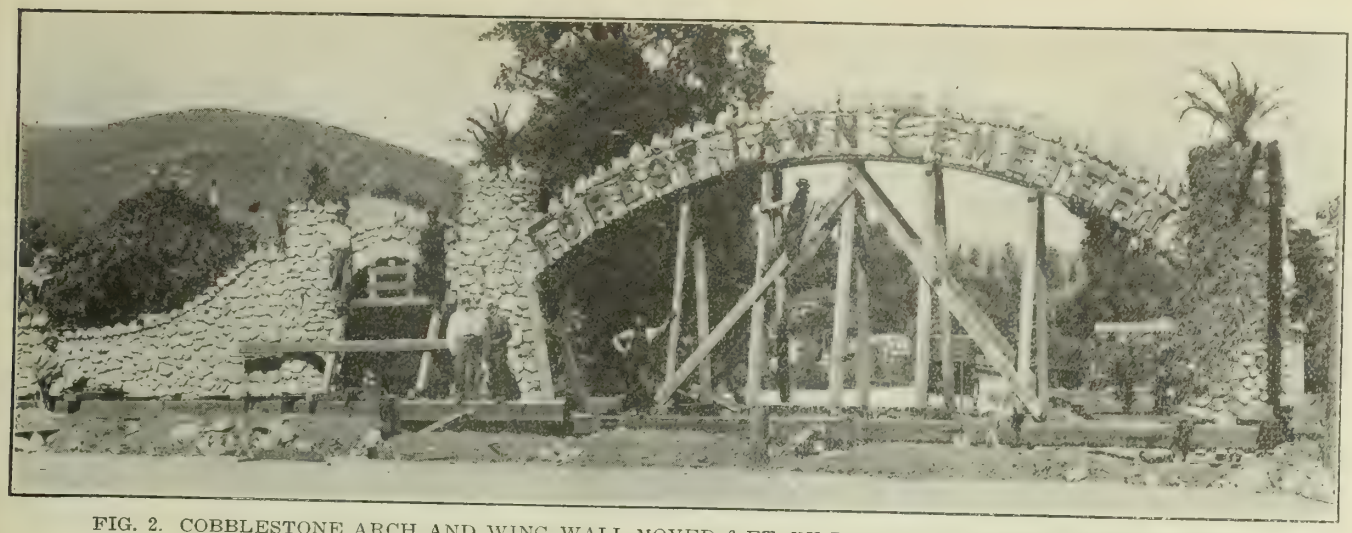


FIG. 2. COBBLESTONE ARCH AND WING-WALL MOVED 6 FT. BY REGULAR HOUSE-MOVING METHODS

As the arch is shown in the large view, Fig. 2, ready for moving, the pier at the right is about in the position of a pivot for the moving. The main arch and the structure to the left are supported on the needles and bents ready to be shoved back horizontally in their new location.

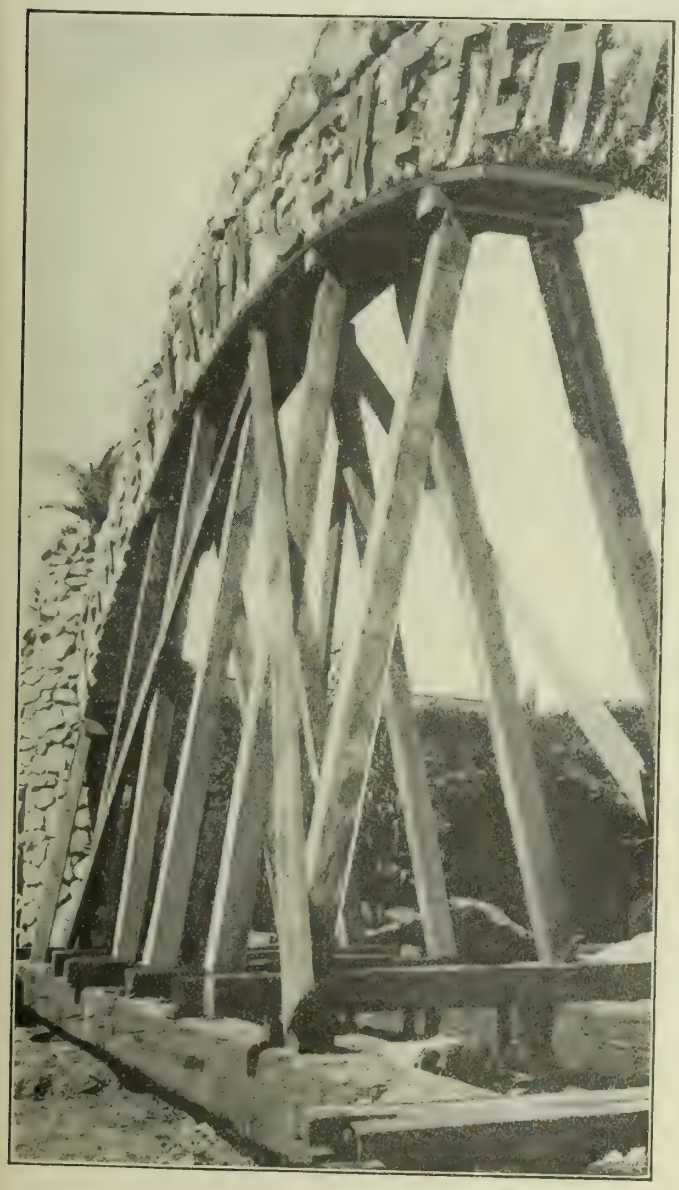


FIG. 3. HOW THE WEIGHT OF THE 38-FT. MAIN ARCH WAS CARRIED TO THE 20x20-IN. SILLS

The whole weight of the structure was about 125 tons. The contract price for the job was $650, which is about half the estimated cost of tearing down and rebuilding the masonry. The work was done within ten days. According to the architect, T. Paterson Ross, of San Francisco, the time taken was only one-fourth the time that it would have taken to wreck and rebuild the arch, the alternative originally considered. Not a crack was found in the masonry after the structure was moved and on its new foundation.

Building a Plate-Girder Bridge with a Locomotive Crane

A locomotive crane, running on a temporary timber trestle, which it built, was used to place the foundations and erect the approach plate-girders of the Linden Ave. Bridge over the Great Miami River at Miamisburg, Ohio. E. L. King, superintendent for the Hezlep-Seaton Co., says that the chief difficulty in the foundation work was

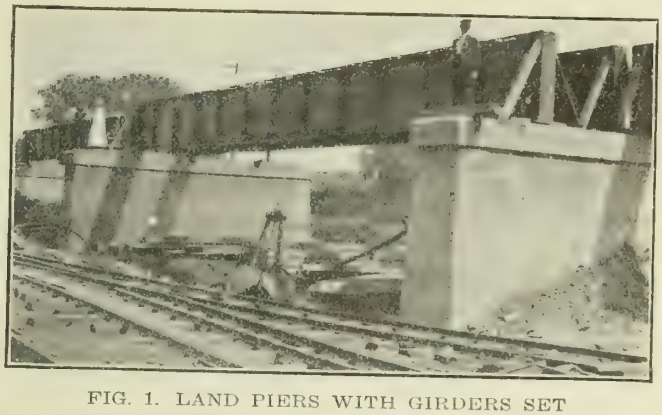


FIG. 1. LAND PIERS WITH GIRDERS SET

to keep the water out of the coffer-dams. Excavation proceeded with a grab bucket, the soil being large gravel containing much water. After excavation, 217 ft. of steel sheetpiling was driven by a No. 2 Union steam hammer attached to the arm of a crane furnished by the Ohio Locomotive Crane Co. There were no leads, and the boom had to reach out 50 ft. to drive the sheeting and the foundation piles.

The bridge consists of two abutments and five piers; three 60-ft. plate-girder spans and two 160-ft. through-truss plans. One abutment went down 15 ft. below low water, two piers went down 20 ft. below low water, one



FIG. 2. ERECTION TRESTLE CARRYING CRANE; FOUNDATION STARTED

pier 10 ft. and two piers and the other abutment 5 ft. Foundation piles were driven for the three river piers and the west abutment. The crane erected the forms and placed the concrete for the five piers and the west abutment. On the east abutment derricks were used.

The girders for the west spans weighed 9 tons each and were unloaded from the cars and placed on the piers in six hours. The far girder had to be placed 45 ft. from the center of the crane track, but this was accomplished without difficulty. It was found possible to pick up a girder at a radius of 53 ft. straight ahead without resort to outriggers. In placing girders on the land piers, the crane track was 32 ft. from the center of the piers. The girders were first set out 30 ft., then one end was picked up and set in place, then the other.

Winter Concreting Under Canvas

By Albert M. Wolf*

SYNOPSIS—Sectional frames with canvas roof and tarpaulin sides. Temperature inside kept at safe point by salamanders. Sand, slag and water heated before mixing with cement.

Now that concrete-building construction is being carried on during winter months quite extensively, some very ingenious devices and methods have been used to protect the fresh concrete from freezing. On the new Ford Service building recently completed at Cleveland, Ohio, a novel method was used to house the concrete work. During the cold weather of the winter of 1914-15 portions of the floor were poured each day and over these were erected sectional frames covered with canvas, resting on supports along column centers. The housing was high enough to allow a man to stand erect inside. The sides were closed in with tarpaulins. All materials except the cement were heated before mixing—the water was heated by steam and the sand and the slag by steam coils in the bins directly over the mixer.

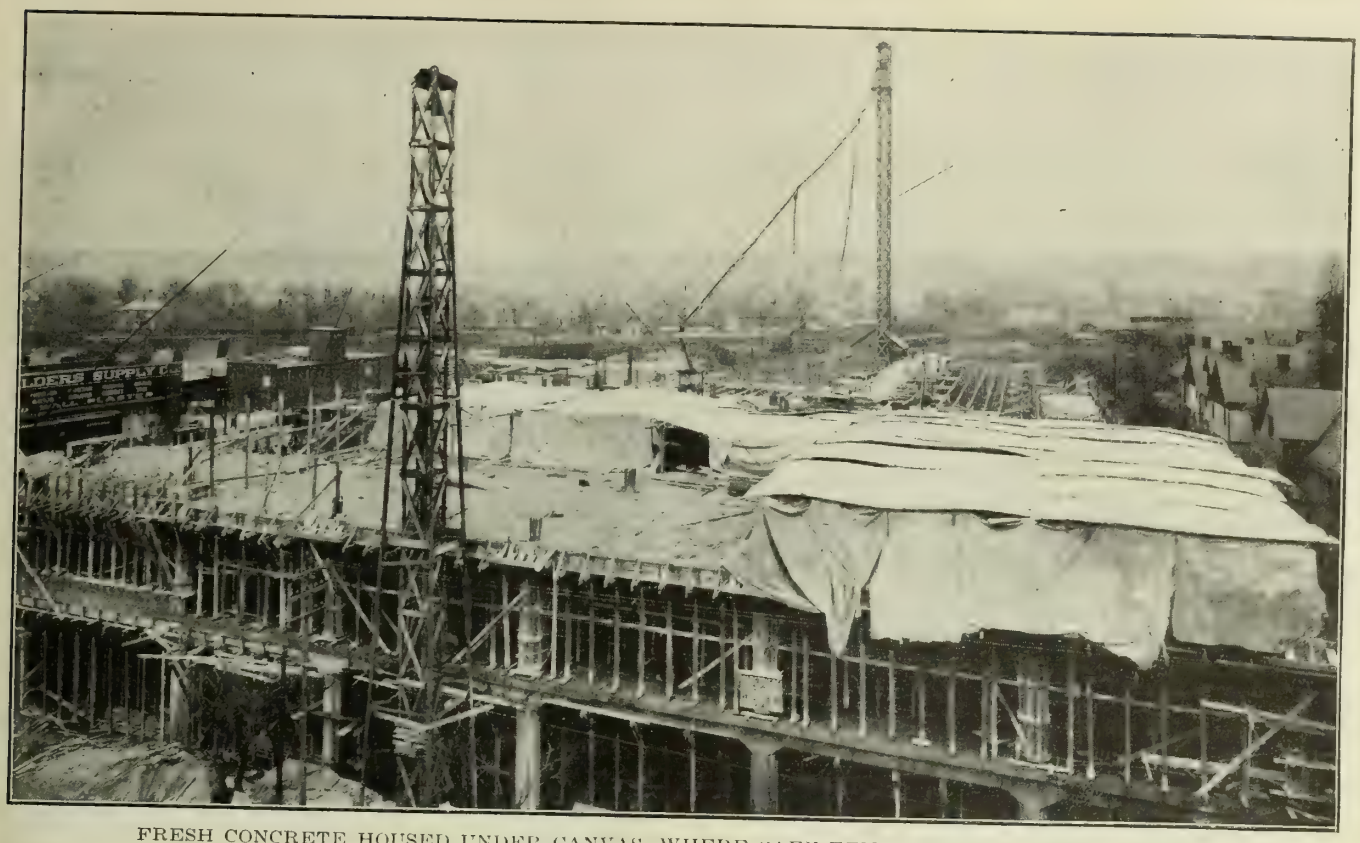
The "roof sections" were composed of trussed wood frames (four frames to a section). They were fastened together at the ends and covered with three 1-yd. strips of canvas, thus making sections 28 ft. long by 9 ft. wide. To support the canvas transversely between the wood frames, narrow strips or ribs $\frac{3}{8}$ in. thick were placed diagonally between frames on about 3-ft. centers. The roof sections rested on and were fastened to continuous post-and-stringer supports at the ends on column center lines (one direction only), the uprights being placed within the projecting column bars and anchored thereto so as not to rest on the finished floor.

The frames were made up of 1x8-in. lumber trussed with heavy wire which when pulled up tight gave the frames a curved top surface. These sections were comparatively light and easily moved from one position to another. The side walls were formed by canvas nailed to the frames and fastened down to the floor at the bottom.

Inside of this canvas housing, salamanders filled with burning coke were placed on the concrete which had previously been poured, and also on the forms just beyond the fresh concrete, to maintain the temperature well above freezing while the concrete was setting. Since these coverings were set up in units which were at least the size of a panel, there was always room along the edge of the new concrete to set the salamanders, as all construction joints were made on panel center lines.

The housings were kept over each section poured for a period of three or four days, depending on the weather conditions, then moved and the surface of the concrete covered with straw or shavings.

*Principal Assistant Engineer, Condron Co., Chicago.



FRESH CONCRETE HOUSED UNDER CANVAS, WHERE SAFE TEMPERATURE IS MAINTAINED

The general contract for this building was held by Morrow Bros., of Cleveland; the architect was John Graham, of Detroit, while the structural features were designed by the Condron Co., of Chicago.

Reconnaissance Surveying with Single Aneroid Barometer

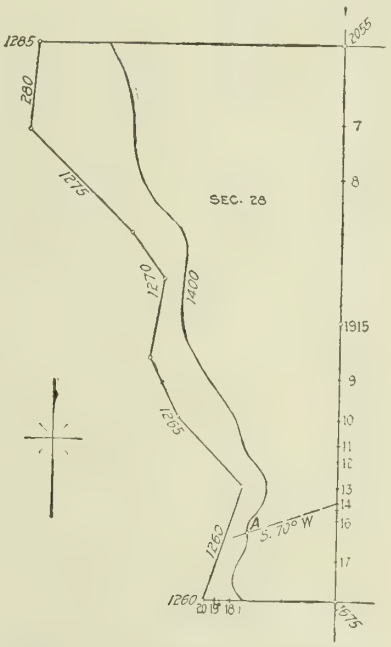
By Leroy A. Palmer*

Having had occasion recently to make a single-handed reconnaissance of about 65,000 acres in which elevations were desirable but great accuracy not necessary, I decided to see what could be done with the use of a single aneroid barometer. The instrument used was a compensated pocket "Tycos" with a 2½-in. dial and an adjustable altitude scale.

Readings were always taken with the instrument in the same position, preferably flat on the ground. The elevation was read by sighting along the pointer with one eye closed. After laying the instrument down, two or three sharp taps on the dial with the finger often helped to bring the needle to the proper position, indicated by a slight quivering; then after two or three minutes the pointer was read.

Readings were taken in the shade and on sand so hot that one could not lay his hand on it with comfort, and yet the readings showed no difference, nor was the instrument affected by proximity to the body in carrying it on a belt under the coat. If one is working in a rough or bushy country an instrument slung from the shoulder and carried outside the coat is more apt to catch or receive a severe jar than one carried on the belt and protected by the coat. It is a good practice, however, to put some tissue paper, loosely wadded, in the bottom of the case to cushion any jar that may be received—as, for instance, by the sudden and precipitate descent of a steep bank, as happened more than once on the trip mentioned.

At the beginning of the work a benchmark was chosen with an assumed elevation of 1,325 ft., which happened



SKETCH OF ANEROID SURVEY

to be the reading of the instrument at that point at the particular time. Each morning before leaving camp a reading was taken on the benchmark and the time noted. As each reading was taken during the day the time was noted to the nearest quarter hour, and on returning to camp in the evening the benchmark was read again.

*Mining Engineer, San Francisco, Calif.

The readings were then corrected as follows: Subtract the first reading of the day on the benchmark from the elevation of the latter. This is the "initial error." Compute the difference between the first and the last reading on the benchmark for that day and divide it by the number of hours elapsed between the two readings. The quotient is the "hourly difference." To correct the reading at any station, multiply the hourly difference by the difference in time between that reading and the first benchmark reading of the day, and apply the correction algebraically; then apply the correction for the initial error in the same manner. With the aid of a slide-rule a long list of readings may be corrected in a very few minutes.

Whenever possible, check readings were taken—that is, the barometer was read on a point whose elevation had been determined, whenever on subsequent days it was convenient to do so. If there was a slight discrepancy in these readings, the average was taken as the final elevation of the point. If the discrepancy was large, it was usually possible to determine which reading was the more nearly correct by comparing it with other elevations. For instance, we might have read A and C on one day, B and C on another and A and B on a third day. The two computed elevations of A might not agree, but by checking the elevations of the three points we could determine which reading of A to accept.

When the camp was moved and a new benchmark established, the same general procedure was followed as in taking the ordinary elevations; but one or more (the more the better) readings were taken on points whose elevations had already been computed, and from these the elevation of the new benchmark was derived. When possible, the series was closed in on elevations taken some time before. For instance, when a long circuit brought benchmarks 12 and 7 near together they were checked across and the mean of the computed elevations was taken as the new starting elevation. This is permissible, as the errors of the aneroid are not cumulative as are those of direct leveling.

The sketch and notes show a practical application of this method. The broken line on the west represents the meandered course of a stream as taken from the Government plats. A good dam site was found downstream at El. 1,150, with a possible height of dam of 250 ft. It was desired to know approximately what 40-acre tracts would be wholly or partly included in the flowage of such a dam—in other words, to map the 1,100-ft. contour.

NOTES OF ANEROID RECONNAISSANCE

Date	Station	Aneroid	Time	Elevation	Remarks
July 3	B. M. 11	2,350	8 : 00	2,435	
	Sec. corner	1,970	9 : 15	2,055	Secs. 21-22-27-28
	7	1,920	9 : 30	2,005	Gulch S 68° W
	8	2,020	9 : 30	2,105	Spur S 60° W
	¼ corner	1,850	9 : 45	1,915	Secs. 27-28
	9	1,700	10 : 00	1,785	Gulch N 70° W
	10	1,820	10 : 00	1,905	Spur S 70° W
	11	1,700	10 : 15	1,785	Gulch S 70° W
	12	1,750	10 : 15	1,835	Spur S 70° W
	13	1,670	10 : 30	1,755	Gulch S 65° W
	14	1,700	10 : 30	1,785	Spur S 70° W
	15	1,680	10 : 30	1,765	Gulch S 72° W
	16	1,740	10 : 30	1,825	Edge of spur S 70° W
	17	1,740	10 : 45	1,825	Edge same spur
	Sec. corner	1,590	11 : 00	1,675	Secs. 27-28-33-34
	18	1,290	11 : 30	1,375	Top of bluff
	19	1,200	11 : 30	1,285	2 ch. from river
	20	1,175	12 : 15	1,260	Meander cor. 28-33
	B.M. 11	2,350	2 : 30	2,435	

The contour was plotted as follows: The difference in elevation of the two points on the stream is 25 ft. The stream is divided into equal parts—five in this case, each representing a change in elevation of 5 ft. These divisions, with the corresponding elevations, are shown on the sketch. Now consider any point, as 14, which is on a spur bearing S 70° W. From this point draw a line S 70° W to represent the approximate course of the spur.

This intercepts the river in the portion assigned an average elevation of 1,260 ft. By scaling we find this line to be 18 chains long. In this 18 chains the elevation rises from 1,260 to 1,785 ft., and by simple proportion we fix the 1,400-ft. point at A. The other points are fixed in like manner and connected by the contour line 1,400.

The examination in question required that section lines be retraced, and as the aneroid readings were taken in the course of this work it can readily be seen that the foregoing method saved an immense amount of fieldwork. This was particularly the case on this reconnaissance, because much of the country was covered with extremely dense brush which would have required the services of an axman to run even a line of hand levels.

The weather, of course, has a vital influence on the work, and readings of this kind can be depended on only when atmospheric conditions are constant or when a change takes place uniformly. If the observer encounters several different kinds of weather in one day he might as well reject the readings taken.

The engineer is frequently called on to make examinations where great accuracy in the matter of survey is not required—where, for example, sights may be taken with a hand compass and distances measured by pacing. I believe that in such cases, if the weather conditions are fairly uniform and the topography is not too gentle, the method just described will be found to be very convenient and sufficiently accurate for the purpose.

Constructing a 10-Ft. Concrete Storm-Water Sewer

The work of constructing the south-side storm sewer at Columbus, Ohio, is proceeding rapidly. Essentially this is a 6,900-ft. concrete conduit to intercept a small creek and conduct it by a shortcut to the Scioto River. From the outlet on the river bank to near the foot of

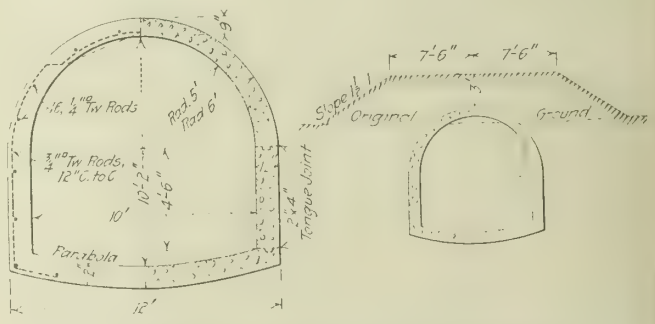


FIG. 1. CROSS-SECTION OF 122-IN. REINFORCED-CONCRETE SEWER, COLUMBUS, OHIO

the railway embankment of the Toledo & Ohio Central R.R. and the Hocking Valley Ry. is a 1,700-ft. section of a 120×122-in. reinforced-concrete structure of the cross-section shown in Fig. 1. This portion of the sewer is in a low-lying meadow subject to flood overflows. The sewer trench here is quite shallow.

The soil is a thin layer of loam overlying strata of stiff clay and hardpan. The trench is excavated by a 1-cu.yd. dragline excavator, no sheeting being required.

Half a dozen shovelers prepare the subgrade for the invert and lay an 8-in. tile subdrain close up to the excavator. The ditch water flows by gravity to a temporary sump on the river bank (from which end work was commenced), where a small boiler and steam pump are kept in operation.

The contractor has a 3-ft.-gage railway connecting with side tracks on the Hocking Valley Ry., where a central supply station and concrete-mixing plant have been established. A grab bucket is used to unload sand and stone from the cars to elevated bins. Concrete for the sewer invert is mixed at this central plant and conveyed to the

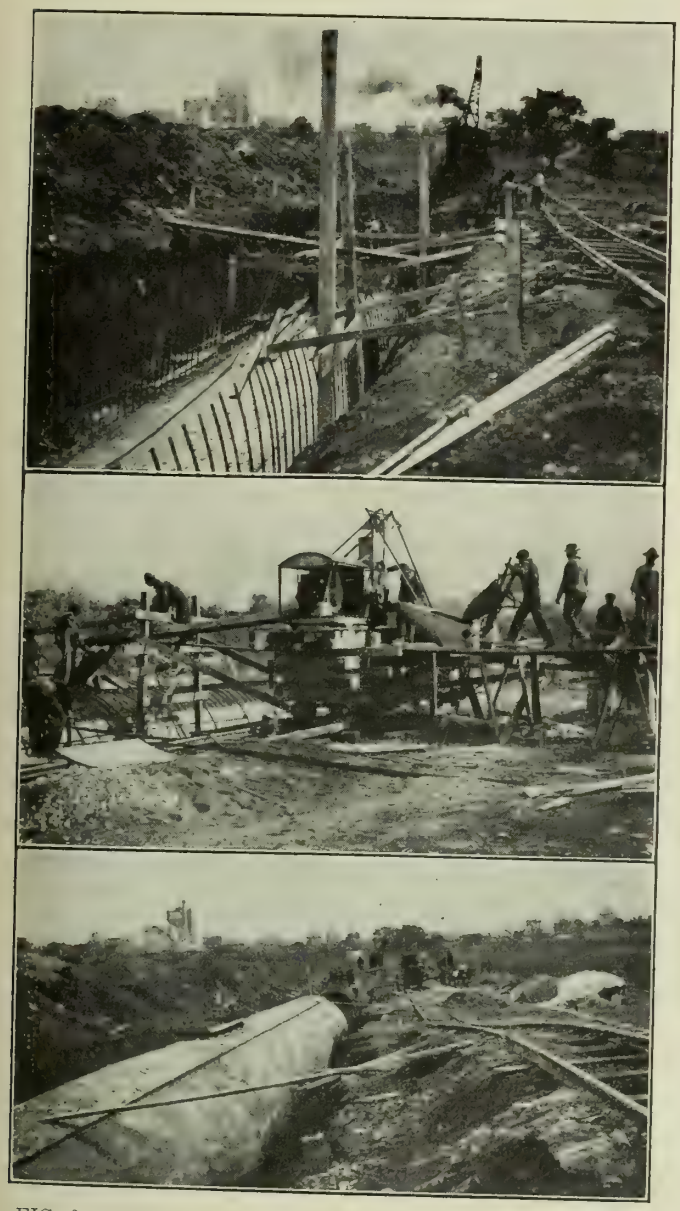


FIG. 2. VIEWS SHOWING THE CONSTRUCTION OF THE SOUTH SIDE STORM SEWER, COLUMBUS, OHIO

work by gravity in two 2-cu.yd. steel tip cars. The cars are hauled back by a dinkey.

For concreting the sewer arch a small ¾-cu.yd. batch mixer driven by a gasoline engine (shown in the middle of the three views) is used. The mixer is mounted on two flat cars so that it may be moved easily. It is blocked up as high as is safe, so that the concrete will flow through the chute; but with the chute at the inclination shown in the view one man is constantly required to push the concrete. The aggregates are dumped on the ground and carried in wheelbarrows up inclines to the mixer hopper.

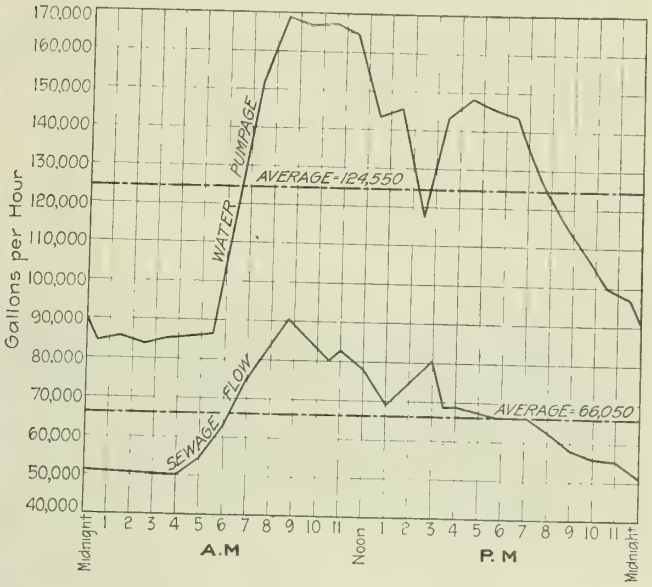
The concrete is 1 : 2½ : 5 mix, broken stone or gravel. The estimated quantities per linear foot of sewer are: Arch ring, 0.529 cu.yd.; side walls, 0.333 cu.yd.; invert, 0.437 cu.yd.—a total of 1.3 cu.yd. of concrete and 70.4 lb. of steel per linear foot. The contract price is $16.55 per linear foot.

The plans and specifications were prepared under the direction of Henry Maetzel, City Engineer of Columbus, with W. J. Weaver engineer in charge, and the contractor is the J. C. Carland Co., Toledo, Ohio.

NOTES

Water and Sewage Flow Curves—Curves of water-supply pumpage and sewage flow as measured in Lexington, Ky., by the Solomon-Norcross Co., engineers, are shown herewith. These curves furnish data on a subject more often covered by assumption than by definite fact. The close parallelism of the two curves is worth noting.

The fact that the sewage flow is little over half the water delivery is mainly due to the incompleteness of the sewer system. Only 65% to 70% of the population is connected to the



ONE-DAY CURVES OF WATER-SUPPLY AND SEWAGE FLOW, LEXINGTON, KY.

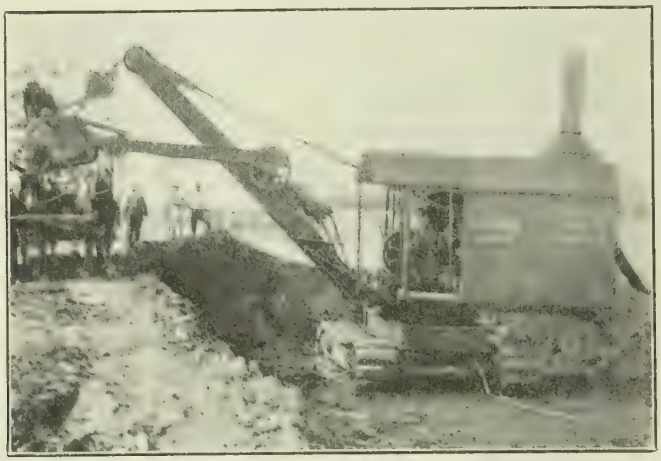
sanitary sewers. Further, 18% of the water pumped is used by power plants and railway companies.

The domestic supply system is fully metered. The consumption (all large consumers, or 1,410,000 gal., being deducted) is 1,770,000 gal. per day, or 44 gal. per capita per day. There are 6.2 inhabitants per service. The curves given are from sewer gagings made last July; the pumpage figures were obtained by correcting pump displacement for slip. A private company supplies Lexington with water. The sewers are separate.

A Portable Rail-Bending Machine operated by power is being used by the Cincinnati, New Orleans & Texas Pacific Ry. to bend rails for curves. The machine, with steam engine for driving the bending rolls, is mounted on a small car of the same height as a flat car. It is stationed at the car-repair shops and stands on a stub track which crosses a siding for the rail cars. In operation the bender car is placed on the crossing between a rail car and an empty car, the rails being run through the machine from one car to the other. The machine can be adjusted to bend rails for right- or left-hand curves and for any desired curve above 2°. It is necessary to set the rolls for a sharper curve than that desired for the rail, owing to the tendency of the rail to straighten after it leaves the roll. To bend rails for a 4° curve the machine is set for a 5° curve. A steam pipe from the power house of the shops

is connected to the engine on the car. The rails can be passed through the machine at the rate of about one rail per minute, and the cost is said to average 5c. per rail.

Revolving Shovel on Caterpillars—A revolving steam shovel mounted on caterpillar wheels has been used on county-road changes incident to the construction of the Chesapeake & Ohio Northern Ry. from Sciotoville to Waverly,



SHOVEL ON CATERPILLAR WHEELS BUILDING ROADS IN OHIO

Ohio. This road work—principally approaches to crossings—involved many shallow cuts; 15,000 cu.yd., all of it earth, had to be excavated. To avoid the frequent and costly moves, the contractor (George Maxwell, of Toledo) used the shovel arrangement mentioned. Heavy rains prevented fast progress during the first part of this work, but the caterpillar shovel demonstrated what it could do on muddy ground. The shovel is an 18-B Bucyrus, with a ⅞-yd. bucket. The spoil, removed by six 2-yd. wagons, is used for embankment filling along the new railway line.

Concrete Trestle in Forest—A reinforced-concrete trestle in a forest of large trees, as shown in the photograph herewith, represents a modern means of avoiding the fire risk of a wooden trestle in a case where continuity of service is vital. The trestle carries a water-supply conduit. For less important service the designer could hardly afford to neglect a cheap and highly satisfactory building material close at hand in favor of a very costly material requiring long transportation. As for the type of the viaduct, the picture clearly shows that kneebrace construction is relied on throughout to the exclusion of diagonals. Except for this the general type of design represents a copy of wooden- and steel-bent construction rather than a distinctive concrete design.

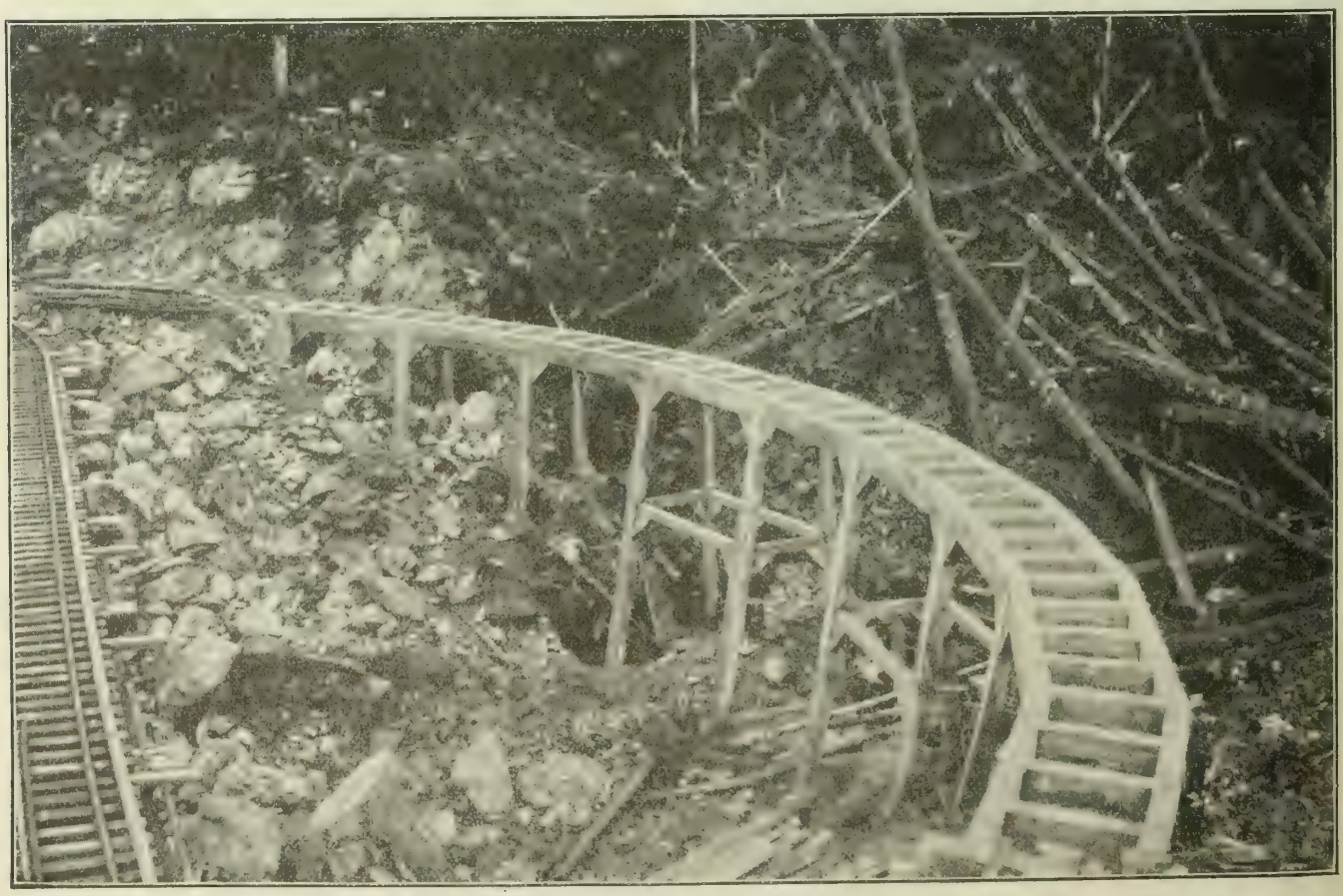
Strength of Annealed Form Wire—A reader inquired recently as to the strength of black annealed form wire. There is no standard grade of this wire, and unless the maker is known the strength would be uncertain. The American Steel and Wire Co. shows in its standards a minimum ultimate strength of 60,000 lb. per sq.in. for bessemer annealed and 40,000 lb. per sq.in. for basic openhearth annealed. This latter is extremely low and would be seldom approached

STRENGTH OF BLACK WIRE ANNEALED

Gage No. (Steel Wire Gage)	Diameter Inches	Tensile Strength, Lb. per Sq.In. 40,000	50,000	60,000
8	0.1620	824	1,030	1,236
9	0.1483	691	863	1,038
10	0.1350	572	715	858
11	0.1205	456	570	684
12	0.1055	350	437	524
13	0.0915	263	329	396
14	0.0800	200	251	300
15	0.0720	162	203	244
16	0.0625	122	153	184

within 15,000 lb. The elastic ratio for bessemer wire of this grade is given as 52% to 74%, elongation 18% to 25%; for openhearth the elastic ratio 40% to 55%, elongation 18% to 30%. Probably 50% elastic ratio (meaning ratio of yield-point to ultimate strength) might safely be counted on in all cases. The accompanying table, based on the American Steel and Wire tables for wire of 100,000 lb. per sq.in. strength, gives the strength of wires of 40,000, 50,000 and 60,000 lb. ultimate.

A Contractor's Water Tank for use on construction jobs can be made by connecting together a number of wooden barrels. One contractor, engaged on road construction, connected six or eight barrels by means of 1-in. pipes and placed them on a 10x10-ft. platform. Beneath the platform, which was 12 ft. above ground, there was an outlet pipe connecting with all the barrels.



REINFORCED-CONCRETE TRESTLE FOR SOOKE LAKE CONDUIT

Editorials

Why Not Experienced Men for Public Utility Commissions?

The State of New York during the administration of Governor Hughes led the way in the establishment of a thorough-going control of public utilities by state commissions. Other states which have followed the example of New York have looked to the New York Commission more or less for their precedents. Unusual interest therefore attaches to the action of Governor Whitman in removing from office Judge McCall, Chairman of the Commission controlling the utilities of New York City, and appointing, in his place Hon. Oscar Straus, who was Secretary of Commerce and Labor in President Roosevelt's administration.

The announced reason for Commissioner McCall's removal is a violation of the New York law which forbids a member of the Public Service Commission from owning securities of any public utility over which he has supervision. A more important reason doubtless for this and other changes in the commission is the general belief that appointments to the commission in recent years have been made rather to award "plums" to men of political prominence than to select experienced business men competent to discharge the great responsibilities laid upon the commissioners.

The Hughes law establishing the Public Service Commission fixed the salary of the individual commissioners at $15,000 per annum, an unusually high figure for a public officer. The idea of those who drafted the law was that this high salary would make it possible to secure the appointment on these commissions of men of a caliber sufficient to command such an income in their private business, and further that men so liberally paid for their services to the public would be free from the temptation to accept graft in any form. It was also hoped that the governors of the state would appreciate the enormous responsibility placed upon the Public Service Commission and in making appointments to it would try to find men who were of such ability and reputation as to be worth such a salary.

This hope has not been realized. Appointments to the Public Service Commission in recent years have not been made because of the knowledge and experience of the candidates concerning the operations of public utility companies, but the selection has been made apparently for political reasons. Of course it does not follow that because a man is a politician he is either dishonest or incompetent. Ability of some sort is undoubtedly a requisite if a man is to achieve prominence in politics. It is increasingly clear, however, that in order to render the best service on a public utility commission a man not only ought to possess honesty and ability, but he should be reasonably familiar with the operations of public utility companies and with the practice of their control on behalf of the public, which has been developed during the past dozen years. As has often been pointed out, Germany far excels all other countries of the world in the excellence of its municipal governments. One reason for this success undoubtedly is that in Germany the business of managing a city's affairs is in the hands of experts. A man who makes a reputation for excellent work in a small city is often called to a larger city where he can make good use of the experience he has acquired. We have had the beginning of this sort of thing in the United States within the last two or three years under the city-manager system, where in a number of cases engineers experienced in municipal administration have been sought for and engaged as city managers in other cities than those where they had gained their experience.

We will not make a great success of commission control of public utilities in this country until the men appointed on the commissions are selected for their ability and *experience*. A very slight beginning has been made, it is true, in the appointment on the Interstate Commerce Commission of men who had previously made distinguished records by service on state utility commissions; but it ought to be possible in the appointment of public utility commissions to go outside state boundaries and select for appointment men who have made good records in the service of other states.

Undoubtedly before any such sweeping reform as this can take place, a great deal must be done in the education of public opinion. At present the public is distrustful in these matters and is even more likely to trust a politician with whose name it has some familiarity than it would be to trust a man with expert knowledge and experience of whom it has never heard. Until the public is better educated as to the value of experience in the control of public utilities it will usually be necessary to appoint men like Mr. Straus, who has been appointed to succeed Judge McCall, not because he has any special knowledge or experience in the work of the commission, but because he is a man widely known and possessing public confidence.

Military Preparedness and the Engineer

The annual message of the President to Congress proposes an enormous increase in the military and naval establishments of the United States. That the civilian engineers of the country are to play an important part in this preparedness program is a foregone conclusion. There are probably few American engineering societies which have not already listened to talks by military officers on national defense and heard the principles of military engineering explained. Several local societies have gone so far as to seek specific instruction in military science for their members. A committee representing the five great national engineering societies has been working with the War Department for months upon a method of utilizing these organizations in a scheme for national defense, and is soon to report on the legislation it has framed. Evidently, interest is not lacking.

The President proposes to increase the Corps of Engineers by 15 companies. At least 50 additional engineer officers will be required for this force, so it seems probable that civilian engineers may obtain some of these commissions. In the army as a whole about 2,000 additional commissioned officers will be required, and the logical candidates for these commissions, according to what engineering societies are being told, are the younger graduates from the engineering schools.

Moreover it is proposed to build up a volunteer army of 400,000 part-time men, to be raised in groups of 133,000 a year for a period of three years. A large number of volunteer officers will be required for these troops, as well as 750 permanent officers to train them; and here again the technical graduate and engineer are likely to come to the front. It has been publicly stated by responsible army officers that every technical graduate with an elementary knowledge of military science is a potential army officer.

As to the methods by which military training for both regular and reserve officers is to be imparted, three schemes are proposed by the Secretary of War in his annual report. One is to organize a certain number of cadet companies to be attached to the regular army units. These cadets will receive special pay and will engage to serve one year with the cadet corps and five years in the reserve army corps. Their year in the cadet corps will consist of intensive training in all positions in the company from private to commissioned officer. A second scheme is to reorganize the military departments of the various colleges and universities under the direction of army officers, so as to make them in effect officers' training schools. The third method is to commission present officers of the National Guard, technical graduates of military training, civil engineers, railway men and others. It is also proposed to increase the capacity of the Military Academy at West Point to 770 students, which is 146 more than at present.

Additional training for reserve officers may be given in connection with the training of the Continental army or by their assignment for service with the regular army. Officers and men of the reserve force will receive pay on the same basis as the regular army for the time actually occupied in the service.

Repugnant as war and destruction are to every peace-loving American, they are doubly so to the engineer who has ever clung tenaciously to Telford's definition of engineering as "directing the great sources of power in nature for the use and convenience of man." The folly of diverting those sources of power to the destruction of life and property is perhaps more keenly appreciated by the engineer than by any other professional man, for the engineer spends his life in the design and execution of structures for preserving and safeguarding life and property—for such purpose indeed in the last analysis are sewers, water-works, bridges and nearly every other engineering structure which could be named.

Nevertheless engineers well understand that in the event of actual war, engineers everywhere will have to assume great responsibilities. In the European war the pioneers and the miners and sappers have become the main reliance of the advanced troops. The frontiers of belligerent European countries have been converted into practically continuous lines of trenches under the direction of engineer officers. The engineers charged with the maintenance and operation of lines of transport and communication are as essential to the military operations as the men behind the guns. On the other hand there are engineer troops whose service is wholly destructive; bridges, railways, tunnels, roads, etc., must be demolished behind a retreating army.

If a preponderance of sound public sentiment is for preparedness, engineers will be ready to respond to the patriotic duties asked of them. The military training they receive will have value anyway. Col. William M. Black, Corps of Engineers, U. S. A., has said that the chief fault to be found with civilian engineers in military work is the lack of a sense of proportion—a tendency to give more time and weight to methods and refinement than expediency justifies. For instance, in military topography the engineer must learn to sacrifice a certain amount of accuracy to speed, and yet retain a high degree of accuracy in the essentials for which the topographic survey is to serve. In other words the study of military engineering ought to cultivate judgment, prompt decision, discrimination and foresight—all excellent qualities for any engineer, civil or military, to possess.

Chicago's City Council Orders Railway Electrification

The publication of the report by the Chicago Association of Commerce Commission demonstrating that the electrification of the railways of Chicago is financially impracticable was promptly responded to by the City Council, which on Dec. 6 by a unanimous vote directed its Railway Terminals Committee to prepare such ordinances as would bring about the adoption of electric traction by the steam railways entering the city.

This action is of interest as showing the opinion of scientific investigation held by the average Chicago alderman. Opinions, however, whether held by individuals in their private capacity or as public officials, cannot alter facts. It may be easy to pass an ordinance obliging railway corporations to do certain things. It is quite another thing, however, to cause these things actually to be done.

By way of illustration, in certain cities of the Northwest the street-railway companies are by the terms of their franchise obliged to pave the space between and alongside their rails. As a result of the competition of jitney busses and private automobiles, however, these railway companies have abandoned all their paving work. When the city authorities order the companies to do what they have agreed to do, the companies reply that they haven't the money to do the work and are unable to get the money!

The question whether the railways entering Chicago shall spend in the neighborhood of $250,000,000 on electrification of their terminals because the aldermen of Chicago order the work done is a question a great deal broader than a mere conflict of authority between a city and certain railways, and a great deal broader than the interests of Chicago alone. Before the railways could borrow the huge sum of money involved in such an electrification they would have to gain the approval of the State Public Utility Commission and very likely of the Interstate Commerce Commission. The rights of many thousands of stockholders and bondholders are involved and the rights of communities in remote states. If the railways were to strain their financial resources to raise this great

sum and spend it on work yielding no financial return, it would seriously affect their ability to make needed improvements on other parts of their system possibly a thousand miles distant. It might be an important factor in making necessary an increase in passenger and freight rates. It is certain that the courts which may pass upon this matter will investigate very carefully the scientific and engineering facts in connection with it, even though the aldermen of Chicago may choose to ignore them.

Edison Fire Report Available

A year ago last week the engineering world was shocked by the news of the partial destruction by fire of the reinforced-concrete buildings at the manufacturing plant of Thomas A. Edison, Inc., at West Orange, N. J. The first reports that went out were indeed disconcerting, for it appeared that the previously accepted high reputation of concrete as a fire resistant had been seriously affected. Later news and views showed that the damage was largely to the contents of the buildings and that the whole catastrophe was mainly due to an almost childish disregard of the first principles of fire protection. The behavior of the concrete buildings under extreme conflagration conditions, however, was so interesting and in some cases so surprising that a thorough expert investigation of the fire and its effects was imperative.

Several such investigations were made, among them being the one conducted by a special committee of the American Concrete Institute, the primary results of which were announced at the annual meeting of the institute last February. It was not until last month, however, that the full report of the committee was made public in the "Journal" of the American Concrete Institute, dated August, 1915. This report comprises over a hundred octavo pages, fully illustrated with views and drawings, and contains in addition to the findings of the committee the discussions at last February's meeting and a complete story of the remarkably effective repairs of the buildings and the tests of the repaired sections.

The Edison fire was capable of teaching people more things about concrete and fire protection than any one textbook ever published. The American Concrete Institute and the members of its committee are to be congratulated in the way in which they rose to the occasion in translating these capabilities into certainty. With a generous distribution of this report among engineers and building owners, the public estimation of reinforced-concrete construction will be raised instead of lowered by the Edison fire.

Planning City Improvements

The careful planning of municipal improvements for years to come is notable by its absence in American cities. It is true that single improvements, particularly water-works and sewerage systems, are so planned in a fair number of cities, but this is far from universal. Beyond these two kinds of public works there is very little systematic planning, and still less execution of such plans as are made. A comprehensive program of municipal improvements for a period of years is almost unknown this side the Atlantic.

That engineers appreciate the value of a municipal program there is no doubt, but comparatively few of them, in or out of city offices, have a clear vision of planning for the future. Fewer still have the courage to urge in season and out of season that their vision should be realized.

It is a pleasure to read in the very first number of "The Bulletin" of the St. Paul Society of Civil Engineers these words:

> When is St. Paul going to plan its future requirements? As little as $10,000 a year spent now in planning future extensions of sewerage, water-supply, streets, boulevards and bridges in a methodical and comprehensive way will save the next generation many times this amount, without considering the resulting chaotic condition that will be left as a legacy to future councils, city planners and engineers, if it is not done.

It is to be hoped that having struck so true a note in its first issue "The Bulletin" will never tire of sounding it, with such variations as will prevent monotony.

It is hardly necessary to add that the present seems to be an exceptionally good time to plan engineering works—not alone for cities—for winter is at hand and in some quarters construction is at low tide for other than seasonal reasons. Neither the rigors of winter nor the industrial exigencies of the period are such as to militate against careful planning for the future, both for individual classes of city work and for all the multifarious needs of the modern city.

Architects Have a Monopoly of Building Construction

Readers of *Engineering News* will recall the successful fight waged by the structural engineers of Illinois to obtain the right to construct buildings, which under a previously enacted law was granted as a monopoly to the architects. Some such movement will apparently have to be started in Michigan, for engineers who undertake work in that state on any form of construction may run foul of a new law just passed. According to the letter of this new statute, any structure which has a foundation, walls and roof is a building, and any person engaged in the business of drawing plans and specifications for such structures is an architect and must have a license from a state board in order to engage in such work.

As the contributor who sends the information regarding this new law points out on another page, under this broad definition water-works, filter plants, standpipes, pumping stations and a large variety of other engineering structures are buildings, and any engineer who makes a business of drawing plans and specifications for them is by the law declared to be an architect. It can readily be understood, however, that the board of examiners provided for by the act are not likely to license as an architect anyone who does not conform to their artistic ideals.

It is a curious illustration of the crude way in which important legislation is often drafted that after making the sweeping provision above recited, the framers of the law added a section which is almost equally sweeping in permitting *any* person, firm or corporation to make plans or specifications or supervise the work on any building to be constructed by said person, firm or corporation.

As this section reads, any building contractor can put up buildings without paying any attention to licensed architects, which is about the last thing the architectural profession desires. Furthermore, it would seem to permit an owner to hire, as a salaried employee, an unlicensed architect to design his building.

Letters to the Editor

Saving to Motor-Car Owners Through Smooth Roads

Sir—Referring to the editorial in *Engineering News* of Dec. 2, 1915, on the savings to automobilists by improving the roads, it may be of interest to mention some cost data that I have kept on a Ford car used over the rather bad roads of central Florida.

I have found that the average cost for about 7,500 mi. during two years has been slightly more than 6c. per mi. (not counting depreciation or interest on investment), while the figures kept by the maintenance department of the United States Office of Public Roads, as published in *Engineering News,* Apr. 22, 1915, show an average of about 4c. per mi. for light automobiles [also Fords] used in inspection work along the National Highway. I have kept careful itemized cost accounts for my car, and by comparing with the similar figures of the Office of Public Roads I find that my costs for gasoline and lubricants are only slightly in excess of the figures obtained on good roads, but the cost for repairs and replacement of damaged parts accounts for nearly all of the difference. My cost for tires has not been much in excess of that obtained on good roads.

The roads in this section are mostly of sand-clay construction. They soon develop holes, or bumps, or ruts, so that an automobile is subjected to very severe shocks unless running at very low speed. My costs for repairs and replacements have in no case been due to any accident, as I have never had one. I have rarely run faster than 20 mi. per hr. and never as fast as 35 mi.

I find that nearly all car owners with whom I have been able to confer keep no cost records that are even approximately complete; they are, therefore, in dense ignorance of their real operating cost. If this situation is general throughout the country I fear that the argument put forward would not carry much weight with automobilists—"Knowledge can convince knowledge, but knowledge cannot convince ignorance."

Gainesville, Fla., Dec. 8, 1915. J. R. Benton.

Alternate Specifications for Public Work

Sir—An article published in *Engineering News,* Nov. 25, 1915, by Daniel T. Pierce, is interesting as showing on the part of the courts cited a remarkable misapprehension as to the underlying principles of competitive bidding on public work.

The writer has had a large experience in preparing specifications and receiving bids for public work, and in prior years has had considerable experience in the preparation and submission of bids in behalf of contractors for public work. In more than 25 yr. of such experience he has met many officials to whose discretion was intrusted the letting of such contracts. He found the large majority of these officials to be honest men with little or no previous experience that would help them in this work. He found that such officials need the protection of law against the greed of contractors and material men, the ambition of politicians and the vanity of the officials themselves.

The laws governing the letting of contracts for public work are similar in most states, and the interpretation of these laws by the courts run along common lines, with the exception of the cases cited in the article in question.

The fundamental principle involved in the letting of contracts for public work, and the one which is embodied in the laws in question, is that the work should be done or the articles furnished at the lowest cost which is compatible with a sufficiency of quality and a fair profit for the contractor.

This matter of obtaining material or of accomplishing work at the lowest cost cannot be done unless the bidders are assured of fair play. Any municipality is in business too long and lets too many contracts to be able to profit from a momentary display of unfair dealing of any sort. Bidders should be certain that there will be no favoritism and that no political influence will be effective in the awarding of the contract. Furthermore, in order to be able to bid the lowest price which is compatible with a fair profit, the bidder should have a maximum of opportunity to buy in the open market.

The ideal condition of letting any contract is to specify a single standard of quality. This should be determined by the specifications, either by tests prescribed or by some standard article that is in the market. If two or more standard articles are specified as standards, the contractor or the seller should have the option to select, and the option should not be exercised by the municipality. This rule applies as well to patented articles, which are incidental to some large project. The municipality should specify the various articles which may be used for the desired purpose, and it should be left to the discretion of the contractor to furnish the one he selects. This policy will relieve the official of a vast amount of pressure from salesmen and their friends and will materially reduce the cost of the work.

The practice of receiving bids from each of the bidders on various paving blocks is vicious. When one contractor submits a low bid on one paving block and another contractor submits a low bid on another paving block, the official to whose discretion is left the awarding of the contract is immediately besieged by the various contractors and their friends, by the material men who furnish the article and by influential politicians. These men present to the inexperienced official the alleged merits of the various paving blocks in question and flatter his vanity until he believes himself competent to decide the matter. The wisdom of such a decision is doubtful, unless the award is finally made to the lowest bidder of all, and however the decision is made, the contractor whose bid is rejected always believes the decision to be unfair and to have been influenced by improper consideration.

The article in question cites a number of cases where there was attempted competition between the pavements of different character, such as brick, bitulithic and asphalt. Such competition is absurd unless all of the pavements are of equal merit and unless the lowest bid of all is to be accepted with option to the contractor to select the pavement. If one of these pavements will necessarily cost much more than one of the others, it is impossible for such a pavement to compete unless the bidder on this pavement has sufficient influence to offset the low price on the other pavement. Any bidder wastes his time who submits a bid for one pavement in such a competition, if the official has already made up his mind that some other pavement is much more desirable.

It is quite possible to submit bids on alternate forms of construction; for example, bids may be received on either brick or concrete sewers, where the option is left to the contractor to select the material after the contract is awarded. That will produce genuine competition; but where one contractor submits a low bid on brick and another contractor submits a low bid on concrete, and the friends of both advocate in various ways the relative merits of the two materials, there is an absence of the fundamental principles of competitive bidding.

The Illinois courts, in accordance with these ideas, have decided against the legality of competitive bids on a bridge based on two or more designs, for the expressed reason that such a method of bidding tends to fraud and collusion between the bidders and the public officials. While attempts should be made to guard against collusion between the bidders, the dangers of such collusion are much less than of collusion between officials and bidders or material men where bids are received in such a manner as to permit favoritism in the award of the contract.

In conclusion, the letting of contracts for public work should be conducted so that the desirable quality will be obtained by a proper specification which includes necessary tests or standards, and low prices will be obtained by giving to the contractor the option to furnish any article which is covered by the specifications. This option, to be exercised after the contract is awarded, is of very material benefit in obtaining a low cost to the contractor and to the public.

The official should have discretion to reject the bid of any bidder who is not responsible, that is, one who has not the ability, financial or otherwise, to do the work. The official should have no opportunity to favor any responsible bidder, but should be compelled either to award the contract to the lowest responsible bidder or to reject all bids. All bids should be identical, except as to prices and names of bidders. There should be in no bid special conditions or qualifications that are not contained in all bids.

C. D. Hill,
Engineer, Board of Public Improvements.
Chicago, Ill., Dec. 6, 1915.

How the Transcona Elevator Settled and Tipped

Sir—This is to point out some inaccuracies in your editorial comments on the "Culebra Slides at Panama," where you refer to the Transcona elevator case. You cite this incident as an example of the sudden apparent change to a state of plasticity of a subsoil under certain conditions of moisture and pressure. To quote your own words: "The same soil carried the same load for a long time, with no yielding; but when some slight change in its nature—no doubt due to an increase in water content—occurred, quite suddenly the bed of clay failed, . . ."

Now the actual facts are as follows: The structure was commenced in the spring of 1912, a phenomenally wet spring, and completed, as far as building operations were concerned, in the spring of 1913. The summer of 1913 was spent in adjusting the machinery and in preparing for the grain rush from the Western Provinces in the fall. The computed dead-load under footings of the Storage Annex was 2,600 lb. per sq.ft., and no settlement other than is to be expected in a building of that magnitude was observed during this period. The building was put into operation in the first week of October. The capacity of the elevator is one million bushels, and the additional load induced on the footings when the building is loaded to capacity was computed at 4,000 lb. per sq.ft., giving a maximum load of 6,620 lb. per sq.ft. Handling the grain proceeded steadily until Oct. 18, the date of failure, when approximately 850,000 bushels of wheat had been stored, the corresponding foundation load being 6,100 lb. per sq.ft. The settlement was sudden, and equilibrium was attained in about 12 hours. Meteorological reports show that the rainfall for the preceding two months was very slight over the whole province. This would appear to prove that increase of load, and not of water content, was the immediate cause of failure; that the viscosity was overcome by pressure and not by dilution.

There is no doubt, however, that a waterbearing stratum played an essential contributing part. A series of borings showed practically uniform conditions over the whole site, thus: About 52 ft. to solid rock, made up of 35 ft. of stiff, impermeable "blue" clay, 5 to 7 ft. of greasy, water-bearing, yellow clay and gravel, and the remainder coarse gravel and disintegrated limestone. The sequence of events would appear to be: A sudden vertical subsidence of about 12 in., due to the increased pressure overcoming the viscosity of the semiliquid stratum; a lean toward the west due to a dip in the bedrock; increased unit pressure consequent on the momentum gained and the lessening of bearing area finally rendering plastic the impermeable blue clay.

My apology for burdening you with these details is that it is evident your source of information cannot have been reliable in this particular instance; and as by associating the case with the masterly work of Governor Goethals you give it so much prominence, I feel in duty bound to correct your misapprehensions.

P. Burke Gaffney, B. E., B. Sc.
Winnipeg, Man., Dec. 2, 1915.

A Sewage-Disposal Problem

Sir—If the writer of the inquiry on page 1140 of your issue of Dec. 9 will write to the Bureau of Animal Industry, Department of Agriculture, Washington, D. C., he will probably be able to secure some useful advice concerning the utilization of the liquid wastes from cow sheds accommodating about 700 head. These have a considerable fertilizing value and are often handled separately from the domestic sewage of farm buildings.

Aquarius.

Concrete Cotton Terminals and Warehouses at Atlanta

SYNOPSIS—What is claimed to be the largest cotton warehouse in the world now under construction at Atlanta, Ga. Distinguished not only by size, but by rapidity in construction. Work started in September of this year; cotton storage started early in November. Involved 200,000 cu.yd. excavation and six large buildings on 40-acre lot. Fireproof construction results in marked reduction in insurance rates.

The European War and the consequent depression in the cotton market are responsible for the construction at Atlanta, Ga., of one of the largest, if not the largest, cotton-handling and storage warehouses in the world. The plant comprises six large reinforced-concrete buildings—the largest 240x1,100 ft. in plan—two cotton compresses and a complete system of railway connections and telpher transfer. It covers practically all of a 40-acre plot of ground about two miles from the center of the city and alongside the main line of the Central of Georgia R.R., with track connections to the Southern R.R. Three months ago this tract was a wooded, roughly contoured lot. Today over 900 men are working at tree-cutting, earth excavation and building erection, two of the warehouses are practically completed and each day trains are bringing in cotton to be stored at one side of a building the other end of which is still under construction. The total cost of the work will be about $1,000,000. It is being built under the direction of Arthur Tufts as designing and constructing engineer, by the Atlanta Warehouse Co., of which the local capitalist, Asa G. Candler, is president.

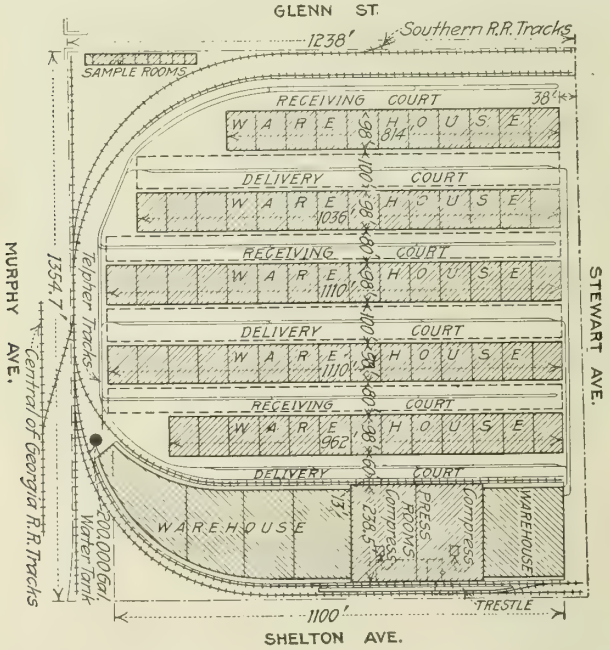


FIG. 1. PLAN OF ATLANTA WAREHOUSE CO.'S COTTON TERMINAL AT ATLANTA, GA.

On account of the present war it has been impracticable to market the cotton crop of Georgia at anything like reasonable prices, and this plant is intended primarily to offer to the farmers, merchants and banks ample facilities for storing and financing their cotton. Special attention has been paid to the facilities for storing and transferring the bales so that warehouse charges may be as low as possible, and the fireproof construction and ample fire protection provided have resulted in a great reduction in insurance rates. It is stated by the company that a rate of 20c. per $100 per annum has been secured, which means that a bale of cotton can be insured for one year for 10c., the lowest rate now existing in the South. The facilities of the plant are being offered to anyone that wishes to store his cotton and to borrow money on it, as well as to those that wish the usual warehouse accommodations.

The general layout of the plant is shown in Fig. 1. It consists of one large building—a combination of press rooms and warehouses 238 ft. 6 in. wide and over 1,100 ft. long—and five other warehouses, each 98 ft. wide and varying in length from 814 to 1,110 ft. Railway tracks run along both sides of the main building and down the opposite side of the lot, and overhead trolleys connect all parts of the various warehouses with the presses and the loading tracks. Between each pair of warehouses is a wooden covered shed and a concrete platform which is used either as a delivery or receiving court. In one corner of the lot is a concrete office and sampling building about 250x25 ft. in plan, and just off the main building is a 158-ft. high reinforced-concrete water-tower of 200,000 gal. capacity, which will supply the sprinkler and fire-protection system.

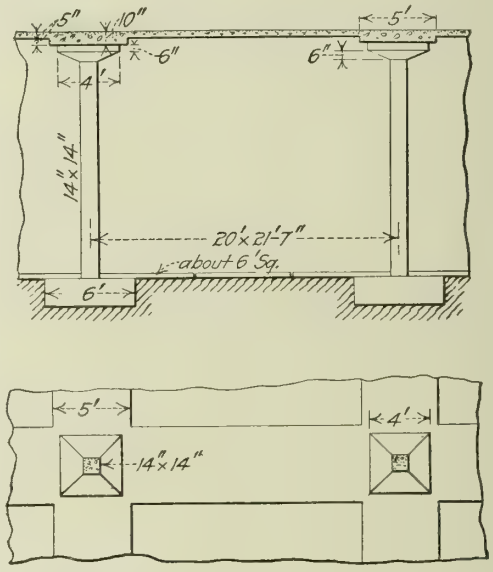


FIG. 2. TYPICAL PANEL OF REINFORCED-CONCRETE WAREHOUSES

All of the buildings are of reinforced concrete, of uniform type, varying only slightly to meet special conditions. Except for warehouse *G*, at the lower end of the main building, which is of two stories, all of the warehouses are one story high. The typical construction comprises square straight-rodded reinforced-concrete columns

resting on enlarged bases, which foot directly on the clay bottom, and carrying in panels about 20 ft. square a flat roof slab supported by rectangularly placed shallow girders. A typical panel without the reinforcement, which varies slightly with conditions, is shown in Fig. 2. The outside walls are of 12-in. thick concrete, and sawmill has been set up on the ground and also a bar-bending plant, so all material is delivered in the rough and worked up as needed.

Slag shipped in from the Birmingham district at the rate of 8 to 10 carloads per day is being used as aggregate for the concrete. All steel is rolled right in Atlanta.

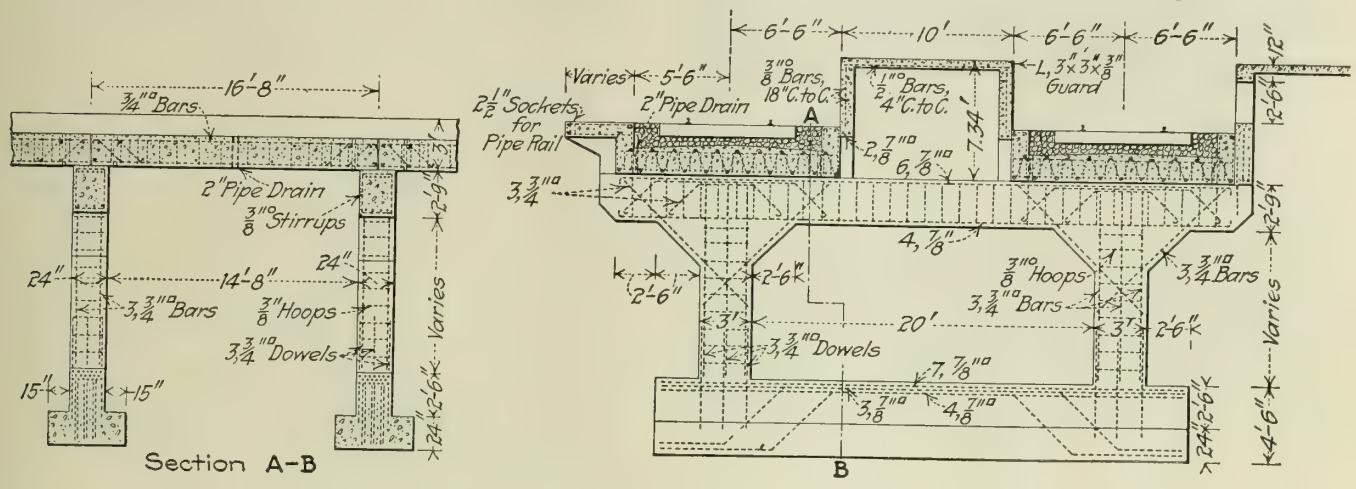


FIG. 3. DETAILS OF RAILROAD TRESTLE ALONGSIDE OF WAREHOUSE

each warehouse is separated into sections about 75 ft. long by 8-in. concrete firewalls provided with fuse-link fire-doors. There are no expansion joints provided either on roof or walls in any of the buildings. The floor, however, is made up of 6-ft. squares of concrete laid directly in the earth in checkerboard fashion, with tar-paper joints. The roof of the main building is cantilevered beyond the outer row of columns to provide a covered way for the outside platforms there. Ventilation and light are secured through skylight monitors.

As the ground slopes sharply down from the front end of the main building, the railway track on the outside of that building had to be carried on a trestle, the details of which are shown in Fig. 3. This consists of unbraced column bents spaced 16 ft. 8 in. longitudinally and 23 ft. transversely, founded each on a continuous inverted T-beam base and carrying over each column a transverse floor-beam. Centered over each column is a ballasted railway track resting on a continuous reinforced-concrete slab, while the space between tracks is occupied by an elevated reinforced-concrete platform which comes level with the car floors.

The main warehouse is equipped with two Webb high-density compresses, which are capable of compressing cotton to a density of 32 lb. per cu.ft. as against the work of an average compress, which is 22½ lb. per cu.ft. One of these presses is already in service; the other will be placed when required.

The construction has been carried on with the utmost rapidity. The lot was not entered until the last part of August, when tree-cutting commenced. Steam shovels started reducing the grade the first week in September. The greatest cut made was about 20 ft. in the characteristic Georgia red clay, which is being rapidly moved by dinky trains to level up the low places on the ground. Footings were made by cutting square holes in the stiff clay and filling them with concrete, on which the column forms were erected. All form work has been standardized, and as the panels are only of two or three sizes, the forms are being used over again several times. A Concreting is being carried on from five separate plants, which are moved from place to place as required. Each plant comprises a mixer, the feed trough to which is sunk below ground, and a low timber tower which elevates the bucket to the roof level, where the concrete is wheeled in buggies to the needed location. All of these plants are driven by steam, piped from a central plant.

Hartford Water-Works Progress*

Due to metering, the city has reduced consumption to 70 gal. per capita per day—giving now about 9,500,000 gal. per day. In 1916 the new system will make available 26,000,000 gal.

Some cast-iron pipe laid in 1854 and in continuous service has been replaced to increase capacity. It was horizontal-cast uncoated pipe and was somewhat tuberculated and filled. If the size had been ample it could have been cleaned. Sections were studied for condition and flow. A 4-in. pipe gave the capacity of new coated 2½-in. In the new work of the City of Hartford over 16,000 tons of cast-iron pipe had been purchased, and the rejections ran from 3 to 62% of various lots, the average being 11%. The rejections from the maker of the largest amount ran about 7%. The cost of inspection was 28c. per net ton of accepted pipe. Since careless foundry methods, lack of skilled labor and improper foundry mixtures were to blame, it was advocated that the maker should pay for the inspection of rejected pipe in excess of 10%.

The per capita use of water in Hartford has been studied, and the distribution by main purposes found to be as follows: Public uses, 3 gal. per day; domestic service, 34; manufacturing, 19; leakage and unaccounted for, 14; total, 70 gal. The amount actually drawn by the fire department was very small (½ pint per capita per day), though the rate of demand was extreme.

*From paper by Chief Engineer C. M. Saville before New England Water-Works Association.

Architects' License Law with Sweeping Provisions

By Herman K. Higgins*

Some extracts from the recently enacted Michigan license law for architects are here given. At first glance it would appear that engineers are not affected, but a closer study shows that the enactment may be construed by the courts to mean almost anything.

Section 1 and the sections from 3 on contain the originally intended enactment and provide machinery for enforcement, incidentally levying a tax on all architects. The fundamental requirement, that unqualified persons shall not use the term architect, is not only perfectly just, but so fair and right that we all, as engineers, applaud it. With these sections we have no possible quarrel.

With Section 2, however, the case is altogether different. Purporting to define the term architect, it entirely ignores the architect proper, but includes practically everybody else engaged in construction work. Not content with so doing, the law goes on to define "building" in such manner that it omits all reference to much that is legitimately architecture—for example, monuments, landscape work, town planning, etc.—and includes such entirely nonarchitectural work as caissons, tunnels, cranes, filters, etc.

Taken altogether, the law stands as prohibiting to all persons not registered as architects the use of any words, letters or devices to indicate that the person using the same is engaged in the business of drawing plans and specifications for the erection, enlargement or alteration for others of structures consisting of foundations, walls and roof, with or without other parts.

It will thus be seen that in the improbable case that the courts sustain these definitions and undertake to enforce them logically, it will be unlawful to either advertise or practice most branches of engineering in the State of Michigan. It will also be necessary for all engineers who do advertise to keep outside the jurisdiction of the Michigan courts. This follows from the fact that practically all branches of engineering involve the use of some kind of structure comprising foundation, walls and roof. Power plants, gatehouses for reservoirs, tunnels, subways, filter plants, sewage-pumping stations, standpipes, cranes, etc., are all included, to say nothing of the work *in toto* of structural and mill engineers.

Of course the courts may speedily nullify the law as a whole or such part as is affected by Section 2, but the greater probability is that there will be a progressive interpretation covering only minor points at first, and that later, in perhaps a decade or so, it will be found that the whole scope of the law will be enforced. Engineers can all see what that would mean for them.

Another interesting phase of the matter is the law's relation to both engineers and architects outside the State of Michigan. Much of the work in Michigan is now done by Ohio architects and engineers, who, being outside the state's jurisdiction, do not pay the tax and can use the proscribed letters, words and devices.

In any event the fact that such a law can be enacted without opposition and with no public notice indicates that engineers should actively seek in all states license laws that will put them in position to forestall such a law as this.

It will be further noted that all owners, builders and contractors are exempted from the operation of the law so far as work for themselves is affected. This exemption probably explains why so little publicity was given the bill. All the organized interests being excepted, there was no one to make a fuss, and the engineering profession simply knew nothing of it. Very few know anything of it now.

Provisions of the Law as Enacted

The following are some of the more important provisions of the law:

Section 1. No person shall use the title "architect," or any variation of the same, or use any other words, letters or device to indicate that the person using the same is an architect, after six months subsequent to the passage of this act, without being registered as an architect, in accordance with the provisions of this act. Any person who shall have been engaged in the practice of architecture under the title of architect prior to the time this act takes effect, may secure such certificate in the manner provided by this act.

Section 2. Any person engaged in the business of drawing plans and specifications for the erection, enlargement or alteration of buildings for others, and to be constructed by other persons than themselves, is hereby declared to be an architect within the provisions of this act. The term "building" in this act shall be understood to be a structure, consisting of foundations, walls and roof, with or without other parts; but nothing contained in this act shall be construed to prevent any person, firm or corporation, whether owner, contractor, mechanic or builder, from making plans or specifications for or supervising the erection, enlargement or alteration of any building that is to be constructed by any such person, firm or corporation, or its agents, servants or employees.

Sections 3 to 13 inclusive refer to the appointment and work of an examining board of five members in whose hands the issue of license certificates is placed. The following sections cover the qualifications, nature of examinations, etc.:

Section 14. Any person of legal age and of good moral character, upon the payment of a fee of $10, may apply for examination for registration under this act.

Section 15. The applicant shall satisfactorily pass an examination in such technical and professional courses as are established by the board of examiners.

Section 16. The examination shall have special reference to the planning, design and construction of buildings; the examination shall be in two parts, A and B, as follows: A—Test of the knowledge of the candidate of the strength of materials, construction and architectural design. B—Test of the ability of the candidate to make practical application of the above knowledge in the professional work of an architect, and in the duties of a supervisor of construction of buildings.

Section 17. In lieu of the first part of the examination, A, the board of examiners may accept a diploma of graduation from a recognized college or school of architecture, whose requirements conform to the standard minima of the Association of Collegiate Schools of Architecture.

Section 18. The second part of the examination, B, must be taken by all candidates.

Section 19. In lieu of all examinations the board of examiners shall accept registration or certification as an architect in another state or country where the standard qualifications for the same are not lower than those required by the board of examiners under this act.

Section 20. The board of examiners in lieu of all examination shall accept satisfactory evidence as to the applicant's character, competency and qualifications, and satisfactory evidence that the applicant has been actually engaged in the practice of architecture under the title of architect on his own account or as a member of a reputable firm or association prior to Feb. 5, 1915.

Section 21. The result of every examination or other evidence of qualification, as provided by this act, shall be recorded by the secretary of the board of examiners and the said board shall issue a certificate of registration to every person having passed such examination or as being otherwise qualified to be entitled to receive same.

*Civil Engineer, Jackson, Mich.

Section 24. The board of examiners may revoke any certificate, after 30 days' written notice to the holder thereof and after a hearing before the board of examiners, upon proof that such certificate has been obtained by fraud or misrepresentation, or upon proof that the holder of such certificate has been guilty of malfeasance or gross incompetency in connection with his practice of architecture.

Section 25. Any violation of the provisions of this act shall be a misdemeanor, punishable for the first offense by a fine of not more than $100, and for a subsequent offense by a fine of not more than $500 or imprisonment for not more than one year, or both in the discretion of the court.

Flood-Water Compensator for Low-Head Power Plant

Readers of *Engineering News* are already familiar with the ingenious "fall increaser" invented by Clemens Herschel and described in this journal, Jan. 14, 1915, p. 84. As will be remembered, the object of the "fall increaser" is to supplement the power of a hydraulic turbine at seasons when, on account of high flood stages, the level of the tailwater rises and the effective head on the power plant is reduced.

At the annual meeting of the American Society of Mechanical Engineers last week, Mark A. Replogle, of Akron, Ohio, described a unique hydraulic power plant at the farm and residence of Henry Ford, on the Rouge River, Dearborn, Mich. This power plant contains two turbines designed to develop 85 hp. at the normal head of the stream, which is only 8 ft. The head, however, is subject to great variation. At extreme high water in the Detroit River, into which the Rouge River discharges a little way below the power plant, the tailwater may rise nearly to the level of the top of the dam, when the power plant must of course shut down. Such conditions last only a few hours, but there are periods lasting sometimes for weeks when the head over the dam is only 2 to 5 ft.

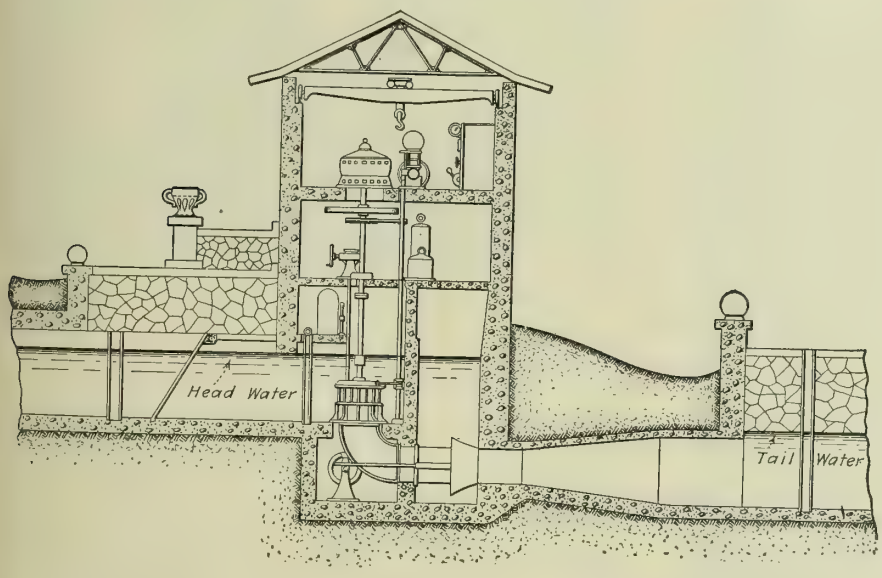


FIG. 1. SECTION THROUGH THE POWER HOUSE

In order to supplement the power of the turbines at times of flood water when the head is reduced, the engineers designed what they term a "discharge accelerator." The purpose of this device, like that of Mr. Herschell's "fall increaser," is to use the power of some of the surplus water to produce a suction on the draft tube of the turbine. In Mr. Herschell's "fall increaser" the principle of the venturi tube is utilized. The suction at the throat of the venturi tube is made to increase the suction in the turbine draft tube. In Mr. Replogle's "discharge accelerator" the principle of the venturi tube is also utilized, but the flood water is discharged in an annular jet around the exterior of the cylinder of water issuing from the draft tube. The accompanying sectional drawing of the power house and the photograph of the turbine, connected draft tube and discharge accelerator set up in the shop will make the operation clear.

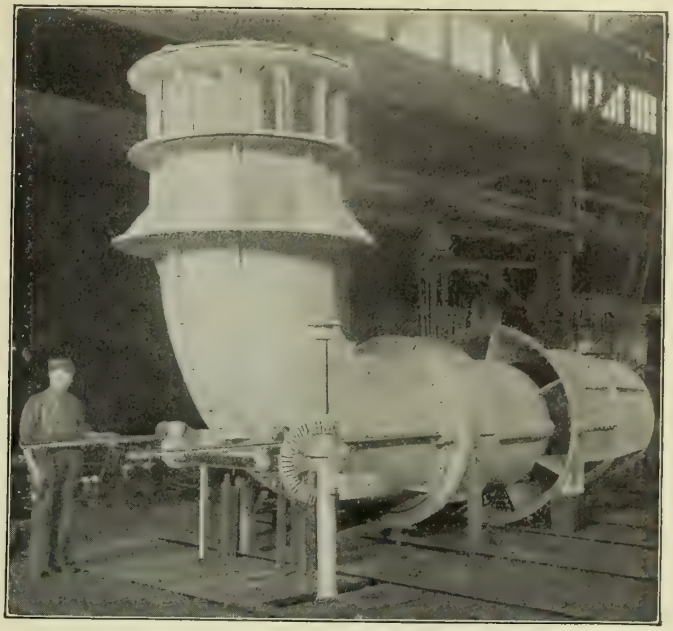


FIG. 2. VIEW OF THE COMPENSATOR

Tests on this power plant, made on Mar. 18 last, were described in Mr. Replogle's paper. At the time of the test the head on the turbine was slightly over 8 ft. The turbine was run without the accelerator and developed approximately 90 hp. With the accelerator gate open 20%, the power was increased to about 93 hp., although the head was reduced 2 in. With the accelerator gate open 80%, the turbine developed about 110 hp., although the head was reduced to 7.43 ft. The stage of water in the stream was so low at the time that the accelerator sucked considerable air.

Mr. Replogle's paper did not state whether tests had been made upon the turbine to determine to what extent the accelerator would increase the turbine's power under the conditions of flood water and very low net head on the turbine.

Mr. Replogle's paper, when presented at the meeting, was discussed by Mr. Herschel, who said that he had experimented with a device operating on a somewhat similar principle to the Replogle accelerator before designing his "fall increaser." The efficiency of the apparatus was so poor, however, that he abandoned it. With the "fall increaser" Mr. Herschel found that the flood water falling through the apparatus converted 30% of its theoretical energy to power in the turbine. Where the amount of flood water is limited it should be used with reasonably high efficiency.

News of the Engineering World

New Heads for Philadelphia Engineering Departments

The appointments of five of the six city department heads have been announced by Mayor-Elect Thomas B. Smith of Philadelphia. The new Director of the Department of City Transit is to be announced later.

The Department of Public Works is to be headed by George E. Datesman, for several years Principal Assistant Engineer of the Bureau of Surveys. He was born in West Milton, Penn., in 1863 and was graduated from Lafayette College in civil engineering in 1883. After graduation he spent a year in architectural work in Des Moines, Iowa, and a year as a mining engineer in charge of collieries in Luzerne County, Pennsylvania. Mr. Datesman entered the service of the City of Philadelphia in 1885 as a draftsman. Except for three years (1888 to 1891) he has been continuously with the city engineering department, having served as Chief Draftsman of the Bureau of Surveys and since 1893 as Principal Assistant Engineer.

The new Director of Department of Wharves, Docks and Ferries is to be George S. Webster, now Chief Engineer of the Bureau of Surveys. He was born in Philadelphia in 1855 and was graduated in civil engineering from the University of Pennsylvania in 1875. His early experience was with the Bureau of Surveys, and in 1892, after 10 years' absence in other public work, he was appointed Principal Assistant Engineer of the Bureau.



George S Webster



Geo E Datesman

In 1893 he was promoted to be Chief Engineer. During his administration of the Bureau of Surveys designs were prepared for many public works, the most important of which were perhaps the water-filtration plant at Torresdale and many notable bridges.

The new Assistant Director of the Department of Wharves, Docks and Ferries is to be Joseph F. Hasskarl, a consulting engineer of Philadelphia. He was born in Hazleton, Penn., in 1863, and was graduated from Elmhurst College. He entered the service of the United States Engineer Department in 1883, the same year being made Chief Inspector of harbor work at Philadelphia. He was successively promoted through various grades to be Principal Assistant Engineer in direct charge of Delaware River work. In 1907 he was appointed Assistant Director of the Philadelphia Department of Wharves, Docks and Ferries; in 1909 he was made Acting Director and for a short time after 1911 was Director.

Mechanical Engineers Meet

The thirty-sixth annual meeting of the American Society of Mechanical Engineers was held last week at the Engineering Societies' Building, New York City. It was the most largely attended meeting in the society's history, 803 members and 620 guests being registered. The meeting opened on Tuesday evening with an address by Dr. John A. Brashear, of Pittsburgh, president of the society, on "Science in Its Relation to Engineering." Dr. Brashear's charm as a public speaker attracted an audience that filled the large auditorium. Dr. Brashear has an international reputation as an astronomer and physicist. Discussing the question as to where the line should be drawn between so-called pure science and applied science, Dr. Brashear denied that any such line of demarcation was possible and held that much of the research work carried on merely to add to the fund of scientific information will eventually be found to contribute to the development of some practical art.

Following Dr. Brashear's address, the result of the annual election of officers was announced. The newly elected president is Dr. D. S. Jacobus, for many years professor of experimental engineering at Stevens Institute and more recently consulting engineer of the Babcock & Wilcox Co. The three new vice-presidents are William B. Jackson, of Chicago; J. Sellers Bancroft, of Philadelphia; and Julian Kennedy, of Pittsburgh. The three new managers are John H. Barr and H. de B. Parsons, of New York City, and John A. Stevens, of Lowell, Mass. William H. Wiley was reëlected treasurer. The usual reception by the president and president-elect and other society officers occupied the remainder of the evening.

The annual business meeting of the society was held Wednesday morning. The report of the council showed that the society has made a very rapid growth in membership during the past year, the total membership on Oct. 1 being 6,573. Only three years ago, in 1912, the membership of the society was only 4,000. One factor in the rapid growth of the society has been doubtless the organization in recent years of local sections. Local meetings of the society are now held in 14 different cities in the United States. During the week a conference was held of the secretaries and delegates from local sections with members of the society's council to discuss the methods by which the work of the local sections can be best carried on.

The financial condition of the society is very strong. The total income for the last fiscal year was $147,628, and the total expenses were somewhat over $120,000, leaving a balance of $26,500 for the year, which was added to the society's reserve fund. The society owns property and assets amounting to $722,600, and its outstanding debt is only $54,000. It is noteworthy that of the society's gross income of $147,628 a little less than $89,000 is from the dues paid by members, while nearly $59,000 is from receipts for advertising in the society's publications, from sales of publications, etc., and interest on society funds.

Amendments to the constitution were next taken up. At present any 20 members of the society may constitute themselves an independent nominating committee with the same power to nominate officers of the society as the regular nominating committee. It was proposed to change this requirement so that at least 1% of the voting membership would have to combine in order to make independent nominations. The other amendment proposed that the society copyright its publications. Division of opinion developed as to the wisdom of each of these amendments, and a vote to lay them on the table was carried, the effect of which is to refer them back to the council for further consideration.

Memorial Session for Frederick W. Taylor

At 11 a.m. the regular business was suspended to hold a memorial session in honor of the late Frederick W. Taylor, past-president of the society, who died last spring. Addresses dealing with Mr. Taylor's professional achievements and his fine personality were made by Henry R. Towne, past-president of the society, Henry L. Gantt, vice-president of the society, long associated with Mr. Taylor, and Rear-Admiral Goodrich, of the United States Navy.

Professional Papers at the Meeting

The large number of papers that have been presented at local sectional meetings and that were available for the annual meeting made it necessary to read a number of the papers at the opening session by title only and present other papers in brief abstract.

On Wednesday afternoon three sessions were held simultaneously, one devoted to railway engineering, one devoted to textile engineering, a third to machine-shop practice. On Thursday forenoon two simultaneous sessions were held, one dealing with various papers on power plants and apparatus, the other considering four papers on miscellaneous subjects. At the closing session on Friday forenoon the general subject was "Safety for Workmen in Industrial Plants." The four papers presented dealt with the standardization of safety principles, the attitude of employers and manufacturers toward the safety movement, workmen's compensation laws, and the relation of industrial safety to the principles of shop management. The sessions was well attended and the papers received careful and thorough discussion.

The principal social features of the convention were a "smoker" in the society's rooms on Wednesday evening and a dinner and dance at the Hotel Astor on Thursday evening.

New Haven Electric Line Put Out of Service by Storm

The electrified line of the New York, New Haven & Hartford R.R.—New York to New Haven—sustained the greatest damage in the storm of the night of Dec. 13-14 that it has ever suffered. The storm was most severe between New Rochelle and Stamford, Conn., for 20 to 25 mi. along the main line of the railroad. The heavy transmission line for the electric current and control wires was either burned out or broken in five places between New Rochelle and Bridgeport. Nearly all the masts that carry the telegraph and telephone wires were blown down from the tops of the transmission bridges. The signal wires went down at many points between New York and New Haven, and the signals were put out of service. Over the worst section the snow was reported as 15 in. deep on the level, with drifts 5 to 10 ft. deep, mainly in the cuts.

Four work-trains were sent out from New Haven and New York as soon as they could be manned, and the repair work proceeded as rapidly as possible. A limited number of trains were operated by steam on Dec. 14 between New Haven and Mott Haven. All passenger trains were brought safely into terminals with the exception of one, which was stalled in the snow near Winsted, Conn.

Between Woodlawn and New Haven there are two designs of supporting bridges. The older type was fully described in *Engineering News* of Sept. 5, 1907. The following is a quotation from p. 241:

> In the calculation of these bridges very heavy weather conditions were assumed, and provision was made for clamping the catenary cables on intermediate bridges so that the latter are obliged to partially withstand the longitudinal pull of the cables. It was assumed that the entire system of bridges and cables might become coated with sleet and that this coating might be ½ in. thick around all surfaces. Under these conditions it was assumed that the wind pressure on the bridges and the catenary spans might be as high as 25 lb. per sq.ft.

The later type of transmission construction, as used on the New York, Westchester & Boston Ry. of the New Haven, between Stamford and New Haven is simpler than the old design. In the new construction the supporting bridges for the overhead wires are placed 300 ft. apart.

Improvement to Nashville Water-Works Needed

Improvement to the water-works of Nashville, Tenn., including an addition to the pumping plant and the metering of all consumers, is recommended in a report to the city authorities, made by James C. Cameron, public accountant, New York City, who is conducting an efficiency survey of the municipal departments of Nashville. Associated with Mr. Cameron in his investigation of the physical conditions and operating methods of the water-works were Barclay Parsons & Klapp, consulting engineers, New York City. Mr. Cameron also recommends the employment of a technically trained superintendent and chief engineer of water-works, and improved means of controlling the application of the aluminum sulphate and the hypochlorite of lime used as a coagulant and a disinfectant respectively.

Alternative plans for increasing the capacity of the pumping plant are recommended to the consideration of the city authorities. The first plan provides for a 20,000,000-gal. steam pump and various minor accessories at the present pumping station, at a total estimated cost of $209,000, and at an operating and capital expense of $90,908. The second plan contemplates placing three 7,500,000-gal. centrifugal pumps with motors in the water-works pumping station, these pumps to be operated with power from the electric-lighting plant. The cost of this plant would be $111,550, including some new boilers and a new turbo-generating unit in the lighting plant. The annual operating and capital charges for the second plant would be $72,778.

A strong recommendation for metering every water-works service is made. It is estimated that this would cost from $50,000 to $60,000, as on Sept. 30, 1915, there were 16,271 meters out of a total of 19,779 connections, leaving only 3,508 taps unmetered.

A question is raised as to whether or not the water-works intake, which now extends a short distance into the main current of the Cumberland River below the outlet of Mill Creek, should not be removed upstream 2,000 to 3.000 ft. in order to avoid contamination from Mill Creek, which is polluted by the discharge of sewage from the State Insane Asylum. A rough estimate of the cost of the extension of the intake is $70,000 to $100,000.

Attention is called to the fact that the distribution system includes a considerable number of old cast-iron pipe cast on its side, and therefore very thin on one side. A progressive replacement of this pipe is advised.

To facilitate cleaning the large reservoir that serves as a settling and coagulating basin, the subdivision into two equal parts of one of the two existing basins is recommended.

First Meeting of the American Association of Engineers

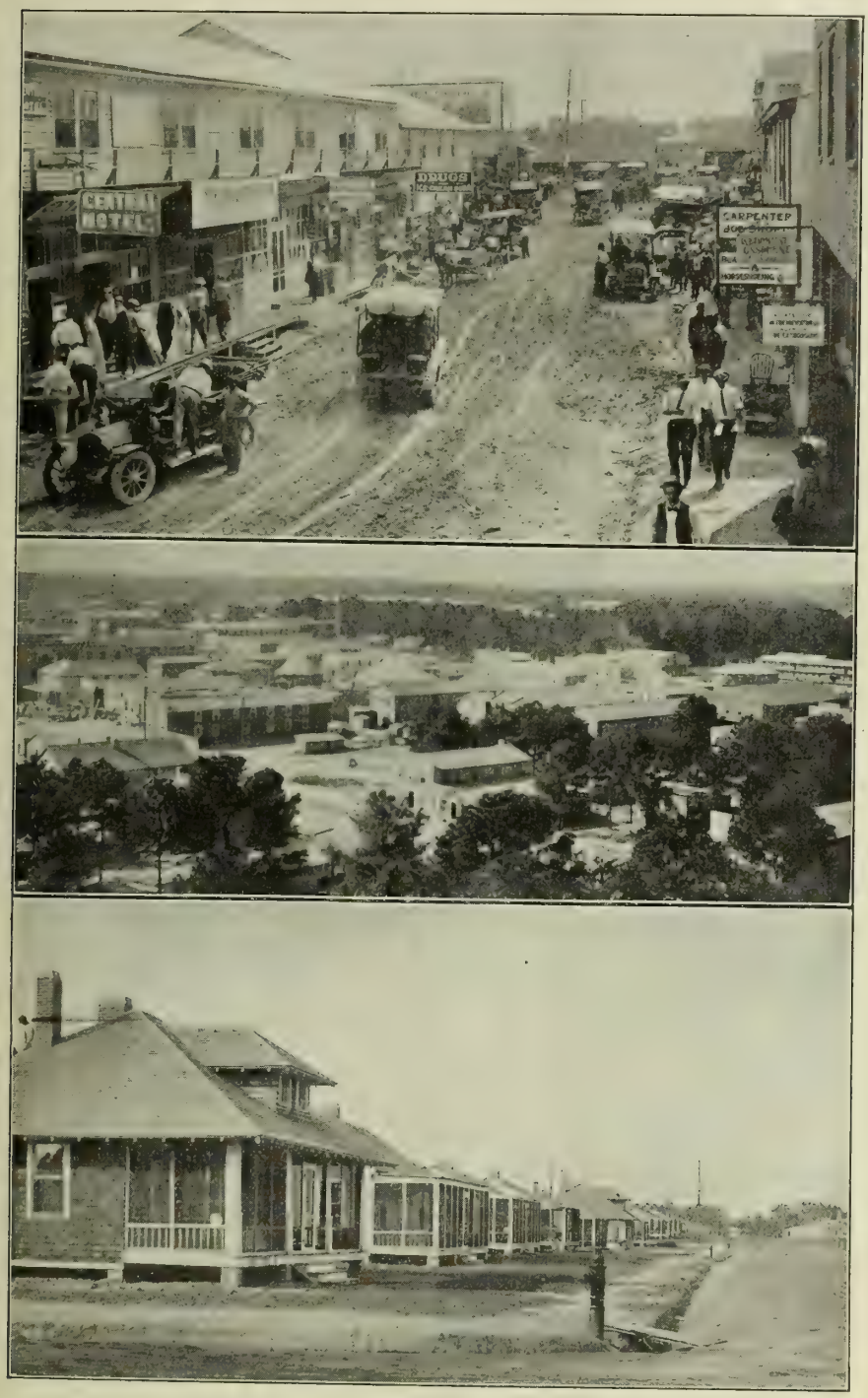
The American Association of Engineers is a new society, whose objects are to raise the standard of ethics and to promote the economic and social welfare of engineers, rather than to deal with technical matters. Its first convention was held Dec. 10 and 11 at the La Salle Hotel, Chicago. The total registration was over 400, though the attendance at the sessions was small (except at the Saturday afternoon session). The society was welcomed by H. S. Baker, Assistant City Engineer, and the opening address was then delivered by the president, W. D. Wilcox (gas engineer), of Chicago. Prof. F. H. Newell, University of Illinois, discussed at some length the desirability of coöperation for improving the position of the engineer and securing proper recognition of the importance of both engineering and the engineer.

A report on the work of the association was presented by the secretary, Arthur Kneisel (patent attorney), Chicago. The work so far has been mainly in the direction of securing employment for engineers, and the results were said to have been very satisfactory. The greater part of one session was devoted to a general discussion of the aims and purposes of the association, and very diverse opinions were presented on certain features, more especially as to the advisability of requiring (as at present) that members must be citizens or at least have declared their intentions to become citizens. On the one hand, it was claimed that membership should be open to anyone having the professional qualifications, regardless of other conditions. On the other hand, it was urged that the association is for the benefit of American engineers and that those who desire to avail themselves of its assistance should at least have shown their intention to become Americans.

This discussion was opened with a paper on "Qualifications," by T. B. Lambert, power engineer of the Chicago Telephone Co. Among the other papers were "Relation of Patent Rights to the Engineer," by G. Willard Rich, patent attorney, Rochester, N. Y.; and "The Economic Aspects of Engineering Pay," by J. H. Prior, Chief Engineer of the Illinois Public Utilities Commission. A dinner was given Dec. 10. At the afternoon session on Dec. 11 the Chicago Telephone Co. had an exhibit of moving pictures, illustrating its activities. The association has now a membership of about 300.

Fire Destroys Infant City

The greater part of the new city of Hopewell, Va., was destroyed by a fire on Dec. 9. Practically all of the main section, that is, the part shown in the middle of the accompanying three views, was in the path of the flames, but two of the adjoining residence districts, known as A Village and B Village, a street of one of which is shown in the lowest of the three views, were saved.



HOPEWELL, VA., BEFORE THE FIRE OF DEC. 9

Upper View—Looking down main business street toward railway station. Middle View—The section which was destroyed. Lower View—A street in B Village

A little more than two years ago the Du Pont Powder Co. opened on the point of land between the Appomattox and the James Rivers, about 12 mi. from Petersburg and 30 mi. down the James River from Richmond, Va., a dynamite plant, in which manufacturing was started on a very small scale. This plant was shut down at the outbreak of the present European war. Somewhat less than a year ago, however, the site was reoccupied, this time for a gun-cotton and sulphuric-acid plant, the latter reported to be the largest in the world.

The details of this new plant are not available. It is fenced around with a high barbed-wire barricade, and visitors are not welcome. There are, however, working in this plant some 18,000 men. It became necessary therefore to provide in a district which up to last April was given over to cornfields and peanut rows living quarters for most of these workmen and their families, together with the necessary adjuncts, such as stores, hotels and restaurants. The city of Hopewell is the result.

The upper view on this page illustrates very well the type of city, a type hitherto unknown to the East and to the present day, but common enough in the Western gold and silver camps of a generation or more ago. Beginning as an aggregation of shacks and tents with a large and active lawless element, Hopewell during the past summer developed into an approximation of an orderly city. Streets were laid out, sewers and water mains were built, electric lighting was installed, and a semblance of a city government was set up, under the direction of the county judge. In the coming legislature a city charter is to be asked for. At the time of the fire there were probably resident in this district at least 35,000 people. Two months ago there were only 20 voters in the place. There were no more who had lived there a sufficient length of time to obtain the local franchise.

The Du Pont company's plant embraces about 3,200 acres. The town of Hopewell spreads over about 500 acres, on a length of approximately 6 mi. and an average width of half a mile. The business section surrounded the Norfolk & Western R.R. station and was made up mostly of one- and two-story shacks, but within the past month or so a number of two- and three-story brick buildings had been built. Practically all of these, the brick as well as the timber, were destroyed by the fire, which started in a restaurant along the street shown in the upper view. In the outlying districts the Du Pont company had built two residence cities. These were laid out in rectangular squares and the lots portioned off in such a fashion that each house would have a sufficient amount of air space surrounding it. On these lots a number of similar houses were built, mostly of the made-to-order style, in which the timber

is shipped to the site all cut and matched ready to erect. A Village is composed of nearly 200 houses, and B Village of about 400 completed houses and 300 unfinished houses. Both were seriously threatened by the fire, but the efforts of the residents managed to save them.

Conflagration risks in the main part of Hopewell were of course as bad as possible. While the Du Pont company had installed sufficient fire protection for its plant, the town had only one inadequate fire engine, and the water-supply was in itself quite limited. A strenuous effort had been made to emphasize the need for individual fire extinguishers; but the restaurant in which the fire started was not so equipped, and the others were of course quite worthless in putting out the conflagration itself.

It is reported that the citizens of Hopewell are immediately going to work to rebuild the burned city. The gun-cotton and acid plant is working under its usual forced draft, and it of necessity requires men who must live near-by. Petersburg is connected to the plant by a single-track line of the Norfolk & Western R.R., which is now being double-tracked, and will be connected early in the coming year by an electric interurban line now nearing completion. The road between Petersburg and Hopewell, the only other land approach, is probably the worst road in the world.

Big Oil-Storage Depot Completed—A storage and distributing depot to take care of 500,000 bbl. of bulk and package oil was recently completed at Point Wells, near Seattle, Wash., to handle the Northwest and Alaska trade of the Standard Oil Co. The fire-protection system is of the Irwin foam type described in "Engineering News" of Aug. 20, 1914. The system as worked out for Seattle employs two tanks, one containing sodium carbonate, glue and carbolic acid, the other containing aluminum sulphate and sulphuric acid. Four-inch pipes connect the chemical tanks with the oil tanks; the mixing of the chemicals named, which happens when fusible plugs melt in burning tanks, produces a thick foam that covers the surface of the oil and smothers the fire. The plant covers 20 acres of filled land on the shore 15 mi. north of the city. There are 33 storage tanks, which include 14 lubricating-oil tanks and 4 fuel-oil tanks; the latter are of 55,000-gal. capacity each. The plant has its own electric power and lighting system and its water system. Power is furnished from a hydro-electric station situated in the hills. A concrete sea wall 1,000 ft. long fronts the plant, and beyond is a pier 550 ft. long and 50 ft. wide, with low water 40 ft. deep. The plant has two approaches to the pier. In its Northwest and Alaska trade the company's Seattle head quarters, in August, 1915 (an average month), distributed 181,600 bbl. of oil.

Municipal Ownership of Water-Works at Chattanooga, Tenn., has been delayed by a Chancery Court decision on a technical point. The decision, if upheld on appeal, ousts the water-works commission and holds void a bond issue for the purchase of the property of the City Water-Works Co. The city is planning to acquire the property by some other means.

PERSONALS

Mr. Thomas A. Bither, M. Am. Soc. C. E., a member of the City Engineer's staff of Berkeley, Calif., has been appointed Superintendent of Streets of that city.

Mr. Walter Anderson, City Engineer of Centralia, Wash., has resigned to accept a position with the Berger Manufacturing Co., Canton, Ohio, at Minneapolis, Minn.

Mr. Edwin Jennings has opened an office as consulting engineer at 835 Broadway, New York City. He was formerly Chief Engineer of a bridge works and for 12 years was with the Department of Bridges of New York City.

Mr. R. W. Creuzbaur, M. Am. Soc. C. E., has been appointed Consulting Engineer for the City of Elizabeth, N. J., on the railway improvements of the Central R.R. of New Jersey between Newark Bay and the city limits. The grade separation and other changes are to be considered by the State Public Utilities Commission early in January. The proposed work involves an expenditure of $4,000,000.

Mr. F. Peiter has resigned as Coke Oven Engineer with the Gas Machinery Co., Cleveland, Ohio. For the past three years Mr. Peiter has been engaged in the designing and development of the gas machinery top-burner regenerative coke oven. Previous to his association with the Gas Machinery Co. he was connected with H. Kopper Co. as Designing and Constructing Engineer and was with the Tennessee Coal and Iron Co. during the designing and construction of the Corey coke-oven plant.

Mr. Oscar S. Straus, former Secretary of the Department of Commerce and Labor, has been appointed Chairman of the Public Service Commission, New York, First District, to succeed Mr. Edward E. McCall, whose removal was noted in the personal columns of last week. Mr. Straus was born in Bavaria in 1850. His father emigrated to this country two years later. Mr. Straus is a graduate of Columbia University and of Columbia Law School. He was twice Minister to Turkey, and has been long prominent in public affairs.

Mr. F. L. Stockburger, whose name was on the certified civil service list, has been appointed Superintendent of the municipal garbage-reduction works of Cleveland, Ohio, succeeding Mr. Fred W. Cummings, who resigned a few months ago to take a position with a privately owned garbage-reduction plant in Detroit. Mr. Stockburger was at one time in the employ of the private company which disposed of the garbage of Toledo, Ohio, by reduction, and when appointed to his new position in Cleveland was acting as contract clerk for that city.

Messrs, Frederick P. Stearns, William Mulholland and R. H. Thomson, M. Am. Soc. C. E., have been appointed a commission to investigate the seepage problem at the Cedar Lake reservoir (Seattle) water-supply, described in "Engineering News," Nov. 25, 1915, p. 1053. Mr. Stearns is a consulting engineer of Boston, Mass., and was formerly Chief Engineer of the Metropolitan Water-Works of Massachusetts. Mr. Mulholland is Chief Engineer of Public Service, Los Angeles, Calif., and was formerly Chief Engineer of the Los Angeles aqueduct. Mr. Thompson was for many years City Engineer of Seattle.

Mr. W. H. Williams, Vice-President of the Delaware & Hudson Co., has been elected Chairman of the Board of Directors and Chairman of the Executive Committee of the newly reorganized Wabash R.R. He will continue his work as Vice-President of the Delaware & Hudson. Mr. Williams was born in Athens, Ohio, in 1874. In 1891 he joined the engineering corps of the Pittsburgh & Lake Erie R.R. Later he went into clerical work, and in 1896 was made private secretary to Mr. L. F. Loree, then General Manager of the Pennsylvania Lines West of Pittsburgh. Most of the time since then he has been associated with Mr. Loree, who is now President of the Delaware & Hudson.

Mr. Robert B. Marshall, M. Am. Soc. C. E., Chief Geographer, United States Geological Survey, has been appointed General Superintendent of National Parks, to succeed Mr. Mark Daniels, who has resigned to engage in private business. Mr. Marshall was formerly a topographer in the Geological Survey and since 1908 has been Chief Geographer. In 1904 he was a member of the Yosemite National Park Commission constituted to consider changing the boundaries of the park. In 1911 he was designated by the Secretary of State head of the American delegation to the Tenth International Congress of Geography. In 1911, 1912 and 1915 he was a member of the National Park Conferences.

Mr. O. E. Carr, City Manager of Cadillac, Mich., has been appointed City Manager of Niagara Falls, N. Y., effective Jan. 1, 1916. His salary will be $5,000 per annum. Mr. Carr was graduated from Allegheny College in civil engineering in 1900. For several years he was with the United States Coast and Geodetic Survey and later with the Baltimore & Ohio R.R. His experience in municipal engineering work was gained in Pittsburgh, Seattle, and Portland, Ore., and Cincinnati. He was appointed City Manager of Cadillac in 1914, being at that time Engineer in charge of underground surveys, division of sewers, at Cincinnati. There were 13 applicants for the position at Niagara Falls—only one of which was from a local man. The vote of the city council for Mr. Carr is reported to have been unanimous.

OBITUARY

S. H. Berry, County Engineer, Kitsap County, Washington, died at his home in Port Orchard, Nov. 26.

Charles W. Lord, of the civil engineering department of the New York, New Haven & Hartford R.R. Co., died Dec. 11 at New Haven, Conn. Mr. Lord was 50 years old and had been in the company's employ for 26 years.

Edward Rathbone Beacon, Vice-President of the Baltimore & Ohio Southwestern R.R., died Dec. 2 at the Johns Hopkins Hospital in Baltimore, Md., from appendicitis. He was born in New York City in 1846 and was educated as a lawyer.

Peter Joseph Flanagan, who for more than 20 years was foreman of the Bureau of Maintenance of the Department of Highways, Borough of the Bronx, New York City, died at his home in that city, Dec. 11, at 74 years of age. He was a native of Ireland.

Alfred M. Wiles, a manufacturer of brick machinery for 60 years, died Dec. 12 at his home in Stony Point, N. Y., at 87 years of age. At the time of his death Mr. Niles was President of the A. M. & W. H. Wiles Co., at Grassy Point, N. Y. Mr. Wiles was born in England.

Ward Crosby, Chief Engineer of the Carolina, Clinchfield & Ohio Ry., Johnson City, Tenn., died recently. He was born in Canada in 1859 and entered the railway service in 1880. He was a transitman for three years on the location of the Mexican Central R.R., and later Assistant Engineer of the Boston & Lowell R.R. and its successor, the Boston & Maine R.R. He went to the Carolina, Clinchfield & Ohio R.R. as Assistant Engineer in 1891, and was successively promoted to be Division Engineer, Principal Assistant Engineer and, in 1911, Chief Engineer.

Lieut.-Col. Charles S. Bromwell, Corps of Engineers, U. S. A., in charge of works for defense of Honolulu and Pearl Harbors and other work in the Hawaiian Islands, committed suicide Dec. 10 at Honolulu. He was 46 years old and a native of Kentucky. He was graduated from the United States Military Academy at West Point in 1890. He had charge of Mississippi River work at New Orleans and Vicksburg, Miss., in 1902 and 1903 and subsequently was in charge of the Office of Public Buildings and Grounds, at Washington, D. C. His last work before going to Honolulu was at Cleveland, Ohio, where he spent two years in charge of the Cleveland district of the War Department work. His most notable achievement in Cleveland was the bringing together of the various conflicting interests in the Cuyahoga River straightening and harbor-line projects, so that the concerted plan which is now being worked out under Maj. P. S. Bond, Corps of Engineers, U. S. A., could be agreed upon.

ENGINEERING SOCIETIES

COMING MEETINGS

SECOND PAN-AMERICAN SCIENTIFIC CONGRESS.
Dec. 27-Jan. 8. Washington, D. C.

OKLAHOMA SOCIETY OF ENGINEERS.
Dec. 28. Annual meeting in Oklahoma City. Secy., H. V. Hinckley, Oklahoma City, Okla.

AMERICAN CIVIC ASSOCIATION.
Dec. 28-31. Annual convention in Washington, D. C. Secy., R. B. Watrous, Union Trust Bldg., Washington, D. C.

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 3-6. Seventh annual convention in Washington, D. C. Secy., C. R. Marsh, Brattleboro, Vt.

CENTRAL RAILWAY CLUB.
Jan. 14. Annual meeeting in Buffalo, N. Y. Secy., H. D. Vought, 95 Liberty St., New York City.

MONTANA INSTITUTE OF MUNICIPAL ENGINEERS.
Jan. 17-19. Annual meeting at Billings, Mont. Secy., C. C. Widener, Bozeman, Mont.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Jan. 18. Annual meeting in Pittsburgh. Secy., E. K. Hiles, 2511 Oliver Building, Pittsburgh, Penn.

KANSAS ENGINEERING SOCIETY.
Jan. 18-19. Annual meeting at Kansas State Agricultural College. Secy., C. A. Foster, Topeka, Kan.

THE FRANKLIN INSTITUTE.
Jan. 19. Annual meeting in Philadelphia. Secy., R. B. Owens, Philadelphia, Penn.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 19-20. Annual meeting in New York City. Secy., C. W. Hunt.

NATIONAL DRAINAGE CONGRESS.
Jan. 19-21. Annual meeting, Cairo, Ill. Vice-Pres., Edmund T. Perkins, First National Bank Building, Chicago, Ill.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
Jan. 20-22. Annual convention in Minneapolis. Secy., Alvin E. Dodd, 140 West 42nd St., New York City.

ILLINOIS CHAPTER: AMERICAN WATER-WORKS ASSOCIATION.
Jan. 25-27. Annual meeting, University of Illinois, Urbana. Secy., Dr. Edward Bartow, Urbana, Ill.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 26-28. Annual meeting, University of Illinois, Urbana, Ill. Secy., E. E. R. Tratman, Wheaton, Ill.

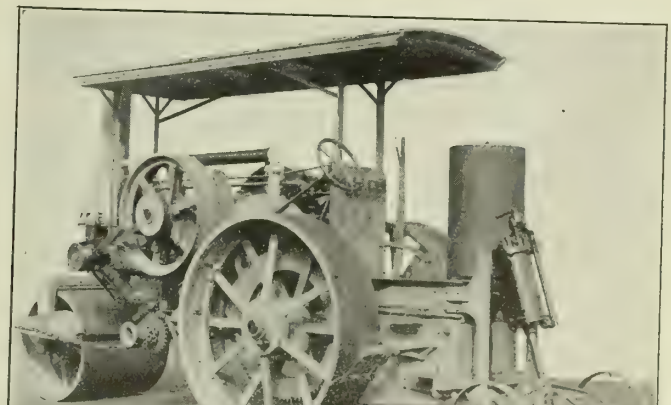
An Iowa Section of the American Water-Works Association was organized at a meeting held in Iowa City, Dec. 3-4. There were 69 registered at this meeting, including members and guests. The following officers were elected: Chairman, Robert N. Kinnaird, chief engineer, Des Moines Water Co.; vice-chairman, C. H. Streeter, Cedar Falls Water and Electric Co.; secretary, Jack J. Hinman, of the State Board of Health, Iowa City; directors, William Molis and J. P. Berry. There are 33 active members of the American Water-Works Association in Iowa.

New England Water-Works Association—The usual monthly meeting was held in Boston, Dec. 8. A paper by Caleb M. Saville, Chief Engineer, Hartford Water-Works, described certain phases of the new supply being developed and gave some interesting water-consumption figures. Some notes from this paper appear elsewhere in this issue. A second paper, on "The Middleboro Reinforced-Concrete Tower Tank," was read by G. A. Sampson, of Boston. This 500,000-gal. 165-ft. structure was described and illustrated in "Engineering News" of Aug. 26, 1915, p. 392.

Appliances and Materials

Power-Operated Road Scarifier

A scarifier attachment for steam or gasoline road rollers, which is operated by steam or compressed air, is a recent development in road machinery. The scarifier may be attached either to a three-wheel or a tandem roller. A unit frame contains the scarifier, carrying two heavy steel rocking shafts, an oscillating cylinder, piston and rod, crosshead fork and individual scarifier beams or arms. The roller operator controls the depth of cut by air or steam pressure. The pressure is applied by means of a double-acting swinging cylinder, the reverse action being provided to lift the teeth quickly from the ground. The cylinder pressure is also designed to insure such elasticity that the teeth will dig to a uniform depth on the roughest surfaces and save broken teeth when running over solid rock. The ordinary width of the scarifier is 6 ft., the same as that of the road roller, but the scarifier width may be varied by the operator, because each tooth is on a separate arm. This device has been successfully used for the toughest kind of scarifying, including ripping up of city pavements. It is made by the Kelly-Springfield Road Roller Co., Springfield, Ohio.



POWER-OPERATED SCARIFIER ATTACHMENT

* * *

Piston Valve for Air Compressors

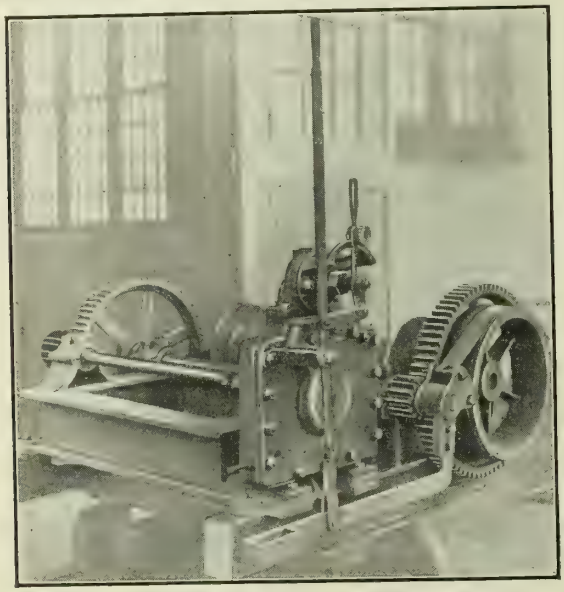
A balanced piston valve for steam-driven air compressors has been developed by the Ingersoll-Rand Co., of New York City. This valve is intended to replace the slide valve used

on compressors below the sizes where the Corliss valve-gear becomes practicable. (The slide valve has given trouble with high pressures and superheats, due to warping, leakage and defective lubrication.) Steam is admitted through the center of the (hollow) piston valve, and the cutoff valves for head- and crank-end ports are inside the piston. The position of these cutoff valves is shifted by turning the cutoff-valve stem, the valves being engaged by right- and left-hand threads on the stem. The chest covers and steam packings are subjected to exhaust steam only. Rotation of the auxiliary steam is effected by a chain-driven oil pump working against a weighted plunger. Both changing speed and changing air pressure affect the cutoff. Constant speed is maintained against changing steam pressure, but variation in demand for air shifts the steady running speed.

* * *

Automatic Brake for Hoisting Engines

The hoisting engine shown in the view has the long vertical hand lever connected by links to the brake pedal or foot lever and to the throttle valve, so that when the throttle is closed the brake is applied automatically. This results in a cushioning effect upon the machine when the



HOISTING ENGINE WITH AUTOMATIC BRAKE

boom is moving and tends to eliminate the danger of breaking gears and pinions when it is desired to stop the boom with the heavy load on the machine. This device has been developed by the Dake Engine Co., of Grand Haven, Mich., and is being applied to its various types of hoisting engines.

* * *

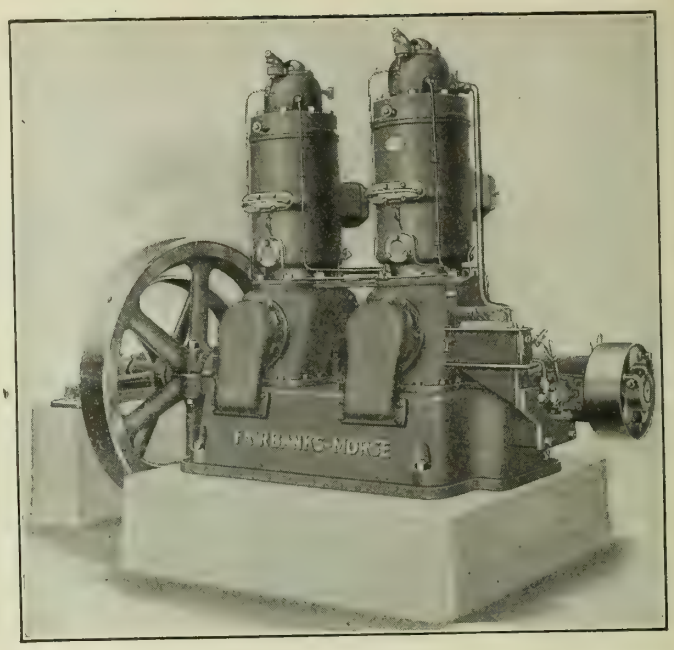
Weather-Forecasting Barometer

A recording aneroid-type barometer has been developed by the Taylor Instrument Co., of Rochester, N. Y., for warning of weather changes. This has been given the trade name "Cyclo Stormograph." Movement of the pressure chamber is communicated to a pen arm and a record is made on a paper chart wrapped about a clock-driven cylinder. The main chart divisions instead of showing pressure lines give lettered sections, A-B, B-C, C-D, etc., to I-J. An explanatory card tells the user, for example, that a falling line in the B-C section means "fair and warmer followed by wind and rain"; in H-I means "stormy weather," and in I-J "hurricane, gale or tornado." A rising line, the card shows, in I-H means "increasing winds followed by colder weather" and in C-B "clear tonight and continued cool with moderate winds."

* * *

Semi-Diesel Oil Engine

A new oil engine of the "semi-Diesel" type, designed to use any grade of crude oil or distillate, is being introduced by Fairbanks, Morse & Co., of Chicago, and is shown in the accompanying view. It is built in sizes up to 25 hp. for horizontal (single-cylinder) and up to 100 hp. for vertical (double-cylinder) engines. There are no valves, the piston covering and uncovering the ports. Crankcase compression not exceeding 2 lb. is used for scavenging and recharging. To save time in starting the engine when cold, a kerosene torch is used to heat an auxiliary starting tube which projects through the wall of the combustion chamber, so that it is



NEW VERTICAL CRUDE-OIL ENGINE

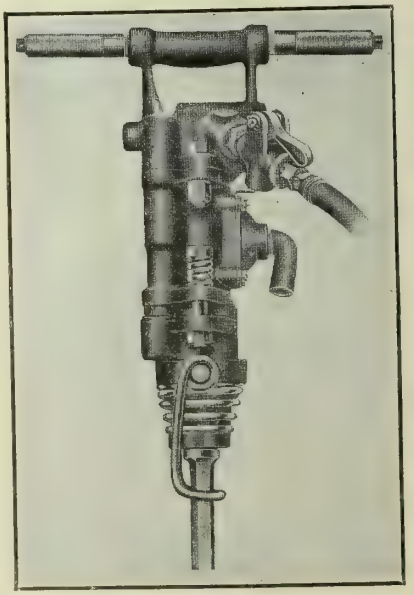
not necessary to bring the walls of this chamber to the ignition temperature before starting. The combustion chamber is waterjacketed like the cylinder.

The oil is injected by a pump driven through a rocking shaft by means of an eccentric on the main shaft. The amount of oil consumed is varied automatically to suit the requirements of the load, being regulated by the inertia governor on the shaft, which changes the position of the eccentric and therefore the length of stroke of the pump. Oil from the main storage tank is delivered by a small pump to an auxiliary reservoir above the main pump, and there is another pump for force-feed lubrication of the cylinder. The main bearings are of the ring-oiling type, with large reservoirs. A special air-seal ring around the bearings in the crankcase prevents the compression of the entering charge of air from interfering with the lubrication.

* * *

New Hand-Hammer Air Drill

A novel design of hand-hammer type of small air drill has been completed by the Chicago Pneumatic Tool Co., Chicago. This has been given the trade name "Hummer Drill." The drill chuck is geared to a shaft parallel to the cylinder and driven through a worm by a simple high-speed rotary air engine. The exhaust goes to the valve chamber of the hammer cylinder. The parts have been kept few and simple. The motor is between the handle and the cylinder. Rotation is always in one direction and no ratchet is used. The valve for the hammer piston is a ¾-in. steel ball with a movement of about ⅛ in. between seats. A throttle valve on the exhaust softens the hammer blow and sends air through the steels (hollow) to clean out the hole. Three sizes are available: The A-66 weighs 40 lb. and bores a ⅞-in. hole 6 ft. deep; the B-66 weighs 55 lb. and drills a 1-in. hole 8 ft.; and C-66 weighs 65 lb. and drills a 1⅛-in. hole 12 ft. All sizes may be column or tripod mounted if desired. All have a 2½-in. cylinder, but the strokes are 2½, 2¾ and 4¾ in. respectively.



NEW 40-LB. HAND DRILL

Engineering News

VOLUME 74 DECEMBER 23, 1915 NUMBER 26

Pike's Peak Highway, Colorado

By R. C. Hardman*

What is claimed to be the world's highest automobile highway has recently been completed from Cascade, Colo., to the summit of Pike's Peak. Pike's Peak, which attains an elevation of 14,109 ft. above sea level, is perhaps the best known and most visited mountain in the United States. Although there are some 26 mountains and peaks in Colorado alone which are higher than Pike's, it, by virtue of its dominant position in the Rampart Range and its easy accessibility, ranks first in the mind of the tourist. Since the construction of an Abt-system cog railway (Manitou & Pike's Peak R.R.) in 1891 thousands of tourists have made the ascent to the summit, from which it is said some 60,000 sq.mi. of the State of Colorado can be seen. A makeshift carriage road has also been available for a number of years, but only very few automobiles have been able to reach the top.

The Peak is located about 14 mi. west of Colorado Springs. The base of the Peak is at Manitou, about 6 mi. northwest of Colorado Springs, the cities being connected by an electric railway. The ascent of the Peak is made from Manitou by cograil railway or burro. The cog road is approximately 9 mi. long, having an average grade of about 16%, with a maximum of 25%.



FIG. 1. VIEW LOOKING OVER A PART OF THE PIKE'S PEAK HIGHWAY

*Civil Engineer, Colorado Springs, Colo.

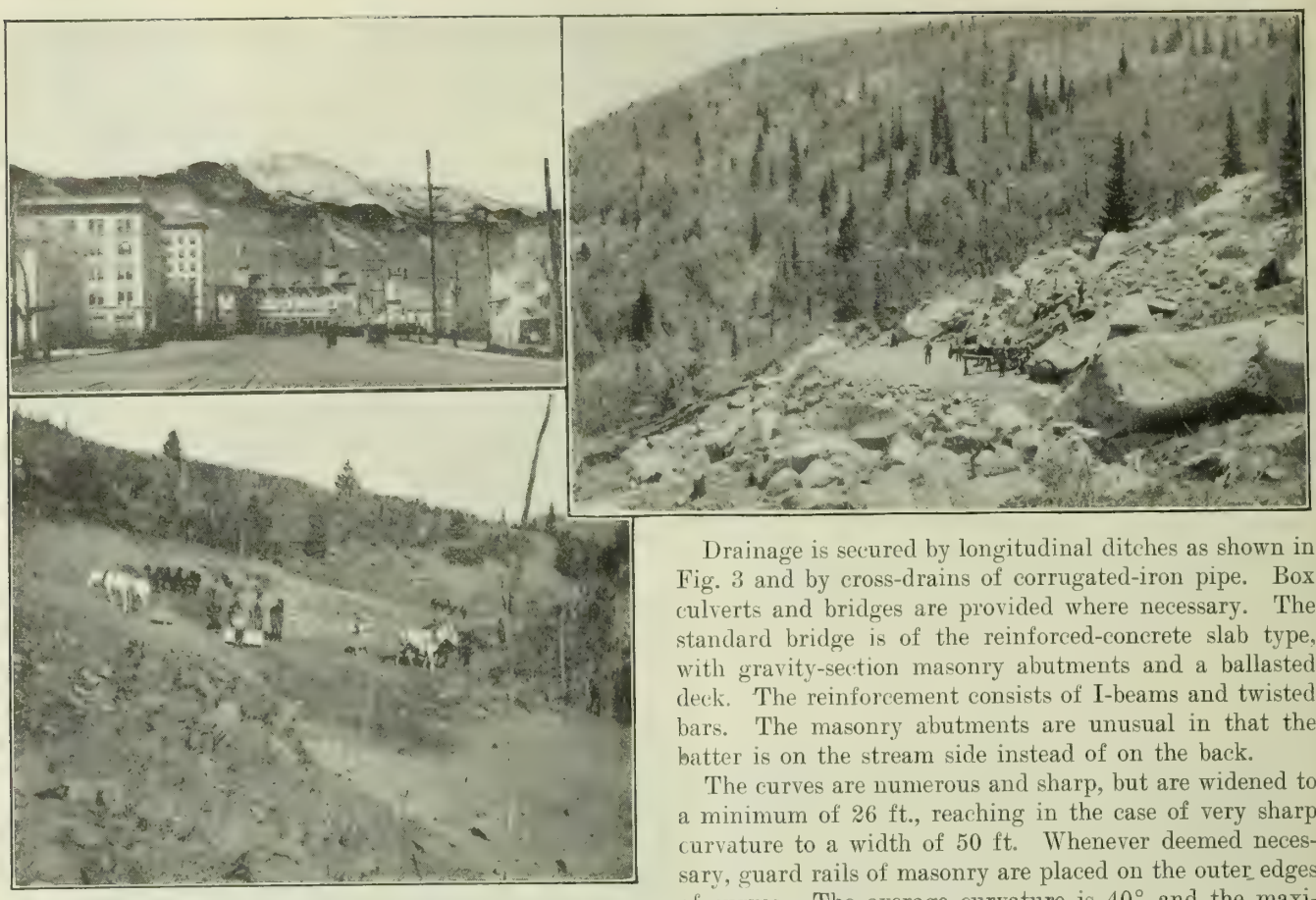


FIG. 2. PIKE'S PEAK FROM COLORADO SPRINGS: CONSTRUCTION VIEWS OF NEW AUTOMOBILE HIGHWAY

About a year ago a company was organized to construct and operate a toll road to the summit. The most feasible route was found to be that of the old carriage road which branches off the Ute Pass state highway at Cascade, about 12 mi. northwest of Colorado Springs in the historic Ute Pass, on Fontaine qui Bouille Creek. Surveys were made early last spring, and the construction work followed closely. The line of the old carriage road was followed in general, although the new line was relocated throughout its entire length, attention being given to the scenic possibilities. Typical of mountain highways, it abounds in sharp curves and steep grades.

Starting from Cascade at an elevation of 7,415 ft., the new road reaches the summit of the Peak in 17.9 mi., rising in elevation 6,694 ft. The road first climbs Cascade Mountain, following Cascade and Crystal Creeks, then traverses Crystal Creek plateau, skirts the Rampart Range, the crest of which is reached at about Mile 15. From there to the Peak, 2.9 mi., the road rises from El. 12,970 to El. 14,109. The timber line is reached at about Mile 12 at El. 11,880.

The engineering features, while not unusual, differ in many ways from the older mountain roads of Colorado, many of which are not wide enough for two vehicles except at intervals where turnouts are provided. The standard width of roadway adopted is 20 ft., of which 3 ft. is used as a shoulder and to form a shallow drainage ditch for all cross-sections except on embankments. On embankments the roadway cross-section is a parabolic curve with a crown of 0.3 ft. On sidehill cut-and-fill cross-sections the surface has a transverse slope of 1 in 40. Typical cross-sections are shown in Fig. 3.

Drainage is secured by longitudinal ditches as shown in Fig. 3 and by cross-drains of corrugated-iron pipe. Box culverts and bridges are provided where necessary. The standard bridge is of the reinforced-concrete slab type, with gravity-section masonry abutments and a ballasted deck. The reinforcement consists of I-beams and twisted bars. The masonry abutments are unusual in that the batter is on the stream side instead of on the back.

The curves are numerous and sharp, but are widened to a minimum of 26 ft., reaching in the case of very sharp curvature to a width of 50 ft. Whenever deemed necessary, guard rails of masonry are placed on the outer edges of curves. The average curvature is 40° and the maximum is 96°. On several of the sharper curves where it was not feasible to use the standard cross-sections, special cross-sections were designed. One of these, at the summit, is shown in Fig. 3. The extremely crooked alignment of the road is shown in Fig. 4. To further show the method of handling the "switchbacks" necessary to make the climb in Miles 14 and 18 enlarged plans are given in Figs. 5 and 6. In Mile 14 an elevation of 455 ft. is overcome. The average grade of the highway is a trifle over 7%.

The maximum grade is 10%. There are few adverse grades. Fig. 7 shows a condensed profile, with the vertical scale ten times the horizontal. The elevations at the mile posts only are used in making this profile, so that the grades shown are average and not the steepest.

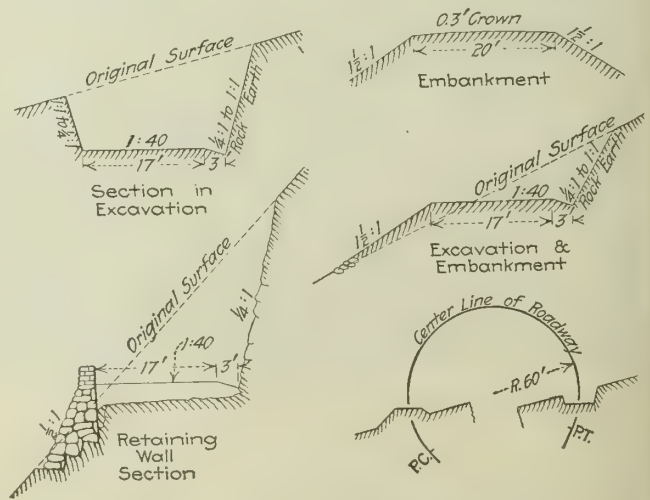


FIG. 3. TYPICAL SECTIONS IN CUT AT RETAINING WALL AND SECTIONS AT THE SUMMIT LOOP

Automobile supply stations are provided along the road. One of these is located at Toll Gate, one at Glen Cove and a third at the summit of the Peak. Water-supply tanks and hose are located as shown on the plan, Fig. 4. A telephone line 12½ mi. in length also reaches from Cascade to the top. The company which built the road

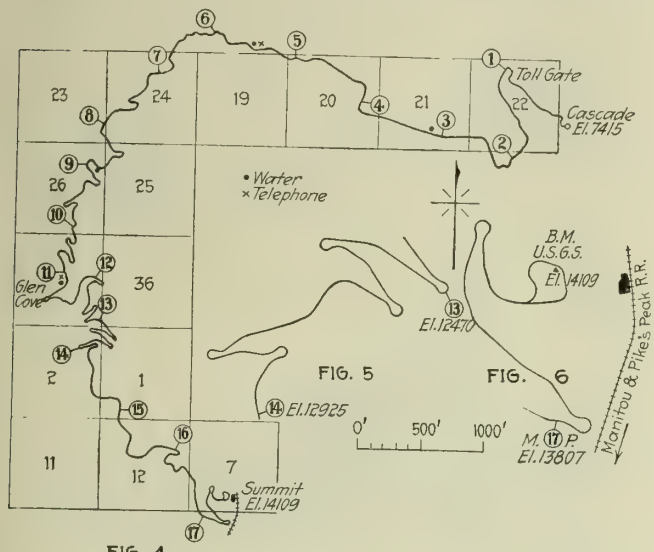


FIG. 4 FIG. 5 FIG. 6

FIGS. 4, 5 AND 6. PLAN OF PIKE'S PEAK AUTOMOBILE TOLL ROAD AND PLANS OF MILES 14 AND 18

operates a number of tourist motor cars. Privately owned cars are also allowed to use the road on payment of toll.

The photographs show the country through which the highway is built, although due to the lack of perspective full justice is not done the magnificent scenery. The material of which the road is built, in common with that of all the Pike's Peak region, is mostly granite and disintegrated granite. In some places a light surface soil was encountered. No special difficulty in construction was experienced, although part of the road is in a region

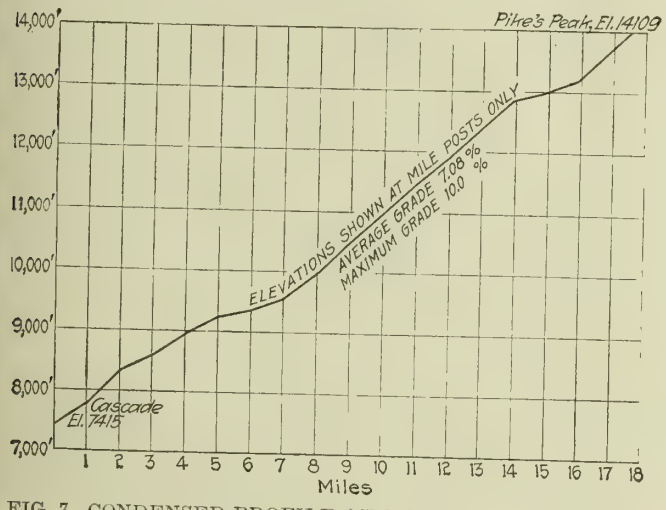


FIG. 7. CONDENSED PROFILE OF PIKE'S PEAK HIGHWAY

of perpetual snow. No power machinery was used for grading. The material was moved by hand shoveling, slip, fresno and wagon, as is usual in the West.

The originator and proprietor of the road is E. A. Sunderlin, of Colorado Springs, Colo. The location and design were under the direction of A. G. Allan, of Denver, as Chief Engineer. The writer wishes to acknowledge the courtesy of N. L. Drew, of the company, in furnishing much of the data given.

Sewage Disposal at Detroit

The problem of sewage disposal at Detroit, to eliminate the present pollution of the Detroit River, is complicated by the fact of the river being an international stream, the prevention of the pollution of which is under investigation by an International Joint Commission. In December, 1914, Clarence W. Hubbell, consulting engineer, was appointed by the city to investigate the problem and make recommendations for its solution. His work is being carried on independently of but in close relation with that of the commission.

For some years past Detroit has been growing at a more rapid rate than any other city in the United States. It has now a population of about 780,000, including immediate suburbs, and it is estimated that it will reach 1,500,000 in the 1935-45 decade. It has the combined system of sewers, with numerous outlets along the river. In this way it pollutes the water of several lower towns.

The city water-works intake is just above the upper sewer outfall, at the Fairview sewage-pumping plant, which is to be enlarged. But the water is already polluted by villages and towns higher up along the shore of Lake St. Clair. Some of these places are building sewerage systems (on the separate plan), and by agreement with them the city has built and expects to extend an intercepting sewer near the shore line to protect the city's water-supply. The water is treated by hypochlorite, but this is to be changed to liquid chlorine.

The highest pollution is below the city on the American side (max. 100,000 B. coli per 100 c.c.), a lower pollution (max. 10,000) on the Canadian side, and relatively low pollution (4 to 10) in the middle of the stream, except that occasional high records (100 or more) in the middle indicate pollution from ships.

The general plan will include large areas that can be successfully handled only by establishing a sanitary district or by extending the city limits to include rapidly developing suburbs. The conversion of the city's sewers from the combined to the separate system will not be recommended except where feasible in new territory. Tentative plans provide for the construction of intercepting sewers to handle the sewage proper and deliver it to treating plants (probably Imhoff tanks or screens, combined with disinfection). Industrial wastes do not present any serious difficulties except that grease and gasoline from the large automobile factories constitute a special problem, and means must be taken to prevent explosions in the sewers and pumping stations.

The instructions issued by George H. Fenkel, Commissioner of Public Works, to Mr. Hubbell cover three principal points: (1) To review the data and conclusions of the International Joint Commission for the purpose of enlarging on any phase of the matter necessary in order to determine what preventive or remedial measures are required with reference to Canadian waters. (2) To what extent does the Detroit sewage pollute American waters so as to render them unfit as a source of raw water for filtration purposes? (3) The means which the city should undertake to purify the sewage, and what expense would be justifiable for that purpose.

The report will be broad and comprehensive, giving general plans, estimates and recommendations, but leaving the preparation of detail plans until action has been taken on the general recommendations.

Sand and Gravel Washing and Grading Plant

By C. B. Breed*

The use of gravel for concrete is well established, and as pit gravel contains usually an excess of sand, it is now general practice to clean and grade these materials by screening and washing. An advantage to the contractor is that the gravel and sand can be shipped from the same pit, so that there is less liability of delay or interruption in the supply of concrete material.

A sand and gravel washing plant recently built at Lynnfield, Mass., is shown in Fig. 1. This has a capacity of handling 800 cu.yd. of pit gravel per 8-hr. day. The material is excavated by means of a dragline cableway with a 2-yd. bucket. A 1⅜-in. track cable passes over a tower 122 ft. high and has one end anchored to a deadman in the pit, while the other end (beyond the tower) is attached by a follower tackle and blocks to an anchorage cable leading to another deadman.

Operating the Dragline Excavator

A traction cable hauls the bucket at a speed of 250 ft. per min. while excavating and 600 ft. per min. while running from the pit to the top of the tower. For raising and lowering the bucket, the sag of the track cable is changed by means of the follower tackle. The two

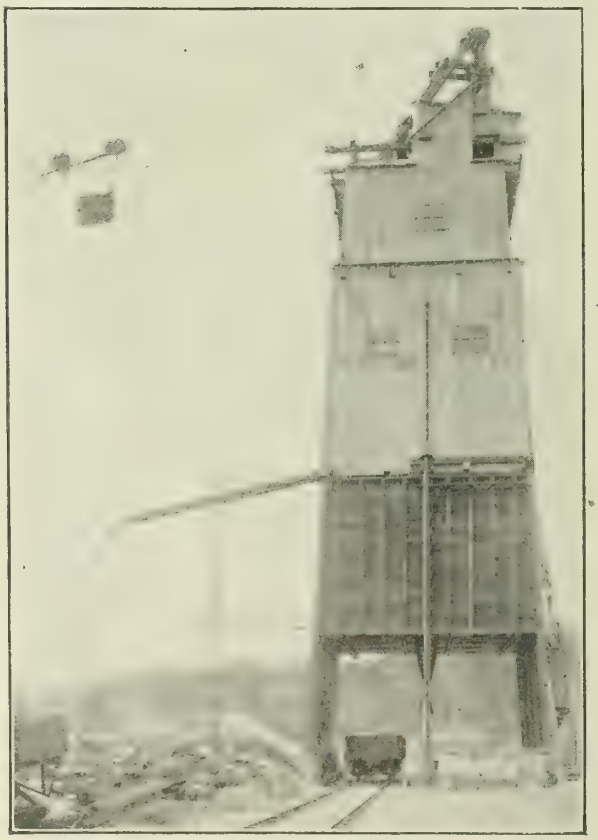


FIG. 1. SAND AND GRAVEL WASHING PLANT WITH DRAGLINE BUCKET EXCAVATOR

operations of raising and lowering the bucket and hauling it to and fro are accomplished by two drums in the tower—a two-speed drum for the traction cable and a one-speed drum for the follower. These are driven by a 75-hp. slip-ring electric motor. A 5-hp. motor in the tower drives an air compressor of the type used on electric cars, the air operating the pneumatic friction control of the traction-cable drums.

The bucket is suspended from the cable by two double sheaves running on the main cable. The forward one

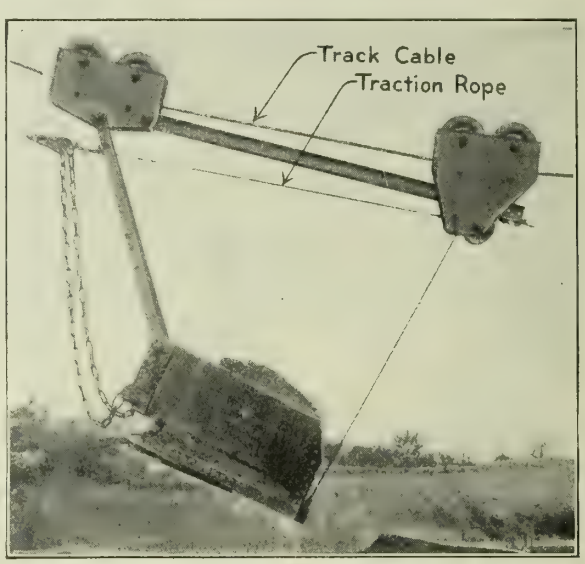


FIG. 2. DRAGLINE BUCKET, SHOWING TROLLEYS AND CABLE CONNECTIONS

is attached to the bail of the bucket and also to the end of a 6-ft. I-beam which passes through (but is not attached to) the rear sheave (Fig. 2). When the empty bucket is returning by gravity from the tower, these sheaves are at the opposite ends of the I-beam, and the bucket is balanced so as to be in digging position as it travels back to the excavation. During the digging process the pull is on the bridle chains attached at the front corners of the bucket.

When the loaded bucket is being pulled back to the tower, the strain is on an extension of the traction cable which passes over a small idler sheave in the rear sheave and is attached to the back of the bucket. As it reaches the tower, the front sheaves come in contact with a stop on the supporting cable and further pulling on the traction cable raises the back end of the bucket and thus accomplishes the dumping. This device requires no latches, and the dumping is effected automatically and rapidly. The average rate of operation is 45 round trips of the bucket per hour.

Screening and Washing the Material

The arrangement of the screens and bins is shown in Fig. 3. The gravel dumped into the hopper passes over a grizzly, or bar screen, which permits all material of less than 2-in. size to pass through onto the top one of four nearly horizontal shaking screens, as shown. The sizes of the round holes in the screens are such as to separate the materials into the following sizes: 2- to ⅜-in. for mass concrete, 1- to ⅜-in. for reinforced concrete, ⅜- to $\frac{3}{16}$-in. for roofing gravel, $\frac{3}{16}$- to ⅛-in. for granolithic sand, and everything below ⅛-in. for building sand.

The oversize material runs over the grizzly bars into a hopper and thence to a crusher, after passing which it is delivered to the top deck of the horizontal screens. Any material that does not pass through the top screen

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(being over 2-in. size) passes off at the lower end of the screen into a chute feeding a bucket elevator which dumps it again into the crusher hopper.

When the material falls on the top screen, it is deluged with water delivered by a 25-hp. centrifugal pump running at 1,800 r.p.m. and delivering 1,000 gal. per min. The water passes through all four screens, thoroughly washing the materials and carrying with it into the settling tank everything less than ⅛ in. in size. A flight conveyor operates through this settling tank and pushes the sand forward to the high end of the tank, at the same time washing it and forcing it finally over the edge of the tank into the chute leading to the proper bin. The loam and other objectionable material pass off in suspension in the dirty water which flows over the lower end of the tank. The crusher, elevator, screens and flight conveyor are all operated by a 75-hp. electric motor.

The material retained on the various screens passes off their ends and falls into metal chutes which run to the proper storage bins below. In these chutes are tipples which permit of diverting the materials in such a manner as to make it possible to mix various sizes as

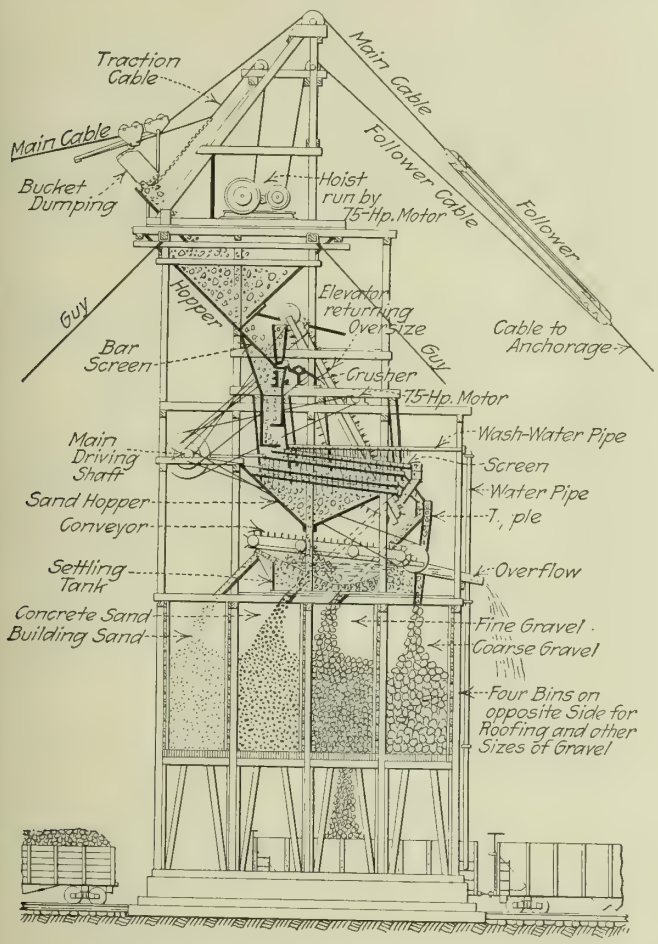


FIG. 3. SECTIONAL ELEVATION OF SAND AND GRAVEL WASHING PLANT AT LYNNFIELD, MASS.

they pass from the screens and so fill a bin with a mixture of sizes if required. Flush gates operated by hand levers allow the material in the bins to drop directly into railway cars beneath.

Excavation can be made as readily under water as in the dry, as the operator in the tower can tell from the load on the engine whether the bucket is being filled. As the excavation proceeds a trench is dug between points as near the deadman and the tower as seems safe, and to the full depth of the material. It is customary to bury a pair of deadmen about 150 ft. apart at the end of the track cable, and to attach the cable to one of these. Blocks and tackle are rigged from the cable to the other deadman, so that the line of the cable can be shifted about 75 ft. without shifting the anchorage on the other side of the tower or bringing excessive strain on the top of the tower.

This permits a wider trench to be excavated than would be possible if the main cable ran directly to one anchorage. When the trench has been excavated the two deadmen, one at each end of the cable, are moved, say, 150 ft. from their old position and a new cut is begun. The entire top of the tower above the hopper is built on a turntable, which is turned as the line of the cable is changed.

Storage and Shipping

The plant is operated by five men—one at the engine in the tower, one at the crusher, one at the screens and two repairing, cleaning and loading the cars.

In addition to the bin storage, provision has been made for ground storage of 100,000 tons of washed and graded materials. These materials are loaded on cars at the rate of 1,000 tons per day by means of a 15-ton steam-driven locomotive crane equipped with a 1-yd. clamshell bucket swung from a 50-ft. boom. The crane operates on standard-gage tracks and may be used when necessary for shifting the freight cars. The tracks, however, are on a grade so that the cars can be dropped by gravity under the bins, receive their load and pass along by gravity to the storage tracks beyond.

From this 122-ft. tower the cables can be stretched so as to permit excavation to be made at a distance of 1,300 ft., giving an available area of ½-mi. diameter before it becomes necessary to move the tower to another site. If the material is 20 ft. deep it will take 12 years of continuous operation before a plant of this capacity would have to be moved. The plant has a bin capacity of 1,300 tons and a daily production capacity of 1,000 tons. The material is a well-graded angular sand and a subangular glacial gravel; very little oversize material has been encountered.

This plant was designed by the Cable Excavator Co., of Philadelphia, Penn., and was built under the direct supervision of its Vice-President, A. D. Hadsel, who is also the inventor of the excavating bucket described. The plant is owned and operated by the New England Sand and Gravel Co., of West Peabody, Mass., the writer serving as consulting engineer for this company.

Progress of Second Simplon Tunnel—The latest report for the second Simplon Tunnel shows that the tunnel is over half-completed, the figures of completed tunnel at the end of October, 1915, being 29.9% for the south end and 25% for the north end, a total of 54.9%, according to the "Schweizerische Bauzeitung." The respective lengths are 19,431 ft. (5,924 m.) and 16,242 ft. (4,952 m.), a total of 35,673 ft. (10,876 m.). At each end four or five hundred feet more of top heading and excavation work has been done. The work accomplished during October amounted to 774 ft. (236 m.) of completed tunnel at the south end and 157 ft. (48 m.) at the north end, a total of 931 ft. (284 m.). This was accomplished with a working force in the tunnel of 628 and 90 for the two ends respectively, and outside the tunnel 212 and 79, making a total working force of 1,009. During recent months the work has been very seriously hampered by continual change of forces on account of the military draft of Italian laborers.

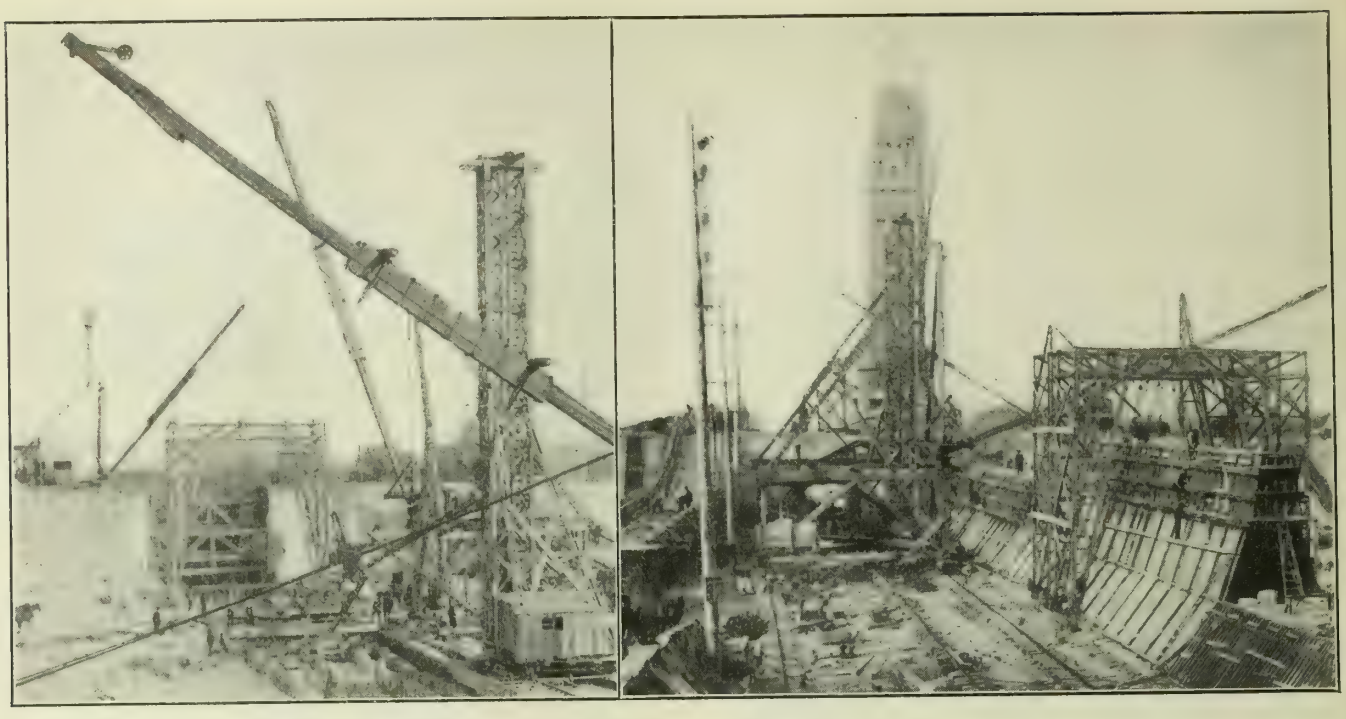


FIG. 1. CONSTRUCTION PLANT ON THE REPAIRS OF THE COMPTON HILL RESERVOIR AT ST. LOUIS

Reconstruction of a Reservoir at St. Louis, Missouri

SYNOPSIS—To check leakage from the earth-embankment reservoir at Compton Hill a new lining is being built and steel sheeting driven through the bank to rock. A new crosswall is also being built. In addition a wall will be built above the present top in order to allow of raising the water level. Concrete piles are used under the walls.

The Compton Hill reservoir at St. Louis has had considerable leakage. Within the past few years this has amounted to nearly 1,000,000 gal. daily. The loss of so much water after the expense incurred in pumping and purifying it has warranted the cost of extensive repairs to stop the leakage. No damage has been done by the escaping water, as it has been carried off by the sewers.

The reservoir is about 850x500 ft. in plan and 20 ft. deep, with a capacity of 65,000,000 gal. It is formed partly by excavation, but mainly by an embankment of stiff red clay, 20 ft. wide on top, with inner and outer slopes of 1½:1 and 2:1 respectively. A puddle wall in the bank was connected with the puddle floor. The slopes were paved with stone blocks on a layer of macadam, and the leakage was largely through this paving. A masonry crosswall divided the reservoir into two basins. This reservoir was completed in 1870.

The work now undertaken to stop the leakage includes the following: The lining of the old floor and slopes with reinforced concrete; the driving of a continuous line of steel sheeting from the top of the bank to rock; the construction of a concrete wall around the top on concrete piles and the steel sheeting; the removal of the old division wall and construction of a new concrete wall, having concrete piles and a cutoff wall extending to rock; the reconstruction of the gate chambers and erection of a new gatehouse.

In this new work the sides and the division wall will be carried up so that the water level can be raised about 10 ft., increasing the storage capacity by about 29,000,000 gal. The work is under the direction of Edward E. Wall, Water Commissioner; G. G. Black is engineer in charge of the Water Division, and F. R. Wiederholdt is Resident Engineer. The contractor is the Hiram Lloyd Construction Co., of St. Louis. The cost of the work will be about $280,000.

Construction of New Division Wall

The reservoir cannot be kept out of service for any great length of time, and the plan adopted was to rebuild the division wall at once, so that water can be stored in one basin while work is in progress on the other. The contract provided, therefore, that between Sept. 15 and Dec. 15 the contractor must reconstruct this wall and the gate chambers at each end, connect the slope and bottom paving of one basin with the wall and chambers, and make this basin sufficiently water-tight for immediate use.

The division wall, Fig. 5, is of reinforced concrete, 37 ft. high, 30 ft. wide on the base and 3 ft. at the top (4 ft. over coping). The batter decreases from 9⅜ in. in 12 in. at the lower portion to ½ in. in 12 in. at the top. Beneath the middle of the base is a 36-in. cutoff wall extending to rock at a depth of about 15 ft. This cutoff wall also extends under the gate chambers. Under each side of its base are two rows of concrete piles driven to rock. The rows are 4 ft. c. to c. and the piles in each row 3 ft. c. to c., not staggered. The construction of the foundation of the wall is shown in Fig. 3.

There are four expansion joints extending the full depth of the wall. These are spaced 129 ft. apart, the

two end joints being at the connection with the walls of the gate chambers. They are of the tongue-and-groove type, as shown, and the filling is built up of alternate layers of felt and asphalt to a thickness of ¾ in. The ends of the walls at these joints have extra vertical reinforcing bars, also horizontal bars bent to fit the tongue and groove.

The concrete is a 1:2½:5 mix, made with crushed limestone or Meramec River gravel of ¼- to 2-in. size, and sand passing a ¼-in. screen. This proportion gives 1 sack of cement to 6 cu.ft. of concrete. No crusher-run stone is permitted. The steel reinforcement consists of round rods. All wires or metal ties for securing the forms must be cut off at least ½ in. from the face of the wall and the holes filled with 1:2 cement mortar. A certain amount of the old stone blocks is allowed to be placed in the new concrete as pudding stone or plums. The remainder is crushed by a crusher erected on the floor of the reservoir for use as concrete aggregate, the contractor disposing of the screenings for street or other work. The old wall contained about 6,000 yd. of masonry, and the new one will have about 10,000 yd. of concrete.

Reinforcing the Sides of the Reservoir

The interior slopes of 1½ on 1 have a paving of 16-in. stone blocks laid on 6 in. of macadam and grouted with cement. This paving will be thoroughly cleaned and covered with 3 in. of concrete, upon which will be a waterproofing course composed of six layers of asphalt and five of felt. Upon this will be a 3-in. concrete covering, reinforced with wire netting and laid in slabs 8 ft. wide, with a horizontal joint along the middle of the slope. In order to thoroughly bond the first layer of concrete with the stone paving, some of the paving blocks will be removed (one for each 64 sq.ft. of surface), the concrete being filled into the opening to form a key, or anchor.

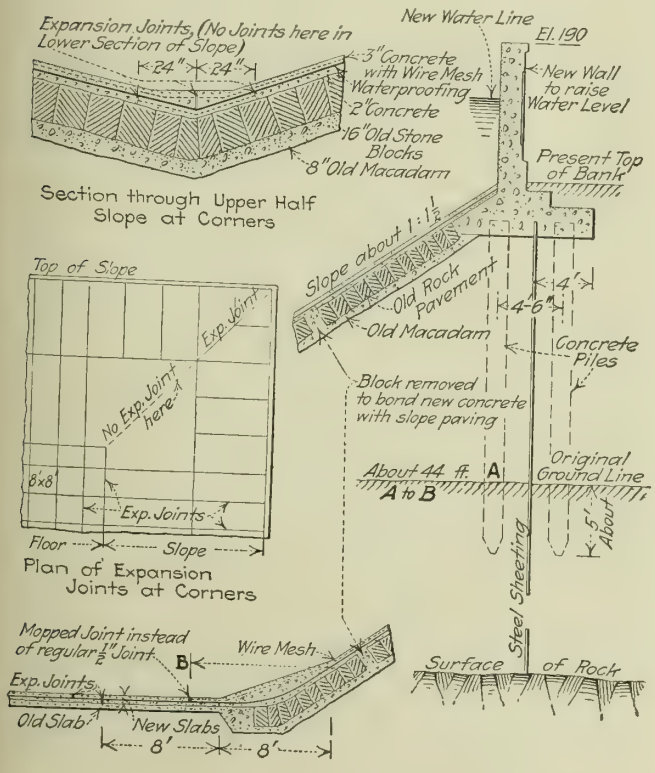


FIG. 2. SLOPE LINING AND REINFORCEMENT OF COMPTON HILL RESERVOIR

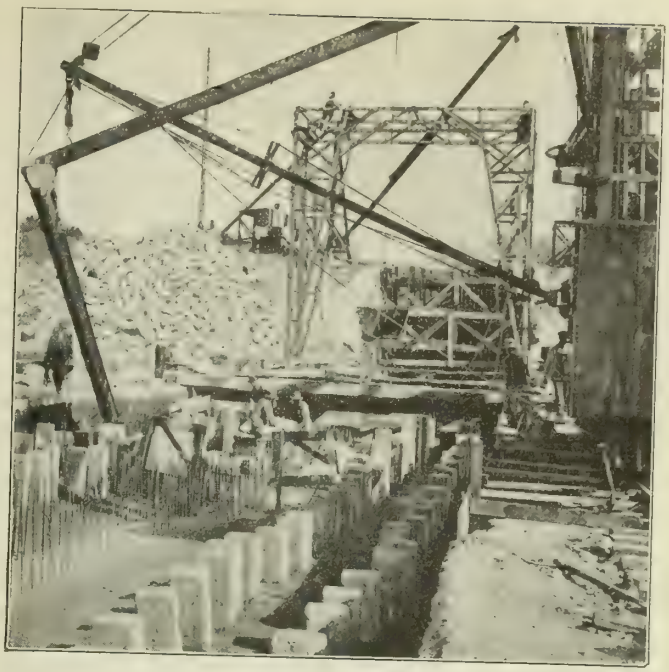


FIG. 3. CONCRETE PILES AND STEEL REINFORCEMENT FOR THE BASE OF DIVISION WALL

The four rows of concrete piles are under the footing, and the reinforcing rods project from the top of the cutoff wall which is carried down to rock. The rock pile at the left is for plums in the concrete. At the end of the wall the men are erecting the traveler for the forms. At the right is the traveling concrete plant, with boom to support the steel chutes

Fig. 2 shows a cross-section of the work and also the arrangement of expansion joints in the floor and slopes.

To prevent the escape of any water through the bank, a row of steel sheetpiling will be driven to rock, as shown. Borings were made at intervals of about 25 ft., showing minimum and maximum depths of 36 and 53 ft., the depth to rock being mainly about 40 to 45 ft. The sheeting is of the Lackawanna arch-web type, and will be driven by a steam hammer. To facilitate this work, the engineers at the site measured the piles and marked each with its length, so that they could be distributed around the reservoir according to the depths shown on the profile.

To enable the depth of water to be increased, a reinforced-concrete wall will be built around the inner edge of the bank, as shown in Figs. 2 and 4. This will be 18 in. thick, with a total height of 13 ft. (or 8 ft. above the footing). The top will be 4 ft. above the new water level. This wall will have a broad footing connected to the new slope paving and will be supported on two rows of concrete piles and the line of steel sheeting. The piles will be 3 ft. c. to c. in each row, staggered, and will be 24 ft. long, giving a penetration of about 5 ft. into the natural ground below the bank.

For this wall the concrete will be made with broken stone of ⅛- to 1-in. size. The mix will be about 1:2:4, giving 1 sack of cement to 4½ cu.ft. of concrete, while to increase the density hydrated lime will be added in the proportion of 10 lb. of lime for each sack of cement. The exterior of the wall will have a simple architectural treatment, as shown. The panels will be bush-hammered, while the remaining part of the exposed outer surface will be rubbed down with carborundum blocks and water.

In building this water-tight wall, 15-in. strips of No. 22 black sheet iron will be embedded in the concrete at all construction joints, to form effective water stops.

The original paving of the floor was of concrete slabs. These will be removed only where required to make room for the new division wall (Fig. 5). After the floor is cleaned of dirt and loose material it will be covered with two 3-in. courses of concrete in blocks or slabs about 8 ft. square, the joints of the upper course breaking joint with those of the lower. This is shown in Fig. 2. Between the two courses will be a waterproofing course similar to that on the slopes, except that pitch will be used instead of asphalt.

The gatehouse will be a concrete building 48x25 ft., over the south gate chamber. Here there will be ornamental stairways, a fountain and other features of architectural treatment. Much of this work will be of cast concrete blocks, the concrete being made with stone of ⅛- to 1-in. size (but without sand) in proportions of 1 : 3½ to 1 : 5. It is reinforced to give sufficient strength for handling and to prevent cracking. The building and decorative features were designed by Roth & Study, architects, of St. Louis.

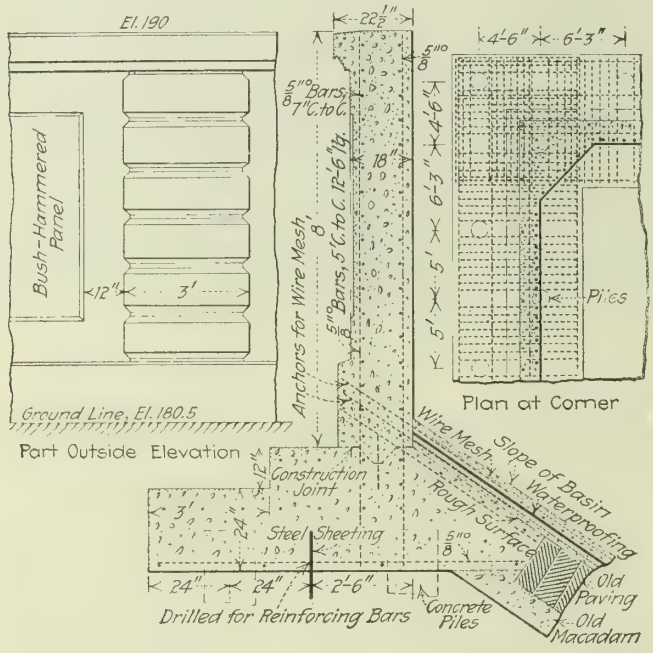


FIG. 4. NEW RETAINING WALL ON TOP OF RESERVOIR
This is bonded to the slope lining and the new water level will be 4 ft. below top of wall

Reinforced-Concrete Piles Used

The specifications permitted the use of concrete piles either straight or tapered and of any form of cross-section, provided that the surface area should be not less than that of a cylindrical pile 15 in. diameter. The contractor preferred to use straight piles, 12½ in. square, with 1-in. chamfer on the corners. The point tapers in 12 in. to 8x8 in. at the end.

The concrete is a 1 : 1½ mix, made with gravel of ¼- to 1-in. size, except that at the ends it is 1 : 3½. The reinforcement consists of six ⅝-in. bars, having the ends bent inward. These are bound by hoops ¼x1 in. about 4 ft. apart, and wrapped spirally with No. 10 wire having a pitch of 4 in., reduced to 1 in. for 18 in. at each end. The bars are wired to the hoops and spiral. They are 1 ft. shorter than the pile, and no reinforcement must come within 6 in. of the head of the pile. These piles will be driven by steam hammers, cushion caps being placed on the heads of the piles.

The concrete piles are made in a yard at the foot of the bank of the reservoir. At one end is a ½-yd. concrete mixer, from which the concrete is delivered to the pile forms by wheelbarrows. Then comes a platform on which the piles are cast and which is long enough for seven rows of 23-ft. piles, with ten in each row. At the other end of the yard is the storage space, where the piles are stacked horizontally while curing.

The platform is heavily built and carefully leveled, so that the piles can be cast directly upon it, and only side forms are required. These are of wood and are used several times. An iron cap, however, is used for the point. The bending of the bars is done by hand. For placing the hoops and wire wrapping, the six bars are fitted to two disks on a long pipe supported on horses and turned by a crank handle at one end. This plant can make 40 piles per day.

The piles remain in the forms for 24 hr. (48 hr. was allowed at first) and are then picked up and removed to the storage stacks by a traveling gantry which spans the yard. This gantry consists of an I-beam of 32-ft. span supported at the ends on timber A-frames 16 ft. high, each mounted on two wheels. On the I-beam runs a trolley hoist carrying a swing beam having chain slings. This gantry is moved by hand. The piles are held at least 30 days for curing and are sprinkled twice daily.

Construction Plant and Methods

The first part of the work, as noted already, was the reconstruction of the division wall and the gate chambers at its ends. This work had to be done rapidly, as explained.

The old stone masonry was drilled by hand, 6-ft. holes being put down by "jumping" long drill rods. Light charges were fired at the end of each shift. The masonry thus thrown down upon the floor was removed in various ways—by a small flat-car on an industrial railway, by stone boats with teams, by chains handled by teams or derricks, and especially by the use of two light steam shovels. These shovels also rooted up the old concrete footing.

Part of the stone was piled for use as plums in the new concrete wall, and part of it was hauled by stone-boats and dump wagons to a stockpile adjacent to a crusher and screening plant erected on the floor of the west basin, in connection with the concreting plant. The earth and rubbish were hauled away in dump carts and used for filling vacant lots owned by the contractor within a few blocks of the reservoir. Screenings from the stone crusher were removed in the same way and used for filling or sold for street-repair work.

For bringing in supplies and hauling away material, two inclined roadways of 12% grade, supported on timber trestling, were built from oposite sides of the bank down to the floor of the reservoir. Loaded wagons were assisted up the inclines by snatch teams or by a cable from a hoisting engine. Concrete material was dumped through openings in the inclined roadways, falling into bins beneath.

For removing the old wall and handling the stone plums of the new wall there are two stiff-leg derricks, mounted on rectangular towers and having 40-ft. masts and 85-ft. booms. They travel on a wide-gage track laid parallel with the wall and are propelled by power. Between the derricks and upon the same track is the traveling

concreting plant, on a platform 14x24 ft. This carries a ¾-yd. mixer and 70-ft. elevator tower, with bucket supplying the gravity chutes. It travels the full length of the wall in about three hours. Wood forms are used, built in sections and handled by a traveler spanning the wall.

Two general views of the work are shown in Fig. 1. The view at the left shows the concreting plant and tower with one of the traveling derricks beyond it. The derrick at the left, on top of the bank, is erecting the traveler for the forms. In the other view there is one of the inclined roadways at the left, and in front of the water

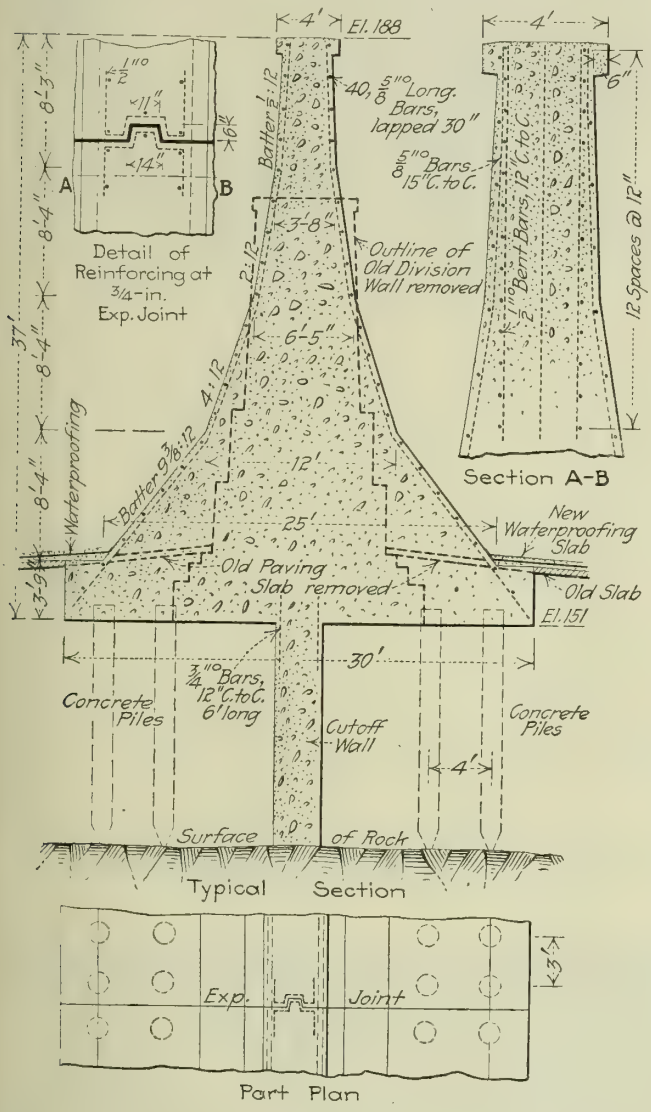


FIG. 5. DIVISION WALL, COMPTON HILL RESERVOIR

tower is the concreting tower and a derrick. At the right is the wall under construction.

The work is carried on by night and day, in two 10-hr. shifts, except that the carpenters work 8-hr. shifts. For the night work there are eight 500-watt tungsten lamps on a wire stretched over the reservoir. These give an excellent light, but during the blasting the lamps were frequently shot out.

The Bergen Turnpike, said to be the last toll road in New Jersey, has been purchased by the Bergen County Board of Freeholders. The turnpike has been owned by the Public Service Corporation, which operates a street railway on the turnpike. It extends from Hackensack to the Hudson County line. Tolls have been collected at four toll gates since 1802, and ever since then Bergen County farmers have had to use this thoroughfare across the Jersey meadows to reach the New York City markets.

A Survey Yarn from Kansas

By A. G. Barnett, Jr.*

Paul Bunyan, who worked as County Surveyor out in Kansas, had some reputation in his profession. The following is an account of a job he did for Silas Emery. Silas himself told the story to a party of Rock Island engineers who had taken refuge in his toolshed from one of the Sunflower State's justly famous summer showers.

"I hired Paul," said Silas, "to run out my north line because my neighbor was aimin' to string a fence on what I knowed was my land. They had been a stone sot twenty rod notheast o' my cow barn when the widder Smith owned the layout, but seemed as if I couldn't rightly locate the durn thing. But Paul, he had the guvment notes fer the whole county and the one west, so I knowed he could fix me up proper.

"Well, out him and his long-laigged boys come one mornin' at sun up and set out to find a monnyment to start out from, but they didn't find none till they come to the second range line east; but that there was a buffalo horn set seven inches down in gravel at the aidge of a crick, as the notes called for, so Paul he felt safe to start and they lit out. They'd chain out eighty rod after the compass was set level and the proper deeclination set off, and then Paul would pull up his instument and go whar the boys had got to and start em off agin. And then this-away, bein' right pert steppers, they seevayed them seven miles in two hours, and come to where my corner was supposed to be at. I recollect Paul he was lookin' mighty cocky when he come up to whar the last pin was stickin' in the ground.

"'Thar she be,' he sings out, 'jest six inches underground, and if you'll shove down on that there pin you can find her yourself.' Wa'll, I goes over and shoves her in clean up to the red flannel but nary stone did I tetch ner feel.

"Now Paul havin' the name he had for doing tiptop work I felt right disappointed thinkin' of him amissin' that stone, and I reckon I showed my feelin's some too. Paul, he wasn't lookin' so cocky no more neither. Never did I see a feller more put out. He reads all his guvment notes over time and agin, and him and the boys they puts down a whole raft of figgers and takes turns a addin' them up.

"Then Paul gits up and takes their sightin' pole and rams her down where the pin was settin'. Full two foot he druv that there pole down 'fore he give it up as a bad job, and set down and went to pawin' over that old yaller note book agin. 'Fore he set down, though, he allowed as how he'd give up and take to ranchin'.

"Finally I heered him snickerin' and I looked over to whar he was, and thar he set grinnin' fit to kill. 'Come here, Si,' sez he, 'and read the discripshun of this here monnyment.' Seems he had overlooked readin' that there discripshun all this time cause of it bein' over on the right-hand page with figgerin' all 'round and runnin' into it. But thar it set, writ plain enough for anybody once you noticed it. 'For the notheast corner of section 14, havin' run out of buffalo horns, I set an old grindstone purloined from the widder Smith's shed, six inches below the surface of the ground.'

"Yep, the pole Paul hed shoved down two foot was stickin' plumb through that there corner."

*Madison, Wis.

Continuous Wire Winding for Wood-Stave Pipe

A new type of wood-stave pipe has recently been developed in California and has been used in building two conduits of considerable length. Engineers everywhere are familiar with the continuous wood-stave pipe in which the staves are secured by round steel hoops meeting at a joint piece and secured by nuts. Smaller sizes of wood pipe have long been on the market in which the exterior of the pipe is wrapped with a spiral wire winding, the pipe being made up in convenient lengths with the wire winding secured at the end. In laying pipe of this latter class, joints have to be made of course between the successive lengths of pipe.

The new type of pipe is a continuous stave pipe wrapped with a continuous helical winding of wire. The wire is wound on the pipe after it is laid in place by a machine, illustrated in the accompanying cut, which winds the wire with a uniform tension and uniform pitch, both the tension and the pitch being adjustable according to the size of the pipe and the water pressure which it is to sustain.

The machine is a simple and rugged affair, and has a gear wheel which encircles the pipe and is driven through speed-reduction gearing by a small compressed-air motor. As this gear wheel is rotated around the pipe it is at the same time given a longitudinal motion along it. This rotating gear wheel carries rollers between which passes the wire to be wound on the pipe, and these rollers are adjustable to give the wire the desired tension. The wire is unwound from a reel that encircles the pipe ahead of the machine.

When a new reel of wire has to be put on, the ends of the wires are welded together by a miniature electric welder furnished with the apparatus. After the electric welding, the joint is regalvanized. The necessity for the electric-welded joint arises from the fact that in order to pass through the machine with even tension the wire must be of uniform diameter and flexibility, a result which could not be obtained with the telegraph lineman's splice.

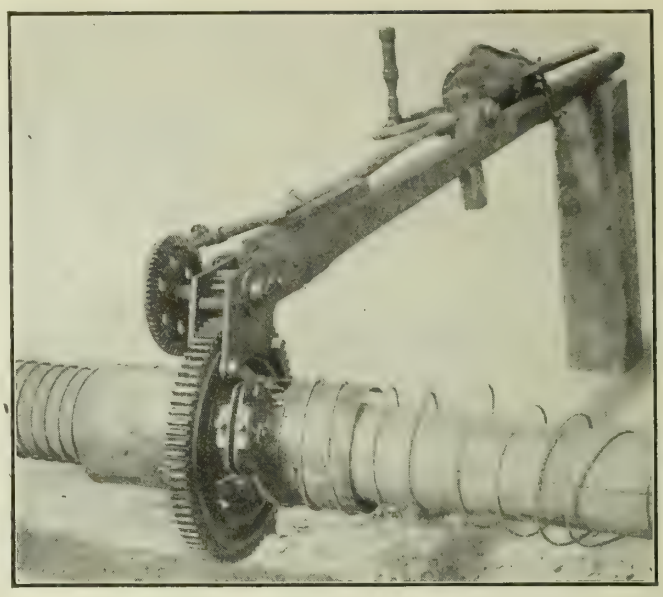


FIG. 1. MACHINE FOR APPLYING A CONTINUOUS SPIRAL WIRE WINDING TO WOOD-STAVE PIPE

After the wire is wound on the pipe and before it is lowered into the trench, the entire pipe with the wire winding is given a heavy coating of asphalt. Fig. 3 illustrates the method of applying the asphalt. A sleeve slightly larger than the pipe has elastic and flexible ends made of fabric which fits snugly over the pipe. By means of a funnel on top, this sleeve may be filled with hot asphalt. It is then drawn slowly along the pipe. It is claimed that by using galvanized wire and heavily coating the pipe with asphalt a long life for the pipe is assured.

The first pipe of this type was laid about four years ago by the Standard Oil Co., of California, near Bakersfield, to furnish a water-supply to a refinery. The pipe is 18 in. in diameter, about 2,400 ft. in length, and carries a maximum head of 60 ft. Recently a longer pipe has been laid for the California Pine Box and Lumber Co., at Delleker, Calif. This line is 6,500 ft. long, of 10-in. diameter, and is under a maximum head of 200

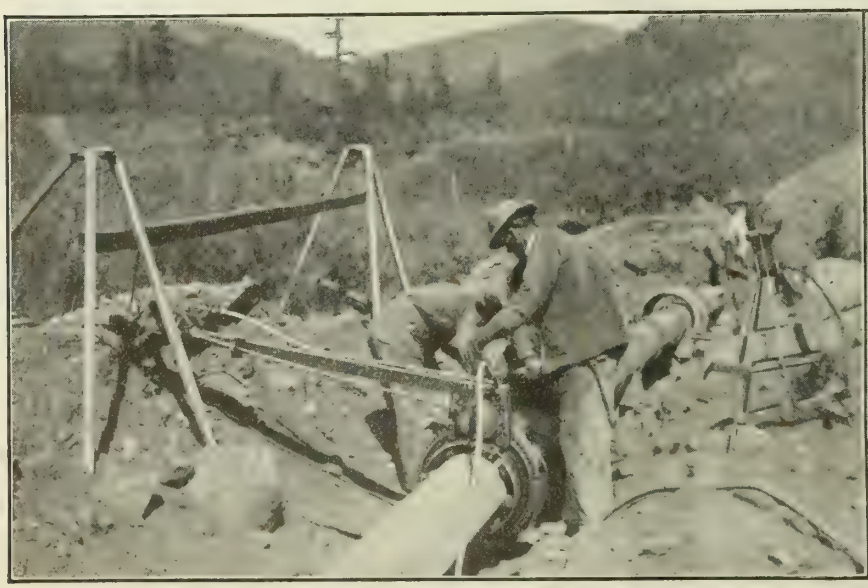


FIG. 2. LAYING A CONTINUOUS WIRE-WOUND WOOD-STAVE PIPE LINE



FIG. 3. APPLYING ASPHALTUM AFTER LAYING

Flexible hose conveys compressed air from a portable compressing outfit to the motor which drives the wire-winding machine. The portable electric welder for joining the lengths of wire is seen at the right of the left-hand view

ft. About 180,000 ft. of No. 4 galvanized wire was used on this line, and 120 welds were made. The spacing of the wire was from $1\frac{1}{16}$ to $2\frac{7}{16}$ in., according to the head on the pipe. The line was laid through very rough country, and some curves as sharp as 30 deg. were made. The pipe was laid at the rate of about 450 ft. per day.

An important advantage claimed for this pipe is its low cost, especially for pipe lines of small diameter. In comparison with wood-stave pipe made up in lengths, the entire expense of the joints is saved; and further, the staves for the pipe can be shipped at much less cost than the made-up lengths of pipe. The pipe can be bent to sharp curves as it is built up, and a great deal of expense in carrying a pipe line through rough country is saved by adapting the pipe line to the contour of the ground.

Ordinary wire of 60,000-lb. tensile strength is used, and wire of various diameters can be used according to the size of the pipe and the pressure it is to carry.

This new method of constructing wood-stave pipe is controlled by the Continuous Wire Wound Pipe Co., Room 1216, Flood Building, San Francisco, Calif.

Engineering-Education Faults

By W. M. Wilson*

Engineers feel that they are not receiving the recognition they deserve. Engineering as a profession apparently does not stand as high in the eyes of the public as do the law and medical professions. Public affairs are in the hands of lawyers, doctors and business men. Commissions, even when called upon to consider questions involving engineering problems, are seldom controlled by engineers.

Although engineers may feel that they are not getting a square deal, as evidenced by the discussions in the engineering periodicals, it is well to remember that men are appointed to commissions, not because they are doctors, lawyers, business men or engineers, but because they have seen the need of society for this thing for which the commission stands, because they are men of ability and reputation and are willing to sacrifice their time and money for the public welfare, qualities which are essential in one who would serve on a public commission.

Are Engineers at Fault?

In view of this fact, does it not seem that the fault may be with the engineer rather than with the public or the ones in power? Since engineering education, as distinguished from other kinds of education, has been in vogue about half a century, if engineers are failing to meet the standards of a learned profession, may not the fault be in their professional training?

Engineering has been defined as the utilization of the resources of nature for the benefit of mankind. In considering the education of an engineer it is this comprehensive view of his work which the writer has in mind rather than the more popular view that an engineer is a person who surveys a railroad, designs a generator, runs an engine or does any other one thing which requires a highly specialized technical training. It is the failure to understand the function of an engineer that is responsible for so many poorly planned courses of study in our schools and that is also responsible for men being classified as poorly paid engineers who are really well-paid mechanics.

University courses of study have changed rapidly. During the early part of the last century they included only the study of pure science, philosophy and literature. About the middle of the century a few schools introduced courses in applied sciences. These met with but little encouragement at first, but finally grew in popularity, until near the close of the century a huge wave of popular engineering education flooded the country. Though this, on the whole, was a good thing, it carried with it some undesirable features. Chief among these was an irresistible demand for what were spoken of with pride as practical courses. It seemed to be the prevailing opinion that in some mysterious manner a student could attain a greater proficiency in certain highly specialized mechanical processes after a few hours' practice each week for a few months than a mechanic could acquire working day after day for years.

Although trade-school training is recognized as valuable to a man who expects to spend his life as a mechanic, the better engineering schools soon realized that such work could not take the place of scientific training for the man who expected to be, not a technical expert, but an engineer in the broader sense of the word. Manual training has therefore lost its standing as a part of a university course of study, and though shop work is still given in most first-class engineering schools, it is used more to illustrate the principles of scientific shop management than to train expert mechanics.

Over-specialization a Menace

Although the danger from over-emphasis of manual training has been largely done away with, the engineering schools of today are facing in over-specialization an even more serious menace. All engineering work was originally classed as either military or civil engineering. Civil engineering was later divided into four major divisions, known as civil, mechanical, electrical and mining engineering. At the present time some of our schools, at least, are apparently vying with one another in their endeavor to subdivide each of these major divisions into the largest number of attractively named subdivisions. Some of the schools frankly admit that this is done for advertising purposes. Manufacturers, however, recognize that any advertising scheme that injures the product is poor business policy.

Schools which recognized the folly of trying to train expert mechanics are, nevertheless, now trying to do for office work what a few years ago they tried to do for shop work. A man who does the technical work in a specialized line of engineering uses certain scientific facts over and over, day after day, and becomes expert at his particular process just as a mechanic does. In a sense he is a mechanic. Although a higher order of mentality is required, it is a difference in degree rather than in kind. Given sufficient training, it is something that almost any one can do. It would seem, therefore, as illogical for universities to train expert draftsmen and calculators as it is admitted to be for them to train expert mechanics.

It is true that special training in college will help a draftsman or a calculator just as a trade school will help

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a mechanic. But although special training is helpful, a greater benefit can be obtained by devoting to other things the time required for training in a specialized line.

All the sciences have developed rapidly during the evolution in education. The pure sciences on which our engineering work is based have increased in scope many times in the last half century. The principles of economics which play such an important part in engineering in its broader sense are just beginning to be understood. Practically all successful engineers in addressing young men emphasize the value of expertness in self-expression, but practically none dwell upon the necessity for technical training. With all of the wealth of knowledge useful in all human activities that is available it would seem to be the height of folly to spend any part of a student's time on a special line of work. The routine duties of specialized industries can best be learned in commercial life. But if science and literature are neglected in college they are not likely to be courted in after life in a busy world.

How to Produce Broad-Minded Men

If after half a century of engineering education the most severe and insistent criticism of our engineers is narrowness, then the training of engineers should be changed so as to produce broader-minded men. If our engineers can build good railroads, but fall short of the highest success because they fail to see the relation between a railroad and the development of a new territory, then let us teach less of bridge design and railroad surveying and more of economics. If our engineers can design and construct an efficient sewer system, but cannot induce a community to install it, then let us teach less of sewer systems and more of sociology. If our engineers are intensely interested in equipment for factories, but are indifferent to the happiness of their families and the health of their employees, then let us teach less of machine design and more literature, philosophy and sociology. A man cannot lightly claim membership in a learned profession if he cannot see beyond the technique of his work.

The argument that a specialized course fits one for his lifework does not hold. In most cases boys do not know what line of work they want to follow. The selection of a university course is often based upon a mere whim, and seldom is the choice made on a basis of solid facts and sound reasoning. A special course is as likely to cause a student to persist in a line of work for which he is not fitted as it is to fit him specially for his career.

Some men may be so fortunate as to be able to pick their job upon graduation, but more often the line of work one enters is determined by the kind of job he can get. Nearly all men have to shift a few times before they find the line of work for which they are best suited. There is a striking illustration of this fact at the University of Illinois. Of six men in the Civil Engineering Department having professorial rank, only two have taken a course in civil engineering.

It is evident that all advantage to be gained by specialization in an undergraduate course is lost in this adjustment. Moreover, observations show that where engineering graduates and graduates of science or literary courses work together, any advantage which the former may have immediately upon graduation is soon lost.

Engineering covers a broad field and requires, not a special knowledge, but a broad view and sound judgment. It is true that many parts of an engineering project require for their execution men having highly specialized technical training. But all of these processes are based on much the same fundamental scientific principles. Because of their universal applicability, these principles should be known by all engineers and therefore may properly be a part of a university course. Each of the highly specialized processes, on the other hand, is used by comparatively few, and can best be learned by daily repetition in commercial work. Training in these processes should therefore form no part of a university course. An engineer in the broader sense is a man who can conceive a project, have it financed and then organize an army of workmen to carry it out. One of these three functions is as important as another. The graduate who will develop into this type of man is what our engineering schools should produce. He is more likely to be produced by a broad training in science, art and literature than by a narrow specialized training in technical subjects.

A school should be interested in the career of its alumni fifteen or twenty years after graduation rather than in a meteoric success during the first year or two. This fact is becoming more and more realized; eventually it will predominate. When that time comes the courses of study in the universities, which originally included only pure science, literature and philosophy, which were later flooded with manual training, and which now are made up largely of highly specialized subjects, will then return to almost their original state. They will, however, contain a more constructive knowledge of literature and a greater wealth of science. Moreover, instead of the application of the sciences to the problems of engineering, the principles governing the application of the sciences will be emphasized.

New York State Barge Canal Prospects—The eastern half of the Erie Canal and the Champlain Canal have each a single unfinished and unawarded contract which has been the chief obstacle to the entire completion of its respective section. By letting these contracts, together with one or two bridge contracts, and by pushing work on them and on the few other contracts which are under award but not quite completed, it is expected that one season's time will be all that is needed to finish the Champlain Canal and also a channel from the Hudson to Lake Ontario by way of the Erie and Oswego branches. The Erie Canal west of the Oswego junction contains several uncompleted portions. Here legal complications are largely responsible for the unfinished condition. There are numerous railroad crossings and these have proved to be very troublesome from the standpoint of the state, both because of delays in coming to agreements with the railroad companies and on account of the slowness in performing the work in such manner as not to interrupt traffic. Because of the amount of work still to be done and the number of crosings still to be made, it is anticipated that two seasons will be required to complete the western half of the Erie Canal. The State Engineer intends to do his utmost to have all uncompleted work under contract at the earliest possible moment, so that the state may no longer than necessary be denied the benefits of the completed waterway and meantime may utilize its finished parts. Thus he will justify his prediction that the Champlain Canal can be completed in one year, as can also the canal between Waterford and Oswego and the branch into Cayuga and Seneca lakes, and that the balance of the canal through to Buffalo can be finished in two years. To do this, however, it will be necessary for the legislature at the beginning of its session and as one of its first acts to make provision for the immediate issuing of the bonds authorized by the vote of the people at the last election, in amount $27,000,000.—From "Barge Canal Bulletin," November, 1915.

Surface-Water Investigations; U. S. Geological Survey

By John C. Hoyt*

The determination of the quantity of water in the surface streams of the country forms the principal work of the surface-water division, water resources branch, United States Geological Survey. For carrying on this work, in addition to the central office at Washington, 15 districts have been established on the mainland of the United States and one for the Hawaiian Islands. Each district has a local office, as noted in the list, with a district engineer, an office engineer, an office clerk and one or more engineering assistants. The total number of men regularly engaged in the work averages about 80.

Division Offices

The districts and their respective offices are as follows: New England, Custom House Building, Boston, Mass.; New York, 19 Federal Building, Albany, N. Y.; Northern Atlantic, United States Geological Survey, Washington, D. C.; Southern Atlantic and eastern Gulf, 305 Federal Building, Atlanta, Ga.; Ohio River, United States Geological Survey, Washington, D. C.; Upper Mississippi River, care of Railroad Commission, Capitol Building; Madison, Wis. (Sub-office: Old Capitol Building, St. Paul, Minn.); Missouri River, Montana National Bank Building, Helena, Mont.; Rocky Mountain, New Federal Building, Denver, Colo.; Great Basin, 421 Federal Building, Salt Lake City, Utah; Washington, 406 Federal Building, Tacoma, Wash.; Oregon, 416 Couch Building, Portland, Ore.; California, 328 Custom House, San Francisco, Calif.; (Sub-office: 619 Federal Building, Los Angeles, Calif.); Arizona, 417 Fleming Building, Phoenix, Ariz.; Texas, Old Post Office Building, Austin, Tex.; Hawaii, Kapiolani Building, Honolulu, T. H.

At the end of the fiscal year, June 30, 1915, there were 1,394 stream-measurement stations being maintained. During the year 282 new stations were established, and 260 stations were discontinued. The observations at these stations are used in computing the daily flow of the streams. For obtaining gage heights 375 of the stations are equipped with water-stage registers which give a continuous record of the fluctuations. The remainder are equipped with staff or chain gages from which daily fluctuations are determined by one or two readings made each day by a local observer. The automatic gages are also frequently inspected by local observers. The type and number of gages are as follows: Stevens graph, 172; Friez graph, 81; Gurley graph, 10; Gurley printing, 28; miscellaneous, 84.

During the last fiscal year 7,241 measurements of discharge were made at the regular gaging stations and 983 at miscellaneous points, or an average of 6 discharge measurements for each gaging station.

In carrying on the work during the fiscal year nearly $220,000 was expended from the district offices, as follows: Federal appropriation for gaging streams, $77,751; coöperation from Federal bureaus, $31,508; coöperation from state organizations, $94,193; miscellaneous coöperation, $16,169. A detailed cost-keeping system is maintained for all expenditures. The basis for this system is a charge sheet accompanying each voucher, on which the amount indicated on the face of the voucher is divided among the various cost-keeping items under the following general headings: operation and maintenance; construction; office work; top cost; nonexpendable property. The first two items are subdivided under services, labor, transportation, subsistence and materials.

From the charge sheets, expenditures on account of the various projects are posted on the cost sheet for that project. The following data in regard to costs, as shown from the annual cost-keeping summary for last year, are of special interest: Average cost of maintenance per station for a full year, $188.06; average cost per month's records, $15.69; operation and maintenance, 49.4%; construction, 12.1; office work, 19.1; top cost, 16.6; nonexpendable property, 2.8.

The above costs include only the expenditures in the district offices and not those in the Washington office, where general administration is carried on and the data are finally checked and prepared for publication.

In the execution of the work all processes have been standardized as far as possible. Each district office uses the same filing systems and in general follows the same methods. Standard equipment has been adopted and is furnished the various district offices from stock maintained in the Washington office. By this means a large saving is made as the cost of special material made locally in small quantities is usually excessive. The standards are maintained by thorough inspection and by annual conferences of the district engineers.

Publications and Coöperation

The results obtained are published annually in a series of water-supply papers, under the general title of "Surface Water-Supply of the United States." For convenience in the publication and use of the records, the United States has been divided into twelve sections, as follows, and a separate report is published for each: (1) North Atlantic coast (St. John River to York River); (2) South Atlantic coast and eastern Gulf of Mexico (James River to the Mississippi); (3) Ohio River; (4) St. Lawrence River and Great Lakes; (5) Hudson Bay and upper Mississippi River; (6) Missouri River; (7) Lower Mississippi River; (8) Western Gulf of Mexico; (9) Colorado River; (10) Great Basin; (11) Pacific Coast in California; (12) Northern Pacific drainage basins. Water-Supply Papers 351 to 362, which contain the data for 1913, comprise over 3,300 pages, of which about 80% is tabular matter.

The district offices serve not only as headquarters for carrying on the work, but also for the general use of the public. Complete files of data and publications are kept and are much used by engineers and others who are interested in the water resources of the area covered by the district.

As indicated by the large amount of coöperative funds received from State organizations, State interest in the work is large. During the last year there was coöperation in Arizona, California, Colorado, Connecticut, Idaho, Illinois, Kentucky, Iowa, Maine, Massachusetts, Minnesota, Montana, Nevada, New Mexico, North Dakota, Oregon, Utah, Vermont, Washington, West Virginia, Wisconsin, Wyoming and Territory of Hawaii.

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Massachusetts Experimental Concrete Pavement

In response to an inquiry, W. R. Farrington, Division Engineer, Massachusetts Highway Commission, Middleboro, Mass., has furnished the following information regarding an experimental concrete road recently constructed in the town of Randolph, about 12 mi. from Boston. This section of road is 9,563 ft. long, and the concrete surface is 18 ft. wide (with rounded edges), 8¼ in. thick in the center and 6 in. on the sides. The surface has a crown of ¼ in. to the foot. The subgrade (transversely) is level.

The concrete was mixed in the ordinary proportions of 1:1½:3 with crushed stone, but 8% of hydrated lime was added to and mixed with the cement before placing in the mixer. The lime was used to form a denser mixture, with the expectation that such a mixture would be more impervious to water than the ordinary mixture and thus less subject to frost action. It is also claimed that the lime aids in retaining the moisture and tends to prevent the outside of the mass from setting more quickly than the inside. As far as the handling is concerned, the only difference noted was that the addition of the lime somewhat retarded the setting of the concrete.

The concrete was mixed in a self-propelled batch mixer equipped with boom and bucket, so that concrete could be deposited in place without rehandling or the use of a chute. Steel forms set to line and grade were used, and the edges of the concrete were rounded with a tool to a 3-in. radius after the concrete had partly set. This has been found more satisfactory than beveling the edges of concrete by the use of a strip fastened to the forms.

The concrete was leveled with shovels, slightly tamped, and struck off with a sheet templet made of angle iron, the ends of templets resting on the forms when in use. After the use of the templet the surface was floated with a long-handled float—the float being about 12x24 in. and the handle set at an angle of about 45°—and finished with an ordinary small wooden hand float. Where armor plates were used at the joints the surface was floated over the joints. On the remainder of the road the surface at the joints was finished with a special split-float.

The surface was not broomed, although some of the concrete surfaces previously constructed by the Massachusetts Highway Commission have been broomed enough to roughen the surface slightly. Brooming, although affording a somewhat better footing for horses, has caused considerable complaint from users of motor vehicles.

The concrete while setting was protected first by canvas covering and later with hay, which was kept wet for about two weeks. On concrete road work in this state both sand and hay have been used for covering. The sand generally has been found preferable if obtainable at a reasonable cost, although the hay ordinarily gives satisfactory results.

On most of the road the transverse expansion or contraction joints were spaced 30 ft. apart, but on one section a 100-ft. slab was tried, it being thought that possibly with a mixture containing lime the joints could be spaced farther apart. Genasco filler and three-ply asphalt roofing paper were used in the joints—the filler (⅜ or ½ in. thick) being used at about every third joint and the paper in the remainder. On a section about 700 ft. long, armor plates were used at the joints.

Several different brands of cement were used and the aggregate was broken stone passing a 1¼-in. screen but retained on a ½-in. screen. The sand was rather fine, but sharp and within the standard specifications for such work.

In making the concrete the batch was turned from ¾ to 1½ min., the mixer making from 7 to 14 revolutions, depending on the conditions.

The cost of the concrete surface, including all materials, was $1.29 per sq.yd., or $6.46 per cu.yd.

The Central Railway Station at Tokyo, Japan

By Charles Potter*

In the City of Tokyo, now said to be the third largest city in the world, there has recently been completed a railway station of a size and elaboration favorably comparing with the recent large stations of the United States. The Japanese railroads, all under governmental ownership, center in the capital. There have been heretofore three separate stations for each of the three main lines converging at the city. In the interest of efficiency and convenience it was decided in 1908 to centralize the terminals and to bring all of the tracks into one union station. The



FIG. 1. TRACKS AND TRAINSHEDS UNDER CONSTRUCTION AT THE NEW STATION IN TOKYO

completed building, shown in Fig. 2, and a great deal of adjoining track and bridge work were completed last year.

The station was designed and erected under the direction of Kingo Tatsuno, an architect who studied for many years in the United States. It is 1,104 ft. long, from 66 to 132 ft. wide, and 54 ft. high in the main building, with domes at each end 152 ft. high.

The foundation is of concrete resting on wooden piles of an average diameter of 7 in., and from 18 to 24 ft. in length. They were all driven by hand, from eight to ten men and women being employed in driving each one; the average time of driving one was one-half hour. These piles were driven 2 ft. apart, and the tops after driving were 12 ft. below ground level. On them was placed 4 ft. of concrete, and the side and other walls were carried up to grade.

The building is of light steel-frame and reinforced-concrete construction, being faced with brick and trimmed with a fine quality of granite which is dressed to perfec-

*Tokyo, Japan.

tion, no better cut stonework being done in any portion of the world.

There are four front entrances; a center entrance for the exclusive use of the imperial household, a second at one end for incoming passengers, a third at the other end for outgoing passengers, and a fourth smaller entrance for urban electric-car passengers.

Ample provisions are made in the building for all classes of passenger traffic, and all are provided with waiting rooms, toilet and smoking rooms, restaurants and dining rooms. The ground floor is entirely for passenger traffic; the second floor is for dining rooms, restaurants and hotel accommodation in that part south of the imperial entrance, while that part north of the imperial entrance will be used for department offices and other work officially pertaining to the Department of Communication, as will all of the third floor.

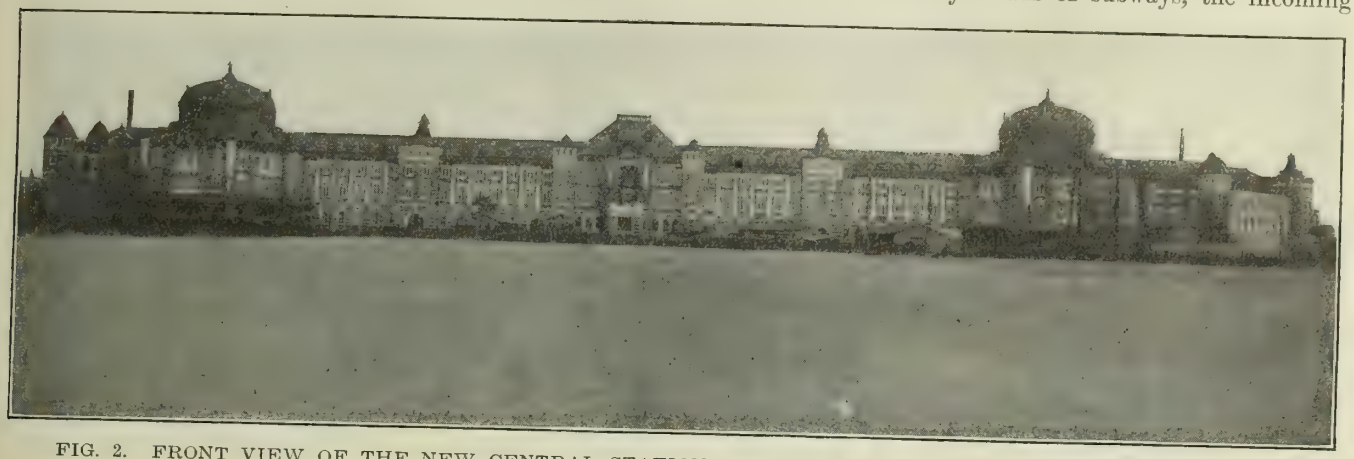


FIG. 2. FRONT VIEW OF THE NEW CENTRAL STATION OF THE IMPERIAL GOVERNMENT RAILWAYS OF JAPAN AT TOKYO

The interior finish of all parts of the ground floor except the imperial suite has wainscoting of marble and artificial stone, and the rest of the side walls are of wood. The ceilings are of Japanese plaster and decorations. The imperial suite is very handsomely decorated by the most eminent artists of Japan, the finish being in marbles, mosaics, rare woods and precious metals, the inlaid work being especially worthy of the highest praise. These rooms are entirely separated from the rest of the rooms, and none but members of the imperial household and their intimate attendants are ever allowed to enter them.



FIG. 3. CONCRETE RETAINING WALL, 1,600 FT. LONG, 39 FT. HIGH

No mechanical power was used in the construction of this wall. All concrete was wheeled in barrows up inclines similar to the one shown.

Baggage, delivery, telephone and telegraph rooms, cloak rooms and parcel rooms, and in fact all accommodations to be found in the best of modern passenger terminals have been provided, as it has been the aim of the department to construct a building and station second to none in the world and fully equipped in every particular for its purpose. The building is lighted by electricity and heated by steam, equipped with American elevators and planned on a basis of American efficiency. It is a credit to the people and the country.

The tracks and platforms are all elevated; access to and exit from them are by means of subways, the incoming and outbound platforms being entirely separate from each other, as are also the inbound and outbound urban-passenger platforms. A view of the track sheds is given in Fig. 1.

The cost of the building has been $1,350,000; the time used in building, estimated in days' labor, the usual method employed by the Japanese, mounts up to 730,000 laborer-days.

An average of 125,000 passengers will use this station daily, and the station master receives the magnificent salary of $60 gold per month. Common laborers on the building received 20c. per day of 10 to 12 hours, carpenters and masons $15 per month, and all other labor was paid in proportion. Very little power except human muscle was used in this work. In the wall shown in Fig. 3, for instance, all of the concrete was mixed by hand and wheeled in barrows up the inclines shown, even though the maximum height of the wall was 39 ft. In all of the bridge work, for grade crossings, no hoisting engines were used, although the heaviest girder reached 40 tons in weight.

The Deepest Well in the United States is said to be the 7,181-ft. well recently put down at McDonald, Penn., for the People's Natural Gas Co., of Pittsburgh, Penn. It ranks next to the 7,300-ft. well in Galicia, which is the deepest in the world. The diameter is 13 in. at the top and is reduced gradually to 5 in. at the bottom. The total weight of casing is 45 tons. A special feature is that the 22-ft. sections of casing were welded together by the oxyacetylene process of the Oxweld Acetylene Co. Two sections were welded on the ground, and the 44-ft. section then hoisted and welded to the top of the casing already driven, when the latter was about 5 ft. above ground. The casing was supported by clamps during the process, and these were not released until the weld was cool. The edges of the pipe were chamfered at 60° to give a deep and wide weld. Special precautions were taken to have the new section in exact alignment with the casing already driven. The welding took about 25 min., and 15 to 20 min. were allowed for cooling. The stress on the joints was relieved by putting a plug in the lower end of the casing so that the water in the well (under pressure) would support the casing. This was drilled out when the well was completed.

Cableway and Railway for the Ascent of Mont Blanc

Two projects are under way for railway lines which will eventually give access to the summit of Mont Blanc, the most notable of the Alpine peaks, and both of these are completed for the lower portion of the route.

The present line extends from Chamonix, Switzerland, for about half the full distance and ends in a steep-grade cableway to the summit of the Aiguille du Midi. The first two sections extend from Chamonix (3,280 ft.) to La Para (grades 15 to 60%) and to the Bossons glacier (average grade 65%), ending at an elevation of 8,202 ft. On these sections the cable is approximately parallel with the ground and is carried by steel towers or bents 33 to 80 ft. high, 132 to 295½ ft. apart; there are two spans of 657 ft. The next two sections are much steeper, with grades of 60 to 85%, and end at the Col du Midi (11,483 ft.).

The last section ascends to a bench about 160 ft. below the top of the Aiguille du Midi, the summit elevation of the line being 12,631 ft. From this, a line is proposed descending to the White Valley (11,693 ft.), where a pleasure resort may be established. The actual summit of Mont Blanc is at 15,974 elevation. The steep grade sections are very similar to the cableways ascending the Wetterhorn and the Bauerkohlern, several illustrations of which are on the opposite page.

Each car will be carried by a single cable (*A*, Fig. 2), instead of two cables, as originally proposed, as experiments have indicated the difficulty of distributing the load equally on two cables. The cables will be $2^{55}/_{64}$-in. diameter, composed of ⅛-in. wires of crucible steel and having a weight of 11¼ lb. per ft. The tension device (with a 25-ton weight) is placed at the lower end of the incline, and is connected to the cable by a chain; two safety anchor cables are attached to the end of the main cable to prevent accident if the chain breaks.

There are two cars on each section (one ascending as the other descends), operated by the wire hauling cable *B*, $1^{5}/_{16}$-in. diameter, weighing 2.24 lb. per ft. and having an ultimate tensile strength of 135,000 lb. A similar cable *C* is provided for braking; a clamp brake *D* grips this if the hauling cable *B* should break. This brake is operated through the pull on the tail rope *D*, releasing a tripping gear which operates the tension rod *F*. The top of the suspension frame of the car is shown at *G*. At the lower stations the hauling and brake cables pass over large guide sheaves and then around the end pulleys, which are connected to the tension device. The driving gear and pulleys are at the upper station. All the cables and connections are designed with a factor of safety of 10.

Each car can carry 24 passengers (18 seated) and weighs four tons with full load. It is attached to an overhead truck running on the main cable, as shown in Fig. 2. The truck has four grooved wheels carried in two separate frames *H*, with holding-down springs and mechanism *J* to prevent the wheels from getting off the

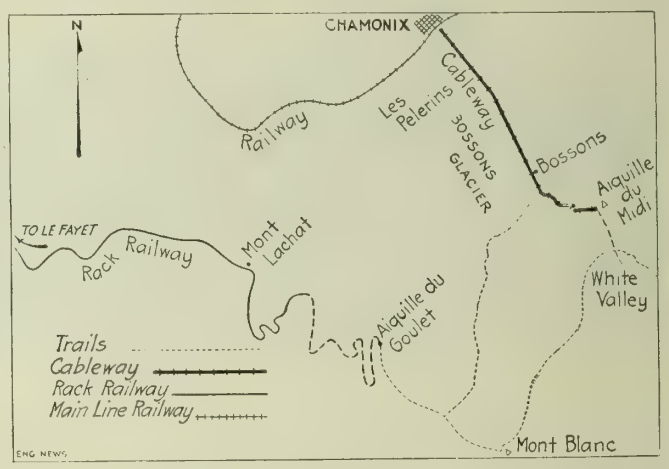


FIG. 1. ROUTES OF CABLEWAY AND RACK RAILWAY

cable. The guide sheaves *K*, beneath the carrying cable, engage it when the journal boxes of the truck axles reach the bottom of the vertical slots *L* in the pedestals. The distance between the cable and the guide sheaves is necessary to clear the cable supports on the towers. The speed will be about 500 ft. per min.

A government concession for a rack railway from Le Fayet to the summit of Mont Blanc was granted in 1904, and the first section was opened in 1909. The lower end is at an elevation of 1903 ft., and the section to the Gouter Summit is 11½ miles long, with a rise of 10,630 ft. The line is operated by steam locomotives at present, but is intended for electric operation. It has a gage of 3 ft. 3⅜ in., and its sharpest curves are of 164 ft. radius. It is laid with 40½-lb. rails, with 12 steel ties to a rail length of 34 ft. 6 in. The rack rails are of the Strub type, in lengths of 11 ft. 6 in. The last section, to the summit of Mont Blanc (15,800 ft.), will be 2½ miles long, with four tunnels aggregating two miles.

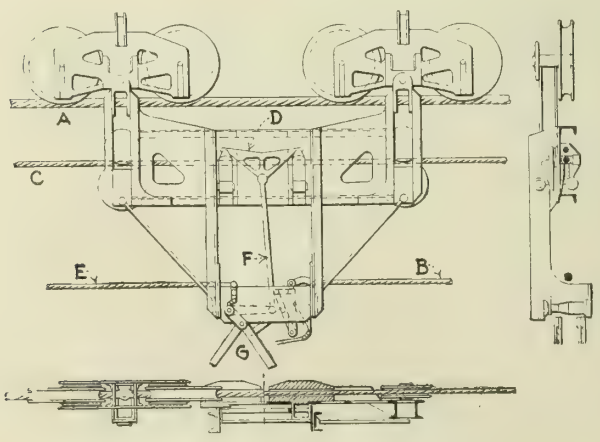


FIG. 2. CARRYING TRUCK OF CAR

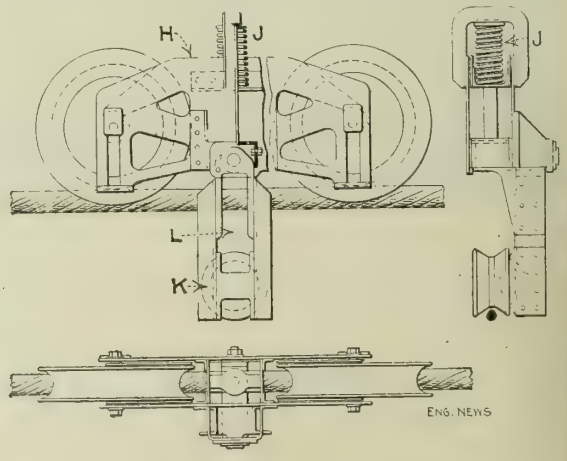


FIG. 3. DETAIL OF RUNNING GEAR

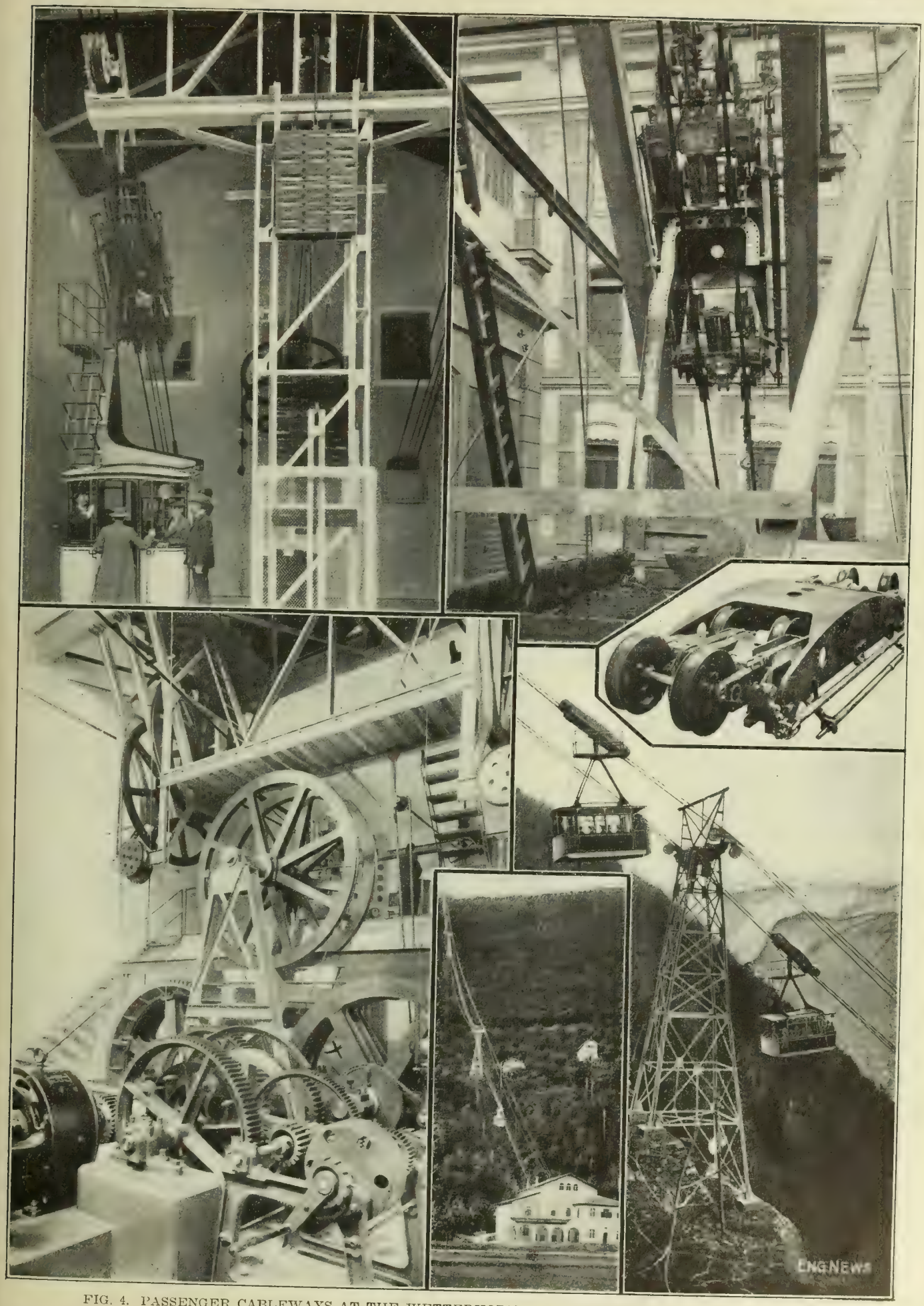


FIG. 4. PASSENGER CABLEWAYS AT THE WETTERHORN AND BAUERKOHLERN, SWITZERLAND

Meridian Park Retaining Wall at Washington, D. C.

Retaining-wall construction of somewhat unusual layout and rather ornamental design is now under way as a part of the new Meridian Park at the northern part of 16th St., Washington, D. C. The site is a sharp elevation of ground rising some 250 ft. above the general city level, where many years ago there existed a standpipe which supplied part of the City of Washington with water. Through the hill ran the Washington meridian, which at one time was used as a datum for observations in this country, and therefore the place received the local name, Meridian Hill. About 20 years ago the extension of the city led to the cutting of 16th St. through the hill, and that street, while still on a rather severe grade, is now from 30 to 40 ft. below the top of the hill, the cut being in a stiff clay which stands almost upright even after the many years since the cutting.

On account of the sightliness of the location and the growth of the high-class residential district in this direction, the government a few years ago purchased the city block comprising most of the hill. This block extended from W St. at the south to Euclid St. at the north and from 16th St. on the west to 15th St. on the east, being about 500 ft., 300 ft., 1,400 ft. and 1,400 ft. on these four respective sides. It is the intention to build here an elaborate park of the formal type, that is, heavily wooded, with gardens, walks, colonnades, fountains, waterfalls, etc. As a part of this work, which is expected to extend over a number of years, the retaining wall on the 16th St. side is now being built.

As shown in the drawing in Fig. 1, the wall is in two sections, partly to avoid the necessity of so high a wall as the total cut would require and partly in order to permit between the two walls a wooded interval which will obscure from the street the possibly offending expanse of the continuous upper wall.

The lower wall is about 1,303 ft. long, there being several gate and stairway openings besides this length, and it varies in height from 7 to 10 ft. It is divided into panels about 29 ft. long, the coping for each panel being level and the next higher wall rising in step fashion to conform with the grade of the street. Fig. 2 shows one of the completed panels. As shown in the section in Fig. 1, the wall is of the gravity type, reinforced slightly in the front and doweled to the continuous base. The panels are first cast with the reinforcing rods extending

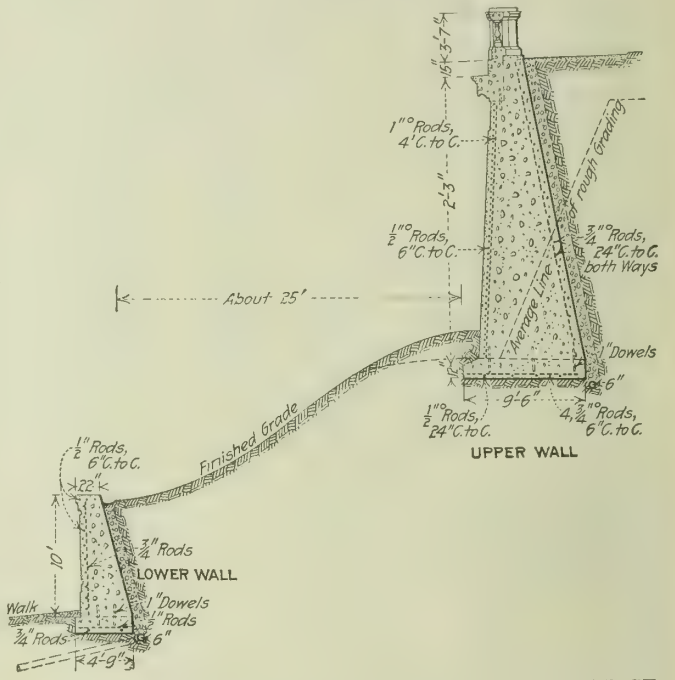


FIG. 1. SECTION THROUGH TWO WALLS ON 16TH ST. SIDE OF MERIDIAN PARK, WASHINGTON, D. C.

out into the pilaster space, and the pilaster is then poured after the wall section is completed.

After some experimenting both in drawings and on an actual section of the wall, the paneling shown in Fig. 2 was decided upon. The rough part of the main-wall section is a scrubbed pebble surface, and the smooth ribbon intermediate parts are rubbed to obtain that appearance. The pilasters, which are also an exposed pebble aggregate scrubbed to obtain a roughened surface, are

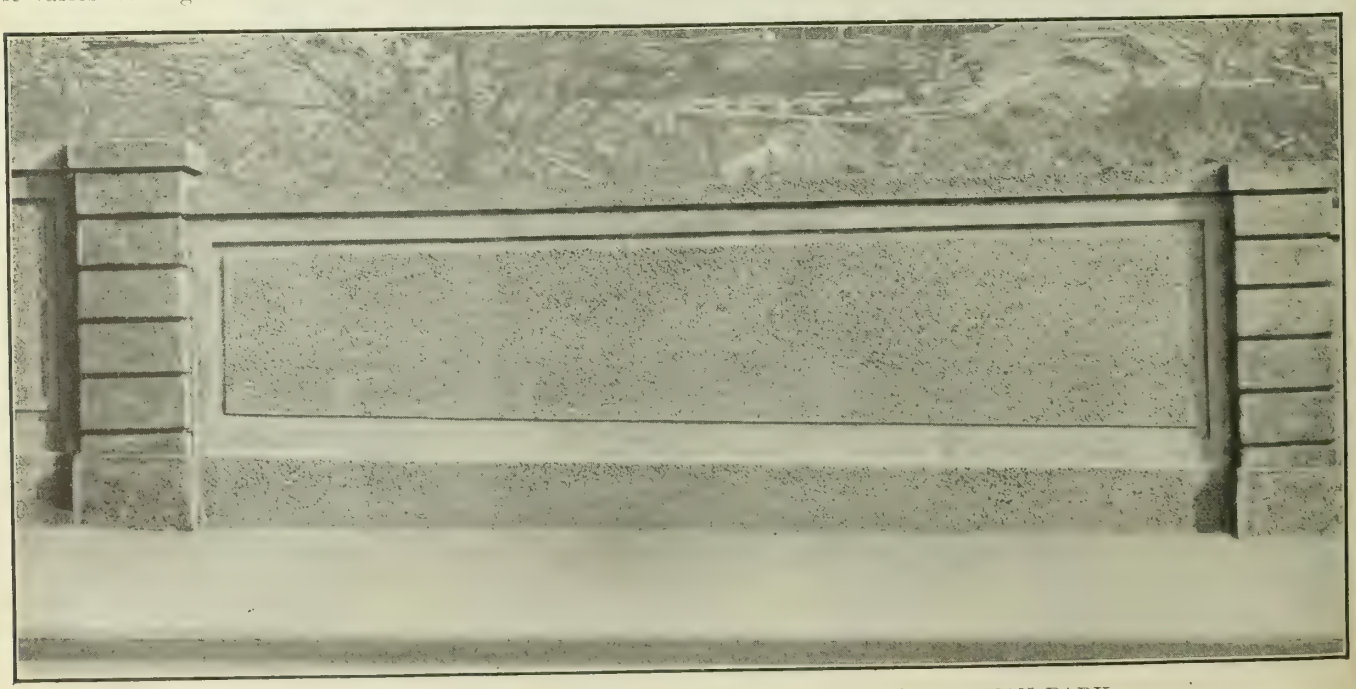


FIG. 2. NEAR VIEW OF A PANEL OF LOWER WALL AT MERIDIAN PARK

cast in plaster molds that are used over and over again. It was found that the plaster mold gave a much better edging for the quoins of the pilasters.

The wall is founded on the natural clay and is drained both at top and bottom. On account of the stiff grade down the hill, no great trouble is anticipated in water-tightness, but the joints between the pilaster and the main section are heavily waterproofed with a pitch-and-felt application.

The upper wall is 280 ft. long and varies in height from 22 to 24 ft. It is set about 25 ft. back from the front wall and is founded on the clay. As shown in Fig. 3, the earth back of this wall stands almost vertically in the cut. However, the wall has been designed in gravity section (Fig. 1) to care for the thrust of the earth for the full height.

The wall is being built in 12 panels, each about 25 ft. long, with a close flush joint between panels. This joint is waterproofed. The sections are being set up alternately and the openings then filled in. The surface is of a plain rubbed face to agree with the lower wall,

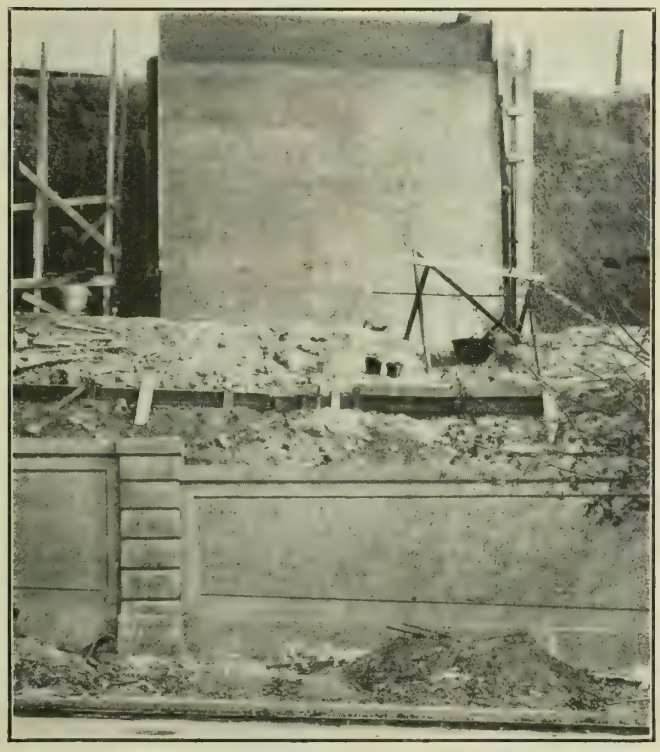


FIG. 3. LOWER WALL COMPLETE AND UPPER WALL UNDER CONSTRUCTION

and the top of the wall is to be capped with an ornamental balustrade of cast concrete.

All of this Meridian Park work is being done under the direction of Col. W. W. Harts, U. S. A., who is Superintendent of Buildings and Grounds, District of Columbia. The plans for the park were drawn by George Burnap, the landscape architect in Colonel Harts' office. The original estimates for the park improvement aggregate $310,000, of which $82,000 is for retaining walls, $118,000 for architectural work, $39,000 for soil and planting, $25,000 for roads and sidewalks, $19,000 for lighting, water and drainage and $27,000 for contingencies. The ground itself cost nearly half a million dollars. The contract is being carried out by the Boyle-Robertson Construction Co., of Washington, D. C.

Sewage-Treatment Works for Altamont Y. W. C. A. Camp

By Henry W. Taylor*

Unusual conditions required a complete system of sewage disposal for the Y. W. C. A. encampment at Altamont, N. Y., and the necessarily high degree of purification made imperative a design that would utilize local materials and avoid as far as possible the high cost of importing sand for sand filters.

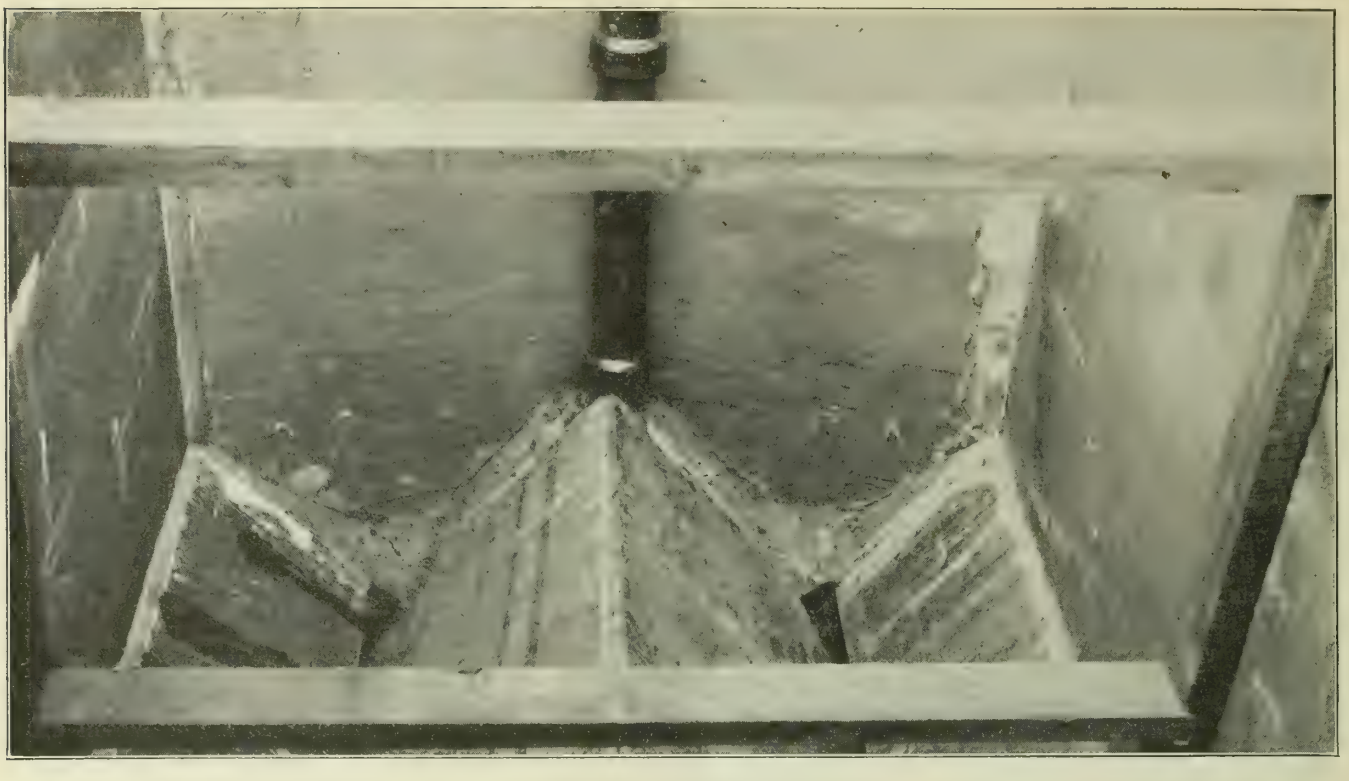
The Y. W. C. A. camp at Altamont is located on a slope of the Helderbergs, about 2 mi. from the Altamont Station and some 400 ft. above the valley level. Five buildings have to be served: A hospital, the main building, the laundry, and two separate water-closet buildings for the majority of the campers, who are housed in tents.

The feasibility of installing a subsoil irrigation system was first investigated, but the subsoil was found to be a stiff clay, underlain with rock. Even with 60 or 70 lin.ft. of drains per person served, the satisfactory operation of such a plant would be questionable. The fact that the disposal plant will not be used in winter was also an argument against the use of subsoil drains, as it was feared that, when not in use, the drains would be seriously disturbed by frost during winter weather. With a moderate footage of drain per person served by the plant, the expense of installing a subsoil system would have been over $3,000.

The small brook receiving the purified sewage flows through pasture lands below the camp and is dry the greater part of the summer. Sand filters were thus required, but no local sand could be obtained. The cost of importing sand led to primary filtration by a sprinkling filter, a small sand filter, and shallow absorption trenches for the sand-filter effluent.

The plant consists of a small circular Imhoff settling tank; a dosing tank; an elliptical sprinkling filter with two nozzles on the major axis; a combination final settling tank and sand-filter dosing chamber, with two alternating siphons; three sand filters 2½ ft. deep; 2,000 ft. of absorption trenches about 6 in. deep and lying above the clay subsoil. The plant will be in active operation for about four months of the year. The design is based on an average population of 200. The actual per capita water consumption is 30 gal. per day, but in designing the filters a people rate was used, since the organic matter to be treated is practically the same as in the case of a normal sewage containing about 100 gal. per capita. The Imhoff tank provides 6 hr. of detention for actual sewage flows. The sprinkling-filter dosing tank contains about 140 gal., and the special Miller siphon will discharge about 40 times per day. The sprinkling filter is 5½ to 6 ft. deep and will operate under a people rate of 18,000 to the acre, while the actual water rate will be less than 600,000 gal. per day per acre. The dosing chamber for the sand filters is designed with a capacity below the low-water line of the siphons, so that there still remains a half-hour detention for the sprinkling-filter effluent. A deep scum board prevents floating matters from reaching the siphons as the water level fluctuates. The sand filters will operate under a people rate of 5,000 per acre and

*Consulting Engineer, 100 State St., Albany, N. Y.



LOOKING DOWN INTO IMHOFF TANK AND SHOWING SLATE BAFFLES, Y. W. C. A. CAMP, ALTAMOUNT, N. Y.

an actual water rate of less than 170,000 gal. per acre per day. One of the three beds is always in reserve, while the shear-gate control of the siphon discharge permits any two of the beds to be used together in alternation.

As to the above rates, it will be noted that the plant is operated only in the midsummer and has a complete rest of eight months between periods of service. The sewage is of course extremely fresh and purely domestic. No lively septic action is expected in the short period of operation of the Imhoff tank, which will be completely emptied, at the end of the season, onto one of the sand-filter beds.. Little deposit will be thrown off by the sprinkling filter except when the plant is first put into operation in June, at which time the remainder of the stone coatings from the last season will probably be flushed from the filter. The combination final settling tank and sand-filter dosing chamber will undoubtedly intercept some solids in the sprinkler effluent and a considerable amount of coagulated fats and greases, while the sewage reaching the sand filters should be comparatively high in oxygen values. Judged from the rates proposed in the past for the sand filtration of a sprinkling-filter effluent, the design is extremely conservative. However, a reasonable amount of drying and scraping of the sand filter is expected and has been allowed for.

The Imhoff tank was built of field-stone rubble. The sprinkling filter is exposed for its entire depth and built of a dry rubble wall with crushed field stone as a filtering medium. Dosing chambers were built of concrete, using crushed field-stone and imported sand aggregate. The baffle walls (see view) of the Imhoff tank consist of 1-in. slate slabs, supported by the tank walls, piers and a diametric wall, the piers and central wall being of brick. Two men laid the brick and placed the slabs in two days. Any other form of baffle construction would have been very expensive and would have required other than local labor. The rubble wall for the sprinkling filter also proved very economical. It provides a filter aërated throughout its depth and presents a creditable appearance.

The work was done under the direction of the local superintendent of the camp and under the general supervision of the engineer. The actual cost of construction of the plant, together with 1,500 ft. of 6-in. sewer, was about $1,470. The sand cost about $2.50 per cu.yd. in place and was shipped from Ballston. If a sand filter had been used without the intermediate sprinkling filter, a rate of not over 1,000 people per acre would have been permissible with an institutional plant, and the sand alone for such a plant would have cost over $2,500. The sprinkler filter complete cost little, as the local stone could be used for concrete floor, rubble wall and filtering medium.

The absorption trenches will be plowed out in the shallow topsoil in an area below the sand filters. This topsoil will absorb, during dry weather, a considerable amount of the plant effluent through vegetable absorption and evaporation. During dry periods a further absorption will take place in the bed of the brook between the point of the plant discharge and the pasture lands below. This absorption will be made possible by the removal of solid matter, especially greases and fats, which in a crude sewage would waterproof the absorption area and give rise to deposits and odors. During wet summer seasons the plant effluent will be diluted about 3 to 1 by the flow of the brook.

Brick and Tile Production in the United States in 1914 amounted to $129,588,000. This was a considerable decrease from 1913, when the value was over $143,000,000. The most important clay product is common building brick, of which nearly $44,000,000 worth was produced in 1914. The value of the firebrick produced was $16,500,000; sewer pipe, $14,000,000; vitrified paving brick, $12,500,000; drain tile, $8,500,000, and fire-proofing material, $8,400,000.

Monumental Timber Building Endangered by Rot

The Forestry Building, constructed at the Alaska-Yukon-Pacific Exposition in Seattle in 1909, the Forestry Building of the Lewis and Clark Fair at Portland, built some years before, and the Oregon Building at the Panama-Pacific Exposition in San Francisco, were all of the same type of construction, having colonnades formed of huge logs with the bark on.

The one at Seattle, shown on this page, became the property of the University of Washington and has been used as a museum by that institution. The building is 312 ft. long, 128 ft. wide and 90 ft. high, contains over 2,000,000 ft. of logs and lumber, about 300,000 cedar shingles, and is the greatest building of the kind ever constructed. There are 126 main columns of Douglas fir, which are from 42 to 54 ft. in height, 5 to 6 ft. in diameter, with an average weight of 25 tons.

The timber foundations began to decay a year or two ago. James J. Hill, of the Great Northern Ry., donated $5,000 to make repairs to the building. Now the decay has extended to the columns and the building itself.

The columns were first affected by the bark beetle. Prof. Trevor Kincaid proposed warming the building to kill them; while this seemed to cure the beetle trouble, it only accelerated the decay and rotting of the columns.

The rotting of the columns is due to the same fungus that is found in lumber piles, favored by moisture and débris. The inside rows of columns in the building have been acted on much more rapidly than the outside ones, due to the heating of the museum. Humphrey, of the University of Wisconsin, has been investigating this class of fungi and the cure for it. The Portland building has been acted on to some extent, although not so badly (as it is not heated). So far nothing has availed to cure the trouble.

The various departments at the university have made reports on the subject. It has been proposed to replace the columns by treated timber ones, and also to reproduce the columns in concrete. The latter scheme has not met with favor from the lumbermen of the state, but that it provides a very pleasing solution is demonstrated by some similar reproductions of rustic wood in arbors on the grounds of R. P. Butchart, manager of the Vancouver Portland Cement Co., near Victoria, B. C., where the bark, knots and worm holes are so faithfully reproduced as almost to defy detection.

A report of Prof. E. O. Eastwood, of the engineering department, just filed with the Board of Regents, recommends that all rotted caps and sills be replaced and the cavities in the columns filled with concrete to keep out the air. The prevention of future decay will probably be taken care of by boring the columns at various points and injecting sulphate of copper. Some of the columns will be so treated as an experiment, as it will be of great value to the lumber interests if some effective method of treating large timbers cheaply to protect from dry rot is found.

It may be remarked incidentally that, however interesting such a building is as a spectacle at an exposition, it is far from being a very useful type of building for a university, so that its eventual decay and demolition will be no serious matter, except for the cost of replacement.



FORESTRY BUILDING AT UNIVERSITY OF WASHINGTON IN SERIOUS CONDITION FROM DECAY

Severe Earthquake in Nevada

By H. P. Boardman*

Several earthquake shocks were felt in northern Nevada on Oct. 2, 1915. The first pronounced shock felt in Reno was about 4 p.m.; the next shortly before 6, and the third and heaviest about 10:50 p.m. This last shock was of about 45 sec. duration and of intensity VI according to the Rossi-Forel scale, causing general awakening of those asleep, oscillation of chandeliers, etc. Many persons left the buildings they were in.

On the University of Nevada seismograph the pointer moved nearly equal amounts in all directions but rather more pronounced easterly and westerly, and the chandeliers noticed were swinging in an easterly and westerly direction. A report was circulated the next day that the center of disturbance was in the Wasatch Mountains in Utah, but this was a mistake. The fault where the earth movement occurred is located in north central Nevada, south of Winnemucca, and about 140 mi. northeasterly from Reno.

It will be evident from the views shown herewith that if the fault had occurred near a large city the damage to property, and probably loss of life, would have been great. Many chimneys and the end of one building were shaken down in Winnemucca, a town of about 2,000 population. Several water tanks along the Southern Pacific railroad were shaken down.

The writer, in company with Prof. J. C. Jones, head of the department of geology of the University of Nevada, visited the fault at several points on Oct. 9 and 10, one week after the earthquake, and took a number of photographs, a few of which are herewith shown.

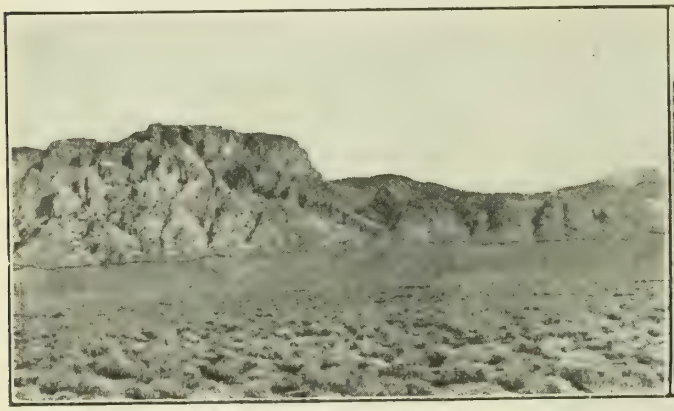


FIG. 1. EARTHQUAKE FAULT ALONG TALUS AT BASE OF SONOMA MOUNTAINS



FIG. 2. WATERFALL OF 10-FT. HEIGHT FORMED BY FAULT

Location of the Fault

The fault extends for a distance of 25 or 30 mi. along the west base of a southern spur of the Sonoma range of mountains on the east side of Pleasant Valley, which valley is about 1½ to 4 mi. wide and lies in a direction about N 10° W. and S 10° E. The valley slopes gradually to the south and is bounded on the west by the East Humboldt range of mountains, commonly called the East Range. North of Pleasant Valley lies a similar valley, somewhat wider, called Grass Valley, which has a slight slope to the northward toward the Humboldt River, into which it drains when there is sufficient running water to flow that far.

An old fault scarp, much like a terrace but not level, is plainly visible for miles along the west base of the Sonoma range on the east side of Grass Valley. At Hot Springs near the low divide between Grass Valley and Pleasant Valley this fault scarp curves out into the valley a mile or more away from the real base of the mountains.

The maximum displacement of the fault of Oct. 2 is at Pierce's ranch, 40 mi. south of Winnemucca and about midway of the fault. Fig. 1 distinctly shows the line of the fault along the talus slope from 1 to 2 mi. north of Pierce's ranch. The photograph was taken from a distance of about 2 mi.

Fig. 2 shows a waterfall of about 10 ft. at Pierce's ranch, created by the fault. We were informed that about three-fourths of the water in this stream is "new," coming from a spring opened up by the earthquake about 4 mi. up the cañon at a point beyond the upper spring that formerly fed this stream. The water was still nearly black with loamy sediment when we were there one week after the earthquake. It is interesting in this connection to note that the State Engineer has received a great many filings since the earthquake on new water rights developed in that part of the state. Ground water and wells were affected in some cases more than 100 mi. from the fault, many of these effects no doubt being only temporary.

Fig. 3 shows the shattered condition of the ground about 100 ft. from the waterfall, which was just to the right of the picture. The leaning of the tree toward the fault was caused by the movement of the ground in which it grew. The tree at the left of the picture was plumb.

Fig. 4 shows the front wall of a dug-out storage house, or cellar, about 200 ft. south of the waterfall. It was evidently too close to the fault to be injured seriously, as only a few stones were shaken from the wall.

Fig. 5 is also at Pierce's ranch, and the vertical displacement of the fault within the limits of this picture ranges from 10 to 15 ft. The fence line, though pulled in two, lined up perfectly straight on opposite sides of the fault as nearly as could be determined by the eye, indicating no horizontal shearing along the fault.

The dip of the "slickenside," seen at the bottom of the fence post in Fig. 6, was about 54°. This post belonged to the fence shown in Fig. 5.

The wrecked barn shown in Fig. 8 is at Pierce's ranch and about 700 ft. from the fault. No other buildings

*Professor of Civil Engineering, University of Nevada, Reno, Nev.

at this ranch were badly damaged, and in fact no frame buildings in the valley were seen that had been seriously damaged, though one small cabin was moved about 9 in. on its foundation. On the other hand practically all the stone-masonry structures in the valley were wrecked except the one shown in Fig. 4.

There was a new concrete house at Cooper's ranch, 18 mi. south of Pierce's and on the other side of the valley, about 3 mi. from the fault. The ground under this house was cracked, and the house was moved forward downhill about 8 in. The rear wall hung back on the foundation at the center, and the effect of this on one of the inside partitions is shown in Fig. 7. The north wall is cracked from the ground to a window and above the window. The ground, foundation and house all moved together from the crack in the ground, which was nearer the rear of the house than the front. An old frame house near the cement house standing on posts about 2 ft. high, was not damaged. The ground cracks did not open up near it.

The ground in the valley near Cooper's ranch and for 10 mi. north of it was very much more cracked and loosened up than in the northern part of the valley. In many places our auto passed over cracks several inches



FIG. 8. BARN WRECKED BY EARTHQUAKE

at Kennedy, extending over a period of two weeks or more, but so far as known, no independent fault has opened up to the surface near Kennedy.

This remarkable fault is interpreted by Professor Jones as confirming his ideas of the origin of most of the interior mountain ranges of Nevada, that is, that they were in the main caused by faulting. He states that this theory is concurred in by most geologists who have made a personal study of field geology in this locality.



FIG. 3. GROUND CRACKS IN FLOOR OF VALLEY NEAR WATERFALL

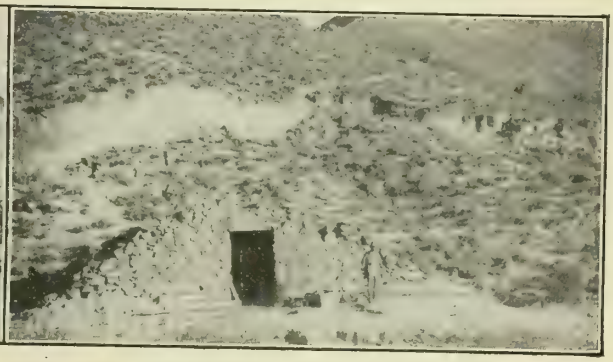
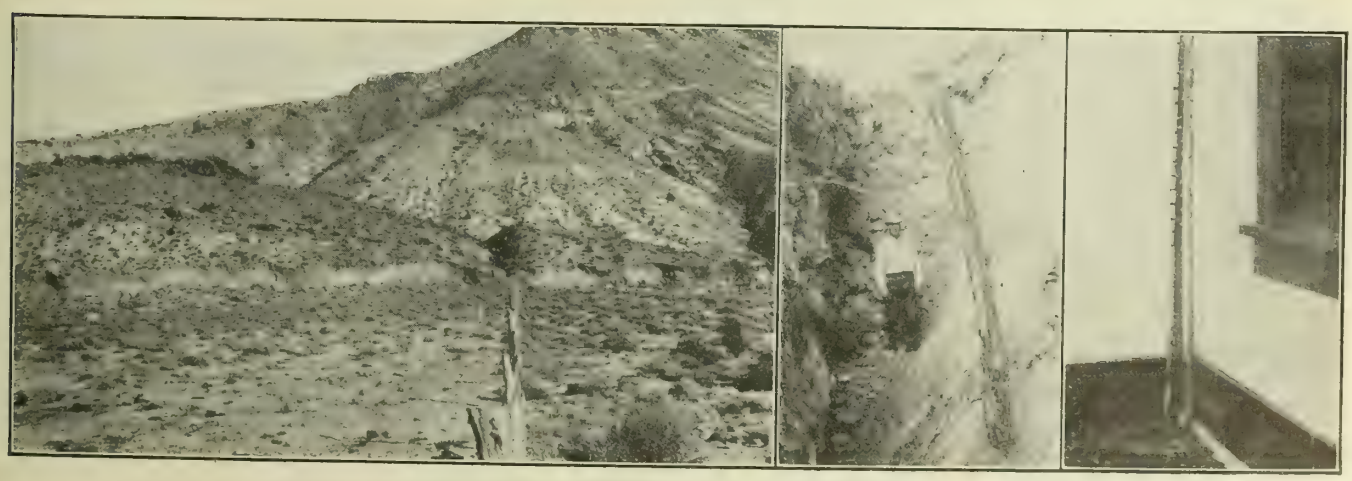


FIG. 4. UNINJURED STORAGE CELLAR CLOSE TO FAULT

wide crossing the road, the vertical displacement being often from 6 to 18 in. From many of these cracks, ground water found a temporary outlet but had stopped flowing in most cases before our arrival.

Kennedy, a mining camp on the east slope of the East Range about 15 mi. southwest of Pierce's ranch, was badly shaken up but had no frame buildings wrecked. A great many minor quakes followed the main severe shock

The writer does not recollect having heard of another earthquake fault of such magnitude occurring so far inland (more than 350 mi.), though such faults doubtless have occurred within historic times and certainly in geologically recent times. There are traditions that a severe earthquake occurred in this same region 40 or 50 years ago, and it may have been at that time that one of the old fault scarps still to be seen was formed.



FIGS. 5 AND 6. FENCE CROSSING FAULT; TRENCH AT FENCE CROSSING

FIG. 7. CRACK IN HOUSE

Constructing a Large Concrete Sewer at Chicago

SYNOPSIS—To check sewage pollution of the lower end of Lake Michigan a 10-mi. concrete sewer, 11 to 16 ft. in diameter, is being built from South Chicago through the Calumet district to a pumping station, whence the sewage will be pumped to the drainage canal. The sewer and its construction methods are described.

The Calumet intercepting sewer is being built to prevent the pollution of Lake Michigan by sewage now discharged into the Calumet River in the southern part of Chicago. It will divert all the domestic sewage of this district and deliver it to the Sag Canal at the controlling works near Blue Island, whence it will flow to the Chicago Drainage Canal. A pumping station with a lift of 20 ft. and a capacity of 1,050 cu.ft. per sec., near the west end of the sewer, will raise the sewage and deliver it through 2 mi. of outfall sewer to the canal. The interceptor has a flow capacity of 1,050 cu.ft. per sec. and will serve an area of about 10,910 acres.

The total length will be over 10 mi. and the cost approximately $3,800,000. The location is shown in Fig. 1. The sewers in South Chicago, with the connection at the east end to the existing 95th St. pumping station, constitute section No. 1. Sections 2 and 3 extend from 97th St. and Baltimore Ave. to Stoney Island Ave. near 101st St.

The sewer will be of horseshoe section (Fig. 2), 11 ft. wide and 8.8 ft. high for the first 4,345 ft., 13x10.4 ft.

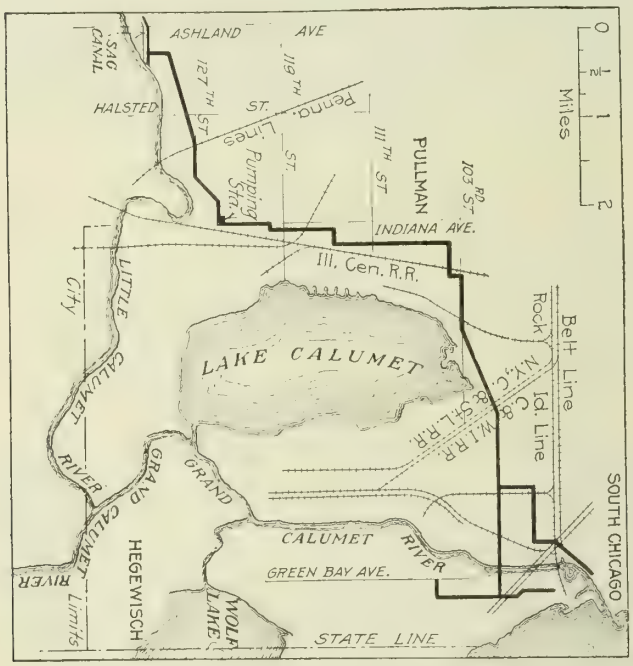


FIG. 1. MAP OF CALUMET INTERCEPTING SEWER

for 7,745 ft. and then 16.5x13.2 ft. to the end. The grade is 0.4 per 1,000 in the 11-ft. section and 0.2 in the larger sections. The construction is of monolithic concrete, reinforced with steel rods in the bottom where soft ground is encountered and with rods in the arch where the sewer passes under railway tracks. Manholes at one side of the arch are provided at intervals of about 600 ft.

The contracts for sections Nos. 2 and 3 have been let to the Byrnes Brothers Dredging and Engineering Co.—No. 2, 4,345 ft. of 11-ft. sewer, $195,583; No. 3, 7,738 ft. of 13-ft. sewer, $331,882. The entire work is under the direction of George M. Wisner, Chief Engineer of the Sanitary District of Chicago; Langdon Pearse, Division Engineer, and H. R. Abbott, Resident Engineer. R. E. Harmon is the engineer in charge of the foregoing contract sections.

The following particulars relate to the construction of section No. 3—7,738 ft. of 13x10.4-ft. sewer. This work is in low-lying ground, swampy on the surface and underlain by stiff blue clay.

The arrangement of the construction plant is shown in Fig. 3. It is located adjacent to the New York, Chicago & St. Louis R.R., a siding from which serves as the material track. Broken stone is dumped near one end of this siding, and beyond this is a line of bins (the bottom of which is about level with the tops of the gondola cars), into which both sand and stone are shoveled from the cars.

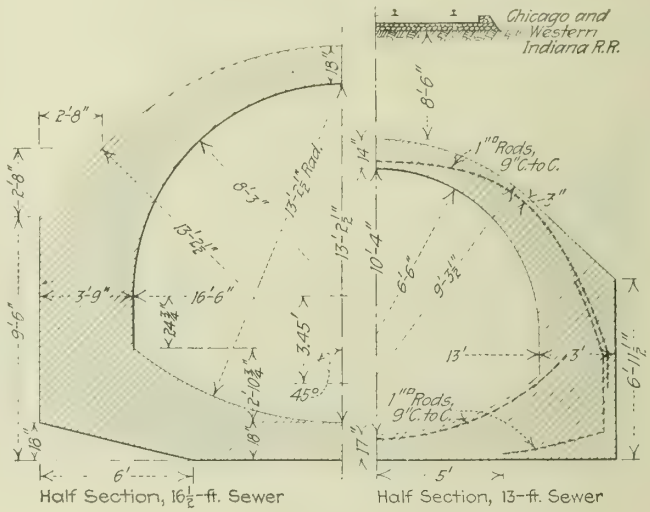


FIG. 2. CROSS-SECTIONS OF INTERCEPTING SEWER

An interesting feature is the introduction of a mechanical unloader to replace hand shoveling of the sand and stone; but this was not put in service until a good part of the work was done. It consists of a traveling tower spanning the supply track and cars and carrying a vertical chain-and-bucket conveyor which can be lowered into the car. The conveyor delivers the material to a horizontal belt conveyor, which discharges into the sand or stone bins. This was designed by A. B. Seavern and has been used for unloading cars at railway coaling stations (*Engineering News*, Aug. 12, 1915).

Concrete materials are hauled from the loading bins alongside the material track in ¾-yd. steel side-dump cars on an industrial track of 20-in. gage. These cars were purchased by the contractor from the Panama Canal and had been used by the French in their early work on the canal. They are of French make (Decauville type), with shallow flat-bottom bodies, having a drop door on the dumping side. The cars were gaged and marked to facili-

tate loading, each car containing material for one batch of concrete.

Empty cars are pushed by hand on the track under the bins and receive stone and sand through sliding doors. Sometimes stone is shoveled by hand from the pile near

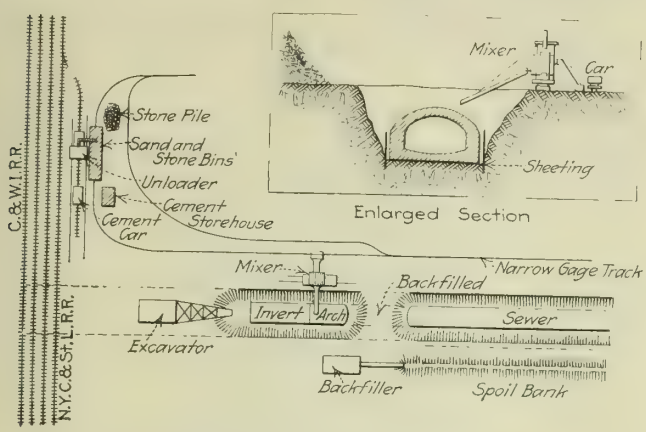


FIG. 3. CONSTRUCTION-PLANT LAYOUT CALUMET INTERCEPTING SEWER

the bins. The car then receives three bags of cement, emptied into it from the storehouse or from a box-car on the material track. Trains of seven cars are hauled to and from the mixer by a mule.

Concreting the Sewer

A Foote concrete mixer with steam engine, vertical boiler and ¾-yd. drum travels on a track along one side of the cut. Material is supplied by the dump cars, each car having stone, sand and cement for one charge. The charging hopper swings down at the side of the supply track and the car is dumped directly into it.

The concrete is spouted into place, the chute having two hinged sections, which are thrown up successively to shorten the chute as the concreting approaches the top of the arch. The chute has a comparatively slight incline when the top of the arch is reached, and men have to push the concrete along it with spades. The concrete mix is 1:2:4.

The specifications allow the use of steel or wood forms for the arch. At the start the contractor used wood sheets supported on steel ribs. The sheets are built up of four or more pieces fastened together by cleats. The arch lagging is 2x6 in., beveled, and well greased on the outer face. For the remainder of the work, however, arrangements have been made to try the Hydraulic Pressed Steel Co.'s forms, consisting of steel ribs and wood panels faced with steel plate. The invert is built in wood forms and is poured first, in lengths of about 25 ft. at a time. After this has set for 24 hr., the steel ribs of the arch forms are erected upon it. The sides and arch are poured at one time.

Excavating and Backfilling the Trench

The excavation is done by a steam dragline excavator traveling ahead along the center line of the work and operating a 2-yd. bucket. It makes a cut about 40 ft. wide on top, 19 ft. wide on the bottom and 15 ft. deep, with the lower part of the sides practically vertical. The material is a peat formation on top, the rest of the cut being in stiff blue clay which has very little water and makes hard digging. The leveling of the bottom and trimming of the sides are done by shovels and mattocks. Timber sheeting in 6-ft. lengths is placed at the sides in the bottom of the cut and held by cross-timbers and trench braces. The spoil bank is along one side of the cut, and a backfiller travels along the center line of this bank. This machine was rigged up on the work and consists of a steam derrick traveling on rollers and having a 50-ft. boom with 1½-yd. grab bucket.

The west end of the section, where work was commenced, is just north of Lake Calumet. A ditch was dug for drainage purposes and serves to bring water to a pump house, from which it is delivered to a pipe extending along the cut to supply the tanks of the mixer, excavator and backfiller.

Portage Railway in Canada

A portage railway on Grand Island in the Athabasca River, Canada, is said to show a profit of $1,000,000 in 60 years' service, while its cost (including equipment) was less than $1,000. The railway is ¼ mi. long and enables river traffic to avoid dangerous rapids. It was built by the Hudson Bay Co., which owns it, and serves to handle the freight and provisions going in to supply the fur traders and prospectors and to carry the valuable outward shipments of furs, etc.

The track consists of strap or bar-iron rails on wood stringers laid upon wood ties. The equipment consists of two flat cars. The freight rate is $2.50 per ton, the men handling their own goods and shoving the cars along the line. One man collects the money and keeps the line in repair.

A scow going inland (downstream) lands its cargo at the upper end of the island and then goes down the rapids in about 70 sec. The vertical descent is about 65 ft. In the quiet (but swift) water below, the crew hold the boat with the oars till they can pick up a timber



PORTAGE RAILWAY ON GRAND ISLAND, ATHABASCA RIVER

thrown out from shore and attached to a light line. With this a heavier cable is pulled out, and the boat then hauled to shore for reloading. A boat coming out upstream is either taken through the rapids by tracking or is hauled across on the railway. The charge for the latter is $10.

A New Labor Law in Portugal has been enacted calling for a 10-hr. day in mercantile establishments, 7 hr. in banks and business offices, 10 hr. in general industries and 8 hr. in shops or works under the immediate supervision of the state or in underground work, as mining, and in industrial works dealing in poisonous or unhealthful materials. Other sections of the law provide for inspection of premises, limit the amount of night work and overtime and specify the rate of pay for overtime.

Field and Office

Building 50,000-Gal. Concrete Standpipe in 40 Hours

By George A. Sampson*

A reinforced-concrete standpipe 14½ ft. in inside diameter, about 40 ft. high and of 50,000-gal. capacity was recently completed at Merrimack, N. H., in less than

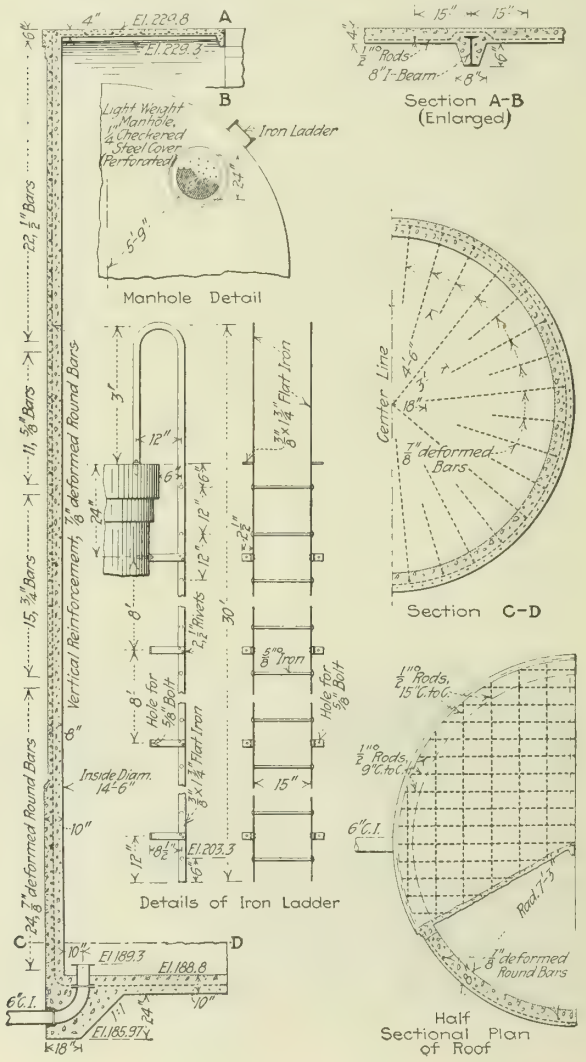


FIG. 1. DETAILS OF 50,000-GAL. REINFORCED-CONCRETE STANDPIPE, MERRIMACK, N. H.

5 days. Instead of building the structure in successive rings of concrete, the pouring was done in one continuous operation, which lasted just 39½ hr.

The illustration shows the essential dimensions. The maximum tensile stress in the concrete at the bottom of the cylindrical wall, assuming the concrete to take the entire pressure, is 155 lb. per sq.in.; in the steel, if it takes the pressure alone, 14,200 lb. per sq.in. With both concrete and steel taking the pressure the stresses are 140 and 1,400 lb. per sq.in. respectively.

*Civil Engineer, 14 Beacon St., Boston, Mass.

A clean, well-graded sand was obtained in the excavation for the standpipe. Briquettes made of this sand compared with those made of standard Ottawa sand had a tensile strength of 105.4% and 88.3% of the latter for the 7- and 28-day periods respectively. The coarse aggregate was gravel obtained from a ditch about 1 mi. distant, screened to give stone varying in size from ¼ to 2½ in. The gravel was washed at the time concrete was being mixed by a stream from a hose and buckets of water poured over wheelbarrows with perforated bottoms. Concrete for the wall was mixed 1 : 1½ : 3.

After the excavation was completed, the first step in construction was the placing of a 2-in. layer of concrete as a working base to aid in the erection of the floor reinforcement and outside form. The outside form was then erected to within a foot of the top and thoroughly braced to eight long telephone poles, erected around the circumference and tied together and cross-braced to insure rigidity. The next step was the placing of the steel reinforcement in the floor and wall. In the meantime the entire inside form was constructed in sections 8 ft. in height and in 10-ft. circular segments, ready for instant erection.

The mixing was done by hand, each batch being turned over at least six times in addition to the various operations of placing the concrete. After mixing, the concrete was elevated by means of a swivel hoist operated by two horses and dumped upon a platform at the top of the structure (see Fig. 2). It was then dropped through a wooden chute upon an inside working platform resting on top of the forms of each section as the work advanced. From this platform the concrete was deposited in the forms by shovels and thoroughly spaded.

The floor was poured on a Friday afternoon and the first section of the inside forms was erected on Saturday. No bolts, wires or other ties that would remain in the concrete were used to secure the forms. The concreting of the wall was started at 4:30 a.m. on Monday. During the day two 8-ft. sections were completed and another section of forms was erected, which was filled during the

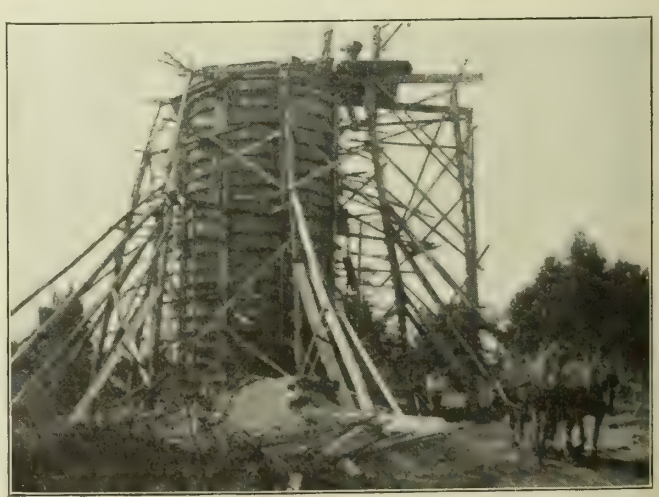


FIG. 2. STANDPIPE UNDER CONSTRUCTION AT MERRIMACK, N. H.

night. The remaining two sections were finished at 8 p.m. the following day, thus making 39½ hr. the total time for concreting the entire wall of the standpipe. At no stage during the casting of the wall did an hour elapse between successive layers of concrete, which was well within the time of initial set. The coping course and

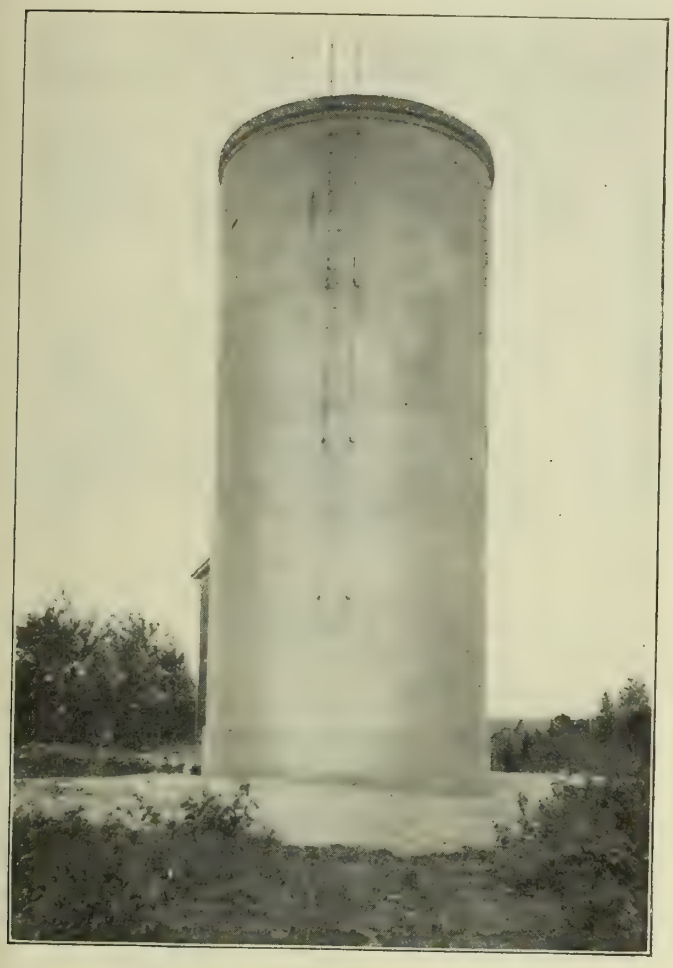


FIG. 3. COMPLETED STANDPIPE; 14½x40 FT., 50,000-GAL. CAPACITY; MERRIMACK, N. H.

roof were constructed Thursday afternoon, so that the whole structure was completed in five working days.

The outside forms were removed on the following Sunday and the surface was wetted and rubbed with a carborundum block to present a uniform appearance, after which a thin brush coat of cement-grout was applied and the surface again rubbed with the carborundum, followed by a dry brush. The total cost of the above-cited treatment of the outside surface was about $20. As soon as the finishing was completed the wall was wetted and kept moist for a period of two weeks.

The standpipe was filled 30 days after the wall was finished and the only leak was about halfway up for a distance of 15 ft. horizontally, where improper spading gave a slightly porous concrete, which was noted on the removal of the forms. There were also a few small damp spots about 4 in. in diameter, which were not visible leaks and were allowed under the terms of the contract.

The water was drawn off and the inside surface at the plane of leakage and wherever any dampness appeared on the outside was treated with waterproofing materials manufactured by the Arco Co., of Cleveland, Ohio. About 400 sq.ft. was waterproofed, at a cost of $23 for materials and labor. The tank was refilled and was found to be water-tight. Fig. 3 shows the finished standpipe filled with water.

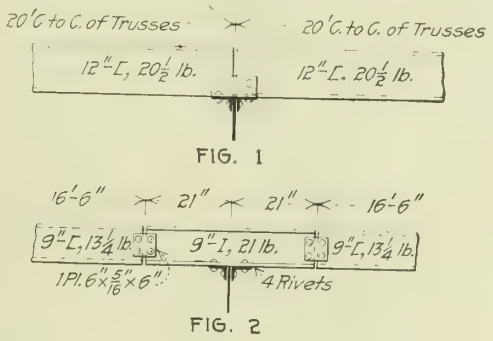
The contract included a deferrization plant and laying of water mains for the water-supply of Merrimack. Robert Spurr Weston was consulting sanitary engineer for the W. H. McElwain Co., owner of the water-works. The contractor was the M. W. Allen Construction Co., of Walpole, Mass. R. E. Whitney was resident engineer and the writer was responsible for the design and construction of the standpipe. The contract price for the monolithic standpipe was $1,821, which was $175 more than the price originally agreed on for a structure built in the usual manner of successive 4-ft. rings.

Large Saving in Roof Steel by Cantilevering Purlins

By J. P. Sartz*

The following method of construction has enabled me to save a considerable amount of steel on roofs of factory buildings and may be applied to any roof or floor where the beams rest on top of the girders.

Let me, for an example, take a roof with trusses 20 ft. on centers, purlins 5 ft. apart, carrying a load of 75 lb. per sq.ft. Using the ordinary method, the purlins would be 20-in. channels, 20½ lb. per ft., as shown in Fig. 1. My method, Fig. 2, reduces the distance between supports to 16½ ft. by cantilevering a 9-in. 21-lb. I on both sides of the truss, making it possible to use a 9-in. 13¼-lb. channel. The purlins for the end-



FIGS. 1 AND 2. ORDINARY AND CANTILEVER ARRANGEMENT OF PURLINS

panels will be 9-in. 21-lb. I's, cantilevering 1 ft. 9 in. over the first truss.

Certain points about this kind of construction may at first glance look doubtful, but careful calculations prove it to be perfectly safe and sound, and the economy of it is of course self-evident.

On the roof of a building 80x240 ft. I saved over 11 tons by using this method.

[Cantilever purlins are the regular thing in German structural practice—or were before the war. The usual arrangement is to make alternate bays cantilever and suspended spans, thus making the short piece of Fig. 2 part of the one adjoining span. Cantilever construction is considered preferable to relying on continuity. In the United States purlins are always proportioned for simple-span bending, though often placed in lengths covering several bays.—Editor.]

*Chief Structural Engineer, North China Department, Standard Oil Co., Shanghai, China.

Successful Soil-Sampling Tools

By Arthur M. Shaw*

In the examination of marsh lands in the lower Mississippi Delta with a view to their reclamation for agricultural purposes, the engineer often has occasion to make a detailed study of the soil and subsoil conditions. These have a bearing not only on agricultural problems, but also on the design and location of levees, canals and pumping stations. For the purpose of making such examinations the writer has had occasion to make frequent use of two devices which are especially well adapted to local conditions. It is not claimed that either device is original with the writer; in fact the soil auger in some form or other is used in all sections of the country.

Soil Auger for Taking Samples Below Surface

The economical construction of satisfactory levees requires that an examination of the soil be made at frequent intervals along the proposed route. Usually this will not require examinations to depths exceeding 8 or 10 ft. For this purpose an auger that will retain samples from various depths is most convenient. A satisfactory outfit used by the writer comprises the following material:

One 1½-in. Snell ship auger with screw. Upset stem, cut off to 18 in. overall, and thread upset end for ⅜-in. standard pipe.
One length ⅜x6-in. galvanized pipe. Thread both ends.
Four lengths ⅜ in. by 2-ft. galvanized pipe. Thread both ends.
Two lengths ⅜x3-in. galvanized pipe. Thread one end.
Eight ⅜-in. galvanized-iron sleeve couplings.
One ⅜-in. galvanized-iron tee.
Two 8-in. Cochran or Stillson pipe wrenches.
All pipe threads to be cut full standard depth, rubbed free from slivers and heavily greased.

The tee with the two 3-in. lengths of pipe forms a handle for turning. In use, the auger is shoved down without turning to the elevation from which a sample is desired, a few turns are made with a slight pressure on the stem and the auger withdrawn. The single worm auger specified has been found especially satisfactory in retaining samples, which may be secured with ease from muck, clay or sandy clay soils. By careful manipulation and some experience, sand samples may be secured from moderate depths; but thick strata of sand, especially where water is present, cannot be sampled satisfactorily with an auger. In hard formations it is of course necessary to bore down for the entire distance.

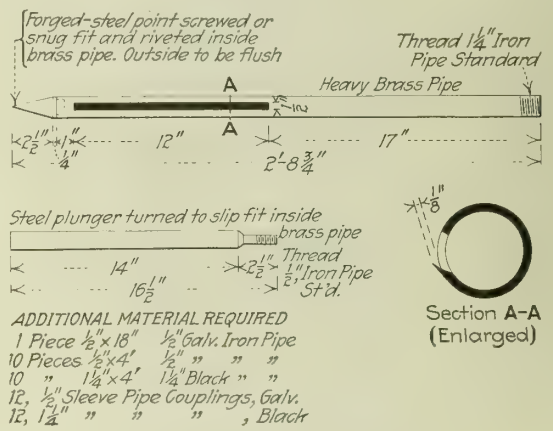
For convenience in transportation to points where only a moderate number of borings is to be made, an additional stem and handle are made of ¼-in. pipe and fittings, using a ¼x⅜-in. reducer at the auger and cutting the ¼-in. pipe into lengths for packing into a grip. The heavier pipe is recommended for ordinary use, especially where many snakes may be encountered. The cost of the single outfit with ⅜-in. pipe, wrenches, etc., will be about $5.

Special Sampler for Deeper Borings

In making deeper borings for investigating foundation conditions, a more elaborate device is employed. This is illustrated by the accompanying cut. In use, the steel plunger is screwed to the 18-in. length of ½-in. pipe and slipped to the bottom of the brass "core barrel." Brass pipe is used for taking the sample, as it runs true to bore and an accurate fit of plunger may be secured.

*Consulting Engineer, Hibernia Building, New Orleans, La.

The instrument is forced down into the ground and successive lengths of the 1¼-in. and ½-in. pipe added until the desired depth is reached, when the plunger is withdrawn far enough to insure clearing the slot cut in the core barrel. In soft material the suction resulting from a sudden withdrawal of the plunger will cause the barrel to fill to the top of the slot, but in harder material it is necessary to rotate the larger pipe by using a pipe wrench, the lip on the brass pipe shaving off a sample. Care should be exercised to see that the slot is fully



SHAW'S SPECIAL SOIL SAMPLER

covered by the plunger until ready to take a sample; otherwise the exact location from which the sample is taken will be in doubt.

If much work is to be done it will be found convenient to erect a staging from which the pipe may be handled. By providing a short length of 1¼-in. pipe with a driving head a moderate amount of driving may be done to pass through sand or other hard strata. Black iron pipe is specified for the outer casing as it is stronger than galvanized pipe and less likely to break off at the joints. Samples have been taken from a depth of 40 ft. with a device of this nature. This equipment may be secured at almost any well-stocked machine shop at a cost of $15 to $20.

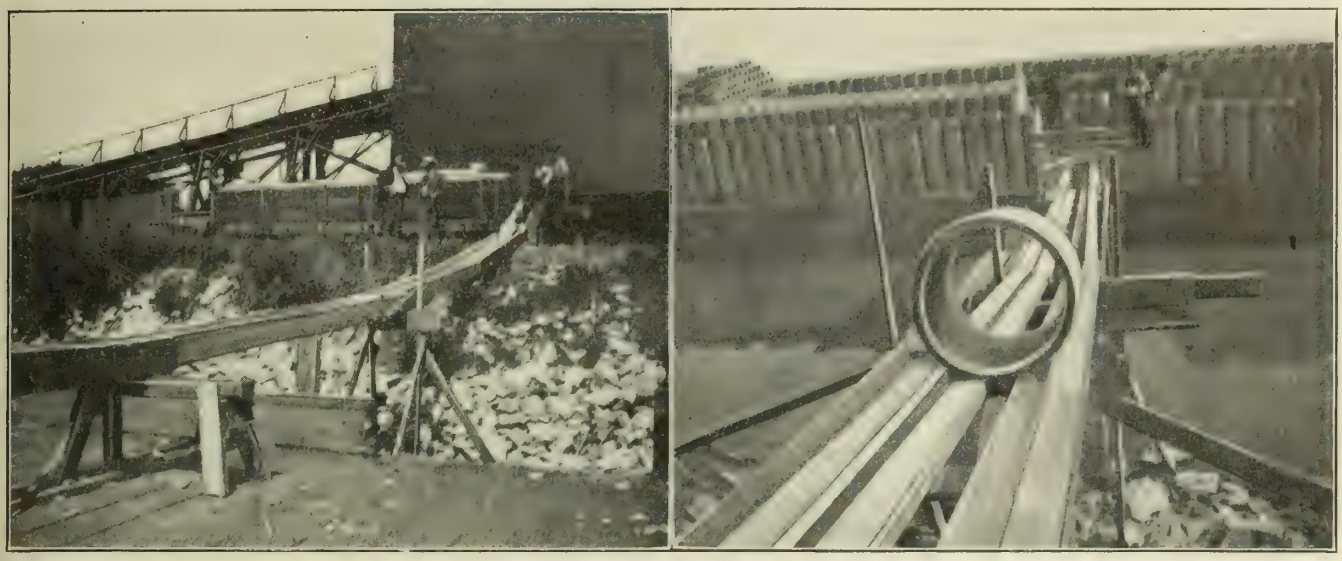
Unloading River Barges by a Series of Chutes

A series of chutes was employed recently to unload concrete drain tiles from barges along the Illinois bank of the Mississippi River. A mast was erected on the deck of the barge, and a chute extending to the bank was hoisted to an inclination which would allow the tiles to slide on the greased runners. Another mast was placed at the foot of the first chute, and another chute was hoisted high enough so that the tiles could slide to a point farther up the slope of the bank. At the foot of this second chute another mast and chute were placed, so that the tiles in the third slide reached the top of the bank. The chutes usually were placed about breast high to a man, so that a man could lift the tiles into the chutes and start them on their way up the bank. At each point of pause another man picked up the tiles and placed them on the next chute. To load the barges only one run of chutes was necessary. The illustrations show the method of loading.

Tiles were loaded on 90-ton barges by the Zeidler Concrete Pipe Co., of Muscatine, Iowa, and the barges

were towed down stream about 11 mi. from Muscatine to the unloading point, which was in Mercer County, Ill. After unloading, the tiles were transported inland several miles by wagon and placed along drainage ditches.

Extensive farm-drainage work is under way in this county on the lands of the Mueller Lumber Co., Zeigler Bros., and M. P. Bomke. Seventy-five miles of 6-in. to 22-in. tiles are being laid. The drainage system was laid out and is being constructed by the Central States Engineering Co., of Muscatine, of which C. H. Young is chief engineer.



TYPE OF SKIDWAY USED FOR HANDLING TILES; LOADING FROM CARS TO BARGE

A Retaining-Wall Failure That Was Not a Failure

By J. E. Smith*

An interesting little piece of emergency work was accomplished late in the summer of this year by Freeman & Brooks, contractors on the Illinois Building, Champaign, Ill., in restoring to an upright position a 17-in. brick wall of rectangular section which had been tipped over by earth pressure to a degree which to the layman looked like failure. Spectators of apparently much intelligence along other lines than engineering were heard discussing the wall "failure," and the conclusions arrived at would surely have been discouraging to the contractor had they reached his ear. Their unanimous verdict was that the wall was a total wreck and should be torn down and rebuilt.

The wall in question was not a part of the foundation wall of the building but was located a few feet outside of, and parallel to, the line of the building to serve as a retaining wall to carry the concrete sidewalk of the street and also to form the outer wall of an extension of the basement a few feet under the street. The plans called for buttress walls at intervals of about 20 ft., connecting with the side-wall columns of the building, but these had not been started at the time. The wall was 10½ ft. high, 120 ft. long, with returns at the ends extending to the line of the building, and weighed approximately 46 tons. It was set upon a concrete footing 25 in. wide, and the masonry consisted of common hard-burned brick recovered from the ruins of the old building which burned last spring on the site of the new building. The mortar used was of portland cement and sand, with proportions about 1 : 4.

Following the completion of the wall, the earth, consisting of yellow clay, was filled in back of the wall even with the top; but on account of its dryness and the expectation of soon connecting the wall to the main building with the buttress walls at the columns, sufficient precaution was not taken to provide against excessive earth pressure on the back of the wall. Unfortunately several days of heavy rainfall followed, and the backfill settled about 12 in., becoming practically a fluid. The consequent heavy pressure broke the bond between wall and footing and tipped the wall forward toward the building until it was 6° out of plumb, the top having moved about 14 in. A large crack developed at each end, running from the bottom corner near the return diagonally upward to the top, making an angle of approximately 26° with the footing—about a 2 to 1 slope. The portion between these cracks tipped forward as a single piece and remained perfectly intact, which was remarkable in view of the fact that the average length was 100 ft. and the weight approximately 38 tons. It indicated either a uniformly strong bond developing during the interval after the wall was completed, which was about two weeks, or a very uniform distribution of the earth pressure, acting practically as a perfect fluid, or both. The ends of the wall next to the return remained vertical and showed only minor cracks near the top.

The movement of the wall was checked by placing against its face five struts spaced about 20 ft. apart. The line of the center of gravity had not fallen outside of the base, so that when the backfill was removed, relieving the earth pressure, the wall settled back about one-third the way toward an upright position. The mud was then thoroughly washed from beneath the wall and a rich cement mortar flushed in. Five small hand jacks placed at the struts brought the leaning wall back to its upright position, still intact, in less than three hours' time. The diagonal cracks were grouted and pointed up and the back of the wall given a waterproof coating of asphalt. So far as strength and appearance were concerned the wall was as good as ever, and the cost was a small part of what it would have been if the wall had been rebuilt.

*805 Indiana Ave., Urbana, Ill.

Resurveying the Ohio Division of the B. & O. S. W. R.R.

By W. W. Gruber*

The following data were compiled during 1913-14 while the writer was employed by the Baltimore & Ohio Southwestern R.R. on a survey of the Ohio division, from Oakley to Athens, Ohio. This work was done with a twofold purpose in view—to furnish the real-estate department with a complete and uptodate set of right-of-way maps and to supply the maintenance-of-way department with revised operating maps.

To meet the requirements of both departments, it was necessary to locate all right-of-way and old land lines, also all yards, sidings, tracks, signals, bridges, buildings and other improvements on and adjacent to the company's property, or on that of industries or other property served by the railroad.

A complete detailed survey was necessary except for 9.6 mi. of track recently reconstructed. The chaining was all done on the right-hand rail of the eastbound main track, each station being marked with white lead on the outside of the ball of the rail and every tenth station painted over the ball and web and numbered. Curve deflections were taken on the center line at each station. Track centers were located by a rod of such length that when one end was placed against the web of the rail, the other end was on the center line. On turning points this rod was applied to both rails and a tack placed at the average point. Curves were run until well beyond the P.T., and the angle turned to the tangent.

To locate land and street lines, etc., where pluses were not required closer than about two or three tenths of a foot, the intersections with the center line were made by holding a plumb-bob over the gage of the rail, sighting over the string and moving until the string coincided with the intersecting line. After an intersection was made on both rails, the left-hand point was transferred to the right-hand rail, and the plus taken to the middle point between the marks. The angles were turned from the intersection with the rail on tangents, and on curves were turned from the intersection with the center line to a backsight at the farther of the adjacent points on the curve.

In many places original line fences had been removed. Here a careful search was made, and often corner stones, a line of old stubs of posts or post holes were found and located by plus and angle. If no better evidence than the general appearance of the ground was found to show the location of the line, it was located approximately, so noted, then checked with the old records and deeds by the draftsman.

No attempt was made to run out right-of-way lines, but all fences and buildings adjacent to the railroad property were located and existing encroachments determined from the maps. A very careful search was made for any property and center-line monuments, and many were found which proved to be very valuable in plotting the right-of-way. Lines dividing right-of-way parcels that could not be established from the original fences or some trace of them, and were not monumented, were plotted from deeds and old records, or were marked indeterminate on the maps.

Parallel sidings were located by offsets, and spurs not parallel by deflections. Buildings and other structures were tied in by pluses and right-angle offsets, if practicable, or by angles and distances from points on the center line. Right-of-way fences, creeks, roads, etc., were usually located by taking the distance at each fifth station, or closer, to a point in a line at right angles to the center line.

In towns the usual procedure was to establish the center line and locate intersecting street lines, then make a closed traverse with adjacent streets, the center line and the first street parallel to the track. Angles were turned three times and the traverse made to close within one minute. The streets and center line were roughly plotted to scale in a cross-section notebook and the details then filled in. Through yards and division points, spur tracks on which deflections were necessary usually served as base lines to tie in structures, etc.; otherwise random lines conveniently located were used.

As soon as practicable, 1,000-ft. markers—2-in. square cast-iron pins 3 ft. long, with the thousand number cast on the side—were set on the sod line opposite the 1,000-ft. points, so that the stationing would be maintained for future surveys.

New maps were plotted except for one section of 9.6 mi., where a set of reconstruction maps, on a scale of 1 in. = 100 ft., was traced. The curves on this section were traversed and new pluses taken so as to make the stationing conform to the new system. All maps were made on sheets 24 in. in width and from 10 to 14 ft. in length, as convenient, and were plotted to a scale of 1 in. = 200 ft., except through yards, terminals and towns, where a 100-ft. scale was used. Through some of the smaller villages the map was also made on the 200-ft. scale to avoid breaking the continuity, and in addition a small 100-ft. inset map was made to show details for use of the maintenance-of-way department.

Practically all information shown in the field notes, such as dimensions of buildings, bridge spans, clearances, etc., was put on the tracings, except deflections on curves and random lines. In addition to this, all dimensions given in deeds and the width of right-of-way were shown, and such explanatory notes regarding old land lines as necessary were made. The plotting was done on detail paper,

TABLE 1. COST DATA FOR NEW MAPS

Item	Survey	Drafting	Total
Actual work	$3,016.00	$1,043.00	$4,059.00
Actual work, per mile	20.93	7.24	28.17
Supervision	632.00	218.00	850.00
Supervision, per mile	4.39	1.51	5.90
Work and supervision	3,648.00	1,261.00	4,909.00
Work and supervision, per mile	25.32	8.75	34.07

TABLE 2. COST DATA FOR REVISING OLD MAPS

Item	Survey	Drafting	Total
Actual work	$80.00	$103.00	$183.00
Actual work, per mile	8.33	10.73	19.06

TABLE 3. FORM FOR SHOWING DEED REFERENCES ON MAPS; B. & O. S. W. R.R.

No.	Document	Date	Grantor	Grantee	Recorded Vol.	Recorded Page	Consideration	Section	Township	Co	Remarks
1	War deed	July 6, 1848	Jas. Smith	M. & C. R.R	10	431	$500	33	Scioto	Ross	
2	Q. C. deed	May 7, 1848	G. F. Smith	B. & P. R.R	12	231	100	31	Scioto	Ross	
3	Release	Sept. 1, 1849	S. T. Smith	M. & C. R.R.	G	492	$1 and 2 cattle guards	1	Madison	Brown	
4	Condemnation	Sept. 25, 1849	V. K. Smith	M. & C. R.R	Jdg. Bk. 4	361	$426	3	Madison	Brown	Com. Pleas Court No. 2, No. 4261, Sept., 1849

*Cincinnati, Ohio; Abstractor, Valuation Department, Cincinnati, Hamilton & Dayton Ry

without dimensions or lettering, and was not intended for filing.

In several instances where the alignment had been changed, considerable time was consumed in reproducing the original center line. In these instances the old, torn and dust-covered drawings, which we are so often tempted to consign to the waste basket, proved invaluable.

The length of main line and branches, exclusive of the 9.6 mi. previously mentioned, is 144.1 mi. The cost of making the survey, drafting and supervision of this portion is shown in Table 1; the cost of the resurvey and revising of maps for the 9.6 mi. is shown in Table 2.

On the 9.6 mi. the cost of drafting is higher than for the new maps. This is due to the fact that the maps were all on a 100-ft. scale and that all old and new right-of-way was shown, most of which was on curves and in irregular parcels.

The cost of fieldwork was $300 per month, of which $100 was for party expenses. The cost of drafting was $105 per month. The average rate of work for the field party of three men was 1 mi. in 17.1 hr. and for the draftsman 1 mi. in 14.6 hr. For the new map 25.7% of the cost is chargeable to drafting and 74.3% to the fieldwork. The total number of right-of-way conveyances was 804, or an average of 7+ per mi. On single track the average was 5 per mi., and on double track 9 per mi.

The 1,000-ft. markers were distributed by the section gang, then set by two section men under the supervision of a rodman, at the rate of about 25 per day. The markers were driven with a sledge, a block of wood being used to absorb the shock and prevent breaking them. Where 1,000-ft. points came on bridges, no markers were set.

The distribution of time for making maps averaged as follows: Plotting field notes, 33%; plotting deeds, 14%; tracing, 27%; lettering details, 19%; lettering deed data, 4%; caption, 3%.

Deed data were shown as in Table 3. The numbers in Column 1 were put on the map to designate the parcel of right-of-way covered by the corresponding deed, each number on the map and in the deed reference column being inclosed in a circle.

NOTES

Record Plans of State-Aid Highways in New Hampshire give all progress data usually kept in several separate files in other highway department offices. These plans are on a scale of 1 in. = 2,000 ft. and comprise a profile on a vertical scale of 1 in. = 100 ft. showing all elevations referred to a sea-level datum, a record strip for construction and maintenance data and a plan of the highway showing all cross-roads, railroad crossings, permanent station marks, location of gravel pits, quarries, crushers, etc. The plan does not show alignment, because few New Hampshire roads have ever been surveyed to obtain complete alignment data. Surveys have been made of short sections for the purpose of curve widening or road straightening, etc. There is no reason, however, why alignment should not be shown on a similar plan, except that the scale is rather small for convenient plotting. The notes in the middle of the strip give the length of the improved road with 1-mi. subdivisions, the type and date of the improvement and the name of the contractor or town (where the town made the improvement by day labor). All subsequent treatment of the road is shown in these same vertical divisions, as, for example, at the extreme right of the accompanying sample plan. Properly filed and indexed these plans give about as handy reference to all highway data as probably could be devised.

A Slope-Trimming Machine used for smoothing the embankment slopes for an oil-storage reservoir in California is described by E. D. Cole in the August "Proceedings" of the American Society of Civil Engineers, pp. 1327-1350, in the paper entitled "Concrete-Lined Oil-Storage Reservoirs in California: Construction Methods and Cost Data," presented to

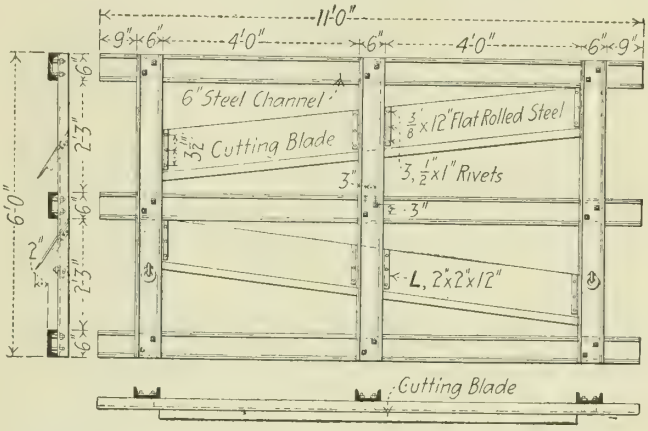
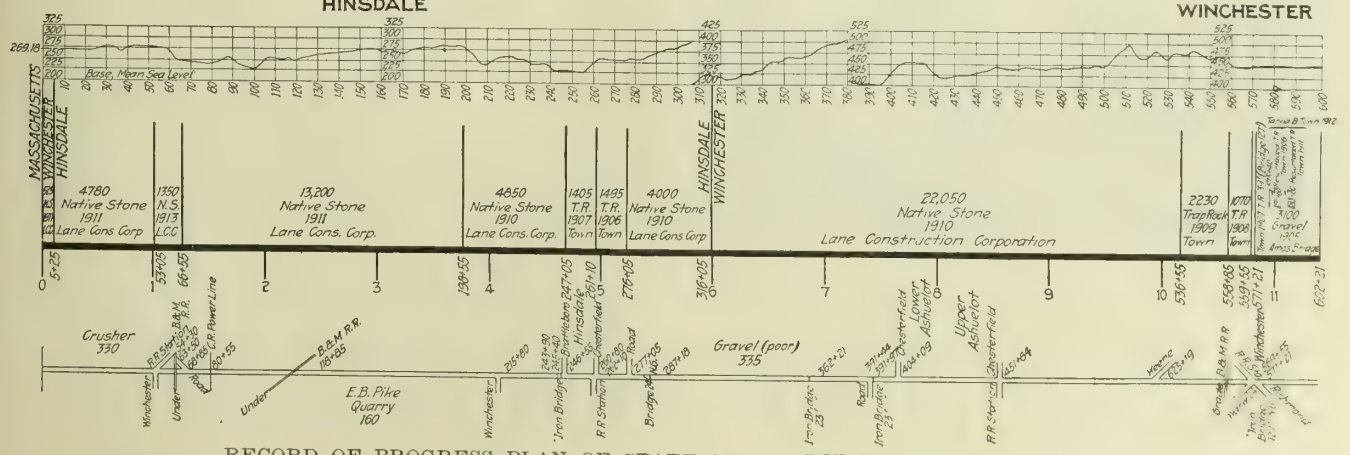


FIG. 1. DETAILS OF SLOPE-TRIMMING MACHINE
Devised by E. D. Cole and C. O. Zeller

the society Sept. 15, 1915. The machine (Fig. 1) consists of a rectangular frame 11 ft. long and 6 ft. wide, built of 6-in. channels bolted together, carrying two cutting blades, which are ⅜x12-in. rolled-steel plates set at an inclination to the frame of 1 on 2½. The blades are also set at a slight angle longitudinally with each other. The cutting edges project 2 in. below the bottom of the frame. The trimmer is dragged back and forth on the slope until the ends of the frame ride on the tops of the guides. The cost of finishing the slope by this method was about one-half the cost of hand finishing. The slopes were both 1½ on 1 and 1 on 1. The crew consisted of seven men, including the hoist operator. Before using the slope-trimming machine men with mattocks and slope-level boards dug narrow trenches 1 ft. wide and true to grade from the top grade stake to the stake at the toe of the



RECORD OF PROGRESS PLAN OF STATE-AID HIGHWAY IN NEW HAMPSHIRE

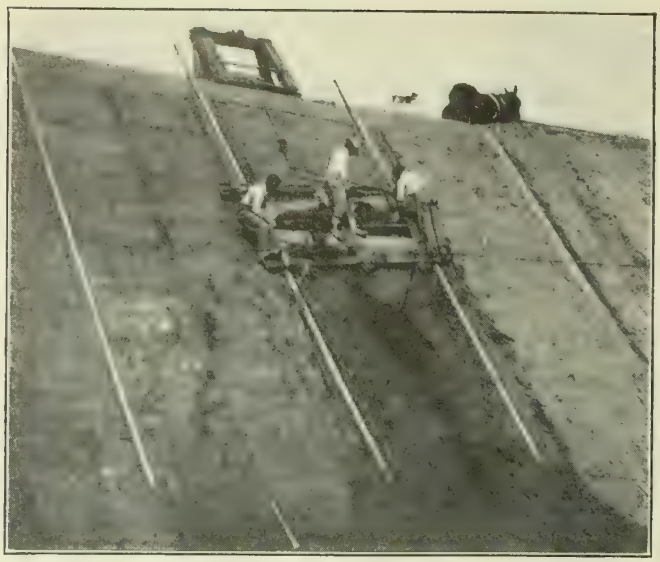
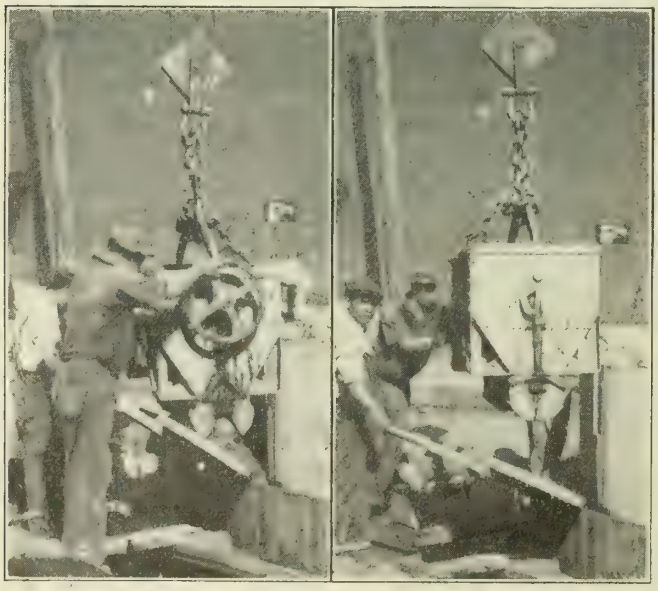


FIG. 2. SLOPE-TRIMMING MACHINE ON RESERVOIR EMBANKMENT

slope. These trenches were in approximately parallel lines (really radial). In the bottom of each trench were placed 2x4-in. timbers faced with strips of sheet steel, which formed the guides for the trimming machine. Before using the machine all excess material above the tops of the guides was scraped off with a specially made Mormon or buck scraper. The power for both the scraper and trimmer was furnished by a double-drum hoisting engine at the center of the reservoir. The back-haul line from the hoist was passed through a 12-in. snatch-block supported at the top of the slope by a portable wooden truss designed for that purpose, which was anchored against overturning by two heavy chains fastened to iron stakes.

Concreting an 8-In. Ring, 11 ft. in diameter, with a bottom-dumping bucket is the operation shown in the accompanying views. The work is for one of the shafts of a new waterworks tunnel under the Cuyahoga River at Cleveland, Ohio. Most of the concrete was poured through spouts, but after the shaft was practically completed it was decided to carry up the sides a few feet farther to keep out surface water. For concreting these sides a small portable batch mixer, a



CONCRETING AN 8-IN RING WITH A BOTTOM DUMPING BUCKET

derrick and a Doud bottom-dumping bucket were used. To use a bucket to fill an 8-in. ring required a little ingenuity. The inside form was made high enough to prevent the concrete falling in that direction, and a portable wooden deflector with a pair of handles was used under the bucket as shown. The superintendent of construction for the City of Cleveland is J. A. Vandevelt.

To Hasten the Setting of Concrete, calcium chloride may be incorporated in solution with the mixing water. The United States Bureau of Standards has been experimenting with the method and has found that the use of a 4% solution of calcium chloride in place of the mixing water will materially accelerate the hardening of the concrete. The acceleration varies somewhat with different cements. With some cements in 1:2:4 concrete it was found that the strength increased 100% in 24 and 48 hours. By microscopic examination it was found that when calcium chloride was used the tricalcium silicates and tricalcium aluminates were more completely hydrated and an appreciable amount of the β-calcium orthosilicates was hydrated, while practically none was hydrated in the normal concrete. It is intended to continue this investigation in order to determine, if possible, the ultimate value of calcium chloride when used in concrete. Its use will add about 12 to 15c. per cu.yd. to the cost of concrete. Calcium chloride should not be used in reinforced concrete if it will be at all exposed to electrolysis, as the salt accelerates corrosion.

A Dragline Carried on Timber Pads is used for excavating trenches on three contracts of the Greater Winnipeg Water Supply. These dragline machines stand at the end of a trench and work backward, the bucket being dragged toward the machine and then swung out to the side to form the dump. The draglines are carried on 16x8-ft. pads of heavy timber and



DRAGLINE STANDING ON SOFT GROUND AND EXCAVATING TRENCH FOR THE GREATER WINNIPEG AQUEDUCT

are able to work successfully upon muskeg so soft as to be hardly able to bear the weight of a man.

To move forward, the machine picks up the pad nearest the end of the excavation and swings it around behind the machine, in line with the trench. Skids are then laid upon the extension of the pads, and upon these the machine pulls itself back by anchoring the bucket in the ground behind and pulling on the line. The skids, or rollers, which are of 6-in pipe, are blocked after the machine is in position for excavating. Moves are made quickly, and the machine does its own grubbing for placing the pads. One of these draglines is shown in operation.

Electric Delivery Vehicles have been selected in preference to gasoline-driven machines by the department store of Meir & Frank Co., Portland, Ore., as the result of the studies and experience of A. N. Stanton, superintendent of deliveries. The company made its first trials in 1909, when it was found that the cost of delivering a package was 0.7c. cheaper by the electric than the gasoline car. The first electric car purchased was of 800-lb. capacity, and this was followed by three of 1,500-lb. capacity, one 1-ton and two 2-ton trucks. In 1911 four 1-ton cars were built especially for the company. One of the earliest records made by the first of the special cars was on a run of 14½ mi. with 157 stops in 195 min. In another run a distance of 37½ mi. with 340 stops in one day; later, 55 mi. with 740 stops were covered in one day. In 1912 four gasoline trucks were purchased and operated, but were later replaced by four 3,000-lb. electric cars equipped with nickel-iron batteries. Practically no difference was found between this type of battery and the lead cells as far as charging cost was concerned, but the nickel-iron battery maintained the original radius of mileage more uniformly than the lead. One great advantage cited by Mr. Stanton is the fewer number of motions required by the driver of an electric vehicle over that required for a gasoline car, the ratio being 5 to 12 for a stopping-and-starting cycle. This is considered to give the driver a better opportunity to bear his other responsibilities. The upkeep cost per mile was 3.62c. for gasoline cars and 2.57c. for the electric cars. Grades of 5, 9, 11, 15, 17 and 20% are covered by the electric cars every day.

Editorials

A Little-Known Earthquake

Earthquake phenomena are of much interest and importance to the engineer. In regions where earthquakes occur with some frequency it is recognized that in the construction of dams, buildings and other structures certain precautions should be taken that are not necessary elsewhere. The information available, however, as to the regions of the United States where earthquake movements may be expected is exceedingly meager. Over all the territory west of the Mississippi River the period of settlement has been too recent to make possible records of earth movements covering any considerable period. Further than this, the world at present relies chiefly on newspaper enterprise for information as to what is happening; and matters of scientific interest generally play a subordinate part in the newspaper scheme of things.

There is another reason why newspaper reports of earthquake phenomena are very incomplete sources of information. As is generally well known on the Pacific Coast, the San Francisco newspapers, ever since the great earthquake and conflagration of 1906, preserve absolute silence with respect to the earthquake trembles which frequently occur in that city and its vicinity. The governing motive is of course the same as that which governs so many otherwise inexplicable things on the Pacific Coast—to avoid doing anything which might unfavorably affect the price of real estate. This well-known policy of the San Francisco journals sets an example which has doubtless more or less influence in other quarters. One need not expect to find any very complete account of seismic movements in the far West printed in the local papers.

Elsewhere in this issue appears a paper written for *Engineering News* by Prof. H. P. Boardman, of the University of Nevada, describing an earthquake which occurred in northern Nevada in October last and which appears to have entirely escaped notice in the newspapers, although Professor Boardman's investigation indicates that it was quite as severe an earth movement as that which brought about the conflagration in San Francisco in 1906. The Nevada earthquake, however, occurred in a country so sparsely inhabited that the only structures affected were some railway water towers and a few buildings on ranches or in small hamlets.

There is some reason to believe that earth movements of magnitude are not very infrequent in certain parts of the United States. Dr. J. C. Branner, of Leland Stanford University, who has probably given more attention to the study of earthquake phenomena than any other American scientist, is authority for the statement that the earthquake in the Imperial Valley, of June 22, 1915, described in *Engineering News* of July 29, was probably at least as severe an earth movement as that at San Francisco in 1906.

It would be valuable information to engineers if a systematic investigation were made of earthquake movements of magnitude and if their location, extent and foci could be definitely ascertained and recorded. With the aid of such records it would be possible to locate definitely the fault lines in the earth's crust along which motion has occurred in recent times and is most likely to occur again.

To obtain the necessary information over the wide extent of territory to be covered, however, is a difficult matter. The United States Geological Survey would probably be the best organization to undertake it, but to secure the best results it would need the coöperation of some such widely extended organizations as the Post Office Department and the telegraph and telephone companies, assisted perhaps by such Federal Government bureaus as the Land Office and the Forestry Department, which have representatives located in the remote sections of the country out of reach of the mails and the telegraph.

If the Valve Should Fail

It is little short of criminal to subject a whole city to the danger of having its entire water-supply cut off through failure of an old valve, as is the case at Nashville, Tenn. The details are thus stated in a report made on the water-works of that city by James Cameron, public accountant, in coöperation with Barclay Parsons & Klapp, all of New York City:

> The supply from the reservoir to the city distribution system is now controlled by a single slide valve of a very old pattern. This 36-in. valve is of a plain slide type, controlled by a stem operated by a handwheel from the gate-house floor. The stem is attached by a single socket and cotter key to the valve rod, and this has been submerged and inaccessible for inspection except by a diver for years. We were informed that this valve is one of the original installation. A rusting or corroding of the cotter key might easily result in a dropping at any time of this valve disk into a closed position, cutting off the center city water-supply. This should be examined by a diver at once and arrangements made for making this valve stem more secure. A duplicate outlet main and modern water-works valve should be installed at an early date.

If dangers as great as this were confined to one city this Nashville incident might be overlooked. But scores if not hundreds of other cities are in as great or greater danger through failure to eliminate from their water-works some weak spot that might result in cutting off the whole water-supply.

Similar conditions exist also, without doubt, in connection with company-owned plants. At a large hydro-electric power plant in western Canada, recently visited by one of the editors of *Engineering News*, the normal water-supply is supplemented at times of low water by drawing from a lake on another watershed through a four-mile tunnel. Gates at the head of the tunnel control the discharge of water from the lake. These gates are in tandem, tight-closing slide gates above and Taintor gates below. At a time when only a week's surplus was left in the forebay reservoir, orders were sent to the headworks at the lake to open the gates. When this was attempted, however, it was found that at the high lake level then existing

the head against the slide gates was so great that they could not be moved.

The lake is located in a remote wilderness, 20 mi. from the nearest town. The chief engineer of the plant was routed out of bed at 2 a.m., and ran his motor car through rain and mud over a corduroy road to the headworks. It was found that the designer of the plant had omitted to install any bypass valve to admit water to the space between the upper and lower gates to relieve the pressure on the slide gates and enable them to be opened easily. Tools and men were hastily assembled and by working night and day for 70 hours, under great difficulties in a contracted space, enough water was admitted between the upper and lower gates to relieve the pressure on the former and permit their opening. It is needless to say that a permanent bypass valve was put in at the headworks at the first opportunity.

Similar stories of emergency work that might have been avoided by greater foresight in original construction or in maintenance could be multiplied indefinitely. Engineers who carry through such emergency work learn a lesson they are not apt to forget.

New Haven Blockade No Blow to Electric Traction

The complete blockade of the New York-New Haven electric zone of the New York, New Haven & Hartford R.R. during the severe storm of Dec. 13 and 14, news of which has spread all over the country, should not be regarded as a demonstration of an inherent difficulty in electric traction for trunk-line railroads. Nor is the New Haven blockade to be cited as a knockout blow to the overhead contact system compared with the third rail. It was apparently a direct result of stingy design—failure to provide adequate mechanical strength in electric circuits.

The tie-up was due simply and solely to the breaking of signal and feeder wires heavily incased with sleet and snow. No catenary bridges, masts or running wires went down. The signal and feeder wires did not break merely at one or two places, but the failures were literally innumerable along 60 mi. of line—indicating a general lack of strength for the loads imposed.

In striking comparison with this situation and the crippled condition of steam-operated lines in the East, the New York electric zone of the New York Central & Hudson River R.R. operated practically without interference through the storm. Comparison of the design on these two roads leads to the inevitable conclusion that the New Haven designers were constrained to be overeconomical and that the company is now dearly paying for its parsimony, in loss of revenue and prestige.

Just one fact needs to be cited here to support that opinion: The New York Central's electric zone is traversed by a line of steel poles carrying transmission and signal circuits having functions fundamentally identical with those of the New Haven circuits that failed. The storm came from the northwest, and the Hudson River exposure was probably fully as severe as that along Long Island Sound. The New York Central did not lose a wire. Why? Probably because its signal-circuit spans were 150 ft. and the wires were No. 0 gage, compared with 300-ft. spans and No. 3 wire on the New Haven. The New York Central wires had half the span and twice the cross-sectional area.

It is apparent that the designers of the Central provided heavier insurance against breakdown than the New Haven engineers were permitted to employ. With the concentration of power supply which accompanies electric traction, there must be nothing less than complete protection against maximum conceivable onslaughts of weather—if such interruptions of traffic are to be prevented.

Data on Strength of Beams Are Inadequate

It is interesting news that the Secretary of Commerce and Labor requests an appropriation for providing a testing machine to make bending tests of large beams and girders. The Bureau of Standards has for some years looked forward to the provision of such a machine. Its present equipment, like that of other testing laboratories, is planned for tension and compression tests and can do only a limited range of small-sized work in bending. If the new machine is built, it will for the first time make possible the determination of the actual strength of large beams, plate girders, slabs, etc., as used daily in large quantities in every branch of construction work.

The calculations of the strength of girders are on their face so simple as to disguise the fact that a very slender basis of fact underlies these calculations. Plate girders with 100 to 200 sq.in. of sectional area in each flange have been built and are carrying railway trains, and the safety of these trains depends directly on the soundness of the calculations by which the flange area was proportioned. The calculations, however, contain a number of quite remarkable assumptions: That the entire area of the flange resists as a unit, that the flange is free from bending stresses and local irregularities, that the shearing service of the web plate is not seriously interfered with by other stresses, and so on. All of these assumptions introduce doubt as to what stresses exist in the girders; in other words, how safe it really is. Only by tests can this be determined—tests not necessarily on the largest structures that have been built, but on sizes approaching them near enough to give us confidence in the truth of our methods of analysis and proportioning.

The situation amply justifies the wish that the appropriation may go through and the machine be provided and put in service.

A point not to be lost sight of is that the design, size, etc., of this testing machine should be based on a thorough canvass of the range of service that it may be called upon to give. It is desirable that engineers in various branches of work should formulate their views as to the kind and size of bending tests necessary and submit these to the bureau in order to make it possible to plan soundly and wisely in this respect.

Overspecialization in the Engineering Schools

Engineering News is often obliged to reject articles offered for publication discussing at length problems in engineering education because of the urgent demands upon its space for articles dealing with current engineering works. The article by Professor Wilson, of the

University of Illinois, published elsewhere in this issue, however, presents with commendable brevity such a strong and convincing criticism of certain present-day tendencies in technical education that space had to be made for it.

It is true that to most of those who have given careful study to engineering education the argument made by Professor Wilson against overspecialization in technical education will not be new. It needs but a glance, however, at the courses of study laid down at most of the engineering colleges to see how far apart are the principles accepted by leading engineering educators and the actual practice of the schools.

It is too much the custom to pass the matter over lightly with the remark that the mental training to be acquired in the four-year course is the main thing after all and that the student will get about as much of this training in one study as in another. That is a statement that will not stand analysis. It is a fact that thousands of boys in our American universities today are being held down to laborious work on a vast mass of technical detail and drill that is narrowing rather than broadening in its educational effect; furthermore, there is being developed in the boys an aversion to any but their selected narrow field and a positive distaste for the so-called "cultural" studies.

There is, however, one argument made by those who defend the present specialization in the engineering schools which deserves some attention. It is said that the number of boys who are studying engineering in some form in the hundreds of schools that are teaching it is so enormous that only a very small percentage of those who graduate can ever hope to reach anything more than a mediocre position in professional work. The number of chief engineers, managers and superintendents needed is comparatively limited, while a hundred times as many men are required with detailed technical knowledge that will fit them for service as designers, computers, draftsmen, instrument men, testers, inspectors, etc. College courses in engineering, it is said, should therefore be planned to fit the needs of the rank and file in the profession rather than of the few who are to become its leaders.

There might have been something in this argument thirty or forty years ago when the scope of engineering work was so narrow that it was possible to give a man during a four years' college course some technical familiarity with most of the work that the average engineer is called upon to do in the field or in the office. The development and specialization of the engineering profession have changed all that. The rank and file of the profession is doing a hundred different things today that were not thought of twenty-five years ago. It is impossible to tell during a boy's college course what line of engineering work he may chance to drop into, if indeed he follows engineering work at all. Changes in economic conditions are constantly changing the tasks of the engineer. A generation ago the demand for engineers for railway location and construction had much to do with shaping the courses of study in technical schools, but the graduates of that day have nearly all had to turn to entirely different fields of work since.

There is indeed a demand for technically trained men from a great variety of industries, and of course many of those who voice this demand would like to have the colleges accomplish the impossible—furnish them competent and experienced experts in a special field of work as the result of a four-year course of study. But the boys trained in any such narrow specialty too often find to their cost that they have so limited a field in which to work and so limited a number of employers that promotion is wellnigh impossible.

Professor Wilson's paper is opportune in view of the current investigation of engineering educational methods which is being carried on by a joint committee of the national engineering societies in coöperation with the Carnegie Foundation for the Advancement of Teaching. *Engineering News* strongly commends his discussion to this organization.

Derailments the Chief Cause of Railway Accidents

The black spot in American railroad practice has long been the frequency of collisions and the heavy casualties resulting from them. The annual report of the Interstate Commerce Commission just issued makes it evident that the widespread extension of the "safety-first" movement in recent years and the general adoption of improved methods of operation, such as the block system, have materially reduced the number of collisions. It is exceedingly disquieting, however, to learn that while collisions have been decreasing, derailments have been increasing.

To quote actual figures, in 1902 there were 8,675 train accidents reported to the commission, of which 5,042 were collisions and 3,633 were derailments. Six years later, in 1908, the collisions had decreased and derailments had increased until their number was about equal.

In the year ending June 30, 1915, derailments outnumbered collisions almost two to one, the figures being 3,538 collisions and 6,849 derailments. Of 40 derailments which the commission investigated during the year, 11 were caused by bad track.

The commission, referring to the investigations of rail failures which have been made, says, "The remarkable increase in speed and weight of trains in recent years confirms the necessity for further investigation to determine with accuracy the stresses to which equipment and track are subjected under present service conditions in order to establish safe working limits for their use."

As many readers will recall, the American Railway Engineering Association undertook some time ago to carry out investigations of this very sort, but the work has gone slowly for lack of necessary funds to carry it through. The statistics of derailments above quoted certainly furnish a strong argument for completing this work at an early date.

It is pretty well understood by track engineers that the stresses in track as well as the resultant damage in the case of derailments increase very rapidly as the speed of trains increases. On one of the largest Western railway systems a rule has been in force for several years limiting the maximum speed of trains under any condition to 50 mi. per hr. We are informed by the chief engineer of the railway in question that the enforcement of this rule has not only had a material effect in decreasing the number of train accidents, but it has also materially reduced the labor and expense of track maintenance.

Letters to the Editor

Ownership of Water Services

Sir—I was interested in the editorial on "Ownership of Water Services," in *Engineering News* of Nov. 25, 1915. I think the principal objection that water companies have to taking over the ownership and maintenance of service connections between the street mains and the houses is that the companies do not wish to do anything not absolutely necessary that tends to make imperative an increase in the water rates. The companies recognize that no matter what the cost of the service, the consumers will invariably object to an increase in rates or to rates higher than those charged in some neighboring towns.

Probably due to the slogan of some well-meaning but misinformed enthusiasts for cleanliness, that water should be as free as air, a psychological condition has been created which makes the general public very loath to spend money for water, although they will readily pay relatively higher rates for gas and electricity, commodities much less essential to the welfare of the community than is water.

The water-works associations and perhaps the engineering journals of the world might do much toward educating the public to an acceptance of higher water rates as essential to improved water-works service.

PAUL HANSEN,
Acting Chief Engineer, Illinois State Board of Health.
Urbana, Ill., Nov. 30, 1915.

Patents on Reinforced Concrete

Sir—The writer has noted with much surprise your discussion of the decision of Judge Lewis in the Luten case in Denver in your issue of Dec. 2. Without entering into the merits of the particular suit, the obvious error of the reasoning which is put forward in the editorial excites comment if it is correctly understood by the writer.

With a given arrangement of steel the stresses are determined by mechanics, hence the principles of mechanics anticipate or negative patentable improvement in design. This position is indeed a novel one to the practical engineer. If by mechanics the stresses and consequent deflections are known in a reinforced-concrete design when the arrangement of steel is known, the writer would be glad to get acquainted with that new advanced kind of mechanics.

Invention may be defined as the discovery of means to produce a desired result, or an improvement in the art to which the invention pertains. A patent claim is a claim on a combination not necessarily of new things, but rather of old things which produce a useful result in a new and novel manner. Nearly all patented machines are made up of elements which are not novel in themselves, which are old and have been known and used for centuries. Thus the gear, shaft, pulley, bearing, frame, lever, etc., are old. When combined in a new and novel manner to produce a new result the practice of the Patent Office is to grant the discoverer of this combination a patent thereon after due proceedings are had.

Now as in the machine, so in the reinforced-concrete structure. The elements are old. Hammered iron rods were buried in puzzolan cement concrete at a date prior to the Christian era, so that the process of burying metal in concrete is a little too old to be patented, notwithstanding that two years ago a judge in the District Court decided that reinforced concrete, if it was patentable at all, was patentable as a process. He might as well have said that it was not patentable at all. (His decision was reversed by the First Circuit Court of Appeals.)

Now the combination and arrangement of the metal in a concrete structure may represent novelty. It may produce greater economy or greater stiffness with the same material than arrangements used earlier in the art. The mere fact that after such an arrangement is devised it may be possible to discover what the stresses are under load by the principles of mechanics in no wise negatives novelty in the arrangement, because under the principles of mechanics the arrangement has to be made first before we can tell anything about the bending stresses in the structure. Otherwise the principle of rigidities, the law of least work, etc., would not apply. Now as the arrangement has to be made before the principles of mechanics can be applied and the arrangement is the means for the discovery of that for which the patent is granted, it would seem that there was radical inconsistency in the editorial referred to.

It seems to the writer that before our patent system may be considered as fulfilling its intended object, there is needed a patent court of appeals of technical experts. The need of such a court has been long recognized by the Bar Association, but its repeated effort to secure such a court has so far been unavailing. Public opinion may perhaps bring about that which the commendable efforts of the Bar Association have thus far failed to accomplish.

F. A. CAMP.
600 Jewelers Exchange, Minneapolis, Minn.,
Dec. 7, 1915.

Sir—In your issue of Dec. 2 you state that the decision of Judge Lewis lays down the principle that the arrangement of the metal parts of a structure to resist the stresses set up involves merely mechanical design and not invention. Now this is a principle applicable equally to articulated structures and to reinforced concrete.

A truss, for example, is a combination of triangular frames. But triangular frames have been used from time immemorial, and hence on this principle there could be nothing patentable in any truss. But the Patent Office of the United States long ago issued patents to Fink, Bollman, Howe, Burr, Post and many others for the arrangement of systems of triangulation in trusses, because these inventors had secured certain tangible advantages, structural and economic, in single-span trusses

by special arrangements and combinations of triangles. In case of cantilever and multiple-span bridges the number of possible arrangements of parts has no limit. Some of these combinations show inventive genius in high degree, so much so that the possible span of bridges has been increased three times in the course of the last fifty years, and this has by no means been accomplished by the "accrued knowledge of the profession."

The patent offices of the whole world are still granting such patents, and this just as much in Germany where "a new technical effect" is required as elsewhere.

If we are going to take the position that we have the principles of mechanics with us and anything that can be done in the structural line, since it is amenable to analysis by those principles, can be no possible improvement, then the object of the patent system by which it seeks to promote progress in science and the useful arts is defeated so far as most engineering is concerned. We should then confine patents to pioneer, or basic, inventions and mostly reject those for mere improvements; and that seems to be what is practically advocated in this editorial. Probably no one would have the hardihood to deny that the Wright brothers made a real invention in their flying machine, which consisted essentially in wings, steering apparatus and propeller. Darius Green excited the risibles of the whole past generation by proposing to fly with wings, and yet the Wright brothers did that very thing; and though before them Maxim and Langley had also done this imperfectly, the wonderful improvement made by the Wright brothers in working out the practical details and successfully flying was real invention, was it not? They made the improvements that made all the difference between failure and success in flying. What they did constituted a real advance in the art of the very kind that it is the intent of the patent laws to foster and protect.

Your editorial covers a similar case. Francois Coignet long ago described the reinforcement in concrete as "a metallic framework linked or arranged so as to strengthen the same." But that did not explain how it would be possible to make a successful reinforced-concrete floor slab that would imitate mechanically the action of a homogeneous flat plate such as steel. That could not be successfully accomplished by introducing the reinforcement in any way you might please, any more than flying could occur in case wings are by chance used. The first man who proposed thin slabs of concrete is so well known to the engineering profession that I do not need to mention his name. His proposal excited ridicule almost as universal as that of Darius Green, although he did not have the good fortune to have his immortality insured by putting his name in a poem. He not only proposed such a slab, but he built it as well, and thousands like it. It was as great a success in this field as the aëroplane in flying, and his success was scored against the adverse opinion of the entire engineering profession. And now if I understand your position, neither the Wrights nor he should have any patent protection.

I am not informed and therefore cannot say whether or no the alleged improvements considered by Judge Lewis are such as deserve protection, but I am saying that in my opinion the position taken in this editorial unduly minimizes the field of effort of inventors.

Taking the broad ground that reinforcement consists merely in burying metal in the concrete, the editorial position would evidently be to put metal where the greatest stresses are. But how will you find out where the greatest unit stress occurs or where the greatest stresses to be borne are to be found before the arrangement of the metal in the structure is determined upon? To do that is impossible, because this is what is called an indeterminate structure or one in which the stresses are determined by the relative rigidity of the parts.

The arrangement then is the thing that comes first before the principles of mechanics can be applied, and a patent is granted for any arrangement of parts in a novel and advantageous manner. It is evident that some arrangements must be superior to others, and so the position taken in the editorial is manifestly incorrect.

We may be ready to admit that the engineer would be better off without the patent system than he is with it so long as the Patent Office continues to grant patents on one theory and the courts continue to construe them as to validity and infringement upon an entirely different and contradictory theory. But it would seem to be the part of the editor of an engineering periodical to uphold the just claims of the men of this profession for due recognition and appreciation, men who are applying the materials and forces that they direct with the highest inventive genius, as against judicial discussions that are based on the most crass ignorance of the simplest principles of mechanics.

H. T. Eddy.

916 S. E. Sixth St., Minneapolis, Dec. 10, 1915.

[Perhaps the best answer that can be made to the arguments presented in the foregoing two letters is to refer our correspondents to the opinion of the United States Supreme Court presented on page 1138 of our issue of Dec. 9. The Supreme Court there declares that "it was never the object of the patent laws to grant a monopoly for every trifling device which would naturally and spontaneously occur to any skilled mechanic or operator in the ordinary progress of manufacture."

In the editorial criticized we did not say that there can be or has been no invention in the field of reinforced concrete. What we did emphasize is that the ordinary placing of reinforcement in position to take stresses, such as is within the ability of any competent engineer experienced in reinforced-concrete design, is not invention, and patents based merely on particular arrangements of reinforcement ought not to be sustained unless it can be shown that the making of that particular arrangement involved invention.

Even though a man may be the first to use and to spread upon the patent records a particular way of placing reinforcing metal, he is not entitled to a monopoly of that particular arrangement unless he can show that his arrangement was a real step forward in the art.

And there is another point which deserves attention in this connection. The steady advance in technical knowledge brings within the field of the ordinary designer work which at an earlier period might rightly have been held to be invention.

The patents issued more than a half century ago to Fink and Bollman and Post and others, cited by Dr. Eddy, illustrate this admirably. When those patents were issued, little was known by practical bridge builders of the stresses in structures, and the forms of truss

referred to were real inventions—valuable contributions to the art. But with the advanced knowledge of bridge design current today, such particular arrangements of trussing could be made by any competent designer to suit the local conditions, and any monopoly of any such special arrangement would be justly opposed on the ground that no invention was involved in its creation.

Patents in the chemical field furnish an equally good illustration. Patents were issued many years ago for chemical compositions that today would be made in the ordinary routine work of any well-equipped chemical laboratory.

The position of the engineering profession almost without exception is that the designing engineer should not be obstructed in his regular routine work by patents issued to some other designer merely because the latter has devised some particular arrangement of parts, without making any real advancement in the art such as justifies the Government in its grant of a monopoly.—Editor.]

Outlet Boxes for Electrical Conduits in Concrete

Sir—One feature of concrete construction that is seldom given the attention it deserves is the proper placing of electrical conduits and outlet boxes in concrete floors. The men engaged in the mechanical trades involved in building construction seem to be imbued with the idea that reinforcement is simply used as a void filler and otherwise performs no useful function. For this reason the "all-important" reinforcement is regarded as a matter of secondary importance in the effort to make the work of other trades as easy of execution as possible.

Architects and engineers have given their stamp of approval to such conditions by an ominous silence, broken but seldom by some "overzealous young upstart" treading rough shod on the toes of the contractors who raise havoc with an otherwise excellent design by the methods they pursue in executing their portion of the work. Without question this condition is brought about by lack of knowledge on the part of the designer regarding seemingly small details, and the worked-to-death practice of "passing the buck" to the man who does the actual work.

In the past, designers of structures, especially buildings, have been too ready to take all the credit for the finished product of a half-baked design, elaborated upon and completed by the contractor with the stereotyped approval of the designer. This approval, with its usual limitations, means absolutely nothing in so far as the contractor is concerned, but always relieves the designer of responsibility. Until men are willing to make a complete design and assume the responsibility for it, much unsatisfactory work will result, and the designer, although he may have a loophole for immediate escape, will sooner or later be held in disrepute by contractors and owners with whom he has had dealings.

Specifications or plans as a rule give the information regarding the proper location of reinforcement, but fail to specify definitely the type of electric outlet box that will allow the placing of electric conduit without interfering with the reinforcement. As a result the contractor bases his estimate on the usual low box, it being the cheapest, and in executing the job insists on using that type. This practice in general plays havoc with the reinforcing, for the conduits, unless goose-necked at each outlet, lie in just about the same plane as the reinforcement.

This situation can be remedied very easily by the use of the high-outlet box 3 in. in height with the conduit entrance 1¾ in. clear above the bottom. The plane of the electrical conduits is thus raised clear of the reinforcement zone as a general rule, and this eliminates the trouble created by the electricians moving and lifting reinforcing bars to make way for conduit connections with outlet boxes.

Some electricians are now using the high-outlet box almost exclusively, for they have found it much more satisfactory. The conduits can in fact be installed more cheaply than if low boxes are used, involving the moving and rearrangement of reinforcement, or the goose-necking of conduit to enter the outlet box. The fact to be emphasized, however, is that it is the duty of the architect and engineer to his client to specify beyond a doubt the type of box to be used. Then he can with impunity specify just where the reinforcement is to be in the finished work, and be reasonably sure that the specifications will be carried out.

A. M. Wolf,
Principal Assistant Engineer, Condron Co.
Chicago, Ill., Dec. 13, 1915.

Eccentric Loading Problems

Sir—In the article of R. Fleming, "Is a Part Stronger Than the Whole?" and the editorial comment thereon, Nov. 25, 1915, I think one point is not emphasized. It is not the dimensions of the piece but rather the type of loading and the character of the resulting strains that govern the strength of the body. Thus an axial load will produce bending merely as a secondary stress, while an eccentric load will produce bending as a primary stress, and a load producing bending is the most inefficient type of loading, since the stress in merely one plane determines the section of the entire member. It is then easily grasped that changing the dimension of a piece so as to alter the type of loading over the enlarged member will so alter the strains as to lessen the resisting strength of the body, as in the classic case of torsion developed by Saint-Venant it is shown that sharp corners produce infinite shears at the edge and hence should be rounded.

I do not agree with the editorial comment on Emerson's paradox. The existence of a crack is not a very serious matter. We would not punch metals if it were, since fine hairlike cracks are often started there. I think the objection to a crack is its appearance more than anything else, that is, of course, assuming that it is due to local excess of strain only. Likewise in the shipping and hauling of steel local injuries occur which we let pass.

G. Paaswell.
2726 Creston Ave., New York, N. Y., Nov. 26, 1915.

Sir—In your editorial comment on an able article entitled "Is a Part Stronger Than the Whole?" by R. Fleming in the issue of Nov. 25, 1915, your concluding paragraph contains the statement, "Common-sense is called for in dealing with problems in eccentric stress." The writer of this letter (who happens to be the engineer referred to in Case 3 of Mr. Fleming's article) thinks this is the crux of the whole subject.

There is a tendency in some quarters to stick slavishly to formulas. It is a curious fact that no one is more narrow and strict in the use of a formula than the man who has not the slightest idea how the latter was evolved. There are few formulas used in structural engineering which are not more or less empirical. There are very few formulas in which the conditions assumed in the mathematical analysis are realized in the working conditions. There are a large number of column formulas in use, but surely they cannot all be right under all circumstances. At best they are but imperfect expressions of the truth, and should be used with this knowledge.

The writer was once made to change a strut by a New York Building Department examiner because it was 130 radii of gyration in length. It carried but one-fifteenth of the allowable load, but this made no difference in the eyes of the examiner, who simply pointed to the code, which specified not over 120 radii. So I had to change the design, although it had already been erected.

There are two general methods of figuring wind bracing for tall buildings. I have seen advocates of one method look with absolute contempt on an engineer who used the other method, and vice versa, yet the facts are that in the analyses of both methods there are assumptions made which are contrary to actual working conditions.

We have seen how it is apparently possible to prove by algebra that 2 equals 1. This ought not to weaken our faith in algebra, but merely show us that sophistry can creep into any form of logic.

We use formulas for eccentricity as well as anything else because they are the best tools we have to work with. Every result, however, should be examined in a broad way to see that it is not obviously absurd, as knocking out a superfluous rivet would be. In other words, the rule of reason applies to formulas as well as to other things, and Mr. Fleming's article brings this home very aptly.

DAVID GUTMAN.

345 Bedford Ave., Mt. Vernon, N. Y., Dec. 7, 1915.

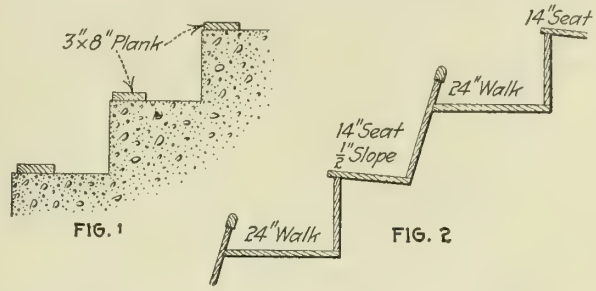
Seats for Grandstands and Railway Station Signs

Sir—As a number of large grandstands, stadium bowls, etc., are being built nowadays, a few remarks on the design from the point of view of the seat occupant may be of interest. It seems to me that in many cases his comfort has not been properly considered.

The writer recently sat for what seemed an eternity in a famous stadium having places for 30,000. The seats—if they can be called such—are built as shown in Fig. 1, the sitter having to rest on the 3x8-in. plank on the edge of the concrete step. There is no support for his back, and he is subject to the kicks of his neighbor behind him.

In the Amphidrome at Houghton, Mich., designed by the writer, the amphitheater seats are arranged as shown in Fig. 2. With this arrangement people can walk to their seats without trouble, and do not kick the people in front either in walking or when seated. This seating scheme is cheap and easily constructed. It seats a maximum number in a given space and can be adapted to any slope.

The insufficiency of station signs is a well-known weak point of our railways. The occasional visitor who takes the subway in New York is pleased to find that the stations have their names frequently and prominently displayed in numerous places on walls and columns. It has often occurred to the writer, when traveling even on our best railways, that a similar liberal use of signs for station names would add much to the convenience and pleasure of the passengers. Ordinarily a passenger in the car cannot see the name, except by chance or by much



DESIGN OF SEATS FOR GRANDSTANDS

neck stretching. Signs placed on both sides of the track and about 8 ft. from the ground, at both ends of the station, and so arranged that they can be read from any car on a long train, would be a boon to the traveler. The cost of installation and maintenance would be small as compared with the advantage.

J. F. JACKSON,
Wisconsin Bridge and Iron Co.

Milwaukee, Wis., Nov. 26, 1915.

Force Needed to Man Coast Fortifications in War

Sir—Apropos of the present discussion of military preparedness for the United States and showing an appreciation of its lack before it was so generally recognized is a word spoken over 10 yr. ago by Maj.-Gen. George W. Goethals, U. S. A., Governor of the Canal Zone, in his paper on "Fortifications" before the International Engineering Congress, 1904:

> At present the greatest difficulty is in the proper care of the guns already mounted. The Coast Artillery branch of the service, to which this belongs, is too small in numbers to man the guns now available, and the greatest danger now confronting the United States arises from this deficiency of properly trained men to fight the guns. At the outbreak of war a fleet could be off any important harbor within a few days, and long before it would be possible to organize the necessary volunteer force to properly man the guns; and even were this possible they would be ignorant of the technical knowledge now needed for the proper handling of the armament. This is a matter, however, which devolves upon Congress to rectify, and what steps will be taken to overcome this danger remains to be seen.

CALEB MILLS SAVILLE.

Hartford, Conn., Dec. 17, 1915.

[Things appear to have gone from bad to worse. Brig.-Gen. E. M. Weaver, Chief of Coast Artillery, in his annual report made public on Dec. 18 declares that we have not half enough troops to man the coast defences already built. The minimum force required is 1,942 officers and 47,176 men. Congress in 1908 adopted the policy of manning half the fortifications with regular troops and half with state militia. This policy has been a failure. The states have not furnished the men required by over 10,000, and the manning of fortifications in United States possessions overseas has left the army with only half the men and officers neccessary to furnish its quota for manning fortifications on the coast of the United States.—Editor.]

Better Highway Specifications for Clearing and Grubbing

By F. W. Harris*

The following clauses are the usual highway specification for grubbing:

All stumps, roots, logs and other obstructions shall be grubbed out and removed from all places where embankments occur less than 3 ft. in height; also where excavations occur less than 3 ft. in depth, and from such other places as the engineer may direct.

All material so grubbed out shall be destroyed in the manner specified.

Grubbing shall be paid for by the acre or fraction of an acre. The area within the limits of the slope stakes, whenever grubbing shall have been done thereon by the contractor, shall be estimated only upon cuts up to 3 ft. in depth, and under embankments of 3 ft. or less in height, and upon uniform ditches wherever the engineer may direct.

This is the old railroad specification. It answered the railroad purpose well enough, for grubbing is but a detail in that class of work, owing to the heavy cuts and fills and the much narrower width of roadbed. It is only with the wide roadways and "scratch work" of roadbuilding that grubbing comes to the front as an important factor.

Grubbing has been estimated and paid for in at least four different ways—by lump sum, station, acreage, and square rod. All these methods are founded on approximate estimates. The lump sum was the easiest way adopted on small jobs where the contractor was in a position to make a fairly close estimate. Grubbing by the station was one way of payment used by the railroads where the cut and fill was under 3 ft. By the present system grubbing is paid for by the acre or fraction thereof.

Interpretation of Grubbing

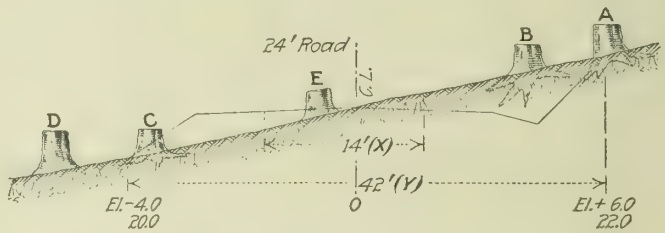
Such a clause has been interpreted in two different ways: One way is shown on the accompanying sketch as *X*, which gives a measurement of 14 ft. This method is close and very unfair. Others use a full width between the slope stakes, shown as *Y*. This gives a measurement of 42 ft., which is more fair and liberal for the following reason: Frequently there is a stump on the slope line (stump *A*) which the engineer wants removed for the sake of appearance. The same reason will apply for grubbing out the stump *C*. Also in both cases the stumps are within the 3-ft. limit. Even using the *Y* method of computing acreage, in nine cases out of ten the grubbing will be done at a loss to the contractor.

The present system of estimating the cost of grubbing for highways results in almost endless confusion and wild guessing, both on the part of the engineer in his estimate and the contractor in bidding. On one large highway contract involving the construction of 25 mi. of mountain road, bids on grubbing ranged from $100 to $300 per acre. The $100 man did not have the least idea of what he was doing. The $300 man figured a profit on the grubbing. In this case $200 was about right, as the grubbing was heavy and in addition to this there was a long and expensive haul to get powder.

The acreage of grubbing in the present estimates of quantity shows only the amount of grubbing that comes within the specification, and not what the contractor will actually be required to do. The engineer does not know the actual amount that the contractor will have to do; neither does the contractor, hence we have wildcat bidding on grubbing and no cost data on the subject that are worth a moment's consideration.

To remedy this condition the contractor should receive payment for every stump removed, regardless of the depth of cut or height of fill. He is entitled to be paid for grubbing stump *B*, as much as for grubbing stump *E*. The idea that stump *B* will cave in with the excavation is a fallacy, as this course is never adopted on construction work, for when a contractor is organized to shovel earth he does not want to break into the scheme to handle stumps.

The system of paying for grubbing by acreage must be abandoned and the stumps graded according to size. A convenient and practicable grading of sizes runs from 6 to 12 in., 12 to 24 in., 24 to 36 in., and above 36 in. No grubbing should be paid for on anything smaller than 6 in. Stumps from 6 to 24 in. should be measured 4 ft.



ROAD CROSS-SECTION, SHOWING HOW GRUBBING SPECIFICATION MAY BE INTERPRETED

from the ground. Stumps over 24 in. should be measured at the butt log. It would be impossible to measure large redwood, cypress and cedar stumps "breast high."

In the schedule of quantities submitted to contractors the stumps would be listed like the following:

100— 6 to 12 in.	150—24 to 36 in.
125—12 to 24 in.	200—above 36 in.

The contractor would then know just exactly what he has to bid on and what he has to move. He will be paid for every stump handled. It would be but a short time before grubbing would be standardized in price according to different localities, which would result in closer estimates of final cost.

There is another feature of grading stumps which makes it a valuable aid in making preliminary estimates, especially for those to be let on a lump-sum basis. The majority of engineers refuse to allow waste in any quantity to show on the profiles. This results in too close a theoretical balance, as the percentage of shrinkage is nearly always underestimated. Consequently the excavations will not make the embankments. A sag has to be put in the fill, or if earth is borrowed there is a bill of "extras" which makes the lump-sum bid almost useless.

Estimating Shrinkage

The method of obtaining an estimate of shrinkage in a timber country is as follows: Plot a trial grade line on the profile, seeing that the quantities balance reasonably close. The excavation should exceed embankment at least 10%. The profile will give the center cut and fill, and an experienced man can stand on the center line and estimate where the slopes will intersect the ground line.

The stumps in each station should be noted and recorded according to sizes and kinds of stump, also the formation of soil, whether rock, gravel or swamp. It is essential to note the kind of stumps, as some stumps will blow out much easier than others. For instance, a 4-ft. fir stump will leave a smaller hole than a 4-ft. cedar

*Renton, Wash.

stump. This should be borne in mind merely as it would be a useless refinement to grade the loss of excavation by the kind of stump shot out. In the office the stumps should be listed according to cuts and fills.

The following table will apply on the Pacific coast for computing loss of excavation by blowing out stumps. Fir, cedar, spruce, hemlock are averaged in the table.

6 to 12 in.	1 cu.yd. each
12 to 24 in.	3 cu.yd. each
24 to 36 in.	5 cu.yd. each
Above 36 in.	10 cu.yd. each

In swamps where the growth is spruce, hemlock, cedar, maple, 50% should be added to these quantities, as it requires more dynamite to lift a stump of given size, owing to the decreased resistance of the swamp soils. To get shrinkage, say between Sta. 20 and 30, this would average a 4-ft. cut on the center line for the entire distance. Assuming the record shows the soil to be clay and hardpan, the list of stumps for this section would total 65, divided as follows:

6 to 12 in.	20	20 cu.yd.
12 to 24 in.	20	60 cu.yd.
24 to 36 in.	20	100 cu.yd.
Above 36 in.	5	50 cu.yd.
	65	230 cu.yd.

In this cut the grade line would have to be lower to give the additional 230 cu.yd. lost in blasting. As the same condition, however, is assumed to exist in the adjacent fill, the grade line will give a correct balance.

The grubbing clause should be revised to include the following:

All stumps and roots on the right-of-way to be grubbed will be paid for according to the list of sizes shown on the schedule of quantities. Stumps 6 to 24 in. will be measured 4 ft. above the ground, stumps over 24 in. diameter will be measued at the butt log or on top of stump.

Progress of Federal Railway-Valuation Work

The annual report of the Interstate Commerce Commission just submitted to Congress summarizes the progress made thus far with the valuation of the railways of the United States. On Jan. 1, 1916, field parties will have completed the surveys upon nearly 50,000 mi. of railway. The total mileage of railway in the United States being approximately 250,000 mi., there will be left on Jan. 1 about 200,000 mi. still to cover, and it is believed that this work can be completed in the next four years. The basis of this estimate is as follows: A year ago there were eight field parties engaged on roadway and track measurement in each of the five valuation districts into which the country is divided. They were covering from 1,500 to 1,700 mi. per month. In the early part of the present year the field parties were increased from eight to twelve, and since June 1 twelve field parties have been continuously at work in each district. Their average total progress from June to October inclusive has been a little over 4,000 mi. per month, or 66 mi. per month for each party. It is believed that with this number of parties continuously at work in each district about 45,000 to 50,000 mi. per annum can be covered. The commission thinks it doubtful, however, whether with the present organization this rate of progress can be materially exceeded.

Besides the field parties handling roadway, track, bridgework, etc., special parties have been organized for appraising bridges, buildings, signal apparatus and other equipment requiring special expert knowledge. This department of the field force, while behind with its work some time ago, has now advanced so that it is keeping pace with the parties engaged on the road surveys.

Another division of the field force is engaged in the appraisal of railway lands and rights-of-way. This division was organized later than the field parties engaged on roadway measurements and has not yet equaled the rate of progress made by them. In the months of August, September and October the average monthly progress of the land-appraisal forces was about 2,500 mi. per month. This lower progress has been partly due to inability to expand the force, since it has been found difficult to obtain suitable land appraisers through the civil-service examinations. New examinations have been held, however, and new lists of eligibles obtained from which additional appraisers will be appointed. With this enlarged force it is expected to bring the rate of progress in the land division up to that in the roadway division.

In the telephone and telegraph division five field parties are now at work and are covering a total pole-line mileage of about 6,000 mi. per month. The progress of work has been delayed by the lack of information that the telegraph companies should furnish. It has been found that neither the Western Union nor the Postal company has information as to the location of the greater part of its lines.

The commission indicates that it has not yet reached a decision as to the prices which it will apply in making the valuation after the quantities are determined. Tentative prices have been applied on the roads where the initial valuation has been made, but the commission states that it has not yet made its decision as to the final prices. It is collecting a great mass of information as to market prices, obtained from catalogs, quotations, correspondence and personal investigations. In addition statements have been obtained from the railways themselves as to the prices actually paid, and these reports have been checked by examination of the railways' records by the commission's own accountants. As to what additions should be made to the quantities and prices, the commission says:

It seems to be universally conceded that in addition to the amount obtained by the application of unit prices to the quantities shown by the inventory, certain additions commonly known as overhead charges must be made. These items are of significance and no opinion should be expressed upon them without the fullest possible information. . . . The commission has believed that it was wise to defer the application of prices and the final statement in dollars of the cost of reproduction new and the cost of reproduction new less depreciation until such information was available as would permit the formation of a reliable opinion.

The valuation act as passed by Congress required the commission to ascertain the original cost of each piece of property owned by the railways. The commission says that experience has demonstrated the impossibility of carrying out this requirement of the act. The best that can be done is to obtain the records of original cost where they are still in existence. In many cases improvements and additions to railways have been charged as part of the operating expenses. In other cases capital has been drawn upon to pay operating expenses. The commission states, however, that, broadly speaking, it can usually be determined how much money has gone into the railroads.

Effect of Iron and Calcium on Concrete Sand

By Thorndike Saville*

In conducting an investigation of the mortar-making properties of certain sands and gravels from several localities in New Hampshire and Vermont,[1] some peculiarities in the results of the tests marked two of the sands as having points of particular interest. The tests were conducted, with a few modifications and additions, after the procedure of the laboratories of Westinghouse Church Kerr & Co., as explained by Cloyd M. Chapman in *Engineering News*, Feb. 5 and Mar. 12, 1914.

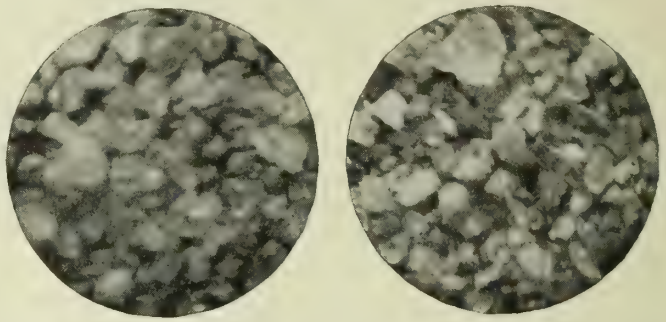
The ratios of the tensile strengths of 1:3 mortars made with five of the sands tested compared to the strengths of 1:3 mortars of standard Ottawa sand made at the same time are given in the table. Some of the tests with standard sand fell below minimum specification, due in large measure to the cement used. The relative strengths of mortars of the different sands when compared with standard sand made at the same time and under the same conditions were affected little. This was shown by making tests with the same sands in a few instances with a different cement, the tests showing greater strength, but the ratio to standard sand being about the same. This article does not purport to indicate what the proper results of tests, tensile or otherwise, ought to be. It presents merely the effects of certain impurities in sands upon their relative mortar-making qualities.

RESULTS OF TENSILE TESTS, RATIO THIS SAND TO OTTAWA

Sample	Occurrence	Impurity	3 Days, %	7 Days, %	28 Days, %
21	Concord	....	36	34	47.8
40	Portsmouth	Fe_2O_3	58	71	82.8
22	Pompanusuc	$CaCO_3$	160	123	188.0
35	Pompanusuc	$CaCO_3$	135	130	142.0
28	River	....	158	110	142.0

The sand from Portsmouth has the same uniformity coefficient, the same effective size and the same general appearance as the sand from Concord. Both are fine and even in texture, and a weak mortar would be expected. The Portsmouth sand (No. 40), however, tests well, while that from Concord (No. 21) tests low. Microscopic examination showed numerous red particles in the Portsmouth sand, which when tested gave a strong reaction for iron. They are probably of the nature of bog iron ore (limonite = $2\ Fe_2O_3 + 3\ H_2O$). This ingredient in the sand causes the mortar to set very slowly and to attain a much greater ultimate strength than it otherwise would, making of a naturally poor sand one of fair strength. The mode of occurrence of this sand the writer has been unable to ascertain, and hence the large amount of iron in it is unaccounted for.

The sands from the Pompanusuc (Vermont) region (Nos. 22 and 35), which contain a high percentage of calcium carbonate ($CaCO_3$) cement, are naturally of good quality, but the addition of the $CaCO_3$ causes an extremely strong mortar, testing well over 125% compared with mortars of standard Ottawa sand of similar proportioning. These sands and gravels are from kame deposits and are of glacial origin, the calcium carbonate being derived from particles of calcite schist from the schist areas to the north. Not only is there much of this schist among the stones composing the gravel, but the gravel itself is strongly cemented. It was necessary to break it up before making briquettes, and on account of this artificial grading of sizes no sieve analysis was made.



FIGS. 1 AND 2. MICRO-PHOTOGRAPHS OF CONCORD SAND (NO. 21) AND PORTSMOUTH SAND (NO. 40).

Left—(No. 21) Showing uniformity of sizes and presence of nothing but quartz fragments. Right (No. 40)—Showing similarity of sizes to Concord sand. White particles are mostly quartz, dark particles hornblende and basalt. Dark particle in center is only limonite fragment in photograph

The fact that the conditions under which the tests were made were fairly uniform is shown by computing the probable error of the means by the methods of least squares. From these computations the probable error of the mean of fifty-two 7-day tensile tests on 1:3 standard sand (Ottawa) mortars was ±2.476 lb., or 1.35%, and that of fifty-four 28-day tests was ±3.82 lb., or 1.64%.

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[1]Condensed from a thesis presented for the degree of Civil Engineer, in April, 1915, to the Thayer School of Civil Engineering, Dartmouth College.

Worcester Road Congress

The so-called International Road Congress held in Worcester, Mass., Dec. 14 to 17, under the auspices of the Worcester Chamber of Commerce, was a notable gathering of New England road officials. The attendance was about 1,000, and several papers of interest to engineers were read. These will be published in full by the Worcester Chamber of Commerce through the secretary of the congress, Herbert N. Davison.

One of the most notable papers was that of William E. McClintock, on "The History of Highway Development in Massachusetts." Mr. McClintock was for many years Chairman of the Massachusetts Highway Commission, and his paper is a valuable collection of reminiscences and early experience in state-road building. This state enjoys the distinction of being about the only one which has followed a consistent policy in state-road building for over 20 yr., and the material Mr. McClintock has put on record will be much sought by future historians and investigators of this present remarkable period of road building.

Papers of general interest were those of Logan Waller Page, Director of the United States Office of Public Roads and Rural Engineering, on "What the United States Is Doing for the Good Roads Movement," and W. A. McLean, Engineer of Highways, Department of Public Works, Province of Ontario, on "The Development of Improved Highways in Canada and What It Means to the Dominion." Mr. Page's paper was largely a discussion of the economics of road construction, and that of Mr. McLean dealt largely with organization and ac-

complishments of the highway departments of the Canadian provinces.

The general subject of road-building materials was discussed in papers by W. W. Crosby, Consulting Engineer, Baltimore, Md., and Dr. Joseph Hyde Pratt, State Geologist of North Carolina. A debate on the relative merits of natural and refined asphalt, which was scheduled to take place between Clifford Richardson, of the Barber Asphalt Co., and Leroy M. Law, of the United States Asphalt Refining Co., did not take place as Mr. Law was the only one of the contestants present. His paper on "The Merits of Refined Asphalt Roads" gave a very good summary of what has been accomplished with the use of the petroleum asphalts, particularly those from Mexico.

City street pavements were treated in papers by George W. Tillson, Consulting Engineer of the Borough of Brooklyn, N. Y., and Henry Welles Durham, Consulting Engineer, New York City. Mr. Tillson went on record as favoring a sand cushion rather than a mortar bed for stone-block and brick pavements. He considers the sand bed necessary for resiliency and holds that the mortar bed will result in a more noisy pavement. Mr. Durham's paper gave an excellent summary of the history of granite-block pavement and of the improvements in practice in this country and abroad.

The financing of street improvements was the subject of an excellent address by Nelson P. Lewis, Chief Engineer of the Board of Estimate and Apportionment, New York City. Some very convincing arguments were presented to establish the fallacy of long-term bonds for temporary improvements. He believes that a large proportion of the cost of street improvements in the great cities should be borne by local property which is directly benefited—in other words, the public should obtain its just part in the unearned increment on real estate.

The paper of W. H. Connell, Chief of the Bureau of Highways, Philadelphia, Penn., on "The Organization of Highway Departments," was chiefly a description of a system for keeping in touch with the many street jobs under way, conditions of pavement, etc., in a great city, by the use of wall maps and colored pins. With the help of combinations of these pins and the use of a visible card index the chief of the bureau is able to answer promptly all ordinary inquiries as to the status of the work, condition of the pavement, etc.

The concrete roads of Milwaukee County, Wisconsin, the methods of construction, maintenance and other essentials, were the subject of a paper by Herbert J. Kuelling, County Highway Commissioner. Concrete, and steel and concrete highway bridges were discussed in a paper by J. R. Worcester, Consulting Engineer, Boston, Mass.

A paper of considerable interest to engineers was that of Edwin Duffey, Commissioner of Highways of New York State. Mr. Duffey stated that under his administration the New York State Highway Department is reverting largely to the construction of waterbound macadam roads—more miles of this type are now under construction in New York than of any other one type. He seemed to consider the experience with bituminous macadam unsatisfactory. He spoke favorably of concrete pavements, the standard width for which his department has made 17 ft. He thought conservatism should be the rule of the department, which now has $22,000,000 worth of work under way.

The other papers covered a variety of subjects from the automobile and horse owners' point of view. There were numerous entertainments and an exhibit of road-building materials and machinery. A registration fee of $3 was charged each of the delegates except those who had a part in the program.

Maintenance and Repair of Concrete Pavements

Milwaukee County, Wisconsin, has adopted concrete pavement almost exclusively for road surfacing. Of this type of construction 40,000 sq.yd. was built in 1912; 218,000 sq.yd. in 1913; 264,000 sq.yd. in 1914; 399,000 sq.yd. in 1915, and about 350,000 sq.yd. will be built during the coming year. All these pavements are 16 or 18 ft. wide, 8 in. thick in the middle and 6 in. thick at the sides. The following notes on the maintenance and repair of these pavements are from a paper by Herbert J. Kuelling, Highway Commissioner, Milwaukee, Wis., read Dec. 16 at the Worcester, Mass., Road Congress.

The best method of repairing small depressions is to first sweep the pavement surface with a steel broom to loosen any dirt; after which the spot is thoroughly swept with fiber street-cleaning brooms and finally with ordinary house brooms to remove all dust and dirt possible. The depression is then covered with hot Tarvia-X and covered with coarse sand or screenings, after which it may be opened to traffic.

If the depressions are of considerable depth, one of two methods may be employed. The depression is cleaned as already described, then tar painted and brought to grade with crushed stone. Care must be taken not to have stone larger in size than the depth of the depression. The stone is tamped in place with hand tampers or with a road roller The voids in the tamped stone are then filled with a bituminous binder, allowing about 1 gal. per sq.yd. per in. of depth. This is the quickest way to make repairs and prevents interruption to traffic for any length of time. The second method is to cut out the poor place entirely and after trimming the sides of the hole and thoroughly sprinkling the surrounding concrete with water, to fill the hole with new concrete of the same mixture as the original road.

In Milwaukee County it has been found economical to have a small maintenance crew, consisting of a foreman and four laborers with a team and wagon, go over all the roads once or twice each year. This maintenance crew under average conditions fills all cracks, bad joints and small pits in from 1 to 2 mi. of 18-ft. concrete pavement per day, at a cost of from $15 to $30 per mi. for labor and materials.

An experiment has been tried of treating the entire surface of some pavements with from ⅓ to ¼ gal. of tar per sq.yd., applied with a power spraying device. Care is of course taken to have the surface thoroughly clean. If a second application is made, asphalt may be used instead of tar, as it has been found the asphalt will adhere to the tar where it will not adhere to the original concrete surface. These experiments have not yet progressed far enough to warrant any conclusions, but Mr. Kuelling seemed convinced that a successful means of treating concrete roads in this manner would soon be developed as a result of the work.

News of the Engineering World

Broken Wires Caused the New Haven Railroad Blockade

The complete interruption of traffic on the Woodlawn-New Haven electric-traction zone of the New York, New Haven & Hartford R.R. during the storm of Dec. 13 and 14 (as described in *Engineering News,* Dec. 16) and the crippled condition of the road for several days thereafter appear to have been due entirely to broken signal and feeder wires. There seems to have been no other part of the electric-traction equipment in serious trouble. A casual inspection of the zone just after the storm (by observation from approaches to the right-of-way and from the rear end of one of the early trains) showed innumerable breaks of the auxiliary circuits along the 60-mi. stretch—and but little else. The catenary overhead contact system was undisturbed, the only trouble apparent being a few loose hangers between messenger cable and running wire at one point—due probably to arcing of a locomotive pantograph at ice barriers. No catenary bridges were damaged, and none of the short masts holding the signal and feeder wires above these bridges showed trouble—beyond three cases of bent cross-arms. There were many broken insulators but no plain evidence of whether these failed first or as the result of unbalanced pull as the wire spans snapped under their ice load.

Liquid Chlorine Adopted by Minneapolis Water-Works

Minneapolis has added its name to the rapidly growing list of cities that have substituted liquid chlorine for hypochlorite of lime to disinfect their water-supply. The change was recommended in November, 1915, by F. W. Cappelen, city engineer. A contract was promptly let to Wallace & Tiernan, New York City, for the installation of three liquid-chlorine outfits with a capacity to treat 60,000,000 gal. a day each. The contract price was $2,000. The apparatus is of the solution-feed manual-control type, similar to that at Buffalo.

The arrangement of the new filtration plant necessitated three units, duplicate machines for regular service and a third in another part of the plant for use in the event of an emergency making it necessary to cut off the clear-water reservoir and resort to direct pumping. A 0.15 solution, or 1 part per million, is being used. The officials believe the the cost will be about 10c. per 1,000,000 gal., or only one-fourth that of the "hypo" process at the last price paid. L. I. Birdsall is superintendent of filtration. The liquid chlorine is being obtained from the Niagara Falls plant of the Electro-Bleaching Gas Co., New York City.

City Engineer Cappelen began his investigation when the war demand sent hypochlorite prices soaring, and Huron, S. D., and other cities in the Northwest began inquiring whether Minneapolis would take care of their needs temporarily should their supplies be shut off.

Huge Steam-Power Plant for Pittsburgh District

A 200,000-kw. steam-electric power station will immediately be erected at Windsor, W. Va. (between Wellsburg and Wheeling on the Ohio River), by the American Gas and Electric Co., of New York City, a concern having plants at Atlantic City, N. J.; Wheeling, W. Va.; Scranton, Penn.; Canton, Newark, Tremont, Mt. Vernon, Fostoria, New Lexington, Lancaster and Tiffin, Ohio; Elwood, Alexandria, Marion and Muncie, Ind.; and Rockford, Ill. This will be a wholesale station to supply the other plants of the company and will also sell large blocks of power to street railways, manufacturers and other electric companies.

The initial installation will be two 30,000-kw. turbine units, and this will be added to until 200,000 kw. is reached. The present aggregate capacity of the company's generating plant is 80,000 kw. The plant has been designed by Sargent & Lundy, of Chicago. Contracts have been let to the Foundation Co., of New York, for the construction of intake tunnels and building and machinery foundations; it is believed that this company will also secure the contract for the building. The General Electric Co. will furnish the turbines and Babcock & Wilcox the boilers. It is expected that the plant will be ready for operation some time in 1916. A contract has been made with a neighboring mine to supply the fuel requirements of the entire plant for the next 45 years. A double-circuit heavy steel-tower line will be at once constructed to Canton and operated at 140,000 volts. Connection will also be made with the company's present system at Wheeling and Newark.

A local business will be developed by the company, inducements being offered to consumers with high load factors. A large acreage was secured by the company in buying land for its station, and this will be sold at moderate prices to desirable customers. Local service will be given at 11,000 volts.

Water-Filtration Experiences

A notable series of papers and discussions on the general subject of "Filter Troubles" was presented at the meeting of the New York Section of the American Water-Works Association on Dec. 16. The main papers were: "Resanding Problems at Albany," by G. E. Willcomb; "Iron Removal by Rapid Sand Filtration," by F. E. Hale; and "Airbound Difficulties at Wilmington, Del.," by E. M. Hoopes. In addition less formal papers or talks by F. W. Green, G. R. Spalding, E. G. Manahan, S. M. Van Loan and A. A. Tolson were scheduled.

The airbound filter difficulties at Wilmington, described by Mr. Hoopes, were caused by cracks in the filter floor separating the slow sand filters from the clear-water reservoir. Air passed from the space above the water in the reservoir up into the filters, resulting at times in serious air binding and making it necessary sometimes to siphon

water off the top of the bed. When these difficulties are at their worst, sole reliance has to be placed on the chlorination of the water.

Mr. Green stated that in studying red-water difficulties at the Little Falls plant of the East Jersey Water Co. he had been working on the carbonic-acid theory and had added lime to the water to neutralize the carbonic acid. Experiments are now being made with an electrolytic process which he did not wish to describe, as it is proposed to patent it. Oiling ditches to prevent mosquito breeding in the meadows forming a part of the Passaic River drainage area, from which the Little Falls plant takes its water, has at times given some trouble at the filter plant. When rains come and the ditches are overflowed, washing out the oil, the meadow grass is killed. This increases the organic matter in the water to such an extent that it is not always possible to add as much chlorine as is necessary for disinfecting purposes. Remarks by Mr. Green and later by George A. Johnson were made to the effect that it might prove desirable for water-works plants to install their own apparatus for reducing a disinfecting agent, instead of buying either hypochlorite of lime or liquid chlorine. War prices, particularly as regards hypochlorite, may hasten such action by municipalities. Mr. Johnson went so far as to state that if at the introduction of the use of hypochlorite as much had been known as at present, instead of hypochlorite of lime becoming the vogue, water-works plants would have put in apparatus for producing hypochlorite of sodium from common salt. Just now hypochlorite costs something like $150 a ton, as compared with $20 to $30 a year ago. The liquid-chlorine prices have advanced from 25 to 50% on account of the war.

The destructive effect of alum on the piping of the mechanical-filter plant of the Hackensack Water Co. was described by Mr. Spalding. Brass piping had to be renewed at intervals of a year and a half or two years on account of the destructive action of the alum. The pipes not only leaked, but clogged. Sections were cut out and eventually the pipe had to be renewed. A 2-in. brass pipe lost 17 lb. weight per 12-ft. length within two years or so. A 1½-in. brass pipe decreased in weight from 36 to 26 lb. per 12-ft. length in a period of four years. To meet these troubles bronze-composition pipe with slip-joint fittings was tried, and later copper pipe was used. The copper seems to have stood better than the bronze. The slip joints permit the easy removal of any defective lengths of pipe, besides providing a pipe of uniform thickness all the way.

A Proposed Bond Issue of $7,000,000 for street improvement work will probably be voted on in Pittsburgh, Penn., early in 1916.

A Steel Truss Bridge over the Spokane River at Spokane, Wash., collapsed on Dec. 18 under two passing street cars. Seven persons were killed and 10 injured in the accident. Details are not available as this issue goes to press.

A Drawbridge Accident on the Chicago, Burlington & Quincy R.R. occurred Nov. 27 at Quincy, Ill. A train from St. Louis had stopped at the Mississippi River bridge while the draw was opened to let a vessel pass, and the engineman started without waiting for the hand signal which would have notified him that the bridge was closed. The engine went into the river, leaving the tender and train on the track, and the only damage to the bridge was the knocking off of a small portion of the coping of the pier at the end of the swing span. The engineman and fireman were drowned.

A Large Transverse Testing Machine for the Bureau of Standards is asked for in the report of the United States Secretary of Commerce and Labor. The machine is to be suitable for "testing full-sized plate girders, arches, floor constructions, and similar work."

A Utility Commission in Alberta, Can., was recently created. It will exercise a general supervisory control over all public utilities in the province and also act as an advisory board on municipal improvements involving bond issues. The chairman receives a salary of $7,200, and each of the other members $6,000.

Excavation from the Culebra Slides, at Panama, during the week ending Tuesday, Nov. 23, amounted to 303,850 cu.yd., according to the "Canal Record" of Nov. 24. On Monday, Nov. 22, 48,622 cu.yd. were excavated in 24 hr., the highest record for a day's excavation in the cut. Of the three 15-yd. dipper dredges working at the slide, the highest record for the week was made by the "Cascadas," which excavated 83,205 cu.yd.

The Panama Canal was temporarily opened on Dec. 20 to permit the passage of six small vessels which had been waiting at Panama since the closing of the canal on Sept. 18 because of the slides in Gaillard cut. The slides have been removed only sufficiently to allow these small boats to pass, and the canal will be again closed pending the final clearing of the channel. No prediction is made as to when this will take place.

A Proposed $2,000,000 Sewerage Loan at Milwaukee for carrying on the intercepting-sewer work in that city was recently defeated in the city council. The loan has been included in the budget for 1916 and will come before the council for passage in January. Its passage will require a three-quarters vote of the council. It is stated that the nine Socialist members of the council are opposed not merely to this loan but to the whole sewerage improvement. If the loan fails, progress on the sewerage work will be confined to an outlay of half a million a year, requiring a period of 16 or 17 years instead of 5 or 6 to complete the work.

The Commission Plan of Municipal Government exists in 81 of the 204 cities of the United States estimated to have a population of 30,000 or upward in 1915, according to information collected by the United States Bureau of the Census. These 81 cities are located in 26 states, distributed as follows: 5 in New England; 27 in other northern states east of the Mississippi River; 16 in still other northern states lying between the Mississippi River and the Pacific Coast states; 9 on the Pacific Coast; 24 in the South. New Orleans, with an estimated population of 365,000, is the largest city in which the commission plan has already gone into effect, but on Jan. 1, 1916, the plan will go into effect at Buffalo, which has an estimated population of 460,000. The great majority of the commissions consist of five members, but a few have six or seven, and some have three, and one has four. The salaries paid the commissioners range from $7,000 a year in Birmingham, Ala., to $500 a year in Jackson, Mich., and Springfield, Ohio. The terms of office range from one to four years. The salaries of the mayors in the 123 cities of 30,000 population and upward not under the commission plan range from $15,000 a year for New York to $100 a year for Flint, Mich.

Motor-Car Speed Regulation, based on the weight of the car, was proposed by Rear-Admiral Geo. W. Baird in a recent meeting of the Washington Society of Engineers at Washington, D. C. Rear-Admiral Baird said: "It is not possible to make a speed rule to satisfy everybody, but a rule may be made which will be considered fair to the great majority. Basing a proposed rule on the energy of motion of the automobile, let us take W as the weight of the car in long tons and S as the speed in miles per hour; then we will have the formula, $S = \sqrt{\frac{125}{W}}$, which is empirical but approximately fair. Then taking three examples we will have the following: For a light runabout weighing about 1,200 lb., S = 15.2; for a touring car weighing 1,800 lb., S = 12.5; and for a truck weighing two tons with a load of four tons, S = 4.56. This may be opposed by car builders who will be required to make changes in their gears, and it may be opposed by owners of high-priced and better-made cars which are necessarily heavier, but it is not likely to be opposed by pedestrians."

The New Freight Terminal of the Lehigh Valley R.R., in Buffalo, N. Y., was formally opened on Dec. 15. The terminal consists of a team-track yard and two buildings—a two-story office building, 111x60 ft. in plan, and a fireproof shed, 700x60 ft. The office building contains two storage rooms, one for damaged shipments and the other for perishable freight. Of the 700-ft. length of the shed, 600 ft. is taken up by floor space. There are three sections which have fireproof walls with doors protected by automatic fireproof steel curtains.

An automatic scale is provided every 75 ft. There is a platform on the street side for the convenience of wagons. On the opposite side there is a platform at which 47 cars can be unloaded at once. In the yard there are 13 team-tracks with capacity for 150 cars. Each pair of tracks is divided by a 45-ft. roadway paved with Belgian block. An especially interesting detail is that one of the bumpers, which are of concrete, can be used as an unloading platform for end-door cars. There is a ramp leading to the top of the bumper. Cars can unload onto this bumper from two adjacent tracks. Included in the equipment of the yard is a 40-ton crane. The entire yard will be inclosed by a brick wall. The new passenger terminal of the railroad is being constructed opposite the freight terminal.

PERSONALS

Mr. J. W. Fox has been appointed Valuation Engineer of the Central of Georgia Ry. He succeeds Mr. H. D. Pollard, who recently resigned.

Mr. O. K. Morgan, Office Engineer of the Carolina, Clinchfield & Ohio Ry., at Johnson City, Tenn., has assumed the duties of the late Ward Crosby as Chief Engineer of the road.

Mr. Sledge Tatum, M. Am. Soc. C. E., has been designated Acting Chief Geographer of the United States Geological Survey by Secretary Lane. He will continue to serve also as Geographer in Charge of the Rocky Mountain Division.

Mr. Joseph K. Gannett, Chief Draftsman of the valuation and the grade-crossing-elimination departments of the New York, Chicago & St. Louis R.R., at Cleveland, has accepted the position of Assistant Chief Engineer of the Samuel Austin & Son Co.

Mr. G. W. Rathjens, Assoc. M. Am. Soc. C. E., Chief Engineer of the Twin City Brick Co., of St. Paul, Minn., has been appointed a member of the new Charter Commission of St. Paul. Mr. Rathjens is also President of the Public Affairs Committee of that city.

Mr. Fred C. Alber, Commissioner of City Parks of Cleveland, Ohio, has resigned to become City Manager of Newburgh, N. Y., at a salary of $6,000 a year. Mr. Frank M. Patterson, Secretary to Mr. Alber, will assume his duties as head of the park system until Jan. 1.

Mr. E. L. Dunbar has resigned as Superintendent of the Water Department of Bay City, Mich. He leaves the service on Jan. 1 and will move to Los Angeles, Calif. Mr. Dunbar was the first superintendent of the department and served for 40 years. He will be succeeded by Mr. R. C. Dawson.

Mr. C. H. Fox, formerly Assistant Division Engineer of the Canadian Pacific Ry., at Winnipeg, Man., has been appointed Resident Engineer of District 2, Manitoba division. He succeeds Mr. E. L. Landorph, who has been transferred, and the position of Assistant Division Engineer has been abolished.

Mr. J. M. Dooley, recently Superintendent of the Rio Grande division of the Texas & Pacific Ry., Dallas, Tex., has been promoted to be Superintendent of Transportation of the entire railway. He is succeeded as Division Superintendent by Mr. C. E. McMullen, formerly Trainmaster at New Orleans.

Mr. Charles H. Paul, M. Am. Soc. C. E., formerly Construction Engineer in charge of the Arrowrock dam, has resigned from the United States Reclamation Service to accept a position with the Miami Conservancy District as one of the principal assistants of Mr. Arthur E. Morgan, M. Am. Soc. C. E., of Memphis, Tenn., Chief Engineer of the district.

Mr. F. E. Kurzenknabe, Consulting Engineer of the Louisville & Nashville R.R. and for the past three years Resident Engineer at Lexington in charge of construction of the West End viaduct and design of the company's freight terminals and yards, has resigned to engage in private practice in Lexington, Ky. He has formed a partnership with W. T. Congleton, of that city, under the firm name of the Congleton Construction Co.

Mr. Wm. R. Billings, M. Am. Soc. M. E., is Secretary and Treasurer of the Farmers' Bureau, Inc., 150 Nassau St., New York City. This is a new institution the object of which is to act as purchasing agent for farm and estate owners, and as contracting and consulting engineers for the design and construction of sewage disposal, water-supply, roadway improvement, etc. Mr. Billings graduated from the Worcester Polytechnic Institute in 1871 and for many years was Vice-President of the Alberger Condenser Co.

Mr. H. L. Vercoe has been appointed Special Engineer of the Canadian Northern Ry. Lines West of Port Arthur, Ont.; Mr. W. T. Moodie, formerly Engineer of Maintenance-of-Way, has been appointed Division Engineer of the Central division; Mr. T. Lucas, formerly Engineer of Maintenance-of-Way West of Winnipeg, has been appointed Lease Engineer of the Lines West of Port Arthur; and Mr. A. T. Fraser, M. Can. Soc. C. E., formerly District Engineer at Edmonton, Alta., has been appointed Division Engineer of the Western division of the road. All have headquarters at Winnipeg, Man.

Mr. Henry Welles Durham, M. Am. Soc. C. E., Consulting Engineer, New York City, has been appointed County Engineer of Bergen County, N. J. Mr. Durham was Chief Engineer of the Bureau of Highways of the Borough of Manhattan, New York City, from 1912 to 1915, previous to which he was Resident Engineer of the Cape Cod Canal. From 1900 to 1904 he was Resident Engineer in charge of municipal improvements in the City of Panama under the Isthmian Canal Commission. He is a graduate of the Columbia School of Mines, class of 1895. Mr. Durham will continue his New York office at 366 Fifth Ave. and his private practice.

Mr. T. W. Ransom, M. Am. Soc. M. E., Consulting Mechanical Engineer of the Board of Public Works of San Francisco, has tendered his resignation to Mr. M. M. O'Shaughnessy, M. Am. Soc. C. E., City Engineer, to take effect on Jan. 1, 1916, in order to return to his former private practice as Consulting Engineer, with offices at 1104 Merchants Exchange Building. For eight years Mr. Ransom has been actively associated with the city engineering department on the design of the high-pressure fire-protection system and on the municipal street-railway system. Previous to his engagement by the city, he was instrumental in perfecting and developing the impulse waterwheel to its present high efficiency; he designed the hoisting works and air-compressor plants of some of the largest mines in California, and was among the first to advocate the construction of bucket gold dredgers of large capacity. He designed the hulls and machinery of a number of towboats and steam schooners plying on the Pacific Coast.

OBITUARY

Frank H. Bailie, Assistant Manager of Sales of the H. K. Porter Co., Pittsburgh, Penn., died on Friday, Dec. 14.

Sam M. Blevins, Commissioner of Public Utilities of Arkansas City, Mo., died at his home, Dec. 14. He was 58 years of age.

Charles K. Olsen, an engineer and contractor of New York City, died at his home in Flushing, L. I., Dec. 11, at 59 years of age. Mr. Olsen was a native of Norway. He was prominent in the civic affairs of Flushing.

Charles D. McKelvey, Chief Inspector of the Railroad Division of the Board of Public Utility Commissioners, former Member of the Finance Commission and Commissioners on the Board of Public Works, of Paterson, N. J., died at his home in Paterson, Dec. 16.

George N. Steinmetz, a contractor on the construction of the Roosevelt Dam, in Arizona, and the Galveston sea wall, died at his home in New York City, Dec. 19, in his fifty-sixth year. He was born in Seagertown, Penn. He retired from active business three years ago.

Kit Colyer, a road contractor well known in the State of Missouri, died at his home in Independence, Mo., Dec. 14, at 52 years of age. He was born in Crab Orchard, Ky., and spent the most of his life in Sweet Springs, Mo. Mr. Colyer, in partnership with his brother Daniel, under the firm name of Colyer Brothers, built many of the roads in Jackson County.

Capt. Jasper Ward Cook, one of the pioneers to engage in the sand-dredging industry in Toledo, Ohio, died at his home in Detroit, Dec. 17, at 80 years of age. In the early '80s Capt. Cook entered into partnership with Capt. Egbert Doville, and for 20 years the firm carried on a dredging business in Toledo, after which Capt. Cook moved to Detroit and followed the same line of business in that city. He retired three years ago.

Rear-Admiral Nicoll Ludlow, U. S. N., retired, an authority on ordnance, died at the Hotel Gotham, New York City, Dec. 16, at 73 years of age. He was born at Riverside, Islip, L. I., and after appointment from New York State to the Naval Academy was graduated in 1863. He had served 19 years at sea and 17 on shore at the time of his retirement in 1899. During his years of service Admiral Ludlow was located at the Brooklyn Navy Yard, was on special duty at New York, inspector of ordnance at the West Point foundry and the Mare Island Navy Yard, San Francisco. In addition he served in the Naval War College and commanded several vessels on the Atlantic station, the last of which was the "Massachusetts." He was a Member of the Naval Retiring Board in 1897 and at one time Governor of the Naval Home, Philadelphia.

ENGINEERING SOCIETIES

COMING MEETINGS

SECOND PAN-AMERICAN SCIENTIFIC CONGRESS.
Dec. 27-Jan. 8. Washington, D. C.

OKLAHOMA SOCIETY OF ENGINEERS.
Dec. 28. Annual meeting in Oklahoma City. Secy., H. V. Hinckley, Oklahoma City, Okla.

AMERICAN CIVIC ASSOCIATION.
Dec. 28-31. Annual convention in Washington, D. C. Secy., R. B. Watrous, Union Trust Bldg., Washington, D. C.

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 3-6. Seventh annual convention in Washington, D. C. Secy., C. R. Marsh, Brattleboro, Vt.

ALABAMA ASSOCIATION OF HIGHWAY ENGINEERS.
Jan. 8. Annual meeting in Montgomery. Secy., J. B. Converse, City Engineer, Selma, Ala.

LOUSIANA ENGINEERING SOCIETY.
Jan. 8. Annual meeting in New Orleans. Secy., W. T. Hogg, State Museum Bldg., New Orleans, La.

WESTERN SOCIETY OF ENGINEERS.
Jan. 12. Annual meeting in Chicago. Acting Secy., E. N. Layfield, 1735 Monadnock Block, Chicago, Ill.

ENGINEERS' SOCIETY OF PENNSYLVANIA.
Jan. 14. Annual meeting in Harrisburg. Secy., E. R. Dasher, 30 So. Front St., Harrisburg, Penn.

CENTRAL RAILWAY CLUB.
Jan. 14. Annual meeeting in Buffalo, N. Y. Secy., H. D. Vought, 95 Liberty St., New York City.

WESTERN PAVING BRICK MANUFACTURERS' ASSOCIATION.
Jan. 14-15. Annual meeting in Kansas City, Mo. Secy., G. W. Thurston, 416 Dwight Bldg., Kansas City, Mo.

MONTANA INSTITUTE OF MUNICIPAL ENGINEERS.
Jan. 17-19. Annual meeting at Billings, Mont. Secy., C. C. Widener, Bozeman, Mont.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 19-20. Annual meeting in New York City. Secy., C. W. Hunt.

NATIONAL DRAINAGE CONGRESS.
Jan. 19-21. Annual meeting, Cairo, Ill. Vice-Pres., Edmund T. Perkins, First National Bank Building, Chicago, Ill.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
Jan. 20-22. Annual convention in Minneapolis. Secy., Alvin E. Dodd, 140 West 42nd St., New York City.

National Drainage Congress—The sixth annual meeting will be held at Cairo, Ill., Jan. 19 to 21. The object of the congress is to obtain national legislation for reclamation of swamp lands, flood protection and related subjects. It does not seek help for any individual projects, but seeks to have the Government adopt a general policy for reclamation of the swamp lands as it has done already for the arid lands. In connection with the meeting there will be an exhibition of ditching and dredging machines, and other machinery and appliances relating to drainage work. Edmund T. Perkins, First National Bank Building, Chicago, Ill., is chairman of the committee of arrangements.

Association of American Portland Cement Manufacturers—At the annual meeting held in New York City on Dec. 15 the following officers were elected: President, B. F. Affleck; vice-president, F. W. Kelley; assistant secretary, L. R. Ferguson; treasurer, G. S. Brown. Percy H. Wilson, who has served as secretary for a number of years, resigned, and J. P. Beck was elected general manager of the association. B. F. Affleck, the new president, is president of the Universal Portland Cement Co.

The Wisconsin Highway Commissioners' Association holds its annual meeting at Madison, Wis., at the state Capitol, in connection with the annual state-road school, in the week commencing Jan. 31. The secretary is G. H. Mainwaring, Gotham, Wis.

The American Wood Preservers' Association will hold its twelfth annual convention in Chicago at the Hotel Sherman, Jan. 18 to 20. The effect of the European war on the American timber-treating industry will be discussed from the viewpoints of importers and users of creosote oil.

The San Francisco Association of Members of the American Society of Civil Engineers held its annual meeting on Dec. 17 at the Palace Hotel, San Francisco.

American Institute of Electrical Engineers—The mid-winter convention of the institute will be held in New York City, Feb. 8 and 9. A Pacific Coast convention will be held in Seattle, Wash., some time in 1916, under the auspices of the Seattle section of the institute.

The Municipal Engineers of the City of New York will hold their thirteenth annual dinner at the Hotel McAlpin on Saturday, Jan. 15, at 7 p.m. The secretary is Geo. A. Taber, Engineering Societies Building, New York City.

The Central Electric Railway Association will hold its annual meeting in Dayton, Ohio, at the Hotel Miami, Feb. 24 and 25. A. L. Neereamer, of Indianapolis, Ind., is secretary.

The Wisconsin Electrical Association will hold its next annual convention at Milwaukee, Mar. 16 and 17, with headquarters at the Hotel Pfister. The meeting will be held jointly with the Wisconsin Gas Association, the convention of which begins on Mar. 15. The secretary of the Electrical Association is George Allison, of Milwaukee, Wis.

Washington Society of Engineers—At the annual meeting held at the Cosmos Club on Dec. 15, the members and guests numbered 200. The following officers were elected: President, John C. Hoyt, hydraulic engineer, Geological Survey; vice-president, Albert L. Baldwin; secretary, Frederick W. Albert; treasurer, C. B. Mirick; directors, Elliot Woods, Morris Hacker and T. H. Taliaferro. The society was organized 10 yr. ago, and it now has a membership of 412.

The Central Railway Club will hold its annual meeting in Buffalo on Jan. 4, at the Hotel Statler. Two papers will be presented, one on "Yard Operations," by J. R. Hamilton, terminal trainmaster, Delaware, Lackawanna & Western R.R.; the other on "Modern Roundhouse Methods."

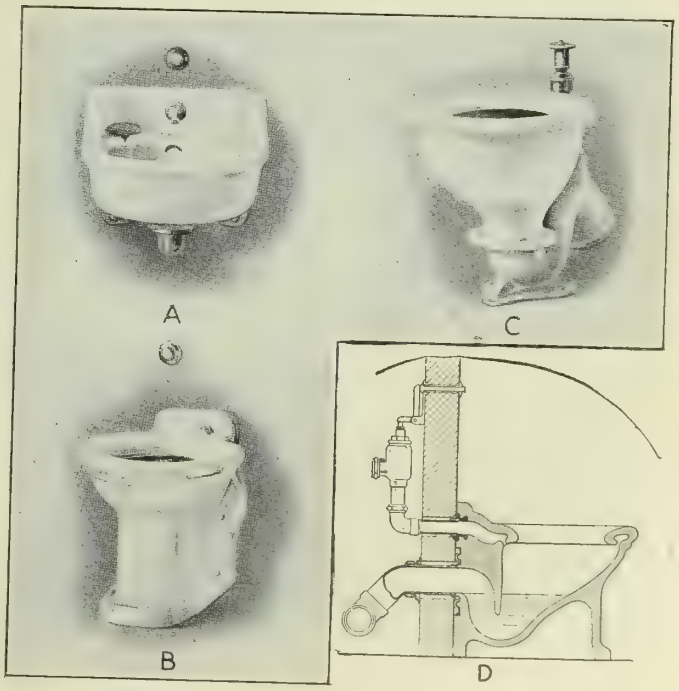
The County Engineers' Association of Yakima, Wash., met in North Yakima on Dec. 2. The officers elected were: President, A. P. Denton; vice-presidents, J. D. Neville and T. J. Wright; secretary, A. L. Strong.

The Indiana Sanitary and Water-Supply Association will hold its ninth annual meeting Feb. 2 to 5 in Indianapolis at the Claypool Hotel. The association meets this year in conjunction with the Indiana Engineering Society, and the program will be continuous, with the program of the association on Feb. 2, and the joint program of the two organizations on Feb. 3 and 4. The engineering society will hold its final session on Dec. 5.

Appliances and Materials

Plumbing Fixtures That Cannot Be Stolen

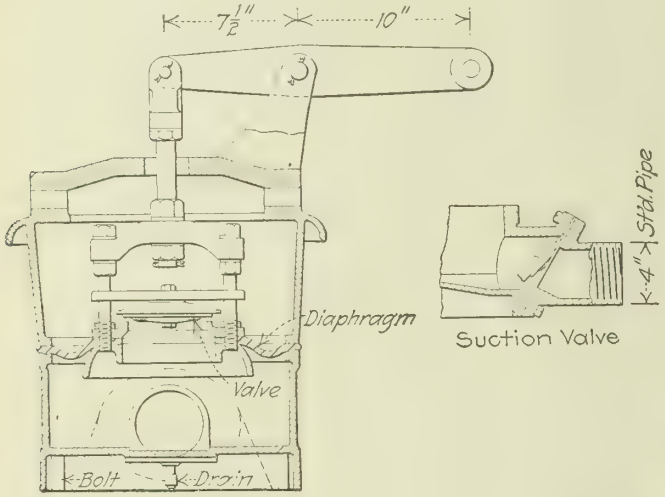
A public-comfort station is not infrequently shut down on account of the surreptitious removal of the brass fittings and lead pipe. The J. L. Mott Iron Works, of New York City, in recognition of this condition has brought out a line of plumbing fixtures the valuable parts of which are concealed from the covetous. Details A and B in combination (see view) are listed at $24.15 to $29.40; the list price for detail C is $17.35. Detail D is a longitudinal cross-section of the closet detail B and shows the concealed flush valve.



PLUMBING FIXTURES WITH CONCEALED FITTINGS

Improvement in Contractors' Pumps

A noteworthy improvement in the design of its contractors' disphragm-type pumps has recently been made by the Harold L. Bond Co., 383 Atlantic Ave., Boston. In working diaphragm pumps by power considerable splashing upon the engine was caused. After experiments with top covers, a



SECTION THROUGH NEW BOND PUMP

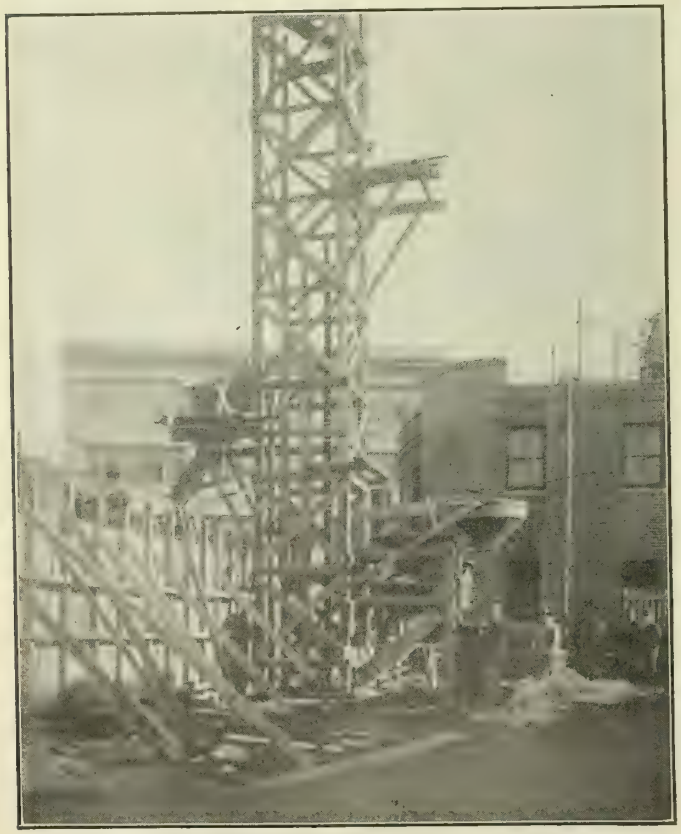
new valve was found successful. It consists of a plate rising vertically and held between two guide bolts by a slotted yoke, as shown in the accompanying figure.

Tests were made on one of the new pumps and a maximum delivery of 189 gal. per min. secured, compared with 100 gal. for the older design run at the same speed.

* * *

New Arrangement of Hains Mixer

Hains automatic mixer equipment is now being furnished for use with elevating towers and chutes. The accompanying view shows a recent outfit made by the Automatic Concrete Mixer Co., of Providence, R. I. The first hopper of the mixer is charged at grade and swung up on an arm to normal discharge position above the second hopper. The hopper may be charged with dry mixture and the water run in after raising the hopper, or the water may be charged at grade. The bottom hopper discharges into a short chute leading to the elevator bucket. The latter automatically tilts into the receiving hopper of the chute. Where there are only two stationary hoppers used below the movable one, the fourth hopper is placed above the chute top instead of a receiving hopper. With three fixed mixing hoppers, the top of the upper one is 12½ ft. above grade.



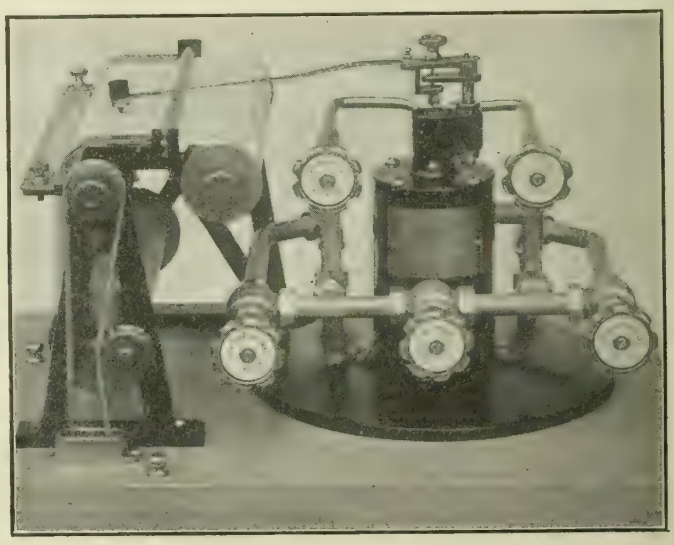
HAINS CONCRETE MIXER ON ELEVATING AND CHUTING TOWER

* * *

Recorder for Pitometers

The continuous meter shown in the view records the variations in flow of water in water mains or other closed conduits and is for use in water-waste surveys and for pump or pumping-station records. A pitometer rod is inserted into the main through a 1-in. cock and its two tubes are connected to pipes in the base of the instrument.

The recorder consists of a collapsible box built up of a series of horizontal hollow corrugated diaphragms in a cylindrical chamber. The upstream and downstream tubes are connected to the interior of the box and the outer chamber respectively. Excess of pressure in the upstream tube, due to the movement or flow of water, causes the box to expand longitudinally (that is vertically). A vertical stem on the box engages a spiral groove on a vertical cylinder,



"DIRECTOGRAPH" RECORDING METER

and this converts the vertical motion of the box to rotary motion of the arm carrying the recording pen. The stem carrying this arm turns on an agate bearing.

The pen traces a line on a ruled chart which passes from a feed roll over a driving roll and down to a take-up roll. Two small rollers between the feed and driving rolls keep the paper level under the pen. The graduation is marked on the chart at 1-ft. intervals, but for greater convenience a scale bar is placed across the paper, as shown. In a dust-proof compartment of the aluminum box which forms the base of the instrument is an eight-day clock movement, with chain drive to the chart rolls. Constant feed is insured by small pins in each end of the driving roll, which engage with perforations in the edges of the chart.

The feed is 1 in. per hour or 2 ft. per day, and the chart is in 65-ft. lengths, or sufficient for a month's record. To examine the chart, the take-up (bottom) roll can be removed and the completed portion of the chart unrolled without affecting the operation of the instrument. The two outer lower valves are for the high- and low-pressure inlets, and the two above are for the respective blowoffs. The middle valve below is for the bypass. The velocity range of the meter is from zero to 12 ft. per sec.

In service the instrument is covered by a sheet-metal case, the locking of which locks the clock chamber, so that there can be no tampering with the operation. The aluminum base has also a chamber for tools, spare parts and charts. The weight complete is about 60 lb.

This instrument is known as the "Directograph" and is the invention of W. R. Brown, of Chicago. In an earlier form it was described in "Engineering News" of Apr. 25, 1912. It is now manufactured by the Municipal Supply Co., 111 West Jackson Boulevard, Chicago.

Engineering News

VOLUME 74 DECEMBER 30, 1915 NUMBER 27

Concrete-Lined Reservoir at Salt Lake City, Utah

By Sylvester Q. Cannon*

A reinforced-concrete lining without expansion joints is the chief feature of the 5,000,000-gal. Pleasant Valley distributing reservoir recently completed as a part of the water-works of Salt Lake City, Utah.

The reservoir is located in City Creek Cañon, about 1½ mi. from the city hall. In plan the reservoir conforms practically to the outline of an old pond. It is chiefly in excavation, but on the south side (left side in the view) there is an embankment built years ago. The inner slopes are 1 to 1 and the water depth is 21 ft.



REINFORCED-CONCRETE LINED DISTRIBUTING RESERVOIR FOR WATER-WORKS OF SALT LAKE CITY, UTAH

The floor, or bottom lining, consists of a two-course pavement with a base of 1:2:4 concrete 5⅝ in. thick and a top of 1:1½ mortar ⅜ in. thick. The slope lining consists of one-course concrete 1:2:3½ mixture 6 in. thick, painted with two coats of neat-cement grout. Reinforcement consists of ½-in. twisted steel bars, 12 in. c. to c. lengthwise and 24 in. c. to c. crosswise of the reservoir. The per cent. of reinforcement is 0.35 longitudinally and 0.17 transversely. The slope lining was laid in horizontal sections 4 ft. high. A drain pipe of 4-in. tile was laid around the base of the reservoir.

The total cost of the reservoir, including valve house, outlet and intake pipes, was $18,720, or $3,744 per 1,000,000 gal. The unit prices were: Excavation, $0.45 per cu.yd.; concrete in the floor, $1.58 per sq.yd., including reinforcement; concrete in slopes, $1.74 per sq.yd., including steel. The contractor was P. J. Moran, Inc.

Upon filling the reservoir the first time, a slight leakage developed which was found to be mainly due to some small cracks that occurred in laying the floor over a section of the ground containing some surface water.

*City Engineer, Salt Lake City, Utah.

Low Concrete Dam at Harrisburg Across Susquehanna River

By Joel D. Justin*

SYNOPSIS—Long concrete dam built mainly to abolish nuisances due to stagnant water. Creates 4-ft. pool and offers no impediment to occasional high water. Unique design, especially in use of precast concrete beams for deck of dam. Construction of piers carried out in novel fashion. Cheaper than similar temporary timber dams.

Many timber crib dams have in the past been built across the shallow Susquehanna. The cost of such dams has averaged from $50 to $80 per lin.ft., the length of the dams frequently exceeding one-half mile. Of course such structures are not of a permanent nature. The City of Harrisburg last year completed the construction of a permanent reinforced-concrete dam 3,139 ft. long across the Susquehanna River at an approximate cost of $75,000, or $24 per ft. The height of the dam varies from 5 to 9 ft.

The Susquehanna River at Harrisburg is a wide, rapid stream flowing over an irregular limestone formation. In most places it is quite shallow, except in times of floods. The limestone stratum forming the bed of the stream is broken in many places and contains very large cavities which are found filled with the products of erosion—boulders, gravel, sand and clay.

Reasons for Building the Dam

Until the completion of the intercepting sewer along the river bank, lateral sewers at practically every street location in the densely populated portion of the city discharged into the river. This sewage, together with the filth and culm carried by the river, was deposited along the shore during the low-water period in the summer time. To make matters worse, the contour of the shore was such as to cause numerous pools of stagnant water to form at that season of the year. The unsightly and odoriferous condition of the shore line can be well imagined. The odors arising from the shore line were very objectionable to residents along Front St., which parallels the river, and were also a source of constant annoyance to pedestrians on the park paths at the top of the river bank. The stagnant pools along the shore line bred countless mosquitoes that made the sojourn of visitors in the park along the river bank anything but pleasant.

Investigation showed that by raising the low-water stage of the river 4 ft. the stagnant pools could be done away with; and the velocity along the shore line would be sufficient to prevent the deposition of filth and would thus do away with the objectionable odors. Accordingly it was as a sanitary measure that the construction of a low dam across the Susquehanna River was first agitated, and in 1901 by vote of the people the sum of $65,000 was appropriated to build the dam as a part of the improved sewerage system of the city. At the 2.5-ft. stage of the river, which is the average low-water stage, the mean velocity of the river is about 1½ ft. per sec. With the dam in place it is about 1 ft. per sec. This velocity with the dam in place is, however, much more evenly distributed, as the dam does away with many riffles. Pleasure boating on the river opposite Harrisburg, which before the construction of the dam was little indulged in, will now undoubtedly become very popular.

After the money had been obtained, it was found that although the city had obtained the approval of the project by the State Water Supply Commission, there were legal difficulties in the way of the city's building a dam. The city solicitor gave it as his legal opinion that the Board of Public Works had no right to go ahead and construct the dam without obtaining express authority from the State Legislature.

People in the lower end of the city and in the adjoining borough of Steelton were strongly opposed to the building of this dam, believing that it would cause ice jams and floods that would sweep away the lower end of the city. The utter absurdity of the contention that a dam which raises the low-water stage 4 ft. would have any effect on the height of a 20-ft. flood is at once apparent to engineers. As a matter of fact, the dam is drowned out at a 10-ft. stage. A legislative committee, however, is far more prone to heed the testimony of the "old riverman" who has rafted on the river for 40 years and remembers the Johnstown flood than to the testimony of the engineer who comes down from New York and makes an investigation and a report. Accordingly it was not until February, 1913, that the city was able to get the special legislation allowing it to construct the dam.

In the meantime an intercepting sewer that passes the sewage below the dam site had been built along the bank. Accordingly the main function of the dam is to do away with mosquito-breeding pools and to provide a stretch of the river about 3 mi. long for boating. Its construction also cheapened, to the extent of $50,000, the design of the stepped reinforced-concrete retaining wall which was built at low-water mark along the river for a distance of 2½ mi. (described in *Engineering News*, July 22, 1915).

Design Features of the Dam

The dam consists of a series of reinforced-concrete piers 2 ft. thick and spaced 10 ft. on centers. The height of these piers varies with the contour of the river bed from 5 to 12 ft. Each of the piers is anchored to the rock bottom of the river by ten 1-in. bars drilled 3 ft. into the rock and grouted. The upstream slope of these piers is 1 on 2, and the downstream 1 on 8. Top beams 2 ft. 3 in. thick, having a clear span of 8 ft., tie the piers together. These beams contain ten 1-in. square reinforcing bars and are cast in place, the piers being provided with a 6-in. key to receive them. The upstream slopes of the piers are provided with 4x10-in. grooves, one on each side, in which are placed slabs having a clear span of 8 ft. and a total length of 8 ft. 8 in. The slabs are 2 ft. in width and vary from 8 to 11 in. in thickness, according to the depth. They are reinforced with ⅝-in. twisted square bars. The casting of these slabs was done on

*Recently Principal Engineer, Board of Public Works, Harrisburg, Penn. Now at Chippewa Falls, Wis.

shore, and they were placed after the completion of the rest of the work.

Leakage between the bottom slab and the bed of the river was taken up by the use of sacks filled with cement and sand. The design is believed to be very economical for the conditions existing at Harrisburg, as it is possible to do the work without the use of coffer-dams.

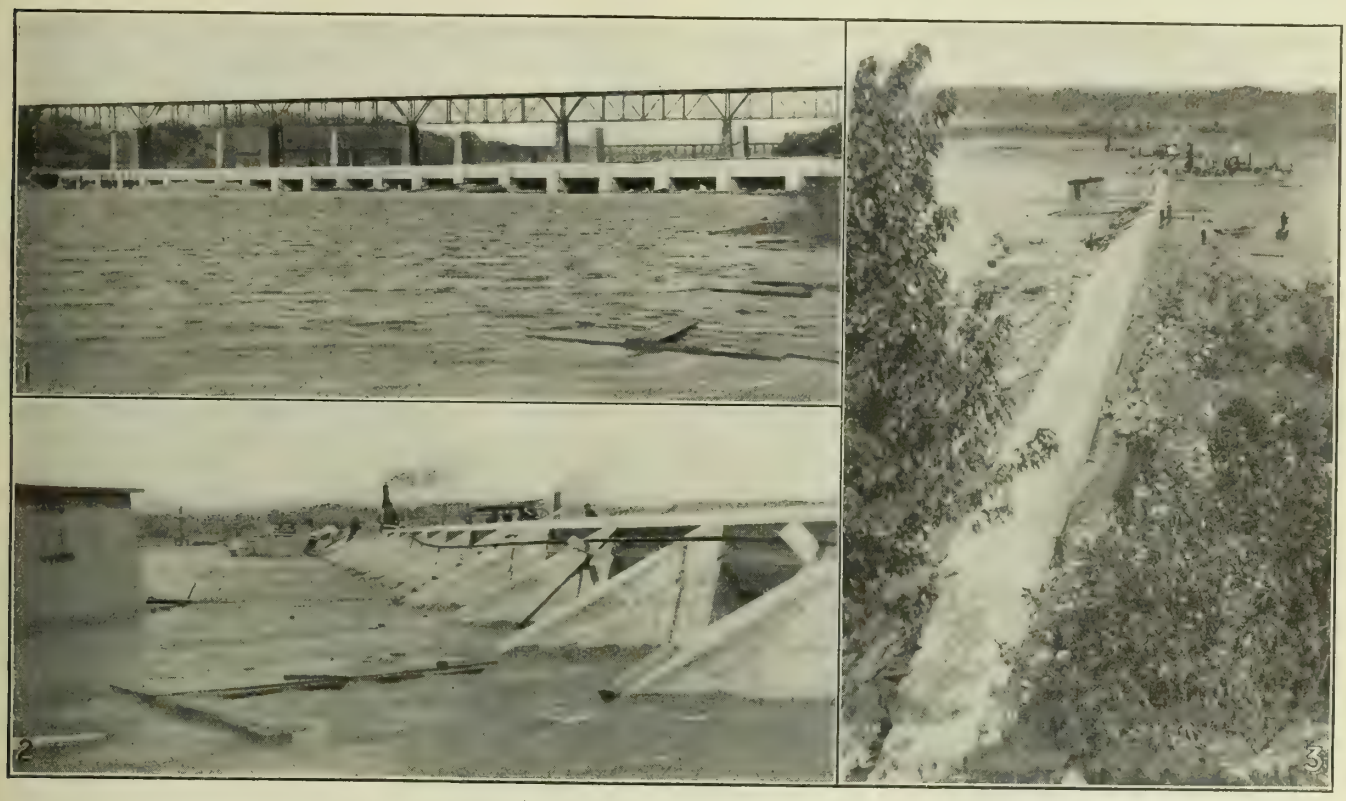
General Methods of Construction

After clearing the site for a pier the contractor set in position a form having neat inside dimensions equivalent to those of the pier at the bottom. This form was then sunk in position and held in place by sand bags piled on the wales. Sand bags were packed around the outside of the forms at the bottom on the rock bed of the river, and frequently sheeting was nailed to the outside of the studs near the bottom to allow of the more ready packing of the sand bags. By taking due precaution in the placing and packing of the bags very little grout was lost. After thoroughly cleaning off the rock inside the form, about 1 ft. of concrete was deposited inside the form through the water.

In depositing this concrete, tremies, either of steel or wood about 8 in. in diameter, were used. The depth of the water through which concrete was deposited varied from 4 to 8 ft. By care in the use of the tremies the washing of the concrete was reduced to a minimum. There was of course some washing, as is shown by the fact that the laitance when removed from some of the footings was found to be 2 in. thick. It is believed that considerable washing was prevented by allowing the concrete to stand on the board from one to two hours before using. At the expiration of this time the concrete was worked over and deposited through the tremies. The mortar of the concrete adhered to the stones better with the "air-set" concrete than with freshly mixed concrete. Both air-set and freshly mixed concrete were tried for this purpose, and it was shown that any decrease in the theoretical strength of the concrete by allowing it to set before using was more than compensated for by the smaller amount of washing with the air-set concrete. As an additional precaution to secure sound, strong footings the concrete was mixed in the proportions, 1 cement, 1¼ sand and 2¼ parts crushed stone. Standard test cylinders made from this reset concrete gave a crushing strength exceeding 2,300 lb. per sq.in.

After the concrete in the footings had hardened sufficiently, it was the intention to drill through the concrete and into the rock and grout in the anchor bars. It was found, however, that the concrete under water hardened so little even in two weeks' time that when drilled it spalled off badly in the 2-ft. piers. Accordingly the contractor used 10 short lengths of iron pipe set in each footing in the required position for the anchor bars. Then after allowing the footing to harden for two or three days the form was pumped out and holes 3 ft. deep were drilled in the rock through the pipes. Owing to the restricted working space (the forms were only 2 ft. wide) "Jackhamer" drills proved to be very convenient in this work. The ten 1-in. square bars of reinforcing steel were then grouted in position. About 1,000 ft. of dam was constructed by this method.

After the anchor bars were in place the pier form, after pumping out, was completed and the remainder of the pier concreted in the dry. The concrete top beam was then formed. Concrete in both top beams and piers was composed of 1 part of cement, 2½ parts of sand and 4½ parts of run-of-crusher stone, maximum size 1 in. The stone was limestone from a local quarry. Although the river contains large deposits of sand, the excavation of which for building and concrete purposes forms a considerable industry at Harrisburg, this local



FIGS. 1 TO 3. COMPLETED REINFORCED-CONCRETE DAM ACROSS SUSQUEHANNA RIVER AT HARRISBURG
Fig. 1—Looking downstream. Fig. 2—Near view of downstream face. Fig. 3—Looking across river

sand was rejected owing to the presence of a large percentage of culm and fine coal. Juniata River sand was used. This proved to be a fairly satisfactory sand, the only thing against it being its poor grading, as is shown by the fact that 80% of it passes a 30-mesh sieve and only 4% a 50-mesh sieve.

Construction Across Island

Throughout a considerable part of the dam the bedrock lay clear of sand and gravel, or was covered by only a few inches. Over this section the method outlined proved to be very economical. About 1,000 ft. of the dam was across an island or sand bar. At this location, after removing the sand, it was here feasible to drill the holes, grout the rods and build the piers without resorting to the method previously outlined, or to the use of coffer-dams. Pumping was of course here necessary.

On other sections where the gravel covering was deeper, the contractor considered it more economical to build sand-bag coffer-dams, generally two bags wide, pump them out, excavate the gravel and build the piers in the dry. In such cases, and also across the island, the slabs of the upstream face were built in place monolithic.

Before construction work was started, soundings were made along the center line of the dam over that portion where bedrock was not exposed. These soundings indicated that where this gravel covering existed it was nowhere more than about 2 ft. deep. When the gravel was excavated it was found that at some locations the rods had struck large boulders lodged in pockets and breaks in the limestone formation. Drills were put down to a depth of 8 to 10 ft. below the bed of the river and no ledge encountered. In such cases excavation was continued below the river bottom only to a sufficient depth to uncover the irregular surfaces of a number of these boulders. A reinforced-concrete footing was then constructed, exceeding the total width of the dam by about 2 ft. It was 18 in. thick at the downstream toe, 12 in. thick at the upstream toe and was reinforced longitudinally with 1-in. square bars spaced 6 in. c. to c.

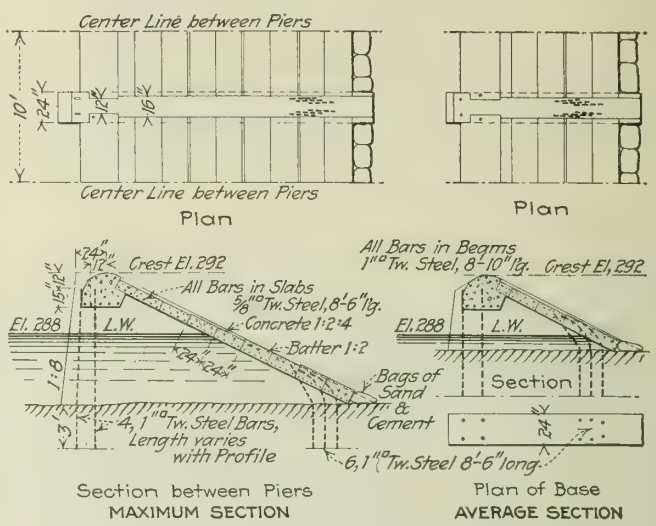
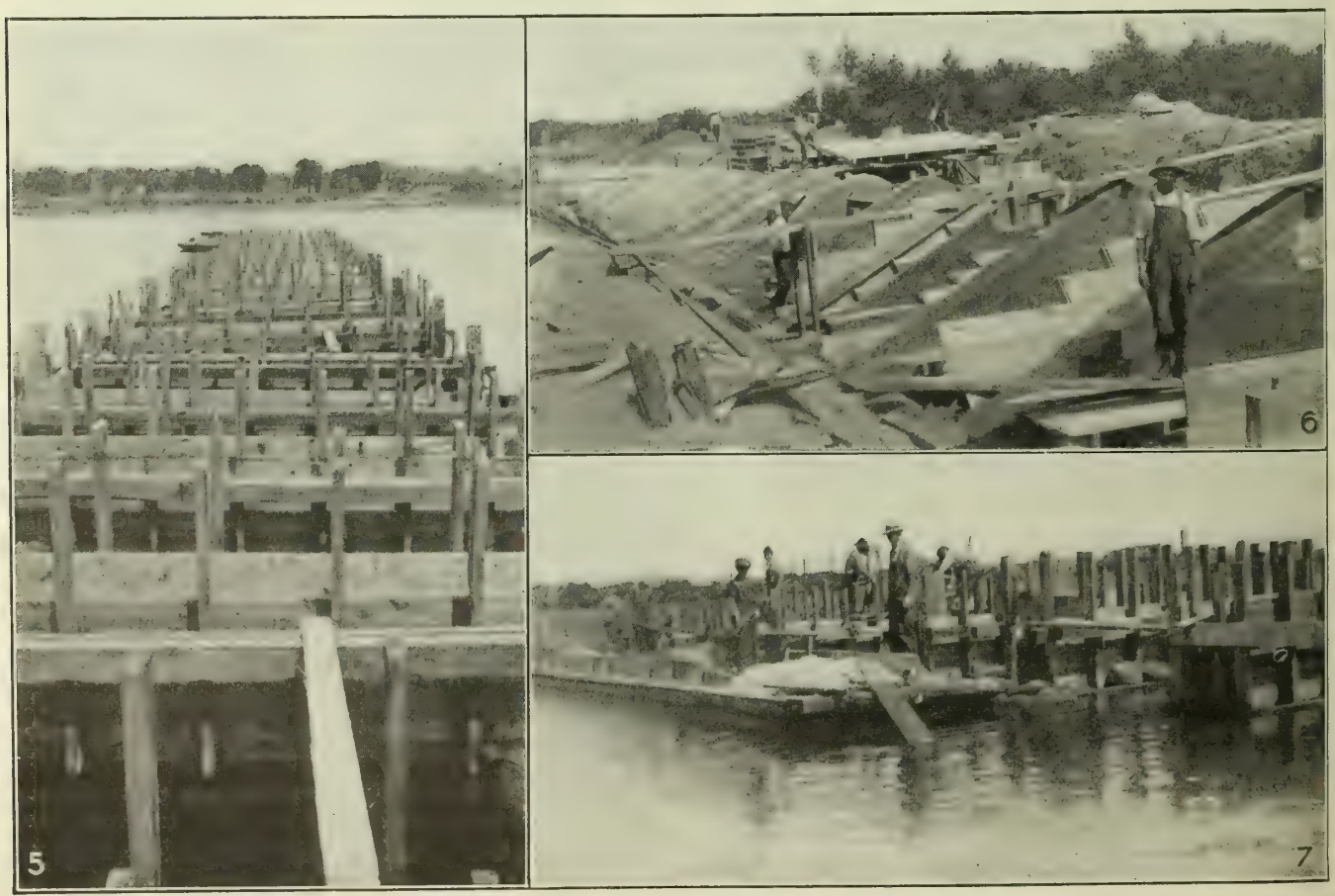


FIG. 4. DETAILS OF HARRISBURG DAM ACROSS SUSQUEHANNA RIVER

at the downstream toe, the spacing increasing to 12 in. at the upstream toe; 1 : 2½ : 4½ concrete was here used. In most cases there was projecting ledge rock either just upstream or downstream from the line of the dam, into which the footing was tied by steel and concrete.



FIGS. 5 TO 7. CONSTRUCTION VIEWS OF HARRISBURG DAM

Fig. 5—Pier forms in place. Fig. 6—Piers in place across island. Fig. 7—Concreting footings in river section

These footings were provided with weep holes between the piers. As the minimum width of the footings is 14 ft. and the maximum head on the dam is only 4 ft., it is not considered that water passing under this footing will have velocity enough to move any of the material composing the foundation. The foundation consists of boulders, stones and gravel with some sand. In some cases the interstices are filled with red clay. For these sections coffer-dams were constructed, and the upstream slabs were built in place monolithic. In addition the top beams were built continuous through the piers, and the reinforcement in them carried through continuously. It was found necessary to build 650 ft. of the dam by this method, out of the total length of 3,139 ft.

There are two openings in the dam. The one at the extreme eastern end is 33 ft. wide. The opening on the island is 12 ft. wide. The size of these openings is determined by the requirement that at minimum low water there shall be a depth of water over the crest of 0.2 ft. At these openings are three solid sections of the dam, each 10 ft. long. At the western end of the dam the section is very low and is built solid for a distance of 220 ft.

The reinforced-concrete slabs used to form the upstream face of the dam, where not built monolithic, were cast in forms on the bank. After sufficient seasoning they were stored, and after the rest of the work had been completed they were loaded on barges by a stiff-leg derrick, transported to the site and set in place in the grooves by a small A-frame derrick mounted on two scows.

Contract Details and Costs

The contract was let on the unit item basis to Frank M. Skene, of Brockport, N. Y. The prices were as follows:

Reinforcing steel, per ton	$80.00
Concrete (1 : 2½ : 4½), per cu.yd.	20.00
Concrete (1 : 2 : 4), per cu.yd.	21.00
Drilling in concrete and rock, per lin.ft.	.85
Bags of cement and sand, per cu.ft.	.80
Riprapping, per sq.yd.	4.50
Stone filling, per cu.yd.	2.50

No work was done under the last two items. The work required about 2,700 cu.yd. of concrete and 128 tons of steel. Considering the character of the work, the contract prices are not considered high. Only three bids were received, and the successful bidder was also the low bidder.

The work was done under the direction of the Board of Public Works of Harrisburg, with James H. Fuertes, of New York City, as Consulting Engineer; Joel D. Justin, Principal Engineer, and E. W. Cowden, Assistant Engineer in immediate charge of the dam for the city.

Pointers for Comparing Types of Pumping Units

By George M. Peek*

In comparing two types of pumps, such as triple-expansion and turbine-driven centrifugal, careful consideration should be given to other points than the first cost, together with the cost of maintenance and repairs. Some of these matters are discussed in the following paragraphs.

The reciprocating pumping engine may be considered complicated and has many moving parts requiring attention, but it has back of it years of reliable service. This type of pump, when well built and properly maintained and repaired, will be efficient for many years—in fact it would be rather difficult to predict the length of time such a machine will give reliable service.

Another point which should not be lost sight of is the fact that the average operating engineer may be familiar with the details of a reciprocating pump and quite unfamiliar with the operation of a turbine-driven centrifugal. This point is illustrated by an experience with an operating engineer of many years of experience. A motor-driven centrifugal pump was installed in the station where this man was employed, and he reported that it would not work. Upon investigation it was found that, in order to try it out, he had disconnected the discharge pipe—thereby reducing the head to such an extent that when he started the motor it was overloaded and the fuse was blown. He did not seem to understand that no damage would result from closing the discharge valve and letting the machine run at its normal rate of speed.

Nearly, if not quite, all repair work required on a reciprocating pumping unit can be done in a water-works machine shop, whereas in case of a steam turbine it is almost necessary to have the repair work, particularly the rebucketing, done by the manufacturers of the machine.

In general the turbine-driven centrifugal pump has the advantage over the reciprocating pump both in simplicity and first cost. While the turbine-driven pump has not reached the high degree of efficiency reached by the reciprocating, improvements are continually being made, and today its efficiency far exceeds that of a very few years ago. It is impossible to make a comparison between the two classes of machines which would be applicable to all cases, and the problem must be solved for each particular set of conditions.

Cost of Buildings and Boilers; Load Factors

In some general cases where comparisons have been made, considerable charges have been placed against the reciprocating unit on account of the size of the building required to house it. This, in the writer's opinion, should be much smaller than has been suggested by some engineers, for the reason that in many, if not in the large majority, of cases, the water-works is municipally owned. Consequently the architectural effect considered necessary would preclude any very great difference in the cost of the building to house either type of apparatus. Some comparisons do not require the consideration of the cost of a building, since one may be in existence, and therefore the cost is the same for either type of machine.

If it is necessary to install additional boiler capacity, at least 50% in excess of that required for operating the new unit should be installed unless there are sufficient boiler units to allow considerable flexibility for cleaning and repairs. It is quite common in commercial plants to find boilers run at a capacity considerably in excess of their rating, but this is not done in municipally owned water-works.

It is not customary for municipalities to lay by a sinking fund for replacing their equipment, and there should be no amortization charge made against pumping equipment. During its useful life the machinery will have been earning dividends for the taxpayers. Another argument that might be used against it is that it

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is impossible to say what the cost of replacement would be at the end of the time assumed to be the life of the machine, owing to the market and also to improvements and changes in the type of machinery for the same class of work. The present relative cost of a triple-expansion pumping unit and a turbine-driven centrifugal for the same service may be used as an illustration.

The station load factor will have to be determined for each individual water-works for which comparisons are to be made. Water-works having very small reservoir capacity or pumping into a closed system will have a comparatively small load factor. Water-works having small reservoir capacity will require pumps capable of delivering nearly the maximum demand; and when pumping into a closed system, the pumping capacity must be equal to the maximum demand.

COMPARISON OF ST. LOUIS WATER-WORKS PUMPING UNITS

	Centrifugal Unit	Reciprocating Unit	Difference
Cost of pump	$353,000.00	$103,953.00	$68,653.00
Cost of foundation	2,000.00	2,550.00	550.00
Cost of boilers, including foundation, setting, superheaters, stokers and stack, at $30 per hp.	13,000.00	10,500.00	2,500.00
Total difference in first cost	.....	.....	66,703.00
Annual interest on difference at 5%	.....	.....	3,335.15
Annual fuel cost of steam at 15c. per 1,000 lb.	10,250.00	8,279.20	1,970.80
Maintenance and repairs on boilers at 5c. per 1,000 lb. of steam at capacity	5,694.00	4,599.00	1,095.00
Maintenance and repairs on pumps	550.00	1,500.00	950.00
Annual difference in cost of reciprocating over the centrifugal	.....	.....	1,219.35

Data are based on 60% load factor.

The cost of pumping units and also the cost of maintenance and repairs in the accompanying tabulation are taken from records of the St. Louis Water-Works, where the average load factor is 60%. The machines compared have a capacity of 20,000,000 gal. per 24 hr. against a total head of some 295 ft. The cost of the centrifugal unit includes wet and dry vacuum pumps, condenser, exhaust heater, 42- and 36-in. hydraulically operated gate valves, together with suction and discharge piping inside of the building. The cost of the reciprocating pump includes a condenser, two gate valves, the same as for the centrifugal, together with suction and discharge piping. Tests on the two pumps showed a steam consumption of 10,500 and 13,000 lb. of steam per hr. for the triple-expansion and turbine-driven pumps respectively, for the same work done; the steam pressure was 160 lb. per sq.in. and 100° superheat.

Where the load factor is 97%, there will be no annual difference. It will be noted that the interest rate has been taken at 5 instead of 4%. The interest rate should be that which the taxpayers can realize on their money and not the rate which paid on city bonds.

Progress on Calaveras Earth Dam for San Francisco

The Calaveras dam, which is under construction by the Spring Valley Water Co. to provide additional water-supply for San Francisco, is now about one-third completed. As described in the extended article on the dam in *Engineering News*, Oct. 1, 1914, this dam when completed will be the highest earth dam in the world. The crest of the dam will be 240 ft. above bedrock, and it will contain over 3,000,000 cu.yd. of material. The dam is being constructed by the hydraulic process. The accompanying views, from photographs taken on Nov. 29, show the pool in the center of the dam, into which the pipes carrying the water charged with sand and clay deliver. Besides the material delivered hydraulically, a large amount of material is being placed on the lower slopes of the dam by teams that are loaded by steam shovels excavating from the hillside at the left in Fig. 2.

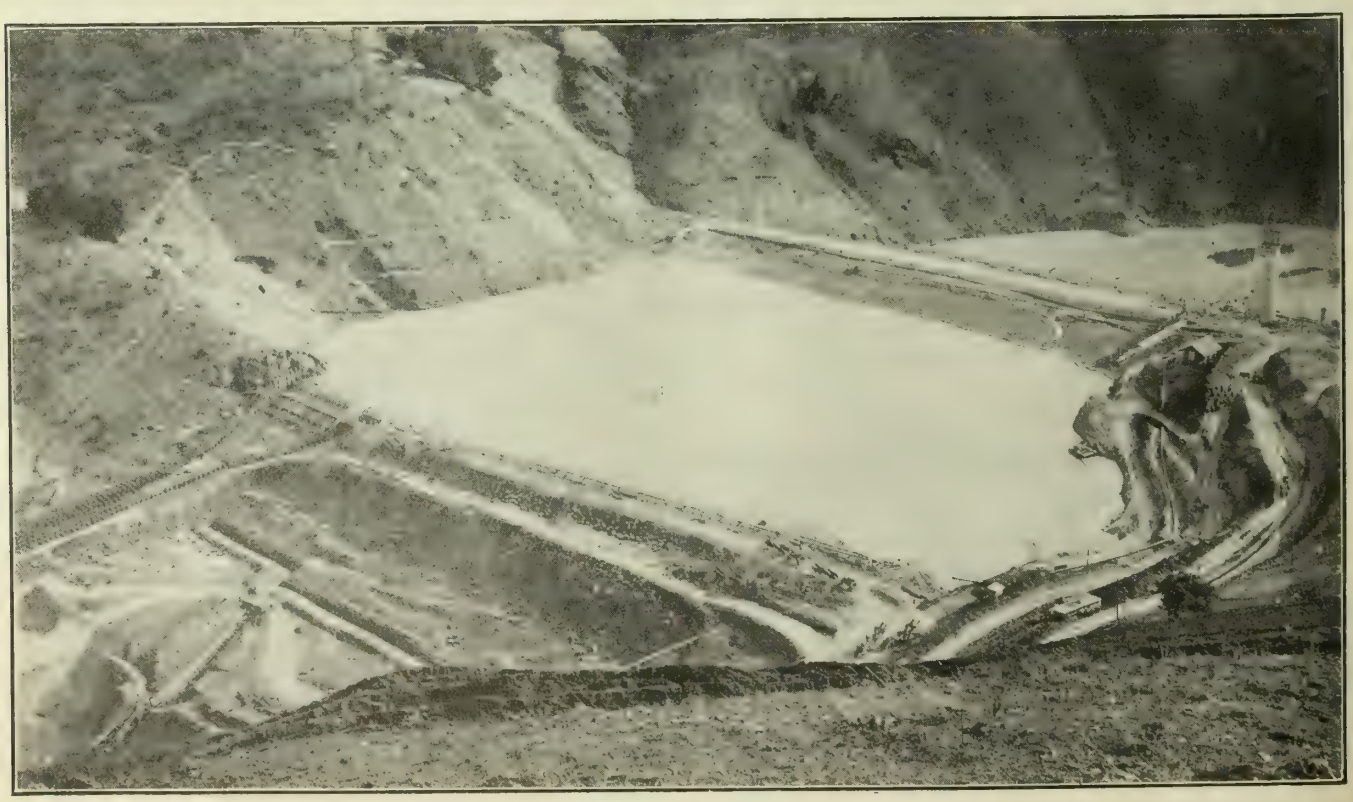


FIG. 1. THE CALAVERAS EARTH DAM FOR THE SAN FRANCISCO WATER-SUPPLY UNDER CONSTRUCTION BY HYDRAULIC PROCESS

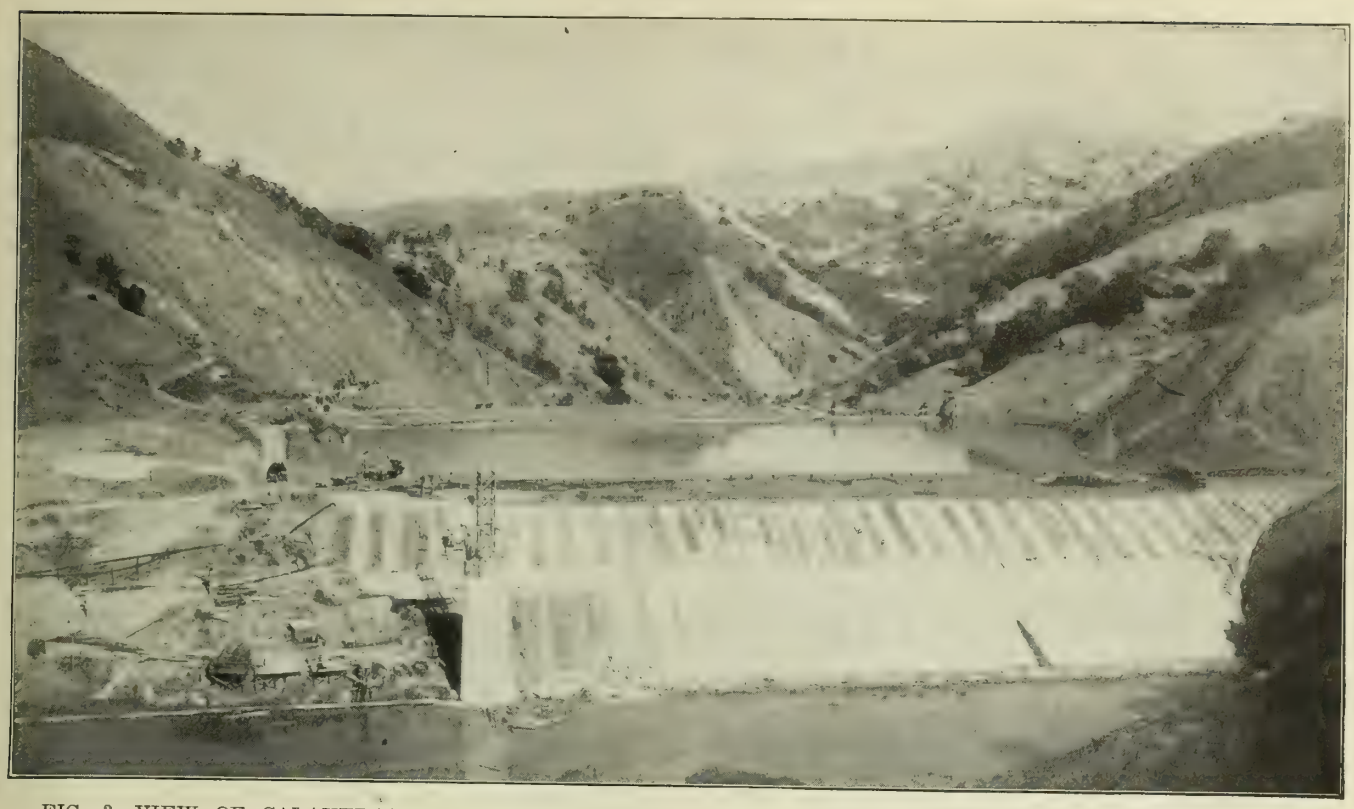


FIG. 2. VIEW OF CALAVERAS EARTH DAM LOOKING DOWN THE VALLEY, SHOWING CONCRETE PAVING LAID IN VERTICAL STRIPS ON UPSTREAM FACE

The engineers aim to keep a large surplus of material at all times deposited on the lower toe of the dam to counterbalance the hydrostatic pressure exerted by the semi-liquid mud in the central core of the dam, which is of course very heavy and which dries out very slowly.

The pressure of the central pool and the mud beneath it against the upper section of the dam will be partly counteracted by the water pressure back of the dam when the reservoir is filled. It is the intention to begin the use of the reservoir for storage purposes during the present rainy season. As may be seen in the views, the upper face of the dam has been paved with concrete to a height of about 80 ft., and the reinforced-concrete inlet tower has been completed to about the same height.

The cast-iron gates to be placed on the tower were ordered from the Rensselaer Valve Co. last spring, and were shipped from New York to San Francisco on a steamer that reached the Panama Canal just in time to be caught in the blockade which resulted from the great slides in October. The steamer was therefore obliged to take the long voyage around South America to reach San Francisco, so that the gates were not delivered at the dam site until the middle of December. While the winter rains have begun in this locality, it is expected that the gates will be placed in time to store a large part of the winter's runoff.

As may be seen from the accompanying photographs, the dam is located in a narrow valley with steep hills rising on each side. Much of the earth on the slopes of these hillsides, however, is not well adapted to hydraulic excavation and placing, and the very large amount of material required for the dam has made it necessary to extend the pipe lines a considerable distance to reach suitable earth. It is estimated that the Calaveras reservoir when completed will increase the available water-supply of San Francisco by 30,000,000 gal. per day. As the present daily consumption of the city is in the neighborhood of 45,000,000 gal., this will provide for its future growth for a considerable time.

The Spring Valley Water Co. is carrying on the construction of the Calaveras dam with its own forces, under the direction of G. A. Elliott, its Engineer.

Present Condition of Second Avenue Test Pavements

By Henry Welles Durham*

An examination was recently made by the writer of the test pavements laid on Second Ave., New York City, in 1912, under the supervision of the Bureau of Highways of the Borough of Manhattan. As these are probably the most varied and extensive tests of city street pavements in this country, brief descriptions of their present condition are of interest. The purpose and extent of the test pavements, with a brief description of each, were published in *Engineering News*, June 27, 1912, at the time they were laid down. The writer's recently issued "Annual Report of the Bureau of Highways" for the year 1914 gives a more complete description and subsequent history to Dec. 31, 1914.

Test Sections of Stone-Block Pavements

The section from the north side of Third St. to the south side of Fourth St. was surfaced with 3½-in. sawed cubes of Medina sandstone, laid on a ½-in. sand cushion and 6-in. concrete base. The blocks were laid with close joints filled with portland-cement grout. The pavement has been in use since January, 1913. The surface is in general smooth, but has developed undulations and many cracks, and at several points considerable areas are

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crushed or depressed. Large amounts of repairs have been made each year.

The section from the south side of Fourth St. to the north side of Fifth St. was paved with standard-size Medina sand-stone blocks 3½ to 5½ in. wide, 7 to 12 in. in length and 6 to 6½ in. in depth, with parallel sides and ends, laid with fairly close joints on a 1½-in. sand cushion over a 6-in. concrete foundation. The joints are filled with cement grout as in the cube section, and the work was completed at the same time. The surface of this section has always been rough and uneven, largely the result of poor workmanship in cutting the blocks. The edges of the blocks have held up well, and the poorest condition is the general wavy surface and inferior quality of patching. In any criticism of this section the original poor condition of the blocks should be borne in mind.

These pavements have demonstrated very conclusively, not only the fact that sandstone is not sufficiently durable for the heavy traffic of Second Ave., but also the impossibility of making satisfactory repairs with cement-grouted joints under the conditions prevalent. It is virtually impossible in New York City to keep traffic off repair areas long enough to permit a proper setting of the grout.

From 21st to 23rd St. an experimental section is laid with granite block having a width of from 3½ to 4 in., a length of 7 to 11 in. and a depth of 5 in. Specifications called for joints not exceeding ⅜ in., the blocks to be laid on a ¾-in. sand cushion on a 6-in. concrete foundation. The joints were filled with dry sand to within 3 in. from the top and cement grouted.

The roadway was opened for traffic in November, 1912. The condition of this pavement is only fair. The blocks as originally furnished were not strictly up to specifications, the joints probably averaging in all cases more than the maximum allowance. The cement-grout joint filler has not worn well, many of the joints having opened, and the blocks show wear at the edges. The general surface is uniform except around manhole boxes or where cuts have been made.

Test Sections of Wood-Block Pavement

Between Fifth and Sixth St. Southern short-leaf pine blocks treated with 20 lb. per cu.ft. of a heavy oil having a specific gravity of not less than 1.10 at 38° C. were used. From the south side of Sixth St. halfway to Seventh St. the blocks used were treated with 20 lb. of light oil having a specific gravity of 1.03 to 1.08 at 38° C. From there to the north side of Seventh St. the treatment used was 20 lb. of water-gas tar.

All types were laid on a 1-in. sand cushion on a 6-in. concrete base, the joints being filled with fine sand and the surface thoroughly rolled and finally spread with a thin coating of sand to be rolled in by traffic. The work was completed in January, 1913.

Except for a slight undulating appearance noticeable only on close examination, these pavements are in very fair condition. No difference in appearance is noticeable between the differently treated sections except in extremely hot weather, when there is a slight evidence of oil on the surface of the blocks treated with light oil, but bleeding has practically stopped.

The section from the south side of 13th St. to the south side of 15th St. is laid with Southern long-leaf yellow pine blocks 3x8 in. on the surface and 4 in. deep, on a 1-in. sand cushion over a 6-in. concrete foundation. On the lower part of this section the blocks were treated with 16 lb. per cu.ft. of heavy oil; on the next section 20 lb. of heavy oil, and on the next the treatment was 20 lb. of light oil. The intersection at 14th St. is paved with blocks treated with 16 lb. per cu.ft. of light oil. The next half-block north of this point has paving blocks treated with 20 lb. of water-gas tar, and then there is a section laid with blocks treated with 16 lb. of water-gas tar.

Above 17th St. a section was laid with Southern short-leaf pine blocks measuring 4 in. deep, 3 in. wide and 8 in. long. They were laid on a sand cushion on a 6-in. concrete foundation, and the joints were filled with fine sand. From 17th to 18th St. the blocks used were treated with 16 lb. per cu.ft. of heavy oil, and at the 18th St. intersection 16 lb. of light oil was employed, and from there to 19th St. the blocks used were treated with 16 lb. of water-gas tar.

Nothing in the present appearance of any of these stretches of pavement indicates that under ordinary conditions any variation of treatment of the blocks had been employed. It is only in extremely warm weather that blocks treated with light oil still show slight evidence of bleeding. The entire area is in first-class condition, except around some manhole boxes. Practically no repairs have been required.

At the 17th St. intersection Australian tallowwood blocks were used. This is a hardwood, and the blocks were untreated other than being painted with tar before laying. They measure 4½ in. in width, 3 in. in depth and 8¼ in. in length, and they were laid on a cushion of tar, the joints being filled with paving pitch. The hardwood blocks failed entirely during the first two seasons and have been replaced by yellow-pine blocks treated in accordance with the standard specifications of the Manhattan Bureau of Highways.

Tests of Sections of Asphalt-Block Pavement

A length of three city blocks north of Houston St. is paved with asphalt blocks measuring 5x12 by 3 in. deep, laid on a ½-in. mortar bed on a 5½-in. concrete foundation. The blocks were required to have a specific gravity of not less than 2.45 and a minimum absorption of 1% after seven days' immersion in water. The work was completed in November, 1912. This pavement presents a better appearance in general than the other asphalt-block sections farther north, but is poor along the rails of the car tracks, the space within which is paved with sheet asphalt. As Second St. on the east side there are depressions and waves, as well as at Third St. on the west side, and the east gutter shows many signs of deterioration. A considerable pitting is to be observed over almost the entire area.

A section from 9th St. to 11th St. is paved with blocks made of natural bituminous limestone rock. The blocks measure 8¼ in. long, 4 in. wide and 2⅓ in. deep, with a minimum weight per block of 6 lb., laid on a ½-in. mortar bed on a 5½-in. concrete foundation. This pavement was opened to traffic in November, 1912. Under traffic the blocks have rolled together so that the joints are barely discernible. The general appearance of the surface is similar to sheet asphalt but somewhat more wavy, and where the joints can be distinguished they

show evidence of having traveled in the direction of traffic. Below Tenth St. this section is in better condition than north of that point, probably due to the less intense traffic encountered.

The two blocks from 15th to 17th St. were paved with asphalt blocks made under practically the same specifications as those used in the first section noted, except that there was an attempt made to get a block more suitable for heavy traffic, and the maximum absorption was reduced to 0.6% after seven days of immersion in water. The blocks measured 5x12 by 3 in. deep, laid on a ½-in. mortar bed on a 5½-in. concrete foundation. The roadway was opened to traffic in November, 1912. The general appearance of this pavement shows considerable waviness. The car-track area was paved at the same time and of the same material. Traffic has worn continuous ruts, adjacent to the rails. Near 16th St. on the east side waves are very apparent, and there are some depressions.

Test Sections of Sheet-Asphalt Pavement

The two blocks from Seventh to Ninth St. have an asphalt pavement consisting of a 2-in. wearing surface on a 1-in. old-specification open binder laid on a 6-in. concrete foundation. It was opened to traffic in November, 1912. There is a slight waviness in the surface, but it is otherwise in good condition and up to the first of the present year had required no repairs due to wear and tear. Within the railway track there is also sheet asphalt, but it is the old pavement which extends in this area north from Houston St. Adjacent to the rails some depressions have developed.

The section from 11th to 13th St. has an asphalt pavement corresponding to the more modern specifications of the Manhattan Bureau of Highways, consisting of a 1½-in. wearing surface on a close binder 1½ in. thick, laid on a 6-in. concrete foundation. This section was opened to traffic in November, 1912, and has required practically no repairs. With the exception of some depressions along the rails and around some sunken manhole boxes, the pavement is in fair shape.

From 19th to 21st St. a section was laid with rock asphalt from Ragusa, Sicily, 2½ in. in thickness on a 6-in. concrete foundation. This was opened to traffic in September, 1912. This section entirely failed during the first two seasons, probably owing to the inferior quality of materials and poor workmanship. It was impossible to require repairs in accordance with the original specifications after the outbreak of the European War, and consequently since that time the contractor has done all such work with standard sheet asphalt in accordance with Manhattan specifications.

Street-Cleaning Cost a Factor in Pavement Design

Although treated in some textbooks, the ease-of-cleaning factor in the selection of pavements probably receives little consideration in practice. Herewith are extracts from a paper read at the recent Worcester Road Congress by Gus H. Hanna, Commissioner of Street Cleaning of Cleveland, Ohio. In reading them it should be borne in mind that there are many local factors which must be taken into account, and that Mr. Hanna's conclusions are based on experience in one city only. The following paragraphs are substantially in Mr. Hanna's words:

An annual expense of $500 a mile in repairing residence streets would be considered an appreciable item of maintenance, yet that figure for cleaning a mile of residence street through a season is extremely low. A cost of $500 for maintaining a mile of one kind of pavement for a year as against a cost of $1,500 for maintaining another kind would be sufficient grounds, in most cases, to decide in favor of the former material. Yet greater difference than this in cleaning cost is blandly overlooked.

Economy from Street Cleaner's Standpoint

A street cleaner looks for two qualities in a pavement. It must be smooth, and particles of litter must not stick to the surface. The question of smoothness opens up the whole matter of durability. Any material that deteriorates and roughens becomes more difficult each year to clean. Any neglect of needed repairs means a larger cleaning bill until the repairs have been completed.

Additional cleaning expense must be made for all bituminous pavements on account of the sticking of particles of litter to the surface. These surfaces are never quite so clean as nonadhesive materials, and it costs from 25% upward additional to put them in a reasonably presentable condition on account of this quality.

This difficulty is seen at its worst in a new creosoted wood-block pavement, when the oil is gradually working out of the wood. The use of steel scrapers must often be employed, as the flushing by water is not effective at all in removing the dirt from such a surface.

The substances most easily cleaned are brick and stone. Neither of them originates any form of dirt, and both wash off readily. The only ground for discrimination between them as to ease of cleaning is on the question of smoothness, where brick has a slight advantage as a rule.

But in the use of these materials, the choice of a filler is all important. A bituminous filler has all the disadvantages of a bituminous surface, from a cleaner's standpoint, and some others besides. Being softer than the brick or block, it recedes, leaving a crevice that invites the lodgment of dirt. With the edges of the brick or block unprotected, it is sure to roughen, thus adding to the difficulties of cleaning. In fact such a street, after a few years, presents an array of cobble stones, with the filler invisible, or else melted and run to the gutter, where it impedes the work of the follow-up gang.

Some Street-Cleaning Costs

The lowest cost-of-cleaning figure that we have been able to achieve on any type of pavement is 15c. per 10,000 sq.ft. on a 10-yr. old grouted brick pavement. The cost on the best asphalt pavement would be not less than 20c. and would increase to 30c. as the surface became wavy or rough. A wood-block pavement costs practically $1 per 10,000 sq.ft. to clean in its initial condition, and it will be at least two years before the oil will have dried out sufficiently to admit of its being cleaned for 30c. A tar-filled block pavement will cost not less than 30c. per 10,000 sq.ft., and as the filler disappears and the blocks roughen, this cost will amount to 60c. or more.

In the case of a pavement 40 ft. wide, there are about 21 squares (of 10,000 sq.ft.) to the mile. As between a material that can be cleaned for 15c. and one that can be cleaned for 30c., there is a difference of $3.15 per mi. per cleaning, a difference of $15.75 per week, of $630 per season of 40 weeks and of $6,300 in 10 yr.

Laying Submerged Water Mains at Vancouver, B. C.

The entire water-supply for the City of Vancouver, B. C., is brought in submerged pipes across the channels connecting the city's harbor with the ocean. These pipes have been successfully laid under conditions of exceptional difficulty.

The City of Vancouver is built on a narrow peninsula between two arms of the sea. The only possible source of an adequate water-supply is in the mountains which rise to a great height only a short distance north of Burrard Inlet, on the southern shores of which the city lies. As may be seen on the accompanying map, the city's water-supply is taken from Capilano River and Seymour Creek. The water from the former is brought down in steel pipes to the first Narrows just below the city, and the water from Seymour Creek to the second Narrows 5 mi. above.

The tidal range on this coast is from 14 to 17 ft. As Burrard Inlet has an area of several square miles and as the deep channel connecting it with the ocean is only some 900 ft. in width, a tidal current of high velocity, 8 mi. an hour or more, sweeps back and forth through the channel with every rising or falling tide. Almost as rapid a tidal current exists at the second Narrows. The period of slack water in the Narrows is very short, often not more than 20 min. The maximum depth of water is 75 ft. at the first Narrows and 80 ft. at the second Narrows. The channel bottom is very rough and strewn with large boulders on the shore next the city; on the opposite shore is a level stretch of mud flats, bare at low tide.

Early Experience in Pipe Laying

The first pipe laid across the Narrows from Seymour Creek was a 12-in. cast-iron pipe with Ward flexible joints. It is stated that Mr. Ward himself came to Vancouver to lay the pipe, but when he saw the swift current in which it had to be placed, he refused to attempt the job and the pipe was laid by a local contractor, who offered to do the work for a lump sum of $10,000, the city of course furnishing the pipe and the jointing material. He carried out his task with little difficulty and at a cost of only about a third of his contract price. Since then there has not been any difficulty in finding men to do the work.

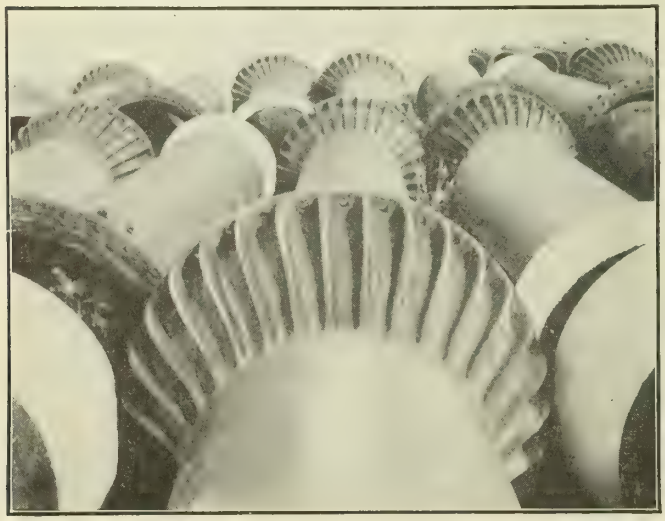


FIG. 1. FLEXIBLE JOINT CAST-IRON PIPE IN WATER WORKS YARD, VANCOUVER, B. C.

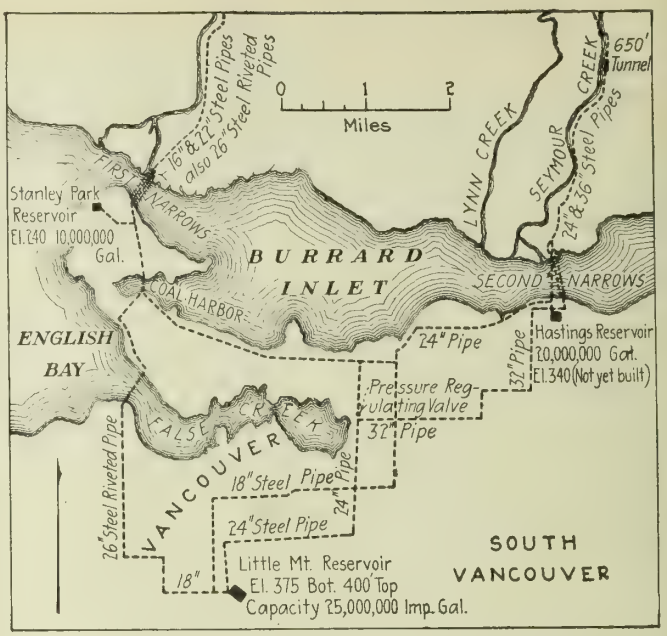


FIG. 2. MAP SHOWING LOCATION OF SUBMERGED PIPE-LINE CROSSINGS, VANCOUVER WATER-SUPPLY

When the supply through the first pipe became inadequate, a second pipe was laid, and additional ones have been added as the water consumption increased. The method of laying is substantially as follows: On the flat tidal marsh on the north shore of the river a low wooden trestle is built, extending back from the shore a distance as great as the entire width of the channel, some 1,300 ft. Upon the plank floor of this trestle the pipe is laid, and the joints are leaded and calked. The bell of each pipe length rests on a flat wooden block free to slide on the plank floor, which is greased with tallow.

Hauling the Pipe Across the Channel

After the pipe has been subjected to a hydrostatic test of 300 lb. per sq.in. and any leaks found have been made tight, a hauling tackle for pulling the pipe across the channel is applied. Originally a wire rope was led through the interior of the pipe and secured to the rear end of the pipe line; but the resistance of the front end as it plowed its way across the channel was so much greater than that of the rear part of the line sliding on the floor of the trestle that the pipe line buckled, notwithstanding the tension on the cable inside it. The present practice therefore is to run a couple of hauling cables the length of the pipe line and lash them securely to it at three or four points. To the front end of the pipe line a heavy wooden prow is attached to enable it to plow its way across and take the shocks of contact with ledges and boulders.

When all is ready, a cable is carried from the end of the hauling tackle across the stream and secured to the drum of a hoisting engine on the opposite bank, and the string of pipe is thus hauled across. After the pipe is in place, connections are made at each end and the pipe is again subjected to hydrostatic test. A diver is sent down and calks any leaks which may be found. The diver has a powerful electric light and can readily discover any leaks by the current of sand and dirt raised by the water jet issuing from the leak. The water in the Narrows is remarkably clear, there being only a trifling inflow of fresh water or sewage compared with the vast volume of fresh sea water entering at each tide.

It may be noted in this connection that the Capilano intake is 485 ft. above sea level, and the Seymour Creek lower intake is 465 ft., while "Little Mountain" reservoir, into which the conduits deliver, is 395 ft. above sea level. The maximum head of water on the submerged pipe at greatest depth is about 480 ft.

Maintenance of the Pipes

Once laid and made tight the pipes give little trouble. Dredging which has been undertaken by the Government in recent years to widen the channel on the north side made it necessary to take up some of these pipe lines, and the oldest pipes were not put down again, as it was found that the erosion of the sand carried by the swift tidal current back and forth across the pipe had worn it thin in spots during its 25 yr. of service. It was therefore determined to lay an 18-in. main in its place, and this was done.

This erosion of the pipe could be prevented of course, if the pipe could be buried in a trench across the channel; but the dredging of a trench in 65 ft. depth of water on a bottom strewn with boulders and with the swift tidal current is no easy task. And even if a trench were dug, it would probably be filled by the tidal current before the pipe could be laid in it.

Moreover, the occurrence of any leak in the pipe line is easily detected and repaired by a diver when the pipe line is exposed on the bottom. The city has in fact an expert diver at its command whenever his services are required. The number of lines of pipe laid at the two separate crossings is such that the temporary withdrawal of service of one or more lines for inspection or repairs still leaves the city well supplied.

In recent years all additions to the submerged lines have been made with 18-in. pipe instead of the 12-in. originally laid. In laying this heavier pipe, it has been found better to pull it into place in three separate sections instead of in one line, as was done with the 12-in. After the three sections are in place they are joined by a diver working in about 40-ft. depth of water.

At the first Narrows there have been eleven 12-in. pipes laid; of these, three are still in service. There are two 18-in. pipes, the last of which was laid last fall. At the second Narrows six 18-in. pipes have been laid and are in service (see the view of this in Fig. 3).



FIG. 3. LINE OF 18-IN. PIPE JOINED UP AND READY FOR DRAWING ACROSS NARROWS, VANCOUVER, B. C.

The flexible pipe used is of the well-known Ward pattern, but has been modified in shape somewhat to reduce the resistance in hauling. A section is shown herewith. This pipe can be deflected 12½° before binding occurs. The pipe is cast in Glasgow and costs $61.50 per long ton delivered at Vancouver. Its weight is about 400 lb. per ft. The total cost of the 18-in. submerged crossings, including the cost of laying, is about $11.50 per lin.ft.

It has occasionally happened that in laying, calking and testing the pipe a bell has been split at one of the joints. Breaks have also occurred from contact with keels

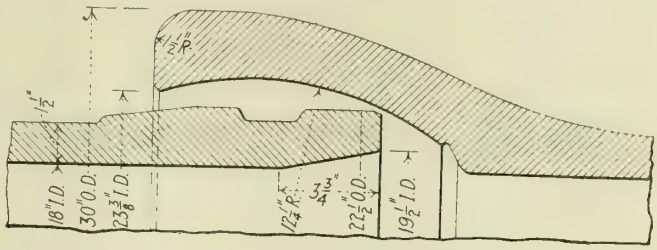


FIG. 4. STANDARD SECTION OF FLEXIBLE JOINT FOR 18-IN. CAST-IRON PIPE, VANCOUVER WATER-WORKS

of ships which have gone ashore in the Narrows during foggy weather. Repairs of such breaks have been effected by placing on the pipe to cover the split a sleeve with a stuffing-box and rubber packing at each end.

Other Descriptions of Pipe Laying

A detailed description of the methods used in laying the 12-in. submerged pipes at Vancouver, written by John Causley, was published in *Engineering News*, May 14, 1908. A description of the laying of the first 18-in. pipe at the second Narrows, written by Mr. H. M. Burwell, at that time engineer of the Vancouver water system, was published in *Engineering News*, Apr. 1, 1909.

The present City Engineer of Vancouver is F. L. Fellowes. We are indebted to Edward M. LeFlufy, Assistant Engineer of the Water-Works Department, of Vancouver, for information from which this article has been prepared.

Taming the Rivers for Use—No one can survey the physical condition of the United States without being impressed and almost overwhelmed with the magnitude of the work that must be done in keeping our rivers within bounds and putting them to use. It is the largest task that the Government must undertake sooner or later, and the sooner in my judgment the better. . . . We need to catch the water when it is young, soon after it has been born from the snows. There, in mountain valleys, it should be kept for a time and, as needed, led into the peaceful paths of usefulness. And on that problem the Reclamation Service is working. The difficulty is to find large reservoir areas. The problem extends from sea to sea. When we come eastward, to the Missouri and the Mississippi for example, we find that in their upper reaches the lands need the waters, while in their lower reaches the lands must be saved from the waters. . . . . How these great works can be carried on calls for constructive thought, not merely on the engineering side, but more immediately upon the financial side as to those ways and means by which the lands reclaimed shall be made to bear in some degree the burden of the expense. As to the funds which will be needed, they mount into such figures as to be staggering. And I can see no hope that this work will be adequately undertaken without the Government advancing its credit and investing directly some of its own funds. A commission to devise the ways and means by which the states and private land owners and the national government can coöperate in paying for the work done seems to me a more needed body than one which will report upon engineering methods.—From the annual report of Franklin K. Lane, Secretary of the Interior.

Steel Framing of a Large Power Station

SYNOPSIS—Careful design shown by low figure of weight per unit of floor area. Switch house designed for only one arrangement of apparatus. Boiler house specially braced for stack wind pressure. Intermediate posts under bridge walls of furnaces. Special roof framing. Turbine house columns carry 100-ton crane.

The new Essex generating station of the Public Service Electric Co., Newark, N. J., has a number of notable features in its steel framework. It is a 50,000-kw. station at present and will later be extended to an ultimate capacity of 200,000 kw. The designers claim that the steel weight per unit of floor area is some 20% less than that of any other large steam station.

The ground-plan area of the buildings is 45,450 sq.ft. and the inclosed volume of the plant is 4,338,000 cu.ft. The total weight of steel is 3,800 tons, which includes the weight of the steel in the stacks, in the coal bunkers outside of the boiler house, in the framing for the ash pocket and in the coal-tower framing and support up to the top of the bunkers. The weight excluding stacks but including the steel for stack supports—an integral part of the boiler-house framing—is 3,475 tons. Taking the total steel weight, the unit weights are 0.765 ton per 1,000 sq.ft. of ground area and 0.79 ton per 1,000 cu.ft. inclosed volume.

The plant comprises three buildings—boiler house, turbine house and switch house, of which the first two are contiguous, while the switch house is separated from the turbine house by a 25-ft. alley. The boiler house and turbine house are designed for extension by adding successive units. Each unit consists of four boilers and one 25,000-kw. turbine. The layout is such that 35,000-kw. or larger units may be installed without changing the scheme. All future extensions are made on the rear or landward side. The coal bunker, coal tower and ash pocket are housed in a steel structure built outside and parallel to the boiler house on the end opposite the turbine house, and the bunkers are to be increasd by duplication, a separate bunker for each firing aisle (for four or eight boilers, as the case may be). The coaling tower will serve all the bunkers. In this tower only one engine and a hoisting equipment are installed at present; it is designed for two in the future.

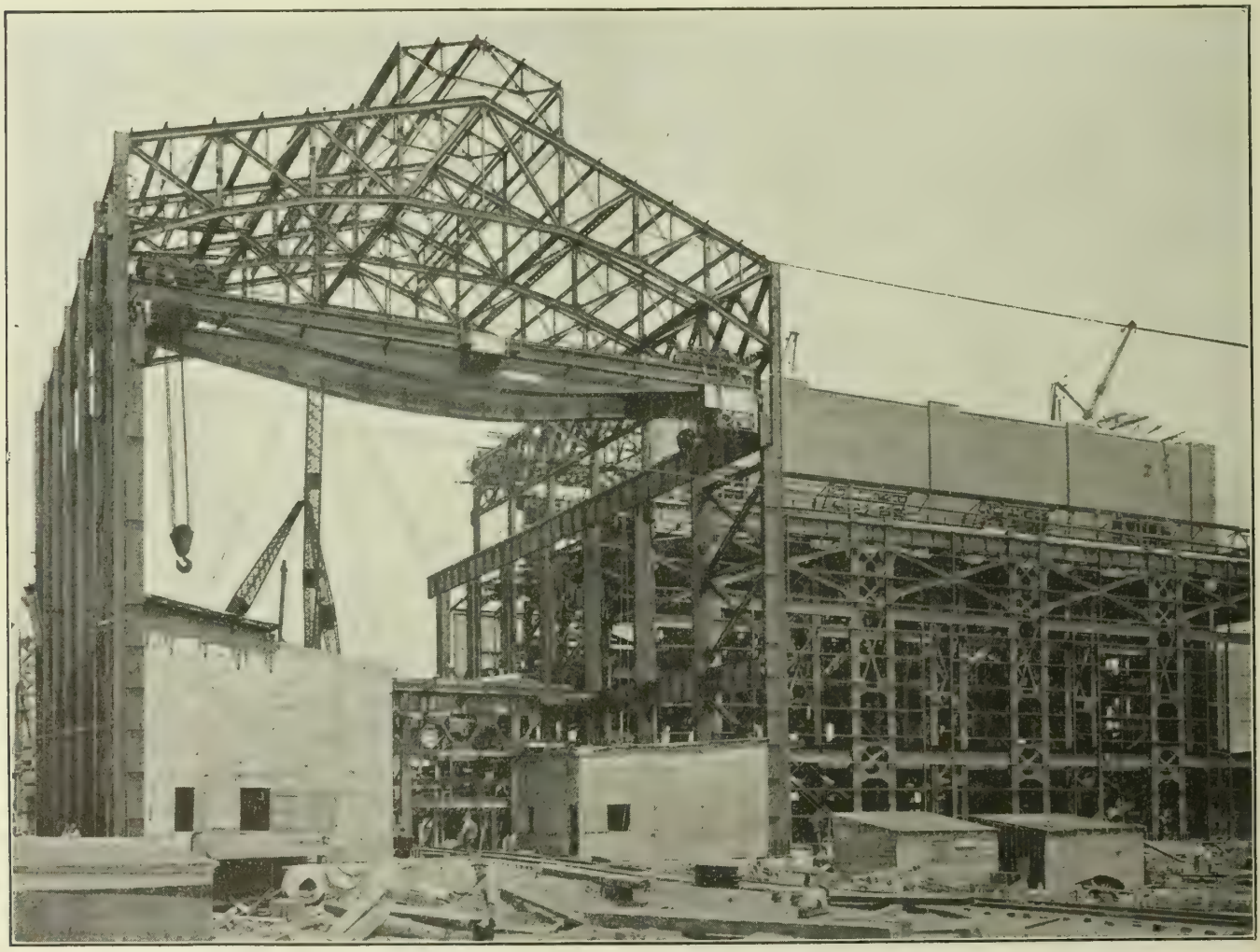


FIG. 1. PARTLY ERECTED TURBINE HOUSE; BOILER HOUSE AT RIGHT, SEEN FROM SOUTH

The switch house is a six-story tier building, and its column and floor framing are of the usual tier-building type. Two features invite notice—(1) the use of box columns, in contrast to the I-section now popular in tier-building work, and (2) the fact that all parts of the framing, each girder and each beam, were designed for the exact load coming upon them in the particular arrangement of apparatus laid out. The designers took the view that the arrangement of switches, boards and other apparatus is not likely to be altered a great deal later. A certain allowance was made, however, for possible variations. As the beam and column spacing was laid out to the best arrangement for the present installation, reconstruction of the floor beams might be necessary in case of any material change in arrangement or equipment.

Because of designing for actual loads, the various panels of the floors are of widely differing capacities, ranging from 150 lb. per sq.ft. to 450 lb., equivalent uniform live-load.

The floor filling in the switch house is reinforced-concrete slab construction throughout. The slab rests on top of the I-beams, so as to make its whole depth available for containing the electrical conduits. The necessity of accommodating a great many such ducts, mainly for the control wiring, affected the thickness of slabs selected. The thickness varied according to the amount of conduit—the number of layers—and ranged from 4 to 10 in. Thus in the switch rooms a 7-in. slab was adopted, in the control gallery (sixth floor) 5 in., in the conduit room (fifth floor) 10 in., and in other floors down to 4 in.

The switchboard room, or control gallery, contains a novel switch-panel arrangement, partly circular and partly straight, partly panel board and partly bench board, with indicating instruments on the back. This control gallery is roofed with trusses spanning the center bay of the building and framing into steel girders. From the under side of the girders trussed steel beams are suspended, to which an ornamental ceiling is attached.

Elsewhere in the top story the same roof outline is maintained, but column-and-beam construction is employed, as columns are not objectionable here.

The turbine house is of typical single-bay mill, or erecting-shop, style, comprising two rows of columns, roof trusses between, and a crane runway carried by the columns. The novelty of the design in this case lies in the proportions of bent spacing to span and height and in the construction of the crane columns used in the house.

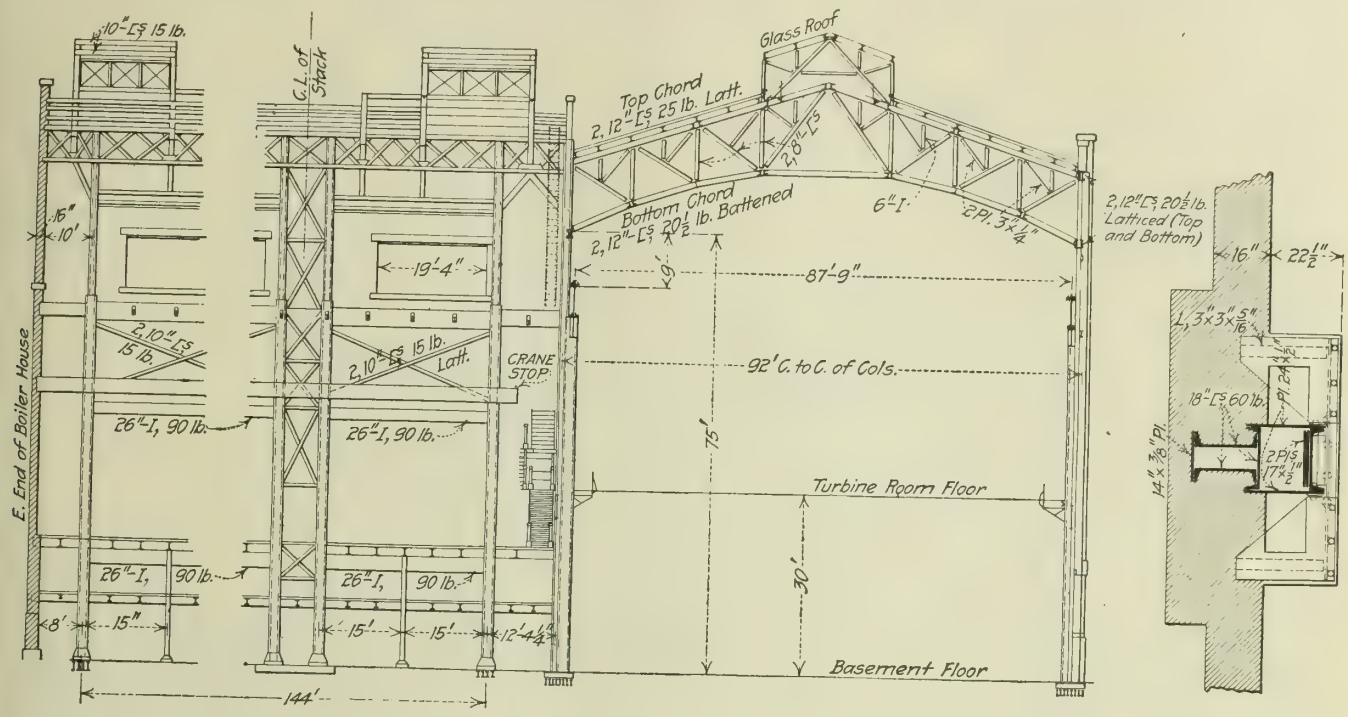


FIG. 2. CONSTRUCTION OF TURBINE HOUSE AND LONGITUDINAL SECTION OF BOILER HOUSE

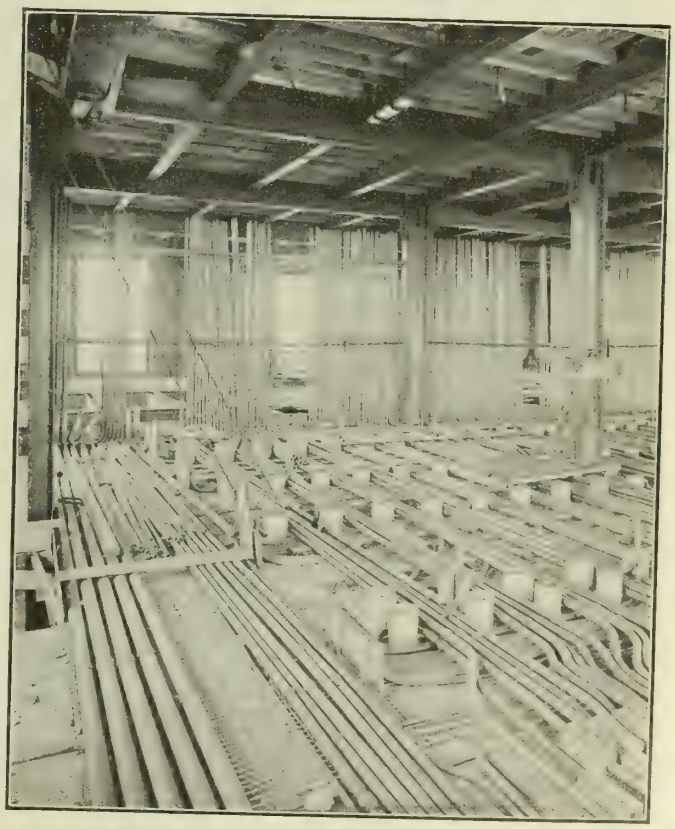


FIG. 3. CONDUITS IN FOURTH FLOOR OF SWITCH HOUSE, BEFORE CONCRETING

The traveling crane of the turbine house has a capacity of 100 tons (on two hooks—that is, the crane is a two-trolley crane, with each trolley of 50 tons' capacity and a 10-ton auxiliary hoist) and spans 87 ft. 9 in. between rails. The height of the building is 66 ft. to the crane rail and 75 ft. 6 in. to the bottom of the roof truss. With these proportions the column or bent spacing of 22 ft. is remarkably short. This is accounted for in part by the fact that the roof construction is heavy, due to the reinforced-concrete roof slab, and by the crane capacity and the entire weight of the crane girders, as well as loading from the main floor.

The crane-column construction is of a remarkably substantial nature. A sectional sketch in Fig. 2 shows its make-up—two box-column units, each designed to be built up of channels and plates (in actual construction 18-in. I-beams were used instead of 18-in. channels, because channels could not be obtained without delay), combined to form one double-cell section, with the heavier unit forming the crane-girder support.

In designing the crane runway the following loads were taken into account: Weight of crane, 200,000 lb.; load or

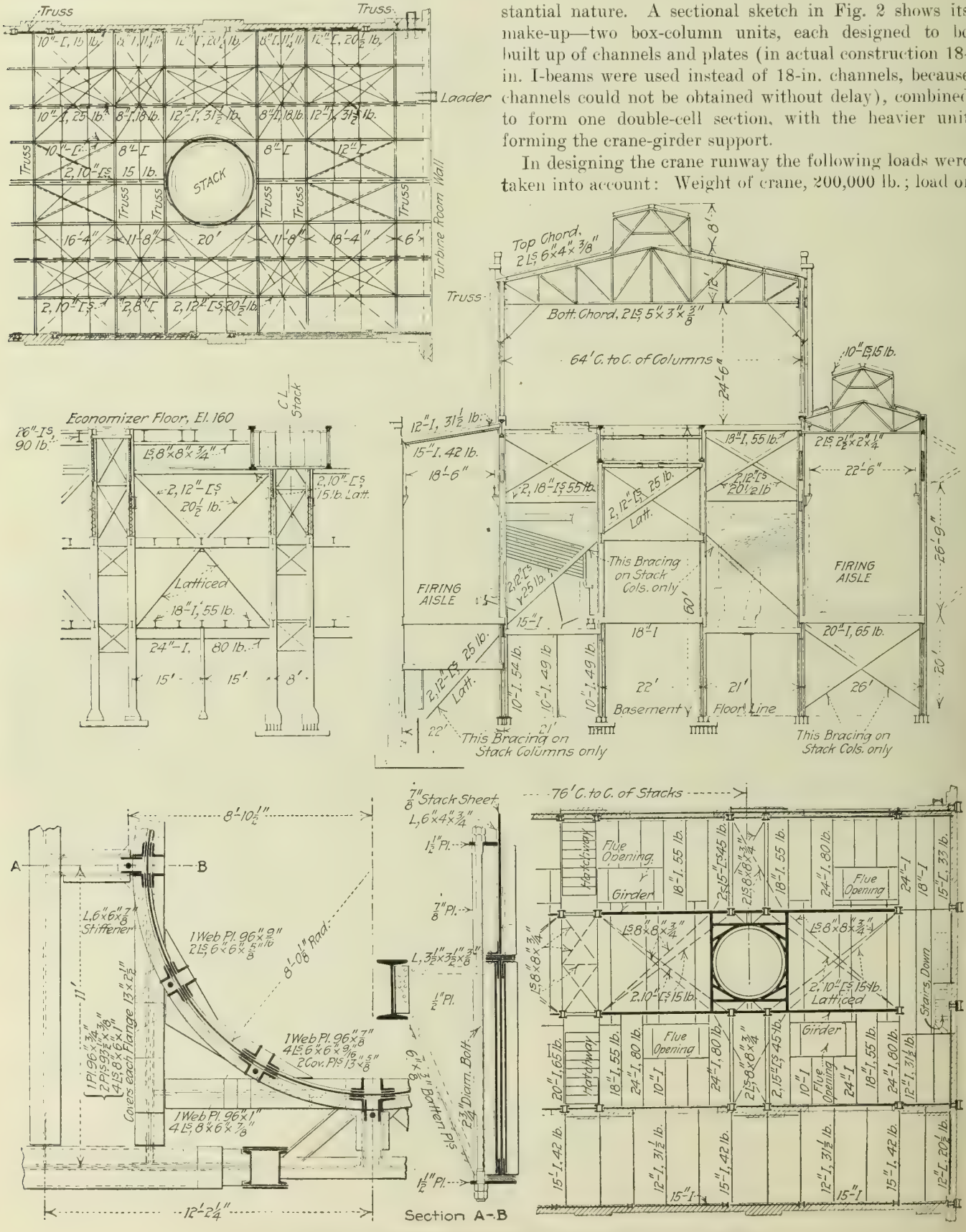


FIG. 4. BOILER-HOUSE SECTIONS AND STACK-SUPPORT FRAMING

capacity of crane, 100 tons; vertical impact amounting to 70% of the crane capacity and horizontal impact amounting to 20% of the crane capacity. Each girder was designed on this basis for a vertical load of 480,000 lb. total (made up of 200,000 net lifted load, 100,000 lb. representing half the weight of crane structure, 40,000 the weight of the carriages and 140,000 the vertical impact) and 40,000 lb. horizontal load due to impact of traveling carriages fully loaded.

It happened that the traveling crane of the turbine house was needed long before the house itself. The generator stators, on account of their size, had to be shipped in two parts, and therefore had to be built up with the core laminations and windings after arrival on the ground. This required the service of a crane of heavy load capacity. It was decided to use the regular traveling crane of the turbine house. Therefore one panel of the turbine house, with its crane girders, was erected, and the traveling crane set in place. A 100-ft. gin-pole did this steel erection. Then two wooden shacks were built in the panel (see view, Fig. 1), as housing within which the assembly (left) and winding (right) went on. Removable roof sections provided for lifting the stator castings and material in and out.

The view, Fig. 1, shows the turbine house shortly after erection of the remaining steelwork was started. The crane, however, is shown in the same position it occupied when only the braced end panel of the frame was up.

The steam turbines are carried on steel framework independent of the framing of the house. This consists of a column-and-girder platform designed to accommodate the condensers under the turbines, on lines similar in a general way to those described in our issue of Jan. 14, 1915, page 66. These turbine-foundation columns are set on piers and walls built on the foundation mat. The steelwork of the platform between the outside girders was filled with concrete to insure rigidity of the joints. The box columns are filled with a concrete grout poured in from the top, 2-in. holes being left for this purpose in the channels of the columns. The space between the columns and kneebraces is likewise filled with concrete to give rigidity to the joints.

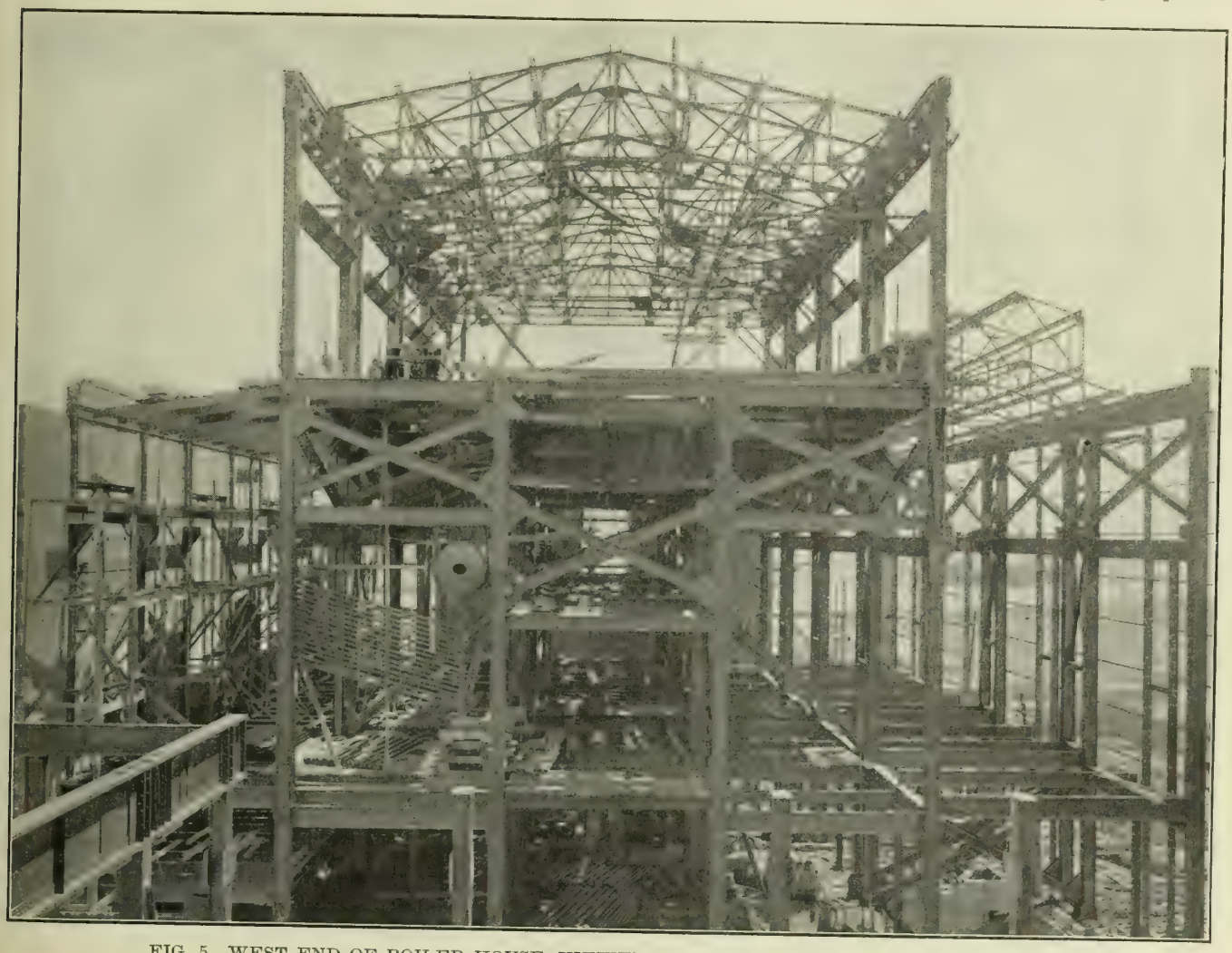


FIG. 5. WEST END OF BOILER HOUSE, VIEWED AT LEVEL JUST BELOW STACK FLOOR
Note diagonal bracing transverse to building to resist the wind pressure on the stacks

The width of the turbine house is more than ample for the 25,000-kw. turbines, of which two have been installed at present. The third unit, which the present section of the turbine house has been designed to accommodate, may be of larger size. The designers figure, however, that the turbine room is of ample width to accommodate the largest steam turbine likely to be built in the future. For this reason, although the turbine house accommodates three units, the foundation framing has been designed and built for only two of them. The support for the third would depend in proportions and strength on the turbine to be subsequently adopted here.

The general arrangement of the boiler house is represented fairly well by the cross-section in Fig. 4 (see also view, Fig. 5). The extension of the house is to be by the addition of successive boiler and firing aisles which will be duplications of the present structure.

Special features of the framing are: (1) The arrangement of the transverse bracing, (2) the use of auxiliary columns under the bridge, front and rear walls of the boiler furnaces to reduce the weight of metal in the girders otherwise necessary and (3) the arrangement of the roof framing on the economizer floor.

The attic story, or economizer room, of the building will receive the economizers, and clear space had to be provided between the roof trusses sufficient to pull out economizer tubes. By this requirement, in conjunction with the location of the two steel stacks, the spacing of the roof trusses and diagonal bracing was determined. The locations thus fixed did not coincide with the column locations, and the roof trusses are therefore carried on longitudinal eave girders of truss construction, running along either side of the building. However, it was desired to secure the same lateral stiffness that would have been obtained with roof trusses framed directly into the columns and provided with kneebraces. To this end each roof truss is fitted with a deep kneebrace at either end, and a plate girder in the plane of the kneebraces on other side of the building transfers the reactions to the columns, thus making this structure rigid against wind.

The necessity of leaving clearance for the economizer tubes also made it impossible to put in the usual lower-chord lateral bracing. The matter of bracing was therefore worked out by using lower-chord laterals inward from the eaves to the first main panel point, thence carrying a diagonal system back and up to the top chord in the plane of a truss diagonal and continuing across the middle of the roof span in the plane of the top chord.

Longitudinal bracing of the building is provided in the bays adjacent to the stack by full diagonals in all the lines of columns transferring the reactions over as large a base as possible. This bracing is clearly shown in Fig. 4.

Brick-Lined Stacks 270 Ft. High

The two steel stacks are supported at the level of the economizer floor, each by a system of 96-in. plate girders arranged in a square. The columns are stiffened by planes of bracing in both directions. On account of the large wind reaction from the stacks, the lateral stresses from this girder group are distributed through the entire floor by a system of floor diagonals to prevent any possibility of twisting the structure.

Each stack-base ring is held down to the main girders by twelve 2¾-in. anchor bolts (upset to 3¼ in.) extending down to the bottom flange of the girder. It was not thought safe to depend on these anchor bolts or on friction for taking the wind shear, and on this account the base ring is connected to the girder flange by twenty-four 1¼-in. turned bolts fitted into holes reamed through base ring and girder flanges to take the entire shear due to pushing the stack off its base by the force of the wind.

The stack, 16 ft. in diameter by 213 ft. 5 in. high above base ring, which is 60 ft. above the basement floor, consists of simple plating with a sectional firebrick lining. The top of the stack is capped with a sectional cast-iron ring. The lining is supported on shelves and provided with holding plates. Under each of the four-column stack groups the concrete mat of the foundation had to be made 5 ft. thick in order to distribute the load over the required number of piles. However, in spite of great stack load it was not thought necessary to reinforce the mat with steel. The stacks were designed for two-thirds of 50 lb. per sq.ft. diametral projection.

Plant Designed Without Outside Retainer

The general design of the Essex station was carried out by the engineering department of the Public Service Electric Co., headed by N. A. Carle, Chief Engineer. The steel design was largely handled by R. Von Fabrice, Chief Draftsman. The Lackwanna Bridge Co., Buffalo, N. Y., is furnishing and erecting the general steelwork. The turbine platforms, however, were let separately to the Pennsylvania Steel Co., for whom Alfred E. Norton is erecting the steel.

A remarkable fact is that throughout the entire planning and building of the Essex station no engineering or architectural assistance outside of the regular organization of the Public Service Electric Co. was employed. The difficult foundation conditions, the complex steel structure and the elaborate mechanical and electrical plant were planned out by the company's engineers after a study of all the recent large power stations in the country and utilization of the best ideas found there, together with the ideas developed by the designers themselves. As a result it is expected that a very low generating cost will be realized in addition to the low construction cost. Remarkably good architectural effects have also been secured, notably in the exterior of the switch house, where the material is common brick.

Steel-Reinforced Asphalt Roof

Reinforced-asphalt roofing will be put on a high-service reservoir to be built by Boston on Bellevue Hill. The reservoir is a steel tank 100 ft. in diameter by 44 ft. high, inclosed within a stone and concrete tower 108 ft. 2 in. inside diameter. The masonry shell is roofed over by concrete carried by a steel-beam framing supported on columns, and this concrete is to be covered by 1 in. of asphalt mastic, reinforced with wire mesh according to the following specifications:

The Neuchatel (Val de Travers) rock asphalt-mastic blocks shall be brought to the site of the work with the name of the above trade-mark stamped thereon. The mineral matter used shall be clean, sharp sand, good sharp grit, fine beach gravel or granite screenings, free from dirt and loam. The reinforcing material shall be No. 16 galvanized-wire fabric, 2-in. mesh. No artificial mastic or coal-tar products shall be used in the preparation of the materials or while laying and finishing the work.

The materials shall be mixed in the following proportions: Rock asphalt mastic, 50 to 55 parts by weight; asphalt fluxes, 10 to 12 parts by weight; mineral matter of stone, grit or granite screenings, 35 to 38 parts by weight. The asphalt blocks shall be broken and melted in regular asphalt-mastic kettles, together with the necessary asphalt fluxes, after which the mineral matter of sand, grit, beach gravel or granite screenings shall be added and thoroughly incorporated by stirring, and the whole mass shall be heated to the temperature of 250° to 300° F.

After sufficient cooking and stirring, the asphalt shall be carefully and uniformly spread in place over the foundation to a depth of ½ in. with wooden spatulas or floats and thoroughly worked or rolled until it is free from voids and an even surface is obtained. The asphalt mastic shall be laid in two layers each ½ in. in thickness with the galvanized-wire fabric embedded in the lower layer. The final surface of the asphalt mastic shall be dusted with either portland cement or white sand, and when laid it shall be perfectly water-tight.

Coleman du Pont Concrete Road

SYNOPSIS—A 20-mi. section nearing completion in Delaware. Extensive experiments with hydrated lime. Different kinds of reinforcement and methods of construction. Expansion joints placed when work is suspended for more than 15 min., and at irregular intervals to determine results. Power screed used on one section.

The first section of the Coleman du Pont Road in Delaware is being completed between Selbyville on the Delaware-Maryland line and Georgetown, Sussex County. This highway, generally of reinforced concrete, is financed by Gen. T. Coleman du Pont for the benefit of his state. The first section will cost more than $200,000 exclusive of the expense of securing a 200-ft. right-of-way. The entire project, 100 mi. long, running the length of the state, is estimated to cost $3,000,000. The present construction is divided into four contract sections, numbering from Selbyville north. A typical cross-section of the road is shown in Fig. 2. The maximum degree of curvature is 2°, and the limiting grade in Sussex County is 2%.



FIG. 1. BOXES USED TO ACCURATELY MEASURE CONCRETE MATERIAL BEFORE ENTERING MIXER

The general surface in Sussex County is mostly sand or clay or a mixture of these. When the roadbed is in drifting sand a small amount of clay is added to facilitate compacting the subgrade. The side slopes vary from 1½:1 in the firmer earth to 2:1 in the sandy soil and 4:1 on embankments where no guard rail is provided.

Embankments are built up in 8-in. layers, and each layer is rolled for its entire width. When possible, material for fill is secured within the slope lines, 20 ft. on each side of the center line. When this material is unsatisfactory for embankments, subgrade or shoulders, earth is obtained from borrow pits. If any black soil, sod or vegetable matter is encountered, it is removed before preparing the subgrade. In one instance, however, where the road traversed a swamp, it was decided that if the specifications were followed the cost would be excessive. The roots and brush that constituted the surface of the swamp floated on soft muck. Holes were cut in the surface of the swamp near the toe of the fill, and the muck was forced out through these holes by the weight of the fill; thus the fill was allowed to settle to firm foundation. This method saved about $1,500.

Drainage everywhere is very carefully planned. The average grade is only 1 ft. in 2,000, while in the most difficult section (from the standpoint of securing adequate drainage) the fall is 1 ft. in ¾ mi. Drainage maps were made showing the drainage survey to extend about ½ mi. on each side of the highway. Without these surveys it would have been impossible to secure a good drainage system.

The Concrete Wearing Surface

The concrete pavement is 14 ft. 7 in. deep in the center and 5 in. at the side. On each side of the concrete there is a 4-ft. shoulder of earth, making the available roadway 22 ft. wide. The pavement is reinforced throughout, with the exception of places where it was decided to leave it out for the sake of experiment. Expanded metal was used for reinforcement, although other kinds of reinforcement were tried. It is placed 2 in. from the top surface in all but a few cases.

Great stress was laid on the accuracy of measuring the concrete ingredients. Wooden measuring boxes of 2-cu.ft. capacity were used by all contractors, and this

method was held in great favor by all parties. The scheme is explained in some detail in *Engineering News* of Oct. 21, 1915, and is illustrated in Fig. 1. While it was very simple to measure the same amount of stone, sand and cement in each batch, it was not such a simple matter to keep the batches of the same consistency. This was in part due to the variation in the amount of water that could be introduced into the drums of the concrete mixers when the water regulators were kept in the same position. A device to obtain exactly the same amount of water in each batch of concrete has been made, and it is hoped it can be attached to all the mixers on the du Pont Road before construction starts in the spring. It will do away with the variation of the consistency of the batches and thus give a more uniform concrete.

The specification for concrete mix is as follows:

The proportions of ingredients shall be approximately 1 bag of portland cement, 2 cu.ft. of fine aggregate and $\frac{1}{10}$ cu.ft. of hydrate of lime. This may be varied slightly in order to obtain the densest mixture, if so approved by engineer.

Acting under this clause the engineer took occasion to vary the proportion of hydrate from zero to 10% of the cement content, with a view to observing the effect of varying quantities of hydrate on both the deposition of the concrete and its wear in a road surface. The experiment is not yet sufficiently advanced to warrant conclusive deductions.

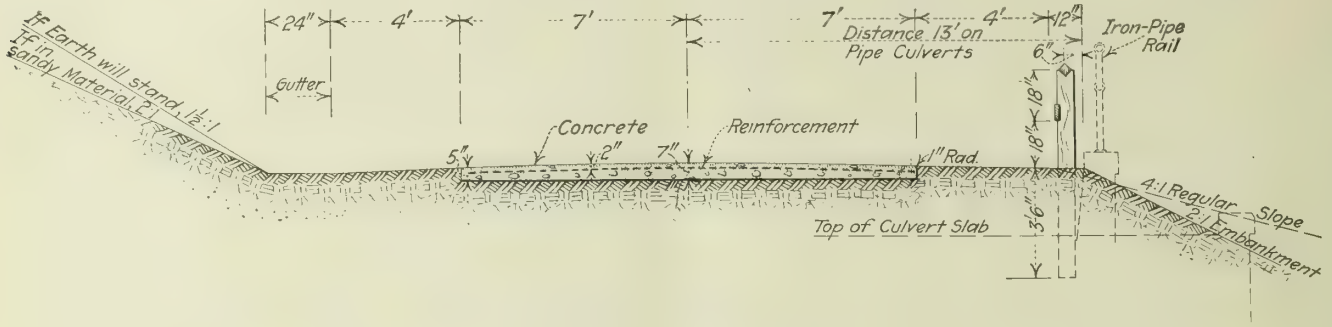


FIG. 2. TYPICAL CROSS-SECTION OF COLEMAN DU PONT ROAD

Each batch of concrete consisted of 2 bags of cement, 4 cu.ft. of sand, 8 cu.ft. of stone and hydrate as stated. The time of mixing was 1½ min., at a minimum of 15 r.p.m. Before the concrete was deposited, the surface of the subgrade was sprinkled with water. There were seven concrete mixers in service in October, 1915. Each mixer averaged 300 lin.ft. of pavement per day.

After carefully considering many coarse aggregates that were available, it was decided to use traprock. This was obtained from quarries in the state and transported as near to the line of the road as possible. Narrow-gage construction railways conveyed the stone from the rail-



FIG. 3. SEVERAL ELEMENTS IN THE CONSTRUCTION OF THE COLEMAN DU PONT ROAD IN DELAWARE

Foreground—Imbedding the reinforcement. Center—Floating the finished concrete. Rear—Canvas-covered frames protecting fresh concrete from sun. Boom of mixer extends in foreground

way to the job, where it was dumped on the subgrade. The requirements of the traprock were that it should have a French coefficient of wear of at least 17, and should be the run of the crusher that would pass a 1½-in. ring and be retained on a ¼-in. screen. The sand used was dredged sand of exceptionally good grading, with the larger particles nearly ¼ in. in size. By using this sand with the graded stone the theoretical grading of the aggregates of the concrete was nearly perfect, and a very dense concrete resulted. A representative of the Bureau of Standards, who made a number of tests to determine the movement of the pavement, declared that the density of this concrete was greater than any he had previously drilled.

In view of the well-known diversity of opinion as regards the spacing of expansion joints, it was decided to place them on this road only when the mixer was shut down for 15 min. or longer. This resulted in some long slabs—in some cases reaching as great a length as 460 ft.

The specifications permitted the use of "any machine devised to finish pavement." On Section 1 a power screed, manufactured by the R. D. Baker Co., was employed successfully. On the other sections hand screeds made by bending 4x4x½-in. angle iron are used.

As soon as the concrete is finished, it is protected from the sun and wind by canvas-covered frames. As soon as possible after the concrete becomes hardened it is covered with 2 in. of earth and kept wet for 14 days. No traffic is allowed on the concrete pavement for at least 30 days.

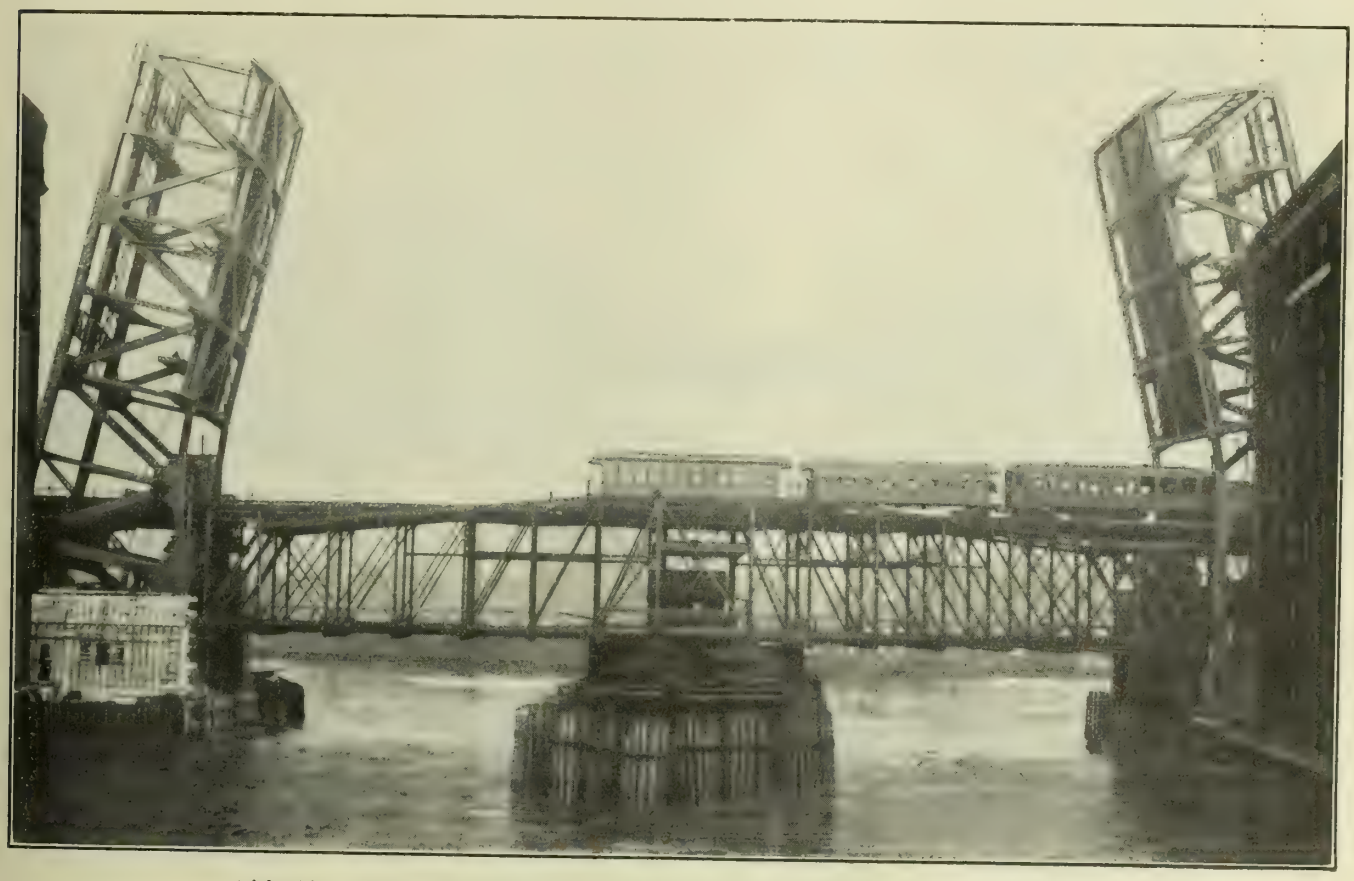
Each of the four contract sections is inspected by a resident engineer, who reports to the Chief Engineer, Charles Upham. Associated with Mr. Upham is C. D. Buck, Superintendent of Construction.

Renewing a Drawbridge Across the Chicago River

The new double-deck bascule bridge and the old center-pier double-deck swingbridge over the Chicago River at Lake St. are shown in the accompanying view, which represents the condition of work a month ago.

The old swingbridge is kept in service to carry the elevated-railway trains, but the roadway is closed to traffic. The bascule bridge was erected with its leaves in the raised position, the deck and bracing of one panel in each leaf being omitted to allow trains to pass through until the bridge is ready for operation. Then traffic will be stopped for a short time while the old bridge is removed and the floor system of the new structure is completed.

The bridge is of the trunnion bascule type, with a span of 245 ft. c. to c. of trunnions, giving a width of 209 ft. between the piers for a channel 195 ft. wide in the clear. The old bridge gives two channels only 65 ft. wide. The trusses are spaced 42 ft. c. to c. and are 30 ft. deep at the center. On the lower deck are a 38-ft. roadway (with car tracks) and two outside 16-ft. walks; on the upper deck is a double-track railway between the trusses.



OLD AND NEW DRAWBRIDGES OVER THE CHICAGO RIVER AT LAKE ST.

The bridge was designed and built under the direction of John Ericson, City Engineer, and Thomas G. Pihlfeldt, Engineer of Bridges and Harbor. The contractors were the Fitzsimons & Connell Dredge and Dock Co. for the substructure, the American Bridge Co. for the steelwork, and the Ketler-Elliott Erection Co. for the erection. The steel was stored on the dock shown beyond the center pier and was floated into place on lighters.

The bridge and its construction were described fully in *Engineering News*, Nov. 4 and 11, 1915.

A 2,223-Ft. Concrete-Arch Bridge Built on Reverse Curve

By A. M. Richter*

SYNOPSIS—A long bridge, curved in plan, with arches of two types; 211-ft. spans, with three arch ribs carrying crosswalls, and 134-ft. spans, with barrel arches. All are reinforced by steel truss ribs. Concrete was placed by a cableway of 2,038-ft. span, handling drop-bottom buckets. The entire construction is being done by the city on the day-labor system.

The construction of the Third Ave. reinforced-concrete arch bridge across the Mississippi River at Minneapolis, Minn., has involved unusual engineering difficulties and presents features of interest in both design and construction. The bridge is notable for its size, because it is curved in plan and because it is being built on the day-labor system, which has been employed for some time in the city engineering department. Some stages of the work under construction are shown in Fig. 1, and the general plan is shown in Fig. 2.

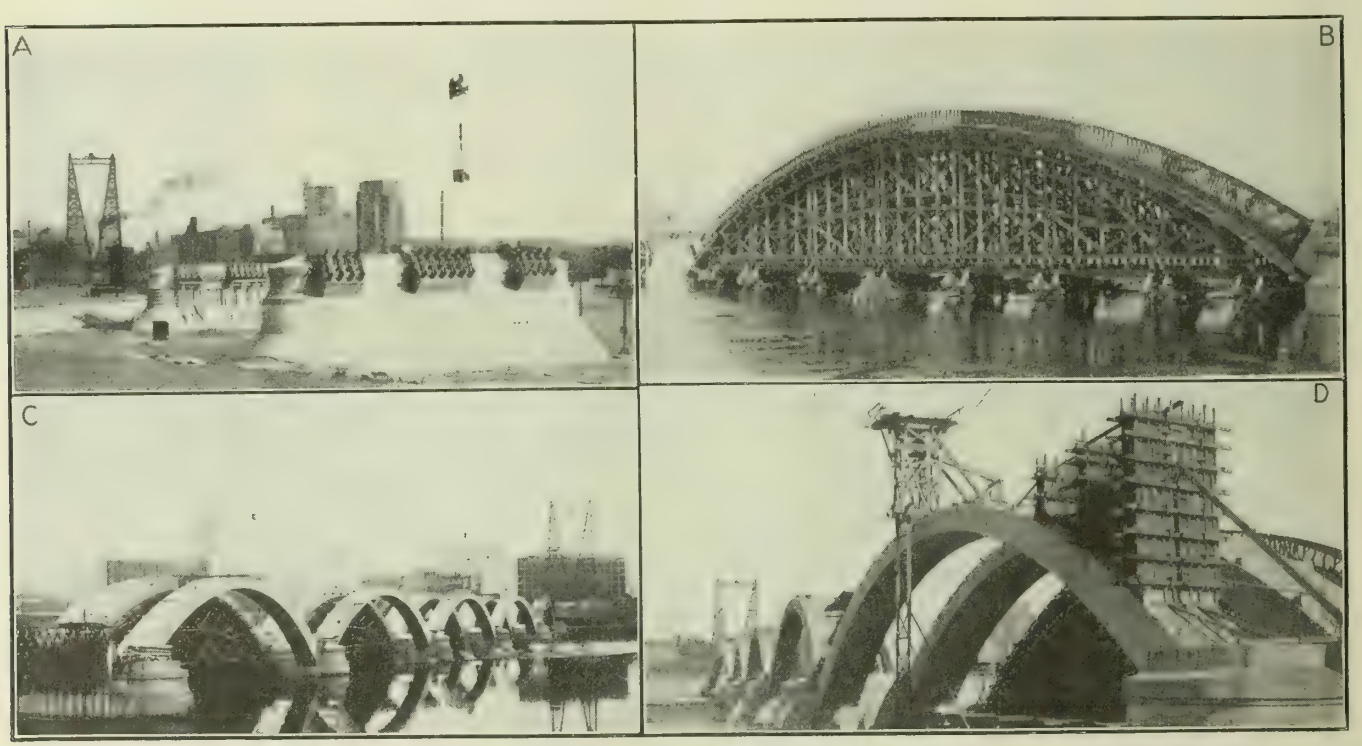


FIG. 1. CONSTRUCTION OF REINFORCED-CONCRETE ARCH BRIDGE OVER MISSISSIPPI RIVER AT THIRD AVE., MINNEAPOLIS, MINN.

A—Piers 4 and 5, showing ends of steel arch ribs, and tail tower of the cableway (Nov. 20, 1914). B—Falsework and steel reinforcing ribs for first 211-ft. arch (July 2, 1915). C—Arch ribs of the five 211-ft. spans; the third line of ribs (at the left) not built (Oct. 12, 1915). D—Fifth 211-ft. span, with two ribs completed and falsework and steel reinforcement in place for third rib. On the outer rib are forms for the cross walls, and a tower for the concreting chute

Troublesome Geological Conditions

Of special interest are the geological conditions which affect the foundation work and which account for the curved line of the bridge. The geological formation of the river bottom at the bridge site consists of a limestone bed about 15 ft. thick, which is practically bare in the west channel and covered only by a few feet of silt and sand in the east channel. The limestone ledge rests on the St. Peter sandstone, which is about 600 ft. in depth. This sandstone is readily excavated with picks and is easily eroded by the action of water, especially when under a head. The limestone extends upstream about 500 ft. from the bridge and downstream about 700 ft. to the crest of St. Anthony Falls.

In the early construction of works to utilize the power from St. Anthony Falls a peculiar advantage was afforded by the facility with which tunnels could be excavated in the soft sandstone. The water was led from the mill pond in a canal above the limestone, and the tunnels served as tailraces. In 1869, however, one of these tunnels had reached a point near the foot of Nicollet Island (2,000 ft. from the point of beginning), when water poured in from a break in the overlying bed of limestone. The project had to be abandoned, and the United States Government made extensive repairs to close the break in order to insure continuance of the water-power and restore the original conditions as far as possible. Another break occurred in 1876. The locations of these breaks in the river bed and their relation to the bridge projects are shown on the plan.

With the growth of the city, there has been strong demand for a bridge in the neighborhood of Third Ave. South. It was desired that this should be of handsome appearance, and a concrete arch structure was considered

*"Minneapolis Journal," Minneapolis, Minn.

the best to meet the requirements of the situation. In 1912 the City Council commissioned the Concrete-Steel Engineering Co., of New York, to prepare designs for a reinforced-concrete arch bridge between Third Ave. South and First Ave. Southeast. The location is indicated by a dotted line on the plan.

The design was subjected to a public hearing before the engineers of the United States War Department in 1913. The water-power companies had not favored any bridge project and announced that, if necessary, they would resort to litigation to oppose any work threatening danger to the falls.

Shortly after affairs had reached this stage, Frederick W. Cappelen was elected city engineer. While bridge engineer for the city in previous years he had built six bridges across the Mississippi River and acquired a thorough knowledge of river conditions. He refused to approve the proposed location. The City Council then rejected the plans and instructed him to design a steel bridge that could be constructed without endangering the falls or affecting water-power rights.

His proposed location is shown on the plan, and his design included one span of 434 ft. to clear entirely the area of the limestone breaks. The trusses were to be of the parabolic through-truss type. In the face of objections (based mainly on æsthetic considerations) the City Council approved the plans and directed the engineer to proceed with construction.

At this time, however, Mr. Cappelen conceived the idea that by adopting a curved location for the line of the bridge, a design satisfactory to all parties might be worked out. On investigation it was found that at one point the limestone break could be cleared by a concrete arch of 211-ft. clear span. A revised

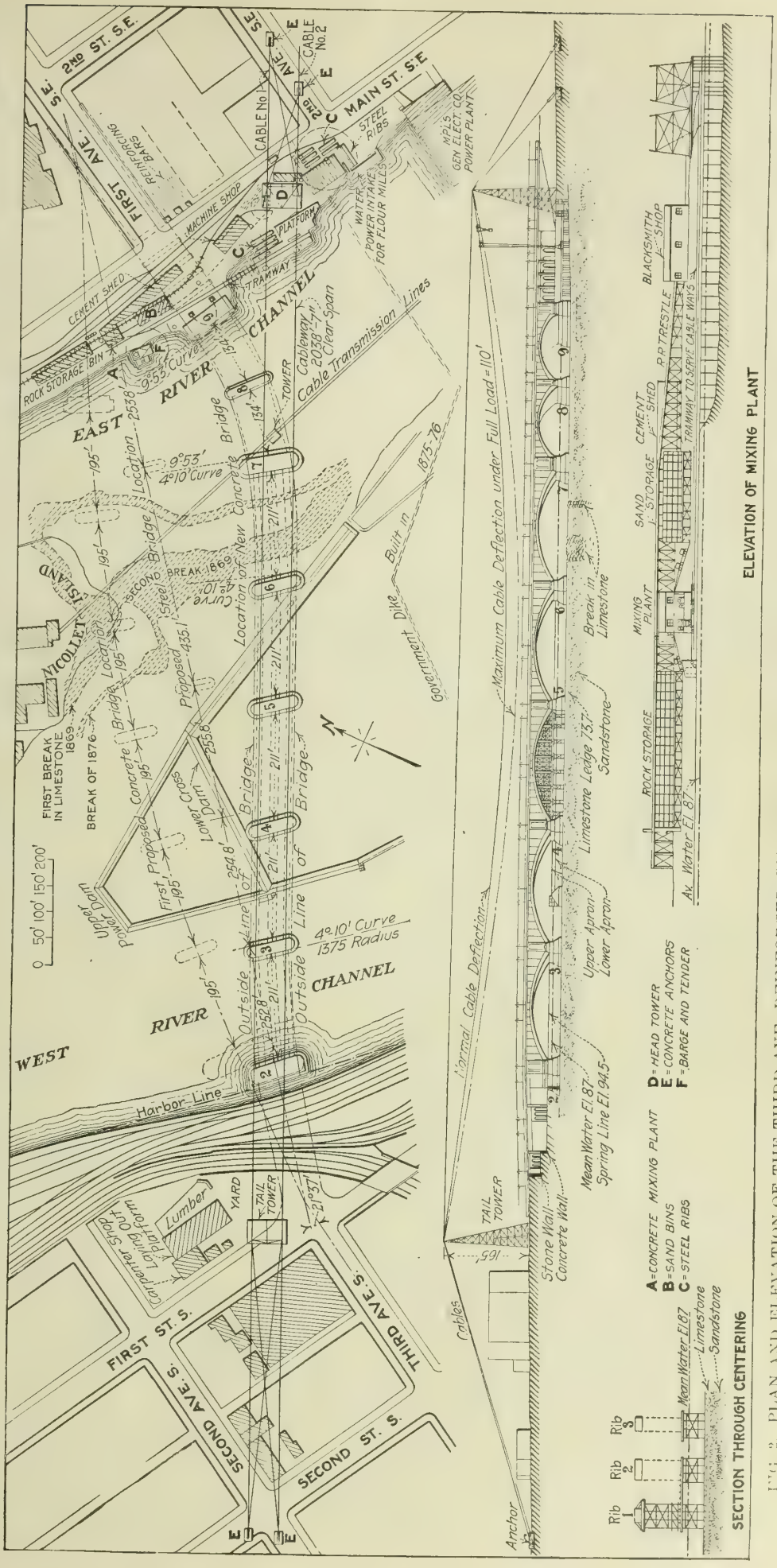


FIG. 2. PLAN AND ELEVATION OF THE THIRD AVE. REINFORCED-CONCRETE ARCH BRIDGE OVER THE MISSISSIPPI RIVER AT MINNEAPOLIS, MINN.

plan for the desired ornamental structure was then prepared. This proved satisfactory to all parties and was finally adopted.

The bridge is 2,223 ft. long and consists of seven main river spans. It has a 54-ft. roadway (with double-track street railway) and two 12-ft. sidewalks. The loading provides for two 40-ton cars and 100 lb. per sq.ft. uniform load. The floor system is designed to carry a 24-ton road roller on a space of 12x18½ ft. The center line starts at the intersection of Third Ave. South and First St. at an angle of 21° 39′, and is on a tangent for 151 ft. to a 4° curve 330.2 ft. long. A tangent 719 ft. long continues to a curve consisting of a 4° compounded into a 10° curve in a distance of 526.83 ft., bringing the center line of the bridge to that of First Ave. Southeast. The

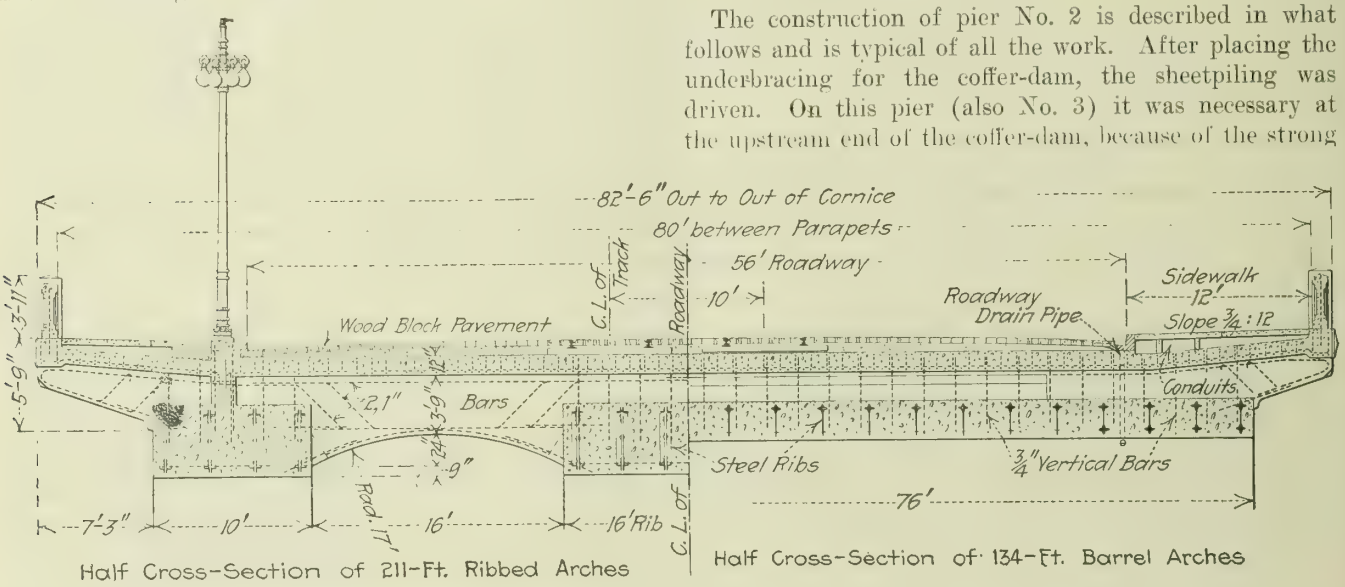


FIG. 3. CROSS-SECTION OF THE CONCRETE ARCH BRIDGE AT THIRD AVE., MINNEAPOLIS, MINN.

bridge is level, with a grade of 0.9% on the east approach and 3.4% on the west approach.

There are five 211-ft. spans with piers 20 ft. wide at springing line and two 134-ft. spans with an intermediate pier 13.79 ft. wide. The two end, or abutment, piers and the pier between the 211-ft. and 134-ft. spans are 30 ft. wide. The approaches are steel girder spans on thin piers. All the river piers are skew to the center line. The 211-ft. spans are on the tangent of the 4° curves and the 134-ft. spans are on the 10° curves.

Each of the 211-ft. spans is carried by three arched ribs of 36-ft. rise, as shown in the cross-section, Fig. 3. The outside ribs are 12 ft. wide in the two end spans and 10 ft. in the intermediate spans, while all center ribs are 16 ft. wide. The reinforcing is of the Melan type, consisting of ribs of 4x4x½-in. angles laced with 3x3x$\frac{5}{16}$-in. angles (at haunches) and 2½x⅜-in. bars. There are six of these ribs in each 16-ft. arch rib, five in the 12-ft. and four in the 10-ft. ribs. They are braced every 30 ft. with 3x3x$\frac{5}{16}$-in. angles.

The two 134-ft. spans over the east channel are full-barrel arches (Fig. 3) with Melan ribs of 3x3x$\frac{5}{16}$-in. angles laced with 2½x¼-in. bars. These are spaced 34 in. c. to c. and cross-braced every 30 ft. with 3x3x⅜-in. angles.

Carrying the floor system from the ribs are transverse walls and girders supporting the floor slab and brackets supporting the sidewalk slabs and parapet-wall beam. These are shown in Figs. 3 and 4.

The piers were constructed in open coffer-dams of Lackawanna steel sheeting, some of the sheeting being used three and four times. The coffer-dam dimensions were as follows: Pier No. 2, 46x121 ft.; Nos. 3 to 6, inclusive, 37x113 ft.; No. 8, 24x101.5 ft.; No. 7 (between the larger and smaller arches), 46x131 ft.; east abutment pier, 42x110 ft.

Practically no silt was found on top of the ledge at piers Nos. 2, 4 and 5, but there were from 6 to 12 in. at No. 3, 5 ft. at the downstream and 7 ft. at the upstream ends of No. 6, 9 and 10 ft. at No. 7, 8 ft. originally and scouring out to 3 ft. minimum at No. 8 and 8 ft. at pier No. 9. The depth of water was 16 ft. at piers Nos. 7, 8 and 9, 12 ft. at Nos. 2, 3, 6 and 12 and 5 ft. at Nos. 4 and 5.

The construction of pier No. 2 is described in what follows and is typical of all the work. After placing the underbracing for the coffer-dam, the sheetpiling was driven. On this pier (also No. 3) it was necessary at the upstream end of the coffer-dam, because of the strong current, to anchor 15-in. I-beam sills to the rock bottom with 2-in. rods to hold the lower end of the sheeting in place. This is shown in Fig. 5.

The steel sheeting was very tight and was made entirely water-tight by a filling of coal dust and fine cinders. Sandbags were placed around the bottom of the sheeting and then pumping was started. If water came in through fissures in the rock, pumping was stopped and the bottom course of concrete, 5 to 6 ft. thick, was placed under water. After this had set, the coffer-dam was pumped out and the remainder of the work placed dry. This was done on piers Nos. 2, 6 and 8 and partly on No. 3. Excavating for piers Nos. 6 and 8 was done entirely with orange-peel buckets. The rock in these coffer-dams was cleaned by divers with water jets. The other foundations were placed dry, but always in sections, and generally four sections to each coffer-dam.

The silt on top of the bedrock was full of old water-soaked logs that caused trouble in the excavation. Two slight breaks occurred in coffer-dam No. 3. Both occurred during night shifts, and might have been prevented had there been an intimation of a break during the day.

Construction of the Piers

After the footings were completed, the piers were concreted in forms which were used over and over again (Fig. 6). The first section above the footing was carried above water level, generally leaving a center space considerably below water level to receive the ends of the

steel ribs. Finally this part of the pier containing the ribs was cast in one continuous pouring. This amounted to about 1,000 yd. on piers Nos. 3, 4, 5 and 6, 1,266 yd. on Nos. 7 and 9 and 750 yd. on pier No. 8. The record run was 1,000 yd. in 22 hr.

Pier construction was carried on through the winter except when the temperature was below zero, special precautions being taken against freezing. The forms were entirely inclosed with tarpaulins (Fig. 6) and heated with coke stoves. The sand and rock bins were supplied with heaters, and when necessary the cableway buckets for handling concrete were dipped in hot-water tanks on shore. Careful records were kept of temperatures of materials at deposit points. As a result, there was no trouble from frozen concrete.

Concrete deposited under water was a 1:2:4 mixture. All other concrete in the piers was 1:3:6. It was mixed in batches of about 1 yd. (24 ft. of stone, 12 of sand and 4 sacks of cement), two batches to each bucket. The stone was mostly traprock from Dresser Junction, Wis., crushed to a maximum size of 3½ in. The sand was a Minnesota product. A timber tower about 50 ft. high, with crib bottom for anchorage, was placed adjacent to the pier, standing on the river bottom. The tower had a hopper near the top, with a chute to the forms. The cableway buckets delivered concrete to the hopper, where a man regulated the discharge to the chute. The towers were picked up bodily by the cableway and moved from place to place.

The first coffer-dam (pier No. 2) was begun Aug. 2, 1914, and the pier work was finished June 28, 1915. The river froze solid early in December, and the ice left the west channel in March and the east channel in April. Between the dates mentioned, 27,000 yd. of concrete was laid in pier construction.

Falsework for the Arch Spans

Falsework for the arches was begun Apr. 19, after the ice was out. One set of falsework was designed for the center ribs for the five 211-ft. spans. It was made in seven sections per span, supported by 24-in. 70-lb. I-

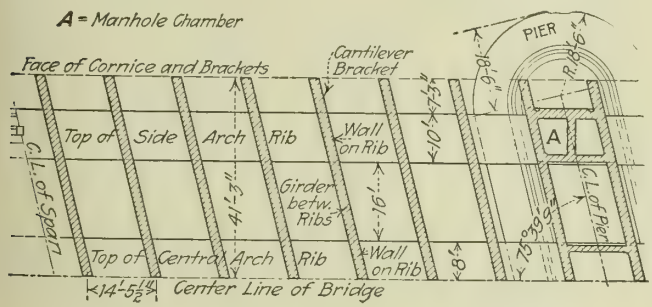


FIG. 4. PART PLAN OF 211-FT. ARCH SPAN
Showing the arch ribs and cross walls

beams, 28 ft. long on the inside sections and 26 ft. on the two end sections. The I-beams were supported on cribs made of eight 10x10-in. posts braced and capped and having open plank bottoms for loading with sandbags to sink them into place. These cribs were placed 28 ft. 11 in. c. to c. (Fig. 1).

The falsework to carry the ribs was of 8x8-in. posts braced with 2x10-in. planks. The bents were capped and furnished with wedges under caps supporting the joists which carried the lagging and the framework for the rib. The lagging and side forms were of 1-in. tongued-and-grooved plank, the forms being supported by 4x4-in. posts and 4x6-in. longitudinal timbers.

The I-beams rested on 8-in. blocking, so that when the centering had been used for one rib, the entire falsework could be moved into place for the next rib by replacing the blocking with rollers. This falsework was placed in position for the upstream rib first and cribs were placed also for the center ribs at the same time. Trouble was experienced in placing them because of high water and

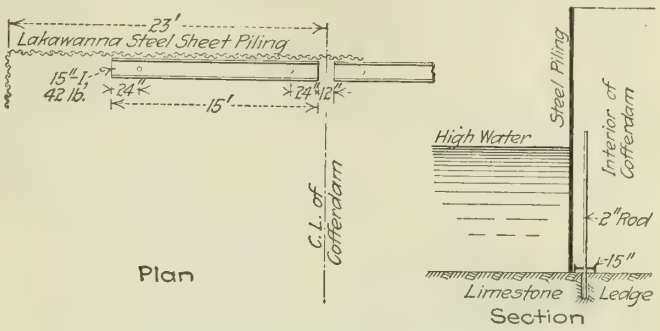


FIG. 5. SUPPORT FOR BOTTOM OF STEEL SHEETING FOR COFFER-DAM

because several cribs were located on the roll dams and aprons. The use of the 24-in. I-beams of 26- and 28-ft. length was decided upon in order to utilize the material for the floor spans of the approaches.

Concreting the Arches of the Bridge

The first arch rib, between piers Nos. 2 and 3, was poured July 8, 1915; 240 yd. of concrete was handled on one cableway in 11 hr. over the center section of the rib. The steel ribs were then riveted at the haunches during the next night and the two end sections poured simultaneously the following day, both cableways being used for 9 hr. to handle 340 yd. of concrete. The last upstream rib was poured Aug. 5. Two days later the centering was struck under the first rib and the falsework rolled over by means of a crab on pier No. 2, with block and tackle hitched to each section. The whole centering for one span was thus moved in one day.

On Aug. 16 the centering for the next span was moved into position and on Aug. 19 and 21 the center rib was poured—768 yd. in 24 hr. A record run was made on the center rib finished Aug. 28, when 450 yd. was poured in 7½ hr. with both cableways, or one bucket every 2 min., at a distance of 1,600 ft. from the mixers. The concrete for the ribs is a 1:2:4 mix, using ¼- to 1½-in. stone.

The program for the rest of the work provided for pouring one rib a week until all 15 were completed. The cribs for the upstream ribs were moved and used again for the third ribs on the downstream side. The centering for the last rib was moved over into place in 2 hr. 40 min.

In October, 1915, the timber for the first three 211-ft. spans was moved over to the 134-ft. spans in order to finish the arches before cold weather sets in. The transverse walls are being put in, and only the floor proper will remain to be put in next spring. It is expected that the new bridge will be opened to travel not later than June 1, 1916.

The alignment of the bridge and skew of the piers necessitated an elaborate system of location. The triangulation had for its base the center tangent line of the bridge.

A series of large triangles was laid out on either side of this base line, regard being given to prominent points as targets for the apices of the triangles.

A secondary triangulation system was calculated, with proper attention to balancing errors for the location of the instrument platforms. Upon this the intersection points of pier, transverse center lines and base line of platforms were accurately established. These intersections were established with ordinary transits reading to 30 sec. Seconds were interpolated on the platforms by means of thread intersections; the minute next greater and that next smaller to the actual triangle calculated to the nearest second were read by the instrument man and recorded on the platform. Actual measurements show a maximum error of ¼ in. in 211 ft.

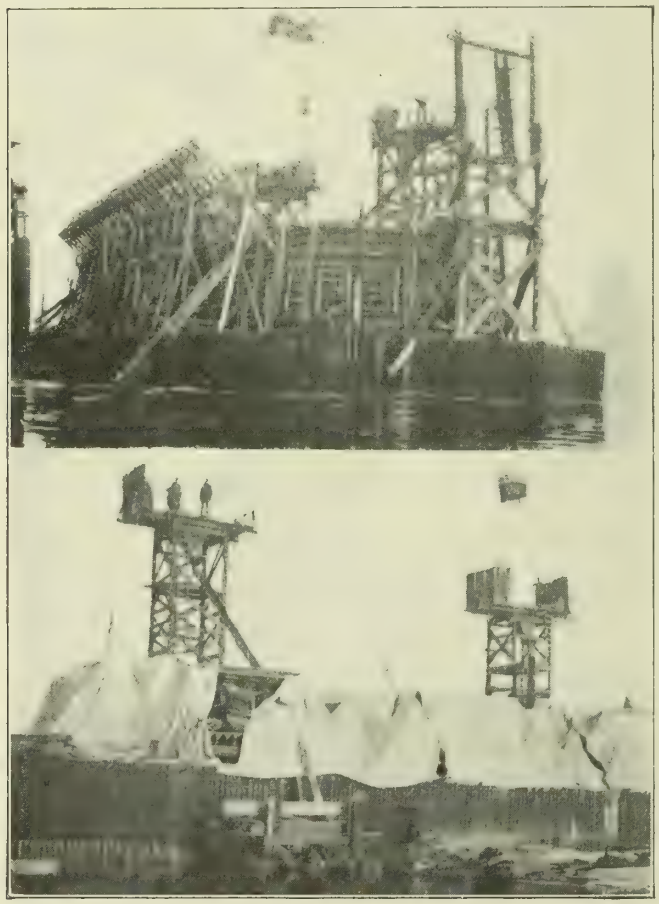


FIG. 6. CONCRETING THE PIERS FOR THE THIRD AVE. BRIDGE

Upper View—Work at pier No. 7 in April, 1915. Lower View—Concreting pier No. 3 during freezing weather in December, 1914

Handling Material by Cableways

The river conditions, as well as railway operations at the site of the bridge, led to the use of a Lidgerwood double cableway to handle the work. This has two 2½-in. steel main cables and is operated by two 75-hp. engines and a 150-hp. tubular boiler. The cables have a working span of 2,020 ft., giving a capacity of 6 tons each at a speed of 1,200 ft. per min. constant work and 10 tons for occasional demand. Fig. 2 shows the location of the cableway and the bridge.

The towers had to be 165 ft. high to insure clearance. The location of the anchors was a difficult problem, which was finally solved by utilizing space in the streets in such a way as to interfere but little with traffic. The towers are 39x76½ ft. at the base. They are built of Douglas-fir timbers, 12x14 to 10x10 in., and capped with oak headblocks, 20x20 in. and 7 ft. long.

The anchors of the head tower (east side) contain 122 yd. of concrete each and weigh 237 tons. They are 27x12½x10 ft. and entirely under the ground. The tail-tower anchors are 22x15x10 ft. each, containing 120 cu.yd. and weighing 230 tons. They are half buried in the street. Each tower is guyed by two 1½-in. lines. Difficulty was met in carrying one of the cable lines over a seven-story building about 100 ft. from the tail tower and in supporting the same line to afford clearance on the street at the anchor, as indicated in Fig. 2. High-water conditions, inability to get near the dam in rowboats and the necessity of precaution against dropping the heavy cable and cutting a power-transmission line, as well as danger of interference with trains on several tracks, were among the complications involved. The task was finally accomplished by using a rope line and then a 1⅛-in. messenger cable to trolley across the 2½-in. cables.

The cableways are located to serve all piers except No. 9, the abutment pier on the east side. This is near the mixing plant and was served direct with towers, elevators and derricks.

The towers were framed on the ground and then erected. The framing began Apr. 1, 1914, and was completed Aug. 1. It was done on the day-labor system, with a crew of 7 ironworkers, 20 carpenters and 15 laborers. The erection cost is estimated at $5,000 and the machinery and special equipment cost approximately $21,000.

Concrete-Mixing and Handling Plant

A difficult part of the work was that of arranging the working plant. There was no room except on Main St. (on the east side), and here some travel had to be provided for. The Great Northern R.R. maintains two industrial tracks on the street and owns the land to the river, which is leased to various concerns. The railway company, however, cancelled the leases and made it possible to establish the mixing plant at that point. Concrete, steel and machinery were located on the east side and lumber on the west side. The layout of the construction plant and supply yards is shown in Fig. 2.

The concrete-mixing plant has a capacity of 400 yd. in 8 hr. There is a 2,000-yd. rock-storage bin 125 ft. long and an 800-yd. sand bin 74 ft. long. The bins are 27½ ft. wide and 12 ft. deep, and are provided with boilers for heating. The material track reaches the top of the bins by a trestle 460 ft. long, with a grade of 4%. Stone and sand are delivered through bottom openings into cars of 24-cu.ft. capacity, which serve the mixing platform by a cable incline operated by hoisting engines. The cement shed, 20x200 ft., of 5,000 bbl. capacity, is served by a sidetrack.

There are two cube-type mixers, each of 1-yd. capacity. They are equipped with steam lines, and in freezing weather the water is run through a reheater. The water tanks are fitted with gages for measuring the supply to each batch. The sand and stone are dumped into the hopper at one level and the cement from a higher level, and the entire charge then spouted into the mixer.

The concrete is discharged into 2-yd. drop-bottom buckets. These are circular in shape, with conical bottoms, and have legs so that they stand upright on flat cars. These cars are hauled between the mixer plant and

the cableway on a double-track cable tramway operated by American reversible hoisting engines.

At the city workhouse prisoners are making the ornamental concrete railing shown in Fig. 7. The concrete is made with mica-spar crystals (from Crown Point, N. Y.) and is cast in steel molds to obtain a smooth finish and polish. The cement workers' union protested against this plan, but finally withdrew its objections. This railing is estimated to cost $20,000.

Other Construction Plant

Space and trackage were very limited on the west side, but three lots at the street level were loaned by the Rock Island Lines. Here was erected a 48x135-ft. platform for framing timber and laying out the centering; also a small planing and ripping mill, tool house, men's house and engineers' field office. The timber is piled high on account of limited space. It is handled by a derrick with a 47-ft. boom and a 17-ft. mast.

The machine shop, 30x60 ft., is also on the east side. It has a blacksmith forge, bolt-threading machine, emery

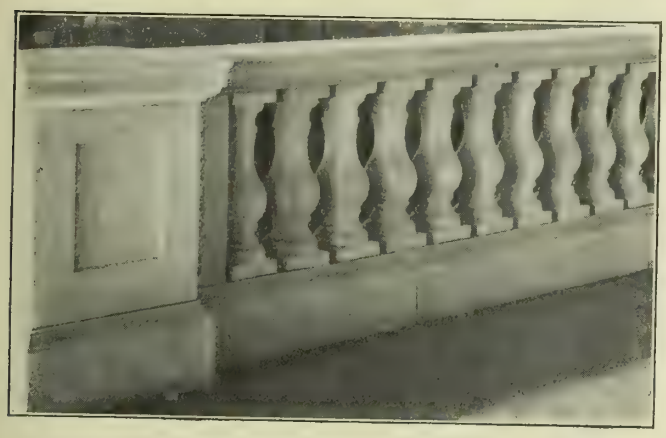


FIG. 7. CONCRETE RAILING FOR THE THIRD AVE. BRIDGE

grinder, miscellaneous tools and one 4-ton and two 2-ton chain blocks. A track runs under the shop from the cableway tower, so that equipment may be run in for repairs. Two movable derricks in the same location have 65-ft. masts and 50-ft. booms. Completing the east-side layout are the steel storage yards, served by a derrick with 65-ft. mast and 75-ft. boom. Each Melan rib is in its own common pile, some running 35 sections high. The reinforcing steel and bar iron are in separate places bundled and labeled for length and location.

Electric motors are used in the mill and machine shop and for operating the concrete mixers. Electric drills are employed in timber framing. All pumping was done with electric belt-driven centrifugal pumps. Compressed air was used for riveting.

The total cost was estimated at $650,000. The bridge will require 53,000 cu.yd. of concrete, 963 tons of structural steel for the arch ribs, 800 tons of reinforcing bars for piers and 1,500,000 ft. of lumber for centering. The prices for materials delivered at the site were as follows: Crushed traprock, $1.45 per cu.yd.; washed sand, 75c.; cement, $1.20 per bbl.; structural steel (including erection bolts and nuts), $53.50 per ton; reinforcing bars, $1.429 per 100 lb.; Lackawanna 7-in. steel sheetpiling, $1.63¾ per 100 lb.; coal (lump), $4.15 to $4.25 per ton; electric current for light and power, 2.9c. per kw.-hr.

The wages paid by the city (for an 8-hr. day) were as follows: Foremen, $4.50 to $6; ironworkers, $5; carpenters, hoisting enginemen and electricians, $4; handymen, $2.65; laborers, $2.50; water boys, $1.10; teams, $5.

The location was determined and the general design made by Frederick W. Cappelen, City Engineer (with whose aid and approval these notes were prepared). All construction was done under his direct supervision. He also designed the methods of construction, the working plant, falsework, etc. The assistant engineers, all employed in the city engineering department, were as follows: K. Oustad, Bridge Engineer; William Elsberg, Superintendent of Construction; and John E. Lawton, Junior Engineer.

The construction foremen were N. Linstrom, for the forms, concreting and falsework, and J. F. McAuley, for the mechanical equipment. The Concrete-Steel Engineering Co. furnished the detail plans under its original commission of 1912. Its resident engineer on the work was Charles F. Bornefeld.

Large Water-Works Figures

Municipal ownership of water-works prevails in 155 of the 204 cities of the United States having an estimated population of 30,000 or more in 1915, according to a statement just issued by the United States Bureau of the Census. The total estimated value of these municipally owned works is $1,071,000,000. The distribution systems in the 155 cities comprise a total of 36,936 mi. of mains, 330,593 fire hydrants and 1,787,448 meters. The total water consumption in the 155 cities for the year covered by the report was 1,326,028,000,000 gal., supplied to 26,200,000 people, giving an average daily per capita consumption of 139 gal. On the range of water consumption and the effect of meters, the Bureau of the Census says:

> The greatest daily consumption of water per inhabitant, 430 gal., is reported for Tacoma, Wash., and the smallest, 34 gal., for Woonsocket, R. I. In the former city 8% of the water is metered and in the latter 98%. The tendency of meters to curtail greatly the use of water is strikingly shown by a comparison of the figures for the 26 cities in which the entire water-supply is metered with those for the 26 cities in which not more than 25% is metered. In the former group the average daily consumption per inhabitant ranges from 42 gal. in Brockton, Mass., to 179 gal. in Columbia, S. C., and in only 7 cities does it exceed 100 gal. In the latter group it varies from 43 gal. in Savannah, Ga., to 430 gal. in Tacoma, Wash., and in only 3 cities does it fall below 100 gal.

The number of cities with water-purification plants is not given. Instead the statement is made that in the 155 cities of over 30,000 population having municipal ownership there are in operation a total of 87 settling reservoirs, in which are treated 958,600,000 gal. a day; 54 coagulation plants, treating 492,100,000 gal.; 527 sand filters, treating 598,700,000 gal.; and 427 mechanical filters with a daily output of 468,200,000 gal. The surprising total of 1,972,900,000 gal. of water per day is treated by some disinfection process.

The range of cost of water treatment per 1,000,000 gal. is reported as from 4c. per 1,000,000 gal. in Chicago, Ill., for disinfection, to $17.46 in Columbus, Ohio, for "mechanical filtration and chemical sterilization."

More detailed information regarding both municipally owned water-works and various other works and operations of the larger cities of the United States will be published later on under the title "General Statistics of Cities, 1915," compiled under the direction of Starke M. Grogan, Chief Statistician for Statistics of Cities. Sam L. Rogers is Director of the Bureau of the Census.

Field and Office

Sinking a Cylinder Pier by Open Dredging

The south shore pier of the continuous-span channel crossing of the new Chesapeake & Ohio Northern Ry. bridge over the Ohio, at Sciotoville, Ohio, was put down by open dredging through wells—the only foundation on this work put down by other than ordinary methods. The sinking went on quite according to expectations and encountered no difficulties.

The most successful feature of the work was that, although sunk in a sharply sloping bank at the edge of the river, the pier was landed almost precisely in correct position; this is to be credited to the well-judged allowance for downhill shift which was made by the contractor at the start of the sinking.

The Dravo Contracting Co., of Pittsburgh, Penn., did the work under the direction of Gustav Lindenthal, Consulting Engineer, who designed the bridge and foundations.

The south shore pier has a base 70x24 ft., with parallel sides and semicircular ends. Four wells, 7 ft. 3 in. in diameter, spaced 14 ft. 8 in. c. to c., were cored in the concrete for doing the dredging. The lower ends of the wells flare outward sharply for a height of 6 ft.

The pier is located some 30 ft. back from the water's edge, somewhat below the middle of the sloping bank. The bank is mainly clay, although farther back the soil is sand practically from the surface down. Rock was expected to be found within 10 ft. below low-water level, the latter being El. 475. It was actually encountered at El. 462.5.

The shoe of the pier was set June 22, 1915, on an excavated bench at El. 487. Forms for the chamber, built on the shoe, were then concreted to a level 6 ft. above the cutting edge, which formed the chamber and roof. Two further 6-ft. lifts were concreted, the pier being allowed to settle during this time with a small amount of hand excavation inside to level it up. On July 17 excavation through the shaft by orangepeel was begun.

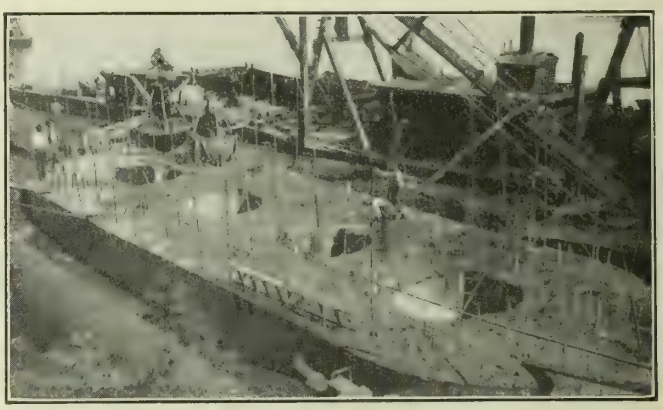
On account of the slope of the bank the contractor set the shoe 7½ in. landward of true position in order to allow for the riverward shift due to the greater earth pressure on the land side.

Shortly after excavation started, masses of old leaves and much clay were encountered on the river side of the pier. The excavation through this material had to be done by hand, the water being held by pumping. When clear soil was reached the chamber was allowed to flood, and thereafter the entire sinking proceeded by orangepeel buckets through the wells to within 18 in. of rock. Two buckets were used, one handled by a stiff-leg derrick set on the bank above the pier and one handled by a derrick boat working close against the bank.

Sinking went on at the rate of ½ to 2 ft. a day in the early stages. After the cutting was through the clay it was in fine sand, and here it made 2 to 3 ft. in 10 hr., the cutting edge being continually buried about 18 in.

Practically all seepage into the pier chamber came from the inshore side and end, there being numerous springs in the bank. Excavated material on the river bank was probably a factor in holding down the inflow from the river.

On July 28 the final 9-ft. lift of concrete was poured, and with this the pier went down to rock, bringing up Aug. 7. The rock was overlain by a layer of gravel on the downstream half of the pier, ranging from 2 to 3 in. at the middle line to 2 ft. at the downstream end. The pier brought up on this gravel. The chamber was then pumped out and the remaining excavation and a 2-ft. cut into the rock to get good bearing were done by hand.



TOP OF CHAMBER, KENTUCKY SHORE PIER OF SCIOTOVILLE BRIDGE

In this work a single No. 4 Emerson pump was sufficient to keep the chamber clear of water. As the shoe was lowered down during the rock excavation, empty cement sacks were packed under, which rolled up behind the cutting edge and shut off most of the water.

In preparing to concrete the chamber on Aug. 18, the bottom (El. 459.3) having reached sound rock, a drain of short lengths of 3-in. pipe covered with concrete in bags was laid around the cutting edge and carried to a sump under one of the shafts. Two 2-in. siphons not worked to their full capacity took the water from this sump. Two grout pipes down each of the four shafts leading to the cutting-edge drain were put in, and then the working chamber was sealed and the shafts filled. After this, grout was forced down one of the grout pipes, using compressed air as the forcing pressure, until it showed at all other pipes.

The pier as finally landed is within 1 in. of true position, departing a little toward the river, and stands practically plumb, is correct in alignment and at a true right angle to the bridge center line. Thus its total lateral shift was 8½ in. from shore toward river.

The total working period was 62 days. Of this period 19 days of 10 hr. were used in excavation.

The above data were supplied largely by R. T. Robinson, resident engineer. He gives credit for the success of the sinking operations to J. Smith Miller, the contractor's superintendent in charge of the work.

Equipment of Concreting Trains

Two concreting trains, each consisting of a mixer car, four to seven stone cars and two to four cars of sand, have been designed and fitted up by the engineers of the Chicago & Western Indiana R.R. for placing 30,000 cu.yd. of concrete in track-elevation work this season. The entire work involves the elevation of 45 mi. of main and yard tracks in Chicago and necessitates the building of retaining walls and abutments, sand fills, steel bridges and 15 subways. There will be grade separation between passenger and freight traffic. The railway is doing the work by its own forces.

The mixer car is placed in the middle of the train, with the cars of stone at one end, the sand at the other and the cement car behind the sand. This arrangement minimizes the distance that materials must be wheeled, calling for a smaller mixer gang. Placing the mixer car at the head of the train in similar work was described in *Engineering News* of Aug. 12, 1915.

A feature of the present work is the use of cement in bulk.

The mixer car is a 35-ft. flat-car, equipped with a ⅔-yd. Smith nontilting mixer, 10-hp. vertical engine, 20-hp. vertical boiler, 700-gal. storage tank and 60-gal. feed tank for the mixer. The machinery is housed, the roof of the car being higher at the discharging hopper than at the ends of the car, thus forming an easy incline from the runways on top of the gondola cars to the charging hopper above the mixer. The mixer is located about 8 ft. from one end of the car and faces the end (Fig. 2). It discharges the concrete into a swiveling chute, which may be swung to discharge from the end or from either side of the car. This arrangement of pouring at different angles, or from either end of the train, eliminates the necessity of turning the mixer car (as required with other types) and makes a considerable saving in work-train service.

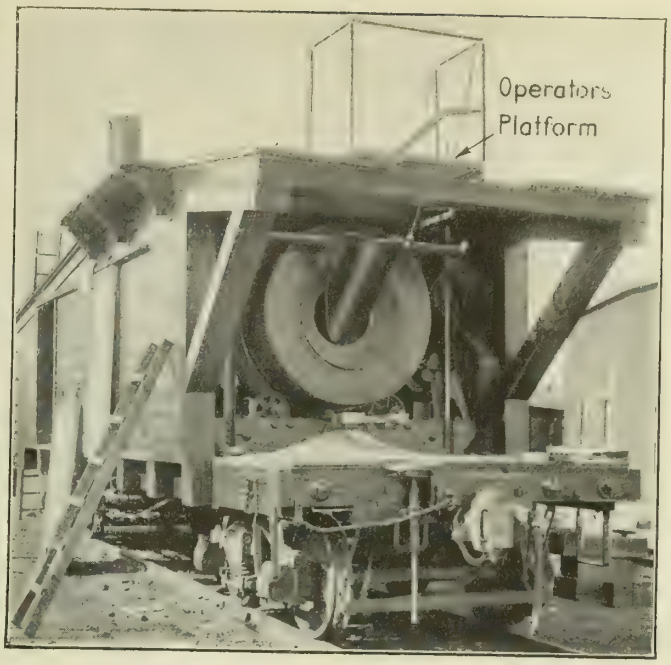


FIG. 2. HEAD OF CONCRETE-MIXER CAR AS USED ON CHICAGO & WESTERN INDIANA R.R.

The chute has intermediate openings, so that concrete can be discharged at different points. A man on top of the car regulates the charging of the mixer, the supply of water and the dumping of the concrete. Usually the mixer trains stand on trestles and the concrete is spouted to the forms for the abutments and piers beneath, as shown in Fig. 1. For the upper part of the piers it has been necessary to elevate the concrete, a crane and bucket being used to place the concrete in the forms.



FIG. 1. CONCRETING TRAIN PLACING THE FOUNDATIONS FOR BRIDGE ABUTMENTS AND RETAINING WALLS; CHICAGO & WESTERN INDIANA R.R.

The mixer car is designed to carry a tower and hoisting engine if required, but as yet this has not been found necessary. A valuable feature of the car is a powerful winch head for a cable, which is anchored ahead. This enables the mixer car to move the train along as the work progresses, thus dispensing with the constant attendance of locomotive and crew.

Each train is placing at the rate of from 20 to 30 cu.yd. per hour, with a monthly total for both trains of 11,000 yd. of concrete. The mixer trains are switched during the night by a regular night crew. Part of the mixer gang is called at 6 a.m., so as to have all chutes and runways placed before 7 a.m., when the full concreting gang starts work.

The work is under the direction of E. H. Lee, Vice-President and Chief Engineer of the Chicago & Western Indiana R.R.; F. E. Morrow, Assistant Chief Engineer; V. R. Walling, Principal Assistant Engineer, and C. E. Minor, Assistant Engineer in Charge.

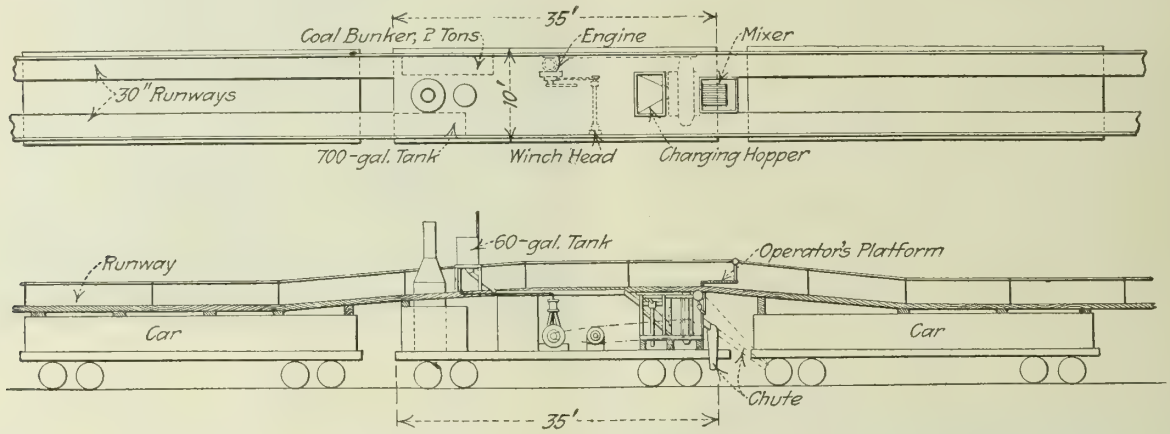
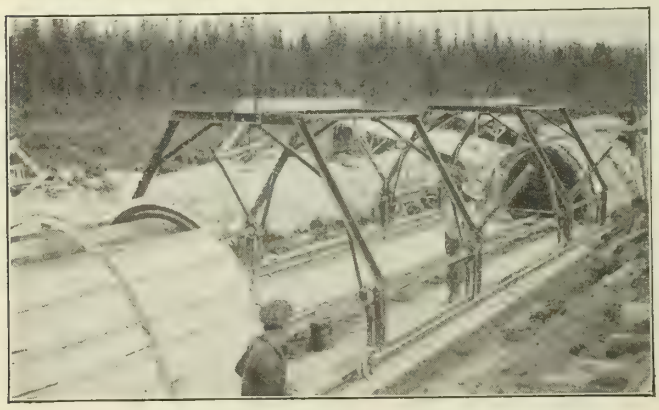


FIG. 3. CONCRETING TRAIN FOR TRACK-ELEVATION WORK; CHICAGO & WESTERN INDIANA R.R.

Traveler for Moving Steel Forms of Water Conduit

Light steel travelers are used to move ahead the arch forms of the Greater Winnipeg water-supply aqueduct now under construction for Winnipeg, St. Boniface, Transcona and several adjacent rural municipalities in Canada. The travelers which handle the interior forms run on a 2-ft.-gage track laid on blocks upon the invert floor. The forms are carried on jacks which form a part of the traveler, and are lined up by turnbuckles on rods which are hinged to the traveler frame. By this method a full arch section of forms 45 ft. in length can be moved at a time. As soon as a section of interior forms is placed, the traveler is run out from under it and the forms are bolted up.

The exterior forms are in 5-ft. sections, which are bolted together to form the full 45-ft. length. These forms are handled variously by the different contractors. In some cases they are taken apart and moved by hand; in others they are lifted as a unit and swung forward by a derrick, while in still other instances a special carrier is employed which straddles the whole construction in the trench, as shown in the illustration. In this case the traveler running on an auxiliary track outside the arch, picks up the outside form (45 ft. long) and transports it to the next section. To remove the outside form, it is suspended by hooks from the roof of the traveler and the sides of the form are connected to the traveler by ratchets operated by long handles. Tightening the ratchets lifts and loosens the form from the hardened concrete. The traveler was built in Winnipeg for the Winnipeg Aqueduct Construction Co.



TRAVELER MOVES FORMS IN COMPLETE SECTIONS WITHOUT DISTURBING ALIGNMENT

Building an Oil-Storage Plant Under Difficulties

A new fuel-oil storage plant has been completed in Providence, R. I., for the Mexican Petroleum Co.—the first of several plants to be built in that locality for supplying oil to various mills. Owing to the small tract of land available on the water front, a number of engineering difficulties were encountered.

Two steel storage tanks were decided upon—one 144½ ft. in diameter and the other 94½ ft. These were placed 3 ft. above mean water, and owing to the unsatisfactory ground, this was excavated to mean high water. Then 55-ft. piles were driven to refusal—700 for tank No. 1 and 500 for tank No. 2. The piles were cut off 6 in. above mean high water, and a 3-ft. slab of concrete was laid on them. In placing the concrete a narrow-gage track was laid, and steel dump cars were run from a ¾-yd. cube mixer. As high as 125 cu.yd. was laid in a 10-hr. day.

Fire walls being necessary, for the larger tank an earth bank was thrown up to 16 ft. above mean high

water by a revolving steam shovel working inside the ring. For tank No. 2 a concrete retaining wall was laid from mean high water up to 12 ft. above; 35- and 40-ft. piles were driven in the ground underneath at 3-ft. centers.

A concrete pump house was built with foundations at mean high water level. The bottom was rod-reinforced,



FIG. 1. TANK FOUNDATIONS AND RETAINING WALL PROVIDENCE OIL-STORAGE TANK

and the bottom and sides were waterproofed. The waterproofing was carried 6 ft. up the walls since the natural surface of the ground was that much above the floor.

As the soil on the water-front side was clay with an underlying layer of fairly soft mud on an inclined hardpan bottom, precautions were taken to prevent sliding. Five rows of piles on 5 ft. 9 in. centers were driven and tied together on top with a reinforced-concrete slab. Anchor rods in the concrete were tied to a close-sheathed timber bulkhead with brace piles. This slab also acts as a foundation for part of the firewall of tank No. 1.

There is a 10-in. pipe line on the upstream side of the dock with 8-in. extensions to both tanks. These serve as charging lines for the plant and loading lines for barges and oil-burning vessels. Screw couplings were used except where flange couplings were necessary. Notwithstanding intricate piping in the pumphouse, the lines are reported absolutely tight. Supply pipes were laid from the pumphouse to a tank-car loading rack placed for overhead loading of five cars at once. An extension goes to an automobile loading rack. In the pumphouse two steam suction pumps were connected to draw from both tanks. The pumps can be worked separately, and valves are placed so that each pump can be repaired without closing down the plant.

The oil is of 14° Bé. specific gravity. It was necessary to run steam mains in the tanks and pipe lines, and steam is supplied by two 70-hp. oil-burning boilers. Instead of covering the floor of the tanks with steam coils as is customary, three sets of coils were placed before the suction pipe. These have a heating surface sufficient to liquefy about 500 gal. per min. The tanks were equipped with foam-system fire extinguishers.

In the construction of the plant Frederic Ewing represented the Mexican Petroleum Co. Ellis & Hauck, of Providence, were the engineers.

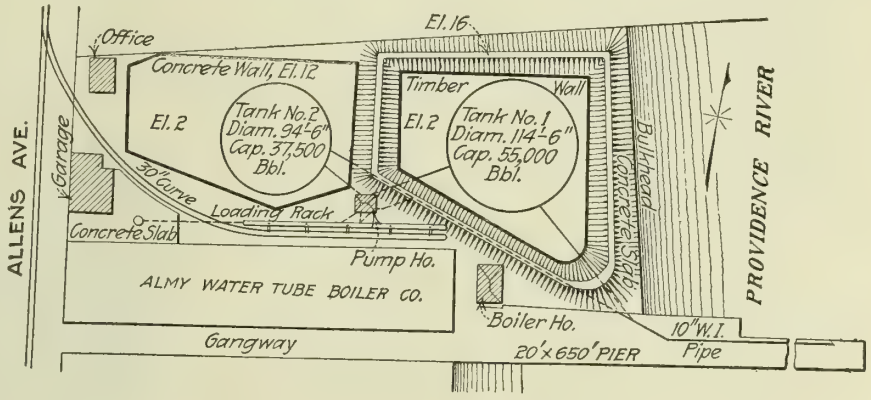


FIG. 2. PLAN OF FUEL-OIL STORAGE PLANT, PROVIDENCE, R. I.

A Simple Accounting System for Highway Maintenance

Maintenance cost accounting is receiving much study from highway engineers, because it is realized that the results of such cost analysis and the conclusions drawn from it are the only way of solving the problem of economic roadbuilding. Failures in the past to arrive at any definite conclusions arise from many causes, but chief of these are a lack of consistent policy in road-maintenance methods and a lack of serviceable maintenance cost records.

A serviceable cost account not only furnishes annual financial statistics in detail, such as are commonly given in state highway reports, but furnishes the responsible engineers with working data throughout the year, so that comparisons can be made of the cost of various types of construction and various maintenance methods for the same service.

With a large office force of clerks and bookkeepers it is possible to build up a great mass of very detailed cost data of unquestioned value if properly digested and used. The trouble is that highway engineers are usually too busy to undertake the analysis of any large accumulation of material, and hence its usefulness is often open to question. Simplicity and utility should be the aims, and some practical use should be made of the data once accumulated. To meet these ends the cost-keeping system of the maintenance division of the Ohio State Highway Department serves admirably. Special effort has been made to eliminate all unnecessary detail.

The first point considered is the road unit to be used in cost keeping. Each through road is designated by name or number, and then further subdivision into sections of convenient length is made. This section length is determined by traffic, geographic conditions, and type of pavement. It ranges up to 8 or 10 mi. Natural features such as corporation lines, cross-roads or rivers are ordinarly selected as section termini.

The first step is the preparation of estimates for maintenance and repairs before the beginning of each season. These estimates are assembled on blank forms containing the following headings: Highway number, Section number, Length, Type, Nature of repairs needed, Bituminous material required, Division of the estimated cost between county and state, and Total cost.

The elements used in routine are the usual requisitions, the material bills or statements, daily post-card reports,

biweekly payrolls, summarized material reports and final summaries of labor and materials for the completed job. Each bill receives rubber-stamp impressions as follows:

M & R.....
Co. .....
I. C. H. No.....
Sec. .....

Roadbed ..... $
Surface ..... $
Bridges and culverts $
Equipment ..... $
Superintendence .... $
Total ..... $

Bills for all material, equipment, etc., are stamped, and the distribution of cost is made at once in the field by the superintendent. The bills are then forwarded in duplicate to the Highway Department office and filed. Triplicates are kept by the superintendent and are entered on a final material record sheet for the entire section of road. These sheets contain the following data: Item number, Parties furnishing material or service, Material received or service rendered, Date ordered, Car initial and number, Date delivered, Date unloaded, Quantity (superintendent's report, company's report), Cost (unit, total), Date invoice approved. On the reverse side a distribution of the cost of each item is made as on the bills.

No..... **DAILY REPORT** I. C. H. No.....
Repair of
.....Road, Section.. .....
.....County.

	Teams	Single Horses	Supt. For.	Men			Roller		
Number Employed									
Total Hours									
Rate per Hour									

	Kind of Work Done	Station to Station	Cu. or Sq. Yards	Team Cost	Single Horse Cost	Man Cost	Roller Cost		
Roadbed	Heavy Earth Work	.....							
Roadbed	Shoulders and Ditches	.....							
		.....							
Surface	Surfacing	.....							
Surface	Bituminous Work	.....							
	Hauling	.....							
	Unloading	.....							
	Culverts and Bridges	.....							
		.....							
	TOTALS								

Material Received **Car Initial and No.**

....., ...
....., ...
....., ...

Date.....19.....

.....
Superintendent.
Foreman.

DAILY WORK CARD, OHIO STATE HIGHWAY DEPARTMENT

The daily-report post card is shown in the accompanying illustration. On the reverse side are the printed address and blanks for the following entries: Time arrived on work, Quit work, Weather, Remarks. The biweekly payroll is of the usual type. It is sent to the Highway Department office in duplicate and contains the signatures and addresses of the payees.

The final record of expenditures for maintenance and repair of a section of road is made up in the Highway Department office from the data contained in the payroll and material report; the daily post-card reports and the original bills are the checks. One side of the final cost sheet is identical with the material sheet except that the columns "Date Delivered" and "Date Unloaded" are omitted. On the reverse side are the following four entries, each with two columns, one headed "Labor" and the other "Material": Roadbed, Surface, Bridges, Equipment. There is a column for superintendence costs and one for remarks. This summary is a detail record in concrete usable form. The sheets are 13¾x8½ in., for filing in a loose-leaf binder.

The heading "Roadbed" is intended to cover such operations as cleaning ditches, repairing shoulders, cutting grass, etc., which in many instances are not separated from the maintenance cost for the pavement proper. In this scheme pavement maintenance comes under the heading "Surface."

The State Highway Commissioner of Ohio is Clinton Cowen, and the Deputy Commissioner in charge of repair and maintenance is A. H. Hinkle, from whom the foregoing information was obtained.

Two Steam Shovels in One Cut

Opening a new gravel pit on the property of the Atwood-Davis Sand Co., of Beloit, Wis., called for a through cut ½ mi. long and 38 ft. deep. Two steam shovels were employed to bring the cut to full width—55 ft. at the bottom and 140 ft. at the top. Fig. 2 shows a 70-ton Vulcan equipped with a 3-yd. dipper, preceded at the right by an 18-B Bucyrus having a ⅞-yd. dipper. Both shovels load the same hopper cars, as shown in

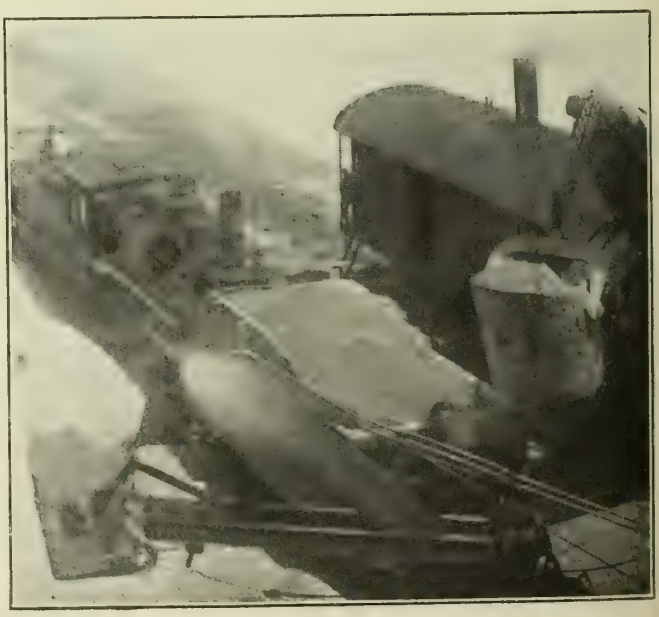


FIG. 1. A SMALL BUCYRUS AND A 70-TON VULCAN LOADING THE SAME CAR

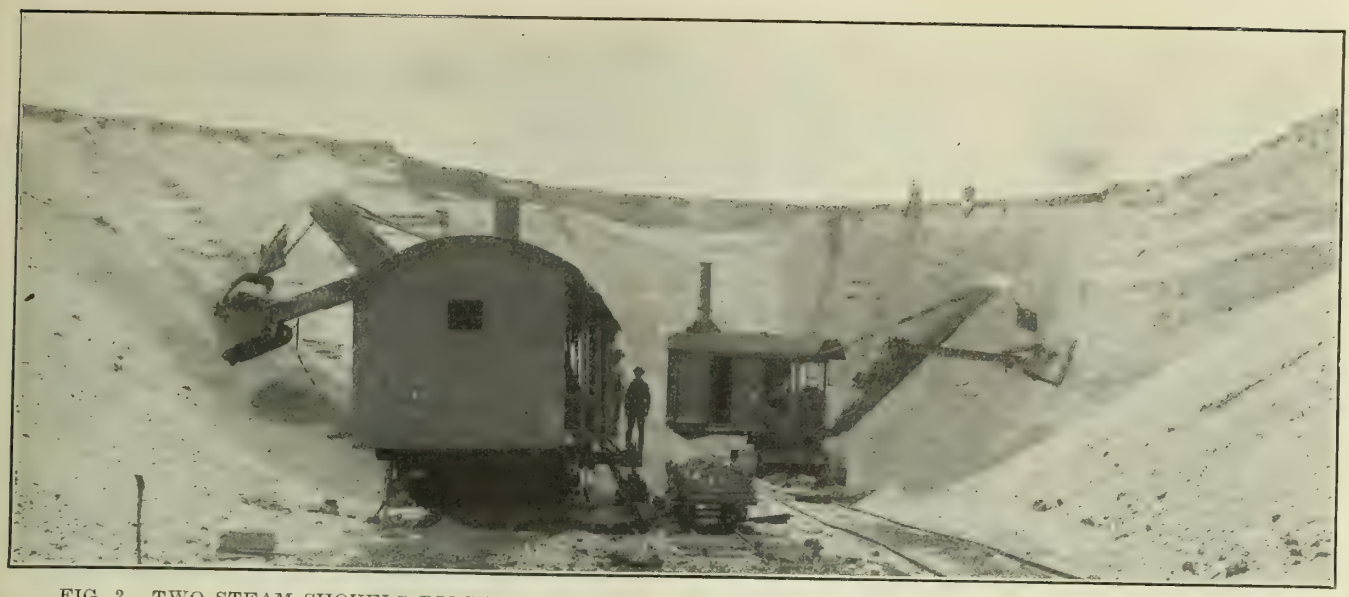


FIG. 2. TWO STEAM SHOVELS DIGGING GRAVEL IN A 38-FT. CUT, ATWOOD-DAVIS SAND CO., BELOIT, WIS.

Fig. 1. A 22-yd. car is loaded in 2½ min., according to the *Excavating Engineer,* and the average output is 45 cars in 10 hr.

The revolving shovel has tractor wheels and stands on three 5½x14-ft. timber floats, 6 in. thick. The floats are blocked up over the loading track. While waiting for empties the revolving shovel overcasts in front of the larger shovel, in order to keep ahead of the latter.

The cars are drawn by a 55-ton standard-gage locomotive. The tender was lengthened to carry on its rear end a coal bunker having capacity for two days' supply for the shovels. This scheme makes their operation as continuous as desired. The two-shovel arrangement was planned out by George B. Harker, superintendent of the sand company.

Table of Feet in Decimals of a Mile

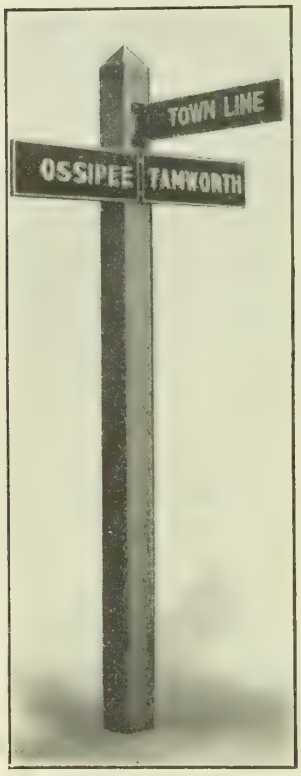
The accompanying table, computed by N. J. Brady, Detroit, Mich., can save a large total of time in railway and road calculations. It is well worth space in the engineer's notebook.

TABLE OF FEET IN DECIMALS OF A MILE

Miles	0.000 Ft.	0.001 Ft.	0.002 Ft.	0.003 Ft.	0.004 Ft.	0.005 Ft.	0.006 Ft.	0.007 Ft.	0.008 Ft.	0.009 Ft.
0.00	....	5	11	16	21	26	32	37	42	48
0.01	53	58	63	69	74	79	84	90	95	100
0.02	106	111	116	121	127	132	137	143	148	153
0.03	158	164	169	174	180	185	190	195	201	206
0.04	211	216	222	227	232	238	243	248	253	259
0.05	264	269	275	280	285	290	296	301	306	312
0.06	317	322	327	333	338	343	348	354	359	364
0.07	370	375	380	385	391	396	401	407	412	417
0.08	422	428	433	438	444	449	454	459	465	470
0.09	475	480	486	491	496	502	507	512	517	523
0.10	528	533	539	544	549	554	560	565	570	576
0.11	581	586	591	597	602	607	612	618	623	628
0.12	634	639	644	649	655	660	665	671	676	681
0.13	686	692	697	702	708	713	718	723	729	734
0.14	739	744	750	755	760	766	771	776	781	787
0.15	792	797	803	808	813	818	824	829	834	840
0.16	845	850	855	861	866	871	876	882	887	892
0.17	898	903	908	913	919	924	929	935	940	945
0.18	950	956	961	966	972	977	982	987	993	998
0.19	1003	1008	1014	1019	1024	1030	1035	1040	1045	1051
0.20	1056	1061	1067	1072	1077	1082	1088	1093	1098	1104
0.21	1109	1114	1119	1125	1130	1135	1140	1146	1151	1156
0.22	1162	1167	1172	1177	1183	1188	1193	1199	1204	1209
0.23	1214	1220	1225	1230	1236	1241	1246	1251	1257	1262
0.24	1267	1272	1278	1283	1288	1294	1299	1304	1309	1315
0.25	1320	1325	1331	1336	1341	1346	1352	1357	1362	1368
0.26	1373	1378	1383	1389	1394	1399	1404	1410	1415	1420
0.27	1426	1431	1436	1441	1447	1452	1457	1463	1468	1473
0.28	1478	1484	1489	1494	1500	1505	1510	1515	1521	1526
0.29	1531	1536	1542	1547	1552	1558	1563	1568	1573	1579
0.30	1584	1589	1595	1600	1605	1610	1616	1621	1626	1632
0.31	1637	1642	1647	1653	1658	1663	1668	1674	1679	1684
0.32	1690	1695	1700	1705	1711	1716	1721	1727	1732	1737
0.33	1742	1748	1753	1758	1764	1769	1774	1779	1785	1790
0.34	1795	1800	1806	1811	1816	1822	1827	1832	1837	1843
0.35	1848	1853	1859	1864	1869	1874	1880	1885	1890	1896
0.36	1901	1906	1911	1917	1922	1927	1932	1938	1943	1948
0.37	1954	1959	1964	1969	1975	1980	1985	1991	1996	2001
0.38	2006	2012	2017	2022	2028	2033	2038	2043	2049	2054
0.39	2059	2064	2070	2075	2080	2086	2091	2096	2101	2107
0.40	2112	2117	2123	2128	2133	2138	2144	2149	2154	2160
0.41	2165	2170	2175	2181	2186	2191	2196	2202	2207	2212
0.42	2218	2223	2228	2233	2239	2244	2249	2255	2260	2265
0.43	2270	2276	2281	2286	2292	2297	2302	2307	2313	2318
0.44	2323	2328	2334	2339	2344	2350	2355	2360	2365	2371
0.45	2376	2381	2387	2392	2397	2402	2408	2413	2418	2424
0.46	2429	2434	2439	2445	2450	2455	2460	2466	2471	2476
0.47	2482	2487	2492	2497	2503	2508	2513	2519	2524	2529
0.48	2534	2540	2545	2550	2556	2561	2566	2571	2577	2582
0.49	2587	2592	2598	2603	2608	2614	2619	2624	2629	2635
0.50	2640	2645	2651	2656	2661	2666	2672	2677	2682	2688
0.51	2693	2698	2703	2709	2714	2719	2724	2730	2735	2740
0.52	2746	2751	2756	2761	2767	2772	2777	2783	2788	2793
0.53	2798	2804	2809	2814	2820	2825	2830	2835	2841	2846
0.54	2851	2856	2862	2867	2872	2878	2883	2888	2893	2899
0.55	2904	2909	2915	2920	2925	2930	2936	2941	2946	2952
0.56	2957	2962	2967	2973	2978	2983	2988	2994	2999	3004
0.57	3010	3015	3020	3025	3031	3036	3041	3047	3052	3057
0.58	3062	3068	3073	3078	3084	3089	3094	3099	3105	3110
0.59	3115	3120	3126	3131	3136	3142	3147	3152	3157	3164
0.60	3168	3173	3179	3184	3189	3194	3200	3205	3210	3216
0.61	3221	3226	3231	3237	3242	3247	3252	3258	3263	3268
0.62	3274	3279	3284	3289	3295	3300	3305	3311	3316	3321
0.63	3326	3332	3337	3342	3348	3353	3358	3363	3369	3374
0.64	3379	3384	3390	3395	3400	3406	3411	3416	3421	3427
0.65	3432	3437	3443	3448	3453	3458	3464	3469	3474	3480
0.66	3485	3490	3495	3501	3506	3511	3516	3522	3527	3532
0.67	3538	3543	3548	3553	3559	3564	3569	3575	3580	3585
0.68	3590	3596	3601	3606	3612	3617	3622	3627	3633	3638
0.69	3643	3648	3654	3659	3664	3670	3675	3680	3685	3691
0.70	3696	3701	3707	3712	3717	3722	3728	3733	3738	3744
0.71	3749	3754	3759	3765	3770	3775	3780	3786	3791	3796
0.72	3802	3807	3812	3817	3823	3828	3833	3839	3844	3849
0.73	3854	3860	3865	3870	3876	3881	3886	3891	3897	3902
0.74	3907	3912	3918	3923	3928	3934	3939	3944	3949	3955
0.75	3960	3965	3971	3976	3681	3986	3992	3997	4002	4008
0.76	4013	4018	4023	4029	4034	4039	4044	4050	4055	4060
0.77	4066	4071	4076	4081	4087	4092	4097	4103	4108	4113
0.78	4118	4124	4129	4134	4140	4145	4150	4155	4161	4166
0.79	4171	4176	4182	4187	4192	4198	4203	4208	4213	4219
0.80	4224	4229	4235	4240	4245	4250	4256	4261	4266	4272
0.81	4277	4282	4287	4293	4298	4303	4308	4314	4319	4324
0.82	4330	4335	4340	4345	4351	4356	4361	4367	4372	4377
0.83	4382	4388	4393	4398	4401	4409	4414	4419	4425	4430
0.84	4435	4440	4446	4451	4456	4462	4467	4472	4477	4483
0.85	4488	4493	4499	4504	4509	4514	4520	4525	4530	4536
0.86	4541	4546	4551	4557	4562	4567	4572	4578	4583	4588
0.87	4594	4599	4604	4609	4615	4620	4625	4631	4636	4641
0.88	4646	4652	4657	4662	4668	4673	4678	4683	4689	4694
0.89	4699	4704	4710	4715	4720	4726	4731	4736	4741	4747
0.90	4752	4757	4763	4768	4773	4778	4784	4789	4794	4800
0.91	4805	4810	4815	4821	4826	4831	4836	4842	4847	4852
0.92	4858	4863	4868	4873	4879	4884	4889	4895	4900	4905
0.93	4910	4916	4921	4926	4932	4937	4942	4947	4953	4958
0.94	4963	4968	4974	4979	4984	4990	4995	5000	5005	5011
0.95	5016	5021	5027	5032	5037	5042	5048	5053	5058	5064
0.96	5069	5074	5079	5085	5090	5095	5100	5106	5111	5116
0.97	5122	5127	5132	5137	5143	5148	5153	5159	5164	5169
0.98	5174	5180	5185	5190	5196	5201	5206	5211	5217	5222
0.99	5227	5232	5238	5243	5248	5254	5259	5264	5269	5275

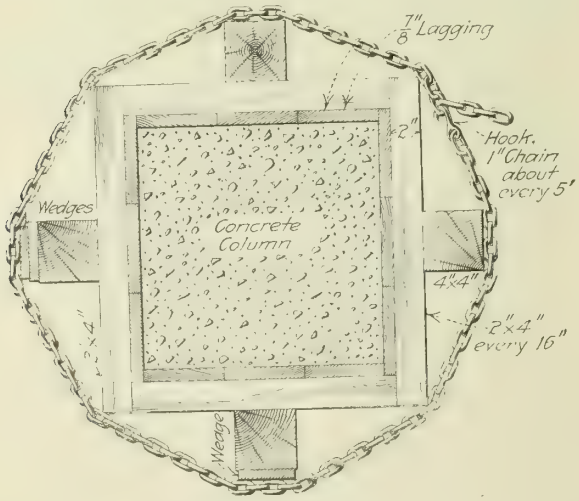
NOTES

Marking Through Highway Routes so that the stranger tourist may readily follow them to his destination without stopping at every branch or crossroad is done in an effective but simple way in New Hampshire. There the difficulty of keeping to the main road is increased because all the roads are of gravel and there is no pavement to follow. Three through routes lead from the Massachusetts state line to the White Mountain country. These are designated both on the map and on the ground by distinctive colors. The Merrimac Valley road is shown green, the East Side road orange, and the West Side road blue. This same color scheme is carried out on the road. At every crossroad or branch three telephone poles each side of the intersection are painted with a band of the color assigned to the highway, inclosed in narrower white bands. To reassure the nervous stranger that he is still on the right road, even where there are few intersecting roads, the end guard-rail posts of each bridge and culvert also receive a color band. The same color scheme is carried out at each crossing of a town line, where signs like that shown in the accompanying illustration are erected, the letters in white and the background of the distinctive road color. There are two east and west through roads marked in a similar manner, the colors being red and brown, respectively. An especially commendable feature of the scheme is that the routes are similarly marked through towns and villages—a plan which saves motor tourists a great deal of annoyance.



NEW HAMPSHIRE TOWNSHIP HIGHWAY SIGN

Column Forms with Chain Ties—On the large cotton warehouse and terminal now under construction at Atlanta, Ga., a novel method of holding the reinforced-concrete column forms is being used. The accompanying section through one of the columns will illustrate the principle. The usual lagging is



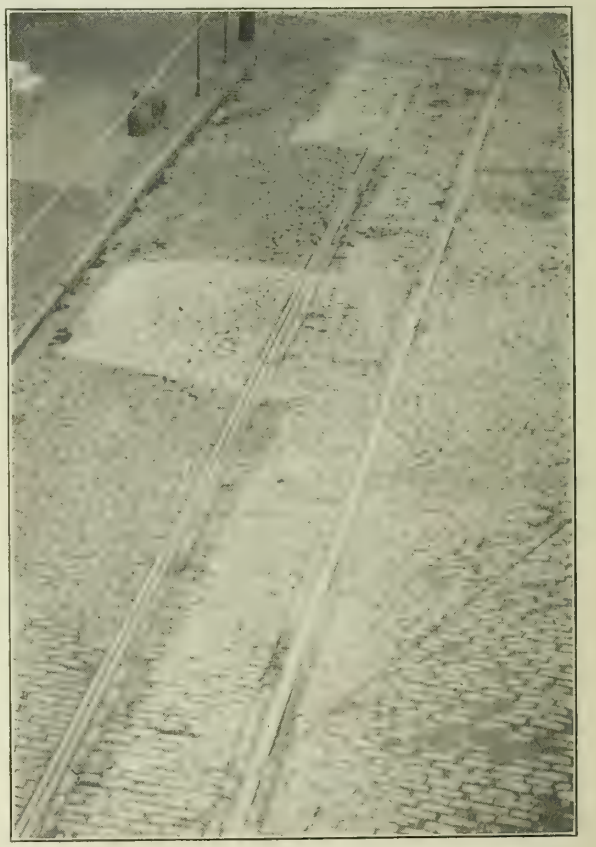
CHAIN TIES ON COLUMN FORMS

Chain shown at walepiece; usual practice is between wales

spiked to 2x4-in. wales spaced every 16 in. vertically. These wales are held in place by vertically placed 4x4's centered on the wales as shown and running the whole length of the column. The 4x4-in. sticks in turn are held tight by chains, spaced about every 5 ft., which are wrapped tight around the form and hooked as shown to complete the circuit. Wedges are then driven where necessary to make the whole form tight. After the concrete has set, the wedges are driven out and the whole form is easily loosened.

Decimals of an Acre in Square Feet—Attention has been called to numerous small errors in the table of decimals of acres in square feet in "Engineering News," of Oct. 7, 1915, p. 702. The number of square feet given for 0.117 acre is 5,097, instead of 5,079 as printed. The other errors are of 1 ft. only to 0.5 acre, and beyond there in many cases the error is 2 ft. B. F. Sperow, of the Carolina, Clinchfield & Ohio Ry., has discovered about 400 such errors. The original table was computed on a computing machine and it seems probable there was some systematic error of setting.

Engineering Photography has been developed to meet many special purposes, such as photosurveying, and not the least important is to furnish testimony in lawsuits, etc. Largely to meet this latter purpose Geo. A. Seip, a professional photographer of Philadelphia, has constructed a camera that can be suspended from a rope strung across a street and



AËRIAL PHOTOGRAPH OF STREET PAVEMENT TO SHOW DEFECTS

operated by clockwork in the camera. The accompanying illustration is from a photograph of a street pavement; it is intended to demonstrate to the lay mind that the pavement is mighty poor. Accompanying this photograph were two enlargements to bring out particular features. While there is nothing new in aërial photography, the scheme of suspending a camera on a rope across a street between two buildings has some novelty.

Low Bidder Made Mistake but Gets Contract—A public-works contract has just been awarded in New York City to a bidder who declared that he had made a mistake in his figures and therefore desired to withdraw his bid (after opening). The contract is for the installation of tracks on the White Plains Road extension of the Lenox Ave. subway. The lowest bidder was the Coast and Lake Contracting Corporation, at $53,930.50. The next lowest bidder was the Southeastern Construction and Engineering Corporation, at $101,205.86, and the other bids ranged up to $137,290.67. After the bids had been opened the low bidder advised the Public Service Commission that he desired to withdraw, as he had made a mistake in his figures, but the Commission, following its usual policy of awarding contracts to the lowest bidder, made the award, so as to give the Coast and Lake Corporation a chance to accept or reject the work.

Editorials

Good Wishes for 1916

To each and every one of its readers *Engineering News* extends its greetings and good wishes for the New Year.

Few engineers in this country will feel any regret over the final passing of the year 1915. One must go back more than a generation to find a year of harder times for those engaged in civil-engineering construction. There has been little complaint, however, for people have involuntarily contrasted the fortunate condition of this country with the conditions prevailing over a large part of the civilized world.

Fortunately the present business outlook for the United States is vastly better than that of a year ago. It is true that the unprecedented events of the war have often proved the predictions of the wisest economists and financiers to be at fault and that the revolutionary changes which seem to be ahead of us are so many and so complex that no conservative man is willing to make any definite prediction as to the conditions which will prevail very far in the future. The immediate outlook, however, is for a period of business prosperity and activity such as the United States has not known for many years, and many lines of wholesale and retail trade and certain industries such as iron and steel production are already in the midst of a boom period.

This revival of general business has already had a marked influence in stimulating work in various fields of civil-engineering construction. There is no longer difficulty in finding money to finance new enterprises of real merit. The restoration of confidence in the banking and investment community has been a notable feature of the past six months and is one of the most favorable indications that 1916 will be a far better year for engineers than was the year just closing.

It is worth emphasis in this connection that the engineers who will profit most from the revival of engineering activity will be those who have kept themselves abreast of the times and are able to meet the changing conditions and demands in the field of engineering service. During the trying year now closing there has been more emphasis than ever before upon the need for efficiency in the conduct of engineering operations.

With all the exaggerations in connection with the efficiency movement and with all the drawbacks due to the work done by some of the amateur efficiency experts, there can be no doubt that real efficiency in the conduct of all productive enterprises is better understood and appreciated than ever before.

The engineer or the constructor who fails to keep himself well posted on the improvements continually being made in his field of work and on the relation of his work to other fields of industrial and economic activity is very apt to find himself beaten in the race of competition by some better-equipped rival. The better the service that the engineering profession can render to the public, the better in the long run will be its chances for continued and profitable employment.

Too Many Highway Meetings

Why should there be two separate national organizations of highway engineers, each holding an annual convention to which all highway engineers the country over are invited and to which all manufacturers of highway supplies and machinery are urged to bring exhibits? The question has been asked with increasing emphasis during the last three or four years by highway engineers all over the country, who would like to attend one convention a year at which the leading men of the industry were assembled, but who cannot and will not afford the time and expense necessary to attend two. The question has been asked with even greater emphasis by the firms dealing in highway supplies and machinery, many of whom have declared that they will no longer undergo the heavy expense of making exhibits at the conventions of two rival associations covering the same field. Practically the same group of men visits the two conventions, and this expense is doubled and attendance duplicated.

At the time the American Road Builders' Association was organized a number of prominent engineers gave it their active support in the belief that the older organization, the American Highway Association, was giving too much prominence to the political end of the good-roads movement and was in danger of becoming an organization whose chief aim would be to secure Federal appropriations for road construction.

That danger, if it existed, long since passed away. Each of these societies has come to be primarily an organization of engineers and others actively engaged in road construction. These are the men who constitute the strength of each organization, and it is the papers and discussions from these men that give standing to the meetings of each society. Papers read before one society deal with the same subjects as those read before the other, and often are written by the same authors. The exhibits of road machinery and supplies, which form one of the most important features of the annual convention, are practically identical at each meeting.

Why, then, should the highway engineers and the highway industry continue to support two rival associations, covering practically the same field? Why should there not be one strong association, with such standing that its work would have the same authority as that of the Society for Testing Materials or the Automobile Engineers' Society?

These are the questions which confront the officers of the two societies, and it remains to be seen how they will solve the problem. What seemed to some like an initial step toward coöperation was taken last fall when the two organizations agreed to hold an "International Highway Congress" at Oakland, Calif., in September, under the joint authority of the two. It has developed, however, that the coöperation in the Oakland meeting was not meant to establish a precedent for future meetings. Further, the Oakland meeting was so nearly a failure that it gave little encouragement that joint conduct of meet-

ings, with the two associations continuing their independent existence, was a good solution of the problem.

Another attempt of this sort, however, is now being made. The board of directors of the American Road Builders' Association at a special meeting on Dec. 16 decided to hold a convention in Pittsburgh, beginning Feb. 28, and held out a small olive branch to the rival association, inviting it to hold its convention at the same time and place, the program of the two conventions to be arranged by a joint committee of the two associations. At the same time the directors declared that consolidation of the two associations is "inexpedient" at the present time and that the holding of a joint convention is impracticable. What response the American Highway Association will make to this invitation remains to be seen, but it appears extremely doubtful whether it will consent to have the time and place of its annual convention fixed by the rival association.

One hears no very urgent demand for the holding of a national meeting of highway engineers of all classes at the date proposed. The highway engineers of New England have just attended, in very considerable numbers, an "International Road Congress" at Worcester, which was engineered by the Worcester Chamber of Commerce. In Chicago, on Feb. 16 to 18, there is to be held a second national conference on concrete-road construction, a meeting which, while devoted to one specific class of roadwork, promises to attract a large attendance and to perform a very useful work.

The situation is one which admits of no halfway measures. There is need of a strong, influential, national engineering organization devoted to highway construction and maintenance. Such an organization can be made powerful and prosperous, and room can be found in it for men who are interested in all the different aspects of highway construction. It need not be an organization merely of engineers. But there is not room for two rival organizations in this field. Those who are appealed to for financial and technical support are ready to exclaim, "A plague on both your houses!" It is time that personal differences and preferences were put one side; and while these past differences are doubtless too great to permit either association to commit hara-kiri for the benefit of the other, it ought to be possible to organize a new association on proper lines with independent officers in no way tied up to the rivalries of the past and have the two old associations bequeath to it all their possessions and wind up their existence. Any measure less radical seems little likely to succeed.

A Sinking-Fund Delusion

If a utility company is to recover the loss of capital caused by the depreciation of its plant, the customers must pay for it in the rates charged them for service. This is clear; it is equally obvious that there is no way to lessen the amount which the customers must pay—if the company recovers the loss *in full*. Yet many people, including such an eminent man as the respected Halford Erickson, of the Wisconsin Commission, claim there is a way in which this miracle has been and can be accomplished.

Now there are two general types of plans followed in this country in extracting indemnity for depreciation out of the customer's pocket. First, there are the direct-repayment, or "straight-line," schemes which aim directly to repay the company for the actual annual loss in impaired capital. The second, or "sinking-fund," group of plans takes out of earnings an annuity which would, if put into a true accumulating sinking fund, equal the cost of the depreciating property when discarded. Since obviously reimbursement for depreciation can come only from the customers, if both of these plans really do cover the depreciation loss, either one must cost the customers the same as the other. Claiming that one plan is cheaper than the other is only doing a trick in words or in bookkeeping.

We may see what the trick is from a few of Mr. Erickson's remarks in a paper before the recent Philadelphia Valuation Conference (noted in *Engineering News,* Nov. 18, 1915):

> Without going into details, it can be said that the sinking-fund method employs a more efficient use of the reserve [than the straight-line plan]. Because of such use, the amount the consumers will have to contribute to cover depreciation is less than under the straight-line method.
>
> Where the amounts so provided have been used for necessary and proper renewals and for the accumulation of a reserve for covering the accrued depreciation of the property still in use, no reduction from the cost new, because of depreciation, should be made in determining the fair value for rate making and certain other purposes.

All that Mr. Erickson and others do is to ask the customer to pay more for interest on capital and less for depreciation. The total is unchanged. The "sinking-fund" annuity is less than the actual annual depreciation loss, and the discrepancy is recovered in interest on a plant value larger than the actual present figures. This interest they do not recognize as part of the depreciation indemnity.

If the matter ended there, this use of the sinking-fund computations would harm no one. But the United States Supreme Court has ruled (City of Knoxville vs. Knoxville Water Co., 29 Sup. Ct. Rep. 148) that the company each year is entitled to recover a dollar, above interest and profits, for each dollar by which the plant that year has lost value in service, while present (depreciated) value must be the basis of rates. It is immediately seen how Mr. Erickson's views run counter to the court's dictum in that he does not openly year by year give a company ample indemnity for depreciation losses, and in that he includes a nonexistent and lost element in the value of the plant. It would clarify all our ideas if we abandoned sinking-fund talk and stuck to the simpler direct annual repayment plans for computing the customer's burden.

The objection that many have held against straight-line or direct-repayment plans of handling depreciation reimbursement has been that the early repayments were larger than the real depreciation and in the later years smaller. But the direct-repayment plan can be handled so that depreciation and the repayment therefor go hand in hand. That was done a few years ago by Frederic P. Stearns when he developed his "equal-annual-payment" plan (described in *Engineering News,* Feb. 12, 1914, p. 350). Briefly stated, each annual compensation is made numerically equal to a hypothetical sinking-fund annuity plus the interest accretion of a hypothetical reserve fund. The customers are loaded with exactly the same costs as under the procedure indicated by Mr. Erickson, but everything is correctly labeled, delusions are dissipated, and the law is entirely satisfied.

Reorganizing the Interstate Commerce Commission

Scarcely anyone doubts that the policy of railway regulation by governmental authority is here to stay. Everyone agrees, likewise, that in the interest of both the public and the owners of the railways, and of those who hold the stocks and bonds, government regulation should be honest, intelligent and effective. To carry out the policy of Federal railway regulation, Congress has given to seven men, constituting the Interstate Commerce Commission, authority over the operations of about 250,000 mi. of interstate railways. Congress has further specified in connection with these railways detail duties for the commission which are beyond the physical ability of any seven men not gifted with superhuman powers to perform efficiently and intelligently.

In its annual report just issued the commission declares that the variety and volume of the work already laid upon it make necessary an early enlargement of its membership and legal authority to take final action through subdivisions of its membership, of course under the general authority of the commission as a whole. Bills to effect this have already been introduced in Congress, and the subject is one of pressing public importance.

As is well known, the commission is compelled by law to be both an executive and a judicial body. As a judicial body it has to hold hearings and render decisions. Some idea of the volume of this work may be gained from the statement that the commission has during the year conducted 1,543 hearings, in which 200,438 pages of testimony were taken; 198 of these cases were orally argued, consuming 103 days in sittings.

While the commission, in order to handle this vast mass of judicial work, employs a force of examiners, somewhat as the judges of the Federal Court assign masters to hold hearings and render reports, the decisions must of course be rendered by the commission itself; and on these decisions hang many great commercial interests. The commission also acts in a judicial capacity in conducting investigations, many of which are exceedingly complicated and involved. They require a great deal of time and effort in order that justice shall be done.

The commission receives and files all railway rate schedules, something like 150,000 being filed in the year just closed. It has jurisdiction over the standard classification of freight and over the operations of express companies. An entire division under the commission is engaged in the search for violations of the laws which the commission was created to enforce. The legal division has charge of all the cases in which the commission appears as a party. The commission has control of the accounting systems of the railways; it collects and compiles the official statistics of railway operations; it conducts investigations of important train accidents to determine their causes; it investigates safety devices of various sorts; it examines periodically all the locomotives in the United States to determine their safety for operation. The immense task of valuing all the railways in the United States is in its charge.

The responsibility for the conduct of all this work is laid upon the shoulders of seven men, who, it may be noted, receive a total compensation of $70,000 per annum—a sum no larger than is paid as a salary to the president of a single railway corporation, who is in charge of operations not a twentieth part the extent of those over which the commission holds jurisdiction, and with very much smaller powers.

It is probably not to be expected that Congress will increase the salaries of the Interstate Commerce Commissioners to correspond to what men would receive for equally great responsibilities in private business. It ought at least, however, to revise the salary schedule and bring it up to the mark set by Justice Hughes when as the governor of New York he fixed the salary of the Public Service Commissioners in that state at $15,000 per annum. Such a rate of compensation, in view of the change in the value of the dollar that has taken place and the increase in the cost of living, would be no higher salary than the $10,000 rate that was fixed when the Interstate Commerce Commission was created in 1887.

But more important than an increase of salary is the reorganization of the commission on broad and intelligent lines and in a manner that will enable it to discharge its duties efficiently. The way is open for such a reorganization now, through the changed attitude of railway officers toward the commission. In place of the antagonism and opposition to government control which the railways maintained during the first 20 years or so of the commission's existence, there is now full acquiescence in the idea that railway regulation through commissions is here to stay. With this established there ought to be no dissent from the proposition that an organization of able men adequate to deal with the great task ought to be created.

Fatigue in the Spokane Bridge

The worst bridge accident for some years, the Spokane collapse, presents unexpected fact and unexpected theory. During a generation at least no failure by breaking of eye-bars has been recorded. The few tension failures of recent times were all complicated by large bending stresses, as for example the alarming breakage of suspender rods in the Brooklyn Bridge 14 yr. ago. The Spokane failure is therefore startlingly new even in its main fact. Still more startling is the fact that the break occurred at very low stress—not much over 16,000 lb. per sq.in. even if one bar carried the entire stress. Finally the fact that short crystalline breaks are in evidence is a complete surprise.

Four engineers in reporting on the case blame the break on "granulation" of the bars; they do not state what caused the "granulation." Another engineer, testifying at the inquest, spoke of "fatigue"—that ancient bugbear of bridge engineering. Just this year the reconstruction of the New York elevated railways gives special opportunity to point out that the thousands of tons of iron and steel in that structure have stood 25 to 35 yr. with a history of stress-repetition, vibration and impact probably unparalleled in the history of iron construction. They have never showed any "fatigue" effects, or "crystallization." Most of the old metal is being continued in service in the rebuilt structure, and without doubt is as good as it was at the start.

"Fatigue crystallization" is properly obsolete. But damage to internal structure of metal by wrong heat-treatment, and under certain conditions by mechanical violence, is a reality that needs to come under closer scrutiny than it has in the past.

Letters to the Editor

Cement Joints for Cast-Iron Pipe at Los Angeles

Sir—I was much interested in your editorial article of Nov. 25, 1915, on cement pipe joints, commenting on the paper on the same subject appearing among the regular subjects in the same issue. In connection therewith I would call your attention to *Engineering News* of Dec. 8, 1904, in which appears a lengthy communication from the late James D. Schuyler on the same subject, dealing with some of our experiences in the water-works of the City of Los Angeles, as well as in the Southwest generally.

It has been our universal practice for more than 20 years in the water-works of the City of Los Angeles to lay cast-iron pipe with cement joints; indeed a few of our largest steel lines also, not alone for reasons of economy, but because as a matter of fact we got a better joint and strange as it may seem, fully as flexible a joint as we obtained with lead. We do not claim, however, that the idea originated with us, as it was the common practice in the older water-works, where cement-lined pipes were used, to join them with sleeve joints having cement packing.

The water-works of the City of Los Angeles were begun in 1868, and the writer found the bell end gates packed with cement inserted in the 8-in. cast-iron line that originally formed the trunk line for the city supply. It is the writer's opinion that there is no limit of pressure within the ordinary strength of cast-iron pipe itself precluding the use of cement joints.

In 1895 the water-works department of Los Angeles laid on Hoover St. a 30-in. line of cast-iron pipe that subsequently had to be lowered at three different points for distances ranging from 200 to 800 ft. in length to accommodate the street grade. At one of these places the pipe was lowered nearly 7 ft. at its maximum point of displacement, and this was done without cutting a single joint. Although the pipe wabbled considerably out of alignment in the operation, the seeping leaks caused by the movement all took up automatically without further attention.

I also read with a great deal of interest the contribution of R. S. Lord, in the same issue of your valuable journal, on the subject of wrought-iron pipe couplings, and would say that I have made extensive use both of the Dresser and the Dayton coupling and am firmly convinced of their merit over threaded pipe. The most noted instance of this type of coupling in the writer's practice was in the penstock line of the Upper Division Creek power plant of the Los Angeles aqueduct. This line was 15 in. in diameter, of plain-end lap-welded pipe, coupling together with the type of Dayton coupling shown at Fig. 16 of Mr. Lord's article. We made a marked departure, however, from the ordinary method of using the coupling. Before inserting the triangular-section gasket, neat cement mortar was rubbed into the joint clear around the pipe in the position to be occupied by the gasket, after which the gasket was pulled home in the regular way.

This line has a head at its lower end of 1,266 ft., and the wrought-iron pipe terminates at its upper end in a riveted sheet-steel pipe at a point where the head is about 400 ft. These joints were absolutely tight, not one of them ever showing the least seep; and I am firmly convinced that there is great merit in the use of cement in this connection. This pipe line has been under this constant head since 1908, seven years.

Recently a 12-in. line for natural gas coming into Los Angeles from the Kern River field required the removal of the Dayton couplings, due to some form of carbonization and destruction of the rubber gasket. I firmly believe that if cement had been used in these joints in the manner above indicated, no such trouble would have been experienced, as the cement mortar would have protected the rubber from contact with the injurious elements in the gas.

WILLIAM MULHOLLAND,
Chief Engineer, Bureau of Water-Works.

Los Angeles, Calif., Nov. 30, 1915.

[The article referred to in *Engineering News* of Dec. 8, 1904, gives a large amount of valuable information as to the history of cement joints for pipe and experience with them.—Editor.]

Problem in Sorting Aggregate in Storage Bins

Sir—In supplying graded aggregate for concrete to the several contractors on the 85-mi. aqueduct work, the Greater Winnipeg Water District has operated for the past year a gravel-screening, crushing and mixing plant located at mile 31. In this plant the material is screened into fine, intermediate and coarse (2½-in.) grades, passing directly into bins, from which it is fed through bottom hoppers in definite proportions to a mixing belt. The remixed material is then elevated and distributed by means of a belt conveyor into storage bins located over a loading track. From these storage bins the graded aggregate is loaded directly into 20-yd. air-dump cars and hauled along the District Railway to the various contractors' receiving platforms.

In the operation of this plant we have encountered a difficulty that we have been unable as yet to overcome, and it may be that the experience of some of your readers may help us in this regard. The trouble has been that when the mixed aggregate is dumped from the conveyor belt into the storage bins it naturally cones up and segregates, the fine material staying in the center and the coarse rolling to the outside, with the result that when the bins are emptied the material fed is far from being uniformly graded. We have tried out baffles and a telescopic chute, which is drawn up as the bin is filled, but any method we have as yet devised has not been satisfactory. During the past season we loaded the cars by chuting the material

directly from the conveyor belt over the bins, but this method depriving us of the use of any storage capacity.

I shall be glad to hear if any of your readers have experienced this difficulty, and if they have been able to overcome it in a satisfactory manner. M. V. SAUER,

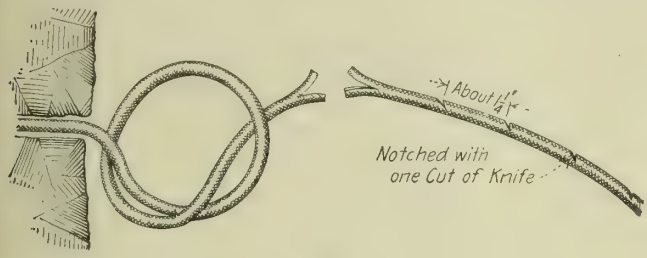
Engineer of Design, Greater Winnipeg Water District.

Winnipeg, Man., Dec. 13, 1915.

Lighting a Fuse with a Fuse

Sir—While not wishing to prolong the discussion on the best way to ignite a blasting fuse, I have a method that I should like to get on record.

First the fuses are arranged so that their cut ends project upward. This may be done by coiling them in a



HOW L. B. CAIN LIGHTS BLASTING FUSES

loose knot. Next, the ends are split for about ⅜ in., exposing the powder. A piece of fuse half as long as the shortest to be fired is notched as is shown in the diagram. The spitter is then lighted and the fuses of the charge are ignited from the successive notches.

The reason for making the spitter one-half the length of the shortest fuse is to give a gage on the time since the first fuse was lighted. Fuse as it is manufactured today is very uniform in its time of burning, so that a glance at the spitter will give a definite idea of the length burned on the first fuse. It is well not to stay longer than the time required to burn one-half the length of the first fuse, but of course this depends on conditions and the length of fuse being used.

This method will be found to be both rapid and convenient. One man can spit, under normal conditions, 18 or 20 fuses in less than one minute when the holes are not scattered too far apart.

I agree with Mr. Martin that short fuses are misplaced economy. LOUIS B. CAIN.

Department of Public Works, Honolulu, T. H.,
Nov. 5, 1915.

Sir—Injecting my little piece into the discussion regarding the different methods of lighting blasting fuses, I will say that I have had marked success in lighting them with a piece of hardwood—preferably oak—about 1 in. in diameter and 1 ft. long, that has been put into a fire until the end is a live coal. I notch the end of the fuses and place a pinch of dynamite therein. The fuse is ignited as soon as the firebrand comes in contact with it. I have lighted as many as 15 charges by this method.

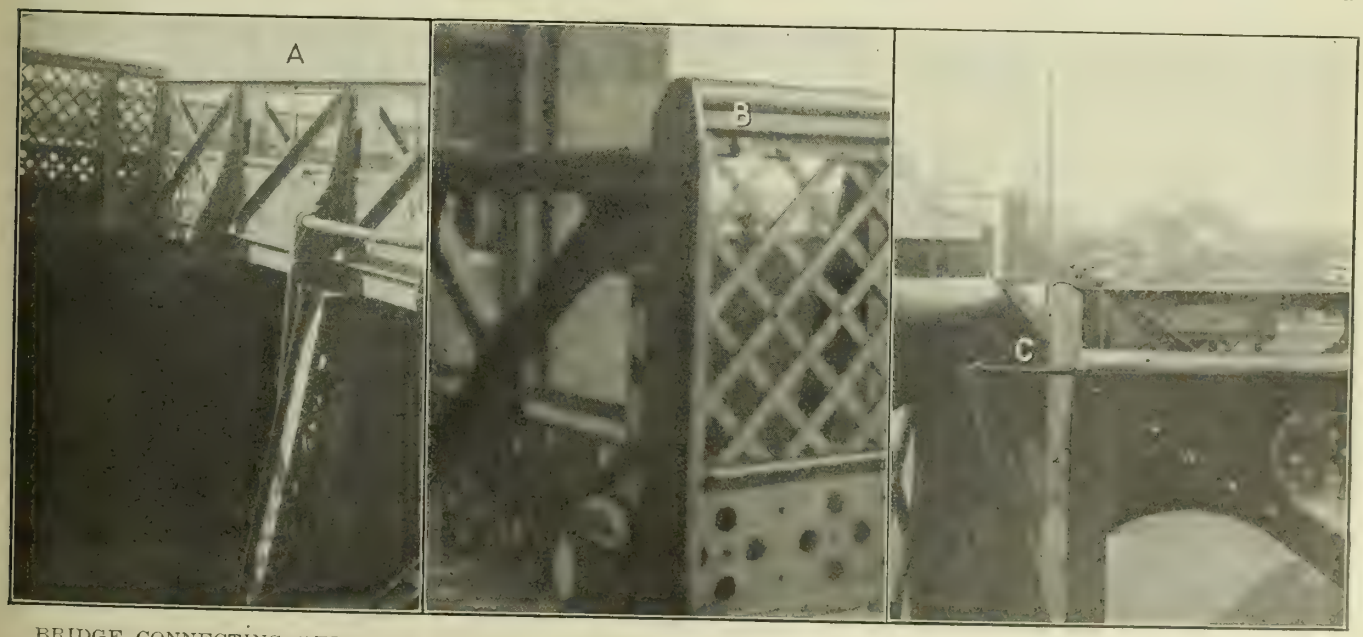
Santa Paula, Calif., Dec. 9, 1915. I. J. GRUNDEL.

Stray Currents on a Bridge

Sir—A year ago when in Youngstown, Ohio, my attention was called to a peculiar condition existing on the Market St. bridge, which spans the Mahoning River valley. The bridge is a steel structure and is about 2,000 ft. long. About midway of its length and about 30 ft. east of it is located the general office of the Republic Iron and Steel Co. This is a brick and iron building rising from the valley below the bridge, and access on a level with the Market St. bridge is had by an iron foot bridge about 6 ft. wide. The guard rail at the top (*A* in the views) is secured to the rail of the main bridge by a single piece of ⅜x1½-in. steel (marked *C*) fastened with a ⅝-in. bolt.

Now the peculiar feature of this bridge to which the writer's attention was called is this: The ⅝-in. bolt referred to (marked *B*) is at all times warm, in fact so warm that the hand can remain in contact but for a moment. This phenomenon is known to almost everybody who has occasion to use the bridge and is shown to visitors as a curiosity.

When asked the probable cause of this heating, bypassers invariably stated that it was due to the vibra-



BRIDGE CONNECTING REPUBLIC IRON AND STEEL CO. OFFICE WITH MARKET ST. VIADUCT, YOUNGSTOWN

tion of the bridge, causing friction between the tightly drawn-up bolts and the rail. The hot bolt has also been featured in one of the local papers, and vibration was given as cause of the heating.

A little thought will make it readily apparent that this could not be the cause. A bolt of that size could not continue to maintain such a tight contact as would be necessary to generate through friction such great heat as is present. I therefore concluded that the only other cause of the heating would be stray currents from the railway tracks crossing the bridge. Not having any means at hand at the time for determining this, I decided to do it at the first opportunity. Having occasion to visit Youngstown a week later, I came prepared with a coarse file and low-reading portable voltmeter. After cleaning the bolt head with the file and filing a clean spot on the $\frac{3}{8}$x1$\frac{1}{2}$-in. bar and applying the voltmeter leads, a deflection of 1 volt was read. This varied from 0.8 to 1.2 volts, the highest reading being secured when trolley cars were passing at that point.

Lack of time did not permit me to make any more extensive tests to determine the amount of current flowing through the $\frac{3}{8}$x1$\frac{1}{2}$-in. bar, which undoubtedly was considerable, judging from the amount of heat developed in it. A letter received Dec. 4, 1915, states that the bolt is still hot. Any further information that readers in Youngstown may be able to furnish regarding this would undoubtedly be of interest.

Cleveland, Ohio, Dec. 16, 1915. P. JUSTUS.

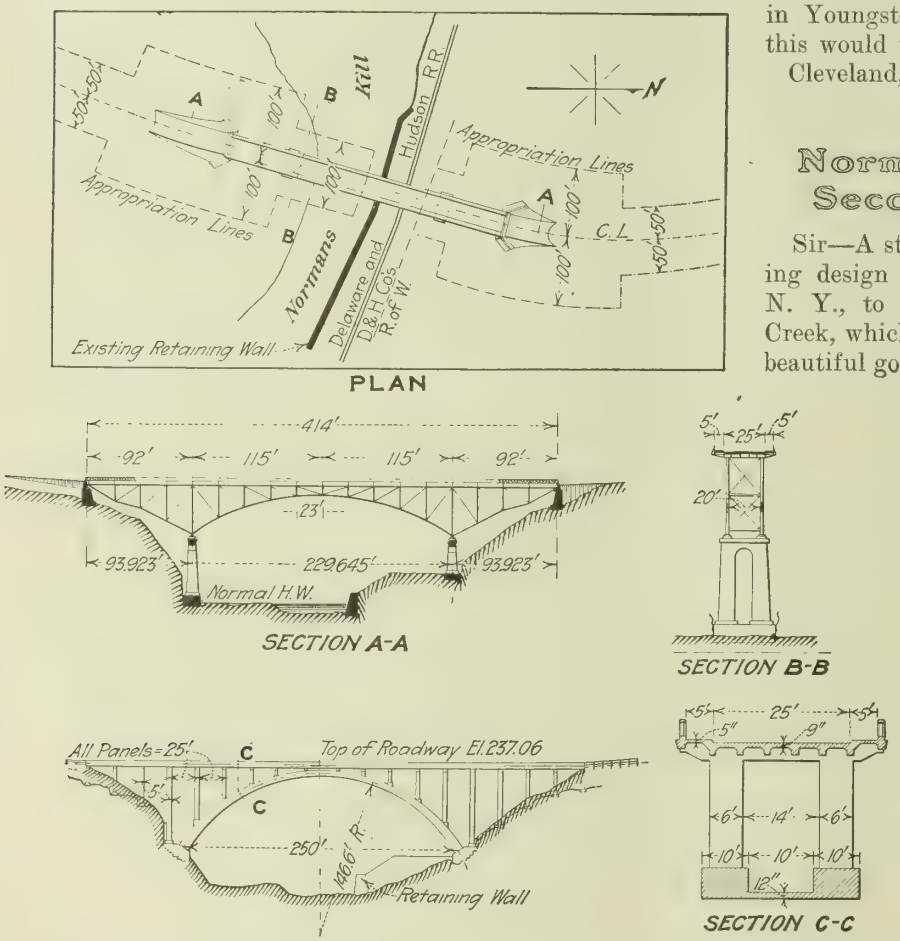


FIG. 1. STEEL AND CONCRETE ARCH DESIGN FOR NORMANSKILL VIADUCT

Normanskill Viaduct; A Second Popolopen Case

Sir—A steel highway bridge, or viaduct, of pleasing design has just been completed near Albany, N. Y., to carry a boulevard across Normanskill Creek, which at the site of this structure traverses a beautiful gorge on its way to the Hudson River. The structure and topography of its site are quite similar to the Popolopen viaduct and gorge shown in your issue of Oct. 28, 1915, and commented upon in your issues of Nov. 4 and 25, 1915. The whole case of the Normanskill viaduct resembles the Popolopen in several ways.

The writer, in February, 1914, as Supervising Engineer, was required to have designs prepared for a bridge over the Normanskill gorge. It was fully realized that a reinforced-concrete arch was the best, and in the long run the most economical, type for the Normanskill site, so an outline design for such a structure (shown in Fig. 1), together with three designs for steel structures, was submitted to the then State Engineer, J. A. Bensel. The total cost of the steel structure was $65,200. The estimated cost of the reinforced-concrete structure was about 17% more; while this difference is not a great sum, lack of funds may have precluded the acceptance of the reinforced-concrete design.



FIGS. 2, 3 AND 4. GENERAL VIEW AND DETAILS, NORMANSKILL VIADUCT

The structure built is shown in Fig. 2. It is a steel cantilever with a curved lower chord, and it provides a highway 25 ft. in width flanked by two sidewalks each 5 ft. wide. The deck, or floor, is of reinforced concrete, affording permanent protection to the structural-steel floor beams and much of the supporting metal of the entire structure. The highway loads assumed were two 15-ton motor trucks, or 100 lb. per sq.ft. of roadway; 80 lb. per sq.ft. was the assumed load on the sidewalks.

W. H. YATES.

52 Wall St., New York City, Dec. 6, 1915.

Railway-Track Maintenance

Sir—In your issue of Dec. 9 a communication signed "Railway" states that no track force can maintain good track where track is composed of defective material. It is admitted that old and decayed track is an evil, and one which it would probably be difficult to eliminate entirely. However, such a condition can be ameliorated when there is an adequate track force, and it is aggravated by a lack of such force.

It has been the writer's observation in the course of practical experience in railway-maintenance work that there are times when new track material is on hand with no labor to insert it in the track, on account of a reduction in force. Ballast has lain on the ties, ties have been stacked on the right-of-way and even new rail and fastenings distributed for months before the forces were increased sufficiently to place the material in the track.

If a minimum track force based, say, on the track-mile be maintained and never decreased in size, our railways would be safer and more comfortable means of transportation.

G. F. SCHLESINGER.

Ohio State University, Columbus, Ohio, Dec. 15, 1915.

NOTES AND QUERIES

Heavy Nickel Plate Girders—Several errors in the article "Record-Breaking Plate Girders for Nickel Plate R.R.," Dec. 9, 1915, p. 1105, should be corrected as follows: In line 3, "four-track" should read "fifteen-track." In line 5, the reference should be to Nov. 4, p. 888. In line 15, "130½ tons" should read "113 tons." In line 17, the Boston & Albany R.R. should be mentioned instead of the New Haven.

Problem in Municipal Accounting—Are paved streets, sidewalks, and bridges proper items to insert in making up a municipal asset and liability sheet? This question is raised by M. J. Guyton, Clerk of the Light and Water Commission of Dublin, Ga. Mr. Guyton is also in a quandary as to whether the fact that the city paid for only one-third of the street pavements and sidewalks and the property owners paid for two-thirds should make any difference in the amount of the entry. He also asks whether unpaved streets are properly listed as a municipal asset and if so, what rule is followed in ascertaining their valuation.

The Use of Streets for Public Markets has met with serious objections from Gus H. Hanna, Commissioner of Street Cleaning of Cleveland, Ohio. In his paper before the recent Worcester Road Congress, Mr. Hanna said: "The greatest source of expense in Cleveland has come not from those who use the street for traffic, but from those who use it as a place of business. A few hundred square feet near a certain street corner cost our department $10,000 to keep clean during the past year. It is the location of a curb market, supposedly a farmers' market, but really the resort of professional hucksters who dispose of provisions that have often become shopworn in adjacent market houses before finding their way to the curb. It would be a small return for the privilege of doing business in the street to require these hucksters to keep their surroundings clean at their own expense, on pain of arrest or forfeiture of their priveleges. My annual report recommends that some method be found of ridding the city of this form of imposition."

General Goethals' Report on the Panama Canal

The annual report of Gen. George W. Goethals, Governor of the Panama Canal, just issued, shows that the total amount which has been expended for the canal, including the balance of appropriations still on hand and available for work now in progress, is $357,456,000. From this total cost there should be deducted receipts from the sale of construction material and equipment, and the value of buildings and plants transferred to the army and the Alaskan Railway Commission without charge, also payments to be made by the Republic of Panama for municipal work in the cities of Panama and Colon. In comparing this figure with the estimate of total cost made in 1908, it should be remembered that the expenditures include a dry dock, two coaling stations and terminal piers which were not provided for in that estimate, and also a payment of over $1,000,000 for employees' injuries, made necessary by laws passed since the estimate was made.

SLIDES IN THE CANAL

The report is dated Aug. 2, 1915, so that it does not cover work on the slides which have since taken place. It is evident, however, that the eventual movement was foreseen of the material which has since slid into the channel. The report states that near Culebra in June, 1915, "the general movement of the bank from Station 1771 to 1796 was noticeable, and it was estimated that 5,000,000 cu.yd. of material were in motion on June 30 on the west side. It is estimated that about 4,000,000 cu.yd. will have to be removed from the east side."

There has been some question among engineers as to why steam shovels have not been employed to supplement the work of the dredges in removing the slides. In this connection the following is of interest:

> An examination of the west bank made subsequent to the break of Oct. 14, 1914, developed the existence of cracks on both banks and the question of resuming steam-shovel operations on both banks was considered seriously but abandoned because the amount of work that could be accomplished by the shovels would be relatively small and the cost excessive. The breaking up of the banks has proceeded so rapidly that this conclusion has been fully justified.

In this connection also the statement as to the relative cost of steam-shovel and dredge excavation is of interest. During the year there was removed by dredging in maintaining the channels through Gaillard cut 4,710,000 cu.yd., at an average division cost of 34.67c. per cu.yd. The average division cost of steam-shovel excavation in that section to June 30, 1914, was 70.66c. per cu.yd. Had it been attempted to do steam-shovel work on the present slides, however, the cost would have been much greater than the sum above stated, due to the large expense of maintaining tracks on the slides.

There is still a good deal of misunderstanding as to the material which is sliding into the canal, many still supposing it to be earth and clay. The report states, however, that of the 6,671,000 cu.yd. removed from the Gaillard cut during the year, 5,559,000 cu.yd. was rock and the balance earth. As showing how this material behaves, the following quotation is of interest:

> On the night of Oct. 14, 1914, a break occurred at East Culebra which completely closed the channel. The entire east bank for a distance of about 2,100 ft., extending back for a distance of about 1,000 ft. from the center line of the canal, settled vertically and the lower strata squeezed into the cut, so that at some points there were only 9 in. of water where prior to the movement there were 45 ft.

This huge slide closed the canal, however, for only six days, when a channel was dredged through it sufficient for the passage of ships. The slide continued to move, however, and the canal was again closed for five days from Oct. 31 to Nov. 4. Four months later it was again closed six days, from Mar. 4 to Mar. 10.

Digging away of the slides is by no means the only work in charge of the dredging division, of which W. G. Comber is the head. At the Pacific end, 542,000 cu.yd. was dredged between deep water in Panama Bay and the Pacific entrance, and about 2,800,000 cu.yd. was dredged from the Balboa inner harbor. At the Atlantic terminal 759,000 cu.yd. was dredged from the Cristobal approach pier channel, and 265,000 cu.yd. of coral rock was excavated.

Water-Supply of the Canal

The water-supply of the Panama Canal was a fruitful subject for argument in the early days of the enterprise. One of the stock arguments of the advocates of the sea-level canal was that the Chagres River would not supply enough water to keep the canal in operation during the dry season. The experience of the dry season of 1915 indicated, however, that the need for anxiety on that score is remote, although it is true that the rainfall during the dry season a year ago was unusually heavy. The rainfall on the surface of the lake during the dry season practically equaled the loss by evaporation. Instead of being obliged to draw down the level of the lake during the dry season to supply water for lockages, enough water was wasted over the spillway during the freshets of Feb. 9, 10 and 11 and Apr. 3 and 4 alone to have raised the lake level 2.95 ft. The water-supply situation of the dry season of 1915 may be presented in tabular form as follows:

	Million Cu.Ft.
Total yield of Gatun Lake watershed	43,924
Evaporation from lake surface	9,427
Used for hydro-electric power	8,312
Used in making 983 lockages and tests	3,724
Used for municipal purposes and by suction dredges	279
Leakage	175
Wasted at the spillway	23,264

The New Dry Dock at Balboa

Dry dock No. 1 is nearly ready for use. This dock is 110 ft. in width at the entrance and 1,044 ft. long from the point of the miter sill to the head. The miter and caisson sills are 39.5 ft. below mean sea level. The dock will contain with the tide at mean sea level 5,265,000 cu.ft. of water. The dock is excavated in rock. The floor is merely a smooth skin of concrete laid over the rock floor after the excavation. The side walls are of gravity section and are connected by a semicircular head. The side walls are reinforced at the back with 70-lb. rails. To prevent hydrostatic pressure accumulating behind the walls, a drain is formed at El. —27.5 ft. on the back of each wall communicating with the interior of the dock by four 8-in. pipes. At the entrance of the dock are a pair of steel miter gates that are identical with the Panama lock gates, except that the bearing surfaces at the miter and quoin ends are of greenheart instead of nickel steel. According to the *Canal Record* of Dec. 8, 1915, the first gate was hung on Nov. 27, and the second gate will probably be hung before the end of the year. In front of the miter gates is a seat for the floating caisson that is used for closing the lock entrance when repairs to the lock gates are necessary. A second dry dock is planned but is not to be built until necessary.

The average time for locking vessels through the three locks at Gatun is 65 min.; through the single lock at Pedro Miguel, 25 min.; and through the two locks at Miraflores, 45 min. Four towing locomotives are generally attached to the ships, though eight are used on the largest battleship. Tandem lockages with two ships in the same chamber at the same time have been made but are limited by the number of towing locomotives available. Parallel lockages are made only in emergencies.

The floating caisson was used for unwatering the lock at Miraflores to clean and paint the submerged machinery. Inspection revealed that galvanic action was taking place in the salt water between metals of different kinds. Tests are being made with preservative coatings having insulating properties which it is hoped will stop the corrosion. The rising stem valves were coated with bituminastic enamel, and a contract was made with the American Bitumastic Enamel Co. to paint all the submerged parts of the lock-gate structures and maintain them in first-class condition under a five-year guarantee.

A Big Blunder as to Vessel Measurement

After the canal had been in operation for some months, protest was made that the rules for vessel measurement adopted by presidential proclamation were not in accordance with the law and demand was made that the tolls collected in excess of legal authority should be refunded. The entire blame for this unfortunate situation is laid by General Goethals on Dr. Emory R. Johnson. Doctor Johnson was specially employed to draft the rules for Panama Canal measurement and to keep in touch with the legislative committees, which framed the law. The rules he drafted were supposed to conform strictly to the law as enacted. It later developed, however, that these rules have no legal standing and that, according to the letter of the law as enacted, the net registered tonnage of the vessel must apply. General Goethals says:

> Much to our chagrin and humiliation we learned that Dr. Johnson was aware of the discrepancy, notwithstanding which he presented his rules of measurement and rates of tolls for promulgation to the shipping interests of the world. Confusion has been the order of the day in consequence.

The greatest difficulty is not the refund of an illegal charge, but that, according to the law as it now stands, vessels must be assessed on their net registered tonnage, which may be varied by rulings and decisions of the Commissioner of Navigation. These rules as now applied cause discrimination in some cases against American ships in favor of foreign ships. It is roughly estimated that the total refunds necessary will amount to $400,000. These refunds cannot be made, however, notwithstanding the fact that the money was illegally collected, until Congress makes an appropriation authorizing them.

The total cost of operation and maintenance of the canal during the year was $4,112,000, while the tolls collected amounted to $4,343,000. When the above refunds are made, the operating expenses will exceed the toll receipts.

A Lighthouse on Navassa Island is under construction by the United States Bureau of Lighthouses. The island is an isolated rock with sheer cliffs about 200 ft. high, lying between Cuba and Hayti and in the track of vessels sailing between North Atlantic ports and the Panama Canal. A round tower 150 ft. high, of reinforced concrete, is being built on top of the rock, bringing the focal plane of the lens 402 ft. above water level. The light will have 56,000 cp., giving a double white flash every 30 sec. It will be visible for 27 nautical miles.

Eye-Bar Failure at Low Stress Causes Bridge Collapse

SYNOPSIS—Collapse of a steel bridge in Spokane, Wash., by the breaking of two lower-chord eye-bars has been investigated by a board of four local engineers and is charged to "granulation" of the metal. The stress in the metal is estimated at about 7,800 lb. per sq.in. Hugh L. Cooper, who designed the bridge, states that the bars were bent in an accident in 1894 and were straightened by local heating.

Breaking of the eye-bar bottom chord caused the collapse of the steel-truss main span of the Division St. bridge in Spokane, Wash., on Dec. 18, and dropped a street car into the Spokane River. Five men were drowned. Another car was left hanging by one truck on a pier. The fractures of the eye-bars were found to be crystalline.

The bridge has a 60-ft. south span and a 180-ft. main span, with trestle to the north. The main span was built in 1892 by the San Francisco Bridge Co.; Hugh L. Cooper, then District Engineer for the company, designed and erected the bridge. It was fabricated by the Edge Moor Bridge Works.

Data of the Span and Its Failure

The 180-ft. span was a through-truss structure of 8 22½-ft. panels, with curved top chords. It had a 40-ft. roadway and two sidewalks about 10 ft. wide. It was designed to carry a live-load of 4,800 lb. per lin.ft. This heavy loading made an unusually strong bridge, probably more than strong enough to carry present-day street cars without exceeding the original unit stress (15,000 lb.). The dead-load (originally about 2,600 lb. per lin. ft.) has been increased somewhat in recent years by added piping and by changes in the floor, probably 10 to 15%. This extra load is not significant. The details of the span were well ahead of contemporary practice. The floor-beams were riveted to posts and hangers.

The point of failure was the north end panel of the lower chord of the east truss, a member consisting of two 5x1½-in. eye-bars. Both bars broke near midlength, with clean square breaks. The bridge turned over in upstream direction and fell into 20 ft. of water. The piers (individual pedestals) were not damaged, though the shoes kicked off.

Board of Engineers Finds "Granulation"

A board of local engineers investigated the wreck at the request of City Engineer Morton Macartney and D. L. Huntington of the Washington Water Power Co. (operating the street railway).

The board, composed of S. H. Hedges, Bertram D. Dean, Frank M. Cortelyou and F. W. Crocker, reported as follows:

> At your request the undersigned have today made a preliminary investigation of the failure of the Division St. bridge.
>
> We examined at the city hall sections from two eye-bars which came from the end panel of the north end and east side of the bridge. We were also shown the original strain and section sheet from which this structure was built. We then went to the site of the bridge and investigated the structure as it now lies, partly in the water and partly on the bank. From all the above we unanimously arrived at the following conclusions:
>
> It is our opinion that the failure was due to the simultaneous breaking of the bottom chord bars of the first panel of the north end of the east truss because of granulation.
>
> There was no excessive load on the bridge at the time it collapsed, and in our opinion it is unlikely that there has ever been put upon this bridge a total load, including wood-block pavement, water pipes, street cars and other traffic, in excess of that for which the structure was designed.
>
> We are reliably informed that the bridge was designed by Hugh L. Cooper, one of the foremost consulting engineers of the United States, and that the same was fabricated by the Edge Moor Bridge Works, one of the best bridge companies in the country.
>
> We noticed breaks in the steelwork other than the ones above mentioned, caused by the falling of the bridge, and these show silky fractures indicating first-class material, and we are of the opinion that had this structure been carefully examined by experts the day before its failure they would have reported the same entirely safe for the duty it was fulfilling, and that there was no reason to expect defects of any character.

Prior Injury of the Chord Bars

An important piece of information is added by Hugh L. Cooper, the designer of the bridge. He says that the chord bars which broke were injured in 1894 and later were repaired in a way that probably left them permanently weakened. Mr. Cooper made the following statement to *Engineering News* of this phase of the matter:

> I visited the scene of the wreck two days after it occurred. It is apparent that the cause of the wreck was the pulling apart of both of the bottom-chord eye-bars of the east truss in the panel next the abutment. These bars were 5x1½ in. in cross-section. The breaks are opposite one another and show the same general characteristics—a very clean break all the way across, practically no fibrous condition of the metal, the entire surface looking highly crystallized.
>
> At the time of the accident it is probable that these bars were being stressed (if they were equally loaded) not to exceed 7,800 lb. per sq.in.
>
> From the information I gathered in Spokane it is apparent that in 1894, at a time of unusual high water, a heavy Howe-truss railway bridge was washed from its foundations and floated downstream and struck the end bottom chords of this span a heavy blow, severely distorting both of the bars that broke. The Howe-truss span, after colliding with the upstream bars, was forced down into the water and came up with a new blow, striking the downstream chord bars opposite the bars that parted, breaking one of these bars entirely. My information is to the effect that when the city authorities came to repair the structure after this accident, the bar that broke entirely in two downstream was replaced by a new bar and the upstream bars were taken out and locally heated, straightened and reinserted in the structure.
>
> My own thought of the explanation in the light of the information I have is that the blow received by the upstream bars was sufficient to stretch them beyond their elastic limit, and in addition the straightening by local heating without reannealing produced conditions that were also unsafe. The bars should never have been allowed to continue in service.
>
> There is some conflict of opinion as to just what point in the upstream chord was first struck by the Howe truss.
>
> One of the incidents confirming my personal view of the cause of the accident is found in the fact that the upstream chord bar of the two that broke shows a marked bruise that might have been caused by a screw end of one of the vertical rods in the Howe-truss span. This bruise is located within three inches of the break and is in the center of the bar.

City Engineer's Doubts Accident Theory

Doubt is thrown on the accident theory by Morton Macartney, city engineer, in the following interview, which appeared in the Spokane dailies:

> City Bridge Foreman John McCormick, who then was in the employ of the city, tells me that it was another panel of

the bridge that was bent in the 1894 flood. He says the bent portion still shows. It is true that blows of a hammer showed on the part of the bridge that broke, a condition apparent after the paint was off, but how the blows came there is more than I can tell. So far I have found no city record telling that this member was bent and repaired at that time.

In rejoinder to this, Mr. Cooper reasserts his information that the eye-bars struck in the 1894 accident were the particular ones that broke in the present collapse.

A further fact possibly bearing on the accident is that at the fracture one bar showed a small flaw like a slag inclusion, making a slight indentation from one side face.

The American Bridge Co., successor of Edge Moor Bridge Works, has not been able to find a record of the character of the metal in the bridge. That the metal is steel is well established; a strength of 60,000 lb. per sq.in. was specified. The eye-bars were press-upset and were then annealed, according to the Edge Moor process, which has since come into general use.

Eye-bars for a railway bridge also designed by Mr. Cooper were made in the same shop at the time the Division St. eye-bars were made, and this bridge is still in service, not far from Spokane.

Garbage-Disposal Bids Invited by New York City

OFFICIAL STATEMENT

The existing contracts for the disposal of garbage, ashes and rubbish in New York City expire Jan. 1, 1917, though the city has the privilege of renewing these contracts for a further period of two years. For the purpose of determining the advisability of such renewal, new contracts will be advertised. Bids will be received Jan. 18, 1916, on two forms of contract for the disposal of garbage.

Form No. 1 provides for the disposal of garbage at private plants located on private lands for a period of five years. The feature of this contract requires the contractor to pay the city an amount per annum for the privilege of disposing of garbage. The total amount of garbage delivered in 1914 was 412,200 cartloads of 2 cu.yd. capacity, weighing approximately 2,330 lb. per cartload. Plans and specifications are to accompany the bid, showing the general outline of plant and methods of treatment proposed for use by the contractor. Stringent provisions cover design of plant and equipment so as to obviate nuisance due to the escape of odorous gases or other obnoxious wastes.

Form No. 2 differs from the preceding contract in that the plant will be erected on a site provided by the city. The contract term is limited by law to a period of five years, and the city agrees to purchase the plant on the termination of the contract, at a price to be fixed in the bid or estimate by the contractor. The contract likewise requires the bidders to submit general plans and a guaranteed maximum estimated cost for the construction of the plant and appurtenances. The methods proposed to be used and the design of apparatus are subject to approval by the Commissioner of Street Cleaning, and definite guarantees covering nuisances and odors are required, as in Form No. 1.

Under the conditions noted in Form No. 1 the contractor would naturally amortize his plant during the five-year term of contract, while in Form No. 2 the contractor finances the undertaking and is required to make any profits out of the operation of the plant during the term of the contract, as the plant is to be built at actual cost under the supervision of the city.

On account of the difficulty of securing city funds for the construction of a municipal plant at the present time, the authorities decided to attempt to interest private capital in financing the undertaking under Form No. 2; as there is but a slight risk in the investment on account of the city's agreement to purchase the plant, it would seem as if this would be the more attractive proposal to contractors.

Last year the Commissioner of Street Cleaning attempted to secure state legislation which would enable the city to make a 15-yr. profit-sharing contract for the disposal of all classes of wastes. The bill passed both houses of the legislature, but was vetoed by the governor. Thus the city has available only two means of disposing of its waste: First, by contract for a period not to exceed five years; and second, by municipal construction and operation of the disposal works.

J. T. Fetherston is Commissioner of Street Cleaning of New York City.

Locomotives for Railways of Sharp Curvature

Anatole Mallet, of Paris, France, the inventor of the Mallet articulated locomotive, was the author of a paper presented before the Railway Section of the American Society of Mechanical Engineers at the recent annual meeting giving a historical review of the numerous locomotives which have been designed to traverse lines of sharp curvature.

The best-known locomotives of this type in use in the United States are the geared locomotives of the Climax, Shay and Heisler systems. These are in extensive use on logging roads, where steep grades and sharp curvature are generally essential to economical construction. Some other locomotives of this type which have been built in the United States are the Cowles locomotive, described in *Engineering News* of Feb. 9, 1893, and the Johnstone locomotive, designed by a former superintendent of motive power of one of the Mexican railways and adopted on several locomotives built in the United States for service there.

The interest in this problem was much greater in the early days of the railway era, when it was supposed to be difficult or impossible to run a locomotive with several coupled pairs of drivers around any but the easiest curves. There is, however, at the present time, constant pressure on the railway mechanical departments to build as heavy locomotives with as many coupled drivers as can possibly be gotten over the track, and there is no doubt that a considerable outlay for track repairs is made necessary by the action on curves of heavy locomotives of long wheel base.

In the discussion upon Mr. Mallet's paper, Mr. Woodward, assistant chief engineer of the American Locomotive Co., stated that his company has recently built a new type of locomotive in which provision is made for lateral movement in the end driving axles (the locomotive is of the 2-10-2 class), to enable it to pass freely around sharp curves without cramping. The locomotive has a rigid wheel base 22 ft. 6 in. long, yet it has been run around yard curves of 20° without injury to the track.

News of the Engineering World

Chattanooga Bridge Falsework Swept Away by Flood

Unexpected high water in the Tennessee River caused the loss of one coffer-dam and the centering of one of the arches of the Market St. bridge now under construction at Chattanooga, Tenn., on Dec. 20. The bridge is a series of reinforced-concrete arches, 165 ft. and 180 ft. in span, with a middle double-leaf bascule span of 300 ft. On the Chattanooga side of the river, arches 1 and 2 were practically completed and the centering under arch 3 (180-ft. span) had just been placed, together with most of the reinforcement for the arch ring. Pier 4 (piers 3 and 4 are the bascule piers) was under construction inside of a steel sheet-pile coffer-dam.

The centering and falsework for arch 3 were completed Dec. 18, and it was planned to start pouring the next day. At that time the river was at a 17-ft. stage; but the Weather Bureau sent in word that a flood stage was due, and the entire bridge force was put to work cleaning out the driftwood. Late Saturday night, however, a large tree broke through the pile footings of the centering. With a pressure of the driftwood 100 ft. behind it the falsework, which had already buckled and cracked, collapsed on Sunday morning at a 29-ft. stage. Immediately afteward a tug was sent after it and captured the débris 10 mi. down the river and tied it to the bank. It is believed that $1,000 worth of steel can be salvaged.

In addition to the loss of the centering the coffer-dam for pier 4 was washed out earlier in the day. This is the third time that this coffer-dam has been lost.

The bridge is being built by the Vang Construction Co., of Cumberland, Md., for the Tennessee River Bridge Commission. It was designed by B. H. Davis, of New York. Ellis Soper is construction engineer.

The foundation work for the bridge has been troublesome from the beginning. Preliminary borings placed the rock bottom too high, and the originally intended open coffer-dam method has had to be replaced by pneumatic caissons in two of the piers.

One Span of Memphis Bridge Falsework Washed Out

A part of the falsework of the new cantilever bridge across the Mississippi River near Memphis, Tenn., was washed out in the high water of Dec. 23, 1915. At the request of *Engineering News* the following statement was made by Thomas Earle, Superintendent of the Bridge and Construction Department of the Pennsylvania Steel Co., which is fabricating and erecting the bridge:

"On the night of Dec. 23, 1915, fifteen bents of the falsework which had been placed in the Mississippi River for the erection of the bridge of the Arkansas & Memphis Railway Bridge and Terminal Co., near Memphis, Tenn., were washed out by high water. These bents were to have supported the semisuspended span between piers 3 and 4. The falsework consisted on an average of 32 piles per bent, the piles ranging from 84 to 94 ft. in length. On these piles rested the timber falsework, consisting of 12x12-in. legs about 65 ft. high. The river was at a height of 28 ft. at the time of the washout and full of heavy drift.

"In addition to the falsework a small amount of erection equipment was lost, including some stringers of the permanent construction which were being used temporarily in the falsework. No other permanent steel was lost.

"The bridge is to carry railway and highway traffic, and starting at the Memphis side will consist of the following spans (see *Engineering News,* Nov. 6, 1913, p. 930): East abutment to pier 1, anchor arm, 186 ft. 3¾ in.; pier 1 to pier 2, 790-ft. 5¼-in. span comprising a cantilever arm of 186 ft. 3¾ in., a suspended span of 417 ft. 9¾ in. and a cantilever arm of 186 ft. 3¾ in.; pier 2 to pier 3, fixed span, 621 ft. long; pier 3 to pier 4, a 604-ft. 1½-in. span comprising a cantilever arm of 186 ft. 3¾ in. and a semisuspended span of 417 ft. 9¾ in.; pier 4 to pier 5, deck span, 345 ft."

Subsequent to the receipt of the foregoing, the following local report of the collapse was received:

"Following an unusual rise in the Mississippi River to about 27 ft. on the Memphis gage, and the piling of drift against it, 14 bents of falsework between piers 3 and 4 of the new Memphis bridge went out at 11:30 p.m., Dec. 23, leaving five bents next to pier 3 standing. On Saturday, Dec. 25, about 3:30 a.m., the fifth bent west of pier 3 went out. A small gantry traveler, the falsework derrick and four hoisting engines with their rigging went with the falsework, as did 120 roadway stringers being used as stringers for the traveler tracks. The remaining bents of this span carry the bottom chord and floor system of the cantilever arm, leaving two panels of bottom chord projecting. Bolts at the splice at panel-point 12 were removed, so if the remaining bents go out, it is expected the break in the steel will occur at this point and not greatly damage the end of the fixed span at pier 3.

"All pins in span 2-3 (621 ft. fixed span) were in by 2 p.m., Dec. 22, and the remaining portal bracing and top laterals by noon the next day. Lowering of this span was begun at once and proceeded until dark under extra force; very little weight then remained on the falsework. All joints are closed and well bolted, and it is believed this span will hold even though the falsework under it goes out. The drift piled up for a distance of about 60 ft. upstream in spite of all attempts to prevent it. The falsework for span 3-4 was in 60 ft. of water at the time of failure, with 30-ft. penetration, while that of span 2-3 was in 75 ft. of water with 35-ft. penetration.

"The river stage at 7 a.m., Dec. 28, is about 31 ft. A stage of 32 ft. is expected."

The Memphis bridge was designed by Ralph Modjeski, of the firm of Modjeski & Angier, Chicago, and is being erected under his supervision.



FIG. 1. LOOKING SOUTH, EXCAVATION FOR PINE HILL CONCRETE DAM

Showing progress of work on the construction of a $700,000 reservoir, using entirely municipal day labor and municipally owned equipment. Text describing the work on opposite page.

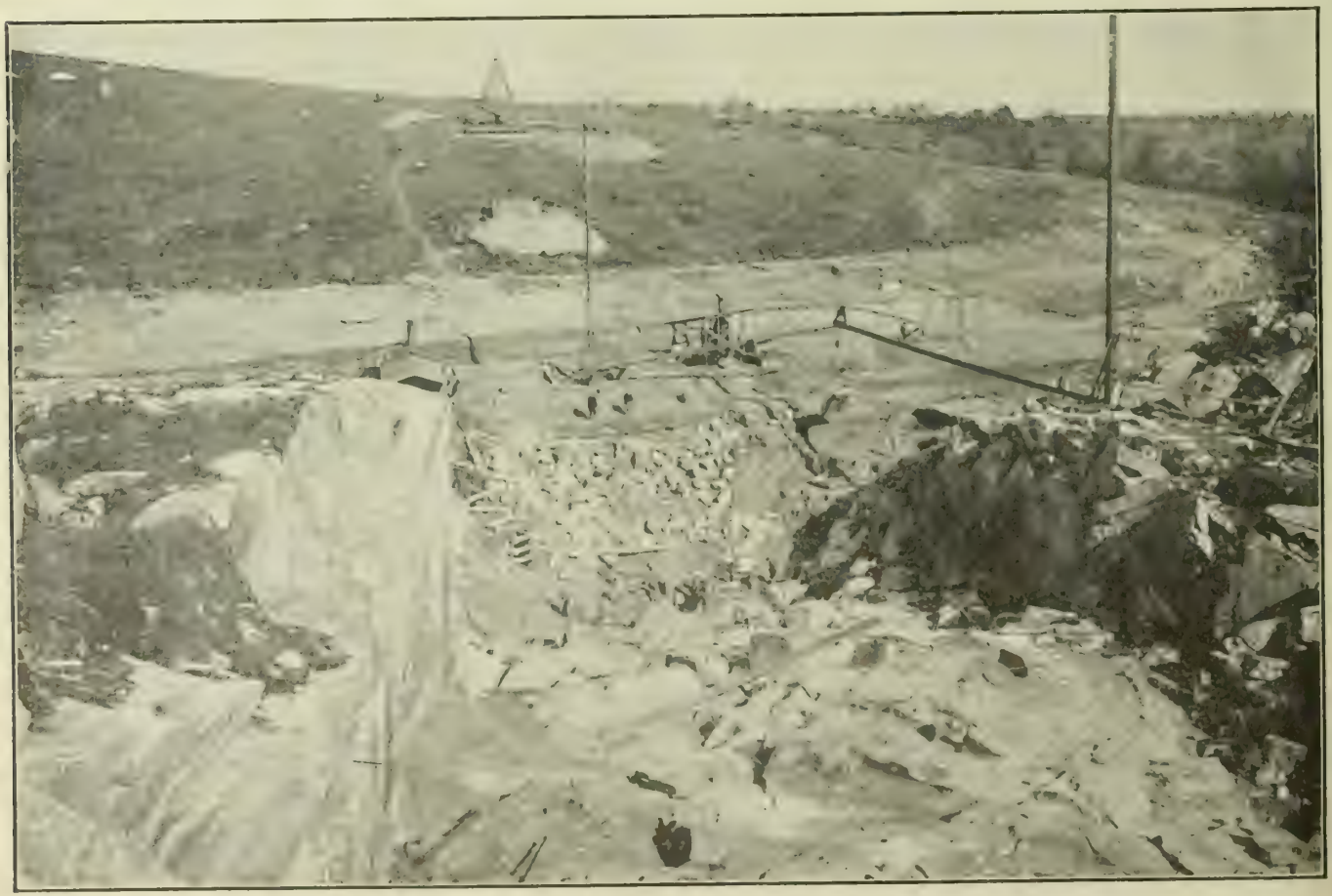


FIG. 2. LOOKING NORTH, EXCAVATION FOR PINE HILL DAM, WORCESTER, MASS.

Excavation to bedrock is completed in the foreground. The distance across is about 850 ft. All rock excavation was done with small compressed-air hand drills.

Pine Hill Dam for Worcester Additional Water-Supply

The city of Worcester, Mass., has had under construction for over a year a cyclopean masonry dam, which will rank among the largest in New England. Construction work is proceeding rather slowly because the city is doing all operations by municipal labor and with small annual appropriations; no construction contracts have been, nor are to be, let. This alone will make the work of much interest to municipal engineers. The estimated cost is about $700,000.

The dam is near the present Holden reservoirs of the city water-supply. It will be 108 ft. high from foundation to top, 80 ft. wide at the base and 17 ft. wide at the top. The top is 850 ft. long. It dams the narrow outlet of a natural basin of rather remarkable topography.

Solid rock underlies the whole dam site. The top strata of soil, soft and disintegrated rock are excavated by derrick skips and conveyed by narrow-gage railways to a temporary spoil bank. The material will be used to grade below the completed dam. Rock excavation is accomplished by two Jackhamer compressed-air drills. A small WK-3 gasoline-engine-driven Sullivan compressor of 20 hp. is used to supply air. Large pieces of rock are piled within reach of the derrick booms to be used later as "plums" in the dam masonry. Steam tripod drills are used to make test holes; some of these are 50 ft. deep.

Rock excavated near the dam site will be used for concrete aggregates. There is no sand within reasonable distance, so a pair of 14x20-in. sand rolls have been installed, and the rock will be used to make sand as well as the coarser concrete aggregate. All the material is handled by derricks, a cableway and narrow-gage railways.

Concrete is to be mixed with a Hains gravity mixer. The sand and stone bins and the cement house are at the north end of the dam. Narrow-gage railway cars will carry these materials to a chute, which will convey them to the hopper platform of the concrete mixer.

All the plant and equipment have been purchased by the city and erected by day labor under the supervision of the City Engineer, F. A. McClure. The city has even gone so far as to build its own railway cars and derricks. At the opening of another season Mr. McClure expects to have 250 men employed. As yet the excavation has not been completed.

Terre Haute Water Rates Cut

The meter rates of the Terre Haute Water Co. have been ordered reduced to the advantage of small consumers, the cost of service connections has been put upon the company, the fire-hydrant rate has been confirmed, but the company is not compelled to install so many hydrants on extensions as heretofore. These and other rulings are embodied in an order of the Indiana Public Service Commission, dated Dec. 18, 1915, as a result of a petition filed Oct. 16, 1913, by the Commercial Club of Terre Haute.

The meter rates are on a sliding scale. For the first 20,000 gal. a month the new rate will be 20c. instead of 30c. per 1,000 gal. For successive additional quantities the rate falls until for all consumption of more than 3,000,000 gal. a month the unit rate is 4¼c.—a slight increase, as the old rate was 4½c. The minimum monthly charge for metered water is $0.60 for ⅝- and ¾-in. meters, $1 for 1-in., on up to $20 for 6-in. and over.

The minimum charge per month for private fire protection is 50% above the charges just given. All private fire-protection services must be metered.

The flat rate is $5 per kitchen faucet for a private family living in six rooms or less, where there is not more than one room rented nor more than two boarders. Additional charges are $3 each for a bath and water closet, $3.50 for one horse and $6 for sprinkling a 50-ft. lot.

The old fire-hydrant rental of $40 each per year stands, but the company need set only one hydrant per 500 ft. of extensions instead of one for each 355 ft. under the old rates.

The value of the property of the company is fixed by the commission at $1,200,000, including $80,000 for going value. The company may earn 6½% on this valuation after allowing for maintenance, operation and 0.83% for depreciation.

The commission ordered the company to pay the state $1,386 for the expense of the rate adjustment and cut from $12,500 to $9,000 the sum the company wished to charge to current expenses on account of the valuation proceedings, holding that the $3,500 must come out of dividends.

Dow R. Gwinn, President of the Terre Haute Water Co., is given credit for getting remarkably good results from a filtration plant now out of date. On this subject the commission says, "We believe the most valuable part of the filtration system is the gray matter of the president of the water company."

New Rules of Practice of the United States Patent Office have been approved by the Secretary of the Interior and are to take effect on Jan. 1. The new rules have been framed by a committee of which R. F. Whitehead, Assistant Commissioner of Patents, is chairman, and before final adoption were submitted for criticism to patent experts and patent attorneys throughout the country.

The Alaskan Engineering Commission, in charge of the construction of the Government railway in Alaska, received over 38,000 applications for positions before it left for Alaska last spring, according to a statement by Secretary Lane in his annual report. Most of those applying for positions, however, were not men out of work, but were men holding positions with railway companies, banks, stores, etc.

Derailment Wrecked Bridge—The steel span of a bridge of the Nashville, Chattanooga & St. Louis Ry., about 25 mi west of Nashville, was destroyed on Dec. 13, when part of a freight train was derailed. The derailment was followed by the ignition of the contents of an oil-tank car, and four tank cars and nine cars of merchandise burned. The span was 96 ft. long and was single-track. A trestle approach on concrete bents was burned completely, with no damage to the bents, the repair crew being able to replace the wooden stringers immediately. The bridge was replaced by a temporary structure in four days, but after one train had run over it three bents were carried away by high water. New bents were erected immediately, and traffic was resumed in a few hours. It is expected that a new steel bridge will be in place permanently by Jan. 1.

The Street Railways of Melbourne, Australia, are operated by the Melbourne Tramway and Omnibus Co., whose franchise expires on July 1, 1916. The railways were built about 30 years ago under a coöperative agreement between the city and the railway company. The city furnished the capital for building the lines (about $8,000,000), and the company furnished the rolling stock, car barns and general offices. The company has paid an annual rental to the city of about $200,000 per annum. The city has planned to take over the lines for municipal operation at the expiration of the franchise, but the Provincial Government has introduced a bill under which it would control and operate the line in connection with a plan for a greater Melbourne consolidation.

The lines are still operated by cable traction, and their rebuilding is likely to be undertaken when the question of control at the expiration of the franchise is settled.

PERSONALS

Prof. Arlo Bates, Professor of English in the Massachusetts Institute of Technology, has retired, under the pension system of the Carnegie Foundation, after 22 yr. of service.

Mr. J. W. Frazier, who has been a draftsman in District No. 4 of the Pennsylvania State Highway Department, has been promoted to the superintendency of highways of Potter County.

Mr. C. H. Orndorf, draftsman attached to District No. 2 of the Pennsylvania State Highway Department, at Harrisburg, has been promoted to be Superintendent of Highways of Clinton County.

Mr. H. S. Wood, Chief of Construction in District No. 15 of the Pennsylvania State Highway Department, has been promoted to be Superintendent of Highways of McKean County, with headquarters at Warren.

Prof. Harold A. Everett, of the Department of Naval Architecture of the Massachusetts Institute of Technology, has resigned to take a position in the Post Graduate School of the United States Naval Academy at Annapolis.

Mr. Henry C. Beckwith, M. Am. Soc. M. E., formerly Chicago Manager of the T. L. Smith Co., is now Treasurer and General Manager of the Byers Machine Co., manufacturers of hoisting and excavating machinery at Ravenna, Ohio.

Mr. William B. Goentner, former Assistant Engineer of the New York City Department of Water-Supply, Gas and Electricity in charge of design of distribution systems, is now Superintendent of the McCabe Chemical Co., Charlotte, N. C.

Mr. W. S. Hanmaker, County Superintendent of Highways of Cumberland County, has been promoted to be Acting Assistant Engineer in charge of District No. 9 of the Pennsylvania State Highway Department, with headquarters at Chambersburg.

Mr. D. A. McCloskey, Acting Chief of Construction of District No. 11 of the Pennsylvania State Highway Department, has been promoted to be Superintendent of Highways of Huntingdon County, taking the place of T. J. Strickler, who recently resigned.

Mr. F. E. Winter, Resident Engineer in charge of inspection at Warren, of the Pennsylvania State Highway Department, has been promoted to the post of Acting Assistant Engineer in the newly created District No. 8, including Clearfield, Indiana, Jefferson, Elk and Cameron counties.

Mr. E. R. Lewis, M. Am. Soc. C. E., Assistant to the General Manager of the Duluth, South Shore & Atlantic Ry. Co., with office at Duluth, Minn., will after Jan. 1 have charge of all matters pertaining to engineering, maintenance of way and structures and federal valuation of the company.

Mr. W. R. Wolfinger, who has been Assistant Engineer in charge of District No. 9 of the Pennsylvania State Highway Department, at Chambersburg, has been transferred to District No. 5, with headquarters at Allentown. He succeeds John T. Gephart, Jr., who will return to Harrisburg and resume his duties as Engineer of Construction.

Maj. R. E. Wood, Chief Quartermaster at Panama and Director of the Panama R.R., has joined the staff of the Barber Asphalt Paving Co. as Assistant to the President, with headquarters at Philadelphia. Major Wood graduated from West Point to 1900, was connected with the building of the canal from 1905 to 1915 and retired with the rank of major under the Panama Canal Act.

Mr. William E. Davis, Vice-President of the Cleveland Construction Co., has been appointed Public Utilities Engineer of Cleveland, Ohio, at an annual salary of $7,000. Mr. Davis will fill the combined positions now held by Lighting Commissioner F. W. Ballard, Assoc. Am. Inst. E. E., and Water Commissioner Charles F. Schulz. Commissioner Ballard receives $7,000, and Commissioner Schulz $5,000 a year.

Prof. William D. Pence, M. Am. Soc. C. E., has decided to sever his connection as Professor of Railway Engineering at the University of Wisconsin. He will be succeeded by Prof. L. F. Van Hagan, Assoc. M. Am. Soc. C. E., who has been promoted to the position of Associate Professor and placed in charge of the department. Professor Pence has been a member of the Interstate Commerce Commission Railway Valuation Board since its inception.

Mr. Gustav J. Requardt, Assoc. M. Am. Soc. C. E., will leave the employ of the Baltimore Sewerage Commission Jan. 1. Mr. Requardt has been with the commission since 1909, when he was a rodman on the location of structures at the sewage-disposal plant; since then he has been Assistant Engineer on the design of sewer and drains through the city, Assistant Division Engineer in charge of design and construction of new filters and Imhoff tanks and for the last year has been acting as Division Engineer in charge of operation and construction at the disposal plant. He expects to go into the private practice of civil and sanitary engineering.

Mr. A. K. Silvernail has been elected President of the newly organized Kimberly Construction Co., Mayro Building, Utica, N. Y. Mr. Silvernail is a graduate in civil engineering of the Carnegie Institute of Technology. Subsequent to his graduation he was engaged in the construction department of the New York Central and Lehigh Valley railroads and was in charge of construction of a large department-store building in Corpus Christi, Tex. In 1912 he went to Utica and has since that time had charge of the contruction of many of the public building in that city. He is at present Supervising Engineer on the Utica Homeopathic Hospital Building.

Mr. William F. Kelly and Mr. Charles B. Cooke, Jr., have formed a partnership with the firm name of Kelly, Cooke & Co., with offices in the Drexel Building, Philadelphia, Penn., to conduct a general practice in public-utility and industrial engineering. Mr. Kelly was for several years connected with the engineering staff of the Union Traction Co., of Philadelphia, and for the past 14 yr. has been a member of the staff of Ford, Bacon & Davis, acting as engineer in charge of several of their larger operations, including the construction and reconstruction of the Knoxville Railway and Light Co. and the Birmingham Railway, Light and Power Co. Mr. Cooke was formerly Assistant Commercial Engineer of the Westinghouse Machine Co., at East Pittsburgh, and for several years past has been on the staff of Ford, Bacon & Davis, during which time he specialized on financial engineering reports and had personal charge of a number of important rate developments and reports for public-utility companies. Both members of the firm are graduates of the University of Pennsylvania.

OBITUARY

Francis Winthrop Scarborough, M. Am. Soc. C. E., Consulting Engineer of Richmond, Va., died in New York City Dec. 24.

Henry Wick, Assoc. Am. Soc. M. E., President of the Elyria Iron and Steel Co., died at Youngstown, Ohio, Dec. 22. He was born in that city in 1846 and had been active for nearly 50 yr. in the iron and steel trade in Ohio. He was formerly President of the Ohio Steel Co. and the early Youngstown Rolling Mill Co.

George V. Sneden, Superintendent of Maintenance-of-Way of the New York & Long Branch R.R., and the oldest employee of the company in point of service, died at his home in Red Bank, N. J., Dec. 24. He was born in Fredericksburg, Va., in 1856 and studied civil engineering at Lehigh University. In 1874 he became a member of the engineering corps engaged in the construction of the road.

William Wilson Ramsey, of the Ramsey Engineering Co., Chicago, died at his home in that city Dec. 3. He was born in Chester County, Pennsylvania, and went to Chicago in 1876. He was formerly Manager of the Northwestern Expanded Metal Co., and was largely influential in promoting the present extensive use of metal lath. About 1893, when reinforced concrete began to be used for building construction, Mr. Ramsey organized the Expanded Metal Fireproofing Co., and since that time he had been actively connected with the design and construction of concrete for structural work.

William Weeden Cole, M. Am. Soc. C. E., Consulting Engineer, New York City, was found dead, Dec. 20, in a hotel in Poughkeepsie, N. Y., to which city he had gone on business. It is thought that he was accidentally asphyxiated. He was born at Medford, Mass., in 1868. At various times he was Division Engineer of the Toledo, St. Louis & Kansas City Ry., Superintendent of Electrical Affairs on the West End Street R.R., in Boston, and was identified with the Utica (N. Y.) Belt Line, designing and building the West Side R.R. and Elmira Heights Water-Works. For a period of 16 years he was associated with the Public Utilities Co., of Elmira, during which time the city's gas, electricity, street

railways and water were consolidated into one corporation, of which he was the Vice-President and General Manager. In 1907 Mr. Cole left Elmira to enter the firm of Day & Zimmerman, of Philadelphia, where he remained for seven years, after which he became a member of the firm of Cole, Ives & Davidson, of New York City.

ENGINEERING SOCIETIES

COMING MEETINGS

SECOND PAN-AMERICAN SCIENTIFIC CONGRESS.
Dec. 27-Jan. 8. Washington, D. C.

AMERICAN CIVIC ASSOCIATION.
Dec. 28-31. Annual convention in Washington, D. C. Secy., R. B. Watrous, Union Trust Bldg., Washington, D. C.

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 3-6. Seventh annual convention in Washington, D. C. Secy., C. R. Marsh, Brattleboro, Vt.

ALABAMA ASSOCIATION OF HIGHWAY ENGINEERS.
Jan. 8. Annual meeting in Montgomery. Secy., J. B. Converse, City Engineer, Selma, Ala.

LOUSIANA ENGINEERING SOCIETY.
Jan. 8. Annual meeting in New Orleans. Secy., W. T. Hogg, State Museum Bldg., New Orleans, La.

WESTERN SOCIETY OF ENGINEERS.
Jan. 12. Annual meeting in Chicago. Acting Secy., E. N. Layfield, 1735 Monadnock Block, Chicago, Ill.

ENGINEERS' SOCIETY OF PENNSYLVANIA.
Jan. 14. Annual meeting in Harrisburg. Secy., E. R. Dasher, 30 So. Front St., Harrisburg, Penn.

CENTRAL RAILWAY CLUB.
Jan. 14. Annual meeeting in Buffalo, N. Y. Secy., H. D. Vought, 95 Liberty St., New York City.

WESTERN PAVING BRICK MANUFACTURERS' ASSOCIATION.
Jan. 14-15. Annual meeting in Kansas City, Mo. Secy., G. W. Thurston, 416 Dwight Bldg., Kansas City, Mo.

MONTANA INSTITUTE OF MUNICIPAL ENGINEERS.
Jan. 17-19. Annual meeting at Billings, Mont. Secy., C. C. Widener, Bozeman, Mont.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 19-20. Annual meeting in New York City. Secy., C. W. Hunt.

NATIONAL DRAINAGE CONGRESS.
Jan. 19-21. Annual meeting, Cairo, Ill. Vice-Pres., Edmund T. Perkins, First National Bank Building, Chicago, Ill.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
Jan. 20-22. Annual convention in Minneapolis. Secy., Alvin E. Dodd, 140 West 42nd St., New York City.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Jan. 18. Annual meeting in Pittsburgh. Secy., E. K. Hiles, 2511 Oliver Building, Pittsburgh, Penn.

KANSAS ENGINEERING SOCIETY.
Jan. 18-19. Annual meeting at Kansas State Agricultural College. Secy., C. A. Foster, Topeka, Kan.

AMERICAN WOOD-PRESERVERS' ASSOCIATION.
Jan. 18-20. Annual convention in Chicago. Secy., F. J. Angier, Mount Royal Station, Baltimore, Md.

THE FRANKLIN INSTITUTE.
Jan. 19. Annual meeting in Philadelphia. Secy., R. B. Owens, Philadelphia, Penn.

ILLINOIS CHAPTER: AMERICAN WATER-WORKS ASSOCIATION.
Jan. 25-27. Annual meeting, University of Illinois, Urbana. Secy., Dr. Edward Bartow, Urbana, Ill.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 26-28. Annual meeting, University of Illinois Urbana, Ill. Secy., E. E. R. Tratman, Wheaton, Ill

WISCONSIN HIGHWAY COMMISSIONERS' ASSOCIATION
Jan. 31. Annual meeting in Madison. Secy., G. H. Marwaring, Gotham, Wis.

INDIANA SANITARY AND WATER-SUPPLY ASSOCIATION.
Feb. 2-5. Annual meeting in Indianapolis. Asst. Secy., W. F. King, Indianapolis, Ind.

INDIANA ENGINEERING SOCIETY.
Feb. 3-5. Annual meeting in Indianapolis. Secy., Charles Brossmann, 1616 Merchants Bank Bldg., Indianapolis, Ind.

NINTH CHICAGO CEMENT SHOW.
Feb. 12-19. First Infantry Armory and Coliseum. Secy., R. F. Hall, 208 South La Salle St., Chicago, Ill.

AMERICAN CONCRETE INSTITUTE.
Feb. 14-17. Annual convention in Chicago. Secy., John M. Goodell, 1418 Walnut St., Philadelphia, Penn.

ASSOCIATION OF ONTARIO LAND SURVEYORS.
Feb. 15. Annual meeting in Toronto, Can. Secy., L. V. Rorke, Parliament Building, Toronto, Ont.

SECOND NATIONAL CONFERENCE ON CONCRETE ROAD BUILDING.
Feb. 15-18. At Chicago. Secy., J. P. Beck, 208 South La Salle St., Chicago, Ill.

IOWA ENGINEERING SOCIETY.
Feb. 16-18. Annual meeting at Des Moines. Secy., J. H. Dunlap, Iowa City, Iowa.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
Feb. 16. Annual meeting in Boston. Secy., N. W. Gifford, 38 Central Sq., East Boston, Mass.

AMERICAN CONCRETE PIPE ASSOCIATION.
Feb. 17-18. Annual convention in Chicago. Secy., E. S. Hanson, 538 South Clark St., Chicago, Ill.

AMERICAN ROAD BUILDERS' ASSOCIATION.
Feb. 22-25. Annual convention in Pittsburgh. Secy., E. L. Powers, 150 Nassau St., New York City.

The Pacific Northwest Society of Engineers will hold its annual meeting and year-end dinner in Seattle, at the Arctic Club, on Jan. 8.

The Ohio Engineering Society will hold its 38th annual meeting in Columbus, Feb. 9 to 11. The secretary is John Laylin, Norwalk, Ohio.

Iowa Engineering Society—The annual meeting will be held at Des Moines, Feb. 16 to 18. The secretary is J. H. Dunlap, Iowa City, Iowa.

American Electric Railway Association—The annual mid-winter meeting will be held at the Congress Hotel, Chicago, Feb. 4, 1916. The general discussions will center around the topics "Valuation" and "Rate of Return."

The Cleveland Association of Members of the American Society of Civil Engineers has elected the following officers for 1916: President, Robert Hoffmann; vice-president, W. J. Watson; secretary-treasurer, Geo. H. Tinker. The new president is chief engineer of the Department of Public Service of Cleveland.

The Engineers' Society of Pennsylvania at its December meeting elected the following officers: President, R. Boone Abbott, division engineer, Philadelphia & Reading Ry.: first vice-president, W. W. Davis; second vice-president, Morris Knowles; directors, F. A. Robbins, Jr., D. E. Tracy, Elton D. Walker; treasurer, John O'Connell; secretary, Edward R. Dasher, 31 So. Front St., Harrisburg, Penn.

Buffalo Engineering Society—At a meeting on Dec. 15 the relation of the engineer to civic welfare and the municipality was discussed by C. E. Drayer, secretary of the Cleveland Engineering Society. He urged that local engineering societies should aid municipal governments in the proper solution of engineering problems. Three of the councilmen-elect, who are to conduct the commission government of Buffalo after Jan. 1, were present at the meeting. A resolution was adopted to appoint a committee of five to coöperate with the municipal commission in the solution of engineering problems. John Younger, Chief Engineer of the truck-department of the Pierce-Arrow Motor Car Co., said that his company was willing to coöperate with the schools of the city in the training of students in mechanical trades according to the coöperative educational plan.

The San Francisco Association of members of the American Society of Civil Engineers held its eleventh annual meeting at the Palace Hotel on Dec. 17. Vice-president Couchot presided, and 49 members and guests were present. A communication from Jerome Newman, suggesting that an effort be made to ascertain the views of the association as to the extent to which it is justifiable for one engineer to use the plans and specifications of another without permission and without giving credit to the latter, was read. After a brief discussion by Messrs. Newman, Marx, Brunnier, Rhodin and Duryea it was ordered that a committee of five be appointed to define principles of ethics in engineering practice and report at a subsequent meeting. Officers for the ensuing year are: President, H. L. Hachl; vice-president, Jerome Newman.

The Engineering Association of the South held its annual meeting in Nashville, Tenn., at the Commercial Club, on Dec. 18. The election of officers was announced as follows: President, T. P. Branch, Professor of Civil Engineering of the Georgia School of Technology, Atlanta, Ga.; vice-presidents, John Howe Peyton and L. M. Thacher; secretary, J. Harwell Allen, of the Allen-Scales Engineering Co., Nashville, Tenn.; directors, C. S. Brown, C. H. Simpson and L. J. Hill. Professor Brown, the retiring president, read a paper on smoke abatement. James Cameron, of New York City, who is conducting the municipal audit at Nashville, called attention to a defect in the present city charter. The commissioners can issue bonds for trunk sewers, but to do the same thing for laterals is illegal. A committee was appointed by the association to devise a remedy.

Associated Engineering Societies is the name under which the following engineering organizations have combined: Pacific Northwest Society of Engineers, Washington Association of Engineers, local sections of the American Society of Civil Engineers, American Institute of Electrical Engineers, American Institute of Mining Engineers, American Chemical Society. A joint council consisting of two members from each of these societies will work out a scheme of operation for

1916. The Engineers' Club is considering the question of joining the association as a charter member, and an invitation has been extended to the Washington Chapter of the American Institute of Architects. The members of the preliminary joint council are: J. T. Dovey, S. H. Hill, S. C. Lindsay, E. A. Loew, G. A. Collins, Amos Slater, C. E. Magnusson, G. P. James, J. H. Linton, C. A. Newhall, J. L. Hall and Robert Howes.

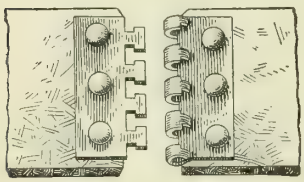
American Road Builders' Association—A special meeting of the board of directors was held in New York on Dec. 16, at which it was decided to hold the convention for 1916 in Pittsburgh, beginning on Feb. 28. The board also adopted a resolution inviting the American Highway Association to hold its annual convention for 1916 at Pittsburgh at the same time. In case the invitation is accepted by the American Highway Association, a committee of the American Road Builders' Association will be authorized to join with representatives of the other association in the preparation of a program for the two meetings, which will avoid the duplication of subjects. The resolution further recited that it was the hope of the directors of the American Boad Builders' Association that some such plan as outlined may be found satisfactory not only for 1916 but for subsequent meetings which may be held under alternate control.

The Minnesota Joint Engineering Board was organized at an informal meeting held recently at the St. Paul Commercial Club. The meeting was called by the president of the Minnesota Section of the American Institute of Electrical Engineeers, and the president or chairman of each of the following engineering organizations was present: Minnesota Section of the American Society of Mechanical Engineers, Northwest Association of the Members of the American Society of Civil Engineers, Minnesota Surveyors' and Engineers' Society, Minneapolis Engineers' Club, Civil Engineers' Society of St. Paul. The dean of the College of Engineering of the University of Minnesota also attended. After general discussion as to how to make the board of greatest value to the engineering profession the meeting was adjourned. It will meet for luncheon at the Minneapolis Club on Jan. 4, at which time it is hoped that the work of organization will be completed.

Appliances and Materials

New Belt Coupling

A new belt coupling, of particular interest to contractors because of the ease of opening the joint, has been brought out by Stewart & Co., 171 Broadway, New York City. As shown in the acompanying sketch, there are two plates riveted to the two ends of the belt (with clinch rivets). From one plate extend a series of eyes engaging the pins of the other plate when the joint is closed. This form of coupling costs complete from 90c. per doz. for 1-in. belts to $2.50 per doz. for the 6-in. size.



STEWART BELT JOINT

* * *

New Glass for Industrial Apparatus

A new borosilicate glass, combining very low thermal expansion with great resistance to attack of chemical reagents, has been developed at the Corning Glass Works, Corning, N. Y. Its specific gravity is 2.25; the mean linear expansion coefficient (19° to 350° C.) is 0.0000032. Water at boiling temperature dissolves an amount of this glass several times less than of the best imported laboratory glass. The physical properties of the new material are due to the simple chemical composition—high silica content and freedom from heavy metals. Water in both thick and thin dishes of this glass exposed to 70° to 90° C. oven temperatures absorbed more heat than in aluminum, tin or enameled earthenware dishes. Resistance to fracture has been studied by dropping 350-gram weights on inverted dishes of 4.3 to 5.8 mm. bottom thickness; falls of 22 to 34 in. were required to break or crack, compared with 6 to 18 in. for enameled earthenware, and 4 to 16 in. for crockery of the same or greater bottom thickness. Culinary ware has been made from this glass and shown to give more rapid baking than that made of metal or earthenware.

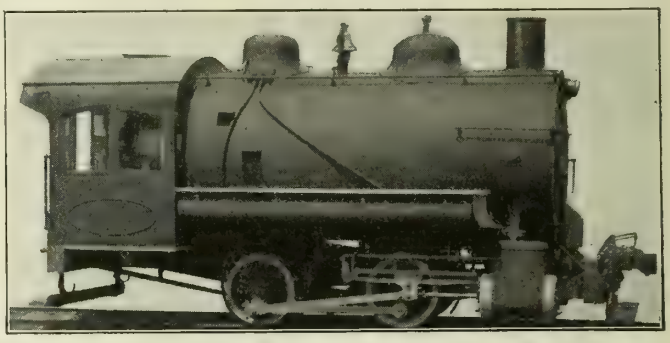
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Steam-Storage Industrial Locomotives

Fireless steam locomotives, in which steam is stored under pressure in a tank taking the place of the ordinary boiler, are desirable for industrial service under certain conditions. Besides eliminating danger from fire, the engines are of comparatively low cost and easy to operate. The illustration shows one of three steam-storage engines built for the National Cash Register Co. by the Lima Locomotive Corporation, of Lima, Ohio.

It is a 38-ton, four-wheel, standard-gage engine, with 9,720 lb. tractive power and a factor of adhesion of 7.9. It has 36-in. wheels and a 6-ft. wheelbase, and is driven by 18x18-in. cylinders. The large cylinder diameter enables the engine to run to the charging station under very low pressure.

The tank is 7 ft. in diameter and 16 ft. long, clothed with 2 in. of magnesia insulation under the steel jacket. Three



STEAM-STORAGE INDUSTRIAL LOCOMOTIVE

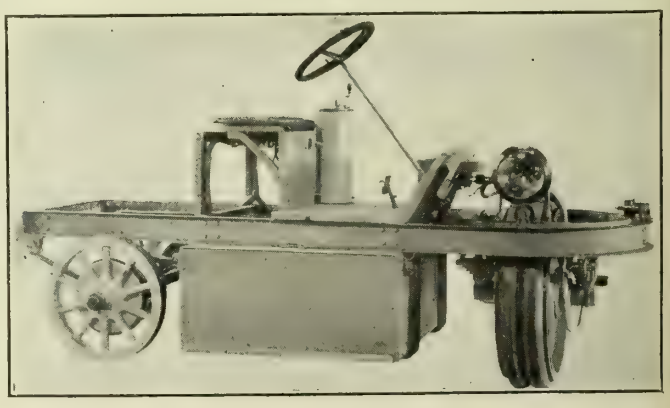
baffle plates with small openings prevent surging of the water, and at the bottom is a 2-in. perforated pipe for charging the steam. With the tank about half full of water, this pipe is connected to the boiler plant and steam forced in under 200-lb. pressure until the pressure in the tank is about 150 to 160 lb. The pressure in the cylinders is reduced to about 60 to 65 lb. by a reducing valve.

A small storage battery supplies current for the headlight. The bell ringer, sand feed and emergency brake are operated by compressed air from tanks which are charged at the power plant. A handbrake is used for ordinary work. The engines operate on about 2 mi. of track.

* * *

A Tractor with One-Wheel Drive

An electric three-wheel tractor, designed to replace team haulage where possible, has been placed on the market by the Couple-Gear Freight-Wheel Co., of Grand Rapids, Mich. The tractor is approximately the length of a team and wagon and can be turned in less space (see view). The motor is contained in and inclosed by the forward wheel and is held rigidly between the steering forks, so that the wheel revolves around the motor. On each end of the motor shaft is a small



TRACTOR WITH SINGLE-WHEEL DRIVE

pinion which engages with a circular rack fastened inside the rim. Tractors of this general design have been ussed to haul lumber from mill to yard and have given good service. The loads, of 3 to 5 tons, were hauled on planking.

In producing a tractor for general freight haulage, the manufacturer proposes that one tractor be used in connection with two wagons—one wagon being loaded while the other is being delivered and unloaded. The Radcaw Lumber Co., of Stamps, Ark., states that on May 1, 1915, it replaced 15 mules and drivers with three tractors. Once a day 15 min. is spent in oiling the machines, and at night the batteries are charged, 4 hr. being required for this operation.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

BUSINESS SLOWLY IMPROVING

The shock given to business in May was perhaps overcome in June, but the volume does not increase as steadily as many believed it would. There seems to be every indication that the groundwork has been prepared for the most prosperous year in the history of the country. There were large crops last year and they were sold at high prices. The prospects are that the crops of this year will be fully as remunerative to the farmer, although it is still too early to talk of the corn crop, and besides, industrial activity is picking up. Still general business does not improve as was expected. The only explanation of this is that people are either saving it or paying their debts, and the former is the more probable. The financial situation will be built on this structure, and was never so sound as it now is. With the steady savings of a great population following an accumulation of capital piled up in 1914, this country is buying back from Europe, at bargain prices, securities sold there years ago. The securities that are coming back, too, are not being paid for in legal tender, but in food stuffs and munitions of war, all of which are commanding high prices.

Foreign business has been large, and fortunately, much of it has been for staple goods and not for war munitions. The car equipment companies and the builders of motive power have had a number of orders for quantities of cars and locomotives. Foreign orders are likewise resulting in American manufacturers taking up new ideas of work and effecting economies therein. The enormous orders for aëroplane engines will result in the building of new types of engines on a scale hitherto thought out of the question, and that in itself will result in lowered costs and make possible the building of better high-speed engines than ever before. A Russian order for locomotives required copper fire box lining, and although these have been rolled in the United States before they have not been of arsenical copper. This will save perhaps half a cent per pound in the refining, and at the present price of copper fully a cent per pound in the deleterious material therein contained.

War orders have been just as large as ever, but few of them have gone forward. It is impossible to secure machine tools of some classes within six months, and manufacturers are unwilling to make any contracts for forward delivery. As war orders continue to increase the number of shops turning from peaceful pursuits to manufacture weapons of destruction increase, and there seems to be no limit to the manufacturing establishments taking orders of this character.

The iron trade has increased steadily, and some of the mills are now operating to 90% of capacity, although 80% would be more nearly the general average. It is noteworthy that the Steel Corporation has put in operation some of its plants which cannot be operated at a profit except when prices are fairly remunerative. This is taken by the trade to mean that the Corporation sees higher prices for steel.

The demand for metals continues unabated, but the ridiculously high prices which were current early in June have given away to more reasonable quotations. Spelter, which went up to 29c., is now available at around 20c. Lead which sold at 7c. can be had at 5¾c. Copper which sold at 20½c. has dropped off about a half a cent. In brass tubes, rods, and sheets, there is much irregularity, and practically no current quotations.

Shipbuilding work is extremely active. All of the yards on the Atlantic Coast have orders which will keep them busy for the next twenty-four months, and quite a little business has been taken by yards on the Pacific Coast. The Great Lakes shops also are busy, either repairing, building, or cutting boats in two so that they can be transported through the Welland Canal to the Atlantic Seaboard.

Contracting work has not been so active. There are a great many small jobs in prospect, but the larger jobs are being held up awaiting more definite news relative to financeering. At least one contract has been noted where the condition precedent to the beginning of the work was that the United States should not be at war on August 1. Subway work in New York continues on a fairly active scale, and there is a prospect that this will be increased later in the season.

Rates for long-time securities are higher, and while it is possible to obtain money in abundance, bankers are reluctant to let it go out on long-time investments for municipal purposes unless 4½ to 5½% can be had. In some cases, cities are changing their financial policy by issuing serial bonds, which find more ready favor among investors, and perhaps much of the work now held up can be carried forward by such schemes.

Cement prices in New York were advanced 10c. per bbl. to $1.42 July 1.

LABOR

The expected shortage of labor has not materalized as yet. There is considerable apprehension at the steel mills, but outside of one or two instances there has been no difficulty in securing all of the needed labor. In the coal mines there is some shortage, as the coal trade is more active, due to large export trade. Among contractors no difficulty has as yet been experienced in securing sufficient men to do the work. This applies to all classes of laborers, and it would be comparatively easy to secure a large number of workmen at $1.75 per day. In some of the recent subway bidding it is evident that the larger companies felt that labor might be higher later in the year, as their figures were considerably higher than formerly. Several strikes have occurred, which indicates that labor is better employed. The fact that some of them were quickly stopped and others nipped in their infancy, indicates that the wiser counsellors among labor leaders perceive that it is not the best time to strike. The Chicago traction strike was somewhat of a political affair, and the tieup of the building trades in that city is not especially remarkable when it is considered that there has been nearly 12 months activity in those trades. A threatened strike by the clerical force of the New Haven R.R. is still in abeyance. Fancy wages are being paid for skilled mechanics having the ability to operate machine tools, and all sorts of inducements are made to them to go to Great Britain and work or to go to Canada. In this line, wages have risen in a spectacular way. There is every reason to believe that from now on the countries at war will produce more of their own war munitions than they have in the past. Whether this will reflect on the American output or not is another question.

CEMENT, LIME AND BRICK

Portland Cement—The consumption of cement is about 80% of the maximum output. Most of it is going into small work; that is, aside from the subways in New York, there is very little large work going on. Railroads are doing practically nothing, and this is the one reason why business in the cement trade continues so dull. The advance of 10c. per barrel made earlier in the month, bringing the price to 92c. New York, less the price for bags, and $1.32 the price with bags, has been fairly well sustained, most of the smaller companies being out of the market. There seems to be very good reason to believe that business in the South has improved to a much greater degree than was thought possible when the strenuous competition in that district is taken into consideration. In the West there has been some excellent trade from the road builders. In the East, the reluctance of the railroads and large corporations to spend money has been a telling factor, but at the same time highway work has taken more cement than usual. In the west prices are above 5c. per bbl. higher. The following quotations are current at the points named, and do not include the usual charge for bags:

Chicago	$1.11	Boston	$1.16
Detroit	1.20	Cleveland	1.20
Jersey City	0.74	Duluth	1.37
New York	0.93	Minneapolis	1.37
St. Paul	1.37	Pittsburgh	1.05

Crushed Stone—The entrance of the new interests in the crushed stone business into the New York market has brought about demoralizing conditions. There seems to be no price. It is more a question of getting an order. Sales have been made as low as 65c. per cu.yd. delivered alongside of dock, New York, and when the difference between the various sizes is taken into consideration, even lower prices in proportion have been made. The market seems without bottom, and moreover, there is practically no new business.

Gravel—Sellers of gravel in the New York market have not met the competition of the crushed stone men, but have kept prices fairly steady at 90c. to $1 for subway gravel. The reason for this is the long-time contracts made for some subway gravel at higher prices. Many contractors prefer to use gravel at a dollar rather than crushed stone at 70c.

Lime—The market is steady and without change. Standard 300-lb. special finishing sells at $1.55 to $1.60. Eastern common sells at $1.15.

Brick—The manufacture of brick in the Hudson River district is about 70% of capacity. The stock of bricks in the yards is large. Although there have been larger stocks in years past, the stock now on hand would be enough to break the market under ordinary conditions. Prices are not at all firm at $6@6.50 for Hudson River common and $6.25 for Raritan River brick.

IRON AND STEEL

Pig Iron—The production of pig iron during May was larger than in the corresponding month last year. The blast furnaces of the country are running to 80% of capacity, prices are firmer, and in general the feeling in the pig-iron trade is much more optimistic than a month ago. Individual sales have not been large but have been numerous. Blast furnace interests are reluctant to sell for forward delivery unless premiums above present prices are given. The demand for steel-making iron is relatively more active than foundry iron, although a noticeable improvement in inquiries for foundry brands has sprung up within the last fortnight. An advance of 25c. a ton in the price of southern iron brings the price to $9.75, and is the important price change of the month. Basic iron is also higher. While the price of coke is only 10c. per ton higher than a month ago, this is having its influence in the pig-iron market. Prices in lots of 100 tons or over at the points named are as follows: Cincinnati Southern Foundry No. 2, $12.50 to $13. Cincinnati Northern Foundry No. 2, $13.75 to $14.25. Cincinnati Northern Foundry No. 3, $13.50 to $13.75. New York Northern Foundry No. 2X, $14.25 to $14.50. New York Northern Foundry, No. 2 plain, $13.75 to $14. Southern Foundry No. 2 in the New York market is $14.25. In Chicago, Northern Foundry No. 2 is $13 to $13.50. In Birmingham, the principal pig-iron interests report that they have no iron for sale for any delivery at less than $10. Other interests are quoting $9.75 to $10. In Pittsburgh, Bessemer iron is $14.65 and basic, $13.55 for July and August delivery; $13.65 to $13.70 for delivery over the second half of the year. This includes the 95c. freight charge from the valley to the Pittsburgh district.

Steel Rails—Business has been fairly satisfactory, and the rail mills are busier than at any time in the last year. The Pennsylvania order for upwards of 150,000 tons was placed, and this order included some 125-lb. rails. Other railroads in the United States bought sparingly, it is true, but still there was a fair business contracted. Most of the business aside from the Pennsylvania order has been for foreign accounts. The Russian Government has placed some orders, but practically all of the business from Russia has been of such dilatory nature that only the most patient firms are willing to continue negotiations. Some orders, particularly for engines, were hanging fire for several months, and it is creditably reported that a shell order was delayed six weeks, due to a small difference in the ideas of price. The French Government has purchased a fair tonnage of light rails. The subway and elevated lines in New York are buying small quantities from time to time for new construction. Prices for lots of a thousand tons or over are as follows: Standard sections of Bessemer, $28; Open Hearth, $30, both per gross ton f.o.b. Pittsburgh. In last month's issue an error was made in stating that Bessemer and open hearth rails were sold per net ton. Girder rails in 30-ft. lengths are $36.40 per gross ton; in 60-ft. lengths, $38.40 per gross ton, both f.o.b. New York. Other quotations f.o.b. Pittsburgh for large lots, the prices being given in cents per lb., are as follows:

Standard sections, 1.25c.; 20 to 30 lb., 1.15c.; 15 to 20 lb., 1.20c.; 12 to 18 lb., 1.25c.; 8 to 12 lb., 1.30c.

Track Supplies—The picking up of business which was noted last month continues, but is not especially active. An advance of a dollar a ton in tie plates is noted, the price in Chicago being $23.25 to $24.25 per net ton. Standard railroad spikes are $1.40 to $1.50 Pittsburgh. In Chicago prices are quoted at $1.50, track bolts and square nuts $1.90 in carload lot. Angle bars are likewise quoted at $1.50. These prices are per 100 lb. It is reported that the Baltimore & Ohio recently bought 10,000 kegs of spikes.

Structural Shapes—An advance of 5c. per 100 lb., which was to have taken place on July 1, occurred about the middle of the month. Fabricating orders are not especially large, but there is a great deal of strength in the market for shapes, due to a demand from car builders and shipbuilding concerns. There is also a very good tonnage just now being shipped out of the mills for the new Rapid Transit construction in New York. Prices as stated are higher, for I-beams 3 to 15 in., channels 3 to 15 in., angles 3 to 6 in., T's 3 in. and over, 1.25c. Other quotations include I-beams over 18 in., H-beams over 18 in., channels over 15 in., angles over 14 in., 1.30c.

Cutting to specified lengths is charged at the following rates: 3 ft. to 2 ft. inclusive, 25c.; 2 ft. to 1 ft., 50c.; under 1 ft., $1.55. No charge is made for cuttting to specified lengths above 3 ft. In Philadelphia the base price is $1.41, in San Francisco $2.05 to $2.10, and in New York $1.42. All these prices are per 100 lb.

Plates—The activity in shipbuilding yards continues, and within the last month there have been a number of orders placed for cars, which has resulted in much new business for plates. All of the larger mills are holding to $1.20 Pittsburgh for plates, and some of them state they will not accept orders for third-quarter shipment at less than $1.25. It is evident that the shipbuilding yards have about all the work they can take care of for the next two years, but car orders are still small. The price of plates is $1.20 to $1.25 Pittsburgh, equivalent to $1.29 to $1.34 Chicago, $1.36 to $1.41 Philadelphia, $1.37 to $1.42 New York. All of these quotations are per 100 lb.

Pipe—Business has been more active, both in the black and galvanized. Galvanized pipe is selling at unheard of prices, and as a further effort to restrict consumption mills are accepting orders only on the basis of 60% black pipe and 40% galvanized. This of course accounts for an increase in the demand for black pipe. The recent decline in spelter may bring about lower prices for galvanized, but still there is little likelihood of any cheap galvanized pipe for some time to come.

	Black	Galvanized
¾- to 2-in. steel, butt welded	79%	57½%
2½- to 6-in. steel, lap welded	78%	56½%
7- to 12-in. steel, lap welded	76%	54½%

At these discounts the net prices of pipe per foot, in large in lots Pittsburgh, are as follows:

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
¾-in.	2.43	4.88	5-in.	32.56	64.38
1-in.	3.57	7.22	6-in.	42.24	83.52
1¼-in.	4.83	9.77	7-in.	57.12	1.08
1½-in.	5.77	11.68	8-in.	60.00	1.13
2-in.	7.77	15.72	9-in.	82.80	1.56
2½-in.	12.87	25.44	10-in.	98.88	1.87
3-in.	16.83	33.27	11-in.	1.11	2.10
4-in.	23.98	47.41	12-in.	1.21	2.31

	Cents per Pound—Large lots Pittsburgh		Cents per Pound—Warehouse delivery New York	
	Black	*Galv.	Black	*Galv.
No. 10	1.55	4.50	....	....
No. 12	1.55	4.60	....	....
No. 14	1.60	4.60	....	....
No. 16	1.65	4.70	2.35	5.25
Nos. 18 and 20	1.70	4.85	2.40	5.40
Nos. 22 and 24	1.75	4.95	2.45	5.55
No. 26	1.80	5.20	2.50	5.75
No. 27	1.85	5.35	2.55	5.85
No. 28	1.90	5.50	2.60	6.00

*Quotations nominal.

Cast-Iron Pipe—Pipe foundries are running about 70% to 80% of capacity. There was a fair amount of export business reported from the Birmingham district, but that is retarded on account of the high freight rate. The advance in the price of pig iron is responsible for the strength in certain markets, such as Chicago, but the entire tendency seems to be upward. In New York, Classs A pipe and gas pipe is $23.50 to $24 per net ton, while Class B pipe is $22.50 to $23.50. In Birmingham, 4 in. is $20, 6 in. and upward, $18. In Chicago prices are 50c. a ton higher than last month, 4 in. being held at $26; 6 to 12 in., $24; 16 in. and upward, $23.50. For Class A pipe and gas pipe $1 per ton extra is charged. All of these prices are per net ton.

Sheets—The mills are operating to about 80% of capacity, and this in spite of the fact that several are refusing to make contracts for galvanized sheets, practically all of them holding their salesmen down to confirmation of their orders by telegraph, and still others doing everything they can to discourage sales. The price of No. 28 galvanized is 5c. per lb. at the mills. This is a difference of 3c. between galvanized and black, compared with about 1c. ordinarily. That trade will quickly turn to black sheets, or stop using sheets for the time being as much as possible, is admitted by all hands. There has been a recent drop of 6 to 8c. in the price of spelter, but this is scarcely enough to let out the galvanizing mills. If the price drops to around 12 or 15c. there is no doubt that prices would be more nearly normal. Black sheets are quiet, although the falling off in the demand for galvanized has resulted in a heavier increase for black. The following quotations are for large lots of sheets f.o.b. Pittsburgh and small lots from store New York:

	Cents per Pound—Large lots Pittsburgh		Cents per Pound—Warehouse delivery New York	
	Black	*Galv.	Black	*Galv.
No. 10	1.55	4.50	....	....
No. 12	1.55	4.60	....	....
No. 14	1.60	4.60	....	....
No. 16	1.65	4.70	2.35	5.25
Nos. 18 and 20	1.70	4.85	2.40	5.40
Nos. 22 and 24	1.75	4.95	2.45	5.55
No. 26	1.80	5.20	2.50	5.70
No. 27	1.85	5.35	2.55	5.85
No. 28	1.90	5.50	2.60	6.00

*Quotations nominal.

Steel Sheet Piling—Prices are somewhat higher, at $1.55 to $1.60 per 100 lb. f.o.b. Pittsburgh.

Old Materials—In all materials the market appears to be considerably better than a month ago. There have been numerous advances, and moreover, customers are asking for material. Holders of scrap are not disposed to let go of it at these prices. Then, with the advance in pig iron, foundrymen are coming into the market. In New York an advance of 50 to 75c. a ton in No. 1 machinery cast is noted, and stove plate is $1 per ton higher than a month ago.

	Per Gross Ton
Heavy-melting steel scrap	$9.00 to $9.25
Pipes and flues	8.25 to 8.50
No. 1 railroad wrought	10.50 to 10.75
Stove plate	8.75 to 9.25
No. 1 machinery cast	12.00 to 12.50
Wrought turnings	6.00 to 6.25

The principal news in Chicago market is much larger buying of heavy melting steel scrap. Prices are unchanged, but the demand is far more active. Then there has been an advance of 50c. per ton in agricultural malleable and one of 25c. per ton in railroad malleable.

	Per Gross Ton
Heavy-melting steel scrap	$9.50 to $9.75
	Per Net Ton
No. 1 railroad wrought	$9.00 to $9.25
No. 2 railroad wrought	8.25 to 8.75
No. 1 cast scrap	9.00 to 9.75
Pipes and flues	6.25 to 6.75
Agricultural malleable	7.75 to 8.00
Railroad malleable	8.50 to 8.75

The Pittsburgh market is dull. The demand does not seem to have reached there yet, and although there is an advance of 25c. a ton in foundry cast and a similar one in machine shop turnings, the general market is lifeless.

	Per Gross Ton
Heavy-melting steel scrap	$11.75
Rerolling rails	11.75 to 12.00
No. 1 foundry cast	12.25 to 12.50
Old car wheels	11.75 to 12.00
Machine shop turnings	8.00 to 8.25
Railroad malleable	10.50 to 10.75

Chain—Prices are steady and without change, as follows. These prices are per 100 lb., f.o.b. Pittsburgh:

3/16 in.	$7.50	½ and 5/8 in.	$3.00
¼ in.	4.95	5/8 and 11/16 in.	2.90
5/16 in.	3.95	¾ and 13/16 in.	2.80
3/8 in.	3.40	⅞ ond 15/16 in.	2.70
7/16 in.	3.20	1 to 1¼ in.	2.60

EXTRAS TO ABOVE LIST PER -00 POUNDS

	For BB	For BBB
3/16-in. and ¼-in.	$1.50	$2.00
5/16-in. and larger	1.25	1.75

Wire—The demand for wire is excellent, and it is practically impossible to secure any immediate delivery of barbed wire. Consequently, orders on this product are being turned down daily. Prices are extremely firm, $1.35@1.40 being asked for annealed fence wire, and $1.60 for painted barbed

wire. Galvanized barbed wire and fence staples are $2.40, but even at this price there is some uncertainty about getting deliveries. All of these prices are f.o.b. Pittsburgh and per 100 lb. Woven wire fencing is higher, being quoted at 79% off in carload lots, 68% in 1000-rod lots, and 67% in small lots, f.o.b. Pittsburgh.

Merchant Steel—Business continues to improve, especially for small lots from merchants' store. There has been no change in price, but it is probable that before the end of the month an advance of at least 5c. per 100 lb. will be made. Quotations from jobbers' store in New York are as follows:

	Cents Per Pound
Refined iron:	
1 to 1⅞ in., round and square	1.85
1½ to 4 in. x ⅜ to 1 in.	1.85
1½ to 4 in. x ¼ to 5/16 in.	2.05
Norway bars	3.20
Burdens bar iron	3.15
Soft steel:	
¾ to 3 in., round and square	1.85
1 to 6 in. x ⅜ to 1 in.	1.85
1 to 6 in. x ¼ and 5/16	2.00
Rods—⅝ and 7/16 in.	1.95
Bands—1½ to 6x 5/16 in. to No. 8	2.15
Beams and channels—3 to 15 in.	1.90
Angles:	
3 in. x ¼ in. and larger	1.90
3 in. x 5/16 in. and ⅛ in.	2.35
1½ to 2¾ in. x 5/16 in. and thicker	2.00
11½ to 2½ in. x ⅛ in.	2.10
1 to 1¼ in. x ⅛ in.	2.10
1 to 1¼ in. x ⅛ in.	2.15
Tees:	
1½ to 2½x¼ in.	2.05
1½ to 2½x 5/16 in.	2.15
3 in. and larger	1.95

Wire Rope—Business shows some increase, but the demand is not yet up to normal. Discounts are unchanged at 47 and 5% from list for galvanized, and 55 and 5% for bright. At these discounts the net prices of wire rope at the mills are as follows:

Diameter in Inches	Price per Foot—Cast Steel	Crucible Steel	Plow Steel
2½	$0.75	$0.90	$1.07
2¼	0.61	0.73	0.86
2	0.47	0.57	0.67
1¾	0.39	0.49	0.58
1½	0.28	0.34	0.40
1¼	0.20	0.24	0.27
1	0.13	0.15	0.18
¾	0.08	0.09	0.11
⅝	0.06	0.07	0.08

Freight Rates—The freight rates on finished steel products from the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized, wire nails, rivets, spikes, bolts, black sheets (except planished), chain, etc., are as follows, in cents per 100 lb.: Boston, 18.9c.; Buffalo, 11.6c.; Baltimore, 15.4c.; Cleveland, 10.5c.; Cincinnati, 15.8c.; Chicago, 18.9c.; Denver, Colo., 68.6c.; New Orleans, 30c.; New York, 16.9c.; Philadelphia, 15.9c.; St. Louis, 23.6c.; Minnesota and St. Paul, 32.9c.; Pacific Coast (all rail), 80c.

REINFORCING MATERIALS

Triangle Mesh—The demand shows a steady improvement. Prices are firm.

PRICE PER 100 SQ.FT.

Style No.	Cross Sec. Area per Ft. Width	Plain Material—Carload Lots	Plain Material—Less Than Car Lots and Over 10,000 Sq.Ft.	Galvanized—Carload Lots	Galvanized—Less Than Car Lots and Over 10,000 Sq.Ft.
†4	0.102	$1.00	$1.23	$1.12	$1.34
5	0.077	0.80	0.97	0.89	1.00
6	0.058	0.63	0.77	0.71	0.84
†7	0.041	0.49	0.60	0.55	0.66
†23	0.170	1.69	2.05	1.88	2.24
24	0.142	1.46	1.77	1.62	1.93
25	0.124	1.29	1.57	1.43	1.71
†26	0.110	1.17	1.42	1.30	1.55
†27	0.085	0.96	1.17	1.07	1.28
28	0.066	0.80	0.97	0.89	1.06
29	0.049	0.66	0.80	0.73	0.87
31	0.261	2.49	3.02	2.76	3.29
32	0.225	2.16	2.62	2.40	2.86
33	0.196	1.93	2.34	2.14	2.55
34	0.140	1.48	1.80	1.64	1.96
35	0.109	1.117	1.42	1.30	1.55
36	0.075	0.87	1.05	0.97	1.15
38	0.380	3.55	4.30	3.93	4.68
†39	0.325	3.05	3.70	3.38	4.03
40	0.283	2.68	3.25	2.97	3.54
41	0.208	2.05	2.48	2.27	2.70
42	0.151	1.55	1.88	1.72	2.05
†43	0.101	1.10	1.34	1.23	1.46

Bars, Concrete Reinforcing—A tremendous amount of business is being done at the mills for the agricultural implement makers, which has resulted in higher prices. This carries with it an advanced quotation for reinforcing bars of $1 per ton at the same mills. The demand for reinforcing bars is not so active as for other bars, but it is far better than at any time in the last year. Prices are higher as stated and are quoted as follows:

Size	Cents per Pound—Mill Shipments Pittsburgh	*Warehouse Pittsburgh	Delivered from *Warehouse New York
¾-in. and larger	1.25	1.60	2.05 to 2.10
⅝-in.	1.30	1.75	2.10 to 2.15
½-in.	1.45	1.90	2.25 to 2.30
⅜-in.	1.55	2.00	2.35 to 2.40
¼-in.	1.83	2.30	2.70 to 2.75

*Bars from warehouse are cut to desired length without extra charge.

CLAY PRODUCTS

Sewer Pipe—There is a great deal of municipal work going on, and as a result quite a flood of inquires has been received. Sales as compared with the same period a year ago have shown an increase. However, prices remain unchanged, the following discounts still being effective: On 3 in. to 24 in., 80% off list; 27 to 30 in., 70%; 30 to 36 in., 65%. At these discounts, prices are as follows:

PRICE OF SEWER PIPE PER FOOT

Size		Size	
3-in.	$0.05	18-in.	$0.38
4-in.	0.05	20-in.	0.45
5-in.	0.08	22-in.	0.60
6-in.	0.08	24-in.	0.65
8-in.	0.11	27-in.	1.35
10-in.	0.16	30-in.	1.65
12-in.	0.20	33-in.	2.20
15-in.	0.27	36-in.	2.45

Flue Lining—The discount on this material remains unchanged at 80% off list. At this rate, prices are as follows:

FLUE LINING PRICE PER FOOT

Size	Weight in Lb.	Price per Ft.	Size	Weight in Lb.	Price per Ft.
4½x8½-in.	14	$0.07	8½x18-in.	45	$0.18
4½x13-in.	20	0.09	13x13-in.	45	0.17
7½x7½-in.	15	0.08	13x18-in.	57	0.24
8½x8½-in.	18	0.09	18x18-in.	75	0.40
8½x13-in.	28	0.13			

METALS

Copper—Dullness marked the refined copper trade more or less during the present month. At times however activity was apparent and prices have been maintained although a tendency toward lower prices was evidenced on more than one occasion. Stocks decreased 20,000,000 lb. during May and refineries are not increasing their output as rapidly as might be but a substantial increase in production is looked for in June. Important producers expect a renewed demand for electrolytic, as the nations at war are making inquiries for large amounts. Exports of copper since June first were 14,400 tons while imports at ports in the United States were 3140 tons of copper. Prices have fluctuated from 18½ to 20½c. the latter price being the quotation at the close of the market on June 26.

Tin—Deliveries of tin into the New York market have been larger during June. The demand on the whole has been good and prices have remained high after the advance reported last month. England placed an embargo on shipments of tin plate to Denmark, Norway, Sweden and Holland resulting in maintaining prices. This caused consumers to make inquiries for both spot and future shipments. The statistical position of tin on July 1 is likely to be favorable as the outlook is that Atlantic Coast deliveries may reach 2800 tons and importations on the Pacific Coast about 1000 tons. This indicates heavy American consumption. The suggestion is made that advances made in prices in London, due to the embargo announcement will result in American producers entering the breach and supplying the neutral countries affected by the order. This should force American consumers to import larger stocks of tin. Spot tin is quoted at 41c., New York.

Lead—The market has been very active during the past month. Prices advanced steadily until June 15 since which time a slight reaction has developed. Italy has an inquiry out for 2000 tons and it is expected contracts will be closed soon. Prices went as high as 8c. but toward the end of the month the situation warranted prices on a basis of 5⅞ to 6c. Speculation entered into the rise and those who were responsible for the advance are now selling at the lower prices.

Spelter—Prices reacted after the sensational advance last month. The heavy buying resulted in an actual advance to 27c. This was mainly due to concentrated buying by American manufacturers. It is said that about 100,000 tons entered into the recent transactions. Toward the end of June the reaction brought spot spelter as low as 17c. to 18c. but many transactions involving small lots are reported at 20c.

MISCELLANEOUS

Railway Ties—Because of the long period of dullness in this market, dealers feel confident that the railroads will soon place some orders and expect that business will pick up during the month of July. First-class standard ties 7x9 in.x8 ft. 6 in. sell at 73c., and 6x8 in.x8 ft. at 60c., these prices being f.o.b. New York.

Asphaltum—A considerable amount of work is now being done in the State of Florida, and highway bonds for $1,200,000 have been issued in two of the counties. The price of Mexican asphaltum is $13.50 per net ton, packed in wooden barrels f.o.b. refineries.

Chemicals—The demand for ammunition has worked a revolution in the chemical industry and has caused some prices to go to almost unheard of levels. Calcium hypochlorite sells at 1¼c. to 1½c. per lb. f.o.b. maker's works. Alumina sulphate is strong and will continue at a high level as long as the phenomenal demand continues for sulphuric acid. The price is $1.65. For alumina ferric sulphate $1.50 is demanded. Liquid chlorine sells at 10c. per lb. maker's works.

RAILWAYS—STEAM AND ELECTRIC

Maine—Skowhegan & Athens Electric R.R.—Plans are being considered by this company for the construction of an electric railway from Skowhegan to Athens, about 12 miles. H. E. Trueworthy, George F. Ayer and James Chapman, Athens, are interested.

Massachusetts—Bay State St. Ry.—This company has applied to the City Council of Revere, Mass., for permission to reconstruct its line on Revere St. from Pierce to Bellevue St. R. S. Goff, Boston, is Vice-Pres. and Gen. Mgr.

✚★New York, N. Y.—(Borough of Queens)—(Official)—The contract for the grading and masonry work on Section 2 of the New York Connecting R.R. has been awarded to WILSON & ENGLISH, 50 Church St., New York, for the first section of this contract and to PATRICK McMANUS, INC., Philadelphia, Penn., for the second section. A. C. Shand, Broad St. Station, Philadelphia, is Ch. Engr., Southern Division. Noted May 20.

New York—The Chamber of Commerce, Troy, N. Y., is considering plans for the construction of an electric railway from Troy to Rensselaer.

New Jersey—Easton & Washington Traction Co.—Plans are being prepared by this company for the extension of its line to Hackettstown and Lake Hopatcong, about 19 miles. W. O. Hay, Easton, Penn., is Secy., Gen. Mgr. and Pur. Agt.

New Jersey—Public Service Ry.—This company has been granted permission to double track its line on Raritan Ave., Raritan, N. J. R. E. Danforth, Newark, is Gen. Mgr.

Pennsylvania—Pennsylvania R.R.—This company contemplates the construction of a new branch freight line into Steelton, Penn., along the bed of the old Pennsylvania Canal. A. C. Shand, Philadelphia, is Ch. Engr.

Maryland—Chesapeake & Curtis Bay R.R.—This company has been incorporated to construct a belt line from the pier of the United States Asphalt Refining Co., on the north side of Curtis Bay, northerly and easterly to the Baltimore & Ohio R.R. tracks in East Brooklyn, Baltimore. Richard D. Upham, New York, and J. Cookman Boyd, John H. Zink, G. Aubrey Beard and Richard B. Pue are the incorporators.

West Virginia—White Sulphur & Huntersville R.R.—This company plans to construct an electric railway to connect White Sulphur, Montague, Mapledale, Divide, Alvon and Shryock, about 27 miles. T. J. Shryock, Baltimore, Md., is Pres.

North Carolina—Statesville Air Line R.R.—Preliminary arrangements are being made and work will soon be started by this company on the construction of its proposed railway from Statesville to a point between Harmony and Houstonville. D. M. Ausley is Treas. and Gen. Mgr.

Georgia—North Georgia Mineral R.R.—This company is making surveys for the construction of a railway from Atlanta to Warfords Crossing. W. J. Morrison, Alex. C. King and J. J. Spalding, Atlanta, are interested.

Florida—W. S. Gardner, Secy., Arcadia Board of Trade, is negotiating with a view to the construction of a railway from Arcadia, via the Everglades to the eastern coast of Florida.

Florida—St. Petersburg & Gulf Ry.—This company contemplates the extension of its electric railway from St. Petersburg to Pinellas Park and Clearwater, Fla. W. M. Mosedale, St. Petersburg, is Ch. Engr.

Alabama—Peoples R.R.—Plans are being considered by this company for the extension of its line from Fairhope to Robertsdale, Ala., about 14 miles.

Alabama—W. W. Shortridge and associates have applied to the City Council of Birmingham, Ala., for a franchise to construct an electric railway from Birmingham to the Warrior River. Noted June 24.

✚Mississippi—Meridian & Memphis Ry.—This company has awarded a contract to C. G. KERSHAW & CO., Birmingham, Ala., for the completion of its line to Meridian.

Mississippi—Yazoo & Southern R.R.—This company has been organized to construct a railway from Yazoo City to Carthage, Miss., about 62 miles. George U. Nichols and S. Murphy, Chicago, Ill., are Dirs.

Kentucky—Charles Edwards, representing White & Co., Chicago, Ill., has secured the right-of-way from John W. Overall for the construction of an electric railway from Lebanon to Smithville. It is stated that the proposed railway will connect with the Nashville, Chattanooga & St. Louis Ry. at Lebanon, which will later be electrified.

✚Kentucky—Louisville & Nashville R.R.—This company has awarded a contract to GRANT MASON, Pineville, Ky., for the extension of its Martins Fork line to Grays Branch.

Ohio—Western Ohio R.R.—This company is considering plans for the extension of its electric railway from St. Marys to Minster, Ft. Loramie and Covington. J. W. S. Riegle, Findlay, is Ch. Engr.

Indiana—Public Utilities Co.—This company has been granted a franchise to extend its Main St. line in Evansville, Ind. A. C. Blinn, Evansville, is Vice-Pres. and Gen. Mgr.

Illinois—The residents of Stevensonville, a suburb of Bloomington, Ill., have petitioned the City Commission to construct an electric railway to that part of the city. A loop system by which the West Washington and Miller Park lines of the Bloomington St. Ry. can connect with a line through Stevensonville is proposed. A. G. Erickson, Comr., is trying to interest the Bloomington & Normal Ry. & Light Co. in the project.

Illinois—Aurora, Mendota & Western Traction Co.—The City Council of Aurora, Ill., has granted a franchise to this company to construct an electric railway through the city. This is part of a proposed line to connect Bristol, Plano, Sandwich, Leland, Earleville, Mendota and Princeton. Noted Apr. 15.

Illinois—Calhoun County Ry.—This company plans to construct an electric railway from Pearl to Golden Eagle, Ill. John E. Melick, Kampsville, is interested.

✚Illinois—New York, Chicago & St. Louis Ry.—The contract for filling on the Chicago track elevation work has been awarded by this company to P. T. CLIFFORD & SON, Valparaiso, Ind. E. E. Hart, Cleveland, Ohio, is Ch. Engr.

Kansas—Hutchinson Interurban Ry.—This company plans to extend its line on Second St. from Main to Walnut St., Hutchinson, Kan. James E. Humbert, Hutchinson, is Gen. Mgr. and Pur. Agt.

Kansas—Southwestern Interurban Ry.—This company plans to extend its electric railway from Winfield to Albright Gardens, near Oxford. S. M. Bradley, Winfield, is Ch. Engr.

Arkansas—A company is being organized to construct a railway from Huntsville Ark., to a connection with the St. Louis & San Francisco R.R., about 15 miles.

Arkansas—Boyd Mayo and D. J. Clotworthy, Turner, and J. F. Watkins, Postelle, are interested in a project to construct a railway from Turner to Postelle, Ark., about 10 miles.

Washington—A project to construct a belt railway to connect with the trackage of different piers owned by the Port of Seattle, is being considered by the Commission. J. R. West is Ch. Engr. of Comn.

Oregon—Oregon-Washington R.R. & Navigation Co.—Plans are being made by this company to construct an extension to its line from Riverside to Crane Creek Gap, Ore., about 30 miles. J. R. Holman, Portland, Ore., is Ch. Engr.

Oregon—Southern Pacific Co.—Plans are being considered by this company for the electrification of its line from Whiteson to Corvallis, Ore., about 43 miles. William Hood, San Francisco, Calif., is Ch. Engr.

California—Castro Point Ry. & Terminal Co.—This company has been granted permission to construct a two-mile railway along the waterfront in Richmond, Calif. Estimated cost, $90,000. Blake Bros. is interested.

California—Tidewater Southern Ry.—This company will extend its railway through Ceres to Turlock, Calif. J. H. Wallace, Stockton, is Ch. Engr.

Alberta—Athabasca & Ft. Vermilion Ry.—This company has started surveys for the construction of its proposed railway from Athabasca to Trout Lakes and Ft. Vermilion, about 300 miles. Noted Apr. 29.

Manitoba—H. W. Adcock, Winnipeg, is interested in the project to construct a gasoline-operated street car line from Winnipeg to Transcona.

LIGHT, HEAT AND POWER

Sorrento, Maine—It is reported that the town is considering the installation of an electric-lighting system.

Brandon, Vt.—It is reported that the Hortonia Power Co., Brandon, has applied to the Public Service Commission for authority to increase its capital stock, and to issue $600,000 in bonds. The company plans to build a power house in Hortonville.

Hartford, Conn.—The Hartford Electric Light Co. has taken out a permit for the construction of a brick and steel substation on Vandyke Ave. The estimated cost is $7000.

Felts Mills, N. Y.—(Official)—See item under "Miscellaneous."

✚New York, N. Y.—(Borough of Bronx)—Bids were received June 21 by the Department of Education for heating and ventilating apparatus in new Public School 55, St. Paul's Pl. between Park and Washington Ave., Borough of the Bronx, as follows: Blake & Williams, $68,690; D. J. Rice, $70,653; Raisler Heating Co., $73,000; LESLIE & TRACY, 220 West 42d St., New York, $66,530 (awarded contract); Wells & Newton, $68,841.

Stockport, N. Y.—The Public Service Commission has granted a franchise to the Albany Southern R.R. Co. to build transmission lines and install a distribution system for furnishing electricity to the town of Stockport. George F. Silvia, Albany, is Elec. Supt. of the Albany Southern R.R. Co.

✚Philadelphia, Penn.—(Official)—The Board of Public Education has awarded contracts in connection with the construction of new wings to the John Hay School as follows: Heating and plumbing, S. FAITH & CO., 2427 Pennsylvania Ave., Philadelphia, at $15,777 and $3867 respectively; electrical work, J. F. BUCHANAN & CO., 1228 Race St., Philadelphia, $2666; ventilating, WALTERS, PURKS & MELLON, 1835 Ludlow St., Philadelphia, $1285. See item under "Buildings."

Smethport, Penn.—The Borough Council has granted a franchise to the Kane Electric Light & Power Co., Kane, to extend its transmission lines to Smethport to furnish electricity to the town.

Norton, Va.—It is reported that the Norton Coal Co. will rebuild its power house which was recently destroyed by fire at a loss of about $25,000.

Spring Hope, N. C.—The Eastern Carolina Light & Power Co., Spring Hope, will establish a hydro-electric plant on the Tar River, and will build transmission lines to several neighboring towns. The plant will eventually develop 2000 hp., the first installment to be a 250-hp. unit.

Tuscaloosa, Ala.—The Birmingham-Tuscaloosa Ry. & Utilities Co., Birmingham, plans to construct a gas holder with a capacity of 100,000 cu.ft., in Tuscaloosa. The company will also lay new mains.

★New Orleans, La.—The lowest bid received June 9 by the Board of Commissioners, Port of New Orleans, for electric cranes for the cotton warehouses was that of the Hauling Co., of Milwaukee, Milwaukee, Wis., at $65,800. Bids were received at the same time for three horizontal boilers for the cotton warehouse from: John H. Murphy Iron Works, $6440; Walsh & Weidner Boiler Co., $6190; Casey-Hagis Co., Chattanooga, Tenn., $7200; A. Baldwin & Co., Ltd., $8038. Bids were referred to the consulting engineers. Noted May 27.

Batesville, Ind.—See item under "Water Supply-Irrigation."

Elgin, Ill.—James B. Dibelka, State Arch., 130 North Fifth Ave., Chicago, is reported to be preparing plans for the construction of a power house for the State Hospital at Elgin.

Mechanicsburg, Ill.—It is reported that the Decatur Ry. & Light Co., Decatur, will extend its lines to Mechanicsburg to supply electricity to the town.

Wautoma, Wis.—Bids will be received until 7:30 p.m., July 2, by C. T. Taylor, Clk. of School Bd., for heating plant for the public school building. W. G. Kirchoffer, Madison, is Engr.

Wilton Junction, Iowa—(Official)—The City of Wilton contemplates the installation of additional generating machinery in the municipal electric-light plant. David G. Fisher & Co., Davenport, is Engr.-in-Charge. Noted May 27.

Lakefield, Minn.—The citizens have voted to issue $31,000 in bonds for the purpose of installing an electric-light and power plant.

Warren, Minn.—The Electric Light & Water Commission is considering plans to double the output of the municipal electric-light plant. W. R. Haney is Mgr., Supt. and Cont. Agt. of the plant.

Burlington, Kan.—The Excelsior Milling Co., Burlington, is considering the establishment of a hydro-electric plant on the Neosho River.

Bosworth, Mo.—Henrici, Kent & Lowry, Reserve Bank Bldg., Kansas City, has been engaged to prepare plans for the construction of the proposed electric light plant in Bosworth.

Rule, Tex.—The Board of Local Improvements is considering the installation of an electric-light plant in Rule. The estimated cost is $10,000.

Boswell, Okla.—The town is considering the installation of a municipal electric-light plant. The estimated cost is $14,000.

Bracebridge, Ont.—It is reported that the Hydro-Electric Commission, Bracebridge, will rebuild its dam at Bayville, Ont. The estimated cost of the work is $12,000.

Penticton, B. C.—It is reported that the city will spend about $6000 in improving and extending the electric-lighting system.

BRIDGES

Enosburg Falls, Vt.—(A correction)—We are advised that in the list of bidders for a bridge at Enosburg Falls, noted in the issue of June 17, the bid given as that of the Concrete-Steel Engineering Co., at $12,045, should have been credited to the Rennell Construction Co., New York. The Concrete-Steel Engineering Co. is consulting engineer only.

Boston, Mass.—Press reports state that the Boston Elevated Ry. Co. plans to construct a railway bridge over the Mystic River.

Bridgeport, Conn.—At the election held June 20 the citizens voted in favor of constructing bridges at East Washington Ave. and Grand St.

✚Manchester, Conn.—The contract has been awarded to the STANDARD ENGINEERING CO., Albany, N. Y., for the construction of a bridge over the Hockanun River.

New York, N. Y.—(Borough of Bronx)—The War Department has authorized the Public Service Commission to build a new bridge across the Bronx River at Westchester Ave. The plans call for a bridge with a clearance of 61 ft. above mean high water. The river above Westchester Ave. will be closed to navigation by masted vessels unable to pass under the proposed bridge. F. J. H. Kracke is Comr. of Bridges. Noted June 17.

Utica, N. Y.—The City Council has voted to construct bridges over the Mohawk River, at North Genesee St. and Miller Rd.

Trenton, N. J.—The New Jersey Harbor Commission has filed a report with the United States Army Engineers condemning the old Central R.R. bridge over Newark Bay connecting Elizabeth and Bayonne. To replace the present bridge would cost the railroad approximately $2,000,000.

Easton, Penn.—Bids will be received until July 2 by the Board of Commissioners of Northampton County for the construction of County Bridge No. 179, over Oughoughton Creek in Washington Township. H. C. Dilliard is County Engr.

✚Grove City, Penn.—(Official)—The Board of Commissioners of Mercer County has awarded the contract for the construction of the Pine Ave. Bridge over Wolf Creek, Grove City, to the PENN BRIDGE CO., Beaver Falls, at $6150. Other bidders were: Canton Bridge Co., Canton, Ohio, $7987; Farris Bridge Co., Pittsburgh, $7541; T. F. Hungiville, Smethport, $8120; F. S. Wilson, Kittanning, $7874. H. C. Comstock is Clk. of Comrs. Noted June 10.

★Philadelphia, Penn.—(Official)—Bids will be received until noon, July 8, by M. L. Cooke, Dir. Dept. of Pub. Wks., for the construction of three bridges, one each on line of Fifth St., Third St. and Fisher Ave. Plans and specifications are on file at the office of "Engineering News," 36th St. and 10th Ave.

Scranton, Penn.—Press reports state that Charles E. Ryder, Ch. Engr. of the State Water Supply Comn., has recommended that the Delaware & Hudson Co. be compelled to rebuild its South Washington Ave. railway bridge. The bridge is too low, and fails to conform in other respects to the specifications of the Water Supply Commission. The approximate cost was $25,000.

Somerset, Penn.—Bids will be received until 1:30 p.m., July 7, by the Board of Commissioners of Somerset County for the construction of five stone or concrete bridges. Jacob Koonta is County Controller.

Bowling Green, Va.—(Official)—Bids will be received until noon, July 8, by the Board of Supervisors of Caroline County for the construction of the following bridges: One 145-ft. steel bridge over the South River; a 44-ft. span over Temples Mill Stream; a 36-ft. span over Big Swamp, and a 60-ft. bridge over Smoots Mill Pond. The last three will be of reinforced concrete with plain concrete substructures. G. P. Coleman, Richmond, is State Highway Comr.

Richmond, Va.—Bids will be received until 11 a.m., July 8, by G. P. Coleman, State Highway Comr., for the construction of a 71-ft. steel bridge over the Cranes Nest River between Wise and Dickenson Counties, and an 81-ft. bridge over the Cranes Nest River in Dickenson County.

Huntington, W. Va.—Bids will be received until July 6 by the Cabell County Court for the construction of a bridge over the right-of-way of the Chesapeake & Ohio Ry. near Mud River.

Lewisburg, W. Va.—Press reports state that bids will be received until July 6 by J. S. Crawford, Clk. of County Court, for constructing three concrete or steel bridges, two 20-ft. and one 16-ft. span.

Gulfport, Miss.—Bids will be received until July 5 by John J. Murphy, Clk. Bd. Supv., for constructing Rutland Bridge over the Big Biloxi River near Wortham on the public road from Gulfport to Bend.

Knoxville, Tenn.—Press reports state that the Commissioners of Knox County contemplate an expenditure of $21,700 for repairing county bridges.

Frankfort, Ky.—Bids will be received until July 6 by the County Clerk for constructing a 70-ft. steel bridge, 16-ft. wide, f.o.b., Paducah.

✚Cincinnati, Ohio—The contract for the construction of the Park Ave. Bridge over Kemper Lane has been awarded to D. P. FOLEY, Cincinnati, at $125,355. Noted May 20 and June 17.

✚Cleveland, Ohio—The Board of Control has awarded the contract for the construction of a concrete culvert over Doan Brook in Rockefeller Park to C. A. WHITE CO., at $15,300.

Cleveland, Ohio—Bids will be received until 10 a.m., July 14, by E. G. Krause, Clk. of the Cuyahoga County Comrs., for the construction of a reinforced-concrete pipe bulkhead, per report No. 3537. W. A. Stinchcomb is Engr.

✚Dayton, Ohio—The Board of Commissioners of Montgomery County has awarded contracts for the Harshmanville Bridge over the Mad River to FRANCIS MINNIGAN, at $11,889 for the concrete substructure, and to the CENTRAL STATES BRIDGE CO., Indianapolis, Ind., at $11,100 for the steel superstructure.

Youngstown, Ohio—(Official)—Bids will be received until 10 a.m., July 14, by the Board of Commissioners of Mahoning County for repairing and rebuilding the pavement of the South Ave. Bridge, Youngstown. Frank H. Vogan is Clk. of Comrs.

✚Brownsville, Ind.—(Official)—The Board of Commissioners of Union County, Liberty, has awarded the contract for the construction of an extension and approach to a bridge over the Whitewater River at Brownsville to the VINCENNES BRIDGE CO., Vincennes, at $7084. Noted June 17,.

Fowler, Ind.—Bids will be received until July 6 by the Commissioners of Benton County for the construction of three concrete bridges. W. Mankey is County Audr.

Indianapolis, Ind.—The Board of Public Works has approved plans of the Candalia R.R. for the extension of the Vincennes and St. Louis Division Bridges across the White River.

✚Grand Rapids, Mich.—The Board of Public Works has awarded contracts for the construction of the Coldbrook Creek Culvert and a bridge at First St., N. W., to the CARPENTER CONSTRUCTION CO., at $3800 and $2433 respectively.

Lansing, Mich.—(Official)—Bids will be received until noon, July 9, by Frank F. Rogers, State Highway Comr., Lansing, for the construction of six trunk line highway bridges, from 40 to 130 ft. long.

Sioux City, Iowa—The City Council contemplates the construction of a concrete bridge over the Sioux River at North Riverside.

Hartland, Minn.—Bids will be received until July 12 by Frederick Tavis, County Audr., for the construction of State Bridge No. 1814, including the removal of the present bridge and the maintenance of a temporary crossing.

✚Kansas City, Kan.—The City Commissioners have awarded the contract for the construction of a reinforced-concrete viaduct at 18th St. over the Union Pacific, and the Chicago, Rock Island & Pacific R.R. to the AMERICAN STEEL CO., at $115,800.

Madison, Neb.—Bids will be received until 1 p.m., July 6, by the Board of Commissioners of Madison County for the construction of one 60-ft. and one 24-ft. bridge, both in Fairview Precinct. W. T. Hodson is County Clk.

Bismarck, N. D.—Bids will be received until July 8 by T. E. Flaherty, County Clk., for the construction of seven reinforced-concrete culverts.

Jamestown, N. D.—Bids will be received until July 2 by Andrew Blewitt, County Clk., for the construction of reinforced-concrete culverts.

Williston, N. D.—Bids will be received until July 15 by M. H. Aaon, County Audr., for the construction of bridges for one year.

✚Jefferson City, Mo.—The Commissioners of Cole County have awarded the contract for constructing a bridge across the Moniteau River west of Marion between Cole and Moniteau Counties to the KANSAS CITY BRIDGE CO., Kansas City, at $5779. Other bidders were: Miller & Borcherding, St. Louis, $6500; Missouri Bridge & Iron Co., $6285; Illinois Steel Bridge Co., $5978; Vincennes Bridge Co., $5876.

Dallas, Tex.—An election will be held July 24 to vote on the question of issuing $150,000 in bonds. The proceeds will be used for the construction of a bridge across the Trinity River at the Commerce St. Crossing. Noted June 24.

Ft. Worth Tex.—The Commissioners Court of Tarrant County contemplates an expenditure of approximately $8000 for the reconstruction of the Park St. Bridge.

✚Houston, Tex.—The contract for the construction of a railroad bridge over the Brazos River for the Houston, Richmond & Western Traction Co. has been awarded to the FEDERAL BRIDGE CO., Des Moines, Iowa, at $56,000.

✚Laredo, Tex.—(Official)—The Street and Bridge Committee of the City Council has awarded the contract for the construction of two reinforced-concrete bridges over Zacate and Chacon Creeks to A. G. RANNEY, San Antonio, at $11,555. Other bidders were: Topeka Bridge & Iron Co., $12,251; Mas & Vasquin, $13,250; C. Jeffries, $15,300. J. S. Westbrook is Chn. of Com. Noted June 3.

Challis, Idaho—At a recent election the citizens of Custer County voted in favor of issuing $35,000 in bonds, the proceeds of which will be used for constructing five steel bridges.

✚Mayfield, Wash.—(Official)—The contract for constructing the steel bridge across the Cowlitz River at Mayfield has been awarded to the BEERS BLDG. CO., Portland, Ore., at $28,888. In all, 21 bids were received. Noted Jan. 28 and June 3.

Seattle, Wash.—The Board of Public Works has instructed the City Engineering Department to begin the construction, by day labor, on the approaches of the Salmon Bay Bridge across the Lake Washington Canal. The City Council has appropriated $90,000 for the work. Noted June 10 and 17.

Seattle, Wash.—Bids will be received until 10 a.m., July 12, by the Board of Commissioners of King County for the construction of the Fall City Bridge. It will be of steel with concrete piers. The estimated cost is $27,000. A. P. Denton is County Engr. Byron Phelps is Clk. of Comrs.

COLUMBIA RIVER INTERTSTATE BRIDGE

The itemized bids for various contracts awarded for the construction of the Interstate Bridge, illustrated on p. 1218, "Engineering News," June 24, across the Columbia River, connecting Portland, Ore., and Vancouver, Wash., are as follows:

Superstructure metal work of the main river bridge—

United States Steel Products Co.		Porter Bros.	
Manufacture and Delivery		Erection	
12,924,000 lb. truss spans	2.59c.	12,924,000 lb. truss spans	0.55c.
822,000 lb. towers	3.43c.	822,000 lb. towers	0.90c.
620,000 lb. rails, etc.	2.755c.	620,000 lb. rails, etc.	0.40c.
318,000 lb. sheaves	10c.	318,000 sheaves	1.25c.
2 motors (lump sum)	$4325	2 motors (lump sum)	$200
6 switchboards (lump sum)	456	6 gasoline engines	200
7 gasoline engines (lump sum)	728	Electric wiring (lump sum)	3100
		Operator's house	2100
		Gate tender's house	700
		621 cu.yd. counterweights	14
Extended totals	$417,316	Extended totals	$99,829

Superstructure metal work to sloughs—

Northwest Steel Co.		Porter Bros.	
Manufacture and Delivery		Erection	
3,191,000 lb. metal	2.55c.	3,191,000 lb. metal	0.55c.
259,000 lb. rails	3.00c.	259,000 lb. rails	0.40c.
Extended totals	$89,140	Extended totals	$18,886

Substructure—Pacific Bridge Co.

Main River Bridge		Sloughs	
53,50 cu. pier shafts	$9.00	2480 cu.yd. pier shafts	$10.00
109,000 lb. reinforcing metal	.03	34,000 lb. reinforcing metal	.04
15,810 cu.yd. bases	12.00	2000 cu.yd. bases	16.00
418 cu.yd. buried piers	12.00	894 cu.yd. buried piers	16.00
77,900 lin.ft. piles	.46	58,100 lin.ft. piles	.35
5900 lin.ft. dolphins	9.25	11,000 cu.yd. riprap	2.00
105 M. ft. b.m. timber ferry	30.00	21,000 sq.ft. mattress	.50
16,000 cu.yd. riprap	2.05		
34,000 sq.yd. mattress	.70		
Extended totals (Riprap)	$319,415	Extended totals (Riprap)	$119,579
(Mattress)	310,825		

Embankment of Union Ave. Approach—United States Steel Products Co.

93,000 cu.yd. embankment in place	$1.324
3000 cu.yd. ditches	.25
38,000 sq.yd. slabs	.80
1900 cu.yd. rock fills	2.00
Extended totals	$158,214

Reinforced-Concrete Floor and Pavement on Steel Structures—Porter Bros.

21,264 sq.yd. bitulithic pavement	$3.48
3254 sq.yd. sidewalk slabs	2.10
21 cu.yd. hand rails	30.00
2 bronze lamp standards	44.00
Extended totals	$82,803

✚Lebanon, Ore.—(Official)—The contract for the construction of a bridge across the South Forks of the Santiam River has been awarded to the PACIFIC IRON WORKS, Portland, at $13,461. Other bids were: Portland Bridge Co., $14,200; Beers Bldg. Co., $14,776; Illinois Steel Bridge Co., $15,380; Portland Bridge & Iron Co., $15,506; E. E. Davis Co., $16,386; A. C. O'Neil, $16,694. Noted June 17.

Portland, Ore.—The City Engineer is preparing plans for the construction of the Union Ave. Viaduct over the tracks of the Oregon-Washington R.R. & Navigation Co. The estimated cost is $50,000.

Hanford, Calif.—Bids will be received until July 6 by the Clerk of the Board of Supervisors for the construction of a reinforced-concrete bridge over the Cross Creek.

✚Martinez, Calif.—The contract for the construction of a drawbridge on Borden Rd. over the San Joaquin River has been awarded to the TIBBITS-PACIFIC CO., San Francisco, at $140,000.

Meridian, Calif.—Press reports state that bids will be asked at once for rebuilding the bridge of the Northern Electric Co. across the Sacramento River at Meridian. The bridge was damaged by floods last winter. The estimated cost of repairs is $75,000, which will be divided among the railway companies, Sutter and Colusa Counties.

★Needles, Calif.—The following are the bids received by Cate Sells, Comr. of Indian Affairs, Washington, D. C., for the construction of a steel bridge over the Colorado River at Topock, Ariz., near Needles: Kansas City Structural Steel Co., Kansas City, Mo., $61,950; Ross Construction Co., Sacramento, Calif., $94,872; Security Construction Co., Los Angeles, Calif., $71,859; Graff Construction Co., Seattle, Wash., $83,150; S. B. Harding, Chicago, Ill., $78,900 (informal); Virginia Iron Co., Roanoke, Va., $70,100; Missouri Valley Bridge & Iron Co., Leavenworth, Kan., $71,100; Omaha Structural Steel Works, Omaha, Neb., $85,334; California Construction Co., San Francisco, Calif., $72,500; Midland Bridge Co., Kansas City, Mo., $73,900. Noted Apr. 15 and June 3.

San Jose, Calif.—Bids will be received by the Board of Supervisors, Santa Clara County, until July 6 for the construction of concrete bridges over Permanente Creek, San Thomas Creek and Calabasas Creek on the Homestead Rd. H. A. Pfister is Clk. of Bd.

✚Santa Rosa, Calif.—The Board of Supervisors of Sonoma County has awarded the contract for the construction of a bridge over Dry Creek to D. E. ALBERS, at $8691.

North Timiskaming, Que.—Bids will be received until July 12 by R. C. Desrochers, Secy., Dept. of Pub. Wks., for the construction of the superstructure of a four span bridge over the Quinze River.

Lansing, Ont.—The York Township Council is considering plans for the construction of a concrete bridge on Lansing Side Rd., at an estimated cost of $5000.

✚Toronto, Ont.—The Board of Control has awarded the contract for the construction of the concrete substructure and the floor of the Strachan Ave. Bridge to RODERICK CAMPBELL, at $23,045, and the contract for the steel superstructure to the DOMINION BRIDGE CO., at $5091. Noted June 10.

Dauphin, Man.—Bids will soon be received for the construction of a 100- or a 150-ft. reinforced-concrete bridge over the Valley River. J. A. Gorley is Clk.

WATER SUPPLY—IRRIGATION

Athol, Mass.—The construction of a 3,000,000-gal. reservoir is favored by Herbert L. Hapgood, Chn. Water Comrs.

✚Dartmouth, Mass.—The contract has been awarded to A. WILLIAMS & CO., 3 Catting St., Boston, at $33,153, for furnishing and laying water mains. Noted Oct. 8.

✚★Barker, N. Y.—The contract has been awarded to B. MOLINARI & CO., 453 North St., Rochester, at $19,780, for laying 4½ miles of c.-i. water mains, standpipe and sand filter, and reservoir. Charles C. Hopkins, Cutler Bldg., Rochester, is Engr. Noted Feb. 11 and Apr. 1.

Lewiston, N. Y.—According to press reports an election will be held to vote on the question of issuing $39,000 in bonds, the proceeds of which will be used for the construction of fire protection and a water-supply system. Noted Feb. 25.

Lockport, N. Y.—All bids received June 7 by the Board of Water Commissioners for laying water mains were rejected. Noted June 24.

New York, N. Y.—(Official)—Bids will be received until 11 a.m., July 7, by Charles Strauss, Pres., Bd. of Water Supply, Municipal Bldg., for erecting at shafts No. 11 and 21, Catskill Aqueduct, drainage equipment for unwatering the tunnel and its shafts.

New York, N. Y.—(Official)—Bids will be received until 11 a.m., July 7, by Charles Strauss, Pres. Bd. of Water Supply, Municipal Bldg., for furnishing, delivering and installing racks, shutters, screens, lifters and other apparatus in gate chambers at Ashokan, Kensico and Hill View reservoirs.

★New York, N. Y.—(Official)—Bids were received June 22 for constructing a coagulating plant in Mt. Pleasant under Contract No. 159, as follows: Guarantee Construction Co., 140 Cedar St., New York, $21,480; James McArthur Co., $32,875; F. N. Lewis, $27,150; Snare & Triest, $29,850; M. L. Bird, $37,000; H. H. Vought & Co., $21,871; N. E. Construction Co., $29,327; Charles Meads, $27,117. Noted June 10.

New York, N. Y.—(Official)—Bids were received June 22 by the Board of Water Supply for furnishing and delivering and installing bronze or steel ladders and nozzles from Charles Meads, $23,280, and the Concord Construction Co., 38 Park Row, New York, $22,565. Noted June 10.

✚New York, N. Y.—(Boroughs of Manhattan and the Bronx)—(Official)—The contract has been awarded to the BUILDERS' IRON FOUNDRY, Providence, R. I., at $18,850, by the Department of Water Supply, Gas and Electricity for furnishing venturi meter tubes and recording apparatus for connections from the Catskill supply. Noted June 24.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by William Williams, Comr., Water Supply, Gas and Electricity, Municipal Bldg., Manhattan, until 2 p.m., July 12, for making the necessary alterations and improvements at new Utrecht Pumping Station, Ave. V and East 14th St., and converting same into a distribution station.

Patchogue, N. Y.—The citizens contemplate establishing a fire district in West Patchogue at an estimated cost of $60,000. Walter E. Sexton, Mineola, is Engr.

✚★Lock Haven, Penn.—(Official)—Bids were received June 14 for constructing storage dam No. 1 on McElhattan Run, as follows: CHARLES DUGAN, Williamsport, $8716 (awarded contract); C. J. Carroll, $10,976; John C. Schrade, $11,407; McNervey Construction Co., $10,903; R. B. Taylor, $8520; Otto Paving & Construction Co., $10,792; E. C. Williams, $11,276; Fogel & Co., $10,078; Cecil N. Harrart, $8849; Horn & Devling, $11,340. H. P. Shoemaker is City Engr. Noted May 27.

✚Frederick, Md.—The contract has been awarded to BRADY BROS., Frostburg, at $4153, by the city for constructping a pipe line from Fishing Creek to the city. Contracts for pipe and valves were awarded to R. D. WOOD & CO., Philadelphia, Penn., for valves and to H. C. BROOKS, Martinsburg, W. Va., at $11,304 for pipe. Noted Oct. 29 and May 13.

Matewan, W. Va.—Bonds for $12,000 have been voted by the citizens, part of the proceeds of which will be used for the construction of a filtration plant. J. S. Albert is Town Recdr.

✚Walterboro, S. C.—The contract has been awarded to the HUGHES ARTESIAN WELL CO., Charleston, for driving a 1600 ft. artesian well and for pipe. Noted Feb. 18 and Apr. 22.

Cartersville, Ga.—(Official)—An election will be held July 17 to vote on the question of issuing $5000 in bonds, the proceeds of which will be used for the extension of the water and fire protection systems. W. W. Doniel is City Engr.

Dawson, Ga.—The citizens voted against issuing $20,000 in bonds, the proceeds of which was to have been used for the extension of the water system. Noted May 27.

McGhee, Ala.—Improvements will be made to the water system and electric-light plant at an estimated cost of $65,000, bonds for which have been voted. J. J. Simmons is Mayor. Noted Mar. 25.

Maryville, Tenn.—Bids will be received until July 7 by the city for the construction of a water system including a filtration plant. Samuel Everett is Mayor and R. C. Huston & Co.,Falls Bldg., Memphis, is Engr. Noted Mar. 25 and Apr. 29.

Ashtabula, Ohio—The Council contemplates issuing bonds for $250,000, the proceeds of which will be used for the construction of a water system.

✚Cincinnati, Ohio—(Official)—The contract has been awarded to M. J. McCARTHY, Cincinnati, at $23,735, for laying water mains in Eighth St., Broadway and Reading Rd. for the high pressure fire service Other bidders were: Kirchner Sons Co., $26,090; H. V. Crumley, $29,100; M. F. Quill, $28,370; Thomas P. Strack, $32,245. Edward P. Durr is Secy., Dept. of Pub. Safety. Noted June 17.

✚Cincinnati, Ohio—The contract has been awarded to M. F. QUILL, Cincinnati, at $24,324, by the city for laying c.-i. water mains in Tennessee Ave. Noted June 17.

✚Cleveland, Ohio—The contract has been awarded to the CLEVELAND MACADAM CO., at $20,450, by the Board of Control for furnishing sand and gravel for the Division Ave. filtration plant. Noted May 6.

East Liverpool, Ohio—(Official)—It is stated that bids will be received in July for the construction of a water system. Bonds for $375,000 have been voted. Chester & Fleming, Pittsburgh, Penn., is Engr. Noted June 3.

Grafton, Ohio—It is reported that C. J. Fitzgerald, Elyria, is interested in the construction of a water system.

Shadyside, Ohio—Bids will be received until July 9 by the Board of Trustees of Public Affairs for constructing a water system. Fred McConn is Clk. Noted Feb. 25.

Batesville, Ind.—Bids will be received until 2 p.m., July 2, by the Batesville Water-Works Co. for constructing an earth dam 250 ft. long by 12 ft. high with a reinforced-concrete face and for laying 5000 ft. of 8-in. c.-i. water mains and constructing 9000 ft. of electric transmission line. Charles Brossmann, Indianapolis, is Engr. Noted June 4.

Mancelona, Mich.—Bonds for $15,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system.

Atkinson, Ill.—A. M. Morgan, Chicago, is preparing plans for the construction of a water system. The estimated cost is $18,000.

Chicago, Ill.—Bids will be received until 11 a.m., July 8, by the Department of Public Works for furnishing a water-tube boiler with super-heaters at Central Park Ave. pumping station No. 5.

Warsaw, Ill.—Extensions will be made to the water system at an estimated cost of $19,000. A. M. Morgan, Chicago, is Engr.

✚Fond du Lac, Wis.—The contract has been awarded to the AMERICAN CAST IRON PIPE CO., Minneapolis, Minn., at $16,000, for furnishing c.-i. water pipe.

Madison, Wis.—The Water Department contemplates laying feeder mains at an estimated cost of $10,000.

Sauk City, Wis.—The citizens contemplate spending $10,000 for the construction of a water system.

Chariton, Iowa—Plans have been prepared by M. G. Hall, Centerville, for the construction of a water system. The estimated cost is $65,000. Noted Oct. 1.

Ft. Dodge, Iowa—The city contemplates calling an election to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for the improvement of the water system. W. L. Tang is City Clk.

Keota, Iowa—C. P. Chase, Clinton, is preparing plans for the construction of a water system.

✚Aurora, Minn.—Contracts have been awarded to SHARP & McGUIRE for drilling a 10-in. well and to MICHAEL BOYLAN, Virginia, at $9480, for laying water mains.

✚Campbell, Minn.—(Official)—The contract has been awarded to WARD & WEIGHTON, Sioux City, Iowa, at $4180, for constructing a pressure water system. J. F. Druar, Commercial Bldg., St. Paul, is Consult. Engr.

Duluth, Minn.—The Buffalo Meter Co., Buffalo, N. Y., at $4320, was low bidder for furnishing 800 water meters. Noted June 10.

✚Moorehead, Minn.—(Official)—The contract has been awarded to the AMERICAN BRIDGE CO., Minneapolis, at $18,000, by the City Clerk for constructing a 300,000-gal. elevated steel tower. Edward P. Burch, Plymouth Bldg., Minneapolis, is Consult. Engr. Noted June 17.

Thief River Falls, Minn.—Bids will be received until 8 p.m., July 6, by E. J. Overland, City Clk., for furnishing material and for the repair of 8000 ft. of 6-in. water mains.

Sterling, Neb.—The citizens voted against issuing bonds for $15,000, the proceeds of which was to have been used for the installation of a water system. Noted May 6 and June 10.

Canova, S. D.—(Official)—Bonds for $9500 have been sold, the proceeds of which will be used for the construction of a water system. H. H. Schulte is Town Clk. Noted May 20 and June 3.

Cheyenne, Wyo.—Bids will be received until noon, July 6, by J. J. Showalter, City Clk., for constructing a rapid-sand filtration plant at Round Top reservoir. The estimated cost is $70,000. R. D. Goodrich is City Engr.

Powell, Wyo.—Bids will be received until July 6 by W. A. Deming, Town Clk., for constructing a gravity water system. The work includes seven miles of 10-in. supply line and three miles of distribution lines. G. H. Setham, Denver, Colo., is Engr. Noted Nov. 5 and Mar. 18.

Fromberg, Mont.—Bonds for $17,500 have been voted by the citizens, the proceeds of which will be used for the construction of a water system. B. T. Ellis, Billings, is Engr. Noted Feb. 11 and Mar. 11.

Missoula, Mont.—An election will be held Aug. 3 to vote on the question of issuing $500,000 in bonds, the proceeds of which will be used for the construction of a water system. Noted Feb. 11.

✚Sidney, Mont.—The contract has been awarded to BENDON, REED & JONES, Sidney, at $17,413, by the Council for constructing a distributing system in Special Improvement District No. 1.

Wibaux, Mont.—(Official)—Bids will be received until 8 p.m., July 10, by J. R. Quammel, Town Clk., for the purchase of $27,000 in bonds, the proceeds of which will be used for the construction of a water system. Noted June 6.

Beaumont, Tex.—Bids will be received until 10 a.m., July 14, for constructing a 30-in. c.-i. pipe line across Neches River and for other improvements. Burns & McDonnell, Kansas City, Mo., is Engr.

Elgin, Tex.—An election will be held July 16 to vote on the question of issuing $11,000 in bonds, the proceeds of which will be used for the construction of a water system. Noted June 24.

Claremore, Okla.—(Official)—The City Council has voted against issuing bonds for $10,000, the proceeds of which was to have been used for the installation of a filtration plant. Noted June 3.

Denver, Colo.—The Council will be asked by A. Lincoln Fellows, Pres. Pub. Utilities Comn., to appropriate $100,000 to make a survey for the construction of a new municipal water system.

St. Maries, Idaho—Plans are being prepared for the construction of a water system, the estimated cost of which is $30,000. Charles R. Schulte is City Clk. Noted Oct. 1.

✚Salt Lake City, Utah—(Official)—The contract has been awarded to P. J. MORAN, INC., 152 West Second St., Salt Lake City, at $18,209, for constructing a reinforced-concrete reservoir. Other bidders were: J. W. Mellen, $18,284; John Holt, $18,975; Mullins & Palm, $19,360; O. H. Gray & Co., $19,487; Heuser, Sim & Vorkink, $19,765; Ryberg Bros., $21,129; Gibbons Bros. & Reed Parrott Bros. Co., $21,873; Campbell Building Co., $22,259; John Shea, $22,653; Lynch Construction Co., $23,004; Midland Bridge Co., $28,677. Noted June 17.

✚Everett, Wash.—The Snohomish County Commissioners have warded the contract to GEORGE WRIGHT, Tacoma, for constructing an irrigation system in District No. 4, at $38,838. Other bids were: Tacoma Dredging Co., Tacoma, $35,991; West Chester Construction Co., Marion Block, Seattle, $39,393; Booker, Kiehl & Whipple, Central Bldg., Seattle, $39,996; Chamberlain Construction Co., Globe Bldg., Seattle, $40,111.

✚Seattle, Wash.—The contract has been awarded to G. ARGENTIERI & CO., 989 Ranier Ave., at $10,000, for laying water mains in Fifth Ave. W. Noted June 24.

Bandon, Ore.—(Official)—Bonds for $80,000 have been voted by the citizens, the proceeds of which will be used for the extension of the water system. Noted June 3.

Eastside, Ore.—The installation of a municipal water system is under consideration. The estimated cost is $20,000.

North Bend, Ore.—The water rights of the Pony Inlet watershed will be acquired by the city to furnish water for the proposed municipal water system.

✚Imperial, Calif.—(Official)—The contract has been awarded to W. J. BATTWICK, Imperial, at 11⅞c. per sq.ft. for constructing 41,809 sq.ft. of floor and lining for the irrigation system. Noted June 3.

McKittrick, Calif.—The Producers' Transportation Co. will install a 4-in. and 6-in. water main between Buttonwillow and Olig, about 13 miles.

✚Pasadena, Calif.—The contract has been awarded to THEODORE L. SYCERTSON, 434 Maple Way, at $19,617, for making extensions to the water system in the Linda Vista District. Noted May 27 and June 24.

✚★Peterboro, Ont.—(Official)—The contract has been awarded to the DELAVAL DAIRY SUPPLY CO., Petersboro, at $15,850, for furnishing a 6,000,000-gal. pumping unit for the water-works. Noted May 13.

✚Selkirk, Man.—The contract for constructing a steel tower tank for the hospital for the insane has been awarded to the CHICAGO BRIDGE & IRON WORKS, Bridgeport, Ont., at $7300.

SEWERS

Portland, Maine—Bids will be received until July 6 by the Board of Public Works for the construction of 3710 ft. of 8-, 10- and 12-in. pipe sewers. The estimated cost is $18,000. B. Bradley, Jr., is Comr. of Pub. Wks. Noted June 17.

Derry, N. H.—The city will issue $25,000 in bonds, the proceeds of which will be used for the construction of a sewer system and a sewage-disposal plant. Dudley & Sawyer, Manchester, is Engr. Noted Apr. 1.

✚Boston, Mass.—The contract for the construction of sewers and drains in Randolph and Rock Rd.; in Rosewood and Oakland St., Dorchester, has been awarded to JOHN GUARINO, at $6353. Noted June 3.

Pittsfield, Mass.—The Board of Aldermen has passed an ordinance appropriating $25,000 for the construction of sewers.

Westfield, Mass.—It is reported that bonds for $12,000 have been sold, the proceeds of which will be used for the construction of sewers. Noted June 3.

New Haven, Conn.—The city contemplates issuing $110,000 in bonds, the proceeds of which will be used for the construction of the Whalley Ave. sewer which provides for the construction of an outlet sewer system in the Westville School District. Noted Apr. 1.

Binghampton, N. Y.—The City Council has approved plans for sewer construction in the Fourth Ward.

Herkimer, N. Y.—Bonds for $30,000 have been sold. The proceeds will be used for the construction of extensions to the sewer system.

✚Newburg, N. Y.—The contract has been awarded to JAMES L. KEHOE, at $6204, for the construction of the Bridge St. sewer. Noted Apr. 22.

New York, N. Y.—(Borough of Bronx)—(Official)—Bids were received June 24 by the Borough President for the construction of sewers and appurtenances in Tyndall Ave. and for improving the roads in Mosholu Ave., as follows: Estates Contracting Co., $35,289; DiMinna & DeBlasio, $31,981; Soraci Contracting Co., $36,976; Delson Contracting Co., $33,852; Simon Russick, $32,831; P. DiMinna Contracting Co., $39,890; Spadaro Contracting Co., $30,461; Anita Contracting Co., $35,101; P. J. Duffy, $35,740; Harris Rose Construction Co., $31,347; Kingsbridge Contracting Co., $40,667; O'Roth Contracting Co., $40,793; Gasperini & DeBasio, $34,497; Briggs & McLoughlin; $36,657; A. Mansini, $33,666; S. Amanna & Sons, $34,154.

New York, N. Y.—(Borough of Manhattan) — (Official)—Bids will be received by Marcus M. Marks, Borough Pres., until 2 p.m., July 9, for constructing a tunnel relief sewer in East 41st St. and Madison Ave., also for improving sewer in Wall St.

New York, N. Y.—(Borough of Queens)—(Official)—Bids were received June 23 by Maurice E. Connolly, Borough Pres., for the construction of sewers and appurtenances in Polk Ave. from 51st St. to Junction Ave., Second Ward, as follows: Stanhope Contracting Co., $34,602; A. Paino, $32,190; Peace Bros., $36,843; Evergreene Construction Co., $34,595; C. Nally, $31,555; Lincoln Steel Co., $34,948; Clancy & Van Alst, $27,569. Noted June 17.

Port Washington, N. Y.—The city contemplates the construction of a sewer system. The estimated cost is $125,000.

Syracuse, N. Y.—(Official)—Bids will be received until 1:30 p.m., July 12, by Robert D. Roney, Secy. Bd. of Contract and Supply, for the construction of the Huntley System No. 2. The estimated cost is $112,000. W. Thomas Wooley is City Engr. Noted May 6.

Avalon, N. J.—Bids will be received until July 12 by Gilbert S. Smith, Mayor, for the construction of approximately 14,000 ft. of 12- to 20-in. c.i. or vitrified pipe sewers. Ralph L. Goff, Ocean City, is Engr.

Jersey City, N. J.—(Official)—Bids will be received until 2 p.m., July 6, by the Hudson County Park Commissioners for vitrified pipe and specials and c.i. catch basin heads for North Park and North Bergen.

Erie, Penn.—(Official)—The information published in the issue of June 17 was incorrect. The city proposes to issue bonds for the construction of a number of short lines of storm sewers, and for reconstructing several old sewers. B. E. Briggs is City Engr. Noted June 17.

✚Montrose, Penn.—(Official)—The contract for the construction of a sewage-disposal plant has been awarded to the NEW YORK SEWAGE DISPOSAL CO., New York, N. Y., at $7063. Noted June 24.

New Kensington, Penn.—An election will be held Aug. 3 to vote on the question of issuing $100,000 in bonds. The proceeds will be used for the construction of sewers and for street improvements.

Philadelphia, Penn.—Bids will be received until July 13 by the city for the enlargement and relocation of the sewers in Buttonwood St. in connection with the Broad St. Subway work. A Merritt Taylor, Dir. of Transit, is in charge. Noted Dec. 17.

Norfolk, Va.—An appropriation of $8000 has been authorized, the proceeds of which will be used for the construction of the Newton's Creek drain. W. T. Brooke is City Engr.

Matewan, W. Va.—Bonds for $12,000 have been voted, the proceeds of which will be used for the construction of sewers. J. S. Albert is Town Recdr.

Charlotte, N. C.—The city contemplates the construction of lateral sewers in various wards. The estimated cost is $141,085.

Cartersville, Ga.—(Official)—An election will be held July 17 to vote on the question of issuing $60,000 in bonds. The proceeds will be used for the construction of sewers. W. W. Daniel is City Engr. Noted June 24.

Savannah, Ga.—An election will soon be held to vote on the question of issuing $400,000 in bonds. The proceeds will be used for the construction of a storm water sewer system. E. R. Conant is Ch. Engr.

New Orleans, La.—The lowest bid submitted for the construction of a sewer system at the new cotton warehouses was that of L. M. Dalgarn, at $15,936. Ford, Bacon & Davis, New Orleans, is Engr.

Cleveland, Tenn.—(Official)—Bids will soon be received by the city for the construction of a sewer system. The estimated cost is $75,000. Walter G. Kirkpatrick is Engr. Noted June 24.

Knoxville, Tenn.—The city contemplates the construction of lateral sewer in the Tenth Ward. The estimated cost is $5000.

Cincinnati, Ohio—Bids will be received until noon, July 9, by Philip Fosdick, Dir. of Pub. Ser., for the construction of main and lateral sewers and drains with appurtenances in Seitz, Dorsey and Goethe St.

✚Cleveland, Ohio—The contract for the construction of sewers in Sandusky Ave. from East 93rd to East 102nd St. has been awarded to the LAKE ERIE PAVING & CONSTRUCTION CO., at $17,697. Noted June 24.

Cleveland, Ohio—Bids will be received until noon, July 7, by the Commissioner of Purchases and Supplies for the construction of approximately 7500 lin.ft. of 6-ft. brick sewers in tunnel, under two contracts. Robert Hoffman is City Engr.

✚Cleveland, Ohio—Contracts have been awarded by the Board of Control to WILLIAM McDOWELL & SON CO., at $17,000, for the construction of a sewer in Spring Rd., S. W., and to J. C. DEVINE CO., at $9500, for the construction of a diversion sewer, junction overflow, and grit chambers, also wooden flumes at the sewage treatment works, West 58th St. and Lake Shore.

Geneva, Ohio—Plans are being prepared by the City Engineer for the construction of sewers in Baline and Orchard St.

✚Frankfort, Ind.—(Official)—The contract for the construction of the South West District sanitary sewer and the South West Local sanitary sewer has been awarded to C. C. HUFTINE & CO., Frankfort, at $2678 and $4348, respectively.

✚Logansport, Ind.—The contract for the construction of a sanitary sewer in Broadway has been awarded to GIRTON & GIRTON, at $5752.

Markle, Ind.—Plans have been prepared by Thomas Ruggles for the construction of a sewer system.

Muncie, Ind.—Bids will be received until 10 a.m., July 3, by the city for the sewer construction.

Winchester, Ind.—Bids will be received until 8 p.m., July 7, by M. R. Chenoweth, City Clk., for the construction of sewers in various streets.

Chicago, Ill.—Michael Pontarelli, 2349 Greenleaf Ave., and Henry J. McNichols, 209 South La Salle St., submitted the lowest bids for the construction of 14 miles of brick sewers in the Norwood and Edison Park Section, to be known as the Argyle St. sewer system. The estimated cost is $683,000. Noted June 3.

Peoria, Ill.—Bids will be received until July 12 by the Board of Local Improvements for the construction of the South End Sewer, East Section. The estimated cost is $221,279. Noted Sept. 3.

Springfield, Ill.—The city contemplates the construction of sewers in various streets.

Warsaw, Ill.—Plans are being prepared by A. M. Morgan, Chicago, for the construction of a sewer system. The estimated cost is $28,500.

Sheboygan, Wis.—Bids will be received until July 2 by the Board of Public Works for the construction of 12,055 ft. of 12-, 10- and 8-in. vitrified pipe sewers. C. U. Boley is Comr. of Pub. Wks. Noted June 24.

Idagrove, Iowa—Plans are being prepared by G. Y. Skeels, Sioux City, for the construction of a sanitary sewer north of Odebolt Creek. The estimated cost is $7500.

Keokuk, Iowa—The city contemplates the construction of sanitary sewers in the Kilbourne's addition.

✚Duluth, Minn.—Contracts for material for sewer construction have been awarded to the DULUTH BUILDERS' SUPPLY CO., at $12,606, and the STANDARD SALT & CEMENT CO., at $12,726. Noted June 17.

Virginia, Minn.—The city contemplates the construction of storm sewers. The estimated cost is $35,000.

Hutchinson, Kan.—(Official)—Plans are being prepared by the City Engineering Department for a sewage pumping plant, and bids for the same will be called for in about two weeks.

Flandreau, S. D.—(Official)—Bonds for $4000 have been sold, the proceeds of which will be used for the construction of storm sewers. Noted June 17.

✚Sisseton, S. D.—(Official)—The contract for the construction of a sewer system and a sewage-disposal plant has been awarded to E. M. SCHEFELOW, Elgin, Ill., at $24,804. Other bids were: James Kennedy, Fargo, N. D., $29,744; Security Bridge Co., Billings, Mont., $29,768; Rimer Bros., St. Paul, Minn., $30,946; Kirtchers Bros., St. Paul, Minn., $32,518. Noted May 27.

Watertown, S. D.—Bids will be received in July for the construction of 18,500 ft. of 15-, 18-, 30- and 33-in. pipe sewers and 9700 ft. of 36-, 42- and 57-in. concrete sewers. The estimated cost is $110,000. F. W. Shreiber is City Engr. and O. M. Lane is City Audr. Noted May 27.

✚Bismark, N. D.—The contract for sewer construction in Broadway from 10th to 14th St. has been awarded to the HAGGART CONSTRUCTION CO., Fargo, at $15,108.

Chouteau, Mont.—The City Council contemplates sewer construction in District No. 6. The estimated cost is $4780. A. L. Powers is City Clk.

✚Sidney, Mont.—The contract for the construction of a main sewer has been awarded to BENDON, REEDS & JONES, Sidney, at $14,537.

Walkerville, Mont.—It is reported that the city contemplates the construction of a sewer system in the business and residence districts. The estimated cost is $25,000. M. Broughton is City Atty.

✚Italy, Tex.—The contract has been awarded to E. L. DALEON, Dallas, at $12,625, for the construction of a sewer system. Noted Mar. 11.

Marlin, Tex.—At a recent election the citizens voted to issue $45,000 in bonds. The proceeds will be used for the construction of sewers. L. Goodrich is City Engr. Noted Mar. 27.

Tulsa, Okla.—(Official)—At a recent election the citizens voted to issue $100,000 in bonds. The proceeds will be used for the construction of storm and sanitary sewers. Bids will be received about Sept. 1. T. C. Hughes is City Engr. Noted June 17.

Mountain View, Colo.—(Manitou post office)—Bids will be received until 8 p.m., July 6, by August Heimberger, Clk., for the construction of a sanitary sewer system. Peter O'Brian & Son, Denver, is Engr.

Steamboat Springs, Colo.—Plans are being prepared for the construction of a sanitary sewer system. The estimated cost is $70,000.

Trinidad, Colo.—Bids will soon be received for the sale of $75,000 in bonds. The proceeds will be used for the construction of trunk sewers and a sewage-disposal plant.

Mesa, Ariz.—The contract will be awarded about Sept. 1 for the construction of a sewer system. The estimated cost is $75,000. Noted June 24.

✚Port Angles, Wash.—The contract for the construction of a sewer system has been awarded to METLER & COYNE, Port Angeles, at $37,804. Noted June 24.

✚Port Angeles, Wash.—The contract for the construction of a sewer system has been awarded to H. A. COTTON, Port Angeles, at $38,404.

Albany, Ore.—The city will construct a main trunk sewer south in Cottage and Tekcna St. The estimated cost is $10,000.

Eugene, Ore.—Plans are being prepared by the Sewer Committee for the construction of a sewer system. The estimated cost is $15,000.

Auburn, Calif.—An election will soon be held to vote on the question of issuing $15,000 in bonds. The proceeds will be used for the improvement of the sewer system.

Imperial, Calif.—W. J. Bathric, Imperial, at $5032, submitted the lowest bid for the construction of a reinforced-concrete settling basin.

Wilmington, Calif.—Bids will be received until July 6 by the Board of Public Work for the construction of a frame pump house, 13x14 ft. over an existing concrete well, and for installing machinery at the sewage-disposal plant.

Peterboro, Ont.—Plans have been approved by the City Council for the construction of sewers in Westcott, Maude, Lansdown and Lafayette St. R. H. Parsons is Engr.

Toronto, Ont.—Bids will be received until July 6 by the Board of Control for the construction of sewers in various streets. R. C. Harris, City Hall, is Comr. of Pub. Wks.

✚Vancouver, B. C.—The contract has been awarded to H. P. PETERSON, 207 Holden Bldg., Vancouver, at $70,056, for the construction of the Clark Drive outfall sewer by tunnel method. Noted Apr. 22.

GARBAGE

★Asbury Park, N. J.—(Official)—Bids will be received until 11 a.m., July 13, by the Board of Commissioners for the collection, removal and disposal of garbage, rubbish, ashes and dead animals. Howard D. Le Roy is Comr.

Union, N. J.—(Weehawken post office)—(Official)—Bids will be received until 8 p.m., July 6, by the Town Council, for the removal of garbage for periods of one, two, three, four or five years. Emil Bantz is Town Clk.

East Chicago, Ind.—Bids will be received until July 16 by the City Clerk for constructing a garbage disposal plant.

Montreal, Que.—Bids will be received until July 15 by the City Council, according to press reports, for the construction of a garbage disposal plant. L. N. Senecal is Secy.

STREETS AND ROADS

✚Bangor, Maine—A contract for constructing a section of the State Highway has been awarded to SMALL & INGALLS, Bar Harbor. Noted June 10.

✚Boston, Mass.—The contract for laying bitulithic pavement on Ridgewood St. from Topliff to Draper St., Roxbury, has been awarded to JAMES DOHERTY, at $7659. Noted June 3.

✚Boston, Mass.—The contract for constructing a bituminous macadam roadway on Howitt Rd. from Bellevue to La Grange St. has been awarded to CHARLES J. JACOBS CO. Noted June 3.

★Hartford, Conn.—(Official)—Bids will be received until 2 p.m., July 2, by C. J. Bennett, State Highway Comr., for state road work as follows: Ashford Township, about 14,960 lin.ft. gravel on the Warrenville Rd. Bethel Township, about 6315 lin.ft. gravel on the Bridgeport-Newton Rd. Canterbury Township, about 5100 lin.ft. native stone macadam and about 1995 lin.ft. native stone resurfacing on the Westminster Rd. Glastonbury Township, about 6500 lin.ft. 2-in. bituminous macadam on the Hartford Turnpike, Killingworth Township, about 7150 lin.ft. graded on the Higganum Rd. Newtown Township, about 8040 lin.ft. native stone macadam on the Dodingtown Rd. Plainfield Township, about 6875 lin.ft. gravel on the Canterbury Rd. Sprague Township, about 1630 lin.ft. gravel on the Versailles Rd. Vernon Township, about 2675 lin.ft. 6-in. bituminous macadam on Vernon Ave.

Batavia, N. Y.—Bids were received June 17 for paving (a) Dellinger Ave., (b) Tracy Ave. as follows: W. H. Ripton, Rochester, (a) $7286, (b) $9014; H. W. Roberts, Utica, (a) $7449, (b) $9205; Whitmore, Rauber & Vicinus, Rochester, (a) $7778, (b) $9669.

Buffalo, N. Y.—Bids will be received until July 2 by Francis G. Ward, Comr. Pub. Wks., for repaving portions of Washington St.

Cohoes, N. Y.—Press reports state that bids will be received until July 9 by the Board of Estimate and Apportionment for paving Bowery St. at an estimated cost of $22,000.

✚Geneva, N. Y.—The contract for resurfacing Exchange St. from the south line of Seneca St. to the north line of North St. with sheet asphalt and brick has been awarded to the WARNER, QUINLAN CO., Syracuse.

✚Herkimer, N. Y.—The contract for paving West Smith, William and George St. and Dewey Ave. has been awarded to the WARREN BROS. CO., at $18,301.

New York, N. Y.—(Borough of Bronx)—(Official) — See item under "Sewers."

New York, N. Y.—(Borough of Bronx)—Bids were received June 24 by Douglas Matthewson, Borough Pres., for paving Fordham Rd. from Webster Ave. to Harlem River Terrace as follows: Uvalde Asphalt Paving Co., $90,176; J. Leopold & Co., $88,613; Rogers & McManus, $102,035; Asphalt Construction Co., $85,094; W. J. Scanlon Co., $85,230; Barber Asphalt Co., $99,285; Rafferty Construction Co., $91,035. Noted June 17.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received by Maurice E. Connolly, Borough Pres., Borough Hall, Long Island City, until 11 a.m., July 8, for regulating, grading, paving, laying sidewalks, etc., on various streets in the borough; also for furnishing and delivering 62,000 asphalt paving blocks.

Niagara Falls, N. Y.—Bids will be received until July 6 by the Board of Public Works for paving portions of Whitney Ave., at an estimated cost of $32,000.

Belleville, N. J.—Press reports state that the town will soon receive bids for paving and improving Campbell Ave.

✚Belleville, N. J.—The contract for paving Greylock Ave. has been awarded to the GLENFIELD CONSTRUCTION CO., Newark. Noted Apr. 29.

Belleville, N. J.—Press reports state that the town plans to pave Howard Pl., Smith, Dow and Heckel St. and Overlook and Belmont Ave.

Hoboken, N. J.—(Official)—Bids were received for repaving portions of Grand, Adams and Madison St. as follows: Henry Waddington, $16,228; E. E. Calder, $18,986; Thomas Cavanaugh, $15,988; F. Fellows Co., $11,922. Noted June 17.

Jersey City, N. J.—William Baker, Inc., 26 Cortlandt St., New York, at $486,688, submitted the lowest bid for improving the Newark Turnpike. Noted June 3.

Jersey City, N. J.—The Van Keuren Contracting Co., at 76.3% standard price, submitted the lowest bid for repaving a portion of Montgomery St. Noted June 3.

✚Millburn, N. J.—The contract for paving Prospect and Mountain Ave., Pine, Elm and Maple St. has been awarded to JOHN DORER, Irvington, at $30,000. Noted June 10.

Newark, N. J.—Bids were received June 17 for repaving (a) Richards St. from Ferry St. to the Passaic River, (b) Oraton St. from Delevan to Elwood Ave., (c) Clifton Ave. from Second to Abington Ave. as follows: Continental Public Works Co., New York, N. Y., (a) $6609, (b) $5929, (c) $11,797; Ralph Sangiovanni, Newark, (a) $6973, (b) $6318, (c) $12,649; Northern Construction Co., Newark, (a) $6939, (b) $6229, (c) $12,462; Newton Paving Co., Newark, (a) $6959, (b) $6240, (c) $12,396; McMahon Construction Co., (a) $7039, (b) $6170, (c) $12,395; Uvalde Asphalt Co., (a) $7224, (b) $6485, (c) $12,739; Glenfield Construction Co., (a) $7355, (b) $6428, (c) $12,560. Noted May 20 and June 3.

✚New Brunswick, N. J.—The contract for improving St. George's Ave. has been awarded to LIDDLE & PFEIFFER, Perth Amboy, at $65,286. Noted June 10 and 24.

Rutherford, N. J.—(Official)—Bids will be received until 8:15 p.m., July 2, by the Borough Council for laying water bound macadam pavement on Sylvan St. from Pierrepont to Van Riper Ave. and on Van Ness Ave. from Lincoln to Park Ave. F. A. Stedman is Borough Clk.

Summit, N. J.—(Official)—Bids will be received until 8 p.m., July 6, by the Common Council for improving Pine Grove Ave.

Weehawken, N. J.—(Official)—Bids will be received until 8 p.m., July 6, by the Township Committee for paving Clifton Terrace from Hudson Blvd. east to Park Ave. Estimated cost, about $50,000. Noted May 20.

✚★Philadelphia, Penn.—(Official)—The contract for improving the Northeast Blvd and branches from Rhawn St. northward has been awarded to the McNICHOL PAVING & CONSTRUCTION CO., at $310,000. Noted June 3 and 24.

Pittsburgh, Penn.—(Official)—Bids will be received until 10 a.m., July 8, by the Commissioners of Allegheny County for improving a number of highways in Allegheny County. Hyatt M. Cribbs is County Controller.

✚Richmond, Penn.—The contract for paving North A St. has been awarded to the ANDREWS PAVING CO., Hamilton, Ohio.

✚★Wilmington, Del.—A contract for laying approximately 100,000 sq.yd. of pavements has been awarded to the TOPEKA PAVING CO., INC., Brooklyn, at about $500,000. Noted May 13.

Fairmont, W. Va.—At the election held June 21 the citizens of Fairmont District, Marion County voted in favor of issuing $100,000 in bonds, the proceeds of which will be used for improving roads. Noted May 13 and 27.

Huntington, W. Va.—Bids will be received until July 20 by the Commissioners of Cabell County for constructing about six miles of the Ohio River Rd. Oliver & Maupin, Courthouse, is Engr.

Matewan, W. Va.—At a recent election the citizens voted in favor of issuing $12,000 in bonds, the proceeds of which will be used for grading and paving streets.

Carthage, N. C.—At a recent election the citizens voted in favor of issuing $5000 in bonds, the proceeds of which will be used for the construction of roads in Sandhill Township, Moore County. Noted May 7.

Dobson, N. C.—An election will be held July 20 to vote on the question of issuing $25,000 in bonds, the proceeds of which will be used to construct roads in Siloam Township, Surry County.

Carterville, Ga.—(Official)—An election will be held July 17 to vote on the question of issuing $15,000 in bonds, the proceeds of which will be used for paving streets. W. W. Daniel is City Engr.

Ocilla, Ga.—An election will be held July 15 to vote on the question of issuing $50,000 in bonds, the proceeds of which will be used for the construction of roads.

Pinellas Park, Fla.—Bids will be received until July 6 for curbing and paving a number of streets with brick. R. J. DeHaas is Town Clk.

✚Tavares, Fla.—A contract for constructing a system of roads in District No. 4 has been awarded to the CONTINENTAL PUBLIC WORKS CO., at $79,023. Noted Dec. 14 and Mar. 18.

Wauchula, Fla.—Bids will be received until July 12 for paving with brick Main St. from the eastern boundary to Florence Ave. and Fifth Ave. from Orange to Palmetto St.

Laurel, Miss.—The city plans to pave about five miles of streets, including portions of Front, Ash, Eighth and 10th St Estimated cost, $150,000.

Meridian, Miss.—At a recent election the citizens voted in favor of issuing $50,000 in bonds, the proceeds of which will be used for constructing roads in Lauderdale County to connect with paved streets in Meridian. Noted May 20.

+Baton Rouge, La.—A contract for paving 12 miles of streets has been awarded to E. W. PRUTMAN, Danville, Ill., at $200,000.

Mansfield, La.—Bids will be received until noon, July 6, by E. D. Hudson, Clk., for constructing approximately 10,130 sq.yd. of street pavement, 3500 lin.ft. of curb and 260 lin.ft. of storm sewer. E. E. Swope is City Engr.

Marksville, La.—The citizens of Avoyelles parish will hold an election July 22 to vote on the question of issuing $350,000 in bonds. The proceeds will be used to construct about 80 miles of roads.

Carrollton, Ky.—An election will be held Aug. 5 to vote on the question of issuing $50,000 in bonds, the proceeds of which will be used for the construction of roads.

Pineville, Ky.—All bids recently received for grading the road from Middlesboro to Four Mile have been rejected by the Commissioners of Bell County. W. C. Bingham is Clk.

Canal Dover, Ohio—Bids will be received until July 15 by C. Weaver, City Clk., for paving East Third St. with brick. The estimated cost of the work is $20,000. George Arnold, New Philadelphia, Ohio, is Engr.

Coshocton, Ohio—(Official)—Bids will be received until noon, July 10, by the City Audr. for the sale of $11,000 in bonds, the proceeds of which will be used for the improvement of Seventh Ave. from Kenilworth Ave. to Bank St.

Euclid, Ohio—(Official)—Bids will be received until noon, July 12, by H. S. Dunlop, Clk., for repairing Euclid Rd. and Chardon Rd. F. A. Pease Engineering Co., 804 Marshall Bldg., Cleveland, is Engr.

+Findlay, Ohio—The contract for paving East Sandusky St. has been awarded to HASKELL & BATTLES, Painesville, at $9856.

Lakewood, Ohio—(Official)—Bids will be received until noon, July 12, by E. A. Fisher, City Engr., for paving Dowd St. and Norton, French and Virginia Ave. with brick bituminous macadam or sheet asphalt, and for surfacing old macadam on Lake Ave. with bituminous concrete, sheet asphalt or bitulithic.

New Albany, Ohio—Bids will be received until noon, July 15, by F. M. Heischmann, Clk., for improving a number of streets. Jennings, Lawrence & Lindsay, Hartman Bldg., Columbus, is Engr.

+Norwalk, Ohio—(Official)—A contract for improving four miles of county highway in Huron County has been awarded to the MODERN CONSTRUCTION CO., Fremont, at $37,290. Other bids were: G. E. Scott, $39,999; Graves & Barrett, $39,880; Riley Pardo, $39,499. Noted June 17.

Portsmouth, Ohio—(Official)—Bids will be received until noon, July 6, by George L. Gableman, City Audr., for the sale of $10,000 in bonds, the proceeds of which will be used for improving a number of streets.

+Rocky River, Ohio — (Official) — The contract for constructing concrete sidewalks on the North Ridge Rd. has been awarded to B. G. FAY, 2087 West 91st St. Cleveland, at $6831. Other bids were: McHugh Bros., $7463; P. H. Peterson, $8025; W. N. Bomfield, $8661; G. B. Sloat, $8513; C. H. Bartholomew, Kent, $8392. Noted June 10.

St. Clairsville, Ohio—(Official)—Bids will be received until 1 p.m., July 5, by Emerson Campbell, Audr. of Belmont County, for repairing and resurfacing a portion of High Ridge Rd., in Pultney, Pease, Colerain and Richland Townships.

West Park, Ohio—Bids will be received until noon, July 6, by Fred F. Feuchter, Clk., for improving Warren, Raymond, Osborne, Belden, Lesure and Midland St.

+Indianapolis, Ind.—The contract for grading, graveling sidewalks and curbing on Sutherland Ave. has been awarded to the AMERICAN CONSTRUCTION CO., at $7000.

+New Castle, Ind.—The contract for paving Bundy Ave. has been awarded to the UNION ASPHALT CO., Indianapolis.

+Bay City, Mich.—Contracts have been awarded for paving Lafayette, Michigan and Kosciusko St. to the WILLISTON CONSTRUCTION CO., at $25,040; Madison and John St. to the CLEVELAND TRINIDAD CO., Cleveland, at $52,039 and $4209 respectively; Germania St. to BATESON BROS., at $12,011; John St. to P. RYAN, at $8417.

Eaton Rapids, Mich.—Bonds for $16,000 have been sold, the proceeds of which will be used for paving a number of streets.

Brocton, Ill.—(Official)—The time for receiving bids has been postponed from June 28 until 2 p.m., July 12, by the Commissioners of Highways of Embarrass Township, Edgar County, for constructing combination rock and gravel roads on four highways in Embarrass Township. Noted June 17.

+Evanston, Ill.—(Official)—The contract for paving Lyons St. from Ridge to Wesley Ave. has been awarded to M FOLEY CO., at $4814.

Fairbury, Ill.—The City Council contemplates paving Third, Walnut and Maple St. with brick, at an estimated cost of $25,000. H. B. Taylor is Mayor.

+Lake Forest, Ill.—A contract for constructing 13,400 sq.yd. of asphaltic concrete pavement has been awarded to H. G. GOELITZ, Oak Park, at $29,661. Other bids were: Western Improvement Co., Racine, $30,628; John A. McGarry Co., Chicago, $31,685.

+Milwaukee, Wis.—Contracts have been awarded for constructing asphalt pavements on 25th, 15th, 18th, and Burnham St. to the WHITE CONSTRUCTION CO., Marietta and Murray Ave., to F. P. COUGHLIN; 27th and 16th St. to the BADGER CONSTRUCTION CO. The estimated cost of the work is $92,000.

Racine, Wis.—(Official)—Bids will be received until 10 a.m., July 10, by the Board of Public Works for the improvement of 17th St. from Hamilton to Phillips Ave. and Lafayette Ave. from West Sixth St. to Root River.

+Atlantic, Iowa—A contract for paving 24,631 sq.yd. with concrete has been awarded to P. C. HANSEN & SON, Sioux City, at $1.14 per sq.yd.

+Marshalltown, Iowa—A contract for constructing concrete pavements on 25 streets has been awarded to THOMAS CAREY & SONS, Clinton. Noted June 10.

+Duluth, Minn.—The contract for paving Sixth and 16th St. has been awarded to AUGUST A. BODIN & SON, at $20,423.

+Mankato, Minn.—A contract for paving about 16 blocks in the business section has been awarded to the WIDELL CO., at $51,786. Noted May 13.

+Beloit, Kan.—(Official)—A contract for constructing pavements has been awarded to McGUIRE & STANTON CONSTRUCTION CO., Leavenworth, at $83,267. Other bids were: E. W. Geiger Construction Co., $86,442; Kaw Paving Co., $87,073; Watts & Amerman, $82,400. Noted June 17.

+Wellington, Kan.—(Official)—The contract for paving F, G, H, Fourth and Second St. with asphaltic concrete has been awarded to the KAW PAVING CO., Topeka, at $76,506. Noted June 17.

Kearney, Neb.—(Official)—Bids will be received until 2 p.m., July 2, by T. N. Hartzell, City Clk., for paving Districts Nos. 4 and 5. Noted May 13.

+Lincoln, Neb.—A contract for constructing asphaltic concrete pavement in District No. 308 has been awarded to the BURKE COCHRANE CONSTRUCTION CO., Lincoln, at approximately $18,000.

+Lewistown, Mont.—The contract for paving several streets in the Eighth Ave. District has been awarded to C. W. JOHNSON, at $10,320.

+Kansas City, Mo.—Contracts have been awarded for paving Campbell St. from 27th St. south to the CLEVELAND TRINIDAD PAVING CO., at $4843; Main St. from 40th to 43d St. and Central St. from 31st to 33rd St., to F. P. McCORMICK, at $6107 and $6652 respectively.

+Newport, Ark.—(Official)—The contract for paving Walnut St. with concrete has been awarded to J. R. HOLDEN, Newport, at $8000. Noted June 17.

Weatherford, Tex.—The citizens of Parker County will hold an election July 31 to vote on the question of issuing $60,000 in bonds. Part of the proceeds will be used for the construction of roads.

Cathlamet, Wash.—Bids will be received until 1 p.m., July 6, by the Board of County Commissioners for improving a portion of State Road No. 19, beginning at Skamokawa, running eastward a distance of 6½ miles.

+Elma, Wash.—(Official)—The contract for paving Main, Third and Young St. has been awarded to the WASHINGTON PAVING CO., at approximately $34,880. Other bids were: Independent Asphalt Paving Co., $36,482; Olympic Paving Co., $38,784; Hougili-Hegg & Co., $39,126. Noted June 10.

+Montesano, Wash.—The contract for hardsurfacing a portion of the Elma Rd. has been awarded to the WASHINGTON PAVING CO., Tacoma, at $14,500. Noted June 17.

+Olympia, Wash.—The contract for constructing 7½ miles of Permanent Highway from Vancouver to La Center in Clark County has been awarded to the GENERAL CONSTRUCTION CO., Spokane, at $25,036. The only other bid was that of Akeson & Baumquist, Portland, at $25,164. Noted June 17.

+Olympia, Wash.—The contract for paving Main St. has been awarded to the INDEPENDENT ASPHALT PAVING CO., Seattle, at $10,000.

+Seattle, Wash.—The contract for constructing the Redmond-Issaquah Rd. has been awarded to the HORROCKS CONSTRUCTION CO., at $55,099. Noted June 3.

Astoria, Ore.—Press reports state that the City Council plans to improve Niagara Ave. from Eighth St. to Olney Ave., at an estimated cost of $20,000.

+Portland, Ore.—The Commissioners of Multnomah County have awarded contracts for highway construction as follows: Columbia River Highway, 26.20 miles, Sections A, B and C, to the WARREN CONSTRUCTION CO., at $288,163; Section D, to the PACIFIC BRIDGE CO., at $155,332; Section E, to the BOYAJOHN-ARNOLD CO. and HANS PEDERSON, at $22,921. Sandy Road, 12.75 miles, Section A and B, to the WARREN CONSTRUCTION CO., at $204,849. Base Line Rd., 8.83 miles, Section A and B, to the CLARK-HENERY CONSTRUCTION CO., Sacramento, at $148,379. Powell Valley Rd., 7.62 miles, to OSCAR HUBER, at $121,603. Foster Rd., 4.34 miles, MONTAGUE-O'REILLY CO., at $94,043. Cañon Rd., 1.67 miles, Section A, to the BOYAJOHN-ARNOLD CO. and HANS PEDERSON, at $16,903; Section B, to MONTAGUE-O'REILLY CO., at $22,352. All bids for paving the St. Helens Rd. were rejected as being too high. Noted Apr. 1 and 29.

Bakersfield, Calif.—Press reports state that the Board of Supervisors of Kern County will receive bids until July 7 for constructing 1.42 miles of the Bakersfield-McKittric Rd.

+Banning, Calif.—A contract for constructing four miles of concrete curb, gutter and sidewalk has been awarded to M. V. McCOMBS, at approximately $24,000.

+Gridley, Calif.—The City Trustees have awarded a contract for paving 15 blocks to the CLARK-HENERY CONSTRUCTION CO., Sacramento, at $52,373.

Hutchinson, Kan.—(Official)—Bids will soon be called for by the City Clerk for paving about five blocks with vitrified brick.

+Los Angeles, Calif.—The contract for improving Medford St. from Murchison to Soto St. has been awarded to BRYANT & AUSTIN, at approximately $13,132.

Riverside, Calif.—Shull-Tucker Co., at $8140, was the lowest bidder for macadamizing and constructing concrete sidewalks, curbs and gutter on Vine St. from First to Seventh St.

Sacramento, Calif.—(Official)—Bids will be received until 2 p.m., July 6, by the State Highway Commission, 515 Forum Bldg., for constructing state highways as follows: Tehama County, from Red Bluff to the northerly boundary, 12.7 miles; Glenn County, From Willows to Grapit, 9.4 miles; Contra Costa County, from El Cievro to Eckley, 3.5 miles; Tulare County, from Goshen to Visalia, 6.4 miles; Tulare County, from westerly boundary to the tracks of the Southern Pacific Company.

+San Bernardino, Calif.—Contracts have been awarded for paving Second St. to TUTTLE & DEVOY, at $12,236, and I St. to the HIGHWAY CONSTRUCTION CO., at $15,380.

✚**Sausalito, Calif.**—A contract for constructing 4259.15 lin.ft. of bituminous brick highway has been awarded to CLARK & HENERY, at $20,489. Noted June 17.

✚**Montreal, Que.**—A contract for constructing sidewalks on about 33 streets has been awarded to the SICILY ASPHALT CO. at approximately $65,000.

Brockville, Ont.—The Town Council plans to lay tarvia pavement on St. Andrew St. and Court House, at a cost of $5500. G. H. Bryson is Engr.

Ingersoll, Ont.—Bids will be received until 5 p.m., July 5, by W. R. Smith, Town Clk., for constructing approximately 7175 sq.yd. of vitrified brick pavement on a concrete base with 3500 lin.ft. of combined curb and gutter.

Orillia, Ont.—The Town Council plans to pave Front St., at an estimated cost of $7500. C. E. Grant is City Clk.

Pembroke, Ont.—The Town Council is considering the construction of pavements on Hincks, Berlin and Murray St., at an estimated cost of $8000. A. J. Fortier is Clk.

✚**Wallace, Ont.**—A contract for constructing 71 miles of roads has been awarded to A. R. BROWN.

INDUSTRIAL WORKS

✚**Boston, Mass.**—George W. Harvey, 201 Devonshire St., will build a ten-story manufacturing and office building at Chauncey and Bedford St. Clinton J. Warren, 804 Old South Bldg., is Arch.

✚**Boston, Mass.**—J. M. & C. J. BUCKLEY, 164 Federal St., has been awarded the contract for the construction of a five-story, 59x100-ft. warehouse for the Boston Wharf Co., 259 Summer St. M. D. Safford, 259 Summer St., is Arch.

Boston, Mass.—Bids are being received by Stebbins & Watkins, 164 Federal St., Arch., for the construction of a one- and two-story, 65x131-ft. manufacturing building for W. F. Smith.

Boston, Mass.—An eight-story, 55x80-ft. manufacturing and storage building will be constructed for Joseph Segal. F. A. Norcross, 46 Cornhill, is Arch.

✚**Charlestown, Mass.**—Walter S. Glidden has awarded the contract for the construction of a three-story, 47x85-ft. garage to F. C. ALEXANDER, Old South Bldg., Boston, Mass. The estimated cost is $25,000. Warren & Gerrish, 53 State St., Boston, Mass., is Arch. Noted June 24.

✚**Chelsea, Mass.**—W. H. LARKIN, 91 Tudor St., has been awarded the contract for the construction of a two-story addition to the factory of the Revere Rubber Co., 200 Devonshire St., Boston, Mass. The cost is estimated at $40,000.

✚**Dover, Mass.**—The contract for the construction of a two-story, 44x54-ft. garage for W. H. Baltzell, has been awarded to LEIGHTON & MITCHELL, 95 Milk St., Boston, Mass. Bellows & Aldrich, 9 Park St., Boston, Mass., is Arch. The estimated cost is $30,000.

Lowell, Mass.—The Wamesit Power Co. will build a two-story, 60x350-ft. factory, to cost about $60,000. It will be built by day labor.

✚**Bridgeport, Conn.**—JAMES STEWART & CO., 30 Church St., New York, N. Y., has been awarded the contract for the construction of 11 factories for the Remington Arms-Union Metallic Cartridge Co.

✚**Waterbury, Conn.**—The Waterbury Farrell Foundry & Machine Co., 465 Bank St., has awarded the contract for the construction of a three-story, 50x150-ft. addition to its factory to the H. WALES LINES CO., Meriden, Conn. W. E. Griggs, 111 West Main St., is Arch. Noted June 3.

✚**Waterville, Conn.**—TRACY BROS.' CO., 57 Benedict St., has been awarded the contract for the construction of a one- and two-story, 40x100-ft. factory for the Rowbottom Machine Co., Sheffield St. W. E. Griggs, 111 West Main St., Waterbury, Conn., is Arch.

✚**Binghamton, N. Y.**—J. L. LEWIS, Wall St., has been awarded the contract for the construction of a two-story, 62x100-ft. addition to the factory of the Barnes-Smith Co.

✚**Buffalo, N. Y.**—The Pierce-Arrow Motor Car Co. has awarded the contract for the construction of a four-story, 200x400-ft. reinforced-concrete addition to its plant on Elmwood Ave. to the ABERTHAW CONSTRUCTION CO., Boston, Mass. The estimated cost is $200,000.

Buffalo, N. Y.—Bids are being received by Joseph J. Geigard, Arch., 346 Herman St., for the construction of a three-story, 30x150-ft. storehouse for Adam J. Menger, 224 Washington Market.

Herkimer, N. Y.—Bids have been received by Carl Hang & Sons, Arch., Little Falls, N. Y., for the construction of a three-story, 60x90-ft. addition to the mill of the Royal Gem Mills. Joseph Reamy, St. Johnsville, N. Y., is Pres.

New York, N. Y.—(Borough of Brooklyn)—The Sperry Gyroscope Co., 126 Nassau St., plans the construction of a ten-story factory. Frank J. Helmle, 190 Montague St., is Arch.

New York, N. Y.—(Borough of Brooklyn)—Bids have been received by Benjamin Dreisler, Arch., 143 Remsen St., for the construction of a two-story, 60x200-ft. warehouse for Becker's Aniline & Chemical Works, 105 Underhill Ave. Noted Mar. 11.

✚**New York, N. Y.**—(Borough of Manhattan)—SMITH & LEO, INC., 103 Park Ave., Borough of Manhattan, has been awarded the contract for the construction of a $10,000 factory extension for J. M. Huber, 65 West Houston St. (Borough of Manhattan). Brutus Gundlack, 185 Madison Ave. (Borough of Manhattan), is Arch.

✚**New York, N. Y.**—(Borough of Manhattan)—C. F. Etzel, 165 West 18th St., has awarded the contract for the construction of a two-story, 60x100-ft. factory to KATZ & SCHOENHOLTZ, 165 West 18th St. The estimated cost is $12,000. Mitchell Bernstein, 131 East 23rd St., is Arch.

✚**New York, N. Y.**—(Borough of Queens)—J. ODELL WHITENACK, 231 West 18th St., Borough of Manhattan, has been awarded the contract for the construction of a four-story factory for Fred Ayer, Boston, Mass. H. N. Paradise, 231 West 18th St. (Borough of Manhattan), is Arch.

✚**Syracuse, N .Y.**—The Merrill-Soule Co., North Franklin St., has awarded the contract for the construction of a two-story, 56x123-ft. machine shop to the TAYLOR-HORNSBY CONSTRUCTION CO., Post-Standard Bldg. The estimated cost is $14,000.

Butler, N. J.—The Pequannock Rubber Co. will build a three-story, 47x180-ft. and a one-story, 40x75-ft. factory, to cost $50,000. M. & W. Oakley, 6 Park Ave., Paterson, N. J., is Arch. Joseph F. McLean is Pres.

✚**Newark, N. J.**—The contract has been awarded to the ESSEX CONSTRUCTION CO., 85 Academy St., for the construction of a two-story, 80x93-ft. garage for Max Mindl, 31 Clinton St. The estimated cost is $12,000. Frank Grad, 245 Springfield Ave., is Arch.

Newark, N. J.—George Stengel, Western Ave., will rebuild his three-story factory. The estimated cost is $40,000. M. N. Shoemaker, 9 Clinton St., is Arch.

Yardville, N. J.—The Chandler Oil Cloth Co. will build a $30,000 factory. J. Osborne Hunt, Inter-state Telephone Bldg., Trenton, N. J., is Arch.

✚**Allentown, Penn.**—Bayuk Bros. Co. has awarded the contract for the construction of a four-story factory to WILLIAM LINKER & CO.

Croyden, Penn.—(Bridgewater post office)—Bids are being received by Heacock & Hokanson, Arch., 1218 Chestnut St., Philadelphia, Penn., for the construction of a one-story, 40x250-ft. dairy for Joseph R. Grundy, Bristol, Penn. The estimated cost is $35,000.

Fleetwood, Penn.—Wayne M. High, Arch., 11 North Fifth St., Reading, Penn., is receiving bids for the construction of a two-story, 40x489-ft. automobile factory for the Fleetwood Metal Body Works, care Harry Urich. The estimated cost is $40,000.

Lebanon, Penn.—A. S. Kreider, Annville, Penn., contemplates the construction of a three-story factory estimated to cost $30,000.

✚**Philadelphia, Penn.**—The Tasty Baking Co., 2335 Sedgley Ave., has awarded the contract for the construction of a three-story, 66x79-ft. bakery to JOSEPH F. MYERS, JR., 1237 Ridge Ave.

✚**Philadelphia, Penn.**—(Official)—JOHN G. BROWN, Witherspoon Bldg., has been awarded the contract to design and build a plant for the mining, pumping, screening, washing and drying of sand for the Norcross & Edmunds Sand Co.

Riverside, Penn.—Bids have been received by W. U. Jurty, Arch., Shamokin, Penn., for the construction of a three-story, 50x120-ft. mill for William F. Taubel. The estimated cost is $45,000.

Hagerstown, Md.—Plans have been completed by Peuckert & Wunder, Arch., 310 Chestnut St., Philadelphia, Penn., for the construction of a one-story, 100x200-ft. factory for the Pangborn Corporation. The estimated cost is $35,000. Noted May 20.

Winchester, Va.—The National Fruit & Products Co., Alexandria, Va., plans the construction of a $20,000 plant. Milburn, Heister & Co., Union Savings Bank Bldg., Washington, D. C., is Arch.

✚**Charleston, W. Va.**—C. W. McNULTY, Huntington, W. Va., has been awarded the contract for the construction of a six-story, reinforced-concrete factory for the Woodrum Home Outfitting Co., to cost $85,000.

New Orleans, La.—Bids have been received by the Board of Commissioners of the Port of New Orleans, Suite 200, New Orleans Court Bldg., for the construction of a two-story, 120x2000-ft. wharf house and a 150x580-ft. warehouse on the Mississippi River near Valence St. Ford, Bacon & Davis, 921 Canal St., is Arch.

✚**Akron, Ohio**—THE HALLER CONSTRUCTION CO., Second National Bldg., has been awarded the contract for the construction of a one-story, 25x59-ft. and 56x68-ft. garage for Dayton A. Doyle, 510 West Market St. The estimated cost is $14,000. Henry & Murphy, Doyle Blk., is Arch.

Akron, Ohio—The Akron Gas Lamp Co. will build a factory at 606 South High St., to cost $14,000.

Barberton, Ohio—The Portage Rubber Co. will build a factory at an estimated cost of $300,000.

✚**Cincinnati, Ohio**—THE FERRO CONCRETE CONSTRUCTION CO., Richmond and Harriet St., has been awarded the contract for the construction of a one- and two-story, 52x203-ft. garage for the Commercial Auto & Sales Co., care Joseph Bering, 128 East Eighth St. The estimated cost is $30,000. Anthony Kunz, Jr., 955 West Court St., is Arch.

Cleveland, Ohio—Plans have been completed by Samuel Austin & Son Co., 14,230 Euclid Ave., for the construction of a four-story, 60x320-ft. factory, a foundry, and a power plant, at Ivanhoe Rd. and the Nickle Plate R.R., for the Frantz-Premier Co., Leader-News Bldg.

✚**Cleveland, Ohio**—JOHN WOIDE, 1659 East 86th St., has been awarded the contract for the construction of a one-story, 70x180-ft. addition to the factory of the Allyne Ryan Foundry Co., Aetna Rd. The Forest City Engineering Co., 512 Hippodrome Bldg., is Engr.

Cleveland, Ohio—The Westinghouse Electric & Mfg. Co., 1220 West 58th St., will remodel its plant at a cost of $500,000.

Cleveland, Ohio—Bids are being received by the Hydraulic Pressed Steel Co., H. O. Davidson, Ch. Engr., 3152 East 61st St., for the construction of a one-story, 80x360-ft. factory.

✚**Columbus, Ohio**—D. Reibel & Sons, Arch., has awarded the contract for the construction of a dairy and ice plant for the S. T. Budd Dairy Co., to WILLIAM WATSON, at $52,856. Noted Apr. 22 and June 24.

✚**Dayton, Ohio**—The contract for the construction of a four-story, 65x70-ft. packing plant for the Henry Burkhardt Packing Co., Huffman and Irwin St., has been awarded to JOSEPH BOREN & SONS, Arcade Bldg., Peters, Herman & Brown, Reibold Bldg., is Arch.

Kokomo, Ind.—Howard Cole & Co. plans the construction of additions to its foundry to cost $75,000.

✚**Muncie, Ind.**—The Warner Gear Co. has awarded the contract for the construction of a two-story addition to its

factory to the ILLINGSWORTH-SPANGLER CO. The estimated cost is $15,000. Cuno Kibele, 335 Johnson Bldg., is Arch.

✚Detroit, Mich.—The Atlas Foundry Co. has awarded the contract for the construction of a 85x270-ft. factory at Artillery Ave. and the Wabash R.R. to the WISCONSIN BRIDGE CO. W. T. Curtis is Engr.

✚Saginaw, Mich.—The Saginaw Daily News, 307 Tuscola St., has awarded the contract for the construction of a three-story, 50x110-ft. press building to J. S. KERNS & SON, 207 South Third St. The estimated cost is $30,000. Cowles & Mutscheller, 1 Chase Blk., is Arch.

Chicago, Ill.—The Bermingham & Seaman Co., 7 South Dearborn St., will build a seven-story, 100x150-ft. paper mill, to cost $150,000. Paul Gerhardt, 64 West Randolph St., is Arch.

✚Chicago, Ill.—The contract for the construction of an eight-story warehouse for the Independent Packing Co., 41st and Halsted St., has been awarded to the E. W. SPROUL CO., 1120 West 35th St. S. S. Joy, 1118 West 35th St., is Arch. Noted Jan. 14.

✚Wausau, Wis.—FRED W. KRAUSE has been awarded the contract for the construction of a three-story, 106x120-ft. packing plant for the Farmers' Coöperative Packing Co. H. C. Gardner, 140 South Dearborn St., Chicago, Ill., is Arch. Noted Feb. 4.

✚Jennings, Mo.—The National Oil Cloth Co. has awarded the contract for the construction of a one-story, 163x347-ft. factory to the McCORMICK-COOMBS CONSTRUCTION CO., Columbia Bldg., St. Louis. Klipstein & Rathmann, Chemical Bldg., St. Louis, is Arch.

Kansas City, Mo.—The Southwest News Co. will build a four-story, 50x133-ft. reinforced-concrete building at 410 East Ninth St., to cost $75,000. Smith, Rea & Lovitt, 602 Finance Bldg., is Arch.

St. Louis, Mo.—O. R. S. Traber, Fullerton Bldg., Arch., is receiving bids for the construction of a four-story, 48x96-ft. factory for Vivianno Bros., 1022 North Seventh St.

Tacoma, Wash.—The Sperry Flour Co. will build an addition to its plant at a cost of $65,000. J. D. Armstrong is Local Mgr. Bullard & Hill, Provident Bldg., is Arch.

San Fernando, Calif.—(Official)—Bids have been received by M. Grassley, Consolidated Realty Bldg., for the construction of a $20,000 lemon-packing plant for the San Fernando Lemon Association. H. A. Hamm, 100 North Daisy Ave., La Manda, Calif., is Arch.

FEDERAL GOVERNMENT WORK

Post Office—Mt. Vernon, N. Y.—Bids were received June 25 for the construction of a post office at Mt. Vernon, (a) using limestone for all stonework, except where granite is specified, (b) using sandstone, except where granite is specified, (c) using marble, except where granite is specified, as follows: J. S. Rogers, Moorestown, N. J., (a) $98,999, (b) $102,700, (c) $116,300; Westchester Engineering Co., White Plains, (a) $96,500, (b) $106,000, (c) $113,900; Dawson & Archer, New York, (a) $99,245, (b) $103,670, (c) $112,075; John G. Unkefer & Co., Minerva, Ohio, (a) $98,600, (b) $106,274, (c) $116,600; George T. Kelley, Yonkers, (a) $96,588, (b) $104,508, (c) $112,608; William J. Morgan, Mt. Vernon, (a) $99,450, (b) $99,000, (c) $112,800; John Lowry, Jr., New York, (a) $106,265, (b) $110,775, (c) $123,865; Thomas J. Waters, New York, (a) $110,000, (b) $115,000, (c) $125,000; William H. Egan, New York, (a) $99,740, (b) $106,300, (c) $127,700; Joseph di Benedetto, New York, (a) $87,737, (b) $95,737, (c) $105,737; Aroldo Barbaresi, New York, (a) $106,500, (b) $107,000, (c) $119,900; John T. Brady & Co., New York, (a) $94,510, (b) $97,510, (c) $110,510. Noted May 27.

✚Plumbing—New York, N. Y.—The contract has been awarded to C. F. MENTZINGER SONS, Brooklyn, at $32,119, for installing a new plumbing system in the U. S. post office and court house. Noted May 13 and June 10.

✚Coast Guard Station—Oswego, N. Y.—The contract has been awarded to R. M. BARNETT, Oswego, at $10,750, for constructing a coast guard station. Noted June 3 and 24.

★Repair to Pier—Erie, Penn.—The T. A. Gillespie Co., Pittsburgh, was low bidder at $30,248, for making repairs to north pier, Erie. Noted May 27.

Immigration Station—Baltimore, Md.—Bids will be received until 3 p.m., Aug. 16, by James A. Wetmore, Act. Superv. Arch., Washington, D. C., for constructing one four-story, one three-story and two two-story buildings.

★Road Work—Washington, D. C.—Bids were received June 22 by the Department of Agriculture for the construction of an experimental road on the Russel Rd., Alexandria County, Virginia, as follows: William P. McDonald Construction Co., New York, N. Y., $18,362; L. M. Johnson, Arlington, Va., $20,925; G. B. Mullen Construction Co., Washington, D. C., $18,574. Noted June 10.

Fuel-Oil Tank—Key West, Fla.—Bids will be received until 11 a.m., July 17, by H. R. Stanford, Ch. of Bureau, Yards and Docks, Navy Dept., Washington, D. C., for constructing a 50,000-gal. steel fuel-oil storage tank at the naval station.

Levee Work—Vicksburg, Miss.—Bids will be received until 11 a.m., July 12, by the officer of the Third Mississippi River District, for levee work consisting of 1,415,000 cu.yd.

✚Post Office—New Albany, Ind.—The contract for the construction of a post office at New Albany has been awarded to R. P. FARNSWORTH & CO., Owensboro, Ky., at $67,675. Noted Apr. 8 and May 20.

✚Post Office—La Salle, Ill.—The contract has been awarded to CHARLES W. GINDELE, Chicago, at $67,000, for constructing the U. S. post office. Noted Apr. 22 and June 3.

Post Office—Ft. Atkinson, Wis.—Bids will be received until 3 p.m., Aug. 2, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing complete the U S. post office at Ft. Atkinson.

✚Post Office—Chillicothe, Mo.—The contract for the construction of a post office at Chillicothe has been awarded to W. H. FISSELL & CO., New York, N. Y., at $87,700. Noted Apr. 22 and June 10.

Post Office—Cuero, Tex.—Bids were received June 21 by the Acting Supervising Architect, Treasury Dept., Washington, D. C., for the construction of a post office at Cuero, (a) limestone, (b) sandstone, as follows: Texas Construction Co., San Antonio, (a) $52,500, (b) $55,300; Richardson Engineering & Construction Co., Bainbridge, Ga., (a) $53,470, (b) $54,470; George A. Shaul, Seneca, Kan., (a) $53,510; R. P. Farnsworth & Co., Owensboro, Ky., (a) $56,470, (b) $59,000; Algernon Blair, Montgomery, Ala., (a) $57,286; Charles Fuess & Son, Cuero, (a) $57,800, (b) $61,200; Potters Lumber Co., East Liverpool, Ohio, (a) $58,200, (b) $60,800; Thomas W. Cissel, Wooster, Ohio, (a) $58,500, (b) $61,000; J. F. McKnight, Hallettsville, (a) $63,500. Noted May 13.

✚Post Office—Long View, Tex.—The contract for the construction of a post office at Long View has been awarded to V. E. TAYLOR, Ennis, at $36,250. Noted Apr. 29 and June 10.

Reclamation Service—Provo, Utah—Bids will be received until 2 p.m., July 15, at the U. S. Engineer Office, Provo, for constructing about 50,000 cu.yd. of canal excavation, 8000 cu.yd. of rolled embankment, 3000 cu.yd. of excavation for structures, 950 cu.yd. of reinforced concrete and 525,000 sq.ft. of canal lining. Morris Bien is Act. Dir. Specifications are on file with "Engineering News."

Repairing Wharfs—Portland, Ore.—Bids will be received until 11 a.m., July 12, at the U. S. Engineer Office, Couch Bldg., Portland, for enlarging and repairing wharfs and tramways and extending the north and south jetties at the mouth of the Sinslaw River.

Barges—Portland, Ore.—Bids will be received until 11 a.m., July 15, at the U. S. Engineer Office, Second District, Portland, for constructing two wooden fuel barges.

Addition to Building—Salem, Ore.—Bids will be received until 2 p.m., July 21, by Cato Sells, Comr. of Indian Affairs, Washington, D. C., for constructing an addition to the brick assembly hall at the Salem School.

Buildings—Guantanamo, Cuba—Bids will be received until 11 a.m., July 31, by H. B. Stanford, Ch., Bureau Yards and Docks, Washington, D. C., for constructing six buildings at the naval station, Guantanamo. Noted Apr. 8.

Locomotives—Panama—Bids will be received until 10:30 a.m., Aug. 16, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing 12 electric towing locomotives for the canal locks. Noted June 17.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., July 9, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies

Steel Doors—Panama—Bids will be received until 10:30 am., July 13, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing steel doors and erecting them at Pier No. 7 at Cristobal and shed on Pier 18 at Balboa

Structural Steel—Panama—Bids will be received until 10:30 a.m., July 12, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing and erecting structural steel and accessory parts for shed on pier No. 7, Atlantic Terminal, Panama Canal.

MISCELLANEOUS

Fire Station—Springfield, Mass.—Bids will be received by the City Clerk until noon, July 12, for the construction of a fire station on Winchester Sq. Specifications may be obtained from B. Hammett Seaburg, Arch., 21 Besse Place, Springfield.

✚Dam—Felts Mills, N. Y.—(Official)—The general contract for constructing a gravity section concrete dam at Felts Mills, has been awarded to the STEWART ENGINEERING CORPORATION 17 Battery Pl., New York. This dam impounds the waters of the Black River, generating power to operate the pulp and paper mill of the Taggart Paper Co.

Subway—New York, N. Y.—(Borough of Bronx)—The United States Government has consented to the construction of the proposed rapid transit bridge over the Bronx River at Westchester Ave. This bridge is to carry the tracks of the Pelham Bay Park branch of the Lexington Ave. subway, which, at this point runs on an elevated structure. The plans call for a permanent bridge with a clearance of 61 ft. above mean high water. The Engineers of the Public Service Commission for the First District are preparing plans.

Lumber, Grits and Sand—New York, N. Y.—(Borough of Bronx)—(Official)—Bids will be received by Douglas Mathewson, Borough Pres., Municipal Bldg., 177th St. and Third Ave., for furnishing and delivering long leaf yellow pine, spruce and chestnut posts and grits and wash sand.

Dredging—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by R. A. C. Smith, Comr., Docks and Ferries, Pier A., Battery Pl., Borough of Manhattan, until noon July 12, for dredging in Mill Basin, Jamaica Bay.

Subway—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by the Public Service Commission, 154 Nassau St., until 12:15 p.m., July 20, for the construction of Section No. 1 of Route No. 49, a part of the Culver Rapid Transit R.R. This is a three-track elevated railroad, which will connect the Fourth Ave. subway through 38th St. and Gravensend Ave., with Coney Island. Section No. 1 extends from a point in 37th St., 246 ft. southeast of Tenth Ave. under private property and intersecting streets to Gravesend Ave. and over Gravesend Ave. to a point about 525 ft. south of Bay Parkway (22nd Ave.) produced.

✚Subway—New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for constructing a part of Route 29, Section 1, beginning at a point under Eastern Parkway, about 192 ft. west of the westerly building line of Nostrand Ave., curving thence southerly under Eastern Parkway and private property into Nostrand Ave. to a point about 220 ft. south of the southerly building line of Church Ave. has been awarded to NEWMAN & CAREY, 215 Montague St. (Borough of Brooklyn), at $2,073,303. Noted June 24.

Lumber and Piles—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by R. W. C. Smith, Comr., Docks and Ferries, Pier A, Battery Pl., until noon, July 12, for furnishing and delivering lumber and piles.

Dredging—New York, N. Y.—(Borough of Manhattan)—(Official)—The following are the bids received by R. A. C. Smith, Comr. Docks and Ferries, for dredging for the Riverside Park improvement, West 87th to West 93rd St., North River: H. DuBois, 17 State St., 13c. per cu.yd.; J. A. Seely, 18c.; Morris & Cummings, 21c. Noted June 17.

✚Track Materials—New York, N. Y.—(Borough of Manhattan)—(Official)—The following awards have been made by the Public Service Commission, 154 Nassau St., Borough of Manhattan, for furnishing track materials: For open hearth rails, including main rails and guard rails, BETHLEHEM STEEL PRODUCTS CO., at $78,949; for rolled manganese rails, including standard and short lengths also the drilling or punching of bond and separate holes, MANGANESE STEEL RAIL CO., at 16,337; for track rail spliced bars, RAIL JOINT CO., at $11,474; for anti creepers, including those for guarded rails and those for unguarded rails, the CREEPCHECK CO., at $2571; for cut track spikes, LACKAWANNA STEEL CO., at $3326; for furnishing ties and timber, J. H. BURTON & CO., at $134,804; for furnishing bolts and nuts, AMERICAN IRON & STEEL MFG. CO., at $20,675; for malleable iron castings, under which classification are included guard rail braces, main rail braces and washers, FORAN FOUNDRY & MFG. CO., $5251; for tie plates under Type A, LACKAWANNA STEEL CO., at $14,190; for tie plates under Classification D, RAMAPO IRON WORKS, $1600, also for tie plates under Classification W and X, at $164; for hand rails, VULCAN RAIL & CONSTRUCTION CO., at $15,606; for special work, the RAMAPO IRON WORKS, at $19,740. Noted May 27 and June 24.

Motor Fire Apparatus—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by Robert Adamson, Fire Comr., until 10:30 a.m., July 7, for furnishing and delivering 24 motor-driven hose wagons, under three separate contracts, each contract providing for eight. Bids will also be opened at that time for furnishing 12 forty-gal. chemical tanks and 12 chemical hose reels.

Special Motor Apparatus—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Municipal Bldg., until 2 p.m., July 9, for furnishing and delivering one four-ton auto truck body, crane, bucket, etc., for cleaning catch basins; one four-ton auto chassis with power take off; one superstructure, including body, crane, bucket, shafts, gears, etc., from plans "A"; one superstructure according to plan "B." Plans are on file with the Auditor, Room 2141 Municipal Bldg.

Supplies—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received at Room 1230, Municipal Bldg., until noon, July 7, for furnishing and delivering lime, cement, sand, rock, fire clay and fire brick to the Department of Bridges, Docks and Ferries, Public Charities, Water Supply, Gas and Electricity and Fire Department.

Lumber—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received at Room 1230, Municipal Bldg., until noon, July 7, for furnishing and delivering lumber to Bellevue and Allied Hospitals, Department of Bridges, Fire Department, Department of Public Charities and Department or Water Supply, Gas and Electricity.

Screen Work—New York, N. Y.—(Borough of Richmond)—(Official)—The following are the bids received by the Department of Charities for furnishing and installing certain screen work on the windows and balconies of various buildings of the Sea View Hospitals. Protector Ventilating Co., $12,967; W. H. Jameanau Co., $14,375; Watson Mfg. Co., $18,759; Theriault Mfg. Co., 946 Flatbush Ave., Brooklyn, $12,939; S. Rorbuck Co., 13,941. Noted May 13 and 27, and June 17.

Flood Protection—Olean, N. Y.—The taxpayers of the city have voted to issue $150,000 in bonds for flood abatement. Noted June 10.

Park Improvements—Caldwell, N. J.—The Essex County Park Commission plans to spend $50,000 in improving Grover Cleveland Park.

Stable—Jersey City, N. J.—The city plans to construct a three-story stable on Cornelison Ave. at an estimated cost of $50,000.

Park Bonds—Jersey City, N. J.—Bids will be received until 3 p.m., July 8, by the Board of Chosen Freeholders of Hudson County for $300,000 of Hudson County park bonds. Walter O'Mara is Clk.

Fire Alarm System—New Kensington, Penn.—Bids will be received by W. G. Goerman, Chn. Fire Com., until 8 p.m., July 6, for furnishing and installing a fire alarm system.

Terminal—Spartanburg, S. C.—According to press reports the Southern Ry. Co. will build a freight terminal consisting of separate inbound and out bound warehouses with ample team track facilities, to cost about $100,000.

✚Sheds—Jacksonville, Fla.—The contract for constructing structural steel sheds, also roofing and siding on the municipal piers, has been awarded to the CHESAPEAKE IRON WORKS, Baltimore, at $33,160 and $24,738 respectively. F. W. Bruce is Ch. Engr., Port Comn. Noted June 3.

Drainage—St. Augustine, Fla.—Press reports state that the County Commissioners have sold bonds for improving the Elkton drainage system.

Wharf—New Decatur, Ala.—It is reported that the City Council has purchased a site at Bank St. along the Tennessee River and plans the construction of a wharf.

Wharf—Tuscaloosa, Ala.—The City Commission is considering the construction of a wharf at a cost of $25,000.

Levee—Senatobia, Miss.—Bids will be received by J. A. Wooten, Clk., County Supervisors, until July 5 for the construction of a levee.

✚Levee Work—New Orleans, La.—The State Board of Commissioners has awarded the following contracts to D. B. HEARIN & SON.; Scott Levee, 210,000 cu.yd. at 11.22c. per cu.yd.; Magnolia Levee, 157,000 cu.yd. at 9.4c.; the Whitney Levee, 110,700 cu.yd. at 9.4c.; Jack Strange Levee, 84,000 cu.yd. at 8.98c.

★✚Cranes and Elevator—New Orleans, La.—The contract for furnishing the electrical cranes for the cotton warehouses, has been awarded to the PAWLING & HARNISCHFEGER CO., Milwaukee, Wis., at about $65,800. Ford, Bacon & Davis, New Orleans, is Engr. Noted May 27.

Lumber and Piling—New Orleans, La.—Bids will be received by Ernest M. Loeb, Pres. Bd. of Comrs., New Orleans, until 2 p.m., July 14, for furnishing creosoted piling, creosoted lumber, and creosoted sheet piling, required for the construction of Julia Street Wharf. Specifications may be obtained of J. Devereux O'Reilly, Engr., 200 New Orleans Court Bldg., New Orleans.

Drainage—Westlake, La.—Bids will be received by W. H. Managan, Pres., Sulphur Drainage District No. 2, until July 7, for constructing 15 miles of open ditches. F. Shutts & Son, Lake Charles, is Engr.

Docks—Memphis, Tenn.—The Memphis Terminal Corporation is considering the construction of docks along the river front.

Drainage—Selmer, Tenn.—Bids will be received by the Board of Directors, Big Snake Creek Drainage District, until July 9, for drainage work, requiring about 253,844 cu.yd. of earth excavation. J. C. Houston, Selmer, is Atty.

Motor Fire Apparatus—Bellaire, Ohio—The voters passed a $16,500 bond issue for the purchase of one triple combination fire automobile, one combination motor fire truck, and one motor tractor.

Motor Fire Apparatus—Cleveland, Ohio—The city plans to spend $450,000 for motorizing and improving the fire department. Alfred A. Benesch, 304 City Hall, is the Safety Dir.

Swimming Pool—Cleveland, Ohio—Plans have been prepared by Walker & Weeks, Archs., 1900 Euclid Ave., for the construction of a swimming pool for the Y. W. C. A., at Prospect Ave. and East 18th St. The estimated cost is $15,000.

Ditch—Shelby, Ohio—Bids will be received until July 6 by George P. Staley, County Audr., for the purchase of $24,200 in ditch bonds.

✚Coke Ovens—Toledo, Ohio—The contract for constructing coke ovens for the Toledo Furnace Co. has been awarded to the H. KOPPERS CO., Pittsburgh, Penn.

✚Ditch—Anderson, Ind.—The contract for constructing Peters Ditch, etc., has been awarded to DANIELS & TYST, Anderson, at $30,125. William F. McVaugh is Drainage Comr. Noted May 13.

Ditch—Belvidere, Ill.—The Commissioners of Coon Creek Drainage District have completed plans for improving Coon Creek at a cost of about $78,000. A. L. Webster, Wheaton, is Engr.

Waterway—Springfield, Ill.—Edward F. Dunne, Governor, has signed the bill which provides for the construction of an eight-ft. channel connecting the Chicago drainage canal with the Illinois River, thereby creating a direct water route between the great lakes and the Gulf of Mexico through the Mississippi River. Noted Mar. 4.

Dam—Duluth, Minn.—Bids will be received by the County Commissioners until July 6 for constructing a dam at Vermillion Falls.

✚Ditches—Fairmont, Minn.—The contracts have been awarded by the County Commissioners for constructing Ditch No. 46 to the CEYLON CEMENT TILE CO., Ceylon, at $10,990, and Ditch No. 27, to JOEL BRAHY, Sherburn, at $6595. H. C. Nolte is County Audr.

Ditches—Roseau, Minn.—Bids will be called sometime in August by the State Drainage Commission, for constructing Judicial Ditches Nos. 61 and 62. The work requires the digging of about 300 miles of ditches in Roseau County, which includes 4,000,000 yd. of excavation. The estimated cost is $490,000. George A. Ralph, St. Paul, Minn., is Engr.

Conduit—Kansas City, Mo.—The City Council has granted permission to the Western Union Telegraph Co. to lay under the surface of the downtown streets, a pneumatic tube service and ducts for carrying low tensions wires.

Wharves and Docks—Beaumont, Tex.—The Wharf and Dock Commission has instructed Hugh M. Harding, Engr., 52 Vanderbilt Ave., New York, N. Y., to prepare working plans for the first wharf and terminal improvements, which includes the raising of the present wharf and the building of another unit of 500 ft., the construction of an 800-ft. shed and the installation of several loading and unloading cranes and other machinery. The estimated cost is $109,000. Noted Apr. 22.

Drainage—Robstown, Tex.—At an election held on June 17 a drainage district, comprising the town of Robstown and the outlying lands, was created and $150,000 bonds voted for the purpose of constructing a drainage system.

Drainage—Texas City, Tex.—The City Commission will soon call an election to vote on the question of issuing about $200,000 bonds for the construction of an underground drainage system. John W. Maxcy, Houston, is Engr.

Drainage—Dexter, N. M.—The construction of a drainage system near here to embrace 20,000 acres of land will be started about Aug. 1, if war is not declared by the United States against Germany. This provision is contained in the option of the Dickey Tile Co. for the purchase of the $250,000 bond issue for the proposed work.

Fire Equipment—Phœnix, Ariz.—Bids will be received by Robert A. Craig, City Mgr., until 4 p.m., July 6, for installing a fire alarm system and furnishing a motor driven fire engine.

✚Ditches, Drainage—Everett, Wash.—The contract for constructing drainage ditches in Drainage District No. 4, between Snohomish and Monroe, has been awarded by the County Commissioners to GEORGE P. WRIGHT, Tacoma, at $33,829. H. P. Niles is Engr. of the Dist.

Dock and Warehouse—Seattle, Wash.—The Harbor Island Dock & Terminal Co., White Bldg., will erect a dock and warehouse on Harbor Island, to cost about $500,000. Among those interested are O. D. Fisher, Fisher Flouring Mills Co., and the Schwager-Nettleton Mill Co., both with offices in the White Bldg.

Sprinkler System—Seattle, Wash.—The following are the bids received by C. E. Remsberg, Secy., Port of Seattle for installing a fire protection system in the storage warehouse at Smith's Cove: Fire Protection & Equipment Co., Seattle, $12,180; Automatic Sprinkler Co., Seattle, $13,140; Pacific Fire Extinguisher Co., Seattle, $13,452; Rockwood Sprinkler Co., Seattle, $13,371. Noted June 10.

Dock and Warehouse—Portland, Ore.—Plans are being prepared by Emil Schacht & Son, Arch., Portland, for the construction of a dock and warehouse on the Willamette River, for Albert Bros., Portland. The estimated cost is $20,000.

+Oil Reservoir—Los Angeles, Calif.—The contract for constructing a concrete oil reservoir at Point Fermin for the General Petroleum Co. has been awarded to LEONARDT & PECK, Hellman Bldg. Los Angeles, at about $60,000.

Levees—Sacramento, Calif.—The West Side Co., will spend $150,000 in the reconstruction of levees from Knights Landing to Colusa. J. H. Ralston and E. L. Low are Dirs.

+Ferry Aprons—San Francisco, Calif.—The Board of State Harbor Commissioners has awarded a contract for the construction of side aprons for ferry slips 6, 7 and 8, to the HEALY-TIBBITTS CONSTRUCTION CO., at $13,000.

+Piles—San Francisco, Calif.—The contract for furnishing the State Harbor Commission with creosoted piles has been awarded to J. M. COLEMAN, at $15,605. Noted June 24.

Bath House, Etc.—Santa Monica, Calif.—Charles F. Gordon, Arch., Los Angeles Investment Bldg., Los Angeles, has been commissioned to prepare plans for a two-story bath-house for W. J. Stadleman. There will also be a bridge about 60 ft. long to connect the roof with the bluff adjoining. The estimated cost is $25,000.

Flume—Weaverville. Calif.—The Corona de Ore Mining Co. will construct a flume 2½ miles long at a cost of about $25,000.

Levee—Yuba City, Calif.—The county plans to spend $50,000 on levee construction.

Dam—Beaverton, Ont.—G. Veale & Co. plans to construct a dam.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

+Augusta, Maine—The contract for the construction of a one-story, 54x127-ft. building for St. Augustine Church, has been awarded to JOHN FRANK CYR, Waterville, Maine. T. G. O'Connell, 18 Boylston St., Boston, Mass., is Arch. The estimated cost is $50,000. Noted May 13.

+Burlington, Vt.—The Rutland R.R. and the Central Vermont R.R. have awarded the contract for the construction of a two-story union station to the W. SHETON SWALLOW CO., 105 West 40th St., New York, N. Y.

Boston, Mass.—The First Universalist Church will build a one-story Church to cost $50,000. Rev. H. D. Maxwell, 10 Grand View Ave., is pastor.

+Boston, Mass.—The contract for the construction of a business block at 725 Atlantic Ave. for Daniel P. Collins has been awarded to NATHAN HURWITZ, 23 Wolcott St. The estimated cost is $50,000. A. J. Carpenter, Jr., 39 Dunreath St., is Arch.

+Lawrence, Mass.—John Flanagan, Supt. of Pub. Bldgs., City Hall Annex, has awarded the contract for the construction of a four-story, 86x217-ft. school to A. D. SHUFELT, 54 Phillips St.

Malden, Mass.—Newhall & Blevins, Arch., has plans prepared for the construction of a $40,000 addition to the public library on Park St.

+Milton, Mass.—BIGELOW & HARRIMAN, 127 Federal St., Boston, Mass., has been awarded the contract for the construction of a two-story building at Milton Academy. George F. Sgepard, 14 Kilby St., Boston, Mass., is Arch.

Waltham, Mass.—St. Charles Congregation will build a one-story, 65x150-ft. church, at an estimated cost of $85,000. Rev. Peter J. Walsh is pastor. James F. Monaghan, Room 401, 79 Milk St., Boston, Mass., is Arch.

Waltham, Mass.—John J. Johnson, 16 Morse St., Boston, Mass., will build a two-story, 65x125-ft. theater and store building by day work. The estimated cost is $45,000. F. A. Norcross, 46 Cornhill, Boston, Mass., is Arch.

Worcester, Mass.—A four-story lodge will be constructed for the Worcester Aerie of Eagles, to cost about $75,000. Thomas Wiseman is Chn. of Bldg. Com. F. M. Conlson, Walker Bldg., is Arch.

Albany, N. Y.—Merrick & Pember, Arch., 51 State St., is preparing plans for the construction of an eight- or ten-story apartment house at Washington Ave. and Swan St. The estimated cost is $150,000.

Albany, N. Y.—Plans are being prepared by Marcus T. Reynolds, Arch., 100 State St., for the construction of a six-story office building at 124 State St. for the Municipal Gas Co., 112 State St. The estimated cost is $600,000. N. F. Brady is Pres.

+Buffalo, N. Y.—W. J. WIERZBOWSKI, 1427 Broadway, Buffalo, has been awarded the contract for the construction of a three-story parochial school on Sycamore and Mills St. for the Church of the Transfiguration. Estimated cost, $60,000. W. H. Zawadski is Arch.

+Buffalo, N. Y.—The general contract for the construction of a two-story, 100x100-ft. reinforced-concrete store building at 300 Delaware Ave., for Harlow C. Curtiss, Erie County Bank Bldg., has been awarded to the EASTERN CONCRETE STEEL CO., Morgan Bldg. Estimated cost, $70,000.

+Katonah, N. Y.—The contract for the construction of a two-story sanatorium for W. Fahnestock, 2 Wall St., New York, has been awarded to STEVENSON & CAMERON, INC., 37 West 25th St., New York. The estimated cost is $45,000.

+New Hartford, N. Y.—PIUS KERNER & SONS, Utica, has been awarded the contract for the construction of a four-story building for St. Elizabeth's Hospital, Genesee St. The estimated cost is $200,000. Noted Dec. 10.

New York, N. Y.—(Borough of Bronx)—The New York Central R.R. contemplates the construction of a station at Park Ave. and Spencer Pl. from 146th to 149th St. The estimated cost is $3,000,000. G. W. Kittredge is Ch. Engr.

New York, N. Y.—(Borough of Bronx)—Plans are being prepared by M. L. Emery and H. G. Emery, 68 Bible House, for the construction of an asylum at Kingsbridge Rd., Grand Blvd., Creston Ave. and 193rd St. for the Society for Relief of Destitute Blind, 896 Amsterdam Ave.

New York, N. Y.—(Borough of Brooklyn)—Lord & Hewlett, Arch., 345 Fifth Ave., New York, is preparing plans for the construction of additions and alterations to the Brooklyn Hospital, at De Kalk Ave. and Raymond St.

New York, N. Y.—(Borough of Manhattan)—Schwartz & Gross, Arch., 347 Fifth Ave., is preparing preliminary plans for the construction of a 13-story apartment house at Park Ave. and 81st St. for Edgar A. Levy, 505 Fifth Ave. The estimated cost is $500,000. Noted May 6.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by C. B. J. Snyder, Supt., Dept. of Education, Park Ave. and 59th St., until 3 p.m., July 12, for the general construction of Public School No. 3 at Grove and Hudson St.

New York, N. Y.—(Borough of Manhattan)—Bernhard Feifer, 109 East 81st St., has purchased a site at 111 East 81st St. upon which he will construct a nine-story apartment house.

New York, N. Y.—(Borough of Manhattan)—Plans are being prepared by Warren & Wetmore, Arch., 16 East 47th St., for the construction of an apartment house on Park Ave. from 55th to 56th St. The estimated cost is $1,600,000. Fullerton-Weaver Realty Co., 30 East 42nd St., is interested.

New York, N. Y.—(Borough of Manhattan)—The George Backer Realty Co. recently purchased a site at Madison Ave. and 29th St. upon which they will construct a commercial building. The estimated cost is $900,000.

New York, N. Y.—(Borough of Manhattan)—Plans are being prepared by Emory Roth, Arch., 405 Lexington Ave., for the construction of an apartment house at 568 Park Ave. for Bing & Bing, 119 West 40th St. The estimated cost is $400,000.

New York, N. Y.—(Borough of Manhattan)—Plans have been prepared by William H. Birkmire, Arch., 1133 Broadway, for the construction of a sixteen-story store and loft building at 53 West 23rd St. upon the site of the Eden Musee. The estimated cost is $400,000.

New York, N. Y.—(Borough of Manhattan)—Plans are being prepared by Cross & Cross, Arch., 10 East 47th St., for the construction of a six-story store and apartment building at 414 Madison Ave., near 48th St., for David Dows. The estimated cost is $100,000.

+New York, N. Y.—(Borough of Queens)—The contract for the construction of a one-story bank building on the Queensboro Bridge Plaza, between Jackson and Hunter Ave. for the Bank of Long Island, 359 Fulton St., Jamaica, has been awarded to JOHN H. DEEVES & BRO., 103 Park Ave., New York.

+Orchard Park, N. Y.—(Official)—Bids will be received until July 7 by Robert North, Arch., Prudential Bldg., Buffalo, for the construction of a two-story school. The estimated cost is $50,000. Noted May 13 and June 24.

Port Chester, N. Y.—Bids will be received about July 8 for the construction of a three-story high school on Irving Ave. Hewitt & Bottomley, 597 Fifth Ave., New York, is Arch. The estimated cost is $120,000. Noted May 13.

Rochester, N. Y.—Eldridge, Comes & Kauzor, Arch., 316 Cutler Bldg., is preparing plans for the construction of a building at Lexington Ave. and Finch St. for the Holy Rosary Church. Estimated cost, $60,000. Arthur H. Hughes is Pastor.

Rochester, N. Y.—Plans are being prepared by Foster & Gade, Arch., Sibley Bldg., for the construction of a two-story auditorium on University Ave. for the University of Rochester. The estimated cost is $150,000. Rush Rhees is Pres.

+Rochester, N. Y.—R. T. FORD CO., 200 South Ave., Rochester, has been awarded the general contract for the construction of School No. 14 at Scio St. near University Ave. The estimated cost is $214,000. J. S. Mullan is Secy., Bd. of Education. Noted June 3.

+Rochester, N. Y.—The contract for the construction of an administration building and gymnasium for the Jewish Orphan Asylum on Genesee St. has been awarded to JOHN LUTHER & SONS, 176 North St., Rochester. Estimated cost, $45,000.

Scotia, N. Y.—The Trustees of the town of Glenville, District No. 2, contemplate the construction of a school. Estimated cost, $60,000. W. F. Gates, 141 Mohawk St., is Chn.

Yonkers, N. Y.—Bids will soon be received by the Masonic Guild, F. and A. M., for the construction of a four-story Masonic Temple on Guion St. and South Broadway. The estimated cost is $70,000. Beersman & Vollmer and Evart Tracy, 244 Fifth Ave., New York, are Assoc. Archs. Noted June 24.

+Arlington, N. J.—The general contract for the construction of a three-story parochial school with two wings, at Midland Ave. and Chestnut St., for St. Stephens Congregation, has been awarded to ROBERT W. PATRICK, 100 Montclair Ave., Newark. Estimated cost, $70,000. Noted May 6.

Bayonne, N. J.—The Jersey City Construction Co., 75 Montgomery St., Jersey City, at $40,000, submitted the lowest bid for the construction of the Hudson County Parental Home. Noted Mar. 18 and May 27.

Hoboken, N. J.—Plans are being prepared by Briscoe & Fagan, Arch., 95 River St., for the construction of a three-story addition and alterations to School No. 8, Jefferson and Seventh St. Estimated cost, $60,000. Noted June 17.

Jersey City, N. J.—Bids will be received by the Board of Chosen Freeholders of Hudson County, Court House, until July 28 for the construction of a jail at Newark Ave. and Willow Court. Noted Dec. 17 and Mar. 18.

Jersey City, N. J.—The Board of Education plans to construct Public School No. 4. Estimated cost, $90,000. John Rowland, 100 Sip Ave., is Arch. and Fred Ege, City Hall, is Clk., Bd. of Education.

Morristown, N. J.—Bids will soon be received for the construction of a two-story library for the Morristown Library and Lyceum Association. The estimated cost is $50,000. Henry C. Pitney, 6 Washington St., is Chn. of Bldg. Com.

Newark, N. J.—E. M. Waldron, Inc., 84 South Sixth St., at $65,153, was the lowest bidder on the general contract for the construction of an administration building on Clifton Ave. Noted May 6 and June 3.

Newark, N. J.—The Newark Building & Construction Co. has purchased a site at Spruce and Charlton St. The company plans to construct a five-story store and apartment building to cost about $50,000.

Passaic, N. J.—Preliminary plans have been prepared for the construction of a three-story building on Lafayette Ave. for the Passaic General Hospital. The estimated cost is $100,000. W. L. Lyall is Chn. of Bldg. Com.

Paterson, N. J.—The Board of Education plans to construct an addition and remodel Public School No. 10. The estimated cost is $125,000. James F. Dunphy, City Hall, is Clk. and Fred Wentworth, 140 Market St., is Arch. Noted Oct. 1.

Skillman, N. J.—Plans have been prepared for the construction of a service building and two cottages for the State Village for Epileptics. The estimated cost is $75,000. George S. Drew, Trenton, is State Arch.

✚West New York, N. J.—(Official)—The contract for the construction of a school at Broadway and 18th St. has been awarded to FREDERICK HEARTER, Hudson Ave. and 22nd St., at $110,435. Other bids were: T. F. Ayling, 205 16th St., $113,311; Jersey City Construction Co., 75 Montgomery St., Jersey City, $110,450; G. T. Kelly, Yonkers, N. Y., $112,607; De Knipe Construction Co., West Hoboken, $111,250. Noted Apr. 15 and June 17.

✚Blairsville, Penn.—The Board of Education has awarded the general contract for the construction of a two-story, 77x133-ft., brick high school to KRATT & AGNEW, Lorain, Ohio, at $60,000.

Clearfield, Penn.—The School Board has commissioned Harrington & Howard, Arch., Dubois, to prepare plans for the construction of a two-story, 125x165-ft. high school. The cost is estimated at $75,000. Noted Apr. 29.

✚Dickson City, Penn.—The general contract for the construction of a 1½-story, 47x96-ft. church for the congregation of St. Thomas Apostle has been awarded to BEILMAN & SON, Scranton. The estimated cost is $60,000.

Hershey, Penn.—Plans are being prepared by C. E. Urban, Arch., Woolworth Bldg., for the construction of a two-story brick and stone theater for M. S. Hershey. The estimated cost is $50,000.

Philadelphia, Penn.—Frederick Webber, Arch. Engr., Morris Bldg., is preparing plans for the construction of a 10-story, 100x120-ft. reinforced-concrete and brick building with one wing at Ninth and Sansom St. for the Wetherill Estate. The estimated cost is $200,000. Noted June 24.

✚Philadelphia, Penn.—JOHN A. FISHER, 3621 North Fifth St., Philadelphia, has been awarded the contract for the construction of a two-story, reinforced-concrete and brick school at Hutchinson St. The estimated cost is $40,000.

Philadelphia, Penn.—Plans are being prepared for the construction of a school at Second, Pike and Sanger St. in the 35th Ward. The estimated cost is $80,000.

Philadelphia, Penn.—F. W. Van Loon, Denckla Bldg., at $86,641, submitted the lowest bid for the construction of a one- and two-story brick and concrete recreation building at Price and McMahon St. for the city. Philip H. Johnson, Land Title Bldg., is Arch.

Philadelphia, Penn.—H. H. Weymeyer, Philadelphia, at $122,863, was the lowest bidder for the construction of a three-story police and fire station at 22nd St. and Hunting Park Ave. Noted Apr. 22.

Philadelphia, Penn.—Bids are being received by the Property Committee of the Board of Education for the construction of a three-story school at Lime Kiln Pike and 65th Ave., East Germantown. Estimated cost, $350,000. Noted June 24.

Pittsburgh, Penn.—Plans are being prepared by E. B. Lee, Arch., Pittsburgh Savings Bank Bldg., for the construction of a 10- or 12-story brick and steel store and loft building at Smithfield St. and Seventh Ave. for the Henry W. Oliver Estate. The estimated cost is $300,000.

✚Youngwood, Penn.—The Board of Education has awarded the general contract for the construction of a high school to WALTER & JONES, Scottdale. The estimated cost is $50,000. A. Brown is Secy. of Bd.

✚Baltimore, Md.—The Board of Awards has awarded the contract for the construction of a school at Jefferson and Caroline St. to the D. M. ANDREW CONTRACTING CO., 600 Equitable Bldg., Baltimore, at $87,000.

Hagerstown, Md.—H. E. Yessler, Arch., has prepared plans for the construction of an eight-story hotel on West Franklin St. for the Maryland Real Estate Co.

✚Washington, D. C.—The MELTON CONSTRUCTION CO., 1012 H St., N. W., has been awarded the contract for the construction of an apartment house at 16th and I St., N. W. The estimated cost is $200,000. Noted May 20.

Washington, D. C.—Kennedy Bros., 1334 H St., N. W., contemplates the construction of a concrete house at 16th St. and Crescent Pl., N. W. The estimated cost is $600,000.

STATE HIGHWAY, WASHINGTON

✚Bids were received May 24 by William R. Roy, State Highway Comr., Olympia, Wash., for the construction of a portion of the Sunset Highway from Rocklyn to Creston, from: (A) Burnett Construction Co., Seattle; (B) West Coast Construction Co., Seattle; (C) Clifton Applegate, Spokane; (D) Quigg Construction Co., Seattle; (E) Carlson Chindahl Co., Spokane; (F) Spokane Feed & Fuel Co., Spokane; (G) MOHR CONSTRUCTION CO., Waterville (awarded contract); (H) Porter & Conley and Edward Wren, Kalama; (I) Mitchell Bros., Spokane; (J) Sloane Bros., Seattle; (K) G. L. Strickler, Davenport; (L) General Construction Co., Spokane. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L
92,530 cu.yd. common excavation	$0.27	$0.32	$0.255	$0.23	$0.19	$0.25	$0.19	$0.23	$0.23	$0 22	$0.27	$0.23
25,900 cu.yd. solid rock excavation	1.00	0 90	1.20	1.00	1.10	1.21	0.85	1.35	1.15	0.80	1.05	0.96
3 acres clearing	150.00	50.00	20.00	10.00	30.00	35.00	8.00	10.00	35.00	40.00	40.00	35.00
14 cu.yd. riprap, hand placed	3.00	2 00	1 50	4.00	2.00	3.50	1.00	2.00	2.50	2.00	2.50	1.75
102 cu.yd. rubble masonry	8.00	6.00	5.00	8.00	7.00	6.50	6.00	8.00	5.00	8.00	6.00	4.00
35.5 cu.yd. concrete, Class 1	16.00	13.00	15.00	14.00	13.00	13.50	10.00	20.00	15.50	15.00	13.00	12.00
2750 lb. steel reinforcing bars in place	0.06	0.05	0.055	0.06	0.05	0.045	0.04	0.05	0.06	0.06	0.05	0.06
168 lin.ft. 12-in. plain concrete pipe in place	1.25	1.00	1.20	1.50	1.00	0.70	0.80	0.90	0.80	1.20	0.95	0.85
604 lin.ft. 18-in. plain concrete pipe in place	2.00	2.00	1.85	2.25	1.60	1.41	1.05	1.40	1.45	2.25	1.35	1.32
Loose rock excavation, per cu.yd.	0.75	0.75	0.49	0.65	0.55	0.80	0.45	0.45	0.60	0.40	0.55	0.37
Overhaul on material excavated, per cu.yd. each 100 ft.	0.03	0.03	0.02	0.025	0.02	0.015	0.025	0.02	0.015	0.02	0.01	0.02
Slope wall, per cu.yd.	5.00	6.00	4.00	6.00	3.00	3.50	2.75	6.00	4.00	2.50	2.50	2.00
Concrete, Class 2, per cu.yd.	12.00	12.00	14.50	12.00	11.00	12.50	9.50	18.00	13.50	14.00	11.00	11.00
Guard rails in place, including spikes and bolts, per lin.ft.	0.35	0.50	0.45	0.25	0.40	0.10	0.20	0.25	0.25	0.50	0.40	0.25
Timber and plank in place per M ft. b.m.	25.00	40.00	35.00	30.00	35.00	35.00	30.00	22.00	35.00	30.00	30.00	33.00
6-in. porous tile drains in place, per lin.ft.	0.20	0.80	0.40	0.60	0.20	0.20	0.35	0.15	0.25	0.45	0.25	0.18
8-in. porous tile drains in place, per lin.ft.	0.40	0.90	0.50	0.80	0.30	0.30	0.60	0.26	0.40	0.55	0.35	0.29
18-in. reinforced-concrete pipe in place, per lin.ft.	2.50	4.00	2.25	2.50	1.95	1.83	1.05	1.72	1.45	3.25	2.10	1.60
24-in. reinforced concrete pipe in place, per lin.ft.	3.50	6.00	3.00	4.00	2.75	2.83	2.25	2.58	2.15	4.00	3.25	2.30
30-in. reinforced concrete pipe in place, per lin.ft.	5.00	9.00	4.00	5.50	4.30	4.50	2.75	4.25	3.25	5.50	3.75	3.14
12-in. vitrified tile pipe in place, per lin.ft.	1.00	1.50	1.50	1.50	0.65	0.55	0.90	0.50	0.60	1.20	0.95	0.48
18-in. vitrified tile pipe in place, per lin.ft.	1.75	3.00	2.00	2.25	1.20	0.95	1.80	1.00	1.25	2.25	1.25	1.05
24-in. vitrified tile pipe in place, per lin.ft.	2.75	5.00	2.50	4.00	1.90	1.55	2.50	2.00	2.00	3.25	2.10	1.75
Extended totals	$54,342	$55,684	$57,268	$50,356	$48,636	$56,860	$41,479	$58,965	$53,442	$44,298	$54,519	$48,214

CALIFORNIA STATE HIGHWAYS

Bids were received May 24 by the California State Highway Commission, Sacramento, for the construction of Division VI, Route 10, Section A, Kings County, and Division VII, Route 4, Section A, Los Angeles County, parts of the State Highway, from: (A) Bent Bros., Los Angeles; (B) Taylor & Berliner, Los Angeles; (C) George S. Benson & Sons, Los Angeles; (D) John D. Marsh, Bakersfield; (E) W. A. Dontanville, Paso Robles; (F) Engineer's Estimate; (G) Leigh Garnsey, Los Angeles; (H) George Weigand, Lamanda Park; (I) Homer R. Kennedy and Frank Williams, Los Angeles; (J) White & Gaskill, Long Beach. The state will furnish pipe railing for culverts, reinforcing steel, corrugated iron pipe, portland cement and sand and coarse aggregate for concrete at a cost of $43,088 and $13,750 respectively, for the two highways. The item bids were as follows:

Kings County, Div. VI Route 10, Sect. A.	A	B	C	D	E	F
25,000 cu.yd. ordinary excavation	$0.84	$0.60	$0.65	$0.60	$0.60	$0.50
5000 cu.yd. borrow excavation	1.35	0.70	0.80	0.60	0.75	0.70
530 lin.ft. 12-in. corrugated pipe	0.65	0.50	0.75	0.80	0.50	0.35
488 lin.ft. 18-in. corrugated pipe	0.75	0.60	0.80	1.00	0.60	0.60
60 lin.ft. 24-in. corrugated pipe	0.95	0.70	0.90	1.20	0.75	0.85
30 lin.ft. 30-in. corrugated pipe	1.50	1.00	1.00	1.40	1.00	1.00
200 cu.yd. concrete, Class B culverts and monuments	20.00	10.00	10.00	20.00	11.00	10.00
8760 cu.yd. concrete pavement, Class B	4.15	4.00	3.00	3.20	3.75	2.90
1170 lin.ft. guard rail	0.50	0.50	0.60	0.50	0.40	0.50
54 monuments, hauling and setting	1.00	1.00	2.00	1.00	1.00	0.50
Extended totals	$69,555	$56,809	$50,212	$51,697	$54,955	$51,262

Los Angeles County, Div. VII, Route 4, Sect. A.	D	E	F	G	H	I	J
12,200 cu.yd. ordinary excavation	$0.60	$0.56	$0.40	$0.50	$0.60	$0.40	$0.55
102 lin.ft. 18-in. corrugated pipe	$0.80	$0.60	$0.45	$0.50	$0.75	$0.50	$0.75
74 lin.ft. 24-in. corrugated pipe	1.00	0.70	0.60	0.75	0.75	0.75	0.75
10 lin.ft. 36-in. corrugated pipe	1.20	1.00	0.90	1.00	1.00	1.00	1.00
95 cu.yd. concrete, Class B culverts and monuments	20.00	9.50	12.50	15.00	13.00	10.00	14.00
4120 cu.yd. concrete pavement, Class B	3.65	3.71	4.00	4.70	3.50	3.49	4.25
1756 lin.ft. guard rail	0.60	0.40	0.40	0.50	0.60	0.40	0.50
73 monuments, hauling and setting	1.00	1.00	0.50	1.00	1.50	1.00	1.00
Extended totals	$25,552	$23,918	$26,893	$27,956	$24,280	$21,101	$26,643

Washington, D. C.—Joseph J. Moebs, 817 G St., N. W., will construct a seven-story reinforced-concrete and brick apartment house at 18th and I St., N. W. Estimated cost, $60,000.

✚**Washington, D. C.**—The contract for the construction of a four-story, 75x75-ft. brick apartment house at 19th St. and Mintwood Pl., N. W., has been awarded to J. E. FOX, 37 R St., N. E. Estimated cost, $55,000.

Clarksburg, W. Va.—Plans have been prepared for the construction of a four-story building at Water and Mechanic St. to replace the Kessler Hospital. The estimated cost is $75,000. Noted June 24.

✚**Parkersburg, W. Va.**—The general contract for the construction of alterations to the Wood County Bank at Fifth and Market St. has been awarded to H. H. VOUGHT & CO., 70 East 45th St., New York. Estimated cost, $40,000. Denneson & Harris, 475 Fifth Ave., New York, N. Y., is Arch.

Gastonia, N. C.—At a recent election the citizens voted in favor of the question of issuing $100,000 in bonds, the proceeds of which will be used for the construction of schools. Noted June 17.

Atlanta, Ga.—Plans are being prepared by W. T. Downing, Arch., for the construction of a 10-story building at Walton and Fairlie St. for Frank Hawkins, Pres. of Third National Bank. Estimated cost, $100,000.

✚**Atlanta, Ga.**—The contract for the construction of a four-story school on South Pryor St. has been awarded to THOMAS J. & ALBERT L. DAY, at $50,000. Walker & Chase is Arch.

✚**Chatsworth, Ga.**—The County Commissioners have awarded the contract for the construction of a three-story, 60x80-ft. concrete court house to H. J. CARR & CO., Atlanta. The estimated cost is $50,000. A. Blair, Macon, is Arch.

Bradentown, Fla.—Plans are being prepared by J. D. Goin, Cummings Bldg., for the construction of a four-story, 100x168-ft. store and hotel building. Estimated cost, $45,000. G. E. Blumenauer is Constr. Engr.

New Smyrna, Fla.—At a recent election the citizens voted in favor of the question of issuing $42,000 in bonds, the proceeds of which will be used for the construction of a two-story school. A. E. Lewis, Real Estate Bldg., Miami, is Arch.

Palmetto, Fla.—An election will be held July 10 to vote on the question of issuing $50,000 in bonds. The proceeds will be used for the construction of a school. C. E. Haley is Chn. of School Bd.

Titusville, Fla.—The Board of Public Instruction will construct a grade and high school. The estimated cost is $65,000. A. E. Lewis, Miami, is Arch.

✚**Andalusia, Ala.**—The Commissioners of Covington County have awarded the contract for the construction of a courthouse to the LITTLE-CLECKER CONSTRUCTION CO., Anniston. The estimated cost is $70,000.

Birmingham, Ala.—Plans are being prepared by Miller & Martin, Arch., for the construction of a two-story, reinforced-concrete and terra-cotta store building on 20th St. The estimated cost is $45,000.

Vicksburg, Miss.—Plans are being prepared by Leon C. Weis, Arch., New Orleans, La., for the construction of a clubhouse for the M'nai B'rith Society. The estimated cost is $50,000. J. Hirsh is Pres.

CALIFORNIA STATE HIGHWAY
Colusa County, Division III, Route 7, Section C

Bids were received June 1 by the State Highway Commission, Sacramento, for the construction of Division III, Route 7, Section C, of the State Highway in Colusa County, from: (A) W. B. Hunt & Sons, Alameda; (B) Taylor & Berliner, Los Angeles; (C) Cammary Peterson Co., Inc., San Francisco; (D) L. F. Gerdetz, San Francisco; (E) Bent Bros., Los Angeles; (F) James Fitzpatrick, Sacramento; (G) Marin Rock Co., San Anselmo; (H) C. H. & A. W. Gorrill, San Francisco; (I) Engineer's Estimate. The state will furnish pipe railing for culverts, reinforcing steel, corrugated iron pipe, portland cement, sand and coarse aggregate amounting to $52,623. The item bids were as follows:

	A	B	C	D	E	F	G	H	I
11,000 cu.yd. excavation, unclassified	$0.62	$0.70	$0.60	$0.45	$0.95	$0.50	$0.75	$0.70	$0.75
60 lin.ft. 12-in. corrugated iron pipe	0.60	0.50	1.00	0.75	0.50	0.50	0.45	0.50	0.50
180 lin.ft. 18-in. corrugated iron pipe	0.70	0.60	1.50	1.00	0.56	0.60	0.65	0.75	0.50
60 lin.ft. 24-in. corrugated iron pipe	0.80	0.70	2.00	1.25	0.60	0.70	0.75	1.00	0.50
360 cu.yd. concrete, Class "B"	10.00	10.00	12.00	9.00	11.20	8.00	9.00	10.00	10.00
10,400 cu.yd. concrete pavement	3.00	2.90	3.10	3.00	3.70	3.25	2.84	2.85	2.90
750 lin.ft. guard rail	0.50	0.40	0.25	0.40	0.40	0.40	0.32	0.35	0.35
62 monuments, hauling and setting	0.60	1.00	1.00	1.00	0.95	1.00	1.50	1.00	1.00
Extended totals	$42,242	$42,002	$43,859	$40,052	$53,488	$42,722	$41,548	$41,489	$48,857

CALIFORNIA STATE HIGHWAY
Monterey County, Division V, Route 2, Section B

Bids were received June 1 by the State Highway Commission, Sacramento, for the construction of Division V, Route 2, Section B of the State Highway in Monterey County, from: (A) W. A. Dontanville, Paso Robles; (B) Manuel Jacinto, Sacramento; (C) Lou G. Hare, Salinas; (D) C. H. & A. W. Gorrill, San Francisco; (E) James Fitzpatrick, Sacramento; (F) Peterson & Grier, San Francisco; (G) Hoffman & McLaren, Oakland; (H) Engineer's Estimate. The state will furnish pipe railing for culverts, reinforcing steel, corrugated iron pipe, portland cement, sand and coarse aggregate amounting to $45,352. The item bids were as follows:

	A	B	C	D	E	F	G	H
11,200 cu.yd. excavation, unclassified	$0.60	$0.60	$0.57	$0.85	$0.70	$0.65	$0.70	$0.40
710 lin.ft. 12-in. corrugated iron pipe	0.50	1.00	0.40	0.50	0.50	0.50	0.50	0.40
245 lin.ft. 18-in. corrugated iron pipe	0.60	1.00	0.60	0.60	0.75	0.75	0.75	0.45
135 lin.ft. 24-in. corrugated iron pipe	0.70	1.00	0.80	0.90	1.00	1.00	1.00	0.55
120 cu.yd. concrete, Class "B"	9.50	10.00	12.00	10.00	15.00	12.00	11.00	8.70
4600 cu.yd. concrete pavement	2.55	3.70	3.10	3.77	4.00	3.00	4.00	4.30
220 lin.ft. guard rail	0.40	0.40	0.35	0.35	0.50	0.40	0.50	0.40
66 monuments, hauling and setting	1.00	2.00	0.50	1.00	1.00	1.50	1.00	0.50
Extended totals	$20,340	$26,250	$22,733	$28,828	$28,890	$23,381	$28,410	$29,777

STATE HIGHWAY, WHITMAN COUNTY, WASHINGTON

✚Bids were received, May 24, by the State Highway Commissioner, Olympia, Wash., for the construction of a portion of the Inland Empire Highway, from Colfax, south in Whitman County, from: (A) Henry Styles, Tacoma; (B) Carlson Chindahl Co., Spokane; (C) W. G. Mulligan & Co., Spokane; (D) H. L. WILSON CO., Walla Walla (awarded contract); (E) G. L. Stickler Co., Davenport; (E) General Construction Co., Spokane; (G) O. F. Leonard, North Yakima; (H) Mitchell Bros. & Payne, Spokane; (I) Dunn & Hogan, North Yakima; (J) Boomer & Hughes, Spokane. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
40,720 cu.yd. common excavation, including haul of 400 ft	$0.25	$0.19	$0.20	$0.20	$0.21	$0.17	$0.19	$0.215	$0.175	$0.22
250 cu.yd. loose rock excavation, including haul of 400 ft	0.50	0.50	0.45	0.45	0.45	0.50	0.60	0.50	0.40	0.40
2740 cu.yd. solid rock excavation, including haul of 400 ft	1.25	1.00	1.20	0.95	1.15	1.07	1.50	1.10	1.00	1.25
28,500 cu.yd. overhaul on any of the above materials, per each 100 ft	0.015	0.02	0.01	0.0125	0.01	0.015	0.02	0.0125	0.02	0.02
Rip rap, hand placed per cu.yd	3.50	2.00	3.00	2.50	2.50	2.00	2.50	2.50	1.50	2.50
Slope wall, per cu.yd	4.00	3.00	1.70	2.50	3.00	2.25	3.00	4.00	1.75	3.50
Rubble masonry, per cu.yd	6.00	8.00	4.50	5.00	6.50	5.00	8.00	5.00	4.00	11.50
55.0 cu.yd. concrete, first class	5.00	14.00	15.50	12.50	13.00	13.00	13.50	14.00	11.75	15.00
3320 cu.yd. concrete, second class	4.00	12.00	14.00	11.50	12.00	11.75	12.00	12.00	11.00	13.50
8800 lb. steel I-beams and structural shapes in place	0.10	0.07	0.055	0.04	0.05	0.06	0.075	0.055	0.06	0.055
1350 lb. steel reinforcing bars in place	0.10	0.05	0.05	0.04	0.05	0.06	0.06	0.055	0.04	0.05
1840 sq.ft. expanded metal in place	0.10	0.10	0.10	0.08	0.08	0.065	0.10	0.09	0.18	0.08
880 sq.ft. chicken wire in place	0.05	0.04	0.015	0.02	0.03	0.03	0.06	0.05	0.06	0.03
210 lin.ft. pipe rail in place	1.00	1.00	0.45	0.75	0.50	0.65	0.80	0.50	0.20	0.80
Guard rail in place, including spikes and bolts per lin.ft	0.40	0.40	0.70	0.30	0.40	0.25	0.30	0.25	0.12	0.25
Timber and plank in place, including spikes and bolts per lin.ft. b.m	40.00	35.00	39.00	30.00	30.00	35.00	33.00	32.00	25.00	30.00
80 lin.ft. porous tile drains in place, 6 in	0.30	0.20	0.16	0.15	0.25	0.18	0.25	0.25	0.35	0.30
Porous tile drains in place, 8 in. per lin.ft	0.45	0.30	0.30	0.20	0.35	0.29	0.40	0.40	0.45	0.45
Plain concrete pipe in place, 12 in. per lin.ft	1.00	1.00	0.55	0.65	0.95	0.87	1.30	0.80	1.00	0.70
694 lin.ft. plain concrete pipe in place, 18 in	1.85	1.60	1.25	0.75	1.35	1.35	2.00	1.45	1.50	1.45
Reinforced concrete pipe in place, 18 in. per lin.ft	2.60	1.95	1.65	0.95	2.10	1.65	2.50	1.45	1.75	1.45
146 lin.ft. reinforced concrete pipe in place, 24 in	3.85	2.75	2.60	1.25	3.25	2.40	3.25	2.15	2.25	2.20
Reinforced concrete pipe in place, 30 in. per lin.ft	4.50	4.50	4.50	1.50	3.75	3.25	3.75	3.25	3.00	3.00
Reinforced concrete pipe in place, 36 in. per lin.ft	6.00	5.15	5.25	2.00	4.75	4.08	4.50	4.25	3.90	4.00
Vitrified tile pipe in place, 12 in. per lin.ft	1.00	0.65	0.50	0.40	1.00	0.52	1.30	0.60	0.75	1.00
Vitrified tile pipe in place, 18 in. per lin.ft	1.80	1.20	1.25	0.60	1.25	1.15	1.80	1.25	1.25	1.80
Vitrified tile pipe in place, 24 in. per lin.ft	3.60	1.90	2.40	0.95	2.10	1.85	2.50	2.00	1.75	2.75
Concrete arch, 40-ft. span (lump sum)	2750.00	2361.00	2470.00	2065.00	2450.00	2041.00	1726.00	3200.00	2200.00	2400.00
Extra concrete per cu.yd	.....	.....	.....	13.00	.....	.....	13.00	.....	.....	.....
Extended totals	$257,03	$20,927	$21,903	$19,229	$21,466	$19,257	$22,047	$22,417	$19,440	$23,005

+Bastrop, La.—The Parish Board of School Directors has awarded the general contract for the construction of a high school to FRANK MASTING, Monroe, at $55,287. W. L. Stevens, New Orleans, is Arch. Noted June 3.

Chattanooga, Tenn.—Plans are being prepared by W. M. De Kalb, Arch., for the construction of the Shenn Memorial Church at Main and Hickory St. for the Universalist Church. The estimated cost is $50,000.

Nashville, Tenn.—At a recent election the citizens voted in favor of the question of issuing $600,000 in bonds. The proceeds will be used for the construction of schools.

Ashland, Ky.—An election will be held July 5 to vote on the question of issuing $125,000 in bonds, the proceeds of which will be used for the construction of a city jail and market house.

+Lexington, Ky.—The contract for the construction of a church for the Maxwell Street Presbyterian Congregation has been awarded to A. G. McGREGOR, Lexington. Estimated cost, $40,000. Richards, McCarthy & Bulford, Columbus, Ohio, is Arch.

+Louisville, Ky.—The contract for the construction of the Belknap School has been awarded to the ALT BUILDING CO., Louisville, at $68,500.

Canton, Ohio—Bids will be received until noon, July 8, by W. C. Lane, Clk., Bd. of Education, for the construction of a three-story, brick school at Third St., S. E., to be known as the Henry S. Martin School. The estimated cost is $75,000. Frank L. Packard, 1212 Tayden Bldg., Columbus, is Arch.

Cincinnati, Ohio—The Board of Trustees of the Chamber of Commerce is considering the construction of a building. The estimated cost is $1,000,000.

STATE HIGHWAY, LEWIS AND COWLITZ COUNTIES, WASHINGTON

+Bids were received June 1 by the State Highway Commissioner, Olympia, Wash., for the construction of a portion of the Pacific Highway in Lewis and Cowlitz Counties, from Toledo south, from: (A) Allred & James, Centralia; (B) M. P. Zindorf, Alaska Bldg., Seattle; (C) A. J. Miesen and J. A. Sandell, Chehalis; (D) Cochran, Nutting & Co., St. Johns, Ore.; (E) ANDREW & HARRER, Portland, Ore. (awarded contract); (F) Hendricks, Ward, Ryan & Gray, Chehalis; (G) Sloane Bros., Seattle; (H) Jeffrey & Bufton, Union Ave. and East Davis St., Portland, Ore. The item bids were as follows:

	A	B	C	D	E	F	G	H
38,160 cu.yd. excavation, including haul of 400 ft.	$0.34	$0.30	$0.40	$0.30	$0.26	$0.29	$0.30	$0.47
22,800 cu.yd. overhaul on above material, per each 100 ft.	0.05	0.015	0.025	0.03	0.02	0.02	0.015	0.02
21.1 acres clearing	150.00	93.00	114.00	75.00	80.00	170.00	100.00	200.00
28.2 acres grubbing	200.00	130.00	274.00	125.00	140.00	150.00	100.00	200.00
25.0 cu.yd. riprap hand placed	8.00	2.50	4.50	3.50	4.00	3.00	3.00	4.00
9 cu.yd. concrete, first class	20.00	14.00	13.10	18.00	16.50	12.00	15.00	17.00
54 cu.yd. concrete, second class	15.00	10.00	13.10	16.00	15.50	10.00	12.00	15.00
1280 lb. steel reinforcing bars in place	0.10	0.05	2.56	0.07	0.05	0.06	0.06	0.05
Lin.ft. guard rail in place, including spikes and bolts	0.25	0.30	....	0.20	0.30	0.25	0.30	0.35
9.0 M ft. b.m. timber and plank in place, including spikes and bolts	25.00	22.00	26.00	22.50	28.00	25.00	25.00	20.00
Porous tile drains in place, 4-in. per lin.ft.	0.15	0.50	0.20	0.15	0.20	0.25	0.35	0.20
Porous tile drains in place, 6-in. per lin.ft.	0.25	0.60	0.30	0.20	0.25	0.35	0.45	0.35
Porous tile drains in place, 8-in. per lin.ft.	0.35	0.70	0.45	0.25	0.30	0.50	0.50	0.40
594 lin.ft. plain concrete pipe in place, 12-in.	2.50	1.00	1.22	1.10	1.25	1.00	1.10	2.00
246 lin.ft. plain concrete pipe in place, 18-in.	3.50	2.00	1.84	1.60	2.75	2.00	2.25	3.00
Reinforced concrete pipe in place, 18-in. per lin.ft.	5.00	3.00	2.61	2.50	3.00	2.75	3.25	3.50
68 lin.ft. reinforced concrete pipe in place, 24-in.	6.50	3.50	3.89	3.75	4.25	3.75	4.25	5.00
Reinforced concrete pipe in place, 30-in. per lin.ft.	7.00	4.00	4.50	4.25	4.90	5.00	4.75	5.50
84 lin.ft. reinforced concrete pipe in place, 36-in.	8.00	4.50	5.93	6.50	5.50	6.00	5.00	6.00
Reinforced concrete pipe in place, 42-in. per lin.ft.	8.75	10.00	7.65	9.50	6.00	8.00	8.00	7.00
Vitrified tile pipe in place, 12-in. per lin.ft.	1.50	1.00	0.75	1.00	1.00	1.00	1.10	1.50
Vitrified tile pipe in place, 18-in. per lin.ft.	3.00	1.75	1.50	1.50	1.75	1.50	2.25	2.00
Vitrified tile pipe in place, 24-in. per lin.ft.	4.50	3.00	2.50	2.00	3.00	2.50	3.50	3.50
Extended totals	$27,922	$20,111	$32,355	$20,493	$19,585	$22,209	$19,796	$32,328

STATE HIGHWAY, THURSTON COUNTY, WASH.

+Bids were received June 1 by the State Highway Commissioner, Olympia, Wash., for the construction of a portion of the Pacific Highway from Lacey to Nisqually, in Thurston County, from: (A) Burnett Construction Co., Seattle; (B) Allred & James, Centralia; (C) L. H. GOERIG, 1027 Bellevue Court, Seattle (awarded contract); (D) West Coast Construction Co., Seattle; (E) Porter & Conley, Kalama; (F) Arvid Rydstrom, Tacoma; (G) Rignell & Rankston, Tacoma; (H) Matson & Carlson, Tacoma; (I) Charles N. & Erle Maxham, Tacoma; (J) Sloane Bros., Seattle; (K) Washington Paving Co., Tacoma; (L) Torger Peterson, Eatonville; (M) M. P. Zindorff, Seattle. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M
50,320 cu.yd. excavation, including haul of 400 ft.	$0.26	$0.34	$0.24	$0.30	$0.32	$0.35	$0.26	$0.25	$0.30	$0.27	$0.38	$0.32	$0.245
32,600 cu.yd. overhaul on above material per each 100 ft.	0.02	0.05	0.015	0.025	0.02	0.02	0.015	0.0175	0.01	0.02	0.015	0.015	0.015
8.6 acres clearing	175.00	125.00	100.00	150.00	100.00	75.00	100.00	125.00	125.00	180.00	150.00	150.00	63.00
5.5 acres grubbing	200.00	200.00	100.00	200.00	150.00	100.00	175.00	150.00	125.00	75.00	100.00	100.00	65.00
Riprap, hand placed per cu.yd	4.00	8.00	4.00	6.00	3.00	3.50	6.00	4.00	3.50	3.00	2.50	2.25	3.00
70 cu.yd. concrete, first class	14.00	20.00	12.00	14.00	14.00	12.00	12.00	12.00	12.00	15.00	12.00	10.00	15.00
2 cu.yd. concrete, second class	12.00	15.00	11.00	12.00	12.00	10.00	10.00	11.00	11.00	7.00	10.00	8.00	12.00
5,600 lb. steel reinforcing bars in place	0.06	0.10	0.06	0.06	0.06	0.08	0.10	0.05	0.07	0.06	0.05	0.05	0.06
1800 lin.ft. guard rail in place, including spikes and bolts	0.30	0.25	0.10	0.30	0.25	0.25	0.35	0.30	0.25	0.35	0.25	0.20	0.20
30 M ft. timber and plank in place, including spikes and bolts	20.00	25.00	20.00	20.00	28.00	25.00	20.00	20.00	22.50	20.00	25.00	20.00	22.00
Porous tile drains in place, 4-in. per lin.ft.	0.15	0.15	0.25	0.40	0.25	0.20	0.25	0.20	0.18	0.30	0.30	0.15	0.40
Porous tile drains in place, 6-in. per lin.ft.	0.20	0.25	0.30	0.60	0.40	0.30	0.30	0.30	0.20	0.40	0.35	0.20	0.50
Porous tile drains in place, 8-in. per lin.ft.	0.40	0.35	0.35	0.80	0.60	0.40	0.35	0.50	0.25	0.50	0.60	0.35	0.65
72 lin.ft. plain concrete pipe in place, 12-in.	1.00	2.50	1.25	1.30	1.00	1.30	1.50	0.90	0.50	1.20	1.00	1.00	1.00
92 lin.ft. plain concrete pipe in place, 18-in.	1.90	3.50	2.00	2.25	2.00	2.00	2.50	2.00	1.00	2.25	1.75	1.25	2.00
Reinforced concrete pipe in place, 18-in. per lin.ft.	2.50	4.50	2.50	4.00	2.50	3.00	3.00	3.00	1.00	3.25	2.50	2.50	3.00
50 lin.ft. reinforced concrete pipe in place, 24-in.	3.50	5.50	3.00	6.00	4.00	4.00	4.50	4.00	1.75	4.00	3.00	3.50	3.50
Reinforced concrete pipe in place, 30-in. per lin.ft.	6.00	6.50	4.50	7.00	5.00	5.00	6.00	6.00	2.75	5.00	6.00	3.50	4.00
Vitrified tile pipe in place, 12-in. per lin.ft.	0.80	1.50	1.25	1.20	1.00	1.50	1.50	0.90	0.65	1.20	1.00	0.75	1.20
Vitrified tile pipe in place, 18-in. per lin.ft.	1.75	3.00	2.00	2.10	1.75	2.50	2.50	2.00	1.25	2.25	1.75	1.50	1.85
Vitrified tile pipe in place, 24-in. per lin.ft.	2.75	4.50	3.00	3.00	2.75	3.50	4.00	4.00	2.00	3.00	2.50	2.25	3.00
Extended totals	$19,242	$24,880	$16,378	$21,381	$21,525	$22,444	$18,608	$17,781	$19,779	$19,322	$24,173	$20,749	$16,589

CALIFORNIA STATE HIGHWAYS
Humboldt County, Division I, Route 1, Section E

Bids were received June 1 by the State Highway Commission, Sacramento, for the construction of Division I, Route 1, Section E, a part of the State Highway in Humboldt County. The bidders were: (A) W. B. Hunt & Sons, Alameda; (B) Frank L. Smith Co., Eureka; (C) Bates, Borland & Ayer, Oakland; (D) A. C. McLean Construction Co., San Francisco; (E) L. F. Gerdetz, San Francisco; (F) Twohy Bros. Co., San Francisco; (G) Hoffman & McLaren, Oakland; (H) Fairbanks & Baechtel, Willits; (I) James Fitzpatrick, Sacramento; (J) Mercer-Fraser Co., Eureka; (K) G. W. Conners, Eureka; (L) F. Rolandi, San Francisco; (M) W. A. Bacchtel, Alton; (N) A. Robinson & R. R. Smith, Fortuna; (O) Crowley, Clomey & Green, Eureka; (P) Engineer's Estimate. The state will furnish pipe railing for culverts, reinforcing steel, corrugated iron pipe and portland cement amounting to $20,021. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
89,000 cu.yd. excavation unclassified	$0.70	$0.69	$0.52	$0.70	$0.50	$0.72	$0.55	$0.58	$0.65	$0.645	$0.5975	$0.77	$0.69	$0.64	$0.74	$0.55
1466 lin.ft. 12-in. corrugated iron pipe	0.60	0.60	0.50	0.50	0.60	0.65	0.40	0.55	0.60	0.55	0.45	0.60	1.00	0.55	0.60	0.55
316 lin.ft. 15-in. corrugated iron pipe	0.70	0.70	0.60	0.60	0.75	0.75	0.50	0.65	0.75	0.70	0.50	0.75	1.00	0.67	0.80	0.65
354 lin.ft. 18-in. corrugated iron pipe	0.80	0.70	0.75	0.70	1.00	0.90	0.60	0.75	1.00	0.80	0.55	0.90	1.00	0.75	1.00	0.80
412 lin.ft. 24-in. corrugated iron pipe	0.90	0.75	1.00	1.00	1.20	1.30	1.00	1.00	1.25	1.10	0.60	1.25	1.00	1.00	1.25	1.10
274 lin.ft. 30-in. corrugated iron pipe	1.00	0.75	1.50	1.50	1.50	2.30	1.50	1.00	1.50	1.60	0.70	1.75	1.00	1.50	1.50	1.60
342 cu.yd. concrete, Class "B", (culverts and monuments)	10.00	12.00	15.00	15.00	14.00	13.50	10.00	14.00	14.00	12.00	12.00	15.00	12.50	12.00	15.00	12.00
7.3 miles moving and resetting property fences	200.00	150.00	200.00	200.00	350.00	180.00	200.00	250.00	200.00	250.00	160.00	200.00	200.00	240.00	300.00	250.00
180 monuments, hauling and setting	0.60	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.50	1.50	1.00	1.00	1.00	0.50	1.00	0.50
Extended totals	$69,317	$68,607	$55,061	$71,063	$54,399	$72,865	$55,790	$60,376	$66,765	$65,806	$60,081	$77,730	$70,147	$65,012	$75,772	$65,729

Cincinnati, Ohio—The Members of the Mystic Shrine of Cincinnati have purchased the old Guilford School property on Sycamore St. near Fourth St., upon which they will construct a building. The estimated cost is $1,000,000.

Cincinnati, Ohio—The Directors of the Longview Hospital have petitioned the Hamilton County Commissioners to vote on the question of issuing $250,000 in bonds, the proceeds of which will be used for the construction of additions to their present buildings.

+Cleveland, Ohio—The contract for the construction of a hotel for the Stillman Amusement Co., Buffalo, N. Y., has been awarded to the CROWELL, LUNDOFF, LITTLE CO., 1951 East 57th St., Cleveland. The estimated cost is $700,000. Noted Apr. 15.

Cleveland, Ohio—The Cleveland & Youngstown R.R. Co. will construct freight and passenger terminals at Broadway and Orange Ave. O. P. Van Sweringen, Marshall Bldg., is Pres.

Cleveland, Ohio—Plans are being prepared by Richard Irvin, Arch., Union Bank Bldg., Pittsburgh, Penn., for the construction of an eight-story reinforced-concrete and brick building at Lakeside Ave. and East Third St. for Harry J. Schlosser, Erie, Penn. Estimated cost, $120,000.

Cleveland, Ohio—Bids will be received until 4 p.m., July 9, by Carl Lorenz, Secy., Cleveland Public Library Bd., 1375 Euclid Ave., for the construction of a library at East 79th St. near Superior Ave. Noted Feb. 25 and June 10.

Cleveland, Ohio—Plans are being prepared and bids will soon be received for the construction of a dancing academy at East 105th St. and Euclid Ave. for H. O. Oster. The estimated cost is $50,000. Noted May 6.

Cleveland, Ohio—Bids will be received about July 20 by W. S. Lougee, Arch., Marshall Bldg., for the construction of additions and alterations to the Meckes Homestead at Franklin Ave., N. W. The building will be used as a county juvenile detention home. The estimated cost is $65,000. Noted Mar. 25.

WESTON AQUEDUCT SUPPLY MAINS, NEWTON, MASS.
Section 5

+Bids were received Apr. 26 by the Metropolitan Water Board, Boston, for laying water pipes in Newton, Section 5 of the Weston Aqueduct Supply Mains, from: (A) ANDREW M. CUSACK, Boston (awarded contract); (B) James L. Pierce & Co., Boston; (C) Rowe Contracting Co., Boston; (D) Coleman Bros., Boston; (E) Bruno & Petitti, Boston; (F) John P. Cavanaugh Co., Boston; (G) M. Russo & Son Co., Boston; (H) Charles A. Kelly, Somerville; (I) Hugh Nawn Contracting Co., Boston; (J) John T. Shea, Jr., Boston; (K) Moore & Co., Boston. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K
8000 lin.ft. laying 60-in. c.i. pipe	$3.74	$3.85	$3.85	$4.10	$4.15	$4.25	$4.30	$4.40	$4.50	$4.48	$5.75
110 lin.ft. laying 12-in. c.i. pipe, for blow-offs	1.00	1.00	1.25	1.00	1.00	1.75	1.50	1.25	2.00	1.00	1.00
680 cu.yd. rock excavation above grade	7.40	5.00	6.00	4.00	3.00	8.00	8.00	6.00	4.00	7.00	8.00
5 cu.yd. rock excavation below grade	7.40	5.00	6.00	5.00	4.00	8.00	8.00	6.00	6.00	10.00	10.00
30 cu.yd. earth excavation below grade	1.50	1.00	2.00	1.00	1.25	2.00	1.60	1.00	1.00	1.50	1.75
5 chambers for air valves	49.00	40.00	50.00	30.00	40.00	50.00	50.00	50.00	50.00	50.00	30.00
4 chambers for blow-off and by-pass valves	55.00	50.00	60.00	95.00	50.00	60.00	65.00	75.00	50.00	60.00	35.00
1 chamber for 36-in. valve	55.00	50.00	60.00	95.00	60.00	60.00	80.00	75.00	60.00	75.00	60.00
60 cu.yd. concrete masonry	6.75	5.00	6.50	7.00	7.00	8.00	7.00	7.00	7.50	7.00	10.00
Extended totals	$32,369	$32,615	$33,047	$34,730	$34,787	$36,762	$37,103	$37,522	$37,960	$38,290	$48,602

SEWER SYSTEM AND SEWAGE-DISPOSAL PLANT, CLEBURNE, TEX.

+Bids were received June 4 by Charles Wilhite, City Secy., for the construction of a sanitary sewer system and a sewage-disposal plant from (A) HAMILTON BROS., Houston (awarded contract); (B) Brown Bros., Kansas City, Mo.; (C) Bash & Janes, Joplin, Mo.; (D) William F. Riley, St. Louis, Mo.; (E) Roach Manigan, Ft. Worth; (F) James A. Pringle, Carthage, Mo.; (G) Henry Rees, Quincy, Ill.; (H) George O. White & Co., Memphis, Tenn.; (I) Tonkawa Construction Co., Kansas City, Mo.; (J) Edgar Main, Liberty, Mo.; (K) J. R. Sutherlin Construction Co., Kansas City, Mo.; (L) Intermountain Bridge & Construction Co., Tecumseh, Neb.; (M) H. C. Gass, San Antonio; (N) Winslett Eldridge Co., Dallas; (O) Bailey Reeder Co., Mobile, Ala.; (P) Koehler-Fowler Construction Co., Memphis, Tenn.; (Q) V. M. Washem & Co., Waco; (R) H. K. McCullum, Ft. Worth; (S) McKenzie Construction Co., San Antonio. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
125,278 lin.ft. 8-in. vitrified sewer pipe	$0.18	$22.5	$0.25	$0.24	$0.22	$0.22	$0.23	$0.21	$0.25	$0.22
18,575 lin.ft. 10-in. vitrified sewer pipe	0.25	0.29	0.34	0.30	0.28	0.29	0.295	0.26	0.34	0.31
13,791 lin.ft. 12-in. vitrified sewer pipe	0.40	0.37	0.42	0.40	0.36	0.36	0.35	0.33	0.45	0.39
6280 lin.ft. 15-in. vitrified sewer pipe	0.60	0.525	0.60	0.60	0.55	0.52	0.50	0.47	0.65	0.60
2956 lin.ft. 18-in. vitrified sewer pipe	0.85	0.77	0.95	0.80	0.78	0.75	0.71	0.70	0.90	0.83
8781 lin.ft. 21-in. vitrified sewer pipe	1.15	1.11	1.35	1.00	1.20	1.10	0.93	1.02	1.40	1.05
12 lin.ft. 8-in. c.i. pipe	0.60	0.90	0.80	1.00	0.875	1.00	1.00	0.90	0.80	0.75
60 lin.ft. 10-in. c.i. pipe	0.825	1.08	1.00	1.25	1.05	1.25	1.25	1.20	1.00	1.00
24 lin.ft. 12-in. c.i. pipe	1.05	1.44	1.30	1.50	1.32	1.75	1.50	1.50	1.40	1.10
120 lin.ft. 18-in. c.i. pipe	1.87	2.70	2.40	1.00	1.96	2.50	2.50	2.00	2.40	1.75
264 lin.ft. 21-in. c.i. pipe	2.25	3.10	2.80	4.00	2.50	3.25	2.50	2.90	3.00	2.10
115,615 lin.ft. 6 ft. trench	0.12	0.16	0.11	0.17	0.14	0.15	0.16	0.22	0.18	0.10
27,660 lin.ft. 6 ft. to 8 ft. trench	0.25	0.19	0.13	0.20	0.20	0.20	0.20	0.27	0.20	0.16
27,060 lin.ft. 8 ft. to 10 ft. trench	0.29	0.24	0.21	0.30	0.40	0.30	0.25	0.35	0.25	0.27
3675 lin.ft. 10 ft. to 12 ft. trench	0.40	0.60	0.60	0.50	0.60	0.40	0.30	0.50	0.35	0.30
1690 lin.ft. 12 ft. to 16 ft. trench	0.88	0.90	0.90	0.90	0.75	0.60	0.45	0.90	0.60	0.98
3140 6-in. on 8-in. Y-connections	0.72	0.35	0.35	0.25	0.35	0.40	0.37	0.40	0.45	0.35
335 6-in. on 10-in. Y-connections	0.97	0.50	0.55	0 30	0.45	0.55	0.47	0.60	0.60	0.57
255 6-in. on 12-in. Y-connections	1.26	0.60	0.75	0.40	0.75	0.65	0.60	0.75	0.75	0.75
57 6-in. on 15-in. Y-connections	1.81	1.00	1.00	0.50	1.25	1.00	0.865	1.00	1.10	1.00
35 6-in. on 18-in. Y-connections	2.80	1.40	1.30	0.70	1.65	1.50	1.30	1.50	1.60	1.25
286 manholes	49.00	27.00	25.00	28.00	29.00	27.50	30 00	25.00	24.00	30.00
50 flush tanks	75.00	64.00	55.00	60.00	65.00	55.00	62.00	55.00	62.00	65.00
52 lampholes	6.00	7.00	7.00	7.00	10.00	7.50	8.00	6.00	8.00	6.00
11900 cu.yd. rock excavation	1.00	1.80	1.25	1.75	1.50	2.25	2.50	1.75	1.50	2.75
151.5 portland cement	11.00	9.00	9.00	7.00	9.00	10.00	7.00	10.00	8.00	10.00
Lumber	30.00	40.00	15.00	30.00	30.00	40.00		30.00	30.00	20.00
Sewage disposal plant complete	28,194.00	24,000.00	34,400.00	24,000.00	31,409.96	28,975.00	25,648.00	26,000.00	26,000.00	29,435.00
Extended totals	$144,527	$148,818	$151,187	$152,468	$155,296	$155,328	$156,408	$156,832	$156,833	$158,450

	K	L	M	N	O	P	Q	R	S
125,278 lin.ft. 8-in. vitrified sewer pipe	$0.20	$0.20	$0.18	$0.22	$0.25	$20.5	$0.25	$0.26	$0.26
18,575 lin.ft. 10-in. vitrified sewer pipe	0.27	0.30	0.24	0.27	0.34	26.5	0.33	0.33	0.34
13,791 lin.ft. 12-in. vitrified sewer pipe	0.36	0.40	0.32	0.37	0.44	33.5	0.41	0.43	0.43
6280 lin.ft. 15-in. vitrified sewer pipe	0.53	0.60	0.44	0.50	0.63	46.5	0.57	0.62	0.63
2956 lin.ft. 18-in. vitrified sewer pipe	0.80	0.80	0.62	0.73	0.93	0.69	0.84	0.90	0.90
8781 lin.ft. 21-in. vitrified sewer pipe	1.12	1.10	0.85	1.05	1.19	98.5	1.28	1.30	1.25
12 lin.ft. 8-in. c.i. pipe	0.95	1.50	1.00	1.00	1.00	1.21	84.5	0.95	1.00
60 lin.ft. 10-in. c.i. pipe	1.40	2.00	1.40	1.25	1.38	1.65	1.10	1.25	1.31
24 lin.ft. 12-in. c.i. pipe	1.75	2.50	1.80	1.50	1.75	2.10	1.37	1.40	1.50
120 lin.ft. 18-in. c.i. pipe	3.10	3.50	3.10	2.75	3.15	3.75	2.35	2.75	2.75
264 lin.ft. 21-in. c.i. pipe	3.60	4.00	3.80	3.50	3.75	4.50	2.89	3.20	3.50
115,615 lin.ft. 6 ft. trench	0.18	0.14	0.32	0.15	0.325	0.30	0.35	0.40	0.40
27,660 lin.ft. 6 ft. to 8 ft. trench	0.23	0.20	0.35	0.22	0.455	0.37	0.38	0.48	0.50
27,060 lin.ft. 8 ft. to 10 ft. trench	0.30	0.30	0.40	0.30	0.62	0.44	0.40	0.78	0.80
3675 lin.ft. 10 ft. to 12 ft. trench	0.40	0.40	0.55	0.73	0.91	0.60	0.60	0.90	0.90
1690 lin.ft. 12 ft. to 16 ft. trench	0.60	0.80	0.65	0.92	1.39	0.80	0.80	1.20	1.25
3140 6-in. on 8-in. Y-connections	0.35	0.60	0.50	0.47	0.35	0.35	0.22	0.65	0.65
335 6-in. on 10-in. Y-connections	0.50	0.80	0.70	0.58	0.45	0.46	0.34	0.80	0.80
255 6-in. on 12-in. Y-connections	0.55	1.00	1.10	0.75	0.60	0.59	0.45	0.90	0.90
57 6-in. on 15-in. Y-connections	1.00	1.50	1.35	1.25	0.85	0.85	0.75	1.30	1.40
35 6-in. on 18-in. Y-connections	1.50	2.00	1.90	1.75	1.25	1.28	1.17	2.00	2.00
286 manholes	27.50	32.00	33.00	0.45	35.00	38.00	40.00	40.00	40.00
50 flush tanks	75.00	60.00	75.00	60.00	70.00	75.00	30.00	85.00	90.00
52 lampholes	5.00	10.00	6.00	10.00	12.00	5.00	20.00	10.00	12.00
11900 cu.yd. rock excavation	2.25	2.50	1.20	2.25	0.01	2.50	2.00	3.00	3.00
151.5 portland cement	7.00	8.00	9.00	10.00	10.00	8.00	9.00	12.00	13.00
Lumber	30.00	30.00	50.00	50.00	25.00	27.00	30.00	35.00	40.00
Sewage disposal plant complete	27,990.00	30,500.00	29,420.65	31,885.50	30,000.00	33,000.00	37,920.00	32,485.00	33,000.00
Extended totals	$159,034	162,$965	$168,409	$167,916	$183,509	$191,354	$204,983	$238,756	$240.857

Cleveland, Ohio—Preliminary plans have been prepared by Charles W. Hopkinson, Arch., 900 Rose Bldg., for the construction of a two-story gymnasium for the Western Reserve University. The estimated cost is $150,000. Charles F. Thwing is Pres. Noted Oct. 15.

Cleveland, Ohio—Preliminary plans have been prepared by W. S. Lougee, Arch., 500 Marshall Bldg., for the construction of a lodge building for the Cleveland Bricklayers Benevolent Association. Estimated cost, $50,000. W. E. Potter, 498 East 117th St., is Secy. Noted June 10.

Cleveland, Ohio—Plans have been prepared by W. R. McCormack, Arch., Board of Education Bldg., East Sixth St. and Rockland Ave. for the construction of a six-story high school and office building. The estimated cost is $1,000,000. Noted Mar. 25.

Cleveland Heights, Ohio—(Warrensville post office)—Bids will soon be received by Ezra K. Bryan, Clk. Bd. of Education, Parkdale Ave., for the construction of a two-story grade school. The estimated cost is $75,000. Franz C. Warner, 767 Hippodrome Bldg., Cleveland, is Arch. Noted May 6 and 20.

Columbus, Ohio—Plans have been prepared by J. B. Martin, East Liverpool, for the construction of a church on West Fifth St. for the Grace United Brethren Congregation. Estimated cost, $50,000.

Dayton, Ohio—Plans have been prepared by W. H. Simms and C. H. Simms for the construction of a five-story, 85x100-ft. reinforced-concrete building to be known as the Advertising Bldg., on Jefferson St. between Second and Third St. The estimated cost is $100,000.

East Cleveland, Ohio—Plans are being prepared by W. H. Nicklas, Arch., 1900 Euclid Ave., for the construction of additions to the Chambers and Rozelle Schools at East Cleveland. Estimated cost, $50,000.

East Liverpool, Ohio—The city contemplates the construction of a two-story market house. The estimated cost is $40,000. P. V. Scheiber is Mayor and E. J. Smith is Dir. of Pub. Ser.

East Moline, Ohio—At a recent election the citizens voted in favor of the question of issuing $75,000 in bonds, the proceeds of which will be used for the construction of a high school.

Indian View, Ohio—(Plainville post office)—Tietig & Lee, Arch., 901 Fouth National Bank Bldg., Cincinnati, is preparing plans for the construction of a two- and three-story brick and stone building for the Rock Hill Sanitarium Co. Estimated cost, $60,000.

McCutchenville, Ohio—Bids will be received about July 14 by Albert Pretzinger and Edward P. Musselman, Archs., 1155 Reibold Bldg., Dayton, for the construction of a two-story school. Estimated cost, $75,000. Noted Feb. 18.

Marion, Ohio—Preliminary plans are being prepared by Marriott, Allen & Hall, Arch., 420 Hayden-Clinton Bank Bldg., Columbus, for the construction of a two-story high school. The estimated cost is $150,000. O. C. Briggs is Clk., Bd. of Education.

+Minerva, Ohio—WILLIAM BROS., Bellevue, has been awarded the general contract for the construction of a two-story, 90x120-ft. fireproof high school. The estimated cost is $60,000. Andrew Dietrich is Clk., Bd. of Education. Noted May 20.

STATE HIGHWAY, PIERCE COUNTY, WASH.

Bids were received June 1 by the State Highway Commissioner, Olympia, Wash., for the construction of a section of the National Park Highway in Mashell Cañon, Pierce County, from: (A) Charles Daley & Co., Seattle; (B) Booker, Kiehl & Wipple, Seattle; (C) Henry Styles, Tacoma; (D) Rajotte, Tobert & Winters, Seattle; (E) Torger Peterson, Eatonville; (F) Standifer Clarkson Co., Portland, Ore.; (G) N. A. Degerstrom & Co., Ballard Station, Seattle; (H) S. Normile, Seattle; (I) KENDLER & EPPLER, Eatonville (awarded contract); (J) C. L. Morris Construction Co., Seattle; (K) W. P. Zindorf, Seattle; (L) Allred & James, Centralia; (M) Sloane Bros.; (N) Atlas Construction Co., Everett; (O) D. V. McDonald & Co., Seattle; (P) Nettleton, Bruce & Eschbach Co., Seattle; (Q) Charles N. & Earle Maxham, Tacoma. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	P	Q
56,100 cu.yd. excavation, including haul of 400 ft.	$0.27	$0.40	$0.40	$0.36	$0.35	$0.33	$0.45	$0.28	$0.25	$0.324	$0.32	$0.345	$0.47	$0.38	$0.40	$0.30	$0.27
50,000 cu.yd. overhaul on above material, per each 100 ft.	0.01	0.015	0.015	0.02	0.005	0.01	0.015	0.01	0.015	0.01	0.015	0.05	0.015	0.01	0.01	0.01	0.01
10 acres clearing	100.00	100.00	90.00	200.00	150.00	135.00	100.00	50.00	100.00	100.00	127.00	150.00	100.00	75.00	100.00	115.00	140.00
4 acres grubbing	125.00	150.00	100.00	150.00	100.00	165.00	125.00	75.00	150.00	85.00	127.00	175.00	100.00	100.00	75.00	100.00	140.00
Riprap, hand placed, per cu.yd.	3.00	3.50	3.00	2.50	2.50	1.85	1.50	3.00	2.00	1.50	3.00	8.00	3.00	1.25	.....	2.50	3.50
Concrete, 1st class, per cu. yd.	14.00	14.00	11.00	11.50	10.00	9.00	12.00	16.00	15.00	7.25	15.00	25.00	17.00	7.50	.....	16.00	13.00
Concrete, 2d class, per cu.yd.	12.00	13.00	10.00	9.50	8.00	8.50	11.00	14.00	12.00	6.65	11.00	18.00	16.00	10.00	.....	14.00	12.00
Guard rail in place, including spikes and bolts per lin.ft.	0.50	0.50	0.25	1.00	0.20	0.10	0.25	0.40	0.025	0.12	0.35	0.25	0.30	0.12	.....	0.18	0.25
Timber and plank in place, including spikes and bolts, per M. ft. b.m.	18.00	25.00	25.00	30 00	20.00	18.50	24.00	20.00	25.00	25.00	25.00	25.00	30.00	15.00	.....	24.00	25.00
Logs for cribbing in place, per lin.ft.	0.25	0.40	0.25	0.10	0.10	0.14	0.25	0.35	0.25	0.50	0.00	0.25	0.30	0.12	....	0.27	0.20
6-in. porous tile drains in place, per lin.ft.	0.60	0.35	0.25	0.25	0.20	0.35	0.35	0.50	0.40	0.23	0.50	0.25	0.40	0.40	.....	0.25	0.20
8-in. porous tile drains in place, per lin.ft.	0.80	0.50	0.35	0.35	0.35	0.50	0.40	0.70	0.60	0.31	0.60	0.35	0.50	0.60	....	0.40	0.25
12-in. plain concrete pipe in place, per lin.ft.	1.50	1.00	0.80	1.50	1.00	1.50	1.00	1.00	2.50	0.74	1.00	2.50	1.10	1.00	0.50	1.00	0.60
18-in. plain concrete pipe in place, per lin.ft.	2.50	2.00	1.50	2.00	1.25	2.00	2.00	1.75	4.00	1.29	2.50	3.50	2.25	1.50	....	1.50	1 25
18-in. reinforced - concrete pipe in place, per lin.ft.	3.25	2.25	2.50	2.75	3.00	3.00	2.50	2.50	4.50	1.56	3.00	4.00	3.25	2.50	....	2.00	1.50
30-in. reinforced - concrete pipe in place, per lin.ft.	4.50	4.50	3.50	4.50	4.00	4.00	5.50	4.00	5.50	3.98	3.50	5.00	5.00	2.75	.....	4.65	2 75
36-in. reinforced - concrete pipe in place, per lin.ft.	5.50	6.00	4.75	5.25	6.00	5.00	6.00	5.00	6.00	5.76	5.00	7.00	6.00	3.00	....	6.75	3.75
42-in. reinforced - concrete pipe in place, per lin.ft.	6.50	7.50	5.00	8.50	8.00	6.00	8.50	7.00	6.50	7.95	12.00	8.50	7.00	4.00	7.00	7.85	6.60
Extended totals	$17,917	$25,525	$25,008	$24,706	$22,555	$21,758	$28,300	$17,708	$17,355	$20,784	$21,530	$25,174	$29,238	$23,458	$24,835	$19,639	$18,195

MAPLEWOOD SEWER, NO. 1—ST. LOUIS, MO.

+Bids were received June 9 for the construction of the Maplewood Sewer, No. 1, as follows: (A) COONEY CONSTRUCTION CO. (awarded contract); (B) N. B. Watters & Son; (C) Century Construction Co.; (D) Kamp-Lewald Engineering Co.; (E) John F. McMahon; (F) Strubel Helmich; (G) E. C. Davis; (H) Thomas Connor & Son; (I) Feuin-Colnon Contracting Co. The item bids were as follows:

	A	B	C	D	E	F	G	H	I
270 cu.yd. class "A" Excavation in open cut	$1.75	$0.50	$5.00	$4.00	$2.50	$2.50	$2.50	$4.10	$3.00
6620 cu.yd. class "A" excavation in tunnel	6.57	5.47	7.10	8.50	8.00	7.90	10.25	11.50	12.00
1630 cu.yd. class "B" excavation in open cut	0.50	0.40	0.90	0.75	0.70	0.60	0.90	2.60	0.80
5 cu.yd. class "B" excavation in tunnel	8.00	50.00	25.00	8.50	4.00	15.00	18.00	27.60	5.00
260 cu.yd. common brick masonry in open cut	7.00	8.00	9.00	9.00	8.00	9.00	9.50	12.00	8.00
30 cu.yd. common brick masonry in tunnel	10.00	15.00	10.00	20.00	14.00	13.00	12.00	19.50	13.00
90 cu.yd. vitrified brick masonry in open cut	8.00	8.00	10.00	10.00	12.00	10.00	11.00	16.00	10.00
5 cu.yd. vitrified brick masonry in tunnel	11.00	12.00	12.00	30.00	14.00	15.00	13.50	21.00	16.00
10 cu.yd. class "A" concrete in open cut	6.50	7.50	8.00	10.50	8.00	7.50	10.00	9.00	8.00
470 cu.yd. class "A" concrete in tunnel	7.50	7.50	9.00	10.50	12.00	8.50	16.00	18.75	9.00
5 cu.yd. class "B" concrete in open cut	6.00	7.00	7.00	10.50	7.00	5.00	10.00	8.50	6.50
120 lin.ft. 12-in. vitrified clay pipe	0.25	0.30	0.25	0.50	0.30	0.75	0.40	1.60	0.35
193 lin.ft. 30-in. vitrified clay pipe	1.85	2.00	1.00	3.00	2.25	2.00	2.25	3.75	2.00
10 6-in. slants	0.25	0.40	0.30	0.50	0.60	0.50	1.00	1.75	1.00
10 12-in. slants	0.35	0.80	....	1.00	1.00	1.00	1.50	2.25	1.00
7 12-in. elbows (¼ curves)	0.35	1.00	0.60	1.00	1.00	1.50	1.50	2.50	1.00
2 12-in. "T" Junctions on 12-in. pipe	0.90	1.00	0.50	1.25	1.25	3.00	2.50	2.75	1.00
1 12-in. "T" Junctions on 15-in. pipe	1.50	1.00	0.75	1.60	1.60	3.00	3.00	3.25	1.50
1 12-in. "T" Junctions on 24-in. pipe	4.50	3.00	1.00	6.00	5.25	8.00	8.00	7.50	4.00
2 12-in. "T" Junctions on 30-in. pipe	7 00	8.00	8.00	7.00	10.00	11.00	12 00	12 10	7 00
1 12-in. "T" Junctions on 33-in. pipe	10.00	10.00	9.00	8 00	15.00	12 00	20.00	15 00	10.00
6-in. "Y" Junctions on 30-in. pipe	7.00	2.00	8.00	7.00	9.00	9.00	12.00	9.75	8.00
3430 lb. cast iron	0.02	0.02	0.03	0.04	0.03	0.04	0.05	0.09	0.03
1090 lb. wrought iron	0.035	0.04	0.04	0.05	0.05	0.04	0.10	0.08	0.05
100 sq.ft. inlet stone	0.25	0.30	0.50	0.50	0.40	0.20	0.50	1.50	0.50
200 lin.ft. extra drilling in tunnel	0.01	0.20	0.50	1.00	0.10	0.25	0.50	0.50	0.60
Extended totals	$51,938	$44,860	$58,491	$68,874	$65,010	$62,683	$82,724	$97,541	$90,233

+Toledo, Ohio—The Board of Education has awarded the general contract for the construction of additions and alterations to the Chase School at Chase and Bassett St. and the Wayne School at Wayne and Ralph St. to the WALLS, BOCK & KUHLMAN CO., Toledo, at $103,000. Noted May 27.

West Alexandria, Ohio—Plans have been prepared by Edward J. Mounstephen, Arch., 802 United Brethren Bldg., Dayton, for the construction of a two-story school for Lanier Township. The estimated cost is $50,000.

Muncie, Ind.—Plans prepared by Charles Honuck, Arch., have been approved by the State Board of Charities and Corrections for the construction of an infirmary building for Delaware County. The estimated cost is $45,000. Noted June 24.

Vincennes, Ind.—John T. Oliphant will construct an eight-story office building. The estimated cost is $75,000.

+Detroit, Mich.—The contract for the structural steel work of the superstructure of the main library to be constructed at Woodward, Cass, Putnam and Kirby Ave. has been been awarded to the AMERICAN BRIDGE CO., 30 Church St., New York, N. Y. Estimated cost, $1,000,000. Noted May 6.

+Grand Rapids, Mich.—The HAUSER-OWEN-AMES CO., Grand Rapids, at $66,030, has been awarded the contract for the construction of a four-story building for the Michigan Soldiers' Home.

+Hastings, Mich.—The contract for the construction of a high school has been awarded to THOMAS R. CROCKETT, Allegan, at $67,324. Noted June 10.

Chicago, Ill.—Plans are being prepared by William L. Klewer & Son, Arch., 64 West Randolph St., for the construction of a four-story theater and office building for Albert Fuchs, 823 Sheridan Rd. The estimated cost is $350,000.

+Chicago, Ill.—The general contract for the construction of a five-story, 75x99-ft. brick department store at 4722 Broadway, for Albert E. Cook, has been awarded to DARLING & EITEL, 128 North Fifth St., Chicago. The estimated cost is $200,000.

Chicago, Ill.—Price & McLanahan, Arch., 16th and Walnut St., Philadelphia, Penn., is preparing plans for the construction of a four-story, 400x800-ft. freight station for the Pennsylvania R.R. Alex C. Shand, Philadelphia, is Ch. Engr.

Jacksonville, Ill.—Bids will be received about July 5 for the construction of a two-story addition to Norbury Sanitarium. Estimated cost, $40,000. C. W. Buckingham, Morrison Blk., is Arch.

Superior, Wis.—Bids are being received by the Building Committee and E. M. Ulrich, Arch., 1900 Euclid Ave., Cleveland, Ohio, for the construction of an orphanage for the Catholic Diocese. Estimated cost, $100,000. Noted Apr. 15.

Ames, Iowa—W. D. Lewis & Co., Ames, at $78,499, submitted the lowest bid for the construction of a four-story hotel for the Ames Improvement Co.

Fontanelle, Iowa—L. D. Willis, Arch., 1119 City National Bank Bldg., Omaha, Neb., is preparing plans for the construction of a two-story, 70x94-ft. school. The estimated cost is $40,000. E. D. Barnhill is Pres., Bd. of Education.

Minneapolis, Minn.—The Gamble-Robinson Commission Co., 222 North Sixth St., will construct a six- or eight-story fruit and produce trade building. The estimated cost is $100,000.

St. Cloud, Minn.—Plans are being prepared by Tyrie, Chapman & Gage, 320 Auditorium Bldg., Minneapolis, for the construction of a high school. The estimated cost is $150,000.

St. Paul, Minn.—(Official)—Bids will be received about Sept. 15 for the construction of a building at Cedar and Central St. for the Minnesota State Historical Society. C. H. Johnston, Capitol Bank Bldg., is State Arch. Noted Apr. 29 and June 24.

BANK ST. BRIDGE, WATERBURY, CONN.

+Bids were received June 1 by the Board of Public Works, Waterbury, for the construction of a reinforced-concrete bridge over the Naugatuck River from: (A) Barbara D'Aurio; (B) C. A. Sibley, New Haven; (C) O'Brien Construction Co., 18 East 41st St., New York; (D) McHarg-Barton Co., 171 Madison Ave., New York; (E) Fred T. Ley & Co., Inc., Springfield, Mass.; (F) Robert Daley Co., New Haven; (G) Barzaghi-Vought Co., Inc., 299 Madison Ave., New York; (H) HUDSON RIVER CO., 149 Broadway, New York (awarded contract). The item bids were as follows:

	A	B	C	D	E	F	G	H
2067 cu.yd. excavation bridge abutments and piers to elevation 110	$1.50	$1.45	$1.00	$2.00	$1.50	$0.50	$1.25	$1.10
1422 cu.yd. excavation bridge abutments and piers below elevation 110	2.00	6.00	3.00	6.00	3.00	0.50	3.00	2.50
1540 cu.yd. concrete masonry, 1-3-6	8.00	6.80	7.50	6.00	7.00	8.00	5.00	7.30
428 cu.yd. concrete masonry, 1-2½-5	12.00	9.60	8.00	7.25	7.00	10.00	6.00	8.30
908 cu.yd. concrete masonry, 1-2-4	16.00	18.50	13.75	9.75	12.00	10.00	12.00	9.20
60 cu.yd. concrete masonry, 1-2-4, 1-in. stone	20.00	24.00	13.75	8.50	15.00	25.00	12.50	9.50
Parapet walls, molding and curbing, lump sum	10,100.00	9,655.00	11,000.00	9,000.00	9,600.00	7,000.00	9,025.00	9,055.05
70 cu.yds. pier ends and coping	59.00	60.00	72.00	60.00	65.00	3,950.00	60.00	61.50
113 tons 1-in. steel reinforcement	100.00	80.00	100.00	50.00	56.00	80.00	45.00	50.00
20.5 tons ¾-in. steel reinforcement	100.00	90.00	100.00	50.00	56.00	75.00	48.00	50.00
8 tons ½-in. steel reinforcement	100.00	100.00	100.00	60.00	66.00	80.00	50.00	50.00
890 sq.yd. wire mesh reinforcement	0.45	0.75	0.50	0.50	0.50	0.35	0.40	0.40
300 sq.yd. brick sidewalk	3.50	2.50	2.50	3.00	1.85	1.00	1.50	2.05
Iron conduit and boxes, (lump sum)	300.00	175.00	200.00	125.00	125.00	100.00	500.00	125.00
40M ft. b.m. wood sheet piling	50.00	60.00	60.00	67.00	60.00	55.00	70.00	50.00
12M ft. b.m. timber grillages	50.00	48.00	50.00	38.00	60.00	50.00	50.00	45.00
670 lin.ft. 6-in. drain tile	1.00	0.75	0.50	0.25	0.40	0.20	0.25	0.20
Construction and removal of temporary bridge, (lump sum)	6500.00	3650.00	3000.00	5000.00	3650.00	6600.00	3500.00	3105.00
6000 lin.ft. timber piling, 12 to 20 ft. long	0.50	0.40	0.75	0.25	0.30	0.20	0.25	0.25
6000 lin.ft. timber piling, 20 to 30 ft. long	0.50	0.40	0.75	0.25	0.30	0.20	0.25	0.25
980 cu.ft. excavation, retaining wall	2.00	1.50	1.00	2.50	2.30	0.50	1.50	0.35
475 cu.yd. rubble masonry	7.00	6.00	5.50	4.00	3.60	5.00	4.00	2.55
Extended totals	$91,574	$87,159	$84,559	$71,598	$70,455	$66,091	$62,870	$61,337

PARK AVE. BRIDGE—CINCINNATI, OHIO

Bids were received June 1 by the Board of Public Service, Cincinnati, for the construction of a reinforced-concrete arch over Kemper Lane at the Park Ave. entrance to Eden Park, from: (A) D. P. Foley; (B) A. J. Yawger, Indianapolis, Ind.; (C) Ohio Valley Contracting Co.; (D) Roos Bros.; (E) Cleary-White Construction Co. and A. J. Brehm; (F) N. R. Porterfield, Youngstown; (G) F. W. Folz & Co.; (H) William F. Nickoson; (I) Ferro-Concrete Construction Co.; (J) Runck Bros.; (K) James Duff Construction Co., Cleveland; (L) L. Eid Concrete Steel Co.; (M) Kirchner Construction Co.; (N) Thomas P. Strack; (O) Engineer's Estimate. All bidders of Cincinnati unless otherwise stated. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
7000 cu.yd. trench excavation, earth	$0.75	$0.75	$1.25	$1.50	$0.75	$1.25	$1.00	$2.00	$1.00	$2.00	$1.00	$1.35	$1.50	$1.00	$1.00
2000 cu.yd. trench excavation, rock	1.00	2.00	2.50	2.25	3.00	1.75	1.50	3.00	2.50	3.00	2.50	2.00	3.00	2.50	2.50
3600 cu.yd. reinforced-concrete footings and abutments	9.10	9.25	8.00	9.00	9.00	11.10	8.60	12.00	9.84	10.00	10.45	9.40	10.00	12.00	9.00
650 cu.yd. reinforced-concrete retaining walls	12.00	14.20	14.60	17.00	15.00	14.00	14.50	15.00	13.00	16.00	16.00	17.10	18.20	18.00	15.00
100 cu.yd. reinforced-concrete stairs	20.00	20.00	18.00	25.00	23.00	25.00	27.50	25.00	25.50	25.00	25.00	31.40	27.00	30.00	25.00
Reinforced-concrete superstructure (lump sum)	46,000	49,200	50,000	48,000	59,250	51,000	62,600	43,730	57,850	70,800	72,364	68,430	72,500	80,000	60,950
26,000 cu.yd. grading excavation	0.35	0.45	0.60	0.50	0.50	0.50	0.50	0.47	0.60	0.01	0.40	0.65	0.60	1.00	0.60
80 lin.ft., 18-in. drain	1.45	2.00	2.50	2.50	2.50	2.50	3.60	2.00	2.50	2.00	2.50	2.00	2.00	2.50	2.50
500 lin.ft., 12-in. drain	0.85	1.25	1.50	1.50	1.25	1.50	1.50	1.50	1.50	1.00	1.50	1.00	1.75	1.50	1.50
175 lin.ft. 6-in. drain	0.85	0.75	1.75	1.00	1.00	1.00	1.00	1.00	1.00	0.50	1.00	0.75	1.25	1.00	1.00
3 manholes	70 00	100.00	150 00	150.00	100.00	150.00	125.00	60.00	150 00	100 00	150.00	150.00	80.00	150.00	150.00
7 inlets, No. 1	40 00	50 00	125.00	75.00	50.00	75.00	50 00	40.00	75.00	60.00	75.00	75.00	50.00	75.00	75.00
4 inlets, No. 3	60 00	75.00	90 00	100.00	60.00	100.00	75.00	50.00	100.00	75.00	100.00	100.00	80.00	100.00	100.00
1600 lin.ft. granite curb	1.00	1 00	1.10	1.10	1.00	1.15	1.10	1.10	1.10	1.00	1.00	1.10	1.00	1.10	1.10
1300 lin.ft. concrete curb	0.40	0.75	0.80	0.70	0.65	0.60	0.70	0.60	0.75	0.50	0.80	0.75	0.70	0.80	0.80
150 cu.yd. concrete base for paving	3.50	5.45	6.00	5.50	5.50	5.00	5.25	5.50	5.50	5.00	6.00	6.75	5.00	6.00	6.00
300 sq.yd. concrete paving	1.00	1.25	1.50	1.50	1.50	1.25	1.50	1.25	1.50	1.50	1.50	1.50	2.50	1.50	1.50
800 sq.yd. asphaltic concrete paving	1.00	1.50	1.20	1.50	1.50	1.40	1.50	1.35	1.50	1.50	1.50	1.50	1.50	1.50	1.50
9000 sq.yd. bituminous macadam paving	1.30	1.20	1.20	1.15	1.11	1.15	1.15	1.20	1.40	1.30	1.15	1.30	1.40	1.30	1.30
1000 sq.yd. bituminous stone walks	1.15	1.20	1.30	1.15	1.16	1.10	1.05	0.50	1.40	1.30	1.30	1.30	1.15	1.30	1.30
10,000 sq.ft. cement walks	0.13½	0.12½	0.15	0.14	0.12	0.12½	0.13	0.12	0.15	0.12	0.15	0.14	0.15	0.15	0.15
480 lin.ft. 2-bar pipe railing	1.00	1 00	1.10	1 00	0.75	1.00	1 00	1 00	1 05	1.00	1.25	1.00	1.25	1.25	1.25
3000 sq.yd. sodding	0 20	0.35	0.40	0.30	0 25	0.35	0.35	0 23	0.40	0.20	0.40	0.30	0.35	0.35	0.40
Extended totals	$125,354	$136,294	$142,429	$143,875	$148,220	$149,405	$150,310	$151,635	$156,788	$160,937	$167,924	$170,219	$179,404	$200,050	$158,000

Caldwell, Kan.—Plans are being prepared by S. S. Voight, Arch., 517 Barnes Bldg., Wichita, for the construction of a two-story school. The estimated cost is $50,000.

Hiawatha, Kan.—Plans are being prepared by J. H. Felt & Co., Arch., 800 Grand Ave., Kansas City, Mo., for the construction of a two-story high school. The estimated cost is $75,000. W. F. Shale is Secy., Bd. of Education.

✚Wichita, Kan.—The general contract for the construction of a six-story bank and office building for the Fourth National Bank has been awarded to the SWENSON CONSTRUCTION CO., Kansas City, Mo., at $113,609.

Weeping Water, Neb.—Smithley & Campbell, Arch., 506 West Broadway, Council Bluffs, Iowa, is preparing plans for the construction of a two-story school. The estimated cost is $40,000.

Kansas City, Mo.—Bids are being received for the construction of a seven-story fireproof office building at 912 Walnut St. to be known as the Ridge Arcade. The estimated cost is $50,000. Smith, Rea & Lovitt, 602 Finance Bldg., is Arch.

Kansas City, Mo.—St. Joseph's Hospital will construct a six-story reinforced-concrete and brick hospital at 31st St. and Linwood Blvd. The estimated cost is $500,000. Wilder & Wight, First National Bank Bldg., is Arch.

Kansas City, Mo.—New bids are being received by the Board of Public Works for the construction of a two-story reinforced-concrete and brick police station at 19th St. and Baltimore Ave. The estimated cost is $75,000. Madorie & Birdsall, 832 Reserve Bank Bldg., is Arch.

Kansas City, Mo.—Bids are being received for the construction of a church at East 24th St. for St. Michaels Congregation. The estimated cost is $50,000. W. E. Brown, 1112 Tracy Ave., is Arch.

Kansas City, Mo.—Frederick H. Michaelis, Arch., is preparing plans for the construction of an 80x125-ft. reinforced-concrete hotel on Central St. between 14th and 15th St. for Ernest Neuer and Edward Neuer. The estimated cost is $75,000.

St. Louis, Mo.—A. J. Francis will construct a 59-suite studio-apartment building at Waterman and De Baliviere Ave. The estimated cost is $100,000.

St. Louis, Mo.—E. Mason Roberts plans to construct two commercial and store buildings at 3872 Washington Blvd. The estimated cost is $100,000.

✚St. Louis, Mo.—The general contract for the construction of a six-story office building at Broadway and Locust St. for the Ranier Realty Co. has been awarded to JAMES STEWART & CO. INC., 343 South Dearborn St., Chicago, Ill. The estimated cost is $400,000. Noted Nov. 26.

Little Rock, Ark.—The Crawford-Williamson Construction Co., Memphis, Tenn., at $56,000, was the lowest bidder for the construction of a two-story school to be known as the U. M. Rose School. J. H. Bilheimer is Secy. of School Bd.

Austin, Tex.—The congregation of the Ebenezer Baptist Church will construct a building at 10th and San Marcos St. The estimated cost is $50,000. L. L. Campbell is Pastor.

Beaumont, Tex.—Plans are being prepared for the construction of a two-story brick school at South Park. The estimated cost is $50,000.

✚Dallas, Tex.—The general contract for the construction of a high school has been awarded to E. C. GERHARD & CO. The estimated cost is $300,000. Noted Mar. 18 and June 10.

Galveston, Tex.—Plans are being prepared by C. D. Hill & Co., Arch., for the construction of a five-story hotel for S. Skitcovitch. The estimated cost is $70,000.

(Continued on page 25)

SEWAGE SYSTEM AND SEWAGE-TREATMENT WORKS—HUNTINGTON, N. Y.

✚Bids were received May 14 by the Sewer Commissioners for the construction of a sewer system and sewage-treatment works from (A) Engineer's Estimate; (B) FRANK NORDONE, Mt. Vernon (awarded contract); (C) Fred E. Gross & Son, Yonkers; (D) Lincoln-Steele Fleming Co., New York; (E) Peter D'Amato, Newark, N. J.; (F) Murphy Bros., Brooklyn; (G) Peace Bros., Flushing; (H) Henry W. Golden & Son, Inc., Troy; (I) John C. Schrade, Inc., Brooklyn; (J) Daly & Merritt, Port Chester; (K) Frank Puglia, Paterson, N. J.; (L) North Eastern Construction Co., New York; (M) Joseph Jennings, Brooklyn; (N) Frank Merandino, Inc., Brooklyn. The item bids were as follows:

Vitrified Pipe Sewer	A	B	C	D	E	F	G	H	I	J	K	L	M	N
4400 lin.ft. 8-in., 0 to 6 ft. deep	$0.46	$0.40	$0.46	$0.39	$0.35	$0.45	$0 46	$0.40	$0.45	$0.41	$0.70	$0.37	$0.82	$0.60
48,375 lin.ft. 8-in., 6 to 8 ft. deep	0.46	0.42	0.52	0.49	0.48	0.55	0.55	0.48	0.52	0.55	0.90	0.58	0.82	0.80
5555 lin.ft. 8-in., 8 to 10 ft. deep	0.65	0.65	0.73	0.65	0.65	0.75	0.71	0.80	0.65	0.71	1.00	1.38	0.95	0.85
2845 lin.ft. 8-in., 10 to 12 ft. deep	0.85	0.80	0.93	0.80	0.80	0.90	0.84	1.10	0.94	0.77	1.25	1.77	1.24	1.01
1040 lin.ft. 8-in., 12 to 14 ft. deep	1.05	0.95	1.22	1.07	1.05	1.15	1.01	1.35	1.07	0.85	1.90	2.22	1.39	1.35
245 lin.ft. 8-in., 14 to 16 ft. deep	1.30	1.10	2.00	1.34	1.50	1.70	1.40	1.75	1.65	0.90	2.25	2.50	1.60	1.51
50 lin.ft. 8-in., 16 to 18 ft. deep	1.60	1.50	2.60	1.60	2.25	2.50	2.00	2.40	2.40	1.25	3.00	3.37	1.80	1.81
310 lin.ft. 10-in., 6 ft. deep	0.53	0.50	0.50	0.46	0.40	0.55	0.55	0.45	0.52	0.63	0.85	0.44	0.89	0.60
7885 lin.ft. 10-in., 6 to 8 ft. deep	0.53	0.60	0.60	0.61	0.55	0.65	0.64	0.55	0.60	0.75	1.00	0.65	0.89	0.76
855 lin.ft. 10-in., 8 to 10 ft. deep	0.75	0.75	0.78	0.72	0.70	0.80	0.82	0.95	0.73	0.79	1.35	1.42	1.03	0.80
50 lin.ft. 10-in., 10 to 12 ft. deep	0.95	0.95	1.00	0.87	1.10	1.40	1.00	1.35	1.03	0.99	1.65	1.86	1.38	1.11
680 lin.ft. 12-in., 6 ft. deep	0.64	0.65	0.57	0.62	1.00	0.90	0.73	0.55	0.60	0.95	1.20	0.52	0.94	0.71
1205 lin.ft. 12-in., 6 to 8 ft. deep	0.64	0.73	0.67	0.72	1.50	1.25	0.85	0.65	0.70	1.00	1.30	0.72	0.94	0.90
120 lin.ft. 12-in., 8 to 10 ft. deep	0.85	0.85	0.85	0.78	2.00	1.50	1.00	1.30	0.87	1.10	1.60	1.52	1.08	1.01
35 lin.ft. 12-in., 10 to 12 ft. deep	1.05	1.00	1.20	0.94	3.00	2.10	1.25	1.60	1.10	1.45	1.75	1.93	1.43	1.16
75 lin.ft. 12-in., 12 to 14 ft. deep	1.35	1.09	1.60	1.20	3.25	2.25	1.40	2.00	1.25	1.50	2.00	2.16	1.51	1.41
80 lin.ft. 12-in., 14 to 16 ft. deep	1.70	1.29	2.15	1.48	3.40	2.80	1.65	2.50	1.85	1.60	2.50	2.30	1.73	1.80
50 lin.ft. 12-in., 16 to 18 ft. deep	2.00	1.50	2.70	1.74	3.65	3.00	2.00	3.00	2.50	1.90	3.00	2.45	1.72	2.00
225 lin.ft. 15-in., 0 to 6 ft. deep	1.00	0.75	0.75	1.05	1.25	2.00	0.91	1.40	1.50	1.45	1.40	0.76	1.12	0.91
730 lin.ft. 15-in., 6 to 8 ft. deep	1.10	0.94	0.90	1.15	1.60	2.50	1.10	1.94	1.75	1.53	1.80	1.92	1.25	1.21
610 lin.ft. 15-in., 8 to 10 ft. deep	1.25	1.05	1.15	1.31	2.00	2.75	1.30	2.55	2.50	1.70	2.30	1.93	1.41	1.36
50 lin.ft. 15-in., 10 to 12 ft. deep	1.50	1.15	1.75	1.46	2.50	4.50	2.00	3.60	3.00	1.90	3.00	2.14	1.71	1.56
20,000 lin.ft. 8-in., with bituminous joints	0.03	0.05	0.04	0.02	0.05	0.05	0.06	0.04	0.04	0.05	0.07	0.30	0.05	0.07
4000 lin.ft. 10-in., with bituminous joints	0.05	0.06	0.05	0.04	0.07	0.06	0.07	0.05	0.05	0.07	0.09	0.32	0.05	0.10
2000 lin.ft. 12-in., with bituminous joints	0.08	0.07	0.07	0.05	0.15	0.08	0.08	0.07	0.06	0.09	0.11	0.35	0.05	0.12
500 lin.ft. 15-in., with bituminous joints	0.15	0.08	0.10	0.06	0.20	0.10	0.13	0.08	0.08	0.11	0.14	0.40	0.08	0.15
2000 lin.ft. laying and trenching 14-in. c.i. pipe, 6 ft. deep	0.75	0.50	0.50	0.48	0.75	0.60	0.75	0.60	1.23	2.85	1.25	2.20	2.48	1.40
2500 5-in. Y-branches on 8-in. pipe	0.50	0.35	0.30	0.35	0.40	0.30	0.40	0.35	0.30	1.00	0.40	0.53	0.60	0.32
365 5-in. Y-branches on 10-in. pipe	0.69	0.45	0.40	0.48	0.60	0.35	0.55	0.50	0.40	1.10	0.75	0.77	0.85	0.45
90 5-in. Y-branches on 12-in. pipe	0.85	0.55	0.50	0.58	0.75	0.35	0.83	0.60	0.45	1.50	2.00	0.96	1.05	0.55
60 5-in. Y-branches on 15-in. pipe	1.00	0.65	0.65	0.88	1.00	0.40	1.10	1.00	0.98	1.75	2.20	1.68	1.60	0.90
2000 5-in. ⅛ bends	0.23	0.25	0.25	0.30	0.40	0.25	0.30	0.15	0.25	0.50	0.30	0.29	0.31	0.30
400 5-in. double Y branches, including caps	0.50	0.50	0.25	0.54	0.50	0.60	0.55	0.40	0.50	1.00	0 95	0.48	0.40	0.50
1500 lin.ft. 5-in. vitrified pipe risers	0.50	0.45	0.30	0.46	0.35	0.30	0.40	0.75	0.90	0 30	0.75	0 91	0.85	0 60
55 flushtanks and appurtenances	70.00	65.00	65.00	72.00	70.00	65 00	80.00	70.00	80.00	60 00	65.00	102.00	196 50	120 00
240 manholes and appurtenances	40.00	37.00	38.00	39.00	36.00	35.00	40 00	40.00	40.00	45.00	40 00	86.00	50.00	60 00
90 tons c.i. pipe	25.00	24.00	30.00	30 00	38.00	25 00	30 00	27.00	23.00	30.00	30.00	31.50	10.00	40 00
1 ton c.i. specials	60 00	59.00	60.00	75.00	60.00	60 00	75 00	60.00	60.00	75.00	75 00	87.50	10.00	80.00
10 cu.yd. rock excavation	3.00	3.00	5.00	3.00	4.00	3 00	5.00	3 00	4.75	4.00	3.00	4.80	1.00	5.00
100 cu.yd. extra earth excavation	0.60	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	0.75	2.00	0.90	0.65	1.00
200 cu.yd. extra earth filling	0.50	0.75	0.50	0.50	0.40	0.75	1.00	1.00	0.30	0.75	0.50	0.42	0.65	1.00
20 cu.yd. extra broken stone or gravel filling	2.00	1.85	2.00	3 00	2.00	2.00	2.00	1.50	1.00	2.75	3.00	1.20	2.00	2 50
20 cu.yd. concrete for sewerage system	10.00	6.00	8.00	7.00	7.00	10 00	7 00	6.50	12 00	9.00	7.00	8.00	7.00	8 00
1000 ft. b.m. lumber for foundations	32.00	35.00	50.00	60.00	40.00	35 00	40.00	30 00	45 00	35.00	65 00	75.00	35.00	40 00
500 lin.ft. piles	0 50	0.60	0.50	0.75	0.50	0.50	0.40	0 30	0.50	0.50	0 80	1.00	0.35	0.70
10,000 ft. b.m. sheathing left in place	32 00	31.00	35.00	35.00	38.00	28.00	35.00	30.00	30.00	35.00	45.00	36.00	27.00	35.00
250 sq.yd. relaying of cement walks	1.35	1.80	1.80	1.80	1.35	1.35	1 50	1.00	1.50	1.50	1.50	1.75	1.35	1.80
20 sq.yd. relaying of wood block pavement with concrete base	3.50	1.90	2.00	3.00	2.00	3.50	2.00	3 00	5.00	3.50	3.00	3.42	3.50	5.00
900 sq.yd. relaying flag stone walk	0.20	0.15	0.50	0.60	0.27	0.35	0.50	0.25	1.00	0.50	0.10	0.90	0.75	1.50
4000 sq.yd. relaying bituminous macadam pavement	0.60	1.60	0.30	0.70	0.45	1.20	0.75	1.60	0.75	1.00	0.75	1.08	0.40	2.00
2000 lin.ft. 1-in. galvanized iron pipe line	0.25	0.18	0.25	0.15	0.25	0.25	0.35	0.20	0.29	0.20	0.40	0.49	0.50	0.16
Settling tank and appurtenances (lump sum)	5100.00	5044.00	6000.00	7327.00	8500.00	5700.00	8076.00	6794.27	8000.00	9000.00	5510 00	4570 00	8500 00	29,500
Storage tank and appurtenances (lump sum)	2500.00	2480.00	1635.00	3475.00	5500.00	1200.00	3000 00	3689.05	6000.00	6800 00	2331 00	2380 00	3500 00	7500 00
Building, sterilizing devices and appurtenances (lump sum)	2200.00	2720.00	2000.00	2498.00	2500.00	2700.00	2900.00	3040.35	5000.00	3000.00	2310 00	2270 00	5000 00	9060 00
Sludge drying bed and appurtenances (lump sum)	300.00	1500.00	1500.00	254.00	360.00	800.00	250.00	975.55	2000.00	2300.00	246.00	82.00	8000.00	4000.00
Extended totals	$76,339	$77,948	$79,302	$81,523	$86,530	$86,758	$88,994	$89,078	$94,788	$104,101	$114,466	$119,783	$130,271	$155,675

WATER-WORKS IMPROVEMENT—SOUTH PHILADELPHIA, PENN.

Bids were received May 25 by the Bureau of Water, Department of Public Works, Philadelphia, for Contract No. 260, furnishing and laying cast-iron water pipe in South Philadelphia, from: (A) Beaver Engineering & Contracting Co., 51 Chambers St., New York; (B) Cunningham Paving & Contracting Co., 1345 Arch St.; (C) M. & J. B. McHugh, 714 Commercial Trust Bldg.; (D) Snare & Triest Co., Pier 40, South Wharves; (E) Keystone State Construction Co., 704 Pennsylvania Bldg.; (F) Edwin H. Vare, 712 Lincoln Bldg.; (G) Peoples Bros., Inc., 237 Commercial Trust Bldg.; (H) Charles P. Bower, Wayne & Roberts Ave.; (I) Degnon Contracting Co., 30 East 42nd St., New York; (J) American Paving & Construction Co., 211 South Ninth St. All bidders of Philadelphia unless otherwise noted. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
55,000 cu.yd. earth excavation not more than 10 ft. deep	$0.99	$1.50	$1.60	$1.10	$1.05	$0.85	$0.95	$1.17	$1.25	$1.65
1000 cu.yd. earth excavation more than 10 ft. deep	1.54	1.80	1.60	1.50	1.60	1.95	0.95	2.00	1.25	1.97
1500 cu.yd. rock excavation not more than 10 ft. deep	2.20	1.50	2.50	2.20	2.50	1.33	1.50	2.50	1.25	2.50
500 cu.yd. rock excavation more than 10 ft. deep	2.20	3.00	4.00	3.00	4.00	1.95	1.50	3.50	1.25	2.50
7200 tons 48x36x30-in. c.i. hub and spigot pipe	30.80	32.00	29.68	28.00	29.60	28.00	28.40	28.75	34.00	27.22
1700 tons 24-in. and smaller c.i. hub and spigot pipe	33.40	36.00	29.97	29.00	31.50	28.00	28.40	30.86	34.00	28.60
200 tons 48x36x30-in. c.i. specials	70.00	78.00	83.00	70.00	80.00	82.40	118.00	79.50	80.00	62.75
50 tons 24-in. and smaller c.i. specials	79.20	87.00	97.00	72.00	77.00	88.00	118.50	84.35	80.00	62.75
8 26-in. stop valves	486.75	525.00	550.00	540.00	470.00	498.00	415.00	460.00	720.00	430.00
2 30-in. stop valves	366.85	380.00	341.00	340.00	360.00	350.00	305.00	300.00	500.00	325.00
5 24-in. stop valves	209.00	225.00	210.00	200.00	230.00	210.00	190.00	179.00	275.00	200.00
10 20-in. stop valves	109.85	135.00	150.00	130.00	150.00	122.00	132.00	135.00	220.00	120.00
20 16-in. stop valves	74.65	87.00	100.00	75.00	110.00	81.00	75.00	74.00	90.00	90.00
15 12-in. stop valves	36.90	45.00	48.00	40.00	60.00	39.00	47.00	37.75	54.00	48.00
10 10-in. stop valves	27.95	33.00	33.00	30.00	50.00	29.50	37.00	29.25	32.00	40.50
15 8-in. stop valves	21.45	24.00	22.00	25.00	45.00	22.00	29.00	20.00	20.00	40.00
25 6-in. stop valves	14.00	17.00	13.50	16.00	40.00	15.50	21.00	14.12	15.00	35.00
15 2½-in. air valves	11.00	10.00	10.00	12.00	14.00	15.65	10.00	10.50	15.00	20.00
35,000 lb. gray iron castings	0.02	0.05	0.04	0.03	0.05	0.03¼	0.05	0.02½	0.03½	0.04
10,000 lb. w.i. and steel fixtures	0.05	0.05	0.10	0.05	0.10	0.10	0.08	0.06	0.06	0.06
5000 lb. structural steel	0.04½	0.05	0.04	0.03	0.05	0.04	0.05	0.05	0.05	0.05
1500 cu.yd. concrete masonry	6.00	7.25	8.00	7.50	7.00	6.50	5.50	6.00	0.01	6.00
2000 cu.yd. brick masonry	11.00	12.00	16.00	10.60	12.00	11.50	12.00	12.00	0.01	15.00
27,000 sq.yd. granite block paving	0.60	0.40	0.36	0.30	0.40	0.40	0.60	0.35	0.01	0.60
6000 sq.yd. asphalt paving	2.20	1.25	1.40	1.10	1.50	1.40	1.50	1.40	0.01	1.25
2000 sq.yd. vitrified brick paving	2.20	0.60	0.70	1.50	1.90	0.75	1.50	1.30	0.01	1.25
1200 sq.yd. wood block paving	3.85	4.00	3.00	3.30	1.90	1.60	3.50	2.25	0.01	3.65
1000 lin.ft. resetting curb	0.05	0.20	0.40	0.20	0.25	0.20	0.25	0.12	0.09	0.20
1000 sq.ft. resetting flag stones	0.05	0.05	0.20	0.10	0.10	0.06½	0.12	0.08	0.05	0.10
100 sq.yd. granolithic sidewalk paving	1.50	1.25	1.75	1.50	1.50	1.60	1.80	1.10	1.25	1.50
100 sq.yd. brick sidewalk paving	1.50	1.00	0.75	0.60	1.00	0.65	0.60	1.00	1.25	1.00
10,000 lin.ft. terra cotta pipe sewer, 15-in. and under	0.55	0.60	1.10	0.45	1.00	0.96	1.00	0.50	0.10	0.90
3 M ft. b.m. timber	0.03½	0.10	60.00	0.06	0.03	0.04	50.00	0.05	0.06	0.05
2000 lb. lead pipe	0.33	0.12	0.25	0.15	0.40	0.17	0.60	0.10	0.20	0.20
Extended totals	$443,916	$478,955	$654,594	$406,855	$438,645	$399,964	$577,250	$424,381	$413,127	$450,531

SANITARY SEWER SYSTEM—SILOAM SPRINGS, ARK.

✚Bids were received May 12 by R. J. Alfrey, Secy., Bd. of Imp., Sewer District No. 1, for the construction of a sanitary sewer system from: (A) Matthews & Forester, Kansas City, Mo.; (B) Morene, Brooks & Burkham, St. Louis, Mo.; (C) W. F. Riley Construction Co., St. Louis, Mo.; (D) John F. McMahon, St. Louis, Mo.; (E) E. J. Heckle, Kansas City, Mo.; (F) D. E. Nipp, Floro, Ill.; (G) McEachin & McEachin, McAlester, Okla.; (H) Hiram Lloyd Building & Construction Co., St. Louis, Mo.; (I) Sutherlin Construction Co., Kansas City, Mo.; (J) W. S. McDowell, Fordyce; (K) John W. Rooks, McAlester, Okla.; (L) Burke Construction Co., Ft. Smith; (M) V. E. Koch, Joplin, Mo.; (N) EVERETT & BURT, Hutchinson, Kan. (awarded contract); (O) Pouncey Paving & Construction Co., Memphis, Tenn.; (P) Edgar Main, Liberty, Mo.; (Q) John Spandri, Springfield, Mo.; (R) Bash & Janes, Joplin, Mo. The item bids were as follows:

	A	B	C	D	E	F	G	H	I
3000 lin.ft 15 in. vitrified sewer pipe	$0.58	$0.40	$0.50	$0.50	$0.56	$0.50	$0.50	$0.45	$0.55
4100 lin.ft. 12 in. vitrified sewer pipe	0.39	0.30	0.35	0.35	0.40	0.39	0.34	0.34	0.36
5500 lin.ft. 10 in. vitrified sewer pipe	0.28	0.25	0.30	0.30	0.30	0.28	0.23	0.26	2.35
26900 lin.ft. 8 in. vitrified sewer pipe	0.22	0.16	0.22	0.20	0.23	0.21	0.18	0.18	0.19
16800 lin.ft. 6 in. vitrified sewer pipe	0.15	0.10	0.18	0.15	0.18	0.14	0.13	0.12	0.15
900 6 in. on 8 in. Y's	0.48	0.30	0.40	0.40	0.85	0.90	0.30	0.34	0.69
500 6 in. on 6 in. Y's	0.36	0.20	0.30	0.30	0.69	0.65	0.20	0.24	0.45
264 lin.ft. 10 in. c.i. pipe	1.02	1.00	1.50	2.00	1.00	0.95	1.00	1.30	0.85
72 lin.ft. 8 in. c.i. pipe	0.78	p.80	1.25	1.50	0.80	0.80	0.90	1.00	0.80
96 lin.ft. 6 in. c.i. pipe	0.54	0.60	1.00	0.90	0.60	0.55	0.75	0.75	0.70
12800 lin.ft. 0 to 4 ft. trench	0.18	0.23	0.18	0.15	0.08	0.12	0.13	0.13	0.11
29100 lin.ft. 4 to 6 ft. trench	0.30	0.37	0.22	0.25	0.15	0.16	0.20	0.20	0.14
7500 lin.ft. 6 to 8 ft. trench	0.42	0.52	0.30	0.35	0.20	0.30	0.31	0.29	0.21
1800 lin.ft. 8 to 10 ft. trench	0.60	0.67	0.45	0.50	0.26	0.35	0.40	0.34	0.28
200 lin.ft. 10 to 12 ft. trench	0.72	1.22	0.60	0.80	0.40	0.40	0.49	0.54	0.45
200 lin.ft. 12 to 14 ft. trench	0.90	1.50	0.80	0.90	0.60	0.55	0.75	0.64	0.75
100 lin.ft. 14 to 16 ft. trench	1.20	2.22	1.00	1.00	0.75	0.80	1.00	0.74	0.95
136 building standard manholes	28.50	35.00	30.00	30.00	28.00	24.00	25.00	27.00	28.30
120 lin.ft. building add. depth of manhole	4.80	5.00	3.00	3.00	2.50	3.00	3.00	3.50	4.00
12 building flush tanks	57.60	75.00	60.00	70.00	50.00	85.00	57.50	65.00	62.50
40 building lampholes	5.40	2.00	7.00	10.00	8.00	9.00	8.00	7.00	7.00
25 cu.yd. extra concrete	9.60	8.00	8.00	9.00	9.00	6.00	8.00	7.00	8.00
3000 cu.yd. excavating rock in trench	2.40	3.00	4.00	3.50	2.80	3.00	2.40	2.50	2.70
1 building disposal plant complete (lump sum)	9000.00	10,000.00	9000.00	8000.00	9200.00	7209.00	9350.00	12,500.00	9150.00
1 M ft. sheeting left in trench	18.00	30.00	25.00	22.00	12.00	18.00	30.00	30.00	39.00
100 cu.yd. placing earth in embankment	0.42	0.50	0.40	0.25	0.75	0.50	0.30	0.50	0.45
Extended total	$53,793.00	$58,941.00	$55,695.00	$53,429.00	$48,682.00	$46,909.00	$46,212.00	$50,033.00	$46,010.00

	J	K	L	M	N	O	P	Q	R
3000 lin.ft. 15 in. vitrified sewer pipe	$0.58	$0.42	$0.55	$0.45	$0.50	$0.50	$0.48	$0.50	$0.47
4100 lin.ft. 12 in. vitrified sewer pipe	0.39	0.29	0.41	0.29	0.32	0.35	0.35	0.40	0.34
5500 lin.ft. 10. in. vitrified sewer pipe	0.29	0.20	0.25½	0.19	0.24	0.28	0.25	0.36	0.26
26900 lin.ft. 8 in. vitrified sewer pipe	0.22	0.16	0.22	0.16	0.18	0.16	0.20	0.18	0.20
16800 lin.ft. 6 in. vitrified sewer pipe	0.17	0.11	0.19	0.11	0.12	0.12	0.12	0.12	0.13
900 6 in. on 8 in. Y's	0.65	0.59	0.75	0.60	0.40	0.30	0.50	0.70	0.55
500 6 in. on 6 in. Y's	0.46	0.35	0.45	0.50	0.30	0.25	0.25	0.46	0.35
264 lin.ft. 10 in. c.i. pipe	0.25	0.94	1.50	1.00	1.25	2.00	1.25	1.30	1.20
72 lin.ft. 8 in. c.i. pipe	1.00	0.68	1.00	1.00	1.00	1.50	1.00	1.00	0.90
96 lin.ft. 6 in. c.i. pipe	0.65	0.55	1.00	1.00	0.75	0.90	0.75	0.75	0.60
12800 lin.ft. 0 to 4 ft. trench	0.14	0.18	0.19	0.18	0.10	0.16	0.14	0.25	0.13
29100 lin.ft. 4 to 6 ft. trench	0.17	0.24	0.27	0.25	0.15	0.17	0.20	0.35	0.17
7500 lin.ft. 6 to 8 ft. trench	0.20	0.31	0.45	0.42	0.20	0.25	0.28	0.50	0.20
1800 lin.ft. 8 to 10 ft. trench	0.30	0.52	0.84	0.60	0.35	0.40	0.45	0.60	0.30
200 lin.ft. 10 to 12 ft. trench	0.40	0.80	1.50	1.00	0.50	0.60	0.64	0.75	0.65
200 lin.ft. 12 to 14 ft. trench	0.65	0.98	2.00	1.10	0.75	0.80	0.82	0.90	0.87
100 lin.ft. 14 to 16 ft. trench	1.00	1.45	3.00	1.25	1.00	1.00	0.98	0.95	1.06
136 building standard manholes	24.00	24.00	27.50	23.00	22.00	26.50	25.00	19.00	30.00
120 lin.ft. building add. depth of manhole	3.00	2.50	4.00	2.00	2.50	3.00	2.00	3.50	3.00
12 building flush tanks	55.00	65.00	60.00	51.00	60.00	50.00	55.00	50.00	65.00
40 building lampholes	6.50	7.00	7.50	7.00	10.00	5.00	6.00	6.00	7.00
25 cu.yd. extra concrete	9.00	10.00	10.00	17.00	10.00	12.00	8.00	6.00	7.00
3000 cu.yd. excavating rock in trench	2.50	3.00	2.70	2.75	3.00	3.00	2.90	4.00	2.25
1 building disposal plant complete (lump sum)	8650.00	9661.31	9334.00	6700.00	8000.00	7650.00	7985.00	9140.00	9200.00
1 M ft. sheeting left in trench	20.00	22.00	25.00	25.00	20.00	20.00	15.00	20.00	12.00
100 cu.yd. placing earth in embankment	0.50	0.25	0.50	1.00	0.30	0.30	0.40	0.75	0.40
Extended total	$47,365.00	$49,339.00	$56,632.00	$47,522.00	$43,711.00	$45,496.00	$46,687.00	$60,484.00	$45,400.00

RAPID TRANSIT SYSTEM, NEW YORK, N. Y.
Station Finish, Fourth Ave. Subway

Bids were received May 28 by the Public Service Commission for the station finish of the Fourth Ave. subway, a part of the Broadway-Fourth Ave. Rapid Transit R.R., from: (A) D. C. Serber, 1123 Broadway, New York; (B) Station Construction Co., Inc., 407 45th St. Brooklyn; (C) Simon Russek, Inc., 251 Broadway, New York; (D) Charles Meads & Co., 38 Park Row, New York; (E) C. L. Dooley, Inc.; (F) Marble Arch Co., Broadway and 216th St., New York. The item bids were as follows:

	A	B	C	D	E	F
300 cu.yd. concrete	$9.00	$7.00	$13.00	$11.00	$17.00	$15.00
11 cu.yd. common brick masonry	15.00	27.00	15.00	15.00	15.00	15.00
200 cu.yd. removal of old masonry	10.00	10.00	13.00	6.00	10.00	5.00
1 cu.yd. hollow tile masonry	15.00	32.00	15.00	50.00	15.00	20.00
10 sq.yd. resurfacing concrete masonry	0.50	2.00	1.00	3.00	0.50	2.00
43,000 duct ft. tunnel ducts	0.12	0.11	0.10	0.15½	0.10	0.15
15 tons riveted steel	80.00	90.00	90.00	90.00	80.00	70.00
5 tons steel beams and shapes	80.00	75.00	80.00	80.00	80.00	70.00
5 tons steel rods and bars	80.00	60.00	60.00	80.00	65.00	70.00
100 lb. special wire forms	0.10	0.10	0.12	0.15	0.10	0.10
1075 lin.ft. hand rail	0.60	0.40	1.00	0.40	0.20	1.00
1080 sq.ft. tile, 3 ft. x 6 in., straight	0.48	0.60	0.45	0.40	0.48	0.50
45 sq.ft. tile, 2½ in. radius	1.32	1.23	1.15	2.00	1.20	1.00
4065 sq.ft. tile, 3 ft. x 9 in. and 6 ft. x 9 in., straight	0.77	0.80	0.70	0.70	0.70	0.70
25 sq.ft. tile, 2½-in. radius	1.65	1.30	1.20	3.00	1.25	1.25
30 lin.ft. tile bead, 2-in. radius	0.44	1.20	0.50	1.00	0.50	0.50
4300 sq.ft. special tile, white mosaic	0.45	0.72	0.50	0.40	0.55	0.50
1300 sq.ft. mosaic and tile bands	1.20	1.50	0.80	1.00	1.00	1.25
50 sq.ft. name tablets	1.20	1.50	1.00	2.00	1.00	1.25
1 lintel, resetting	20.00	15.00	30.00	20.00	7.00	20.00
700 sq.yd. plastering arch surface on brick and hollow tile	1.05	1.60	0.70	1.00	1.10	1.10
680 sq.yd. plastering on concrete	0.90	1.44	0.70	1.00	0.90	1.10
470 sq.yd. plastering flat surface on brick and hollow tile	0.95	1.44	0.70	1.00	1.00	0.60
45 sq.yd. plastering on concrete	0.70	1.38	0.70	1.00	0.65	0.60
3425 sq.ft. cement work, wainscot or base	0.12	0.12	0.12	0.20	0.15	0.20
175 lin. ft. cement work, cove	0.12	0.11	0.12	0.20	0.15	0.15
1450 sq.ft. cement work, floor finish	0.16	0.15	0.15	0.20	0.15	0.15
25 lin.ft. concrete stairs, self-supporting	0.85	1.60	1.20	3.00	1.50	2.00
10 sq.ft. concrete landings, self-supporting	0.50	0.65	0.60	2.00	0.55	1.00
30 sq.ft. non-slip treads	1.00	0.75	1.00	2.00	1.00	1.00
100 lin.ft. cement in side of stairs	0.12	0.12	0.40	0.50	0.50	0.30
2000 sq.ft. replacing non-slip treads	0.70	0.70	0.80	1.50	1.00	1.00
2 ticket booths, type "P"	750.00	800.00	740.00	650.00	790.00	750.00
8 ticket booths, type "Q"	750.00	800.00	750.00	650.00	790 00	750.00
3 doors, type "D"	73.00	81.00	85.00	80.00	95.00	90.00
3 doors, type "M"	73.00	65.00	65.00	70.00	12.00	70.00
3 doors, toilet stalls, single	50.00	53.00	45.00	60.00	55.00	50.00
1 resetting door	14.00	15.00	14.00	30.00	15.00	20.00
190 sq.ft. windows, double hung	2.85	2.70	2.50	2.00	2.75	3.00
75 sq.ft. windows, hinged	2.80	2.70	3.00	2.00	2 75	3.00
6 door stops	2.35	2.25	2.50	5.00	2 25	3 00
2 chains	1.25	1.80	2 00	2 00	1.75	3.00
70 lin.ft. railings.pipe	1.65	1.80	2.00	2.00	1.75	3.00
32 lin.ft. railings, guard at street	3.00	2.40	3.50	3 00	3.25	3.00
Remove existing and install new railing, lump sum	770.00	150.00	150.00	400.00	74.25	....
48 lin.ft. low-slide gates	11.00	9.00	11.00	10.00	10.50	10.00
10 additional floor boxes	5.00	3.60	6.00	5.00	5 00	5.00
75 lin.ft. 1¼-in. galvanized w.i. pipe	1.10	0.25	1.00	0.40	1.25	0.50
10 lin.ft., 1-in. square steel tubing for ropes	1.70	0.60	1.50	0.40	1.70	1.00
10 lb. c.i. fittings	0.50	0.25	0.50	1.00	0.50	0.10
8 pair c.i. gate posts	85.00	56.00	80.00	40.00	75.00	30.00
6 additional high posts	14.00	6.00	14.00	10.00	15.00	30.00
18 lin.ft. reflectors	2.00	2.00	1.50	2.00	1 50	2.00
25 sq.ft. enam. sign plates	1.00	1.15	1.40	2.00	0 90	2.00
25 vert. in. copper letters	0.20	0.12	0.40	1.00	0.12	0.10
100 sq.ft. polished plate window glass	0.75	0.90	1.00	1.00	1.00	1.00
32 old lamps on posts	3.00	1.80	6.00	4.00	2.50	2.00
45 lin.ft. tread	2.20	2.25	3.00	2.00	2 50	5 00
30 sq.ft. steel platforms	1.10	2.25	2.00	2.00	1.40	2.50
36 ladders track to platform	6.00	11.50	10.00	10.00	7.00	20.00
40 lin.ft. oak hand rail, new	1.00	0.60	1.00	1.00	1.00	1.00
300 lin.ft. oak hand rail place, old	0.50	0.20	0.40	0.50	0.50	0.50
200 sq.ft. platform edge, safety tread	0.75	1.40	0.80	2.40	1.00	1.00
Rough plumbing (lump sum)	1320.00	700.00	900.00	763.00	1350.00	500.00
1 water closet bowl	60.00	65.00	60.00	60.00	64.00	50.00
3 lavatories	50.00	47.00	45.00	60.00	52.00	60.00
2 marine water closet bowls	110.00	125.00	110.00	100.00	118.00	75.00
10 sq.ft. soapstone partition, etc., pipe chamber partition	0.75	1.00	1.50	3.00	1.75	2.00
10 sq.ft. soapstone partition shelves	0.75	1.00	1.50	3.00	1.75	2.00
90 sq.ft. soapstone partition for stalls	0.85	1.00	1.50	2.00	1.75	2.00
100 lb. steel angles, plates, etc	0.05	0.07	0.10	0.10	0.10	0.10
300 lin.ft. electric conduit, ¾ in	0.30	0.21	0.30	0.30	0.29	0.20
150 lin.ft. electric conduit, 1 in	0.40	0.28	0.40	0.40	0.40	0.20
125 lin.ft. electric conduit, ¾-in. flexible conduit	0.30	0.25	0.60	0.40	0.35	0.20
40 electric conduit, 2½-in. galvanized w.i. ferrules	0.50	0.50	0.60	0.50	1.00	1.00
30 c.i. pull boxes, 6x6x6 in.	5.50	1.50	3.00	3.00	4.50	3.00
Asbestos lumber box (lump sum)	100.00	150.00	150.00	150.00	75.00	200.00
3000 painting iron, steel, etc., letters and number	0.20	0.15	0.12	0.15	0.13	0.15
Existing steel, etc. (lump sum)	1500.00	970.00	2500.00	2230.00	2700.00	1000.00
Extended totals	$40,676	$40,694	$41,251	$42,219	$43,117	$42,199

CALIFORNIA STATE HIGHWAY
Tulare County, Division VI, Route 10, Section A

Bids were received June 1 by the State Highway Commission, Sacramento, for the construction of Division VI, Route 10, Section A, of the State Highway in Tulare County, from: (A) Taylor & Berliner, Los Angeles; (B) W. A. Dontanville, Paso Robles; (C) George S. Benson & Co., Los Angeles; (D) Engineer's Estimate. The state will furnish pipe railing for culverts, corrugated iron pipe, reinforcing steel, portland cement, sand and coarse aggregate to cost $17,592. The item bids were as follows:

	A	B	C	D
2970 cu.yd. ordinary excavation	$0.60	$0.65	$0.75	$0.60
2220 cu.yd. borrow excavation	0.70	0.80	0.90	0.60
210 lin.ft. 12-in. corrugated iron pipe	0.60	0.50	0.80	0.40
174 lin.ft. 18-in. corrugated iron pipe	0.80	0.60	1.00	0.50
11 cu.yd. cement-concrete, Class "B" (culverts and monuments)	20.00	15.00	15.00	10.00
3840 cu.yd. cement-concrete pavement	5.50	4.24	3.35	2.85
16 monuments, hauling and setting	1.00	1.00	2.00	0.50
Extended totals	$24,957	$20,378	$17,628	$16,490

WILL LABOR BE SCARCE?

Securing sufficient labor to carry on work under way promises to be one of the particular problems confronting contractors during the coming months. It is true that there was an increase in the number of third-class passengers arriving during the months of March and April, compared with February, but there was likewise an increase in the number of departures. In fact, the total net gain of aliens arriving and departing for the ten months of the current fiscal year, covering practically the war period, was only 28,000. In the year 1914 there was a net gain of 769,000; in 1913 of 815,000; and in 1912, 401,000. Immigration has fallen to such low figures that it is practically useless to make comparisons. For example, in April the arrivals were less than 25 per cent. of what they were in the corresponding month of 1914, and 18 per cent. compared with the corresponding month in 1913. In four of the nine months since the European war started, as shown by these figures, the number of departures exceeded the arrivals. Now with Italy in the fray it will mean that no more Italian labor, particularly male labor, will come to this country, and transportation from southern Europe, is so unsatisfactory that there is no inducement for the Greeks, Romanians, and Bulgarians to come to the United States, even should their governments be willing to permit them, which is a serious question. Moreover, the Italians going back to Italy are numerous, although it must be admitted that there is no such return as was noted among the French, nor the willingness to return which was manifest in the Germans. In the appended table is shown the arrivals and departures, month by month, for the years 1913 and 1914, and the first four months of the present year.

IMMIGRATION STATISTICS

	1915		1914		1913	
	Arrival	Departure	Arrival	Departure	Arrival	Departure
January	20,684	31,556	53,150	69,218	155,235	57,035
February	18,704	14,188	56,115	34,722	71,355	30,119
March	26,335	15,167	108,923	28,777	121,241	30,867
April	31,765	17,670	142,207	50,234	175,179	45,526
May	.....	.....	126,848	57,783	164,692	62,349
June	.....	.....	85,094	78,207	198,457	58,186
July	.....	.....	72,015	54,885	154,602	62,702
August	.....	.....	44,624	34,757	156,688	37,900
September	.....	.....	45,241	39,410	153,067	54,609
October	.....	.....	35,325	40,748	117,031	53,971
November	.....	.....	27,458	42,525	106,701	56,597
December	.....	.....	72,015	54,885	154,602	62,702

RAPID TRANSIT SYSTEM, NEW YORK, N. Y. SECTION 1, ROUTE 29

✚Bids were received June 15 by the Public Service Commission for the construction of a part of Route 29, Section 1, beginning at a point under Eastern Parkway, about 192 ft. west of the westerly building line of Nostrand Ave., curving thence southerly under Eastern Parkway and private property into Nostrand Ave. to a point about 220 ft. south of the southerly building line of Church Ave. from (A) NEWMAN & CAREY, 215 Montague St., Brooklyn, N. Y. (awarded contract); (B) Underpining & Foundation Co., (C) D. Donegon, (D) Rodgers & Hagerty, (E) Dock Contracting Co., (F) McArthur Brs., (G) T. A. Gillespie, (H) Charles Copper, (I) E. E. Smith Contracting Co., (J) Degnan Contracting Co., (K) Frawley Kaufman Contracting Co., (L) A. McMullen, (M) Oscar Daniels, (N) J. C. Green. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
370,600 cu.yd. earth excavation above mean high water	$2.12	$1.80	$2.10	$2.85	$1.50	$2.45	$2.90	$2.91	$2.64	$2.75	$3.00	$3.25	$3.00	$4.00
33,000 cu.yd. earth excavation above and below mean high water sewers	1 17	1.80	2.10	2.85	2.50	2.45	3.00	2.81	3.00	2.75	4.00	3.25	3.00	4.00
1690 lf.ft. underpinning, buildings under 7 stories	29 00	40.00	34.00	1.00	32.00	40.00	45.00	40.00	50.00	1.00	30.00	40 00	60 00	50.00
1800 lf.ft. maintaining, protecting and securing buildings	14 50	40.00	34.00	1.00	32.00	25.00	20.00	15 00	30.00	1.00	30 00	35 00	10 00	50 00
56,200 cu.yd. concrete masonry	7.00	8.30	7.00	7.50	6.90	7.20	7.25	6.50	8.00	7.50	7.50	8.00	9.00	8.00
5640 cu.yd. protective concrete masonry	5.50	8.30	7.00	7.50	6 90	7.30	7.25	6.50	7.00	7.50	7.00	8.00	9.00	8.00
20 cu.yd. rubble stone masonry	10.00	6.50	8.00	5.00	7.00	10.00	10.00	6.50	7.00	7.50	6.00	5.00	4.00	8 00
20 cu.yd. dry rubble masonry	10 00	6.00	6.00	3.00	7 00	8.00	8.00	6.50	6.00	5.00	5.00	3.00	3.00	6.00
10 cu.yd. brick masonry	20 00	20.00	18.00	15.00	20 00	15.00	20.00	15.00	15.00	15.00	20 00	15 00	15 00	15 00
2 cu.yd. vitrified brick masonry	40 00	20.00	30 00	30.00	35.00	30.00	18 00	20.00	25.00	20.00	20.00	25 00	25 00	30 00
40 cu.yd. hollow terra cotta brick or tile masonry	15.00	25.00	15.00	15.00	15.00	15.00	18.00	15.00	15.00	15.00	25 00	15 00	15.00	15 00
1000 bbl. Portland cement grout	2 40	1.60	2.50	2.50	1.00	2 50	2.75	2.50	2.50	1 50	2 00	2.00	1 50	2 50
1000 lin.ft. timber piles in place and prepared	0.60	0.20	0.25	0.25	0 25	0.50	0 40	0.01	0.40	0.50	0.50	0.30	0.30	0 30
2 M ft. b.m. timber foundations, placed and fastened	50 00	40 00	30 00	30.00	30.00	80.00	55 00	0.01	50 00	50 00	100.00	40 00	40.00	50 00
50 cu.yd. broken stone or gravel	3 00	3.00	3.50	2.00	1.00	2.00	2.10	2.00	3 00	3 00	2.00	2.50	1.50	2 00
15,500 sq.yd. waterproofing, 1-ply	0 36	0.40	0.45	0.35	0.40	0.36	0.35	0.40	0.50	0.50	0.50	0 40	0.35	0 40
100 sq.yd. waterproofing, 2-ply	0.75	0.80	0.85	0.60	0.84	0.60	0.70	0.75	0.75	1.00	0.75	0.50	0.70	0.65
35,000 sq.yd. waterproofing, 3-ply	0 95	1.20	1.00	0.80	1.00	0.92	1.00	1.00	1.00	1.25	1.00	0.75	1.20	1 00
100 sq.yd. waterproofing, 4-ply	1 25	1.60	1.40	1.15	1.25	1.25	1.30	1.25	1.25	1.50	1.30	1.00	1.40	1.25
100 sq.yd. waterproofing, 5-ply	1 50	2.00	1.80	1.40	1.50	1.60	1.75	1.50	1.50	1.75	1.65	1.35	1.70	1.50
210 sq.yd. waterproofing, 6-ply	1.85	2.40	2.10	2.00	2 40	1.90	2.10	1.75	1.75	2.00	2.00	1.60	2.00	2 50
100 sq.yd. waterproofing, dry ply	0 20	0.35	0.40	0.35	0.15	0.30	0 25	0.45	0.50	0 30	0.40	0 20	0.35	0.30
2180 cu.yd. waterproofing, brick in asphalt mastic	23 00	20 00	23.00	20.00	22 00	25 00	23.00	25.00	17.50	18.00	20.00	22.00	25.00	25 00
50 lin.ft. drain pipe, 12 in. vitrified	0 50	1.20	1.00	0.75	2.00	0.90	0.65	1.40	1.00	0.80	1.00	1.00	1.50	0.70
50 lin.ft. drain pipe, 10 in. vitrified	0.50	1.00	1.00	0.65	1.80	0.80	0 60	1.25	0.88	0.55	0.70	0.80	1.00	0 60
50 lin.ft. drain pipe, 8 in. vitrified	0 40	0.80	0.75	0.50	1.70	0.70	0.50	1.00	0.75	0.40	0.50	0.60	0.80	0.50
50 lin.ft. drain pipe, 6 in. vitrified	0 40	0.60	0.75	0.45	1.60	0.50	0.45	0.60	0 65	0.30	0.40	0.50	0.60	0.40
50 lin.ft. drain pipe, 4 in. vitrified	0 30	0.40	0.50	0.40	1.50	0.25	0.40	0.60	0.55	0 20	0.30	0.40	0.30	0.30
50 lin.ft. drain pipe, 6 in. c.i.	1.00	2.50	1.00	1.00	3.00	1.25	0.65	1.25	2.00	1.25	1.50	1.25	1.00	1.00
50 lin.ft. drain pipe, 4 in. c.i.	0.80	1.60	0.75	0.50	2.50	1.00	0.50	1.00	1.50	1.00	1.00	1.00	0.75	0.60
200 lin.ft. drain pipe, 10 in. c.i.	1.80	3.00	2.30	2.50	2.00	1.70	1.90	3.00	4.00	2.00	2.00	2 00	2.00	1.50
100 lin.ft. 3 in. "extra heavy" c.i. pipe and fittings	0 60	1.50	0.75	1.00	0.85	1.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	0.75
350 lin.ft. 4-in. "extra heavy" c.i. pipe and fittings	0.80	1.60	1.25	1.25	1.25	1.30	0.65	1.25	1.50	1.00	1.25	1.25	1.25	1.00
300 lin.ft. 6-in. "extra heavy" c.i. pipe and fittings	1.20	2.50	1.50	1.50	1.35	1.90	0.90	2.00	2 00	1.25	1.75	1.65	1.50	1.25
300 lin.ft. 8-in. "extra heavy" c.i. pipe and fittings	1 40	3.00	2.00	2.50	2.00	2.50	1.35	3.00	3.00	1.50	2.00	2.00	2.50	2.00
263,800 duct. ft. tunnel ducts in place	0.11	0.20	0.11	0.12	0.11½	0 10	0.14	0.10	0.11	0.15	0.10	0.11	0.12	0.11
56,100 duct. ft. railroad ducts in place	0 22	0.20	0.12	0.15	0.11½	0.15	0.25	0.12	0.15	0.20	0 20	0.17	0.14	0.16
2600 ton riveted steel, painted and erected	60 00	52.00	58.00	55.00	57.00	59.65	53.00	55 00	65 00	65.00	60.00	58.00	67.00	63 00
3815 ton steel beams and shapes with connections	40 75	42.00	52 00	55.00	51.00	53.30	50.00	55.00	57 50	55.00	60 00	55 00	62 00	57 00
735 ton steel rods and bars built in concrete	43.00	70.00	57 00	50.00	45.00	50.00	40.00	55.00	45.00	50.00	50 00	65.00	50.00	50 00
35 ton miscellaneous iron castings	75 00	90.00	70 00	65.00	65.00	65.00	32.00	70.00	55.00	60.00	50.00	50.00	50.00	50.00
3 ton miscellaneous iron furnishings	75.00	100.00	70.00	100.00	75.00	100.00	33.00	70.00	65.00	75.00	80.00	70.00	50.00	50.00
20 lb. special wire forms, in pace	1.00	0.25	0.25	0.10	0.25	0.10	1.00	0.12	0.50	0.25	0.30	0.50	0.50	0.10
9760 lin.ft. 1¾ seasoned oak hand rail, in place	0.30	0.30	0.45	0.26	0.28	0.40	0.45	0.30	0.30	0.50	0.50	0.35	0.50	0.50
11,750 sq.ft. steel gratings for ventilation	1.70	1.00	1.50	1.50	1.40	1.50	1.40	1.30	1.50	1.25	1.25	1.40	1.75	1.50
1500 sq.ft. vault lights, in place	1 30	1.00	1.50	1.25	1.10	1.50	1.00	1.30	1.10	3.00	1.50	1.50	1.50	1.50
4750 sq.yd. sidewalks restored	3.00	1.35	1.25	1.35	2.25	2.00	1.20	1.25	1.60	2.00	2.00	1 00	2.00	2.00
1120 sq.yd. repavement of roadways, asphalt	2.50	2.20	2.50	2.50	2.25	2.75	1.60	2.50	2.00	2.50	2 50	2.50	1.50	2 50
26,700 sq.yd. repavement of roadways, granite block	0 75	0.80	2 00	0.25	1.25	2.50	0.55	3.00	0.70	2 50	2.50	2.00	2 00	2 50
9400 sq.yd. repavement of roadways, Belgian block	0.40	0.80	2.00	0.25	1.25	3.00	0.55	1.00	0.75	2.50	1 00	2.00	2 00	0 75
100 lin.ft. new bluestone curb in place	1 50	2.00	1.30	1.00	2 00	1.00	0 65	1.00	1.40	1 50	1.25	1 50	1.50	1.00
100 lin.ft. new 8-in. granite curb	2.50	2.50	2.25	2.00	2.00	1.20	0 90	1.50	2.50	1.75	2.00	2.50	2.00	2.00
95 sq.yd. park surface restored, all classes	2 00	2.00	1.00	1.00	1.00	2.00	1.00	1.25	2.50	2.00	2.00	1.00	2.00	1 00
15,500 lin.ft. ¾-in. w.i. electric conduits	0.19	0.20	0.25	0.15	0.18	0.15	0.07	0.20	0.30	0.20	0.25	0.20	0.20	0.20
800 lin.ft. 1¼-in. w.i. electric conduits	0 30	0 40	0.50	0.25	0.32	0.30	0.17	0.40	0.40	0.30	0.40	0.30	0.40	0.30
450 lin.ft. 2-in. w.i. electric conduits	0.45	0.50	0.75	0.30	0.40	0.40	0.25	0.60	0.55	0.40	0.60	0.50	0.50	0.40
4500 lin.ft. 1-in. w.i. electric conduits	0 25	0.30	0.40	0.20	0.24	0.20	0.11	0.30	0 33	0.25	0.30	0.25	0.30	0.25
1250 c.i. outlet boxes	1 00	1.50	1.30	1.00	0.50	1.00	0.50	1.00	0.80	1.00	1.00	0.75	1.00	0.97
10 c.i. pull boxes	1.12	1.50	12.00	2.00	3.50	2.00	1.00	1.00	5.00	1.00	3.00	3.00	1.00	5.00
300 lin.ft. 6-in. c.i. pipe and fittings "extra heavy"	1.20	2.50	1.30	1.50	1.40	1.50	0.75	2.00	2.00	1.50	1.50	1.50	2.00	1.50
150 lin.ft. 3-in. c.i. pipe and fittings "extra heavy"	0.60	1.50	0.90	1.00	1.00	1.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	0.75
3460 lin.ft. sewer pipe, 12-in. vitrified	0.50	3.60	2.50	2.40	2.75	3.00	0.90	3.00	2.75	3.50	3.00	2.50	2.50	3.10
1000 lin.ft. sewer pipe, 15-in. vitrified	0.85	2.80	3.00	2.75	3.00	3.70	1.00	3.50	3.25	4.00	3.50	3.00	3.00	3.35
100 lin.ft. sewer pipe, 18-in. vitrified	1.40	5.00	3.00	3.25	3.20	4.20	1.50	4.00	3.50	4.50	4.00	4.00	3.50	3.60
100 lin.ft. sewer pipe, 20-in. vitrified	1 75	5.00	4.00	4.00	3.55	4.50	2.00	4.50	4.00	5.00	4.50	4.50	3.75	3.85
100 lin.ft. sewer pipe, 22-in. vitrified	2.00	5.00	5.00	4.50	3.95	5.00	2.00	4.75	4.50	5.25	5.00	4.75	4.00	4.10
1300 lin.ft. sewer pipe, 24-in. vitrified	2.00	6.00	5.00	4.50	4.00	5.20	3.00	5.00	5.00	5.50	5.50	5.00	5.00	4.35
60 ton sewer pipe, c.i. straight	50.00	40.00	50.00	40.00	36.00	45.00	50.00	50.00	45.00	60.00	50.00	60.00	37.00	40.00
12 ton sewer pipe, c.i. special	100.00	80.00	72.00	75.00	70.00	70.00	60.00	60.00	90.00	90.00	80.00	90.00	65.00	70 00
1060 lin.ft. sewer egg-shaped 3 ft. 6 in. x 2 ft. 4 in.	3.60	6.00	7.50	6.00	6.25	6.50	8.00	6.00	7.00	8.00	6.00	8.00	7.00	5.60
140 lin.ft. sewer egg-shaped 3 ft. 9 in. x 2 ft. 6 in.	4 00	6.00	8.50	6.25	6.50	7.00	9.00	6 50	7.50	9.00	7.00	9.00	7.50	6.10
50 lin.ft. sewer egg-shaped 4 ft. 6 in. x 3 ft. 6 in.	6 00	6.00	10.00	8.00	8.00	10.00	12.00	7.00	8.00	10.00	8.00	10.00	8.00	6.25
650 lin.ft. circular sewer 4 ft. ; in. diameter	5 00	7.00	10.00	6.00	8.00	8.00	8.00	7.00	8.25	10.00	10.00	10.00	8.00	6.60
1280 lin.ft. circular sewer 4 ft. 9 in. diameter	7.30	9.50	12 00	8 50	8.75	9.00	10.00	7.50	10.00	11 00	10.50	12.00	9.00	8 70
1600 lin.ft. circular sewer 5 ft. 0 in. diameter	8.00	11.00	12.00	9.00	9.25	10.00	13.00	8.00	10.50	13.00	11.00	14.00	10 00	10.80
2620 lin.ft. circular sewer 5 ft. 3 in. diameter	8 25	11.25	13.00	9.25	9.60	12.00	14.50	8.50	11.50	14.00	11.50	16.00	12.00	11.40
350 lin.ft. circular sewer 5 ft. 6 in. diameter	9.00	12.00	13.00	9 50	10.00	14.00	16.00	9.00	12.50	15.00	12.00	18 00	14.00	12 00
2 12-in. iron bronze sluice gates with sipots	75.00	200.00	75.00	50.00	75.00	100 00	80.00	20.00	50.00	100.00	50.00	50.00	200.00	50.00
15,000 lin.ft. electric (overhead trolley) railroads, one track	2 30	0.50	4.00	0 25	2.25	5.00	1.50	3.00	3.00	10.00	7.00	4.00	8.00	10.00
350 lin.ft. water pipe, 4-in.	0.35	0.60	1.00	0.30	0.75	0.50	1.00	0.60	0.75	1.00	0.80	0.80	1.00	0.75
1400 lin.ft. water pipe, 6-in.	0.35	0.90	1.00	0.40	1.00	0.80	1.10	0.75	0.90	1.25	1.00	1.00	2.00	1.00
1400 lin.ft. water pipe, 8-in.	0.50	1.20	1.30	0.50	1.25	1.10	1.40	1.50	1.10	1.50	1.25	1.50	2.50	1.25
150 lin.ft. water pipe, 12-in.	0.60	1 80	1.60	0.75	1.75	1.50	1.65	1.60	1.50	2.00	1.40	2.00	3.00	1.50
75 lin.ft. water pipe, 16-in.	0.85	2.40	2.50	0.90	2.50	2.00	2.40	1.80	2 00	2.50	2.60	3.00	4.00	2.50
1920 lin.ft. water pipe, 20-in.	1.20	3.00	3.10	1.25	3.50	2.50	3.00	2.00	2.25	2.50	4.00	4.00	5.00	2.75
300 lin.ft. water pipe, 48-in.	5.50	7.00	10.00	4.00	7.00	6.50	11.00	4.00	9.00	10.00	10.00	12.00	6.00	9.00

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
100 service connections for water pipes	12.00	20.00	20.00	25.00	20.00	12.00	20.00	20.00	25.00	25.00	20.00	20.00	10.00	15.00
250 lin.ft. gas pipe, 3-in.	0.35	0.50	0.50	0.30	0.60	0.60	0.70	0.50	0.75	1.00	0.40	0.60	1.00	0.50
700 lin.ft. gas pipe, 4-in.	0.35	0.60	0.50	0.40	0.85	0.75	1.00	0.60	0.90	1.00	0.50	0.75	1.50	0.75
650 lin.ft. gas pipe, 6-in.	0.35	0.90	0.75	0.50	1.00	1.00	1.10	0.75	1.10	1.25	0.60	1.00	2.00	1.00
300 lin.ft. gas pipe, 8-in.	0.50	1.20	1.00	0.60	1.15	1.25	1.65	1.50	1.25	1.25	0.80	1.25	2.50	1.25
1900 lin.ft. gas pipe, 10-in.	0.60	1.50	1.50	0.70	1.40	1.50	1.80	1.60	1.50	1.50	1.00	1.50	3.00	1.50
100 lin.ft. gas pipe, 12-in.	0.75	1.80	1.50	0.75	1.60	1.80	2.00	1.60	1.75	1.50	1.20	1.75	3.50	1.75
1850 lin.ft. gas pipe, 16-in.	0.90	2.00	2.00	1.26	2.00	2.50	2.20	1.80	2.00	1.75	1.60	2.25	4.00	2.00
450 lin.ft. gas pipe, 42-in.	4.50	8.00	7.00	4.00	6.00	7.00	5.50	3.60	7.50	8.00	10.00	12.50	4.50	7.00
80 lin.ft. gas pipe, 20-in.	1.25	2.00	4.00	1.50	3.00	4.00	2.35	2.00	2.50	2.00	2.50	3.00	5.00	2.50
50 lin.ft. gas pipe, 24-in.	1.50	2.00	4.00	2.00	4.00	6.00	2.75	2.50	3.50	2.25	4.00	4.00	6.00	3.50
8000 lin.ft. 6-in. by-passing pipe	1.00	3.00	3.00	2.50	2.75	2.20	2.10	3.00	3.50	7.00	2.50	3.00	2.50	3.00
7300 lin.ft. 8-in. by-passing pipe	1.40	3.00	3.00	3.50	3.50	3.00	2.65	3.50	5.00	8.00	3.50	3.50	3.00	3.25
2000 lin.ft. 12-in. by-passing pipe	2.50	3.50	4.50	4.50	4.50	4.00	4.00	5.00	7.50	8.00	4.00	4.50	3.50	4.00
650 lin.ft 4-in. by-passing pipe	0.85	2.50	2.00	2.00	2.25	2.00	1.00	2.80	2.50	6.00	2.50	2.75	1.50	2.50
350 lin.ft. 12-in. by-passing pipe, on trestle	3.50	3.50	8.00	3.50	3.60	4.00	4.00	5.00	7.50	8.00	6.00	4.75	3.50	4.50
1550 lin.ft. 16-in. by-passing pipe, on trestle	4.50	5.00	8.00	5.00	4.50	6.00	5.00	6.00	10.00	10.00	8.00	6.00	4.00	4.75
170 lin.ft. 6-in. by-passing pipe, on trestle	1.10	3.00	5.00	2.00	2.50	2.20	2.50	2.50	5.00	7.00	3.00	3.25	1.50	3.00
500 lin.ft. 36-in. by-passing pipe, on trestle	14.50	7.00	20.00	9.00	10.00	10.00	8.50	15.00	15.00	14.00	15.00	15.00	10.00	13.50
500 lin.ft. 8-in. by-passing pipe, on trestle	1.40	3.00	5.00	3.00	3.00	3.00	3.00	3.00	6.00	8.00	4.00	3.75	3.00	3.50
1300 lin.ft. trestle to support by-passing pipes	2.40	3.00	3.00	2.50	2.00	3.00	2.75	4.00	3.00	2.00	5.00	2.00	3.50	3.50
160 lin.ft. catenary for over 16-in. pipe	7.50	12.00	1.00	2.50	8.00	8.00	2.20	6.00	6.00	2.00	5.00	2.50	2.00	4.50
1300 lin.ft. catenary for 16-in. pipe and under	4.75	3.00	0.75	2.50	8.00	5.00	1.80	4.00	4.50	2.00	5.00	2.00	2.00	2.25
250 service connection for gas pipes, all sizes	6.25	20.00	12.00	25.00	8.00	12.00	20.00	10.00	25.00	25.00	20.00	20.00	10.00	10.00
Maintain and supply 16-in. G Main in Nostrand Ave. (lump sum)	23,000.00	1550.00	3000.00	500.00	1500.00	5000.00	5000.00	100.00	1500.00	2500.00	500.00	3000.00	2350.00	
75 ton new c.i. hub and spigot straight pipe	34.00	40.00	45.00	30.00	40.00	35.00	25.00	45.00	30.00	40.00	50.00	45.00	35.00	35.00
30 ton new c.i. hub and spigot special pipe	80.00	80.00	70.00	65.00	75.00	70.00	40.00	65.00	75.00	60.00	80.00	75.00	65.00	65.00
2200 duct. ft. electric ducts and conduits	0.40	0.75	0.50	0.50	0.50	0.40	1.00	0.40	1.00	1.00	1.00	0.50	0.70	0.54
100 lin.ft. 2½-in. w.i. electric conduits	0.35	1.00	0.75	1.00	0.60	0.40	0.75	0.40	1.00	1.00	1.00	0.50	1.00	0.65
100 lin.ft. 3-in. w.i. electric conduits	0.40	1.00	1.00	1.00	0.90	0.45	0.90	0.45	1.10	1.00	1.00	0.60	1.00	0.70
100 lin.ft. 3½-in. w.i. electric conduits	0.50	1.00	1.50	1.00	1.10	0.50	1.10	0.50	1.20	1.00	1.00	0.70	1.00	0.75
100 lin.ft. 4-in. w.i. electric conduits	0.60	1.00	2.00	1.00	1.30	0.55	1.40	0.55	1.40	1.00	1.00	0.80	1.00	0.80
100 lin.ft. 4½-in. w.i. electric conduits	0.80	1.00	2.50	1.00	1.40	0.60	1.50	0.60	1.50	1.00	1.00	0.80	1.00	0.85
650 lin.ft. 2-in. Edison conduit	0.35	1.00	0.75	1.00	1.50	0.40	1.45	1.00	1.25	1.00	1.00	0.50	1.00	1.25
50 lin.ft. 2½-in. Edison conduit	0.40	1.00	1.00	1.00	2.00	0.50	1.50	1.25	1.50	1.00	1.00	0.60	1.00	1.50
300 lin.ft. 3-in. Edison conduit	0.45	1.00	1.50	1.00	2.00	0.60	1.60	1.50	2.00	1.00	1.00	0.70	1.00	1.75
30 service connection for electric ducts	10.00	25.00	20.00	25.00	20.00	20.00	20.00	10.00	25.00	50.00	10.00	20.00	10.00	15.00
100 duct. ft. wooden electric-ducts and conduits	0.25	1.00	0.80	1.00	0.60	1.00	1.20	0.50	1.00	1.00	1.00	0.50	0.50	0.60
Extended totals	$2,073,303	$2,187,286	$2,342,401	$2,376,309	$2,392,608	$2,512,485	$2,534,532	$2,539,048	$2,633,766	$2,765,887	$2,834,736	$2,904,029	$2,944,287	$3,331,566

(Continued from Page 21)

Marlin, Tex.—At a recent election the citizens voted in favor of the question of issuing $60,000 in bonds. The proceeds will be used for the construction of a school. Noted June 3.

San Diego, Tex.—An election will be held July 20 by the Commissioners of Duval County to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for the construction of a courthouse.

Stillwell, Okla.—An election will be held July 20 to vote on the question of issuing $40,000 in bonds, the proceeds of which will be used for the construction of a courthouse and jail for Adair County.

✚**Tucson, Ariz.**—The general contract for the construction of a cathedral for the Scottish Rite Corporation has been awarded to WEYMOUTH CROWELL, 2026 West Ninth St., Los Angeles, Calif. The estimated cost is $74,000. Noted May 27.

Davenport, Wash.—Bids will be received until July 3 by H. L. Paige, Clk. of School Dist. No. 14, for the construction of a school. The estimated cost is $50,000. A. G. Rigg, Empire State Bldg., Spokane, is Arch.

Seattle, Wash.—Bids will be received about July 10 by the Metropolitan Building Co., for the construction of a 120x240-ft. building at Fifth Ave. between University and Seneca St. The building will be occupied by the Seattle Arena Co. and will cost about $100,000. Howells & Stokes is Arch.

✚**Walla Walla, Wash.**—(Official)—J. B. SWEATT & CO., Spokane, at $149,900, using Indiana sandstone, has been awarded the contract for the construction of a courthouse for Walla Walla County. C. F. Dement is County Audr. and Osterman & Seibert is Arch. Noted May 27 and June 10.

✚**Pilot Rock Junction, Ore.**—(Pendleton post office)—The contract for the construction of terminals for the Oregon-Washington R.R. & Navigation Co. has been awarded to TWOHY BROS., Portland. The estimated cost is $400,000. Noted under The Dalles, Ore., June 24.

Los Angeles, Calif.—The lowest bid submitted on the general contract for the construction of a two-story high school at Rowan Ave. was that of the Huntsberger-Reed Co., Van Nuys Bldg., at $48,636. Noted June 3.

Suisun City, Calif.—At a recent election the citizens voted in favor of issuing $40,000 in bonds to be used for the construction of a high school.

✚**London, Ont.**—The Board of Education has awarded the contract for the construction of a school to S. WILLIS, 765 Talbot St., London. The estimated cost is $75,000. Noted Feb. 25.

The Narrows, Man.—Bids will be received until July 10 by David Clapp, Secy., School Bd., for the construction of a school. The estimated cost is $43,000. G. N. Taylor is Arch.

Electrification on the Pennsylvania—By July 1 electrification work is expected to be completed and the line in operation on the 20 miles of the Pennsylvania's Philadelphia-New York line between the Broad St. Station in Philadelphia and Paoli, Penn. The cost is put at $4,000,000. Part of the work has been unusually difficult. For instance, between West Philadelphia and Broad St. the movement of 2295 trains and engines is squeezed down to a six-track neck at the first interlocking tower west of Broad St. Station, where 55 switches and 52 signals are established. Reconstruction of this neck for electrification had to be carried on without interference with traffic. In the 20-mile stretch not a life was lost nor did any serious accident occur from electric shock throughout the work, although 660 miles of electric wires were set up and 760 poles erected in addition to 36 signal stations and four power stations. The electric service will be operated by the catenary system of conductors, the current being drawn from the lower of two trolley wires suspended from the catenary. The lower or contact wire is made of a hard, lasting alloy called "phonobronze" and is suspended below the other wire which is of copper. Instead of trolley poles and wheels, the current is conveyed from the wire to the car motors by means of "pantagraphs." The airbrakes are of the new type known as "electrically actuated," while the automatic block signal system used in the new electrified zone is of an entirely new style. The main feature of the latter is the employment day and night of rows of brilliant white electric lights set in a black background.

CATALOG NOTICES

Orton & Steinbrenner Co., Chicago, Ill. Catalog. Locomotive cranes and grab buckets. Illustrated, 44 pp., 6x9½ in.

Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill. Catalog No. 114A. Practical Irrigation by Pumping. Illustrated, 40 pp., 6x9 in.

Ayer & Lord Tie Co., Railway Exchange Bldg., Chicago, Ill Booklet. Interior wood blocks for floors. Illustrated, 16 pp., 3½x6½ in.

Emerson Pump & Valve Co., Alexandria, Va. Catalog. Steam pumps, foot valve and quick cleaning strainers. Illustrated, 80 pp., 6x9 in.

The Weber Chimney Co., 332 South Michigan Ave., Chicago, Ill. Catalog No. 10. Reinforced concrete chimneys. Illustrated, 48 pp., 5x9 in.

The Fargo Mfg. Co., Inc., Poughkeepsie, N. Y. Catalog No. 800. Electrical wiring devices. Illustrated, 18 pp., 6x9 in. Catalog No. 700 and Bulletin No. 402. Mechanical connecting devices for trolley construction. Illustrated, 6x9 in.

Cement-Gun Co., Inc., 30 Church St., New York. Bulletin No. 91. "Tunnel Waterproofing with Cement-and-Clay Mortar Fifty Feet Below Sea Level." Illustrated, 4 pp., 3½x6 in. Bulletin No. 101. "The Cement-Gun Process of Permanently Repairing Coke Ovens." Illustrated, 4 pp., 6x9 in.

Gifford-Wood Co., Hudson, N. Y. Buletin No. 16. Wagon loaders for handling stone, gravel, etc. Illustrated, 12 pp., 6x9 in.

Gifford-Wood Co., Hudson, N. Y. Bulletin No. 17. Pivoted bucket carrier for elevating and conveying stone, gravel, sand, etc. Illustrated, 16 pp., 6x9 in.

Contracts to Be Let

Bids received until July 19, 1915.

Water-Works Distributing System

Borough of Totowa, Passaic Co., N. J.

Sealed proposals will be received by the Mayor and Borough Council of the Borough of Totowa, Passaic Co., N. J., until 8:15 P.M. on Monday, the 19th day of July, 1915, at the Council Chamber, in the Borough Hall, on Lincoln Avenue, in said Borough, for the construction of a water-works distributing system.

The work involved consists of furnishing all material and labor in the construction of about 11 miles of water mains (bell and spigot pipe), 4″ to 10″ in size, together with furnishing and installing about 75 fire hydrants, furnishing and setting about 150 gate valves and boxes, constructing two meter chambers, and other incidental work necessary to complete the system.

Bids will be received as follows (on any or all of the four below):

(1) For furnishing c.i. water pipe (bell and spigot) and special castings.

(2) For furnishing Fire Hydrants, Gate Valves and Boxes.

(3) For Construction (Labor and Workmanship, etc.).

(4) For the work as a whole (furnishing all material and labor necessary to complete the system).

Each proposal or bid shall be accompanied by a certified check for five per cent. (5%) of the amount of the bid.

The contract bond will be fifty per cent. (50%) of the amount of the contract.

Copies of the plans, proposal forms, specifications, and forms of bonds, and contract can be seen at the office of Wm. Ferguson's Son, United Bank Building, No. 152 Market St., Paterson, N. J.; or may be obtained by prospective bidders upon depositing five dollars ($5.00) with Wm. Ferguson, Jr., Boro. Engr., which sum will be refunded upon return of plans and specifications within five (5) days after the contract is awarded, if same are in good condition when returned.

The Mayor and Borough Council reserve the right to reject any or all bids, waive any informalities in the bids received, and to accept any bids which it deems most favorable to the Borough of Totowa, N. J.

LINDEN REDMAN, Boro. Clerk.
WALTER R. HUDSON, Mayor.

Bids received until July 15, 1915.

Water-Works, Sewerage System, Disposal Plant

Clayton, Del.

Sealed proposals will be received by the Town Council of Clayton, Delaware, up to 8 o'clock P.M. of the 15th day of July, for furnishing all the labor, plant and material and doing all the work necessary to construct a water supply, sewerage system and disposal plant.

The work includes a tower and tank, pumping station, driving wells, all machinery, laying 4 and 6″ cast iron mains, also 2½ miles sewers 8″ to 12″, appurtenances, and a disposal plant.

A certified check for $1000 must accompany each bid. The Council reserves the right to reject any or all bids or accept the most favorable bid.

Plans may be seen and specifications and forms of proposal obtained from W. R. Clements, Secretary, or at the office of Herbert W. Hatton, Consulting Engineer, Equitable Building, Wilmington, Del. A full set of prints will be mailed to bidders upon receipt of $3, which sum will be returned only to the successful bidder.

U. S. ENGINEER OFFICE, Wilmington, Del.—Sealed proposals for dredging Tuckerton Creek and Absecon Creek, N. J., will be received here until 11 A.M., July 24, 1915, and then opened. Further information on application.

OFFICE OF THE COMMISSIONERS, D. C., June 24, 1915.—Sealed proposals will be received at this office, Room 509 District Building, until 2 o'clock P.M., on July 7, 1915, for the construction of Sewers in the District of Columbia, involving the construction of approximately 6,000 linear feet of pipe sewer 10 inches to 12 inches diameter. Forms of proposals, specifications and necessary information may be obtained from the Chief Clerk, Engineer Department, Room 427 District Building, Washington, D. C. OLIVER P. NEWMAN, LOUIS BROWNLOW, CHARLES W. KUTZ, Commissioners, D. C.

Bids received until July 7, 1915.

Highway Work

OFFICE OF THE STATE COMMISSION OF HIGHWAYS,
Albany, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p.m. on Wednesday, the 7th day of July, 1915, for the repair of highways in the following counties:

Albany (two contracts—resurfacing); Broome (one contract); Cayuga (two contracts—Resurfacing and Surface Treatment); Columbia (4 contracts—Surface Treatment); Delaware (one contract—Surface Treatment); Dutchess (one contract—Resurfacing); Erie (one contract—Resurfacing); Franklin (one contract—Surface Treatment); Greene (one contract—Surface Treatment); Herkimer (one contract—Resurfacing); Madison (one contract—Resurfacing); Monroe (one contract—Resurfacing); Oneida (5 contracts—Resurfacing and Surface Treatment); Ontario (two contracts—Resurfacing and Surface Treatment); Orange (one contract—Surface Treatment); Rensselaer (one contract—Resurfacing); Rockland (two contracts—Resurfacing); Saratoga (one contract—Resurfacing); St. Lawrence (two contracts—surface treatment); Schenectady (one contract—Surface Treatment); Suffolk (one contract—Surface Treatment); Westchester (one contract—Surface Treatment).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the Division Engineers in whose divisions the contracts are to be repaired. The addresses of the Division Engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "Information for Bidders" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY, Commissioner.
I. J. MORRIS, Secretary.

Bids received until July 23, 1915.

Concrete Reservoir

Binghamton, N. Y.

Sealed proposals will be received by the Board of Water Commissioners, at its office in Binghamton, New York, up to ten o'clock A.M., Friday, July 23, 1915, and then and there opened, for furnishing the materials and constructing a Covered Reservoir of 750,000 gallons capacity.

Plans and Specifications, with blank form of proposal, may be examined at the office of the Board of Water Commissioners, Binghamton, N. Y., or copies will be furnished to intending bidders on receipt of a deposit of ten dollars ($10.00), which will be returned to the party furnishing the same upon the return, in good order, of the Plans and Specifications.

A deposit of $500.00 in cash or certified check is required with proposal. Bond of $5000.000 required with contract.

Payments monthly to the extent of 90% of the Engineer's estimate of work accomplished, including allowance for materials.

Each bidder will be required to state what work of a similar nature he has done, and the Board of Water Commissioners reserve the right to reject any or all bids if they deem it to the interest of the City so to do.

JOHN D. DAVIDSON, Secretary,
Board of Water Commissioners
FREDERIC E. BECK, Engineer.

U. S. ENGINEER OFFICE, 305 Southern Building, Washington, D. C.—Sealed proposals for furnishing materials and erecting complete a brick storehouse in McMillan Park will be received here until 12 M., July 17, 1915, and then publicly opened. Information on application.

U. S. ENGINEER OFFICE, Jacksonville, Fla.—Sealed proposals will be received here until 12 noon, July 24, 1915, and then opened, for dredging and rock removal in St. Johns River, Fla. Further information on application.

PROPOSALS FOR LEVEE WORK—Office of Third Mississippi River District, P. O. Box 404, Vicksburg, Miss.—Sealed proposals will be received here until 11 a.m., July 12, 1915, and then opened, for constructing about 1,415,000 cubic yards of levee work. Further information on application.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

BUILDING LESS ACTIVE

Chiefly due to the lack of any large building work in New York City, the returns showing the estimated cost of buildings from plans filed in June are below those of the corresponding month last year in 21 Eastern cities. It must be remembered, too, that June last year was more active than usual. For the first six months of the year, however, there is a slight gain. In 12 Southern cities, the falling off is less than in the earlier months of the year. In the Central States, while the expenditures are large, they are below last year, and in the Western States the boom last year incident to the fair this year makes the comparison unfortunate.

In the following table is given the estimated cost of buildings in important cities compared with the corresponding month in 1914, together with the total estimated expenditure in the first six months of 1915 and of 1914:

EASTERN STATES

	Month of June		First Six Months of Year	
	1915	1914	1915	1914
Albany, N. Y.	$359,405	$860,685	$2,011,990	$3,884,460
Buffalo, N. Y.	1,667,000	2,569,000	5,597,000	6,564,000
Elizabeth, N. J.	109,614	132,453	568,459	708,933
Hartford, Conn.	462,523	658,672	2,763,927	2,373,371
Hoboken, N. J.	2,400	58,375	64,530	561,902
Jersey City, N. J.	519,958	395,162	2,800,736	1,957,253
Newark, N. J.	770,884	586,220	4,640,966	4,072,237
New Bedford, Mass.	201,150	269,625	1,816,574	1,734,607
New Haven, Conn.	451,025	440,271	2,867,565	1,978,410
New York, N. Y.				
Bronx	1,173,075	2,700,000	15,897,500	13,952,603
Brooklyn	4,063,355	5,298,550	12,267,245	22,604,150
Manhattan	3,290,330	3,393,350	39,638,720	26,276,740
Queens	1,744,075	2,530,655	10,015,546	10,800,167
Paterson, N. J.	314,748	186,326	771,241	848,911
Philadelphia, Penn.	3,873,850	3,557,895	19,066,390	21,105,720
Pittsburgh, Penn.	1,212,472	2,450,281	4,205,306	9,340,936
Portland, Maine	215,425	215,325	.....	.....
Reading, Penn.	152,900	67,575	556,575	910,200
Rochester, N. Y.	969,632	1,026,327	4,757,668	5,028,524
Scranton, Penn.	343,121	106,303	801,750	585,309
Springfield, Mass.	451,538	560,735	3,269,189	2,741,064
Syracuse, N. Y.	414,119	181,020	1,842,485	1,019,005
Utica, N. Y.	272,400	329,815	1,160,900	892,000
Wilkes-Barre, Penn.	58,111	410,811	.....	.....
Totals	$23,093,101	$28,985,431	$137,355,262	$135,868,065

SOUTHERN STATES

	Month of June		First Six Months of Year	
	1915	1914	1915	1914
Atlanta, Ga.	$334,246	$419,654	$2,131,691	$2,999,797
Chattanooga, Tenn.	61,435	60,145	253,885	633,440
Dallas, Tex.	142,125	588,945	1,524,515	3,483,563
Ft. Worth, Tex.	52,553	180,175	453,358	1,225,413
Houston, Tex.	114,392	242,345	838,662	1,823,486
Louisville, Ky.	332,710	517,540	1,788,095	2,557,855
Memphis, Tenn.	285,275	283,012	1,501,493	2,014,882
New Orleans, La.	279,731	364,599	1,355,690	1,427,990
Norfolk, Va.	245,384	217,827	1,037,468	1,359,840
Richmond, Va.	264,398	172,539	1,734,662	2,099,821
San Antonio, Tex.	98,310	240,090	.....	.....
Washington, D. C.	1,142,482	942,325	5,240,159	5,647,819
Totals	$3,353,341	$4,229,196	$17,859,678	$25,275,906

CENTRAL STATES

	Month of June		First Six Months of Year	
	1915	1914	1915	1914
Akron, Ohio	$318,900	$398,325	$1,516,690	$1,973,070
Canton, Ohio	135,670	148,010	829,740	757,105
Cedar Rapids, Iowa	135,000	270,000	1,020,000	1,530,000
Chicago, Ill.	7,613,500	9,538,300	40,273,050	44,859,200
Cincinnati, Ohio	940,635	1,081,395	4,667,664	4,988,770
Cleveland, Ohio	2,378,510	3,125,545	18,226,879	14,689,365
Columbus, Ohio	410,370	625,650	2,544,860	3,220,855
Des Moines, Iowa	150,252	193,475	893,115	1,143,660
Detroit, Mich.	2,669,265	2,639,745	13,045,560	16,566,995
Evansville, Ind.	53,777	133,159	924,379	818,169
Grand Rapids, Mich.	216,908	203,227	1,340,099	2,306,363
Indianapolis, Ind.	526,299	814,238	3,260,746	4,956,405
Kansas City, Kan.	72,531	125,893	540,791	611,120
Kansas City, Mo.	752,245	1,632,700	4,916,435	6,380,230
Milwaukee, Wis.	838,841	899,989	4,756,860	5,510,777
Minneapolis, Minn.	1,350,535	1,604,195	7,725,895	9,773,595
Oak Park, Ill.	343,980	325,700	947,885	1,281,400
Omaha, Neb.	594,590	404,025	2,654,430	2,866,693
St. Louis, Mo.	1,465,695	1,374,798	6,454,703	7,818,052
St. Paul, Minn.	1,169,946	1,987,250	5,628,552	7,918,688
Toledo, Ohio	762,845	881,113	4,030,204	3,843,638
Youngstown, Ohio	433,080	333,720	1,450,572	1,521,021
Totals	$23,331,374	$29,470,452	$122,732,674	$145,335,121

WESTERN STATES

	Month of June		First Six Months of Year	
	1915	1914	1915	1914
Los Angeles, Calif.	$997,240	$2,100,451	$6,278,440	$9,788,820
Oakland, Calif.	395,474	451,231	2,382,748	2,438,505
Portland, Ore.	460,095	834,435	2,639,760	4,180,910
Salt Lake City, Utah.	119,958	232,600	1,085,341	1,396,317
San Francisco, Calif.	891,007	1,308,882	6,566,267	20,677,625
Seattle, Wash.	631,045	1,163,165	3,274,110	5,883,855
Spokane, Wash.	231,305	83,025	704,871	545,662
Tacoma, Wash.	56,828	80,611	463,514	788,098
Totals	$3,782,952	$6,164,400	$23,395,051	$45,699,789

The Thompson Meter Co., manufacturer of the well-known Lambert water meter, celebrated on the afternoon of July 2, at its factory in Brooklyn, N. Y., the completion of meter No. 700,000. The chief feature of the celebration was the award of prizes in a guessing contest by the employees of the company. Two years ago, when the company completed its 600,000th meter, every employee of the company was allowed to guess as to the date and hour when meter No. 700,000 would be completed. It was announced that $700 would be awarded in prizes to those employees who made the nearest guesses to the actual time. The 700,000th meter was completed on June 17, and on the afternoon of July 2 the employees gathered in the company's offices where the sealed envelopes were opened, the guesses were read and tabulated, and the prizes were awarded to the winners. The central feature of the table in front of the audience was a massive silver loving cup filled with roses. This cup was presented to the company from its employees by a general subscription two years ago. The company will award $800 in prizes to those of its employees who make the nearest guesses to the date of the completion of the 800,000th meter by the company.

RAILWAYS—STEAM AND ELECTRIC

Massachusetts—Bay State St. Ry.—This company has asked the Council for a franchise to alter and relocate its tracks on Washington St., Woburn. R. S. Goff, Boston, is Vice-Pres. and Gen. Mgr.

Massachusetts—Springfield St. Ry.—This company has petitioned the Council for a franchise to construct a line along Page Blvd to East St. in Chicopee. R. W. Reynolds, Springfield, is Mgr.

Connecticut—Connecticut Co.—A petition has been presented to the Council of New Britain asking for a franchise to extend its lines from Main to Myrtle St., Grove, Board, Washington St. and Commonwealth Ave. to a point 100 ft. beyond Farmington Ave. F. L. Beardsley, New Britain, is Supt.

New York—Rochester Connecting R.R.—This company has applied to the Public Service Commission for permission to construct a railway from Rochester to Niagara Falls. The directors include Frank A. Dudley, Alfred W. Gray, Albert H. Merritt, Alexander J. Porter and Ronald G. Wright, Niagara Falls; Charles Hickey, Lockport; Sanford T. Church, Albion; C. Loomis Allen, Syracuse, and E. G. Connette, Buffalo.

New York—Third Ave. Ry.—The extension of this company's line from its present terminus on the Queensboro Bridge Plaza through Astoria to Casino Beach (Borough of Queens), is under consideration by the Long Island City Business Men's Association.

New Jersey—The Board of City Commissioners, Jersey City, has directed Fred Dunham, City Engr., to prepare tentative plans and estimates for the construction of the proposed connecting railroad in the lower city section and other districts, operative in conjunction with the Pennsylvania, Erie and Jersey Central railroads. By recent State law, the city is authorized to expend $2,000,000 on the project. Noted Apr. 22.

Pennsylvania—Farrell & Mercer Ry.—This company has been granted a franchise by the City Council to construct and operate an electric railway in Mercer, Penn. This is part of a proposed railway to connect Farrell, Mercer and New Castle.

Virginia—Lynchburg Traction & Light Co.—The City Council of Lynchburg has granted a franchise to this company to extend its line from the Fair Grounds to Fort Hill. J. W. Hancock, Lynchburg, is Gen. Mgr. and Pur. Agt. Noted June 3.

Virginia—Norfolk, Washington & New York Ry.—This company is securing the right-of-way for the construction of its proposed railway from Riverside, Va., to Sheperd's, D. C. Channing M. Ward, Richmond, is Pres.

Virginia—Petersburg & James River Ry. Corporation—This company plans to construct an electric railway from Petersburg to Hopewell, Va. J. Walter Long, Washington, D. C., is Pres.

West Virginia—According to press reports the Pennsylvania Electric & Lighting Co., Valley Falls, is interested in the construction of an electric railway from Wheeling, W. Va., to Baltimore, Md.

West Virginia—George W. Curtin is interested in the construction of a railway to connect Charleston and Summerville, W. Va., about 42 miles.

West Virginia—Virginian Ry.—Preliminary arrangements are being made by this company for the construction of a branch line from Bluefield, W. Va., through the coal fields in Buchanan and Dickenson Counties, Va., about 80 miles. H. Fernstrom, Norfolk, is Ch. Engr. Noted June 17.

Georgia—Americus, Flint River & Gains R.R.—This company has been granted a franchise to construct and operate a railway in Americus, Ga. This is part of a proposed line which will connect Byromville and Americus. Noted Mar. 11.

Florida—G. C. Rogan and M. F. Hetherington are interested in a project to construct a railway in Lakeland.

✚**Kentucky**—Cumberland & Manchester R.R.—This company has awarded the contract for the construction of six miles of its line from Barbourville to Manchester to T. V. VERMILION & SON, Barbourville. Noted June 10.

Kentucky—Bids will be received until Aug. 2 by the City Commissioners of Newport for a franchise to construct an electric railway.

Ohio—Toledo, Bowling Green & Southern Traction Co.—Plans are being considered by this company for the extension of its line from Findlay to Kenton. C. F. Smith, Findlay, is Gen. Mgr. and Pur. Agt.

Indiana—Terre Haute, Indianapolis & Eastern Traction Co.—The citizens of Newcastle, Ind., have petitioned this company to extend its lines from Terre Haute to Newcastle. T. F. Grover, Terre Haute, is Gen. Mgr.

Wisconsin—Ettrick & Northern R.R.—This company has been organized to construct a railway from Ettrick to Blair, Wis., about 14 miles.

Kansas—Southwestern Interurban Ry.—This company is considering plans for the extension of its line from Winfield to the Albright Gardens near Oxford, thence through Mulvane to Wichita where it will connect with other interurban lines. S. M. Bradley, Winfield, is Ch. Engr.

Arkansas—Ozark Southern Ry.—Arrangements are being made by this company for the construction of a railway from Harrison to Jasper and Parthenon, Ark., about 20 miles. G. W. T. Shaw, Lee Center, Ill., is Consult. Engr. Noted June 17.

Texas—According to press reports the properties of the Texas Traction Co. and the Southern Traction Co. will be consolidated and the electric railway which runs from Dallas to Waco will be extended to San Antonio, about 185 miles.

Texas—Missouri, Kansas & Texas Ry.—At a recent meeting of the Board of Directors of this company plans were adopted for the improvement and extension of its lines in Texas to cost about $300,000. L. F. Lonnbladh, Dallas, is Ch. Engr.

Texas—St. Louis, Brownsville & Mexico Ry.—Plans are being considered by this company for the construction of a branch line from Edinburg to Falfurrias, Tex., about 70 miles. J. S. Pyeatt, Houston, is Mgr.

Colorado—Wolf Creek R.R.—This company has been incorporated to construct a railway from the Morgan-Wolf Creek divide to Pilot Knob to carry coal from the property of the Victor-American Co.

Arizona—Phœnix Ry.—This company has been granted a franchise to construct a double-track line on Fourth St. from Roosevelt to Washington St., and to extend the Monroe St. loop to Fourth St. Samuel H. Mitchell, Phœnix, is Gen. Mgr. and Pur. Agt. Noted May 6.

Oregon—The Silver Falls Timber Co., Portland, plans an expenditure of $400,000 for the construction of an extension to its logging railway.

✚**California**—CHADWICK & SYKES, San Francisco, has been awarded the contract for the construction of a branch railway to connect the Los Angeles Pressed Brick Works with the main line of the Atchison, Topeka & Santa Fé Ry., Richmond, Calif.

Saskatchewan—Regina Municipal Ry.—Plans are being prepared by this company for an expenditure of $10,000 for constructing extensions to its street railway lines in Regina. D. W. Houston, Regina, is Supt.

Hawaii—See item under "Federal Government Work, Marine Railway."

LIGHT, HEAT AND POWER

✚**Cranston, R. I.**—(Providence post office)—The State Board of Control and Supply, Providence, has awarded contracts for a central heating plant at the state institutions at Cranston, as follows: Building, F. H. LIBBEY CO., $26,465; steam piping, GENERAL FIRE EXTINGUISHER CO., $30,305; engines and generators, AMES IRON & ENGINE CO., $13,425; electrical work, WHITALL ELECTRICAL CO., $16,253; boilers, WICKS BOILER CO., $7772. Noted June 10.

★**Middletown, N. Y.**—Bids were received June 29 by the State Hospital Commission, Albany, for power house equipment, construction, additions and alterations of heating, plumbing and electrical work at the Middletown State Homeopathic Hospital, as follows: Construction, Arthur Casey, 536 Broadway, Albany, $4378; Peter Keeler Building Co., Albany, $6162; N. R. Valkenburgh, Middletown, $6556. Heating, Edward Joy Co., Syracuse, $99,320; Gillis & Geoghegan, New York, $104,435; R. T. Ford Co., Rochester, $108,893; Lynch & Woodward, 26 Beach St., Boston, $109,393; Peter Keeler Building Co., Albany, $111,222; Raisler Heating Co., 129 Amsterdam Ave., New York, $118,000; Walker & Chambers, 222 East 41st St., New York, $121,000; John W. Danforth Co., 72 Ellicott Sq., Buffalo, $122,300; James H. Merritt & Co., 48 Cliff St., New York, $122,962; Cleghorn Co., 54 Battery March St., Boston, Mass., $123,500; J. J. Horan & Co., Troy, $129,000. Plumbing, R. T. Ford Co., Rochester, $2087; Peter Keeler Building Co., Albany, $2100; John F. Knaupp, Troy, 2539; Edward Joy Co., Syracuse, $3200. Electrical work, Buffalo Electric Co., 555 Washington St., Buffalo, $3972; Isidor Fajans, 122 East 25th St., New York, $4073; Enterprise Electrical Co., Middletown, $4428; Edward Joy Co., Syracuse, $4500; Conduit-Miller Co., Inc., Syracuse, $4595; Peter Keeler Building Co., Albany, $4722; New York Construction Co., 1328 Broadway, New York, $4755; T. Frederick Jackson, 99 John St., New York, $4940.

Nutley, N. J.—At a recent special election the citizens approved a bond issue of $11,000, the proceeds of which will be used to install a new heating plant in the Park School. Noted June 10.

Kaplan, La.—A special tax assessment and bond issue for the purpose of constructing an electric-light plant and making improvements to the water-works system was voted on June 24.

Hindman, Ky.—An election will be held July 15 to vote on the question of issuing $200,000 in bonds for the purpose of building an electric-light and power plant. Dr. B. W. Duke, Hindman, is interested.

Jenkins, Ky.—It is reported that a franchise has been secured and arrangements completed for the installation of a municipal power plant.

Cleveland, Ohio—It is reported that the Kessler Co., Cleveland, will build a 45x50-ft. power house at 1000 Newburg Ave.

Cleveland, Ohio—Bids will be received until noon, July 16, by the Commissioner of Purchases and Supplies, Room 511, City Hall, for service switches for the municipal Light Department. F. W. Ballard, 1443 East Third St., is Comr. of Light and Heat Dept.

Kent, Ohio—(Official)—Bids will be received until noon, Aug. 2, by the Board of Trustees of the Kent State Normal School for heating and ventilating of an auditorium, library, gymnasium and office building, and the heating and ventilating of an agricultural and training school building. J. A. McDowell is Secy. of the Bd. George F. Hammond, 4220 Prospect Ave., Columbus, is Arch

Painesville, Ohio—At an election held June 22, it was voted to issue $35,000 in bonds for the improvement of the municipal electric-light plant. H. Whitford Jones, Citizens Bldg., Cleveland, has prepared preliminary plans for the work. Noted June 3.

Indianapolis, Ind.—The Indianapolis Light & Heat Co. has secured a permit for an additon to its plant at 18th and Mill St. It will cost about $14,000. Thomas A. Wynne is Vice-Pres. and Treas.

Mt. Pleasant, Mich.—Bids will be received until noon, July 12, by Frederick L. Keeler, Secy., State Bd. of Education, Lansing, for heating and plumbing systems in the science building at the Central State Normal School, Mt. Pleasant. E. V. Arnold, Battle Creek, is Arch.

Fredericksburg, Iowa—At a recent election bonds were voted for the purpose of constructing an electric-light plant and water tower. Energy will be secured from the power plant at Clermont.

Minneapolis, Minn.—It is reported that the Minneapolis General Electric Co. will soon construct about 75 miles of new transmission lines. The estimated cost is $100,000. R. F. Pack is Gen. Mgr.

Netawaka, Kan.—An election will be held July 12 to vote for an issue of $10,000 in bonds for the installation of an electric-light system. A transmission line will probably be built from the municipal power plant at Holton.

Bartlett, Tex.—The Texas Power & Light Co., Dallas, has purchased the property of the Bartlett Electric Co., and has been granted a 50-year franchise by the City Council. The plant will be improved.

Dallas, Tex.—The Dallas Union Terminal Co. will build an electric-light, power and heating plant to supply the new Union Station and terminals now under construction. The estimated cost of the work is $60,000.

Denison, Tex.—Press reports state that the Texas Power & Light Co., Dallas, will build a hydro-electric plant on the Red River near Denison. It will cost between $400,000 and $500,000. Noted July 17, 1913.

Prescott, Ariz.—The Arizona Power Co. will build a second hydro-electric plant on Fossil Creek near Prescott. The new plant, with the original one, also on Fossil Creek, will supply power for various industries in Prescott and its vicinity. Energy will also be supplied to the Prescott Gas & Electric Co., a subsidiary of the Arizona Power Co. M. V. Watson is Mgr. Noted Apr. 8.

Ellensburg, Wash.—R. N. Bull, Ellensburg, has petitioned the Commissioners of Kittitas County for a 50-year franchise to build and maintain electric power and transmission lines along the highways of Kittitas County.

Langley, Wash.—H. E. Wood, Elec. Engr., Prince Rupert, B. C., is investigating the feasibility of establishing an electric-light and power plant to serve Langley and other towns in the vicinity.

Metaline Falls, Wash.—Hugh L. Cooper & Co., Consult. Engr., 101 Park Ave., New York, N. Y., has been engaged to investigate the possibilities of the "Z" Cañon water power site on the Pen d'Oreille River near Metaline Falls. D. R. Cooper is Engr.-in-Charge.

Eugene, Ore.—The City Council is considering tentative plans for the installation of a steam electric-generating plant as an auxiliary to the municipal plant. The present plant has two 700-kw. generators and it is proposed to add 1250 kw. to the capacity.

Prairie City, Ore.—It is reported that the Prairie City Light Co. will shortly begin work on its new power plant. The estimated cost is $50,000. A pipe line, three miles long, will carry water from the river to the power station.

Burbank, Calif.—The Board of City Trustees will soon ask bids for the construction of a municipal electric-light plant to cost about $25,000. Bonds for this purpose were recently voted. Noted June 24.

Corona, Calif.—The Board of City Trustees has appointed a committee to investigate the feasibility of establishing a municipal electric-light plant.

Santa Barbara, Calif.—The Santa Barbara Gas & Electric Co. will make improvements and additions to its gas plant at a cost of about $85,000. The work will be completed by Oct. 1.

Quebec, Que.—The Public Service Corporation of Quebec, Ltd., has been incorporated with a capital of $3,000,000 to acquire water rights and develop electric power for the cities of Quebec and Three Rivers. The incorporators include Charles H. Branchaud, Milton L. Hersey, Howard Murray, Thomas McDougall and Julian C. Smith, all of Montreal.

Leamington, Ont.—It is reported that the Town Council will at once engage an engineer to prepare plans for an electric-light plant and distribution system. The estimated cost is $25,000. B. M. Selkirk is Clk.

BRIDGES

Montpelier, Vt.—It is reported that the City Council has voted to issue $35,000 in bonds the proceeds of which will be used for the construction of a steel bridge on State St.

Boston, Mass.—(Official)—Bids will be received until noon, July 9, by Patrick O'Hearn, Act. Comr. of Pub. Wks., Room 602, City Hall Annex, for the construction of the Boston approach to the Spring St. Bridge, West Roxbury. Noted May 20.

Dedham, Mass.—(Official)—Bids will be received until noon, July 9, by John A. Hirsch, Chn. of Selectmen, Room 602, City Hall Annex, Boston, for the construction of the Dedham approach to the Spring St. Bridge. See preceding item.

Keyport, N. J.—The Board of Chosen Freeholders of Monmouth County, Freehold, has submitted plans to the War Department for its approval, of a drawbridge over Matawan Creek on the Keyport-South Amboy Rd. near Keyport. C. E. Close is Clk. Bd. of Freeholders. Noted May 13.

New Brunswick, N. J.—Bids will be received until 2:30 p.m., July 12, by the Board of Chosen Freeholders of Middlesex County for the construction of a reinforced-concrete bridge with a Strauss trunnion bascule span, over the South River on the South Amboy-New Brunswick Rd. A. B. Fox, Perth Amboy, is County Engr.

✚North Plainfield, N. J.—(Plainfield post office)—The contract for a bridge at Grove St. connecting North Plainfield and Plainfield has been awarded to ARTHUR E. SMITH, Plainfield, at $7373. Noted June 24.

Pine Brook, N. J.—(Official)—The date of receiving bids for rebuilding the bridge over the Passaic River at Pine Brook between Morris and Essex Counties has been extended from June 28 until 11 a.m., July 13. William E. King, Morristown, is Engr. of Morris County, and Frederick A. Reimer, Newark, is Engr. of Essex County. Noted June 17.

✚Greensburg, Penn.—The Commissioners of Moreland County have awarded the contract for a 100-ft. steel bridge over Big Sewickley Creek to RINEHART BROS., East Liverpool, Ohio, at $10,500. C. B. Parkinson is County Engr.

Harrisburg, Penn.—Press reports state that bids will be received until July 21 by the Commissioners of Dauphin County for the construction of a concrete bridge over the tracks of the Philadelphia & Reading Ry. at 19th St. It will have a 24-ft. roadway with a 6-ft. sidewalk on each side.

Harrisburg, Penn.—The property owners of Allison Hill, a suburb of Harrisburg, are interested in a movement to build a bridge over the tracks of the Pennsylvania R.R. at Walnut St. A petition is being prepared, asking the City Commissioners to submit a bond issue of $300,000 for this purpose to the voters at the November election.

Mercer, Penn.—Bids will be received until July 19 by H. C. Comstock, Controller of Mercer County, Mercer, for the construction of eight bridges in various townships. Lewis E. Burnside, Grove City, is County Engr.

Norristown, Penn.—(Official)—Bids will be received until 11 a.m., July 9, by the Board of Commissioners of Montgomery County for the construction of three new bridges and the repair of two, in various townships. John N. Jacobs is County Controller.

Pittsburgh, Penn.—(Official)—Bids will be received until noon, July 16, by Hyatt M. Cribbs, Controller of Allegheny County, for bridge work, as follows: Construction of two reinforced-concrete elliptical arches in Richland and Moon Townships; extension of Arch-Bridge No. 1, Kilbuck Run, Glenfield Borough; diversion of Pine Creek, eliminating County Bridges 17 and 18 in Shaler Township. J. G. Chalfant, Room 308, Court House, is County Engr.

Surry C. H., Va.—(Official)—Bids will be received until noon, July 13, by the Clerk of the Circuit Court of Surry County for the construction of three steel bridges, one each over Judkins Run, College Run and the Blackwater River.

Moundsville, W. Va.—Bids will be received until July 22 by the Commissioners of Marshall County for the construction of either a concrete bridge, or a steel bridge with concrete abutments, across the mouth of Lynn Camp Run at Fish Creek in Meade District.

✚Marshall, N. C.—(Official)—The Commissioners of Madison County opened bids June 22 for the construction of a steel bridge, as follows: SOUTHERN BRIDGE CO., Birmingham, Ala., $16,842, (awarded contract); Nashville Bridge Co., $17,895; Virginia Bridge & Iron Co., $20,110; Vincennes Bridge Co., $19,113; Roanoke Bridge Co., $19,209. J. B. Clingman is County Engr.

Lexington, Ky.—The Fiscal Court of Fayette County is considering the construction of a new bridge across the Kentucky River between Fayette and Madison Counties. F. A. Bullock is County Judge.

✚Cincinnati, Ohio—(Official)—The Department of Public Service has awarded contracts for rebuilding and repairing bridges in Mt. Washington, and Bridges Nos. 1 and 2 on Crawford Ave. to THOMAS A. MURRAY, Cincinnati, at $2780, and RUNCK & BRO., Cincinnati, at $2460, respectively. Noted May 27 and June 3.

✚Cincinnati, Ohio—(Official)—The Board of Commissioners of Hamilton County has awarded the contract for the construction of a culvert in Cincinnati Ave., Miami Township, to the CLEARY-WHITE CONSTRUCTION CO., care of A. J. Brehm, Cincinnati, at $5452. Other bidders were: L. Eid Concrete Steel Co., $7001; Gordon Engineering Co., $6870; Welling & Franz, $7884; R. C. Baksley, $6742; John Ruebel Contracting Co., $7341; William Nickoson, $6360; M. Hanlon, $7714; J. J. Foley, $5471. Noted June 10.

Cleveland, Ohio—Bids will be received until noon, July 19, by the Commissioner of Purchases and Supplies, Room 511, City Hall, for the construction of two concrete culverts on the Woodland Hills-Garfield Blvd., and for iron fencing at the East 93rd St. bath house and Brookside Park.

✚Hamilton, Ohio—The Board of Commissioners of Butler County has awarded the contract for the construction of the new Columbia Bridge over the Great Miami River at Wood St. to the A. J. YAWGER CO., Indianapolis, Ind., at $96,000. Noted May 20.

Youngstown, Ohio—(Official)—Bids will be received until 10 a.m., July 21, by the Board of Commissioners of Mahoning County for the construction of a bridge in Green Township. Frank H. Vogan is Clk. of Comrs.

Brazil, Ind.—The Board of Commissioners of Clay County has petitioned the County Council for an appropriation to build six reinforced-concrete bridges to cost from $800 to $2000 each. W. O. Graeser is County Audr. George Sheehan is County Surv.

Indianapolis, Ind.—It is reported that the Board of Public Works and the Commissioners of Marion County will coöperate in the construction of two additional spans for the West Washington St. Bridge over the White River, which is now under construction. The estimated cost of the two spans is $110,000. Noted July 23, 1914.

Richmond, Ind.—It is reported that the Commissioners of Wayne County will soon ask bids for the construction of a double-arch concrete bridge across the Whitewater River connecting North 12th St. and Middleboro Pike. It will cost about $15,000.

Richmond, Ind.—The County Engineer is preparing plans for the construction of new bridges at South G and South E St., Richmond. The G St. Bridge will be 725 ft. long, and is estimated to cost $167,475. The E St. Bridge will be 600 ft. long, and will cost about $141,000.

Annawan, Ill.—(Official)—Bids will be received until 2:30 p.m., July 15, by the Town Commissioners of Highways for steel joists and oak floors on existing steel bridge, 120-ft. span and 14-ft. roadway. James H. Reed, Cambridge, is Supt. of Highways of Henry County.

Webster City, Iowa—It is reported that bids will be received in July for the construction of concrete bridges and culverts to cost about $35,000. F. H. Austin is Engr. C. Peterson is Audr. of Hamilton County. Noted June 10.

Austin, Minn.—(Official)—Bids will be received until 4 p.m., July 12, by O. J. Simmons, Audr. of Mower County, for the construction of one 50-ft. and one 40-ft. through-girder bridge to be built in the Towns of Windom and Red Rock .

St. James, Minn.—Bids will be received until July 19 by John C. Jensen, Audr. of Watonwan County, for the construction of steel and reinforced-concrete bridges. The estimated cost is $20,000. J. H. A. Bratz, 312 Commercial Bldg., St. Paul, is Engr.

Girard, Kan.—Plans have been submitted for the approval of the Attorney General, Topeka, for steel and reinforced-concrete bridges to cost about $15,000. W. E. Robson is Engr. of Crawford County. C. E. Everett is County Clk.

Great Bend, Kan.—The Board of Commissioners of Barton County has adopted a resolution to appropriate $20,000 for the construction of a concrete bridge across the Arkansas River south of Ellinwood.

Holton, Kan.—(Official)—Bids will be received until July 15 by the Commissioners of Jackson County for the construction of one 50-, one 60- and one 70-ft. bridge. This is a postponement of bids first advertised for June 25. W. H. Webster is County Clk. Noted June 17.

Kansas City, Kan.—It is reported that the Commissioners of Wyandotte County will ask bids in about 30 days for the construction of the Central Ave. Viaduct over the Kaw River. The present double-deck structure will be replaced by a single-deck bridge with a 27-ft. roadway and double car tracks. The estimated cost of the bridge and its approaches is $450,000. The total length will be about 2200 ft. R. L. McAlpine is County Engr. Noted May 27.

Topeka, Kan.—Press reports state that bids will be asked at once for the construction of a three-span reinforced-concrete bridge over Shunganunga Creek on Kansas Ave. It will cost approximately $18,000 of which the Topeka Ry. Co. will pay a part. W. G. Tandy is Bridge Comr. Noted Jan. 7.

Topeka, Kan.—Plans are being prepared by the city for a three-span reinforced-concrete bridge across Shunganunga Creek on Lincoln St. Bids for its construction will probably be asked in the fall. J. E. House is Mayor.

✚Wellington, Kan.—A contract for the construction of two reinforced-concrete bridges has been awarded to the TOPEKA BRIDGE & IRON CO., Topeka, at $5470.

Watertown, S. D.—Bids will be received until 4 p.m., July 20, by the Board of Commissioners of Codington County for the construction of three steel bridges. M. A. Hockman is County Bridge Supvr.

Williston, N. D.—Bids will be received until 1:30 p.m., July 15, by the Commissioners of Williams County for bridge construction for a period of one year from date of contract. M. H. Aaen is County Audr.

Carrollton, Mo.—A special election will soon be held in Carroll County to vote on the question of issuing $200,000 in bonds the proceeds of which will be used for the construction of bridges.

Kansas City, Mo.—It is reported that bids are being received by the Commissioners of Jackson County for the construction of a concrete viaduct over the tracks of the Chicago & Alton R.R. at 15th St. The estimated cost is $35,000, of which the railway will pay 60%. Allen C. Southern is County Engr.

St. Louis, Mo.—Bids were received by the Board of Public Service on June 29 for about 24,000 tons of structural steel for the Illinois approach of the Municipal Bridge as follows, per pound: Fort Pitt Bridge Works, 2.35c.; American Bridge Co., 2.165c. (probably awarded contract); Pennsylvania Steel Co., 2.25c.; Cambria Steel Co., 2.175c.; King Bridge Co., 2.45c.; McClintic-Marshall Co., 2.445c.; Phœnix Bridge Co., 2.59c. Noted June 17.

Dallas, Tex.—(Official)—Plans are not yet completed for the construction of a 900-ft. bridge across the Trinity River at Commerce St., Dallas. The estimated cost is $135,000. J. F. Witt is County Engr. Noted June 24 and July 1.

✚Dallas, Tex.—The Commissioners Court of Dallas County has awarded the contract for completing the Trinity Heights Bridge to the MISSOURI VALLEY BRIDGE & IRON CO., Leavenworth, Kan. The original contract for this work was awarded to Hess & Skinner which has given it up.

Hempstead, Tex.—The Business League of Hempstead is promoting a plan to rebuild the bridge across the Brazos River. The estimated cost of the work is from $30,000 to $42,000.

✚Rockport, Tex.—A contract for building the Bayside Bridge over Puerto Bay, to connect Aransas and Refugio Counties, has been awarded to the ALAMO CONSTRUCTION CO., San Antonio, at $19,400. Noted Feb. 18.

Tecumseh, Okla.—Bids will be received until 3 p.m., July 21, by the Commissioners of Pottawatomie County for bridge construction as follows: One steel bridge across the North Canadian River at Beard St., Tecumseh; one 24-ft. bridge; four 30-ft. bridges and eight 50-ft. bridges, all to be of steel with 16-ft. roadways. J. Krouch is Chn. of Comrs. R. C. Green is Clk.

Seattle, Wash.—Bids will be received until 11 p.m., July 20, by the Commissioners of King County for the construction of the Duwamish Bridge. The estimated cost is $30,000. Byron Phelps is Clk. of Comrs. A. P. Denton is County Engr.

Tillamook, Ore.—The City Council has approved plans prepared by the City Engineer for a new bridge across Hoquarton Slough. Noted Mar. 18.

Los Angeles, Calif.—The city and Los Angeles County have appointed a committee to promote the construction of a reinforced-concrete viaduct from Mission Rd. to the Plaza. The estimated cost is $750,000. R. W. Kelly, Chn., L. R. Alderman, M. A. Marcotte, J. W. Seras and George Archer form the Com. in-Charge.

★✚Needles, Calif.—It is reported that the contract for the interstate bridge across the Colorado River at Topock, Ariz., has been awarded to the KANSAS CITY STRUCTURAL STEEL CO., Kansas City, Mo. List of bidders noted July 1.

Sacramento, Calif.—(Official)—Bids will be received until 2 p.m., July 19, by the State Highway Commission, Forum Bldg., for the construction of five reinforced-concrete bridges in Shasta County, and a 532-ft. bridge across the Sacramento River near Dunsmuir, Siskiyou County.

★San Francisco, Calif.—Bids were received June 23 by the Board of Public Works for the construction of a Strauss trunnion bascule bridge over the Channel St. waterway, (a) substructure; (b) superstructure; (c) bridge complete. The bidders were: A. H. Scherzer Rolling Lift Bridge Co., (b) $48,628; F. Rolandi, (a) $67,000, (c) $117,000; Tibbitts Pacific Co., (a) $46,877, (b) $48,500, (c) $92,877; MacArthur Bros. Co., (a) $59,130, (c) $106,421; Pacific Rolling Mill Co., (b) $43,900; Thomson Bridge Co., (a) $37,147, (b) $47,140, (c) $84,287; Dyer Bros., (b) $45,000; Lindgren Co., (a) $58,880; (b) $50,500; (c) $107,700; W. E. Dawson, (a) $55,993; Ross Construction Co., (b) $48,783; Healy Tibbitts Construction Co., (a) $45,217, (b) $50,824, (c) $94,421; California Construction Co., (b) $43,700; (c) $102,833. Noted June 10.

✚San Francisco, Calif.—(Official)—The Board of Public Works has awarded the contract for the construction of the Channel St. Bridge to the THOMSON BRIDGE CO., 103 Main St., San Francisco, at $84,287 for the complete structure.

✚Santa Barbara, Calif.—The City Trustees have awarded the contract for the construction of a reinforced-concrete bridge over Mission Creek to the BOARDMAN CONSTRUCTION CO., Story Bldg., Los Angeles, at $6760. Noted June 17.

✚Scotia, Calif.—The Board of Supervisors of Humboldt County, Eureka, has awarded the contract for the construction of a 650-ft. steel bridge across the Eel River to the MERCER-FRASER CO., Eureka, at $55,160. A. J. Logan is County Engr.

✚Brantford, Ont.—(Official)—The County Council of Brant County has awarded contracts for the construction of abutments and steel superstructures of two 60-ft. bridges to GEORGE THOMPSON, Brantford, at $3000, and the HAMILTON BRIDGE CO., Hamilton, at $2687 respectively.

Locust Hill, Ont.—Plans have been prepared by E. A. James, 57 Adelaide St., E., Toronto, for a high level bridge over the Little Rouge River. The estimated cost is $18,000 for reinforced-concrete or $20,000 for a steel bridge.

✚Vancouver, B. C.—The City Council has awarded contracts for the repair of the Connaught Bridge to COUGHLAN & SONS, Vancouver, for furnishing the steel and to the COAST CONTRACTING CO., 16 Hastings St., E., Vancouver, for dismantling and erection. The city will supply rails, and furnish and lay wood block pavement. List of bidders noted June 24.

WATER SUPPLY—IRRIGATION

Athol, Mass.—(Official)—We have been advised that the city will not build the proposed 3,000,000-gal. reservoir this year. Herbert L. Hapgood is Supt. Water Dept. Noted July 1.

Pittsfield, Mass.—An appropriation of $40,000 has been made. The proceeds will be used for the construction of additional filter beds. An appropriation of $6500 has also been made for the construction of a water main to Cottsville.

Warren, Mass.—The citizens at a recent meeting voted in favor of constructing a water system at an estimated cost of $100,000. Joseph S. Hastings is one of the Commissioners. Noted Mar. 4 and Apr. 29.

★Binghamton, N. Y.—(Official)—Bids will be received until 10 a.m., July 23, by the Board of Water Commissioners for constructing a 750,000-gal. covered reservoir. John D. Davidson is Secy. Bd. of Water Comrs.

★Hilton, N. Y.—(Official)—Bids will be received until noon, July 16, by the Village Trustees for constructing a water system. C. P. Cooper is Clk. and H. C. Kittredge, Rochester, is Engr. Noted June 10 and 17.

Ilion, N. Y.—Bids will be received until July 9 by the Board of Water Commissioners for furnishing about 3½ miles of 10-in. c.-i. water mains and for constructing a concrete diverting dam, intake chamber and gate house. George R. Russell is Secy. Noted May 6 and June 17.

✚★New York, N. Y.—(Official)—The contract has been awarded to the GUARANTEE CONSTRUCTION CO., 140 Cedar St., New York, at $21,480, for constructing a coagulant plant in Mt. Pleasant under Contract No. 159. Noted June 10 and July 1.

✚New York, N. Y.—(Official)—The contract has been awarded to the CONCORD CONSTRUCTION CO., 38 Park Row, New York, at $22,565, for furnishing and installing bronze or steel ladders and nozzles and ladders. Noted June 10 and July 1.

★Totowa, N. J.—(Paterson post office)—(Official)—Bids will be received until 8:15 p.m., July 19, by Walter R. Hudson, Mayor, and Borough Council, for constructing a water-works distributing system. Linden Redman is Borough Clk. Noted Feb. 11.

Wenonah, N. J.—Improvements will be made to the water system at an estimated cost of $8000.

★Woodbury, N. J.—(Official)—Bids will be received until 8 p.m., July 27, by Arthur Starr, City Clk., for making addition to the brick pumping station, and furnishing and installing water tube boilers, high service pumping machinery and a brick chimney.

Connellsville, Penn.—(Official)—The filter plant of the Connellsville Water Co. will be remodeled. Plans have been approved by the State Department of Health.

Honesdale, Penn.—(Official)—Plans have been approved by the Department of Health for the extension of the distributing system of the Honesdale Water Co.

Jersey Shore, Penn.—(Official)—The State Department of Health has approved plans of the Jersey Shore Water Co. for the construction of a rapid sand filtration plant.

Langhorne, Penn.—(Official)—The Langhorne Spring Water Co. has had plans approved by the State Department of Health for the construction of a rapid sand filtration plant.

Linesville, Penn.—(Official)—Extensions will be made to the distributing system of the Bunday Water Co. Plans have been approved by the State Department of Health.

Mt. Carmel, Penn.—(Official)—Extensions will be made to the distributing system of the Bear Gap Water Co. Plans have been approved by the State Department of Health.

Morrisville, Penn.—The Borough Council will soon call a special election to vote on the question of issuing $20,000 in bonds, the proceeds of which will be used for the construction of a filtration plant. Noted June 10.

Oil City, Penn.—(Official)—Extensions will be made to the distributing system, plans for which have been approved by the State Department of Health.

Stroudsburg, Penn.—(Official)—The Stroudsburg Water Supply Co. has had plans approved by the State Department of Health for the construction of a temporary disinfection apparatus.

★Clayton, Del.—(Official)—Bids will be received until 8 p.m., July 15, by the Town Council for the construction of water and sewer systems and a disposal plant. W. R. Clements is Secy. Council.

Dover, Del.—According to press reports the Frederica Water & Ice Co. has been incorporated with $25,000 capital. The company will construct a water system and an ice plant. Fremont W. Frankhouser, Reading, Penn., is interested.

✚Milton, Del.—The contract has been awarded to WILLIAM CONFELL, Milton, at $18,500, for constructing a water system. Noted May 6.

★Baltimore, Md.—(Official)—Bids will be received until 11 a.m., July 14, by the Board of Awards for furnishing and erecting a 20,000,000-gal. centrifugal pump and electric power equipment for the Eastern pumping station. Robert L. Clemmitt is Act. Water Engr. Noted June 24.

Wheeling, W. Va.—The City Council has received a report from C. C. Smith and C. B. Cooke, City Engr., estimating the cost of installing a water well filtration system at $189,350, and of 102 wells in place $45,437. Noted June 10.

✚White Sulphur Springs, W. Va.—The contract has been awarded to W. E. CARTER, Richmond, Va., at $8245, for constructing water and sewer systems. Noted Apr. 1.

Leesburg, Ga.—The city will lay about 3½ miles of 6- and 8-in. water mains and construct two wells with a 50,000-gal. tank. W. F. King is City Clk. Noted June 17.

Nicholls, Ga.—According to press reports W. Byck, Waycross, has been granted a franchise by the City Council for the construction of a water system and electric-light plant.

Tennille, Ga.—Plans are being prepared by Crook M. Kanneau, Macon, for the construction of water, sewer and electric-light systems.

Ft. Meade, Fla.—All bids received June 15 for the purchase of $58,000 in bonds, part of which was to have been used for the construction of a water system, have been rejected. New bids will soon be received in connection with bids for the construction of a water system. Noted June 3.

Ashland, Ala.—The city will construct a water system. About four miles of 4-, 6- and 8-in. c.-i. pipe and 150,000-gal. reservoir will be required. H. L. Adair is Mayor and Edgar B. Kay, Tuscaloosa, is Engr.

Clarksdale, Miss.—Bonds for $150,000 have been voted. Part of the proceeds will be used for the extension of the water system. Noted May 27.

Kosciusko, Miss.—Bonds for $30,000 have been voted by the citizens, the proceeds will be used for the construction of water and electric-light systems.

Bogalusa, La.—An election will probably be held to vote on the question of issuing $200,000 in bonds, part of the proceeds of which will be used for the purchase and improvement of the water system.

✚Cleveland, Ohio—The contract has been awarded to SANFORD RILEY STOKER CO., Ltd., Worcester, Mass., at $19,000, by the Board of Control for installing stokers for the Division Ave. pumping station.

★**Paris, Ill.**—(Official)—Bids will be received until 10 a.m., July 22, by the City Council for constructing a rapid sand filter plant at the water-works. Simon Risser is Comr. of Pub. Property.

Kenosha, Wis.—All bids received June 14 for constructing 10,000 ft. of 42-in. c.-i. water intake main, have been rejected. Noted May 27 and June 24.

Grinnell, Iowa—(Official)—Bids will be received until 2 p.m., July 17, by A. C. Harriman, City Clk., for making extensions to the water system. Charles P. Chase, Clinton, is Engr.

Keota, Iowa—(Official)—Bids will be received until 2 p.m., July 20, by the Council for constructing a water system. Charles P. Chase, Clinton, is Engr.

Riverside, Iowa—(Official)—Bids will be received until 3 p.m., July 15, by the Council for constructing a water system. Charles P. Chase, Clinton, is Engr.

Sabetha, Kan.—(Official)—The citizens defeated the bond election for $65,000, the proceeds of which was to have been used for the construction of a water system. Noted June 17.

Omaha, Neb.—The construction of a 24-in. pipe line from 36th to 48th St. will be recommended to the Board of Works by W. Howell, Mgr. Water-Wks.

✚**Eureka, Mont.**—The contract has been awarded to BOOMER & HUGHES, Spokane, Wash., at about $100,000 for constructing canals for the Glen Lake irrigation project.

Kirksville, Mo.—The city will not hold an election to vote on the question of issuing $70,000 in bonds, the proceeds of which was to have been used for the rebuilding of the water system. Noted June 24.

St Louis, Mo.—Bids will be received until July 9 by E. R. Kinsey, Pres., Bd. of Pub. Ser., for installing two 350-hp. Heine type boilers at the high service pumping station No. 2, Bissell's Point.

St. Louis, Mo.—An appropriation of $430,000 will probably be made by the Board of Public Service for the rebuilding of the Compton Hill reservoir.

St. Louis, Mo.—Bids have been received for furnishing 2595 tons of c.-i. water pipe from the American Cast Iron Pipe Co., at $60,693, and the United States Cast Iron Pipe Co., $59.525.

Benton, Ark.—(Official)—Bids will be received until 10 a.m., July 15, by the Commissioners of Water-Works Improvement District No. 1 and Sewer Improvement District No. 1 for constructing water and sewer systems. Plans are on file with the J. B. McCrary Co., Atlanta, Ga. and Little Rock, Ark.

✚**Harrison, Ark.**—(Official)—The contract has been awarded to SQUIRE ELECTRIC & CONSTRUCTION CO., Kansas City, Mo., $43,500, for constructing a water system. Noted Apr. 22 and June 3.

Malvern, Ark.—Bids will be received until July 15 by G. E. Matterson, Secy. Improv. Dist., for constructing a water system. W. L. Collie is City Recdr. The estimated cost is $90,000. Noted Mar. 25.

Mineral Wells, Tex.—An election will be held to vote on the question of issuing $74,000 in bonds, the proceeds of which will be used for the construction of a water system and for the purchase of Lake Pinto.

Moody, Tex.—The water-works owned by Cormany Bros., which was recently destroyed by fire, will be rebuilt at an estimated cost of $15,000.

Chandler, Okla.—Bonds for $5000 have been voted by the citizens, the proceeds of which will be used for the improvement of the water system, according to press reports. A. B. Oleson is Mayor. Noted Apr. 22.

Jones, Okla.—(Official)—An election will be held to vote on the question of issuing bonds for the construction of water and electric-light systems. The Benham Engineering Co., Colcord Bldg., Oklahoma City, is Engr.

Wellston, Okla.—(Official)—The Benham Engineering Co., Oklahoma, has been retained by the Board of Trustees to prepare plans for the construction of a water system. The estimated cost is about $20,000.

Logan, Utah—Bids are being received, according to press reports, for the construction of a five-mile 22-in. pipe line and for a 1,000,000-gal. reservoir.

Seattle, Wash.—Plans have been approved by L. B. Young, Chn., Bd. of Pub. Wks., for the construction of water mains in 37th Ave., N. E. The estimated cost is $12,000.

West Lynn, Ore.—Bids will be received until 2 p.m., July 20, by L. L. Porter, Secy., West Lynn Water Comn., for constructing a water system.

Weaverville, Calif.—A flume 2½ miles long will be constructed by the Corona de Ore Mining Co. to carry water to its mine at Hawkins Bar on the Lower Trinity. The estimated cost is $25,000.

Bathurst, N. B.—Bids will be received until July 10 by the Water and Sewerage Committee for constructing water and sewer systems complete.

Montreal, Que.—Bids will be received until noon, July 20, by L. M. Senecal, Secy., Bd. of Comrs., City Hall, for furnishing and installing underground cables at the filtration plant.

Unionville, Ont.—Plans are being prepared by James Houdon and Hertzburg, 79 Adelaide St., East Toronto, for the construction of a water system. The estimated cost is $25,000.

The Narrows, Man.—According to press reports an election will be held to vote on the question of issuing $80,000 in bonds, the proceeds of which will be used for the construction of water and sewer systems.

SEWERS

✚**Augusta, Maine**—The contract has been awarded to E. PAYSON WITHAM, at $4008, for the construction of the Hayden Brook Sewer.

South Manchester, Vt.—The city contemplates the construction of a sewer system.

✚**Boston, Mass.**—The contract for the construction of sewers in Temple and other streets has been awarded to ANTONY CEFALO, at $70,525. Other bids were: Anthony Baruffaldi, $72,457; West Roxbury Trap Rock Co., $76,429; Merrimack Construction Co., $79,250; William Barrett & Co., $82,562; McCarthy & Walsh, $82,807; Bruno & Petitti, $83,612; Coleman Bros., $88,661; Michael Meehan, $70,358. Noted June 10.

Boston, Mass.—Bids will be received until noon, July 9, by Patrick O'Hearn, Act. Comr. of Pub. Wks., for the construction of sewers and drains in Buckminster St., Brighton, Cabot St., Roxbury, and in Kittredge St., West Roxbury.

✚**Boston, Mass.**—The contract for the construction of the Mattapan Brook sewer, Dorchester, has been awarded to the WEST ROXBURY TRAP ROCK CO., at $24,428. Noted June 10.

Albany, N. Y.—An ordinance has been approved by J. W. Stevens, Mayor, for the construction of a system of sewers to stop the pollution of the Tivoli Lakes. I. Wachsman is Secy., Bd. of Contract and Supply.

Kenmore, N. Y.—The contract will be awarded about Aug. 1 for the construction of 10,193 ft. 12- to 60-in. of circular sewers. The estimated cost is $20,000. Noted May 20.

✚**New York, N. Y.**—(Borough of Bronx)—(Official)—The contract for the construction of sewers and appurtenances in Tyndall Ave. and for improving the roads in Mosholu Ave. has been awarded to the SPADARO CONTRACTING CO., at $30,461. Noted July 1.

Patchogue, N. Y.—Plans are being prepared by Clyde Potts, 30 Church St., New York, N. Y., for the construction of a sewage-disposal plant and approximately 14 miles of sewers.

✚**Rochester, N. Y.**—The Board of Contract and Supply has awarded the contract for the construction of sewers in Hollenbeck and other streets to JOHN PETROSSI CO., at $67,367. Noted Apr. 15.

Camden, N. J.—Bids will be received until 8 p.m., July 19, by the Committee on Streets and Highways, for the construction of sewers in Chelton, Langham, Empire and Wildwood Ave. and in Sixth, Carman and Fairview St. A. B. Sparks is Chn.

✚**Irvington, N. J.**—The contract for the construction of 72-in. sewers in Ball and Cottage St. has been awarded to JOHN DORER, at $18,986.

Maywood, N. J.—Bids will be received until July 26 by the Borough Council for the construction of a sanitary sewer system. Noted June 24.

Newark, N. J.—Bids will be received until Aug. 31 by the Passaic Valley Sewerage Commissioners for the construction of the superstructure of the Meadows pumping station. The estimated cost is from $300,000 to $500,000.

Newark, N. J.—The Board of Freeholders contemplates the construction of a sewage-disposal plant at the Overbrook Hospital for the Insane. The estimated cost is $35,000. Frederic A. Reimer is County Engr.

Perth Amboy, N. J.—The Board of Aldermen contemplates the construction of a sewer system in the northern section of the city.

Freeport, Penn.—(Official)—The State Department of Health has approved plans for the construction of sewage treatment works.

Greenville, Penn.—(Official)—The State Department of Health has approved plans for the relocation of the sewage treatment works.

North East, Penn.—(Official)—The State Department of Health has approved plans for the construction of sewage treatment works.

Washington, Penn.—(Official)—The State Department of Health has approved plans for the construction of lateral sewer extensions.

✚**Wilkes-Barre, Penn.**—The contract for the construction of sewers has been awarded to MICHAEL J. MALLORY, Sugar Notch, at $6006.

★**Clayton, Del.**—(Official)—See item under "Water Supply-Irrigation."

Baltimore, Md.—Bids will be received until 11 a.m., July 21, by Charles England, Chn. Sewerage Comn., for the construction of Section No. 1 of the Jenkins Run Trunk Drain, Storm Water Contract No. 45.

Rockville, Md.—The County Commissioners contemplate the construction of a sewer system in the section drained by Little Falls Brook, including Chevy Chase, Hills, Somerset, Friendship Heights, Bethesda, Edgewood, Woodmont and other subdivisions. The estimated cost is $83,000.

✚**Richmond, Va.**—The contract for the construction of the Canepa St. sewer has been awarded to A. W. MAYNARD, at $14,000.

Mannington, W. Va.—The city contemplates the construction of approximately two miles of sewers. C. C. Smith, 508 Board of Trade Bldg., Wheeling, is Engr.

White Sulphur Spring, W. Va.—See item under "Water supply—Irrigation."

Boston, Ga.—Plans are being prepared by W. Hopson Goodloe, Engr., Macon, for the construction of a sewer system.

✚**Richland, Ga.**—The contract for the construction of approximately 4½ miles of sewers has been awarded to the J. B. McCRARY CO., Atlanta. The estimated cost is $15,000. Noted Apr. 8.

Tennille, Ga.—See item under "Water Supply-Irrigation."

Marianna, Fla.—At a recent election the citizens voted to issue $18,000 in bonds. The proceeds will be used for the construction of sewers.

Miami, Fla.—An election will be held Aug. 19 to vote on the question of issuing $50,000 in bonds. The proceeds will be used for the construction of sewers. B. H. Klyce is City Engr.

Cloverdale, Ala.—Bids will be received until July 27 by W. R. McDade, Clk., for the construction of storm and sanitary sewers.

Clarksdale, Miss.—At a recent election the citizens voted to issue $150,000 in bonds. The proceeds will be used for extending the sewer system.

Meridian, Miss.—An election will be held July 23 to vote on the question of issuing $25,000 in bonds. Part of the proceeds will be used for the construction of extensions to the sanitary sewer system. Noted Mar. 18.

Bogalusa, La.—The city contemplates holding an election to vote on the question of issuing $200,000 in bonds. The proceeds will be used for the purchase of a sewer system.

+New Orleans, La.—The contract for the construction of a sewer system at the new cotton warehouses has been awarded to L. M. DAHLGREN, at $15,936. Noted July 1.

+Dayton, Ky.—The contract has been awarded to J. B. McLANE & CO., Newport, for the construction of sewers in various streets.

Paducah, Ky.—(Official)—Bids will be received until 10 a.m., Aug. 3, by the Commissioner of Public Works for the construction of the outfall sewer, District No. 3, Contract No. 1. Noted May 20.

Bedford, Ohio—Bids will be received until noon, July 19, by H. T. Hubbell, Clk., for the construction of sewers in various streets.

Canton, Ohio—Bids will be received until 10 a.m., July 21, by the Commissioners of Stark County for the construction of the Domer Ditch in Canton Township, open and tile work. C. L. Stoner is Clk.

Cincinnati, Ohio—All bids received June 18 for the construction of sewers in the Madisonville Sewer District, Contract No. 3, have been rejected. New bids will be received by Philip Fosdick, Dir. of Pub. Ser. Noted June 17.

Cincinnati, Ohio—Bids will be received until noon, July 16, by Philip Fosdick, Dir. of Pub. Ser., for the construction of sewers in East Third and Elmore St., in Hamilton, Bruce and Glenway Ave.

+Cleveland, Ohio—(Official)—The contract for the construction of sewers in Sandusky Ave. has been awarded to the LAKE ERIE PAVING & CONSTRUCTION CO., at $17,697. Noted June 24.

+Cleveland, Ohio—(Official)—The contract for the construction of sewers in West Third St. and Prospect Ave. has been awarded to WILLIAM LEHMANN, at $7121 and $8914, respectively. Noted June 17.

+Columbus, Ohio—The contract for improving and constructing an addition to the sewage-disposal plant has been awarded to D. W. McGRATH & SON, Columbus, at $197,996. Noted June 3.

Portsmouth, Ohio—It is reported that G. S. Wilhelm, City Engr., is preparing plans for the construction of sewers in the Sunnyside District.

Brazil, Ind.—Bids will be received about July 20 by the Board of Public Works for the construction of a sanitary sewer in the West End, requiring approximately 2843 lin.ft. of 10-in. and 3801 lin.ft. of 8-in. vitrified pipe. F. C. Wilson is City Engr.

+Indianapolis, Ind.—(Official)—The contract for the construction of the main drain in 38th St. and in Central Ave. has been awarded to the McLAUGHLIN CONTRACTING CO., Pittsburgh, Penn., at $143,732. Noted June 17.

+Muncie, Ind.—(Official)—The contract for sewer construction has been awarded to WILLIAM M. BIRCH CO., Muncie. Noted July 1.

Saginaw, Mich.—Bids will be received about July 15 by the Commissioners of Saginaw County for the construction of two drains, one nine miles and the other seven miles.

Chicago, Ill.—Byrne Bros.' Dredging & Engineering Co., Chicago, at $195,583, submitted the lowest bid for the construction of the Calumet Intercepting Sewer, Contract No. 2.

+Chicago, Ill.—The Board of Local Improvements has awarded the contract to the H. J. McNICHOLS CO. for the construction of both sections of the Argyle St. sewer system. The estimated cost is $683,000. Noted July 1.

Chicago, Ill.—The lowest bid submitted for the construction of the Calumet Intercepting Sewer, Contract No. 3 was that of the Byrne Bros.' Dredging & Engineering Co., Chicago, at $331,883. Noted June 10.

Cicero, Ill.—Bids will be received until July 12 by the Board of Local Improvements for the construction of vitrified pipe sewers in West 18th and West 58th St.

Marshall, Ill.—Preliminary plans are being prepared by W. Robert Paige, Terre Haute, Ind., for the construction of extensions to the sanitary sewer system. Bids will be received about Aug. 1 by the Board of Local Improvements.

+Ottawa, Ill.—The contract for the construction of the Madison St. sewer has been awarded to the OMAHA CONSTRUCTION CO., Omaha, Neb., at $4530. Noted June 24.

+Kewaunee, Wis.—The contract for sewer construction has been awarded to the GREY, ROBINSON CONSTRUCTION CO., Kewaunee.

Milwaukee, Wis.—(Official)—Bids will be received until July 22 by the Sewerage Commission for the construction of 11 reinforced-concrete tanks on pile foundation. The tanks will be 30 ft. inside diameter by 14 ft. deep. This is the first part of the construction of the sewage-disposal works which will be built by the city. T. Chalkley Hatton is Ch. Engr. Noted Apr. 29.

+Milwaukee, Wis.—The Department of Public Works has awarded the contract for the construction of sewers in Hawley Rd. to A. J. HEWITT, Milwaukee, at $4330, and for the construction of sewers in Green Bay Ave. and in 44th, 45th and 46th St. at $2100 and $3885, respectively.

+Waupaca, Wis.—(Official)—The contract for sewer construction in South Main St. has been awarded to C. H. PHILLIPS, Waupaca. Noted June 17.

Whitewater, Wis.—(Official)—Bids will be received until 2 p.m., July 12, by A. N. Savee, City Clk., for the construction of sewers.

Lenox, Iowa—The contract will be awarded about July 15 for the construction of a sewage-disposal plant and sewers T. S. DeLay, Creston, is Engr. Noted Jan. 7.

+Newton, Iowa—(Official)—The contract for the construction of a sewage-disposal plant and sewers has been awarded to C. B. REYNOLDS, Council Bluffs, at $4405. Other bids were: J. W. Turner Improvement Co., Des Moines, $5383; A. W. Merrick, Boone, $4766; Elkhorn Construction Co., Fremont, Neb., $5493; Koss Construction Co., Des Moines, $6027. Noted June 24.

Ogden, Iowa—The city contemplates the construction of sewers estimated to cost $45,000. R. B. Reasoner, Perry, is Engr.-in-Charge.

Sanborn, Iowa—Bids will be received until July 9 by J. H. McNeil, Mayor, for the construction of a sewage-disposal plant and approximately four miles of sewers. P. A. Edquist, 865 Omaha National Bank Bldg., Omaha, Neb., is Engr. Noted Apr. 1.

Waterloo, Iowa—Plans are being prepared for the construction of a sewer system in the Galloway, Hagerman and Downing additions, also the construction of a sewage-disposal plant. C. A. Roby is City Engr. Noted Apr. 22.

+Pipestone, Minn.—The contract for the construction of storm sewers has been awarded to G. S. REDMON, Pipestone, at $8366.

Rochester, Minn.—(Official)—Bids will be received until July 12 by the city for the construction of sewers. The estimated cost is $6700. J. C. Utton is City Engr. Noted June 10.

Clyde, Kan.—Bids will be received until 5 p.m., July 15, by J. A. Hawkinson, Mayor, for the construction of a sewer system. The estimated cost is $25,000. E. T. Archer & Co., 514 New England Bldg., Kansas City, Mo., is Consult. Engr. Noted May 20.

Emporia, Kan.—The city contemplates the construction of 2½ miles of sewers. M. Brown is City Engr. and F. Smith is City Clk.

Wymore, Neb.—The city contemplates the construction of a sewer system.

Choteau, Mont.—Bids will be received until July 9 by A. L. Powers, City Clk., for the construction of sanitary sewers including 5176 lin.ft. of 8- and 9-in. vitrified pipe sewers. Noted June 1.

+Laurel, Mont.—The contract for the construction of a sewer system has been awarded to the SECURITY BRIDGE CO., Lewiston, Idaho, at $14,033. Noted June 3.

Jefferson City, Mo.—Plans are being prepared for the construction of a sewer system. The estimated cost is $50,000. P. C. Harding is City Engr. and Frank Morris is City Clk.

+Maplewood, Mo.—The contract for the construction of the Maplewood Sewer, No. 1 has been awarded to the CONNEY CONSTRUCTION CO., at $51,938. Noted May 27.

+Benton, Ark.—The contract for the construction of a sewer system has been awarded to the J. B. McCRARY CO., Atlanta, Ga. Noted May 27.

Moscow, Idaho—Bids will be received until July 12 by J. R. Strong, City Clk., for the construction of storm sewers.

Salt Lake City, Utah—(Official)—Bonds for $300,000 have been sold. Part of the proceeds will be used for the construction of sewers. Contracts will be awarded about July 20. Noted May 6.

+Phœnix, Ariz.—The contract for the construction of an addition at the sewage-disposal plant has been awarded to GEORGE TISDALE, Phœnix, at $10,000.

Forest Grove, Ore.—Plans are being prepared by R. E. Koon, Portland, for the construction of a sewer system. The estimated cost is $20,000. Noted June 10.

Mt. Angel, Ore.—Bids will be received until 3 p.m., July 13, by P. N. Smith, City Recdr., for cement, sand, gravel, sewer pipe and for the construction of a sewer system. The estimated cost is $15,000. Noted June 24.

+Portland, Ore.—C. G. Randles, at $6514, submitted the lowest bid for the construction of the Westover Terrace Sewer System.

Tillamook, Ore.—Bids will be received until 8 p.m., July 14, by John Aschim, City Recdr., for the construction of sewers and drains. The estimated cost is $10,000.

East San Diego, Calif.—The city contemplates the construction of a sewer system. The estimated cost is $50,000.

+Sacramento, Calif.—The contract for the construction of Unit No. 2 of the trunk sewer from Freeport Rd. to the Lower Stockton Rd. has been awarded to the CLINTON FIREPROOFING CO., San Francisco, at $92,192.

San Diego, Calif.—The city contemplates the construction of sewers from Old Town to Mission Bay.

San Diego, Calif.—The City Council contemplates the construction of a sewer in Bisbee St. The estimated cost is $12,000.

+San Francisco, Calif.—The contract for the construction of a sewer in Vermont St. has been awarded to the TIBBITTS-PACIFIC CO., at $12,701.

Trenton, N. S.—Bids will soon be received for the construction of sewers. The estimated cost is $4300. W. Fraser is Clk.

Bathurst, N. B.—See item under "Water Supply—Irrigation."

Verdun, Que.—The city contemplates an expenditure of $100,000 for the construction of sewers and for paving.

Toronto, Ont.—Bids will be received until July 20 by T. L. Church, Mayor, for sewer construction.

Prince Albert, Sask.—The city contemplates the construction of sanitary sewers in 15th St. The estimated cost is $11,000. J. H. Brown is Clk.

Regina, Sask.—The City Council will construct sewers estimated to cost $11,000. George Beach is Clk.

STREETS AND ROADS

Boston, Mass.—(Official)—Bids will be received until noon, July 12, by the Commissioner of Public Works for constructing a bituminous roadway in Schiller Rd. from Rockland St. to Dedham line, West Roxbury.

✚Boston, Mass.—The contract for constructing 3700 lin.ft. of road in Danvers has been awarded to D. LENEHAN, Beverly, at $8977. Noted June 24.

✚Boston, Mass.—The contract for furnishing 7500 bbl. of portland cement to the State Highway Commission has been awarded to E. S. FIELDS at $1.18 per bbl. Other bids were: Davis W. Lewis, $1.30; Powers Bros., $1.20; J. W. Ramsay, $1.30; Bath Portland Cement Co., $1.20; R. O'Connell Co., $1.30; Waldo Bros., $1.30. Noted June 24.

Lawrence, Mass.—The City Council contemplates an expenditure of $31,337 for street improvements.

Walpole, Mass.—(Official)—Bids will be received until 7:30 p.m., July 12, by the Town Council for grading and surfacing a number of streets.

Providence, R. I.—(Official)—Bids will be received until 2:15 p.m., July 12, by the Board of Contract and Supply for paving Fountain and Empire St. with wooden block pavement. William C. Pelkey is Clk.

✚Hartford, Conn.—The contract for constructing approximately 8300 lin.ft. of stone macadam on the Riverton Rd. has been awarded to JOHN DE MICHAEL & BRO., Torrington, at $10,360. Noted May 20.

✚New York, N. Y.—(Borough of Bronx)—(Official)—The contract for paving Fordham Rd. from Webster Ave. to Harlem River Terrace has been awarded to the UVALDE ASPHALT PAVING CO., at $90,176. Noted June 17 and July 1.

✚New York, N. Y.—(Borough of Bronx)—(Official)—See item under "Sewers."

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received June 30 by L. H. Pounds, Borough Pres., for regulating and repaving (a) Lincoln Rd. from Bedford to Rogers Ave., (b) Pioneer St. from Van Brunt to Richards St., (c) Vernon Ave. from Marcy to Tompkins Ave. and Tompkins Ave. from Vernon to Greene Ave., as follows: Sicilian Asphalt Paving Co., 41 Park Row, (a) $6075, (c) $17,993; Uvalde Asphalt Co., (a) $7942, (b) $7689, (c) $23,026; Cranford Co., (a) $7946; Barber Asphalt Co., (a) $7505, (c) $27,716; McFarlane Contracting Co., 504 Park Pl., (b) $6882; J. P. B. LaMarsh, (b) $8341; Rosenthal Engineering Co., (c) $21,244. Noted June 24.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received June 28 by Marcus M. Marks, Borough Pres., for improving (a) 38th St. from Park to Madison Ave., (b) 62nd St. from Columbus to Amsterdam Ave., (c)) West End Ave. from 91st to 96th St. and 95th St. from Broadway to West End Ave., (d) 36th St. from 10th to 11th Ave., (e) Amsterdam Ave. from 63rd to 68th St., as follows: Aztec Paving Co., 90 West St., (a) $3271, (b) $81,289, (c) $19,397; Uvalde Asphalt Co., (a) $3648, (b) $207,011, (c) $20,913; Cleveland Trinidad Paving Co., (a) $4219, (b) $158,181, (c) $24,361; Sicilian Asphalt Co., (a) $3447, (b) $119,194, (c) $19,007; Barber Asphalt Co., (a) $3969, (b) $126,733, (c) $21,432; Asphalt Construction Co., 50 Church St., (a) $3499, (b) $66,386, (c) $17,923; (d) $12,017, (e) 153,877; Matthew Baird Construction Co., 433 East 92nd St., (d) $12,879, (e) $58,429; W. J. Fitzgerald, (d) $12,749, (e) $126,742; Fitzgerald & Brenan, (d) $13,436, (e) $242,374; Rogers & McManus, (e) 217,863; Rafferty Contracting Co., (e) $186,938.

Rochester, N. Y.—The Common Council has voted to pave Pitkin St. with asphalt and Woodlawn St. with brick. The estimated cost is $13,700.

Camden, N. J.—Press reports state that bonds for $50,000 have been sold, the proceeds of which will be used for repaving a number of streets.

Elizabeth, N. J.—According to press reports the Board of Works in its budget for the present year has made an appropriation of $20,000 for street improvements.

Guttenberg, N. J.—(Official)—Bids will be received until 8 p.m., July 19, by William J. Bramley, Town Clk., for regulating and paving Bergenline Ave. Noted June 17.

Hackensack, N. J.—Bids will be received until July 12 by the Board of Chosen Freeholders of Bergen County for improving portions of the Kinderkamack Rd., Piermont Rd. and Grand Ave.

Hoboken, N. J.—The City Commissioners plan to repave River St. from Hudson Pl. to Fourth St., 14th St. from Willow Ave. to its eastern boundary, Hudson St. from 11th to 14th St. James H. Londrigan is Comr. Streets and Pub. Impv.

Jersey City, N. J.—(Official)—Bids will be received until 11 a.m., July 15, by the City Commissioners for repaving the Secaucas Rd. Michael I. Fagen is City Clk.

Jersey City, N. J.—Press reports state that the City Council is considering the improvement of Tonnele Ave. by paving with wood on a concrete base.

Trenton, N. J.—Engineers recently finished the survey of the proposed Delaware River Blvd., which when completed will rival the famous drive along the Hudson, north of New York. The thorofare will be 100 ft. wide, and will be divided into two parts, one for heavy traffic and the other for automobiles. The road will connect the cities of Camden and Trenton.

Middletown, N. J.—Bids will be received until July 12 by the Board of Chosen Freeholders of Monmouth County, Freehold, for repairing a portion of the Red Bank-Middletown Rd. in Middletown Township.

Millburn, N. J.—(Official)—Bids will be received until 8 p.m., July 12, by the Township Committee for grading, draining and paving Highland Ave.

✚Newark, N. J.—Contracts have been awarded for paving Oraton St., Richard St. and Clifton Ave. to the CONTINENTAL PUBLIC WORKS, at $5929, $6609 and $11,797 respectively. Noted May 20, June 3 and July 1.

Newark, N. J.—Bids will be received until July 28 by the Board of Street and Water Commissioners for constructing Bound Creek and Frelinghuysen Ave.

Newark, N. J.—Bids will be received until July 22 by the Board of Street and Water Commissioners for paving Conklin Ave. from Osborne Terrace to about 350 lin.ft. west of Seymour Ave. and Shadwick Ave. from Jeffery Pl. to Renner Ave.

Newark, N. J.—(Official)—Bids will be received until July 15 by the Board of Streets and Water Commissioners for repaving South Orange Ave. from South Ninth St. to South 29th St.

New Brunswick, N. J.—Bids were received for resurfacing the Old Bridge Turnpike, as follows: Thomas H. Riddle, $34,674; Utility Construction Co., $35,742; Northern Construction Co., $36,504; Thomas F. Dunigan, $36,503. Noted Apr. 29.

Newton, N. J.—Press reports state that the Town Committee contemplates improving Spring St. from the Delaware, Lackawanna & Western R.R. to Madison St. with concrete.

Perth Amboy, N. J.—(Official)—We are advised that Front St. from Market to Gordon St. will be improved by paving with concrete. The work will be done by the city forces. Noted June 17.

Westville, N. J.—(Official)—At a recent election the question of issuing $50,000 in bonds, the proceeds of which was to have been used for street improvements was defeated. Noted June 17.

Berlin, Penn.—At the election held June 30 the citizens voted in favor of issuing $8000 in bonds, the proceeds of which will be used for paving Main St.

✚Cementon, Penn.—The contract for constructing a concrete road on Third St. has been awarded to E. R. HAWKE, Northampton, at $6000.

Clarion, Penn.—Bids will be received until July 15 by F. M. Arnold, Jr., Secy. Borough Council, for constructing brick and concrete pavements.

Easton, Penn.—Press reports state that the Commissioners of Northampton County have voted an appropriation of $9000 for constructing a concrete road connecting Easton, Bethlehem and Allentown. Private subscriptions to the amount of $15,000 have been received for the same purpose.

Philadelphia, Penn.—(Official)—Bids will be received until July 13 by the Bureau of Highways for grading, paving and resurfacing a number of roads, at an estimated cost of $635,000.

✚Wilkes-Barre, Penn.—The contract for paving Lehigh St. has been awarded to MICHAEL J. MALLORY, Sugar Notch, at $5631.

✚Baltimore, Md.—The contract for paving Camden St. from Paca to Eutaw St. with granite blocks has been awarded to the CONSOLIDATED ENGINEERING CO., at $6595.

Chestertown, Md.—(Official)—Bids will be received until noon, July 13, by the Commissioners of Kent County for constructing a section of State Aid Highway in Kent County.

Richmond, Va.—The City Council plans to pave Grove Ave. from the Boulevard to the city limits.

✚Richmond, Va.—Contracts have been awarded for paving Cary St. to J. J. CURLEY, at $4500; Broad St. Rd. to A. L. PHILLIPS SONS, at $6000; Hermitage Rd. to L. K. BLACK, at $10,000.

Elkins City, W. Va.—The City Council has appropriated $40,000 for new pavements on unpaved streets in the main part of the city.

✚Lincoln, N. C.—A contract for constructing 20,000 sq.yd. of asphaltic concrete pavement has been awarded to the NOLL CONSTRUCTION CO., Chattanooga, Tenn. Noted May 20.

✚Wilmington, N. C.—(Official)—A contract for constructing 15 miles of sand clay road in Northwest Township, Brunswick County has been awarded to HENING & HAGEDORN, Four Oaks, at $20,000.

Melbourne, Fla.—At a recent election the citizens of Brevard County voted in favor of issuing $150,000 in bonds, the proceeds of which will be used for improving and constructing roads.

✚Selma, Ala.—(Official)—Contracts have been awarded for constructing the Barker's Mill Rd. to the CENTRAL ALABAMA CONSTRUCTION CO., Luverne, at $7000, and the Blablock and Uniontown Rd. to D. R. COOK & CO., Montgomery, at $7000. Noted June 7.

Bogalusa, La.—Press reports state that the city contemplates holding an election for the purpose of voting on the question of issuing $200,000 in bonds, the proceeds of which will be used for improving streets.

★New Orleans, La.—(Official)—Bids will be received until 11 a.m., July 20, by the Commission Council for paving approximately 75,510 sq.yd.; also for constructing about 55,000 sq.yd. of gravel macadam oiled surface roadway.

★New Orleans, La.—(Official)—Bids will be received until 11 a.m., Aug. 3 by the Commission Council for paving additional streets. A. G. Ricks is Comr. Pub. Finances.

Byrdstown, Tenn.—Press reports state that the Quarterly Court of Pickett County has voted in favor of issuing $50,000 in bonds, the proceeds of which will be used for constructing roads.

Crossville, Tenn.—An election will be held July 12 to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for improving roads in Cumberland County.

Spring Hill, Tenn.—At the election held June 26 the citizens voted in favor of issuing $10,000 in bonds, the proceeds of which will be used for paving a number of streets.

Owensboro, Ky.—Press reports state that the citizens of Daviess County voted in favor of issuing $600,000 in bonds, the proceeds of which will be used for building 100 miles of rock roads.

✚Canton, Ohio—(Official)—Contracts have been awarded for paving Deuber Ave. to the CLEVELAND TRINIDAD PAVING CO., at $49,797; Harrisburg Rd. to the F. A. DOWNS CONSTRUCTION CO., at $25,306; Ninth St. to HARRY CORL, at $22,200; Fifth St. to PETER CHRISTIANSON, at $28,015; Indiana Way to M. NELSON, at $14,320.

Cincinnati, Ohio—(Official)—Bids will be received until noon, July 16, by Philip Fosdick, Dir. Pub. Ser., for improving Montgomery Rd. from Gilbert Ave. to the Norfolk & Western Ry.

Cincinnati, Ohio—(Official)—Bids will be received until noon, July 12, by Philip Fosdick, Dir. Pub. Ser., for improving Glenway Ave. from Warsaw Ave. to the wood-block pavement at West Line Section 36.

Cincinnati, Ohio—(Official)—All bids received for repaving Bloody Run Parkway have been rejected. Noted June 10.

Cleveland, Ohio—(Official)—Bids will be received until 10 a.m., July 21, by E. G. Krause, Clk. of Comrs. of Cuyahoga County, for the sale of $23,582 in bonds, the proceeds of which will be for improving the Chagrin Falls-Greenville Rd.

✚Columbus, Ohio—Contracts have been awarded for paving as follows: Main St. from High to Parsons St. to the CLEVELAND TRINIDAD PAVING CO., at $53,945; West Broad St. from Sandusky to Shady Lane to the ANDREWS ASPHALT PAVING CO., at $102,248; Peters Ave. from Fifth to Leona Ave. to B. F. PATTERSON, at $8000; Second St. from Livingston to Rich St. to GEORGE GEIGLE & SON, at $10,000.

Jefferson, Ohio—(Official)—Bids will be received until noon, July 26, by W. B. Culp, Village Clk., for grading and paving a portion of Main St.

Jeromesville, Ohio—(Official)—Bids will be received until noon, July 10, by M. L. Hosler, Clk., of the Village Council, for the sale of $18,500 in bonds, the proceeds of which will be used for improving a portion of Main St.

✚Lakewood, Ohio—(Official)—Contracts have been awarded for paving Matthews Ave., Park Row, Clifton Rd., Forest Rd. and West Forest Rd. to the CLEVELAND TRINIDAD PAVING CO., Cleveland, at $9923, 6527, $31,913, $10,365 and $8246 respectively. Noted June 10.

Lorain, Ohio—(Official)—Bids will be received until noon, July 13, by George N. Damon, City Audr., for the sale of $16,000 in bonds, the proceeds of which will be used for improving certain streets.

Mt. Victory, Ohio—(Official)—Bids will be received until noon, July 26, by Frank Lydick, Village Clk., for the sale of $11,300 in bonds, the proceeds of which will be used for paving Main St.

New Philadelphia, Ohio—(Official)—Bids will be received until 1 p.m., July 19, by the Commissioners of Tuscarawas County for improving Section 1 of the Oldtown Road Improvement in Goshen and York Townships. R. H. Nussdorfer is County Audr.

Silverton, Ohio—(Official)—Bids will be received until noon, July 23, by A. A. Sprague, Village Clk., for the sale of $8000 in bonds, the proceeds of which will be used for improving a number of streets.

Tiffin, Ohio—(Official)—Bids will be received until noon, July 12, by William Heller, Dir. Pub. Ser., for improving a number of streets.

Wapakoneta, Ohio—Bids will be received until July 16 for the sale of $23,000 in bonds, the proceeds of which will be used for improving Rapp Pike. F. W. Langhorst is County Audr.

Westerville, Ohio—Bids will be received until July 16 by the City Clerk for improving Winter St. from State to Vine St., Vine St. from Broadway to the county line and West Home St. from State to West St.

Xenia, Ohio—(Official)—Bids will be received until noon, July 20, by C. W. Whitmer, Dir. Pub. Ser., for paving Church and King St.

Indiana—(Official)—Bids will be received for road improvements in Indiana as follows: Bridgeport, until 1 p.m., July 15, by the Highway Commission of Bridgeport Township for constructing three miles of hard road; Goshen, until 1 p.m., July 17, by the Commissioners of Elkhart County for constructing concrete roads in Harrison, Olive and Concord Townships; Noblesville, until 10 a.m., July 20, by the Commissioners of Hamilton and Marion Counties for constructing a county line road; Indianapolis, until 10 a.m., July 30, by the Commissioners of Hamilton and Marion Counties for constructing a county line road.

✚Evansville, Ind.—(Official)—A contract for constructing a rock road in Scott Township has been awarded to JOHN FRIDY, Evansville, at $8300. Noted June 17.

Gary, Ind.—Bids will be received until July 19 by the Board of Public Works for resurfacing Washington Ave., Section 6, from 11th to 17th Ave. with granite asphalt, at an estimated cost of $8215. W. J. Fulton is City Engr.

Gary, Ind.—Bids will be received until July 12 by the Board of Public Works for resurfacing Seventh Ave., Section 1, from Alley 2 West to Alley 2 East, at an estimated cost of $10,519.

✚Gary, Ind.—(Official)—The contract for paving Mass St. with concrete macadam on slag foundation has been awarded to M. D. HEINY, Gary, at $6942. Noted June 10.

Indianapolis, Ind.—(Official)—Bids will be received until 10 a.m., July 12, by the Board of Public Works for improving Linwood Ave.

✚South Bend, Ind.—(Official)—The contract for paving Allen St. has been awarded to H. N. BARNES, Johnson St., South Bend, at $9367. Noted June 17.

✚Kalamazoo, Mich.—(Official)—A contract for constructing 20,000 sq.yd. of asphaltic concrete pavement has been awarded to the GLOBE CONSTRUCTION CO., Kalamazoo, at $0.85 per sq.yd. Contracts for 113,000 paving blocks have not been awarded. Noted Apr. 29.

Cicero, Ill.—(Official)—Bids will be received until 8 p.m., July 12, by the Board of Local Improvements for Improving 61st St. from 12th to 15th St. and 60th St. from 12th to 22d St. Charles Stoffel is Town Clk.

✚Elgin, Ill.—(Official)—Bids were received June 26 for paving North State St. from LOGAN & GIERTZ CONSTRUCTION CO., Elgin, Ill., $24,360 (awarded contract); Illinois Hydraulic Stone & Construction Co., Elgin, $25,310; H. G. Goelitz, Oak Park, $25,240. Noted June 24.

✚Springfield, Ill.—(Official)—Contracts have been awarded for road construction in various counties as follows: Du Page County, Section B, THOMAS B. CUTLER, Gary, $4480; Jo Daviess County, Sections A and B, EMPIRE CONSTRUCTION CO., Des Moines, $9989; La Salle County, Sections B and D, F. E. BALL, Hampshire, $8800, and W. J. BRENNAN, La Salle, $8027, respectively. Noted June 24.

✚Black River Falls, Wis.—The Board of Public Works has awarded the contract for paving Main, Polk and 10th St. with reinforced-concrete pavement to J. R. McDONALD, at $12,320.

✚Dodgeville, Wis.—The contract for paving Diagonal St. with concrete has been awarded to T. W. QUINN, Madison, at $10,495.

Horicon, Wis.—Bids will be received until July 10 by the City Clerk for paving streets.

Shawano, Wis.—(Official)—All bids received for paving 9233 sq.yd. with macadam and 3763 lin.ft. combined curb and gutter have been rejected. Noted June 17.

✚Ft. Dodge, Iowa—The contract for paving First Ave., S., has been awarded to the JOHN A. McGARRY CO., Chicago, Ill., at $38,306.

✚Sheldon, Iowa—A contract for paving nine blocks has been awarded to the DEARBORN CONSTRUCTION CO., at $1.21 per sq.yd.

Valley Junction, Iowa—The City Council plans to pave a number of streets.

St. Paul, Minn.—The City Council plans to repave University Ave. from Rice to Dale St. with creosoted blocks, at an estimated cost of $57,514.

Willmar, Minn.—No bids were received June 25 for constructing State Roads Nos. 3 and 7. Samuel Nelson is Audr. of Kandiyohi County.

Ft. Scott, Kan.—Press reports state that bids will be received until Aug. 2 by N. J. Rose, Clk. of Bourbon County for constructing three miles of macadam on Coleman Rd.

✚Glasco, Kan.—(Official)—A contract for constructing concrete pavement, curb and gutter on Main St. has been awarded to A. R. STIMSON, Topeka. Noted June 10.

Ottawa, Kan.—(Official)—Bids will be received until 1 p.m., July 10, by Edith M. Cusick, City Clk., for grading, curbing, guttering and paving a portion of Walnut St. F. M. Harris is Mayor.

Kalispell, Mont.—Press reports state that the City Council has voted to construct concrete sidewalks and crosswalks in Districts Nos. 166 and 167, at an estimated cost of $30,850.

Bethany, Mo.—The Universal Concrete Co., St. Joseph, Mo., was the lowest bidder for paving 11,500 sq.yd. with concrete. J. R. McClure is City Clk.

✚Kansas City, Mo.—The contract for paving 12th St. has been awarded to A. R. MENISE, at $21,921.

✚Helena, Ark.—The contract for paving Perry St. has been awarded to the SOUTHERN BITULITHIC CO., Nashville, Tenn., at $41,000.

Howe, Tex.—At the election held June 25 the citizens of Grayson County voted in favor of issuing $60,000 in bonds, the proceeds of which will be used for constructing roads.

Longview, Tex.—(Official)—Bids will be received until noon, July 14, by the Commissioners Court of Gregg County for grading and surfacing with stone and gravel 15 miles of the Dallas-Shreveport Highway. D. K. Caldwell is County Engr.

Paris, Tex.—Bonds for $50,000 have been sold, the proceeds of which will be used for improving streets.

★San Antonio, Tex.—(Official)—Bids will be received until 4 p.m., July 15, by Fred Fries, City Clk., for approximately 120,000 sq.yd. of paving.

✚McAlester, Okla.—The contract for paving Third St. has been awarded to JOHN W. ROOKS, at $13,593. Noted Oct. 8 and June 25.

Tulsa, Okla.—At a recent election the citizens voted in favor of issuing $100,000 in bonds for improving and constructing parks and boulevards. Noted June 24.

✚Ft. Collins, Colo.—The Commissioners of Larimer County have awarded the contract to F. C. DREHER, Denver, at $16,255, for constructing three miles of the Fall River-Grand Lake Highway. Noted June 24.

✚Ogden, Utah—The contract for paving Madison Ave. from 25th to 28th St. has been awarded to P. J. MORAN, Salt Lake City, at $28,280. Noted June 10.

Kingman, Ariz.—An election will be held July 27 to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for constructing roads in Mohave County.

Phœnix, Ariz.—The City Commission plans to pave about 153,000 sq.ft. on West Adams St. with bitulithic pavement.

✚Goldendale, Wash.—(Official)—The contract for constructing Permanent Highway No. 4 has been awarded to the TRANSFER & LIVERY CO., Hood River, Ore., at $20,950. Other bids were: Saulsberry & Nelson, Prosser, $21,945; Cascade Construction Co., Walla Walla, $21,499. Noted June 17.

✚Olympia, Wash.—The contract for paving East Fourth St. has been awarded to the INDEPENDENT ASPHALT CO., Seattle.

Port Townsend, Wash.—(Official)—The contract for improving a number of streets has been awarded to the NETTLETON, BRUCE ESCHBACH CO., 903 American Bank Bldg., Seattle, at $15,190. Other bids were: Erickson Construction Co., $24,500; M. P. Zindorf, $16,600; Rown & Anderson, $19,600. Noted June 17.

✚Seattle, Wash.—The contract for constructing the Woodinville-Duvall Rd. has been awarded to BOOKER, KIEHL & WHIPPLE, at $45,214. Noted June 10.

Seattle, Wash.—Bids will be received until 10 a.m., July 20, by the Commissioners of King County for constructing the Enumclaw-Franklin Rd. The estimated cost is $50,000.

✚Oregon City, Ore.—The contract for paving Main St. has been awarded to the WORSWICK PAVING CO., Astoria, at $14,184. Noted Apr. 8.

Manhattan Beach, Calif.—The Municipal Improvement Co. submitted the lowest bid for improving two sections of Manhattan Ave.

+Pasadena, Calif.—The contract for paving and curbing Pasadena Ave. has been awarded to ANDREW HOLLOWAY, 415 South Broadway, at $7200.

+Petaluma, Calif.—The City Trustees have awarded a contract for street improvements to EATON & SMITH, San Francisco, at $12,172.

+Portersville, Calif.—The contract for paving Morton, E and F St. has been awarded to the SUNSET CONSTRUCTION CO., San Francisco, at $30,000.

+Sacramento, Calif.—Contracts have been awarded for road construction in Colusa County from Colusa Junction to the northerly boundary, 10½ miles, to L. F. GERDETZ, San Francisco, at $40,052 and Kings County from Hanford to the eastern boundary, 9 miles, to GEORGE S. BENSON & SONS, Los Angeles, $50,212. Noted June 17.

Sacramento, Calif.—The City Council is having plans prepared for paving Front St. from N to Q St. and from Q to S St.

Sacramento, Calif.—(Official)—Bids will be received until 2 p.m., July 19, by the State Highway Commission for constructing state highways as follows: Alameda County, from Livermore to Santa Rita, 5.8 miles; Santa Clara County, from Los Gatos to San José, 8.9 miles; Los Angeles County, from Rancho Tujunga to La Canada, 4.9 miles.

+San Bernardino, Calif.—The contract for improving Second St. from E to I St. has been awarded to TUTTLE & DEYOE, at $12,236.

+San Francisco, Calif.—The contract for improving Arguello Blvd. has been awarded to the FEDERAL CONSTRUCTION CO., at $12,198.

San Francisco, Calif.—Press reports state that the Board of Public Works plans to pave Gates, Missouri, Spruce and Excelsior St.

+San Francisco, Calif.—The contract for constructing the first section of the Twin Peaks Blvd. has been awarded to EATON & SMITH, at $24,058.

New Glasgow, N. S.—Press reports state that the City Council will lay bitulithic pavement on Archimedes St.

Scotstown, Que.—The Town Council will construct pavements, at an estimated cost of $5000.

Verdun, Que.—See item under "Sewers."

Hensall, Ont.—Bids will soon be received by the City Council for constructing concrete sidewalks on Alfred and Albert St.

INDUSTRIAL WORKS

Boston, Mass.—(Official)—The storage building to be constructed for Joseph Segal will be two stories instead of eight stories, and will be built by day work. F. A. Norcross, 46 Cornhill, is Arch. Noted July 1.

+Waterbury, Conn.—The Scoville Mfg. Co. has awarded the contract for the construction of a four-story, 68x203-ft. factory on Silver St. to the McCLINTIC-MARSHALL CO.

+Lockport, N. Y.—MARION BROS., Rochester, N. Y., has been awarded the contract for the construction of a $30,000 addition to the plant of the Covert Motor Vehicle Co., Grand and Green St.

Jamestown, N. Y.—The Crescent Tool Co. will build a three-story, 50x106-ft. factory by day labor. The estimated cost is $55,000. Freeburg & Fidler is Arch. Noted Mar. 18.

+New York, N. Y.—(Borough of Brooklyn—Jason S. Bailey has awarded the contract for the construction of a seven-story reinforced-concrete factory on Bond St. to the CONCRETE STEEL CO. Parfitt Bros., 26 Court St., is Arch. Noted June 10.

New York, N. Y.—(Borough of Brooklyn)—The American Tobacco Co., Kent Ave., will build a 200x300-ft. factory at Park and Nostrand Ave., to cost approximately $500,000. Francisco & Jacobus, 200 Fifth Ave., Borough of Manhattan, is Arch.

+New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for the construction of a three-story,60x200 -ft. reinforced-concrete building for W. Becker's Aniline & Chemical Works, Inc., 105 Underhill Ave., has been awarded to the TURNER CONSTRUCTION CO., 11 Broadway (Borough of Manhattan). Benjamin Driesler, 153 Remsen St., is Arch. Noted Mar. 11 and July 1.

New York, N. Y.—(Borough of Brooklyn)—Kirkman & Son, 215 Water St., will build a seven-story, 75x100-ft. brick and steel storage building at Bridge and Plymouth St. The estimated cost is $100,000.

New York, N. Y.—(Borough of Manhattan)—Joseph Stern & Sons, Inc., will build a nine-story warehouse at 630 West 40th St. E. Poirot is Arch. The estimated cost is $180,000.

Camden, N. J.—Bids are being received for the construction of a four-story, 96x100 ft. factory for E. & R. Preisendanz. J. C. Jefferis, 1001 Chestnut St., Philadelphia, Penn., is Arch.

Newark, N. J.—Bids are being received for the construction of a four-story, 60x100-ft. garage for the Cadillac Motor Car Co., 1881 Broadway, New York, N. Y. The estimated cost is $80,000. William E. Lehman, 738 Broad St., is Arch.

+Trenton, N. J.—The contract for the construction of a three-story, 50x150-ft. brick and concrete factory for W. F. Taubel, Riverside, N. J., has been awarded to the HARRISON C. REA CO. W. U. Jury, Shamokin, Penn., is Arch.

+Trenton, N. J.—J. L. Mott Co. has awarded the contract for the construction of a 100x240-ft. warehouse to the NEWTON A. K. BUGBEE CONSTRUCTION CO. The estimated cost is $20,000.

Chester, Penn.—The Roach Shipyard plans the construction of a $1,000,000 ship-building plant. Joseph H. Hinkson is Secy. Charles P. M. Jack, 17 Battery Pl., New York, N. Y., is Engr.

New Castle, Penn.—The Federal Radiator Co. has been incorporated with a capital of $600,000 by Parker H. Cunningham and others and will remodel the plant of the Penn Motor Co.

+Philadelphia, Penn.—The contract for the construction of a seven-story, 47x120-ft. reinforced-concrete warehouse for Joseph C. & Roy A. Heymann has been awarded to CRAMP & CO., 801 Denckla Bldg. Charles E. Oelschlager, Harrison Bldg., is Arch.

+Philadelphia, Penn.—Janney & Burrows, 315 North Third St., has awarded the contract for the construction of additions to its warehouse to KETCHEM & McQUADE, 1129 Brown St. Ballinger & Perrott, 1701 Arch St., is Arch. The estimated cost is $15,000. Noted June 24.

Tacony Station, Penn.—(Philadelphia post office)—(Official)—The L. H. Gilmer Co., 52 North Seventh St., Philadelphia, Penn., has purchased a two-acre site at Tacony Station and will build a factory.

+Wilkes-Barre, Penn.—Nelson Bros., 38 Baltimore St., has awarded the contract for the construction of a five-story, 30x50-ft. warehouse to ECKENRODE BROS., 115 Park Ave. The estimated cost is $10,000. Henry Maier, Coal Exchange Bldg., is Arch. Noted May 27.

Hagerstown, Md.—(Official)—Plans will soon be ready for bids for the construction of a two-story, 100x200-ft. reinforced-concrete factory for the Pangborn Corporation. The estimated cost is $50,000. Penckert & Wunder, 310 Chestnut St., Philadelphia, Penn., is Arch. Noted May 20 and July 1.

Valdosta, Ga.—J. M. Ashley, H. R. Buckley and associates plan the construction of a 50x200-ft. hosiery factory at an estimated cost of $50,000.

North Birmingham, Ala.—(Birmingham post office)—The Birmingham Stove & Range Co. plans the construction of a $100,000 plant.

Nashville, Tenn.—Bids are being received by Marr & Holman, Arch., for the construction of a two-story, 170x175-ft. reinforced-concrete garage for the Bransford Realty Co.

+Mt. Sterling, Ky.—Kirkpatrick & Clay has awarded the contract for the construction of a tobacco warehouse on Sycamore St. to EDWARD L. WILLIAMS.

Akron, Ohio—The Goodyear Tire & Rubber Co. plans the construction of one eight-story and two seven-story buildings to cost about $400,000.

Cleveland, Ohio—W. S. Ferguson & Co., Engr., Euclid Bldg., is preparing plans for the construction of a three-story, 50x200-ft. garage for the Adams, Oakland Co., H. M. Adams, 1901 Euclid Ave., is Pres. The estimated cost is $50,000.

+Toledo, Ohio—The Toledo Cooker Co., West Bancroft St., has awarded the contract for the construction of a two-story, 72x185-ft. addition to its factory to SCHILLINGER BROS. Mills, Rhines, Bellman & Nordhoff, 1234 Ohio Bldg., is Arch. Noted May 6.

+Youngstown, Ohio—The Youngstown Sheet & Tube Co. has awarded the contract for the construction of its new mills to the MORGAN CONSTRUCTION CO., Worcester, Mass. The estimated cost is $300,000. Noted May 13.

+Indianapolis, Ind.—The Citizens' Gas Co. has awarded the contract for the construction of a benzol plant to the OTTO COKING CO., 6 Church St., New York, N. Y.

+Detroit, Mich.—The contract for the construction of a one-story, 60x170-ft. addition to the plant of the Federal Motor Truck Co. has been awarded to DE LISLE & COPPER.

+Detroit, Mich.—The Ford Motor Co. has awarded the contract for the construction of a four-story, 100x470-ft. factory to the TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y. The estimated cost is $400,000.

Detroit, Mich.—The Detroit Wire Spring Co., Morrow and Marston St., plans the construction of a two-story 80x400-ft. factory to cost about $100,000. Albert Kahn and E. Wilby, Trussed Concrete Bldg., are Archs.

Detroit, Mich.—The Packard Motor Car Co. will build a five-story factory on Concord St., to cost $175,000. Albert Kahn, 58 La Fayette St., is Arch.

Saginaw, Mich.—The Saginaw Beef Co. will build a six-story, 88x96-ft. building, to cost about $100,000.

Chicago, Ill.—The Standard Oil Co., 72 West Adams St., has purchased a site on 58th St., and plans the construction of a warehouse, garage and office building. Estimated cost, $25,000.

Minneapolis, Minn.—The Lindsay Bros. will build a brick warehouse, to cost $20,000.

+Beatrice, Neb.—C. G. Walker has awarded the contract for the construction of a two-story garage to ROBERTSON & O'NEIL, 5202 Military Ave., Omaha, Neb. R. W. Grant is Arch. The estimated cost is $20,000.

Kansas City, Mo.—The American Can Co., 14th St. and Tenth Ave., New York, N. Y., plans the construction of a $500,000 plant at 13th and 14th St.

Kansas City, Mo.—The Columbian Steel Tank Co. will expend $250,000 for the construction of an eight-story warehouse and two 150x300-ft. factories. Andrew A. Kramer, 1605 West 12th St., is Pres.

+Kansas City, Mo.—The Perkey Bros.' Transfer & Storage Co., 2431 Prospect St., has awarded the contract for the construction of a two-story, 54x121 ft. addition to its warehouse to the CLARK CONSTRUCTION CO., 2431 Prospect St. The estimated cost is $10,000. O. G. Knecht, 928 Broadway, is Arch.

Macon, Mo.—Wallace Smith and E. E. Wilson will build a 92x120-ft. garage on Bourke St., to cost $10,000 or $12,000.

St. Louis, Mo.—E. Mason Roberts plans the construction of a two-story garage at 3872 Washington Blvd. The estimated cost is $100,000.

+Vinita, Okla.—J. A. Wise has awarded the contract for the construction of a one-story, 100x150-ft. garage to W. N. LANGHART. The estimated cost is $10,000.

Houston, Tex.—F. H. Stewart will build a one-story garage at 509 Capitol Ave., to cost $12,000.

+Portland, Ore.—THOMAS MUIR has been awarded the contract for the construction of a three-story addition to the plant of the Marshall-Wells Co., 15th and Kearney St., at about $50,000. E. B. McNoughton is Arch. Noted May 6.

FEDERAL GOVERNMENT WORK

Post Office—Gardiner, Maine—Bids will be received until 3 p.m., Aug. 13, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing complete the U. S. post office at Gardiner.

Post Office—North Attleboro, Mass.—Bids will be received until 3 p.m., Aug. 12, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing complete the U. S. post office at North Attleboro.

Riprap—New York, N. Y.—Bids will be received until 2 p.m., July 14, by J. T. Yates, Lighthouse Inspector, Tompkinsville, for constructing riprap at Coney Island Light Station, New York.

✚★**Riprap**—New York, N. Y.—The contract has been awarded to McHARG BARBON CO., 171 Madison Ave., New York, at about $6000 for constructing riprap and repairing sea wall at Governors Island, New York Harbor. Noted May 27.

★**Dredging**—Port Chester, N. Y.—Bids will be received until noon, July 30, at the U. S. Engineer Office, First District, Room 710 Army Bldg., Whitehall St., New York, for dredging in Port Chester Harbor.

★**Steam Engine**—Pittsburgh, Penn.—Bids will be received until 3 p.m., July 30, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for supplying one steam engine to the Experimental Station, U. S. Bureau of Mines.

Generator—Pittsburgh, Penn.—Bids will be received until 3 p.m., July 30, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for one electric generator and generator panel for the U. S. Bureau of Mines, Pittsburgh.

✚**Post Office**—Reading, Penn.—The contract has been awarded to JOHN LOWRY, JR., 8 West 40th St., New York, N. Y., at $90,880, for constructing an extension to the post office. Noted May 6 and June 17.

★**Building**—Washington, D. C.—Bids will be received until 2 p.m., Aug. 2, by the Bureau of Standards, Washington, for constructing a chemical laboratory at the Bureau of Standards at Connecticut Ave. and the Mill Pierce Rd.

Electrical Work—Washington, D. C.—Bids will be received until 3 p.m., July 15, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, for electrical work in the U. S. Treasury and in the Winder Bldg.

Pipe—Washington, D. C.—Bids will be received until 2 p.m., July 19, by the Commissioners of the District of Columbia, Room 509 District Bldg., Washington, for furnishing c.-i. water pipe and specials.

✚**Steps**—Washington, D. C.—The contract has been awarded to ARTHUR COWSILL, Washington, at $9120, for constructing the new capitol steps. Noted June 17.

★**Dredging**—Norfolk, Va.—Bids will be received until noon, Aug. 4, at the U. S. Engineer Office, Custom House, Norfolk, for dredging in Inland Waterway from Norfolk to Beaufort, N. C.

Post Office—Wellsburg, W. Va.—Bids will be received until 3 p.m., Aug. 11, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing complete the U. S. post office at Wellsburg.

★**Jetties**—New Orleans, La.—Bids will be received until 11 a.m., July 21, at the U. S. Engineer Office, New Orleans, for constructing jetties at Southwest Pass, Mississippi River.

Breakwater and Pierhead—Conneaut, Ohio—Bids will be received until noon, July 30, at the U. S. Engineer Office, Cleveland, for constructing a pierhead and rubble mound breakwater at Conneaut Harbor.

★**Breakwater**—Chicago, Ill.—Bids will be received until 10 a.m., Aug. 3, at the U. S. Engineer Office, Chicago, for constructing a rubble mound breakwater at Chicago Harbor.

★**Shore Protection**—Rock Island, Ill.—Bids will be received until 3 p.m., July 31, at the U. S. Engineer Office, Rock Island, for constructing dams and shore protection in Iowa, Illinois and Missouri.

Building—Crow Agency, Mont.—Bids were received June 30 by the Commissioner of Indian Affairs, Washington, D. C., for constructing a brick school and heating plant at the Crow Indian School: Gagnon & Co., Billings, $20,900 (school only); W. D. Lovell, Minneapolis, Minn., $21,490 (school), $4500 (heating plant). Noted June 17.

Dredging—Bremerton, Wash.—Bids will be received until 11 a.m., Aug. 14, by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging at the navy yard, Puget Sound.

★**Cylinder Gates**—Yakima, Wash.—Bids will be received until 2 p.m., July 28, by the U. S. Reclamation Service, Washington, D. C., for furnishing two c.-i. cylinder gates for the Keechelus Reservoir.

★**Structural Steel**—Balboa, Panama—Bids will be received until 10:30 a.m., July 23, by Maj. F. C. Boggs, Pur. Agt., Panama Canal, Washington, D. C., for furnishing and erecting structural steel.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., July 20, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

Marine Railway—Pearl Harbor, Hawaii—Bids will be received until 11 a.m., Sept. 18, by H. R. Stanford, Ch. of Bureau, Yards and Docks, Navy Dept., Washington, D. C., for constructing a marine railway at the naval station.

Officers' Quarters—Pearl Harbor, Hawaii—Bids will be received until 11 a.m., Aug. 21, by H. R. Stanford, Ch. of Bureau, Yards and Docks, Navy Dept., Washington, D. C., for constructing four one-story officers' quarters at the naval station.

MISCELLANEOUS

Dredging—Boston, Mass.—Bids will be received until 11 a.m., July 14, by the State Harbor and Land Commission for dredging about 117,000 cu.yd. at Lynn Harbor.

Dredging—Boston, Mass.—Bids were received for dredging 15,000 cu.yd. at Pleasant Park Yacht Club, Winthrop, from: Eastern Dredging Co., 30c. per cu.yd.; $4500 (total); Bay State Dredging Co., 28c. per cu.yd.; $4200 (total).

Memorial—Cambridge, Mass.—The members of the Christian Science Church, Boston, will erect a monument as a memorial to Mary Baker G. Eddy in Mt. Auburn Cemetery. The estimated cost is $110,000.

Dredging—Boston, Mass.—The Board of Harbor and Land Commissioners has awarded the contract for dredging about 24,000 cu.yd. in Plymouth Harbor to the EASTERN DREDGING CO., 172 Condor St., East Boston, Mass., at (a) $0.259 per cu.yd., (b) $0.1925 per cu.yd., (c) $9.50 per cu.yd. Other bidders were: John H. Gerrish, (a) $0.277, (b) $0.227; (c) $8; Bay State Dredging Co., Ltd., (a) $0.38; (b) $0.203; (c) $8; John R. Burke, (a) $0.305; (b) $0.24; (c) $10. William F. Williams is Ch. Engr.

Motor Fire Apparatus—Everett, Mass.—Bids will be received until July 14 by the Fire Commissioners for the purchase of an auto pumping engine. Frank D. Terry is Chn. of Fire Comr.

Harbor Improvement—Providence, R. I.—The State Harbor Improvement Commission has approved the plans of William D. Bullock, Ch. Engr., for the development and improvement of the harbor, also the entrance to Seekonk River. Noted May 6.

✚**Mausoleum**—New York, N. Y.—(Borough of Bronx)—The contract for the construction of a one-story mausoleum at Woodlawn Cemetery has been awarded to the HEDDEN CONSTRUCTION CO., 52 Vanderbilt Ave., at about $75,000. John R. Hegeman, 1 Madison Ave., is the owner.

Field House—New York, N. Y.—(Borough of Brooklyn)—(Official)—The following are the bids received by George W. Wingate, Room 527, Municipal Bldg., for the general construction and completion of a field house at the Betsy Head Memorial Playground, Brownsville, Brooklyn: T. J. Buckley, 303 Fifth Ave., New York, $14,995; B. Diamond, $15,300; H. C. Stowe Construction Co., $16,889. Noted June 24.

Playground—New York, N. Y.—(Borough of Brooklyn)—Albert Brown, 90 Taylor St., is interested in a project to establish a playground on Taylor St. near Kent Ave.

Razing Buildings—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by the Public Service Commission, 154 Nassau St. (Borough of Manhattan), until noon, July 9, for the wrecking of eight buildings.

✚**Dredging**—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for dredging for the Riverside Park improvement, West 87th St. to West 93rd St., North River, has been awarded to H. DU BOIS, 17 State St., at 13c. per cu.yd. Noted June 17 and July 1.

Fire Hose—New York, N. Y.—(Borough of Manhattan)—(Official)—The following are the bids received by Robert Adamson, Fire Comr., Municipal Bldg., for furnishing and delivering cotton rubber lined fire hose: (a) 20,000 ft. of 2½ in.; (b) 10,000 ft. of 1½ in.; (c) total: Empire Rubber & Tire Co., 19 Warren St., New York, (a) $10,396; (b) $3380; (c) $13,756; B. F. Goodrich Co., (a) $12,400; (b) $3700; (c) $16,200; Manhattan Rubber Mfg. Co., (a) $10,726; (b) $2622; (c) $14,348. Noted June 24.

Motor Fire Apparatus—New York, N. Y.—(Borough of Manhattan)—(Official)—The only bid received by Robert Adamson, Fire Comr., for furnishing and applying 26 two-wheel gasoline-driven tractors, 16 for fire engines and 10 for hook and ladder trucks, was from the Front Drive Motor Co., Willow Ave., Hoboken, N. J., at $84,500. Noted June 17 and 24.

Open-Hearth Rails—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by the Public Service Commission, 154 Nassau St., until 12:15 p.m., July 16, for furnishing open-hearth rails for use in construction of the Rapid Transit Railroads.

Removal of Street Encroachments—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by C. B. J. Snyder, Supt. of School Bldgs., Park Ave. and 59th St., for the removal of street encroachments, etc., at Lexington Ave. and 86th St.

Subway—New York, N. Y.—(Borough of Manhattan)—According to press reports the Queensboro subway will be extended to the Grand Central Station. The Board of Estimate has appropriated $25,000 toward this purpose.

✚**Screen Work**—New York, N. Y.—(Borough of Richmond)—(Official)—The contract for furnishing and installing certain screen work on the windows and balconies of various buildings of the Sea View Hospital has been awarded to the THERIAULT MFG. CO., 946 Flatbush Ave., Brooklyn, at $12,-939. Noted June 17 and July 1.

✚**Motor Fire Apparatus**—Camden, N. J.—The City Council has awarded the following contracts for new fire equipment: JAMES BOYD & BROS., Philadelphia, pumping engine and hose wagon, $7543, 85-ft. aërial truck, $10,693, and city service truck, $5593; COMMERCIAL TRUCK CO., five tractors for present equipment and motorizing five combination wagons, $15,600. Noted Feb. 4 and 18.

Park Improvements—Camden, N. J.—A bond issue of $50,000 has been issued by the City Council for the purpose of improving the parks.

Monument and Park Extensions—Harrisburg, Penn.—The Governor has approved of appropriating $300,000 for extensions to Capital Park, and $50,000 for a monument to Gen. Meade.

✚**Dam**—Lock Haven, Penn.—The contract for constructing a portion of storage Dam No. 1 on McElhattan Run, Wayne Township, has been awarded to CHARLES DUGAN, Williamsport. H. P. Shoemaker is City Engr.

Subway—Philadelphia—Penn.—According to press reports work will be started about Aug. 1 on the construction of the proposed Broad St. Subway. A. M. Taylor is Dir., Dept. of City Transit. Noted Mar. 11 and 18.

Mausoleum—Reading, Penn.—The Pennsylvania Mausoleum Co. will erect a one-story mausoleum, 100x110-ft., at Memorial Park, to cost about $170,000. D. M. Rottenberger, Lancaster, Penn., is Arch.

Bank Protection—Augusta, Ga.—The Simons-Mayrant Co., Charleston, S. C., at $17,275, submitted the lowest bid for bank protection at Augusta.

Drainage—Savannah, Ga.—The City Council is considering the establishment of a drainage district. The estimated cost is $400,000.

Drainage—Hastings, Fla.—A drainage district, east of the boulevard will be formed embracing 5000 acres.

Harbor Channel and Piers—Miami, Fla.—The city has voted favorably on the issue of bonds for a deep-water channel and a basin with piers, etc. Arrangements are now being made for the sale of the bonds, and bids for construction work probably will be asked in August. The work is under the direction of the Harbor Committee of the City Council. Isham Randolph, Chicago, is Consult. Engr.

✚Levee Work—Vicksburg, Miss.—The contract for about 519,000 cu.yd. of levee work from Opossum Point to Wilson Point, has been awarded by the Mississippi River Commission of the Third District to N. C. WILLIAMSON & CO., Milliken, La., at 1487c. per cu.yd.

Drainage—White Castle, La.—The citizens have voted $60,000 in bonds for the construction of a drainage system. Danby & Waddill, New Orleans, has prepared plans. S. M. Levy is Secy. of the Drainage Dist.

✚Drainage—Selmer, Tenn.—According to press reports the contract for the construction of the Big Owl Creek Drainage Canal, in the southern portion of McNairy County, has been awarded to the TUPELO DREDGING CO., Tupelo, Miss., at 66⅔c. per cu.yd. Noted Apr. 29.

Ditch—Canton, Ohio—Bids will be received by C. L. Stoner, County Clk., until July 21, for constructing Domer Ditch in Canton.

Bathhouse—Cincinnati, Ohio—Bids will be received until noon, July 13, by Philip Fosdick, Dir. of Pub. Ser., City Hall, for the construction of a bathhouse at Spring and East 13th St. Noted Apr. 8.

Iron Fencing—Cleveland, Ohio—See item under "Bridges."

✚Steamer Improvements—Cleveland, Ohio—The contract for the improvement of four steamers of the Erie Line has been awarded to the AMERICAN SHIPBUILDING CO., 2017 Superior Viaduct, Cleveland, Ohio. Estimated cost, $60,000.

Revetment Wall—Columbus, Ohio—Bids will be received by John I. Miller, State Supt. of Pub. Wks., until July 12 for constructing concrete revetment wall along the south shore of Indian Lake.

Ditch—Defiance, Ohio—The citizens will vote July 19, on the question of issuing $17,500 in bonds for constructing Dry Creek Ditch No. 434. Roger Daoust is County Audr. Noted Mar. 18.

Ditch—Sidney, Ohio—The city plans to sell $24,200 in bonds for ditch improvements. George P. Staley is County Audr.

Levee Work—Alton, Ill.—It is reported that bids will be received by the East Side Levee and Sanitary District Board until July 12 for completing the levee front along the Mississippi River. The work requires about 800,000 cu.yd. of material.

Pumping Station—Quincy, Ill.—Bids will be received until July 21 by the Board of Supervisors of Fabrius River Drainage District, Illinois State Bank of Quincy, for the construction of a steam-driven pumping plant, containing two 42-in. centrifugal pumps, normal capacity 46,000 gal. per minute against a maximum static pumping head of 15 ft.

Jail Equipment, Etc.—Butte, Mont.—The County Commissioners have decided to hold an election on July 27, for the purpose of voting $100,000 in bonds for the installation of jail equipment in the court house and for improving the grounds.

Dike and Sluiceway—Myers, Mont.—Bids will be received until 2 p.m., July 15, by the Directors of the Rancher Ditch Co., for the construction of a brush-filled dike and concrete sluiceway. J. O. Crandall is Secy.

Improvement to Creek—Kansas City, Mo.—Curtis Hill, City Engr., has completed plans for carrying off the flood waters of Turkey Creek. If these plans are accepted by the City Council it will be necessary to raise the railroad tracks in several places from three to six feet. The work would cost about $400,000.

Drainage—Corpus Christi, Tex.—It is reported that the citizens have voted $158,000 in bonds for the drainage of about 96,000 acres.

Dry Dock—Galveston, Tex.—According to press reports work will soon be started on the construction of a dry dock. Estimated cost, $500,000.

Drainage—Victoria, Tex.—At an election held June 23 the city voted in favor of the question of issuing $190,500 in bonds, the proceeds of which will be used for the construction of a drainage system in Victoria County Drainage District No. 3. Noted Feb. 11 and June 24.

Sea Wall—Seattle, Wash.—Bids will be received about July 13 for the construction of a sea wall along Railroad Ave. Estimated cost, $92,083. A. H. Dimock is City Engr. Noted Apr. 1.

✚Dredging—Los Angeles, Calif.—The Harbor Commission has awarded the contract for dredging 115,000 cu.yd. at municipal dock No. 1, to the STANDARD AMERICAN DREDGING CO., at $37,869.

Levees—Sacramento, Calif.—The State Corporation Commissioner has granted permission to the West Side Levee Co. to sell $150,000 in bonds for reconstructing levees from Knights Landing to Colusa. E. L. Low is interested.

Ship Yard—Stockton, Calif.—The Island Transportation Co. has purchased Wood Island and plans to construct a ship yard to cost about $50,000. Capt. Benjamin Walters is interested.

✚Lake—St. John, N. B.—The contract for the construction of an artificial lake adjacent to the Jordan Memorial Sanitarium has been awarded by the Commissioners to F. L. BOONE, St. Mary's, York, N. B., at about $20,000.

Improvements to Creek—Ridgeville, Ont.—Bids will be received by A. N. Armbrust, Clk., until July 16 for widening, deepening and straightening Disher Creek. The contract will be let as a whole or in sections. L. A. Kinnear is Township Engr.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous."

Amherst, Mass.—Bids are being received by James T. Ritchie, Arch., 8 Beacon St., Boston, Mass., for the construction of a 2½-story building for the Massachusetts Agricultural College. The estimated cost is $60,000.

✚Andover, Mass.—The contract for the construction of a 12-story, 48x60-ft. fraternity house for the A. U. V. Fraternity, Andover Academy, has been awarded to L. E. LOCKE, Bay State Bldg., Lawrence, Mass. Codman & Despradelle, 31 Beacon St., Boston, Mass., is Arch. The estimated cost is $40,000.

Boston, Mass.—Bids will be received by John F. Keliher, State House Bldg., 505 State House, until noon, July 27, for the construction of an addition to the State House.

✚Dalton, Mass.—The contract for the construction of a $50,000 school addition has been awarded to JOHN DWYER. C. G. & E. C. Gardner, 33 Lyman St., Springfield, Mass., is Arch. George Allen is Supt. of Schools.

East Providence, R. I.—Plans have been prepared by John F. O'Malley, 75 Westminster St., Providence, R. I., for the construction of a naval armory for the Fourth Division of the Rhode Island Naval Battalion.

Providence, R. I.—Revised bids will be received by William R. Walker & Sons, 17 Custom House St., for the construction of a three-story, 90x125-ft. theater for the Empire Realty Co. The estimated cost is $125,000.

★Albany, N. Y.—Bids will be received until noon, July 27, by the Trustees of Public Buildings, Executive Chamber, Capitol, Albany, for the construction of additions and alterations to the State House on Eagle St. The estimated cost is $350,000. Lewis F. Pilcher, Capitol, Albany, is State Arch. Noted Apr. 1 and May 6.

Buffalo, N. Y.—Bids will be received until July 9 for the construction of a hospital. The estimated cost is $600,000. A. Myer, White Bldg., is Chn. of City Hospital Comrs. Noted Apr. 24.

Harrison, N. Y.—Bids will be received until 3 p.m., July 10, by the Board of Education, for the construction of a high and grade school on Macon St. Peabody, Wilson & Brown, 389 Fifth Ave., New York, is Arch. Estimated cost, $40,000. Noted May 13.

New York, N. Y.—(Borough of Brooklyn)—The Directors of the Williamsburgh Hospital plan to construct a six-story building at South Ninth St. and Driggs Ave. The estimated cost is $150,000. Jacob Dangler and Hugh DeHaven are Dirs.

New York, N. Y.—(Borough of Manhattan)—Plans have been prepared by Gronenberg & Leuchtag, Arch., 303 Fifth Ave., for the construction of a six-story, brick and terra cotta apartment house at St. Nicholas Ave. and 157th St. for the Lehigh Building Co. The estimated cost is $215,000.

✚New York, N. Y.—(Borough of Manhattan)—The contract for the construction of a one-story, 125x165-ft. brick and terra cotta market house at Broadway and 95th St. for Vincent Astor has been awarded to JAMES McWALTERS & SON, INC., 1493 Broadway, New York. Estimated cost, $150,000. Noted June 17.

✚New York, N. Y.—(Borough of Manhattan)—The contract for the construction of the Central Club for Nurses at 132-138 East 45th St. for the Y. W. C. A., has been awarded to the WHITNEY CO., 1 Liberty St., New York. The estimated cost is $400,000. Parish & Schroeder, 12 West 31st St., is Arch. Noted June 10.

New York, N. Y.—(Borough of Manhattan)—Julius Tishman & Sons has purchased a site at 156-164 East 79th St. upon which to construct a 13-story apartment house.

✚New York, N. Y.—(Borough of Manhattan)—The CHARLES MEAD & CO., 38 Park Row, New York, has been awarded the general contract for the alterations to the Metropolitan Hospital, Blackwells Island. Estimated cost, $50,000. Charles B. Meyers, 1 Union Sq., is Arch. Noted June 3.

✚New York, N. Y.—(Borough of Manhattan)—The WHITNEY CO., 1 Liberty St., New York, has been awarded the contract for the construction of the Central Y. W. C. A. building at 53d St. and Lexington Ave. Estimated cost, $350,000. Donn Barber, 101 Park Ave., is Arch. Noted June 10.

Troy, N. Y.—Bids will be received about July 15 by Louis N. Milliman, Arch., Stoll Bldg., for the construction of a two-story, 150x300-ft. building for Rensselaer County Tuberculosis Hospital.

Troy, N. Y.—Bids are being received by W. E. Clark, Arch., Cannon Pl., for the construction of a two-story, 30x61-ft. nurses' home for Leonard Hospital. The estimated cost is $60,000. Noted Dec. 3.

Utica, N. Y.—Bids will be received until 8 p.m., July 13, by Frank P. Winant, Pres., of Bd. of Education, for the construction of a two-story, 128x200-ft. grade school at Warren and Court St. The estimated cost is $120,000. George & Ames, 70 Genesee St., is Arch. Noted Apr. 15 and May 6.

Elizabeth, N. J.—Plans have been prepared by C. Godfrey Poggi, Arch., 2 Julian Pl., for the construction of the Elmora Public School on Magie St. The estimated cost is $52,000. Noted Apr. 22.

✚Newark, N. J.—The contract for the construction of an administration building in Branch Brook Park for the Essex

County Park Commission has been awarded to the E. M. WALDRON CO., 84 South Sixth St., Newark, at $62,271. Noted June 3 and July 1.

+Newark, N. J.—The general contract for the construction of a school on Oliver St. has been awarded to FREDERICK FATZLER, 810 Broad St., Newark, at $63,341. Noted Feb. 18 and May 13.

+Ridgewood, N. J.—ARTHUR McMULLEN CO., 149 Broadway, New York, N. Y., and the CORNING BUILDING & CONSTRUCTION CO., Corning, N. Y., have been awarded the general contract for the construction of a station on Ridgewood Ave. for the Erie R.R., 50 Church St., New York, N. Y. Estimated cost, $160,000.

Elizabethtown, Penn.—Bids are being received by Guy King & Co., Arch., 1513 Walnut St., Philadelphia, for the construction of a three-story, 35x100-ft. hospital for the Philadelphia Free Masons. Noted June 3.

Lansford, Penn.—Bids will be received until July 15 by John T. Simpson, Civil Engr., Essex Bldg., Newark, N. J., for the construction of a school. The estimated cost is $50,000.

Philadelphia, Penn.—(Official)—Bids will be received until 1:30 p.m., July 9, by the Property Committee of the Board of Education for the construction of a school at 65th Ave. and Lime Kiln Pike, East Germantown. Noted June 24.

+Philadelphia, Penn.—The general contract for the construction of a one- and two-story recreation building at Price and McMahon St. has been awarded to F. W. VAN LOON, Denckla Bldg., Philadelphia, at $87,971. Noted July 1.

Philadelphia, Penn.—Plans are being prepared by Horace Trumbauer, Arch., Land Title Bldg., for the construction of a two-story, 190x300-ft., brick building at 33rd and Wallace St. for the Philadelphia Skating Rink Co.

Pittsburgh, Penn.—Bids will soon be received for the construction of a community house for the First United Presbyterian Church on Perrysville Ave. The estimated cost is $300,000.

Pittsburgh, Penn.—Plans have been prepared by E. B. Lee, Arch., Pittsburgh Savings Bank Bldg., for the construction of an eight-story addition to the Pittsburgh Hospital. The estimated cost is $125,000. J. B. Lawler, East End Savings & Trust Bldg., is Secy., Bd. of Trustees. Noted Apr. 15.

+Rankin Station, Penn.—(Braddock post office) — The HODDER CONSTRUCTION CO., Braddock, has been awarded the general contract for the construction of a two-story school. The estimated cost is $75,000.

Wilmington, Del.—Bids will soon be received by the Board of Education for the construction of a four-story, 85x133-ft. school. The estimated cost is $150,000. Wallace E. Hance, 204 West 24th St., is Arch. Noted May 6.

+Baltimore, Md.—The general contract for the construction of a church for St. Luke's congregation has been awarded to C. C. WATTS, 113 West Hamilton St., Baltimore. Estimated cost, $50,000. Rev. Atville Connor, 1118 Penrose Ave., is Pastor.

Baltimore, Md.—The members of the City Club contemplate the construction of a store, office and club building. The estimated cost is $250,000.

Abington, Va.—Plans have been prepared by R. H. Hunt, Arch., James Bldg., Chattanooga, Tenn., for the construction of buildings at Stonewall Jackson College. The estimated cost is $125,000. W. M. Hunter, Williamsburg, is interested.

+Charlottesville, Va.—The University of Virginia has awarded the contract for the construction of a hospital to the KING LUMBER CO., Charlottesville. Estimated cost, $50,000. Noted Apr. 8.

Lexington, Va.—Tentative plans have been prepared by Bertram G. Goodhue, Arch., 2 West 47th St., New York, for the construction of the Jackson Memorial Hall at Virginia Military Institute. Estimated cost, $80,000.

Roanoke, Va.—Plans are being prepared by N. T. Wingfield, Arch., Charlottesville, for the construction of a brick and stone building for the Melrose Baptist Church. The estimated cost is $50,000.

Ashland, W. Va.—An election will soon be held to vote on the question of issuing $125,000 in bonds. The proceeds will be used for the construction of a city hall, jail and market house.

Berkeley Springs, W. Va.—According to press reports a site has been purchased upon which a hotel will be constructed estimated to cost $100,000. Alexander McNeil is interested.

+Charleston, W. Va.—The Woodrum Home Outfitting Co. has awarded the contract for the construction of a six-story reinforced-concrete building to C. W. McNULTY, Huntington. Estimated cost, $85,000.

Fairmont, W. Va.—Henry Schmulbach, Wheeling, plans to construct a five-story brick building at Madison St. and Park Ave. The estimated cost is $75,000.

+Glenville, W. Va.—LONGEST & TESSIER, Greensboro, N. C., has been awarded the contract for the construction of a dormitory at the State College. Estimated cost, $40,000. Noted June 10.

+Huntington, W. Va.—The contract for the construction of a Science Hall at Marshall College has been awarded to LONGEST & TESSIER, Greensboro, N. C., at $48,600. Noted June 10.

+Morgantown, W. Va.—The contract for the construction of Mechanical Hall and School of Medicine at the West Virginia University has been awarded to P. Q. SHRAKE & SON, New Matamoras, Ohio, at $57,000. Noted June 10.

Camden, S. C.—Henry Savage, Camden, and Joseph B. Cocker, Boston, Mass., plan to construct a bank and office building at Broad and DeKalb St. Estimated cost, $40,000.

Pacolet, S. C.—The Pacolet Mfg. Co. plans to expend about $125,000 for the construction of buildings. V. M. Montgomery is Pres.

Albany, Ga.—Bids will be received about July 15 for the construction of an auditorium. The estimated cost is $45,000. Noted June 24.

Savannah, Ga.—An election will soon be held to vote on the question of issuing $400,000 in bonds, the proceeds of which will be used for the construction of schools.

Seabreeze, Fla.—Plans have been prepared by Mark & Sheftall, Arch., 210 Clark Bldg., Jacksonville, for the construction of a two-story, 70x144-ft. fireproof school. The estimated cost is $50,000.

+Tampa, Fla.—LOGAN BROS., Tampa, has been awarded the contract for the construction of two junior high schools. The estimated cost is $40,000. Hagy & Parslow is Arch.

+Tampa, Fla.—The Board of Public Instruction has awarded the contract for the construction of the Tampa Heights School to G. A. MILLER, Tampa. Estimated cost, $45,000.

Ybor City, Fla.—The Board of Public Instruction will award the contract July 19 for the construction of a 100x140-ft. brick school. The estimated cost is $40,000.

Anniston, Ala.—The members of Anniston Lodge No. 443, F. and A. M., plans to construct a seven-story, reinforced-concrete store, lodge and office building at Willmer Ave. and 11th St. The estimated cost is $75,000.

Clarksdale, Miss.—At a recent election the citizens voted in favor of the question of issuing $150,000 in bonds, the proceeds of which will be used for the construction of schools. Noted June 3.

Bogalusa, La.—An election will soon be held to vote on the question of issuing $200,000 in bonds, the proceeds of which will be used for the construction of schools, a city hall and jail.

Nashville, Tenn.—Contracts will be awarded about Aug. 1 for the construction of a three-story, 80x164-ft. brick and stone school to be known as the Elliott School. The estimated cost is $45,000. Noted June 11.

Louisville, Ky.—(Official)—Bids will be received until July 22 by Arthur Loomis and Julius Hartman, Arch., Todd Bldg., for the construction of a four-story, reinforced-concrete and terra cotta mercantile building on Fourth near Guthrie St. for the Speed Realty Co. Estimated cost, $200,000. Noted May 13.

Akron, Ohio—Bids will be received about July 15 by B. L. Bargar, Secy., State Armory Bd., New Hayden Bldg., Columbus, for the construction of a three-story, 115x165-ft. auditorium and armory. The estimated cost is $100,000. Harpster & Bliss, Nantucket Bldg., Akron, and Karl I. Best, Hayden Bldg., Columbus, are Assoc. Archs. Noted June 10.

Akron, Ohio—Plans have been prepared by Lauer & Young, Arch., I. O. O. F. Bldg., for the construction of a two-story church for the North Hill M. E. congregation. The estimated cost is $40,000. A. T. Foster, 16 West Tallmadge Ave., is Pastor.

+Akron, Ohio—The general contract for the construction of a one-story, 60x150-ft. church for St. Mary's Congregation has been awarded to the CARMICHAEL CONSTRUCTION CO., 526 Hamilton Bldg., Akron. The estimated cost is $75,000.

Athens, Ohio—F. L. Packard, Arch., 16 East Broad St., Columbus, is preparing plans for the construction of a dormitory for girls at the Ohio University. The estimated cost is $120,000. Alston B. Ellis is Pres.

+Bellaire, Ohio—R. R. KITCHEN & CO., 891 National Bank Bldg., Wheeling, W. Va., has been awarded the general contract for the construction of a three-story bank, office and apartment building for the Farmers and Merchants National Bank. The estimated cost is $40,000. Charles W. Bates, Wheeling, W. Va., is Arch.

Canton, Ohio—Preliminary plans are being prepared by William S. Epperson, Arch., 10 North Cleveland Ave., for the construction of a church for the Lutheran congregation. The estimated cost is $40,000. G. M. Schmucker, 722 Bluff Rd., is Pastor.

Cincinnati, Ohio—Bids will be received until noon, July 30, by the Commissioners of Hamilton County, Courthouse, Pioneer St. and Broadway, for alterations to the north wing of the City Work House, known as the "Women's Cell House" on Colerain Ave. Fred D. Wesselmann is Pres. of Hamilton County Comrs.

Cincinnati, Ohio—Plans are being prepared by Louis G. Ditto, Arch., 617 Provident Bank Bldg., for the construction of an addition to the club house of the Cincinnati Aerie of Eagles No. 142. Harry E. McVeigh is Chn.

+Cleveland, Ohio—The contract for the construction of an apartment building at 4311 Prospect Ave. for the Cleveland Realty Owners Co. has been awarded to the B. W. CONSTRUCTION CO., 10 South LaSalle St., Chicago, Ill. The estimated cost is $160,000. Noted May 20.

Cleveland Heights, Ohio—(Warrensville post office)—Bids will be received about July 15 by F. W. Striebinger, Arch., Euclid Bldg., Cleveland, for the construction of a four-story, 80x154-ft. building for the Cleveland Heights Masonic Temple Co. Estimated cost, $100,000. C. L. Murfey, National Commercial Bank Bldg., is Chn. of Finance Com. Noted Mar. 11.

+Columbus, Ohio—JOHN W. HECKERT, Ruggery Bldg., Columbus, has been awarded the general contract for the construction of a seven-story, brick store and office building at 60 Gay St. for the Peters Realty Co. The estimated cost is $100,000. Charles M. Peters, Gift and Curbertson St., is Pres. Noted Feb. 18.

Dayton, Ohio—Plans are being prepared by Pretzinger & Mussellman, Arch., for the construction of a brick lodge building on South Main St. for the Order of Eagles. Estimated cost, $70,000. Noted June 17.

Richwood, Ohio—Bids will be received about July 15 by G. M. Howard, Clk., Bd. of Education, for the construction of a two-story school. The estimated cost is $49,000. Noted under Richmond, Ohio, June 24.

+Steubenville, Ohio—JOHN METCALF, Fifth and Market St., Steubenville, has been awarded the general contract for the construction of a three-story, 48x180-ft. motion picture theater and office building for Frank Dementros, 114 South Fourth St. The estimated cost is $50,000. Noted Jan. 28.

Detroit, Mich.—Bids will be received until July 12 for the construction of a three-story club house for the B. P. O. E. No. 34. The estimated cost is $250,000. Harmon Hunt, Elks' Temple Bldg., is Chn. of Bldg. Com. Noted Feb. 11.

Grand Rapids, Mich.—The Grand Rapids Savings Building Co. plans to construct a 13-story office building at Monroe and Ionia Ave. Estimated cost, $400,000. William Alden Smith is Pres.

Grand Rapids, Mich.—The Trustees of Calvin College plan to construct a main building and dormitory. The estimated cost is $125,000.

Grand Rapids, Mich.—The Goodspeed Co. will construct an office building at Monroe Ave. and Pearl St. The estimated cost is $175,000.

Lake Linden, Mich.—The Board of Education of Fractional District No. 1, Schoolcraft and Torch Lake Townships, is considering the construction of a high school. The estimated cost is $100,000.

✚Chicago, Ill.—(Official)—The contract for the structural steel work for the freight house at Polk St., for the Pennsylvania R.R. has been awarded to the THOMPSON-STARRETT CO., Chicago, Ill. A. C. Shand, Philadelphia, is Ch. Engr.

✚Chicago, Ill.—JOHN GRIFFITHS & SON CO., 112 West Adams St., Chicago, has been awarded the general contract for the construction of a 12-story, fireproof office building at Dearborn and Randolph St. for E. Eiger & Bros., 1249 Wabash Ave. The estimated cost is $375,000. Noted Mar. 4.

✚Chicago, Ill.—The general contract for the construction of a theater, store and office building at Milwaukee and North Sawyer Ave. for G. H. Gotteschalk & Co., 111 West Washington St. has been awarded to OLSON BROS., 6200 Evans Ave., Chicago. The estimated cost is $130,000.

Chicago, Ill.—E. N. Bertha, 6 East Lake St., plans to construct an apartment house at Stony Island Ave. and 16th St. The estimated cost is $175,000.

Chicago, Ill.—The Birmingham & Seaman Co. will construct a seven-story, 100x150-ft. reinforced-concrete building at 411-23 West Orange St., between Orleans and Kingsbury St. The estimated cost is $140,000.

Danville, Ill.—Contracts will be awarded about Aug. 15 for the construction of a four-story, 75x150-ft. Masonic Temple. The estimated cost is $150,000. Noted June 24.

✚Joliet, Ill.—The general contract for the construction of a four-story, fireproof office building at Van Buren and Chicago St. for J. W. D'Arcy has been awarded to the WILLIAM CRILLY CO., 35 South Dearborn St., Chicago. The estimated cost is $125,000. Noted Mar. 4.

Moline, Ill.—At a recent election the citizens voted in favor of issuing $75,000 in bonds, the proceeds of which will be used for the construction of a high school.

Ottawa, Ill.—Plans are being prepared by Jason F. Richardson, Arch., for the construction of a 2½-story, 125x240-ft. building for the Illinois Valley Hospital. The estimated cost is $75,000.

Springfield, Ill.—The State Legislature has passed a bill appropriating $100,000 for the construction of a memorial building. Estimated cost, $1,000,000. Noted Dec. 24.

✚Chilton, Wis.—The contract for the construction of a church for St. Mary's congregation has been awarded to the IMMEL CONSTRUCTION CO. The estimated cost is $45,000.

Chippewa Falls, Wis.—Plans are being prepared by C. H. Johnston, Arch., 715 Capitol Bank Bldg., St. Paul, Minn., for the construction of a three-story administration building. The estimated cost is $50,000.

De Pere, Wis.—The Trustees of St. Norbert's College plan to construct a school. The estimated cost is $60,000.

Milwaukee, Wis.—The members of the University Club voted to purchase a site at Oneida St. and Juneau Ave. for the construction of a club house. The estimated cost is $225,000. Robert E. Friend is Chn. of Bldg. Com.

Milwaukee, Wis.—The Wisconsin National Guard contemplates the construction of an armory. The estimated cost is $50,000. D. A. Stearns, Monroe, is Col.

Milwaukee, Wis.—Plans are being prepared by R. Messmer & Bro., Arch., for the construction of a three-story, reinforced-concrete and brick hall for the Moritz Arndt Lodge, I. O. O. F. The estimated cost is $45,000. Noted May 2.

Stevens Point, Wis.—Bids will be received until July 31 by Van Ryn & De Gelleke, Arch., Caswell Blk., Milwaukee, for the construction of a three-story, 68x159-ft. brick dormitory at the State Normal School. The estimated cost is $85,000. William Kittle, Madison, is Secy., Bd. of Normal Regents. Noted May 13 and 27.

✚Ames, Iowa—The contract for the construction of a nurses' lodge at the Michigan Soldiers Home has been awarded to the HAUSER-OWEN AMES CO., Ames, at $66,030.

Armstrong, Iowa—The Joseph Bass Co., Faribault, Minn., submitted the lowest bid for the construction of a two-story school. Estimated cost, $50,000. William Stuart is Pres., Bd. of Education. Noted June 10.

✚Cedar Rapids, Iowa—The general contract for the construction of a one-story church for the Bohemian Presbyterian congregation has been awarded to BROWNS & MATTAS, Cedar Rapids. The estimated cost is $40,000. W. Jones, 30 North La Salle St., Chicago, Ill., is Arch.

Forest City, Iowa—(Official)—The Independent School District will not receive bids for some time for the construction of a three-story high school as mentioned in the issue of June 10. Noted May 6 and June 10.

Woodward, Iowa—(Official)—Bids will be received until July 14 by the Board of Control for the construction of buildings at the State Colony for Epileptics. The estimated cost is $500,000. Noted June 14.

Austin, Minn.—Kinney & Macomber, Arch., 1004 Plymouth Bldg., Minneapolis, is preparing plans for the construction of a one-story, 96x155-ft. school. The estimated cost is $40,000.

✚Fairmont, Minn.—The general contract for the construction of a two-story, brick high school has been awarded to the A. M. WOLD CONSTRUCTION CO., Brookings, S. D. The estimated cost is $135,000. C. A. Porter is Secy., Bd. of Education. Noted June 17.

Minneapolis, Minn.—The Board of Education plans the expenditure of $480,000 for the construction of schools. The buildings will include a 12-room addition to the John Ericson School, $75,000; a 12-room addition to Hiawatha School, $75,000; an eight-room addition to the Whitney School, $50,000; and an eight-room addition to the Corcoran School, $50,000.

✚St. Paul, Minn.—The contract for the construction of a three-story, reinforced-concrete and brick addition to St. Lukes Hospital has been awarded to the BOYD CONSTRUCTION CO., St. Paul. The estimated cost is $80,000. Noted Mar. 18.

Emporia, Kan.—Bids will be received until 1:30 p.m., July 12, for the construction of a three-story addition and alterations to the Masonic Temple. Charles W. Cleaver is Secy.

✚Winfield, Kan.—WILLIAM FRANKENFELD, Enid, Okla., at $52,500, has been awarded the general contract for the construction of a dormitory for St. John's College. A. W. Meyer is Pres. Noted Mar. 18.

✚Hastings, Neb.—C. D. RICHEY, Hastings, has been awarded the general contract for the construction of a building for the M. E. Church. The estimated cost is $60,000. Fulton & Butler, Uniontown, Penn., is Arch.

Omaha, Neb.—John H. Harte, 1609 Webster St., submitted the lowest bid on the general contract for the construction of a six-story, store and office building at 16th and Farnum St. for the Rose Realty Co., 210 State Bank Bldg. The estimated cost is $300,000. Noted Apr. 8.

Schuyler, Neb.—Plans are being prepared by Grabe & Helleberg, Arch., Columbus, for the construction of a two- and three-story high school. The estimated cost is $45,000. O. Luelow is Secy., Bd. of Education.

Yankton, S. D.—Bids will be received until July 15 by Miller, Fullenwider & Dowling, Arch., 6 North Michigan Ave., Chicago, Ill., for the construction of a two-story, 105x150-ft., fireproof high school. The estimated cost is $100,000. M. M. Bennett is Pres., Bd. of Education. Noted Feb. 25.

Miles City, Mont.—Bids will soon be received for the construction of a two-story addition to the high school. The estimated cost is $60,000. J. B. Collins is Clk., Bd. of Education. Noted June 3.

✚Jefferson City, Mo.—The general contract for the construction of the Missouri State Capitol has been awarded to JOHN GILL & CO., Citizens Bldg., Cleveland, Ohio. The estimated cost is $4,000,000. Cornelius Roach is State Secy.

Richmond, Mo.—Bids will soon be received for the construction of a two-story, 65x130-ft. church for the M. E. congregation. The estimated cost is $45,000. Eckel & Aldrich, Corby-Forsee Bldg., St. Joseph, is Arch.

✚St. Joseph, Mo.—The contract for the construction of a five-story, 41x162-ft. building for the Methodist Episcopal Deaconess Hospital has been awarded to the J. E. LEHR BUILDING & CONSTRUCTION CO., 1710 Fred Ave., St. Joseph. The estimated cost is $350,000. J. J. Bentley, Seventh and Jole St., is Chn. of Bldg. Com. Noted Mar. 18.

Beaumont, Tex.—Plans are being prepared by C. D. Hill & Co., Arch., Galveston, for the construction of a 60x145-ft. fireproof theater and office building at 500 Pearl St. for C. N. Blanchette and Lynn Gilbert. Estimated cost, $90,000.

El Paso, Tex.—Bids will be received about Aug. 1 by the Commissioners of El Paso County for the construction of a five-story courthouse. The estimated cost is $400,000. Trost & Trost is Arch. Noted May 6.

Tulsa, Okla.—R. F. Morley will construct a five-story reinforced-concrete building on Cincinnati Ave., between Third and Fourth St. Estimated cost, $100,000.

✚Albuquerque, N. M.—The contract for the construction of a Y. M. C. A. building has been awarded to J. W. McQUADE, Alburquerque, at about $57,000. Shattuck & Hussey, 19 South La Salle St., Chicago, Ill., is Arch. Noted June 24.

Reno, Nev.—The Reno Amusement Co. will construct a theater estimated to cost about $50,000. R. L. Fulton is interested.

Douglas, Ariz.—(Official)—Bids will be received about July 30 for the construction of two grade schools. Lescher & Kibbey, Arch., Phoenix, prepared the plans. Estimated cost, $70,,000. Noted June 3.

Florence, Ariz.—(Official)—Bids will be received about July 15 for the construction of the Florence Union High School. Lescher & Kibbey, Phoenix, is Arch. Noted June 3.

Olympia, Wash.—Watson & Vernon, Arch., Aberdeen, is preparing plans for the construction of a building at the Girls' Training School. Estimated cost, $45,000. Noted Mar. 25.

✚Portland, Ore.—The contract for the construction of a building at 12th and Taylor St. for the First Methodist Episcopal Church has been awarded to J. A. Backstrand, Portland. The estimated cost is $40,000. Noted May 6.

✚Hydepark, Calif.—H. M. BOWARD & SONS CO., 274 South Flower St., Los Angeles, at $43,682, has been awarded the contract for the construction of grammar school buildings at Hydepark. G. A. Howard, Jr., Brant Bldg., is Arch. Noted June 3.

✚Winnipeg, Man.—The Winnipeg School Board has awarded the contract for the construction of the two-story George V school in Elmwood to the WORSWICK BROS., 123 Hart St., Winnipeg, at $41,299.

✚Victoria, B. C.—The contract for the construction of an observatory on Little Saanich Mountain has been awarded to the McALPINE-ROBERTSON CO., Vancouver, at $75,000.

Moncton, N. B.—The Town Council will construct a city hall at an estimated cost of $50,000.

Contracts to Be Let

Bids received until Aug. 4, 1915.

Strauss Trunnion Bascule Bridge

Matawan, N. J.

Sealed proposals for the furnishing of all labor, tools and materials for the construction of a Strauss Bascule Trunnion Bridge, over Matawan creek, on the road from South Amboy to Keyport, in the County of Monmouth, State of New Jersey, in accordance with the plans and specifications prepared therefor and heretofore approved by the Board of Chosen Freeholders of the County of Monmouth, State of New Jersey, will be received by the Board of Chosen Freeholders of the County of Monmouth, at their rooms, Court House, Freehold, New Jersey, on Wednesday, August 4, 1915, at the hour of eleven o"clock, in the forenoon of said day, and then and there publicly opened and read.

All proposals must be submitted in a sealed envelope, be endorsed with the name and address of the bidder and the name of the work bid on.

Plans and specifications can be seen on any day, excepting holidays and Sunday, between the hours of nine a.m. and four p.m., at the office of Gerofe D. Cooper, County Engineer, 60 Broad St., Red Bank, New Jersey; at the office of the Clerk of the Board of Chosen Freeholders of the County of Monmouth, Chas. E. Close, 41 Main Street, Matawan, N. J.; and at the office of the Collector of the County of Monmouth, Court House, Freehold, N. J., or can be obtained upon application to the Strauss Bascule Trunnion Bridge Company, 104 South Michigan Avenue, Chicago, Ill.

All proposals must be accompanied by a certified cheque, drawn in the sum of five thousand dollars ($5000.00) to the order of the Collector of the County of Monmouth, New Jersey, or a bid bond, for said amount of five thousand dollars, given by a surety company authorized to do business in the State of New Jersey, to said Collector.

The Board of Chosen Freeholders of the County of Monmouth reserves the right to reject any or all bids, if deemed to the best interests of the County of Monmouth so to do.

Each bidder must submit with his or their bid a certificate that he or they have visited the location of the proposed work and have made themselves acquainted with the local conditions in connection therewith, and that his or their bid is submitted in strict compliance with the requirements of Chapter 253, Laws of New Jersey, 1913.

Any proposal not complying with the above requirements or the requirements of the specifications as to the submission of bids or proposals will not be considered by the Board of Chosen Freeholders of the County of Monmouth.

No proposals will be received before the hour advertised to receive same, nor will any proposals be received after the hour advertised to receive same.

J. M. CORLIES, Director of Board.

Attest:
C. E. CLOSE, Clerk of Board.

Bids received until July 27, 1915.

Public Highway

DEPARTMENT OF PUBLIC FINANCES.
Accounting Division, City of New Orleans.
New Orleans, La., June 23rd, 1915.

Pursuant to Ordinances Nos. 2440 and 2453 C. C. S., sealed proposals will be received at this office until the hour of 11 o'clock A.M., Tuesday, July 27th, 1915, for the construction of a public highway from a point connecting with the existing Chef Menteur Road, in the vicinity of Chef Menteur, and thence to the Rigolets, in accordance with plans and specifications on file in the office of the City Engineer. Deposit $1000.00 with the City Treasurer, and his receipt enclosed with bid. Bond in an amount equal to twenty-five per cent. of the estimated cost of the work based on the price bid in the proposal. The City Engineer will furnish bidders with a blank form of proposal; no proposal will be considered unless submitted on such form. Bidders must have paid their City License in order that their bids may be accepted.

The City reserves the right to reject any and all bids.

A. G. RICKS, Commissioner.

Bids received until July 13 and 15, 1915.

Highway Work

OFFICE OF THE STATE COMMISSION OF HIGHWAYS,
Albany, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p.m. on Tuesday, July 13th, 1915, for the improvement of highways in the following counties and also for the following repair contracts:

Broome (approx. 3.15); Chenango (2 highways 7.78; 4.02); Jefferson (2 highways 2.86; 2.40); Lewis (3 highways 2.00; 8.82; 1.27); Montgomery (approx. length 7.10); St. Lawrence (approx. length 5.50); Schoharie (approx. length 4.79); Schuyler (two highways 6.03; 1.11); Steuben (3 highways 9.09, 3.42, 7.31); Sullivan (approx. length 0.72); Tompkins (approx. 3.04); Westchester (approx. length 4.32); Wyoming (2 highways 1.53; 6.99); Delaware, 1 contract (resurfacing); Ontario, 1 contract (resurfacing); Suffolk, 1 contract (resurfacing).

Sealed proposals will also be received by the undersigned at their office, No. 55 Lancaster Streeet, Albany, N. Y., at 1 o'clock p.m. on Thursday, July 15th, 1915, for the construction and repair of highways in the following counties:

Broome, 1 highway (approx. length 0.91); 1 contract (resurfacing); Cattaraugus (approx. length 0.93); Chautauqua, 4 highways (1.51; 0.77; 3.55; 0.93); Cortland (approx. length 0.23); Erie, 2 highways (0.34; 0.59); Fulton (approx. length 2.12); Monroe, 1 highway (approx. length 1.53); 3 contracts (resurfacing); Montgomery (approx. length 3.81); Nassau (approx. length 1.57); Onondaga (approx. length 0.27); Ontario (approx. length 1.38); Otsego, 2 highways (12.66; 2.52); Rockland (approx. length 2.95); Suffolk (approx. length 3.25); Ulster (approx. length 2.97); Warren (approx. length 5.13); Steuben County (1 highway, approx. length 1.72 miles).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the Division Engineers in whose divisions the roads are to be constructed or repaired. The addresses of the Division Engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "Information for Bidders" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY, Commissioner.

IRVING J. MORRIS, Secretary.

Bids received until Aug. 3, 1915.

Sewerage Construction

Paducah, Ky., June 28th, 1915.

Sealed proposals, endorsed "Proposals for Outfall Sewer, District No. 3, Contract No. 1," will be received by the Commissioner of Public Works, of the City of Paducah, at his office in the City Hall, until 10 A.M., Standard time, on Tuesday, August 3rd, when they will be publicly opened.

The work for which tenders are invited consists of completely constructing about 1650 feet of 10′ by 12′ horse-shoe conduit of reinforced concrete, or of brick, or of both materials.

Copies of information for bidders, proposal forms, contracts, specifications and contract drawings are on file in the office of the Commissioner of Public Works, and may be obtained upon deposit of Ten Dollars ($10.00), which sum so deposited will be refunded if said documents are returned within ten days following the opening of bids. Each bid must be accompanied by a certified check for Two thousand dollars ($2,000.00).

The Commissioner of Public Works reserves the right to reject any or all proposals and to waive informalities.

Payments will be monthly to the extent of 85% of the estimate of work accomplished, including an allowance for a reasonable stock of material on the work.

L. A. WASHINGTON,
Commissioner of Public Works.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

An Important Inquiry—The Public Service Commission, purchasing for the city of New York, will place the largest order for ties, ballast and rails and other track accessories for the new subway and elevated lines of the Dual System, that has ever been given by an American municipality. An idea of the magnitude of these contracts is obtained by the fact that the orders cover about 35,000 tons of 100-lb. open hearth rail; about 3000 tons of rolled manganese rail; over 1,000,000 tie plates; about 356,000 cu.yd. of broken stone ballast, and 30,000,000 ft. of ties and timber.

Besides the saving in cost to the city by placing the orders at the prevailing low prices, it is expected that considerable saving will be made in the handling of the material, in that the supply contractor is required to deliver the material directly to the contractors who will lay the track, thus eliminating any necessity for a city store yard.

The Commission is already advertising the contract for open hearth rail, bids for which will be opened July 16, and it is expected that advertisements will be ordered for bids to be opened by the end of July for the supply of the balance of the track materials.

The new materials are needed for the track-laying on all lines of the Dual System except the Fourth Ave. subway in Brooklyn and the Center St. Loop subway in Manhattan, which have been already equipped and the New Utrecht Ave. elevated line in Brooklyn for which the materials have been ordered. On the new lines of this system, to be owned by the city, there will be approximately 260 miles of single track railroad. In the Fourth Ave. subway and the Center St. Loop there are approximately 30 miles of single track, and as these tracks have already been laid there remains to be equipped about 230 miles upon other lines.

RAILWAYS—STEAM AND ELECTRIC

New York—New York State Ry.—This company plans to expend $200,000 for trackage improvements in Syracuse. B. E. Tilton, Syracuse, is Gen. Mgr.

Maryland—Cumberland Valley R.R.—According to press reports, this company plans to make extensive improvements, to include yards, at Hagerstown, Md. J. H. Tonge, Chambersburg, Penn., is Supt.

Virginia—Patrick Hogan, High Knobs, Va., is interested in the construction of a railway from Norton to High Knobs, about five miles.

Virginia—Lynchburg Traction & Light Co.—Plans are being prepared by this company to double-track its line on Main St., Lynchburg. J. W. Hancock, Lynchburg, is Gen. Mgr. and Pur. Agt.

West Virginia—Cherry River Southern Ry.—This company is securing the right-of-way and is making preliminary arrangements for the construction of its proposed railway from Curtin to Bays, W. Va., about 42 miles. E. H. Venable, Charleston, W. Va., is Ch. Engr. Noted Oct. 29.

West Virginia—Weston & Glenville Electric Ry.—Surveys are being made by this company for the construction of its proposed railway from Weston to Glenville. Lloyd Rinehart, Weston, is interested. Noted Oct. 22.

North Carolina—The Graham Lumber Co. is having surveys made for the construction of a railway from Murphy, N. C., to the timber lands of the company. W. C. Sandblin, Andrews, N. C., is Engr.

✚**North Carolina**—Linville River Ry.—This company has awarded a contract to W. S. WHITING, Elizabethton, Tenn., for the construction of a railway from Montezuma to Fascoe, N. C., about 12 miles.

Georgia—East Georgia Ry.—This company has been granted a charter to construct an interurban railway from Glenville to Adabelle, about 30 miles, with a branch from Hagan to Claxton. H. P. Talmage, C. J. Baldwin and E. Leffler are among the incorporators. Noted Apr. 8.

Florida—Orlando Interurban Traction Co.—According to press reports this company has abandoned the project to construct an electric railway to connect Orlando, Kissimmee and Sanford. Noted Apr. 17, 1913.

Florida—The Southern Investment Co. contemplates the construction of a railway from Placida to Venice, Fla., about 22 miles. Langbourne M. Williams, Richmond, Va., is Pres.

Alabama—Lauderdale Power Co.—This company has been incorporated to construct an electric railway from Florence to Huntsville, Ala., about 75 miles. Alan Jemmison, Birmingham, is Pres. Noted Mar. 25.

Louisiana—The Cady Lumber Co., McNary, La., is having surveys made for the construction of a railway to connect with the Texas & Pacific and the Rock Island lines at Lamourie, La.

Tennessee—Knoxville Ry. & Light Co.—Plans are being considered by this company to reconstruct its line on Cumberland Ave., from Ninth St. to the city limits of Knoxville. T. C. Kelly, Knoxville, is Supt. Ry.

✚**Tennessee**—Tennessee Ry.—A contract has been awarded by this company to J. C. RODES & CO., Franklin, for the extension of its line toward Petros, Tenn., about 11 miles.

✚**Kentucky**—Louisville & Nashville R.R.—This company has awarded a contract to GRANT MASON, Pineville, Ky., for the extension of its Martins Fork to Grays Branch.

Ohio—Dennis Dwyer, Dayton, is interested in the construction of an electric railway from Dayton to St. Marys.

Indiana—Evansville & New Harmony Traction Co.—This company has arranged with the M. A. Peoples Co., Chicago, Ill., for financing and constructing its proposed electric railway from Evansville to New Harmony, Ind., about 30 miles. C. J. Seibert, Evansville, is Gen. Mgr. Noted Dec. 3.

Illinois—Lincoln Ry. & Light Co.—Plans are being considered by this company for the reconstruction of its line on Union St. from Broadway to Tremont St. A. R. Thomas, Lincoln, is Mgr., Pur. Agt. and Supt.

Kansas—Hutchinson Interurban Ry.—The City Council of Hutchinson has granted a franchise to this company to extend its line on Second St. from Main St. to a point east of Walnut St. James E. Humbert, Hutchinson, is Gen. Mgr. and Pur. Agt. Noted July 1.

Kansas—Newton, Kansas & Nebraska Ry.—This company has been granted permission by the Kansas Public Utilities Commission to issue stock for the construction of its proposed railway from Newton through Harvey, McPherson, Dickinson, Saline, Clay and Washington Counties, about 142 miles.

Missouri—United Rys.—Plans are being prepared by the company for the reconstruction of its line on Olive St. from 14th St. to Boyle Ave., St. Louis. Robert McCulloch, St. Louis, is Pres., Gen. Mgr. and Pur. Agt.

Arkansas—According to press reports, A. V. Alexander, 317 West Second St., Little Rock, is interested in the construction of a railway from Yellville, Ark., to the Rush Creek mining district, about 14 miles.

Arkansas—Cache Valley R.R.—A movement has been started by the Chamber of Commerce of Paragould, Ark., to purchase this company's line, running from Sedgwick to Light, Ark., and to extend it to Paragould.

Arkansas—Cotton Plant & Southwestern R.R.—Plans are being considered by this company for the construction of a railway from Cotton Plant to Kramer, about 25 miles. E. C. Nelson and W. R. Satterfield, Helena, Ark., are interested.

Arkansas—Hoxie Electric Ry.—This company is preparing plans to revive the project to construct an electric railway from Hoxie to Calico Rock, Ark. J. W. Myers, Calico Rock, is interested. Noted Mar. 4.

Arkansas—Intercity Terminal Ry.—This company has been incorporated to construct an electric railway from Little Rock to Argenta, Ark. C. C. Kavanaugh is Pres., E. W. Jackson, Vice-Pres., and F. J. Schmutz, Secy.

✚**Arkansas**—Ozarks Ry.—The BLODGETT CONSTRUCTION CO., Kansas City, Mo., has been awarded the contract by this company for the construction of its railway from Mountain Home to Rothville townsite, about 15 miles.

Texas—Brownsville St. Ry.—Plans are being considered by this company for the extension of its line in Brownsville to a connection with the Rio Grande R.R. It is reported that the Rio Grande R.R., which runs from Brownsville to Point Isabel, about 22 miles, will be rehabilitated and equipped for electric transit.

Texas—Corpus Christi Ry. & Light Co.—This company proposes to extend its lines over a distance of four miles. D. R. Locher is Gen. Mgr.

Texas—Corpus Christi-Ward Island Interurban Ry.—This company has started preliminary arrangements for the construction of its proposed electric railway from Corpus Christi to Ward Island, about seven miles. J. H. Caswell, San Diego, Tex., is interested.

✚**Texas**—Oklahoma & Texas Southern Ry.—This company has awarded a contract to WARD & LEE, Floresville, Tex., for the construction of part of its proposed railway which will connect Denton and Buckburnette, Tex., and Ft. Smith, Ark., about 450 miles. W. R. Heagler, Potosi, Mo., is Ch. Engr. Noted June 10.

Oklahoma—Oklahoma Ry.—This company plans to reconstruct its line on Broadway and on East Fourth St., Oklahoma. George W. Knox, Oklahoma, is Vice-Pres. and Gen. Mgr.

California—The City Council of Los Angeles has authorized the Board of Public Works to advertise for bids on a street railway franchise on South Park Ave.

LIGHT, HEAT AND POWER

Belleville, N. J.—The Sleeth Mfg. Co., manufacturer of wire specialties, will build a new boiler house at its plant on Cortlandt St., Belleville.

✚**Newark, N. J.**—The Board of Education has awarded the contract for a heating plant in the new school on Oliver St. to JAMES F. KELLY, 126 South 14th St., Newark, at $20,466.

Spray, N. C.—The Thread Mills Co. is having plans prepared for the construction of a 3000-hp. electric power plant in Spray. F. P. Sheldon & Son, Industrial Trust Bldg., Providence, R. I., is Arch. and Engr.

Wake Forest, N. C.—An election will be held July 27 for the purpose of voting for a bond issue of $10,000, the proceeds of which will be used for the improvement and extension of the municipal electric-lighting system. J. L. Bullard is Supt. of the plant.

Orangeburg, S. C.—At an election held June 29 the citizens voted in favor of issuing $15,000 in bonds, the proceeds of which will be used for the improvement of the municipal electric-light plant. Noted June 17.

Clarksdale, Miss.—It is reported that the city has voted to issue $150,000 in bonds, a part of which will be used for the enlargement of the municipal electric-light plant. W. B. Perkins is Chn. of the Light Com.

Danville, Ky.—The Danville Electric Light & Power Co. plans an expenditure of $20,000 for the improvement of its plant

Henderson, Ky.—The Henderson Traction Co. is considering the improvement of its power plant.

Ashtabula, Ohio—Bids will be received until July 29 by Charles E. Peck, Clk., Bd. of Education, for the construction of a central heating plant for several school buildings.

Cincinnati, Ohio—(Official)—Bids will be received until noon, July 23, by the Board of Commissioners of Hamilton County for the removal of three boilers from the old Court House, Main and Sycamore St., Cincinnati, and installing the same in the Hamilton County Infirmary, Carthage, Cincinnati. Fred E. Wesselman is Pres. of the Bd.

Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, Room 511, City Hall, until noon, July 23, for furnishing fiber conduit for the municipal electric light department.

Cleveland, Ohio—(Official)—Bids will be received until 1 p.m., Aug. 2, by the Clerk of the Board of Education, Rockwell Ave. and East Sixth St., for new boiler and new steam fitting in the East Technical High School, Scovill Ave. and East 55th St. Frank G. Hogen is Dir. of Schools.

Troy, Ohio—The County Commissioners have approved the plans of C. F. Bowdle, Piqua, for the construction of an addition to the power plant at the courthouse. The estimated cost is $10,000.

Wellsville, Ohio—Bids will be received by J. F. McQueen, City Audr., until Aug. 7 for the purchase of $60,000 in bonds, the proceeds of which will be used for the construction of a municipal electric-light plant. Noted June 24.

✚Batesville, Ind.—(Official)—See item under "Water Supply —Irrigation."

Greencastle, Ind.—Bids will be received until 2 p.m., July 21, by C. E. Talkington, Supt., Greencastle, for two engines, two 250-hp. boilers, two generators and accessories for the power plant at the State Farm.

North Vernon, Ind.—The city plans to install an additional engine and generator and to remodel the municipal electric-light plant at a cost of about $15,000. A. B. Berkshire is Supt.

Springfield, Ill.—Bids will be received until July 26 by Frank D. Whipp, State Fiscal Supvr., for the construction of power houses at the State Hospitals at Dunning and Elgin. James B. Dibelka, 130 North Fifth Ave., Chicago, is State Arch.

Lakefield, Minn.—Bids will be received until July 31 by the Village Recorder for the construction of an addition to the building of the municipal electric-light plant, and installing new equipment, including 125-hp. boiler, concrete chimney, generator, switchboard, etc. Earle D. Jackson, Capital Bank Bldg., St. Paul, is Consult. Engr. Noted July 1.

St. Paul, Minn.—Plans are being prepared by Charles L. Pillsbury, Minneapolis, for the construction of a power plant at St. Joseph's Hospital. The estimated cost is $50,000.

Warren, Minn.—Bids will be received until July 22 by G. O. Gross, City Recdr., for the construction of an addition to the municipal power house and installing some new equipment, including generator, switchboard, etc. Earle D. Jackson, St. Paul, is Consult. Engr. Noted July 1.

Canton, Kan.—Press reports state that work will soon be started on the construction of a power house and electric-light plant.

Larned, Kan.—Bids will be received until July 19 by the City Council for the construction of an electric-light plant. Worley & Black, 301 Reliance Bldg., Kansas City, Mo., is Engr.

Robinson, Kan.—At a recent election the citizens voted in favor of the question of issuing $10,000 in bonds, the proceeds of which will be used for the construction of a power plant and the installation of an electric-lighting system.

✚Dakota, Neb.—It is reported that a contract for the construction of a municipal electric-light plant has been awarded to the JOHNSTON ELECTRIC CO., 1207 Harney St., Omaha. H. J. Ryan, Sioux City, Iowa, is Engr.-in-Charge.

Fullerton, Neb.—A bond issue of $28,000 has been voted, the proceeds of which will be used for the installation of a municipal electric-light plant.

Lincoln, Neb.—Bids will be received by L. Mathews, Secy., Bd. of Comrs., State Institutions, until 1:30 p.m., July 21, for the construction of an addition to the power plant at the State Penitentiary and Hospital for Insane.

Minot, N. D.—The Consumers Power Co. plans an expenditure of about $75,000 for the construction of an addition and alterations to the power house. It will also install additional boilers, engines and other machinery.

Cassville, Mo.—Press reports state that the Cassville Mill & Power Co. is considering the construction of a power house.

Drexel, Mo.—The City Council plans to install a municipal electric-light plant to cost about $10,000.

Pleasant Hill, Mo.—It is reported that the Rawls Electric Light & Power Co., successor to the Reader Co., plans the reconstruction of the light plant. The estimated cost is $10,000.

St. Joseph, Mo.—An election will soon be held to vote on the question of issuing $75,000 in bonds, the proceeds of which will be used for the improvement of the electric-light plant.

Brownwood, Tex.—The Central Texas Gas Co., recently organized with a capital stock of $150,000, will install natural-gas systems in a number of towns in the vicinity of Brownwood. The gas will be obtained from the Bangs field.

Bixby, Okla.—The City Council has decided to call an election to vote on the question of issuing $4000 in bonds, the proceeds of which will be used for the construction of a municipal electric-light plant.

Coeur d'Alene, Idaho—The City Council has authorized the Light Committee to ask the Public Utilities Commission for permission to build and operate a municipal electric-light plant.

Wallace, Idaho—John H. Wourms and associates have been granted a franchise for the installation of a gas plant in Wallace.

Tacoma, Wash.—Press reports state that the Tacoma Smelting & Refining Co. will construct a new power house. W. R. Rust is Pres.

Orillia, Ont.—The Orillia Water, Power & Light Commission is having plans prepared for the installation of an electric power system. C. E. Grant is Clk.

BRIDGES

Manchester, N. H.—The city contemplates the construction of a reinforced-concrete bridge at Elm St.

Winnisquam, N. H.—Storrs & Storrs, Concord, is preparing plans for the construction of a 450-ft. steel bridge with a concrete slab floor over the outlet of Lake Winnisquam. The estimated cost is $40,000.

✚Springfield, Mass.—(Official)—The general contract for the construction of the Plainfield St. Bridge over the tracks of the Boston & Maine R.R. has been awarded to the JOBSON-GIFFORD CO., 30 East 42d St., New York, N. Y., at $25,950. The contract for furnishing the structural steel has been awarded to the AMERICAN BRIDGE CO., 120 Franklin St., Boston, at $12,450. Noted June 24.

Kingston, N. Y.—The construction of a viaduct in Kingston is contemplated. The estimated cost is $97,489, to be borne by the city, the Ontario & Western and the Ulster & Delaware railroads and the state.

LaSalle, N. Y.—The Village Board contemplates the construction of a viaduct over the railroad tracks at Hamilton Ave. The estimated cost is $15,000.

Utica, N. Y.—Charles Kiehm, Consult. Engr., Utica, has been engaged to prepare plans for a bridge across the Mohawk River between Utica and Deerfield at North Genesee St. The estimated cost is $75,000. Noted July 1.

★Matawan, N. J.—(Official)—Bids will be received until 11 a.m., Aug. 4, by the Board of Chosen Freeholders of Monmouth County, Court House, Freehold, for the construction of a Strauss trunnion bascule bridge over Matawan Creek, on the South Amboy-Keyport Rd. George D. Cooper, 60 Broad St., Red Bank, is County Engr. Charles E. Close, 41 Main St., Matawan, is Clk. Bd. of Freeholders. Noted May 13 and July 8 under Keyport, N. J.

West Milton, Penn.—Press reports state that the Philadelphia & Reading Ry. will build a new bridge at West Milton to replace the present structure. A new site will probably be chosen in order to eliminate a dangerous curve at this point. The estimated cost of the bridge is $150,000. S. T. Wagner, Philadelphia, is Ch. Engr.

Wilkes-Barre, Penn.—The Luzerne County Court has approved the plans for the construction of the proposed bridge over the Susquehanna River at West Market St. The estimated cost is $500,000.

York, Penn.—Bids will be received until July 19 by F. S. Bartenschlager, Controller of York County, for the construction of an 80-ft. steel bridge over Bad Run in Washington Township, and for a 40-ft. reinforced-concrete arch, with parapet and wing walls, over Cabin Creek near East Prospect.

Baltimore, Md.—The lowest bid received by the State Roads Commission for resurfacing the approaches to the Dover Bridge, Talbot and Caroline Counties, was that of Austin Bennett & Co., Baltimore, at $9212 for concrete, and $8708 for macadam.

Rocky Mount, Va.—(Official)—Bids will be received until noon, July 23, by the Clerk of the Circuit Court of Franklin County for the construction of a 110-ft. bridge over Maggoty Creek, about four miles from Wirtz. G. P. Coleman, Richmond, is State Highway Comr.

✚Grafton, W. Va.—The Commissioners of Taylor County have awarded the contract for the construction of a new bridge over the Tygarts Valley River to the LUTEN BRIDGE CO., Clarksburg, at $50,600. It will be a six-span reinforced-concrete structure 560 ft. long.

Rainelle, W. Va.—(Official)—All bids received July 6 by the Greenbrier County Court, Lewisburg, for the construction of three steel or reinforced-concrete bridges near Rainelle were rejected. The Commissioners have placed an engineer in charge and will build the bridges themselves. John S. Crawford is Clk. Noted June 24.

✚Asheville, N. C.—The Board of Commissioners of Buncombe County has awarded the contract for the construction of three bridges to the ROANOKE BRIDGE & IRON CO., Roanoke, Va., at $4030, and a contract for three bridges to the NASHVILLE BRIDGE CO., Nashville, Tenn., at $4865.

Athens, Ga.—It is reported that the Commissioners of Clarke County are considering the reconstruction of the Princeton Bridge by placing a new steel superstructure on the present foundations. The estimated cost is $4000.

Miami, Fla.—It is reported that an election will be held Aug. 19 to vote for an issue of $150,000 in bonds, the proceeds of which will be used for the construction of two bridges across the Miami River. Estimated cost, $75,000 each. B. H. Klyce is Engr.

Pineville, Ky.—Bids will be received by the County Commissioners until July 17 for the construction of a bridge over the Cumberland River, consisting of two 150-ft. spans and one 50-ft. span.

Meridian, Miss.—The City Council contemplates an expenditure of $15,000 for the construction of a concrete bridge.

Ashland, Ohio—Bids will be received by B. Welty, Clk., Bd. of County Comrs., until noon, Aug. 6, for constructing and repairing seven bridges in various townships.

+Bucyrus, Ohio—The Board of Commissioners of Crawford County has awarded contracts for the construction of the Mary St. Bridge, Bucyrus, to MARTIN TEYNOR at $4900 for the substructure, and to the ELKHART BRIDGE & IRON CO. at $1498 for the superstructure. Contracts for the Parcher Bridge over the Sandusky River in Dallas Township were awarded to BRADY, O'CONNELL & MALLOY, Marion, at $8544 for substructure and fill, and to the ELKHART BRIDGE & IRON CO., at $5658 for the superstructure. Noted May 27.

Carrollton, Ohio—Bids will be received until Aug. 2 by the Board of Commissioners of Carroll County for rebuilding the bridge over Big Sandy Creek, west of Magnolia, Rose Township. S. G. Shotwell is Pres.

Columbus, Ohio—(Official)—Bids will be received until noon, July 30, by the Board of Commissioners of Franklin County for the following bridge work: Building approaches to the Schrock Bridge over Alum Creek on the Schrock Rd., Blendon Township; removing and reërecting the Third Ave. Bridge over the Olentangy River on the Eberly Rd. over Alum Creek, Truro and Madison Townships; construction of the substructure, superstructure and roadway of the Eberly Bridge over Alum Creek, Truro and Madison Townships. John Scott is Clk. of Comrs.

Dayton, Ohio—Plans are being prepared by the City Commissioners for the construction of new bridges at Keowee, Fifth and Webster St., to replace those washed away by the floods of 1913. The estimated cost is $70,000, $125,000 and $100,000 respectively. E. C. Cummin is City Engr.

Lebanon, Ohio—(Official)—Bids will be received until 11 a.m., Aug. 2, by the Board of Commissioners of Warren County for the construction of creosoted plank and block floors on two bridges, one over Clear Creek on the Union Rd., Franklin Township, and the other over the Little Miami River in the Village of South Lebanon, Union and Hamilton Townships. John M. Mulford is County Audr. and Clk. of Comrs.

Marietta, Ohio—Bids will be received until July 20 by the Board of Commissioners of Washington County for the construction of the Forshey Bridge on Fleming Rd., Adams Township, and the Weir Bridge in Decatur Township. W. B. Alexander is County Audr.

Newark, Ohio—Bids will be received until July 24 by the Board of Commissioners of Licking County for the construction of a bridge over Dry Creek in Newton Township on the Newark-Mt. Vernon Rd. The work will include extending and repairing the present wings and abutments, 104-ft. steel superstructure with 18-ft. roadway, paved with reinforced concrete. J. W. Hursey is County Audr.

Portsmouth, Ohio—W. F. Nugent, Louisville, at $119,946, submitted the lowest bid for the construction of the Lawson Run Viaduct over the tracks of the Norfolk & Western Ry. Noted June 24.

Strasburg, Ohio—The Board of Commissioners of Tuscarawas County, New Philadelphia, has decided to replace the present wooden bridge over Sugar Creek near Strasburg with a 100-ft. steel structure. The estimated cost is $4500. The present piers will be used.

Toledo, Ohio—Bids will be received until 10 a.m., Aug. 6, by Charles J. Sanzenbacher, Audr., Lucas County Comrs., for the construction of three bridges and new abutments.

+Bloomington, Ind.—(Official)—The contract for the construction of the Willard Farr Steel bridge in Bloomington Township has been awarded to the SULLIVAN BRIDGE CO., Sullivan. Noted June 24.

Indianapolis, Ind.—The Board of Public Works received bids June 28 for the construction of a three-arch reinforced-concrete bridge over Fall Creek at North Meridian St., as follows: Marsch-Cleary-White Construction Co., Chicago, Ill., $144,700; Dunn-McCarthy Construction Co., $146,378; Hickey Bros., St. Louis, Mo., $170,239; Mansfield Engineering Co., $172,789; Hackedorn Construction Co., $179,819; A. J. Yawger Co., $182,734; Carmichael-Cryder Co., St. Louis, $187,400; Kuert Contracting Co., Indianapolis, $198,700. B. J. Jeup is City Engr. Noted June 17.

+Lawrenceburg, Ind.—The OREGONIA BRIDGE CO., Lebanon, Ohio, at $19,335, has been awarded the contract for the construction of a bridge over the White River.

+Madison, Ind.—The Jefferson County Commissioners have awarded the contract for the construction of a bridge to the EAST ST. LOUIS BRIDGE CO., East St. Louis, Ill.

+Springfield, Ill.—(Official)—The State Highway Department has awarded the contract for the construction of a 155-ft. steel bridge in Bernadotte Township, Fulton County, to the CENTRAL STATES BRIDGE & IRON CO., Indianapolis, Ind., at $4888. Other bidders were: Joliet Bridge & Iron Co., $5264; East St. Louis Bridge Co., $5190; Porter McCullough Construction Co., $5270; Decatur Bridge Co., $4985; Illinois Steel Bridge Co., $4981. Noted June 24.

Eagle Point, Wis.—An election will soon be held to vote on the question of issuing $21,000 in bonds, the proceeds of which will be used for the construction of a bridge over the Chippewa River at Cobban.

+Milwaukee, Wis.—FRANK LUENZMANN, at $4711, has been awarded the contract for the construction of a temporary bridge across the tracks of the Northwestern Ry.

Dubuque, Iowa—Bids will be received until July 20 by the Board of Supervisors of Dubuque County for the construction of 75 bridges and culverts in the county. W. B. Turlay is County Engr. John Inghram is County Audr.

+Red Oak, Iowa—The Commissioners of Montgomery County have awarded the contract for the construction of steel bridge with a 100 ft. main span, two 20-ft. approaches and a 16-ft. roadway over Modaway River, Grant Township, to the RED OAK BRIDGE & IRON WORKS.

+Cannon Falls, Minn.—JOHNSON & DRAKE, Minneapolis, has been awarded the contract for the construction of a reinforced-concrete bridge consisting of three 60-ft. spans of the arch rib type. The WALES, CAMPBELL CO., Minneapolis, was awarded the contract for a bridge with two 67-ft. girder spans estimated to cost $25,000. Noted June 10 and 17.

Sioux City, Iowa—It is reported that the City Council is considering the construction of a bridge across Floyd River at 37th St.

+St. Paul, Minn.—The contract for the construction of a bridge on Wheelock Parkway across the tracks of the Minneapolis, St. Paul & Sault Ste. Marie Ry. has been awarded to A. H. HEINBACH, at $6750.

Hill City, Kan.—Bids will be received until July 16 by J. C. Herman, Clk. of Graham County, for replacing three bridges and the construction of three new ones.

Minneapolis, Kan.—(Official)—Bids will be received until noon, July 16, by the Commissioners of Ottawa County for the construction of a 90-ft. steel bridge with concrete floor and reinforced-concrete abutments over the west branch of Pipe Creek, Logan Township, Ottawa County.

Wichita, Kan.—It is reported that the Commissioners of Sedgwick County will soon ask for bids for the construction of two reinforced-concrete bridges, one over the drainage canal on 21st St. to cost about $8000, and the other over Jester Creek in Valley Center Township, estimated to cost $4500.

Kearney, Neb.—It is reported that the Commissioners of Buffalo County contemplate the construction of five bridges.

Hardin, Mont.—Bids will be received until July 21 by R. P. Ross, Clk. of Big Horn County, for the construction of three bridges, one over the Little Big Horn River on the Sarpy Rd., one over the same stream near Wyola, and the third over the Big Horn River, about 1½ miles northeast of Hardin. Noted June 10 and 24.

+Clinton, Mo.—The Commissioners of the Henry County Court have awarded the contract for the construction of a 150-ft. bridge over the Grand River to the CANTON BRIDGE CO.

Kansas City, Mo.—The City Council proposes to sell bonds for $400,000, the proceeds to be used for the construction of the 12th St. viaduct approaches.

Maryville, Mo.—Press reports state that plans are being prepared for the construction of four bridges. Fred Yoeman is Clk. of Nodaway County.

Oak Grove, Mo.—Bids will soon be received for the construction of a concrete bridge over a creek on the new Oak Grove Mecklin Rd. The estimated cost is $6000.

Poplar Bluff, Mo.—Bids will be received until July 19 by John H. Greason, Engr., Butler County Drainage Dist. No. 10, Court House, Poplar Bluff, for the construction of 28 steel bridges in connection with nine drainage canals in the district. J. O. Chambers is Clk. of County Court.

+St. Louis, Mo.—(Official)—The contract for 23,000 tons of structural steel for the Illinois approach of the Municipal Bridge has been awarded to the AMERICAN BRIDGE CO. Estimated cost, $1,035,000. Noted July 8.

+Portland, Tex.—It is reported that W. T. MONTGOMERY, San Antonio, at $8761, has been awarded the contract for the construction of a concrete bridge and culverts from Sap Depot to the north line of the district.

+La Junta, Colo.—(Official)—The Board of Commissioners of Otero County Courthouse has awarded the contract for the construction of a bridge across Anderson Arroyo on Fifth St. to the PUEBLO BRIDGE CO., Pueblo, at $6640. Noted June 24.

+Ribera, N. M.—The contract for the construction of a 14-ft. steel bridge over the Pecos River has been awarded to the MISSOURI VALLEY BRIDGE CO., Leavenworth, Kan., at $5500.

Colville, Wash.—Bids will be received until July 19 by the Commissioners of Stevens County for the construction of a steel truss highway bridge near Kettles Falls. The estimated cost is $16,000.

Davenport, Wash.—It is reported that Lincoln County will spend about $50,000 in the construction of new bridges this year. Guy H. Harvey is County Engr.

+Elma, Wash.—The Commissioners of Chehalis County, Montesano, have awarded the contract for the construction of a 255-ft. steel bridge over the Chehalis River near Elma to the COAST BRIDGE CO., Portland, Ore., at $11,000. Other bidders were: T. H. Clingan, Seattle, $11,360; Charles G. Huber, Seattle, $12,395; Portland Bridge Co., Portland, Ore., $12,483; Illinois Steel Bridge Co., Spokane, $13,640; Portland Bridge & Iron Co., Portland, Ore., $13,990.

Kettle Falls, Wash.—Bids will be received until July 19 by the Auditor of Stevens County, Colville, for the construction of a steel truss bridge near Kettle Falls.

Seattle, Wash.—The lowest bid received by the Commissioners of King County for the construction of the Stossel Bridge was that of A. H. Cox & Co., 309 First Ave. S., Seattle, at $14,735. The bridge will be a 209-ft. steel span. Noted June 17.

Tacoma, Wash.—It is reported that bids will be received about July 21 by Owen Woods, Comr. of Pub. Wks., for the construction of a wooden bridge across the gulch on 34th St. It will cost about $14,000. Noted May 27 and June 10.

Portland, Ore.—(Official)—Bids will be received by A. L. Barbour, City Audr., until noon, July 26, for the construction of a reinforced-concrete viaduct and approaches over the Troutdale Branch of the Oregon-Washington R.R. & Navigation Co. The estimated cost is $53,000. Noted July 1.

+Burlingame, Calif.—Press reports state that the City Trustees have awarded the contract for the construction of eight bridges to EATON & SMITH, at $20,072. Noted May 27.

Marysville, Calif.—The Board of Supervisors of Yuba County have accepted plans for the construction of three bridges on the State Highway between Wheatland and Morrison's Crossing. The estimated cost is $15,000.

Red Bluff, Calif.—The Board of Supervisors of Tehama County has rejected all bids received June 29 for the con-

struction of three steel or concrete bridges, a 2200-ft. bridge across Sand Slough, a 450-ft. bridge across Samson Slough and a 600-ft. bridge across Payne Creek. The work will be readvertised. Noted June 24.

San José, Calif.—Bids will be received by the Board of Supervisors of Santa Clara County until 11 a.m., July 19, for the construction of two reinforced-concrete bridges on Alviso Rd.

✚Quebec, Que.—The City Council has awarded the contract for the construction of a steel bridge at Stadacona Rd. to the EASTERN CANADA STEEL & IRON CO., Montreal, at $116,000. Noted Aug. 13.

WATER SUPPLY—IRRIGATION

Boston, Mass.—(Official)—Bids will be received until noon, July 20, by the Commissioner of Public Works, Room 511 City Hall Annex, for laying water mains in C, South Boston, Albany, Bristol, Endicott, Federal, Green, Haverhill, Leverett, Norway and Stillman St. Patrick O'Hearn is Act. Comr. of Pub. Wks.

✚Boston, Mass.—The contract has been awarded to the DAVIS FOUNDRY CO., for furnishing 300 c.-i. gate boxes for the Water Department.

Lenox, Mass.—According to press reports the Lenox Water Co. has postponed the construction of a reservoir. Noted Oct. 8 and June 24.

South Hadley Falls, Mass.—The town has been advised by the State Board of Health to either secure a new water supply or filter its present supply.

★Hartford, Conn.—(Official)—Bids will be received until 3 p.m., Aug. 2, by the Board of Water Commissioners for the construction of the Richards Corner dam, compensating reservoir in New Hartford under Contract No. 10. Caleb Mills Saville is Ch. Engr.

Lewiston, N. Y.—Bonds for $39,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system. Noted Feb. 25 and July 1.

Youngsville, N. Y.—Bonds for $28,000 have been voted by the citizens, according to press reports, the proceeds of which will be used for the construction of a water system.

Jersey City, N. J.—According to press reports bids will soon be received for the construction of a 72-in. steel pipe line 11 miles long. Charles A. Van Keuren is City Engr. Noted Feb. 11 and June 10.

West Orange, N. J.—William B. Fuller, Consult. Engr., in a final report on the water question to the West Orange Town Council recommended the purchase of the present distributing system of the West Orange Water Co., at an estimated cost of $201,625. Improvements will cost $250,000. Noted Apr. 1.

Altoona, Penn.—(Official)—Bids are being received by the Allegheny Water Co. for an auxiliary pumping station for the water system. Chester & Fleming, Pittsburgh, is Engr. Noted Nov. 12.

Gallitzin, Penn.—(Official)—Bids will be received until July 24 by Harry F. Conrad, Borough Secy., for constructing a storage reservoir on Gum Tree Rd. D. W. Dillman, 47 Altoona Trust Bldg., Altoona, is Engr. Noted Jan. 21 and Apr. 29.

Langhorne, Penn.—Bids will be received until July 20 by H. J. Briggs, Secy., Langhorne Spring Water Co., for constructing a filtration plant with a daily capacity of 300,000 gal. William H. Boardman, 426 Walnut St., Philadelphia, is Engr. Noted July 8.

Boonsboro, Md.—Official)—Plans have been approved by the State Department of Health for the construction of a new water supply pipe line.

Chestertown, Md.—(Official)—Permission has been granted by the State Department of Health for the issuance of $12,000 in bonds, the proceeds of which will be used for the improvement of the water system. Noted Jan. 7.

New Windsor, Md.—(Official)—The State Department of Health has approved plans for the extension of the water system.

Alexandria, Va.—Extensions will be made to the water system. The Common Council has authorized a loan of $50,000, part of which will be used for the extension.

Salisbury, N. C.—An election will be held Aug. 7 to vote on the question of issuing $125,000 in bonds, the proceeds of which will be used for the construction of a water plant at the north fork of the Yadkin River. Noted May 6.

Orangeburg, S. C.—Bonds for $15,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system. Noted Mar. 18 and June 17.

Tallapoosa, Ga.—Bonds for $35,000 have been voted by the citizens, the proceeds of which will be used for the purchase of the privately owned water system and for its improvement, for which $10,000 will be spent. Noted May 20 and June 10.

Ocala, Fla.—Bonds for $155,000 have been sold. The proceeds will be used for the improvement of the water and sewer systems. Twombly & Henney, 55 Liberty St., New York, N. Y., is Engr. Noted Mar. 18 and June 24.

St. Petersburg, Fla.—An election will be held to vote on the question of issuing bonds, the proceeds of which will be used for the extension of the water system and the sewer system and for waterfront improvements.

Gretna, La.—An election will be held to vote on the question of issuing bonds for $50,000, the proceeds of which will be used for the construction of a water system. Noted June 17.

✚Maryville, Tenn.—(Official)—The contract has been awarded to R. E. OLIVER, Maryville, at $49,356, for constructing a water system. W. A. McTeer is Recdr. Noted Apr. 29 and July 1.

Covington, Ky.—Bids will be received until 10 a.m., July 29, by J. Mason Howk, Comr. of Pub. Property, for pipe trenching and back filling for 10,950 ft. of 24-in. water mains.

Erlanger, Ky.—Press reports state that the Erlanger Improvement Association plans to extend the water mains from Ft. Mitchell to Erlanger at an estimated cost of $30,000.

Ashtabula, Ohio—(Official)—Chester & Fleming, Pittsburgh, Penn., has been retained by the Ashtabula Water Supply Co. to prepare plans for the construction of a 10-in. pipe line under the Ashtabula River. Noted July 1.

Bedford, Ohio—Bids will be received until July 19 by H. T. Hubbell, Village Clk., for furnishing and laying water mains in Tarbell and Enniss Ave., Jefferson and Harriman St.

Cambridge, Ohio—Bids will be received until Aug. 5 by the city for constructing a 200,000,000-gal. reservoir, a water filtration plant, a new pumping engine and laying about nine miles of water mains. The W. J. Sherman Co., Nasby Bldg., Toledo, is Engr. Noted Feb. 4.

Cincinnati, Ohio—(Official)—Bids will be received until noon, July 22, by the Director of Public Safety for laying water mains in connection with the high pressure fire service. Edward P. Durr is Secy.

Cincinnati, Ohio—The city plans to build tanks to conserve the water supply and to construct a 20-in. main in Broadway and Reading Rd. to connect the high service pipes on the hilltops with the high pressure pipes in the bottoms for the fire service.

Cleveland Heights, Ohio—(Warrensville post office)—Bids will be received until noon, Aug. 16, by H. H. Canfield, Clk., for constructing 12-in. c.-i. water mains in Warrensville Center Rd. F. A. Pease Engineering Co. Marshall Bldg., Cleveland, is Engr.

Columbus, Ohio—Bids will be received until noon, July 27, by George A. Borden, Dir. of Pub. Service, for furnishing and constructing water tube boilers, steam and feed water piping, grease extractor and mechanical stokers for the Scioto River pumping station.

Linden Heights, Ohio—(Official)—At the recent election the citizens voted against the question of issuing bonds for $20,000 for the construction of a water system. Noted June 24.

✚★Rittman, Ohio—(Official)—The contract has been awarded to C. A. PIERCE, Rittman, at $40,000, for constructing a water system. Vance Hickin is City Clk. Noted June 17.

✚★Rittman, Ohio—(Official)—The contract has been awarded to the BESSEMER GAS ENGINE CO., Cleveland, at $4000, for furnishing pumping equipment for the water-works. Noted June 17.

✚Shadyside, Ohio — (Official) — The contract has been awarded to HARPER & STEWART, Bellaire, at $33,233, for constructing a water system. A. J. Harbaugh, Shadyside, is Engr. Noted Jan. 21 and July 1.

South Newburg, Ohio—(Cleveland post office)—(Official)—Bids will be received until noon, Aug. 7, by H. H. Bohning, Clk., for the purchase of $26,662 in bonds, the proceeds of which will be used for the construction of water mains in Broadway and Winfall Ave.

Wellington, Ohio—(Official)—Bids will be received until noon, July 31, by E. E. Goodrich, Clk. Bd. of Pub. Affairs, for making improvements to the water system.

✚Youngstown, Ohio—The contract has been awarded to WILLIAM HENDERSON at $54,975, by the Board of Control for rebuilding the filter beds.

✚Batesville, Ind.—(Official)—The contract has been awarded to the HILLENBRAND CO., Batesville, at $12,600, for constructing an earth dam and for laying water mains and constructing 9000 ft. of electric transmission line. Charles Brossmann, Indianapolis, is Engr. and A. W. Ronweber is Secy. and Treas. Noted June 4 and July 1.

★Rockford, Ill.—(Official)—Bids will be received until 10 a.m., July 27, by the Purchasing Committee, at the office of the Water-Works Superintendent, for pumping equipment.

Viola, Ill.—Bids will be received until 8 p.m., July 19, by B. D. Baxter, Pres., Bd. of Local Imp., for constructing a 10-in. well. Terhune & Horton, Central National Bank Bldg., Peoria, is Engr. Noted Feb. 25.

Kenosha, Wis.—Bids will be received until 8 p.m., July 20, by the Board of Water Commissioners for constructing a new intake.

Sheboygan, Wis.—See item under "Sewers."

Denison, Iowa—(Official)—Bids will be received until 8 p.m., July 22, by E. F. Tucker, City Clk., for drilling an artesian well. The work consists of 100 ft. of 12-in. well, cased complete, 300 ft. of 10-in. well, cased complete, 300 ft. of 10-in. well cased complete and 1400 ft. of 8-in. hole. J. G. Thorne, 317 Howes Blk., Clinton, is Engr.

Keota, Iowa—(Official)—We have been advised that the awarding of a contract for the construction of a water system has been canceled, owing to recent rulings of the Supreme Court in regards to bond elections. The work will probably be readvertised about Sept. 1. Charles P. Chase, Clinton, is Engr. Noted July 8.

✚Lowden, Iowa—(Official)—Bids were received July 8 for constructing a water system as follows: W. D. LOVELL, Minneapolis, Minn., at $12,601 (awarded contract) for pipe line, elevated tank and tower and motor; Des Moines Bridge & Iron Works, $13,181; Alamo Engine & Supply Co., Omaha, Neb., $13,116; M. McEllicott, Evanstone, Ill., $13,569; C. W. Roland, Des Moines, $12,868; Ideal Heating Co., Davenport, $13,109; F. E. MYERS & BROS., Ashland, Ohio, at $370 (awarded contract) for deep well pump. Noted Apr. 22. J. G. Thorne, 317 Howes Blk., Clinton, is Engr.

Riverside, Iowa—(Official)—We have been advised that the awarding of a contract for the construction of a water system has been canceled, owing to recent rulings of the

Supreme Court in regards to bond elections. The work will probably be readvertised about Sept. 1. Charles P. Chase, Clinton, is Engr. Noted July 8.

Lakefield, Minn.—Bids will be received until July 28 by E. C. Anderson, Village Recdr., for making improvements to the water and electric-light systems. Earle D. Jackson, St. Paul, is Engr. Noted June 24.

✚Thief River Falls, Minn.—(Official)—The contract has been awarded to the ROBINSO VAN ALSTINE CO., Grand Forks, N. D., at $8398, for repairing the water system. E. J. Overland is City Clk. Noted July 1.

Larned, Kan.—Bids will be received until July 19 by L. D. Burgess, City Clk., for making improvements to the water system. The work includes the following: Motor driven pumps, test boilers, steam and exhaust piping and auxiliary boiler room equipment and furnishing and constructing a stack.

Simpson, Kan.—Bonds for $12,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system. E. T. Archer & Co., Midland Bldg., Kansas City, Mo., is Engr. Noted June 24.

Spearville, Kan.—An election will be held to vote on the question of issuing $25,000 in bonds, the proceeds of which will be used for the construction of a water system. E. T. Archer & Co., Midland Bldg., Kansas City Mo., is Engr. Noted June 24.

Norfolk, Neb.—An election will be held July 31 to vote on the question of issuing $10,000 in bonds, the proceeds of which will be used for the extension of the water system.

Syracuse, Neb.—Another election will be held to vote on the question of issuing bonds, the proceeds of which will be used for the extension of the water system. Noted June 10.

★Sioux Falls, S. D.—(Official)—Bids will be received until July 26 by Walter C. Leyse, City Audr., for constructing a 1,200,000-gal. reinforced-concrete covered reservoir, a 350,000-gal. elevated tank and for pumping machinery. John Mundt is Comr. of Water-Wks.

Hettinger, N. D.—Bonds for $75,000 have been voted by the citizens. The proceeds will be used for the construction of a water system. C. H. Green, Spokane, Wash., is Engr.

✚Cheyenne, Wyo.—(Official)—The contract has been awarded to the PITTSBURGH FILTER MFG. CO., Pittsburgh, Penn., at $81,900, for constructing a rapid sand filtration plant. Noted July 2.

Three Forks, Mont.—The City Council has retained Swearinger & McCulloch, Engr., Great Falls, to prepare plans for the construction of a water system for Three Forks. The estimated cost is $25,000, bonds for which have been voted.

Independence, Mo.—The County Court of Jackson County is negotiating with the city for an extension of the water mains to the Girls' Home.

St. Louis, Mo.—Bids will be received until noon, July 20, by the Board of Public Service for constructing a reinforced-concrete pipe tunnel between engine houses 1 and 2, Bessell's Point Pumping Station.

St. Louis, Mo.—Bids will be received until noon, July 20, by the Board of Public Service for laying about 23,000 ft. of water mains.

Star City, Ark.—According to press reports the city has granted a franchise to the Star City Water Co. to construct water and sewer systems. Water will be piped from Atkins Springs, about two miles. J. C. Hellums is one of the Comrs.

Houston, Tex.—(Official)—Bids will be received until 2 p.m., July 23, by the city for constructing two 50,000-gal. steel tanks.

Cœur d'Alene, Idaho—The City Attorney will make application to the Public Utilities Commission, Boise, for permission to construct a municipal water system.

Vernal, Utah—The supply pipe line of the water system will be extended five miles, according to press reports.

Phoenix, Ariz.—The City Commission contemplates installing a pure water supply. J. B. Girand is City Engr.

✚Oroville, Wash.—The contract has been awarded to A. GUTHRIE & CO., St. Paul, Minn., at $600,000, by the East and West Okanogan Irrigation Project for constructing an irrigation system to water several thousand acres of land.

Seattle, Wash.—The City Council will construct water mains in North 28th St., Bradner Pl. and 29th Ave., at an estimated cost of $25,000. L. B. Young is Chn. Bd. of Pub. Wks.

Eastside, Ore.—The cost of constructing a water system has been estimated by S. B. Cathcart, City Engr., at between $25,000 and $40,000, according to the kind of pipe used. Noted July 1.

Doyle, Calif.—The Lassen Irrigation District has retained William Wells as engineer for its irrigation system. Elbert Howard is interested.

Oakdale, Calif.—Plans are being prepared for the Oakdale Irrigation District for the construction of an 8000-ft. tunnel to be bored through Cape Horn. The estimated cost is $50,-000.

Montreal, Que.—Hering & Fuller, New York, N. Y., is preparing plans, according to press reports, for the construction of a mechanical filtration plant to increase the daily capacity from 50,000 to 100,000 gal. Noted June 17.

Lambeth, Ont.—J. A. Bell, St. Thomas, is preparing plans for a new water system, including a pumping plant, the estimated cost of which is $20,000.

Oakville, Ont.—Bids will be received until 8 p.m., July 26, by C. G. Marlatt, Chn. Water & Light Commission, for furnishing and installing one electrically operated turbine pump of 600 imperial gal. capacity against a head of 300 ft.

Ottawa, Ont.—Bids will be received until Aug. 3 by the City Clerk for constructing the overland pipe line. The estimated cost is $460,000. J. B. McRae, Ottawa, is Consult. Engr. Noted May 13.

Kamsack, Sask.—The citizens plan to spend $35,000 for the construction of a water system. H. H. Crawford is Clk.

SEWERS

✚Portland, Maine—(Official)—The contract for sewer construction has been awarded to FERANTE PROFENNO CO., Portland, at $5363. Other bids were: Paolo De Biasa & Co., $6879; Petrantonio Pajio & Co., Informal; Forgione & Romano Co., $7052; Profensio & Larello, $5526; Rafalle Leo & Co., $5879. Noted July 1.

Andover, Mass.—Bids will be received until 5 p.m., July 17, by the Board of Public Works for the construction of approximately 15,422 ft. of sewers. Noted Apr. 22.

Boston, Mass.—Bids will be received until noon, July 16, by Patrick O'Hearn, Act. Comr. of Pub. Wks., for the construction of pipe sewers and drains in Cedric St., Roxbury, in Aldwin Rd. and Cornell St., West Roxbury.

Pittsfield, Mass.—The city has appropriated $10,000 for the construction of lateral sewer extensions.

✚Greenwich, Conn.—(Official)—The contract for the construction of sewage-disposal works in East Port Chester Sewer District No. 9 has been awarded to DALY & MERRITT, Port Chester, N. Y. S. E. Minor is City Engr. Noted May 13.

New Haven, Conn.—(Official)—Bids will be received until 2 p.m., July 15, by the Director of Public Works for the construction of Whalley Ave. sewer. The estimated cost is $100,-000. Noted July 1.

✚Waterbury, Conn.—The contract for the construction of sewers in East Main, Chipman, Ridge St., in Congress and Yates Ave. has been awarded to the H. SPINACH CONSTRUCTION CO., at $6206.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 11 a.m., July 21, by L. H. Pounds, Borough Pres., for the construction of sewers in 15th St., Eight, Gravesend and Pennsylvania Ave.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received July 9 by Marcus M. Marks, Borough Pres., for the construction of sewers, (a) in East 41st St. and in Madison Ave., (b) in Wall St., as follows: Kingsbridge Contracting Co., (a) $144,404, (b) $13,252; L. E. Kelly, Inc., (a) $175,000, (b) $17,293; Henry E. Fox Construction Co., (a) $180,000; Rodgers & Haggerty, (a) $194,784; Battery Engineering & Construction Co., (a) $184,000; Fitzgerald & Brennen, (b) $12,353; P. L. Kearns Contracting Co., (b) $12,628; Merrill Ruckgaber, (b) Informal; J. J. Haiduveh, (b) $14,851; Patrick Reilly, (b) $12,906; Laconia Contracting Co., (b) $10,-926; U. S. Drainage & Irregation Co., (b) $12,648; Lawrence Contracting Co., (b) $13,505; Melrose Contracting Co., (b) $11,462. Noted July 1.

Olean, N. Y.—The city has postponed the construction of the proposed sewers, estimated to cost $8000, for about one year. Noted Apr. 22.

✚Scarsdale, N. Y.—(Official)—Bids were received June 22 by the Sewer Commissioners for the construction of sewer extensions as follows: (a) Division A, (b) Division B, (c) Division C, William R. Neely, Tarrytown, (a) $8297, (b) $6701; FRED E. GROSS & SON, Yonkers, (a) $8426 (awarded contract), (b) $6713, (awarded contract); Sound Engineering & Contracting Co., Inc., 1476 Broadway, New York, (a) $8723, (b) $7371; Lincoln Steele Fleming Co., 17 Madison Ave., New York (a) $9028, (b) $7985, (c) $43,589; Charles Smith, Pelham, (a) $9086, (b) $7682; F. A. Cianfaglione, Yonkers, (a) $9180, (b) $6929; Briggs & McLaughlin Contracting Co., 337 East 134th St., New York, (a) $9503, (b) $7875, (c) $40,481; Richards & Cestona, White Plains, (a) $9701, (b) $6845, (c) $53,074; DALY & MERRITT, Port Chester, (a) $9834, (b) $9552, (c) $31,964, (awarded contract); Frank George, White Plains, (a) $9910, (b) $7631, (c) $43,205; Joseph Dimando, Inc., Mamaroneck, (a) $10,175; John L. Hayes Construction Co., Yonkers, (a) $10,205, (b) $8493, (c) $42,483; Di Menna & Del Balso, 2336 Cambrelling Ave., New York, (a) $11,711; Mauro Paradiso, White Plains, (a) $12,452, (b) $7957, (c) $48,924; Charles E. Farrell Contracting Co., 1831 Southern Blvd., New York, (b) $8646; Engineers Estimate, (a) $10,263, (b) $8394, (c) $43,-336. Waring, Chapman & Farquhar, 874 Broadway, New York, N. Y., is Consult. Engr. Noted June 17.

Edgewater, N. J.—Bids were received July 7 by the Town Council for the construction of sewer outlet No. 10 from B. Paddington & Co., $64,014, John J. McGarry, $47,119, and Edward English, $36,678.

Jersey City, N. J.—Plans are being prepared for the construction of a sewage-disposal plant at Fiske St. and Newark Bay. This is the first of the four to be constructed by order of the Board of Health. The estimated cost is $100,000. Noted Jan. 7.

✚Harrisburg, Penn.—The contract for the construction of sewers in Rudy, Delancey and Spencer St. has been awarded to M. M. SHESSLEY & SON, Johnstown, at $7638. Noted Mar. 18.

Lebanon, Penn.—The City Council has approved plans submitted by T. R. Crowell, City Engr., for the construction of a sewage-disposal plant.

Philadelphia, Penn.—The City Council has authorized the construction of the Franklin Creek Intercepting Sewer. The estimated cost is $500,000.

Wilmington, Del.—The city contemplates the construction of sewers along the Brandywine Creek from Henry Clay. The estimated cost is $60,000 of which the DuPont Powder Co. will pay $10,000. Alexander Taylor is City Engr.

★Ocean City, Md.—(Official)—Bids will be received until July 26 by the Mayor for the construction of a sewage pumping station, clarification tank, intercepting and branch sewers. Pugh & Mubbard, 731 Witherspoon Bldg., Philadelphia, Penn., is Engr. Noted June 3.

Alexandria, Va.—The Common Council has authorized a loan of $50,000 for the construction of sewers. Albert Bryan is Chn. of Finance Com.

+Kinston, N. C.—The city has awarded contracts for the construction of extensions to the sewer system to MISCHLER & FLYNN, Chattanooga, Tenn., at $28,200, and for sewer pipe to the CHATTANOOGA SEWER PIPE & FIRE BRICK CO., at $7753.

Salisbury, N. C.—An election will be held Aug. 7 to vote on the question of issuing $20,000 in bonds. The proceeds will be used for the construction of sewers and for street improvements.

+Winston-Salem, N. C.—The city has awarded contracts for the construction of concrete disposal tanks and irrigation ditches to the MUNICIPAL ENGINEERING & CONSTRUCTION CO., Atlanta, Ga., and to the HEWITT CONSTRUCTION CO., Hickory, N. C., for the construction of approximately one mile of pipe line leading directly to the plant. The estimated cost is $50,000. Noted June 17.

Hammond, La.—Bonds for $40,000 have been sold, the proceeds of which will be used for the construction of a sewer system. Noted June 3.

Harlan, Ky.—Plans are being prepared for the construction of a sewer system. The estimated cost is $75,000. D. H. Goss is City Clk. Noted June 24.

Lexington, Ky.—Plans are being prepared by Solomon-Norcross Co., Consult, Engr., Atlanta, Ga., for the construction of a sewage-disposal plant and a sewer system. The estimated cost is $200,000. Noted June 17.

+Madisonville, Ky.—The contract for the construction of sanitary sewers has been awarded to QUINN & ELLIS, Nashville, Tenn., at $6057. Noted June 24.

Ashtabula, Ohio—(Official)—Bids will be received until July 17 by M. H. Turner, Dir. of Pub. Ser., for the construction of sewers in Mill, Gern St., Kain Rd. and in Woodman Ave. The estimated cost is $4938. Lewis A. Amsden is City Engr. Noted May 6.

Brewster, Ohio—(Official)—Bids were received July 2 for the construction of sewers from the Ross-Cook Engineering Co., Akron, $9267; Gessher & Gothrel, Toledo, $14,329; Kohbarger & Hoyles, Marion, $13,822; Philip Sheets, Newcomerstown, $18,972; Thomas P. Egan, Cleveland, $16,004; Hadley & Dickey, Canton, $10,016; Wise Bros., Canton, $13,357. Noted June 17.

Cincinnati, Ohio—Bids will be received until noon, July 21, by Philip Fosdick, Dir. of Pub. Ser., for the construction of sewers in Carll St., Kirby and Clinton Springs Ave.

Cincinnati, Ohio—Bids will be received until Aug. 5 by the city for the construction of sewers and appurtenances in South Canal St., in county property from Sycamore to Main St. and in the Hamilton County Courthouse.

Cleveland, Ohio—(Official)—Bids were received July 7 for the construction of the Walworth Run Diversion Sewer under two contracts, (a) Section No. 1, (b) Section No. 2, as follows: Hoag & Zullo, Cleveland, (a) $114,900, (b) $101,537; Donnelly & Graham, Cleveland, (a) $121,490, (b) $101,262; Manson Co., Cleveland, (a) $131,080, (b) $121,875; Gawne Contracting Co., Cleveland, (a) $137,590; Dock Contractor Co., Hoboken, N. J., (a) $140,460, (b) $116,725; Joseph Winterbottom, Cleveland, (a) $142,700, (b) $116,925; J. Connelly Construction Co., Cleveland, (a) $147,140, (b) $121,875; W. P. Gibbons Construction Co., Cleveland, (a) $155,534, (b) $146,037; Henry C. Ulen, Chicago, Ill., (a) $159,400, (b) $131,800; William McDowell & Son Co., Cleveland, (a) $162,670, (b) $134,112; Charles A. Haskin, Boston, (a) $185,740, (b) $153,250; J. Wagner & Son, Detroit, Mich., (a) $208,000. Robert Hoffman is City Engr. Noted July 1.

+Columbus, Ohio—The Director of Public Service has awarded the contract for the construction of the south side storm sewer to J. C. CARLAND & CO., Toledo, at $220,249, to O'DONNELL & THORNBERRY, Vincennes, Ind., at $48,256, for the constructing the Maryland Ave. storm sewer, and to I. O. JONES, Columbus, at $12,703, for constructing the Granville St. relief sewer. Noted June 24.

Cuyahoga Falls, Ohio—(Official)—Bids will be received until noon, July 28, by the Village Clerk for the construction of sewers in various streets. E. D. Barstow is Village Engr.

+Delphos, Ohio—It is reported that the contract for the construction of a sewage-disposal plant has been awarded to SUMMERS & HARDIN, Lima, at $9766.

+New Boston, Ohio—(Portsmouth post office)—The contract for sewer construction has been awarded to the SLUSS-BAKER CONSTRUCTION CO., at $45,000.

Northfield, Ohio—Bids will be received until noon, July 19, by C. S. Machwart, Village Clk., for the construction of 12,000 ft. of 4-in. tile drain, 3000 ft. of 6-in. tile drain, 444 ft. of 15-in. corrugated culvert pipe and 10 bbl. portland cement. C. W. Courtney, 1150 Leader News Bldg., Cleveland, is Engr.

Springfield, Ohio—Bids will be received until noon, July 26, by Charles E. Ashburner, City Mgr., for the construction of sewers in Gallagher St.

Springfield, Ohio—Bids will be received until noon, July 26, by Frank B. Thomas, City Audr., for the sale of $31,168 in bonds. The proceeds will be used for the construction of the Walter St. Sewer System.

Westerville, Ohio—Bids will be received until July 16 by R. D. Bennett, Clk., for the construction of sanitary sewers in Glenwood Drive, State, East Park and West St.

Wyoming, Ohio—(Cincinnati post office)—Bids will be received until noon, July 24, by Ernest Van Bargen, City Pur. Agt., for the construction of a sanitary sewage-disposal plant at the Refuge Farm for Girls.

+Franklin, Ind.—The contract for the construction of sewer extensions at the Masonic Home has been awarded to O'DONNELL & THORNBERRY, Vincennes, at $6148.

+Indianapolis, Ind.—The contract for cleaning and repairing the Myers drain, Cass County, has been awarded to F. JEROME BECKLEY, Royal Center, at $6000.

Markle, Ind.—(Official)—Bids will be received until 1 p.m., July 24, by the Town Clerk for the construction of a sewer system. Thomas Ruggles is Engr. Noted July 1.

Grand Rapids, Mich.—W. H. Hoad, University of Michigan, has submitted a report on sewage disposal to the Board of Public Works. The estimated cost is $500,000. Noted Mar. 25.

+Chicago, Ill.—(Official)—The contract for the construction of 14 miles of brick sewers in the Norwood and Edison Park Section, to be known as the Argyle St. sewer system has been awarded to the H. J. McNICHOLS CO., Chicago, at $694,461. Noted July 1.

Appleton, Wis.—Bids will be received until 9 a.m., July 26, by E. L. Williams, City Clk., for the construction of sewers in College Ave. and State Rd.

Burlington, Wis.—Bids will be received until 2 p.m., July 17, by the Board of Public Works for the construction of storm sewers, manholes and catch basins.

Madison, Wis.—The lowest bid submitted for the construction of a sewer in Williamson St. was that of J. W. Mitchell, at $9994.

Mayville, Wis.—The city contemplates the construction of a sewer system.

Milwaukee, Wis.—Bonds for $200,000 have been sold, the proceeds of which will be used for the construction of sewers. Noted June 24.

+Sheboygan, Wis.—(Official)—The contract for the construction of sanitary sewers has been awarded to the BIRDSALL GRIFFITH CONSTRUCTION CO., Racine, at $8398. Noted July 1.

Watertown, Wis.—The lowest bid received for the construction of a sewer in Nashotah St. and through private property to the river was that of E. L. Bartlett, Watertown, at $6550.

+Wauwatosa, Wis.—The contract for the construction of storm sewers has been awarded to W. P. KUEHN, at $4005.

Cedar Falls, Iowa—The city contemplates the construction of sewers estimated to cost $5000. C. H. Streeter is Engr.

+Council Bluffs, Iowa—The contract has been awarded to E. A. WICKHAM, Council Bluffs, at $62,573, for the construction of approximately 12½ miles of sewers in District No. 1. Noted May 6.

+Marion, Iowa—The contract for the construction of approximately 8000 ft. of sewers has been awarded to MARK JACKSON, Cedar Rapids, at $4820.

What Cheer, Iowa—The city contemplates the construction of sewers and a sewage-disposal plant. The estimated cost is $30,000. Bruce, Standeven & Boynton, 400 Bee Bldg., Omaha, Neb., is Engr.

Breckenridge, Minn.—At a recent election the citizens voted to issue $18,000 in bonds, the proceeds of which will be used for the construction of sewers. Noted May 6.

St. Paul, Minn.—All bids received June 14 by August Hohenstein, City Pur. Agt., for the construction of sewers in Glenham, Maplewood, Medford and Otto Ave. have been rejected. The estimated cost is $20,000. Noted June 24.

Atchison, Kan.—Plans are being prepared for the construction of approximately 5000 ft. of 18- to 30-in. vitrified pipe sewers and 20 manholes. Bids will be received about Aug. 15. V. L. King is City Clk.

Wisner, Neb.—Bids will be received until July 19 by C. S. Daily, City Clk., for the construction of a sewer system. The estimated cost is $20,000. Bruce, Standeven & Boynton, 430 Bee Bldg., Omaha, is Engr. Noted May 20.

Centerville, S. D.—An election will be held July 16 to vote on the question of issuing $27,000 in bonds. The proceeds will be used for the construction of a sewer system.

+Sidney, Mont.—The contract for the construction of lateral sewers in Special Improvement District No. 3 has been awarded to BENDON, JONES & REED, Sidney, at $9708.

Three Forks, Mont.—Swearinger & McCulloch, Engr., Great Falls, is making surveys for the construction of a sewer system. The estimated cost is from $20,000 to $25,000.

Independence, Mo.—Plans are being prepared by H. H. Pendleton, City Engr., for the construction of a sewer system for the Girls' Home.

Kansas City, Mo.—The City Council has authorized the sale of $100,000 in bonds, the proceeds of which will be used for the construction of sewers.

+Kirksville, Mo.—The contract for the construction of storm sewers in Joint Storm Sewer District No. 3 has been awarded to the HIRAM LLOYD CONSTRUCTION CO., St. Louis, at $6110. Noted June 10.

St. Joseph, Mo.—The city contemplates issuing $500,000 in bonds, the proceeds of which will be used for the construction of a sewer system.

Corsicana, Tex.—The city contemplates holding an election to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for the construction of sewers.

+Houston, Tex.—The contract for the construction of storm sewers in South Main St. at Harris Gully has been awarded to HORTON & HORTON, at $9000.

Muskogee, Okla.—The city contemplates the construction of the North Mill St. sewer. The estimated cost is $23,000.

+Salt Lake City, Utah—(Official)—The contract for the construction of the Sewer Extension No. 351 has been awarded to JAMES KENNEDY, Fargo, N. D., at $25,017. Noted June 17.

Roslyn, Wash.—The City Council has organized Local Improvement Districts Nos. 1 and 2 and will construct sewers. George T. Wake is City Clk.

+Alameda, Calif.—(Official)—The contract for sewer construction has been awarded to the TIBBITTS PACIFIC CO., San Francisco, at $9667. Noted June 24.

East San Diego, Calif.—Preliminary plans are being prepared by the City Engineer for the construction of a municipal sewer system. The estimated cost is $50,000. Noted July 8.

Visalia, Calif.—At a recent election the citizens voted to issue $50,000 in bonds, the proceeds of which will be used for the construction of sewer extensions. Noted June 24.

✚Toronto, Ont.—The contract for the construction of a sewer in Weston Rd. from St. Clair Ave. to the city limits has been awarded to ORPEN CO., LTD., at $23,868. Noted June 17.

Victoria, B. C.—The Council Street Committee has authorized an expenditure of $74,654 for the construction of sewers and for paving work.

STREETS AND ROADS

Boston, Mass.—(Official)—Bids will be received until noon, July 19, by the Commissioner of Public Works for constructing a bituminous macadam roadway on Haslet St. from Amherst to Metcalf St., West Roxbury, for laying artificial stone side walks on Lake St., Brighton and for bitulithic pavement on Birch St. from Penfield St. Dudley Ave., West Roxbury.

✚Boston, Mass.—Contracts have been awarded for paving with asphalt Claxton St. from Blue Hill Ave. to Callender St., Dorchester, to D. M. BIGGS & CO., $11,507; Claybourne St. from Dakota to Park St., Dorchester, with bitulithic to JAMES DOHERTY, at $8657. Noted June 17.

✚Cranston, R. I.—E. P. TRACY, Derby, at $24,000, has been awarded the contract to resurface Broad St. with asphalt.

✚Warwick, R. I.—The town council has awarded the contract for building bituminous highway at Ludlow Corner to JOSEPH McCORMICK, East Providence.

★Hartford, Conn.—Bids were received July 2 by Charles J. Bennett, State Highway Comr., for constructing roads as follows: Ashford Township, 14,960 lin.ft. gravel on the Warrenville Rd.: Robert G. Miller Contracting Co., Hartford, $19,261; A. D. Ambrosia & Co., Hartford, $25,165; A. Brazos & Sons, Middletown, $24,545; Framingham Contracting Co., South Framingham, $20,155; A. D. Bridge's Sons, Inc., Hazardville, $19,177; Connecticut Good Roads & Construction Co., New Britain, $16,344; Ahern Construction Co., Willimantic, $18,299; Archie B. Cadwell, New Britain, $20,180; Louis Longhi & Bro., Torrington, $18,443. Glastonbury Township, 6500 lin.ft. 2-in. bituminous macadam on the Hartford-New London Township Rd., A. D. Ambrosia & Co., Hartford, $14,206; Piersen Engineering & Construction Co., Hartford, $10,690; Connecticut Good Roads & Construction Co., New Britain, $9565; A. E. Douglass, Glastonbury, $8600; A. D. Bridge's Sons, Inc., Hazardville, $8752. Sprague Township, about 1630 lin.ft. gravel, A. D. Bridge's Sons, Inc., Hazardville, $2325; Frank A. Wilcox, Norwich, $1299; Fred D. Miller, Norwich, $1508. Killingworth Township, about 7150 lin.ft. graded on the Higganum Rd., Louis Longhi & Bro., Torrington, $5481; Frank Arrigoni & Bro., Middletown, $6053; A. Brazos & Sons, Middletown, $6317. Vernon Township, about 2675 lin.ft. bituminous macadam on Vernon Ave., A. D. Bridge's Sons, Inc., Hazardville, $5435; A. D. Ambrosia & Co., Hartford, $7801. Newtown Township, about 8040 lin.ft. 5-in. native stone macadam on the Dodingtown Rd. Connecticut Good Roads & Construction Co., New Britain, $14,400; A. Brazos & Sons, Middletown, $25,678; Goodman & Trumbull Co., Litchfield, $13,174; Louis Longhi & Bro., Torrington, $14,025; H. Sanford Osborn, Redding Ridge, $14,568; Kellogg & Gregory Co., Danbury, $11,492; Stafford & Mather, Hartford, $14,004; Archie B. Cadwell, New Britain, $13,001; Bennett N. Beard Co., Shelton, $14,562; John de Michiel & Bro., Torrington, $12,893. Canterbury Township, about 5100 lin.ft. native stone and 1995 lin.ft. native stone resurfacing on the Westminster Rd., Alco Construction Co., 178 North St., Boston, $9710; Goodman & Trumbull Co., Litchfield, $8402; Robert G. Miller Contracting Co., Hartford, Conn., $8720; Frank A. Wilcox, Norwich, $8626; A. D. Bridge's Sons, Inc., Hazardville, $9538; F. H. Gilbert, Jewett City, $15,087; Louis Longhi & Bro., Torrington, $9326; Ahern Construction Co., Willimantic, $9648. Bethel Township, about 6315 lin.ft. gravel on the Bridgeport-Newtown Rd. H. Sanford Osborn, Redding Ridge, $7497; Archie B. Cadwell, New Britain, $9623; Goodman & Trumbull Co., $8114; Bennett N. Beard Co., Shelton, $8726; Kellogg & Gregory Co., Danbury, $6795; Connecticut Good Roads & Construction Co., New Britain, $8569; John de Michiel & Bro., Torrington, $7975; Louis Longhi & Bro., Torrington, $8009. Plainfield Township, about 6875 lin.ft. gravel on the Canterbury Rd., Ahern Construction Co., Willimantic, $8976; Alco Construction Co., 178 North St., Boston, $7885; Fred H. Gilbert, Jewett City, $7197; Goodman & Trumbull Co., Litchfield, $7802; A. D. Bridge's Sons, Inc., Hazardville, $7496; John Arborio, 172 Congress Ave., New Haven, $7167; Frank A. Wilcox, Norwich, $7266; Louis Longhi & Bro., Torrington, $7285; A. Brazos & Sons, Middletown, $9476; Fred D. Miller, Norwich, Conn., $7639. Noted July 1.

✚★Albany, N. Y.—(Official)—Bids were received June 7 by Edwin Duffey, State Highway Comr., for repairing highways, as follows:

Repair Contract No. 792, Albany, County, 7.69 miles: W. L. LAWTON, Glens Falls, $23,611 (awarded contract); Olin T. Benedict, Pittsfield, Mass., $24,309; De Graff & Hogeboom, Kingston, $25,866; A. J. Malloy, Schenectady, $25,868; Belmar Contracting Corporation, Inc., Troy, $26,856; James Anderson, Menands, $27,153; Thomas H. Karr, Troy, $28,404.

Repair Contract No. 806, Albany County, 2.02 miles: BELMAR CONTRACTING CORPORATION, INC., Troy, $10,516 (awarded contract); Huntoon & Ferguson, Hudson Falls, $10,603; James Anderson, Menands, $10,881; M. F. Dollard, Albany, $10,832; J. J. Malloy, Schenectady, $11,126; Olin T. Benedict, Pittsfield, Mass., $11,276; Thomas H. Karr, Troy, $12,039.

Repair Contract No. 799, Broome County, 0.31 mile: KINGSBURY & RYAN, Binghamton, $4449 (awarded contract); Frank Stento, Binghamton, $4972; Nash & Griffin, Norwich, $4990; Rock & Griffin, Massena, $5274; John H. Gordon, Albany, $5294; E. W. Walsh, Elmira, $5407; William R. Kimmey, Albany, $5426; Lee Du Bois, Lestershire, $5539.

Repair Contract No. 741, Cayuga County, 6.15 miles: SEMPER BROS., Watertown, $33,987 (awarded contract); Brayer Bros., Auburn, $34,082; Antonio Mondo, Syracuse, $34,369; Thomas Grady, Rochester, $34,778; J. H. Weidman, Syracuse, $35,858; Joseph McCormick, E. Providence, R. I., $36,092; John H. Gordon, Albany, $35,965.

Repair Contract No. 798, Cayuga County, 11.52 miles: DANA W. ROBBINS, INC., New York, $5933 (awarded contract); Pathfinder Construction Co., Inc., Fulton, $6096; Dale Engineering Co., Utica, $6106; Richard Hopkins, Troy, $6354; Brayer Bros., Auburn, $6400.

Repair Contract No. 791, Columbia County, 7.88 miles: HENRY CLINTON, Poughkeepsie, $3353 (awarded contract); Gleason & Davitt, Albany, $3821; Edward Hartney, Modena, $3983; Richard Hopkins, Troy, $4148; Westchester-Dutchess Corporation, Mt. Vernon, $4198; Marks Kearney, Hudson, $4254; Van Dusen Holsapple, Hillsdale, $4304; Conway Bros. & Kennedy, Eddyville, $4347; Brady-Oltarsh Construction Co., Inc., New York, $4568.

Repair Contract No. 788, Columbia County, 7.45 miles: WILLIAM DOYLE, Saugerties, $5116 (awarded contract); Thomas H. Karr, Troy, $5139; Gleason & Davitt, Auburn, $5192; Brady-Oltarsh Construction Co., Inc., New York, $5487; Westchester-Dutchess Corporation, Mt. Vernon, $5496; Richard Hopkins, Troy, $5789.

Repair Contract No. 787, Columbia County, 2.81 miles: WILLIAM DOYLE, Saugerties, $5085 (awarded contract); Marks Mearney, Hudson, $5275; Gleason & Davitt, Albany, $5418; Westchester-Dutchess Corporation, Mt. Vernon, $5831; Thomas H. Karr, Troy, $5837; Brady-Oltarsh Construction Co., Inc., New York, $5865.

Repair Contract No. 794, Columbia County, 7.63 miles: WILLIAM DOYLE, Saugerties, $4255 (awarded contract); Edward Hartney, Modena, $4391; Richard Hopkins, Troy, $4520; Thomas H. Karr, Troy, $4550; Gleason & Davitt, Albany, $4619; William R. Kimmey, Albany, $4619; Westchester-Dutchess Corporation, Mt. Vernon, $4674; Brady-Oltarsh Construction Co., Inc., New York, $4776; Conway Bros. & Kennedy, Eddyville, $5051.

Repair Contract No. 786, Delaware County, 7.69 miles: RUDDY-SAUNDERS CONSTRUCTION CO., Troy, $14,689 (awarded contract); McGreevey, McGuigan & Baum, Elmira, $16,419; Richard Hopkins, Troy, $16,966; Lane Construction Corporation, Meriden, Conn., $17,272; De Graff & Hogeboom, Kingston, $17,707.

Repair Contract No. 490, Dutchess County, 3.44 miles; HENRY CLINTON, Poughkeepsie, $9995 (awarded contract); Thomas J. Martin, Beacon, $10,258; William Doyle, Saugerties, $10,870; John A. Jova, Inc., Newburgh, $11,664; Westchester-Dutchess Corporation, Mt. Vernon, $11,901; Gleason & Davitt, Albany, $12,050.

Repair Contract No. 796, Erie County, 3.15 miles: COLD SPRING CONSTRUCTION CO., Buffalo, $16,971 (awarded contract); John W. Landel, Tonawanda, $18,765.

Repair Contract No. 805, Franklin and St. Lawrence Counties, 32.7 miles: HARRY W. ROBERTS & CO., Utica, $11,072 (awarded contract); Spellman-Oliver Co., Chateaugay, $11,116; E. T. Eggleston, Yonkers, $11,563; Richard Hopkins, Troy, $11,764; Dennis C. Flanigan, Watertown, $12,146; Rock & Griffin, Massena, $12,713.

Repair Contract No. 804, Greene County, 14.85 miles: CATSKILL CONSTRUCTION CO., Catskill, $7184 (awarded contract); Conway Bros. & Kennedy, Eddyville, $7267; William Doyle, Saugerties, $7460; Defiance Corporation, Ticonderoga, $7921; Westchester-Dutchess Corporation, Mt. Vernon, $8094; Richard Hopkins, Troy, $8843.

Repair Contract No. 797, Herkimer County, 8.78 miles: DANIEL B. DONOVAN, Rome, $11,440 (awarded contract); W. L. Lawton, Glens Falls, $13,813; John J. Guinan Contracting Co., Brooklyn, $13,837; John A. Jova, Inc., Newburgh, $14,347; Clarence Welsh & Co., Gloversville, $15,253; Newport Construction Co., Herkimer, $16,248.

Repair Contract No. 662, Madison County, 5.68 miles: J. H. WEIDMAN, Syracuse, $26,884 (awarded contract); Paddleford & King, Sherburne, $27,033; John H. Gordon, Albany, $27,146; Charles E. Haney, Camillus, $27,195; Conroy & Nixdorf, Oneida, $27,937; Harry W. Roberts Co., Utica, $28,143; Dana W. Robbins, Inc., New York, $28,918; R. D. Cooper, Little Falls, $29,740; Joseph McCormick, East Providence, R. I., $31,546.

Repair Contract No. 633, Monroe County, 1.39 miles: I. M. LUDINGTON SONS, INC., Rochester, $10,686 (awarded contract); Monroe Roads Co., Pittsford, $11,083; Ribstein-Holter Co., Inc., Rochester, $11,691; Whitmore-Rauber & Vicinius, Rochester, $12,538.

Repair Contract No. 676, Oneida County, 1.04 miles: PHELAN & SULLIVAN, Utica, $5972 (awarded contract); Charles E. Haney, Camillus, $6189; R. D. Cooper, Little Falls, $6379; John H. Weidman, Syracuse, $6489.

Repair Contract No. 782, Oneida County, 1.58 miles: HARRY W. ROBERTS & CO., Utica, $9011 (awarded contract); Charles E. Haney, Camillus, $9525; John H. Weidman, Syracuse, $9566; Paddelford & King, Sherburne, $9813; R. D. Cooper, Little Falls, $9992; Daniel L. Mott, Utica, $10,497.

Repair Contract No. 783, Oneida County, 1 mile: DANIEL O'CONNELL & SONS, Holyoke, Mass., $16,937 (awarded contract); Langan Contracting Corporation, Albany, $17,391; Harry W. Roberts & Co., Utica, $17,981; R. B. Cooper, Little Falls, $23,883.

Repair Contract No. 784, Oneida County, 4.02 miles: DANA W. ROBBINS, INC., New York, $5936 (awarded contract); Charles E. Haney, Camillus, $6132; Harry W. Roberts & Co., Utica, $6210; R. B. Cooper, Little Falls, $7166.

Repair Contract No. 801, Oneida County, 24.82 miles: HARRY W. ROBERTS & CO., Utica, $8490 (awarded contract); Dana W. Robbins, Inc., New York, $8974; Nash & Griffin, Norwich, $9148; County Construction Co., Troy, $9664; De Barber & Hill, Fulton, $9573; Richard Hopkins, Troy, $10,542.

Repair Contract No. 644, Ontario County, 5.68 miles: SEMPER BROS., Watertown, $16,531 (awarded contract); Chambers & Barnes, Rochester, $17,825; Thomas Grady, Rochester, $18,273; Dale Engineering Co., Utica, $18,444; J. W. Brennan Construction Co., Inc., Geneva, $18,950; Monroe Roads Co., Pittsford, $19,841; Ribstein-Holter Co., Inc., Rochester, $20,431.

Repair Contract No. 802, Ontario County, 7.37 miles: COUNTY CONSTRUCTION CO., Troy, N. Y., $4358 (awarded contract); Sweeney & Boland, Rochester, $4524; Dale Engineering Co., Utica, $4608; Crouch Bros., Rochester, $4880; J. W. Brennan Construction Co., Inc., Geneva, $5068.

Repair Contract No. 789, Orange County, 37.31 miles: EDWARD HARTNEY, Modena, $2736 (awarded contract); Westchester-Dutchess Corporation, Mt. Vernon, $3120; Defiance Corporation, Ticonderoga, $3229; William Doyle, Saugerties, $3229; Paul Gsanger, Monsey, $3229; Nash & Griffin, Norwich, $3278; John A. Jova, Inc., Newburgh, $3284; Schunnemunk Construction Co., Highland Mills, $3284; Headley Good Roads Co., Philadelphia, Penn., $3738.

Repair Contract No. 807, Rensselaer County, 5.94 miles: GLEASON & DAVITT, Albany, $30,931 (awarded contract); Olin T. Benedict, Pittsfield, Mass., $31,644; Huntoon & Ferguson, Hudson Falls, $31,663; Belmar Contracting Corporation, Inc., Troy, $31,766; James J. Ringney, Rensselaer, $31,930; Thomas H. Karr, Troy, $32,200; County Construction Co., Troy, $33,407; John B. Dower, Ballston Spa, $34,737.

Repair Contract No. 800, Rockland County, 3.90 miles: JOHN A. JOVA, INC., Newburgh $21,166 (awarded contract); Schunnemunk Construction Co., Highland Mills, $22,568; H. B. Sproul Contracting Co., Inc., Peekskill, $24,525.

Repair Contract No. 803, Rockland County, 3.53 miles: JOHN J. GUINAN CONTRACTING CO., Brooklyn, $17,585 (awarded contract); Paul Gsanger, Monsey, $13,261; John A. Jova, Inc., Newburgh, $18,783; H. B. Sproul Construction Co., Inc., Peekskill, $22,987.

Repair Contract No. 795, Saratoga County, 3.09 miles: WILLIAM J. MORRISSEY, Saratoga Springs, $13,497 (awarded contract); Gaylor Stone Co., Inc., Saratoga Springs, $14,633; Huntoon & Ferguson, Hudson Falls, $15,245; William L. Sherrill, Hudson Falls, $15,551; Thomas H. Karr, Troy, $15,692; Flood & Van Wirt Co., Hudson Falls, $16,106; T. A. Sullivan, Ballston Spa., $16,148; John B. Dower, Ballston Spa, $16,146.

Repair Contract No. 795, St. Lawrence County, 17.66 miles: P. J. KENNEDY, Brasie Corners, $5956; (awarded contract); Richard Hopkins, Troy, $6865; Spellman-Oliver Co., Chateaugay, $6906; DeBarker & Hill, Fulton, $6983; Rock & Griffin, Massena, $7255; Flood & Van Wirt Co., Hudson Falls, $7348; E. Eggleston, Yonkers, $7368.

Repair Contract No. 808, Schenectady County, 8.34 miles: HUNTOON & FERGUSON, Hudson Falls, $3800 (awarded contract); Defiance Corporation, Ticonderoga, $3879; J. J. Malloy, Schenectady, $4244.

Repair Contract No. 790, Westchester County, 14.87 miles: MIGUEL HOUCK, White Plains, $6679 (awarded contract); Tri-County Construction Co., Mt. Vernon, $7479; Westchester-Dutchess Corporation, Mt. Vernon, $7501; Defiance Corporation, Ticonderoga, $7507; Phillipsburg Construction Corporation, Yonkers, $7507; E. T. Eggleston, Yonkers, $7606; Hughes & Gardner, North Tarrytown, $7625; Dailey & Merritt, Portchester, $8443. Noted June 24.

★**Albany, N. Y.**—(Official)—Bids will be received until 1 p.m., Aug. 3, by Edwin Duffey, State Highway Comr., for repairing highways in various counties.

✚**Batavia, N. Y.**—The contract for paving Ellicott St. has been awarded to the THOMAS FITZGERALD CONSTRUCTION CO., Fredonia, at $12,067.

Boonville, N. Y.—Bonds for $11,000 were sold, the proceeds of which will be used for street paving.

✚**Islip, N. Y.**—A contract for constructing 200,000 sq.ft. of concrete sidewalk has been awarded to the CLIFFORD CONSTRUCTION CO., Jamaica (Borough of Queens).

✚**New York, N. Y.**—(Borough of Brooklyn)—(Official)—Contracts have been awarded for regulating and repaving Lincoln Rd. from Bedford to Rogers Ave. and Vernon Ave. from Marcy to Tompkins Ave. and Tompkins Ave. from Vernon to Greene Ave., to the SICILIAN ASPHALT PAVING CO., 41 Park Row, at $6075 and $17,993, respectively; Pioneer St. from Van Brunt to Richards St. to the McFARLANE CONTRACTING CO., 504 Park Pl., at $6882. Noted June 24 and July 8.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 11 a.m., July 21, by L. H. Pounds, Borough Pres., for regulating, grading, curbing and laying sidewalks on Montgomery St. from Utica to Schenectady Ave., Porter Ave. from Meeker Ave. to Anthony St., West 36th St. from Canal to Neptune Ave., 63rd St. from 21st Ave. to Bay Parkway and 81st St. from 19th to 21st Ave.

New York, N. Y.—(Borough of Queens)—(Official)—Bids were received July 8 by Maurice E. Connolly, Borough Pres., for improving portions of Van Alst Ave., as follows: F. B. Smith, Inc., $49,750; Clancy & Nuhn, $57,772; A. D. Gunner, $33,227; Thomas Crimmons Contracting Co., $82,820; James P. Hudson, $48,265; Evergreen Construction Co., $59,805; Anabel Construction Co., $40,156; Press Improvement Co., $46,764; Paladine Contracting Co., $109,840; Peace Bros., $90,500; Charles A. Myers Contracting Co., $70,840. Noted July 1.

✚**Belvidere, N. J.**—The contract for resurfacing the Allamuchy Rd. has been awarded to SALMON BROS., Netcong, at $3729, and for treating other macadam roads in the county with tarvia, at $8245. Noted June 24.

Burlington, N. J.—Bids will be received until July 26 by F. W. Parrott, County Audr., for paving one mile of county road.

Camden, N. J.—The City Planning Commission is negotiating for paving Federal St. from 27th St. to the city line.

✚**Jersey City, N. J.**—Contracts have been awarded for paving Pavonia Ave. with asphalt to W. T. S. CRICHFIELD, and Mercer St. with chipped blocks to PHILIP O'REILLY. Noted June 10 and 17.

Keyport, N. J.—Bids will be received about Sept. 1 by the Borough Clerk for paving Broad St. with concrete, at an estimated cost of $12,000. Noted June 24.

Newton, N. J.—The Township Board plans to improve Cooper's Glen Rd. from Sussex to Colesville with macadam. The Board will also resurface the Glove-Sussex macadam road.

Weehawken, N. J.—Bids were received July 6 for paving Clifton Terrace with (a) concrete block, (b) bituminous concrete, (c) bitulithic as follows: Hastings Paving Co., (a) $12,282; W. T. S. Crichfield, (a) $9549, (b) $7960; Uvalde Asphalt Paving Co., (a) $11,074, (b) $10,393; Nolan & Hornung, (a) $11,026, (c) $12,842; Clinton Contracting Co., (a) $9868, (c) $12,046. Noted May 29 and July 1.

Weehawken, N. J.—The Township Commission, July 6, approved plans and specifications for the improvement of Columbia Terrace.

✚**Philadelphia, Penn.**—The contract for grading Mitchell St. from Pennsdale St. to Walnut Lane has been awarded to AMOS W. BARNES, at $7748. Noted June 17.

Sewickley, Penn.—Press reports state that the Borough Council plans to construct a four mile boulevard.

Uniontown, Penn.—(Official)—Bids will be received until noon, July 27, by Harry Kisinger, Controller of Fayette County, for constructing 2800 lin.ft. of road in North Union Township and for furnishing and delivering 345,000 bricks f.o.b., Alicia or South Brownsville, for the Alicia Rd., in Luzerne Township.

✚**Baltimore, Md.**—Contracts have been awarded by the State Road Commissioners, Garrett Bldg., to McNERNEY CONSTRUCTION CO., Canton, Penn., to construct concrete roadway in Somerset County, from Marion to Hopewell, at $44,285; PENN CONSTRUCTION CO., 652 Equitable Bldg., Baltimore, to resurface Yord Rd. from Glencoe to Verona, Baltimore, County 1.04 miles, at $7516; AUSTIN-BENNETT CONSTRUCTION CO., 321 Knickerbocker Bldg., Baltimore, to construct macadam roadway approaches, 1.02 miles, to Dover Bridge in Caroline and Talbot Counties, at $9212.

✚**Baltimore, Md.**—Contracts have been awarded for paving Camden St. from Paca to Eutaw St. to the CONSOLIDATED ENGINEERING CO., 243 Calvert Bldg., at $6595; Tyson St. from Saratoga to Center St., Hargrove Alley from Federal to Trenton St. and other streets to MARTIN J. BEACH, 8 Beck Lane, at $20,740. Noted June 3.

★**Cumberland, Md.**—(Official)—Bids will be received until 9:30 a.m., July 19, by the City Clerk for improving Baltimore St. between the Western Maryland Ry. and the Baltimore & Ohio R.R. James P. Gaffney is City Engr.

✚**Frederick, Md.**—(Official)—Bids were received July 3 for constructing approximately 1.83 miles of State Aid road near Petersville, and 1.04 miles in Brunswick as follows: M. J. Grove Lime Co., Lime Kiln, $34,028; C. H. Hoyt, $50,794; A. H. Gosnell, $35,780; Bester Long & Co., $39,764; Austin Bennett Construction Co.; $35,851; Thomas Bennett & Hunter, $38,935. Noted June 24.

Charles City, Va.—Bids will be received until noon, July 22, for constructing one mile of gravel road between Henrico and Charles City Counties.

★**Norfolk, Va.**—(Official)—Bids will be received until 1 p.m., July 29, by the Board of Control for paving certain streets.

Prince George, Va.—Press reports state that the Commissioners of Prince George County contemplate holding an election to vote on the question of issuing $200,000 in bonds, the proceeds of which will be used for improving and constructing roads.

Broad Oaks, W. Va.—(Clarksburg post office)—Bids will be received until 7 p.m., Aug. 2, by the Common Council for grading, curbing and paving with brick on concrete base Bridge, Point, Harrison, Marshall, Main and Daisy St. and Buckhannon Pike.

✚**Elkins, W. Va.**—(Official)—A contract for constructing a number of streets has been awarded to the ENTERPRISE CONSTRUCTION CO., Elkins. Noted June 17.

Huntington, W. Va.—Bids will be received until Aug. 3, by the Cabell County Commissioners for the construction of 15 miles of additional roads, including paving of eight miles of Kanawha and James River Turnpike, two miles Ohio River Rd., four miles Hamlin Pike and one mile Harveytown and Wayne County Pike.

Morgantown, W. Va.—An election will be held July 31 in Morgan and Union Districts for the purpose of voting on the question of issuing $50,000 and $120,000 in bonds respectively, the proceeds of which will be used for constructing roads.

Ronceverte, W. Va.—An election will be held July 31 to vote on the question of issuing $150,000 in bonds, the proceeds of which will be used for road improvement in Greenbrier District.

Salisbury, N. C.—See item under "Sewers."

Sarasota, Fla.—Bids will be received until July 24 by the City Council for paving portions of Palm and Strawberry Ave. F. P. Wright is Comr. Pub. Wks.

Greenwood, Miss.—(Official)—Bids will be received until 7:30 p.m., July 20, for constructing gravel or concrete pavement. Warner Wells is City Clk. and Stanley Cobham is City Engr.

Laurel, Miss.—Bids will be received until July 20 by D. F. Gardiner, City Clk., for street improvements. H. W. Bill is City Engr.

New Orleans, La.—Bids will be received until July 27 by A. G. Ricks, Comr. of Pub. Finances, for constructing a road from a point connecting with Chef Menteur Rd., near Chef Menteur, to Rigolets.

Thibodaux, La.—Press reports state that Lefourche Parish will soon vote on the question of issuing bonds, the proceeds of which will be used for improving highways in District No. 2.

Jasper, Tenn.—Press reports state that the citizens of Marion County voted in favor of issuing $100,000 in bonds, the proceeds of which will be used for constructing the Dixie Highway.

Memphis, Tenn.—Bids were received for improving Mississippi Blvd. from Calhoun Ave. to Lauderdale St., as follows: Southern Asphalt Construction Co., $11,628; L. W. Johnson, $9309; Memphis Asphalt & Paving Co., $9329.

✚**Owensboro, Ky.**—A contract for constructing 4¾ miles of macadam road has been awarded to MARTIN & MARTIN, Evansville, at $24,500.

Stanford, Ky.—According to press reports the citizens o Lincoln County will vote on the question of issuing $130,000 in bonds, the proceeds of which will be used for constructing roads.

Cincinnati, Ohio—(Official)—Bids will be received until noon, July 21, by the Commissioner of Purchases and Supplies for improving Jennings Rd.

Cincinnati, Ohio—(Official)—Bids will be received until noon, July 22, by Philip Fosdick, Dir. Pub. Ser., for improving Magnolia St. from Plum to Elm St., Wade St. from Plum to Elm St. and from Central Ave. to Providence St. and until July 23 for the improvement of intersection of Hopple and Beekman St., at the west end of viaduct.

✚**Cincinnati, Ohio**—The contract for improving the Compton Rd. from Hamilton Pike to Carthage Pike has been awarded to the JOHN REUBEL CONSTRUCTION CO., at $9138. Noted June 3.

Columbus, Ohio—(Official)—Bids will be received until 2 p.m., July 23, by Clinton Cowen, State Highway Comr., for improving a number of roads in various counties.

+Columbus, Ohio—(Official)—Contracts have been awarded for road construction as follows: Licking County, Summit Extension, waterbound macadam, J. C. IMBODEN, Logan, $3375; Muskingum County, Zanesville-McConnelsville Rd., brick, WARD PATRICK & CO., $9927; Sandusky County, Sandusky-Clyde Rd., EARL WALTERS, Sandusky, $15,490; Franklin County, Columbus-Newark Rd., bituminous macadam, GRAHAM & KINNEAR, Columbus, $60,128; Union County, Marysville-Marion Rd., bituminous macadam, SYLVESTER BAUGHMAN, Marysville, $10,642. Noted June 24.

Cuyahoga Falls, Ohio—(Official)—Bids will be received until noon, July 28, by W. F. Williamson, Village Clk., for improving Portage Ave.

+Mt. Gilead, Ohio—The contract for improving Foust Rd. in Westfield Township has been awarded to W. H. MILLER, Cardington, at $7064. Noted June 3.

Mt. Gilead, Ohio—Bids will be received until 11 a.m., Aug. 6, by C. O. Higgins, Audr. of Morrow County for improving and macadamizing the Sexon-Thatcher Rd. in Gilead and Canaan Townships.

+Polk, Ohio—(Official)—Contracts for constructing ½ mile of concrete road 16-ft. wide, and 3½ miles of bituminous road, 14-ft. wide, have been awarded to E. F. DOWNS & CO., Toledo, at $7625 and $31,688 respectively. Noted June 24.

+St. Clairsville, Ohio—(Official)—The contract for repairing and resurfacing a portion of High Ridge Rd., in Pultney, Pease, Colerain and Richland Townships has been awarded to SEIPLE & WOLF, Toledo, at $8000. Noted July 1.

+Toledo, Ohio—Contracts have been awarded for paving Hoag St., to PETER H. WATTERS, $12,668; Summit St., to GARRIGAN BROS., $34,268; Forest St., to the ASPHALT BLOCK CO., $8909.

Wauseon, Ohio—Bonds for $9571 were sold July 5, the proceeds of which will be used for street improvements.

West Jefferson, Ohio—Bids will be received until July 26 by the City Clerk for paving Main St. with asphalt macadam, estimated to cost $42,000. Noted June 17.

West Park, Ohio—Bids will be received until noon, July 19, by Frederick Feuchter, Clk., for constructing sidewalks on a number of streets.

Woodstock, Ohio—At a recent election the question of issuing $4800 in bonds, the proceeds of which was to have been used for street paving, was defeated.

Indiana—(Official)—Bids will be received for road construction in Indiana as follows: Greensburg, until 1 p.m., Aug. 2., by the Commissioners of Decatur County for constructing roads in Fugit and Washington Townships; Albion, until 2 p.m., Aug. 2, by the Commissioners of Noble County, for constructing a road on line between York and Jefferson, Noble and Green Townships; Versailles, until 1 p.m., Aug. 2, by the Commissioners of Ripley County for constructing a crushed stone road in Johnson Township; Boonville, until 10 a.m., Aug. 3, by the Commissioners of Warrick County for the construction of a rock or concrete road in Boon Township; Valparaiso, until 2 p.m., Aug. 3, by the Commissioners of Porter County for constructing gravel roads in Morgan Center and Portage Townships; Noblesville, until 10 a.m., Aug. 3, by the Commissioners of Hamilton County for constructing a road in Washington Township and two in Wayne Township; Winchester, until 10 a.m., Aug. 3, by the Commissioners of Randolph County for constructing a road in Greene Township; Goshen, until 1 p.m., Aug. 3, by the Commissioners of Elkhart County for constructing a gravel, concrete or brick road in Elkhart Township.

+Columbus, Ind.—The contract for constructing a crushed stone road in Hawcreek Township has been awarded to the MOORE & CHRIST CONSTRUCTION CO., Letts, at $8000.

+Hartford City, Ind.—The contract for constructing a macadam road in Blackford County has been awarded to ALBERT CLAMME, Hartford City, at $11,740.

+Jasper, Ind.—The contract for constructing a rock road in Patoka Township has been awarded to TRAYLOR & KREMPP, Jasper, at $9280.

+Kokomo, Ind.—The contract for constructing a stone road in Clay Township has been awarded to MARTIN McHALE, Logansport, at $5024.

+Liberty, Ind.—The contract for constructing a road in Union Township, Union County has been awarded to WILK & CO., Rushville, at $19,767.

+Logansport, Ind.—The contract for constructing a road in Washington Township has been awarded to R. A. SULLIVAN, Peru, at $9999.

Portland, Ind.—(Official)—Bids will be received until 7 p.m., July 26, by the City Council for improving Commerce and Ship St.

+Rensselær, Ind.—The contract for constructing a stone road in Carpenter Township has been awarded to TABER & HALLIHAN, Wabash, at $7218.

+Rockville, Ind.—The contract for constructing the Rockville-Nyesville gravel road has been awarded to THOMAS WILSON, Montezuma, at $15,422. Other bids were: Frank L. Adams, $17,298; L. W. De Voto, $17,400; A. L. Tribble, $16,438; W. P. Harrison, $16,875.

+Shelbyville, Ind.—The contract for constructing the Moral-Van Buren Township line gravel road has been awarded to CHARLES E. MOBERLY, Shelbyville, at $6959.

Birmingham, Mich.—Bonds for $23,300 have been sold, the proceeds of which will be used for street paving.

Mt. Clemens, Mich.—Bids will be received until 7:30 p.m., July 19, by A. A. Devantier, Clk., for paving North and Grand Ave.

Havana, Ill.—The City Council plans to pave a number of streets.

+Peoria, Ill.—(Official)—The contract for improving Callender Ave. from Institute Pl. to Western Ave. has been awarded to JOHN W. BUSHNELL, at $6557.

Janesville, Wis.—(Official)—Bids will be received until 2 p.m., July 27, by the Board of Public Works for paving Wisconsin, South Bluff St. and Milton Ave.

+Milwaukee, Wis.—The contract for paving Grand Ave. from Fourth to Eighth St. has been awarded to HENRY HASE, at $14,500. Noted June 24.

Sioux City, Iowa—(Official)—Bids will be received until 10 a.m., July 17, by Paul J. Wells, City Clk., for street paving.

Spencer, Iowa—(Official)—Bids will be received until 8 p.m., July 27, for laying 70,000 sq.yd. of pavement. E. O'Keefe is City Engr.

Norfolk, Neb.—Bids will be received until July 19 by P. F. Stafford, City Clk., for constructing 30,000 yd. of concrete pavement and 16,000 lin.ft. of concrete curb. Noted June 3.

+Fargo, N. D.—The contract for paving Fourth St. has been awarded to S. BIRCH & SONS, at $26,122.

Butte, Mont.—Bids will be received about Aug. 7 by J. C. Driscoll, City Clk., for paving Main St., at an estimated cost of $15,000.

Hardin, Mont.—Bids will be received until July 20 by F. M. Lipp, Town Clk., for improving streets in District No. 1.

Walkerville, Mont.—The City Council plans to improve North Main St. from Lexington Mine to Daly St. by macadamizing, estimated to cost $10,000.

Independence, Mo.—The County Court will receive bids about Aug. 1 for widening and paving Van Horn Blvd., the old Santa Fé trail connection between Independence and Kansas City.

Kansas City, Mo.—Press reports state that bids will be received about Aug. 1 for grading portions of Donnelly, Jackson and Booth Ave. and 59th, Olive and Ninth St.

St. Joseph, Mo.—The Park Board is receiving bids for paving Noyes Blvd.

Caldwell, Tex.—(Official)—Bids will be received until 2 p.m., July 31, by the Commissioners of Burleson County for road improvements in District No. 1.

+Clarksville, Tex.—The City Council has awarded a contract for paving 35 streets to McCULLAN & DALTON, Dallas. Noted Apr. 8 and May 20.

Cuero, Tex.—At a recent election the question of issuing $58,000 in bonds, the proceeds of which was to have been used for constructing roads in District No. 4, De Witt County, was defeated.

Ft. Stockton, Tex.—The construction of an automobile highway between Ft. Stockton and Grand Falls is being promoted by a committee of citizens representing the two towns. Most of the work will be on a stretch of road between Grand Falls and Salt Crossing, 18 miles. James Rooney, Mayor of Ft. Stockton, is interested in the project.

El Paso, Tex.—It is planned by the Commissioners' Court to use the proceeds of the $750,000 bonds to be voted on at an election to be held Aug. 3 in the construction of a concrete highway from the New Mexico-Texas State line to Fabens, in the Rio Grande Valley, a distance of 50 miles. The concrete material will be laid upon the top of the present paved road.

Port Lavaca, Tex.—An election will be held July 27 to vote on the question of issuing $17,000 in bonds, the proceeds of which will be used for constructing roads and bridges.

Seguin, Tex.—(Official)—Bids will be received until July 19 by the Commissioners of Guadalupe County for constructing six miles of road. Bonds for this purpose were sold recently. F. E. Hess, 1604 Southwestern Life Bldg., Dallas, is Engr.

+Salt Lake City, Utah—The contract for paving West St. from First to Second South St. has been awarded to G. A HEMAN, at $9618.

+Everett, Wash.—The contract for constructing Permanent Highway No. 18 has been awarded to WARD & TEMPLETON, Everett, at $13,694.

+Mt. Vernon, Wash.—The contract for paving Cleveland Ave. has been awarded to M. E. MORRIS, Burlington, at $10,469. Other bids were: Grant-Evig & Co., Anacortes, $11,056; N. W. Ball, Seattle, $10,780; R. W. McKinstry, Mt. Vernon, $10,848.

+Tacoma, Wash.—A contract for constructing concrete sidewalks in the North End District has been awarded to S. R. GRAY, Tacoma, at $9695. Other bids were: B. S. Davis, Tacoma, $10,474; Joseph Warter, Tacoma, $10,745; Macheller Bros., $9775.

+St. Helens, Ore.—The Columbia County Court has awarded a contract for the construction of a section of the St. Helens-Pittsburgh Highway, near Houlton, to A. H. TARBELL, at approximately $40,000.

+Burlingame, Calif.—The City Council has awarded a contract for street improvements to the RAISCH IMPROVEMENT CO., San Francisco, at $10,369. Noted May 20.

Sacramento, Calif.—Bids will be received until July 26 by the State Highway Commission, 515 Forum Bldg., for road construction, as follows: Colusa County, through Arbuckle, about 0.3 mile to be surfaced with asphalt; Marin County, between Burdell and St. Vincent, about four miles, to be graded; Monterey County, from Greenfield to Camphora, about 11.7 miles, to be paved with portland cement concrete; Santa Barbara County, from Gaviota Pass to Zaca Station, about 11.4 miles, to be graded; San Luis Obispo County, from Atascadero Creek to Paso Robles, about 10 miles, to be paved with portland cement concrete. Wilson R. Ellis is Secy. of the Comn.

+San Diego, Calif.—The contract for grading Edgemont St. from Grape to Cedar St. has been awarded to the C. L. HYDE CONSTRUCTION CO., at $4426.

+San Leandro, Calif.—The City Trustees have awarded a contract for street paving to the CALIFORNIA BITHULITHIC CO., at $64,696.

Amherstburg, Ont.—The Town Council plans to lay one mile of pavement on Sandwich and Aspley St. G. E. Pulford is Clk.

Renfrew, Ont.—Press reports state that the Town Council plans to pave Hall and Coombs St. with macadam, at an estimated cost of $7750. J. R. Stewart is Engr.

INDUSTRIAL WORKS

Fall River, Mass.—The Algonquin Printing Co. will build a three-story, 104x255-ft. addition to its plant.

Lowell, Mass.—The Appleton Co. will build a ten-story, 92x133-ft., reinforced-concrete storehouse to cost approximately $75,000. Noted June 3

New Bedford, Mass.—The Merchants' Terminal Warehouse Co., recently organized, will build an eight-story, 108x158-ft., concrete warehouse. James F. Bacon is Pres.

✚Salem, Mass.—C. S. CUNNINGHAM & SONS, 101 Tremont St., Boston, Mass., has been awarded the contract for the construction of a two-story, 54x97-ft., reinforced-concrete garage on Essex St., for G. H. Keefe, 46 Boston St. The estimated cost is $20,000.

Salem, Mass.—The Hygrade Incandescent Lamp Co. will build a four-story, 54x206-ft. brick factory on Federal St.

Springfield, Mass.—A. A. Geisel will build a two-story, 67x165-ft. garage and repair shop on Chestnut St. E. C. & G. C. Gardner is Arch.

✚Springfield, Mass.—The contract for the construction of a two-story, 69x101-ft. building for the Springfield Daily News has been awarded to FRED T. LEY CO., INC. H. L. Sprague is Arch.

Springfield, Mass.—The Springfield Union plans the construction of a three-story building on Fort St., for its mechanical department.

Springfield, Mass.—M. C. Barrett, 600 State St., will build a 62x66-ft., brick garage to cost $12,000.

Ansonia, Conn.—The Farrell Foundry & Machine Co. will build a 120x226x400-ft., brick and reinforced-concrete building to cost $100,000. James E. Brooks, Bloomfield, N. J., is Arch.

Ansonia, Conn.—The American Brass Co. plans the construction of buildings at its A. B. C. Branch as follows: A 100x220-ft. rolling mill, to cost $100,000; a 132x148-ft. casting shop, to cost $100,000; a metal storage building, to cost $100,000; an 85x95-ft. coal pocket, to cost $10,000; and a 55x75-ft. ash reducing plant, to cost $8000; all of reinforced-concrete and brick.

Bridgeport, Conn.—The Bridgeport Arms Co., Boston Ave., will build two five-story, brick and steel factories, to cost $200,000 each.

Hartford, Conn.—H. B. Beach & Co. will repair the damage to its factory on Mechanic St., caused by fire, at a cost of $15,000.

✚Herkimer, N. Y.—(Official)—Carl Haug, Arch., Little Falls, N. Y., has awarded the contract to STEPHEN HINES for the construction of a three-story, 60x90-ft. addition to the Royal Gem Mills. Joseph Reamy, St. Johnsville, N. Y., is Pres. Noted July 1.

✚Jamestown, N. Y.—The Gurney Ball Bearing Co. has awarded the contract for the construction of a one-story, 170x266-ft. factory on Chandler St. to the JAMESTOWN CONSTRUCTION CO. Noted Apr. 22.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received about Sept. 1 for the construction of a 200x300-ft. factory at Park and Nostrand Ave. for the American Tobacco Co., Kent Ave. The estimated cost is $500,000. Francisco & Jacobus, 200 Fifth Ave. (Borough of Manhattan) is Arch. Noted July 8.

Rochester, N. Y.—The Brewster-Gordon Wholesale Grocery Co. will build a five-story, 89x202 ft., reinforced-concrete warehouse on Canal St.

✚Rochester, N. Y.—(Official)—The TURNER CONSTRUCTION CO., Prudential Bldg., Buffalo, has been awarded the contract for the construction of a three-story, 95x217-ft. reinforced-concrete factory and warehouse for the Vacuum Oil Co.

Syracuse, N. Y.—The Globe Malleable Iron & Steel Co., 101 Greenway Ave., will expend $200,000 for additions to its foundry.

Jersey City, N. J.—Plans have been prepared by R. W. Sailer, Arch., 75 Montgomery St., for the construction of a concrete garage and bakery at Montgomery and Merseles St. for the National Grocery Co. The estimated cost is $75,000.

Newark, N. J.—Franklin Gruman plans alterations to his brick factory at 77 St. Francis St., to cost approximately $17,000.

Fallston, Penn.—(New Brighton post office)—The C. C. & E. P. Townsend Co. will rebuild its factory which was recently destroyed by fire at a loss of $100,000.

Marcus Hook, Penn.—The contract will soon be awarded by Ballinger & Perrot, Arch., 1710 Arch St., Philadelphia, Penn., for the construction of a one-story, 153x423-ft. brick factory, and a two-story, 44x73-ft. brick and concrete factory for the Viscose Co.

Philadelphia, Penn.—William Steele & Sons Co., Arch., 1600 Arch St., has prepared plans for the construction of a four-story, 108x120-ft. factory at Second and Erie Ave. for the Thomas Potter & Sons Co., to replace the one recently destroyed by fire with a $50,000 loss.

Pittsburgh, Penn.—The Westinghouse Co., plans the construction of an ammunition factory, with a daily capacity of 200,000 rounds.

✚Riverside, Penn.—The Carpenter Steel Co. has awarded the contract for the construction of a one-story, 65x185-ft. annex to L. H. FOCHT & SON. The estimated cost is $25,000.

✚South Bethlehem, Penn.—The contract for the construction of a $350,000 benzol plant for the Lehigh Coke Co., has been awarded to the CARL STILL CO.

Baltimore, Md.—The Baltimore Enamel & Novelty Co., Woodall and Clement St., plans the construction of a 128x300-ft. addition.

Baltimore, Md.—The Maryland Cold Storage Co. will soon award the contract for the construction of a $175,000 cold-storage plant.

✚Baltimore, Md.—The Baltimore City Garage Co. has awarded the contract for the construction of a four-story garage at 29 South Charles St., to JOSEPH C. SCHANBERGER. The estimated cost is $100,000. Wyatt & Nolting is Arch.

✚Baltimore, Md.—J. HENRY SMITH has been awarded the contract for the construction of a three-story, 39x111-ft., brick warehouse at 14 South High St., for the Joseph Fisher Specialty Co. The estimated cost is $20,000. George R. Callis, Jr., is Arch.

Baltimore, Md.—John T. Buckley, 916 Bolton St., will build a one-story garage at an estimated cost of $15,000.

✚Suffolk, Va.—HARWOOD & MOSS, Newport News, Va., has been awarded the contract for the construction of a two-story, reinforced-concrete storage warehouse for the Holland-Lee Co. A. T. Holland is Pres.

Wheeling, W. Va.—(Official)—The Saturn Machine Co. plans the construction of a brass foundry. E. W. Krause is Mgr.

✚Akron, Ohio—The contract for the construction of three additions to the plant of the Goodyear Tire & Rubber Co. has been awarded to the HUNKIN-CONKEY CONSTRUCTION CO., 321 Cuyahoga Bldg. Estimated cost, $400,000. Noted July 8.

✚Cleveland, Ohio—The Frantz-Premier Co., Leader-News Bldg., has awarded the contract for the construction of a four-story, 61x320-ft. factory and a 38x50-ft. foundry at Ivanhoe Rd. and the New York, Chicago & St. Louis R.R. to the SAMUEL AUSTIN & SON CO., 14,230 Euclid Ave. The estimated cost is $115,000. Noted July 1.

✚Cleveland, Ohio—The contract for the construction of a factory at East 55th and Superior Ave., for the Richman Bros. Co., Prospect and Ontario St., has been awarded to the HUNKIN-CONKEY CONSTRUCTION CO., 321 Cuyahoga Bldg. Estimated cost, $250,000. Noted June 10.

Cleveland, Ohio—Plans have been prepared by the W. S. Ferguson, Arch., 615 Euclid Bldg., for the construction of a one-story, 80x120-ft. factory for the Cleveland White Metal Co., 8005 Melrose Ave. The estimated cost is $60,000.

Cleveland, Ohio—The Standard Welding Co., West 76th St. and New York Central R.R., plans the construction of a $100,000 plant.

✚Cleveland, Ohio—The contract for the construction of an 80x360-ft. factory on East 61st St. for the Hydraulic Pressed Steel Co. has been awarded to the SAMUEL W. EMERSON CO., Chamber of Commerce Bldg. Noted July 1.

Columbus, Ohio—The contract for the construction of a warehouse for Rosenthal Bros., on West Spruce St., has been awarded to D. W. McGRATH, at $32,500. Riebel & Son, is Arch.

Fostoria, Ohio—The contract will soon be awarded by J. M. Myers, Pres. of the Fostoria Provision Co., 106½ Main St., for the construction of a packing plant.

Hamilton, Ohio—Bids are being received for the construction of a two-story brick warehouse at Seventh St. and Maple Ave. for the B. H. Kroger Grocery & Bakery Co. The estimated cost is $25,000. J. P. Mormer is Local Mgr.

✚Toledo, Ohio—THEODORE STERRITT, Detroit, Mich., has been awarded the contract for the construction of a seven-story reinforced-concrete warehouse at Spielbusch Ave. and State St. for the Scheiwe Storage Co., 645 Ohio Bldg. Manfred M. Stophlet is Arch. Noted Apr. 8.

Toledo, Ohio—Gortland Bros., Marion, Ind., plans the construction of a foundry. Estimated cost, $40,000.

✚Toledo, Ohio—The contract for the construction of a two-story, brick and stone storage building on Palmwood Ave. for the De Vilbiss Mfg. Co., has been awarded to JACOB JACOBS. Manfred M. Stophlet is Arch.

Uhrichsville, Ohio—The United States Clay Products Co. plans the construction of a three-story, 80x256-ft. building with a 35x112-ft. annex, and 12 kilns, 36 ft. in diameter. The estimated cost is $95,000. S. L. Weaver is Arch.

Indianapolis, Ind.—The E. C. Atkins Co. will build a two-story, 100x400-ft. reinforced-concrete addition to its plant to cost $130,000.

Tell City, Ind.—The Southwestern Furniture Co. plans the construction of a factory.

✚Bay City, Mich.—THE BAY CITY STONE CO. has been awarded the contract for the construction of a one-story, 80x210-ft. storage building, and a two-story, 70x298-ft. factory on Marquette and Sidney St., for the Bigelow Cooper Co.

✚Detroit, Mich.—The H. C. CHRISMAN CO. has been awarded the contract for the construction of a four-story, brick and steel factory on Russell St., for the Detroit Wire Spring Co. Albert Kahn, 58 La Fayette Ave., is Arch. Noted July 8.

Detroit, Mich.—A permit has been granted to the Hudson Motor Car Co. for the construction of a two-story, 60x180-ft., and a three-story, 60x100-ft. addition to its plant at Jefferson Ave., E., and Conner's Creek. The estimated cost is $40,000. Albert Kahn, 58 LaFayette Ave., is Arch.

✚Detroit, Mich.—The Rands Mfg. Co., Holden Ave., has awarded the contract for the construction of a three-story, concrete addition to its plant to the W. E. WOOD CO., Ford Bldg. The estimated cost is $20,000.

Detroit, Mich.—The Schleider Mfg. Co., Fort St., E., will build a one-story, concrete plant on East Grand Blvd., to cost $19,000.

Detroit, Mich.—The Timken-Detroit Axle Co. will build a four-story factory to cost $60,000 and a one-story garage to cost $5000, on Clark St.

Detroit, Mich.—The Rands Mfg. Co. will build a two-story factory on Holton St., to cost $20,000.

Chicago, Ill.—The American Car & Foundry Co., Railway Exchange, will build a one-story steel-car shop at 2416 South Paulina St., to cost $20,000. A. A. Bown is Arch.

Chicago, Ill.—The Sidlo Steel Co. will build a five-story, brick factory at 2350 Canal St., to cost $30,000. C. A. Eckstrom, 5 North La Salle St., is Arch.

Chicago, Ill.—The Galena Signal Oil Co., 80 East Jackson Blvd., has purchased 131,000 sq.ft. of land at 58th Ave. and 66th St., on which it will build a brick and concrete warehouse and distributing station to cost $50,000. Frank D. Chase, 122 South Michigan Ave., is Arch.

St. Paul, Minn.—The Willys Overland Co., Toledo, Ohio, plans the construction of a $250,000 warehouse. Royal R. Scott is Secy.

✚**St. Louis, Mo.**—(Official)—O. R. S. Traber, Arch., Fullerton Bldg., has awarded the contract for the construction of a four-story, 48x96-ft. factory for Vivianno Bros., 1022 North Seventh St., to THEODORE H. RATZ, 2616 Vanderburgh Ave., at $27,000. Noted July 1.

✚**Corpus Christi, Tex.**—Weil Bros. has awarded the contract for the construction of a 100x150-ft. warehouse on Tiger St., to OSCAR LUTZ.

Niles City, Tex.—The grain elevator of E. R. & D. C. Kolp, which was recently damaged by fire to the extent of $40,000, will be repaired.

✚**Avon, Calif.**—(Martinez post office)—The Associated Oil Co. has awarded the contract for the construction of an addition to its plant to the WESTERN PIPE & STEEL CO., San Francisco, at $38,158. Noted May 20.

✚**El Modeno, Calif.**—The contract for the construction of an 84x144-ft. addition to the packing house of David Hewes has been awarded to GEORGE PREBLE, Santa Ana. The estimated cost is $12,000. R. L. Folger is Arch.

✚**Los Angeles, Calif.**—The Rudger-Merle Co. has awarded the contract for the construction of a three-story warehouse at 532 South Alameda St. to the ALTA PLANING MILL CO., at $53,000. William Curlett & Son is Arch.

San Francisco, Calif.—The Harbor Warehouse Co., North Point and Kearing St., will build a two-story, 133x205-ft., brick warehouse at Bay and Kearny St., to cost $30,000.

San Francisco, Calif.—A four-story building will be constructed at Fourth and Brannan St. for the John Bollman Co., at an estimated cost of $200,000. C. P. Weeks, Mutual Bank Bldg., is Arch.

Victorville, Calif.—The Southwest Portland Cement Co. will build a plant to have a daily capacity of 2500 bbl. of cement. Carl Leonardt, Los Angeles, is Pres. Estimated cost, $1,000,000.

Ottawa, Ont.—Bids are being received by W. H. George, Arch., Castle Bldg., for the construction of a brick and concrete garage for M. Landreville. The estimated cost is $20,000.

Toronto, Ont.—The Borthwick Bakery will build a two-story addition to its plant to cost $14,000.

Vancouver, B. C.—The McLaughlin Motor Car Co., 1219 Georgia St., will build a reinforced-concrete garage to cost $75,000.

FEDERAL GOVERNMENT WORK

✚**Post Office**—Mt. Vernon, N. Y.—The contract for the construction of the post office at Mt. Vernon has been awarded to JOSEPH DI BENEDETTO, 423 East 115th St., New York, at $87,737. Noted May 27 and July 1.

Dredging—New York, N. Y.—Bids will be received until noon, Aug. 2, at the U. S. Engineer Office, Room 707 Army Bldg., New York, for dredging in Hempstead and Huntington harbors.

★**Dredging**—Philadelphia, Penn.—Bids will be received until noon, Aug. 9, at the U. S. Engineer Office, Philadelphia, for dredging in Delaware River on Bellevue and Cherry Island lighthouse ranges.

Riprap—Philadelphia, Penn.—Bids were received July 8 by Col. George A. Zinn, Philadelphia, for constructing about 12,000 tons of riprap along the channel face on the bulkhead in the Delaware River at the lower end of Artificial Island as follows: C. R. Simpson, 170 Broadway, New York, N. Y., $1.72 per ton; Ellis D. Thompson, 1505 Arch St., Philadelphia, Penn., $1.89; Coast & Lakes Contracting Corporation, 41 Broad St., New York, N. Y., $1.39 (will probably be awarded contract); Edwin S. Sickles, New Baltimore, N. Y., $2.18. Noted June 22.

Boiler Plant—Indian Head, Md.—Bids were received July 3, by the Bureau of Yards and Docks, Navy Dept., Washington, for the construction of an extension to the existing boiler plant at the U. S. Naval Proving Grounds, Indian, Head: (a) on Government specifications; (b) on bidder's specifications, as follows: Day & Zimmerman, Philadelphia, Penn., (b) $192,144; John W. Danforth Co., Buffalo, N. Y., (a) $169,987; Evans, Almiral & Co., New York, N. Y. (b) $191,831. Noted June 3.

✚**School**—Washington, D. C.—Contracts for the construction of the superstructure of High School No. 174, known as the Colored High School, have been awarded as follows: Construction proper P. F. GORMLEY CO., Washington, at $260,767; plumbing, STANDARD ENGINEERING CO., Washington, D. C.; heating, DRIGS, DISTERN & STRINGER, Baltimore, Md., at $61,317 and stack, HEINE CHIMNEY CO., New York, N. Y., $1786. Noted May 20.

Sewers—Washington, D. C.—Bids were received July 7, by the Commissioners of the District of Columbia for the construction of sewers as follows: (a) George Hyman, Washington, (b) Warren F. Brenizer Co., Washington, (c) Continental Contracting Co., Baltimort, Md., (d) William F. Cush, Washington: Service sewers, ordinary excavation, (a) $0.50, (b) $0.65, (c) $1.85, (d) $0.60; sewer brick masonry, (a) $14, (b) $14, (c) $15, (d) $14; 12-in. diameter sewer pipe, (a) $0.55, (b) $0.70, (c) $1.35, (d) $0.62; 10-in. diameter sewer pipe, (a) $0.45, (b) $0.60, (c) $1.20, (d) $0.60; Northhampton St. Outlet Sewer; ordinary excavation, (a) $0.60, (b) $0.50, (c) $2.75, (d) $0.60; sewer brick masonry, (a) $16, (b) $16, (c) $18, (d) $14; 12-inich diameter sewer pipe, (a) $0.80, (b) $0.95, (c) $1.85, (d) $0.62.

★**Sidewalks**—Washington, D. C.—Bids will be received until 2 p.m., Aug. 10, by the Board of Commissioners for constructing concrete sidewalks in the District of Columbia.

★**Steel Barges**—Vicksburg, Miss.—Bids will be received until noon, Aug. 12, by the Officer of the Third Mississippi River District, P. O. box 404, Vicksburg, for six steel barges.

Post Office—Ypsilanti, Mich.—Bids will be received until 3 p.m., Aug. 20, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing the U. S. post office complete.

✚**Canal Work**—Great Falls, Mont.—The contract has been awarded to the TWO-MIRACLE CONCRETE CORPORATION, Great Falls, at about $31,000, for constructing Panlo laterals A and 31 A, Flathead Irrigation project.

★**Post Office**—Blackwell, Okla.—Bids will be received until 3 p.m., Aug. 19, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing the U. S. post office at Backwell.

★**Cylinder Gates**—Yakima, Wash.—Bids will be received until 2 p.m., July 19, by Morris Bien, Act. Dir., U. S. Reclamation Service, Dept. of the Interior, Washington, D. C., for two c.-i. cylinder gates of 12 ft. diameter for service under 100 ft. head for the Keechelus Reservoir, Yakima Project, and a duplicate set. Noted July 19.

Subtreasury—San Francisco, Calif.—Bids were received July 7, by the Supervising Architect, Treasury Dept., Washington, D. C., for changes in the Subtreasury building, San Francisco, Calif. as follows: Williams Bros., $15,300; C. A. Day Co., $16,125; Harvey A. Klyce, $15,670; Grant Fee, $12,500; Lange & Bergstrom, $17,500; B. F. Owsley, $10,800; Construction Engineering Co., $9760; Campbell Building Co. of Utah, Salt Lake City, Utah, $12,800. Above bidders are of San Francisco unless otherwise specified. Noted June 10.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., July 16, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

Structural Steel—Panama—Bids were received by Maj. F. C. Boggs, Corps of Engineers, U. S. A., General Purchasing Officer, The Panama Canal, Washington, D. C., for furnishing structural steel and accessory parts for shed on Pier No. 7, Atlantic Terminal, consisting of 4,265,000 lb. structural steel, 16,700 lb. handrailing, and 36,000 lb, downspouts, (a) fabricated and delivered at the Isthmus, (b) fabricated, delivered and erected as follows: Belmont Iron Works, Philadelphia, Penn., (a) $115,201; McClintic-Marshall Construction Co., Pittsburgh, Penn., (a) $114,685; Milliken Bros., 17 Battery Pl., New York, N. Y., (a) $98,478; Penn Bridge Co., Beaver Falls, Penn., (b) $138,949; Pennsylvania Steel Co., Steelton, Penn., (a) $99,898; Riter-Conley Mfg. Co., Pittsburgh, Penn., (a) $106,378; (b) $140,751; United States Steel Products Co., New York, N. Y., (a) $118,180, (b) $144,588. Noted July 1.

Piers—Pearl Harbor, Hawaii—Bids will be received until 11 a.m., Sept. 18, by H. R. Stanford, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing reinforced-concrete torpedo boat piers at the Naval Station, Pearl Harbor.

MISCELLANEOUS

✚**Dredging**—Boston, Mass.—The Board of Harbor and Land Commissioners has awarded the contract for dredging the channel at South River, Salem, to the BAY STATE DREDGING CO., 172 Condor St., Boston, at (a) 33c. per cu.yd., (b) $10 per cu.yd.

Dredging—Boston, Mass.—The following bids were received July 7 by the Board of Harbor and Land Commissioners for dredging the channel of Ipswich River, Ipswich: John H. Gerrish, 101 Tremont St., Boston, (a) $0.317 per cu.yd., (b) $6 per cu.yd.; Bay State Dredging Co., Ltd., 247 Atlantic Ave., Boston, (a) $0.322 per cu.yd., (b) $8 per cu.yd.; Eastern Dredging Co., Ltd., 172 Condor St., East Boston, (a) $0.325 per cu.yd., (b) $9.50 per cu.yd. William F. Williams is Ch. Engr.

★**Interior Skylights**—Albany, N. Y.—(Official)—Bids will be received until noon, July 27, by the Trustees of Public Buildings, Executive Chamber, Capitol, Albany, for the restoration of interior skylights over the western staircase of the State Capitol.

Fire Alarm System—New York, N. Y.—(Borough of Manhattan)—The Board of Estimate has authorized an issue of $879,588 in bonds to be used for the construction of a fire alarm system in the Borough of Manhattan.

Dredging—New York, N. Y.—(Borough of Manhattan)—Bids will be received until noon, July 21, by R. A. C. Smith, Comr. of Docks, Pier A, Battery Pl., for dredging the dumping boards of the Department of Street Cleaning, Boroughs of Manhattan, the Bronx and Brooklyn.

Motor Fire Apparatus—New York, N. Y.—(Borough of Manhattan)—(Official)—The only bid received by Robert Adamson, Fire Comr., for furnishing and delivering 24 motor-driven hose wagons under three separate contracts, each providing for eight, was that of the International Motor Co., 64th St. and West End Ave., New York. (a) $28,938, (b) $28,938, (c) 28,938, total, $86,814. Noted July 1.

Street Signs—New York, N. Y.—(Borough of Manhattan)—Bids will be received until July 15 by Marcus M. Marks, Borough Pres., for furnishing 500 street sign container frames, each frame to contain two enamel street signs.

★**Subway**—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until July 30 by the Public Service Commission, 154 Nassau St., for the construction of Section No. 3, Routes Nos. 4 and 36, a part of the Broadway Subway lying between 38th and 51st St .

Dredging—New York, N. Y.—(Borough of Brooklyn)—Bids will be received by R. A. Smith, Comr., Docks and Ferries, Pier A., Battery Pl. (Borough of Manhattan), until noon, July 16, for dredging in Mill Basin, Jamaica Bay.

✚Pier—New York, N. Y.—(Borough of Brooklyn)—The contract for the construction of a pier at the foot of 30th St., to be known as the 30th St. pier, has been awarded to W. P. SEAVER, INC., Grand Central Terminal, New York, at $196,263. Noted June 10 and 24.

Pier—New York, N. Y.—(Borough of Brooklyn)—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier A, Battery Pl. (Borough of Manhattan) until noon, July 15, for building a new pier at the foot of 35th St.

★Subway—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by the Public Service Commission, 154 Nassau St. (Borough of Manhattan), for the construction of Section No. 3, Route No. 12, of the Eastern Parkway Subway.

★Subway—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by the Public Service Commission, 154 Nassau St. (Borough of Manhattan), for the construction of Section No. 2, Route No. 29, of the Nostrand Ave. Subway.

Track Materials—New York, N. Y.—(Borough of Brooklyn)—The following bids have been received by the Public Service Commission for a three-track elevated railroad beginning at a point near 38th St. and 10th Ave. and extending thence to 10th Ave.; thence over 10th Ave. and New Utrecht Ave. to a point at or near 81st St. thence to a point in 86th St. to a point at or near Bay 41st St.; thence over 26th Ave. to Stillwell Ave.; and thence over Stillwell Ave. to a point at or near Ave. Y: Ward & Tully, $71,355; W. F. Jordon, $78,525; Joseph A. McElroy, $75,183; Joseph J. Klien, $116,436; Post & McCord, $82,639; Degnon Contracting Co., $85,000; Charles Cooper, $102,500; Holbrook, Cabot & Rollins, $103,781; Gibson & Gifford, $100,500; Joseph J. Frazer, $118,000; Snare & Triest, $94,864; Thomas Crimmons Contracting Co., $99,560.

★Subway Station—New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received by the Public Service Commission, 154 Nassau St. (Borough of Manhattan), for the construction of the station finish on Section No. 2, Route Nos. 36 and 37, of the Astoria Elevated R.R.

★Subway Station—New York, N. Y.—Borough of Queens)—(Official)—Bids will be received until Aug. 3 by the Public Service Commission, 154 Nassau St. (Borough of Manhattan), for the construction of the station finish on Route No. 50 of the Queensboro Subway extension, and Section Nos. 1 and 3, Route Nos. 36 and 37, of the Corona Elevated R.R.

✚Grand Stand—Newark, N. J.—The Essex County Park Commission has awarded contracts for the construction of a grand stand in Weequahic Park, as follows: Steel work, LAVERING & GARRIGUES, $21,500; masonry, NEW JERSEY CEMENT CO., $21,532; carpenter work, H. N. DOREMUS & CO., $3987; roof and sheet metal work, JACOB STEINBERG, $5455. Noted May 20 and June 3.

Elimination of Grade Crossings—Crafton, Penn. — The Board of Trade has submitted plans to the City Council for the elimination of the grade crossings of the Pittsburg, Cincinnati, Chicago and St. Louis Division of the Pennsylvania R.R. at Crafton Ave. and Smily St. The estimated cost is $76,000.

Channel—Philadelphia, Penn.—The Maryland Dredging & Contracting Co., Baltimore, Md., at 2.49c. submitted the lowest bid for the construction of a channel in the Delaware River in the upper end of Philadelphia Harbor. The channel is to be 2000 ft. long, 1000 ft. wide and 35 ft. deep at mean low water. The work will involve the removal of about 900,000 cu.yd.

★Subway—Philadelphia, Penn.—(Official)—Bids will be received by A. M. Taylor, Dir., Dept. of City Transit, 754 Bourse Bldg., until noon, Aug. 16, for the construction of the City Hall station section of the Broad St. Subway and the Market St. Subway. This section will be about 700 ft. long and will include the underpinning of the west side of City Hall and the Market St. Subway. Noted Mar. 18 and July 8.

✚Drain—Salisbury, N. C.—L. O. WHITE, Statesville, at $14,500, has been awarded the contract for removing 331,591 cu.yd. of material and other work necessary to drain Withrow Creek. G. A. Brown is Chn. of Drainage Comn.

★Wharf and Warehouse—Augusta, Ga.—(Official)—Bids will be received until 4 p.m., July 22, by the City Council for the construction of a reinforced-concrete wharf and steel warehouse. Nisbet Winfield is Ch. Engr., River and Canal Comn. Noted June 24.

Levee Work—New Orleans, La.—The following are the lowest bids for the construction of the following levee work: H. W. Bond Bros. for the construction of the Aurora levee, Fifth District, at $28,622, for Orleans Levee Board; earthwork, $2040; sheet piling, $11,872; concrete, $24,900; Hampton Reynolds, at .1748c. per cu.yd. for the levee from Southern Pacific R.R. terminal to the U. S. Naval Station; Lower Coast Construction Co., at .136c. for the upper station river side enlargement, Fifth District, and for filling in barrow pits from the U. S. Government Depot to the lower side of Audubon Park at .147c. Noted June 17.

✚Canal—Lexington, Tenn.—The Beech River Drainage District Board has awarded the contract for the construction of a canal to the TUPELO DREDGING CO., Tupelo, Miss. The estimated cost is $20,000. W. F. Appleby is interested.

★Trenching—Covington, Ky.—(Official)—Bids will be received until 10 a.m., July 29, by J. M. Howk, Comr. of Pub-Property, for pipe trenching and backfilling.

Telephone Cable—Columbus, Ohio—Bids will be received by H. L. Barger, Dir. of Pub. Safety, until noon, July 20, for furnishing approximately 25,000 ft. of high-grade rubber insulated lead covering telephone cable.

Elimination of Grade Crossings—Youngstown, Ohio—The Erie R.R. Co. is having plans prepared for the elimination of grade crossings through the business section of the city. Bonds for $800,000 have been sold for this purpose. The total cost of the work is estimated at $3,000,000.

Dredging—Indianapolis, Ind.—Bids will be received by the Board of Park Commissioners until 10 a.m., July 16, for dredging the lagoon in Garfield Park; also a portion of Pleasant Run between Shelby and Raymond St., and that portion of Bean Creek lying within Garfield Park.

Drainage—Chicago, Ill.—Bids were received June 24 by John McGillen, Clk., Sanitary Dist., for excavating side slopes and constructing pile and timber protection on North Shore Channel of Sanitary District in Evanston and Wilmette as follows: Byrne Bros. Dredging & Engineering Co., (a) 150,000 cu.yd. excavation, 59c.; (b) 9500 lin.ft. piles, 47c.; (c) 40 M ft. timber, $75; Great Lakes Dredge & Dock Co., (a) 59c.; (b) 50c.; (c) $78.

Fire Hose—Oshkosh, Wis.—The City Council has authorized the Board of Public Works to advertise for bids for 1800 ft. of fire hose.

Drainage—Atlantic, Iowa—J. H. Mayne, Council Bluffs, is making preliminary surveys for draining about 100,000 cu.yd. of Indian Creek. Noted June 24.

Dam—Tonganopie, Kan.—Press reports state that the citizens contemplate the construction of a dam to extend 50 miles along Big Stranger Creek.

Fill—Grand Island, Neb.—Bids will be received by G. E. Neuman, Clk., Hall County, until 5 p.m., July 26, for the construction of a fill in the Platte River, between Sections 17 and 18, in Martin Township.

Ditch—Harrisonville, Mo.—The Supervisors of the Grand River Drainage District will soon award the contract for the construction of a 24-mile ditch in Cass and Bates Counties. C. L. Van Sandt is Secy.

Improvement to Creek—Kansas City, Mo.—The Board of Public Works has approved the plans of Curtis Hill, City Engr., for deepening and widening Turkey Creek along South West Blvd. Noted June 3 and July 8.

Ditches—Poplar Bluff, Mo.—Bids will be received by J. L. Chambers, County Clk., until 1 p.m., July 19, for the construction of nine ditches in Drainage District No. 10. The total yardage is 1,021,607 cu.yd.

Motor Fire Apparatus—St. Joseph, Mo.—An election will soon be held to vote on the question of issuing $150,000 in bonds, the proceeds of which will be used to purchase motor-driven hose carts and other equipment for the fire department.

✚Levee—Watson, Ark.—The Board of Directors has awarded the contract for the construction of the Redfork Levee to DENISON & ROGERS, at $1.75 per cu.yd.

Levee—Caldwell, Tex.—The date for receiving bids for levee work has been extended to July 31. R. S. Newson is Chn., Comrs. of Burleson County Improvement District No. 1. Noted June 3.

Levee—Ft. Worth, Tex.—According to press reports, the Mayor is in favor of constructing a levee at Holly Plant, estimated to cost $16,500.

✚Ditches—Port Lavaca, Tex.—The contract for the construction of 45 miles of ditches requiring 326,000 cu.yd. earth excavation in Seadrift Drainage District No. 3 has been awarded to HOWARD KENYON, Houston, at 12.95c. per cu.yd. T. H. Clement is Engr. Noted June 17.

Drainage—Grand Junction, Colo.—An election will soon be held to vote on the question of issuing $1,000,000 in bonds, the proceeds of which will be used for a drainage scheme.

Dam—Boise, Idaho—According to press reports the Utah Construction Co., Ogden, Utah, has decided to replace the Mackey Dam.

Fire Engine—Ogden, Utah—Bids will soon be received for an American La France fire engine to be used in the new fire station at Ninth and Washington St.

Drainage—Reno, Nev.—The bond issue of $21,000 for draining the Truckee River Drainage District has been defeated.

Ditch—Bellingham, Wash.—Bids will be received by W. D. Wallace, County Audr., until 10 a.m., July 27, for the construction of a ditch in Improvement District No. 9.

Dock—Seattle, Wash.—The Port Commission has granted a permit to the Fisher Flouring Mills Co. to extend its dock 50-ft. into the west waterway along the warehouse, a distance of 800-ft.

Dock and Warehouse—Seattle, Wash.—Plans are being prepared by J. R. West, Ch. Engr., Port of Seattle, for the construction of two wings to the dock and warehouse at the foot of Whatcom Ave. The estimated cost is $50,000.

Steamer—Seattle, Wash.—W. R. Grace & Co. will soon ask for bids on the construction of a new steamer, costing about $800,000.

Tunnel—Seattle, Wash —The City Council and the County Commissioners have authorized Daniel Huntington, City Arch., to prepare plans for the construction of a tunnel to connect with the basement of the new courthouse. Estimated cost, $16,000.

✚Dock—Portland, Ore.—The Shell Oil Co. of California has awarded the contract for the construction of a dock at its new distribution plant on the Portland River front to the J. A. McEACHERN CO., INC., Colman Bldg., Seattle, Wash. The work involves about 35,000 lin.ft. of piling, 250 M ft. B.M. lumber and 10,000 lb. of iron. J. C. Storey, Northern Bank Bldg., Seattle, Wash., is Engr.

Dredge Equipment—Portland, Ore.—Bids will soon be received by the Commissioners of the Port of Portland for the installation of a ladder, cutting machinery and other equipment necessary to fit out the dredge of the port. The estimated cost is $22,500. E. W. Wright is Mgr. of Port.

Dredging—Portland, Ore.—The Chamber of Commerce has asked the Port of Portland Commissioners to consider either redredging north Portland harbor or constructing dikes to increase the depth of the channel to allow for the construction of coal chutes.

✚Motor Fire Apparatus—Portland, Ore.—The contract for furnishing the city with one 85-ft. aërial truck for the fire department has been awarded to A. G. LONG, Portland, at $11,950.

Pier—Hueneme, Calif.—The city plans to construct a pier to cost about $50,000. Charles Donlon, J. D. McGrath, A. Camarillo and J. F. Leonard are Members of the Com.

Pier—Redmondo, Calif.—Bids will be received by the Board of Trustees until July 16 for the construction of a reinforced-concrete pier, triangular in shape extending into the ocean a distance of 750 ft. It will be 40 ft. wide with a pavilion 200x200-ft. at the outer end. The estimated cost is $121,000. George W. Harding, Washington Bldg., Los Angeles, is Engr. Noted Apr. 1 and 29.

✚Metal Furniture—San Francisco, Calif.—The Board of Public Works has awarded a contract for the installation of metal furniture in the new City Hall to the CAPITOL SHEET METAL WORKS, at $15,228.

Pier—San Francisco, Calif.—The State Board of Harbor Commissioners is having plans prepared for the reconstruction of Pier No. 11. The estimated cost is $25,000. Leo V. Merle is Secy. of Bd.

✚Snow Sheds—Ladner, B. C.—According to press reports, the contract for the construction of snow sheds for the Kettle Valley & Vancouver, Victoria & Eastern Ry. in Coquihalla Pass has been awarded to the GUTHRIE-McDOUGALL CO., Portland, Ore.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Brookline, Mass.—Bids are being received by Andrews, Jasques & Rantoul, Arch., 50 Congress St., Boston, Mass., for the construction of a three-story addition to the high school to cost $125,000. Phillip S. Parker is Chn. of the Selectmen.

Lexington, Mass.—Plans are being prepared by Williard D. Brown, Arch., 15 Beacon St., Boston, Mass., for the construction of a two-story addition to the school. Arthur L. Blanchard, 73 Batterymarch St., Boston, Mass., is Chn. of the Bldg. Com. The estimated cost is $50,000. Noted June 24.

Swansea, Mass.—Henry Vaughn, Arch., Pemberton Sq., Boston, Mass., has plans in progress for the construction of a two-story high school to cost $50,000. Noted Mar. 11.

Westfield, Mass.—(Official)—The town voted $60,000 for the construction of a school. J. M. Dutton is Chn. of the Bldg. Com.

✚Providence, R. I.—(Official)—W. F. Fontaine, Arch., Woonsocket, R. I., has awarded the contract for the construction of a 66x151-ft. brick and stone church for St. Borromeo Parish to the P. J. TROTTIER BLDG. CO., East Providence, R. I. Noted June 24.

✚Providence, R. I.—(Official)—William R. Walker, Arch., 17 Custom House St., has awarded the contract for the construction of a three-story, 90x125-ft. theater for the Empire Realty Co. to WILLIAM WILLIAMS. The estimated cost is $125,000. Noted July 8.

Buffalo, N. Y.—Bids will be received until July 22 by Frank T. Reynolds, Dept. of Bldg. Comn. for the construction of a three-story addition to Public School No. 54, Main St. and Leroy Ave. The estimated cost is $75,000. Greene & Wicks, 110 Franklin St., is Arch. Noted Aug. 20.

Buffalo, N. Y.—Bids have been received for the construction of tuberculosis pavilions, service and ward buildings, psychopathic and administration buildings and a power house at the new City Hospital. John Lannen, Prudential Bldg., Buffalo, at $345,042, submitted the lowest bid on the general contract. Noted Apr. 29 and July 8.

✚Ft. Plain, N. Y.—The Board of Education has awarded the contract for the construction of a school to F. A. GASWELL, Syracuse, at $51,986.

Little Falls, N. Y.—Bids will be received about July 20, by W. L. Stoddart, Arch., 9 East 40th St., New York, for the construction of a four-story bank and office building for the National Herkimer County Bank. The estimated cost is $75,000. Noted June 24.

Mt. Vernon, N. Y.—Plans have been prepared by Clark, MacMullen & Riley, Arch., 101 Park Ave., New York, for the construction of a three-story telephone building at 35 South Sixth Ave. for the New York Telephone Co., 15 Dey St., New York. The estimated cost is $50,000. Noted Apr. 15.

Mt. Vernon, N. Y.—An appropriation of $45,000 has been made by the Board of Education for the construction of an addition to Public School No. 9 at East Fifth St. and Bedford Ave. George Howard, 60 South Third Ave., is Pres. and E. W. Robischon is Chn. of Bldg. Com.

New York, N. Y.—(Borough of Bronx)—The Board of Estimate of the Board of Education plans to expend $790,000 for the construction of additions and alterations to various schools in the Bronx. The amount includes $157,000 for two swimming pools, two gymnasiums and 12 classrooms for Public School No. 4, Fulton and Third Ave. and 173rd St.; $120,000 for an auditorium, swimming pool, gymnasium two workshops and a library for Public School No. 40, Prospect Ave. Jennings St. and Ritter Pl.; $115,000 for a swimming pool, auditorium, five shops and seven classrooms, for Public School No. 32, 183d St., Beaumont and Cambreling Ave.; $147,000 for a swimming pool, four workshops, two drawing rooms, two science rooms and eight classrooms for Public School No. 45, 189th and Hoffman St. and Lorillard Pl. Additions and alterations will also be made to Public Schools Nos. 2, Third Ave. near 169th St.; 5, Webster Ave. and 189th St., Fordham; 6, Tremont, Bryant and Vyse Ave., West Farms; 28, Tremont and Anthony Ave. and Mt. Hope Pl.; 44, Prospect Ave. and 176th St.; 50, Bryant and Vyse Ave.; 53, 168th St., Findlay and Teller Ave.

New York, N. Y.—(Borough of Brooklyn)—The Board of Managers of the Norwegian Hospital, Fourth Ave. and 46th St., Bay Ridge, plans the construction of a five-story addition. The estimated cost is $100,000. Emil Erickson is Pres. and Peter Berger is Secy.

Rensselaer, N. Y.—The Board of Education contemplates the construction of an addition and alterations to Public School No. 1 at Washington St. and Third Ave. Estimated cost, $40,000.

✚Rochester, N. Y.—The contract for the construction of a two-story store and school building at Clinton Ave., S., and Washington Park for the Rochester Business Institute has been awarded to GEORGE C. HOLLISTER. Estimated cost, $75,000. Alice R. May, Arlington Bldg., is Arch.

Scarsdale, N. Y.—Bids will be received until 8:15 p.m., July 26, by the Board of Education, School House, Post and Depot Rd., or by Herbert C. Lakin, Clk., Bd. of Education, 49 Wall St., New York, for the construction of a one-story brick school with an auditorium, on Post Rd. Guy Lowell, 225 Fifth Ave., New York, is Arch. Noted June 17.

✚Schenectady, N. Y.—The Mohawk Baths Co., 220 South Center St., has awarded the general contract for the construction of an addition to the eight-story hotel on Center St. to the J. F. GROWE CONSTRUCTION CO., 118 Hudson Ave., Albany. Estimated cost, $150,000. Noted June 17.

✚Syracuse, N. Y.—The Vocational High School Commission has awarded the general contract for the construction of the vocational high school to the PHELAN ENGINEERING & CONSTRUCTION CO., Hoboken, N. J., at $290,788. Noted June 17 and 24.

Syracuse, N. Y.—Bids will soon be received by D. R. Roney, Secy. Bd. of Contract and Supply for the construction of the Delaware School on Delaware and Geddes St. The estimated cost is $225,000. James A. Randall is City Arch. Noted May 27.

Syracuse, N. Y.—The lowest bid received by the Vocational High School Commission for the construction of the Vocational High School was submitted by the Phelan Engineering & Contracting Co., Hoboken, N. J., at $288,750, using Indiana limestone; $289,600, using cast stone; and $289,000, using terra cotta. Noted June 17 and 24.

White Plains, N. Y.—Contracts will be awarded about Aug. 1 by the Westchester County Building Commission for the construction of a 6½-story, 100x200-ft. county courthouse. The estimated cost is $800,000. B. W. Morris, 101 Park Ave., New York, is Arch. Noted Apr. 22 and June 24.

Bayonne, N. J.—All bids received July 1 for the construction of a parental school have been rejected by the Hudson County Parental School Board. New bids will be received until 10 a.m., July 14. Noted May 27 and July 1.

East Rutherford, N. J.—(Rutherford post office)—Bids will be received about July 15 by John T. Simpson, Engr., Essex Bldg., Newark, for the construction of a school. Estimated cost, $40,000.

✚Hoboken, N. J.—(Official)—The JERSEY CITY CONSTRUCTION CO., 75 Montgomery St., Jersey City, at $42,017, has been awarded the contract for the construction of additions and repairs to Public School No. 8. Noted June 17 and July 1.

Perth Amboy, N. J.—Bids will be received until July 19 by the Board of Education for the construction of an addition to the high school on State St. J. N. Pierson & Son is Arch. Noted Apr. 15 and 22.

Trenton, N. J.—Plans have been prepared by George S. Drew, State Arch., for the construction of a five-story, 40x95-ft. brick and stone building for the State Hospital. The estimated cost is $60,000.

✚Ebensburg, Penn.—The Directors of Cambria Title Savings & Trust Co. have awarded the contract for the construction of a building to the ANDREW J. ROBINSON CO., 123 East 23d St., New York, N. Y. Estimated cost, $60,000. Noted May 13.

✚Philadelphia, Penn.—H. H. WEYMEYER, Philadelphia, at $122,863, has been awarded the contract for the construction of a police and fire station at 22nd St. and Hunting Park Ave. Noted July 1.

Philadelphia, Penn.—Bids will be received about July 20 for the construction of a seven-story, 45x179-ft. building with four 45x175-ft. wings at 54th St. and Cedar Ave. for the Miserecordia Hospital. E. F. Durang & Son, 12th and Chestnut St., is Arch. Noted Apr. 1.

Philadelphia, Penn.—Bids will be received until July 20 by the Jewish Hospital for the construction of additions and alterations to the hospital at York and Tabor Rd. Magaziner & Potter, 137 South Fifth St., is Arch.

Philadelphia, Penn.—Cramp & Co., Denckla Bldg., Philadelphia, at $278,056, submitted the lowest bid for the construction of a three-story school at 65th St. and Lime Kiln Pike, East Germantown. Noted June 24 and July 8.

✚Renovo, Penn.—The contract for the construction of a two-story, 94x183-ft. school has been awarded to the SHAMOKIN LUMBER CO., Shamokin, at $76,500. Woodnutt & Schmohl, 150 West Fourth St., Williamsport, is Arch. Noted June 24.

Blue Mountain, Md.—Plans are being prepared by Baldwin & Pennington, Arch., Professional Bldg., Baltimore, for the construction of a three-story concrete hotel. The estimated cost is $150,000.

Roanoke, Va.—Bids will be received until Aug. 1, by the Melrose Baptist Church, for the construction of a 95x120-ft. building at Melrose Ave. and 12th St. Estimated cost, $50,000. N. T. Wingfield, Charlottesville, is Arch. Noted July 8.

Huntington, W. Va.—Plans are being prepared by McMichael & Cain, Arch., Richmond, Va., for the construction of a $100,000 church and a $100,000 building for women for the Baptist Church.

Weston, W. Va.—Bids will be received until noon, July 27, by J. S. Lakin, Pres., State Bd. of Control, Charleston, for the construction of a two-story, 63x306-ft. building at the Weston State Hospital. H. Rus Farne, Charleston, is Arch.

Florence, S. C.—The citizens voted in favor of issuing $232,000 in bonds. Of this amount $52,000 will be used for the construction of a school.

✚Spartanburg, S. C.—The contract for the construction of a seven-story, reinforced-concrete hotel to replace the Spartan Inn has been awarded to LONGEST & TESSIER, Greensboro, N. C. Estimated cost, $250,000. J. W. Allen is Chn. of Bldg. Com.

Atlanta, Ga.—Plans are being prepared by Morgan & Dillon, Arch., Grant Bldg., for the construction of a four-story, brick and steel building on Whitehall St. for Mrs. Mary G. Thurman. The estimated cost is $50,000.

Birmingham, Ala.—Plans have been prepared by Harry Wheelock and H. A. Stockman, Archs., for the construction of a two-story business building at First Ave. and 19th St. for T. H. Molton and Mrs. Annie Henley. Estimated cost, $50,000. Noted Feb. 4.

New Orleans, La.—The B. P. O. E. plans to construct a four-story clubhouse at Elks' Pl. near the Canal. The estimated cost is $150,000. John P. Sullivan is Chn. of Bldg. Com. Noted Dec. 3.

Memphis, Tenn.—The members of the Knights of Pythias contemplate the construction of a two-story store and lodge building. The estimated cost is $50,000. J. A. Goodman is Dir. of Bldg. Association.

+Louisville, Ky.—The GEORGE H. ROMMEL CO., Louisville, at $130,000, has been awarded the contract for the construction of the Y. M. C. A. building at Second St. and Broadway. John Bacon Hutchings & Son, Columbia Bldg., is Arch. Noted June 10.

+Canton, Ohio—(Official)—The INDIANA ENGINEERING & CONSTRUCTION CO., Ft. Wayne, Ind., at $81,000, has been awarded the contract for the construction of the three-story Henry S. Martin School at Third St., S. W. W. C. Lane is Clk., Bd. of Education. Noted July 1.

Canton, Ohio—Plans have been prepared by W. C. Owens & Co., Arch. and Engr., 449 Leader-News Bldg., Cleveland, for the construction of a four-story 87x200 ft. commercial building on North Market St., for C. N. Vickary, Canton.

+Canton, Ohio—MELBOURNE BROS., 403-15th St., Canton, at $74,900, has been awarded the contract for the construction of the J. J. Burns School. W. C. Lane is Clk., Bd. of Education. Noted June 17.

Cincinnati, Ohio—Garber & Woodward, Arch., 2803 Union Central Bldg., has prepared plans for the construction of a two-story observatory for the Cincinnati Astronomical Society. The estimated cost is $50,000.

Cincinnati, Ohio—Plans are being prepared for the construction of a building for the Chamber of Commerce. The estimated cost is $1,000,000.

Cincinnati, Ohio—Work will soon be started on the construction of buildings at the Miami Medical College. C. R. Holmes, Harry Laws and Harry Levi, General Hospital, are interested. Noted June 17 and 24.

Cleveland, Ohio—A. M. Gordon Co., Illuminating Bldg., plans the construction of a hotel at East 79th St. and Hough Ave. Estimated cost, $300,000.

Cleveland, Ohio—Plans have been prepared by Willard Hirsh, Arch., 1302 Swetland Bldg., for the construction of telephone buildings on the West Side for the Ohio State Telephone Co. The estimated cost is $100,000. Noted June 24.

Cleveland, Ohio—Plans have been prepared by Meade & Hamilton, Arch., 1002 Garfield Bldg., for alterations and improvements to the clubhouse of the Union-Club, Euclid Ave. and East 12th St. Estimated cost, $150,000.

Cleveland, Ohio—Plans are being prepared by S. H. Weis, Arch., 1030 Schofield Bldg., for the construction of a two-story commercial building at Superior Ave. and East 113th St. for B. B. Given, Syracuse, N. Y. Estimated cost, $40,000.

+Marion, Ohio—E. ELFORD, Columbus, has been awarded the contract for the construction of a two-story building on South Main St. for the Marion County Telephone Co. The estimated cost is $40,000.

+Milford Center, Ohio—The contract for the construction of a school has been awarded to A. M. FRY, Piqua, at $41,919. Noted Apr. 8.

Oxford, Ohio—The Trustees of Miami University have approved plans prepared by Louis G. Dittoe, Arch., Cincinnati, for the construction of a dormitory to be known as George C. Ogden Hall. The estimated cost is $250,000. Noted Apr. 29.

+Toledo, Ohio—The general contract for the construction of a five-story addition and alterations to the Niagara Hotel has been awarded to the H. J. SPIEKER CO., 409 Michigan St., Toledo. The estimated cost is $50,000.

+Van Wert, Ohio—The contract for the construction of a four-story, 102x108-ft. brick and terra cotta building for the Y. W. C. A. has been awarded to the LARSON-DANIELSON CONSTRUCTION CO., Laporte, Ind. The estimated cost is $100,000.

+Kendallville, Ind.—The LARSON-DANIELSON CONSTRUCTION CO., Laporte, Ind., at about $50,000, has been awarded the contract for the construction of a 10-room fireproof school building. Noted May 6.

Sullivan, Ind.—The citizens contemplate the construction of a court house for Sullivan County. The estimated cost is $250,000. W. S. Bicknell is Audr.

Terre Haute, Ind.—Plans have been prepared by A. H. Hubbard, Arch., 300 First National Bank Bldg., Champaign, Ill., for the construction of a building for the Masonic Temple Association. John S. Jordan is Chn., Bd. of Trustees. Estimated cost, $90,000.

Detroit, Mich.—E. R. Dunlap and L. Willeke, Archs., have prepared plans for the construction of a 12-story hotel at Cass Ave. and Peterboro St. for the Buckingham Hotel Co. The estimated cost is $300,000. J. Allen R. Wray and William J. Hendricks are interested.

+Newberry, Mich.—The contract for the construction of a nurses' home, cottage and addition to the tuberculosis ward at the Newberry State Hospital has been awarded to HERMAN GUNDLACH, Houghton. Estimated cost, $70,000. Charlton & Kuenzli, Marquette, is Arch.

+Sandusky, Mich.—(Official)—CHARLES COVELL, Ionia, at $74,528, has been awarded the contract for the construction of a three-story courthouse for Sanilac County. Sanford L. Utley is County Clk. Noted Mar. 11 and June 17.

+Sault Ste. Marie, Mich.—The contract for the construction of the three-story 150x200-ft. Soo High School has been awarded to L. E. CHAUSSEE, Negaunee. Estimated cost, $150,000. John D. Chubb, 32 North Clark St., Chicago, Ill., is Arch.

Chicago, Ill.—Bids will soon be received by C. C. Taylor, Chn. of Bldg. Com., 39 South La Salle St., for the construction of an edifice for the Ninth Church of Christ, Scientist. The estimated cost is $100,000. Carl Barkhausen, 121 Wisconsin St., Milwaukee, Wis., is Arch. Noted June 24.

Peoria, Ill.—Contracts will be awarded about Aug. 1 for the construction of a two-story church for the Central Christian Church. The estimated cost is $50,000. Whitmeyer & Chaffee, 204 South Glenwood Ave., is Arch.

Rockford, Ill.—Contracts will be awarded about Aug. 15 by the Board of Education for the construction of a two-story grade school. The estimated cost is $80,000. Frank A. Carpenter is Arch. Noted Mar. 11.

Chippewa Falls, Wis.—Contracts will be awarded about Aug. 1 by C. H. Johnston, Arch., 715 Capitol Bank Bldg., St. Paul, Minn., for the construction of a three-story administration building for the Edward Rutledge Charity. The estimated cost is $50,000. Noted July 8.

Eau Claire, Wis.—Bids will soon be received by the Common Council for the construction of a city hall and municipal auditorium. Estimated cost, $50,000. George Awsumb, 14 East Jackson Blvd., Chicago, Ill., is Arch. Noted May 6.

Watertown, Wis.—Bids will be received until July 20 by the Board of Education for the construction of a two-story, 160x170-ft. high school. The estimated cost is $125,000. Parkinson & Dockendorff, La Crosse, is Arch. Noted Apr. 8.

Iowa City, Iowa—The Iowa State Board of Education plans to construct a library at the University of Iowa. The estimated cost is $700,000.

Jefferson, Iowa—Plans are being prepared by Proudfoot, Bird & Rawson, Hubbell Bldg., Des Moines, for the construction of a two-story high school. The estimated cost is $55,000.

+Albert Lea, Minn.—W. S. KINGSLEY, Faribault, has been awarded the contract for the construction of a six-story, fireproof, store and office building. Hoffman & Morse, Rochester, is Arch. Noted June 17.

Proctor, Minn.—Plans have been prepared by Vernon J. Price & Co., 608 Palladio Bldg., Duluth, for the construction of a school. The estimated cost is $40,000. Noted Feb. 25 and May 13.

+St. Paul, Minn.—The STANDARD CONSTRUCTION CO., Plymouth Bldg., Minneapolis, Minn., has been awarded the general contract for the construction of a three-story, reinforced-concrete and brick academy for the Swedish Baptist General Conference of America. The estimated cost is $60,000.

Wheaton, Minn.—Edward F. Broomhall, Arch., 710 Alworth Bldg., Duluth, is preparing plans for the construction of a high school addition and gymnasium at Wheaton. Estimated cost, $40,000

Winona, Minn.—The Board of Education contemplates the construction of a high school. The estimated cost is $100,000.

Dodge City, Kan.—The Sacred Heart Congregation contemplates the construction of a church and parochial school for boys. The estimated cost is $50,000.

+Kansas City, Kan.—The general contract for the construction of a 67x80-ft., brick building for the congregation of the First Church of Christ, Scientist, has been awarded to EUGENE DRIER. The estimated cost is $40,000.

+Lincoln, Neb.—The Board of Regents of the University of Nebraska has awarded the contract for the construction of a three-story, 65x141-ft. building with a two-story, 61x80-ft. addition at the State Farm to GOULD & SON, Omaha, at $113,657.

Schuyler, Neb.—Bids will be received until Aug. 15 by the Board of Education for the construction of a two-story, 80x110-ft. high school. Estimated cost, $40,000. Noted July 8.

+Milbank, S. D.—(Official)—The contract for the construction of a courthouse has been awarded to J. B. EVANS CONSTRUCTION CO., Mexico, Mo., at $74,990. E. M. Harper is County Audr. Noted May 20 and June 24.

+Butte, Mont.—(Official)—The contract for the construction of a high school, including a gymnasium and swimming pool for School District No. 1, Silver Bow County, has been awarded to the MONTANA CONSTRUCTION & ENGINEERING CO., 84 Owsley Blk., Butte, at $111,750. Other bidders were: Silver Johnston, Butte, Shoblom & Hexen, Butte; Kroffganz & Frank, Butte; S. P. Guimont, Anaconda. Noted May 20.

+Great Falls, Mont.—The Board of Education has awarded the contract for the construction of the Emerson School on Second Ave., S., to RUDE & SEARLES, at $68,194.

Ozark, Mo.—The County Commissioners have been petitioned by the citizens to hold an election to vote on the question of issuing $50,000 in bonds. The proceeds will be used for the construction of a county courthouse.

Little Rock, Ark.—(Official)—The STEWART McGEHEE CONSTRUCTION CO., Little Rock, at $45,000, has been awarded the contract for the contruction of a two-story school to be known as the U. M. Rose School. Noted July 1.

+Marshall, Tex.—The CADDO CONSTRUCTION CO., Muskogee, Okla., at $74,480, has been awarded the contract for the construction of an administration building for the College of Marshall.

Walla Walla, Wash.—Bids will soon be received for the construction of a four-story building for St. Mary's Hospital. The estimated cost is $212,000. Robert Tegen, Journal Bldg., Portland, Ore., is Arch. Noted May 6 and June 3.

San Bernardino, Calif.—Plans are being prepared by Lyman Farwell, Story Bldg., Los Angeles, Calif., for the construction of a group of buildings for the new county hospital. The estimated cost is $150,000. Noted Mar. 11.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

PROPOSED TEN-MILE CONCRETE ROAD IN PENNSYLVANIA

It is rather odd that Pennsylvania, the center of the portland cement industry, has practically no example of concrete road construction in its state highway system. The reason, however, is not far to seek. Since the institution of the State Highway Department there has been little or no money available for new construction. The state is very large, has many miles of road not naturally of the best materials, and has a large population, a great proportion of which own motor cars. Hence there has been a constant and insistent demand to keep all the highway system in good condition, leaving very little money, without the issuance of bonds, for building pavements of high first cost.

It has remained for the cement companies themselves to be the means of building a first-class concrete highway in Pennsylvania. Through the activity of the Hon. H. J. Steele, of Easton, Penn., the cement companies of the Lehigh Valley have agreed to contribute the cement for an 11 to 12 mile concrete pavement between Easton and Allentown, two famous homes of the portland cement industry. The State Highway Department has agreed to furnish the labor and supervision and it is expected the road will be completed during the present season.

Foremost in this work have been Col. H. C. Trexler, Pres. of the Lehigh Portland Cement Co., Allentown, and C. S. Brown, Pres. of the Alpha Portland Cement Co., Easton.

GRAIN ELEVATORS WANTED IN ARGENTINA

An inquiry has just been received by "Engineering News" asking American manufacturers to consider the construction of 60 to 80 grain elevators. Extracts from the letter, sent by A, U, Sassy, Calle San Martin 66, Buenos Aires, are as follows:

"I am negotiating at present a contract for some 60 or 80 grain elevators and would like to have you advise your friends who specialize in this line that they may bid on the job and with this object in mind I enclose a specification and data sheet, also sketch and plan of the style of elevator which I believe will fill the bill under the existing conditions. The plan has been drawn by a friend who has a very good knowledge of the conditons but he is not exactly an elevator expert and while I wish that the interested parties would be guided by his general ideas they are at liberty to improve upon the type and construction in any way they may see fit.

"As you may know, we cannot expect to buy locally any materials cheaper than they can be imported for and I shall be glad therefore to receive price on each type of elevator complete (that is including every thing down to nails and sundries) delivered c.i.f. Buenos Aires, mentioning gross and net weights also cubic measurements. I must call your attention to the fact that the information is most urgently wanted: in fact my securing the business will largely depend on how quick I get the data together and I shall esteem it a favor if you will please ask your friends to let me have bid with complete plans (outline and detail), sketches, data and specifications at the earliest possible moment. I would like to be advised as to their charges for sending down an expert to superintend the erecting and starting of the elevators.

"If I have not given all the information and data needed by your friends in order to get figures together kindly ask them to let me hear by cable and I will gladly give it to them.

"I may add that should the business be secured it would be financed, so far as the interested parties are concerned, through the local branch of the National City Bank and their Home Bank."

For those who desire further information a blue print and data sheet may be consulted at the office of "Engineering News." Tenth Ave. at 36th St., New York, N. Y.

RAILWAYS—STEAM AND ELECTRIC

Massachusetts—Bay State St. Ry.—This company has petitioned the Council for a franchise to extend its double tracks from Merrimac St., North Andover, over the new Shawsheen Bridge into Sutton St. R. S. Goff, Boston, is Gen. Mgr.

Massachusetts—Massachusetts Northeastern St. Ry.—The Council has granted this company a franchise to relocate its tracks on Main St. and also at the curves into White St. and to Kenoza Ave. Franklin Woodman, Haverhill, is Vice-Pres. and Gen. Mgr.

Massachusetts—New York, New Haven & Hartford R.R.—According to press reports this company contemplates electrifying its Tariffville and Midland divisions. Edward Gagel, New Haven, is Ch. Engr.

New York—Binghamton Ry.—The Public Service Commission has ordered this company to extend its line from its present terminus to Port Dickinson. H. Tracy Rogers, Binghamton, is Supt. and Pur. Agt.

✚**Pennsylvania**—Johnstown & Somerset Ry.—This company has awarded a contract to the J. A. VANDERGRIFT CO., Somerset, Penn., for the construction of an electric railway from Johnstown to Somerset and Rockwood, about 40 miles.

Pennsylvania—Scranton & Binghamton Ry.—This company plans to extend its lines from Foster to Brooklyn, about five miles. Richard W. Day, Scranton, is Gen. Mgr.

Pennsylvania—Lehigh Valley Transit Co.—This company will double track its line on Broad St., West Bethlehem, Penn. Thomas Gibson, Allentown, is Pur. Agt.

✚**Virginia**—Petersburg & James River Electric Ry.—This company has awarded the contract for the construction of its line from City Point to Petersburg, about 11 miles, to PERKINSON & FINN, Petersburg. Noted July 8.

✚**West Virginia**—(Official)—Kanawha, Glen Jean & Eastern R.R.—This company has awarded the contract to BOARD & DUFFIELD, 1010 Virginia St., Charleston, for constructing its Dun Loop branch. V. S. Veazey, Glen Jean, is Ch. Engr. Noted May 20.

North Carolina—Alamance, Durham & Orange Ry. & Electric Co.—H. G. Palmer & Co., Yorkville, Ill., has been retained as engineer by this company for the construction of its proposed line from Ossippee to Durham, N. C. Noted June 24.

North Carolina—Eastern Tennessee & Western North Carolina R.R.—This company plans to extend its line from Pineola to Boone, about 18 miles.

South Carolina—Southern Ry.—This company has issued $3,500,000 in bonds, the proceeds of which will be used for double-tracking its line from Spartanburg to Central, New Holland and Cornelia, S. C., about 76 miles. B. Herman, Washington, D. C., is Ch. Engr.

South Carolina—Augusta-Aiken Ry. & Electric Corporation—This company has increased its capital stock for the purpose of constructing an extension of its line from Aiken to Columbia, S. C., about 50 miles. R. W. Spofford, Augusta, Ga., is Gen. Supt. and Pur. Agt.

Georgia—Ocilla, Pinebloom & Valdosta Ry.—The Henderson Lumber Co. has purchased the properties of this company including an 11-mile railway in Coffee County. The new owner, it is reported, will extend the line from Lax to Ocilla, about 15 miles.

Georgia—Pelham & Havana R.R.—This company contemplates extending its line from Darsey to Havana, about five miles. J. M. Wilkinson, Valdosta, Ga., is Pres.

Florida—Florida East Coast Ry.—Plans are being considered by this company for the extension of its line from Okeechobee to West Palm Beach. E. B. Carter, Jacksonville, is Ch. Engr.

Kentucky—Evansville, Henderson & Owensboro Ry.—This company will ask the council for a twenty year franchise to operate its cars on the city streets. If granted the franchise it plans to construct interurban lines to Owensboro, Morganfield and Providence.

Illinois—East St. Louis & Suburban Ry.—This company has asked the council for a franchise to extend its lines in East St. Louis to 19th St. and Baker Ave. A. J. Purinton is Gen. Supt. and Pur. Agt.

Illinois—Kankakee & Urbana Traction Co.—Surveys are being made by this company for the extension of its line from Ludlow to Paxton. William I. Laffell, Urbana, is Gen. Mgr.

Illinois—Peoria & Chillicothe Ry.—This company has completed surveys on its line from Peoria to Chillicothe and plans to start work within a short time. Noted Mar. 11.

South Dakota—Mitchell St. Car & Interurban Ry.—This company has been incorporated to construct an electric railway in Mitchell, S. D. A. N. Hill, Mitchell, and D. N. Hill, Lake Hills, Iowa, are interested.

Missouri—Jefferson City Bridge & Transit Co.—This company, it is reported, will extend its electric railway from Jefferson City to Columbia, Mo. D. W. Snyder, Jr., Jefferson City, is Gen. Supt.

Missouri—St. Louis Ry. & Dock Co.—This company has been incorporated to construct a railway from the south bank of the Missouri River near Columbia Bottom Rd., and thence southward to the vicinity of Van Buren and Catalan St. in St. Louis, about 25 miles. H. F. Bell is interested.

Missouri—Springfield Traction Co.—Plans are being considered by this company to extend its State St. line from New to Fort St., Springfield. Charles H. Guskel, Springfield, is Gen. Mgr.

Texas—Beaumont, Liberty & Houston Traction Co.—Surveys have been made and preliminary arrangements are being made by this company for the construction of its proposed line to connect Beaumont, Anahuac and Houston. J. H. McCracken is Gen. Mgr.

Texas—The City Council has granted a franchise to F. W. Davis and A. B. Phillips for the construction of a railway through Texas City.

Texas—Artesian Belt R.R.—This company plans to extend its line from Christine to Crowther and Beeville, Tex., about 50 miles. J. O. Terrell, San Antonio, is interested.

Texas—Southwestern Ry.—This company has decided to extend its line from Henrietta, Tex., to Waurika, Okla., about 25 miles. A. C. Parks, Henrietta, is Vice-Pres. and Gen. Mgr.

Utah—Ogden, Logan & Idaho Ry.—This company will soon start construction on a new electric line from Ogden to Brigham City; also on a new line from Willard to Bingham City.

Washington—According to press reports the Port Commission will soon receive bids for the construction of a belt railway to connect all the port facilities on the waterfront. J. R. West is Ch. Engr. of Comn. Noted July 1.

California—Pacific Electric Ry.—This company has asked the council for a franchise to double track its line to San Pedro via Gadena. J. McMillan, Los Angeles, is Gen. Mgr.

California—The franchise for the extension of the Brooklyn Ave. line on Evergreen Ave. to the east of the city limits has been sold by the Council of Los Angeles to P. D. Sornelius, Pres., Malabar Dist. Improvement Association. The franchise will be turned over to the Los Angeles Ry. without charge so that the extension may be built. Howard Huntington, Los Angeles, is Vice-Pres. and Gen. Mgr.

New Brunswick—Moncton Tramways, Electric & Gas Co.—Arrangements are being made by this company for the extension of its line on Bonaccord St., Moncton, N. B. E. B. Reeser, Farmers Bank Bldg., Pittsburgh, Penn., is Vice-Pres. and Gen. Mgr.

+Alberta—Edmonton, Dunvegan & British Columbia Ry.—This company has awarded a contract for constructing about 60 miles of its line through the Grande Prairie District to G. H. WEBSTER, 1316 Prospect Ave., Calgary. Noted June 10.

LIGHT, HEAT AND POWER

Barnet, Vt.—It is reported that D. L. Judkins plans to construct a new power house on the bank of the Stevens River.

+Saundersville, Mass.—The contract for the construction of a brick boiler house for the Saunders Cotton Mill has been awarded to the J. W. BISHOP CO. The estimated cost is $4000.

West Newbury, Mass.—Press reports state that the Newburyport Gas & Electric Co. of Newburyport has applied for permission to erect a transmission line from Pipestave Hill to the Groveland line.

Lincoln, R. I.—(Central Falls post office)—The Connecticut Power Co., 50 Congress St., Boston, Mass., has been granted a permit by the Town Council for the construction of a distributing station on Hazel St. This station will have an output of 25,000 kw. which will be distributed in Pawtucket, Providence and other towns and cities in the Blackstone Valley.

Altmar, N. Y.—It is reported that the Pulaski Electric Light Co., of Pulaski, a subsidiary of the Salmon River Co., will soon start work on the extension of its transmission lines to Altmar.

La Fargeville, N. Y.—It is reported that the La Fargeville Electric-Light Co. has petitioned the Public Service Commission for permission to construct electric light plants in Theresa and Orleans.

Spencerport, N. Y.—Bids will be received until 8 p.m., July 26, by the Town Clerk for the installation of an electric-lighting system. Bonds for $16,000 have been sold for this purpose.

+Philadelphia, Penn.—(Official)—The contract for the heating and plumbing equipment for the new school at 65th St. and Lime Kiln Pike, East Germantown, has been awarded to S. FAITH & CO., 2427 Pennsylvania Ave., Philadelphia, at $51,344; the contract for the electric work was awarded to J. F. BUCHANAN & CO., 1228 Race St., Philadelphia, at $15,134. See item under "Buildings."

+Philadelphia, Penn.—The Board of Education has awarded the contract for the heating system in the school at Second, Pike and Sanger St. to S. FAITH & CO., 2427 Pennsylvania Ave., Philadelphia, at $9981. See item under "Buildings."

Shamokin, Penn.—It is reported that plans are being considered for the installation of an electric generating plant to supply electricity for the new high school building.

Salisbury, N. C.—It is reported that the Southern Power Co. will soon start work on the construction of a steel tower electric transmission line from Salisbury to Statesville.

+Spray, N. C.—The contract for the construction of a 3000-hp. electric power plant for the Thread Mills Co. has been awarded to the GALLIVAN BUILDING CO., Greenville, S. C. Noted July 15.

Columbia, S. C.—Plans are being considered for the construction of a power plant, capable of developing 600 hp., at the State Hospital for Insane.

Oxford, Miss.—At a recent election the citizens voted in favor of issuing $6500 in bonds, the proceeds of which will be used to improve the electric-light plant.

Cuyahoga Falls, Ohio—It is reported that bids are being received by Ernest McGeorge, Engr., 855 Leader News Bldg., for the construction of a one-story, 40x60-ft., brick and steel power house for the Falls Rubber Co. Noted June 24.

Painesville, Ohio—Bids will soon be received by H. Whitford Jones, Engr., 1302 Citizens Bldg., Cleveland, for furnishing engines, generators and condensers for the municipal-electric light plant. Noted July 8.

Coldwater, Mich.—Press reports state that the Board of Public Works contemplates the purchase of a new 350-generating unit consisting of a 350-kw. generator and engine. K. E. Norton is Supt.

+Springfield, Ill.—The Secretary of State has awarded the contract for the boilers for the new power plant at the State Capitol to the SPRINGFIELD BOILER & MFG. CO., Springfield, at $40,000. The Legislature recently appropriated $140,000 for the plant. Noted May 20.

La Crosse, Wis.—According to press reports the Wisconsin Minnesota Light & Power Co. plans to expend about $210,000 for the construction of new buildings and equipment. J. N. Moncreiff is Mgr.

+Wilton Junction, Iowa—(Official)—The ELECTRIC CONSTRUCTION & MACHINERY CO., Rock Island, Ill., at $4328, has been awarded the contract for the construction of additions to the power plant.

Hallock, Minn.—Press reports state that the Council is considering the proposition of issuing $15,000 in bonds, the proceeds of which will be used for the installation of an electric-lighting system.

+Canton, Kan.—The CHALLENGE CO., 1404 West 11th St., Kansas City, Mo., has been awarded the contract for one 30-hp. and one 40-hp. St. Mary's oil engine, one 25-kw., 2300-volt generator and switchboard to be installed in the new power house of the municipal electric light plant. W. D. Moore is Supt., Light and Water Dept. Noted July 15.

Everest, Kan.—At a recent election the citizens voted in favor of the question of issuing $8000 in bonds, the proceeds of which will be used for installing an electric light system.

+Broken Bow, Neb.—The contract for the construction of a municipal electric-light plant has been awarded to the ALAMO ENGINE & SUPPLY CO., Omaha, Neb., at $10,000. R. M. Thompson is City Clk. Noted Apr. 1 and 22.

+Davenport, Neb.—The ALAMO ENGINE & SUPPLY CO., Omaha, at $4606, has been awarded the contract for the installation of an electric-light plant. Noted June 17 and 24.

Hale, Mo.—Plans are being prepared and bids will soon be received for the construction of an electric-light plant. The estimated cost is $11,000. W. B. Rollins & Co., 439 Midland Bldg., Kansas City, is Engr.

Keytesville, Mo.—The Henrici, Kent & Lowry Engineering Co., Reserve Bank Bldg., Kansas City, has been engaged by R. W. Cropper to prepare plans and take charge of the engineering work for the construction of an electric-light plant in Keytesville.

Springfield, Mo.—The Board of Regents of the Fourth District Normal School is considering plans for the construction of a power house to furnish electricity for all the school buildings. John J. Schneider is Pres.

Austin, Tex.—The Superintendent of Public Buildings and Grounds has announced that about $100,000 will be spent in installing a power and heating plant in the State Capitol. Noted Mar. 25.

Ft. Worth, Tex.—Press reports state that if the Lone Star Gas Co. is successful in securing a lease of 9600 acres of natural gas lands belonging to the Osage Indian reservation in Oklahoma it will develop the property on an extensive scale and will lay a pipe line from the field to Dallas and other towns.

Mexia, Tex.—It is reported that the People's Gas Co., recently organized with a captial stock of $50,000, will supply the towns of this section with natural gas. N. B. Robinson is interested.

Muskogee, Okla.—The Greater Muskogee Association has appointed a committee of five local citizens to work out a project for building a dam across the Grand River between Muskogee and Ft. Gibson to generate hydro-electric power. Surveys have been made and plans are in the hands of the committee. The estimated cost is $750,000.

Holbrook, Ariz.—T. M. Quebedeaux and K. H. Myers have applied to the Board of Supervisors for a franchise to construct and operate an electric-light plant.

Seattle, Wash.—It is reported that the Puget Sound Light & Power Co. will expend about $30,000 for the construction of a new system.

Burns, Ore.—A resolution has been passed by the City Council authorizing the sale of $10,000 in bonds, the proceeds of which will be used for the construction of an electric-light plant.

Lindsay, Calif.—The Tulare Power Co., Visalia, Calif., plans to construct additions and make improvements to its plant.

Placerville, Calif.—The Western States Gas & Electric Co. plans to enlarge its hydro-electric plant. The estimated cost is $75,000. H. R. Bennett is Mgr.

Visalia, Calif.—It is reported that the Mount Whitney Power & Electric Co. has awarded the contracts for the construction of its fifth hydro-electric generating plant on the Kahweah River in the Sequoia National Forest. The new station will have an output of 10,000-hp. Estimated cost, $750,000. Noted June 17.

+Montreal, Que.—The Board of Commissioners has awarded the contract for the construction of an electric system for the filtration plant to G. M. GEST, Power Bldg., at $6275. Noted June 10.

Brockville, Ont.—G. K. Dewey is interested in a project to construct an electric power line through Elizabethtown Township. The estimated cost is $25,000.

The Narrows, Man.—It is reported that the Town Council is considering the installation of a light and power system. The estimated cost is $50,000. H. H. Elliott is Clk.

+Winnipeg, Man.—The contract for furnishing one 150-kw. motor generator and exciter set to be installed in the generating station at Point du Bois has been awarded to VICKERS, LTD., Montreal, Que., at $5244. Noted May 20.

BRIDGES

+Boston, Mass.—John S. Merrill, Chn., Bridge Comn., has awarded the contract for constructing the Boston approach to the Spring St. Bridge to CLARK & GOVE, Boston, at $15,850. Noted May 20 and July 8.

Worcester, Mass.—(Official)—The Samuel H. Pitcher Co., Engr., Worcester, Mass., has been retained by the city to prepare plans and supervise the construction of the Lake Quinsigamond Bridge. The structure will be of reinforced-concrete with six arches, one 120-ft., two 70-ft. and three 60-ft., total length 850 ft. and width 60 ft. The State Legislature recently passed a bill authorizing an appropriation of $250,000 for this purpose, the cost to be borne by the city, county, town of Shrewsbury and the Worcester Consolidated St. Ry. Noted Feb. 5, 1914 and Apr. 29, 1915.

+Berlin, Conn.—JAMES E. GOODRICH, Glastonbury, has been awarded the contract by the Highway Commissioners for the construction of a concrete bridge across the Sebeth River.

★Bridgeport, Conn.—(Official)—Bids will be received by the Board of Contracts and Supplies, City Hall, until noon, Aug. 7, for the construction of a reinforced-concrete girder bridge, with a double leaf bascule channel span and all substructures and approaches at Stratford Ave. Greiner & Whitman, Fidelity Bldg., Baltimore, Md., is Consult. Engr.

Derby, Conn.—It is reported that the construction of a concrete bridge over the Naugatuck River at Division St.

to replace the present structure is contemplated by the cities of Derby and Ansonia. The estimated cost is $10,000. V. B. Clark is City Engr.

Binghamton, N. Y.—An election will soon be held to vote on the question of issuing $30,000 in bonds, the proceeds of which will be used for the construction of a bridge on Noyse Island and one across Pierce Creek. J. A. Giles is City Engr.

New York, N. Y.—(Borough of Bronx)—It is reported that the Public Service Commission, 154 Nassau St., will probably call for bids some time in September for the construction of a bridge across the Bronx River at Westchester Ave. F. J. H. Kracke is Comr. of Bridges. Noted June 17 and 24.

★**Oswego, N. Y.**—(Official)—Bids will be received by E. A. Howard, County Supt. of Highways, until 10 a.m., July 31, for the construction of a reinforced-concrete arch bridge over the Oswego River at Minetto, N. Y. The Concrete-Steel Engineering Co., Park Row Bldg., New York, is Engr. Noted Apr. 8.

✚**Utica, N. Y.**—The Board of Contract and Supply has awarded the contract for the construction of a three-span reinforced-concrete bridge across the Mohawk River between Utica and Deerfield at North Genesee St. to WILLIAM F. COGLEY, Utica, at $59,158. Noted July 15.

New Brunswick, N. J.—(Official)—Bids were received by the Board of Chosen Freeholders of Middlesex County for the construction of a reinforced-concrete bridge over the South River on the South Amboy-New Brunswick Rd., as follows: A. Jelin, New Brunswick, $70,829; Long & Broadhurst, Hackensack, $87,706; McHarg-Barton Co., 171 Madison Ave., New York, N. Y., $76,683; General Contracting & Engineering Co., 29 Rector St., New York, N. Y., $66,714. A. B. Fox, Perth Amboy, is County Engr. Noted July 8.

Pine Brook, N. J.—(Official)—Bids were received by the Board of Chosen Freeholders of Morris and Essex Counties for rebuilding the bridge over the Passaic River at Pine Brook, as follows: Averill-Matthews Co., Clinton St., Newark, $39,860 (recommended for acceptance); Dover Boiler Works, $40,930; Foster Construction Co., $42,125; J. A. Hart & Co., $44,134; Long & Broadhurst, $44,887; Linde & Griffith, $42,210. Noted July 8.

Houtzdale, Penn.—(Official)—Bids will be received until July 29 by Charles Dickey, Secy. of Council, for the construction of a reinforced-concrete bridge 60 ft. long with a 20-ft. span. E. W. Hess, Clearfield, is Engr.

✚**Philadelphia, Penn.**—(Official)—M. L. Cooke, Dir. Dept. of Pub. Ser. has awarded contracts for the construction of three bridges as follows: Bridge at Fifth St. over North Pennsylvania R.R. to the BROWN-KING CONSTRUCTION CO., Philadelphia, at $59,940; bridge on line of Third St. over Philadelphia, Newtown and New York R.R. to THOMAS F. REILLY, Philadelphia, at $24,000; bridge on line of Fisher Ave. over North Pennsylvania R.R. to THOMAS F. REILLY, Philadelphia, at $22,000. Noted July 1.

✚**Elkridge, Md.**—O. E. Weller, Chn., State Rd. Comn., has awarded the contract for the construction of a bridge across the Patapsco River along the Baltimore and Washington Blvd. to A. J. BOYLE, Lanvale and Pulaski St., Baltimore, at $14,706. Noted June 10.

Norfolk, Va.—Plans are being prepared for the construction of viaducts at the eastern branch of the Elizabeth River at Lamberts Point for the Norfolk & Western Ry. The estimated cost is $50,000. J. E. Crawford is Ch. Engr.

Nottaway, Va.—(Official)—Bids will be received until noon, Aug. 2, at the Clerk's Office, Nottoway Court House, for the construction of a 203-ft. steel bridge with one 80-ft. steel span across the Nottoway River between Nottoway and Lunenburg Counties. G. P. Coleman, Richmond, Va., is State Highway Comr.

Portsmouth, Va.—It is reported that the Norfolk County Road Board will rebuild the Tanner's Creek Bridge on Jamestown Blvd. The estimated cost is $80,000.

Hinton, W. Va.—An election will be held in Summers County, Talcott District, Aug. 7 to vote on the question of issuing $30,000 in bonds, the proceeds of which will be used for the construction of bridges. J. M. Carden is Clk.

Snow Hill, N. C.—Press reports state that Greene County will construct a bridge across Contentnea Creek estimated to cost $20,000.

Greensboro, Ga.—It is reported that the citizens of Greene County defeated the bond issue of $50,000, the proceeds of which was to have been used for the construction and repair of bridges.

Springfield, Ga.—The Board of Commissioners of Effingham and Bulloch Counties will construct a bridge across the Ogeechee River. The estimated cost is $5000.

Bradentown, Fla.—An election will be held Aug. 10 to vote on the question of issuing $21,000 in bonds. The proceeds will be used for the construction of the unfinished contracts on the Ware Creek Bridge.

✚**Clearwater, Fla.**—The LUTEN BRIDGE CO., York, Penn., at $8000, has been awarded the contract for the construction of a bridge across the creek at the entrance to the grounds of the Belleview Hotel.

Kissimmee, Fla.—Press reports state that the city contemplates issuing bonds for the construction of a bridge across the head of the lake.

St. Francisville, La.—An expenditure of $25,000 has been authorized by the West Feliciana Parish Police Jury for the construction of bridges over Thompson's Creek, Tunica Bayou, Big Bayou Sara Creek, Little Bayou Sara Creek and Alexander's Creek. The bridge over Thompson's Creek will be built jointly by West and East Feliciana Parishes.

Walkerford, Tenn.—(Maynardville post office)—Press reports state that a bridge will be constructed across the Clinch River at Walkerford by Union and Claiborne Counties. The estimated cost is $10,000.

Lexington, Ky.—It is reported that the citizens of Fayette County contemplate holding an election to vote on the question of issuing $300,000 in bonds, the proceeds of which will be used for the construction of a bridge across the Kentucky River between Fayette and Madison Counties. F. A. Bullock is County Judge. Noted July 8.

Cincinnati, Ohio—Bids will be received until noon, July 26, by Philip Fosdick, Dir. of Pub. Ser., for the reconstruction of the existing bridge on Kirby Rd.

✚**Cincinnati, Ohio**—The contract for the construction of a bridge and culverts on Cameron Road has been awarded to J. J. FOLEY, Cleveland, at $4058. Noted June 10.

Dayton, Ohio—Plans for the construction of a railroad bridge across the Miami River at Dayton have been submitted by the Pennsylvania R.R. to the city authorities for their approval. The estimated cost is $260,000. J. C. Brand, Cincinnati, is Bridge Engr.

Mansfield, Ohio—Bids will be received until 10 a.m., July 28, by John A. Dalton, Audr., Clinton County, for the construction of the Orange St. Bridge. Charles L. Bushey is County Engr.

✚**Portsmouth, Ohio**—(Official)—The contract for the construction of the Lawson Run Viaduct over the tracks of the Norfolk & Western Ry. has been awarded to L. E. STURM, Columbus, at $120,405. C. F. Losh, Portsmouth, is Asst. Engr. Noted June 24 and July 15.

Warren, Ohio—The construction of a bridge across the Mahoning River at McDonald is contemplated by the County Commissioners, the Carnegie Steel Co. and the railroad companies.

✚**Youngstown, Ohio**—(Official)—The Board of Commissioners of Mahoning County has awarded the contract for repairing and rebuilding the pavement on the South Avenue Bridge, Youngstown, to COLUCCI BROS., Youngstown, at $5073. Noted July 1.

Crown Point, Ind.—Bids will be received by the County Commissioners until 1 p.m., Aug. 5, for the construction of a Scherzer rolling lift bridge and one concrete bridge. E. Simon is County Audr.

✚**Greensburg, Ind.**—The CENTRAL STATES BRIDGE CO., Indianapolis, at $8933, has been awarded the contract for the superstructure of a bridge over Sugar Creek, and the contract for the substructure of a bridge over Little Blue River, Union Township, has been awarded to the CRAIG CONSTRUCTION CO., Greensburg, at $5899.

Indianapolis, Ind.—The only bid received for the construction of two additional spans for the West Washington St. Bridge over the White River was that of the National Concrete Co., at $110,000. Noted July 23, 1914 and July 8, 1915.

Lebanon, Ind.—Bids will be received about Aug. 15 by the Commissioners of Boone County for the construction of ten bridges, some of reinforced concrete and some of pony truss steel span. D. M. Clark is Audr.

✚**Monticello, Ind.**—The County Commissioners have awarded the contract for the construction of six bridges to G. A. KELLENBURGER, Reynolds.

✚**Shelbyville, Ind.**—The CENTRAL STATES BRIDGE CO., Indianapolis, at $5893, has been awarded the contract for the construction of the superstructure of the McConnell Bridge.

Detroit, Mich.—At an election held July 9 the citizens voted against the question of issuing $2,000,000 in bonds, the proceeds of which was to have been used for the construction of the proposed new Belle Isle Bridge. Noted May 13 and June 17.

Bishop Hill, Ill.—Bids will be received until 3 p.m., July 27, at the Town Hall for the construction of the Falk Bridge. The bridge will be of reinforced-concrete with a 12-ft. span and a 24-ft. roadway. James H. Reed, Cambridge, is County Supt. of Highways.

✚**Nunda, Ill.**—(North Crystal Lake post office)—The contract for the construction of a bridge across the Fox River has been awarded to the JOHN J. O'HERON CONSTRUCTION CO., Chicago, at $16,000.

✚**Rockford, Ill.**—The contract for the construction of a concrete bridge over Keith Creek at Kishwaukee St. has been awarded to G. HOLM, Rockford, at $8878. Noted May 13 and June 24.

Green Bay, Wis.—Bids will soon be received for the construction of a Strauss Bascule Bridge over the East River at Main St. The estimated cost is $55,000. A. Braun is City Engr. Noted Mar. 4.

✚**Mosinee, Wis.**—The Village Board of Trustees has awarded the contract for the construction of a steel bridge, with concrete approaches, over the Wisconsin River to the WAUSAU IRON WORKS, Wausau, at $22,400.

Burlington, Iowa—At an election held June 30 the citizens voted in favor of issuing $200,000 in bonds, the proceeds of which will be used for the construction of a bridge across the Mississippi River at Burlington. Noted June 24.

✚**Austin, Minn.**—(Official)—The contract for the construction of one 50-ft. and one 40-ft. through-girder bridge to be built in the towns of Windom and Red Rock has been awarded to H. F. GARBIST, Austin, at $2250 and $1970 respectively. Other bidders were: Illinois Steel Bridge Co., $5170; Hennepin Bridge Co., $5270; Iowa Bridge Co., $4665; McClure Contracting Co., $6294. Noted July 8.

Ellinwood, Kan.—Plans are being prepared and bids will be received about Sept. 1 for the construction of a reinforced-concrete bridge with nine spans, 44 ft. each with a 24-ft. roadway. W. S. Gearhart, State Agricultural College, Manhattan, is State Engr.

Girard, Kan.—(Official)—Bids will be received until noon, Aug. 11, by the Board of County Commissioners, for five steel or reinforced-concrete bridges. The work will include the construction of three new bridges and the removing of two old ones to other locations. The estimated cost of the steel bridges is $7475 and the reinforced-concrete $9717. Noted July 8.

Hutchinson, Kan.—Press reports state that the County Commissioners have decided to construct two concrete bridges across the Arkansas River, one at Hutchinson and one at Nickerson.

✝Bismarck, N. D.—(Official)—The contract for the construction of seven reinforced-concrete culverts has been awarded to M. P. MOORE, Bismarck, at $11,200. P. E. Atkinson is County Engr. Noted July 1.

Ft. Yates, N. D.—Bids will be received until 2 p.m., Aug. 10, by the Commissioners of Sioux County for the construction of two steel span bridges. A. Colville is Audr.

✝Jamestown, N. D.—(Official)—The contract for the construction of reinforced-concrete culverts has been awarded to JARDINE & ANDERSON, Fargo. Noted July 1.

✝Marmath, N. D.—The contract for the construction of a bridge across the Little Missouri River at Marmath has been awarded to the SECURITY BRIDGE CO., at $11,243.

Bowling Green, Mo.—Bids will be received until July 28 by the Commissioners of Pike County for the construction of a 180-ft. bridge across Buffalo Creek. C. H. Harris is Highway Engr.

✝Kansas City, Mo.—(Official)—The Commissioners of Jackson County have awarded the contract for the construction of a concrete viaduct over the tracks of the Chicago & Alton R.R. at 15th St. to the J. W. McMURRAY CONSTRUCTION CO., Kansas City, at $24,312. Allen C. Southern is County Engr. Noted July 8.

St. Joseph, Mo.—An election will be held Sept. 7 to vote on the question of issuing $8000 in bonds, the proceds of which will be used for the construction of a bridge at Second and Atchison St., also on a bond issue of $5000 for the repair of viaducts.

✝Bryan, Tex.—The County Court has awarded the contract for the construction of a bridge over the Brazos River to AUSTIN BROS., Dallas, at $7500.

✝Pawnee, Okla.—The County Commissioners have awarded the contract for the construction of the Cimmaron River Bridge to the MIDLAND BRIDGE CO., Kansas City, Mo., at $17,249. Other bidders were: Missouri Bridge & Iron Co., St. Louis, Mo., $17,690; Canton Bridge Co., Kansas City, Mo., $17,495.

Tulsa, Okla.—Press reports state that the contract for the construction of the bridge across the Arkansas River connecting Tulsa with West Tulsa will be awarded about Sept. 1. The estimated cost is $200,000. Noted June 24.

Warrenton, Ore.—It is reported that the Spokane, Portland & Seattle Ry. has applied to the War Department for a permit to reconstruct a draw bridge over Skipanon Creek. A. M. Lupfer, Portland, is Ch. Engr.

Alameda, Calif.—Plans for the construction of a bridge at Webster St., estimated to cost about $700,000, are being considered. Frank Bartlett is interested.

Berkeley, Calif.—Bids will soon be received by the City Council for the construction of a reinforced-concrete bridge 106 ft. long and 40 ft. wide across Codornices Creek. A. G. Briggs is City Clk.

✝Hanford, Calif.—(Official)—The contract for the construction of a bridge across the Cross Creek has been awarded to S. G. SWARTT, Bakersfield, at $5284. Other bidders were: Walker Bros., $6269; Johnson Bros., $5637; Trewhitt-Shields Co., $5800. E. F. Pickerill is County Clk. Noted July 1.

✝Meriden, Calif.—The Northern Electric Co. has awarded the contract for the reconstruction of the bridge across the Sacramento River to the MISSOURI VALLEY BRIDGE. CO., Leavenworth, Kan. The estimated cost is $80,000. Noted July 1.

✝Orange, Calif.—(Official)—The HOLLAND CONSTRUCTION CO., San Diego, at $7994, has been awarded the contract for the construction of a reinforced-concrete bridge across Santiago Creek on East Chapman Ave. Noted June 10.

Red Bluff, Calif.—It is reported that the Board of Supervisors of Tehama County has voted to readvertise for bids for the construction of three bridges, a 2200-ft. bridge across Sand Slough, a 450-ft. bridge across Samson Slough and a 600-ft. bridge across Payne Creek. Noted June 24 and July 15.

San Jose, Calif.—Bids will be received until 11 a.m., Aug. 2, by the Board of Supervisors of Santa Clara County for the construction of a reinforced-concrete bridge over Guadalupe Creek. Harry A. Pfister is Clk. of Bd.

✝San Luis Obispo, Calif.—The County Commissioners have awarded the contract for the construction of the Miles Station Bridge to GUTLEBEN BROS., New Call Bldg., San Francisco, at $21,700.

✝Darling, Ont.—The Canadian Pacific Ry. has awarded the contract for the construction of a bridge to the FOUNDATION CO., Montreal, Que. The estimated cost is $50,000.

WATER SUPPLY—IRRIGATION

Belchertown, Mass.—At a special election held July 12 the citizens voted against issuing $40,000 in bonds, the proceeds of which was to have been used for the construction of a water system. Noted May 20.

★Hartford, Conn.—(Official)—Plans are on file with "Engineering News" for the construction of the Richards Corner dam. Noted July 15.

Centerville, N. Y.—At a recent election the citizens voted in favor of issuing $25,000 in bonds, the proceeds of which will be used for the construction of a water system. C. H. Smith, Times-Press Bldg., Middletown, is Engr. and I. D. Wolf is Village Pres.

★Ilion, N. Y.—(Official)—Bids will be received until 9 a.m., Aug. 3, by the Board of Water Commissioners for laying 3½ miles of c.-i. pipe, constructing a concrete diverting dam, intake chamber and gate house. George O. Rasbach is Clk.

★New York, N. Y.—(Official)—Bids will be received until 11 a.m., Aug. 3, by the Board of Water Supply, Municipal Bldg., Manhattan, for making six borings through rock at the East shaft of the Hudson siphon under Contract 165.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 2 p.m., July 23, by William Williams, Comr. of Water Supply, Gas and Electricity, for laying water mains in various streets.

✝New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received July 12 by the Department of Water, Gas & Electricity for making alterations and improvements at the New Utrecht pumping station (a) for mason, steel roofing and carpenter work, (b) plumbing and gas fitting and (c) steam-heating work: J. J. HEARN CONSTRUCTION CO., 69 West 46th St., New York, at $10,362 (awarded contract for (a)); Smith & Triest, 65 Lawrence Ave., Brooklyn, (c) $1044; Dolan Watnik, 146 Dumont Ave., Brooklyn, (b) $1190. Noted July 1.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received July 14 by the Department of Water, Gas & Electricity for laying water mains in several streets as follows: Beaver Engineering Co., $48,176; L. D. Gregory, $53,201; Murphy Bros., $51,327; Knight & DiMicco, $53,682; Brady Oltarsch Co., $47,934; James McAvoy, $44,985; Melrose Construction Co., $51,337.

✝Oswego, N. Y.—Contracts have been awarded to M. B. CRAWFORD & SON, Oswego, at $16,189, for furnishing c.-i. pipe and valves; RENSSELAER VALVE CO., Troy, at $1580, for valves and hydrants; CHARLES MILLER & SONS CO., Utica, at $1680, for pig lead and to VINCENT TESCIERO, Oswego, at $4832, for trenching. Noted June 24.

★Watervliet, N. Y.—(Official)—Bids will be received until 2:30 p.m., Aug. 16, by the Board of Water Commissioners, No. 1555 Broadway, Watervliet, for furnishing materials and constructing a complete municipal water system. Plans are on file with "Engineering News." Walter G. Clute is Pres., Bd. of Water Comn. Noted Apr. 22, 1914.

East Orange, N. J.—Bids will be received until 8 p.m., Aug. 9, by the City Council for the purchase of $125,000 in bonds, the proceeds of which will be used for constructing a water distributing system. L. E. Rowley is City Clk.

Gloucester, N. J.—All bids received June 25 for extensions to the water system have been rejected. J. F. Lenny is City Clk., and A. Blatchley, Drexel Bldg., Philadelphia, Penn., is Engr. Noted Apr. 15 and June 24.

Brownsville, Penn.—Plans have been prepared and submitted to the State Board of Health for the construction of a filtration plant in South Brownsville.

Cassandra, Penn.—According to press reports the citizens voted $8000 in bonds, the proceeds of which will be used for the construction of a water system.

★Mifflinburg, Penn.—(Official)—Bids will be received until 8 p.m., July 22, by the Borough Council for constructing a 500,000-gal. concrete reservoir. Alexander Potter, 50 Church St., New York, N. Y., is Consult. Engr. Noted May 20 and 27.

Ringtown, Penn.—According to press reports the Borough Council contemplates constructing a water system.

Seaford, Del.—According to press reports bonds for $20,000 have been voted by the citizens, the proceeds of which will be used for the construction of water and sewer systems.

✝Crownsville, Md.—(Waterbury post office)—The contract has been awarded by the Crownsville State Hospital to RIGGS, DISTLER & STRINGER, 25 Light St., Baltimore, at about $8000, for installing a water system.

✝St. Marys, W. Va.—(Official)—The contract has been awarded to FOREMAN & PUTNAM, Marietta, Ohio, at $6894, for constructing a concrete reservoir. Noted June 10.

Sheperdstown, W. Va.—Press reports state that a company is being formed to construct a water system in Sheperdstown.

★Warrenton, N. C.—(Official)—Bids will be received until 3 p.m., Aug. 10, by the Board of Commissioners and the Mayor for constructing water and sewer systems. Gilbert C. White, Charlotte, is Engr. Noted June 3 and 17.

Wilson, N. C.—Bonds for $400,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system and gas plant. Noted Feb. 25 and June 3.

Bamberg, S. C.—The city contemplates constructing a water system. The estimated cost is $10,000.

Cartersville, Ga.—(Official)—An election will be held Aug. 14 to vote on the question of issuing $5000 in bonds, the proceeds of which will be used for the construction of water mains. W. W. Danniel is City Engr.

Bradentown, Fla.—The election to vote on the question of issuing $10,000 in bonds for the construction of a well for the water system has been postponed until Aug. 10. Noted June 24.

✝Pensacola, Fla.—The contract has been awarded to F. M. BLOUNT CONSTRUCTION CO., Pensacola, at $12,842, for constructing a pumping station for the Water Department. Noted June 24.

Neshoba, Miss.—Bonds for $30,000 have been voted by the citizens, according to press reports, the proceeds of which will be used for the construction of water and sewer systems.

Amite, La.—The city contemplates constructing a water system. An election will probably be held to vote bonds. X. A. Kramer, Magnolia, Miss., is Engr.

Gretna, La.—Bonds for $50,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system to connect with the municipal water system in Algiers. Noted July 15.

Kaplan, La.—Bonds have been voted by the citizens, the proceeds of which will be used for the improvement of the water system.

Athens, Ohio—Plans are being prepared by Burgess & Long, Columbus, for the construction of a water system. The estimated cost is $40,000. Noted Dec. 4, 1913.

Attica, Ohio—At an election held July 12 the citizens voted in favor of issuing bonds for $10,000, the proceeds of which will be used for the installation of a filtration plant. Noted June 10 and 24.

★Cambridge, Ohio—(Official)—Bids will be received until noon, Aug. 5, by T. D. L. Lee, Dir. of Pub. Ser., for making improvements to the municipal water system. The W. J. Sherman Co., Toledo, is Engr.

Cincinnati, Ohio—Bids will be received until noon, July 26, by Edward P. Durr, Secy., Dept. of Pub. Safety, for constructing a high pressure fire system in Central Ave. and Sixth St.

East Youngstown, Ohio—An election will be held Aug. 11 to vote on the question of issuing $165,000 in bonds, the proceeds of which will be used for the construction of a water system. Noted Feb. 25.

Glendale, Ohio—At the November election the citizens will vote on the question of issuing $10,000 in bonds, the proceeds of which will be used for the improvement of the water system.

Marietta, Ohio—(Official)—Chester & Fleming, Pittsburgh, Penn., has been retained by J. W. Frye, Dir. of Pub. Service, to prepare a report on the different locations for a high level reservoir and the fitness of the present pumping machinery relative to its ability to deliver into the reservoir. Noted May 20.

Miamisburg, Ohio—(Official)—Bids will be received until noon, July 27, by the Trustees of Public Affairs for laying water mains.

+Sandusky, Ohio—The contract has been awarded to the MASSILLON IRON & STEEL CO., Massillon, for furnishing c.-i. pipe and specials.

West Park, Ohio—(Official)—Bids will be received until noon, Aug. 17, by Frederick Feuchter, Clk., for the purchase of $10,000 in bonds, the proceeds of which will be used for the extension and improvement of the water system.

Ladoga, Ind.—The city plans to install a municipal water system.

Miller, Ind.—The Town Board plans to issue $15,000 in bonds, the proceeds of which will be used for the construction of a water system. W. J. Fulton, Gary, is Engr.

Vanburen, Ind.—Bonds for $12,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water-works.

Versailles, Ind.—Bonds have been voted by the citizens, the proceeds of which will be used for the construction of a water system.

Menominee, Mich.—(Official)—The city has retained the W. J. Sherman Co., The Nasby, Toledo, Ohio, to prepare detailed estimates of the cost of the proposed municipal water system. Noted Dec. 24.

Frankfort, Ill.—Bids will be received until 7:30 p.m., July 29, by Max F. Haas, Pres., for constructing a water tank, tower and connections. The estimated cost is $5065.

Monticello, Ill.—Bids will be received until 10 a.m., July 28, by the City Council for making improvements to the water system. Noted Apr. 1.

Ellsworth, Wis.—Bids will be received until July 29 by C. B. Wood, Village Clk., for the construction of a water system. J. F. Druar, St. Paul, Minn., is Engr. The estimated cost is $7500. Noted June 10.

+Fond du Lac, Wis.—(Official)—The contract has been awarded to GEORGE A. MALLORY & CO., Kewanee, Ill., at $3190, for laying water mains. Noted June 24.

+Kohler, Wis.—The contract has been awarded to E. M. SCHREFLOW, Elgin, Ill., at $10,633, for constructing water and sewer systems. Noted June 10.

West Allis, Wis.—Bids will be received until noon, Aug. 6, by the Acting Board of Public Works for laying water mains and installing hydrants in seven streets. George Mahoney is City Clk. Noted Mar. 11.

Ogden, Iowa—Bids will be received until 8 p.m., July 30, by the Town Council for making extensions to the water system. About 18,006 ft. of 4-in. water mains will be laid.

Riverside, Iowa—(Official)—Bids will be received until Aug. 5 for constructing a water system we have been advised. Charles P. Chase, Clinton, is Engr. Noted July 15.

Solomon, Kan.—At a recent election the citizens voted against the question of issuing bonds, the proceeds of which was to have been used for the installation of a water system. G. M. Spaulding is City Clk. Noted May 6.

Ord, Neb.—Bids will be received until Aug. 13 by J. C. North, Mayor, and O. P. Conwell, City Clk., for the construction of a water-works. Bruce, Standeven & Boynton, Bee Bldg., Omaha, is Engr.

Anamoose, N. D.—Bonds for $10,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system. Noted June 10 and 24.

Wibaux, Mont.—Bids will be received until July 26, according to press reports, by the Town Clk, for constructing a water system. The estimated cost is $27,000. C. H. Green, Spokane, Wash., is Engr. Noted June 6 and July 1.

Canton, Mo.—The city plans to sell $14,000 in bonds, the proceeds of which will be used for the construction of a water system. L. H. Condit is Chn. Bd. of Pub. Wks.

Bixby, Okla.—An election will be held to vote on the question of issuing bonds for $26,000, the proceeds of which will be used for the construction of a water system.

St. Maries, Idaho—(Official)—An election will be held July 27 to vote on the question of issuing $37,000 in bonds, the proceeds of which will be used for the improvement of the water system. Charles R. Schulte is City Clk. Noted July 1.

Brigham City, Utah—Plans have been prepared for the construction of an irrigation system for the bench lands near Brigham City. A. K. Chatfield, Salt Lake City, is interested. Noted Apr. 29.

+Colfax, Wash.—The contract has been awarded to the UNITED STATES CAST IRON PIPE CO., Portland, Ore., at $54,386, for furnishing 2000 ft. of c.-i. pipe. Noted June 3.

Everett, Wash.—(Official)—An election will be held Aug. 24 to vote on the question of issuing $1,100,000 in bonds and $650,000 in bonds; the proceeds of the former will be used for the purchase of the present water system and the latter for the construction of a new water supply. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., is Engr.

Pateros, Wash.—(Official)—Bids will be received until July 30 by the Town for constructing a water system. W. H. Noble is Engr. The estimated cost is $10,000.

Burns, Ore.—Bonds for $60,000 have been authorized by the City Council, the proceeds of which will be used for the construction of a water system. H. C. Levins is Mayor.

West Lima, Ore.—Bids will be received until July 29 by L. L. Porter, Secy., Water Comn., for constructing a water system. The work includes laying 12,000 ft. of 10-in. supply main, 30,000 ft. of 4-in. and 6-in. mains and a 2,000,000-gal. reservoir and standpipe.

+Modesto, Calif.—The contract for the construction of a concrete lined flume at Gasburg Gulch has been awarded by the Modesto Irrigation District to the TIBBITTS PACIFIC CO., San Francisco, at $54,950.

Moorpark, Calif.—The Moorpark Mutual Water Co. will issue bonds for $25,000, the proceeds of which will be used for the improvement and extension of the water system.

Guelph, Ont.—The City Council plans to lay water mains between Victoria Bridge and the pumping station. G. B. Ryan is Chn.

Canora, Sask.—The installation of a water system at an estimated cost of $17,700, is under consideration by the Council. Chipman & Power, Mail Bldg., Toronto, Ont., is Engr.

Revelstoke, B. C.—Plans are being prepared by the Riverside Water Co. for the installation of a new water-works. The estimated cost is $20,000.

Vancouver, B. C.—At a recent election the citizens voted against the question of issuing $230,000 in bonds, the proceeds of which was to have been used for a water system. Noted Mar. 5.

Vernon, B. C.—The construction of an auxiliary pumping plant for the water system is under consideration. D. G. Tate is Clk.

SEWERS

Boston, Mass.—Bids will be received until noon, July 26, by Edward F. Murphy, Comr. of Pub. Wks., for the construction of pipe sewers and drains in Dumas, Cygnet, Ascot and Lincoln St. and in Commonwealth Ave., Brighton.

Boston, Mass.—Bids will be received until 1:30 p.m., July 28, by the Metropolitan Water and Sewerage Board for the construction of sewers in Sections Nos. 105 and 106 of the high level sewer, South Metropolitan System, in Needham and Wellesley.

Danbury, Conn.—The only bid received for the construction of sewers in Crane, Osborne, Tamarack St. and in Ninth Ave. was that of Luke E. Sweeney, Danbury, at $11,839. Noted June 10.

+New Haven, Conn.—(Official)—The contract for the construction of the Whalley Ave. sewer has been awarded to DWYER & MANNIX, New Haven, at $81,002. Other bids were: Charles W. Blakesler & Sons, New Haven, $122,310; Thomas F. Maher, New Haven, $93,955; Antonio Lambo, Waterbury, $99,955; O'Neil Bros., Hartford, $96,770; Leonardo Suzio, Meriden, $87,054. Noted July 15.

+Binghamton, N. Y.—The contract for the construction of storm and sanitary sewers in West End and Cleveland Ave. and in Division St. has been awarded to GEORGE SERAFINI, Binghamton, at $4065.

New York, N. Y.—(Borough of Bronx)—(Official)—Bids were received July 1 by Douglas Mathewson, Borough Pres., for the construction of sewers and appurtenances in Randall, Metcalf and Bronx River Ave., as follows: Anita Construction Co., $91,848; Rodgers & Haggerty, $80,805; H. E. Fox, $120,127; Melrose Construction Co., $109,294; Joseph L. Sigretto, $81,567; Hanover Contracting Co., $88,723; Briggs & McLaughlin, $95,308; Lawrence Contracting Co., $88,342; D. J. Duffy, $98,141; F. B. Smith, $99,454; Kingsbridge Contracting Co., $97,096; U. S. Drainage & Irrigation Co., $63,931; J. S. F. Frazer and V. D. Burchard, $80,757.

New York, N. Y.—(Borough of Bronx)—(Official)—Bids were received July 1 by Douglas Mathewson, Borough Pres., for the construction of sewers and appurtenances as follows: (a) in Raymond, Olmstead and Benedict Ave., (b) in Herschell St. and Butler Plane; S. Amanna & Sullivan, (a) $11,866, (b) $4308; Marone & Burchard, (a) $12,294, (b) $5000; A. Mancini, (a) $14,370, (b) $5770; Briggs & McLaughlin, (a) $12,392, (b) $5997; Delson Contracting Co., (a) $11,628; Anita Construction Co., (a) $10,689, (b) $7316; Gasperini & De Blasio, (a) $10,471, (b) $5174; Estates Contracting Co., (a) $10,869; D. J. Donlin, (a) $11,652, (b) $4552; Joseph L. Sigretto, (a) $12,014, (b) $5107; Hanover Contracting Co., (a) $11,854; Dragonetti Bros., (b) $5000; M. DiMenna, (b) $4994; Charles E. Farrell, (b) $4622; DeMinna & DeBalsio, (b) $4585; Burnside Contracting Co., (b) $4592; Knight & DiMissa, (b) $5000.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received July 14 by L. H. Pounds, Borough Pres., for installing complete the mechanical plant at the 26th Ward Disposal Works at Hendrix St. and Vandalia Ave., as follows: F. J. Eisinger, $4873; Adams Britz Co., $4971; Stewart & Miller, $4747; North Eastern Construction Co., $4698; Reiss & O'Donovan, $5880.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received July 15 by Marcus M. Marks, Borough Pres., for the alteration and improvement to the sewer in 32nd St. from Broadway to Fifth Ave. from P. Reilly, $13,361; D. J. Donlin, $9894; J. J. Haidewen, $13,896; Lawrence Contracting Co., $17,687; Fitzgerald & Brennen, $20,347; P. J. Kearns, $7198; Kingsbridge Contracting Co., $9562.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., July 28, by Maurice E. Connolly, Borough Pres., for the construction of sewers and appurtenances in Cedar, Briggs (Park St.), Myrtle, Lantic Ave. and in the South Side of Atlantic Ave., Fourth Ward.

New York, N. Y.—(Borough of Richmond)—(Official)—Bids were received July 13 for the construction of temporary sanitary sewers in Kissel, Castleton, Henderson Ave., and in Brighton Blvd. from J. E. Donovan, at $26,609, and Joseph Johnson Sons, at $20,907.

+Perrysburg, N. Y.—The contract for the construction of a sewage-disposal plant has been awarded to GEORGE W. MOORE, Buffalo, at $5800. Noted June 10.

+Rochester, N. Y.—The Board of Contract and Supplies has awarded the contract for the construction of sewers in Thurston, Gardiner and West St. to FRANK LACHINSA, at $17,363. Noted Apr. 15.

+Syracuse, N. Y.—(Official)—Bids were received July 12 for the construction of the Huntley Sewer System No. 2 as follows: (a) reinforced concrete, (b) brick, (c) monolithic concrete, J. C. SCHRADE, Brooklyn, (a) $82,731 (awarded contract), (b) $117,657, (c) $104,714; Mondo Construction Co., Syracuse, (a) $84,305; Bonn & Marnell, Syracuse, (a) $85,516; Frank George, White Plains, (a) $85,921, (b) $101,802, (c) $97,245; Samuel Bonn, Syracuse, (a) $86,957; F. S. Sposato, Syracuse, (a) $92,100, (b) $105,988, (c) 103,327; Grant, Smith & Co. & Locher, Rome, (a) $92,165, (b) $118,651, (c) $103,276; Hookway Construction Co., Syracuse, (a) $95,152; Charles Ippolito, Orange, N. J., (a) $126,743, (b) $166,335, (c) $158,476. W. Thomas Wooley is City Engr. Noted July 1.

+Avalon, N. J.—(Official)—The contract for the construction of approximately 14,000 ft. of 12- to 20-in. pipe sewers has been awarded to SUTTON & CORSON, Ocean City. Noted July 1.

+Edgewater, N. J.—The contract for the construction of sewer outlet No. 10 has been awarded to EDWARD ENGLISH, Edgewater, at $36,678. Noted July 15.

Hackensack, N. J.—Bids will be received until 8:30 p.m., July 26, by the Borough Council for the construction of a sanitary sewer system under two contracts, Contract A, constructing approximately 11 miles of 8- to 20-in. lateral and trunk sewers, Contract B, constructing a sewage-disposal plant consisting of a circular two-story settling tank, sludge beds and cast iron outlet to the river. Noted Feb. 4.

Newark, N. J.—Bids will be received July 29 by the city for the construction of the Bound Creek and Frelinghuysen Ave. sewer. M. R. Sherrerd is Engr.

+Orange, N. J.—The Orange City Commission has awarded the contract for the construction of storm sewers in Main St. to the FUSCO CONSTRUCTION CO., at $4100.

+Philadelphia, Penn.—The contract for the enlargement and the relocation of the sewers in Buttonwood St. in connection with the Broad St. Subway work has been awarded to JOHN McMENANY, at $17,500. Noted July 1.

Govans, Md.—Ezra B. Whitman, Consult. Engr., 1319 Fidelity Bldg., Baltimore, has been retained by the Baltimore County Commissioners to prepare plans for the construction of a sewer system for Govans.

Huntington, W. Va.—Plans are being prepared by John Sanborn, City Engr., for the construction of sewers in the First and Second Wards. The estimated cost is $8000.

Warrenton, N. C.—Bids will be received until Aug. 10 by the city for the construction of approximately 7½ miles of 8- to 15-in. pipe sewers. J. W. Allen is Mayor and Gilbert C. White, Charlotte, is Engr. Noted June 3.

Hamburg, S. C.—(North Augusta post office)—The city contemplates holding an election to vote on the question of issuing $30,000 in bonds. The proceeds will be used for the construction of a sewer system.

Catersville, Ga.—(Official)—An election will be held Aug. 14 instead of July 17 as was noted in the issue of July 1 to vote on the question of issuing $60,000 in bonds. The proceeds will be used for the construction of a sewer system. W. W. Daniel is City Engr. Noted July 1.

Greensboro, Ga.—The citizens of Greene County defeated a bond issue of $50,000, the proceeds of which was to have been used for the construction of sewers and for repairing bridges. Noted June 17.

Savannah, Ga.—An election will be held Oct. 12 to vote on the question of issuing $400,000 in bonds. The proceeds will be used for the construction of a storm water sewer system. E. R. Conant is Engr. Noted July 1.

St. Petersburg, Fla.—The City Commissioners contemplate issuing $146,000 in bonds. Part of the proceeds will be used for the construction of sewers.

Gulfport, Miss.—At a recent election the citizens defeated the question of issuing $5000 in bonds. The proceeds were to have been used for the construction of a sanitary sewer system. Noted May 20.

Neshoba, Miss.—See item under "Water Supply-Irrigation."

Amite, La.—Xavier A. Kramer, Engr., Magnolia, Miss., is preparing a report on the construction of a sewer system for Amite.

Cleveland, Tenn.—It is reported that bonds for $75,000 have been sold. The proceeds will be used for the construction of a sewer system. Noted June 24.

+Memphis, Tenn.—The contract for the construction of the Bayou Gayaso outfall sewer from the North Memphis pumping station to the mouth of the Wolf River has been awarded to the KOEHLER BROS. FOWLER CONSTRUCTION CO., Memphis, at $23,682.

+Brewster, Ohio—The contract for sewer construction has been awarded to the ROSS-COOK ENGINEERING CO., Akron, at $9267. Noted July 1.

Cheviot, Ohio—(Cincinnati post-office)—Bids will be received until noon, July 28, by Albert J. Reusing, Clk., for the construction of a trunk drain in Powells Track and in the Schlenker and Reubel property.

Cincinnati, Ohio—Bids will be received until noon, July 27, by Philip Fosdick, Dir. of Pub. Ser., for the construction of sewers in Observatory Pl., Seegar and Waverly Ave. and in Streng St.

Cincinnati, Ohio—Bids will be received until noon, July 30, by Philip Fosdick, Dir. of Pub. Ser., for the construction of sewers in Athens, Dunlap, Lossing, Randolph St. and in Broadwell, Crescent, Missouri and Duluth Ave.

Cincinnati, Ohio—Henkel & Sullivan submitted a bid at $11,212 for the construction of sewers in Seitz, Dorsey and Goethe St. from Sycamore to Alexander St. Noted July 1.

Cincinnati, Ohio—Bids were received July 12 by the Director of Public Service for the construction of the Madisonville District Sewer, Contract No. 3 as follows: (a) brick, (b) concrete, (c) reinforced-concrete, (d) segmental block, (e) vitrified pipe and miscellaneous quantities, Engineers Estimate, (a) $13,960, (b) $13,960, (c) $13,960, (d) $13,960, (e) $54,-988; Thomas P. Strack, Cincinnati, (c) $17,661, (d) $17,661, (e) $41,894; Thomas Maloney, Cincinnati, (a) $14,320, (d) $14,320, (e) $49,264; Welling & Franz, Cincinnati, (d) $13,450, (e) $51,-224; Thurber & Browning, Cincinnati, (a) $15,326, (b) $15,316, (d) $13,641, (e) $50,251. Noted July 8.

+Lowellville, Ohio—The contract has been awarded to the TURNER-OLSEN CONTRACTING CO., Youngstown, at $6346 for the construction of sewers in District No. 2. Noted June 24.

+Indianapolis, Ind.—The contract for the construction of sewers in various streets has been awarded to the COLUMBIA CONSTRUCTION CO.

Indianapolis, Ind.—The lowest bid received by the Board of Public Works for the construction of the overflow sewer in Maple Rd. was that of the Marion County Construction Co., Indianapolis, at $78,210.

Detroit, Mich.—The Supreme Court has approved a bond issue of $503,000, the proceeds of which will be used for the construction of sewers.

Aurora, Ill.—The City Council contemplates the construction of a sewer in the Arlington Heights addition estimated to cost $13,000. Myron Tarble is City Engr.

+Berwyn, Ill.—The contract for the construction of sewers in Ogden Ave. and other streets west of Oak Park Ave. has been awarded to CHARLES M. PORTER CO., Chicago, at $18,685. Noted May 13.

+Cicero, Ill.—The contract has been awarded to CHARLES M. PORTER CO., Chicago, at $4461, for the construction of sewers in West 15th St., South 61st and South 62nd Ave. and other streets. Noted July 8.

+Gibson City, Ill.—The contract for sewer construction has been awarded to HENRY REES, Quincy, at $33,422.

Glencoe, Ill.—Bids will be received until 8 p.m., Aug. 3 for the construction of a sanitary sewer system. The estimated cost is $5000. Windes & Marsh, Winnetka, is Engr.

Joliet, Ill.—Bids will be received about Aug. 1 for the construction of the Third Ward sewer system. The estimated cost is $69,470. C. O'Callahan is City Engr. Noted Apr. 8.

+Peoria, Ill.—(Official)—The contract for the construction of the South End Sewer, East Section, has been awarded to E. R. HARDING CO., Racine, at $202,824. Other bids were: J. B. Sheets, Pittsburgh, Penn., $208,353; Foulkes Construction Co., Terre Haute, Ind., $217,023; Cedar Rapids Construction Co., Cedar Rapids, Iowa, $221,983; Public Service Construction Co., Omaha, Neb., $251,332. Noted July 1.

+Algoma, Wis.—The contract has been awarded to GRAY-ROBINSON CO., Manitowoc, at $6947, for the construction of a sewer in Dodge St.

Beaver Dam, Wis.—Bids will be received until 7:30 p.m., Aug. 2, by the Board of Public Works for the construction of sewers in various streets.

Green Bay, Wis.—Bids will be received until 10 a.m., July 27, by L. Findeisen for the construction of sewers in various streets.

+Kohler, Wis.—(Official)—The contract for the construction of sanitary sewer and storm drainage systems has been awarded to E. M. SCHEFLOW, Elgin, Ill., at $10,633. Noted June 24.

+Milwaukee, Wis.—The Department of Public Works has awarded contracts for sanitary sewer construction to GEORGE ZIMMERMAN, Seventh Ave. sewer, $7133, Manitoba Ave. sewer, $2115, First Ave. sewer, $13,833, Pennsylvania Ave. sewer, $2021, and Ninth Ave. sewer, $1735.

+Watertown, Wis.—(Official)—The contract for the construction of a sewer in Nashotah St. and through private property to the river has been awarded to E. L. BARTLETT, Watertown, at $6550. Noted July 15.

West Allis, Wis.—Bids will be received until noon, Aug. 6, by the Acting Department of Public Works for the construction of sewers in various streets. E. G. Orbert is City Engr.

Clinton, Iowa—Bids will be received early in Aug. for the construction of a sewer system in District No. 3. J. G. Thorne is City Engr.

Ogden, Iowa—(Official)—Bids will be received about Aug. 24 by D. Sickler, Mayor, for the construction of a sewer system and a sewage-disposal plant. The estimated cost is $45,000. R. B. Reasoner, Perry, is Engr.-in-Charge. Noted July 8.

Primghar, Iowa—Plans are being prepared for the construction of a sewer system. Bruce, Standeven & Boynton, 430 Bee Bldg., Omaha, Neb., is Engr.

Breckenridge, Minn.—(Official)—At a recent election the citizens defeated the question of issuing $18,000 in bonds. The proceeds were to be used for the construction of a sewer system. Noted July 15.

+Rochester, Minn.—(Official)—The contract has been awarded to W. C. FRASER, St. Paul, at $5728, for the construction of sewers Noted July 8.

Sandstone, Minn.—Bids will be received until July 26 by C. Rudsuhle, Village Recdr., for the construction of approximately 9025 ft. of 8- and 6-in. sewers.

St. Paul, Minn.—Bids will be received until 10:30 a.m., July 26, by August Hohenstein, Pur. Agt., for the construction of storm and sanitary sewers in various streets to be included in part of the Snelling-Como sewer system. Noted June 3.

Manhattan, Kan.—Plans are being prepared for the construction sewers in Districts Nos. 3, 4 and 5, consisting of approximately six miles of sewers. F. Walters is City Engr. and C. F. Gist is City Clk.

Mitchell, S. D.—Bids will be received until Aug. 2 by Thomas Eastcott, City Audr., for the construction of sewers in various streets.

✚Choteau, Mont.—(Official)—The contract for the construction of sanitary sewers has been awarded to the TWO MIRACLE CONCRETE CORPORATION, Kalispell, at $10,824. Other bids were: F. E. Evans, Great Falls, $11,501; G. H. Nash & Co., Missoula, $10,830; Geo. H. Kemper, Minot, N. D., $10,832; Wilson & Smith, Great Falls, $11,819; Lindstrom & Oren, Billings, $12,936. Noted July 8.

Wibaux, Mont.—Bids will be received until July 26 for the construction of a sewer system. The estimated cost is $13,000. R. Quamme is City Clk. Noted June 3.

St. Joseph, Mo.—An election will be held Sept. 7 to vote on the question of issuing $650,000 in bonds. The proceeds will be used for the extension of the sewer system. Noted July 15.

Springfield, Mo.—An election will be held Aug. 2 to vote on the question of issuing $50,000 in bonds. The proceeds will be used for the construction of sewers and repairing the old sewers. Noted June 17.

Austin, Tex.—The City Commission has appropriated $5250 for the purchase of a site for the construction of a sewage-disposal plant estimated to cost $75,000.

Beeville, Tex.—At a recent election the citizens voted to issue $15,000 in bonds. The proceeds will be used for the construction of approximately 26,000 ft. of sewer extensions. Noted June 24.

San Antonio, Tex.—An election will soon be held to vote on the question of issuing $500,000 in bonds. The proceeds will be used for the construction of storm and sanitary sewers systems.

West, Tex.—At a recent election the citizens voted to issue $12,000 in bonds. The proceeds will be used for the construction of a sewer system. Noted June 24.

Muskogee, Okla.—The City Commissioners contemplate the construction of the North Mill St. sewer. The estimated cost is $23,000.

Sand Springs, Okla.—The city contemplates the construction of approximately 1½ miles of main sewers.

Salt Lake City, Utah—(Official)—Bids will be received until Aug. 4 by Karl A. Scheid, City Recdr., for the construction of the main trunk sewer. The estimated cost is $300,000. S. Q. Cannon is City Engr. Noted July 8.

Port Angeles, Wash.—All bids received for the construction of the Francis St. sewer have been rejected. New bids will be received.

Burns, Ore.—The City Council has authorized a bond issue of $40,000, the proceeds of which will be used for the construction of a sewer system. H. C. Levins is Mayor.

Portland, Ore.—The City Council contemplates the construction of an intercepting trunk sewer in South Portland. The estimated cost is $16,000.

Compton, Calif.—At a recent election the citizens voted to issue $70,000 in bonds. The proceeds will be used for the construction of a municipal sewer system. Olmsted & Gillen, Hollingsworth Bldg., Los Angeles, is Consult. Engr.

Los Angeles, Calif.—The city contemplates the construction of sewers in various streets.

Sacramento, Calif.—Bonds for $106,000 have been sold, part of the proceeds of which will be used for the construction of sewers.

San Bruno, Calif.—See item under "Streets and Roads."

San Francisco, Calif.—The Board of City Supervisors have appropriated $65,000 for the construction of sewers in Fifth St. Noted June 3.

San Francisco, Calif.—A. L. Meyerstein contemplates the construction of a concrete sewer large enough to be a part of the main outlet for storm sewers through his residence north of Portola Drive. The estimated cost is $16,000.

✚Stockton, Calif.—The contract for the construction of lateral and branch sewers in Sonoma, Mendocino, Mariposa and Monterey St. has been awarded to W. J. TOBIN, Oakland, at $5587. Noted Apr. 29.

Berlin, Ont.—A tentative report has been submitted by Willis Chipman, Toronto, for the construction of a new septic tank, extension of a sewage-disposal plant and additonal filtration beds. The estimated cost is $55,000.

The Narrows, Man.—The city contemplates the construction of sewer and water works systems. The estimated cost is $80,000. H. H. Elliott is Clk.

GARBAGE

Glen Ridge, N. J.—The construction of a garbage disposal plant is under consideration by the Town Council. L. H. Davey is interested.

Nutley, N. J.—The Board of Health plans to install an incinerator for the disposal of refuse and garbage.

Union, N. J.—(Weehawken post office)—Bids were received as follows, July 6, by the Town Council for collecting and removing ashes and garbage: (a) one year; (b) two years; (c) three years; (d) four years; (e) five years: Clinton Contracting Co., (a) $5400, (b) $11,200, (c) $17,400, (d) $24,000, (e) $31,000; Otto Roman, (a) $5800, (b) $11,600, (c) $17,400, (d) 23,200, (e) $29,000; Michael Volpi, (a) $5500, (b) $11,000, (c) $16,500, (d) $22,000, (e) $27,000; John Muller, (a) $4900, (b) $9850, (c) $14,860, (d) $19,900, (e) $25,000; Nicholas Triano, (a) $5800 for each year, or $29,000 for five years. Noted July 1.

✚West Hoboken, N. J.—Bids were received as follows, June 30, for removing garbage and ashes for periods of one, three and five years: (a) one year; (b) three years; (c) five years: CLINTON CONTRACTING CO., West Hoboken, (a) $9000, (b) $27,300, (c) $46,000 (awarded contract); A. C. Aschoff, (a) $9500, (b) $30,500, (c) $52,500; Michael Volpi, (a) $9545, (b) $28,725, (c) $48,995; F. D. Amato, (a) $9825, (b) $29,100, (c) $48,000; Tony Capone, (a) $9985, (b) $29,555, (c) $49,925; P. Peluso, (a) $11,000, (b) $34,934, (c) $60,981. Noted June 24.

Farrell, Penn.—At a recent election the citizens voted in favor of issuing bonds for $50,000, part of the proceeds of which will be used for the construction of a garbage incinerator.

★Detroit, Mich.—Bids were received June 24 by the Department of Public Works for constructing a garbage reduction plant as follows: F. H. Goddard, Inc., Detroit, $180,788; H. L. Van der Horst, Kalamazoo, $184,000; George D. Nutt Co., $185,740; C. A. Fuller Co., $186,433; John H. Parker Co., $194,877; Corrick Bros., $201,000. Noted June 3.

Kingston, Ont.—An incinerator will be constructed. Bonds for $7000 have been voted for this purpose. R. J. McClelland is Engr. Noted Feb. 4.

STREETS AND ROADS

✚Boston, Mass.—The contract for constructing 8000 lin.ft. of state road in Amherst has been awarded to the LANE CONSTRUCTION CO., Quincy, at $19,455.

Boston, Mass.—Bids will be received until July 27 by the State Highway Commission for the construction of 4600 lin.ft. of road in Andover. Arthur W. Dean, 15 Ashburton Pl., is Chf. Engr.

✚Boston, Mass.—The contract for building a bituminous macadam roadway in Pelton St. from Park St. to West Roxbury Parkway, West Roxbury, has been awarded to the CHARLES J. JACOBS CO.

✚Boston, Mass.—The contract for paving Lingard St. from Magnolia to Hartford St., Dorchester, with bitulithic has been awarded to JAMES DOHERTY, at $4731.

Boston, Mass.—(Official)—Bids will be received until noon, July 23, by E. F. Murphy, Comr. Pub. Wks., for improving Poplar St. from Sycamore St. to Brown Ave. and Hilburn St.

★Holyoke, Mass.—(Official)—Bids will be received until 2 p.m., July 23, by the Board of Public Works for approximately 1500 sq.yd. of prepared wooden paving blocks.

Whately, Mass.—Bids will be received until July 23 by the Board of Selectmen for constructing 3300 lin.ft. of macadam road. M. L. Crafts is Chn. of Selectmen.

✚Hartford, Conn.—Contracts for state road work have been awarded by the State Highway Commissioner as follows: Glastonbury Township, about 6500 lin.ft. 2-in. bituminous macadam on the Hartford-New London Turnpike, to A. E. DOUGLASS, Glastonbury, at $8289. Bethel Township, about 6315 lin.ft. gravel on the Bridgeport-Newton Turnpike, to the KELLOGG & GREGORY CO., Danbury, at $8803. Canterbury Township, about 5100 lin.ft. native stone and 1995 lin.ft. native stone resurfacing on the Westminster Rd., to the GOODMAN & TRUMBULL CO., Litchfield, at $8153. Sprague Township, about 1630 lin.ft. gravel on the Versailles Rd., to FRANK A. WILCOX, Norwich, at $1094. Noted July 1 and 15.

★Meriden, Conn.—(Official)—Bids will be received until 8 p.m., July 27, by the Board of Public Works for paving Hanover St. with wood block and reinforced-concrete pavements.

✚Providence, R. I.—(Official)—Contracts for paving Fountain and Empire St. with wood block have been awarded to the FRANKLIN CONTRACTING CO., 52 Vandervilt Ave., New York, at $11,398 and $16,465 respectively. Noted July 8.

✚★Albany, N. Y.—(Official)—Bids were received July 15 by the State Highway Commissioner for constructing roads in various counties as follows:

Road No. 1240, Broome County, 0.9 mile. FITCH & DOUGLAS, Rochester, $43,212 (awarded contract); Frank Stento, Binghamton, $43,870; Tyne & Willey, Binghamton, $45,095; William C. Evans, Ambler, Penn., $45,101; George Serofini and M. Barber, Binghamton, $46,970.

Road No. 5265-A, Cattaraugus County, 0.93 mile. THOMAS FITZGERALD CO., Fredonia, $47,994 (awarded contract); H. E. Bunce, Olean, $51,056; South Shore Construction Co., Inc., Erie, Penn., $52,329; William C. Evans, Ambler, Penn., $52,359; C. H. Kaumeir, Buffalo, $56,288.

Road No. 1012-A, Chautauqua County, 1.51 miles. DUNKIRK CONSTRUCTION CO., Dunkirk, $19,760 (awarded contract); Woolsey Construction Co., Poughkeepsie, Penn., $19,830; William C. Evans, Ambler, Penn., $20,592; Shaw & Lakin, Jamestown, $20,744; South Shore Construction Co. Inc., Erie, Penn., $21,227; O. M. Severson, Erie, Penn., $21,622.

Road No. 1296, Chautauqua County, 0.77 mile. WILLIAM C. EVANS, Ambler, Penn., $11,982 (awarded contract); Dunkirk Construction Co., Dunkirk, $11,996; Elmer M. Love & Sons, Corry, Penn., $12,144.

Road No. 1297, Chautauqua County, 3.55 miles. JOHN F. DOLAN CONTRACTING CO., New York, $72,537 (awarded contract); William C. Evans, Ambler, Penn., $73,814; Dunkirk Construction Co., Dunkirk, $74,154; O. M. Severson, Erie, Penn., $74,416; South Shore Construction Co. Inc., Erie, Penn., $75,951.

Road No. 1298, Chautauqua County, 0.93 mile. WILLIAM C. EVANS, Ambler, Penn., $21,875 (awarded contract); Dunkirk Construction Co., Dunkirk, $21,943; O. M. Severson, Erie, Penn., $22,167; South Shore Construction Co. Inc., Erie, Penn., $22,752; Shaw & Lakin, Jamestown, Penn., $23,034.

Road No. 5566, Cortland County, 0.23 mile. S. P. HULL, Cortland, $2318 (awarded contract); Richard Hopkins, Troy, N. Y., $2498.

Road No. 1289, Erie County, 0.34 mile. Busch & Percival, Buffalo, $16,601; Rich Construction Co., Inc., East Aurora, $17,627. Award withheld.

Road No. 5550, Erie County, 0.59 mile. Busch & Percival, Buffalo, $28,459; William C. Evans, Ambler, Penn., $28,789; Rich Construction Co., Inc., East Aurora, $30,230. Award withheld.

Road No. 619, Fulton County, 2.12 miles. BRADY-OLTARSH CONSTRUCTION CO. INC., New York, $20,237 (awarded contract); Clarence Welsh & Co., Gloversville, $20,264.

Road No. 1290, Monroe County, 1.53 miles. THOMAS GRADY, Rochester, $15,679 (awarded contract); Newport Construction Co., Herkimer, $16,284; Monroe Roads Co., Pittsford, $16,436; Ribstein-Holter Co. Inc., Rochester, $16,578; Morrisson & Quinn, Rochester, $16,717; Chambers & Barnes, Rochester.

Road No. 511, Montgomery County, 3.81 miles. DALE ENGINEERING CO., Utica, $31,869 (awarded contract); Semper Bros., Watertown, $32,310; Brady-Oltarsh Construction Co. Inc., New York, $33,010; Newport Construction Co., Herkimer,

$33,390; D. I. Snell & Co., Canajoharie, $33,537; Fort Schuyler Construction Co. Inc., Oneida, $35,063.

Road No. 5280, Nassau County., 1.57 miles. ULRICH & PERSICANE, Brooklyn, $24,035 (awarded contract); Westchester-Dutchess Corporation, Mt. Vernon, $24,208; Nordone & Petrillo, Mt. Vernon, $24,762; E. T. Eggleston, Yonkers, $25,811; John L. Hayes Construction Co., Yonkers, $25,907; Gifford Construction Co., Jamaica, $26,429; Thomas F. Tuohy, Flushing, $26,470; Murray & Gardner, Center Moriches, $26,809; Belmar Contracting Co. Inc., Troy, $26,938.

Road No. 1209, Onondaga County, 0.27 mile. MONODO CONSTRUCTION CO., Syracuse, $12,654 (awarded contract); C. T. Hookway Construction Co., Syracuse, $12,660; John Davin, Syracuse, $12,944; M. J. Gleason & Co., Syracuse, $13,156; J. J. Cashin, Fayetteville, $13,426; Samuel Bonn, Syracuse, $13,428; Sullivan Construction Co., Syracuse, $13,831; William H. Ring Contracting Co., Ogdensburgh, $14,338.

Road No. 1294, Ontario County, 1.38. CHAMBERS & BARNES, Rochester, $14,520 (awarded contract); Ribstein-Holter Co. Inc., Rochester, $15,140; J. W. Brennan Construction Co. Inc., Geneva, $15,333; Ontario Roads Co., Manchester, $15,610; Thomas F. Murray, Le Roy, $16,292.

Road No. 1302, Otsego County, 12.66 miles. J. A. CULKIN, Oswego, $130,509 (awarded contract); Ruddy-Saunders Construction Co. Inc., Troy, $132,741; Peter F. Connolly Co., Horseheads, $133,067; Weed & Walsh, Mechanicsville, $133,734; D. L. Anderson, Albany, $134,797; Richard Hopkins, Troy, $135,821; Brady-Oltarsh Construction Co., Inc., New York, $139,548; Conroy & Nixdorf, Oneida, $147,689.

Road No. 1 1303, Otsego County, 2.52 miles. ALONZO SCHAUPP, Guilderland, $19,982 (awarded contract); Newport Construction Co., Herkimer, $21,275; Weed & Walsh, Mechanicsville, $22,049; John H. Gordon, Albany, $22,186; Paddelford & King, Sherburne, $22,420; F. P. Meckes, Long Pond, Penn., $22,802; Richard Hopkins, Troy, $22,958; Dale Engineering Co., Utica, $23,341; John A. Jova Inc., Newburgh, $23,412; Fort Schuyler Construction Co., Inc., Oneida, $23,903; Brady-Oltarsh Construction Co. Inc., New York, $23,933.

Road No. 1295, Rockland County, 2.95 miles. BRADY-OLTARSH CONSTRUCTION CO. INC., New York, $38,135 (awarded contract); Ruddy-Saunders Construction Co., Troy, $39,914; John A. Jova, Inc., Newburgh, $40,279; William F. McCabe Contracting Co. Inc., White Plains, $40,326; E. T. Eggleston, Yonkers, $40,398; John L. Hayes Construction Co., Yonkers, $40,751; Utility Construction Co. Inc., New Brunswick, N. J., $48,107.

Road No. 5537, Steuben County, 1.72 miles. KENNEDY CONSTRUCTION CO., Albany, $29,880 (awarded contract); Frank Malone, Syracuse, $30,964; Greenfield Construction Co., Hornell, $30,995; William C. Evans, Ambler, Penn., $31,607; Sullivan Construction Co., Syracuse, $32,168; Chambers & Barnes, Rochester, $32,603; C. F. McGuire, Hornell, $32,920.

Road No. 1291, Suffolk County., 3.25 miles. NORDONE & PETRILLO, Mt. Vernon, $39,879 (awarded contract); Westchester-Dutchess Corporation, Mt. Vernon, $41,544; Brady-Oltarsh Construction Co. Inc., New York, $42,025; John L. Hayes Construction Co., Yonkers, $42,530; Municipal Asphalt Corporation, New York, $42,670; E. T. Eggleston, Yonkers, $43,732; Murray & Gardner, Center Moriches, $43,754; Belmar Contracting Co., Inc., Troy, $45,172; James J. Gallagher, Brooklyn, $45,347; Rosenthal Engineering & Contracting Co., Inc., Brooklyn, $52,780.

Road No. 5570, Ulster County, 2.97 miles. FRANK SALVOUCCI, West Hurley, $29,214 (awarded contract); Marks Kearney, Hudson, $31,139; Henry Clinton, Poughkeepsie, $31,870; Ruddy-Saunders Construction Co., Troy, $32,755; John F. Gallagher, Kingston, $32,905; S. V. Van Wagonen, Inc., Roundout, $33,191; George McEvoy, Creek Locks, $34,148; William G. Fox, Saratoga Springs, $35,237; Conroy Bros. & Kennedy, Eddyville, $35,254; Blankfield & Donovan, Kingston, $36,711; Brady-Oltarsh Construction Co. Inc., New York, $36,876; De Graaf & Hogeboom, Kingston, $37,244; Winston & Co., Brown Station, $37,511.

Road No. 1228, Warren County, 5.13 miles. Kingsbury Construction Co., Hudson Falls, $69,583; D. L. ANDERSON, Albany, $69,707 (awarded contract); John H. Gordon, Albany, $69,852; Brady-Oltarsh Construction Co. Inc., New York, $71,420; Kellogg & Boynton, Keesville, $74,460; Cæsar A. Rossi, Horicon, $74,828; William G. Fox, Saratoga Springs, $75,091; Joseph McCormick, East Providence, R. I., $75,128.

✚★**Albany, N. Y.**—(Official)—Bids were received July 15 by the State Highway Commissioner for repaving highways in various counties as follows:

Repair Contract No. 812, Road No. 125, Road No. 174, Broome County, 3.67 miles. LANE CONSTRUCTION CORPORATION, Meriden, Conn., $33,292 (awarded contract); Charles E. Haney, Camillus, $33,415; Ruddy-Saunders Construction Co., Troy, $34,596; W. C. Evans, Ambler, Penn., $36,969.

Repair Contract No. 810, Road No. 294, Monroe County, 2.92 miles. DODGE CONSTRUCTION CO. INC., Rochester, $12,591 (awarded contract); Monroe Roads Co., Pittsford, $12,828; Ribstein-Holter Co. Inc., Rochester, $12,859; I. M. Ludington Sons, Inc., Rochester, $13,168; Thomas Grady, Rochester, $13,625.

Repair Contract No. 811, Road No. 172, Monroe County, 0.67 mile. FLOWER CITY CONTRACTING CO., Rochester, $14,828 (awarded contract); Dodge Construction Co., Rochester, $14,841; Whitmore-Rauber & Vicinius, Rochester, $14,895; Ribstein-Holter Co. Inc., Rochester, $15,204.

Repair Contract No. 489, Road No. 63, Road No. 79, Monroe County, 1.52 miles. UNION PAVING CO., Schenectady, $15,074 (awarded contract); Langan Construction Corporation, Albany, $15,317; Whitmore-Rauber & Vincinius, Rochester, $18,195; Peter F. Connolly Co., Horseheads, $18,648; Ribstein-Holter Co. Inc., Rochester, $20,873. Noted June 24.

✚★**Albany, N. Y.**—(Official)—Bids were received July 13, by the State Highway Commissioner for constructing roads in various counties as follows:

Road No. 5565, Chenango County, 7.78 miles. FRED E. GROSS & SONS, Yonkers, $85,290 (awarded contract); T. H. Gill Co., Binghamton, $86,184; Paddelford & King, Sherburne, $86,547; Weed & Walsh, Mechanicsville, $87,896; George F. Child, Albany, $88,502; Lane Construction Corporation, Meriden, Conn., $89,271; Ruddy-Saunders Construction Co., Troy, $89,842; Semper Bros., Watertown, $90,469; Conroy & Nixdorf, Oneida, $91,396; Joseph McCormick, East Providence, R. I., $92,867.

Road No. 5568, Chenango County, 4.02 miles. PADDELFORD & KING, Sherburne, $46,693 (awarded contract); Newport Construction Co., Herkimer, $47,965; Greenfield Construction Co., Hornell, $48,572; Joseph McCormick, East Providence, R. I. $51,714.

Road No. 1225, Jefferson County, 2.86 miles. JOSEPH McCORMICK, East Providence, R. I., $17,830 (awarded contract).

Road No. 1226, Jefferson County, 2.40 miles. JOSEPH McCORMICK, East Providence, R. I., $15,621 (awarded contract).

Road No. 1299 Lewis County, 2 miles. SPELLMAN-OLIVER CO., Chateaugay, $18,646 (awarded contract); Thomas Grady, Rochester, $19,416.

Road No. 1300, Lewis County, 8.82 miles. FRED E. GROSS & SON, Yonkers, $76,244 (awarded contract); J. A. Culkin, Oswego, $81,385; Brady-Oltarsh Construction Co., Inc., New York, $84,545; J. G. Hayes Co. Inc., Rome, $86,361; C. S. Mathusa, Albany, $87,145; J. H. Weidman, Syracuse, $87,855; Thomas Grady, Rochester, $88,328; James E. Martin, Utica, $94,118.

Road No. 1301, Lewis County, 1.27 miles. HARRY W. ROBERTS & CO., Utica, $32,398 (awarded contract); R. D. Cooper, Little Falls, $34,235.

Road No. 410, Montgomery County, 7.10 miles. JAMES ANDERSON, Menands, $70,465 (awarded contract); Brady-Oltarsh Construction Co. Inc., New York, $71,965; Conroy & Nixdorf, Oneida, $76,328; James E. Martin, Utica, $81,144.

Road No. 1265, St. Lawrence County, 5.50 miles. FRED E. GROSS & SON, Yonkers, $48,961 (awarded contract); Thomas Grady, Rochester, $51,882; Henry P. Burgard Co., Buffalo, $51,948; E. T. Eggleston, Yonkers, $51,949; Ross-Hallenbeck Construction Co., Copenhagen, $54,328; L. S. Derosia, Massena, $57,209.

Road No. 5569, Schoharie County, 4.79 miles. DEGRAAF & HOGEBOOM, Kingston, $47,980 (awarded contract); Weed & Walsh, Mechanicsville, $48,243; S. V. Van Wagonen, Inc., Rondout, $48,612; Ruddy-Saunders Construction Co., Troy, $48,842; George F. Child, Albany, $50,068; C. S. Mathusa, Albany, $51,010; Brady-Oltarsh Construction Co. Inc., New York, $51,979; George Holler, Albany, $53,339; Lane Construction Corporation, Meriden, Conn., $54,160; John A. Jova, Inc., Newburgh, $54,441.

Road No. 5557, Schuyler County, 6.03 miles. JAMES T. MOORE, Elmira, $61,507 (awarded contract); J. W. Brennan Construction Co. Inc., Geneva, $61,954; Sullivan Construction Co., Syracuse, $62,425; Atlanta Construction Co., Atlanta, $63,828; John W. Gurnett, Watkins, $64,577; Richard Hopkins, Troy, $64,854; Peter F. Connolly Co., Horseheads, $64,871; John H. Gordon, Albany, $65,001; Brady-Oltarsh Construction Co., Inc., New York, $65,732; Lane Construction Corporation, Meriden, Conn., $69,502.

Road No. 1232, Schuyler County, 1.11 miles. FRANK MALONE, Syracuse, $26,157 (awarded contract); J. W. Brennan Construction Co. Inc., Geneva, $26,533; Peter F. Connolly Co., Horseheads, $27,105; John R. Burchill, Syracuse, $28,123.

Road No. 1102, Steuben County, 9.09 miles. ATLANTA CONSTRUCTION CO., Atlanta, $77,710 (awarded contract); Sullivan Construction Co., Syracuse, $81,202; Richard Hopkins, Troy, $83,331; Dale Engineering Co., Utica, $83,679; John R. Burchill, Syracuse, $84,229; Thomas Hucknall, Albion, $83,882; John H. Gordon, Albany, $85,918; Brady-Oltarsh Construction Co., Inc., New York City, $87,435; John Johnson Construction Co., Buffalo, $88,474.

Road No. 1292, Steuben County, 3.42 miles. J. G. HAYES CO., INC., Rome, $34,178 (awarded contract); Dale Engine Co., Inc., Utica, $34,566; Thomas Grady, Rochester, $34,946; Atlanta Construction Co., Atlanta, $34,964; Sullivan Construction Co., Syracuse, $35,297; Frank Malone, Syracuse, $36,377; Richard Hopkins, Troy, $37,499; Bison City Engineering & Contracting Co., Buffalo, $38,019.

Road No. 5564, Steuben County, 7.31 miles. DALE ENGINEERING CO., Utica, $59,744 (awarded contract); Kennedy Construction Co., Albany, $61,974; Atlanta Construction Co., Atlanta, $65,125; P. H. Murray, Rochester, $65,859; J. G. Hayes & Co. Inc., Rome, $66,029; Sullivan Construction Co., Syracuse, $67,756; John H. Gordon, Albany, $67,928; Peter F. Conley Co., Horseheads, $68,067; John C. Bradley, Corning, $68,759; Fred E. Gross & Sons, Yonkers, $69,405; James T. Moore, Elmira, $70,501.

Road No. 5457-A, Sullivan County, 0.72 mile. JOHN A. JOVA, INC., Newburgh, $12,266 (awarded contract); John J. Keating, Monticello, $12,672; Jackson Bros., Cuddebackville, $12,964.

Road No. 5567, Tompkins County, 3.04 miles. JOHN R. BURCHILL, Syracuse, $28,872 (awarded contract); Frank Malone, Syracuse, $29,104; Sullivan Construction Co., Syracuse, $29,779; Brady-Oltarsh Construction Co. Inc., New York, $30,643; Patrick D. Conley, Ithaca, $31,183; F. P. Meckes, Long Pond, Penn., $31,313; Richard Hopkins, Troy, $31,442; Juniata Co., Philadelphia, Penn., $31,997.

Road No. 5571, Westchester, County, 4.32 miles. FAGNANI & MARRA, Tuckahoe, $49,822 (awarded contract); Fred E. Gross & Sons, Yonkers, $52,430; John L. Hayes Construction Co., Yonkers, $53,620; Westchester-Dutchess Corporation, Mt. Vernon, $53,846; White & Colligan, Purchase, $55,516; Harris-Rose Construction Corporation, New York, $56,509; Brady-Oltarsh Construction Co., Inc., New York, $56,607; E. T. Ekkleston, Yonkers, $56,956; William F. McCabe Contracting Corporation, Inc., White Plains, $57,875; Nordone & Petrillo, Mt. Vernon, $58,345; Frank G. Fowler Construction Co., Mt. Kisco, $58,498.

Road No. 1088, Wyoming County, 1.53 miles. FRANK M. FOOTE, Arcade, $24,932 (awarded contract); John Johnson Construction Co., Buffalo, $25,172.

Road No. 1267, Wyoming County, 6.99 miles. FRED E. GROSS & SONS, Yonkers, $67,390 (awarded contract).

★**Albany, N. Y.**—(Official)—Bids were received July 13 by the State Highway Commission, Lancaster St., Albany, for the repair of highways by state aid as follows:

Repair Contract No. 556, Road No. 216, Delaware County, 0.95 mile. SCHUNNEMUNK CONSTRUCTION CO., Highland Mills, $7901 (awarded contract); DeGraafe & Hogeboom, Inc., Kingston, $10,236.

Repair Contract No. 809, Road No. 334, Ontario County, 1.69 mile. HARRY W. ROBERTS CO., Utica, $17,170 (awarded contract); Lane Construction Corporation, Meriden, Conn., $18,830; Langan Construction Corporation, Albany, $18,885; J. W. Brennan Construction Co., Inc., Geneva, $19,467; Union

Paving Co., Schenectady, $20,745; Federal Asphalt Corporation, New York, $22,027.

Repair Contract No. 813, Road No. 5111 and 5112, Suffolk County, 4.08 miles. WILLIAM DOYLE, Saugerties, $17,787 (awarded contract); Municipal Asphalt Co., New York, $19,967; Barker-Bonner Co., Inc., New York, $20,405; Frank Nordone, Mt. Vernon, $21,186; John J. Guinan Contracting Co., Brooklyn, $22,096. Noted June 24.

✚Batavia, N. Y.—A contract for paving Tracy, Dellinger and Vernon Ave. and Elm St. has been awarded to THOMAS HOLAHAN, Rochester, at $53,156. Noted July 1.

✚Binghamton, N. Y.—The contract for paving Beethoven St. has been awarded to WARREN BROS., at $2.28 per sq.yd.

New York, N. Y.—(Borough of Bronx)—(Official)—Bids were received by Douglas Mathewson, Borough Pres., for improving (a) Rosewood St. from Bronx Blvd. to White Plains Ave., (b) Glover St. from Castle Hill to Westchester Ave., (c) Holland Ave. from Baker to Hunt Ave., (d) East 174th St. from Bryant to Boone Ave., (e) Albany Crescent from Bailey Ave. south of West 231st St. to Bailey Ave. to West 233rd St., as follows: Harris-Rose Construction Co., (a) $6039; H. F. Breen, (a) $5847; J. Di Menna, (a) $5511, (b) $9275, (c) $15,500; Burnside Contracting Co., (a) $6035, (b) $9322, (c) $15,860; M. Maher, (a) $6035; M. Di Menna, (a) $5890; Delson Contracting Co., (a) $6038, (b) $10,379, (c) $15,067; Sparara Contracting Co., (a) $6172; S. Amanna & Sullivan, (a) $6065, (c) $17,074; Di Menna & De Blasio, (a) $5666, (b) $10,050, (c) $15,851; J. F. Calahan, (b) $9586; D. J. Duffy, (c) $19,683; Barber Asphalt Co., (d) $4195, (e) $6324; Municipal Asphalt Co., (d) $3805, (e) $6324; Asphalt Construction Co., (d) $3986, (e) $6373; Uvalde Asphalt Co., (d) $3589, (e) $5751.

✚New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received for regulating, grading and paving with asphalt on a concrete foundation a traffic roadway on Park Circle, at the interception of Coney Island Ave. and Ocean Parkway, as follows: Uvalde Asphalt Co., 1 Broadway, $5049; Barber Asphalt Co., $6475; Sicilian Asphalt Co., $7670; Cranford Co., $6908.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 11 a.m., July 28, by L. H. Pounds, Borough Pres., for improving portions of Newton St., Skillman St. and Vernon Ave., also for 50,000 asphalt paving blocks, 50,000 wood paving blocks, 1800 cu.yd. of broken trap rock and 1200 cu.yd. of trap rock screenings.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received July 15 by Marcus M. Marks, Borough Pres., for improving (a) 68th St. from Park to Fifth Ave., (b) 100th St. from Central Park West to Amsterdam Ave., (c) 100th St. from West End Ave. to Riverside Drive, (d) Riverside Drive from 177th to 181st St., as follows: Cleveland Trinidad Paving Co., (a) $8499, (b) $39,328, (c) $5309; Barber Asphalt Co., (a) $7901, (b) $36,795, (c) $3946; Aztec Asphalt Co., (a) $7464, (b) $29,302, (c) $4036; Sicilian Asphalt Co., (a) $7109, (b) $35,642, (c) $4288; Asphalt Construction Co., (a) $7098, (b) $35,672, (c) $4189; Uvalde Asphalt Co., (a) $7780, (b) $29,553, (c) $4521; Peter Kramer, (d) $7537; P. J. Duffy, (d) $6043; Di Menna & De Paola, (d) $6876; Di Menna & De Blasio, (d) $5697; Arthur Casey, (d) $9087; Federal Asphalt Co., (d) $6839.

✚Rochester, N. Y.—The contract for paving Mayberry St. with asphalt has been awarded to the JULIUS FRIEDERICH CO., at $5250.

Bloomfield, N. J.—Bids will be received until 8 p.m., Aug. 2, by Raymond F. Davis, Town Clk., for improving Essex Ave., Berkeley Ave., Harrison and Grove St. Estimated cost, about $15,200.

East Orange, N. J.—Bids will be received until 8 p.m., July 26, by the City Council for grading, curbing and paving Girard Ave. and Linden Ave.

✚Elberon, N. J.—The contract for repaving Ocean Ave. from the Allenhurst line to Elberon has been awarded to the SCHEFFIER-BURNS CO., at $132,000.

Elizabeth, N. J.—Press reports state that the Common Council has appropriated $70,368 for resurfacing Telford roads and $32,000 for repaving Broad St.

✚Harrison, N. J.—The contract for paving Middlesex St. from Second to Fourth St. has been awarded to the GLENFIELD CONSTRUCTION CO., at $10,632.

Hoboken, N. J.—Bids will be received until 10 a.m., July 28, by the Board of City Commissioners for grading and repaving portions of Third, Fourth, Fifth, Sixth, Jefferson, Adams, Hudson, River and 14th St. and Willow Ave.

Hoboken, N. J.—(Official)—Bids will be received until 10 a.m., July 28, by the Board of City Commissioners for improving a portion of the concrete walks in Elysian Park. Daniel A. Haggerty is City Clk.

Jersey City, N. J.—Bids will be received until 11 a.m., July 28, by the Board of Commissioners for repaving a portion of Whiton St. with asphalt block and a portion of Tonnele Ave. with wood block. Michael I. Fagen is City Clk. Noted July 8.

✚Millburn, N. J.—(Official)—A contract for grading, draining and paving Highland Ave. has been awarded to J. H. SCHMIDT, Millburn. Noted July 8.

Newark, N. J.—The Board of Street and Water Commissioners plans to pave Eckert Ave. with asphalt from Seymour Ave. to Osborne Terrace. P. H. Ryan is Pres. Bd.

Newark, N. J.—Bids were received July 15 for paving South Orange Ave. from South Ninth to South 20th St., as follows: John E. Donovan, Port Richmond (Borough of Richmond), $28,885; John S. Geiger & Son, Newark, $32,850; Hastings Pavement Co., 25 Broad St., Newark, $32,410; Northern Construction Co., $35,031; Newark Paving Co., $30,923; Ralph Sangiovanni, $27,826; Glenfield Construction Co., $30,616. Noted July 8.

Norwood, N. J.—(Official)—Bids will be received until 8 p.m., July 23, by the Borough Council for repairing Tappan Rd. A. J. Kuhl is Borough Clk.

✚Weehawken, N. J.—(Official)—The contract for paving Clifton Terrace with concrete block has been awarded to the CLINTON CONTRACTING CO., West Hoboken, at $7518. Noted July 1 and 15.

West New York, N. J.—The Town Council has authorized the City Engineer to prepare plans and specifications for the improvement of 10th and 11th St.

West New York, N. J.—The Town Council has had plans prepared for improving Adams and Seventh St.

✚Clarion, Penn.—(Official)—A contract for constructing brick and concrete pavements has been awarded to L. H HILEMAN & CO., New Kensington, $12,628. Noted July 8.

Greensburg, Penn.—(Official)—Bids will be received until noon, July 23, by John S. Sell, City Controller, for improving sections of the highway in Mt. Pleasant Township, being parts of the Kecksburg-Donegal Rd.

✚Pittsburgh, Penn.—Contracts have been awarded by the Commissioners of Allegheny County for road construction as follows: Braddock and Ardmore Rd. in Braddock Township, brick, McCURDY BROS., $7086; Newton and Rodi Rd. in Wilkins Township, brick, JAMES SWEENEY, $25,568; McCoy Extension Rd. in Stowe and Kennedy Townships, macadam, D. W. CHALLIS & SONS, $17,669; Wilmerding and Monroeville connecting road in Patton Township, macadam, R. H. CUNNINGHAM & SONS CO., $25,204; Millers Rune Extension Rd. in South Fayette Township, brick, WILLIAM J. PAYNE, JR., CO., $42,473. Noted July 1.

✚Baltimore, Md.—The contract for paving Cliftview Ave. and Norwood Rd. with asphalt has been awarded to the AMERICAN PAVING CO., at $10,717.

✚Towson, Md.—The contract for paving Roland Ave. from Deepdine Rd. to Lake Ave. has been awarded to P. FLANIGAN & SONS, 120 East Lexington St., at $50,000.

✚Charleston, W. Va.—A contract for constructing 5½ miles of improved roadway has been awarded to the CAREY-REED CO., Lexington, Ky., at $90,000.

Moundsville, W. Va.—(Official)—Bids will be received until noon, July 26, by O. B. Bonar, City Clk., for improving Fifth St.

✚Baton Rouge, La.—A contract for constructing 15 miles of street pavement has been awarded to G. W. PRUTSMAN, Danville, at approximately $200,000.

Lake Charles, La.—Press reports state that the Commissioners of Cemeron Parish have authorized the expenditure of $36,000 for constructing and improving roads.

✚Chattanooga, Tenn.—A contract for constructing Lookout Mountain Pike has been awarded to the McISAAC-GENTRY CONSTRUCTION CO., Chattanooga, at $101,000. Noted May 27.

Knoxville, Tenn.—The citizens of Union County have voted in favor of issuing $100,000 in bonds, the proceeds of which will be used for work to be done on the Dixie Highway.

Memphis, Tenn.—All bids received for paving the Mississippi Blvd. from Calhoun Ave. and Lauderdale St. have been rejected. Noted July 15.

✚Elizabethtown, Ky.—A contract for constructing four miles of macadam road has been awarded to J. VAN FLETCHER, Elizabethtown, at $5000.

✚Georgetown, Ky.—A contract for constructing macadam roads in Scott County has been awarded to J. WILLIAM COYLE and J. S. LANCASTER, at $18,000.

✚Morganfield, Ky.—The contract for paving Main St. with vitrified brick has been awarded to COLLINS & PAVEY, Mt. Vernon, Ill., at $12,600.

Bexley, Ohio—(Official)—Bids will be received until noon, Aug. 6, by Chester A. Miller, Village Clk., for the sale of $124,000 in bonds, the proceeds of which will be used for improving various streets.

✚Cincinnati, Ohio—Contracts have been awarded for improving the Plainfield Rd. to R. E. CASH, $6038; Lee's Creek Rd. to TOPH & HOLDEN, $9550. Noted June 17.

✚Cincinnati, Ohio—(Official)—The contract for improving Lee's Creek Rd. from Biddinger Pike to Crosby Township line, in Harrison Township has been awarded to TOPH & HOLDEN, Harrison, at $9550. Noted June 17.

Coshocton, Ohio—(Official)—Bonds for $11,000 were sold July 10, the proceeds of which will be used for improving Seventh Ave. from Kenilworth Ave. to Bank St. Noted July 1.

Cuyahoga Falls, Ohio—(Official)—Bids will be received until noon, July 28, by W. F. Williston, Village Clk., for improving Portage St.

Defiance, Ohio—(Official)—Bids will be received until July 28 by Clayton M. Rath, Dir. Pub. Ser., for laying 28,129 sq.yd. of pavement.

Delaware, Ohio—Bids will be received until 10 a.m., Aug. 4, by the County Surveyor for improving and paving 0.56 miles of Trimmer Joint County Rd., in Delaware County. F. C. Higley is Engr.

East Cleveland, Ohio—Press reports state that the City Council plans an expenditure of $200,000 for paving three miles of Euclid Ave.

✚Euclid, Ohio—(Official)—The contract for repairing Euclid Rd. and Chardon Rd. has been awarded to SPENCE BROS., Cleveland. Noted July 1.

Lima, Ohio—(Official)—Bids will be received until noon, July 29, by the Board of Commissioners of Allen County for constructing approximately 5800 sq.yd. of concrete pavement, 18 lin.ft. wide. H. J. Lawlor is County Clk.

✚Portsmouth, Ohio—(Official)—Contracts for paving Park Ave., Harward Pl., Walnut and Norfolk St., have been awarded to KELLEY BROS., Portsmouth, at $4745, $1949, $2089 and $15,468 respectively. Noted July 1.

Salineville, Ohio—(Official)—Bids will be received until noon, Aug. 2, by W. E. Schubert, Village Clk., for the sale of $9000 in bonds, the proceeds of which will be used for improving a number of streets.

✚Franklin, Ind.—The contract for constructing a gravel road in Union Township has been awarded to BROWN & PITCHER, Bargersville.

South Bend, Ind.—(Official)—Bids will be received until 11 a.m., Aug. 16, by the Commissioners of St. Joseph County for constructing a concrete road in Penn Township. Clarence Sedwick is County Audr.

Aurora, Ill.—Bids will be received about Aug. 1 for paving South River St. M. Tarble is Engr.

Paris, Ill.—(Official)—Bids will be received until 2 p.m., July 31, by the Commissioners of Highways of Hunter Township for constructing 3960 lin.ft. of gravel road on the Baldwinsville State Line Rd. and 5280 lin.ft. of gravel road on the Heelan Rd. in Hunter Township.

+Brocton, Ill.—(Official)—The contract for constructing combination rock and gravel roads on four highways in Embarrass Township has been awarded to SNYDER & BARNETT, Frankfort, at $20,345. Noted June 17 and July 1.

+Paris, Ill.—A contract for graveling the Redmon, Stewart and Culbertson Roads has been awarded to RALPH BAUM, at $8886.

+Madison, Wis.—The contract for paving Williamson St. from South Blair to South Blount St. has been awarded to J. W. MITCHELL, Madison, at $9994.

Milwaukee, Wis.—Press reports state that the Board of Public Works plans to pave Center and Vliet St.

Racine, Wis.—Bids will be received until 10 a.m., Aug. 7, by the Board of Public Works for paving West Blvd. from Washington to Kinzie Ave.

+Racine, Wis.—A contract for paving a number of alleys has been awarded to the FLEROTILE & CEMENT CONSTRUCTION CO., Racine.

+Sheboygan, Wis.—The contract for paving South 14th St. with concrete has been awarded to JOHN BRAUN, Sheboygan, at $30,260.

Duluth, Minn.—(Official)—Bids will be received until 11 a.m., July 26, by the Commissioner of Public Works for improving Colorado St.

+St. Cloud, Minn.—A contract for constructing concrete sidewalks has been awarded to GRUBER & CO. Noted June 3.

+Grand Island, Neb.—A contract for laying approximately nine block of brick block pavement has been awarded to R. D. KINGSBURY.

Lincoln, Neb.—(Official)—Bids will be received until 10 a.m., July 27, by Thomas J. Flynn, City Clk., for improving a number of streets.

Sinto, Tex.—At a recent election the citizens of District No. 3, San Patrico County, voted in favor of issuing $75,000 in bonds, the proceeds of which will be used for constructing roads.

Santa Fé, N. M.—Bonds for $500,000 have been sold by the State Highway Commission, the proceeds of which will be used for constructing roads throughout the state.

Provo, Utah.—Press reports state that bids will soon be received by the City Council for constructing one mile of concrete pavement, at an estimated cost of $30,000.

Phœnix, Ariz.—Press reports state that the citizens of Cohise County will soon vote on the question of issuing bonds, the proceeds of which will be used for constructing and improving roads throughout the county.

+Blaine, Wash.—A contract for constructing concrete pavements has been awarded to BOOKER & CAMPBELL, Bellingham.

+Cathlamet, Wash.—(Official)—The contract for improving a portion of State Road No. 19, beginning at Skamokawa, running eastward a distance of 6½ miles has been awarded to SLOAN BROS., Seattle, at $26,311. Other bids were: Standefer-Clarkson, $30,000; Montague O'Reilly Co., $28,000; Elliott Contracting Co., $27,000. Noted July 1.

+Ferndale, Wash.—A contract for street paving has been awarded to TROPMAN & BOERHAVE, Lynden, at $12,485.

+Mt. Vernon, Wash.—The contract for paving Permanent Highway No. 2 has been awarded to FERCH & GASS, White Bldg., Seattle, at $26,595.

Seattle, Wash.—Bids will be received until 11 a.m., Aug. 2, by the Commissioners of King County for constructing Permanent Highway No. 11. Byron Phelps is County Audr. and Clk.

Seattle, Wash.—The City Council has approved plans for the paving of Utah Ave. with brick.

Walla Walla, Wash.—The City Commission plans to pave Rose and 12th St., which when completed will connect with Walla Walla County macadam roads. The estimated cost is $18,000.

+Wenatchee, Wash.—The contract for constructing permanent Highway No. 6 has been awarded to J. GARLAND, at $14,797.

Clatskanie, Ore.—The City Council plans to construct concrete sidewalks on the main streets of the city, at an estimated cost of $20,000.

+Portland, Ore.—The contract for paving Brooke St. from Scott Ave. to East Stark St. with concrete has been awarded to GIEBISCH & JOPLIN, Portland, at $14,071.

+Fullerton, Calif.—The contract for paving Broad Rd. with asphaltic concrete has been awarded to O. & C. CONSTRUCTION CO., La Habra (Fullerton post office), at $36,000.

Lindsay, Calif.—Bids will soon be received by the City Council for paving approximately 12 blocks of city streets.

+Los Angeles, Calif.—The contract for improving Ardmore Ave. from San Marino and 11th St. has been awarded to E. A. BAKER, at $5972.

Los Angeles, Calif.—Bids will be received until 2 p.m., July 26, by the Board of Supervisors for road improvements in District No. 3 of Los Angeles County.

+Quincy, Calif.—The Supervisors of Plumas County have awarded the contract to the BRADLEY ENGINEERING CO., Reno, at $7600, for constructing a road in Sierra Valley.

Sacramento, Calif.—(Official)—Bids were received July 6 by the State Highway Commission for constructing highways as follows: (a) Contra Costa County, Route 14, Section B, (b) Glen County, Route 7, Section B, (c) Tehama County, Route 3, Section C, (d) Tulare County, Route 10, Section A, (e) Tulare County, Routes 4 and 10, Sections B and D: F. Rolandi, San Francisco, (a) $39,234, (c) $48,773; Contra Costa Construction Co., Berkeley, (a) $35,980; James Fitzpatrick, Sacramento, (a) $39,009, (c) $48,137; Theodore Maretas and Thomas H. Muller, San Francisco, (a) $39,306; J. H. Falconer, Pinole, (a) $39,662; O'Brien Bros., Martinez, (a) $35,548; Spring Construction Co., Berkeley, (a) $38,198; W. A. Bechtel, Atton, (a) $45,297; W. B. Hunter & Sons, Alameda, (a) $39,844, (b) $38,441; Hard Bros., Ukiah, (a) $51,185; A. C. McLean Construction Co., San Francisco, (a) $40,425, (c) $54,486; W. J. Schmidt, Berkeley, (a) $36,098; Palmer & McBryde, San Francisco, (a) $47,708; Richard Rothwell, Los Angeles, (a) $34,054, (c) $60,967; Urban Construction Co., San Francisco, (a) $29,833; Blanchard Brown Co., (a) $37,116; Bates Borland & Ayer, Oakland, (a) $33,623; Occidental Construction Co., Los Angeles, (a) $38,987; Fairbanks & Bachtel, Willits, (a) $34,190; G. W. Conners, Eureka, (a) $37,216, (c) $52,117; L. F. Gerdetz, San Francisco, (b) $37,327; Marin Rock Co., San Anselmo, (b) $37,204; Highway Paving & Construction Co., San Francisco, (b) $39,867, (d) $17,439, (e) $33,462; H. G. Vaughan Construction Co., San Francisco, (b) $35,209; C. H. & A. W. Gorrill, San Francisco, (b) $37,362; P. H. Hoare, Oakland, (b) $44,876; Taylor & Berliner, Los Angeles, (b) $33,817, (e) $40,504; H. H. Harlan & C. M. Harlan, Williams, (c) $49,214; Shattuck & Nimmo Warehouse Co., Bakersfield, (d) $17,522, (e) $32,461; Rogers Bros. Co., Los Angeles, (d) $23,256, (e) $45,666; Bent Bros., Los Angeles, (d) $19,543, (e) $37,954; White & Gaskill, Long Beach, (d) $14,813, (e) $30,378; John D. Marsh, Bakersfield, (d) $15,270, (e) $30,409; M. Blumenkranz, Davis, (e) $41,416. Noted July 1.

Sacramento, Calif.—(Official)—Bids will be received until 2 p.m., July 26, by the State Highway Commission, 515 Forum Bldg., for constructing roads in various counties. Austin B. Fletcher is State Highway Engr.

+Salinas, Calif.—The contract for paving Alisal St. with macadam has been awarded to the GRANITE ROCK CO., at $20,268.

San Bruno, Calif.—Bids will soon be received by the City Trustees for constructing new streets and sewers, at an estimated cost of $31,000.

+San Francisco, Calif.—The contract for improving 19th Ave. from Noriege to Quintate St. has been awarded to F. R. RITCHIE, at $23,255.

Visalia, Calif.—According to press reports bids will be received some time in August by the Supervisors of Tulare County for constructing a section of highway between Three Rivers and Lemon Cove.

INDUSTRIAL WORKS

Everett, Mass.—The New England Mfg. Co., Woburn, Mass., has purchased a site, and will build a benzol plant.

Greendale, Mass.—(Worcester post office)—Plans have been prepared by Lockwood, Green & Co., Arch., 60 Federal St., Boston, Mass., for the construction of a 120x200-ft. addition to the plant of the Heald Machine Co., New Bond St. J. N. Heald is Treas.

Marblehead, Mass.—The Parker Shoe Co. has purchased a site on Elm St. and will build a three-story factory in addition to its present plant.

New Bedford, Mass.—(Official)—Bids are being received by Lockwood Green & Co., Arch., 60 Federal St., Boston, Mass., for the construction of an eight-story, 108x158-ft., concrete warehouse for the Merchants' Terminal Warehouse Co. Noted July 15.

Quincy, Mass.—The Fore River Ship Building Corporation will build a two-story, 185x779-ft. brick and steel storage building on East Howard St. The estimated cost is $400,000.

Salem, Mass.—The Hydgrade Incandescent Lamp Co. will build a 52x202-ft. factory, with a 11x45-ft. wing, on Boston St.

+Worcester, Mass.—F. W. MARK has been awarded the contract for the construction of a one-story garage for William H. Murray to cost $20,000. The L. W. Briggs Co. is Arch.

Hartford, Conn.—Bids are being received by Ford, Buck & Sheldon, Inc., Arch., for the construction of a one-story, 55x320-ft. factory on Homestead Ave. for the Hartford Special Machinery Co., 734 Main St.

Waterbury, Conn.—The Chase Metal Works has been granted a permit for the construction of a two-story, 60x200-ft., brick and steel addition to its factory on Thomaston Ave.

+Auburn, N. Y.—The Firth Carpet Co. has awarded the contract for the construction of a one-story, 105x150-ft. addition to its plant to JOHN W. FERGUSON, Paterson, N. J. The estimated cost is $15,000.

Buffalo, N. Y.—The Danaby Packing Co. has been granted a permit for the construction of a cooling house at 25 Metcalfe St., to cost $20,000.

★Cortland, N. Y.—(Official)—Bids will be received until 4 p.m., July 27, at the office of the Armory Commission, 174 State St., Albany, N. Y., for the construction of a two-story reinforced-concrete storage house at the State Camp of Instruction.

New Hartford, N. Y.—The Sanquoit Toilet Paper Co. will build a 58x194-ft. and a 101x143-ft. manufacturing building, both three-stories. The estimated cost is $100,000. H. L. Meader, 178 Fifth Ave., New York, N. Y., is Arch.

New York, N. Y.—(Borough of Richmond)—Plans have been prepared by M. A. Cantor, Arch., 373 Fulton St (Borough of Brooklyn), for the construction of a one-story, 50x125-ft., brick storage building in Elm Park for the S. J. Linoleum Co.

+Utica, N. Y.—H. R. BEEBE has been awarded the contract for the construction of a one-story, 77x180-ft. and 49x49-ft. machine shop on Gray Ave. for the Brunner Mfg. Co. Leo Brunner is Pres.

Bloomfield, N. J.—The International Arms & Fuse Co. will build a factory at Grove St. and Bloomfield Ave. Francisco & Jacobus, 200 Fifth Ave., New York, N. Y., is Arch.

+Erie, Penn.—The Malleable Iron Co. has awarded to HENRY J. CONRATH, 439 East Sixth St., the contract for al-

terations to present buildings and the construction of a new structure at 12th and Cherry St., to cost $100,000.

Franklin, Penn.—The Citizens Traction Co. is receiving bids for the construction of a 52x150-ft. car-barn on Liberty St.

✚Marcus Hook, Penn.—(Official)—The contract has been awarded by Ballinger & Perrot, Arch., 17th and Arch St., Philadelphia, Penn., to WILLIAM PROVOST, JR., Chester, Penn., for the construction of a plant for the Viscose Co. Noted July 15.

✚Philadelphia, Penn.—(Official)—WILLIAM STEELE & SONS CO., 1600 Arch St., has been awarded the contract for the construction of a factory at Second and Erie Ave. for Thomas Potter & Sons Co. The estimated cost is $80,000. Noted July 15.

Philadelphia, Penn.—Kahn & Greenberg will build a seven-story, reinforced-concrete and brick manufacturing building at 24th and Market St.

Pittsburgh, Penn.—The contract will soon be awarded for the construction of a six-story, reinforced-concrete warehouse on Penn Ave. near Marbeau St., for the George S. Dougherty Co.

✚Wheatland, Penn.—The Knox Press & Welded Steel Co. has awarded the contract for the construction of a 130x700-ft. plant to the BLAW CONSTRUCTION CO., Pittsburgh, Penn.

Baltimore, Md.—Plans have been prepared by the G. E. Painter Co., Arch., for the construction of a 128x300-ft. addition to the plant of the Enamel & Novelty Co., Woodward and Clement St.

Hagerstown, Md.—(Official)—Bids are being received by Peuckert & Wunder, Arch., 310 Chestnut St., Philadelphia, Penn., for the construction of a two-story, 100x200 ft., reinforced-concrete factory for the Pangborn Corporation. Noted July 1 and 8.

✚Douglas, Ga.—The Douglas Compress Co. has awarded the contract to the EMPIRE CONSTRUCTION CO. for the construction of a compress building and sheds to cost approximately $40,000.

✚Anderson, S. C.—The GALLIVAN BUILDING CO., Greenville, S. C., has been awarded the contract for the construction of a one-story, 72x83-ft. mill and a one-story, 50x100-ft. storage warehouse for the Equinox Mills. The estimated cost is $15,000. J. E. Sirrine, Greenville, S. C., is Arch. and Engr.

Cleveland, Ohio—The Osborn Engineering Co., 740 Engineers Bldg., will receive bids for the construction of a five-story, 200x200-ft., brick and reinforced-concrete factory for the B. F. Goodrich Co., Akron, Ohio.

✚Uhrichsville, Ohio—(Official)—GEORGE J. BOCK, Coshocton, Ohio, has been awarded the contract for the construction of a $95,000 sewer plant for the United States Clay Products Co. S. L. Weaver is Arch. Noted July 15.

Cleveland, Ohio—Bids are being received for the construction of a brick and steel addition to the plant of the Chandler Motor Car Co., St. Clair Ave. and East 131st St. Ernest McGeorge, 855 Leader News Bldg., is Arch.

✚Hamilton, Ohio—THE CULLEN & VAUGHN CO. has been awarded the contract for building an addition to the plant of the Herring-Hall-Marvin Safe Co.

✚Painesville, Ohio—The Ohio Cast Stone Co. has awarded the contract to J. T. RICHARDS, Citizens Bldg., Cleveland, Ohio, for the construction of a 40x200-ft. plant with a 60x100-ft. wing, at the New York Central R.R. tracks near Forest St.

Reading, Ohio—The Tubular Products & Steel Works plans the construction of a plant.

Steubenville, Ohio—Plans are being revised by Peterson & Co., Arch., North Bldg., for the construction of a four-story warehouse for the Steubenville Stone Co., 435 Market St. Noted May 13.

✚Toledo, Ohio—The Atwood Automobile Co. has awarded the contract for the construction of a two-story, 100x175-ft., brick addition to its garage on Monroe St. to the SCHMIDT-HARDWOOD CO. Manfred M. Stophlet is Arch.

✚Fort Wayne, Ind.—The General Electric Co. of Indiana has awarded the contract for the construction of a five-story, 100x300-ft., brick warehouse to A. BENTLEY & SONS CO. Harris & Richards, Drexel Bldg., is Arch.

Detroit, Mich.—The Aluminum Casting Co. is receiving bids for the construction of a one-story, 120x160-ft., brick and reinforced-concrete machine shop, to cost $25,000. The Forest City Engineering Co., 512 Hippodrome Bldg., Cleveland, Ohio, is Arch.

Muskegon, Mich.—The Campbell, Wynant & Cannon Foundry Co. plans the construction of a 75x175-ft. addition to its plant at Sanford St. and McKinney Ave., Muskegon Heights.

Trumann, Ark.—The Trumann Cooperage Co. will build a $90,000 addition to its plant.

Salt Lake City, Utah—Plans have been prepared by Ware & Treganza, Arch., for the construction of a six-story, 50x115-ft. factory for the Purity Biscuit Co. Noted June 24.

Welland, Ont.—A 70x80-ft. addition will be built at the plant of the Canadian Billings Spencer Co. to cost, with equipment, $30,000.

FEDERAL GOVERNMENT WORK

★Dredging—Portland, Maine—Bids will be received until noon, Aug. 16, at the U. S. Engineer Office, Portland, for dredging in the St. Crois River.

✚Pattern Shop—Boston, Mass.—The contract has been awarded to the AMERICAN BRIDGE CO., Continental Bldg., Baltimore, Md., at $7375, for furnishing steel work for a pattern shop floor at the navy yard. Noted May 27.

Coal-Handling Equipment—Springfield, Mass.—Bids will be received until 2 p.m., Aug. 6, by the Commanding Officer, Springfield Arsenal, for furnishing and constructing coal storage and coal handling equipment.

★Rebuilding Basin Walls—Block Island, R. I.—Bids were received June 29 by Col. John Millis, Newport, for rebuilding basin walls and repairing the breakwaters at Block Island Harbor as follows: Estate of John Beattie, Leets Island, Conn., $9460 and E. S. Belden & Sons, Hartford, Conn., $9136 and $10,098. Noted June 3.

✚Building—New York, N. Y.—The contract has been awarded to the RIVERSIDE CONTRACTING CO., 39 Cortlandt St., New York, at $14,733, for constructing three one-story brick buildings at the Navy Yard, New York. Noted June 3.

✚★Breakwater—Oswego, N. Y.—The contract has been awarded H. S. KERBAUGH, Inc., Buffalo, at $78,606, for constructing a concrete superstructure on the outer breakwater at Oswego Harbor. Noted June 3.

✚Riprap—Philadelphia, Penn.—The contract has been awarded to the COAST & LAKES CONSTRUCTION CO., New York, N. Y., at $16,680 for constructing riprap in the Delaware River at Artificial Island. Noted June 22 and July 15 .

Building—Washington, D. C.—Bids were received as follows, July 13, by the Acting Supervising Architect, Treasury Dept., Washington, D. C., for the construction of the new building for the Interior Department, Washington: Conners Bros. Co., New York, N. Y., $1,804,524; Irwin & Leighton, Philadelphia, Penn., $1,684,000; Boyle-Robertson Construction Co., Washington, D. C., $1,690,000; P. F. Gormley Co., Washington, $1,676,970; John Griffith & Son Co., Chicago, Ill., $1,913,000; A. L. Guidone & Son, New York, N. Y., $1,733,313; John W. Brady & Co., New York, N. Y., $1,690,000; John H. Parker Co., New York, N. Y., $1,622,487; Thompson-Starrett Co., New York, $1,675,000, including mechanical equipment, $1,915,000; George A. Fuller Co., New York, N. Y., $1,645,000; Cramp & Co., Philadelphia, Penn., $1,732,655; John Gill & Co., Cleveland, Ohio, $1,849,000; William Dall Co., Cleveland, Ohio, $1,797,000; Bing & Bing Construction Co., New York, N. Y., $1,988,700, including mechanical equipment. Mechanical equipment, excluding elevators: John W. Danforth Co., Buffalo, N. Y., $300,000; Thompson-Starrett Co., New York, N. Y., $280,000; William Gordon Corporation, New York, N. Y., $237,213; W. G. Cornell Co., Washington, D. C., $247,748; Standard Engineering Co., Washington, D. C., $248,850; L. K. Comstock & Co., New York, N. Y., $294,304; Walker & Chambers, New York, N. Y., $335,890; Hanley-Casey Mechanical Equipment Co., Chicago, Ill., $278,000; Crook-Kries Co., Baltimore, Md., $306,296; Chris Irving Plumbing Co., Denver, Colo., $598,600; Fitzpatrick & Hoepfner, Columbus, Ohio, $288,671; Isador Freund, Washington, $289,466; Lord Electric Co., New York, N. Y., $248,842; G. A. Kees Domestic Engineering Co., St. Paul, Minn., $318,746; S. Faith & Co., Philadelphia, Penn., $280,771. Elevator equipment: A. B. See Electric Elevator Co., Washington, D. C., $53,600; Kaestner & Hecht, Chicago, Ill., $58,565; Ohio Elevator & Machine Co., Columbus, Ohio, $82,400; Otis Elevator Co., Washington, D. C., $49,849; Gurney Elevator Co., New York, N. Y., $59,200.

★Post Office—Palatka, Fla.—Bids will be received until 3 p.m., Aug. 27, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing the U. S. post office at Palatka.

Levee—Vicksburg, Miss.—All bids received for 1,415,000 yd. of levee work at Ashbrook Neck levee have been rejected on account of being too high. Noted July 1.

✚Levee Work—Vicksburg, Miss.—The contract has been awarded by the U. S. Engineer Office to N. C. WILLIAMSON & CO., Vicksburg, at $0.1475 per yard for about 500,000 cu.yd. of levee work. Noted June 17.

Post Office—Opelika, Ala.—Bids were received July 14 by the Supervising Architect, Washington, D. C., for constructing a post office and court at Opelika as follows: J. S. Rogers Co., Moorestown, N. J., $101,990. Richardson Engineering and Construction Co., Bainbridge, Ga., $93,370. George W. Stiles Construction Co., Rookery Bldg., Chicago, Ill., $93,610. George Becking, Chattanooga, Tenn., $93,218. Algernon Blair, Montgomery, $85,971. Colonial Construction and Supply Co., Charlottesville, Va., $87,840. King Lumber Co., Charlottesville, Va., $98,900. Herman Construction Co., St. Louis, Mo., $105,000. Barnes Bros., Logansport, Ind., $100,000. George A. Clayton, Atlanta, Ga., $84,364. George A. Shaul, Seneca, Kan., $88,937. Westchester Engineering Co., White Plains, N. Y., $88,870. Burke's Construction Co., Hattiesburg, Miss., $94,973.99. W. H. Fissel & Co., New York, N. Y., $84,735. John G. Unkefer & Co., Minerva, Ohio, $94,315. Christ Kanzler & Sons, Evansville, Ind., $84,898. Thomas W. Cissel, Wooster, Ohio, $97,450. Callahan-Mandle Co., Chicago, Ill., $92,384.13. M. Yeager & Son, Danville, Ill., $93,586 and Dobbs & Wetmore, Meridian, Miss., $99,535. Noted June 10.

✚Riprap—Memphis, Tenn.—Contracts have been awarded to the ARNOLD STONE CO., Neely's Landing, Mo., at $4100 and C. C. HUTHMASHER, Grand Tower, Ill., at $9240 for riprap stone. Noted June 10.

✚Stone—Memphis, Tenn.—The contract has been awarded to the U. S. STONE CO., Little Rock, Ark., at $13,800, for furnishing stone. Noted Jnne 10.

Machine Tools—Rock Island, Ill.—Bids will be received until July 26 by the Commanding Officer, Rock Island Arsenal, for furnishing machine tools under Proposals 7, 20, 31 and 33.

Machine Tools—Rock Island, Ill.—Bids will be received until July 30 by the Commanding Officer, Rock Island Arsenal, under Proposals 17, 18, 19, 25 and 26 for machine tools.

★Reclamation Work—St. Ignatius, Mont.—Bids will be received until 3 p.m., Aug. 18, by the U. S. Reclamation Service, St. Ignatius, for constructing laterals and sublaterals on the Flathead project. A. P. Davis is Ch. Engr.

Post Office—Galveston, Tex.—Bids were received July 14 by the Supervising Architect, Washington, D. C., for remodeling the U. S. post office and custom house as follows: M. C. Bowden, Galveston, $7963.50. Frank M. Weakley, Portsmouth, Va., $8349. Dieter & Wenzel Construction Co., Wichita, Kan., $8273. O. E. Fischer Building Co., Galveston, $8985.75.

Radio Station Buildings—Isabel, Tex.—Bids will be received until 11 a.m., Aug. 28, by H. R. Stanford, Ch., Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing buildings at the radio station.

★**Post Office**—Grand Junction, Colo.—Bids will be received until 3 p.m., Aug. 24, by James A. Wetmore, Act. Superv. Arch., Washington, D. C., for constructing the U. S. post office at Grand Junction.

Miscellaneous Supplies—Panama — Bids will be received until 10:30 a.m., Aug. 2, by Maj. F. G. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., Aug. 6, by Maj. F. G. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

★**Light Station**—Navassa Island, West Indies—Bids will be received until 2 p.m., Sept. 30, by the Bureau of Lighthouses, Dept. of Commerce, Washington, D. C., for constructing the Navassa Island light station.

MISCELLANEOUS

Enlarging Basin—Boston, Mass.—The following bids were received by the Harbor and Land Commissioners on July 14, for enlarging the anchorage basin in Lynn Harbor. J. S. Packard Dredging Co., 1004 Turks Head Bldg., Providence, R. I., 29.4c. per cu.yd.; $10 per cu.yd. rock; Maryland Dredging & Contracting Co., Baltimore, Md., 30.9c.; $8; Bay State Dredging Co., Ltd., 247 Atlantic Ave., Boston, Mass., 34c.; $10. About 11,700 cu.yd. of material will be removed. William I. Williams, State House, Boston, is Ch. Engr.

Dredging—Boston, Mass.—Bids will be received until July 26 by the Metropolitan Park Commissioner for 15,000 cu.yd. of dredging in Aberjoria River. John R. Bablin, 14 Beacon St., is Ch. Engr.

Dredging—Boston, Mass.—Bids will be received until July 28 by the State Harbor and Land Commission for 57,000 cu.yd. of dredging in Wellfleet Harbor. William F. Williams, State House, Boston, is Ch. Engr.

Dock—Buffalo, N. Y.—Bids will soon be received by the New York Central R.R. for constructing a reinforced-concrete dock on the Buffalo River adjoining the dock of the Eastern Grain & Elevator Co. The estimated cost is $30,000.

Dredging—New York, N. Y.—(Borough of Brooklyn) — (Official)—Bids were received by R. A. C. Smith, Comr., Docks and Ferries, for dredging in mill basin Jamaica Bay, from the Atlantic Gulf & Pacific Co., No. 13 Park Row, at 0.05c. per cu.yd., and the Maryland Dredging Co., at 0.10c. Noted July 15.

✚**Pier**—New York, N. Y.—(Borough of Brooklyn) — (Official)—The contract for building the pier at the foot of East 30th St. has been awarded to W. B. SEAVER, INC., Grand Central Terminal. Noted June 10 and 24.

Pier—New York, N. Y.—(Borough of Brooklyn)—(Official) —The following are the bids received by R. A. C. Smith, Comr., Docks and Ferries for building a pier near the foot of 35th St. (Borough of Brooklyn), Thomas H. Kerbaugh, Inc., $363,091; Foundation Co., $349,777; Phœnix Construction Co., $347,897; Stillman, Delahanty & Ferries Co., $333,878; G. B. Spearin, 90 West St., New York, $310,201; Henry Steers, $342,866.

Subway—New York, N. Y.—(Borough of Brooklyn)—The following are the unofficial totals of the bids received by the Public Service Commission for the construction of Section No. 1 of Route No. 49, a part of the Culver Rapid Transit R.R.: Post & McCord, Inc., 103 Park Ave., New York, $877,959; Phœnix Bridge Co., $894,000; A. L. Guidone & Son, Inc., $903,000; Cooper & Evans Co., $914,732; Rodgers & Hagerty, Inc., $924,933; Frawley-Kaufman Contracting Co., Inc., $926,000; Connex Engineering & Construction Co., $930,000; Oscar Daniels Co., $931,740; McClintic-Marshall Co., $947,358; Underpinning & Foundation Co., $947,410; Ft. Pitt Bridge Works, $959,000; Snare & Triest, Inc., $971,000. Noted July 1.

✚**Razing Buildings**—New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for the wrecking of eight buildings has been awarded to JACOB SCHUMER at his offer of $2387 to the Public Service Commission for the privilege. The contractor will receive all material used in the construction of these buildings. Noted July 8.

★**Subway**—New York, N. Y.—(Borough of Brooklyn)—(Official)—The following are the bids received by the Public Service Commission for track laying on the New Eutrcht Ave. elevated line: Ward & Tully, Inc., $71,355; Joseph A. McElroy, $75,183; W. F. Jordan, $78,525; Post & McCord, $82,639; Degnon Contracting Co., $85,105; Snare & Triest Co., $94,864; Connex Engineering & Construction Co., $99,414; Thomas Crimmins Contracting Co., $99,564; Jobson-Gifford Co., $100,516; Charles Cooper, $102,587; Holbrook, Cabot & Rollins Corporation and George W. McNulty, $103,781; Max Raymond, $111,616; Joseph J. Klein, $116,436; James S. Frazer, $118,217. Noted June 24.

Lumber—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until July 27 for furnishing and delivering lumber for the Departments of Charities, Water Supply, Gas and Electricity, Fire and Bellevue and Allied Hospitals.

Cement, Sand and Stone—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by R. H. C. Smith, Comr., Docks and Ferries, Pier A, Battery Pl., until noon, July 28, for furnishing and delivering cement, sand and broken stone.

Automobile Runabouts—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by Robert Adamson, Fire Comr., Municipal Bldg., New York, until 10:30 a.m., July 26, for furnishing and delivering 20 automobile runabouts.

Open-Hearth Rails—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received by the Public Service Commission for furnishing and supplying open-hearth rails for use on the construction of the Rapid Transit Railroads from the Bethelem Steel Products Co., at $1,202,126 and Lackawana Steel Co., $1,202,126. Noted July 8.

Drainage—Garfield, N. J.—The Board of Chosen Freeholders, Hackensack, N. J., has granted an appropriation of $12,000 to the borough of Garfield, for drainage and changing the course of the brook in the borough.

Cement, Traprock, Etc.—Jersey City, N. J.—Bids will be received until 2 p.m., July 27, by the Hudson County Park Commission, Jersey City, for 600 bbl. Alpha portland cement, 450 cu.yd. broken trap rock, 300 cu.yd. Cow Bay sand and 25 cu.yd. of coarse trap rock screenings. Walter G. Muirhead is Secy.

Cable—Jersey City, N. J.—Bids will be received until 2 p.m., July 27, by the Hudson County Park Commission Jersey City, for furnishing 18,000 ft. of No. 8, steel-armored, 7500-volt park cable, delivered at Bayonne Park.

Pier—Chester, Penn.—The Philadelphia Suburban Gas & Electric Co. plans to erect a double deck pier at the foot of Norris St.

Elevated Railway—Philadelphia, Penn. — (Official) — Bids will soon be received by A. M. Taylor, Dir., Dept. of City Transit, for the construction of concrete column foundations and piers for about 26,000 lin.ft. of elevated railway in Front St., Kensington Ave. and Frankford Ave.

Piers—Philadelphia, Penn.—The next improvement to be undertaken by the Department of Wharves, Docks and Ferries, and the most important one yet projected from the standpoint of the modernization and expansion of the port, is the Moyamensing Pier Group planned to be located along the Delaware River waterfront between McKean and Hoyt Sts, South Wharves. This will consist of a group of 10 or 12 long, wide piers, ranging from 250 ft. in width by 900 ft. in length, to 300 ft. in width by 1200 ft. in length, with docks between them of about the same width as the piers. The first pier of the group will be at the foot of McKean St. and will be 250 ft. wide by 900 ft. long. It will be two stories high, provided with electrical lighting and mechanical freight handling equipment and will afford berthing space for four steamers at one time. Sunken car tracks will run on the pier for its whole length, and ample car storage space will be provided outside of the pier between its entrance and Delaware Ave. to guarantee prompt shifting service of cars in and out. Money is available for starting the construction of the McKean St. pier and work on the substructure will be started this summer. The completion of this first pier will be followed by the gradual carrying-out of the rest of the general plan for this section of the waterfront. Each one of these piers, with its equipment, is estimated to cost about $1,500,000, including property damages. The bids for the dredging of the site of the first of these piers follow that item. John Meigs is Dir., Dept. Wharves, Docks and Ferries. Noted June 10 and 24.

Dredging—Philadelphia, Penn.—Only two bids were receivd for dredging and preparing the sites for the Moyamensing piers at the foot of McKean St., Delaware River. The specifications call for the removal of 400,000 cu.yd. of material. The bidders were required to submit two separate prices, the first item (a) calling for dredging and depositing the material removed above high water mark in the city limits, the second (b) for dredging and delivering the material in front of the municipal rehandling machine at Cannon Ball Farm. The bidders were: American Dredging Co., (a) 14¼c., (b) 10¼c.; Bowers, Southern & Co., (a) 19c., (b) 14½c. Noted June 24.

Pier—Philadelphia, Penn.—Bids will be received by John Meigs, Dir., Department of Wharves, Docks and Ferries, until noon, Aug. 9, for constructing a pier in the Delaware River, between McKean St. and Snyder Ave. Noted June 24.

Bulkheads and Dredging—Philadelphia, Penn.—The City Council has granted the Dock Department permission to spend $67,000 for bulkheading the Schuylkill River and $50,000 for deepening the Delaware River channel.

✚**Channel**—Philadelphia, Penn.—The contract for the construction of a channel in the Delaware River, in the upper end of Philadelphia Harbor, has been awarded to the MARYLAND DREDGING & CONTRACTING CO., Baltimore, Md., at $199,200. Noted July 15.

River Improvement—Philadelphia, Penn.—The City Council has passed an ordinance for an allotment of $75,000 state funds for deepening and widening the ship channel between lower end of Cramp's shipyard and Port Richmond export pier, south of Allegheny Ave.

★**Plaza**—Philadelphia, Penn.—The lowest bid received by the Department of Public Works for constructing the South Broad St. plaza was from Edwin H. Vare, Philadelphia, at $123,565. Noted June 24.

✚**Tunnel**—Pittsburgh, Penn.—The contract for the construction of the Neeld tunnel to the South Hills, has been awarded to BOOTH & FLINN, LTD., 1942, Forbes St., Pittsburgh, at $1,347,018. The tunnel will be 4816, ft. long and 33 ft. wide of monolithic concrete. Noted May 27.

✚**Bank Protection**—Augusta, Ga.—The contract for repairs to bank protection on the Savannah River has been awarded to the SIMONS-MAYRANT CO., Charleston, S. C., at $17,275. Noted July 8.

✚**Drainage**—Bartow, Fla.—The contract for constructing about 142 miles of drainage ditches has been awarded by the Peace Creek Drainage District, to A. V. WILLS & SONS, Pittsfield, Ill., at 8.5c. per cu.yd. Noted June 17.

Levee—Greenville, Miss.—Bids will be received by W. L. Thompson, Ch. Engr., Mississippi Levee Commissioners, until Aug. 17 for levee work in Issaquena County. The estimated cost is $100,000.

Drainage—Lake Charles, La.—The Board of Commissioners of Sulphur Drainage District No. 2 have awarded the contract for excavating 180,000 cu.yd. to GRAY & ALEXANDER at about $16,000.

Wharves—New Orleans, La. — Bids will be received by Ernest M. Loeb, Pres. of Comrs., New Orleans Bldg., until 2 p.m., Aug. 11, for rebuilding the Julia St. wharf, and for extensions to Girod St. wharf. Plans may be obtained of J. Devereux O'Reilly, Engr., New Orleans Bldg., New Orleans. leans.

Speedway—New Orleans, La.—According to press reports an automobile speedway is to be constructed in New Orleans at a cost of $500,000. H. S. Moore and S. H. Lindsay, Chicago, are representing the owners.

+Drainage—Sulphur, La.—The Board of Commissioners of Sulphur Drainage District No. 2 has awarded the contract for the excavation of 180,000 cu.yd. of earth material in the district to GRAY & ALEXANDER, at $16,000.

Motor Truck—Cincinnati, Ohio—Bids will be received by Ernst Von Bargen, City Pur. Agt., City Hall, for furnishing one two-ton motor truck with special body.

Motor Apparatus—Cleveland, Ohio—Bids will be received by A. R. Callow, Comr. Purchases and Supplies, City Hall, until noon, July 29, for furnishing steam tractor fire engine, auto police patrol, and one steel hull for the fire boat, "Clevelander."

Motor Apparatus—Columbus, Ohio—Bids will be received by B. L. Bargar, Dir. of Pub. Safety, City Hall, until noon, Aug. 6, for furnishing two motor driven patrol vehicles for the police department.

+Piers and Coalbins—Youngstown, Ohio—The Lake Erie & Eastern Ry. has awarded the contract for the construction of nine piers and eight coal bins at Pike St. to BYERS & CHAIG, New Castle, at $15,000.

Levee—East St. Louis, Ill.—According to press reports the lowest bid submitted for the construction of an earth levee was from John & Patrick Keeley, at 36c. per cu.yd. Noted June 24.

Drainage—Grand View, Wis.—It is reported that the White River Drainage District has been organized for the purpose of draining 20,000 acres of swamp land. Adolph Habelt, Grand View ,is interested.

Drainage—Urbana, Ill.—Bids will be received by the County Clerk until 10 a.m., July 29, for the construction work in District No. 17.

+Ditches—Three Lakes, Wis.—The contract for constructing about 11 miles of open ditches has been awarded to SCHULTZ & BIECY, Clarion, Iowa. Noted June 3.

Ditches—Marshall, Minn.—Bids will be received by E. S. Shepard, County Audr., until July 26 for constructing Ditches Nos. 13, 15 and 16. The estimated cost is about $82,000.

Ditches—Slayton, Minn.—Bids will be received until July 27 by E. V. O'Brien, County Audr., for constructing the following ditches: No. 9, length, 28,285 ft.; cost, $9015; No. 9A, length, 43,800 ft.; cost, $12,250; No. 45, length, 16,000 ft.; cost, $4360; No. 5, length, 23,835 ft.; cost, $8563.

Elimination of Grade Crossing—Kansas City, Mo.—The contract for the construction of the subway under the Missouri Pacific Ry. tracks on Van Horn boulevard has been awarded to KIT COLYER at $26,000. Noted Mar. 4.

+Drainage—Pine Bluff, Ark.—The contract for constructing about 13 miles of drainage canals in District No. 5 has been awarded to McWILLIAMS BROS., Memphis, Tenn., at about $28,000. Noted Apr. 29.

Drainage—North Yakima, Wash.—It is reported that bids will be received by Charles E. Barrett, County Audr., until July 31 for constructing a system of open and closed drains in Drainage Improvement District No. 25.

Motor Fire Apparatus—Seattle, Wash.—Bids will soon be received by the Board of Public Works for furnishing motor fire apparatus.

Improvements to Telephone System—Portland, Ore.—The Pacific Telephone & Telegraph Co., Portland, will spend $19,000 for improvements to its system.

Mausoleum—Glendora, Calif.—The Oakdale Cemetery Co. plans to erect a reinforced-concrete mausoleum in Oakdale Cemetery. The estimated cost is $75,000. Lyman Farwell, Story Bldg., Los Angeles, is Arch.

+Oil Tanks—Martinez, Calif.—The Shell Refinery, Los Angeles, has awarded the contract for the construction of 26 oil tanks to the LLEWELLYN IRON WORKS, Los Angeles, at $250,000.

+Pier—San Francisco, Calif.—The Board of State Harbor Commissioners has awarded a contract for the repairing of Pier No. 11 to the HEALY-TIBBITTS CONSTRUCTION CO. at $14.281. Noted July 15.

+Cable and Alarm Boxes—Montreal, Que.—The city has awarded the contract for furnishing cable and alarm boxes to the NORTHERN ELECTRIC CO., 814 Notre Dame St., West, Montreal, at $48,000.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Andover, Mass.—Plans are being prepared by Charles R. Greco, 8 Beacon St., for the construction of a parochial school to cost $50,000.

Boston, Mass.—A nine-story, 92x105-ft., brick apartment block will be built for Snider & Druker, 18 Tremont St. Clapp & Wihtemore, 20 Beacon St., is Arch.

+Boston, Mass.—J. EDWARD McLEAN, 10 Fanieul Hall Sq., has been awarded the contract for the construction of a two-story addition to Boston College. Kendall, Taylor & Co., 93 Federal St., is Arch.

+Burlington, Mass.—The contract for the construction of a three-story, 40x75-ft. town hall has been awarded to CUSTANCE BROS., Lexington, Mass. Loring & Phipps, 53 State St., Boston, Mass., is Arch. The estimated cost is $45,000.

Jamaica Plain, Mass.—(Boston post office)—Yervant Kayanjian will build a $50,000 brick store and office building. H. S. Demoorjani, State Mutual Bldg., Worcester, Mass., is Arch.

+North Easton, Mass.—The contract for the construction of a $70,000 brick school has been awarded to J. P. HURLEY, Marlboro, Mass.

Springfield, Mass.—The Cohasset Hotel Co. has been incorporated with a capital of $600,000 and will build a hotel at the corner of Dwight and Worthington St. Clifford A. Tinker is Arch.

Springfield, Mass.—Albert Karp and F. E. Bidwell will build an $85,000 hotel. B. Hammett Seabury is Arch.

Waltham, Mass.—(Official)—Bids will be received until Aug. 15 by James F. Monaghan, Arch., Room 401, 79 Milk St., Boston, Mass., for the construction of a one-story, 65x195-ft. brick church for St. Charles Congregation. The estimated cost is $80,000. Noted July 1.

Albany, N. Y.—The St. Vincent de Paul's Congregation plans to construct a three-story convent on Morris St. near Partridge St. Estimated cost, $50,000. The construction of a parochial school on Madison Ave. and Ontario St. is also contemplated. Estimated cost, $175,000. Noted Apr. 15.

Allegany, N. Y.—The Trustees of St. Bonaventure College plan to construct a building. Work will be started in the fall. Estimated cost, $100,000.

Buffalo, N. Y.—The Cleveland-Buffalo Transit Co., 1290 West 11th St., Cleveland, Ohio, plans to construct a freight and passenger terminal building at Michigan Ave. and the Buffalo River. M. Newman is Pres.

Buffalo, N. Y.—The Board of Education plans to construct a school on Walden Ave. between St. Louis Ave. and Moselle St. The estimated cost is $50,000.

+Harriman, N. Y.—The JERSEY CITY CONSTRUCTION CO., 75 Montgomery St., Jersey City, N. J., has been awarded the contract for the construction of a high and grade school on Main St. Estimated cost, $40,000. Noted under Harrison, N. J., July 8.

New York, N. Y.—(Borough of Manhattan)—Herman Lee Meader, Arch., 2 West 33rd St., is preparing plans for the construction of a 12-story store and loft building at 7 East 39th St. and through to 10 East 38th St., adjoining the Craftsman Bldg. The estimated cost is $250,000. Leslie R. Palmer, 68 William St., is interested. Noted June 17.

New York, N. Y.—(Borough of Manhattan)—Abraham Lincoln Levin, 103 Park Ave., has purchased a site on 86th St., between Columbus and Amsterdam Ave., upon which to construct a 12-story fireproof apartment house. The estimated cost is $700,000.

New York, N. Y.—(Borough of Manhattan)—George Backer, 56 West 45th St., has purchased a site at Madison Ave. from 31st to 32d St. upon which to construct a 16-story mercantile building.

New York, N. Y.—(Borough of Manhattan)—Neville & Bagge, Arch., 105 West 40th St., is preparing plans for the construction of a 12-story, 100x110-ft. apartment house on West End Ave. and 99th St. for the McMorrow Engineering & Construction Co., 271 West 125th St. The estimated cost is $400,000. Noted June 10.

New York, N. Y.—(Borough of Manhattan)—Bids are being received by Katherine B. Davis, Comr., Dept. of Correction, Municipal Bldg., New York, for the construction of a one-story concrete and brick disciplinary building on the east side of Shore Drive near Main St. on Rikers Island. F. B. & A. Ware, 1170 Broadway, is Arch. The estimated cost is $64,000.

New York, N. Y.—(Borough of Manhattan)—Plans have been prepared by Arthur Loomis Harmon, Arch., 3 West 29th St., for the construction of a 16-story loft building at Madison Ave. and 38th St., on the site of the Havemeyer mansion, for August Heckscher, 576 Fifth Ave. The estimated cost is $550,000. Noted June 10.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received for the construction of additions and alterations to Public School No. 3 on Grove St. between Hudson and Bedford St., as follows: J. Kresse Co., 52 Vanderbilt Ave., $43,400; H. C. Stowe Construction Co., Academy and Vermylia Ave., $49,746; T. A. Clarke Co., 122 Livingston St., Brooklyn, $57,700; William H. Egan, Lexington Ave. and 125th St., $59,959; Frymier & Hanna Co., 25 West 45th St., $54,468; John J. Hearn Construction Co., 69 West 46th St., $51,541; H. H. Vought & Co., Grand Central Terminal, $58,862; Lawrence J. Rice, 42nd St. and Lexington Ave., $52,993; Frank J. Felgenhauer Co., Inc., 4 Court Sq., Brooklyn, $51,873. Noted July 1.

Onondago, N. Y.—Bids recently received by Lewis F. Pilcher, State Arch., Capitol, Albany, for the constructon of a school and teacher's cottage at the Onondago Indian Reservation have been rejected. New bids will soon be received.

Port Chester, N. Y.—Bids will be received until 8 p.m., July 30, by Clarence D. Camp, Clk., Bd. of Education, for the construction of a three-story high school on Irving Ave. The estimated cost is $120,000. Hewitt & Bottomley, 597 Fifth Ave., New York, is Arch. Noted May 13 and July 1.

Rochester, N. Y.—Maurer & Mills, Arch., 1338 Schofield Bldg., is preparing plans for the construction of a church for the Dewey Avenue Presbyterian Church. Estimated cost, $55,000.

Rochester, N. Y.—Bids are being received by W. J. Brackett, Arch., Power Blk., for the construction of a three-story Labor Temple at North Fitzhugh and Church St. for the Labor Temple Association, Arcade Bldg. The estimated cost is $90,000. Noted June 17.

Syracuse, N. Y.—Abraham Rubenstein has purchased a site on West Fayette St. between South Clinton and South Franklin St. upon which to construct a store and apartment building, to cost about $50,000.

+Syracuse, N. Y.—(Official)—The PHELAN ENGINEERING & CONSTRUCTION CO., Second National Bldg., Hoboken, N. J., at $290,778 has been awarded the contract for the construction of the Vocational High School. Noted June 24 and July 15.

Valley Stream, N. Y.—Plans are being prepared by Ludlow & Peabody, Arch., 101 Park Ave., New York, for the construction of a two-story home for wayward girls at the Wayside Home, 356 Bridge St., Brooklyn. Mrs. Homer A. Lattin is Pres.

White Plains, N. Y.—Bids will be received about Aug. 1 by the Westchester County Building Commission for the construction of a county penitentiary and workhouse at East View. The estimated cost is $500,000. Alfred Hopkins, Arch., 101 Park Ave., New York, prepared the plans. Noted May 20.

Burlington, N. J.—C. W. Oakley & Son, Arch., 280 North Broad St., is preparing plans for the construction of a building for the New Jersey Grand Lodge F. and A. M. The estimated cost is $40,000. T. B. Townley, Elizabeth, is Secy.

Camden, N. J.—Plans are being prepared by Moffett & Stewart, Arch., for the construction of a five-story office building on Market St. for the John H. Heaton Piano Co. The estimated cost is $70,000.

Camden, N. J.—Plans are being prepared by Custer & Seltzer, Arch., for the construction of a hotel. The estimated cost is $65,000.

Jersey City, N. J.—On July 12 the city sold $439,000 in bonds to be used for the construction of schools in Jersey City.

Newark, N. J.—Plans have been prepared by Kallich & Lubroth, Arch., 215 Montague St., Brooklyn, N. Y., for the construction of a four-story apartment house on Mt. Pleasant Ave. near Oriental St. for Joseph Moshkowitz, 5305 Fifth Ave., Brooklyn, N. Y. Estimated cost, $100,000.

Paterson, N. J.—Plans have been approved by the congregation of the Church of the Covenant for the construction of an edifice at Broadway and East 27th St. The estimated cost is $100,000. Lee & Hewitt, 1123 Broadway, New York, N. Y. is Arch. Noted May 27.

Weehawken, N. J.—Hyman Rosenthal, Arch., 800 Broad St., Newark, has prepared plans for the construction of a five-story, 117x125-ft. apartment house at Liberty St. and Hudson County Blvd. for S. M. Adelman, 229 Bergenline Ave., Union. The estimated cost is $100,000.

Ben Avon, Penn.—(Allegheny post office)—The Odd Fellows plan to construct an orphanage at Ben Avon to cost about $50,000.

Dormont, Penn.—Plans have been prepared by J. A. Long & Son, Benedum-Trees Bldg., Pittsburgh, for the construction of a three-story, 65x100-ft. store and lodge building for the South Hills Association. Estimated cost, $55,000. Frank Ryman is Pres. Noted June 10.

Lansford, Penn.—(Official)—The time for receiving bids has been extended from Aug. 2 to Aug. 9 for the construction of a fireproof high school. John T. Simpson, 1224 Essex Bldg., Newark, N. J., and Tooker & Marsh, 101 Park Ave., New York, N. Y., are Assoc. Archs. and Engrs. The estimated cost is $150,000.

Muncy, Penn.—Bids were received June 30 by Frank Smith, Secy. of Comn., Harrisburg, for the construction of four cottages and an administration building for the industrial home at Muncy, as follows: Loose & Dothead, Philadelphia, $224,250; George A. Fuller Co., Philadelphia, $199,150; Shamokin Lumber & Mfg. Co., $205,000; Henry E. Baton, Philadelphia, $203,597; George Borst, Philadelphia, $221,882;F. Rowe Searing, Philadelphia, $204,890; F. H. Keyser & Co., Pottstown, $209,700; Ketcham & McQuade, Philadelphia, $211,420; Metzger & Fisher, Philadelphia, $178,500; Conners Bros. Co., Lowell, Mass., $194,450; Samuel L. Larivee, Williamsport, $207,000; Edward Fay & Son, Philadelphia, $183,930; James V. Bennett & Co., Williamsport, $218,716; Beard Construction Co., Reading, $222,236. Noted June 24.

Oxford, Penn.—Plans have been prepared by Roscoe C. Tindall, Arch., Equitable Bldg., Wilmington, Del., for the construction of a two-story theater for Joseph G. Crowl. The estimated cost is $40,000.

Philadelphia, Penn.—The Pennsylvania R.R. has had plans prepared for the construction of an immigrant station at Washington Ave. and the Delaware River. The estimated cost is $70,000. Alex. C. Shand is Ch. Engr.

Philadelphia, Penn.—The lowest bid received for the construction of a school at Sixth St. and Hunting Park Ave. was submitted by Wilbert Beaumont, at $52,735.

✚Philadelphia, Penn.—The contract for the construction of additions and alterations to the office and store building at Juniper and Chestnut St. for the Weighman Estate has been awarded to JAMES S. TALLEY, 1931 Market St., Philadelphia. Estimated cost is $60,000.

Philadelphia, Penn.—Bids will soon be received for the construction of a six-story, 65x188-ft. loft building at 315-19 Arch St. Sauer & Hahn, 1112 Chestnut St., is Arch. Noted June 10.

Philadelphia, Penn.—Harris & Rush, Arch., 1001 Chestnut St., is preparing plans for the construction of a four-story fireproof building at 1607-15 Christian St. for the Y. M. C. A.

Philadelphia, Penn.—Plans are being prepared by Frederick Webber, Arch., Morris Bldg., for the construction of a 12-story apartment house at 235-45 South 15th and Locust St. The estimated cost is $800,000. Noted Mar. 11.

✚Philadelphia, Penn.—(Official)—WILLIAM R. DOUGHERTY, 1608 Sansom St., Philadelphia, at $68,229 has been awarded the contract for the construction of a school at Second, Pike and Sanger St. Noted July 1.

Philadelphia, Penn.—The Franklin National Bank, Broad and Chestnut St., plans to construct a three-story bank and a 20-story office building at 1416-18 Chestnut St. Estimated cost, $1,000,000. McKim, Mead & White, 101 Park Ave., New York, N. Y., is Arch.

✚Philadelphia, Penn.—(Official)—CRAMP & CO., Denckla Bldg., Philadelphia, at $278,056 has been awarded the contract for the construction of a three-story school at 65th St. and Lime Kiln Pike, East Germantown. Noted July 1, 18 and 15.

✚Pittsburgh, Penn.—GOLDEN & CRICK has been awarded the contract for the construction of a brick dormitory and dining-room on Troy Hill Rd., North Side, for St. Joseph's Orpham Asylum. The estimated cost is $45,000.

Pittsburgh, Penn.—Arrangements are under way to construct a laboratory at Sandusky St. and Parkway, North Side, to be operated in connection with the Allegheny General Hospital. The estimated cost is $400,000.

Pittsburgh, Penn.—Plans are being prepared by John T. Comes, Arch., Renshaw Bldg., for the construction of a church at Fifth Ave. and Robinson St. for St. Agnes congregation. The estimated cost is $80,000. Noted June 24.

Pittsburgh, Penn.—Plans have been prepared by John T. Comes and John E. Kauser, Archs., Renshaw Bldg., for the construction of a church on Mission St. for St. Joseph's congregation. The estimated cost is $40,000.

Baltimore, Md.—Joseph Evans Sperry, Arch., 409 Calvert Bldg., is preparing plans for the construction of a three-story engineering building, for the Johns Hopkins University, at Homewood. Estimated cost, $150,000.

Baltimore, Md.—Plans are being prepared by Archer & Allen, Arch., for the construction of a mechanical laboratory addition to Johns Hopkins Medical School, on Monument St. Estimated cost, $50,000.

Washington, D. C.—The American Federation of Labor will construct a building to cost about $150,000.

Washington, D. C.—A. M. Schneider Co., Arch., have prepared plans for the construction of a six-story, 150x200-ft. apartment house at Adams Mill and Quarry Rd., N. W., for Harry Wardman. The estimated cost is $500,000.

Washington, D. C.—Plans have been prepared by Hunter & Bell, Arch., 1421 H St., N. W., for the construction of a seven-story apartment house at 2129 Connecticut Ave., N. W., for Bates Warren. The estimated cost is $400,000. Noted Jan. 14.

✚Petersburg, Va.—The contract for the construction of a hotel on West Tabb St. for the Petersburg Investment Corporation has been awarded to the FULTON BRICK WORKS, Richmond, at $21,000. Noted Apr. 15.

Staunton, Va.—The First Presbyterian Church plans to construct a school to cost about $50,000.

Madison, W. Va.—Bids will be received until Aug. 10 by Elmer Nelson, Clk. of Boone County Court, for the construction of a courthouse. H. Rus Warne, Charleston, is Arch.

Moundsville, W. Va.—The congregation of St. Francis Xavier will construct a church. The estimated cost is $75,000.

Parkersburg, W. Va.—The Chamber of Commerce has introduced a plan to finance the construction of a market house, convention hall and armory. Estimated cost, $60,000.

Parkersburg, W. Va.—Bids will be received about Aug. 11 for the construction of a high school. Frank L. Packard, 1212 Hayden Bldg., Columbus, Ohio, is Arch. Noted Apr. 15.

Triadelphia, W. Va.—Bonds to the amount of $125,000 have been sold by the Board of Education. The proceeds will be used for the construction of a school. S. S. Jacobs is Dist. Supt.

Wheeling, W. Va.—The Commissioners of Ohio County will construct an infirmary. The estimated cost is $100,000.

Durham, N. C.—The Board of County Commissioners plans to construct a courthouse on the site of the Arcade Theater and the Rigsbee property. The estimated cost is $150,000. George W. Woodward is City Clk.

Wilmington, N. C.—J. H. Hinton plans to construct a 14-story hotel on the Orton property.

Augusta, Ga.—According to press reports a building will be constructed to be known as the Georgia State Hospital for Cripples. The estimated cost is $100,000. Minnie B. Allyn is interested.

Macon, Ga.—Bids will be received about Sept. 1 for the construction of a union station for the Southern Ry. and the Central of Georgia Ry. The estimated cost is $800,000. Noted Apr. 1.

Palm Beach, Fla.—The East Coast Club Co. plans to construct a clubhouse and other improvements, to cost about $300,000.

Seabreeze, Fla.—(Official)—Bids will be received about Sept. 15 by the Board of Public Instruction of the County of Volusia for the construction of a two-story school. The estimated cost is $45,000. Mark & Sheftall, 210 Clark Bldg., Jacksonville, is Arch. Noted July 8.

Meridan, Miss.—The East End Methodist Congregation plans to construct a church to cost about $50,000. William B. Hogg is Pastor.

✚Vicksburg, Miss.—H. H. HAVIS, Vicksburg, has been awarded the contract for the construction of a telephone exchange building at Crawford St. and Monroe Blvd. for the Cumberland Telephone Co. Estimated cost, $40,000.

Alexandria, La.—The State Board of Health is planning to construct a tuberculosis hospital 10 miles south of Alexandria.

Lebanon, Tenn.—The members of the F. and A. M. contemplate the construction of an office and lodge building. The estimated cost is $75,000.

Memphis, Tenn.—Bids have been received by C. C. Ogilvie, Supt. of the Goodwyn Institute, and are being considered by the Commissioners, for the construction of a seven-story addition and improvements to the present auditorium. Estimated cost, $125,000. Noted June 24.

✚Morristown, Tenn.—WILLIAM H. BOSTWICK, Johnson City, has been awarded the contract for the construction of a hotel on Main St. The estimated cost is $40,000. J. C. Mitchell and L. V. Rader are interested.

Lexington, Ky.—The Building Committee of the Broadway Christian Church plans to construct an edifice. The estimated cost is $75,000.

Akron, Ohio—Bids will be received until Aug. 1 by B. L. Bargar, Secy., State Armory Bd., New Hayden Bldg., Columbus, for the construction of an armory and auditorium on South High St. The estimated cost is $165,000. Harpster & Bliss, Nantucket Bldg., is Arch. Noted June 10 and July 8.

Canton, Ohio—Frank A. Luther plans to construct a two-story store and office building on Second St., N. E. The estimated cost is $40,000.

Cincinnati, Ohio—Bids will soon be received by the Board of Education for the construction of the East Hills High School. The estimated cost is $1,000,000. Garber & Woodward is Arch. Noted Mar. 4.

Cincinnati, Ohio—The Board of Education will construct two school buildings in the West End of Cincinnati. Charles Handman is Business Mgr.

Cincinnati, Ohio—Harry Hake, Arch., Bell Telephone Bldg., is preparing plans for the construction of an office building at Court and Main St. for the Title Guarantee & Trust Co.

Cleveland, Ohio—M. Schallhiem, 8021 Cedar Ave., plans the construction of a commercial building at Oakview Ave. and Eddry Rd. Estimated cost, $50,000.

Cleveland, Ohio—Plans have been prepared by Koehl & Renssalaer, Arch., 906 Park Bldg., for the construction of an addition to the Parish of St. Rose, at Detroit Ave. and West 116th St. Estimated cost, $40,000.

Cleveland, Ohio—William S. Lougree, Arch., Marshall Bldg., has prepared tentative plans for the construction of a 16-story fireproof office building on the site of the Republic Bldg., 647 Euclid Ave. for Arthur M. Brown and Philip Brown, Newcastle, Penn. The estimated cost is $2,000,000.

Cleveland Heights, Ohio—(Warrensville post office)—Bids will be received until noon, Aug. 6, by Ezra K. Bryan, Clk., Bd. of Education, Cleveland Heights Village School Dist., Lee Rd., Cleveland Heights, for the construction of a grade school at Fairfax, Scarborough and Lee Rd. Franz C. Warner, 767 Hippodrome Bldg., Cleveland, is Arch. Noted July 1.

Columbus, Ohio—An election will be held Aug. 10 to vote on the question of issuing $150,000 in bonds. The proceeds will be used for the construction of a workhouse, shops, powerhouse, barns, storehouses and other necessary buildings. George J. Karb is Mayor.

Columbus, Ohio—Plans are being prepared by Tressett & Bassett, Arch., for the construction of a recreation building at Schiller Park, Columbus. Estimated cost, $40,000.

Dayton, Ohio—The Directors of the Miami Conservancy District will construct an office building at Monument Ave. and Jefferson St. opposite Van Cleave Park. The building will be used as offices by the engineers, appraisers, clerks and staff to be employed on the construction of the proposed $18,000,000 dry reservoir system. Edward A. Deeds is Chn.

Defiance, Ohio—The Members of Defiance Lodge B. P. O. E. No. 147 contemplate the construction of a two-story building. The estimated cost is $60,000.

Elyria, Ohio—The Lorain County Banking Co. will construct a 10-story fireproof bank and office building on the N. L. Johnson Blk. A. B. Taylor is Pres. and A. J. Plocher is Secy.

Ironton, Ohio—Bids will soon be received for the construction of a hotel. The estimated cost is $100,000. T. J. Kennedy is Secy. of Bldg Com. and W. H. St. Clair, Charleston, W. Va., is Arch. Noted June 10.

✚**Newburg, Ohio**—(Cleveland post office)—The contract for the construction of a temple on Miles Park Ave. for the Newburg Masonic Temple Co. has been awarded to the SAMUEL W. EMERSON CO., Chamber of Commerce Bldg., Cleveland. W. J. Carter, 1423 Illuminating Bldg., Cleveland, is Arch. Estimated cost, $70,000. Noted May 6 and June 3.

Toledo, Ohio—Contracts will be awarded about Sept. 15 for the construction of a six-story, 56x67-ft. apartment hotel for the Scottwood Realty Co. Estimated cost, $100,000. Noted June 10.

Wyoming, Ohio—Plans have been prepared by Garber & Woodward, Arch., 2803 Union Central Bldg., Cincinnati, for the construction of a two-story grade school addition. The estimated cost is $50,000.

Evansville, Ind.—Bids are being received and contracts will be awarded about Aug. 1 by the Directors of the Vanderburg County Coliseum for the construction of a $250,000 coliseum. Charles P. Beard is Secy., Bd. of Dirs. Noted Mar. 25 and Apr. 8.

✚**Franklin, Ind.**—The contract for the construction of buildings at the State Masonic Home for the Grand Masonic Lodge of Indiana has been awarded to the STATE CONSTRUCTION CO. OF INDIANAPOLIS, at $140,779. Noted May 6 and 27.

Indianapolis, Ind.—Contracts will soon be awarded for the construction of a six-story brick and steel business building at South Meriden St. for John B. Bright & Son, 221 East Maryland St. The estimated cost is $100,000.

✚**Lafayette, Ind.**—The contract for the construction of a two-story veterinary building for Purdue University, has been awarded to the WILLIAM P. JUNGSCLAUS CO., Indianapolis, at $40,000. Noted June 24.

SEWER SYSTEM—DOWNINGTOWN, PENN.

✚Bids were received June 7 by the Borough Council for the construction of a sewer system from: (A) Engineer's Estimate, (B) Polock & Lewis, Downingtown, (C) Edwin H. Vare, Philadelphia, (D) John A. Clark, Wilmington, Del., (E) Martin, Miller & Pizzimenti, Caldwell, N. J., (F) Frank X. Hinden, Lancaster, (G) W. H. Johnson, Philadelphia, (H) F. E. Gross, Yonkers, N. Y., (I) Jones & Haggart, Pittsburgh, (J) Dabbs & Meyers, Laurel, Md., (K) Thomas E. Dwyer, Philadelphia, (L) M. & T. E. Farrell, West Chester, (M) Cantrell Construction Co., Philadelphia, (N) GEORGE C. SOUDER, Lancaster (awarded contract). The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
18-in. terra cotta pipe 4 ft. deep	$1.00	$0.96	$0.91	$1.00	$0.85	$0.78	$0.95	$1.20	$1.12	$1.00	$0.73	$8.45	$0.86	$0.72
618 lin.ft. 18-in. terra cotta pipe, 4 to 6 ft. deep	1.40	1.08	1.00	1.20	0.93	0.80	0.97	1.20	1.29	1.10	0.85	0.95	1.10	0.79
700 lin.ft. 18-in. terra cotta pipe, 6 to 8 ft. deep	1.50	1.24	1.11	1.35	1.00	0.85	1.15	1.20	1.43	1.20	1.11	1.05	1.28	1.88
1500 lin.ft. 18-in. terra cotta pipe, 8 to 10 ft. deep	1.60	1.56	1.26	1.55	1.23	0.91	1.35	2.00	1.57	1.50	1.21	1.24	1.47	0.98
1500 lin.ft. 15-in. terra cotta pipe, 4 to 6 ft. deep	1.00	0.72	0.81	0.90	0.62	0.72	0.78	0.80	1.12	0.80	0.97	0.705	0.85	0.60
490 lin.ft. 15-in. terra cotta pipe, 6 to 8 ft. deep	1.25	0.87	0.92	1.05	0.72	0.77	0.90	1.25	1.26	1.00	0.89	0.79	1.00	0.69
15 in. terra cotta pipe, 8 to 10 ft. deep per lin.ft.	....	1.20	1.07	1.25	0.95	0.82	1.25	1.60	1.40	1.30	1.01	0.915	1.39	0.78
15-in. terra cotta pipe, 10 to 12 ft. deep per lin.ft.	....	1.65	1.15	1.50	1.25	0.87	1.50	2 00	1.54	1.50	1.25	1.08	1.72	1.02
12-in. terra cotta pipe, 0 to 4 ft. deep per lin.ft.	....	0.47	0.51	0.65	0.45	0.53	0.55	0.60	0.91	0.60	0.73	0 48	0.56	0.43
1070 lin.ft. 12-in. terra cotta pipe, 4 to 6 ft. deep	0.60	0.57	0.60	0.70	0.48	0.55	0.60	0.60	0.98	0.70	0.73	0.57	0.68	0.44
12 in. terra cotta pipe, 6 to 8 ft. deep, per lin.ft.	0.80	0.71	0.67	0.82	0.65	0.60	0.80	0.90	1.12	0.90	0.99	0 65	0.78	0.53
460 lin.ft. 12-in. terra cotta pipe 8 to 10 ft. deep	1.00	0.95	0.80	1.00	0.78	0.69	0.93	1.00	1.26	1.10	1.27	0.82	1.00	0 63
12-in. terra cotta pipe, 10 to 12 ft. deep per lin.ft.	.....	1.44	0.83	1.25	1.00	0.78	1.25	1.90	1.40	1.40	1.61	0.92	1.36	0.85
12-in. terra cotta pipe, 12 to 15 ft. deep per lin.ft.	.....	2.30	1.11	1.70	1.50	0.93	1.65	3.25	1.55	1.60	2.51	1.10	1.95	1.10
3290 lin.ft. 10-in. terra cotta pipe, 4 to 6 ft. deep	0.60	0.51	0.53	0.57	0.45	0.47	0.45	0.55	0.94	0.60	0.45	0.49	0.55	0.40
110 lin.ft. 10-in. terra cotta pipe, 6 to 8 ft. deep	0.70	0.65	0.60	0.70	0.60	0.57	0.60	0.65	1.08	0.75	0.69	0.57	0.72	0.48
10-in. terra cotta pipe, 8 to 10 ft. deep per lin.ft.	.....	0.93	0.72	0.86	0.80	0.62	0.85	1.00	1.22	0.90	0.99	0.68	0.89	0.58
10-in. terra cotta pipe, 10 to 12 ft. deep per lin.ft.	.....	1.38	0.82	1.06	1.10	0.69	1.00	1.50	1.36	1.20	1.61	0.79	1.31	0.81
10-in. terra cotta pipe, 12 to 15 ft. deep per lin.ft.	.....	2.30	1.04	1.50	1.40	0.84	1.25	3.00	1.51	1.50	2.51	1.00	1.88	1.05
19,632 lin.ft. 8-in. terra cotta pipe, 4 to 6 ft. deep	0.40	0.41	0.46	0.49	0.41	0.43	0.35	0.40	0.68	0 50	0.37	0.38	0.46	0.33
12,657 lin.ft. 8-in. terra cotta pipe, 6 to 8 ft. deep	0.50	0.52	0.60	0.59	0.49	0.56	0.46	0.50	0.82	0.65	0.53	0.48	0.60	0.41
1973 lin.ft. 8-in. terra cotta pipe, 8 to 10 ft. deep	0.80	0.78	0.65	0.70	0.65	0.76	0.70	0.65	0.96	0.75	0.97	0.60	0.82	0.52
300 lin.ft. 8-in. terra cotta pipe, 10 to 12 ft. deep	1.50	0.93	0.75	0.90	0.91	0.75	0.90	1 00	1.10	1.00	1.01	0.75	1 18	0.75
8-in. terra cotta pipe, 12 to 14 ft. deep	.....	1.20	0.95	1.20	1.30	0.89	1.20	2.75	1.23	1.25	1 51	0.93	1.57	1.00
2 18-in. Y-branches	.....	2.50	3.14	1.55	1.50	2.11	1.00	1.00	2.40	1.00	1.97	2.00	1.70	1.20
2 15-in. Y branches	.....	1.65	2.31	1.15	1.00	1.51	0.80	1.00	1.57	0.75	1.31	1.50	1.15	1 00
4 12-in. Y branches	.....	1.10	1.55	0.90	0.75	1.05	0.65	0.75	1.17	0.50	1.05	1 25	0.75	0.75
20 10-in. Y branches	. .	0.65	1.44	0.75	0.50	0.88	0.50	0.60	1.04	0.45	1.81	1.00	0 60	0 60
1025 8-in. Y branches	.	0.60	1.17	0.50	0.40	0.68	0.35	0.40	0.78	0.40	0.51	0.75	0.40	0.44
11 Lampholes	12.00	13.10	16.85	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	8 00	10.30
144 plain manholes	40.00	40.00	51.00	40.00	35.00	30.00	43.00	32.00	40.00	35.00	43.50	48.00	41.00	35.50
1 flush manhole	55.00	75.00	80.00	60.00	55.00	74.00	55.00	75.00	60.00	40.00	75.00	73.00	80 00	50.00
Drop manhole	50.00	75.00	51.00	42.00	45.00	32.00	50.00	75.00	50.00	40.00	60.00	82 00	50 00	38.00
5 catch buckets	4.50	6.00	6.00	4.50	3.00	4.50	4.00	3.00	5.00	15.00	5.00	4 00	6 00	4.80
7 flush tanks	65.00	75.00	100.00	85.00	75.00	94.00	75.00	95.00	75.00	75.00	75.00	100.00	105.00	88.00
5 house connections	0.35	0.45	0.40	0.50	0.45	0.32	0.45	0.80	0.75	0.40	0.60	0.60	0.60	0.50
196 lin.ft. 8-in. c.i. pipe, 4 to 6 ft. deep	1.50	1.71	1.71	1.54	2.71	1.08	2.55	1.30	1.46	1.50	1.37	1.28	1.01	1.47
108 lin.ft. 8-in. c.i. pipe, 6 to 8 ft. deep	1.80	1.84	1.85	1.64	2.79	1.21	2.66	1.40	1.60	1.65	1.53	1.38	1.15	1.55
416 lin.ft. 12-in. c.i. pipe, 4 to 6 ft. deep	2.00	2.27	2.10	3.05	3.23	2.18	3.35	2.05	2.44	2.20	2.40	2.32	1.61	2.14
15-in. per lin.ft.	.....	1.81	1.75	3.00	3.00	3.09	3.25	2.00	1.74	2.00	2.25	2.25	1.42	2.40
192 lin.ft. 18-in. c.i. pipe, 4 to 6 ft. deep	3.00	2.89	3.00	4.95	4.93	4.28	4.57	3.70	3.53	3.35	3.35	3.95	2.77	3.29
Extended totals	$34,207	$34,009	$37,472	$37,572	$31,923	$32,080	$33,333	$33,012	$46,707	$36,777	$33,825	$32,972	$36,010	$27,231

Muncie, Ind.—Bids will be received until July 30 by F. M. Williams, County Audr., for the construction of a two-story, 36x100-ft. infirmary building. Estimated cost, $40,000. C. H. Houck is Arch. Noted June 24 and July 1.

Muncie, Ind.—The Ball Bros. Glass Mfg. Co. plans to construct a two-story office building which will cost about $75,000.

Detroit, Mich.—Crowley, Milner & Co., Gratiot and Monroe Ave., plans to construct an eight-story fireproof addition on Monroe Ave. The estimated cost is $400,000. Albert Kahn, 58 Lafayette Blvd., is Arch.

Grand Rapids, Mich.—The Compau Square Bldg. Co. plans the construction of a 10-story fireproof building to be used as a furniture exposition and commercial building on Pearl and Louis St. and Campau Ave. The estimated cost is between $450,000 and $500,000.

Kalamazoo, Mich.—The Trustees of the Kalamazoo State Hospital plan to construct a three-story building as a home for employees of the hospital. Estimated cost, $74,000. Wenette, Bradfield, Mead & Co., Grand Rapids, is Arch.

Marquette, Mich.—The First Church of Christ, Scientist, plans to construct a church. Estimated cost, $50,000.

Saginaw, Mich.—The Bancroft Realty Co. will construct a six-story hotel to replace the Bancroft House. The estimated cost is $650,000.

Bensenville, Ill.—The Northern District of the German Evangelical Synod, Champaign, has decided to construct a home for the aged at Bensenville. Estimated cost, $50,000.

Chicago, Ill.—Plans have been prepared by Henry L. Newhouse, Arch., 4630 Prairie Ave., for the construction of a two-story theater and lodge building on Ashland Ave. for Nathan Ascher. Estimated cost, $90,000.

Chicago, Ill.—Charles H. Kusel plans to construct a theater, store and apartment building at Montrose Ave. and North Lincoln St. The estimated cost is $150,000.

Macomb, Ill.—The members of the Board of Trustees of the Western Illinois State Normal School plan the construction of a building for the school of Manual Arts on the campus. The estimated cost is $95,000.

Oblong, Ill.—L. H. Osterhage, Arch., Vincennes, Ind., is preparing plans for the construction of a township high school. The estimated cost is $60,000.

Milwaukee, Wis.—The Directors of St. Catherine's Home, 1131 Sycamore St., plan to construct a four-story home on the present site. Estimated cost, $65,000. James J. Quinn is Chn. of Bldg. Com.

Milwaukee, Wis.—Plans are being revised by Brust & Philipp, Arch., 506 Free Press Bldg., for the remodeling and improving of the Merrill Bldg., at Second St. and Grand Ave. The estimated cost is $150,000. Noted Apr. 8.

Montello, Wis.—Bids will soon be received for the construction of a two-story courthouse and jail. The estimated cost is $50,000. Parkinson & Dockendorff, La Crosse, is Arch. Noted June 24.

Neenah, Wis.—Plans are being prepared by Edward Bergstrom, Arch., Los Angeles, Calif., for the construction of a fireproof hotel for the Merchants & Manufacturers' Hotel Co. The estimated cost is $75,000. Frank J. Sensenbrenner is Pres.

Alta, Iowa—At a recent election the citizens voted in favor of the question of isuing $55,000 in bonds; proceeds to be used for the construction of a school. Noted June 17.

Charter Oak, Iowa—At a recent election the citizens voted in favor of the question of issuing $50,000 in bonds, the proceeds of which will be used for the construction of a school.

Des Moines, Iowa—The Grocers Wholesale Co. plans to construct a three-story building estimated to cost $50,000.

Grinnell, Iowa—Plans have been prepared for the construction of a building for the Alumni Association at Grinnell College. The estimated cost is $150,000.

✚Imogene, Iowa—G. W. SPRAGUE & SON, Omaha, Neb., has been awarded the contract for the construction of a church at Imogene to cost about $45,000.

Iowa City, Iowa—Contracts will be awarded about Aug. 24 by the State Board of Education for the construction of a four-story dental building at Iowa University. The estimated cost is $175,000. Noted Jan. 14.

✚Primghar, Iowa—(Official)—Bids were received June 15 by J. B. Stamp, County Audr., for the construction of a court house for O'Brien County as follows: C. E. Atkinson, Webster City, $117,936; Bankers Realty Investment Co., Omaha, Neb., $114,995; J. P. Cullen Construction Co., Janesville, Wis., $121,000; L. W. Dumas, Jr., Construction Co., Columbia, Mo., $122,649; E. Eilenberger & Co., Chicago, Ill., $130,421; J. B. Evans Construction Co., Mexico, Mo., $126,600; Charles Franklin, Iowa City, $125,000; Gray Construction Co., Watertown, S. D., $121,641; A. Cuthrie & Co., St. Paul, Minn., $118,990; J. H. Hunzinger & Co., Burlington, $139,430; G. A. Johnson & Son, Chicago, Ill., $127,550; King Lumber Co., Charlottesville, Va., $127,700; William S. Kingsley, Faribault, Minn., $117,000; La Crosse Steel & Construction Co., La Crosse, Wis., $122,952; J. E. LOVEJOY, Des Moines, $116,550 (awarded contract); W. F. Mitchell, Des Moines, $122,000; J. B. Nelson Construction Co., Mankato, Minn., $123,948; O. H. Olsen, Stillwater, Minn., $117,280; William O'Neill & Son, Faribault, Minn., $129,747; Splady, Albee & Smith, Minneapolis, Minn., $117,450; A. M. Wold Construction Co., Brookings, S. D., $116,600. Noted May 27.

✚Woodward, Iowa—(Official)—The BAILEY-MARSH CO., Minneapolis, Minn., at $230,602 has been awarded the contract for the construction of buildings at the State Colony for Epileptics. Other bidders were: T. Eilenberger & Co., Chicago, Ill., $244,000; C. E. Atkinson, Webster City, Iowa, $257,354; George J. Grant Construction Co., St. Paul, Minn., $279,987; A. H. Neumann & Co., Des Moines, Iowa, $281,449; J. W. Turner Improvement Co., Des Moines, Iowa, $294,825; J. B. Evans Construction Co., Mexico, Mo., $242,786; Splady, Albee & Smith, Minneapolis, Minn., $239,984. M. N. Voldeng is Supt. Noted June 14 and July 8.

✚Little Falls, Minn.—The general contract for the construction of a hospital has been awarded to N. P. FRANZEN, St. Paul, at $50,000. Noted June 17.

Minneapolis, Minn.—The Board of Directors of the Salvation Army contemplates rebuilding its industrial home recently destroyed by fire. Estimated cost, $100,000.

St. Paul, Minn.—The Brown, Treacy & Sperry Co., Fifth and Minnesota St., will construct a two-story, 100x150-ft. concrete and glass building on University and Wheeler Ave. The estimated cost is $100,000.

LINCOLN ST. TRUNK SEWER—PORT ANGELES, WASH.

✚Bids were received June 29 for the construction of the Lincoln St. Trunk Sewer from (A) METTLER & COIT (awarded contract), (B) Zindorf & Lidral, (C) Grant Shearer, (D) Ferch & Gass, (E) Dicken & Anderson, (F) H. A. Cotton, (G) E. M. More, (H) C. Kuppler. The item bids were as follows:

	A	B	C	D	E	F	G	H
370 lin.ft. vitrified clay sewer pipe, 8-in.	$0.36	$0.32	$0.42	$0.75	$0.40	$0.38	$0.35	$0.37
370 lin.ft. vitrified clay sewer pipe, 10-in.	.53	.47	.60	.90	.60	.53	.40	.53
370 lin.ft. vitrified clay sewer pipe, 12-in.	.66	.59	.69	1.00	.65	.66	.60	.70
1310 lin.ft. vitrified clay sewer pipe, 15-in.	1.15	1.03	1.25	1.50	1.20	1.17	1.40	1.10
430 lin.ft. vitrified clay sewer pipe, 18-in.	1.54	1.39	1.66	1.75	1.55	1.55	1.40	1.63
570 lin.ft. vitrified clay sewer pipe, 21-in.	2.05	1.82	2.20	2.25	2.25	2.05	1.70	2.20
2670 lin.ft. vitrified clay sewer pipe, 24-in.	2.54	2.25	2.65	2.50	2.50	2.70	2.75	2.75
220 lin.ft. vitrified clay sewer pipe, 30-in.	5.26	4.60	5.35	4.50	5.50	5.61	4.35	4.96
370 lin.ft. cement sewer pipe, 8-in.	.20	.30	.25	....	....	....	....	....
370 lin.ft. cement sewer pipe, 10-in.	.27	.41	.35	....	....	....	....	....
370 lin.ft. cement sewer pipe, 12-in.	.34	.50	.40	....	....	....	....	....
1310 lin.ft. reinforced concrete pipe, 15-in.	.93	....	1.00	....	....	....	....	....
430 lin.ft. reinforced concrete pipe, 18-in.	1.16	....	1.20	....	....	....	....	....
570 lin.ft. reinforced concrete pipe, 21-in.	1.66	....	1.75	....	....	....	....	....
2670 lin.ft. reinforced concrete pipe, 24-in.	1.89	....	1.99	2.75	....	....	....	....
220 lin.ft. reinforced concrete pipe, 30-in.	3.13	....	3.25	3.75	....	....	....	....
225 lin.ft. c.i. pipe including excavation and backfilling, 18-in.	4.00	5.00	4.50	5.00	5.00	7.00	3.50	....
220 lin.ft. one ring brick sewer, 30 in.	4.00	2.80	4.00	2.50	3.00	3.00	5.00	3.50
25 brick manholes 4½ ft. x 8 ft.	40.00	65.00	55.00	80.00	50 00	60.00	40.00	45.00
76 lin.ft. additional depth of m.H.	4.00	6.80	5.00	3.00	5.00	6.00	4.00	8.00
1 brick flush tank	100.00	100.00	100.00	130.00	100.00	100.00	90.00	100.00
31 brick catch basin	40.00	55.00	55.00	60.00	50.00	60.00	40 00	45.00
12 cu.yd. reinforced concrete in saddles and outfall	12.00	25.00	15.00	16.00	20.00	25.00	15.00	20.00
400 lin.ft. lumber cradle to carry sewer on trestle	.85	.70	.90	.50	1.25	1.30	1 25	1.00
Storm sewer overflow (lump sum)	30.00	25.00	35.00	40.00	75.00	50.00	50.00	100.00
75 lin.ft. trenching and backfilling for 6 in. to 12-in. pipe, 10 ft. deep.	.46	.48	.55	.75	.75	.42	1.22	.51
300 lin.ft. trenching and backfilling for 6-in. to 12-in. pipe, 12 ft. deep.	.65	.60	.75	.90	.75	.55	1.24	.70
400 lin.ft. trenching and backfilling for 6-in. to 12-in. pipe, 14 ft. deep.	.78	.63	.80	1.05	.75	.70	1.27	.78
250 lin.ft. trenching and backfilling for 6-in. to 12-in. pipe, 16 ft. deep.	.98	.86	1.00	1.30	.75	.90	1.37	.98
85 lin.ft. trenching and backfilling for 6-in. to 12-in. pipe, 18 ft. deep.	1.17	1.03	1.25	1.50	.75	1.14	1.52	1.25
160 lin.ft. trenching and backfilling for 15-in. to 18-in. pipe, 6 ft. deep.	.33	.34	.40	.45	.80	.32	1.17	.33
75 lin.ft. trenching and backfilling for 15-in. to 18-in. pipe, 8 ft. deep.	.39	.48	.43	.60	.80	.42	1.27	.50
375 lin.ft. trenching and backfilling for 15-in. to 18-in. pipe, 10 ft. deep.	.52	.61	.60	.75	.80	.59	1.47	.70
420 lin.ft. trenching and backfilling for 15-in. to 18-in. pipe, 12 ft. deep.	.72	.76	.72	.90	.80	.76	1.57	.85
485 lin.ft. trenching and backfilling for 15-in. to 18-in. pipe, 14 ft. deep.	.87	.93	.87	1.15	.80	1.00	1.62	1.10
225 lin.ft. trenching and backfilling for 15-in. to 18-in. pipe, 16 ft. deep.	1.17	1.08	1.25	1.50	.80	1.25	1.67	1.35
100 lin.ft. trenching and backfilling for 21-in. to 24-in. pipe, 6 ft. deep.	.39	.40	.42	.60	1.00	.34	1.32	.45
250 lin.ft. trenching and backfilling for 21-in. to 24-in. pipe, 8 ft. deep.	.52	.59	.55	.75	1.00	.51	1.42	.70
200 lin.ft. trenching and backfilling for 21-in. to 24-in. pipe, 10 ft. deep.	.63	.74	.70	.90	1.00	.66	1.57	1.00
700 lin.ft. trenching and backfilling for 21-in. to 24-in. pipe, 12 ft. deep.	.78	.92	.80	1.10	1.00	.90	1.67	1.45
800 lin.ft. trenching and backfilling for 21-in. to 24-in. pipe, 14 ft. deep.	.98	1.13	1.05	1.25	1.10	1.20	1.82	2.00
490 lin.ft. trenching and backfilling for 21-in. to 24-in. pipe, 16 ft. deep.	1.24	1.33	1.30	1.50	1.10	1.52	2.07	2.20
200 lin.ft. trenching and backfilling for 21-in. to 24-in. pipe, 18 ft. deep.	1.37	1.58	1.50	2.00	1.10	1.80	2.17	2 80
100 lin.ft. trenching and backfilling for 21-in. to 24-in. pipe, 26 ft. deep.	3.64	2.70	4.00	2.50	3.00	3.20	2.32	3.00
50 lin.ft. trenching and backfilling for 30-in. pipe, 14 ft. deep.	1.17	1.29	1.25	1.30	3.50	1.38	2.32	2.00
70 lin.ft. trenching and backfilling for 30-in. pipe, 16 ft. deep.	1.50	1.49	1.70	1.50	3.00	1.75	2.62	2.50
100 lin.ft. trenching and backfilling for 30-in. pipe, 18 ft. deep.	1.76	1.79	1.85	1.70	3.00	2.20	3.02	3.00
Extended totals	$30,268	$30,863	$32,314	$34,213	$32,335	$33,660	$35,090	$33,996

Kansas City, Kan.—The Kansas City Terminal Ry. Co. plans to construct a terminal station. The estimated cost is $200,000.

Newton, Kan.—The Trustees of the M. E. Church contemplate the construction of a church. The estimated cost is $45,000.

Salina, Kan.—The congregation of the First Methodist Church plan to construct a new building. The estimated cost is $40,000.

Omaha, Neb.—A medical and surgical hospital will be constructed at 25th and Douglas St. at cost of about $150,000. Michael J. Ford will be in charge of the hospital.

Butte, Mont.—Bids will soon be received for the construction of a four-story, 65x100-ft. fireproof building for the Knights of Columbus. The estimated cost is $125,000. Link & Haire, 615 State Savings Bank Bldg., is Arch.

Butte, Mont.—The Directors of St. James Hospital plan to improve the hospital by constructing an additional story to the building. Estimated cost, $60,000.

Miles City, Mont.—(Official)—Bids will be received until 7:30 p.m., Aug. 12, by J. B. Collins, Clk. of School Dist. No. 1, for the construction of an addition to the high school. Estimated cost, $60,000. Noted June 3 and July 8.

White Sulphur Springs, Mont.—Plans have been prepared by H. H. Johnson, Arch., Great Falls, for the construction of a three-story, 175x185-ft. hotel. The estimated cost is $100,000. A. F. Conrad, Great Falls, is interested.

Boonville, Mo.—H. H. Hohenschild, Arch., Navarre Bldg., St. Louis, is preparing plans for the construction of two buildings for the State Reformatory. The estimated cost is $200,000. Cornelius Roach, Jefferson City, is State Secy.

Carterville, Mo.—An election will soon be held to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for the construction of a tuberculosis sanitarium for Jasper County.

Kansas City, Mo.—The American Institute of Homeopathy plans to construct a hospital and school of medicine. The estimated cost is $1,000,000.

Kansas City, Mo.—H. F. Hall and F. G. Crowell plan to construct a business building at 1533 Walnut St. The estimated cost is $75,000.

Kansas City, Mo.—The Morbros Investment Co. plans to construct a six-story, 117x170-ft. business building at 201 East 22d St. The estimated cost is $65,000.

✚Kansas City, Mo.—The Baltimore Avenue Investment Co. has awarded the contract for the construction of a nine-story reinforced-concrete hotel at 1114 Baltimore Ave. to FRED H. CRITES, at $65,705. J. H. Martling, 15 West Ninth St., is Arch. Noted June 24.

✚St. Joseph, Mo.—The contract for the construction of an eight-room fireproof addition to the Hosea School at Gordon and Hyde Park Ave. has been awarded to HACKETT & SIMPSON, at $40,302. Noted June 10 and 24.

College Station, Tex.—Contracts will soon be awarded for the constructionof an agricultural building at the Agricultural and Mechanical College. The estimated cost is $100,000. W. B. Bizzell is Pres.

Corsicana, Tex.—An election will soon be held to vote on the question of issuing $50,000 in bonds. The proceeds will be used for the construction of a hospital for Navarro County.

Dallas, Tex.—Bids were received by the Board of Education on the general contract for the construction of the Lamar School on Corinth and Gould St., as follows: Hewett & Hilner, $52,697; Gowin & Stearman, $51,000; Ennison & McCord, $54,789; Hughes-O'Rourke, $59,189; Buchanan & Gilder, $50,990; Watson Co., $56,890; Gilsonite Co., $57,600; W. H. King, $52,756.

El Paso, Tex.—The citizens of El Paso County will vote Aug. 3 on the question of issuing $750,000 in bonds. The proceeds will be used for the construction of an addition to the hospital, and for a poor farm.

El Paso, Tex.—Hugh W. Crouse and others plan to construct an eight-story, reinforced-concrete medical building at Oregon and Missouri St. Estimated cost, $200,000.

Huntsville, Tex.—Endress & Watkin, Arch., Austin, has been commissioned by the State Normal Board to prepare plans for the construction of a science building at the Sam Houston Normal School.

Palestine, Tex.—On July 2 the citizens voted in favor of the question of issuing $100,000 in bonds. The proceeds will be used for the construction of a high school. Noted June 17.

San Antonio, Tex.—Bids will be received about Aug. 1 for the construction of a four-story reinforced-concrete and brick hospital to be known as the Robert B. Green Memorial. The estimated cost is $250,000. Atlee B. Ayres and Reuter & Harrington are Archs.

✚Tulsa, Okla.—The contract for the construction of a two-story library has been awarded to THOMAS O'KEEFE, Tulsa, at $51,438. J. W. Hawk, Ohio Bldg., is Arch. Noted Mar. 11.

Idaho Springs, Colo.—Plans have been prepared for improving the Idaho Springs Hotel. The estimated cost is $100,000. C. L. Simpson, 619 Dwight Bldg., Kansas City, Mo., is Arch.

Salt Lake City, Utah—The Salt Lake Security & Trust Co. will construct a 17-story building at First, South and Main St. on the site of the Utah State National Bank. The estimated cost is $1,200,000. F. E. McGurrin is Pres. and Joseph J. Cannon is Secy.

Aberdeen, Wash.—Ralph L. Phillbrick and associates plan to construct a business block on Eighth St. between J and I St. The estimated cost is $150,000.

Bellingham, Wash.—Plans are being prepared by T. F. Doan, Arch., for the construction of an addition to the North Side High School. The estimated cost is $95,000. Noted June 24.

Hoquiam, Wash.—Ralph L. Philbrick is interested in a project to construct a business building on Eighth St., between J and L St. The estimated cost is $150,000.

Seattle, Wash.—Somerville & Putnam, White Bldg., is preparing plans for the construction of a three-story, 60x120-ft. brick hotel for F. E. Welty, New York Blk. The estimated cost is $50,000. Noted Mar. 18.

Spokane, Wash.—Plans have been prepared by Julius Zittel, Arch., The Rookery, Spokane, for the construction of a three-story brick and stone nunnery for the Franciscan Monastery of St. Clare. Estimated cost, $60,000. Noted June 10.

Vancouver, Wash.—Plans have been prepared by D. Nichols, Arch., for the construction of a School for the Blind. Estimated cost, $75,000. Noted June 10.

Portland, Ore.—Bids have been received for the Franklin High School as follows: James S. Winters, Couch Bldg., $74,897; John Almeter, Builders' Exchange, $83,600; Parker & Banfield, $83,222; Sound Construction Co., Lowman Bldg., Seattle, $82,332. Noted May 20.

✚Los Angeles, Calif.—(Official)—The HUNTSBERGER-REED CO., 414 Van Nuys Bldg., Los Angeles, at $48,636, has been awarded the contract for the construction of a two-story high school on Rowan Ave. Other bids were: Barber-Bradley Construction Co., $49,378; Cresmer Mfg. Co., $49,980; Frank R. May, $49,300; Broadway Construction Co., $50,975; J. T. Atkinson, $51,000. Noted June 3 and July 1.

Los Angeles, Calif.—W. J. Bliesner, Arch., Van Nuys Bldg., is preparing plans for a gymnasium at the Polytechnic High School. The estimated cost is $40,000.

✚Los Angeles, Calif.—The general contract for the construction of a school has been awarded to the BROADWAY CONSTRUCTION CO., 235 East Washington St., at $80,070.

✚Los Angeles, Calif.—The contract for the construction of a school at First and Vermont St. has been awarded to the LOS ANGELES PLANING MILL CO., Los Angeles, at $95,987. Noted June 3 and 24.

Oakland, Calif.—The Southern Pacific Co. will construct a station at 13th and Franklin St. The estimated cost is $1,250,000.

Sacramento, Calif.—The city plans to construct a two-story concrete and brick Carnegie library at Ninth and I St. The estimated cost is between $75,000 and $100,000.

Susanville, Calif.—(Official)—Bids will be received until Aug. 2 by W. W. Sharp, County Treas. and Tax Collector, for the construction of a courthouse and county hospital. The estimated cost is $100,000. George E. Bassett is County Clk. Noted May 20 and June 24.

Visalia, Calif.—The city plans to expend about $50,000 for the construction of a municipal auditorium.

✚Woodland, Calif.—The Board of Education has awarded the contract for the construction of a grammar school to ROBERT TROST, at $68,534. Noted Nov. 19.

London, Ont.—Work will soon begin on the construction of a hotel and business block at London. The estimated cost is $250,000.

✚Vancouver, B. C.—PURDY & HENDERSON, Henry Bldg., Seattle, Wash., has been awarded the contract for the construction of a three-story reinforced-concrete bank building at Pender and Granville St. for the Merchants Bank of Canada. Estimated cost, $150,000. Noted Apr. 8.

✚Victoria, B. C.—The contract for the construction of a two-story office building has been awarded to TUNEY BROS., Victoria. Estimated cost, $75,000. Percy Fox is Arch.

PAVING, ELGIN, ILL.

✚Bids were received June 26 by the Board of Local Improvements, Elgin, Ill., for paving North State St. from: (A) LOGAN & GIERTZ CONSTRUCTION CO., Elgin, for Purington block (awarded contract); (B) same company, using Barr block; (C) Illinois Hydraulic Stone & Construction Co., Elgin; (D) H. G. Goelitz, Oak Park; (E) Engineer's Estimate. The item bids were as follows:

	A	B	C	D	E
12,062 sq.yd. brick pavement	$1.75	$1.77	$1.84	$1.82	$1.90
3593 lin.ft. curb and gutter	.50	.50	.44	.44	.55
2895 lin.ft. curb	.30	.30	.38	.38	.40
298 lin.ft. concrete header	.20	.20	.20	.30	.35
26 crosswalk headers	2.00	2.00	1.50	2.00	2.00
16 gutter plates	3.00	3.00	2.50	3.00	3.00
9 catch basins	30.00	30.00	20.00	25.00	25.00
170 lin.ft. 8-in. sewer	.50	.50	.30	.60	.60
Adjusting manholes and catch basins (lump sum)	41.90	40.66	50.00	50.00	50.00
Extended totals	$24,360	$24,600	$25,310	$25,240	$26,673

Case Co. Increasing Facilities—The J. I. Case Threshing Machine Co., Racine, Wis., has taken over the plant and equipment of the Perfection Road Machinery Co. of Galion, Ohio. This company made Perfection road graders, drags, and rooter plows, for a number of years, which have been sold during the last few years by the Case Co. Frank K. Bull, President of the company, in referring to the transaction, says: "The demand made for road graders has impressed the company, and it has been deemed wise to take over the actual production of this machinery because it will be more economical to concentrate all manufacturing at Racine, as the business can be handled much better from that point." He outlined the logical development of the company from purely as a threshing machine company to an important factor in the road machinery business.

The Sandusky Portland Cement Co. will move its general offices on Aug. 1 from Sandusky to Cleveland, Ohio. The headquarters of the secretary and treasurer, etc., are already at Cleveland, and will be combined with the offices of the president and general superintendent and the sales, publicity and accounting departments. The offices will be located in the Engineers Bldg.

The Bayonne Casting Co., East Tenth St., Bayonne, N. J., announces that J. F. McNamara has been appointed general manager, effective July 1. Such changes have been made in the foundry and office as will assure customers even more prompt and satisfactory service than in the past.

SEWER EXTENSIONS—SCARSDALE, N. Y.

✚Bids were received June 22 by the Sewer Commissioners of Scrasdale, for the construction of sewer extension, Divisions A, B and C, from (A) William R. Neely, Tarrytown, (B) FRED E. GROSS & SON, Yonkers (awarded contract for Divisions A and B); (C) Sound Engineering & Contracting Co., Inc., 1476 Broadway, New York, (D) Lincoln Steele Fleming Co., 17 Madison Ave., New York; (E) Charles Smith, Pelham; (F) F. A. Cianfaglione, Yonkers; (G) Briggs & McLaughlin Contracting Co., 337 East 134th St.; (H) Richards & Cestonia, White Plains; (I) DALY & MERRITT, Port Chester (awarded contract for Division C); (J) Frank George, White Plains; (K) Joseph Dimando, Inc., Mamaroneck; (L) John L. Hayes Construction Co., Inc., Yonkers; (M) Di Menna & Del Balso, 2336 Cambrelling Ave., New York; (N) Mauro Paradiso, White Plains; (O) Charles E. Farrell Contracting Co., 1831 Southern Blvd., New York; (P) Engineers' Estimtae. The item bids were as follows:

DIVISION A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
100 lin.ft. 10-in. vitrified sewer 6 ft. to 8 ft. deep, inc. 8 ft.	$0.55	$0.80	$0.58	$0.74	$0.72	$0.65	$1.00	$0.79	$1.00	$1.20	$0.90	$0.74	$0.85	$1.25	0$.95
450 lin.ft., 8 ft. to 10 ft. deep, inc. 10 ft.	.70	.94	.75	.96	.95	.76	1.00	.95	1.09	1.35	1.00	.88	1.50	1.35	1.15
340 lin.ft., 8-in. vitrified sewer 6 ft. deep or less	.40	.56	.43	.55	.54	.55	1.00	.55	91	.70	80	60	.85	1.00	70
400 lin.ft., 6 ft. to 8 ft. deep, inc. 8 ft.	.50	.69	.48	.65	.68	.60	1.00	.65	1 01	.85	90	.69	1.00	1.25	.80
1300 lin.ft., 8 ft. to 10 ft. deep, inc. 10 ft.	.60	80	.65	.88	.90	.75	1.00	.77	1.10	1.05	.95	.83	1.50	1.35	1.00
600 lin.ft., 10 ft. to 12 ft. deep, inc. 12 ft.	.75	1.10	.80	1.23	1.35	.90	1.50	1.10	1.25	1.30	1 00	1.02	1.75	1.60	1.25
100 lin.ft., 12 ft. to 14 ft. deep, inc. 14 ft.	.93	1.65	.95	1.40	2.00	1.15	1.50	1.50	1.70	1.55	1 20	1.18	2.00	1.75	1.60
10 lin.ft., 14 ft. to 16 ft. deep, inc. 16 ft.	1.15	2.30	1.30	2.00	3.00	1 50	2.00	2.00	2.00	1.95	1.60	1.43	2.00	1.90	2.00
20 Ys on 10 ft. sewer (over sewer price)	.55	.55	.75	.47	.75	.80	.40	1.00	1.00	.70	1.00	1.68	1.00	.60	.80
90 Ys on 8 ft. sewer (over sewer price)	.40	.45	.63	.35	.60	60	.30	.75	.90	.65	.70	1.12	1.00	.50	.60
6 Y-extensions (over Y-price)	.80	1.90	1.43	1.25	.30	.50	.60	1.00	1 00	1 50	1.45	1 88	.50	.25	2.00
5 additional 2-ft. pcs. 6-in. pipe	.80	.28	.20	.34	.30	.40	.25	1.50	.40	.60	50	28	1.00	.25	.50
12 ft. 10-in. iron pipe sewer (over vitrified price)	1.00	90	1.12	.92	1.50	3.50	2.00	3.00	1.50	1.15	.80	3.60	1.00	.55	.80
36 ft. 8-in. iron pipe sewer (over vitrified price)	.70	70	.92	.69	1.25	2.75	2.00	2.50	1.35	.90	.75	3 00	.75	.55	.60
1 manhole, 6 ft. deep or less	30.00	38.00	49.00	45.00	37.00	30.00	45.00	45.00	40.00	42 00	40.00	35.00	35.00	60.00	45.00
9 manholes, 6 ft. to 8 ft. deep, inc. 8 ft.	40.00	45 00	59.00	48.00	42.00	35.00	50.00	50.00	45.00	52.00	50.00	44.00	40.00	65.00	60.00
22 ft. manholes, depth over 8 ft. (necks)	4.00	3.50	3.80	3.75	8.00	3.00	4.00	5.00	5.00	2.50	3.00	4.00	4.00	11.00	4.00
2 spurs in manholes, 6-in.	3.00	.60	.32	.37	.40	.30	.25	.50	2.00	.50	4.00	.25	1.00	.45	.60
2 sewer drop connections, 8-in.	10.00	7.00	7.88	10.00	6.00	.45	5.00	5.00	25.00	12.00	10.00	6.50	15.00	7.00	10.00
1 lamphole on 8-in. sewer	8.00	8.00	24.95	8.53	10.00	7.00	15.00	15.00	50.00	10.00	15.00	7.50	20.00	9.00	10 00
1 flush-tank, inc. l.h.	75.00	80.00	140.00	90.00	90.00	40.00	95.00	110.00	110.00	85 00	90.00	190.00	150.00	150.00	85.00
800 yd. rock excavation	3.00	2.25	3.00	3.20	2.70	2.90	3.00	2.50	3.50	2.65	3.00	3.15	3.00	2.70	3.00
Contingent Extras															
10 yd. concrete not shown on details	6.00	5.75	6.00	6.00	7.00	6.00	5.00	6.00	7.00	7.00	8.00	6.00	5.00	10.00	8.00
25 M. ft. b.m. sheeting and shoring left in	38.00	30.00	35.00	20.00	25.00	40.00	1.00	45.00	5.00	30.00	40.00	40.00	30.00	45.00	35.00
1 M ft. b.m. flooring or foundation lumber	35.00	35.00	35 00	40.00	30.00	40.00	30.00	60.00	35.00	30.00	40.00	40.00	30.00	45.00	40.00
500 ft. b.m. forms for concrete	35.00	35.00	35.00	90.00	60.00	50.00	30.00	60.00	35.00	35.00	40.00	40.00	10.00	15.00	30.00
100 yd. earth excavation not included otherwise	0.35	0.90	0.50	1.50	0.70	0.75	0.70	.40	.60	.50	.50	.66	.75	1.00	.80
Extension of Division A															
500 lin.ft. 8-in. vitrified sewer, 6 ft. deep or less	.40	.56	.43	.55	.54	.55	1.00	.55	.91	.70	.80	.60	1.00	.05	.70
440 lin.ft., 6 ft. to 8 ft. deep, inc. 8 ft.	.50	.69	.48	.65	.68	.60	1.20	.65	1.01	.90	.85	.69	1.50	1.15	.80
200 lin.ft., 8 ft. to 10 ft. deep, inc. 10 ft.	.60	.80	.65	.88	.90	.75	1.40	.79	1.10	1.30	.85	.83	1.75	1.25	1.00
10 lin.ft., 10 ft. to 12 ft. deep, inc. 12 ft.	.75	1.10	1.20	1.23	1.35	.90	1.60	1.10	1.25	1.40	1.00	1.02	2.00	1.50	1.25
70 Ys on 8-in. sewer (over sewer price)	.40	.45	.63	.35	.75	.60	1.30	.75	.90	.65	.70	1.12	1.00	.65	.60
108 lin.ft. 8-in. iron pipe sewer (over vitrified price)	70	.60	.92	.69	1.25	2.75	3.00	2.00	1.35	.90	75	3.00	1.00	.60	.60
3 manholes 6 ft. deep or less	30.00	38.00	49.00	45.00	37.00	30.00	35.00	45.00	40.00	42.00	40.00	35.00	35.00	65.00	45.00
1 manhole 6 ft. to 8 ft. deep, inc. 8 ft.	40.00	45.00	59.00	48.00	42.00	35.00	40.00	50.00	45.00	52.00	50 00	44.00	60.00	70.00	60.00
3 lin.ft. manholes depth over 8 ft. (necks)	4.00	3.50	3.80	3.75	8.00	3.00	4.00	5.00	5.00	3.00	3.00	4.00	4.00	11.00	4.00
100 yd. rock excavation	3.00	2.75	3.00	3.20	2.65	2.90	4.00	2.50	3.50	2.75	3.00	3.15	2.50	2.75	3.00
Contingent Extras															
10 yds. concrete not shown on details	6.00	5.75	6.00	6.00	7.00	6.00	5.00	6.00	7.00	7.00	8.00	6.00	5.00	10.00	8.00
23 M. ft. b.m. sheeting and shoring left in	38.00	30.00	35.00	20.00	25.00	40.00	1.00	45.00	5.00	30.00	40.00	40.00	30.00	50.00	35.00
100 ft. b.m. flooring or foundation lumber	35.00	35.00	35.00	40.00	30.00	40.00	30.00	60.00	35.00	30.00	40.00	40.00	30.00	50.00	40.00
500 ft. b.m. forms for concrete	35.00	35.00	35.00	90.00	60.00	50.00	30.00	60.00	35.00	35.00	40.00	40.00	10.00	15.00	30 00
Extended totals	$8297	$8426	$8723	$9082	$9086	$9180	$9503	$9701	$9834	$9910	$10,175	$10,205	$11,711	$12,452	$10,263

DIVISION B	A	B	C	D	E	F	G	H	I	J	L	N	O	P
100 lin.ft. 8-in. vitrified sewer, 6 ft. deep or less	$0.40	$0.56	$0.43	$0.55	$0.62	$0.55	$0.80	$0.55	$0.91	$0.70	$0.60	$0.50	$0.85	$0.70
2200 lin.ft., 6 ft. to 8 ft. deep, inc. 8 ft.	.50	.69	.48	.65	.76	.60	.80	.65	1.01	.82	.69	.60	1.00	.80
1400 lin.ft., 8 ft. to 10 ft. deep inc. 10 ft.	.60	.80	.65	.88	.98	.75	.90	.77	1.10	1.00	.83	.90	1.25	1.00
50 lin.ft., 10 ft. to 12 ft. deep, inc. 12 ft.	.75	1.10	1.20	1.23	1.43	.90	1.00	1.00	1.25	1.25	1.02	1.00	1.50	1.25
250 Ys on 8-in. sewer (over sewer price)	.40	.45	.63	.35	.60	.60	.40	.75	.90	.65	1.12	1.00	.60	.60
12 lin.ft. 8-in. iron pipe sewer (over vitrified price)	.70	.70	.92	.69	1.25	2.75	2.00	2.00	1.35	1.00	3.00	.60	1.25	.60
2 manholes, 6 ft. deep or less	30.00	38.00	50.00	45.00	37.00	30.00	40.00	45.00	40.00	42.00	35.00	50.00	25.00	45.00
8 manholes, 6 ft. to 8 ft. deep, inc. 8 ft.	40.00	45.00	60.00	48.00	42.00	35.00	45.00	50 00	45.00	50.00	44.00	60.00	30.00	60.00
6 ft. manholes, depth over 8 ft. (necks)	4.00	3.50	3.80	3.75	8.00	3.00	4.00	5.00	5.00	2.50	4.00	11.00	2.00	4.00
2 spurs in manholes, 6-in.	3.00	.60	.32	.37	.40	.30	.50	.50	1.50	1.00	.25	.50	1.00	.60
1 sewer drop connection, 8-in.	10.00	7.00	7.88	10.00	6.00	.45	5.00	5.00	25.00	10.00	6.50	7.00	15.00	10.00
1 lamp-hole on 8-in. sewer	8.00	8.00	24.95	8.50	10.00	7.00	15.00	15.00	50.00	12.00	7.50	9.00	20.00	10.00
4 flush-tanks	75.00	80.00	140.00	90.00	90.00	40.00	95.00	110.00	110.00	85.00	190.00	150.00	150.00	85.00
1200 yd. rock excavation	3.00	2.25	3.00	3.20	2.65	2.80	3.00	2.25	3.50	2.50	3.15	2.75	2.65	3.00
Contingent extras														
10 yds. concrete not shown on details	6.00	5.75	6.00	6.00	7.00	6.00	5.00	6.00	7.00	7.00	6.00	10.00	6.00	8.00
5 M ft. b.m. sheeting and shoring left in	38 00	30.00	35.00	20.00	25.00	40.00	1.00	30.00	5.00	20.00	40.00	45.00	18.00	35.00
1000 ft. b.m. flooring or foundation lumber	35.00	35.00	35 00	40.00	30.00	40.00	1.00	60.00	35.00	20.00	40.00	45.00	18.00	40.00
500 ft. b.m. forms for concrete	35.00	35.00	35.00	90.00	60.00	50.00	20.00	60.00	35.00	35.00	40.00	15.00	18.00	30 00
100 yd. earth excavation not included otherwise	.35	.90	.50	1.50	.70	.65	.70	.40	.60	.50	.66	.80	.75	.80
Extended totals	$6791	$6713	$7371	$7985	$7682	$6929	$7875	$6845	$95552	$7631	$8493	$7957	$8646	$8394

WALWORTH RUN DIVERSION SEWER—CLEVELAND, OHIO

Bids were received July 7 by the Commissioner of Purchases and Supplies for the construction of the Walworth Run Diversion Sewer under two contracts, Sections Nos. 1 and 2 from (A) Hoag & Zullo, Cleveland, (B) Donnelly & Graham, Cleveland, (C) Manson Co., Cleveland, (D) Gawne Contracting Co., Cleveland, (E) Dock Contractor Co., Hoboken, N. J., (F) Joseph Winterbottom, Cleveland, (G) J. Connelly Construction Co., Cleveland, (H) W. P. Gibbons Co., Cleveland, (I) Henry C. Ulen, Chicago, Ill., (J) William McDowell & Son Co., Cleveland, (K) Charles A. Haskin, Boston, Mass., (L) J. Wagner & Son, Detroit, Mich. The item bids were as follows:

Section No. 1	A	B	C	D	E	F	G	H	I	J	K	L
4600 lin.ft. 5 ft. 6 in. circular brick sewer complete in place	$24.00	$25.65	$27.80	$29.15	$30.10	$35.00	$30.90	$32.29	$34.00	$34.50	$39.40	$45.00
4600 lin.ft. 6 ft. circular brick sewer complete in place	27.31	28.30	27.80	31.00	...	35.00	.....	32.29	35.00	33.95	41.30	45.00
4600 lin.ft. 6 ft. 6 in. circular brick sewer complete in place	28.45	28.50	27.80	32.00	..	30.50	...	32.29	36.00	34.50	43.50	45.00
4600 lin.ft. 6 ft. 6 in. x 5 ft. 6 in. section brick sewer in place	26.47	29.11	27.80	35.00	.	35.00	.	33.29	36.00	34.50	50.00	45.00
1 drop manhole and overflow chamber	4500.00	3500.00	3200.00	3500.00	2000.00	2400.00	5000.00	7000.00	3000.00	6500.00	4500 00	1000.00
Extended totals	$114,900	$121,490	$131,080	$137,590	$140,460	$142,700	$147,140	$155,534	$159,400	$162,670	$185,740	$208,000

Section No. 2	A	B	C	D	E	F	G	H	I	J	K
3750 lin.ft. 5 ft. 6 in. circular brick sewer complete in place	$25.45	$26.23	$31.50	$30.50	$35.00	$30.90	$37.29	$34.00	$34.50	$39.40	
3750 lin.ft. 6 ft. circular brick sewer complete in place	28.56	27.00	31.50	.....	35.00	.....	37.29	35.00	33.95	41.30	
3750 lin.ft. 6 ft. 6 in. circular brick sewer complete in place	29.70	28.35	31.50	.....	30.50	.....	37.29	36.00	34.50	43.50	
3750 lin.ft. 6 ft. 6 in. x 5 ft. 6 in. section brick sewer in place	27.72	29.11	31.50	.....	35.00	.....	38.29	36.00	34.50	50.00	
1 manhole "B"	6000.00	2800.00	3500.00	2000.00	2400.00	5000.00	6000.00	3450.00	6500.00	4500.00	
1 manhole "C"	100.00	100.00	250.00	350.00	150.00	1000.00	200.00	850.00	300.00	1000.00	
Extended totals	$101,537	$101,262	$121,875	$116,725	$116,925	$121,875	$146,037	$131,800	$134,112	$153,250	

SEWER EXTENSIONS—SCARSDALE, N. Y. (continued)

DIVISION C	C	G	H	I	J	L	N	P
1800 lin.ft. 10-in. vitrified sewer, 6 ft. deep or less	$0.77	$0.80	$0.79	$0.50	$1.00	$0.64	$0.75	$0.80
1200 lin.ft., 6 ft. to 8 ft. deep, inc. 8 ft.	.96	.90	1.10	.55	1.20	.80	1.00	.95
560 lin.ft., 8 ft. to 10 ft. deep, inc. 10 ft.	1.26	1.00	1.50	.60	1.25	1.10	1.10	1.15
350 lin.ft., 10 ft. to 12 ft. deep, inc. 12 ft.	1.49	1.20	2.00	1.00	1.35	1.30	1.50	1.40
300 lin.ft., 12 ft. to 14 ft. deep, inc. 14 ft.	1.70	1.50	2.50	1.10	1.80	1.52	1.65	1.70
150 lin.ft., 14 ft. to 16 ft. deep, inc. 16 ft.	2.40	1.50	3.50	1.25	1.95	1.75	2.00	2.10
200 lin.ft., 16 ft. to 18 ft. deep, inc. 18 ft.	2.95	2.00	4.50	1.50	2.70	2.00	2.10	2.60
150 lin.ft., 18 ft. to 20 ft. deep, inc. 20 ft.	3.70	2.50	5.50	1.75	3.30	2.30	2.60	3.20
250 lin.ft., 20 ft. to 22 ft. deep, inc. 22 ft.	4.40	4.00	7.00	1.90	4.50	3.50	3.00	3.90
250 lin.ft., 22 ft. to 24 ft. deep, inc. 24 ft.	5.30	5.00	9.00	2.50	7.50	5.00	3.50	4.70
100 lin.ft., 24 ft. to 26 ft. deep, inc. 26 ft.	5.75	6.00	9.00	2.75	9.50	6.00	3.75	5.60
60 lin.ft., 26 ft. to 28 ft. deep, inc. 28 ft.	6.50	8.00	9.00	3.00	10.50	6.40	5.00	6.60
10 lin.ft., 28 ft. to 30 ft. deep, inc. 30 ft.	7.70	8.00	9.00	3.50	11.00	7.00	5.50	8.00
600 lin.ft., 8-in. vitrified sewer, 6 ft. deep or less	.71	.70	.75	.47	.70	.60	1.00	.70
3500 lin.ft., 6 ft. to 8 ft. deep, inc. 8 ft.	.88	.80	1.10	.53	.82	.69	1.25	.80
5000 lin.ft., 8 ft. to 10 ft. deep, inc. 10 ft.	1.19	.90	1.50	.55	.95	.83	1.60	1.00
800 lin.ft., 10 ft. to 12 ft. deep, inc. 12 ft.	1.39	1.00	1.25	.75	1.15	1.02	1.75	1.25
250 lin.ft., 12 ft. to 14 ft. deep, inc. 14 ft.	1.60	1.20	2.00	.99	1.50	1.12	2.00	1.60
80 lin.ft., 14 ft. to 16 ft. deep, inc. 16 ft.	2.30	1.50	2.50	1.21	2.00	1.27	2.25	2.00
10 lin.ft., 16 ft. to 18 ft. deep, inc. 18 ft.	2.90	2.00	3.00	1.51	2.40	1.67	2.50	2.50
200 Ys on 10-in. sewer (over sewer price)	.47	.60	1.00	.90	.70	1.68	.90	.80
500 Ys on 8-in. sewer (over sewer price)	.35	.50	1.00	.70	.60	1.12	.65	.60
60 Y-extensions (over Y price)	1.25	.60	1.25	1.00	1.00	1.88	.20	2.00
90 additional 2-ft. pieces, 6-in. pipe	.34	.30	.75	.40	.50	.25	.20	.50
72 lin.ft. 10-in. iron pipe sewer (over vitrified price)	.92	2.50	3.50	2.00	1.10	3.60	.60	.80
24 lin.ft. 8-in. iron pipe sewer (over vitrified price)	.69	2.00	2.50	1.75	.90	3.00	.55	.60
7 manholes, 6 ft. deep or less	45.00	90.00	50.00	40.00	42.00	35.00	60.00	45.00
41 manholes, 6 ft. to 8 ft. deep, inc. 8 ft.	48.00	100.00	60.00	45.00	50.00	44.00	65.00	60.00
110 lin.ft. manholes depth over 8 ft. (necks)	3.75	4.00	5.00	5.00	2.50	4.00	11.00	4.00
24 lin.ft. manholes depth below 16 ft. (13 in. walls)	6.00	8.00	15.00	7.00	5.00	5.25	15.00	7.00
10 spurs in manholes, 6-in.	.40	.30	1.00	1.00	.50	.25	.50	.60
3 sewer drop connections, 8-in.	10.00	5.00	25.00	25.00	12.00	6.50	7.00	10.00
1 lamp-hole on 8-in. sewer	10.00	20.00	15.00	50.00	10.00	7.50	9.00	10.00
8 flush-tanks	90.00	90.00	125.00	100.00	82.00	190.00	160.00	85.00
5000 yd. rock excavation	3.10	3.00	3.00	3.00	2.75	3.15	2.70	3.00
Contingent Extras								
80 yd. concrete not shown on details	6.00	6.00	6.00	7.00	7.00	6.00	10.00	8.00
100 M. ft. b.m. sheeting and shoring left in	20.00	1.00	40.00	5.00	35.00	40.00	45.00	35.00
3 M ft. b.m. flooring or foundation lumber	40.00	30.00	60.00	10.00	35.00	40.00	40.00	40.00
1000 ft. b.m. forms for concrete	90.00	30.00	60.00	10.00	35.00	40.00	15.00	30.00
100 yd. earth excavation not included otherwise	2.00	1.00	.40	.60	.50	.68	1.00	.80
50 yd. gravel backfilling	2.50	2.00	1.75	2.00	2.00	2.00	2.00	3.50
100 lin.ft. 6-in. vitrified house sewer 6 ft. deep or less	.80	.60	.40	.35	.60	.48	.50	.50
100 lin.ft., 6 ft. to 8 ft. deep, inc. 8 ft.	.90	.70	.55	.50	.80	.64	.60	.60
100 lin.ft., 8 ft. to 10 ft. deep, inc. 10 ft.	1.00	.80	.75	.60	1.00	.76	1.00	.80
100 lin.ft., 10 ft. to 12 ft. deep, inc. 12 ft.	1.20	1.00	1.50	.70	1.20	.96	1.25	1.05
50 lin.ft., 12 ft. to 14 ft. deep, inc. 14 ft.	1.50	1.00	2.00	.80	1.50	1.10	1.60	1.40
30 yd. rock excavation in house sewer trench	4.00	4.00	3.00	3.25	3.00	3.15	2.75	3.00
Extended totals	$43,589	$40,481	$53,074	$31,964	$43,205	$42,483	$48,924	$43,336

HUNTLEY SEWER SYSTEM NO. 2—SYRACUSE, N. Y.

✚Bids were received July 12 for the construction of the Huntley Sewer System No. 2 from (A) J. C. SCHRADE, Brooklyn (awarded contract, using reinforced concrete); (B) Mondo Construction Co., Syracuse; (C) Bonn & Marnell, Syracuse; (D) Frank George, White Plains; (E) Samuel Bonn, Syracuse; (F) F. S. Sposato, Syracuse; (G) Grant, Smith & Co. & Locher, Rome; (H) Hookway Construction Co., Syracuse; (I) Charles Ippolito, Orange, N. J. The item bids were as follows:

Reinforced concrete	A	B	C	D	E	F	G	H	I
1250 lin.ft. 66-in. storm sewer	$9.25	$7.90	$7.55	$6.99	$7.25	$6.75	$7.86	$9.00	$11.89
640 lin.ft. 60-in. storm sewer	7.15	7.00	6.07	5.90	5.90	5.65	6.26	7.50	10.29
660 lin.ft. 45-in. storm sewer	4.60	5.50	4.41	4.17	4.65	4.25	4.57	5.50	8.03
860 lin.ft. 42-in. storm sewer	4.15	5.20	4.12	3.84	4.25	4.10	3.83	5.50	7.62
920 lin.ft. 36-in. storm sewer	3.85	4.50	3.71	3.71	3.80	4.85	3.34	4.75	6.22
1600 lin.ft. 33-in. storm sewer	2.95	3.25	2.95	2.89	2.80	3.00	2.93	3.75	6.11
2930 lin.ft. 27-in. storm sewer	2.65	2.60	2.55	2.45	2.35	2.40	2.59	3.00	5.38
Brick									
1250 lin.ft. 66-in. storm sewer	16.75	....	....	11.92	.	10.95	12.94	. .	21.81
640 lin.ft. 60-in. storm sewer	14.75	....	....	10.51	.	10.00	11.54	.	19.72
660 lin.ft. 45-in. storm sewer	10.00	....	....	5.49	. .	5.75	8.93	. .	13.18
860 lin.ft. 42-in. storm sewer	9.00	..	....	5.30	. .	5.62	7.62	. .	13.00
920 lin.ft. 36-in. storm sewer	8.90	. .	. .	5.11	. .	6.02	6.40	. .	11.16
1600 lin.ft. 33-in. storm sewer	7.50	. .	. .	4.29	. .	4.55	5.72	....	10.89
2930 lin.ft. 27-in. vitrified pipe storm sewer	3.00	. .	. .	2.83	..	2.40	3.73	. . .	5.70
Monolithic concrete									
1250 lin.ft. 66-in. vitrified pipe storm sewer	11.75	....	. .	9.86	.	9.63	11.22	. . .	15.94
640 lin.ft. 60-in. vitrified pipe storm sewer	9.65	.	. .	8.53	.	8.50	8.88	. . .	13.09
660 lin.ft. 45-in. vitrified pipe storm sewer	7.10	.	. .	5.46	.	5.59	5.59	. .	11.39
860 lin.ft. 42-in. vitrified pipe storm sewer	6.85	.	. .	5.19	.	5.22	4.68	. .	11.87
920 lin.ft. 36-in. vitrified pipe storm sewer	5.75	. . .	.	4.63	.	5.45	3.92	. .	9.73
1600 lin.ft. 35-in. vitrified pipe storm sewer	5.40	. . .	. .	3.66	.	3.90	3.80	.	10.11
2930 lin.ft. 27-in. vitrified pipe storm sewer	5.25	. . .	....	3.12	.	3.07	3.24	.	8.58
Vitrified pipe									
1080 lin.ft. 24-in. storm sewer	1.65	1.25	1.74	2.01	1.55	2.50	2.27	1 90	3.93
590 lin.ft. 22-in. storm sewer	1.60	1.10	1.74	1.86	1.50	2.45	2.23	1 90	3.53
1680 lin.ft. 20-in. storm sewer	1.35	1.00	1.40	1.60	1.25	2.00	2.00	1.50	3.35
1020 lin.ft. 18-in. storm sewer	1.10	1.00	1.25	1.36	1.10	1.50	1.60	1.40	3.22
2380 lin.ft. 15-in. storm sewer	.95	.85	1.09	1.25	1.00	1.20	1.45	1.10	2.84
4460 lin.ft. 12-in. storm sewer	.40	.60	.87	.84	.75	.95	1.02	.80	2.12
80 lin.ft. 24-in. sanitary sewer	3.35	1.50	2.01	2.38	3.27	3.00	3.54	4.00	1.59
820 lin.ft. 22-in. sanitary sewer	3.20	1.40	1.92	2.14	2.40	2.00	1.52	2.50	1.52
120 lin.ft. 20-in. sanitary sewer	2.75	1.40	1.98	2.55	3.29	3.50	1.30	3.00	1.34
950 lin.ft. 18-in. sanitary sewer	1.80	1.25	1.48	1.35	1.60	1.95	1.20	1.75	1.22
5750 lin.ft. 12-in. sanitary sewer	.90	1.00	1.05	1.15	1.10	1.20	.78	1.00	.70
6450 lin.ft. 10-in. sanitary sewer	.55	.60	.93	1.10	.90	1.10	.56	.95	.65
5880 lin.ft. 8-in. sanitary sewer	.45	.55	.93	.85	.90	.90	.67	.85	.55
12,100 lin.ft. 6-in. sanitary laterals	.40	.40	.50	.40	.39	.50	.61	.45	.50
1700 lin.ft. 10-in. storm laterals	.50	.60	.50	.59	.60	.75	.78	.65	.50
39 line manholes, 3x4 ft.	40.00	55.00	40.00	37.50	45.00	50.00	62.10	38.00	38.00
8 line manholes, 4x4 ft.	45.00	60.00	55.00	58.25	65.00	53 00	71.20	45.00	45.00
6 line manholes, Type "L"	60.00	160.00	80.00	71.50	55.00	60.00	85 00	70.00	50.00
25 double line manholes	75.00	150.00	60.00	72.00	90.00	80.00	166 00	70.00	60 00
3 junction manholes	60.00	60.00	60.00	58.75	75.00	55.00	97.00	70 00	70.00
17 double junction manholes, Type "O"	140.00	150.00	85.00	88.00	255.00	110.00	135.00	120.00	100 00
9 double junction manholes, Type "D"	175.00	150.00	125.00	137.00	85.00	95 00	170 00	125.00	100 00
2 double drop junction manholes	200.00	200.00	155.00	180.00	110.00	90 00	220 00	140 00	100.00
1 special manhole No. 8	330.00	200.00	160.00	300 00	525.00	140 00	500 00	120.00	150 00
6 large catch basins	40.00	60.00	35.00	55.00	37.00	40 00	54.00	40 00	40.00
75 small catch basins	25.00	23.00	25.00	25 00	25.00	30 00	41 50	30.00	32 00
1 connection existing sewer	500.00	5.00	25.00	15.00	35.00	30 00	25.00	100.00	50 00
2 connection existing manholes	50.00	5.00	5.00	5.00	5.00	10.00	25.00	20.00	50 00
5 cu.yd. brick or concrete piers	15.00	8.00	5.00	7.50	15.00	9.00	13.20	8 00	18 00
Extended totals reinforced concrete sewer	$82,731	$84,305	$85,305	$85,921	$86,957	$92,100	$92,165	$95,152	$126,743
Extended totals brick sewer	$117,657			$101,802		$105,988	$118,651		$166,335
Extended totals monolithic concrete sewer	$104,714			$97,245		$103,327	$103,276		$158,476

Contracts to Be Let

Bids received until July 26, 1915.

Highway Work

Albany, N. Y.

State of New York, Office of the State Commission of Highways, Albany, N. Y.—Pursuant to the provisions of Chapter 30, Laws of 1909, as amended by Chapter 646, Laws of 1911, and Chapter 80, laws of 1913, sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p.m. on Monday, July 26th, 1915, for the construction of the following highways:

Road No.	County	Name of Road	Approx. length
5498	Orange	Cornwall-West Point, Parts 1 and 2	4.03
5573	Orange	Cornwall-West Point, Part 3	1.27

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of Division Engineer Bertrand H. Wait, Columbus Institute, 11 Washington Street, Poughkeepsie, N. Y.

The especial attention of bidders is called to "Information for Bidders" in the itemized proposal, specifications and contract agreement.

Proposals for each contract must be presented in a separate sealed envelope endorsed on the outside with the number of the road for which the proposal is made. Each proposal must be accompanied by a draft or certified check issued by a National or State bank in good credit within the State and payable at sight to the order of the State Commission of Highways for an amount equal to at least five per cent. of the amount of the proposal which such draft or check accompanies.

This draft or check will be held by the Commission until the contract and bond are duly executed.

The successful bidder will be required to give a bond for fifty per cent. of the amount of the contract, such bond to be executed by a surety company to be approved by the Commission, or a bond secured by the deposit of collateral securities to be approved by the Commission.

The right is reserved to reject any or all bids.

EDWIN DUFFEY, Commissioner.

I. J. MORRIS, Secretary.

Bids received until Aug. 7, 1915.

Stratford Avenue Bridge and Approaches

Bridgeport, Connecticut.

Sealed proposals addressed to the Stratford Avenue Bridge Commission, Bridgeport, Conn., will be received at the office of the Board of Contracts and Supplies, City Hall, Bridgeport, Conn., until twelve o'clock noon on the seventh day of August, 1915, and at that time will be publicly opened and read. The work involved includes the construction of a reinforced-concrete girder bridge, with a double leaf bascule channel span and all substructures and approaches. The bridge will have a roadway 54 ft. clear of the curbs, two sidewalks 13 ft. wide, length of bridge from abutment to abutment being 499 ft.

Complete data, plans, specifications, etc., can be seen after July 15 in the office of the Board of Contracts and Supplies, City Hall, Bridgeport, Conn., and in the office of the Consulting Engineers, Greiner & Whitman, Fidelity Building, Baltimore, Md. Contractors can obtain complete sets for $5.00 per set upon application to the Consulting Engineers, the sets thus secured to remain the property of the purchaser without refund.

A certified check for ten thousand dollars must accompany each bid. Contractors will be required to furnish satisfactory evidence of their experience in doing similar work and their ability to finance the work, and the successful contractor will be required to furnish a bond to the full amount of the contract price. The Commission reserves the right to reject any or all proposals, or parts of proposals, or make the award for the entire work or such portion thereof as may be considered best for the interests of the city.

Bids received until Aug. 31, 1915.

Passaic Valley Sewerage Commissioners

SUPERSTRUCTURE FOR NEWARK BAY PUMPING STATION

NOTICE TO CONTRACTORS.

Notice is hereby given that the Passaic Valley Sewerage Commissioners have designated Tuesday, the thirty-first day of August, nineteen hundred and fifteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals, in writing, for the construction of Superstructure and appurtenances for Newark Bay Pumping Station, the said work being Part of Section 5, of the Passaic Valley Sewerage Works.

Particulars that may enable Contractors to judge of the character of the work are given below:

The work to be done consists of the construction and completion of the Superstructure of Newark Bay Pumping Station and all appurtenances, comprising, in part, of Engine-Room, Screen-House, Administration Building, Boiler-House, Coal-House, Chimney, and including Crane runways, Economizer support, steel water storage tank, and all plumbing, electric light wiring and fixtures, water-supply piping, electric conduits, interior and exterior decorations and all appurtenant work.

A certified check for two thousand ($2000.00) dollars (drawn on a National Bank or Trust Company, established in the City of New York, or in the State of New Jersey, within Passaic Valley Sewerage District), must accompany the bid. A bond in the sum of thirty thousand ($30,000.00) dollars will be required for the further performance of the contract.

Drawings, form of contract and specifications, and blank form for proposal, may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.
JOSEPH H. QUIGG, Clerk.
July 13, 1915.

Bids received until Aug. 3, 1915.

Highway Work

OFFICE OF THE STATE COMMISSION OF HIGHWAYS.

Albany, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p.m. on Tuesday, the 3rd day of August, 1915, for the repair of highways in the following counties:

Broome (one contract—resurfacing); Chemung (one contract—resurfacing); Chenango (one contract—resurfacing); Clinton (one contract—resurfacing); Columbia (one contract—surface treatment and resurfacing); Dutchess (two contracts—surface treatment and resurfacing); Erie (one contract—resurfacing); Herkimer (one contract—surface treatment); Monroe (one contract—resurfacing); Montgomery (one contract—surface treatment); Otsego (one contract—resurfacing); Putnam (one contract—surface treatment and resurfacing); St. Lawrence (three contracts—surface treatment and resurfacing); Schoharie (one contract—retaining walls); Steuben (one contract—resurfacing); Sullivan (one contract—resurfacing); Tompkins (one contract—surface treatment); Warren (one contract—surface treatment); Westchester (two contracts—surface treatment and resurfacing).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the Division Engineers in whose division the contracts are to be repaired. The addresses of the Division Engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "Information for Bidders" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY, Commissioner.

I. J. MORRIS, Secretary.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS—STEAM AND ELECTRIC

Massachusetts—Bay State St. Ry.—This company has applied to the Council of Wakefield, Mass., for a franchise to improve its lines on Main St. R. S. Goff, Boston, is Vice-Pres. and Gen. Mgr.

Massachusetts—Holyoke St. Ry.—This company has applied to the Council of Amherst, Mass., for a franchise to extend its line on South Pleasant St. Louis D. Pellissier, Holyoke, is Vice-Pres., Gen. Mgr. and Pur. Agt.

Connecticut—Connecticut Co.—This company plans to reconstruct its line on North Ave., from North Main St. to Trumbull Rd., Bridgeport, Conn. Charles H. Chapman, Bridgeport, is Mgr.

New York—According to press reports Charles W. Morse and associates of the Hudson Navigation Co. are organizing a company for the purpose of constructing a railway on Front St., Troy, N. Y.

New York—International Ry. Co.—This company plans to extend its lines on Michigan Ave. and Ohio St., Buffalo, N. Y. J. C. Sheldon, Buffalo, is Pur. Agt.

New Jersey—Morris County Traction Co.—This company is interested in the organization of a company for the purpose of constructing an electric railway from Landing to Lake Hopatcong, through Port Morris to Netcong, N. J.

Pennsylvania—A movement is being agitated for the construction of a railway from Sinking Spring to Ephrata, where it will connect with lines operating to Lancaster and Lebanon.

✚**Pennsylvania**—Shenandoah, Frackville & Pottsville Ry.—This company has awarded the contract to J. B. TREXLER, Reading, for the construction of a railway connecting Frackville with St. Clair, about five miles.

Pennsylvania—South Brownsville St. Ry.—This company is being organized for the purpose of constructing an electric railway from Brownsville to South Brownsville, Penn. W. E. Moore, H. L. Mitchell, J. S. Jenks and E. T. Brashears are interested.

Virginia—Louisville & Nashville R.R.—This company contemplates the construction of an 18-mile line from Blackley, Va., to the headwaters of Rockhouse Creek. W. H. Courtenay, Louisville, Ky., is Ch. Engr.

Virginia—York & Rappahannock River Ry.—This company has applied for a charter to construct a railway from West Point to Urbanna, Va., about 17 miles. R. S. Bristow, Urbanna, is Pres., F. H. Sprague, West Point, Vice-Pres. and W. H. Ryland, Urbanna, Secy.

West Virginia—Fairmont & Helen's Run R.R.—This company has been incorporated to construct a railway from the mines of the Consolidated Coal Co. on Helen's Run to the tracks of the Baltimore & Ohio R.R., near Fairmont, W. Va. The incorporators are: Carl R. Gray, M. C. Byers, C. H. Porter and H. R. Pratt.

✚**West Virginia**—Ohio Valley Electric Ry.—The contract has been awarded by this company to the BRUBAKER CONSTRUCTION CO. for the construction of an extension to the line on 12th Ave., Huntington.

Georgia—Pelham & Havana R.R.—Surveys have been completed by this company for the extension of its line from Darsey, Ga., to Havana, Fla., about five miles. J. M. Wilkinson, Valdosta, in Pres. Noted June 22.

Alabama—The Alabama Power Co. contemplates the extension of the street car lines of the Anniston Electric & Gas Co., which it recently acquired, from Anniston to Blue Mountain. A. L. Kenyon, Anniston, is Mgr.

Tennessee—Nashville, Chattanooga & St. Louis Ry.—Plans are being considered by this company for the construction of a three-mile extension from Tottys to Valley, Tenn. H. McDonald, Nashville, is Ch. Engr.

Ohio—Cleveland Ry.—This company will extend its line on Euclid Ave. from 22nd to 40th St., Cleveland, Ohio. George L. Radcliffe, Cleveland, is Gen. Mgr.

Ohio—East Village & Harbor Traction Co.—Surveys are being made by this company for the construction of a railway in Ashtabula.

Ohio—Lorain, Ashland & Southern R.R.—According to press reports this company is making preliminary arrangements for the extension of its line from Custaloga to Big Prairie, Ohio. John Lake, Big Prairie, is interested. Noted June 10.

Indiana—Ft. Wayne & Northern Indiana Traction Co.—Preliminary arrangements are being made by this company for the reconstruction of its line on State Blvd., Ft. Wayne, Ind. Samuel W. Greenland, Ft. Wayne, is Gen. Mgr. and Pur. Agt. Noted May 20.

Michigan—Detroit, Pontiac & Owosso Ry.—This company has been granted a franchise to construct a railway in Pontiac, Mich. This is part of a proposed railway which will connect Owosso and Detroit. George H. Lau, Detroit, is interested. Noted June 24.

Iowa—The Des Moines & Southern R.R.—This company will soon start work on the construction of a five-mile railway from Swanwood Junction to Des Moines. C. H. Crooks is Gen. Mgr.

Minnesota—Duluth St. Ry.—Plans are being prepared by this company for the extension of its line from West Duluth to New Duluth, Minn. Herbert Warren is Gen. Mgr.

Arkansas—A. C. Veach, Gravette, Ark., is interested in the construction of an electric railway from Melbourne, Ark., to a connection with the St. Louis, Iron Mountain & Southern R.R., about 12 miles.

Texas—Plans are being considered for merging the properties of the Texas Traction Co. and the Southern Traction Co. It is planned to extend the line of the latter company from Waco to San Antonio.

Texas—Corpus Christi Traction Co.—This company, recently incorporated, will construct a system of interurban electric railways to radiate out of Corpus Christi.

Oklahoma—Plans are being prepared for the construction of an electric railway from Henryetta to Denver, about three miles. Z. T. Sweeney, Columbus, Ind., is interested.

Oregon—At a recent election held at Grants Pass the citizens voted in favor of ratifying the contract by which Twohy Bros., Portland, will take over ten miles of municipal constructed railroad and continue the line to the coast.

✚**Oregon**—St. Helens Lumber Co.—It is reported that this company has awarded the contract for the construction of four miles of railway to the ELLIOTT CONSTRUCTION CO., Portland.

Oregon—Southern Oregon Traction Co.—This company has purchased the steam railway from Medford to Jacksonville, Ore., and will electrify it. S. S. Bullis, Medford, is interested.

California—According to press reports surveys are being made for the construction of a railway from Eureka, Calif., to Klamath Falls, Ore.

British Columbia—Surveys have been made for the construction of a railway from Kittamaat Arm, B. C. to Prince Albert by way of Ft. St. John and Peace River Landing. D. A. Thomas, Wales, England, is interested.

LIGHT, HEAT AND POWER

Dedham, Mass.—(Official)—Bids will be received by the Superintendent of Schools, Town Hall, until 4 p.m., Aug. 3, for the installation of a heating and ventilating system in the new high school building. Samuel H. Capen is Chn., High School Bldg. Com.

✚**Buffalo, N. Y.**—The contract for the installation of a heating system in the new City Hospital has been awarded to FITZPATRICK & HOEPNER, Cleveland, Ohio, at $67,929; the contract for the electrical work was awarded to the BISON ELECTRIC CO., Buffalo, at $17,328. See item under "Buildings."

Ellisburg, N. Y.—Frank E. Hamm will construct an electric-light plant and system in Ellisburg.

La Fargeville, N. Y.—The La Fargeville Electric Light Co. has been granted permission by the Public Service Commission to construct electric-light plants in the towns of Theresa and Orleans. Noted July 22.

Perry, N. Y.—The Perry Electric Light Co. plans to construct six miles of transmission line between Perry and Silver Springs, also nine miles between Perry and Warsaw.

Bloomfield, N. J.—The Westinghouse Lamp Co. plans to construct an addition to its power house in the Watsessing Section.

✚**Newark, N. J.**—The Public Service Electric Co. has awarded the contract for the construction of smoke flues at its new power plant at Point-No-Point to the STEVENS-AYLESWORTH CO., 90 West St., New York, N. Y. The estimated cost is $12,250.

Leonardtown, Md.—The construction of a municipal electric-light plant is being considered by the City Commissioners.

Guntersville, Ala.—The construction of a steam driven power plant in Guntersville is contemplated by the Alabama Power Co. of Birmingham. The company also plans to build a transmission line between Gadsen and Guntersville to furnish electricity to Albertville, Boaz and other towns.

Hazard, Ky.—It is reported that E. C. Lilly, Bluefield, Va., and D. Terpstra, Norton, Va., are considering plans for the construction of an electric generating plant to supply electricity to the coal mines in the Hazard field.

Cincinnati, Ohio—Bids will be received until noon, Aug. 3, by Philip Fosdick, Dir. of Pub. Ser., City Hall, for the installation of a heating and ventilating system in the public bath house at Spring and East 13th St.

✚**Madison, Wis.**—The Madison Gas & Electric Co. has awarded the contract for the construction of a brick power transmission station on Blunt St. to T. C. McCARTHY. The estimated cost is $15,000.

Milwaukee, Wis.—Work will soon be started on the construction of a power plant on Greenfield St. for the Milwaukee Coke & Gas Co. The estimated cost is $12,000.

Bancroft, Iowa—At a recent election the citizens voted in favor of issuing $10,000 in bonds. The proceeds will be used for the construction of a municipal electric-light plant .

Nevada, Iowa—A 13,500-volt, 3-phase transmission line will be constructed from Nevada into Colorado by the Iowa Ry. & Lighting Co. They will also build a sub-station and distribution system in Colorado.

+Thompson, Iowa—The contract for the construction of an electric-light plant has been awarded to the STRONG ELECTRIC CO., Des Moines.

Hardwick, Minn.—At a recent election the citizens voted in favor of issuing $5000 in bonds, the proceeds of which will be used for improving the village power plant.

Hastings, Minn.—Bids will be received by P. A. Hoffman, County Audr., until 11 a.m., Aug. 16, for furnishing two Kewanee locomotive fire box low pressure steam heating boilers or equal thereof, to be installed in the courthouse.

Rochester, Minn.—Bids will soon be received for the construction of a new municipal electric-light plant. The estimated cost is $110,000. A. F. Wright is City Clk.

Attica, Kan.—Plans are being prepared for the construction of an electric-light plant. The estimated cost is $15,000. F. H. Kelburn, Woodward, Okla., is Engr.

Haviland, Kan.—The citizens have voted in favor of issuing $7000 in bonds, the proceeds of which will be used for the installation of a municipal electric-light plant.

Parker, Kan.—The citizens have voted to issue $5000 in bonds, the proceeds of which will be used for the installation of a municipal-electric light plant. C. O. Conrad is City Clk.

Sharon Springs, Kan.—Plans are being prepared for remodeling the lighting plant. The estimated cost is $10,000. W. E. Hulse & Co., Hutchinson, is Engr.

Osceola, Neb.—It is reported that the Osceola & Shelby Electric-Light, Heat & Power Co. plans to construct six miles of transmission lines and to purchase additional electrical appliances.

Billings, Mont.—The Montana Power Co. will construct an addition to its plant at an estimated cost of $20,000.

Campbell, Mo.—It is reported that the Campbell Public Service Co. plans to construct an addition to its power house and to purchase a new boiler and a Corliss steam or oil engine.

Brandon, Tex.—The Texas Light & Power Co. of Dallas will install an electric-lighting system in Brandon. The transmission line will be extended from Milford to Brandon.

Seguin, Tex.—Bids will be received until Aug. 10 by the Seguin Electric-Light & Power Co. for furnishing power plant equipment, including water wheels, transmission machinery, generator and switchboards. Owen A. Gafford is Mgr.

Grants Pass, Ore.—The citizens have voted in favor of granting a franchise to the Rogue River Public Service Corporation for the construction of a light and power plant.

Portland, Ore.—Bids will be received by R. H. Thomas, Clk., 401 Court House, until 4 p.m., Aug. 5, for the installation of a heating and ventilating system in the Franklin High School.

Exeter, Ont.—The rate-payers have voted to appropriate $20,000 for the installation of a hydro-electric system.

Otterville, Ont.—The Town Council is considering the installation of a hydro-electric system.

Petrolia, Ont.—An appropriation of $35,000 has been voted by the rate-payers for the installation of a hydro-electric plant and distribution system. Noted June 10.

BRIDGES

Montpelier, Vt.—Bids will be received until 7:30 p.m., Aug. 2, by J. M. Bontwell, Mayor, for the construction of a steel girder bridge with a concrete floor at State St. Noted July 8.

+Salem, Mass.—The Salem Rebuilding Commission has awarded the contract for the construction of a culvert and retaining wall to PETER BOMPIANI & CO., 14 Federal St., Boston, at $8881.

+Hartford, Conn.—The Board of Contract and Supply has awarded the contract for the construction of a reinforced-concrete beam bridge on Newfield Ave. to CHARLES A. SIBLEY, 902 Chapel St., New Haven, at $6726.

Albany, N. Y.—The Delaware & Hudson Co. has submitted plans for the construction of a bridge over Island Creek to the Public Service Commission. F. Pond is Bridge Engr. Noted June 24.

Cheektowga, N. Y.—(Forks post office)—The Public Service Commission, Buffalo, has appropriated $100,000 for the construction of a viaduct at Harlem Ave. Devoe P. Hodson is Comr.

Olean, N. Y.—It is reported that the city will construct a bridge over the Allegany River to connect Olean with South Olean. H. E. Bunce is City Engr.

Chatham, N. J.—Philip A. Hickey, Somerville, at $7333, submitted the lowest bid for the construction of a new bridge. He will probably be awarded the contract.

+New Brunswick, N. J.—(Official)—The Board of Chosen Freeholders of Middlesex County has awarded the contract for the construction of a reinforced-concrete bridge over the South River on the South Amboy-New Brunswick Rd. to the GENERAL CONTRACTING & ENGINEERING CO., 29 Rector St., New York, N. Y., at $66,714. Noted July 8 and 22.

+Pine Brook, N. J.—The Board of Chosen Freeholders of Morris and Essex Counties has awarded the contract for the construction of a bridge over the Passaic River at Pine Brook to the AVERILL-MATTHEWS CO., Clinton St., Newark, at $39,860. Noted July 8 and 22.

Trenton, N. J.—Bids will be received by the Board of Chosen Freeholders of Mercer County until 2:30 p.m., Aug. 3, for the following bridge work: Construction of a steel truss bridge with reinforced-concrete retaining walls over Doctor's Creek, Hamilton Township; reinforced-concrete bridge over Beedens Brook, Rosedale-Mt. Rose Rd.; bridge over Assunpink Creek, crossing Nottingham Way. Theodore Tobish is County Engr. Noted May 27.

★Media, Penn.—(Official)—Bids will be received until 10 a.m., Aug. 2, by the Commissioners of Delaware County for the construction of a reinforced-concrete bridge on Glenolden Ave. over Muckinapatus Creek, Glenolden Borough and Darby Township.

★Philadelphia, Penn.—(Official)—Bids will be received until noon, Aug. 2, by M. L. Cooke, Dir. Dept. of Pub. Wks., City Hall, for the construction of a bridge on line of Cambria and A. St., and one on line of Holme Ave. over Pennypacker Creek. Bids will also be received on Aug. 4 for a bridge on line of Whitby Ave. over Philadelphia & Baltimore & Washington R.R. and one on Front St. over the Municipal Hospital Drive.

+Pittsburgh, Penn.—The County Commissioners have awarded the contracts for bridge work as follows: Construction of reinforced-concrete arch in Richland Township to JOHN F. HOWLEY & CO., 237 Fourth Ave., Pittsburgh, at $5887; construction of reinforced-concrete arch in Moon Township and extension of Arch-Bridge No. 1, Kilbuck Run, Glenfield Borough to the ADAM LAIDLOW CO., Bessemer Bldg., Pittsburgh, at $9547; diversion of Pine Creek, eliminating County Bridges Nos. 17 and 18 in Shaler Township to J. TONER BARR, 237 Fourth Ave., Pittsburgh, at $11,290. J. G. Chalfont, Room 308, Courthouse, is County Engr. Noted July 8.

Reading, Penn.—E. B. Ulrich, City Engr., has approved the plans submitted by the Philadelphia & Reading Ry. for the rebuilding of the three bridges over the Lebanon Valley Railroad tracks at Center Ave. The estimated cost is $80,000. C. Dillenback, Reading, is Engr. of Bridges and Bldgs.

Sharon, Penn.—It is reported that the contract will soon be awarded for the construction of a bridge over the Shenango River at State St. for the county, city and the street railway company. The estimated cost is $40,000.

+West Milton, Penn.—The Philadelphia & Reading Ry. has awarded the contract for the construction of the substructure and masonry of a new bridge to replace the old structure to the ROBERT GRACE CONTRACTING CO., Pittsburgh. The estimated cost is $300,000. S. T. Wagner, Philadelphia, is Ch. Engr. Noted July 15.

Wilmington, Del.—Plans have been submitted to the War Department for the construction of a lift pattern bridge, 300 ft. long, across Lewes Canal connecting Delaware Bay with Rehoboth Bay. This bridge will carry the tracks of the Delaware, Maryland & Virginia R.R. Co. H. R. Leonard, Philadelphia, Penn., is Bridge Engr.

Leesburg, Va.—(Official)—Bids will be received until noon, Aug. 5, at the Clerk's Office for the construction of two reinforced-concrete bridges, one over Limestone Creek and the other over James Creek. The plans call for a 62-ft. 6-in. bridge with two 30-ft. spans over Limestone Creek and a 45-ft. bridge with two 20-ft. spans over James Creek. G. P. Coleman, Richmond, is State Highway Comr.

Radford, Va.—The construction of a highway bridge across the New River is contemplated by the city and the County Commissioners. William Ingles is Chn. of Com.

Grimesland, N. C.—Bids will be received until Aug. 2 by the Commissioners of Pitt County for the construction of a reinforced-concrete bridge across Chicod Creek near Grimesland.

Leesburg, Ga.—At a recent election the citizens voted in favor of the question of issuing $7500 in bonds, the proceeds of which will be used for the construction of a bridge.

Sardis, Miss.—Bids will be received by R. W. Draper, County Clk., until Aug. 2, for the construction of two steel bridges and one trestle with concrete abutments.

Lake Charles, La.—Bids will be received until 11 a.m., Aug. 3, by E. C. House, Clk. of Police Jury, for the construction of a steel draw bridge over Bayou Choupique on the Lockport-Ged Highway. F. H. Frankland is Bridge Engr.

Chattanooga, Tenn.—The Hamilton County Court has authorized a bond issue of $400,000 for the construction of an additional bridge across the Tennessee River.

Covington, Tenn.—An appropriation of $20,000 has been voted by the Tipton County Quarterly Court toward the construction of a bridge across Big Hatchie River. Lauderdale County will also contribute $20,000 toward the cost.

Dandridge, Tenn.—The Commissioners of Jefferson County Court have passed an ordinance appropriating $5000 for the construction of a bridge across the Houston River between Jefferson and Grainger Counties. The estimated cost is $15,000.

Cleveland, Ohio—A resolution authorizing a bond issue of $100,000 to provide for the engineering surveys and options on the property for the proposed bridge over the Cuyahoga River to connect Loraine Ave. either with Huron Road or Bolivar Ave. has been passed by the County Commissioners. The estimated cost is $5,000,000.

+Ironton, Ohio—The County Commissioners have awarded the contract for the construction of a bridge across Ice Creek at Coal Grove to the CAPITAL BRIDGE CO., at $19,112.

+Lebanon, Ohio—The Board of Commissioners of Warren County has awarded the contract for the construction of the superstructure of a high truss steel bridge over Caesar's Creek in Massie Township to the OREGONIA BRIDGE CO., Lebanon, at $3865; the contract for the substructure was awarded to G. C. HARDEN, Middletown, at $2600, and the contract for the construction of a bridge over Turtle Creek at West St. in the Village of Lebanon to the OREGONIA BRIDGE CO., at $1619. Noted June 24.

Mt. Gilead, Ohio—Bids will be received until 11 a.m., Aug. 29, by C. O. Huggins, Audr., Bd. of Commissioners of Morrow County, for the construction of the 124-ft. Beatty Bridge in Cardington Township.

+Indianapolis, Ind.—The Board of Public Works has awarded the contract for the construction of two additional spans to the West Washington St. Bridge over the White River to the NATIONAL CONCRETE CO., Indianapolis, at $110,000. Noted July 8 and 22.

+Sullivan, Ind.—The contracts for the construction of nine bridges have been awarded by the County Commissioners as follows: Construction of two steel bridges to the VINCENNES BRIDGE CO., Vincennes; construction of one steel

bridge to the MONTGOMERY PARKER CO., Hatfield; construction of six concrete bridges to GEORGE SOLLER, Princeton. Noted May 20.

Paris, Ill.—Bids will be received by A. Allen Brubaker, City Clk., until 2 p.m., Aug. 2, for the construction of a 60-ft. reinforced-concrete, steel plate girder reservoir bridge on the Chicago Rd. at Sugar Creek. K. J. Barr is County Supt. of Highways.

+Rockford, Ill.—(Official)—G. HOHN, Rockford, has been awarded the contract for the construction of three bridges as follows: Kishwaukee St. Bridge, $8870; 10th St. Bridge, $3590; 11th St. Bridge, $3540. Edwin Main is City Engr. Noted May 13 and June 24.

Green Bay, Wis.—At a recent election the citizens voted against the question of issuing $5000 in bonds, the proceeds of which was to have been used for the construction of a bridge over the East River at Pleasant St.

+Grant, Iowa—The contract for the construction of 19 new bridges and the repair of 11 old ones has been awarded to the STANDARD BRIDGE CO., Omaha, Neb.

+Griswold, Iowa—The contract for the construction of a steel bridge has been awarded to the LANA CONSTRUCTION CO., Council Bluffs, at $4547.

+Radcliffe, Iowa—N. M. STARK CO., Des Moines, at $11,777, has been awarded the contract for the construction of eight bridges by the County Board of Supervisors.

Waukon, Iowa—Bids will be received until noon, Aug. 3, for the construction of 13 reinforced-concrete bridges, culverts and abutments. William F. Shafer is County Audr.

Iola, Kan.—Bids will soon be received for the construction of a bridge across the Neosha River near Iola. The estimated cost is $20,000. W. S. Gearhart is Engr.

Topeka, Kan.—It is reported that a new bridge will be constructed across Butcher Creek at 21st and Madison St. The estimated cost is $5500. W. G. Tandy is Comr.

Wichita, Kan.—Bids will be received until Aug. 8 by H. M. Barrett, County Clk., for the construction of a reinforced-concrete bridge over the drainage canal on 21st St. The estimated cost is $8000. E. V. Moore, Wichita, is Engr. Noted July 15.

Minden, Neb.—A resolution has been passed by the County Supervisors asking the state to aid in the construction of a bridge across the Platte River between Buffalo and Kearney Counties. The estimated cost is $65,000, to be borne by the two counties and the state.

St. Paul, Neb.—The State has been asked by the County Commissioners to proceed with the construction of an 800-ft. bridge across Middle Loup River. The estimated cost is $50,000, half of which will be borne by the county. A. Johnson, Lincoln, is State Engr.

Aberdeen, S. D.—The construction of a bridge across Chester Creek is being considered by the city. The estimated cost is $32,000.

Florence, Mont.—Bids will be received until Aug. 3 by the Board of County Commissioners, Hamilton, for the construction of a bridge across the Bitter Root River. The plans call for two designs, a 220-ft. pin connected steel truss bridge with concrete abutments and a 120-ft. two riveted steel span bridge with concrete abutments and two tubular steel piers for center piers.

Houston, Tex.—Press reports state that the city will construct three reinforced-concrete bridges, one on Telephone Rd. and two on Humble St.

+Lipscomb, Tex.—The County Commissioners have awarded the contract for the construction of two steel bridges across Wolfe Creek to AUSTIN BROS., Dallas, at $10,800.

+Longview, Tex.—The BLODGETT CONSTRUCTION CO., Shreveport, La., has been awarded the contract for the construction of a 120-ft. steel bridge across the Sabine River.

+Port Sullivan, Tex.—The Commissioners Court of Milam and Robertson Counties, Hearne, has awarded the contract for rebuilding the bridge across the Brazos River at Port Sullivan to the VINCENNES BRIDGE CO., Vincennes, Ind., at $13,490.

+Runge, Tex.—The Commissioners of Karnes County have awarded the contract for the construction of 37 bridges and 63 corrugated iron culverts to the ALAMO CONSTRUCTION CO., San Antonio, at $35,750. L. L. Yates is Engr.

Antlers, Okla.—Bids will be received by the County Clerk until 5 p.m., Aug. 3, for the construction of five steel bridges across the Kiomichi River. Charles E. Hagerty, Muskogee, is Engr.

Tulsa, Okla.—Bids will be received until Sept. 1 for the construction of a bridge across the Arkansas River. The estimated cost is $200,000. R. R. Hughes is County Engr. Noted June 24 and July 22.

Silver City, N. M.—The construction of a bridge over the Gila River at Old Fort West is contemplated by the County Commissioners. The estimated cost is $20,000. F. L. Cox is County Engr.

Winkelman, Ariz.—At a recent election the citizens voted in favor of the question of issuing $150,000 in bonds, the proceeds of which will be used for the construction of a bridge across the Gila River near Kelvin.

+Colfax, Wash.—The County Commissioners have awarded the contracts for the construction of four bridges as follows: A 60-ft. span at Pullman to CHARLES G. HUBER, Seattle, at $3769; a 40-ft. span at Clinton to W. A. LAUDER, Spokane, at $1745; a 25-ft. span at Garfield and a 30-ft. span at Farmington to H. C. MALLOTT, Seattle, at $1672 and $1536 respectively. Noted June 24.

Marblemount, Wash.—A. L. Strong, County Engr., is preparing preliminary plans for the construction of a 200-ft. bridge over Diasbud Creek.

Olympia, Wash.—Bids will be received until Aug. 9 by William A. Roy, State Highway Comr., for the construction of a steel riveted truss bridge, 195 ft. long, over the Snohomish River on the Olympic Highway in Mason County.

+Seattle, Wash.—The Commissioners of King County have awarded the contract for the construction of the Fall City Bridge to M. P. ZINDORF, Alaska Bldg., Seattle, at $27,522. A. P. Denton is County Engr. Noted July 1.

Seattle, Wash.—The Commissioners of King County have rejected all bids for the construction of the Stossel Bridge. Noted June 17 and July 15.

Seattle, Wash.—(Official)—The lowest bids received by the Board of Public Works for constructing the Lake Washington Canal bridges were as follows: 15th Ave. N. W. substructure, Booker, Kill & Whipple, Central Bldg., Seattle, $92,145; Superstructure Beers Building Co., Pitlock Bldg., Portland, Ore., $146,049; Fremont Ave. substructure, Pacific States Construction Co., Burke Bldg., Seattle, $112,651; superstructure, Beers Bldg. Co., $154,601. There were 21 bids submitted for the work. Noted June 17 and July 1.

+Tacoma, Wash.—(Official)—Bids were received July 7 by the State Highway Board, Olympia, for the construction of a reinforced-concrete bridge over the Mashell River, Pierce County, as follows: (a) Design No. 1, (b) Design No. 2, McRae Bros., Seattle, (a) $14,532, (b) $15,340; H. C. MALOTTE, Seattle, (a) $8850, (b) $7850 (awarded contract); Zindorf & Tiderol, Seattle, (a) $10,628, (b) $9836.76; Ferch & Gass, Seattle, (a) $12,700; Nettleton-Bruce-Eschbach Co., Seattle, (a) $12,200, (b) $12,700; Yelverton & Wolf, Olympia, (a) $10,285.61, (b) $10,655.17; Graff & Sheldon, Tacoma, (a) $8497, (b) $8300; Howard S. Wright, Everett, (a) $11,971, (b) $11,459; Pacific States Construction Co., Seattle, (a) $13,930, (b) $15,015; Charles G. Huber, Seattle, (a) $11,000, (b) $10,990; J. Hanson, Tacoma, (a) $10,781, (b) $11,661; Erle & Charles W. Maxham, Tacoma, (a) $11,750. (b) $11,900. Noted June 24.

+Tillamook, Ore.—The City Council has awarded the contract for the construction of a steel draw bridge across Hoquarton Slough to the FEENEY-BREMER CO., at $6650. Noted July 8.

El Monte, Calif.—Bids will be received until Aug. 2 by the Board of Supervisors of Los Angeles County for the construction of a steel girder bridge with concrete abutments and steel cylinder concrete piers across the San Gabriel River at El Monte. The estimated cost is $135,000.

Igo, Calif.—The County Supervisors have rejected all bids for the construction of a steel bridge over Clear Creek, and have decided to call for plans for a bridge of reinforced concrete.

Kennett, Calif.—(Official)—Bids will be received until Aug. 21 by S. N. Witherau, Clk., Bd. of Supervisors of Shasta County, Redding, for the construction of a wood and steel bridge with three 200-ft. spans and three 300-ft. spans across the Sacramento River at Kennett. The estimated cost is $20,000. C. R. Wiezel is City Engr. Noted June 24.

+Marysville, Calif.—(Official)—The Board of Supervisors of Yuba County has awarded the contract for the construction of three reinforced-concrete bridges on line of the State Highway across Best Slough, Dry Creek and Grasshopper Creek to JENKINS & WELLS, Sacramento, at $14,500. L. B. Cook is County Engr. Noted July 15.

Modesto, Calif.—Plans have been approved by the Board of Supervisors of Stanislaus County and bids will soon be received for the construction of a bridge across the Tuolumne River about eight miles east of Waterford. E. H. Annear, Modesto, is County Engr.

+Oakdale, Calif.—The Board of Supervisors of Stanislaus County has awarded the contract for the construction of a steel bridge across Wildcat Cañon, between Oakdale and Knight's Ferry, to the ROSS CONSTRUCTION CO., at $10,000.

+San Jose, Calif.—The Board of Supervisors of Santa Clara County has awarded the contracts for the construction of bridges as follows: Bridge over Campbell Creek on the Homestead Rd. to M. E. KILCOURSE, San Jose, at $4387; bridges over San Tomas, Calabasas and Permenente Creeks to JOHN DOYLE, San Jose, at $5730. Noted July 1.

+St. Boniface, Man.—The City Council has awarded the contract for the construction of the superstructure of the Provencher Ave. Bridge to the DOMINION BRIDGE CO., Lachine Locks, Que., at $264,000.

WATER SUPPLY—IRRIGATION

Pittsfield, Mass.—It is reported that the General Electric Co. has completed plans for the construction of a reservoir at Perinne Ave. The estimated cost is $110,000. Noted Aug. 27.

Centerville, N. Y.—Bonds for $35,000 have been sold. The proceeds will be used for the construction of a water system.

LeRoy, N. Y.—At a recent election the citizens voted in favor of the question of issuing $15,000 in bonds. The proceeds will be used for the extension of the water system. Noted Mar. 25 and June 17.

Lockport, N. Y.—Bids will be received by William G. Spalding, Clk., Bd. of Water Comrs., until Aug. 5 for the construction of a 10-in. and 12-in. water pipe in Market and Mill St. Noted June 24 and July 1.

+Rochester, N. Y.—The Board of Contract and Supply has awarded the contract for laying water mains to W. E. KINNEY, Rochester, at $10,556.

★Wellsville, N. Y.—(Official)—Bids will be received until noon, Aug. 25, by the Board of Water and Light Commissioners, for the construction of improvements to the water system. Plans may be seen at the office of the Board at Wellsville or at the office of Charles C. Hopkins, Engr., Rochester. F. M. Leonard is Acting Clk.

Camden, N. J.—Plans have been prepared for the construction of an auxiliary pumping station at Morris Station. The plans provide for a building in which will be installed two pumps each with a daily capacity of 5,000,000 gal. Noted May 6.

Philadelphia, Penn.—An expenditure of $30,000 for the improvement of the water supply of South Philadelphia is contemplated.

Castlewood, Va.—According to press reports the Castlewood Water Co. has been incorporated with a capital of $5000 by J. W. Huff, Pres. and R. S. Gose, Secy., Treas.

+Covington, Va.—The city has awarded the contract for the construction of a 2,000,000-gal. concrete reservoir and improvements to the water system to BEARDSLEY, DONGAN & BEARDSLEY, McBain Bldg., Roanoke, at $12,021. Harry Stevens, Washington, D. C., is Engr. Noted June 10 and 24.

Harrisonburg, Va.—Bonds for $60,000 have been appropriated by the Town Council. The proceeds will be used for the construction of a filtration plant. Noted Jan. 21.

Keyser, W. Va.—At a recent election the citizens voted in favor of issuing $35,000 in bonds. The proceeds will be used for the construction of a water system. Leander Schaidt, Cumberland, Md., is Engr. Noted June 3.

Boston, Ga.—The water system will be extended. W. Hopson Goodloe, Macon, is Engr.

Coolidge, Fla.—An election will be held Aug. 16 to vote on the question of issuing $4500 in bonds, the proceeds of which will be used for the construction of a water system. G. T. Knight is Mayor.

Palmetto, Fla.—An election will be held Aug. 10 to vote on the question of issuing $16,000 in bonds. The proceeds will be used for the construction of water and sewer systems. Noted Feb. 25.

Tutwiler, Miss.—The city plans to issue $15,000 in bonds. The proceeds will be used for the construction of water and sewer systems.

Bellbuckle, Tenn.—At a recent election the citizens voted against the question of issuing bonds for $25,000, the proceeds of which was to have been used for the construction of a water system. Noted June 24.

+Covington, Ky.—The contract for furnishing the city with 2000 tons of 24-in. c.-i. pipe for the construction of the emergency main from the Ft. Thomas reservoir to Covington has been awarded to the UNITED STATES CAST IRON PIPE & FOUNDRY CO., Addyston, Ohio, at $92,000.

East View, Ohio—(Warrensville post office)—Bids will be received until noon, Aug. 12, by Charles E. Burger, Clk., for the purchase of $7556 in bonds. The proceeds will be used for laying 6-in. water mains in Elm and Allen St.

Hamilton, Ohio—Bonds for $10,000 have been authorized by the Public Service Commission. The proceeds will be used for the installation of three new 10-in. wells and intake for the water works system. Joseph B. Meyers is Dir. of Pub. Ser.

Maumee, Ohio—Bids will be received by Thomas N. Dowling, Clk., until 7.30 p.m., Aug. 23, for the purchase of $56,000 in bonds. The proceeds will be used for the construction of a water works system. Noted Aug. 6 and 13.

Redkey, Ind.—The Redkey Water Works Co. will install a water works system. Bonds for $10,000 have been sold for this purpose. Noted Apr. 15.

Manitowoc, Wis.—The city has rejected all bids for the construction of water mains and has decided to do the work by day labor.

Milwaukee, Wis.—Bids will be received by the Department of Public Works until 10:30 a.m., Aug. 3, for laying c.-i. water pipe and setting hydrants on Florida St.

Murphysboro, Ill.—(Official) — The Murphysboro Water Works, Electric & Gas Light Co. has engaged Edward Flad & Co., Consult. Engr., De Menil Bldg., St. Louis, Mo., in connection with the installation of a filtration plant for the water system.

Wittenberg, Wis.—Bonds for $12,000 have been sold by the city. The proceeds will be used for the installation of a municipal water works system. Noted Apr. 8 and May 27.

Cresco, Iowa—Bonds for $10,000 have been sold by the Commissioners of Howard County. The proceeds will be used for the construction of a water system.

Denison, Iowa—(Official)—The date for receiving bids for drilling an artesian well has been extended to Aug. 12. All bids received on July 22 were rejected. E. F. Tucker is City Clk. Noted July 15.

Kingsley, Iowa—Bids will be received by W. R. Payne, Town Clk., until Aug. 5 for a 100,000-gal. water tank.

Marshalltown, Iowa—The Lynchburg Foundry Co., Lynchburg, Va., was the lowest bidder for furnishing the city with water pipe, at $23.85 per ton for 6-, 8- and 12-in. pipe and $25.85 per ton for 4-in. pipe.

Sidney, Iowa—At a recent election the citizens voted in favor of the question of issuing $20,000 in bonds. The proceeds will be used for the extension of the water system.

Attica, Kan.—Plans are being prepared for the construction of a water system. The estimated cost is $15,000. F. H. Kilburn is Engr.

+Larned, Kan.—(Official)—The contract for making improvements to the water system, including motor-driven pumps, test boilers, steam and exhaust piping and auxiliary boiler room equipment, and constructing a stack has been awarded to the MERKLE-HEINES MACHINERY CO., at $26,-170. Noted July 15.

+Pratt, Kan.—The contract for the extension of the municipal water system has been awarded to BASH & JAMES, Joplin, Mo., at $31,980. Other bidders were: English Tool & Supply Co., Kansas City, Mo., $27,000 (incomplete bid); Commercial Construction Co., Kansas City, Mo., $32,990; Merkle-Hines Co., Kansas City, Mo., $30,500. The E. T. Archer Co., New England Bldg., Kansas City, Mo., is Engr. Noted July 24.

Norfolk, Neb.—(Official)—An election will be held Aug. 2 to vote on the question of issuing $10,000 in bonds, the proceeds of which will be used for the extension of the water system. Noted July 15.

Veblen, S. D.—Press reports state that the town contemplates holding an election to vote on the question of issuing $16,000 in bonds. The proceeds will be used for the construction of a water system.

Watertown, S. D.—Bids will be received by the City Auditor until Aug. 2 for furnishing c.-i. pipe and castings. F. W. Shreiber is City Engr.

Chouteau, Mont.—(Official)—Bids will be received until 8 p.m., Aug. 9, by A. L. Powers, Town Clk., for the construction of a municipal water system. The work includes the installing of electric pumps, laying mains and the construction of a concrete reservoir. The estimated cost is $42,000. Swearingen & McCulloh, Chouteau, is City Engr. Noted June 24.

Fromberg, Mont.—Bids will be received by Charles J. Jones, Town Clk., until Aug. 14 for the construction of a water system. The estimated cost is $17,500. B. C. Lillis, Billings, is Engr. Noted July 1.

Helena, Mont.—The construction of a 6300-ft. flume has been recommended to the City Council by the Water Commission.

Lees Summit, Mo.—The citizens contemplate holding an election to vote on the question of issuing bonds for the construction of a reservoir and pumping station.

Lees Summit, Mo.—The citizens have subscribed a fund of $18,000 to form a company for the purpose of constructing a five-mile pipe line from the County Hospital. O. C. Browning is interested.

+St. Louis, Mo.—The city has awarded the contract for installing two 350-hp. boilers at high service pumping station No. 2 to the HEINE SAFETY BOILER CO., at $15,126. Noted July 8.

Washington, Mo.—An election will be held to vote on the question of issuing $60,000 in bonds, the proceeds of which will be used for the purchase of the water system. If the plant is purchased improvements will be made.

Leslie, Ark.—The city plans to issue bonds, the proceeds of which will be used for the construction of a water system. W. F. Cook, Jr., Little Rock, is Engr. Noted Mar. 18.

+Bangs, Tex.—The contract for developing a water supply for the proposed water system has been awarded to CHARLES HART & SONS.

Beaumont, Tex.—All bids received July 14 for the construction of a c.-i. pipe have been rejected. Bids will be received until Aug. 17 for this work. Burns & McDonnell, Scaritt Bldg., Kansas City, Mo., is Engr. Noted July 1.

Elgin, Tex.—At a recent election the citizens voted in favor of the question of issuing $11,000 in bonds. The proceeds will be used for the construction of a water system. Noted June 24 and July 1.

+Lehigh, Okla.—The contract for the extension of the water system has been awarded to W. S. SWANWICK, Joplin, Mo., at $38,600. The Benham Engineering Co., Oklahoma City, is Consult. Engr. Noted May 13.

Edgewater, Colo.—An election will be held Aug. 2 to vote on the question of issuing $72,000 in bonds. The proceeds will be used for the construction of a water system. C. W. Gist is Town Clk.

Denver, Colo.—The VaSant-Houghton Engineering Co., San Francisco, Calif., has been engaged to prepare preliminary plans for the construction of a new municipal water system. The estimated cost is $150,000. Noted July 1.

Sugar City, Idaho—At a recent election the citizens voted in favor of the question of issuing $15,000 in bonds. The proceeds will be used for the installation of a water system.

Bingham Canyon, Utah—Bids will be received until Aug. 5 by F. W. Quinn, Clk., for the purchase of $17,000 in bonds. The proceeds will be used for the improvement of the water system.

Logan, Utah—Bids have been received for constructing (a) a five-mile 22-in. pipe line and (b) for a 1,000,000-gal. reservoir as follows: Olof Nelson, Logan, (a) $49,550, (b) $16,612; Owen H. Grey, Salt Lake City, (a) $53,673, (b) $18,447; J. E. Wilson, Logan, (a) $54,011, (b) $20,616. Noted July 8.

Florence, Ariz.—F. N. Ensign, Phœnix, is preparing plans for the construction of a municipal water works plant and an electric-light system. The estimated cost is $50,000.

Hillyard, Wash.—The city plans to issue $6000 in bonds. The proceeds will be used for the construction of a water system.

Seattle, Wash.—Plans have been approved by the Board of Public Works for the construction of water mains in 59th Ave., N. E. The estimated cost is $6000.

+Wenatchee, Wash.—The Trustees of the West Okanogan Irrigation District have awarded the contract for the construction of an irrigation system, to serve 10,000 acres, to the GUTHRIE, McDOUGAL & CO., Portland, at $510,650.

Milwaukee, Ore.—An election will soon be held to vote on the question of issuing $15,000 in bonds. The proceeds will be used for the extension of the water mains from Milwaukee to Portland.

+Mono Lake, Calif.—The contract for the construction of a reinforced-concrete irrigation dam has been awarded to the DUNCANSON-HARRELSON CO., Chronicle Bldg., San Francisco. The estimated cost is $250,000.

San Rafael, Calif.—An election will be held Aug. 28 to vote on the question of issuing $300,000 in bonds. The proceeds will be used for the construction of a municipal water system.

The Narrows, Man.—Plans will soon be prepared for the construction of a new water system. The estimated cost is $80,000. H. H. Elliott is Town Clk. Noted July 8.

Canora, Sask.—Plans are being prepared by Chipman & Power, Mail Bldg., Toronto, for the installation of a water system. The estimated cost is $20,000. Noted July 22.

SEWERS

+Augusta, Maine—The contract for the construction of sewers in Pope, Middle, Bridge, Liberty and Spruce St. has been awarded to THOMAS HICKEY.

Portland, Maine—The city has made a supplementary appropriation of $30,000 for the construction of the East Side Intercepting Sewer and the proposed Libbytown Gulley Sewer.

+Andover, Mass.—(Official)—The Board of Public Works has awarded the contract for the construction of the Abbott and Marland sewer system to CENENDELLA & CO., Milford, at $39,739. Other bids were: Philip Holland, $39,980; F. E. McDonough, $46,000; J. Wagenbauch, $40,242; D. Sheean, $46,-000; J. J. Evans, $41,200; Rosso & Co., $40,700; C. E. Trumbull Co., $45,000; Morrison & Young, $45,891. Noted July 15.

Lowell, Mass.—The City Council has voted to borrow $20,000 for the completion of the sewer system.

★**Pittsfield, Mass.**—(Official)—Bids will be received until Aug. 4 by the Clerk of the Board of Public Works for the construction of sanitary sewers and filtration beds. A. B. Farnham is City Engr. Noted May 27.

Salem, Mass.—The City Council has appropriated $7000 for the construction of sewers in Cleveland Rd., Loring Ave. and connecting streets.

Wallingford, Conn.—Bids will be received until Aug. 3 by John E. Martin, Warden, for the construction of tile pipe sewers and for the completion of the low-level trunk sewer. W. A. Mackenzie is City Engr.

✚**New York, N. Y.**—(Borough of Brooklyn)—(Official)—Contracts for sewer construction have been awarded to the STANHOPE CONTRACTING CO., 404 Stanhope St., Brooklyn, at $15,995, for constructing sewers in 15th St.; and JOHN C. SCHRADE, Inc., 2132 Beverly Rd., Brooklyn, at $2503, for constructing sewers in Gravesend Ave. Noted July 15.

✚**New York, N. Y.**—(Borough of Brooklyn)—(Official)—The contract for installing complete the mechanical equipment at the 26th Ward Disposal Works at Hendrix St. and Vandalia Ave. has been awarded to the NORTH EASTERN CONSTRUCTION CO., 225 Fifth Ave., N. Y., at $4698. Noted July 22.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 2 p.m., Aug. 3, by Marcus M. Marks, Borough Pres., for the relocation and reconstruction of sewers in Rector St.

✚**New York, N. Y.**—(Borough of Manhattan)—(Official)—Contracts for sewer construction have been awarded to the KINGSBRIDGE CONTRACTING CO., at $144,404, for constructing sewers in East 41st St. and in Madison Ave.; and to the LACONIA CONTRACTING CO., at $10,926, for constructing sewers in Wall St. Noted July 15.

✚**New York, N. Y.**—(Borough of Manhattan)—(Official)—The contract for improving the sewer in 32nd St. from Broadway to Fifth Ave. has been awarded to P. J. KEARNS, at $7198. Noted July 22.

Syracuse, N. Y.—Bids will be received until Aug. 4 by Harry J. Hamlin, Secy., Intercepting Sewer Board, for the construction of storm-water sewers in the northeasterly section of the city.

Utica, N. Y.—Bonds for $18,000 have been sold, the proceeds of which will be used for the construction of the Kossuth Ave. relief sewer. A. M. Burke is City Comptroller.

Bayonne, N. J.—Bids will be received until 4 p.m., Aug. 3, by the Board of City Commissioners for the reconstruction of sewers and appurtenances in West First St. William P. Lee is City Clk.

Newark, N. J.—(Official)—Bids will be received until 3:15 p.m., Aug. 5, by M. R. Sherrerd, City Engr., for the construction of sewers in Lexington and North 12th St.

Trenton, N. J.—The Board of City Commissioners has authorized the construction of a sewer system in Melrose Ave. Frank Thompson is City Clk.

Bellwood, Penn.—(Official)—The State Board of Health has approved plans for the construction of a sanitary sewer system. Noted Feb. 4.

Erie, Penn.—Plans have been prepared for the construction of an experimental sewage-disposal plant. The estimated cost is $8000. E. B. Briggs is City Engr.

Juniata, Penn.—(Official)—The State Board of Health has approved plans for the construction of a sanitary sewer system.

★**Lebanon, Penn.**—(Official)—Bids will be received by the Mayor and the City Council until 5 p.m., Aug. 18, for the construction of a sewage-disposal plant. T. R. Crowell is City Engr. and D. M. Sharp is City Clk. Noted July 15.

South Connellsville, Penn.—At a recent election the citizens defeated the question of issuing $30,000 in bonds. The proceeds of which was to have been used for the construction of a sewer system. Noted June 17.

West Chester, Penn.—It is reported that the Borough Engineer will prepare plans for the construction of a sewage pumping station at Everhart Grove.

Baltimore, Md.—Plans have been prepared for the construction of approximately eight miles of lateral sewers. The estimated cost is $100,000.

Richmond, Va.—Bids will soon be received by the City Engineer for the construction of sewers in various streets. The estimated cost is $42,000.

Eustis, Fla.—An election will be held about Aug. 13 to vote on the question of issuing $20,000 in bonds. The proceeds will be used for the construction of approximately three miles of sanitary sewers and Imhoff tanks. Noted Nov. 12.

Largo, Fla.—Bids will be received until Aug. 3 by the Pinellas County Commissioners for the construction of a sanitary sewer system and a septic tank.

Palmetto, Fla.—An election will be held Aug. 10 to vote on the question of issuing $16,000 in bonds. Part of the proceeds will be used for the construction of sewers. Charles Dennett is Mayor.

Starke, Fla.—An election will be held Oct. 5 to vote on the question of issuing $26,000 in bonds. The proceeds will be used for the construction of a sewer system. C. F. Hoover is Mayor. Noted May 6.

Clarksdale, Miss.—Bids will be received until Aug. 3 by W. S. Bobo, City Engr., for the sale of $15,000 in bonds. The proceeds will be used for the construction of sewers. Noted July 8.

Tutwiler, Miss.—The city contemplates issuing $15,,000 in bonds. Part of the proceeds will be used for the construction of a sewer system.

Harlan, Ky.—At a recent election the citizens voted to issue $7500 in bonds. The proceeds will be used for the construction of a sewer system. Noted June 24 and July 15.

✚**Madisonville, Ky.**—The contract for the construction of a sewer has been awarded to the QUINN CONSTRUCTION CO., Nashville, Tenn., at $6057.

Akron, Ohio—The State Board of Health has given the city six months in which to repair, improve or enlarge the sewage-disposal plant at the County Infirmary grounds.

✚**Cincinnati, Ohio**—(Official)—Contracts for the construction of the Walworth Run Diversion Sewer have been awarded to HOAG & ZULLO, Cleveland, Section No. 1, at $114,900 and to DONOLLEY & GRAHAM, Cleveland, Section No. 2, at $101,-262. Noted July 15.

✚**Cincinnati, Ohio**—(Official)—The contract for the construction of sewers in the Madisonville Sewer District, Contract No. 3, has been awarded to THOMAS P. STRACK, Cincinnati, at $61,756. Noted July 22.

✚**Cincinnati, Ohio**—(Official)—The contract for the construction of sewers in East Third St. and Hamilton Ave. has been awarded to THOMAS MALONEY, at $5059 and $22,-827 respectively. Noted July 8.

✚**Cincinnati, Ohio**—(Official)—The contract for the construction of main and lateral sewers and drains with appurtenances in Seitz, Dorsey and Goethe St. has been awarded to HENKEL & SULLIVAN, Cincinnati, at $11,912. Noted July 1.

Cleveland, Ohio—The State Board of Health has made an extension of two years in which to stop the pollution of the Cuyahoga River.

Columbus, Ohio—Bids will be received until Aug. 3 by the Director of Public Service for the construction of the Milo main trunk sewer, Contract No. 4.

Dayton, Ohio—Bids will be received until Aug. 1 by J. E. Bartow, Dir. of Pub. Ser., for the construction of sewers in Old Orchard, Summit, Second, Arbor, Evanston, Eaton, Commercial and Highland St. F. O. Eichelberger is City Engr. Noted Apr. 22.

Delphos, Ohio—Bonds for $12,387 have been sold, the proceeds of which will be used for the construction of a sewage-disposal plant.

Lakewood, Ohio—Plans have been approved by the State Board of Health, Columbus, for the construction of a sewage-disposal plant.

Northfield, Ohio—(Official)—No bids were received July 19 by C. S. Machwart, Village Clk., for the construction of 12,000 ft. of 4-in., 3000 ft. of 6-in. tile drain, 444 ft. of 15-in. corrugated culvert pipe and 10 bbl. portland cement. Noted July 15.

✚**Painesville, Ohio**—The contract for the construction of storm sewers in Richmond St. has been awarded to TONY TRIFILETTE, Lorain, at $11,813.

Sandusky, Ohio—The State Board of Health, Columbus, has approved plans for the construction of a sewage-disposal plant and an intercepting sewer system. The estimated cost is $200,000.

Toledo, Ohio—Plans are being prepared by William H. Gould, County Sanitary Surveyor, for the construction of 14 miles of 8-, 10-, 12-, 15-, 18- and 24-in. vitrified pipe sewers.

Toledo, Ohio—Bids will be received until noon, Aug. 3, by Charles J. Sanzenbacher, Audr., Lucas County Comn., for the construction of local sanitary sewer No. 18, in Lucas County.

Brazil, Ind.—(Official)—The city will not construct the proposed sanitary sewers in the West End as was noted in the issue of July 8. F. C. Wilson is City Engr.

✚**Logansport, Ind.**—A contract for sewer construction has been awarded to PALMER, MOORE & CO.

✚**Grand Rapids, Mich.**—(Official)—The contract for the construction of approximately six miles of 8- to 18-in. pipe sewers and a sewage-disposal plant has been awarded to A. H. PRANGE, Grand Rapids, at $37,000. Other bids were: Harry Vander View, $37,500; J. N. Bick, $38,200; Whaley & Edwards, $38,300; Allegan County Construction Co., $39,300; Verhey & Kart, $40,000. Noted June 10.

Reed City, Mich.—The contract will be awarded about Aug. 12 for the construction of sewers. The estimated cost is $15,000. M. W. Brown is Chn. of Sewer Com.

Chrisman, Ill.—The city contemplates the construction of sewers. The estimated cost is $9500. George W. Fair is City Engr.

Rock Island, Ill.—Plans have been submitted to the Board of Local Improvements for the construction of storm drains in the southern section of the city. The estimated cost is $10,000. Wallace Treicher is City Engr.

Wenona, Ill.—(Official)—We have been advised by F. H. Ong, City Clk., that the contract for the construction of a sewer system with septic tanks will be awarded without fail on Aug. 3. Noted June 24.

✚**Milwaukee, Wis.**—(Official)—The contract for the construction of 11 reinforced-concrete tanks on pile foundation has been awarded to JOHN F. CASEY CO., Pittsburgh, Penn., at $55,000. Noted July 8.

Whitewater, Wis.—The lowest bid submitted for the construction of sewers was that of M. A. Lanyon, Waukegan, Ill., at $23,900. Noted July 8.

Cherokee, Iowa—(Official)—Bids will be received until July 30 by William Shardlow, City Clk., for the construction of approximately 3½ miles of sanitary sewers. The estimated cost is $16,000. G. Y. Skeels, Sioux City, is Engr. Noted July 1 under Idagrove, Iowa.

Fairfield, Iowa—Bids will be received until Aug. 7 by the City Clerk for the construction of a sanitary sewer. The estimated cost is $10,000.

Laporte City, Iowa—Bids will be received until 8 p.m., Aug. 4, by G. E. Stebbins, Town Clk., for the construction of sewers and a sewage-disposal plant. M. Tschirgi & Sons, Cedar Rapids, is Engr. Noted June 24.

✚**Eveleth, Minn.**—(Official)—The contract for the construction of a sewage-disposal plant has been awarded to the EVELETH CONSTRUCTION CO., Eveleth, at $34,900. Noted June 24.

✚Clyde, Kan.—The contract for the construction of a sewer system has been awarded to BASH & JAMES, Joplin, Mo., at $15,299. Other bids were: P. A. Johnson, Kansas City, $17,275; Axtel G. Oldham, Kansas City, Mo., $15,915; James Stanton, Leavenworth, $19,254; Eby Construction Co., Wellington, $15,891; Inter Mountain Bridge & Construction Co., Tecumseh, Neb., $18,122; Gilkeson & Martin, Muskogee, Okla., $17,485; McCoy & Taylor, Kansas City, Mo., $20,309; Tonkawa Construction Co., Kansas City, Mo., $16,640. Noted July 8.

Hutchinson, Kan.—Bids will be received until 3 p.m., Aug. 3, by G. W. McLane, City Engr., for sewer extensions. The estimated cost is $10,000. Noted July 1.

Norton, Kan.—Bids will be received until 7:30 p.m., Aug. 2, by Vernie Fawcett, City Clk., for the construction of main, intercepting and lateral sewers and a sewage-disposal plant. Worley & Black, Reliance Bldg., Kansas City, Mo., is Engr

✚Pratt, Kan.—The contract for sewer construction has been awarded to the LAUNDER CONSTRUCTION CO., Kansas City, Mo., at $11,500. Noted June 24.

Topeka, Kan.—Bids have been received for the construction of the East Side sewer from the Commercial Construction Co., Chicago, Ill., $127,375; J. A. Pringle, Topeka, $125,834; F. M. Torson, Kansas City, $105,430. A. R. Young is City Engr. Noted June 24.

Wichita, Kan.—The city contemplates the construction of sewers in the northern section of the city. The estimated cost is $4000.

Bridgeport, Neb.—Bids will be received until Aug. 3 by the City Clerk for the construction of approximately 5700 ft. of 12-in. and 3400 ft. of 10-in. sewers. Noted Mar. 25.

Grand Island, Neb.—The City Council contemplates holding an election to vote on the question of issuing $100,000 in bonds. The proceeds will be used for the construction of sewers. Noted Mar. 18.

Watertown, S. D.—(Official)—Bids will be received until 8 p.m., Aug. 16, by O. M. Lane, City Audr., for the construction of approximately 1558 ft. of 15-in., 5004 ft. of 18-in., 2112 ft. of 30-in. and 2167 ft. of 33-in. of sanitary sewers, 1186 ft. of 36-in., 3469 ft. of 42-in., 5034 ft. of 57-in. storm sewers, pumping station, and 4824 ft. of 16-in. c.i. force mains. The estimated cost is $112,000. F. W. Schreiber is City Engr. Noted July 1.

★Dallas, Tex.—(Official)—Bids will be received until 10:30 a.m., Aug. 23, by J. B. Winslett, City Secy., for the construction of improved sewerage works, Contract No. 5, North Interceptor, Contract No. 6, pumping station, 36-in. force main and Oak Cliff trunk line across the Trinity River, Contract No. 7, disposal works including 36-in. force main from Station No. 5 plus 88.7 to the disposal works.

Santa Anna, Tex.—At a recent election the citizens voted to issue $6000 in bonds. The proceeds will be used for the construction of a sewer system.

✚Moscow, Idaho—(Official)—The contract for the construction of sanitary sewers has been awarded to GEORGE E. WYCOFF, Spokane, Wash., at $11,879. Noted July 8.

Harrington, Wash.—An election will be held July 31 to vote on the question of issuing bonds, the proceeds of which will be used for the construction of a sewer system.

Enterprise, Ore.—The city contemplates the construction of lateral sewers in various streets estimated to cost $23,000.

Los Angeles, Calif.—J. Chutuk, at $39,118, submitted the lowest bid for the construction of sewers in Temple St. from Oxford Ave. to Kingsley Drive and in other streets.

✚Oakland, Calif.—The City Council has awarded the contract to the TIBBITTS-PACIFIC CO., San Francisco, at $9679, for the construction of the North Side sewer.

✚Santa Cruz, Calif.—The contract for the construction of sewer extensions has been awarded to D. BRYNE, at $11,770.

New Toronto, Ont.—It is reported that the city of New Toronto and Mimico will construct a sewer system and a sewage-disposal plant. The disposal plant will be built in Mimico. The estimated cost is $50,000.

St. Thomas, Ont.—Plans are being prepared by W. N. Ferguson, Engr., for the construction of a sewage-disposal plant. The estimated cost is $15,000.

Vancouver, B. C.—Plans have been approved by the Joint Sewerage Commission for the construction of the Hastings Park trunk sewer. The estimated cost is $200,000.

Victoria, B. C.—(Official)—The Council plans an expenditure of $74,654 for paving and sewer construction. The work will be done by day labor. Noted July 15.

GARBAGE

Gainesville, Fla.—The city contemplates the construction of a garage incinerator.

Fresno, Calif.—An election will soon be held to vote on the question of issuing $50,000 in bonds. The proceeds will be used for the construction of an incinerator.

Lachme, Que.—The city will soon start work on the construction of a new incinerator.

STREETS AND ROADS

✚Augusta, Maine—(Official)—Contracts have been awarded for constructing roads as follows: Hermon Rd., 1.09 miles to the AHERN CONSTRUCTION CO., Willimantic, Conn., $7369; Ellsworth Rd., 0.78 mile to the AHERN CONSTRUCTION CO., Willimantic, Conn., $5610; Brewer Rd., 0.43 mile to H. A. & S. G. DAY, Bangor, $1905; Monson Rd., 2.27 miles, to JAMES H. KERR, Rumford, $13,850.

✚Hinsdale, N. H.—A contract for constructing the state road and grading the hills on Brattleboro St. has been awarded to JAMES E. HELYAR, Brattleboro, at $7000.

Beverly, Mass.—The City Council plans to repave Rantoul St. from Bow to Chestnut St.

Boston, Mass.—Bids will be received until Aug. 3 by the State Highway Commission for constructing 5200 lin.ft. of road in Ashburnham and 5200 lin.ft. of road in Chelmsford. Arthur W. Dean is Ch. Engr. of Comn.

Quincy, Mass.—The sum of $15,300 has been appropriated for road work on a number of streets. Chester I. Campbell is Mayor.

✚Glastonbury, Conn.—A contract for paving Naubuc Ave. with macadam has been awarded to the R G. MILLER CONSTRUCTION CO.

★Albany, N. Y.—(Official)—Bids were received July 26 by the State Highway Commissioner for constructing Road No. 5498, Cornwall-West Point, Parts 1 and 2, Orange County, 4.03 miles. John J. Hart, Peekskill, $280,065; Nordone & Petrillo, Mt. Vernon, $294,545; Samuel Besmin, Inc., Beacon, $295,823; William Horne Co., New York, $297,822; P. J. Joyce Co., Inc., New York, $298,620; James M. Hamilton & Co., Gardner, $299,310; James Anderson, Menands, $312,040; Cleveland & Sons Co., Brockport, $316,790; Peter F. Connolly Co., Boston, Mass., $322,403; Woolsey Construction Co., Poughkeepsie, $336,320; Winston & Co., Brown Station, $343,193; Richards & Gaston Inc., New York, $359,253; Scott Bros., Rome, $392,937; H. S. Kervaugh, Inc., New York, $395,176. Road No. 5573, Cornwall-West Point, Part 3, Orange County, 1.17 miles. Nordone & Petrillo, Mt. Vernon, $13,341; Woolsey Construction Co., Poughkeepsie, $13,387; Samuel Beskin, Inc., Beacon, $13,400; James Anderson, Menands, $13,637; Winston & Co., Brown Station, $13,908; Cleveland & Sons Co., Brockport, $14,097; James M. Hamilton & Co., Gardner, $14,483.

✚Cohoes, N. Y.—The contract for paving Bowery St. with brick has been awarded to WALSH & KEEGAN, Albany, at $17,045.

New York, N. Y.—(Borough of Bronx)—(Official)—Bids will be received until 10:30 a.m., Aug. 3, by Douglas Mathewson, Borough Pres., for regulating, grading, paving, laying sidewalks, etc., on various streets.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received by L. H. Pounds, Borough Pres., for regulating, grading, curbing and laying sidewalks on 81st St. from 19th to 21st Ave. as follows: B. Tawrecano, Inc., $5177; W. T. Maxwell, $5474; M. Paconi, $5002. Noted July 15.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received July 14 by L. H. Pounds, Borough Pres., for improving (a) East Ninth St. from Ave. O to Ave. Q, (b) East 19th St. from Ave. L to Ave. M, (c) East 39th St. from Ave. I to Ave. K as follows: Uvalde Asphalt Co., (a) $12,491, (b) $4932, (c) $9724; Cranford Co., (a) $14,828, (b) $5732, (c) $11,261; Brooklyn Alcatraz Co., 407 Hamilton Ave., (a) $11,779, (b) $4428, (c) $8974; Sicilian Asphalt Co., (a) $13,976, (b) $5333, (c) $10,530.

✚New York, N. Y.—(Borough of Brooklyn)—(Official)—Contracts have been awarded for regulating, grading, curbing and laying sidewalks on 63rd St. from 21st Ave. to Bay Parkway to the UVALDE ASPHALT PAVING CO., 1 Broadway, at $4283; 81st St. from 19th to 21st Ave. to NICOLA PAVONI, 1320 65th St., at $5002. Noted July 15.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 2 p.m., Aug. 3, by Marcus M. Marks, Borough Pres., for regulating and paving with sheet asphalt a number of streets.

New York, N. Y.—(Borough of Richmond)—(Official)—Bids were received July 20 for regulating and grading Haven Esplanade from Barrett Blvd. to Castleton Ave. as follows: C. Vanderbilt, 24 Elizabeth St., West New Brighton, $5631; Barber Asphalt Paving Co., $7212; Joseph Johnson Sons, $6809 J. F. Donovan, $5686.

✚Salamanca, N. Y.—The contract for paving Summit, Wilson, Armstrong and Jefferson St. has been awarded to H. E. BUNCE, Olean, $28,861.

Bound Brook, N. J.—The Borough Council plans to pave Main St., one portion of which will be paved with asphalt block and another with concrete.

Camden, N. J.—It is reported that the Board of Freeholders of Camden County plans to improve the White Horse Pike from Camden to Berlin with amesite.

✚Flemington, N. J.—The contract for improving Pennsylvania Ave. from Broad St. to the borough line has been awarded to J. L. LeCOMPTE.

Guttenburg, N. J.—Nolan & Hornung, 711 Du Bois St., West Hoboken, submitted the lowest bid at $2.20 per sq.yd. for paving 3908 sq.yd. of Bergenline Ave. Noted July 8.

Jersey City, N. J.—Bids will be received until 11 a.m., Aug. 5, by the Board of City Commissioners for repairing portions of Grand and Bay St., Bramhall and Ocean Ave. Michael I. Fagen is City Clk.

Jersey City, N. J.—Bids will be received until 11 a.m., Aug. 5, by the Board of City Commissioners for repairing Jackson Ave. from Bayview to Bidwell Ave. M. I. Fagen is City Clk.

Jersey City, N. J.—Plans have been approved for repairing and improving the Paterson Planbroad in Hudson County for a distance of 1½ miles. Thomas J. Wasser is County Engr.

Jersey City, N. J.—Henry Byrne, Comr. of Streets, plans to pave Garfield Ave. with asphalt at an estimated cost of $25,000.

Newark, N. J.—(Official)—Bids will be received until 3:30 p.m., Aug. 5, by the Board of Street and Water Commissioners for paving Oxford Ave. from Fleming to Passaic Ave., Tyler St. from Chestnut to Malvert St., Vesey St. from Pacific to McWorter St., Yates Ave. from Osborne Terrace to about 346 lin.ft. easterly therefrom on both sides of a central parkway 12 lin.ft. in width and Read St. from Market St. to Passaic Ave.

Newark, N. J.—(Official)—Bids will be received until 3:30 p.m., Aug. 5, by the Board of Street and Water Commissioners for paving Hinsdale Pl. Morris R. Sherrerd is Chief Engr.

✚Trenton, N. J.—The contract for resurfacing the Brunswick Pike has been awarded to the CONTINENTAL PUBLIC WORKS CO., New York, N. Y. Noted May 20.

Harrisburg, Penn.—(Official)—Bids will be received until 10 a.m., Aug. 10, by the State Highway Department for reconstructing roads as follows: Lycoming County, 5843 lin.ft. of brick block pavement in Muncy Borough, Northumberland County, 4940 lin.ft. of brick block pavement in Milton Borough and Monroe County, 4871 lin.ft. of brick block pavement in Stroudsburg Borough. Robert J. Cunningham is State Highway Comr.

Philadelphia, Penn.—Bids will be received until noon, Aug. 4, by M. L. Cook, Dir. Pub. Ser., for improving, paving and opening Emerald St. under the Philadelphia & Reading R.R.

+Plymouth, Penn.—The contract for paving West Main St. has been awarded to EDWARD QUINN, Plymouth, at $11,181.

+★Cumberland, Md.—(Official)—The contract for improving Baltimore St. between the Western Maryland Ry. and the Baltimore & Ohio R.R. has been awarded to J. TONER BARR, Pittsburgh, at $22,416. Other bids were: John J. Carley, Richmond, Va., $23,608; Brady Bros., Frostburg, Md., $25,731. Noted July 15.

Bristol, Va.—At a recent election the citizens of Montgomery County voted in favor of issuing $100,000 in bonds, the proceeds of which will be used for improving roads.

Christiansburg, Va.—At a recent election the citizens of Christiansburg District of Montgomery County voted in favor of issuing $100,000 in bonds, the proceeds of which will be used for improving roads. Noted June 10.

★Staunton, Va.—(Official)—Bids will be received until 10 a.m., Aug. 6, by the Board of Supervisors of Augusta County for grading and macadamizing about four miles of road in Middle River District. R. W. Moore is Supt. Roads.

Logan, W. Va.—Press reports state that an election will be held Sept. 7 to vote on the question of issuing $200,000 in bonds, the proceeds of which will be used for constructing roads.

+Parkersburg, W. Va.—The contract for paving sections of Avery and 18th St. has been awarded to the PARSON CONSTRUCTION CO., Brownsville, Penn.

Philippi, W. Va.—At a recent election the citizens voted in favor of issuing $20,000 in bonds, $9000 of which will be used for street paving.

Welch, W. Va.—(Official)—Bids will be received until Aug. 3 for constructing 34 miles of dirt road, 16 ft. wide in Big Creek District. W. J. McClaren is County Road Engr. Noted Apr. 13.

Dobson, N. C.—An election will be held Aug. 24 in Bryan Township to vote on the question of issuing $35,000 in bonds, the proceeds of which will be used for constructing roads in Bryan Township, Surrey County.

Dobson, N. C.—An election will be held Aug. 10 in Westfield Township to vote on the question of issuing $30,000 in bonds, the proceeds of which will be used for constructing roads in Westfield Township, Surrey County.

Augusta, Ga.—Press reports state that the City Council plans to pave Ninth St. from Broad to Walker St. with creosoted wood block at an estimated cost of $30,000.

Leesburg, Ga.—At a recent election the citizens of Lee County voted in favor of issuing $27,000 in bonds, the proceeds of which will be used for improving roads.

+Laurel, Miss.—A contract for paving a number of streets has been awarded to the SOUTHERN PAVING & CONSTRUCTION CO., Chattanooga, at approximately $95,000. Noted July 15.

Algiers, La.—(New Orleans post office)—According to press reports the citizens plan to construct a five-mile paved boulevard from the immigration station and naval-station grounds to the Cut-Off road to the southward. E. E. Lafaye is Comr. of Pub. Property.

New Orleans, La.—(Official)—Bids will be received until noon, Aug. 16, by the highway Department of the Board of State Engineers, 104 New Orleans Court Bldg., for constructing 26 miles of highway in Road District No. 1, West Baton Rouge Parish. W. E. Atkinson is State Highway Engr. and Frank M. Kerr is Ch. State Engr. and Pres. Bd. of State Engineers.

Madisonville, Tenn.—At a recent election the question of issuing $300,000 in bonds, the proceeds of which was to have been used for constructing roads, was defeated. Noted Apr. 29.

+Elkton, Ky.—The Todd County Fiscal Court has awarded a contract to ROY L. GOWELL, Russellville, at $17,445, for constructing 43.3 miles of model pike road.

Winchester, Ky.—Bids will be received until 8 p.m., Aug. 6, by C. B. Tracy, Clk., for paving 13,000 sq.yd. with asphalt.

+Bellefontaine, Ohio—A contract for improving the south end of Anderson Bell Pike has been awarded to M. R. KOFFROTH, Richwood, at $9560.

Bowling Green, Ohio—(Official)—Bids will be received until 2 p.m., Aug. 16, by C. E. Stinebaugh, County Audr., for constructing the Elizabeth Schnell bituminous macadam road and the John Minning waterbound macadam road.

Chardon, Ohio—Bonds for $30,000 have been sold, the proceeds of which will be used for improving roads in Huntsburg Township.

+Cincinnati, Ohio—(Official)—The contract for improving Glenway Ave. from Warsaw Ave. to the wood-block pavement at West Line Section 36 has been awarded to the KIRCHNER CONSTRUCTION CO., Cincinnati, at $79,752. Noted July 8.

+Cincinnati, Ohio—(Official)—The contract for improving Montgomery Rd. from Gilbert Ave. to the Norfolk & Western Ry. has been awarded to the KIRCHNER CONSTRUCTION CO., Cincinnati, at $86,949. Noted July 8.

Cleveland Heights, Ohio—(Warrensville post office)—(Official)—Bids will be received until noon, Aug. 16, by H. H. Canfield, Village Clk., for improving the Warrensville Center Rd.

+Columbus, Ohio—Contracts have been awarded for road construction as follows: Ashland County, Ashland-Loudonville Rd., 3.58 miles, macadam, D. A. PHILLIPS, Ashland, $44,036; Montgomery County, Cincinnati-Dayton Rd., 2.45 miles, brick, STRODBICK BROS., Middletown, $62,359; Stark County, Canton-Steubenville Rd., 2.59 miles, TURNBULL BROS. & CO., Canton, $51,084; Union County, Urbana-Marysville Rd., 4.27 miles, concrete, OATHER M. JUNK, Chillicothe, $51,990. Noted July 15.

Defiance, Ohio—(Official)—The time for receiving bids has been extended from July 28 to noon, Aug. 4, by Clayton M. Rath, Dir. Pub. Ser., for laying 28,129 sq.yd. of pavement. Noted July 22.

East View, Ohio—Bids will be received until noon, Aug. 12, by Charles E. Burger, Clk., for improving and constructing sidewalks on Helen St. from Kinsman Rd. to the village limits. The Pease Engineering Co., 804 Marshall Bldg., Cleveland, is Engr.

+Lakewood, Ohio—(Official)—Contracts have been awarded by the city for paving Norton Ave. with brick and Lake Ave. with sheet asphalt to the CLEVELAND TRINIDAD PAVING CO., Cleveland, at $5707 and $35,293 respectively; French and Virginia Ave. with brick to PACE BROS., at $13,274 and $10,469 respectively; Dowd St. to BALDWIN BROS., at $11,150. Noted July 1.

+Lockland, Ohio—(Official)—The contract for improving Mill St. has been awarded to HENKEL & SULLIVAN, Cincinnati, at $10,917. Other bids were: Kirchner Construction Co., $11,782; C. N. Danenhower, $11,815; Thomas P. Strack, $12,400. Noted June 17.

Mt. Gilead, Ohio—(Official)—Bids will be received until 11 a.m., Aug. 6, by the Commissioners of Morrow County for constructing the Sexon-Thatcher Rd. in Gilead and Canaan Townships. C. O. Higgins is County Audr.

Newburg Heights, Ohio—(Newburg post office)—Bids will be received until noon, Aug. 3, by J. A. Fitzgerald, Clk., for improving and paving Beta, Bridgeview, Gama and Sigma Ave.

+New Philadelphia, Ohio—(Official)—The contract for improving Section 1 of the Oldtown Road Improvement in Goshen and York Townships has been awarded to the W. M. BRODE CO., Newcomerstown, at approximately $16,500. Noted July 8.

Reading, Ohio—Bids will be received until noon, Aug. 2, by William F. Klopmeyer, Clk., for improving Clark St. from Jefferson to Main St. D. S. Hosbrook, Pickering Bldg., Cincinnati, is Engr.

Rocky River, Ohio—Bids will be received until noon, Aug. 3, by Frank Mitchell, Clk., for constructing sidewalks in Center Ridge Rd.

+Tiffin, Ohio—(Official)—Contracts have been awarded for paving Coe and East Market St. to JOHN E. KING, Tiffin; and West Davis and Wentz St. to LOUIS SCHANDER, Tiffin. Noted July 8.

Toledo, Ohio—Bids will be received until 10 a.m., Aug. 23, by the Commissioners of Lucas County for improving Jerusalem and Oregon Township Road No. 71. Charles J. Sanzenbacher is County Audr.

+Upper Sandusky, Ohio—The contract for paving South Eighth St. has been awarded to the MODERN CONSTRUCTION CO., Fremont, at $19,802.

Warren, Ohio—(Official)—Bids will be received until noon, Aug. 21, by George T. Hecklinger, City Audr., for the sale of $13,000 in bonds, the proceeds of which will be used for improving North Tod Ave.

Brownstown, Ind.—Bids will be received until Aug. 9 by the City Clk., for paving approximately 17 blocks.

+Indianapolis, Ind.—The contract for paving Keystone Ave. from Washington to Michigan St. with asphalt has been awarded to the REPUBLIC CONSTRUCTION CO., at $12,009.

Indianapolis, Ind.—(Official)—Bids will be received until 10 a.m., Aug. 4, by the Board of Public Works for improving a number of streets.

Knightstown, Ind.—(Official)—Bids will be received until 8 p.m., Aug. 2, by the Board of Trustees for grading, paving and curbing the public square; also Brown and Washington St.

+Liberty, Ind.—The contract for constructing the Widan Rd. in Union Township has been awarded to WILKS & CO., Rushville, at $19,767.

+Noblestown, Ind.—(Official)—A contract for constructing a county line road has been awarded to T. F. McCARTY, Noblesville, at $4100, by the Commissioners of Hamilton and Marion Counties. Noted June 17.

Vincennes, Ind.—(Official)—Bids will be received until 4 p.m., Aug. 9, by the Board of Public Works for paving Main St.

+Winchester, Ind.—A contract for constructing the St. John Rd. in Green Township has been awarded to JOSEPH THORNHILL, Indianapolis, at $5075.

Burlington, Wis.—(Official)—Bids will be received until 2 p.m., Aug. 7, by the Board of Public Works for street paving. P. J. Hurtgen is City Engr.

+Milwaukee, Wis.—The Department of Public Works has awarded contracts for paving Vliet St. to the BADGER CONSTRUCTION CO., $50,564; 21st Ave. and Eighth Ave. to the WHITE CONSTRUCTION CO., at $12,859 and $18,837 respectively; Fratney St. to F. P. COUGHLIN, at $6672.

+Sheboygan, Wis.—The contract for constructing concrete pavement on Superior Ave. has been awarded to PETER SINNER, Sheboygan.

+Clinton, Iowa—(Official)—The contract for paving Fourth St. has been awarded to THOMAS CAREY & SONS, Clinton, at $27,917. The only other bid was that of the Independent Construction Co., Davenport, at $29,736.

+Columbus Junction, Iowa—A contract for laying 7910 sq.yd. of brick pavement has been awarded to KORNEMAN & SMITH, Muscatine, at $16,406.

Duluth, Minn.—The Board of Public Works plans to repave East Superior St. from 16th to 24th St.

+Fairmont, Minn.—(Official)—A contract for laying 24,000 sq.yd. of wood-block pavement and constructing 6000 lin.ft. of curbing has been awarded to FIELDING & SHEPLEY, St. Paul, at $57,299. Noted June 24.

+Virginia, Minn.—A contract for constructing curbs and gutters in various streets has been awarded to RISBERG-MARWICK, Virginia, at approximately $20,000. Noted June 24.

Wichita, Kan.—Bids will be received until Aug. 10 by Bert Wells, City Engr., for paving Park Ave. with concrete.

+Norfolk, Neb.—(Official)—A contract for constructing 30,000 yd. of concrete pavement and 16,000 lin.ft. of concrete curb has been awarded to the H. J. CATHROE CO., Omaha,

at $40,900. Other bids were: D. S. Sears, $42,300; W. J. Creedon, $43,000; A. G. Doll. Noted June 4 and July 15.

Bozeman, Mont.—Bids will be received until Aug. 5 by C. A. Spieth, City Clk., for improving streets in a number of districts.

✚Helena, Mont.—The contract for paving Wilder Ave. has been awarded to ADAMI BROS., Helena, at $9529.

Laurel, Mont.—Bids will be received until Aug. 3 for constructing a road in District No. 15 at an estimated cost of $10,000.

Missoula, Mont.—(Official)—Bids will be received until 5 p.m., Aug. 3, by L. E. Harris, City Clk., for paving in Special Improvement District No. 35. E. S. Hathway is City Engr.

✚Philipsburg, Mont.—The Commissioners of Granite and Deer Lodge Counties have awarded the contract to the CLIFTON-APPLEGATE CO., at $13,000 for building the Flint creek hill road between Philipsburg and Anaconda.

✚White Sulphur Springs, Mont.—A contract for paving about 30 blocks has been awarded to A. G. PETERS, at $7897. Other bids were: Two-Miracle Construction Co., $8522; W. E. Winnie, $9179; McLaughlin & O'Neal, $8486.

Kansas City, Mo.—The Board of Public Works plans to pave Park Ave. from 41st to 43rd St. with asphalt.

✚St. Joseph, Mo.—(Official)—The contract for paving Noyes Blvd. with refined asphalt has been awarded to the METROPOLITAN PAVING CO., St. Joseph, at $67,510. Other bids were: Van Hafften Contracting Co., $74,432; C. W. Dillingham, $68,019; Cathey Construction Co., $68,169. Noted July 15.

Houston, Tex.—The Commissioners of Harris County have authorized the extension of the paving on Clinton Rd. to Penn City, a distance of seven miles, at an estimated cost of $30,000.

Seguin, Tex.—(Official)—All bids received July 19 for constructing six miles of road in Guadalupe County were rejected. New bids will be received by the Commissioners of Guadalupe County until Aug. 2 for constructing 12 miles of road. Noted July 15.

Boulder, Colo.—Press reports state that bids will be received some time this summer for paving streets in the business section.

✚Roswell, N. M.—The contract for paving Seventh St. from Missouri Ave. to Main St. has been awarded to the CLEVELAND TRINIDAD PAVING CO.

✚Tucson, Ariz.—The contract for improving Sixth Ave. and other streets has been awarded to the WARREN BROS. CO., at approximately $118,000.

Aberdeen, Wash.—Press reports state that the City Council has voted to pave Washington St., at an estimated cost of $16,000.

✚Anacortes, Wash.—The contract for paving State St. with concrete has been awarded to N. W. BALL, Seattle, at $10,000.

Everett, Wash.—The Commissioners of Snohomish County have authorized Hans Mumm, Jr., County Engr., to prepare plans for the improvement of Permanent Highway No. 19. M. Weatherbee is County Audr.

Everett, Wash.—J. W. Hoover, City Engr., is preparing plans for paving and constructing concrete sidewalks in South Rucker Ave.

✚Olympia, Wash.—(Official)—Bids were received July 19 by William R. Roy, State Highway Comr., for constructing the Pacific Highway between Custer and Enterprise in Whatcom County as follows: CHARLES E. LIND, Bellingham, $12,187 (awarded contract); Worthen & Satterthwaite, Lynden, $14,489; Sloane Bros., Seattle, $14,733; L. H. Goerig, Seattle, $14,324.

Olympia, Wash.—(Official)—Bids were received July 14 by William R. Roy, State Highway Comr., for constructing 15 miles of Olympic Highway between Mud Bay and McCleary in Thurston County as follows: Rojotte, Fobert & Winters, Olympia, $36,304; Burnet Construction Co., Seattle, $34,334; August Wallin, Aberdeen, $32,146; Allred & James, Centralia, $42,778; L. H. Goerig, Lacey, $33,792; Zindorf-Tideral, Seattle, $37,773; H. Graff & F. L. Sheldon, Tacoma, $37,614; Sloane Bros., Seattle, $33,582; Rignell & Bankston, Tacoma, $31,922. Noted June 24.

Olympia, Wash.—Bids will be received until 2 p.m., Aug. 9, by William R. Roy, State Highway Comr., for improving 14 miles of McClellan Pass Highway, between Natches and Summit in Yakima County.

✚Port Angeles, Wash.—A contract for grading and paving a number of streets has been awarded to FERCH & GASS, Seattle, at $94,533.

Seattle, Wash.—Bids were received for constructing four miles of road between Duwamish River and Renton Junction as follows: P. J. McHugh, $59,344; Standifer-Clarkston, Portland, Ore., $85,600; Porter & Conley, $95,531; Rowan & Anderson, $82,598; C. H. Kiel, $89,271; Holt & Jeffery, $95,535; Burnett Construction Co., $73,844; Charles Daley & Co., $80,253; Nettleton-Bruce Eschbach Co., $88,958; Ferch & Gass, $80,776; M. P. Zindorf, $81,212; West Coast Construction Co., $79,793; Horrocks Construction Co., $75,925.

Tacoma, Wash.—D. H. White, Engr. of Pierce County, has been authorized by the County Commissioners to prepare plans for hard surfacing the Pacific Highway from the County Club to Dupont, a distance of 5.6 miles. The work will cost approximately $80,000.

Eugene, Ore.—The City Council contemplates paving Lawrence St. and other streets. The estimated cost of the work is $11,000.

✚Portland, Ore.—The contract for paving San Rafael St. and Rodney Ave. has been awarded to OSKAR HUBER. at $13,004.

Portland, Ore.—The City Council plans to repave Upper Washington St. P. H. Dater is City Engr.

✚Tillamook, Ore.—A contract for paving three sections of county road with concrete has been awarded to the ARENZ CONSTRUCTION CO., Portland, at $33,227.

Compton, Calif.—Press reports state that bids wil soon be received by the Board of Trustees for paving and improving Main St. E. M. Lynch, Glendale, is Engr.

Fresno, Calif.—Bids will be received until 2 p.m., Aug. 5, by the Board of Supervisors of Fresno County for constructing 2.7 miles of Badger Sand Creek Rd. D. M. Barnwell is Clk. of the Bd.

Hermosa Beach, Calif.—The California Arizona Construction Co., at $8416 was lowest bidder for improving Hoansler Court.

✚Livermore, Calif.—The City Trustees have awarded a contract for street paving to the CALIFORNIA BITULITHIC CO., at $64,696.

✚Los Angeles, Calif.—Contracts have been awarded for improving Evergreen Ave. from Harrison to Wasbash Ave. to F. W. WHITTIER, at $7984; York Blvd. from Ave. 45 to Ave. 54 to BENJAMIN F. FORD and FRED H. STOUT, at $64,062.

✚Los Banos, Calif.—A contract for paving and improving 14 blocks has been awarded to W. H. WORSWICK, JR., Fresno, at $48,810.

✚Manhattan Beach, Calif.—The contract for improving Ninth, 10th and 11th St. has been awarded to the MODERN CONSTRUCTION CO., at $16,206.

Quincy, Calif.—Bids will be received until Aug. 6 by the Board of Supervisors of Plumas County for constructing the Ramelli Turnpike between Beckwith and Vinton. F. R. Young is County Clk.

✚Riverside, Calif.—The contract for improving 10.5 miles of county highway in Riverside County has been awarded to the C. L. HYDE CONSTRUCTION CO., San Diego, at $40,599.

Sacramento, Calif.—(Official)—Bids were received July 19 by the State Highway Commission for road construction in various counties as follows: (a) Los Angeles County, Section A, Route 9, (b) Santa Clara County, Section B, Route 5, (c) Alameda County, Section B, Route 5; Peter L. Ferry, Tropico, (a) $45,165; Andrew Holloway, Pasdena, (a) $34,583; White & Gaskill, Long Beach, (a) $56,636; Leigh G. Garnsey, Los Angeles, (a) $46,130; Tryon & Brain, Los Angeles, (a) $43,758; C. T. Sloltax and H. A. Taylor, Los Angeles, (a) $48,450; Rogers Bros. Co., Los Angeles, (a) $50,753, M. R. Co., Los Angeles, (a) $49,841; Fred Hoffman, Long Beach, (a) $51,099; Palmer & McBryde, San Francisco, (b) $58,617, (c) $42,884; Bates Borland & Ayer, Oakland, (b) $50,326, (c) $44,520; Highway Paving & Construction Co., San Francisco, (b) $45,694; C. H. & A. W. Gorrill, San Francisco, (b) $48,724, (c) $42,222; John W. McDonald, Jr., San Jose, (b) $90,306; Marin Rock Co., San Anselmo, (b) $44,135, (c) $39,748; Commary Peterson Co., San Francisco, (b) $46,710, (c) $42,590; Ranson & Grummey, Oakland, (b) $48,600; Petersen & Grier, San Francisco, (b) $51,929, (c) $41,815; Tieslau Bros., San Francisco, (b) $59,403, (c) $46,542; Raisch Improvement Co., San Francisco, (b) $45,-884; Blanchard-Brown Co., San Francisco, (b) $54,882, (c) $43,-284; M. Blumenkranz, Davis, (c) $43,581; Spring Construction Co., Berkeley, (c) $35,884; H. G. Vaughan Construction Co., San Francisco, (c) $34,486; Parrott Bros. Co., Salt Lake City, Utah. (c) $37,857; P. H. Hoare, Oakland, (c) $43,471; W. B. Hunt & Sons, Alameda, (c) $39,230; W. J. Schmidt, Berkeley, (c) $41,138. Noted July 8.

✚San Diego, Calif.—The contract for improving 30th St. from University to El Cajon Ave. has been awarded to G. R. DALEY, at $6804.

Sanger, Calif.—Bids were received July 15 by the City Council for paving two miles of streets from J. W. Haynes, Oakland, $19,953 and Thompson Bros., Fresno, $18,765.

✚Oshawa, Ont.—A contract for constructing concrete pavements has been awarded to DREW & FLINTOFF.

INDUSTRIAL WORKS

Boston, Mass.—F. C. Larkin will build an eight-story, 70x100-ft., brick and steel warehouse at Berkeley and Stuart St. Densmore & Le Clear, 88 Broad St., is Engr.

✚Leicester, Mass.—EDWARD D. WARD, Worcester, Mass., has been awarded the contract for the construction of a three-story, 24x74-ft. addition to the plant of the L. S. Watson Mfg. Co. The estimated cost is $20,000. Cutting, Carleton & Cutting, Worcester, Mass., is Arch.

✚Quincy, Mass.—The Fore River Shipbuilding Co. has awarded the contract for the construction of a two-story, 185x779-ft. building on Howard St. to the ABERTHAW CONSTRUCTION CO. The estimated cost is $400,000. Noted July 22.

✚West Groton, Mass.—The Groton Leatherboard Co., 16 State St., Boston, Mass., has awarded the contract for the construction of a two-story, 75x140-ft. mill to the BOYLSTON CONSTRUCTION CO., 1126 Boylston St., Boston, Mass. I. W. Jones, Milton, M. H., is Engr.

✚West Springfield, Mass.—The Gilbert & Barker Co. has awarded the contract to the CASPER RANGER CONSTRUCTION CO., Holyoke, Mass., for the construction of a two-story, 63x100-ft. addition to its machine shop, a two-story, 27x32-ft. addition to its testing department, and a 40x80-ft. addition to its factory.

✚Worcester, Mass.—The BARROWS-STEWART CONSTRUCTION CO., 40 Central St., Boston, Mass., has been awarded the contract for the construction of two additional stories to the 60x154-ft., brick and steel main building of the plant of the R. B. Philips Mfg. Co.

✚Hartford, Conn.—(Official)—Ford, Buck & Sheldon, Inc., Engr., 60 Prospect St., has awarded the contract for the construction of a one-story, 55x320-ft. factory on Homestead Ave. to the JAMES H. GROZIER CO., for the Hartford Special Machinery Co., 734 Main St. Noted July 22.

✚New Haven, Conn.—The Winchester Repeating Arms Co. has awarded the contract for the construction of a four-story factory and two-story addition to its plant to the WESTINGHOUSE-CHURCH-KERR CO., New York, N. Y. The estimated cost is $314,000.

✚Waterbury, Conn.—The Scoville Mfg. Co. has awarded the contract for the construction of a five-story factory at East Main St. and Hamilton Ave. to the TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y.

✚Buffalo, N. Y.—The Danahy Packing Co. has awarded the contract to the LACKAWANNA BRIDGE CO. for the construction of a cooling building at its plant at Metcalfe St. and the N. Y. C. R.R. tracks. The estimated cost is $25,000.

+Buffalo, N. Y.—THE EASTERN CONCRETE STEEL CO. has been awarded the contract for the construction of a reinforced-concrete mill and elevator at Toisul Rd. and the N. Y. C. R.R. tracks for the Clover Leaf Milling Co. Noted June 24.

+New York, N. Y.—(Borough of Queens)—The AMERICAN CONCRETE STEEL CO., 31 Clinton St., Newark, N. J., has been awarded the contract for the construction of a four-story, 80x160-ft. factory for the Degnon Realty & Terminal Improvement Co., 30 East 42nd St. (Borough of Manhattan) William Higginson, 13 Park Row (Borough of Manhattan) is Arch.

+Rochester, N. Y.—The contract for the construction of a concrete warehouse for Brewster, Gordon & Co., has been awarded to R. K. FENNO. Foster & Gade is Arch. Estimated cost, $136,000. Noted July 15.

Syracuse, N. Y.—Bids are being received by Edward Howard & Son, Arch., for the construction of a one-story, 61x122-ft. refrigerating building, garage and office for the Fleischmann Co. Robert Embleton, 701 Washington Ave., New York, N. Y., is Mgr. The estimated cost is $20,000.

Syracuse, N. Y.—Bids are being received by Gordon Wright, Arch., Union Bldg., for the construction of a three-story, 60x175-ft. factory for Samuel Shapiro, 581 South Clinton St. The estimated cost is $20,000.

+Syracuse, N. Y.—The H. H. Franklin Mfg. Co., 722 Gifford St., has awarded the contract for the construction of a four-story, 153x60-ft. factory to the W. J. BURNS CO.

Bayonne, N. J.—The Standard Oil Co. plans the construction of a $40,000 storage plant.

Newark, N. J.—Marshall N. Shoemaker, Engr., 9 Clinton St., has awarded the contract to the BECKER CONSTRUCTION CO., 361 Grove St., at $28,550, for the rebuilding of the leather factory of George Stengel, Inc. Noted July 1.

+Riverside, N. J.—William F. Taubel has awarded to H. B. MILLER, Beverly, N. J., the contract for the construction of a three-story, 50x120-ft. factory to cost $35,000. W. U. Jury, Shamokin, Penn., is Arch.

+Philadelphia, Penn.—The contract for the construction of an addition to the factory of H. A. Romberger, Bourse Bldg., has been awarded to JOHN N. GILL & CO., Held Bldg. E. T. Bertolett and Raymond Mathews, 1614 Cherry St., are Archs. The estimated cost is $12,000.

Pittsburgh, Penn.—The Union Storage Co. will build an eight-story, cold-storage warehouse on Smallman St., to cost $500,000.

+Pittsburgh, Penn.—William Beckett, 6887 Hamilton Ave., has awarded the contract for the construction of a one-story, 50x100-ft. commercial garage to WALKER & CARLEY, Bessemer Bldg. H. Viehman, Hays Ave., Carrick, Penn., is Arch. The estimated cost is $10,000.

Reading, Penn.—William S. Markley, 236 High St., has purchased a site at Penn and Queen St., and will build a $50,000 plant.

+Baltimore, Md.—The Poehlman Auto Co., 1107 Cathedral St., has awarded the contract for the construction of a four-story, 45x70-ft. garage to the COWAN BUILDING CO., 106 West Madison St. Wyatt & Nolting, Keyser Bldg., is Arch. The estimated cost is $20,000.

Longisland, N. C.—The Longisland Mills, will enlarge and improve its plant, at an estimated cost of $20,000.

Worth, N. C.—The cotton mill of the Harden Mfg. Co., recently destroyed by fire, will be rebuilt. The loss was $175,000.

+West Point, Ga.—The contract for the construction of a three-story cotton mill for George H. Lanier, has been awarded to the GALLIVAN BUILDING CO., Greenville, S. D. Estimated cost, $500,000.

Jacksonville, Fla.—The Ford Motor Co., Detroit, Mich., will establish an automobile assembling plant at Ocean and Church St.

New Orleans, La.—The National Fish, Game, Produce & Ice Co. will build two cold-storage plants, to cost about $100,000.

Chattanooga, Tenn.—The Parish Coffee Co. will build a three-story, brick factory on Rossville Blvd., to cost between $15,000 and $18,000.

Nashville, Tenn.—The Ford Motor Co., Detroit, Mich., will establish a branch factory.

+Akron, Ohio—The B. F. Goodrich Co. has awarded to the CARMICHAEL CONSTRUCTION CO. the contract for the construction of a five-story, 200x200-ft., reinforced-concrete factory to cost about $500,000.

+Cleveland, Ohio—The Musterole Co., 4612 St. Clair Ave., has awarded the contract for the construction of a three-story, 65x100-ft. factory to SAMUEL AUSTIN & SON CO., 14,230 Euclid Ave. The estimated cost is $40,000.

+Cleveland, Ohio—The contract for the construction of a two-story 80x200-ft. factory on Grant Ave., for the Cleveland White Metal Co. has been awarded to the A. B. LOOMIS CONSTRUCTION CO. The W. F. Ferguson Co., 1900 Euclid Ave., is Arch. Estimated cost, $75,000. Noted July 15.

Fremont, Ohio—The Herband Co. plans the construction of a $20,000 addition to its plant.

Toledo, Ohio—Plans have been prepared by Thomas F. Huber, Arch., for the construction of a three-story building at Canton and Shepard St. for the American Plumbers Supply Co. The estimated cost is $40,000.

+Toledo, Ohio—The contract for the construction of a coke oven plant on Front St., for the Toledo Furnace Co., has been awarded to the H. KOPPENS CO., Pittsburgh, Penn., at $145,000.

Youngstown, Ohio—The Republic Iron & Steel Co. will expend $1,000,000 for the construction of an addition to its plant. Thomas J. Bray is Pres.

Muncie, Ind.—Ball Bros. will build a two-story addition to its plant, to cost $75,000.

+Detroit, Mich.—The Chalmers Motor Co., Jefferson Ave., has awarded the contract for the construction of a four-story, 80x95-ft. addition to its factory to H. G. CHRISTMAN, South Bend, Ind. Kahn & Wilby, 58 La Fayette Ave., is Arch.

+Detroit, Mich.—(Official)—The Aluminum Castings Co. has awarded the contract to MARTIN N. BURKHEISER, 660 Ellery St., for the construction of a $25,000 machine shop. The Forest City Engineering Co., 512 Hippodrome Bldg., Cleveland, Ohio, is Arch. Noted July 22.

+Detroit, Mich.—The contract for the construction of a four-story factory, and a forge shop, at Clark Ave., and the Wabash R.R., for the Timken-Detroit Axle Co., has been awarded to the GEORGE A. FULLER CO. Nettleton & Weaver is Arch. Estimated cost, $60,000. Noted July 15.

+Chicago, Ill.—The contract for the construction of a seven-story, 100x150-ft. paper mill for the Bermingham & Seaman Co., 7 South Dearborn St. has been awarded to the O. W. ROSENTHAL CO., 80 East Jackson Blvd. The estimated cost is $150,000. Paul Gerhardt, 64 West Randolph St., is Arch. Noted July 1.

+Milwaukee, Wis.—The Ford Motor Co., Detroit, Mich., has awarded the contract for the construction of a plant at Prospect Ave. and Kenilworth Pl., to the O. H. BOSSERT CO., 848 Jackson St. The estimated cost is $275,000. Noted May 20.

Racine, Wis.—The Hamilton Beach Mfg. Co., will build an addition to its plant to cost $30,000.

Kansas City, Kan.—Plans have been prepared by the Heidenrich Engineering Co., 714 Dwight Bldg., Kansas City, Mo., for the construction of a reinforced-concrete grain elevator, to have a capacity of 1,000,000 bu. for the Union Pacific R.R. Co. The estimated cost is $250,000.

+Kansas City, Mo.—The contract for the construction of a 700,000-bu., reinforced-concrete grain elevator at North Topping Ave. and the Kansas City Southern R.R. tracks for the Norris Grain Co., 612 Board of Trade Bldg., has been awarded to the BURRELL ENGINEERING & CONSTRUCTION CO. The estimated cost is $200,000.

Houston, Tex.—The Farmers' Warehouse Corporation will build a warehouse to cost about $25,000. H. T. Williams is interested.

Oklahoma City, Okla.—The Ford Motor Co., Detroit, Mich., will build an automobile assembling plant at Main and Grand St., and the St. Louis & San Francisco R.R.

Eureka, Utah—The Union Grain Elevator Co., will build a 50,000 bu. grain elevator, to cost $15,000. J. Knight is Pres.

+New Westminster, B. C.—The contract for the construction of a $30,000 building on Front St. for the Brackman-Ker Milling Co. has been awarded to F. T. SHERBORNE, Metropolitan Bldg., Vancouver, B. C.

Prince Rupert, B. C.—George L. Clayton will build a cold-storage plant to cost $150,000.

FEDERAL GOVERNMENT WORK

Dredging—New York, N. Y.—(Borough of Queens)—(Official)—The following are the bids received for dredging in Newtown Creek: Maryland Dredging & Contracting Co., 1515 Fidelity Bldg., Baltimore, Md., 27c. per cu.yd. (scow measurement); Morris & Cummins Dredging Co., 32c.; P. Sanford Ross, Inc., 26⅜c.; R. G. Packard Co., 38c.; John A. Seeley, 27½c.; Coastwise Dredging Co., 29½c. Noted June 3.

Building—New York, N. Y.—Bids were received June 26 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a contagious diseases building at Naval Hospital, New York, as follows: John J. Hearn Construction Co., 67 West 46th St., New York, $18,600; J. Kresse Co., 32 Vanderbilt Ave., New York, $18,450; R. C. Emmons, 6406 Third Ave., Brooklyn, $18,373; John F. Kuhn, 328 East 51st St., New York, $23,875; R. H. Brown, Inc., 350 Fulton St., New York, $18,810; Riverside Construction Co., 39 Cortlandt St., New York, $14,733; Thomas J. Brady, Jr., Construction Co., 1170 Broadway, New York, $35,460; Simon Russek, Inc., 261 Broadway, New York, $19,237; Hermanns, Madden & Co., 103 Park Ave., New York, $19,422; Neptune B. Smyth, 413 East 34th St., $23,513; James F. McFerran, 129 West 42nd St., New York, $16,881; William H. Egan, 147 East 125th St., $24,744; M. J. Marshall, 1123 Broadway, New York, $21,589; Lewis J. Sieling, 171 Madison Ave., New York, $16,835; Jersey City Construction Co., 75 Montgomery St., Jersey City, N. J., $34,010; B. Diamond, 12 Bergen St., Brooklyn, $15,612; James McArthur Co., 22 Ormond St., Brooklyn, $23,722. Noted June 3.

★Buildings—Pittsburgh, Penn.—(Official)—Bids will be received until noon, Aug. 25, at the U. S. Engineer Office, for building two brick lockkeeper's houses at Dam No. 10, Ohio River.

★Bridge and Trestles—Pittsburgh, Penn.—(Official)—Bids will be received at the U. S. Engineer Office until noon, Aug. 26, for furnishing and delivering a service bridge and Poiree trestles at Dam No. 10, Ohio River.

★Air Compressors—Pittsburgh, Penn.—(Official)—Bids will be received at the U. S. Engineer Office until Aug. 21 for furnishing and installing air compressors, gas engine, turbine, electric light plant, etc., at Lock 6, Monongahela River.

★Lock Gates, Etc.—Pittsburgh, Penn.—(Official)—Bids will be received until noon, Aug. 21, at the U. S. Engineer Office, for furnishing and erecting steel lock gates and furnishing valves and lock operating machinery, at Lock 6, Monongahela River.

Mechanical Equipment—Washington, D. C.—The following are the bids received for furnishing the mechanical equipment in the Interior Department office building, (a) heating; (b) plumbing; (c) conduit and wiring: William Gordon Corporation, 107 W. 13th St., New York, N. Y., (a) $80,000; (b) $94,000, (c) $63,213; W. G. Cornell Co., (a) $80,529, (b) $99,510, (c) $67,410; Lord Electric Co., (a) $64,800, (b) $94,600, (c) $89,442; Standard Engineering Co., (a) $78,000, (b) $97,500, (c) $74,350; Hanley-Casey Mechanical Equipment Co., (a) $85,000, (b) $110,000, (c) $83,000; Thompson-Starrett Co., (a) $83,000, (b) $120,000, (c) $77,000; S. Faith & Co., (a) $90,000, (b) $111,500, (c) $79,271; Fitzpatrick & Hoepfner, (a) $78,000, (b) $104,000, (c) $75,000; Isadore Freund, (a) $89,000, (b) $129,500, (c) $70,966; L. K. Comstock & Co., (a) $90,947, (b) $125,000, (c) $78,357; John W. Danforth Co., (a) $103,000, (b) $116,000, (c) $81,000; Crook, Kries & Co., (a) $86,285, (b) $122,716, (c) $97,295; G. A. Kees Domestic Engineering Co., (a) $105,000, (b) $117,746, (c) $97,000; Warner & Chambers, (a) $114,390, (b) $135,000, (c) $86,500; Chris Irving Plumbing & Heating Co., (a) $157,544, (b) $208,756, (c) $232,300.

Lock Gates—Wilmington, N. C.—(Official)—The following are the bids received for erecting lock gates, opened July 19, at the U. S. Engineer Office: Lawrence D. Weaning, Cleveland, Ohio, $10,800; Independent Bridge Co., $11,084; Riter-Conley Mfg. Co., $9,460; Penn Bridge Co., $10,300; Stacey-Schmidt Mfg. Co., $9500; Chicago Bridge & Iron Works, $11,200; Whitehead & Kales Iron Works, $10,732; Wilmington Iron Works, $14,-977; McMyler Interstate Co., $21,370. Noted June 24.

★**Derrick Boat**—Washington, D. C.—(Official)—Bids will be received at the U. S. Engineer Office until noon, Aug. 23, for furnishing steel derrick boat complete with machinery and equipment.

Repairs to Jetties—Wilmington, Del.—Bids will be received at the U. S. Engineers Office, Old Federal Bldg., until 11 a.m., Aug. 20, for furnishing and placing stone for repairs of jetties at Cold Spring Inlet, N. J.

★**Post Office**—Charlotte, N. C.—Bids were received July 2, by the Acting Supervising Architect, Treasury Dept., Washington, D. C., for the construction of a post office at Charlotte, as follows: (a) light-colored marble, (b) light-colored granite: Norcross Bros., Worcester, Mass., (a) $26,700, (b) $27,300; J. S. Rogers Co., Moorestown, N. J., (a) $264,613, (b) $275,500; P. F. Gormeley Co., Washington, D. C., (a) $243,000, (b) $253,-000; Travers Wood Co., Richmond, Va., (a) $247,400, (b) $258,-000; J. A. Jones, Charlotte, (a) $257,634, (b) $265,750; Westchester Engineering Co., White Plains, N. Y., (a) $243,000, (b) $266,000; James Devault, Canton, Ohio, (a) $267,000, (b) $233,-000 (limestone); Thomas W. Cissell, Wooster, Ohio, (a) $245,-700, (b) $256,000; M. Yeager & Co., Danville, Ill., (a) $247,905; Torbert Construction Co., Philadelphia, Penn., (a) $247,676, (b) $257,976; John G. Unkefer & Co., Minerva, Ohio, (a) $242,-294, (b) $253,294; W. H. Fissell & Co., New York, N. Y., (a) $246,000, (b) $261,755; Barnes Bros., Logansport, Ind., (a) $240,000, (b) $249,000; Wise Granite & Construction Co., Richmond, Va., (a) $262,800, (b) $265,000; William H. Maxwell, Bangor, Maine, (a) $275,184, $274,484 (Vermont marble); (b) $285,144; Boyle-Robinson Construction Co., Washington, D. C., (a) $249,981, (b) $268,781. Noted May 27.

Dredging—Grand Marais, Mich.—The following are the bids received for dredging 30,000 cu.yd. at Grand Marais, opened at Duluth, Minn., July 15 by Maj. E. D. Peek: Zenith Dredge Co., Duluth, Minn., 30c. per cu.yd.; Great Lakes Duluth-Superior Dredging Co., Duluth, Minn., 194-5c.; North-Dredge & Dock Co., Alworth Bldg., Duluth, Minn., 20.3c.; ern Dredge & Dock Co., Duluth, Minn., 20½c.

Post Office—Beardstown, Ill.—Bids were received July 9, by the Supervising Architect, Treasury Department, Washington, D. C., for the construction of a post office at Beardstown, (a) limestone, (b) sandstone as follows: Rogers & Kaiser, Chicago, (a) $45,795, (b) $46,800; Clarke Construction Co., Danville, (a) $40,985; Callahan-Mandl Co., Chicago, (a) $43,252; W. G. Carter Co., Chicago, (a) $41,968, (b) $42,318; R. S. Moore, Lafayette, Ind., (a) $44,679, (b) $45,180; Frank J. Griffey & Son, Kansas City, Mo., (a) $49,615; Christ Kanzler & Son, Evansville, Ind., (a) $49,900, (b) $50,300; Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $43,337; (b) $43,737; Thomas W. Cissel, Wooster, Ohio, (a) $545,993, (b) $46,293; E. A. Steininger Construction Co., St. Louis, Mo., (a) $43,173; George W. Stiles Construction Co., Chicago, (a) $42,886; Colonial Construction & Supply Co., Charlottesville, Va., (a) $42,578, (b) $42,860; George A. Shaul, Seneca, Kan., (a) $41,-794; John Lauritzen, Fergus Falls, Mont., (a) $39,990; Thomas G. Gage Co., Chicago, (a) $43,000 and Potters Lumber Co., East Liverpool, Ohio, (a) $44,785, (b) $45,700. Noted June 3.

★**Dredging**—Chicago, Ill.—(Official)—Bids will be received at the U. S. Engineer Office, Federal Bldg., until 10 a.m., Aug. 17, for dredging in Calumet River.

Post Office—Des Moines, Iowa—The following bids were received July 8, by the Supervising Architect, Treasury Dept., Washington, D. C., for remodelling the post office at Des Moines; Grohne Decorating Co., Joliet, Ill., $14,390; Charles Weitz Sons, Des Moines, $10,360; Frank M. Weakley, Portsmouth, Va., $15,229. Noted Apr. 22 and June 3.

Earthwork—Saco, Mont.—(Official)—Bids will be received at the office of the U. S. Reclamation Service, Malta, Mont., until 2 p.m., Aug. 12, for about 355,000 cu.yd. of canal excavation. The work is located from three to 10 miles from Saco, Mont., on the Great Northern Ry.

Pumping Plant—Ft. Bliss, Tex.—Preliminary plans are reported ready and bids will soon be asked by the War Department, for the construction of a pumping plant. The estimated cost is $45,000.

✚**Post Office**—Narmion, Tex.—The contract for the construction of the post office at Narmion, has been awarded to VOLNEY E. TAYLOR, Huntington, W. Va., at $45,950.

Extension to Jetties—Portland, Ore.—The following are the bids received at the U. S. Engineer Office for the extension to the north and south jetties at Suislaw: Miami Quarry Co., Selling Bldg., $176,416; I. N. Day, $183,613; Porter Bros., $187,283; Peers Building Co., $176,994; Johnson-Anderson Co., $181,560.

Addition to Building—Salem, Ore.—The following bids were received by the Commissioner of Indian Affairs, Washington, D. C., for the construction of an addition to the brick assembly hall at the Salem Indian School: L. C. Denison, 185 South 19th St., Salem, $10,719; Siewert & Engstrom, $12,927; W. D. Lovell, $18,500; Southwick & Headrick, $13,597; John Almeter, $13,829. Noted July 14.

MISCELLANEOUS

Coal-Handling Plant—Portland, Me.—A coal-handling plant to have a storage capacity of 25,000 tons will be built at Portland by the Pocahontas Fuel Co., 1 Broadway, New York, N. Y.

✚**Coal Pocket**—Boston, Mass.—The contract for the construction of a concrete coal pocket on Hilton St. for Batchelder Bros., 10 Post-Office Sq., has been awarded to W. A. MORTON CO., South Boston. J. H. Proctor & Co., Old South Bldg., is Engr.

★**Barge Canal Work**—Albany, N. Y.—Bids will be received by W. W. Witherspoon, Supt. of Pub. Wks., Capitol, Albany, until noon, Aug. 17, for constructing under Terminal Contract No. 37, a harbor and dockwall on the south side of the Mohawk River at Canajoharies, and under Terminal Contract No. 46, a dockwall and approach on the south side of the Seneca River, west of the Weedsport Bridge.

Dock—Buffalo, N. Y.—According to press reports the New York Central R.R. Co. will soon award a contract for the construction of a concrete dock on the Buffalo River, estimated to cost $30,000.

Motor Fire Apparatus—Geneva, N. Y.—The Common Council has voted to hold a special election on Aug. 4, for the purpose of voting on an expenditure of $18,500 for the purchase of motor fire apparatus.

Station Finish—New York, N. Y.—(Borough of Bronx)—(Official)—Bids will be received by the Public Service Commission, until 12:15 p.m., Aug. 18, for the construction of station finish for 23 stations on the Seventh Ave.-Lexington Ave. and White Plains Rd. Rapid Transit Railroads in the Bronx.

✚**Dredging**—New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for dredging in Mill basin, Jamaica Bay, has been awarded to the ATLANTIC GULF & PACIFIC CO., 13 Park Row, New York, at 0.05c. per cu.yd. Noted July 15 and 22.

✚**Pier**—New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for building a pier near the foot of 35th St. has been awarded to G. B. SPEARIN, 90 West St., New York, at $310,201. Noted July 22.

★✚**Subway**—New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for constructing a three-track elevated railroad beginning at a point near 38th St. and 10th Ave. and extending thence to 10th Ave.; thence over 10th Ave. and New Utrecht Ave. to a point at or near 81st. thence to a point in 86th St. to a point at or near Bay 41st St.; thence over 26th Ave. to Stillwell Ave.; and thence over Stillwell Ave. to a point at or near Ave. Y has been awarded to WARD & TULLEY at $71,355. Noted June 24 and July 22.

Dredging—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Borough Pres., until 11 a.m., Aug. 4, for dredging Newtown Creek Canal at and in the canal and basin included within the boundaries of Johnson Ave., Montrose Ave., Morgan Ave., Varick Ave., and also in the Stagg St. Basin, and in Newton Creek near the intersection of Scott and Metropolitan Ave.

★**Subway**—New York, N. Y.—(Borough of Brooklyn)—The following are the unofficial totals of bids received by the Public Service Commission for the construction of Section No. 3, Route No. 12, of the Eastern Parkway Subway: Rodgers & Hagerty, Inc., 152nd St. and Harlem River, New York, $2,170,000; W. H. Gahagen, Inc., $2,200,000; T. A. Gillespie Co., $2,203,000; Charles Cooper, $2,204,000; Battery Engineering & Construction Co. and Fraser, Burchenell Co., $2,260,000; Dock Contractor Co., $2,294,000; A. L. Guidone & Son, Inc., $2,296,000; Mason & Hanger Co., $2,333,000; Connex Engineering & Construction Co., $2,424,000; James E. Gaffney, $2,-438,000; Degnon Contracting Co., $2,544,000; John J. Creem, $3,-196,000. Noted July 15.

Lamp Posts—New York, N. Y.—(Borough of Manhattan)—(Official)—The following are the bids received by the Department of Water Supply, Gas and Electricity on July 19, for furnishing and delivering cast-iron lamp posts with steel shafts: J. Fox & Co., $48,300; Hecla, Winslow & Co., Inc., $64,750; Western Electric Co., $50,167; J. L. Mott Co., 118 5th Ave., New York, $39,568.

✚**Open-Hearth Rails**—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for furnishing and supplying open-hearth rails for use on the construction of the Rapid Transit Railroads has been awarded by the Public Service Commission to the BETHLEHEM STEEL PRODUCTS CO. Noted July 8 and 22.

✚**Motor Fire Apparatus**—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for furnishing and delivering 24 motor-driven hose wagons under three separate contracts, has been awarded to the INTERNATIONAL MOTOR CO., 64th St. and West End Ave., New York, at $86,814. Noted July 1 and 15.

✚**Motor Fire Apparatus**—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for furnishing and applying 26 two-wheel gasoline-driven tractors, 16 for fire engines and 10 for hook and ladder trucks, has been awarded to the FRONT DRIVE MOTOR CO., Willow Ave., Hoboken, N. J., at $82,680. Noted June 17, 24 and July 8.

Automobile Runabouts—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received by Robert Adamson, Fire Comr,. for furnishing and delivering 20 automobile runabouts from the Ford Motor Co., 1723 Broadway, New York, at $8465, and the Maxwell Motor Co., at $10,000. Noted July 22.

✚**Fire Hose**—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for furnishing and delivering 20,000 ft. of 2½-in. and 10,000 ft. of 1½-in. cotton rubber lined hose has been awarded to the EMPIRE RUBBER & TIRE CO., 19 Warren St., New York, at $13,756. Noted July 8.

★**Subway**—New York, N. Y.—(Borough of Manhattan)—The following are the unofficial totals of bids received by the Public Service Commission for the construction of Section No. 3, Routes Nos. 4 and 36, a part of the Broadway Subway lying between 38th and 51st St.: Holbrook, Cabot & Rollins Corporation, 52 Vanderbilt Ave., New York, $3,741,000; Rodgers & Haggerty, Inc., $3,754,000; Smith, Hauser & McIsaacs, $3,814,000; MacArthur Bros. Co., $3,959,000; Underpinning & Foundation Co., $3,987,000; Oscar Daniels Co., $3,953,-516; Degnon Contracting Co., $4,162,920; T. A. Gillespie Co., $4,230,000; Rapid Transit Subway Construction Co., $4,444,000. Noted July 15.

Piles—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier A, Battery Pl., until noon, Aug. 5, for furnishing and delivering piles.

Track Materials—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by the Public Ser-

vice Commission, until 12:15 p.m., Aug. 18, for furnishing track materials for use in the construction of Rapid Transit Railroads.

Track Supplies—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by the Public Service Commission, 154 Nassau St., until Aug. 18, for the supply of special work (frogs and switches), Order No. 3, for use on the construction of Rapid Transit Railroads.

Conduits and Subway Work—Utica, N. Y.—According to press reports, bonds for $53,000 will be sold for constructing conduits and for draining and improving subways. A. M. Burke is City Comptroller.

Elimination of Grade Crossing.—Arlington, N. J.—Thomas J. Wasser, County Engr., Jersey City, is preparing plans for eliminating the grade-crossing of the New York & Greenwood Lake Branch of the Erie R.R. at Arlington.

+Dredging—Philadelphia, Penn.—According to press reports the contract for dredging in preparation for the site of the first of the Moyamensing piers has been awarded to the AMERICAN DREDGING CO., at 14.4c. per cu.yd. for removing the material and depositing it above the high-water mark within the city limits. Noted June 24 and July 22.

Dock—Bayonne, N. J.—The Standard Oil Co. will erect a dock to cost about $65,000.

Swimming Pool—Cumberland, Md.—M. J. Clark, 10 North Liberty St., is interested in the construction of the proposed swimming pool in Amusement Park.

Causeway—Fairmont, W. Va.—According to press reports, a causeway will be built across Coal Run ravine to connect Main St. and Fairmont Ave. John R. Bennett and C. D. Robinson are interested. The estimated cost is about $500,000. Albert J. Kern, City Clk., is interested.

Elimination of Grade Crossing—Atlanta, Ga.—Plans are being prepared by the City Construction Department, for eliminating the grade crossing at Angier and Bellgrade Ave., at the Southern R.R. The estimated cost is $50,000.

Drainage—Bradentown, Fla.—According to press reports, bids will be received by Aug. 4 by the County Commissioners for about 896,202 cu.yd. of excavation for the Gamble Creek Drainage District. Charles S. Hill, P.O.B. 83, Palmetto, is Engr.

Canal—Parish, Fla.—Bids will be received by the Drainage Commissioners until Aug. 2 for the construction of a drainage system, to cost about $110,000. Noted Feb. 11.

+Drainage—Bucktown, La.—The contract for dredging in Jefferson Drainage District No. 4 has been awarded to G. A. McWILLIAMS, Chicago, Ill., at $35,000.

Canal—New Orleans, La.—Bids will soon be asked for the construction of a canal 10 ft. deep, 200 ft. wide at the surface, and 80 ft. wide on the bottom. Ford, Bacon & Davis, Engr. of the Board of Port Commissioners has submitted four plans for approval.

+Sprinkler System, Etc.—New Orleans, La.—(Official)—The contract for the installation of sprinkler equipment and underground water supply system for that portion of the cotton warehouses and terminal, now under construction, has been awarded by the Board of Commissioners to the GENERAL FIRE EXTINGUISHER CO., at $65,275.

★Levee—Vicksburg, Miss.—All bids received on July 12 by the Third Mississippi River District for about 1,415,000 cu.yd. of levee work have been rejected. Noted June 24.

Lumber and Piling—New Orleans, La.—The lowest bid submitted to the Port Commissioners for furnishing concrete piling was from the Creosoted Wood Block Co., at $79,599. Noted July 1.

+Levee—Hickman, Ky.—Press reports state that the contract for enlarging the Reelfoot levee has been awarded to the BONDURANT CONSTRUCTION CO., Hickman, at about $18,000.

+Revetment Wall—Columbus, Ohio—The contract for constructing the revetment wall has been awarded by the State Department of Public Works to PHILIP KIRSCHNER, 831 Cuyahoga Bldg., Cleveland, at $15,140.

Motor Fire Apparatus—Hamilton, Ohio—The City Council contemplates motorizing the fire department at an estimated cost of $50,000. C. E. Deneen is Comr. of Pub. Safety.

Equipment for Fire Department—Springfield, Ohio—Bids will be received until noon, Aug. 5, by the Business Manager, for furnishing $40,000 worth of fire equipment.

Ditch—Richmond, Ind.—Bids will be received by L. C. Peacock, County Surveyor, until Aug. 5 for constructing Nettle Creek Ditch, about 6¾ miles long.

Drainage—Bloomington, Ill.—Press reports state that the Blue Ridge Special District has been organized for the purpose of constructing a drainage system in McLean, De Witt and Pratt Counties. Belle & Hare has prepared plans.

Levee Work—East St. Louis, Ill.—The contract for constructing an earth levee has been awarded by the Board of Trustees, East Side Levee and Sanitary District, to JOHN KEELEY, East St. Louis, at 36c. per cu.yd. Noted June 24 and July 22.

Cement—Burlington, Wis.—(Official)—Bids will be received by the Board of Public Works, until Aug. 7 for furnishing 2600 bbl. of approved portland cement. P. J. Hartgen is City Engr.

Drainage—Atlantic, Iowa—Bids will be called for during September by the Commissioners of Cass County for the construction of about 3.2 miles of open ditches, requiring about 125,000 cu.yd. of excavation. J. H. Mayne, Engr., Council Bluffs is preparing plans. Noted June 24 and July 15.

Motor Fire Apparatus—Sioux City, S. D.—According to press reports, bids will soon be called by William Sloan, Fire Comr., for furnishing and delivering motor fire apparatus.

Ditches and Levees—Tekamah, Neb.—(Official)—Bids will be received by J. J. Breckenridge, Secy., Burt-Washington Drainage Dist., until noon, Aug. 14, for 1,000,000 cu.yd. of diversion ditches and levees. The Towl Engineering Co., National Bank Bldg., Omaha, is Engr.

Elimination of Grade Crossing—Kansas City, Mo.—According to press reports, the lowest bid submitted for the construction of the overhead crossing for the Chicago & Alton Ry. at Van Horn Blvd. was from J. T. Coughlin, at $30,196. Noted Mar. 4.

Dike—St. Joseph, Mo.—Surveys are being made and plans drawn for the construction of a dike for flood protection at 29th St. and Taraon Ave. Carl P. Hoff is City Engr.

Levee—Cummins, Ark.—It is reported that bids will be received until Aug. 2 by G. Waterman, Chn. Linwood and Auburn Levee Board, for constructing 4.2 miles of levee. E. G. Price, Dumas, is Engr.

+Levee Work—Texarkana, Ark.—The contract for levee work in Miller County Levee District No. 1, has been awarded to JAMES T. CONSTANT, Alexandria, La. The estimated cost is $100,000.

+Drainage—Garwood, Tex.—The contract for the construction of 16 miles of drainage ditches, with concrete culverts in Colorado Drainage Dist. No. 1, has been awarded to HOWARD KENYON, 3406 Audubon Pl., Houston, Tex.

Drainage—Monte Vista, Colo.—Bids will be received by O. A. Cramer, Secy., Rio Grande Drainage Dist., for constructing 17 miles of drainage outlet ditches. The work requires 325,000 cu.yd. of earth excavation.

Fire Alarm System—Phoenix, Ariz.—The contract for furnishing equipment for the proposed extensions to the fire-alarm system, has been awarded by the City Commission, to the STAR ELECTRIC CO., Binghamton, N. Y., at $15,822.

Dikes—Kelso, Wash.—At an election to be held soon the citizens will vote on the question of a bond issue, the proceeds of which will be used for the construction of dikes to protect 7000 acres of bottom land.

Improvements to Fire Department—Fresno, Calif.—An election will soon be held to vote on the question of issuing $200,000 in bonds for improving the fire department.

+Steamer—San Francisco, Calif.—The Union Oil Co. has awarded a contract for the construction of an oil-carrying tank steamer to the UNION IRON WORKS, at about $1,000,000.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous."

+Concord, N. H.—The contract for the construction of the Plymouth Normal School dormitory has been awarded to B. H. Wiggin & Co., Lowell, Mass., at $57,830.

Billerica, Mass.—The town has borrowed of the Central Savings Bank of Lowell, $90,000 for the construction of a new high school.

Boston, Mass.—Clarence H. Blackwell, Arch., 20 Beacon St., has completed plans for the construction of a 12-story building for the Pelham Trust Co., at Tremont and Boylston St.

Boston, Mass.—Bids will soon be received for the construction of an addition to the high school on Harvard St. The estimated cost is $75,000. Charles R. Greco, 8 Beacon St., is Arch.

Boston, Mass.—A Normal Art School is proposed on Commonwealth Ave. and Warren St. Cram & Ferguson, 15 Beacon St., is Arch. Daniel Snedden is Chn. of State Bd. of Education.

Boston, Mass.—Bids will be received about Aug. 1 for the construction of a ten-story, brick and steel store and office building on High St., for the High St. Trust. Parker, Thomas & Rice, 110 State St., is Arch. John D. Hardy is Pres.

Chelsea, Mass.—The city has appropriated $120,000 for the construction of an addition to Williams School.

Dedham, Mass.—Bids will be received until Aug. 3 by the Building Committee for the construction of a high school. Kilham & Hopkins, 9 Park St., Boston, Mass., is the Arch.

+Holyoke, Mass.—A. L. CARREAU, Williamsett, Mass., has been awarded the contract for the construction of a six-story store and office building on High St., to cost $60,000. P. B. Alderman & Co. is Arch.

+Holyoke, Mass.—L. P. TROWBRIDGE has been awarded the contract for the construction of a block at Laurel and Charles St. for M. M. Mahoney.

Shirley, Mass.—Bids are being received by Densmore & Le Clair, Arch., 88 Broad St., Boston, Mass., for the construction of an addition to the Industrial School for Boys.

Southbridge, Mass.—All bids were rejected and revised bids will be received by the School Commissioners for the construction of a high school.

+Webster, Mass.—THE TORRINGTON CONSTRUCTION CO., Torrington, Conn., has been awarded the contract for the construction of a $90,000 business block for the Corbin Estate.

+Worcester, Mass.—The contract for the construction of a brick church for St. Casimers R. C. Parish has been awarded to E. L. SIMPSON & BROS. CO., Springfield, Mass. The estimated cost is $60,000. W. J. Donoghue, Springfield, Mass., is Arch.

Worcester, Mass.—Samuel Wolfson, 74 Providence St., will build a two-story, 62x100-ft. building on Grafton St. to cost $50,000. Edward P. Fitzfierald, State Mutual Bldg., is Arch.

Providence, R. I.—Bids will soon be received for the construction of the Beaufort St. school which will contain 19 classrooms and an essembly hall. Murphy, Hindle & Wright, 146 Westminster St., is Arch.

Albany, N. Y.—Contracts will be awarded about Aug. 1 by Merrick & Pember, Arch., 51 State St., for the construction of an eight-story, 77x95-ft. apartment at Washington Ave. and Swan St. The estimated cost is $110,000. Noted July 1.

Buffalo, N. Y.—The Delaware, Lackawanna & Western R.R. will construct a seven-story terminal building at Main and Ohio St. The estimated cost is $360,000. G. J. Ray, Hoboken, N. J., is Ch. Engr.

New York, N. Y.—(Borough of Bronx)—The House of the Holy Comforter plans to construct a modern hospital at the Grand Concourse and 196th St. The cost is estimated at $175,000. John B. Snook & Sons, 261 Broadway, New York, is Arch.

New York, N. Y.—(Borough of Brooklyn)—The Brighton Beach Development Co. plans to construct a fireproof hotel at Brighton Beach. Densmore & Le Clear, Arch., 88 Broad St., Boston, Mass., is preparing tentative plans. Chauncey Marshall is Pres. of the company.

New York, N. Y.—(Borough of Manhattan)—Plans are being prepared by L. F. J. Weicher, Arch., 271 West 125th St., for the construction of a three-story motion picture theater and office building at 235-37 East 14th St. for the American Movie Co., 111 East Seventh St.

New York, N. Y.—(Borough of Manhattan)—Plans are being prepared by Gaetan Ajello, Arch., 1 West 34th St., for the construction of a 12-story 100x100-ft. apartment house at West End Ave. and 103d St. for Paterno Bros. Joseph Paterno, 601 West 115th St., is Pres.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids have been received for the construction and completion of a building at the Gouverneur Hospital, Front St. and Gouveneur Slip, New York, as follows: William H. Egan, Lexington Ave. and 125th St., $168,168; Charles Meade & Co., 38 Park Row, $160,000; John H. Parker Co., 315 Fourth Ave., $144,997; Norcross Bros. Co., 103 Park Ave., $152,900; P. J. Carlin Construction Co., 1123 Broadway, $158,760; P. J. Brennen & Son, 624 Madison Ave., $153,700; Cramp & Co., 25 East 26th St., $160,466; Harby Abroms & Melius, 30 East 42nd St., $158,800; J. T .Brady & Co., 103 Park Ave., $148,840; P. F. Kenny Co., 33 Old Broadway, $160,000; John Kennedy & Co., 1133 Broadway, $159,670; Simon Russek, Inc., 261 Broadway, $169,520.

New York, N. Y.—(Borough of Manhattan)—Charles A. Rich and Frederic Mathesuis, Jr., Arch., 320 Fifth Ave., have prepared plans for the construction of a hall to be known as the Students' Bldg., at 119th St. between Broadway and Claremont Ave. for Barnard College. The estimated cost is $600,000. Noted May 27.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids have been received for the construction and completion of the day room and industrial building and for alterations to the ward buildings for women at the New York City Home District, Blackwells Island, as follows: B. Diamond, 12 Bergen St., Brooklyn, $47,200; Charles Mead & Co., 38 Park Row, $53,110; Joseph Kressel Co., 1133 Broadway, $48,400; George L. Hiltl Co., 114 East 28th St., $55,936; Albert Winternitz, 237 East 72d St., $49,000; William H. Egan, Lexington Ave. and 125th St., $51,066; William Werner, 657 Vanderbilt Ave., Brooklyn, $58,673; Thomas J. Waters Co., 271 West 125th St., $49,400.

Rensselaer, N. Y.—The R. R. Y. M. C. A., 835 Broadway, plans to construct a building to cost about $68,000. A. C. Long is Secy. and Charles Gibson, Orange St. and Broadway, is Chn. of Bldg. Com.

Rochester, N. Y.—Plans have been prepared by Claude Bragdon, Arch., 415 Cutler Bldg., for the construction of a two-story, Northwest Branch of the Y. M. C. A. at Driving Park and Lake Ave. Herbert P. Lansdale, Smith Ave., is Chn. of Bldg. Com. Estimated cost, $50,000. Noted June 24.

Rochester, N. Y.—Bids will be received about Aug. 15 for the construction of a one- and two-story, 200x250-ft., brick and reinforced-concrete armory with a stable on Culver Rd. Louis F. Pilcher, State Arch., Capitol, Albany, and Walker, Livingston & Bracket, Assoc. Arch., Rochester, have prepared the plans. Noted June 24.

Schenectady, N. Y.—The Directors of Union College plan to construct a building to be known as the General Daniel Butterfield Memorial. The estimated cost is $100,000. C. A. Richmond is Pres. of the college.

+Syracuse, N. Y.—The O'BRIEN CONSTRUCTION CO. has been awarded the contract for the construction of a three-story, 63x183-ft. brick and mill constructed building on North State St. for the S. Shapero Co. The estimated cost is $100,000.

Utica, N. Y.—The Board of Education has rejected all bids received for the construction of a two-story grade school to be known as the Kernan School in West Utica. Estimated cost, $130,000. Plans will be revised by Gouge & Ames, Arch., 70 Genesee St. Noted May 6 and July 8.

+White Plains, N. Y.—E. T. EGGLESTON, 156 Woodworth Ave., Yonkers, has been awarded the contract for the wrecking and excavating for the construction of the county courthouse on Main St. between Court and Grand St. for Westchester County. E. E. Seelye, 101 Park Ave., New York, is Structural Engr. The estimated cost of the entire project is $800,000. Noted June 24 and July 15.

Yorktown, N. Y.—Lewis F. Pilcher, State Arch., Capitol, Albany, has prepared plans for the construction of additional buildings to the Mohansic State Hospital for the Insane. E. S. Elwood is Secy. of the hospital. The estimated cost is $500,000. Noted under Yorktown Heights, N. Y., June 3.

Bayonne, N. J.—The Board of Estimate of the Board of Education has authorized the issuing of $631,000 in bonds for improving the schools of Bayonne. The amount will be used as follows: $200,000 for the construction of buildings to replace Public Schools Nos. 1 and 4; $260,000 for an addition to the high school; $146,000 for a building to replace Public School No. 5. Noted June 24.

+Newark, N. J.—The Petty Estate has awarded the contract for the construction of a six-story store and loft building at Market and Halsey St. to the TRENTON BUILDING & CONSTRUCTION CO. Estimated cost, $98,000. Noted May 6.

+Perth Amboy, N. Y.—(Official)—J. C. FOWLER, 130 Smith St., Perth Amboy, has been awarded the contract for the construction of an addition to the high school on State St. J. N. Pierson & Son is Arch. Noted July 15.

West Hoboken, N. J.—Plans are being prepared by Hensel & Feir, Arch., 809 Savoga St., for the construction of a three-story, 50x120-ft. Masonic Temple on Palisade Ave. for the Doric Lodge, F. & A. M. The estimated cost is $40,000. William A. White, Palisade Ave., Weehawken Heights, is Chn. of Bldg. Com.

Clearfield, Penn.—The School Board will award contracts about Sept. 1 for the construction of a two-story, 113x138-ft. concrete and brick high school. Estimated cost, $80,000. Harrington & Howard, Arch., Du Bois, prepared the plans. Noted Apr. 29 and July 1.

Erie, Penn.—Bonds to the amount of $250,000 have been sold. The proceeds will be used for the construction of a high school on 26th and State St.

Langhorne, Penn.—Plans are being prepared for the construction of a college for fatherless girls to be known as the Charles E. Ellis Memorial School. The estimated cost is $3,000,000. The Commonwealth Title, Insurance & Trust Co., 12th and Chestnut St., Philadelphia, is Trustee of the Ellis Estate.

Philadelphia, Penn.—Bids will be received until Aug. 31 for the construction of an immigrant station at the Reed St. Yards, South Wharves, for the Pennsylvania R.R. Alex. C. Shand is Ch. Engr. Noted July 22.

Philadelphia, Penn.—Bids will soon be received for the construction of a three-story bank and a 20-story office building at 1416-18 Chestnut St. for the Franklin National Bank. The estimated cost is $1,000,000. McKim, Meade & White, 101 Park Ave., New York, N. Y. is Arch. and Furness, Evans & Co., Provident Bldg., Philadelphia, is Assoc. Arch. Noted July 22.

+Philadelphia, Penn.—The contract for the construction of a ten-story, 46x164-ft. addition to the Evening Bulletin Bldg., Juniper & Filbert St., for W. L. McLean, has been awarded to DOYLE & CO., 1519 Sansom St., Philadelphia. Estimated cost, $350,000.

Philadelphia, Penn.—Plans are being prepared by Andrew Borgner, Arch., 721 Walnut St., for the construction of a four-story, 128x160-ft. apartment house at Horter and Jefferson St. for Max Lichtenstein. The estimated cost is $150,000.

Sharon, Penn.—Wallis & Carley Co. submitted the lowest bid on the general contract for the construction of the three-story, Kimberly Nurses Home adjoining the C. H. Buhl Hospital. C. H. & C. F. Owsley, Youngstown, Ohio, is Arch. Noted Feb. 18.

+Wanamie, Penn.—The School Board of Newport Township has awarded the contract for the construction of an eight-room school to HERMAN MAILANDER, Wilkes-Barré, at $46,986.

Wilmington, Del.—A. S. Reed & Bro. Co., Wilmington, at $123,773, submitted the lowest bid on the general contract for the construction of a four-story, 85x183-ft. brick and stone addition to the Wilmington High School at Monroe St. and Delaware Ave. Noted May 6 and July 8.

RAPID TRANSIT SYSTEM, NEW YORK, N. Y.

TRACK INSTALLATION

Bids were received July 9 by the Public Service Commission for track laying on the New Utrecht Ave. elevated line from (A) Ward & Tully, Inc., (B) Joseph A. McElroy, (C) W. F. Jordon, (D) Post & McCord, (E) Degnon Contracting Co., (F) Snare & Triest Co., (G) Connex Engineering & Construction Co., (H) Thomas Crimmins Construction Co., (I) Johnson-Gifford Co., (J) Charles Cooper, (K) Holbrook, Cabot & Rollins Corporation and George W. McNulty, (L) Max Raymond, (M) Joseph J. Klein, (N) James S. Frazer. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
48,770 lin.ft. for installation of hand rail	$0.10	$0.16	$0.20	$0.14	$0.175	$0.15	$0.20	$0.13	$0.20	$0.25	$0.42	$0.21	$0.20	$0.25
563 ft. b.m. for installation of plank walks	11.00	10.00	12.00	14.00	18.25	10.00	25.00	20.50	22.00	19.00	28.00	25.00	20.00	15.00
14,300 for installation of anti-creepers complete	.10	.10	.10	.10	.11	.10	.10	.12	.12	.12½	.08	.10	.08	.10
57,300 lin.ft. (a) on tangents and curves of more than 2,000 ft. radius	.60	.65	.65	.70	.68	.85	.75	.86	.80	.75	.70	.90	1.01	1.00
300 lin.ft. (b) on curves of 2,000 ft. to 701 ft. radius	1.25	1.25	1.25	1.10	1.07	1.50	1.80	1.33	1.40	1.25	1.10	1.60	1.85	1.50
5,400 lin.ft. (c) on curves of less than 701 ft. radius	1.55	1.45	1.30	1.40	1.07	1.55	2.00	1.33	1.65	1.25	1.40	1.80	2.00	1.75
14,800 lin.ft. (d) at and adjoining stations	.60	.65	.70	.75	.80	.93	.80	.86	.80	.95	.80	1.00	1.25	1.50
For installation of special work, portion 35 (lump sum)	1,000.00	800.00	840.00	1,125.00	1,350.00	1,500.00	1,200.00	1,800.00	1,600.00	2,500.00	1,050.00	1,500.00	950.00	1,000.00
For installation of special work, portion 36	1,000.00	800.00	840.00	1,125.00	1,350.00	1,500.00	1,200.00	1,800.00	1,600.00	2,500.00	1,050.00	1,500.00	950.00	1,000.00
For installation of special work, portion 37 (lump sum)	1,000.00	800.00	840.00	1,125.00	1,350.00	1,500.00	1,200.00	1,800.00	1,600.00	2,500.00	1,050.00	1,500.00	950.00	1,000.00
For installation of special work, portion 38 (lump sum)	1,000.00	800.00	840.00	1,125.00	1,350.00	1,500.00	1,200.00	1,800.00	1,600.00	2,500.00	1,050.00	1,500.00	1,200.00	1,000.00
For installation of special work, portion 39 (lump sum)	1,300.00	600.00	925.00	1,500.00	1,350.00	1,650.00	1,200.00	1,850.00	1,600.00	2,500.00	950.00	1,500.00	500.00	1,000.00
Extended totals	$71,355	$75,183	$78,525	$82,639	$85,105	$94,864	$99,414	$99,564	$100,516	$102,587	$103,781	$111,616	$116,436	$118,217

Baltimore, Md.—Bids will soon be received for the construction of an addition to the mechanical laboratory on Monument St. at Johns Hopkins University. The estimated cost is $50,000. Noted July 22.

Washington, D. C.—Plans have been prepared by Milburn, Heister & Co., Arch., Union Savings Bank Bldg., for the construction of a nine-story, 121x198-ft. office building at D, E and 13th St. for the Federal City Construction Co. The estimated cost is $950,000. Noted June 24.

Washington, D. C.—(Official)—Milburn, Heister & Co., Arch., is preparing plans for the construction of a building on Ninth and Massachusetts Ave. for the American Federation of Labor. Samuel Gompers is Pres. Bids will be received about Aug. 20. Noted July 22.

✚Richmond, Va.—The contract for the construction of a two-story brick and concrete school on Chamberlayne Ave. and Myrtle Pl. has been awarded to JOHN T. WILSON CO., Richmond, at $63,430.

✚Richmond, Va.—JAMES FOX & SONS, Norfolk, at $48,232, has been awarded the contract for the construction of a 95x114-ft. addition to the Franklin St. School and a 66x96-ft. addition to the Maury St. School. Charles M. Robinson, Inc., is Arch.

✚Berkeley Springs, W. Va.—The contract for the construction of a four-story, 56x100-ft. hotel, to be known as Hotel Raleigh, for the Berkeley Hotel Co., has been awarded to CRAISER & FREEMAN, Berkeley Springs. H. F. Wysong, Princeton, is Arch. Noted July 8.

Durham, N. C.—(Official)—The Board of County Commissioners of Durham County has commissioned Milburn, Heister & Co., Arch., Washington, D. C., to prepare plans for the construction of a six-story county courthouse and a city and county jail. The cost will be between $200,000 and $250,000. Plans will be ready for bids about Sept. 15. Noted July 22.

Greensboro, N. C.—At a recent election the citizens voted in favor of issuing $60,000 in bonds. The proceeds will be used for the construction of schools. Noted Apr. 29.

Raleigh, N. C.—The County Commissioners have been petitioned to hold an election to vote on the question of issuing $100,000 in bonds. The proceeds will be used for the construction of schools.

✚Atlanta, Ga.—The contract for the construction of a three-story brick apartment building on Peachtree and Fourth St. form R. P. Black has been awarded to the GUDE & CO., Grant Bldg., Atlanta. Estimated cost, $70,000. C. E. Fraser, Candler Bldg., is Arch.

Atlanta, Ga.—The Building Committee of the Emory College plans to construct several buildings on the campus. The estimated cost of the entire project is $500,000. A. G. Candler, Sr., is Member of Bldg. Com.

✚Savannah, Ga.—The contract for the construction of a Carnegie Public Library has been awarded to A. A. ARTLEY, Savannah. Noted June 17.

St. Augustine, Fla.—Bids will be received until noon, Aug. 9, by P. K. Younge, Chn., Bd. of Control of the State of Florida, Mason Hotel, Jacksonville, for the construction of a hospital for negroes at the State School for Deaf and Blind. Edwards & Sayward, 633 Candler Bldg., Atlanta, Ga., is Arch.

Anniston, Ala.—L. M. Weathers Co., Arch., Memphis, Tenn., has prepared plans for the construction of a seven-story brick and terra cotta store, office and lodge building for the Anniston Lodge No 443, A. F. & A. M. The estimated cost is $75,000. Noted July 8.

Nashville, Tenn.—Bids will be received until 9 a.m., July 31, by John F. Gaffney, Chn., of Davidson County Asylum Comn., 333 Fourth Ave., Nashville, for the construction of two additions to the Davidson County Asylum. Edward E. Dougherty is Arch.

✚Alliance, Ohio—The contract for the construction of a Masonic Temple for the Conrad Lodge No. 271, F. & A. M., has been awarded to F. C. KROEMER, Dayton. The estimated cost is $50,000. Noted June 10.

✚Canton, Ohio—The contract for the construction of the Henry Martin School has been awarded to the INDIANA ENGINEERING & CONSTRUCTION CO., Ft. Wayne, Ind., at $81,365. Noted July 1.

Cincinnati, Ohio—Work will be started about Oct. 1 on the construction of the East Hill High School. The estimated cost is $1,000,000. Noted July 22.

Cleveland, Ohio—Bids will soon be received by Charles S. Schneider, Arch., 2248 Euclid Ave., for the construction of a building at Cedar Rd. and Euclid Blvd. for the Plymouth Congregational Church. Estimated cost, $150,000. Noted May 20.

Cleveland, Ohio—An ordinance granting a franchise to the Cleveland & Youngstown R. R. Co. has been passed by the City Council for the construction of freight and passenger terminals in the downtown district. Noted July 1.

Cleveland, Ohio—The Trustees of the Jewish Orphans' Asylum plan to construct an addition to the institute which will cost about $1,000,000.

Columbus, Ohio—The College of Homeopathic Medicine of the Ohio State University plans to construct a hospital on the campus. Estimated cost, $50,000.

Columbus, Ohio—Plans are being prepared for the construction of a hotel on South High St. on the site of the Neil House. The cost will be between $1,500,000 and $2,000,000.

East Cleveland, Ohio—Plans have been prepared by A. F. Janowitz, Arch., 323 Permanent Bldg., for the construction of a three-story commercial and apartment building at St. Clair and Hayden Ave. for H. A. Kangesser. Estimated cost, $75,000.

Lilly Chapel, Ohio—The citizens of Lilly Chapel and Big Plain have voted in favor of the question of issuing $40,000 in bonds. The proceeds will be used for the construction of a school.

Steubenville, Ohio—Peterson & Clark, Arch., has prepared plans for the construction of a brick and terra cotta addition to the Wells High School. The estimated cost is $70,000.

Wilmington, Ohio—Bids will be received about Aug. 15 by Weber, Werner & Adkins, 1206 Mercantile Library Bldg., Cincinnati, for the construction of a courthouse at Wilmington. The estimated cost is $300,000. Noted June 17.

Hammond, Ind.—Bids will be received until 8 p.m., Aug. 2, by the Board of School Trustees, for the construction of a building to be known as the Hammond Industrial High School Building. J. T. Hutton & Son, Hammond Bldg., is Arch.

Sanford, Ind.—Bids will be received until Aug. 3 by Edward B. Martin, Trustee, for the construction of a two-story, 65x80-ft. brick school. Johnson & Miller, Terre Haute, is Arch.

Ann Arbor, Mich.—The Trustees of the University of Michigan have accepted plans for the construction of a building for the Michigan Union. The estimated cost is $1,000,000. H. B. Hutchins is Pres. Noted May 13.

Chicago, Ill.—Joy Morton, Railway Exchange Bldg., has purchased a site at Washington St. and Fifth Ave., the present site of the Chicago Times Bldg., upon which he will construct a commercial and office building. The estimated cost is $1,000,000.

✚Chicago, Ill.—The general contract for the construction of a three-story, 350x700-ft. fireproof museum near 12th St. and the Illinois Central R.R. for the Marshall Field Museum of Natural History has been awarded to the THOMPSON-STARRETT CO., 343 South Dearborn St., Chicago. The estimated cost is $5,100,000. Stanley Field is Pres. Noted Jan. 28.

Chicago, Ill.—Fred Becklenberg, 29 South La Salle St., plans to construct a store, theater and office building at Division St. and Washtenaw Ave. The estimated cost is $85,000. Thomas R. Bishop is Arch.

✚Galesburg, Ill.—The MONMOUTH-GALESBURG CONSTRUCTION CO., at $40,422, has been awarded the contract for the construction of an armory. Noted June 24.

Hoyleton, Ill.—The Directors of the Evangelical Orphans' Home plan to rebuild the home which was destroyed by fire. It will be fireproof and brick and cost about $50,000.

Princeton, Ill.—Plans are being prepared by Aldrich & Aldrich, Arch., Galesburg, for the construction of a hotel. The estimated cost is $100,000.

Rock Island, Ill.—Plans will be revised by Olof Z. Cervin, Arch., 401 Safety Bldg., for the construction of a three-story school. Noted Mar. 4.

Urbana, Ill.—Plans are being prepared by J. M. White, Supervising Arch., at the University of Illinois for the construction of a four-story, 112x168-ft. stone and terra cotta dormitory for girls on Nevada St.

Appleton, Wis.—Bids are being received by Cooledge & Hodgson, Arch., 134 South La Salle St., Chicago, Ill., for the construction of a two-story bank building for the Citizens' National Bank. Estimated cost, $65,000. Noted June 10 and 17.

Eau Claire, Wis.—(Official)—Bids will be received about Aug. 6 for the construction of a municipal auditorium and city hall. The estimated cost is $50,000. George Awsumb, 14 East Jackson Blvd., Chicago, Ill., is Arch. Noted May 6 and July 15.

✚Milwaukee, Wis.—The RAULF CONSTRUCTION CO., Milwaukee, has been awarded the contract for the construction of a theater and commercial building at Downer Ave. and Belleview Pl. for the Read & Nancy Investment Co. Noted June 17.

✚Milwaukee, Wis.—The general contract for the construction of an addition to the Merrill Bldg., Second St. near Grand Ave. has been awarded to H. SCHMITT & SONS, 684 Jackson St., Milwaukee. Estimated cost, $125,000. Noted July 22.

✚Armstrong, Iowa—The contract for the construction of a three-story, 71x110-ft. grade and high school has been awarded to JOSEPH A. BASS & CO., Faribault, Minn. Estimated cost, $50,000. Alban & Lockhart, Arch., 347 Endicott Bldg., St., Paul, Minn., prepared the plans. Noted June 10 and July 8.

Grinnell, Iowa—An election will be held Aug. 16 to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for the construction of a high school.

Newton, Iowa—Bids will soon be received by the Jasper County School Board for the construction of schools at Newton. The estimated cost is $100,000.

Tipton, Iowa—At a recent election the citizens voted in favor of issuing $50,000 in bonds. The proceeds will be used for the construction of a county home.

Minneapolis, Minn.—Plans are being prepared by A. R. Van Dyck, Arch., 742 McKnight Bldg., for the construction of a three-story, 43x120-ft. hospital for the Maternity Hospital, 2201 Western Ave. The estimated cost is $50,000.

Lyons, Kan.—The Methodist Congregation is having plans prepared for the construction of a church. The estimated cost is $40,000. Charles D. Cuthbert, 435 Kansas Ave., Topeka, is Arch.

Kearney, Neb.—Bids will be received until 10 a.m., Aug. 3, by the Secretary of the Board of Education of the Nebraska State Normal Schools, Lincoln, Neb., for the construction of an auditorium for the State Normal School at Kearney. J. H. Craddock, 12 Continental Bldg., Omaha, is Arch. Noted Mar. 4.

North Platte, Neb.—N. McCabe contemplates the construction of a hotel at North Platte to cost about $45,000.

Omaha, Neb.—Plans have been prepared by Burd F. Miller, Arch., Brandeis Theater Bldg., for the construction of a four-story brick and stone business building at 14th and Jones St. for the Goodrich Drug Co., 1310 Harney St. The estimated cost is $75,000. Noted June 24.

Sioux Falls, S. D.—E. Jackson Casse Co., Arch., & Engr., 53 West Jackson St., Chicago, Ill., has prepared plans for the construction of a six-story, 66x87-ft. brick and stone, office and bank building at Main Ave. and Ninth St. for the Security Building Co.

Columbia, Mo.—The citizens contemplate the construction of a new brick city hall, at an estimated cost of $75,000. James M. Batterton is Mayor.

✚Kansas City, Mo.—The contract for the construction of a six-story, 50x115-ft. brick and concrete building at 21st and Grand Ave. for E. W. Shields, Board of Trade Bldg., has been awarded to the SWENSON CONSTRUCTION CO., 625 Finance Bldg., Kansas City. Estimated cost, $100,000. Wilder & Wight, 401 First National Bank Bldg., is Arch.

Kansas City, Mo.—Bids will soon be received for the construction of a two-story brick church at Benton Blvd. and Lexington St. for the Church of the Assumption. The estimated cost is $65,000. W. J. Connolly, 3210 Lexington St., is Pastor, and W. Hilton Smith, 518 Massachusetts Bldg., is Arch.

✚St. Joseph, Mo.—The contract for the construction of a theater at Seventh and Edmond St. for the Electric Theater Co. has been awarded to HACKETT & SIMPSON, St. Joseph, at $40,000. Carl Boller & Bro., 7 Gayety Theater Bldg., Kansas City, is Arch.

St. Louis, Mo.—Bids are being received for the construction of a 115x127-ft. fireproof theater at Ninth and St. Charles St. for the Orpheum Theater Co. of Missouri. The estimated cost is $450,000. Frank Tate is interested. Noted June 17.

✚Warrensburg, Mo.—The Board of Regents of the Warrensburg State Normal School has awarded the contract for the construction of the Science Hall to the CAPITAL CITY PLANING MILL CO., Jefferson City. Estimated cost, $64,000.

Warrensburg, Mo.—Plans are being prepared for the construction of a training school to cost $50,000 and a main building costing $200,000. E. J. Hendricks is Pres. of the school. Noted May 27.

Little Rock, Ark.—The Grand Lodge of the Knights and Daughters of Tabor will construct a temple. Estimated cost, $60,000.

✚Little Rock, Ark.—The School Board has awarded the contract for the construction of a two-story brick and terra cotta school to JOHNSON BROS., Little Rock, at $40,000. Thomas Harding is Arch. Noted July 1 and 15.

College Station, Tex.—The State Agriculture and Mechanical College will construct a hospital and a dairy barn. The estimated cost of the hospital is $50,000.

Galveston, Tex.—George E. Robinson, Galveston, plans to construct an eight-story hotel at Tremont and Postoffice St.

Tahoka, Tex.—An election will be held July 31 by the Commissioners' Court of Lynn County to vote on the question of issuing $60,000 in bonds. The proceeds will be used for the construction of a courthouse and jail.

✚Okmulgee, Okla.—The Board of Education has awarded the contract for the construction of a three-story, 70x178-ft. high school to the CADDO CONSTRUCTION CO., Okmulgee, at $73,000. Other bidders were: Cashner & Leavengood, Kansas City, Mo., $94,395; A. J. Hingle, Bartlesville, $77,273; L. W. Dumas Construction Co., Richmond, Mo., $75,500; Kreipke & Schaefer, Atchison, Kan., $79,500; A. C. Campbell, Wichita, Kan., $81,100; L. F. Lee, Oklahoma City, $88,000; Lloyd Hiram Construction Co., 404 Odd Fellows Bldg., St. Louis, Mo., $85,-867; Reinhardt & Donnovan, Oklahoma City, Okla., $88,200; L. Crosby & Son, 517 Massachusetts Bldg., Kansas City, Mo., $88,-975; H. Eilenberger & Co., 60th St. and Swope Parkway, Kansas City, Mo., $92,327; Loftus & Skidmore, P. O. Box 350, Durango, Colo., $93,000. Smith, Rea & Lovitt, 602 Finance Bldg., Kansas City, Mo., is Arch. Noted Apr. 15 and 29.

Grand Mound, Wash.—Plans have been prepared by Watson Vernon, Arch., 1 Gabrielson & Holmer Bldg., Aberdeen, for the construction of a new administration building at the State School for Girls, Grand Mound. Estimated cost, $60,000.

Mt. Vernon, Wash.—An election was held July 24, by the School Board to vote on the question of issuing $50,000 in bonds. The proceeds will be used for the construction of a school. Stephen & Stephen, 726 New York Blk., Seattle, is Arch. Noted June 24.

✚Ocean Park, Wash.—The contract for the construction of a reinforced-concrete theater and dancing pavilion has been awarded to MARTIN & DUGAN, Northern Bank Bldg., Seattle. Estimated cost is $60,000.

Olympia, Wash.—Bids will soon be received by the State Board of Control for the construction of two ward buildings for the Northern Hospital for Insane. Heath & Gove, Tacoma, is Arch. The estimated cost is $128,000. Noted Mar. 25.

✚Seattle, Wash.—The GRANT, SMITH & CO., Henry Bldg., Seattle, have been awarded the contract for the construction of a 120x240-ft., reinforced-concrete ice arena at Fifth Ave. between University and Seneca St. for the Metropolitan Building Co., White Bldg. Estimated cost, $70,000. Noted July 1.

✚Seattle, Wash.—MARTIN & DUGAN, Northern Bank Bldg., Seattle, has been awarded the contract for the construction of a four-story hotel on First Hill for the Quaker Investment Co., Green Bldg. The estimated cost is $80,000. R. Hamilton Towe is Arch.

Seattle, Wash.—Bebb & Gould, Arch., Denny Bldg., has prepared plans for the construction of a four-story, 45x108-ft. reinforced-concrete, fireproof, office building on Second Ave. near Virginia St. for the Puget Sound News Co. The estimated cost is $50,000. Noted under "Industrial Works June 17.

Monmouth, Ore.—Bids are being received for the construction of a two-story, 84x128-ft. building at the State Normal School. The estimated cost is $60,000. J. V. Bennes, Chamber of Commerce Bldg., is Arch. Noted Jan. 7 and June 17.

✚Portland, Ore.—The contract for the construction of a building at the Franklin High School has been awarded to JAMES S. WINTERS, Couch Bldg., Portland, at $74,897. Noted May 20 and July 22.

Portland, Ore.—Whitehouse & Fouilhoux, Arch., 809-13 Wilcox Bldg., has prepared preliminary plans for the construction of the public auditorium on the Market Blk. The estimated cost is $600,000. Noted Apr. 15.

Berkeley, Calif.—Bids will be received until Aug. 9 for the construction of a four-story, 200x200-ft. building to be known as the Benjamin Ide Wheeler Hall at the University of California. The building will cost about $800,000. Noted June 24.

Ingleside, Calif.—(San Francisco post office)—The San Francisco Golf and Country Club will construct a clubhouse. The estimated cost is $500,000.

Sacramento, Calif.—Shea & Lofquist, Arch., 742 Market St., San Francisco, has prepared plans for the construction of the Hall of Justice for the city. The estimated cost is $225,-000. Noted Nov. 5.

San Bernardino, Calif.—The City Council plans to hold an election Sept. 6, to vote on the question of issuing $210,000 in bonds. The proceeds will be used for the construction of a city hall, municipal auditorium and parks. Noted June 24.

MADISONVILLE SEWER DISTRICT, CONTRACT NO. 3—CINCINNATI, OHIO

Bids were received July 12 by Philip Fosdick, Dir. of Pub. Ser., for the construction of sewers in the Madisonville Sewer District, Contract No. 3 from (A) Engineering Estimate, (B) Thomas P. Strack, Cincinnati, (C) Thomas Maloney, Cincinnati, (D) Welling & Franz, Cincinnati, (E) Thurber & Browning, Cincinnati. The item bids were as follows:

Brick	A	B	C	D	E
865 lin.ft., 33-in. brick sewer	$5.20	....	$4 00	....	$6 21
1140 lin.ft. 42-inbrick sewer	7.80	....	9.00	....	8 25
6 manholes (standard) on brick sewer, 4 ft. diameter or less	75.00	....	75.00	....	75.00
1 junction chamber (brick or concrete)	120.00	....	150 00	....	100.00
Extended totals	$13,960	....	$14,320	....	$15,326
Concrete					
865 lin.ft. 33-in. concrete sewer	$5.20	....	....	....	$6 00
1140 lin.ft. 42-in. concrete sewer	7.80	....	....	....	8 40
8 manholes (standard) on concrete sewers, 4 ft. diameter or less	75.00	....	....	....	75.00
1 junction chamber (brick or concrete)	120.00	....	....	....	100.00
Extended totals	$13,960	....	....	....	$15,316
Reinforced Concrete Pipe					
865 lin.ft. 33-in. reinforced concrete pipe sewer, complete	$5.20	$7 30	....	....	....
1140 lin.ft. 42-in. reinforced concrete pipe sewer, complete	7.80	9.55	....	....	....
6 manholes (standard) on reinforced concrete sewer, 4 ft. diameter or less	75.00	60.00	....	....	....
1 junction chamber (brick or concrete)	120 00	100.00	....	....	....
Extended totals	$13,960	$17,661	....	....	....
Segmental Block					
865 lin.ft. 33-in. segmental block sewer, complete	$5.20	$7.30	$4.00	$5.00	$5.25
1140 lin.ft. 42-in. segmental block sewer, complete	7.80	9.55	9.00	7.50	7.50
6 manholes (standard) on segmental block sewer, 4 ft. diameter, or less	75.00	60.00	75.00	75.00	75 00
1 junction chamber (brick or concrete)	120.00	100.00	150.00	125.00	100 00
Extended totals	$13,960	$17,661	$14,320	$13,450	$13,641

Vitrified Pipe and Miscellaneous Quantities	A	B	C	D	E
7940 lin.ft. 12-in. vitrified pipe sewer	$2.00	$1.50	$1.75	$2.00	$1.75
2900 lin.ft. 15-in. vitrified pipe sewer	2.60	1.75	2.60	2.50	2.00
1480 lin.ft. 18-in. vitrified pipe sewer	2.85	1.90	2.80	2.75	2.40
1540 lin.ft. 22-in. vitrified pipe sewer	4.10	2.65	3 50	3.40	3 10
1480 lin.ft. 24-in. vitrified pipe sewer	3.70	3.00	3.50	3.40	3.40
470 lin.ft. 27-in. vitrified pipe sewer	5.10	6.00	5.00	6.00	4.40
600 T-branches on 12-in. pipe sewer	0.80	0.50	0.50	0.70	0.55
200 T-branches on 15-in. pipe sewer	1.00	0.65	0.75	1.00	0.80
100 T-branches on 18-in. pipe sewer	1.45	1.00	1.00	1.25	1.22
100 T-branches on 22-in. pipe sewer	2.20	1.70	2.00	1.70	2.10
90 T-branches on 24-in. pipe sewer	4.00	2.00	2.50	1.80	2.35
30 T-branches on 27-in. pipe sewer	5.00	4.50	3.50	5.00	5.30
425 lin.ft. 6-in. vitrified pipe	0.25	0.15	0.20	0.25	0 30
55 6-in. vitrified bends for chimney extension	0.40	0.25	0.30	0.30	0.30
1300 lin.ft. 12-in. vitrified pipe inlet connections	1.50	1.00	1.00	1.00	2.00
50 lin.ft. 15-in. vitrified pipe inlet connections	1.50	1.25	1.00	1.00	2.35
95 manholes (standard) on pipe sewer	60.00	55.00	55.00	55.00	75 00
Manhole, drop (lump sum)	130.00	100.00	100.00	100.00	90.00
100 6-in. stubs in trunk sewer	0.35	0.20	0.20	0.40	0.20
1 12-in. stub in trunk sewer	1.00	0.75	0.75	1.00	0.30
1 12-in. slant in trunk sewer	1.00	0.75	0.75	1.00	0.80
1 15-in. slant in trunk sewer	1.50	1.00	0.75	1.00	1.75
18 street inlets, plan 1	50.00	45.00	40.00	40.00	50.00
2 street inlets, plan 3	60.00	55.00	50.00	50.00	80.00
4 street inlets, type B	40.00	35.00	30.00	40.00	30.00
10 cu.yd. concrete masonry, class 2 (headwalls)	10.00	8.00	5.00	8.00	11.00
12 cu.yd. concrete masonry, class 2 (soft ground foundations)	8.00	6 00	5.00	0.02	11.00
40 cu.yd. concrete masonry, class 3 (chimney extensions)	8.00	6.00	10.00	7.00	10.00
100 cu.yd. masonry concrete, class 3 (Haunch walls, etc.)	7.00	6.00	7.00	7.00	10.00
1 cu.yd. brick masonry	13.00	12.00	0.02	9.00	20.00
500 lin.ft. 8-in. underdrain	0.50	0.10	0.02	0.02	0.40
10 cu.yd. gravel refill	2.00	1.75	0.02	0.02	3.00
36 lin.ft. 24-in. c.i. pipe sewer	15.00	15.00	12.00	12.00	5.00
50 sq.yd. rip-rap	2.00	2.00	1.50	2.00	1.50
100 cu.yd. special excavation	0.50	0.01	0.50	0.50	2.50
7 street inlets, type C	15.00	12.00	12.00	20.00	20.00
3 street inlets, type D	20.00	15.00	18.00	20.00	30.00
100 lb. w.i. for screens	0.10	0.10	0.06	0.10	0.10
425 lb. c.i. grating	0.10	0 10	0 06	0 04	0.05
Extended totals	$54,988	$41,894	$49,264	$51,224	$50,351

San Bernardino, Calif.—(Official)—Bids will be received about Sept. 15 for the construction of a group of buildings for the new county hospital. Lyman Farwell, Story Bldg., Los Angeles, is Arch. Noted Mar. 11 and July 15.

Toronto, Ont.—E. M. Statler, Detroit, Mich., plans to construct a hotel containing 1000 rooms at Toronto. The estimated cost is $2,000,000.

CATALOG NOTICES

The International Nickel Co., 43 Exchange Pl., New York. Catalog. Monel metal. 12 pp., 4x8½ in.

Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3031. Ingersoll-Rogler Class FR-1 air compressors. Illustrated, 24 pp., 6x9 in. Form No. 4034. Leyner-Ingersoll water drill. Illustrated, 4 pp., 6x9 in.

Chicago Pneumatic Tool Co., Fisher Bldg., Chicago, Ill. Bulletin No. 34-X. Class A-G "Giant" gas and gasoline engines. Illustrated, 8 pp., 6x9 in.

The Locomobile Co. of America, Bridgeport, Conn. Catalog. Locomobile worm drive motor trucks. Illustrated, 42 pp., 8½x11 in.

Austin-Western Road Machinery Co., Chicago, Ill. Catalog. Grading, rock crushing and road surfacing equipment. Illustrated, 66 pp., 7x10 in.

I. P. Morris Co., Beach and Ball St., Philadelphia, Penn. Bulletin No. 4. Hydraulic turbines. Illustrated, 70 pp., 8½x10½ in.

A. S. Cameron Steam Pump Works, 11 Broadway, New York. Bulletin No. 104. Station and sinking pumps. Illustrated, 36 pp., 6x9 in. Bulletin No. 150. Double suction volute centrifugal pumps. Illustrated, 16 pp., 6x9 in. Bulletin No. 151. Turbine centrifugal pumps. Illustrated, 20 pp., 6x9 in. Bulletin No. 152. Single suction volute centrifugal pumps. Illustrated, 8 pp., 6x9 in. Bulletin No. 153. Centrifugal pumps for house service. Illustrated, 8 pp., 6x9 in. Bulletin No. 300. Triplex pumps. Illustrated, 4 pp., 6x9 in.

Automatic Concrete Mixer Co., Providence, R. I. Catalog. Concrete mixers—Hains-Weaver Patents. Illustrated, 32 pp., 6x9 in.

Continuous Wire Wound Pipe Co., Flood Bldg., Los Angeles, Calif. Catalog. Continuous wire wound wood stave pipe. Illustrated, 16 pp., 4x9 in.

General Electric Co., Schenectady, N. Y. Bulletin No. 42,-552. Motor generator sets. Illustrated, 28 pp., 8x10½ in.

The Esterline Co., Indianapolis, Ind. Catalog No. 364. Golden Glow incandescent headlights for railway, mine and industrial service. Illustrated, 32 pp., 6x9 in.

Bausch & Lomb Optical Co., Rochester, N. Y. Catalog. Optical instruments for inspection and testing of materials. Illustrated, 36 pp., 6½x9½ in.

The Titanium Alloy Mfg. Co., Niagara Falls, N. Y. Booklet. Titanium aluminum and other standard bronze castings. Illustrated, 32 pp., 3½x8½ in.

W. N. Best, 11 Broadway, New York. Catalog. Oil and tar burning apparatus for marine, locomotive and stationary boilers. Illustrated, 32 pp., 6x9 in.

R. & J. Dick, Ltd., Passaic, N. J. Catalog. Balata belting. Illustrated, 20 pp., 3½x6 in.

The Brown Hoisting Machine Co., Cleveland, Ohio. Bulletin. Brownhoist Schnable patent drag-line bucket. Illustrated, 12 pp., 6x9 in.

The Gardner Governor Co., Quincy, Ill. Circular A-C 12. Air lift pumping system. Illustrated, 16 pp., 6x9 in.

Wallace & Tiernan Co., Inc., 136 Liberty St., New York. Catalog. Chlorine control apparatus for water and sewage purification. Illustrated, 36 pp., 9x12 in.

The Blackmer Rotary Pump Co., Petoskey, Mich. Catalog. Rotary pumps. Illustrated, 32 pp., 6x9 in.

Pneumercator Co., 118 Liberty St., New York. Catalog. The pneumercator. Instrument for weighing, registering and measuring forward and aft draft of vessels, tonnage displacement, bunker weights and consumption, etc., also depth and volume of liquids and semi-liquids. Illustrated, 6x9 in.

Orenstein-Arthur Koppel Co., Koppel, Penn. Catalog No. 911. Koppel hauling equipment for road construction. Illustrated, 28 pp., 6x9 in.

Stone & Webster Engineering Corporation, Boston, Mass. Catalog. Building construction. Illustrated, 30 pp., 6x7½ in.

Trussed Concrete Steel Co., Youngstown, Ohio. Seventh Edition, United Steel Sash Book. Illustrated, 128 pp., 8½x11 in.

Richard E. Barry Co., Boston, Mass. Catalog. Barry system fireproof floor and roof construction. Illustrated, 12 pp., 7x9 in.

Chicago Pneumatic Tool Co., 1010 Fisher Bldg., Chicago, Ill. Bulletin E-36. Duntley electric grinders. Illustrated, 8 pp., 6x9 in.

Pittsburgh Air Brake Co., 309 Carson St., Pittsburgh, Penn. Pamphlet. Snyder "No-Kicker" attachment as applied to automatic tiple valves. Illustrated, 30 pp., 4½x6½ in. Pamphlet. "Something New In Air Brakes." Address by J. Ruch Snyder at Air Brake Association Convention. Illustrated, 32 pp., 8x10½ in.

Joseph E. Love, formerly Structural Engineer for the Electrification Department of the Chicago, Milwaukee & St. Paul Ry. at Butte, Mont., has been appointed Engineer for the Board of Railroad Commissioners of South Dakota.

Albrecht Excavator and Loader—The T. L. Smith Co., Milwaukee, Wis., has recently announced that it has purchased from J. H. Albrecht the exclusive manufacturings and selling rights for his excavator and loader. This means that one of the best known crusher and mixer concerns has entered the excavator field. While a number of the Albrecht machines have been in successful use, lack of capital has limited its commercial development. The machine occupies a field about half way between hand digging and steam-shovel excavation.

CALUMET INTERCEPTING SEWER, CHICAGO, ILL.

Contract No. 2.

Bids were received June 24 for the construction of the Calumet Intercepting Sewer, Contract No. 2, from (A) Byrne Bros. Dredging & Engineering Co., (B) Marquette Construction Co., (C) John W. Farley, (D) Nash Bros., (E) Nash-Dowdle Co., (F) Henry C. Ulen. The item bids were as follows:

	A	B	C	D	E	F
4370 lin.ft. sewer, 11 ft. concrete	$34.50	$45.00	$48.00	$48.40	$35.90	$39.00
7 manholes on concrete sewer	50.00	30.00	40.00	40.00	40.00	29.00
3200 lin.ft. sewer, 12-in. vitrified tile pipe	1.00	1.50	1.50	2.00	1.50	1.50
350 lin.ft. sewer, 9-in. vitrified tile pipe	1.00	1.00	1.00	0.50	1.00	1.00
32 manholes on tile sewer, without covers	30.00	25 00	30.00	35.00	35.00	54.00
15 standard c.i. manhole cover and frame	10.00	9.00	7.50	8.00	8.50	13.00
Rebuilding existing sewer at 97th St. and Houston Ave. (lump sum)	1000.00	1700.00	3500.00	3400.00	500.00	5200.00
Crossing Commercial Ave. at 97th St. (lump sum)	1400.00	1200.00	10,000	2500.00	350.00	2800.00
Crossing C. & W. I. R.R. and C.R.I. & P.R.R. tracks (lump sum)	1500 00	1500.00	10,000	4500.00	3000.00	2400.00
88 M ft. b.m. plank road along Torrence Ave.	40.00	25.00	35.00	35.00	40.00	34.00
1700 lin.ft. relaying water service pipes	1.00	.50	1.90	.60	2.00	.70
140 lin.ft. relaying 6-in. sewer house connections	.50	.50	1.00	.60	1.00	.70
1,200,000 lb. reinforcing steel	02½	.03	.05	.02½	.02½	.03½
500 lin.ft. additional piling furnished	.20	.20	.15	.30	.25	.35
500 lin.ft. additional piling driven	.20	.50	1.00	.30	.50	.85
5 M. ft. b.m. cribwork on piling	40.00	50.00	40.00	50.00	42.50	55.00
5 M. ft. b.m. plank foundations	25.00	25.00	25.00	25.00	25.00	25.00
5 cu.yd. additional excavation, earth	.75	.75	.75	.75	.75	.75
1 cu.yd. additional excavation, rock	3.00	3.00	3.00	3.00	3.00	3.00
5 cu.yd. additional concrete, Class A	8.00	8.00	8.00	8.00	8.00	8.00
5 cu.yd. additional concrete, Class B	7.50	7.50	7.50	7.50	7.50	7.50
1 cu.yd. additional brickwork	9.00	9.00	9.00	9.00	9.00	9.00
Extended totals	$195,583	$247,283	$307,205	$264,990	$205,596	$200,999

CALUMET INTERCEPTING SEWER—CHICAGO, ILL.

Contract No. 3

Bids were received June 24 for the construction of the Calumet Intercepting Sewer, Contract No. 3, from (A) Byrne Bros. Dredging & Engineering Co., (B) Marquette Construction Co., (C) John W. Farley, (D) Nash Bros., (E) Nash-Dowdle Co., (F) Henry C. Ulen. The item bids were as follows:

	A	B	C	D	E	F
7700 lin.ft. concrete sewer, 13-ft. diameter	$40.25	$46.00	$44.40	$55.50	$42.25	$40.00
12 manholes on concrete sewer	50.00	31.00	40.00	40.00	40.00	30.00
Connection at 100th St. (lump sum)	500.00	900.00	300.00	300.00	300.00	2340.00
Crossing under C. & W. I. R.R. and N.Y.C. & St. L. R.R. (lump sum)	2000.00	4000.00	2000.00	4000.00	3600.00	5500.00
35 M. ft. b.m. plank Roadway on Torrence Ave.	40.00	25.00	35.00	35.00	40. 0	34.00
684,000 lb. reinforcing steel	.02½	.03	.05	.02½	.02½	.03½
37 tile pipe future connections, 18-in.	2.00	5.00	5.00	15.00	3.00	14.00
5 tile pipe future connections, 24-in.	3.50	6.00	5.00	25.00	4.00	14.00
5 cu.yd. additional excavation, earth	.75	.75	.75	.75	.75	.75
5 cu.yd. additional excavation, rock	3.00	3.00	3.00	3.00	3.00	3.00
5 cu.yd. additional concrete, Class A	8.00	8.00	8.00	8.00	8.00	8.00
5 cu.yd. additional concrete, Class B	7.50	7.50	7.50	7.50	7.50	7.50
5 cu.yd. additional brickwork	9.00	9.00	9.00	9.00	9.00	9.00
5 M ft. b.m. plank foundations	25.00	25.00	25.00	25.00	25.00	25.00
Extended totals	$331,882	$381,348	$380,561	$451,401	$348,602	$342,184

Oil Burning Locomotives—Morley Donaldson, Vice-Pres. of the Grand Trunk Pacific Ry., announces that the installation of oil-burning locomotives on the mountain section of the line has now been completed. These locomotives are of the most modern type, and were placed in service for passenger traffic for the first time today. They are in operation from Jasper to Prince Rupert, over 719 miles of main line. Especial interest attaches to the installation of this class of motive power, as it marks the first use of oil burners on an extensive scale in Canada. Great oil storage tanks have been erected at various points along the line for supplying locomotives with the necessary fuel. The Grand Trunk Pacific steamships Prince George and Prince Rupert, which operate from the Pacific terminal of the line at Prince Rupert to Victoria, Vancouver and Seattle, are also oil burners, and this gives the Grand Trunk Pacific nearly 1500 miles of rail and water route on which this form of fuel only is used.

EXPANSION AT STEEL MILLS

A recent report from the Youngstown district states that since the first of the year steel mills there have appropriated fully $12,000,000 for extensions and new construction. The Youngstown Sheet & Tube Co. is spending $5,000,000 for a new plant, the Republic Iron & Steel Co. has authorized the construction of new furnaces and tube mills costing $1,000,000, thus swelling this company's expenditures for development up to $3,500,000. The Youngstown Iron & Steel Co. has improvements costing $750,000 under way, the Brier Hill Steel Co. is spending $250,000, while the Trumbull Steel Co. has an extension in course of construction costing $500,000. Steel authorities assert that no other single year in the history of the Youngstown district has seen such large expenditures for new plants and additions for the production of steel and iron.

The expansion in the Youngstown district is not an isolated incident, by any means. Reports from Pittsburgh, the Middle West and the South bear indications of new construction for steel and iron plants tending to prove that expansion on a large scale is general in all the steel and iron districts of the country.

The question naturally arises as to whether or not this development of the iron and steel industry is on a scale that may, after the conclusion of hostilities and at the same time the abnormal demand for steel and iron, result in a reaction so pronounced as to largely counteract the gains derived from the war. Some manufacturers pointed out that while the volume of expansion this year is greater than the normal in 1914 the amount expended for new construction was well below the average, so that this year's investment instead of being in the nature of a too rapid advance makes up more or less for the lethargy that pervaded the steel industry last year, causing suspension of development. But on the other hand, some of the steel manufacturers who look forward to a marked reaction after the conclusion of the war openly state that conservatism should pervade the steel industry at this time and that too rapid expansion may make the burden to be carried after peace is declared all the more great.

Each day brings new reports of the increased demand for steel. Mills are enjoying production at the rate of fully 85% of capacity and further increases are regarded as a certainty. A few incidents that can be regarded as pointers may be cited. The open hearth steel capacity is, with a few exceptions, in full operation. The purchase of pig iron by the Republic Iron & Steel Co., which normally produces enough pig iron for its requirements, the buying of billets by the United States Steel Corporation, estimated at 70,000 tons, all strikingly tell of the period of prosperity that today obtains in the steel trade. New war orders for shells, rails, cars, etc., have been noted during the past fortnight and inquiries are in the market that portend further active buying of shells by Russia. Italy and Australia have been in the market for rails and this business, amounting to over 30,000 tons may soon be closed.

War business, which for a considerable time furnished the greatest impetus for the steel trade, is finding a strong competitor at the present time in domestic business. The advances in the prices of structural steel, bars, shapes and plates have forced steel consumers to enter the market for requirements that they would not have purchased until this winter. Although the new price of $1.30 is not being firmly maintained, the advance from $1.25 has placed a large volume of domestic business on the books of the steel companies. The latest report of the fabricating association shows that bookings in June reached 80% of capacity against an average of 62½% in the preceding three months. Thus June has been the best month since April, 1914. The city of New York is to be a large purchaser of steel in the next fortnight. The awarding of the 37,000 tons rail contract to the Bethlehem Steel Products Co. by the Public Service Commission is but a forerunner of the steel orders to be placed on the market by that board. Five important subway contracts are to be awarded shortly and the steel involved amounts to over 25,000 tons. Railroad buying shows a marked tendency to improve. The recent inquiries for automobile cars are to be followed, if reports are correct, by fairly large buying of ordinary freight cars by some large Eastern roads.

Progress on New York Subway Work—Bids were opened July 27 by the Public Service Commission for the construction of two sections on two of the most important lines of the dual system in Manhattan and Brooklyn, namely, one section of the Broadway subway in Manhattan and one section of the Eastern Parkway subway in Brooklyn. In addition the Commission opened bids for the supply of rolled manganese rails, for use on all lines of the dual system not already provided for.

The contract for the Broadway subway is for Section 3 of Routes 4 and 36. This section begins at 38th St. and runs north under Broadway to 42d St., where it crosses under the line of the existing subway and continues north through Seventh Ave. to 51st St. The plans call for a four-track railroad, with an express station at 42d St. and a local station at 49th St. The Broadway subway is to be operated by the New York Cosolidated R.R. Co. under the contract between the city and the New York Municipal Ry. Corporation. It runs from the lower part of Manhattan Island to 59th St. and through 59th and 60th St. to the East River, which it will cross probably by tunnels to a connection with the new rapid transit lines in Queens over which the Brooklyn company will have trackage rights. On the southern end it will be connected through Canal St. and the Manhattan Bridge with the Fourth Ave. subway in Brooklyn, and also with the same subway by a new tunnel from Whitehall St., Manhattan, to Montague St., Brooklyn. It is a four-track line from City Hall to 59th St. All other sections on this subway in Manhattan are already under contract. The Eastern Parkway contract is for Section 3 of Route 12, which runs under Eastern Parkway, Brooklyn, from Nostrand Ave. to Buffalo Ave. The contract calls for a four-track railroad, with stations at Kingston Ave. and Utica Ave., the latter an express station. The method of construction will be by open trench excavation except at cross streets, where it will be under cover. The Eastern Parkway subway is for operation by the Interborough Rapid Transit Co. as an extension of the existing subway. It runs from the terminus of the present subway at Atlantic and Flatbush Ave., Brooklyn, under Flatbush Ave. and Eastern Parkway to Buffalo Ave., beyond which point there will be an elevated extension through East 98th St. and Livonia Ave. to New Lots Rd. With the exception of the work under the Long Island R.R. station at the present subway terminus all other underground work on the Eastern Parkway line is under contract. It will have a two-track branch subway down Nostrand Ave. to Flatbush Ave. One section of this line is already under contract, and bids for the other section will be opened this week.

The contract for manganese rails is for the supply of about 2200 tons to 3000 tons of standard and short lengths, and the bidder was required to bid upon the time of delivery. These rails will be used upon about 230 miles of single track of the new subway and elevated lines to be owned by the city. The city has already purchased the main open hearth steel rails for such lines. Under today's bidding the successful contractor must have the first lot ready for delivery within 60 days from the delivery of the contract and the remainder as called for. Each proposal was accompanied by a certified check for $25,000. The bond for the faithful performance of the contract is fixed at $25,000.

Expanding Foreign Trade—Exports to Germany during April were zero, according to an analysis of the foreign trade issued by the Department of Commerce Monday. During April last year, however, the exports to Germany amounted to more than $18,000,000. The exports to the United Kingdom, however, amounted to more than $94,000,000 during April, an increase of more than $57,000,000. The exports to Austria-Hungary, the Department reports amounted to but $1249 in April, whereas it was nearly $2,000,000 in April, 1914. The loss in trade with Germany and Austria has been more than made up in the increase in trade with the Allies. This is the first time since the outbreak of war that the Department has reported, however, that the United States shipped not a cent's worth to Germany. The imports from Germany during April amounted to $2,600,000, a reduction of nearly $14,000,000 for the month. The imports from Germany ending with April amounted to $86,000,000, just a little over one-half what they were during the same ten months last year. The exports to Germany during the ten months have amounted to nearly $29,000,000, a reduction of about $280,000,000.

During April the United States shipped to France, $51,000,000 worth of merchandise, an increase of $43,000,000; to Italy, $19,000,000 worth, an increase of $14,000,000; to the Netherlands, $20,000,000, an increase of $11,000,000; to Norway, $3,500,000, an increase of $2,800,000; to Russia in Europe $4,800,000, an increase of $2,000,000, and to Sweden $5,900,000, an increase of $4,800,000. Italy is the only European country from which the United States has obtained an increased volume of imports during April. The imports from Italy amounted to $6,600,000, an increase of $1,600,000. There was an increase of about $10,500,000 in the imports from Cuba, an increase of $3,000,000 in the imports from Argentina; an increase of $2,000,000 in the imports from Brazil; an increase of about $1,000,000 in the imports from Japan, and an increase of $1,800,000 in the imports from Australia. The total exports from the United States in April amounted to $294,746,117, against $162,550,870 in April, 1914, while total imports were $610,576,106, compared with $173,896,476 a year ago. For the ten months' period ended with April, exports were $2,225,823,986, against $2,045,772,785 in the same period a year ago. Imports for the ten months' period were $1,374,189,749, against $1,572,438,054 a year ago.

An analysis of the tabulated report for ten months shows that despite the so-called war orders the exports of manufactures of all kinds other than foodstuffs have been less than in the similar period before the war. The normal sales of manufactures during peace were greater than those under existing war conditions. Because of this fact and of the extraordinary shrinkage of exports of crude materials it is found that the net increase in our total exports has been wholly in foodstuffs and in that item of foodstuffs which covers those in crude condition and food animals.

On the import side it is noteworthy that there has been an absolute increase in the ten months of importations of foodstuffs partly or wholly manufactured. The larger part of the total shrinkage of total imports has been in the items of manufactures and particularly in that of manufactures ready for consumption.

An Arbitrary Reduction of a Contract Price by a Government officer was overruled by the Comptroller of the Treasury in a decision rendered June 18 on the claim of W. R. Grace & Co. According to the recital of facts in the Comptroller's decision, W. R. Grace & Co. in May, 1913, contracted to deliver on the Isthmus of Panama some 635,000 ft. of creosoted Douglas fir for $53.70 per M. ft. The timber was to be treated with not less than 16 lb. of dead oil per cubic foot was to receive a preliminary inspection at the creosoting works and at the loading dock on Puget Sound, and final acceptance was to be made after delivery on the Isthmus. On the first shipload sent by this contractor, the Government representatives failed to make any accurate test to determine whether the timber had received the proper amount of creosote. It was, however, inspected by the depot quartermaster as delivered, and was paid for under his certificate. On the second shipment sent by the contractor, including much the larger part of the order, the Bogardus Testing Laboratories were employed by the Government to inspect the work. They reported creosoting in excess of the contract requirements. In the use of the first shipload delivered, however, the engineer in charge thought he detected insufficient creosoting. After weighing nine pieces of untreated and eight pieces of treated lumber, and finding the average weight of the treated was 45.9 lb. against 38.8 lb. per cu.ft. for the uncreosoted, he reported that the timber had not been properly creosoted. Similar tests were made by two other engineers, one of whom recommended a reduction of $15 per M-ft. in the price to be paid for the lumber, and another $10 per M. The chief quarter-master, after studying the reports of the two engineers, fixed upon a reduction of $18.12 per M. The Comptroller of the Treasury concludes that the tests made by the engineers on the Isthmus were unreliable as proof that the creosoting was actually deficient, and that the Government representatives had no right to arbitrarily reduce a contractor's price on the basis of these tests. R. D. Micou, of Washington acted as attorney for the claimant in the prosecution of the case before the Comptroller.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

PRICE CHANGES AND THE BUSINESS OUTLOOK

With the turn of the year came a change for the better in general business. This was pronounced in the steel trade, perceptibly felt in the dry goods industry, and its influence noted in other trades all along the line. It was less felt in the engineering and contracting field than in any other, but that was to be expected, for business activity has always shown later in this field than in any other.

The iron trade is phenomenally good. The leading interests are operating at the rate of 93% of capacity, and the independent mills are even more actively engaged. Of course, a goodly share of this is for war orders, perhaps 25% of the total output, but domestic trade is continuing without abatement week by week, and it is only a question of time when car orders will be much larger. There have been numerous advances in iron and steel products, and the scrap market continues to make new high records almost weekly.

The volume of war orders is almost beyond comprehension, and if the trade were not satisfied with the large volume of business being booked, there is every reason to believe that a strong effort would be made at the coming session of Congress to put through a bill which would result in piling up munitions of war in the United States on a stupendous scale.

The ridiculous prices which have been current for metals have given way. Electrolytic copper has been sold down as low as 18½c. This, however, was not from the producers but from second-hands who had overbought. This, perhaps, was an extreme figure, but it did show that the market was to some extent artificial. The price of tin has likewise declined, lead is easier, and spelter down to more nearly normal level.

The activity in shipbuilding work continues. It will be a question of only a short time before new shipbuilding yards will be projected, and probably on an enormous scale. An extensive program of steel building capacity has been arranged in the Youngstown district, and it is evident that the producing capacity will soon be found to be too small for the demand.

The agricultural outlook is more promising but not as hopeful as it might be. The corn crop is late. There is no doubt that it is two to three weeks behind normal. Of course with a succession of hot days great improvement would be shown, as the plant has a good start and the acreage is large. The corn crop has for a great many years been more or less a true guide to business activity. Of course it will not be so much of a factor this year when there will be large exports of wheat.

Construction in New York is active, although building has fallen off. The subway work keeps up, and some extremely large contracts for track materials, ballast, and the like will be let in the next few weeks. There is no doubt that every effort has been made to push construction work on the subway at a time of low prices.

Financial conditions are very satisfactory. The indebtedness of the United States to Europe has been greatly reduced, but not altogether eliminated. The stock of gold in this country is abnormally large. Capital is available in limited amounts for new enterprises, but the supply of time money is almost beyond comprehension. It is undoubtedly a period of economy, retrenchment, and paying of bills, but such a period of affairs, be they those of a nation, a state, or an individual, leads to wealth in a very short time.

CEMENT, LIME AND BRICK

Portland Cement—The prices of cement show no change compared with last month, and the demand is slightly better. It cannot be said that any of the mills are rushed with orders, but there is undoubtedly considerably more business than there was a month ago. The advance of July 1 did not retard buying to any marked degree, but it did not hasten matters at all. The price is now $1.42 New York, equivalent to $1.02 less the charge for bags. The following quotations are current at the points named, and do not include the usual charge for bags:

Chicago	$1.11	Boston	1.26
Detroit	1.20	Cleveland	1.20
Jersey City,	.84	Duluth	1.37
New York	1.03	Minneapolis	1.37
St. Paul	1.37	Pittsburgh	1.05

Brick—The market in New York is very quiet. Some talk is heard of the Hudson River brick yards closing down late in August or early in September. This step will be taken to prevent any accumulation either at the yards or in New York. The price is attractive to those who believe building will improve for brick can be had at $5.25 to $5.75 New York.

Labor—The demand is small, yet some orders have been received by labor agencies in the City of New York, offering $1.65 and $1.70 for laborers to go out of town, and it has been impossible to fill these. There is great deal more work than a month ago, and fewer men to do it; but the expected shortage of labor which has been predicted, has not as yet materialized. Of course, it is the belief of those who have given the matter much careful attention that this is simply postponing the time and not in any way lessening the belief that there will be a real shortage later. It is evident that a great deal of the surplus labor has been taken in hand, and put to work; while an epidemic of strikes late last month may be taken to indicate that the point has nearly been reached when laborers could be induced to work for the same rate of pay as formerly.

Crushed Stone—Considerable exception has been taken to statements made in "Engineering News" a month ago that "as low as 65c. per cu.yd. alongside of dock has been done," and this is vigorously denied in certain quarters. There is no doubt, however, that some low quotations have been made. For example, late in the month of July there was vigorous bidding on a contract for 6000 yd. of 1½-in. stone for the Dock Department, and as low as 62c. was bid. There was another bid of 65c., and an oldtime seller of stone bid 67½c. It was pointed out, however, that this was a very desirable contract, as the Dock Department takes a great deal of its material in the winter, when times are usually dull. Considerable interest is evidenced about a contract for 300,000 yd. for ballast for the New York municipal railways, and there is undoubtedly more business than a year ago.

IRON AND STEEL

Pig Iron—The chief interest in the pig iron market has been the rapid expansion in the demand for steel-making iron. Foundry iron has not picked up with the quickness evident in the market for steel-making iron, but it has gone ahead faster than most people believe. There is little doubt that a great deal of the cheap iron has been gathered by speculators, who will keep it off the market until prices are considerably higher. As it is, there are not many furnaces that are disposed to sell far ahead at prevailing prices. Most of them are anxious for business for nearby delivery, but fight shy of future contract. This is the most healthy sign of the market. Of course, many of the furnaces have a good back log in orders placed some time ago, at lower prices it is true, but still sufficiently remunerative to make them quite independent as far as new business is concerned. Prices as stated are considerably higher, and for lots of 100 tons and over prices named are as follows:

Cincinnati Southern Foundry No. 2, $13 to $13.50; Cincinnati Northern Foundry No. 2, $14,25 to $14.75; Cincinnati Northern Foundry No. 3, $14.25 to $14.50; New York Northern Foundry No. 2 plain, $13.75 to $14; New York Southern Foundry No. 2, $14.25; New York Northern Foundry No. 2X, $14.25 to $14.50.

In Chicago, Northern Foundry No. 2 is $13 to $13.50; in Birmingham, Southern Foundry No. 2 is $10 to $10.25. In Pittsburgh, Bessemer iron is $15.20 and basic $13.95. These quotations include the 95c. freight charge from the valley to the Pittsburgh district.

Steel Rails—Business is active, the leading mills of the United States Steel Corporation running practically full time, but some of their operations are confined to light rails, chiefly for the lumber interests, for the coal mining industry is not buying rails to any extent. The rail mills have recently taken some work for rounds which will go into shrapnel. The order for the Russian Government has been partially closed, but there is still quite a little more foreign business that has to be developed. There is no doubt that the railroads will buy more rails for track maintenance this year than they did last, but they are still economizing to a marked degree. Quotations show no change, and for lots of 1000 tons or over, prices are as follows: Standard sections of Bessemer, $28; open hearth, $30; both per gross ton f.o.b. Pittsburgh. Girder rails in 30-ft. lengths are $36.40 per gross ton; in 60-ft. lengths $38.40 per gross ton, both f.o.b. New York. Other quotations f.o.b. Pittsburgh for large lots, prices given being in cents per lb., are as follows: Standard sections, 1.25c.; 20- to 30-lb., 1.15c.; 15- to 20-lb., 1.20c.; 12- to 18-lb., 1.25c.; 8- to 12-lb., 1.30c.

Track Supplies—Makers of spikes have not received any orders lately, but they say that the railroads have contracted for enough material to keep them busy for several months to come. Prices of spikes are unchanged, the demand for tie plates continues to increase. Standard railroad spikes are quoted at 1.50 to 1.55c., track bolts and square nuts, 1.90 to 2c.; all in carload lots. Tie plates are $25 to $26 per net ton at the mill. Angle bars are quoted at the unchanged price of 1.50c. Chicago. These prices, with the exception of those for tie plates, are given in cents per lb.

Structural Materials—The rapid increase in the amount of work required for New York City has kept many of the structural mills busy. Subways and rapid transit extensions in New York are demanding more steel than any one thought they would a year ago. In consequence, this has proved a very good foundation, then, too, there have been a number of hurry orders for structural steel for factory work. All of this stuff has been of the utmost urgency, for delivery was essential, and sometimes be only requisite. In the Youngstown district there is an active program of steel mill construction going on, and this is taking a very fair tonnage of steel. The railroads are not heavy buyers of steel at present, but the car supply must be augmented soon. Prices show no change from last month. I-beams 3- to 15-in., channels 3- to 15-in., angles 3- to 6-in., T's 3-in. and over, are 1.25c. Pittsburgh. Other quotations, including I-beams over 15 in., H-beams 18 in. and over, channels over 15 in., angles over 6 in., are $1.30. Cutting to specified lengths is charged at the following rates: 2 ft. to 3 ft. inclusive, 25c.; 2 ft. to 1 ft., 50c.; under 1 ft., 1.55. No charge is made for cutting to specified lengths above 3 ft. In Philadelphia, the base price is $1.41; in San Francisco, $2.05 to $2.10; in New York, $1.42. All of these quotations are per 100 lb.

Plates—The shipbuilding works are taking plates freely, but the car builders have not bought as many plates as was expected. The mills rolling plates are fairly busy, and prices are firm. Car orders include 1000 gondolas for the Lake Shore, 1500 automobile cars for the New York Central, a number of mine cars for a coke concern, as well as coal cars for some of the smaller lines. It is evident that shipbuilding work will continue to be just as active as it has been, for

the next two or three years. It is possible that some new shipyards may be built on the Atlantic Coast. The minimum for plates is now $1.25 Pittsburgh. This is equivalent to $1.34 Chicago, $1.41 Philadelphia, and $1.42 New York. All of these quotations are per 100 lb.

Pipe—The demand for pipe is good. There is more of a demand for small pipe than there was a month ago, and since the prices of galvanized pipe have come down to a more sane level, there has been a fair amount of buying there. The orders for line pipe have not been as heavy as they were two months ago, but the demand for merchant pipe shows a considerable increase.

	Black	Galvanized
¾- to 2-in. steel, butt welded	79%	57½%
2½- to 6-in. steel, lap welded	78%	56½%
7- to 12-in. steel, lap welded	76%	54½%

At these discounts the net prices of pipe per foot, in large in lots Pittsburgh, are as follows:

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
¾-in.	2.43	4.88	5-in.	32.56	64.38
1-in.	3.57	7.22	6-in.	42.24	83.52
1¼-in.	4.83	9.77	7-in.	57.12	1.08
1½-in.	5.77	11.68	8-in.	60.00	1.13
2-in.	7.77	15.72	9-in.	82.80	1.56
2½-in.	12.87	25.44	10-in.	98.88	1.87
3-in.	16.83	33.27	11-in.	1.11	2.10
4-in.	23.98	47.41	12-in.	1.21	2.31

Sheets—The market for sheets is more or less mixed. There is no doubt that black sheets are considerably stronger, and that the mills are operating at even a higher ratio than a month ago, and there is a very fair business. On the other hand, there has been a sharp cut in the price of galvanized sheets. This does not represent so much the reduction in the price of spelter, although that has been considerable, but it represents a disposition on the part of those mills which have spelter bought or contracted for at much lower prices, to realize something on their contracts. The reduction in the price at the mill amounts to fully $20 per ton, but this has not been followed up at the same ratio by the stores in New York. Of course such a reduction will come later. At the present, however, prices are at such a high level that they seriously restrict consumption. The sheet trade is not so active as the other lines of steel industry, perhaps because the present activity in the steel trade is due to abnormal causes and not especial activity in the building trade. It is probable, however, that the sheet business will improve somewhat a little later. The following quotations are for large lots of sheets f.o.b. Pittsburgh and small lots in stone; New York.

	Cents per Pound — Large lots Pittsburgh Black	Large lots Pittsburgh Galv.	Warehouse delivery New York Black	Warehouse delivery New York Galv.
No. 10	1.55	4.50	....	....
No. 12	1.55	4.60	....	....
No. 14	1.60	4.60	....	....
No. 16	1.65	4.70	2.35	5.25
Nos. 18 and 20	1.70	4.85	2.40	5.40
Nos. 22 and 24	1.75	4.95	2.45	5.55
No. 26	1.80	5.20	2.50	5.75
No. 27	1.85	5.35	2.55	5.85
No. 28	1.90	5.50	2.60	6.00

	Cents per Pound — Large lots Pittsburgh Black	Large lots Pittsburgh Galv.	Warehouse delivery New York Black	Warehouse delivery New York Galv.
No. 10	1.55	3.50	....	....
No. 12	1.55	3.60	....	....
No. 14	1.60	3.60	....	....
No. 16	1.65	3.70	2.35	5.00
Nos. 18 and 20	1.70	3.85	2.40	5.15
Nos. 22 and 24	1.75	4.05	2.45	5.30
No. 26	1.80	4.20	2.50	5.45
No. 27	1.85	4.35	2.55	5.85
No. 28	1.90	4.50	2.60	6.00

Cast Iron Pipe—There has been no great animation in the pipe market, except that pig iron has imparted a new steadiness to the pipe trade. It will be recalled that last year there was a great deal of scattered buying by the small private companies, who were making extensions. This continued during this year, and some of the larger cities are now in the market, though it cannot be said that the pipe market is especially animated. In New York prices are steady, 6-in. pipe, Class B, being quoted at $22.50 to $23, Class A pipe $23.50 to $24; and the same price applies to gas pipe. In Birmingham, business is active, and quotations f.o.b. yard are as follows: 4-in., $20.50; 6-in. and upward, $18.50. Gas pipe is $1 per ton higher. In Chicago 4-in. pipe is $26; 6- to 12-in., $24; 15-in .and upward, $23.50. There has been a fair amount of bidding in that market.

Steel Sheet Piling—Prices are steady and without change, at $1.55 to $1.60 per 100 lb. f.o.b. Pittsburgh.

Wire—Trade is extremely active, the mills have orders sufficient to carry them well into the fall. Some mills are well assured that they will have no slack time for the remainder of the year. The foreign demand for barbed wire is continuous and insistent. Takings have been large. Prices are somewhat higher, plain and annealed wire being quoted at $1.40, galvanized barbed wire and fence staples, $2.50; painted barbed wire, $1.70; polished fence staples, $1.70. All these quotations are f.o.b. Pittsburgh per 100 lb. and in large lots. The discount on woven wire fencing is 69% off list in carload lots, 68% from list in 1000-rod lots, and 67% for small lots.

Old Materials—The market is much more active, prices are higher, and in general there is a feeling that real betterment has at last made itself felt. This is evident on every hand, but in particular in steel scrap. In New York the market is broader, prices are from 50c. to $1 per ton higher than last month. In addition, there is quite a fair volume of business ruling. Prices in New York are as follows:

	Per Gross Ton
Heavy-melting steel scrap	$10.00 to $10.25
Pipes and flues	8.75 to 9.25
No. 1 railroad wrought	11.25 to 11.75
	Per Net Ton
Stove plate	$8.75 to $9.00
No. 1 machinery cast	11.75 to 12.25
Wrought turnings	6.50 to 6.75

In the Chicago market there has been some extremely heavy buying by large interests. The Illinois Steel Co. alone has taken at least 20,000 tons of scrap at a price of $11 per gross ton, which represents a considerable advance over last month. The reason for this was the inability of the blast furnaces of the Gary works to keep pace with the open-hearth capacity. This probably will be rectified in a few days, but nevertheless the market has been established on a higher level, and many who are in a position to judge the market think that this higher level will be maintained for some time to come. Quotations in the Chicago market, as stated, are much higher, as follows:

	Per Gross Ton
Heavy-melting steel scrap	$11.25 to $11.50
	Per Net Ton
No. 1 railroad wrought	9.50 to $9.75
No. 2 railroad wrought	9.75 to 10.00
No. 1 cast scrap	9.50 to 10.00
Pipes and flues	7.00 to 7.25
Agricultural malleable	8.75 to 9.00
Railroad malleable	9.50 to 10.00

In the Pittsburgh district the principal item of demand is heavy melting steel scrap, the price of which has advanced from $11.75 to $12.75, and even at the latter figure dealers state that they cannot secure adequate supplies. There is an unusual clamor for this kind of scrap, and it does not look as if it would be satisfied for some time to come. In other lines there is not any special activity, machine shop turnings being slightly lower, owing to the enormous tonnage coming on the market, and railroad malleable showing a gain of 50c. per ton. Quotations in the Pittsburgh district are as follows:

	Per Gross Ton
Heavy-melting steel scrap	$12.75 to $13.00
Rerolling rails	11.50 to 11.75
No. 1 foundry cast	12.00 to 12.25
Old car wheels	11.75 to 12.00
Machine shop turnings	7.50 to 7.75
Railroad malleable	11.00 to 11.25

Chain—Prices are steady and without change, as follows. These prices are per 100 lb., f.o.b. Pittsburgh:

5/16 in.	$7.50	½ and 9/16 in.	$3.00
¼ in.	4.95	5/8 and 11/16 in.	2.90
7/32 in.	3.95	¾ and 13/16 in.	2.80
3/8 in.	3.40	7/8 and 15/16 in.	2.70
5/16 in.	3.20	1 to 1¼ in.	2.60

EXTRAS TO ABOVE LIST PER 100 POUNDS

	For BB	For BBB
3/16-in. and ¼-in.	$1.50	$2.00
5/16-in. and larger	1.25	1.75

Wire Rope—Business is good, but prices for galvanized rope are considerably higher. Discount off list for galvanized is 40 and 5%; for bright it is 55 and 5; and special brands of bright are sold at 50 and 5. At the above discounts the net price of wire rope at the mills is as follows:

Diameter in Inches	Price per Foot — Cast Steel	Crucible Steel	Plow Steel
2½	$0.75	$0.90	$1.07
2¼	0.61	0.73	0.86
2	0.47	0.57	0.67
1¾	0.39	0.49	0.58
1½	0.28	0.34	0.40
1¼	0.20	0.24	0.27
1	0.13	0.15	0.18
¾	0.08	0.09	0.11
⅝	0.06	0.07	0.08

Freight Rates—The freight rate on finished steel products in the Pittsburgh district, inculding plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, black sheets (except planished), chain, etc., are as follows in cents per 100 lb.; Boston, 18.9; Buffalo, 11.6; Baltimore, 15.4; Cleveland, 10.5; Cincinnati, 15.8; Chicago, 18.9; Denver, 68.6; New Orleans, 30c.; New York, 16.9; Philadelphia, 15.9; St. Louis, 23.6; Minnesota and St. Paul, 32.9. Pacific Coast (all rail). 80c

Merchant Steel—Business is steady, and shows a distinct improvement, and while the advance that was felt to be imminent a month ago has not materialized, it is evident

that the manufacturers themselves are getting more for their product, and it will only be a question of time when the quotations which are for small lots from jobbers' store, and given below, are revised:

	Cents Per Pound
Refined iron:	
1 to 1⅞ in., round and square	1.85
1½ to 4 in. x ⅜ to 1 in	1.85
1½ to 4 in. x ¼ to 5/16 in	2.05
Norway bars	3.20
Burdens bar iron	3.15
Soft steel:	
¾ to 3 in., round and square	1.85
1 to 6 in. x ⅜ to 1 in	1.85
1 to 6 in. x ¼ and 5/16	2.00
Rods—⅝ and 7/16 in	1.95
Bands—1½ to 6x1/16 in. to No. 8	2.15
Beams and channels—3 to 15 in	1.90
Angles:	
3 in. x ¼ in. and larger	1.90
3 in. x 5/16 in. and ⅛ in	2.35
1½ to 2¾ in. x 3/16 in. and thicker	2.00
11½ to 2½ in. x ⅛ in	2.10
1 to 1¼ in. x 3/16 in	2.10
1 to 1¼ in. x ⅛ in	2.15
Tees:	
1½ to 2½x¼ in	2.05
1½ to 2½x5/16 in	2.15
3 in. and larger	1.95

Triangle Mesh—The market is steady and the demand shows a slight improvement. Quotations are as follows:

PRICE PER 100 SQ.FT.

Style No.	Cross Sec. Area per Ft. Width	Plain Material—Carload Lots	Plain Material—Less Than Car Lots and Over 10,000 Sq.Ft.	Galvanized—Carload Lots	Galvanized—Less Than Car Lots and Over 10,000 Sq.Ft.
†4	0.102	$1.00	$1.23	$1.12	$1.34
5	0.077	0.80	0.97	0.89	1.00
6	0.058	0.63	0.77	0.71	0.84
†7	0.041	0.49	0.60	0.55	0.66
†23	0.170	1.69	2.05	1.88	2.24
24	0.142	1.46	1.77	1.62	1.93
25	0.124	1.29	1.57	1.43	1.71
†26	0.110	1.17	1.42	1.30	1.55
†27	0.085	0.96	1.17	1.07	1.28
28	0.066	0.80	0.97	0.89	1.06
29	0.049	0.66	0.80	0.73	0.87
31	0.261	2.49	3.02	2.76	3.29
32	0.225	2.16	2.62	2.40	2.86
33	0.196	1.93	2.34	2.14	2.55
34	0.140	1.48	1.80	1.64	1.96
35	0.109	1.17	1.42	1.30	1.55
36	0.075	0.87	1.05	0.97	1.15
38	0.380	3.55	4.30	3.93	4.68
†39	0.325	3.05	3.70	3.38	4.03
40	0.283	2.68	3.25	2.97	3.54
41	0.208	2.05	2.48	2.27	2.70
42	0.151	1.55	1.88	1.72	2.05
†43	0.101	1.10	1.34	1.23	1.46

†This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths of rolls are 150, 300 and 600 ft. Cutting to special length is charged extra.

Bars, Concrete Reinforcing—Business is only fair but the market is strong due to the fact that mills rolling these bars are also working on shrapnel bars. Prices are as follows:

Size	Cents per Pound—Mill Shipments Pittsburgh	Cents per Pound—*Warehouse Pittsburgh	Cents per Pound—Delivered from *Warehouse New York
¾-in. and larger	1.25	1.60	2.05 to 2.10
⅝-in.	1.30	1.75	2.10 to 2.15
½-in.	1.45	1.90	2.25 to 2.30
⅜-in.	1.55	2.00	2.35 to 2.40
¼-in.	1.83	2.30	2.70 to 2.75

*Bars from warehouse are cut to desired length without extra charge.

METALS

Copper—Electrolytic copper sustained a break in price during July, both here and abroad, as a result of the further evidence of accumulation in the hands of producers. Small producers who have been accumulating the metal for some time hoping foreign buying would soon be renewed, offered the metal down to 19c. which price was 1½c. less than the ruling price July 1. General opinion indicated that the recent high prices stimulated production considerably beyond requirements and lower levels are anticipated. Much confidence is expressed, however, in a resumption of domestic requirements as a result of large orders for munitions placed in this country. But July was a disappointment to the large producers. As compared with June the month was extremely dull, although there were some sales by large producers at prices ranging from 20c. down to 19c.

Tin—Large imports of tin and an increase in stocks afloat, materially effected the market producing a marked decline in prices during July. Besides the actual amount of business consummated was not nearly as large as dealers had anticipated. Large buying orders did not materialize with the steady decline in prices and dealers were forced to admit that consumers were well supplied for current needs and were holding off waiting further declines before purchasing. At the beginning of July spot tin was held at 41c. while at the close of the month offerings were made as low as 34¾c. Arrivals of tin for July amounted to 3439 tons, while stocks afloat to this country total 5415 tons.

Lead—Dullness ruled in the lead market during most of the month reflected in a slight decline in prices. The metal was steadily offered by outside interests at concessions resulting in prices showing a net decline for the month of only ¼c., indicating that the supply is firmly held. The American Smelting & Refining Co. reduced its price late in the month to 5½c.

Spelter—Irregularity ruled in the market in spelter during July with the closing quotations about 4c. per lb. less than at the beginning of the month. The possibility of the workers in the Joplin section striking produced uneasiness early in the month with the producers reflected in a strong market but after settlement of the difficulty prices declined steadily until the end of the month when spot was quoted at 18¼ to 18½c.

Old Metals—Prices quoted are nominal. The market eased off under pressure of free selling.

	Cents per Lb.
Copper, heavy cut and crucible	17
Copper, heavy and wire	16⅝
Copper, light and bottoms	14½
Heavy machinery comp	12½
Heavy machinery composition	12½
Brass, heavy	11½
Brass, light	10
No. 1 clean brass turnings	14¼
No. 1 composition turnings	13
Lead, heavy	4⅞
Tea had	4⅛
Zinc scrap	14

MISCELLANEOUS

Sewer Pipe—The demand has decreased and as a result there has been a drop in price, the following discounts being effective: On 3-in. to 24-in., 82% off list; 27- to 30-in., 72%; 30- to 36-in., 67%. At these discounts, prices are as follows:

PRICE OF SEWER PIPE PER FOOT

Size		Size	
3-in.	$0.045	18-in.	$0.342
4-in.	0.045	20-in.	0.405
5-in.	0.072	22-in.	0.54
6-in.	0.072	24-in.	0.585
8-in.	0.099	27-in.	1.26
10-in.	0.144	30-in.	1.54
12-in.	0.18	33-in.	2.06
15-in.	0.243	36-in.	2.31

Flue Lining—While the demand for this material is considered fair, a discount of 84% off list is holding firm. At this rate, prices are as follows:

FLUE LINING PRICE PER FOOT

Size	Weight in Lb.	Price per Ft.	Size	Weight in Lb.	Price per Ft.
4½x8½-in	14	$0.056	8½x18-in	45	$0.144
4½x13-in	20	0.072	13x13-in	45	0.136
7½x7½-in	15	0.064	13x18-in	57	0.192
8½x8½-in	18	0.072	18x18-in	75	0.32
8½x13-in	28	0.104			

Blue Stone—Dealers report business as being exceedingly dull. Bronx flagging sells at 17c. per sq.ft. and Manhattan 18c. per sq.ft. Curbing prices are steady, 5x16-in. selling at 40c. per lin.ft., and 5x20-in. at 45c. Sewer bottoms 5x5-ft. by 3 in. are quoted at 25c. per sq.ft. Belgian bridging, 5x24-in., sells at 65c. per lin. ft.

Swedish (Norway) Iron—There is a decided shortage of material on hand, and it seems almost impossible to expect any shipments from foreign quarters. Prices have been so elastic that at present quotations have practically been withdrawn.

Railway Ties—A decided inactivity characterizes the market. First-class standard ties 7x9-in. by 8 ft. 6 in. sell at 72c., 6x8-in. by 8 ft. at 60c., these prices being f.o.b. New York.

The Total Wealth of the United States in 1912, according to an estimate just completed by the Census Bureau, was $187,739,000,000. Of this amount $110,000,000,000 is represented by real estate, $16,000,000,000 by railways and their equipment, $4,600,000,000 by street railways, $1,500,000,000 by shipping and canals, $2,100,000,000 by electric light and power stations and $6,100,000,000 by machinery, tools and factories. There has been an enormous increase in wealth since 1904, when the last estimate was made and when the total was $107,000,000,000. The bulletin also gives an estimate of the comparative wealth of the nations based on statistics of 1904. At that time the British Empire, including all its colonial possessions, had an estimated wealth of $108,000,000,000, or substantially the same as the United States. France had $47,000,000,000 and Germany $78,000,000,000.

Drainage of the Everglades in southern Florida has been carried on in a limited way by the state for a number of years, but with results generally unsatisfactory. Part of this has been due to the lack of adequate engineering plans for the conduct of the work, and part has been due to doubts as to the legality of bonds issued by the state to raise money for carrying on the work, which doubts have interfered with the sale of the bonds. The drainage work has hitherto been in charge of a board made up of state officials who hold their positions as members of the board by virtue of their office. A bill is now pending in the Florida legislature which places the control of the Everglades drainage under a commission of three men to be appointed by the Governor, who are to devote their whole time to the work. All the public lands owned within the district which are owned by the state will be transferred to the district and may be sold to raise funds to pay for the work of drainage. The bonds to be issued for the work are limited to a term of 30 years.

RAILWAYS—STEAM AND ELECTRIC

Massachusetts—Springfield St. Ry.—The City Council of Springfield, Mass., has granted a franchise to this company for the construction of an electric railway from East Springfield to Chicopee. R. W. Reynolds, Springfield, is Mgr. Noted July 8.

New York—Buffalo Southern Ry.—This company plans to extend its line from Buffalo St. to Pierce Ave., Hamburg, N. Y. Frederick Wing, Buffalo, is Ch. Engr.

New York—International Ry.—This company has been granted a franchise to construct a special track on Michigan Ave. and Ohio St., Buffalo. J. C. Sheldon, Buffalo, is Pur. Agt. Noted July 29.

New York—New York State Ry.—This company contemplates the extension of its line on Elm St., Utica. B. E. Tilton, Utica, is Gen. Mgr.

New York—Niagara River & Eastern Ry.—This company has applied to the Public Service Commission for permission to construct an electric railway from Lockport to Niagara Falls.

New Jersey—Arthur B. Smith, H. G. Hart, James S. Wheeler and Welsey F. Sinnickson are interested in the construction of an electric railway to connect Salem and Pennsgrove, N. J.

Pennsylvania—Lehigh Valley Transit Co.—Plans are being prepared by this company for laying a second track along Broad St., West Bethlehem, Penn. Thomas Gibson, Allentown, is Pur. Agt.

+Pennsylvania—Schuylkill Electric Ry.—This company has awarded a contract to the TREXLER CONTRACTING CO., Reading, for the construction of its line over Broad Mountain. The proposed line will connect Pottsville, Frackville and Shenandoah, Penn. Noted June 24.

Pennsylvania—Wilkes-Barre Ry. — The City Council of Wilkes-Barre, Penn., has granted a franchise to this company to construct an electric railway on East North St. from North Main St. to North Pennsylvania Ave. Thomas A. Wright, Wilkes-Barre, is Vice-Pres., Gen. Mgr. and Pur. Agt.

Maryland—Idlewylde Park Ry.—This company has been granted a franchise to construct an electric railway on Regester Ave. from York Rd. to Idlewylde Park, Baltimore. Noted June 24.

Virginia—Virginia Ry. & Power Co.—Plans are being prepared by this company for double-tracking its line on 14th St. from Mayo Bridge to Cary St., Richmond. C. B. Buchanan, Richmond, is Gen. Mgr.

West Virginia—Southern Ry.—This company will double track a section of its Washington Atlantic line. B. Herman, Washington, D. C., is Ch. Engr.

North Carolina—Goldsboro Electric Ry.—Plans are being prepared by this company for the construction of new track in Goldsboro, N. C. E. L. Gentir, Goldsboro, is Secy. and Gen. Mgr.

Florida—The construction of an electric railway in Clearwater, Fla., and vicinity is contemplated by E. W. Parker, Tampa, and associates.

Florida—Work will soon be started on the construction of the proposed electric railway from Brooksville to St. Petersburg, Fla. James Murphy, St. Petersburg, is interested.

Tennessee—The citizens of Alexandria, Tenn., will hold an election to vote on the question of issuing $150,000 in bonds as their contribution toward the construction of an electric railway through DeKalb and Wilson Counties.

Kentucky—Ohio Valley Electric Ry.—Plans are being considered by this company for the construction of an electric railway from Ashland to Russell, Ky.

Ohio—Cleveland Ry.—This company will extend its line on Buckeye Rd. from 116th to 130th St. and its line on Woodland Ave. from 122nd to 130th St., Cleveland. George L. Radcliffe, Cleveland, is Gen. Mgr.

Michigan—Detroit United Ry.—This company plans to start work soon on the extension of its lines into the Fourth Ward, Detroit, Mich. F. W. Brooks, Detroit, is Gen. Mgr.

Michigan—Kalamazoo-Grand Rapids Interurban Ry.—Preliminary arrangements are being made by this company to start work soon on the construction of its proposed railway from Owasso to Bay City, Mich.

Illinois—La Salle County Electric R.R.—This company has submitted plans to the Public Utilities Commission of Illinois for the construction of its proposed electric railway which will connect Ottawa and Mendota, Ill.

Iowa—Minneapolis & St. Louis R.R.—This company plans an expenditure of $100,000 for the improvement of its yards at Marshalltown, Iowa. R. G. Kenly, Minneapolis, Minn., is Ch. Engr.

Iowa—Ottumwa Ry. & Light Co.—This company contemplates the extension of its Court Hill line in Ottumwa, Iowa. Charles E. Fahrney, Ottumwa, is Gen. Mgr.

Kansas—Arkansas Valley Interurban Ry.—This company is reported to be making preliminary arrangements for the extension of its line from Wichita to Salina, Kan. Charles D. Bell, Wichita, is Supt. Noted June 17.

Texas—According to press reports Charles H. Doak, O'Donnell, Tex., is interested in the construction of a railway from Brownfield to Lubback to connect with the Atchison, Topeka & Santa Fé Ry.

Texas—Northern Texas Traction Co.—This company has been granted a franchise to extend its Summit Ave. line in Ft. Worth. G. H. Clifford is Vice-Pres. and Gen. Mgr.

Texas—Northern Texas Traction Co.—Plans are being considered by this company for the extension of its electric railway on Folsom Ave. and Gordon St., Ft. Worth, Tex. George H. Clifford, Ft. Worth, is Vice-Pres. and Gen. Mgr

Oklahoma—According to press reports arrangements are being made for the construction of an electric interurban railway to connect Joplin, Mo., and Miami, Tulsa and Collinsville, Okla. J. R. Eldridge and A. G. Ritz, Oklahoma, are interested.

Idaho—Lewiston-Clarkston Transit Co.—Preliminary arrangements are being made by this company for the extension of its lines in Lewiston and Clarkston, Idaho.

California—The Board of Supervising Engineers of San Jose, Calif., will receive bids until Sept. 7 for a franchise to construct an electric railway on Alum Rock Ave.

California—Peninsular Ry.—This company plans to start work soon on the reconstruction of its electric railway from San Jose to Linda Vista, Calif. F. E. Chapin, San Jose, is Gen. Mgr. and Pur. Agt.

California—Tidewater Southern Ry.—Preliminary arrangements are being made by this company for the extension of its line from Modesto through Ceres to Turlock, Calif. J. H. Wallace, Stockton, is Ch. Engr. Noted July 1.

LIGHT, HEAT AND POWER

Westfield, Mass.—Bonds for $25,000 have been voted. The proceeds will be used for the improvement of its electric-light plant and system.

Syracuse, N. Y.—The Globe Malleable Iron & Steel Co. is having plans prepared for the construction of a power plant to be built in connection with its plant.

Avis, Penn.—The Council contemplates the installation of a new street-lighting system.

+New Orleans, La.—The Board of Port Commissioners has awarded the contract for installing the steam piping in the cotton warehouses, now being constructed, to H. M. MOODY, New Orleans.

Nashville, Tenn.—Plans are being prepared for the installation of a new heating plant in St. Thomas Hospital.

North Chattanooga, Tenn.—Plans are being considered for the installation of a street-lighting system.

+Soddy, Tenn.—The Richmond Hosiery Mills has awarded the contract for the construction of a power plant in connection with its establishment to the MARK K. WILSON CO., Chattanooga.

Ft. Thomas, Ky.—Plans are being considered by the Highland Film Corporation for the construction of a power plant to cost $30,000.

Smithland, Ky.—J. W. Watters and V. D. Pressnell are interested in the organization of a company which proposes to install an electric-light plant in Smithland.

West Park, Ohio—Bids will be received by W. J. Fetherstone, Clk., Bd. of Education, until noon, Aug. 20, for the installation of a heating system in the Settlement School.

Sparta, Mich.—The citizens have voted to issue $12,000 in bonds, the proceeds of which will be used for the installation of a municipal electric-light plant.

Brookville, Ind.—The Brookville Electric Co. has applied to the Public Utilities Commission for permission to issue $10,000 in bonds, the proceeds of which will be used for the improvement of its power plant.

Milwaukee, Wis.—The Common Council has received the report of Vaughan, Meyer & Sweet, Consult. Engr., on the survey of the street lighting system of Milwaukee, which recommends an expenditure of $1,279,646 in equipment, transmission lines, etc., for an 8500-lamp system. F. G. Simmons is Comr. of Pub. Wks.

Rippey, Iowa—The construction of a municipal electric-light plant is under consideration.

Ellendale, Minn.—Plans are being considered for the installation of an electric-lighting system.

Hardwick, Minn.—Bonds for $5000 have been voted, the proceeds of which will be used for remodeling the municipal electric-light plant.

Rochester, Minn.—According to press reports bids will soon be received for the construction of the proposed municipal electric-light plant. The estimated cost is $110,000.

Netawaka, Kan.—At a recent election bonds for $10,000 were voted. The proceeds will be used for the installation of an electric-light plant. Noted July 8.

Republic, Kan.—Bonds for $6500 have been voted. The proceeds will be used for the installation of an electric-lighting system.

Seward, Neb.—The City Council contemplates an expenditure of $12,000 for the reconstruction of the electric-light plant which was recently destroyed by fire.

Milnor, N. D.—The Council has granted a franchise to D. L. Vail and associates for the construction of an electric-light plant in Milnor.

Galveston, Tex.—The Galveston Gas Co. contemplates an expenditure of $100,000 for the extension of its gas mains and the improvement of its system. F. M. Lege, Jr. is Gen. Mgr.

Holland, Tex.—The City Council has decided to install an electric-lighting system.

Lockhart, Tex.—The Citizens Water Works, Electric Light & Ice Co. has been organized for the purpose of constructing an electric-light plant at Lockhart. E. B. Coopwood is interested.

Royse City, Tex.—The Royse City Ice & Electric Co. has been organized with a capital of $16,000 for the purpose of constructing an electric light plant and ice factory. The incorporators are J. T. Murphy, A. F. Davis and E. C. Murphy.

Strawn, Tex.—The Texas & Pacific Co. plans to lay pipe lines to a number of towns from the natural gas well near Strawn which it recently purchased.

Jones, Okla.—According to press reports an election will soon be held to vote on the question of issuing bonds for the construction of an electric-light plant.

Marshall, Okla.—At a recent election the citizens voted in favor of a bond issue of $25,000. The proceeds will be used for the construction of an electric light plant and a water system.

+Salt Lake City, Utah—The Caribou Gold Mines Co. has awarded the contract to R. S. LUND, Salt Lake City, for the construction of a hydro-electric plant on Eagle Creek.

Quincy, Calif.—The Board of Supervisors has granted permission to the Great Western Power Co. to erect a transmission line from the Nevis Dam in Big Meadows to the Engels Copper Mine in Lights Cañon, about 35 miles.

Harriston, Ont.—The installation of a hydro-electric system is under consideration.

Milverton, Ont.—The citizens recently voted to install a hydro-electric system.

BRIDGES

Boston, Mass.—(Official)—Bids will be received until noon, Aug. 10, by the Metropolitan Park Commissioners for constructing a concrete bridge at Furnace Brook Parkway, Quincy. John R. Rablin, 20 Beacon St., is Engr.

✚Concord, Mass.—The contract for constructing a bridge across Winnisquam Lake has been awarded to the UNITED CONSTRUCTION CO., Albany, N. Y., at $46,222. Other bids were: Berlin Construction Co., $54,000; Bay State Dredge Co., $53,000; Boston Bridge Co., $47,191.

Lawrence, Mass.—(Official)—Bids will be received until 9:30 a.m., Aug. 16, by the Commissioners of Essex County for rebuilding the Loring St. bridge over the Shawsheen River at the North Andover line.

Worcester, Mass.—The Samuel H. Pitcher Co., Engr., Worcester, Mass., which has been engaged by the city to prepare plans and supervise the construction of the Lake Quinsigamond Bridge, has announced that plans will not be completed before Oct. 1 and bids will probably be asked about one month later. Noted Apr. 29 and July 22.

Woonsocket, R. I.—(Official)—Bids will be received until 7:45 p.m., Aug. 9, by the Board of Aldermen for constructing two reinforced-concrete bridges on Clinton St. Noted June 17.

Hartford, Conn.—Bids will be received until 2 p.m., Aug. 16, by the State Highway Commissioner for the construction of a 35-ft. reinforced-concrete girded bridge over the Blackledge River.

Hartford, Conn.—Bids will be received until 11 a.m., Aug. 10, by the Board of Contract for constructing a concrete bridge with stone facings across Park River, at an estimated cost of $19,000.

★Westport, Conn.—(Official)—Bids will be received by the State Highway Commissioner, Room 27, Capitol Bldg., Hartford, until 2 p.m., Aug. 10, for the construction of a highway bridge over the Saugatuck River at State St., Westport. The estimated cost is $125,000. Noted May 27 and June 10.

Checktowga, N. Y.—(Forks post office)—(Official)—The Delaware, Lackawanna & Western R.R. will build a viaduct at Harlem Ave., at an estimated cost of $400,000. Noted July 29.

Trenton, N. J.—Bids will be received until 2:30 p.m., Aug. 10, by the Board of Chosen Freeholders of Mercer County for the construction of a reinforced-concrete arch over Sanhican Creek at Willow St. Theodore Tobish is County Engr.

Harrisburg, Penn.—It is reported that bids will be received until Aug. 11 by the Commissioners of Dauphin County for rebuilding the concrete bridge over the tracks of the Philadelphia & Reading Ry. at 19th St. Henry W. Gough is County Controller. Noted July 8.

Mercer, Penn.—(Official)—Bids will be received until noon, Aug. 10, by the Commissioners of Mercer County for removing the present plank floor, cleaning and painting the steelwork, and constructing concrete floor on the roadway of the Greenman Bridge, New Hamburg, and the Saw Mill Run Bridge, Stoneboro. Lewis E. Burnside, Grove City, is County Engr. H. C. Comstock is Clk. of Comrs.

Athens, Ga.—(Official)—Bids will be received until Aug. 17 by Tate Wright, Clk., Athens, for new abutments and raising existing piers, containing 21 cu.yd. rubble masonry and 58.6 cu.yd. concrete, two steel spans of 73 ft. each, and one steel span of 105 ft.

Springfield, Ga.—(Official)—Bids will be received until 2 p.m., Sept. 6, by W. H. Cone Ordmay, for the construction of a steel bridge across the Ogeechee River between Effingham and Bulloch Counties. The estimated cost is $4500.

Cocoa, Fla.—C. M. Rogers, Daytona, has been retained to prepare plans for the construction of a concrete bridge 1⅛ miles long across the Indian River.

Cleveland, Ohio—(Official)—Bids will be received until 10 a.m., Aug. 18, by the Board of Commissioners of Cuyahoga County for steel deck bridge repairs, Report No. 3553. E. G. Krause is Clk. of Comrs. W. A. Stincomb is County Surv.

✚Mansfield, Ohio—The contract for constructing the Orange St. bridge has been awarded to the OHIO CONCRETE SUPPLY CO., Fremont, at $13,333. Noted July 22.

Marietta, Ohio—Bids will be received until 1 p.m., Aug. 17, by the Board of Commissioners of Washington County for the construction of a concrete bridge over Little Hocking Creek near Dunbar, Fairfield County. W. B. Alexander is County Audr.

Steubenville, Ohio—Bids will be received until Aug. 20 by the Board of Commissioners of Jefferson County for the construction of Bridge No. 8 in Smithfield Township, known as the Harpersville Bridge, and for repairing the bridge at the east end of Dillonvale. John L. Means is County Audr.

Ft. Wayne, Ind.—Bids will be received until 10 a.m., Aug. 9, by William Johnson, Audr. of Allen County, for the construction of concrete culverts and the repair of bridges.

Dixon, Ill.—(Official)—Bids will be received until 8 a.m., Aug. 7, by L. B. Neighbour, County Supt. of Highways of Lee County, for reflooring the Grand Detour Bridge between Nachusa Township, Lee County, and Grand Detour Township, Ogle County. The estimated cost is $7900.

Green Bay, Wis.—(Official)—Bids will be received until 10 a.m., Aug. 30, by the Committee of Streets and Bridges for the construction of a Strauss bascule bridge over the East River at Main St. and a swing bridge. The estimated cost is $55,000. A. Braun is City Engr. Noted Mar. 4 and July 22.

✚Adel, Iowa—The contract for the construction of the Brumfield Bridge has been awarded to the DES MOINES BRIDGE & IRON WORKS, Des Moines, at $4375.

Audubon, Iowa—Bids will be received until 1 p.m., Aug. 9, by the Board of Supervisors of Audubon County for the construction of five concrete culverts and two bulkheads. C. D. Forsbeck is County Engr.

✚Dubuque, Iowa—The Board of Supervisors of Dubuque County has awarded the contract for the construction of 75 concrete bridges and culverts in the county to PAUL N. KINGSLEY, Strawberry Point, at $34,446. Noted July 15.

Ft. Madison, Iowa—The Board of Supervisors of Lee County has rejected all bids for the construction of the Santa Fe Ave. Bridge over Dry Creek, and has decided to have the work done under county supervision. The lowest bid received was $8215.

Richfield, Kan.—At a recent election the citizens voted in favor of issuing $8000 in bonds, the proceeds of which will be used for constructing a bridge over the Cimarron River near here.

Crete, Neb.—According to press reports bids will soon be received for the construction of a 290-ft. steel bridge, the estimated cost of which is $5000.

✚Williston, S. D.—The Board of Commissioners of Williams County has awarded the contract for county bridge construction for one year to M. A. ADAMS & CO., Minneapolis, Minn. Noted July 8.

✚Hardin, Mont.—(Official)—The County Clerk has awarded the contracts for the construction of three bridges, one over Little Big Horn River on the Sarpy Rd. and one over the same stream near Wyola to the SECURITY BRIDGE CO., Billings, at $27,622 and $8450 respectively; bridge over Big Horn River, about 1½ miles northeast of Hardin to J. STOUT, Sheridan, Wyo., at $3798. Noted June 19 and July 15.

Eureka Springs, Ark.—It is reported that the Commissioners of Carroll County contemplate the construction of a new bridge across the White River. The estimated cost is $20,000.

Dallas, Tex.—(Official)—Plans for the new Commerce St. Bridge over the Trinity River will not be ready for bids for two or three months. The estimated cost is $135,000. J. F. Witt is County Engr. Noted July 1 and 8.

Palestine, Tex.—Press reports state that the International & Great Northern Ry. Co. plans to construct a steel viaduct from Spring St. into Reagan Park, at an estimated cost of $7000.

Lehigh, Okla.—Bids will be received until Aug. 14 for constructing seven steel bridges in Coal County. Richard Bunch is County Clk.

✚Tecumseh, Okla.—(Official)—The Board of Commissioners of Pottawatomie County has awarded the contract for the construction of a bridge to the KANSAS CITY BRIDGE CO., Kansas City, Mo., at $5570. Other bidders were: Missouri Bridge & Iron Co., $5872; Vincennes Bridge Co., $5741; Illinois Steel Bridge Co., $5764; Western Bridge Co. (suspension bridge), $4200. B. B. Wyatt is Deputy County Clk.

Tulsa, Okla.—(Official)—Bids will be received until 10 a.m., Aug. 26, by the Board of Commissioners of Tulsa County for the construction of a reinforced-concrete bridge over the Arkansas River. It will consist of 18 arch spans, each 78 ft. between piers. The bridge will have a 30-ft. roadway and two 4-ft. sidewalks. Harrington, Howard & Ash, Kansas City, Mo., is Consult. Engr. Noted July 22 and 29.

✚Seattle, Wash.—(Official)—The contract for the construction of the Duwamish River Bridge has been awarded to the MANHATTAN CONTRACTING CO., Central Bldg., Seattle, at $26,594. Other bidders were: Albien Engineering Co., Seattle, $29,972; Weymouth Construction Co., Seattle, $28,695; Beers Building Co., Portland, $28,888; H. S. Wright, Everett, $32,179; Gerrick & Gerrick, Seattle, $34,993. A. P. Denton is County Engr. Noted July 8.

✚Tacoma, Wash.—(Official)—The contract for the construction of a wooden bridge across the gulch on 34th St. has been awarded to GRAFF & SHELDON, Tacoma, at $10,894. Other bidders were: Batchelor Bros., $12,250; A. Redstrom, $11,758; P. Mauson, $13,495; McHugh Construction Co., $11,709. Noted June 10 and July 15.

Walla Walla, Wash.—G. Cookerly, County Engr., is preparing plans for the construction of a steel bridge over the Walla Walla River at Swegle Crossing. The estimated cost of the work is $18,000.

✚Eugene, Ore.—The contract for the construction of the Coast Fork Bridge between Eugene and Pleasant Hill, has been awarded to the PORTLAND BRIDGE CO., Portland, at $9540. Noted June 3.

Baird, Calif.—The Ross Construction Co., Sacramento, at $28,235, submitted the lowest bid for the construction of a reinforced-concrete bridge about 395 ft long, across the Pit River.

Dunsmuir, Calif.—The lowest bid submitted for the construction of a reinforced-concrete bridge about 532 ft. long, with one arch 180 ft. clear span, and two arches 114 ft. clear span, across the Sacramento River near Dunsmuir, was that of the Pacific Coast Construction Co., Fresno, at $26,922.

Placerville, Calif.—The Board of Supervisors of Eldorado County will soon receive bids for the construction of a steel and concrete bridge across the American River at Coloma. Plans have been prepared by A. V. Saph, San Francisco.

Redding, Calif.—Bids will be received by the Board of Supervisors of Shasta County until Aug. 21 for the construction of a wood and steel bridge across the Sacramento River at Kennett, the estimated cost of which is $20,000.

Santa Rosa, Calif.—Bids will be received until Aug. 12 by the Board of Supervisors of Sonoma County for the construction of two reinforced-concrete bridges, one on the Alexander Valley Rd., and the other on the Petaluma Rd. W. W. Felt, Jr., is County Clk.

✚Santa Barbara, Calif.—MUNOZ & MUNOZ, Central Bldg., Los Angeles, at $18,973, has been awarded the contract for the construction of a reinforced-concrete bridge.

✚Shawenegan Falls, Que.—The Municipal Council has awarded the contract for the construction of a bridge over the Shawenegan River to B. J. TREPANIER, 24 Niverville St., Three Rivers. A sub-contract will be awarded for the steel superstructure. The estimated cost of the structure is $15,000.

Swan River, Man.—A bylaw has been passed authorizing the issue of $22,000 in bonds to be used for the construction of several bridges. Joseph Armstrong is Municipal Secy.

✚Vancouver, B. C.—The City Council has awarded the contract for repairs to the Connaught Bridge to W. GREENLESS, 407 Cordova St., W., Vancouver, at $7491. All previous contracts rescinded. Noted June 24 and July 8.

WATER SUPPLY—IRRIGATION

Anson, Maine—At a recent election the citizens voted in favor of installing a water system. The estimated cost is $120,000. Noted Feb. 4.

Dalton, Mass.—Press reports state that the Dalton Fire District plans to lay between 7000 and 8000 ft. of 4- and 6-in. water pipe.

New Britain, Conn.—The Water Board will purchase about 3000-ft. of 6-in. water pipe.

★Windsor, Conn.—(Official)—Bids will be received until 2 p.m., Aug. 20, by the Board of Commissioners of the Windsor Fire District for the construction of a water system.

✚Albany, N. Y.—The Bureau of Water Supply has awarded the contract for furnishing c.-i. pipe to the WARREN FOUNDRY & MACHINE CO., New York, N. Y., at $23.50 per ton.

✚Binghamton, N. Y.—The Board of Water Commissioners has awarded the contract for the construction of a reservoir on South Mountain to BARILLY & INGERSOLL at $20,032. Other bidders were: Frank Stento, $42,598; H. R. Porterfield, $21,700; H. B. Sproul, $29,203; W. H. Genegan, $23,869; J. F. Leary Co., $31,165; J. W. Gummo, $33,768; Williams & Richardson, $33,503. Noted July 8.

✚Hilton, N. Y.—(Official)—The following contracts have been awarded for the construction of a water system: Pipe and specials, UNITED STATES CAST IRON PIPE & FOUNDRY CO.; valves and hydrants, LUDLOW VALVE CO.; elevated water tank, CHICAGO BRIDGE & IRON WORKS; general contract, M. APPLEGATE & SON, Bradford, Penn. H. C. Kittredge, Rochester, is Engr. Noted July 8.

Keansburg, N. J.—The Keansburg Water Co. plans to extend its system throughout Keansburg and the vicinity.

Newark, N. J.—The New Jersey Water Supply Commission has been denied the application by the city for the exclusive use of the waters of the Wanaque River as a water supply. Noted Apr. 29.

Perth Amboy, N. J.—The Board of Water Commissioners plans to extend the new water main from Ernston Hill to the Raritan River. Noted June 17.

✚Clayton, Del.—The contract for the construction of water and sewer systems and a disposal plant has been awarded to the AMBLER-DAVIS CO., 1016 Harrison Bldg., Philadelphia, Penn., at $18,284. Herbert W. Hatton, Equitable Bldg., Wilmington, Del., is Engr. Noted July 8.

✚Baltimore, Md.—The Board of Awards has awarded the contract for furnishing and erecting a 20,000,000-gal. centrifugal pump for the Eastern Pumping Station to the WESTINGHOUSE ELECTRIC & MACHINE CO., Pittsburgh, Penn., at $12,538. Noted June 24 and July 8.

South Boston, Va.—An election will be held Aug. 10 to vote on the question of issuing $125,000 in bonds. The proceeds will be used for the installation of a water system, making extensions to the sewer system and for paving. W. L. Penick is Mayor. Noted Feb. 11.

Keyser, W. Va.—An election will be held Aug. 10 to vote on the question of issuing $35,000 in bonds. Part of the proceeds will be used for the extension of the water system.

Atlanta, Ga.—An election will soon be held to vote on the question of issuing $750,000 in bonds. The proceeds will be used for the construction of a water system.

Baconton, Ga.—The city will hold an election Aug. 19 to vote on the question of issuing $12,000 in bonds. Part of the proceeds will be used for the construction of a water system.

Dunedin, Fla.—An election will be held Sept. 4 to vote on the question of issuing bonds, the proceeds of which will be used for the construction of a water system.

Ocala, Fla.—Plans are being prepared by Twombly & Henney, Engr., 55 Liberty St., New York, N. Y., for the improvement of the water and sewer system. Bonds for $155,000 have been sold for this purpose. Noted June 24 and July 15.

Houma, La.—Calvin Wurzlow, Mayor, will soon call an election to vote on the question of issuing $60,000 in bonds. The proceeds will be used for the construction of a purification plant.

Madisonville, Tenn.—The city plans the construction of a water system. W. H. McCroskey, Mayor, is interested.

✚Covington, Ky.—The contract for pipe trenching and back filling for 10,950-ft. of 24-in. water mains has been awarded to the UNITED STATES CAST IRON PIPE & FOUNDRY CO., Chicago, Ill., at $92,000. Noted July 15.

✚Cincinnati, Ohio—(Official)—The contract for laying water mains in connection with the high pressure fire service has been awarded to the KIRCHNER CONSTRUCTION CO., Cincinnati, at $13,555. Other bidders were: M. J. McCarthy, $14,427; T. P. Strach, $16,621; H. V. Conneley, $17,252; M. F. Quill, $18,047. J. A. Heller is Supt. of Water Works. Noted July 15.

Marion, Ohio—The Marion Water Co. has been granted permission to issue $12,500 in bonds. The proceeds will be used for the extension of the water mains.

South Newburg, Ohio—(Newburg post office)—Bids will be received until noon, Aug. 14, by H. H. Bohning, Clk., for the construction of water mains in Windfall and Broadway Ave. Ralph Hecker, Cleveland, is Engr. Noted July 15.

Miller, Ind.—An election will be held Aug. 12 to vote on the question of issuing $15,000 in bonds. The proceeds will be used for the construction of a water system. W. J. Fulton, Gary, is Engr. Noted July 22.

Kenosha, Wis.—The Board of Water Commissioners has awarded the contract for constructing 10,000-ft. of 42-in. c.-i. water intake main, a submerged intake crib and a 24-in. main to GEORGE A. GREEN, Green Bay. B. C. Brennan is City Engr. Noted July 15 and June 24.

Oshkosh, Wis.—Henry A. Allen, Consult, Engr., Chicago, Ill., has been retained by the city to prepare plans and supervise the construction of the new filtration plant. Noted Feb. 18.

Chariton, Iowa—It is reported that the contract for the construction of a water system will soon be awarded. The estimated cost is $80,000. M. G. Hall, Centerville, is Engr. Noted Oct. 1 and July 1.

✚Council Bluffs, Iowa—The contract for the installation of an 8,000,000-gal. triple expansion pump for the water system has been awarded to the MERKLE-HINES MACHINE CO., Kansas City, Mo.

✚Grinnell, Iowa—The contract for making extensions to the water system has been awarded to BASH & JANES, Joplin, Mo., at $9736. Charles P. Chase, Clinton, is Engr. Noted July 8.

✚Keota, Iowa—The contract for the construction of a water system has been awarded to BASH & JANES, Joplin, Mo. Charles P. Chase, Clinton, is Engr. Noted July 8 and 15.

Broken Bow, Neb.—The City Council has rejected all bids received July 3 for the construction of a pumping plant for the water system and an electric-light plant. They will advertise for new bids. Charles F. Sturtevant, Holdredge, is Engr. Noted June 10 and 24.

Spearville, Kan.—At a recent election the citizens voted to issue $25,000 in bonds. The proceeds will be used for the construction of a water system.

✚Canova, S. D.—The contract for the construction of a water system has been awarded to the DES MOINES BRIDGE & IRON WORKS, Des Moines, Iowa. Bonds for $9500 have been sold for this purpose. Noted June 3 and July 1.

✚Sioux Falls, S. D.—(Official)—Contracts have been awarded to the BEISCH SULZER BROS. DIESEL ENGINE CO., St. Louis, Mo., at $33,955, for oil engines, pumps and generators; CHICAGO BRIDGE & IRON WORKS, Chicago, Ill., at $12,190, for the construction of a 350,000 gal. elevated tank; FANEBUST BROS., Sioux Falls, at $16,181, for the construction of a 1,200,000-gal. reinforced-concrete reservoir. Noted July 15.

Hamilton, Mont.—The construction of a municipal water system and a distributing system is being considered by the City Council.

✚Wibaux, Mont.—(Official)—The contract for the construction of a water system has been awarded to the HOGGART CONSTRUCTION CO., Fargo, N. D., at $24,500. C. H. Green, Spokane, Wash., is Consult, Engr. Noted July 1 and 22.

St. Louis, Mo.—Bids will be received by the Board of Public Service until Aug. 13 for the reconstruction of the Compton Hill Reservoir. The estimated cost is $400,000. E. E. Wall is Water Comr. Noted July 8.

Beaumont, Tex.—Bids will be received until 10 a.m., Aug. 7, by J. G. Sutten, City Secy., for the construction of a 36-in. c.-i. pipe across the Neches River, canal intake and other improvements in connection with the canal extension for the water-works. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., is Engr. Noted July 1 and 29.

Floresville, Tex.—The city will purchase 5000-ft. of c.-i. pipe for the purpose of extending the water mains to the gin and oil mill section.

Lockhart, Tex.—Bids will soon be received by the Citizens Water Works, Electric-Light & Ice Co., for the construction of a water system and electric-light plant. The estimated cost is $45,000. W. B. Swearingen is Pres.

Mission, Tex.—A franchise has been granted to the Mission Ice Light & Water Co. for the construction of a water works plant. J. A. Sadler is Pres.

Grove, Okla.—An election will be held Aug. 9 to vote on the question of issuing $10,000 in bonds. Part of the proceeds will be used for extending the water system.

Marshall, Okla.—At a recent election the citizens voted to issue $25,000 in bonds, the proceeds of which will be used for the construction of a water system and an electric-light plant.

Tulsa, Okla.—A proposition has been submitted to the City Commissioners by E. M. Kerling, Tulsa, D. A. Coulter and J. B. Marvin, Franfort, Ind., for the construction of a water system.

Rogerson, Idaho—An application has been filed with the Public Utilities Commission, Boise, by W. R. McMillan and John McRae for the installation of a water system. The estimated cost is $15,000.

St. Maries, Idaho—(Official)—At a recent election the citizens voted to issue $37,000 in bonds. The proceeds will be used for the improving of the water system. Charles R. Schulte is Clk. Noted July 22.

Salt Lake City, Utah—Plans are being prepared for the construction of a new dam for the Hatchtown irrigation project. The estimated cost is $100,000. G. Stirling and J. L. Reed are Engrs.

Vernal, Utah—It is reported that the city has decided not to extend the water system at the present time. The work will probably be done some time next year. George A. Davis is City Recdr. Noted July 15.

Aberdeen, Wash.—An election will soon be held to vote on the question of issuing $500,000 in bonds. The proceeds will be used for the construction of the Wynoochee water system. Noted June 10.

Kirkland, Wash.—The City Council has rejected all bids for the construction of a water system in District No. 32. It has been decided to do the work under the direction of the City Engineer.

Prosser, Wash.—The Benton County Commissioners have approved the plans of the Horse Heaven Land Owner's Association for the construction of an irrigation district and will hold an election Aug. 7. The district will comprise about 500,000 acres lying in Benton, Kakima and Klickitat Counties. About $200,000 has already been expended in preliminary engineering and surveying work conducted by the Klickitat Irrigation Co. C. H. Hinman, North Yakima, Ira W. Prosser, Prosser, and John Sumner, Patterson, are Dir.

Seattle, Wash.—The City Council has instructed the Board of Public Works to advertise for bids for laying water mains in East 54th St. and Bradner Pl. L. B. Young is Chn. of Bd.

Seattle, Wash.—The citizens plan to issue $3,000,000 in bonds. The proceeds will be used for the extension of the water system.

✚Linn, Ore.—The contract for the construction of waterworks in West Linn has been awarded to the OREGON ENGINEERING & CONSTRUCTION CO., Oregon City.

Salem, Ore.—The Public Utilities Commission has granted permission to the Rouge River Public Service Corporation to construct an irrigation system to irrigate 12,640 acres of land in the vicinity of Grants Pass. Estimated cost, $135,000.

✚Oakdale, Calif.—The Oakdale Irrigation District has awarded the contract for extensions to the irrigation system to SHAW & BATCHER, Sacramento. The estimated cost is $100,000. Noted Apr. 29 and June 17.

Oceanside, Calif.—An election will be held Aug. 16 to vote on the question of issuing $20,000 in bonds. Part of the proceeds will be used for improving the municipal-water system.

Stockton, Calif.—The Pacific Gas & Electric Co. will install water mains, including an 8-in. fire-protection main in California St. The estimated cost is $32,000.

✚Levis, Que.—The contract for the construction of a storage dam on the St. Maurice River has been awarded to JOSEPH GOSSELIN, at $1,300,000.

Montreal, Que.—It is reported that the Board of Control has decided to engage local engineers to prepare plans for the construction of a filtration plant to increase the daily capacity from 50,000 to 100,000 gal. instead of the New York engineers recently appointed. Noted July 15 and June 17.

Collingwood, Ont.—The Town Council will improve its water system. The estimated cost is $15,000. J. H. Duncan is Clk.

✚Guelph, Ont.—The contract for the construction of a pumping station in connection with the extension of the water system has been awarded to BRENNAN & HOLLINGWORTH, Hamilton, at $8600. Noted July 22.

✚Assiniboia, Sask.—The contract for furnishing the city with 500 ton of c.-i. pipe has been awarded to the CANADIAN PIPE CO., at about $19,000.

SEWERS

✚Boston, Mass.—Bids were received July 28 by the Metropolitan Water and Sewerage Board for the construction of (a) Section No. 105, (b) Section No. 106 of the high level sewer, South Metropolitan System in Needham and Wellesley from HUGH NAWN CONTRACTING CO., Roxbury, (a) $29,655 (awarded contract), (b) $27,912 (awarded contract); George M. Bryne, (a) $37,272, (b) $43,315; Coleman Bros., (a) $44,230, (b) $37,651; Michael Meehan, (a) $52,187, (b) $44,605; Henry Spinach Contracting Co., (a) $52,493, (b) $43,630; M. Russo & Son, (a) $54,162, (b) $53,047; Bruno & Petitti, (a) $58,385, (b) $61,685. Noted July 22.

Boston, Mass.—Bids will be received until noon, Aug. 6, by Edward F. Murphy, Comr. of Pub. Wks., for the construction of sewers and drains in Columbia Park, Favre St. and private land, Dorchester, Royal Rd., Dorchester and Hyde Park.

Huntington, Mass.—(Official)—Bids have been received for the construction of approximately 4000 ft. of 8-, 10-, 12- and 15-in. sewers from A. Williams & Co., Boston, $3599; James L. Bryner Boston, $3392; Way & Cellilli, Springfield, $3338; Hampden Contracting Co., Springfield, $3121; Cordner & Montague, Springfield, $2851; William Orlando, Belchertown, $2764; Frank D. O'Connor, Holyoke, $2636. James L. Tighe is Consult. Engr.

Marlboro, Mass.—The City Council contemplates the construction of sewers in various streets. The estimated cost is $20,000. Thomas H. O'Halloran is Mayor.

Norwood, Mass.—(Official)—The city will construct sewers, water-works, underground municipal light system and pave various streets. The estimated cost is $100,000. G. A. Smith is Engr.

Salem, Mass.—(Official)—The city will construct sewers in Cleveland Rd., Loring Ave. and connecting streets by day labor. The estimated cost is $7000 Noted July 29

Hockanum, Conn—Bids will be received until 8 pm,, Aug. 12, by the Sewer Committee for the construction of approximately 9300 ft. of 12-, 10- and 8-in. sewers. C. Henry Olmsted is Engr.

★Albany, N. Y.—(Official)—Bids will be received by the Board of Contract and Supply until 3 p.m., Sept. 7, for the construction of sewage pumping stations. Isadore Wachman is Secy. of Bd.

Binghamton, N. Y.—Surveys are being made by the Engineering Bureau for the construction of a sewer system. Arthur La Roche is Asst. City Engr.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., Aug. 17, by Maurice E. Connolly, Borough Pres., for the construction of sewers and appurtenances in Maspeth, Clark, Perrk and Maurice Ave. and in Rust and Grand St.

✚Yonkers, N. Y.—It is reported that the contract for the construction of house and storm sewers has been awarded to JOSEPH CIANCULLI & SON, Yonkers, at $14,700.

✚Camden, N. J.—The contract for the construction of sewers in Chelton Ave., Fairview and North Sixth St. has been awarded to F. A. WARD. Noted July 8.

✚Maywood, N. J.—(Official)—The contract for the construction of a sanitary sewer system has been awarded to MARTIN-MILLER & PIZZIMENTI, Caldwell, at $87,911. Other bids were: Frisco Construction Co., Newark, $94,131; Di Napolio & Toriella Construction Co., $96,458; E. C. Humphrey, $127,280. Noted July 8.

Newark, N. J.—Bids were received July 29 by the city for the construction of the Bound Brook and Frelinghuysen Ave. sewer from O'Gara & Maguire, Newark, $33,175; Averill Mathews Co., Montclair, $36,377; John W. Heller, Newark, $37,956; P. L. Braunwith, $38,164; Frisco Construction Co., Newark, $39,295; Harrison & Craig, Newark, $44,930; P. D'Anato, Newark, $53,194; Charles Ippolito, Montclair, $76,661. Noted July 22.

Pitman, N. J.—An election will soon be held to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for the construction of a sewer system. Remington & Vosbury, Camden, is Engr. Noted June 10.

Pleasantville, N. J.—(Official)—Plans are being prepared by Remington & Vosbury, Engr., Camden, for the construction of a sewer system and a sewage-disposal plant. The estimated cost is $100,000.

Exter, Penn.—(Pittston post-office)—The lowest bid submitted for the construction of sewers in Penn, Lincoln and Grant St. was that of Joseph Banks, Wilkes-Barre, at $7000.

Franklin, Penn.—The Borough Council contemplates the construction of a sanitary sewer system.

Clayton, Del.—See item under "Water, Supply-Irrigation."

✚Baltimore, Md.—(Official)—The contract for the construction of Section No. 1 of the Jenkins Run Trunk Drain, Storm Water Contract No. 45 has been awarded to SLACK & SLACK, Baltimore, at $81,742. Other bids were. Whiting Turner Construction Co., $84,999; C. B. Clark & Co., $88,418; Ryan and Reilley, $90,069; Continental Contracting Co., $92,404; Janon Fisher, $93,434. Noted July 8.

✚Ocean City, Md.—The contract for the construction of a sewage pumping station, clarification tank, intercepting and branch sewers has been awarded to the BOYLE-LOHMULLER CONSTRUCTION CO., Baltimore, at $14,296. Noted July 15.

Harrisonburg, Va.—The city will construct an Imhoff sewage-disposal plant and filter beds. The estimated cost is $6000. J. H. Downing is Mayor.

South Boston, Va.—An election will be held Aug. 10 to vote on the question of issuing $100,000 in bonds. Part of the proceeds will be used for the construction of sewers. Plans have been prepared by Anderson & Christie, Charlotte, N. C. W. I. Penick is Mayor.

Keyser, W. Va.—An election will be held Aug. 10 to vote on the question of issuing $35,000 in bonds. Part of the proceeds will be used for the construction sewers in bed of New Creek.

✚Clinton, N. C.—The contract for the construction of a sewer system has been awarded to C. C. JACOBS, Durham. Noted Apr. 1.

Chester, S. C.—The city has been instructed by the State Board of Health to take definite action by Sept. 12 toward the installation of a sanitary sewer system.

★Greenville, S. C.—(Official)—Bids will be received until 4 p.m., Aug. 10, by the city for the construction of sanitary sewers. C. P. Ballenger is City Engr. Noted Apr. 29.

Atlanta, Ga.—An election will be held to vote on the question of issuing $1,000,000 for the construction of sewers and sewage-disposal plants.

Dunedin, Fla.—An election will be held Sept. 4 to vote on the question of issuing bonds, the proceeds of which will be used for the construction of a sewer system and a sewage-disposal plant.

St. Petersburg, Fla.—(Official)—The city will not issue bonds for the construction of a sanitary sewer system, as was noted in the issue of July 22.

Florence, Ala.—The city contemplates the construction of approximately three miles of sanitary sewers. N. M. Striplin is Mayor.

Meriden, Miss.—At a recent election the citizens voted to issue $10,000 in bonds. The proceeds will be used for the construction of sanitary sewers. Noted July 8.

La Fayette, La.—The city contemplates the construction of a sewer system. The estimated cost is $100,000.

✚Cheviot, Ohio—(Cincinnati post office)—(Official)—Contracts for sewer construction have been awarded to JAMES McLAIN, Newport, Ky., for constructing a trunk drain in Powells Track and to A. BOERESON, Cincinnati, for constructing a trunk drain in the Schlenker and Reubel property. Noted July 22.

✚Cincinnati, Ohio—The contract for the construction of the Poague Ave. sewer has been awarded to RUNCK PROS., at $5701.

Cincinnati, Ohio—Bids will be received until noon, Aug. 11, by Philip Fosdick, Dir. of Pub, Ser., for the construction of sewers in McDowell and Strafer St. and in Columbia Ave.

✚Cincinnati, Ohio—The Board of Control has awarded contracts for sewer construction to JOHN B. McLANE, at $14,977, for constructing sewers in Clinton Springs and Glenmore St.; CONNOLLY CONSTRUCTION CO., at $4625, for constructing sewers in Carll Rd.; M. J. CONNOLLY, JR., at $5226, for constructing sewers in Kirby Rd. Noted July 15.

★Cleveland, Ohio—(Official)—Bids will be received by the Commissioner of Purchases and Supplies until noon, Aug. 18, for the construction of a concrete open channel outfall sewer, approximately 630 ft. long and a submerged outfall pipe line about 3600 ft. long.

Columbus, Ohio—Bids will be received until Aug. 17 by the Director of Public Service for the construction of sewers in various streets.

Port Clinton, Ohio—The City Council contemplates constructing an addition to the sewer system in the South Side. The estimated cost is $44,000.

Lafayette, Ind.—Preliminary plans are being prepared for the construction of storm and sanitary sewers. H. B. Obersch, Jr., is City Engr.

+Markle, Ind.—(Official)—The contract for the construction of a sewer system has been awarded to THOMAS B. McGOVERN, Wabash, at $11,510. Other bids were: J. Hipskind, Wabash, $11,721; R. P. Nipp, Flora, Ill., $12,120; Keefer & Bailey, Huntington, $12,313; Martin Koch, Huntington, $12,570; T. B. House, Franklin, $12,693. Noted July 15.

Chrisman, Ill.—Plans are being prepared by George A. Fair for the construction of concrete sewers. The estimated cost is $9500. Frank McCuddy is City Clk. Noted July 29.

East St. Louis, Ill.—Plans are being prepared by E. F. Harper, City Engr., for the construction of the Bowman Ave. sewer from First to 16th St.

Green Bay, Wis.—Bids will be received until 10 a.m., Aug. 17, by the Committee on Sewers of the Common Council for the construction of a steel outlet for the terminus of the Cedar St. sewer to the Fox River.

Oshkosh, Wis.—Bids will be received until 2 p.m., Aug. 6, by the Board of Public Works for the construction of sewers in the Eighth Ward.

West Allis, Wis.—Bids will be received until noon, Aug. 9, by the Acting Board of Public Works for the construction of storm sewers in Mitchell St. from 51st St. to 63rd Ave.

+Whitewater, Wis.—The contract for the construction of sewers has been awarded to A. M. LANIGON, Waukegan, Ill., at $23,900. Noted July 29.

+Cherokee, Iowa—(Official)—The contract for the construction of approximately 3½ miles of sanitary sewers has been awarded to the MOORE-SEIG CONSTRUCTION CO., Waterloo, at $24,380. Other bids were: George M. King, Des Moines, $26,993; William C. Fraser, St. Paul, Minn., $25,398. Noted July 29.

Clinton, Iowa—It is reported that the City Council contemplates the construction of sewers in the Fourth Ward. The estimated cost is $80,000.

Spencer, Iowa—(Official)—Bids will be received until Aug. 6 by E. O'Keeffe, City Engr., for the construction of approximately 6000 ft. of 8-, 10- and 12-in. sewers.

Sandstone, Minn.—(Official)—All bids received July 26 for the construction of approximately 9025 ft. of 8- and 6-in. sewers have been rejected. New bids will be received until Aug. 23 by C. Rudisukle, Village Recdr. Noted July 22.

+St. Paul, Minn.—(Official)—The contract for the construction of storm and sanitary sewers in various streets to be included in part of the Smelling-Como sewer system has been awarded to THOMSON BROS., St. Paul, at $236,000. Noted July 22.

Topeka, Kan.—Plans have been prepared and bids will scon be received by A. R. Young, City Engr., for the construction of sewers in District No. 45. Noted May 13.

+Topeka, Kan.—The contract for the construction of the East Side sewer has been awarded to JAMES A. PRINGEL, at $125,834. Noted July 29.

Crofton, Neb.—The city contemplates the construction of a sewer system and a septic tank. The estimated cost is $8000. J. D. Clair Smith, Hartington, is Engr.

+Omaha, Neb.—The contract for the construction of storm sewers from 36th Ave. to the junction connecting with the Everett Pl. sewer in Fontenelle Park has been awarded to JAMES JENSON, Omaha, at $39,646.

Omaha, Neb.—The State Legislature has authorized the City Council to issue bonds for $1,000,000. The bonds will be isued in five annual installments of $200,000 each. The proceeds will be used for the construction of a sewer system.

Wausa, Neb.—An election will be held Sept. 3 to vote on the question of isuing $20,000 in bonds. The proceeds will be used for the construction of a sewer system and a sewage-disposal plant. Noted June 24.

+Wisner, Neb.—(Official)—The contract for the construction of a sewer system has been awarded to ARTHUR A. DABSON CO., Lincoln, at $14,510. Noted July 15.

Centerville, S. D.—At a recent election the citizens voted to issue $27,000 in bonds, the proceeds of which will be used for the construction of a sewer system. Noted July 15.

Poplar Bluffs, Mo.—(Official)—Bids will be received until 7: 30 p.m., Aug. 16, by H. H. Wilcox, City Clk., for the construction of sewers in Sanitary Sewer District No. 2. The estimated cost is $17,426. Edward C. Thomas is City Engr.

+Springfield, Mo.—The contract has been awarded to PLUMNER-ADAMS CO., Springfield, at $9153, for the construction of sewers in District No. 22, Section No. 3.

St. Louis, Mo.—Bids will be received until noon, Aug. 6, by the Board of Public Service for the construction of the Florissant Ave. public sewer extensions, Sections Nos. 1 and 2.

Argenta, Ark.—Bids will be received until 10 a.m., Aug. 11, by the city for two 14,000-gal. sewerage pumps, two 60-hp. slow-speed motors and other equipment. J. P. Faucette is Mayor.

Amarillo, Tex.—The city contemplates constructing sewers estimated to cost $10,000. J. M. Beasley is Mayor.

Beeville, Tex.—Bids will be received until Aug. 20 by W. G. Gayle, City Clk., for extending the sewer system. Bartlett & Ranney, San Antonio, is Engr. Noted July 22.

+Drumright, Okla.—The contract for the construction of lateral sewers has been awarded to the TOLBERT CONSTRUCTION CO., at $28,000. Noted Feb. 25.

Sand Springs, Okla.—(Official)—Bids will be received until Sept. 1 by A. F. Shultz, City Clk., for the construction of 1½ miles of sewers. The estimated cost is $4000. M. P. Lartimer is City Engr. Noted July 22.

Steamboat Springs, Colo.—Bids will be received until Aug. 9 by the Town Council for the construction of a sanitary sewer system. The estimated cost is $62,000. B. G. Bradley is Town Engr. Noted July 1.

Deming, N. M.—An election will be held to vote on the question of issuing bonds for $30,000, the proceeds of which will be used for the construction of septic tanks and for extending the sewer system.

Richfield, Utah—The city contemplates issuing bonds, the proceeds of which will be used for the construction of a sewer system.

Burns, Ore.—(Official)—At a recent election the citizens defeated the question of issuing bonds for $40,000, the proceeds of which was to have been used for the construction of a sewer system. Noted July 22.

Portland, Ore.—Bids were received by the City Council for the construction of the East Alder St. sewer from 135 ft. west of East Second St. to the east harbor line of the Willamette River from the Alexis Contracting Co., Portland, at $21,106, and Giebisch & Joplin, Portland, at $25,970.

+Corning, Calif.—The contract has been awarded to A. C. HAMLIN, San José, at $15,381, for sewer construction.

+Los Angeles, Calif.—The contract for the construction of sewers in Temple St. from Oxford Ave. to Kingsley Drive has been awarded to JOSEPH CHUTUK, at $39,116. Noted July 29.

Marysville, Calif.—An election will be held to vote on the question of issuing $18,000 in bonds. The proceeds will be used for the construction of sewers in the Ellis Lake District. Noted Apr. 8.

+Sacramento, Calif.—The contract for the construction of Unit No. 4 of the trunk sewer in Montclair Ave. has been awarded to JAMES KENNEDY, Fargo, N. D., at $37,280.

+Santa Barbara, Calif.—The contract for sewer construction has been awarded to EGGART & UKOVISIA, Los Angeles, at $20,717.

+Stockton, Calif.—The contract for the construction of sanitary sewers in the McCloud addition has been awarded to A. TEICHERT & SON, Sacramento, at $6968.

London, Ont.—Bids will soon be received for the construction of sewers in Waterloo St. H. A. Brazier is Engr.

Stratford, Ont.—The city contemplates the construction of sewers in Front, Mile, High and Railway Ave. A. B. Manson is Engr.

Thorold, Ont.—Bids will soon be received for the construction of sewers in various streets. D. J. Munro is City Clk. Noted June 3.

Welland, Ont.—The Town Council will construct sewers in Seeley St. D. J. Black is Engr.

GARBAGE

New York, N. Y.—The following are the lowest bids submitted to J. T. Fetherston, Comr. of Street Cleaning, for the removal of snow and ice during the winter season of 1915-1916: Borough of Manhattan: Celestino De Marco, 239 East 17th St., 37c. per cu.yd.; Borough of Bronx: Thomas Cummins Contractor Co., 444 East 69th St., 30c. per cu.yd.; Borough of Brooklyn: Rosenthal Engineering & Contracting Co., 165 Hooper St., Brooklyn, 35.3c. per cu.yd.; Manhattan Borough, Dists. 1, 2 and 3: Snow Contracting Co., 1 Madison Ave., 43c. per cu.yd.; Brooklyn Borough, Dists. 1, 2, 3 and 4: Parsons & Langtry Co., 30 Church St., New York, lowest on Dist. 1, 34.7c. per cu.yd.; Rosenthal Engineering & Contracting Co., 165 Hooper St., Brooklyn, lowest on Dists. 2 and 3, 28c. and 31c. per cu.yd.; Thomas Callandrello, 425 Malbone St., only bidder on Dist. 4, at 34c. per cu.yd.

Fort Wayne, Ind.—The Board of Public Works contemplates the construction of a garbage incinerating plant, also the construction of collection sub-stations.

STREETS AND ROADS

+Boston, Mass.—A contract for furnishing approximately 200,000 gal. of emulsified road oil has been awarded to the STANDARD OIL CO., at $0.0367 per gal.

+Boston, Mass.—The contract for paving Birch St. from Penfield St. to Dudley Ave., West Roxbury, has been awarded to A. H. ARCHER, at $7223.

Boston, Mass.—(Official)—Bids will be received until noon, Aug. 9, by the Commissioner of Public Works for paving Glendower Rd. from Kittredge to Poplar St., West Roxbury District.

Boston, Mass.—Bids will be received until Aug. 10 by the State Highway Commission for constructing 11,000 lin.ft. of road in Northampton. Arthur W. Dean, 15 Ashburton Pl., is Ch. Engr.

+Boston, Mass.—The contract for constructing 4600 lin.ft. of state road in Andover has been awarded to D. J. SHEEHAN, Lynn, at $10,905. Noted July 22.

Northampton, Mass.—Bids will be received until noon, Aug. 10, by the State Highway Commission, Boston, for constructing 11,000 lin.ft. of state highway.

Hartford, Conn.—Bids will be received by Charles J. Bennett, State Highway Comr., until 2 p.m., Aug. 16, for road work as follows: North Haven Township, about 4950 lin.ft. macadam on the Mt. Carmel-North Haven Rd.; Southington Township, about 6200 lin.ft. 2-in. bituminous macadam resurfacing on the Misery Brook Rd.; Waterford Township, about 5937 lin.ft. native stone macadam on the Hartford-New London Turnpike; Durham Township, about 4940 lin.ft. bituminous macadam resurfacing on the Middlefield Rd.; Killingly Township, about 2950 lin.ft. concrete, amiesite, warrenite or bituminous concrete resurfacting on Main St., Danielson.

+Hartford, Conn.—Contracts for State Road work have been awarded by the State Highway Commissioner as follows: Plainfield Township, about 6875 lin.ft. gravel, to JOHN ARBORIA, 172 Congress St., New Haven, at $8000. Vernon Township, a section of bituminous native stone macadam on Vernon Ave., to A. D. BRIDGE'S SONS, INC., Hazardsville, at $4843. Roxbury Township, a section of graded road to JOHN DE MICHIEL & BRO., Torrington, at approximately $16,311. Killingworth Township, a section of gravel road to LOUIS LONGHI & BRO., Torrington, at $6000. Bridgeport City, a section of warrenite pavement to the WARREN BROS. CO., Boston, Mass., at $8529.

+New Haven, Conn.—The contract for paving Exchange St. with sheet asphalt has been awarded to the C. W. BLAKESLEE SONS CO., New Haven, at $14,298.

✚Albany, N. Y.—The contract for improving Glendale and Highland Ave. has been awarded to GLEASON & DAVITT, at $17,757.

✚Albany, N. Y.—The contract for grading a portion of the easterly section of Beaver Park has been awarded to MARTIN MURRAY & CO., at $30,743.

✚Albany, N. Y.—The contract for improving Bancker, Mercer, Peyster and Warren St. and Main, Park and Ryckmann Ave. has been awarded to GLEASON & DAVITT, Troy, at $95,618.

Buffalo, N. Y.—The Common Council has voted to pave Tifft St. with brick, at an estimated cost of $25,000.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received July 28 by L. H. Pounds, Borough Pres., for improving Skillman St. from Park to Myrtle Ave., Myrtle Ave. from Franklin to Nostrand Ave., Nostrand Ave. from Stockton St. to 75 ft. south of Willoughby Ave. and Vernon Ave. from Nostrand to Marcy Ave. as follows: Rosenthal Engineering Co., $26,446; Barber Asphalt Co., $26,519; Sicilian Asphalt Co., $25,203; Borough Asphalt Co., $24,059; McFarlane Contracting Co., $27,288. Noted July 22.

New York, N. Y.—(Borough of Brooklyn)—Bids will be received until 11 a.m., Aug. 11, by L. H. Pounds, Borough Pres., for improving Jamaica Ave. from Broadway to the borough line.

✚New York, N. Y.—(Borough of Manhattan)—(Official)—Contracts have been awarded for improving portions of 38th St., 62nd St., West End Ave., and 95th St., 36th St. and Amsterdam Ave. to the ASPHALT CONSTRUCTION CO., 50 Church St. at $66,386, $17,923, $12,017 and $153,877 respectively. Noted July 8.

★Scarsdale, N. Y.—(Official)—Bids will be received until 8 p.m., Aug. 25, by the Board of Trustees for constructing the Popham Rd. John R. Ross is Clk.

✚Yonkers, N. Y.—The contract for regulating, grading and improving Fortfield Ave. has been awarded to JOHN O. WESTON, at $23,450.

Cranford, N. J.—Press reports state that the Township Committee plans to pave Springfield Ave. with macadam and construct concrete curbs and gutters.

✚East Orange, N. J.—(Official)—The contract for grading, curbing and paving Girard and Linden Ave. with telford pavement has been awarded to JOHN S. GEIGER'S SONS, Newark, N. J. Noted July 22.

Hackensack, N. J.—(Official)—Bids will be received until 1 p.m., Aug. 16, by the Board of Chosen Freeholders of Bergen County for repairing Oakland Ave. from Page's Corner to the Passaic County line.

✚Haddonfield, N. J.—A contract for resurfacing a number of street has been awarded to MANWARING & CUMMINGS, Philadelphia, at $16,700.

✚Hoboken, N. J.—(Official)—The contract for improving a portion of the concrete walks in Elysian Park has been awarded to the O'REILLY CONTRACTING CO., 90 Neptune Ave., Jersey City. Noted July 22.

✚Hoboken, N. J.—(Official)—The contract for grading and repaving portions of Third, Fourth, Fifth, Sixth, Jefferson, Adams, Hudson, River, and 14th St. and Willow Ave. has been awarded to the UVALDE ASPHALT PAVING CO., at $42,040. Noted July 22.

✚Kearney, N. J.—The contract for paving Stewart Ave. from Schuyler Ave. to Argyle Pl. has been awarded to VAN KEUREN & SON, at $17,183.

✚Morristown, N. J.—The Board of Freeholders has awarded contracts for the improvement of the Denville-Dover Rd., in two sections Denville-Rockaway Section, to the WELDON CONTRACTING CO., $21,181; Rockaway-Dover Section, to OSBORNE & MARSEILLIS CO., $31,993.

South Amboy, N. J.—Plans are being prepared by the City Engineer for paving Main St. from Broadway to Thompson St.

Trenton, N. J.—The Board of City Commissioners plans to improve Ellsworth Ave. by paving with bituminous concrete on a 5-in. concrete foundation.

Brackenridge, Penn.—At a recent election the citizens voted in favor of issuing $35,000 in bonds, the proceeds of which will be used for street paving.

Camp Hill, Penn.—Press reports state that the citizens voted in favor of issuing $30,000 in bonds, the proceeds of which will be used for paving Mark St.

Greensburg, Penn.—(Official)—All bids received July 23 for improving sections of the highway in Mt. Pleasant Township were rejected. New bids will be readvertised. Noted July 22.

Philadelphia, Penn.—(Official)—Bids will be received until Aug. 10 by the Department of Public Works for improving a number of streets.

★Wilmington, Del.—(Official)—Bids will be received until 4 p.m., Aug. 10, by the Board of Directors of the Street and Sewer Department for improving a number of streets. L. V. Christy is Secy.

Baltimore, Md.—The Paving Committee has voted to pave Hillen, Fayette Gold St. with sheet asphalt.

Clintonwood, Va.—The Commissioners of Dickinson County contemplate an expenditure of $48,000 for the construction of 30 miles of road.

Isle of Wight, Va.—The Commissioners of Isle of Wight County contemplate constructing 35 miles of road, at an estimated cost of $15,000.

✚★Norfolk, Va.—(Official)—A contract for paving certain streets has been awarded to LOUIS LAUSON, Norfolk, at $32,992. Other bids were: Atlantic Bitulithic Co., $40,112; F. J. McGuinn, $40,062; Continental Public Works Co., $35,128; Central Contracting Co., $35,127. Noted July 15.

South Boston, Va.—An election will be held Aug. 10 to vote on the question of issuing $25,000 in bonds, the proceeds of which will be used for street improvements.

Piedmont, W Va.—Press reports state that an election will soon be held to vote on the question of issuing $36,000 in bonds, the proceeds of which will be used for improving streets.

Lillington, N. C.—An election will be held Aug. 7 to vote on the question of issuing $25,000 in bonds, the proceeds of which will be used for constructing 20 miles of road in Harnett County.

Cartersville, Ga.—The date of holding an election has been postponed from July 17 to Aug. 14 to vote on the question of issuing $15,000 in bonds, the proceeds of which will be used for street paving. Noted July 1.

Folkston, Ga.—The Commissioners of Charlton County contemplate constructing 20 miles of road, at an estimated cost of $20,000.

Apalachicola, Fla.—The Commissioners of Franklin County plan to construct approximately 25 miles of road.

Kissimmee, Fla.—An election will be held Aug. 7 to vote on the question of issuing $45,000 in bonds, the proceeds of which will be used for paving six streets.

✚Sarasota, Fla.—(Official)—Contracts have been awarded for paving portions of Palm St. to the SOUTHERN ASPHALT & CONSTRUCTION CO., Birmingham, Ala., and Strawberry St. to the GEORGIA ENGINEERING CO., Augusta, Ga. Noted July 15.

New Orleans, La.—A. G. Thomas, New Orleans, at $6.95 per cu.yd. was the lowest bidder for constructing a highway from the Rigolets to Chef Menteur. Noted July 15.

Jasper, Tenn.—At a recent election the Commissioners of Marion County voted in favor of issuing $100,000 in bonds, the proceeds of which will be used for constructing a section of the Dixie Highway.

Linden, Tenn.—The Commissioners of Perry County contemplate constructing 100 miles of road, at an estimated cost of $100,000.

Hartford, Ky.—The Commissioners of Ohio County contemplate constructing three miles of macadam road. W. C. Blankenship is Clk.

Hazard, Ky.—An election will be held Aug. 11 to vote on the question of issuing $50,000 in bonds, the proceeds of which will be used for constructing concrete sidewalks.

Paducah, Ky.—According to press reports the Commissioners of McCracken County will improve Glandville Rd.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Aug. 12, by Philip Fosdick, Dir. Pub. Ser., for improving Magnolia St. from Plum to Elm St. Noted July 15.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Aug. 12, by Philip Fosdick, Dir. Pub. Ser., for improving Wade St. Noted July 15.

Columbus, Ohio—Bids will be received until Aug. 17 by the Director of Public Service for paving a number of streets.

Columbus, Ohio—Bids will be received until 10 a.m., Aug. 23, by John Scott, Clk. of the Bd. of County Comrs. of Franklin County, for improving roads in various townships.

Columbus, Ohio—(Official)—Bids will be received until 2 p.m., Aug. 6, by Clinton Cowen, State Highway Comr., for improving a number of roads in various counties.

✚West Jefferson, Ohio—A contract for paving a number of streets has been awarded to the ANDREWS PAVING CO., Hamilton, at $40,000. Noted June 17 and July 15.

Greencastle, Ind.—(Official)—Bids will be received until 2 p.m., Sept. 4, by the Commissioners of Putnam County for constructing a gravel road on line between Putnam and Parke Counties.

Portland, Ind.—(Official)—No contract has been awarded for improving Commerce and Ship St. as the Mayor vetoed the improvement resolutions. Noted July 15.

✚Warsaw, Ind.—The contract for constructing the Gwin Rd. has been awarded to T. E. SPARKS, Kirkland, at $19,500.

Mt. Carmel, Ill.—Bids will be received until Aug. 12 for constructing 20 miles of gravel roads in District No. 3. E. E. Seiles is Clk.

✚Green Bay, Wis.—(Official)—A contract for paving various streets has been awarded to WILLIAM PICKETT, 1200 Doty St., Green Bay, at $10,400. Other bids were: Murphy Construction Co., $11,400; Carlin Bros., $10,977. Noted June 10.

Neenah, Wis.—Bids will be received until 2 p.m., Aug. 23, by the Board of Public Works for paving Walnut St. from East Wisconsin to Doty Ave.

West Allis, Wis.—Press reports state that the City Council plans to pave Greenfield, National and Mitchell St.

✚Clinton, Iowa—The contract for repaving Fourth St. from Fifth to 10th St. has been awarded to THOMAS CAREY & SONS, Clinton, at $27,917.

✚Grundy Center, Iowa—A contract for paving a number of streets with asphaltic concrete has been awarded to the FORD PAVING CO., Cedar Rapids.

Idagrove, Iowa—The citizens will soon vote on the question of issuing $15,000 in bonds, the proceeds of which will be used for street paving.

✚La Mars, Iowa—A contract for paving 43 blocks with concrete has been awarded to A. R. LAKE.

✚Spencer, Iowa—(Official)—A contract for laying 70,000 sq.yd. of pavement has been awarded to the BRYANT PAVING CO., Waterloo, at $12,000. Noted July 15.

✚Duluth, Minn.—The contract for paving 12th Ave. has been awarded to OLSEN & JOHNSON, Duluth.

Northfield, Minn.—An election will be held Aug. 12 to vote on the question of issuing $19,000 in bonds, part of the proceeds will be used for street paving.

✚Hutchinson, Kan.—The contract for improving Main St. has been awarded to the STOMEY-MACKEY CONSTRUCTION CO., at approximately $30,000.

✚Omaha, Neb.—The contract for paving 24th St. from Vinton to A St. and 13th St. from Mason to Howard St. with brick has been awarded to the JAMES J. PARKS CO., South Omaha, at $52,000.

✚York, Neb.—A contract for paving in Districts No. 10 and 11 has been awarded to ABEL & ROBERTS, Lincoln, at $36,500.

Jefferson City, Mo.—Press reports state that the citizens of Cole County contemplate voting on the question of issuing $100,000 in bonds, the proceeds of which will be used for improving roads.

Kirkwood, Mo.—The city contemplates constructing two miles of streets, at an estimated cost of $14,000.

Poplar Bluff, Mo.—Bids will be received until Aug. 16 by E. C. Thomas, City Engr., for constructing 65,000 sq.yd. of concrete pavement, at an estimated cost of $10,000.

Springfield, Mo.—Plans are being prepared for the construction of approximately 100 miles of roads in Greene County.

+Pine Bluff, Ark.—The contract for paving Laurel and 15th Ave. has been awarded to the KAW PAVING CO., Kansas City, at $43,202.

Amarillo, Tex.—A special election will soon be held to vote on the question of issuing $50,000 in bonds, the proceeds of which will be used for street improvements.

+Ft. Worth, Tex.—The contract for paving Richmond Ave. from Evans to New York Ave. has been awarded to the ROACH-MANIGAN PAVING CO.

Higgins, Tex.—At a recent election the citizens of Lipscomb County voted in favor of issuing $50,000 in bonds, the proceeds of which will be used for constructing and improving roads.

Orange, Tex.—At a recent election the citizens voted in favor of issuing $25,000 in bonds, the proceeds of which will be used for improving streets. Noted June 24.

+Ogden, Utah—A contract for paving in District No. 117 has been awarded to the J. P. O'NEIL CONSTRUCTION CO., Ogden, at $4163.

+Elko, Nev.—The Commissioners of Elko County have awarded a contract for the construction of the Secret Pass Rd., 16 miles from Halleck, to the SMITH-SPRAGGIN CO., Salt Lake City, Utah, at $9980.

Miami, Ariz.—Press reports state that an election will be held Aug. 12 to vote on the question of issuing $50,000 in bonds, part of the proceeds will be used for improving county highways in Gilla County.

+Bellingham, Wash.—The contract for paving the Lake Rd. has been awarded to L. H. LICH, at $41,236.

Colfax, Wash.—Bids will be received until 11 a.m., Aug. 7, by the Commissioners of Whitman County for draining, bridging and grading 11½ miles of Permanent Highway between Colfax and Pullman. John M. McCaw is County Engr.

+Seattle, Wash.—The contract for paving Horton St. has been awarded to D. H. TRAPHAGEN, Alaska Bldg., Seattle, at $20,555.

Stevenson, Wash.—At a recent election the citizens of Skamania County voted in favor of issuing $210,000 in bonds, the proceeds of which will be used for improving and constructing roads.

Tacoma, Wash.—Bids will be received until Aug. 14 by the Commissioners of Pierce County for improving Permanent Highway No. 5-A.

Walla Walla, Wash.—(Official)—Bids will be received until Aug. 10 by M. A. Power, City Clk., for paving Rose and 12th St.

Gresham, Ore.—The City Council will soon award the contract for hardsurfacing Roberts Ave. and Second St. The estimated cost of the work is $12,000.

Marshfield, Ore.—According to press reports, the City Council has voted to improve Pine St., at an estimated cost of $10,000.

Oswego, Ore.—Bids will be received until Aug. 5 by H. W. Koehler, City Recdr., for grading and hard surfacing Front St.

+Eureka, Calif.—The City Trustees have awarded a contract for street improvement to ELSMORE & JACOBS, at $6939.

+Gridley, Calif.—(Official)—A contract for paving a number of streets has been awarded to the CLARKE & HENERY CONSTRUCTION CO., Sacramento, at $52,609.

+Ontario, Calif.—The contract for paving A St. has been awarded to L. G. GARNSEY, Los Angeles, at $23,000.

+Richmond, Calif.—The City Council has awarded a contract for paving North Tenth St. with bitulithic to JOHN WORD, at $14,251.

Sacramento, Calif—(Official)—Bids were received July 26 by the State Highway Commission for constructing roads in various Counties as follows: (a) Colusa County, Division 3, Route 7, Section A, (b) Monterey County, Division 5, Route 2, Section D, (c) San Luis Obispo County, Division 5, Route 2, Section B, (d) Marin County, Division 5, Route 1, Section A, (e) Santa Barbara County, Division 5, Route 2, Section D; Clark & Henry Construction Co., Sacramento, (a) $5779; A. W. & C. H. Gorrell, San Francisco, (b) $72,848, (c) $70,864; W. A. Dontanville, Salines, (b) $69,064, (c) $74,492; Hoffmann & McLaren, Oakland, (b) $63,395; Lou G. Hare, Salines, (b) $76,527; Highway Paving & Construction Co., San Francisco, (b) $54,507; Twohy Bros., San Francisco, (b) $85,437, (c) $82,791, (d) $52,084; Tieslau Bros., San Francisco, (b) $73,966, (c) $74,802, (d) $28,883, (e) $71,802; Petersen & Grier, San Francisco, (b) $66,733, (c) $78,191; F. Rolandi, San Frencisco, (c) $72,651, (d) $29,088, (e) $73,685; Leigh G. Garnsey, Los Angeles, (c) $76,362, (e) $67,959; Bent Bros., Los Angeles, (c) $72,495; Pacific Coast Construction Co., Fresno, (c) $69,396; Bates Borland & Ayer, Oakland, (c) $75,079, (d) $26,849, (e) $61,564; Seabury B. Peterson, San Francisco, (c) $74,748; John D. Marsh, Bakersfield, (c) $67,809; Palmer & McBryde, San Francisco, (d) $25,489; Daniel O'Day Co., San Francisco, (d) $29,201; Baver & Beard, Two Rivers, (d) $27,421; W. J. Schmidt, Berkeley, (d) $34,872; Erickson & Petterson, Inc., San Francisco, (d) $34,290; Spring Construction Co., Berkeley, (d) $30,858; Sunset Construction Co., San Francisco, (d) $31,552; Fairbanks & Baechtel, Willits, (d) $29,961, (b) $69,919; R. B. Markle, Jr., San Francisco, (d) $21,255; Theodore Manetas, San Francisco, (d) $26,504; J. H. Falconer, Pinole, (d) $23,498; G. W. Conners, Eureka, (d) $26,885, (e) $63,005; O'Brein Bros., Martinez, (d) $28,220; Contra Costa Construction Co., Berkeley, (d) $27,532; P. H. Hoare, Oakland, (d) $24,476; C. H. Hudson, Los Angeles, (e) $54,586; Maurice Ryan & Son, El Centro, (e) $65,293; Richmon Rothwell, Los Angeles, (e) $60,631; Robert Sherer, Los Angeles, (e) $58,148; Occidental Construction Co., Los Angeles, (e) $69,655; F. L. Smith Co., Eureka, (e) $59,466; F. H. Green, Eureka, (e) $59,994; E. J. Hunt, Santa Margarita, (e) $61,831. Noted July 15.

+Vernon, Calif.—The contract for paving Alamada St. from 38th to 56th St. has been awarded to the LOS ANGELES PAVING CO., Hellman Bldg., Los Angeles.

Halifax, N. S.—Press reports state that the City Council plans to construct concrete sidewalks on Morris St. and Victoria Rd. F. W. Doane is City Engr.

INDUSTRIAL WORKS

+Cambridge, Mass.—The contract for the construction of a three-story, 100x100-ft. brick factory at Haywood and Main St. for J. L. Hammett has been awarded to J. M. & C. J. BUCKLEY, 164 Federal St., Boston, Mass. Densmore & Le Clear, 88 Broad St., Boston, Mass., is Arch.

Holyoke, Mass.—The Yoerk Tire & Rubber Co. will build a garage on Chestnut St. The estimated cost is $18,000. G. P. Alderman & Co. is Arch.

+Worcester, Mass.—The Wright Wire Co., Hammond St., has awarded the contract for the construction of a four-story brick addition to its plant to E. D. WARD. The estimated cost is $25,000.

+Hartford, Conn.—The Whitney Mfg. Co., Bartholomew Ave., has awarded the contract for the construction of a four-story, 60x64-ft. reinforced-concrete addition to its plant to the J. H. CROZIER CO., 721 Main St. William A. Boring, 32 Broadway, New York, N. Y., is Arch. Noted May 6.

New Haven, Conn.—The New Haven Pulp & Board Co. will build a brick building on Railroad Ave., estimated to cost $70,000.

New Haven, Conn.—Cowles Folman, 677 State St., will build a three-story, 60x75-ft. brick and steel garage and repair shop at State and Trumbull St. R. W. Foote, 424 Chamber of Commerce Bldg., is Arch.

Providence, R. I.—Simeon Klein, Ashburton St., will build a 2½-story, 46x100-ft. brick smelting plant.

Buffalo, N. Y.—The Dold Packing Co. will build a five-story, 100x160-ft. reinforced-concrete addition to its plant at William, Howard and Detroit St., to cost $200,000.

+Jamestown, N. Y.—The Gurney Ball Bearing Co. has awarded the contract for the construction of its plant to the LACKAWANNA BRIDGE CO., Buffalo, N. Y.

New York, N. Y.—(Borough of Brooklyn)—P. H. Connor will build a three-story, 100x128-ft. brick and concrete factory and warehouse on 18th St., to cost about $100,000. William Higginson, 13 Park Row (Borough of Manhattan), is Arch.

+New York, N. Y.—(Borough of Brooklyn)—(Official)—The TURNER CONSTRUCTION CO., 11 Broadway (Borough of Manhattan), has been awarded the contract for the construction of a seven-story, 100x168-ft. reinforced-concrete addition to the plant of A. Schrader's Son, Inc., Vanderbilt and Atlantic Ave. Timmis & Chapman is Arch.

+New York, N. Y.—(Borough of Brooklyn)—(Official)—The TURNER CONSTRUCTION CO., 11 Broadway (Borough of Manhattan), has been awarded the contract for the construction of an 11-story, 100x134x177-ft. reinforced-concrete factory at Flatbush Ave. and Concord St. for the Sperry Gyroscope Co. Frank J. Helmle, 190 Montague St., is Arch. Noted July 1.

New York, N. Y.—(Borough of Queens)—The Texas Oil Co., 17 Battery Pl. (Borough of Manhattan), will build a plant at Marsh St. and Dutchkills Creek to cost $100,000.

Syracuse, N. Y.—(Official)—Bids are being received by Edward A. Howard & Son, Arch., 503 The Bastable, for the construction of a $20,000 building for the Fleischmann Co. Noted July 29.

+Troy, N. Y.—The DEVERALL-SPENCER CO., Baltimore, Md., has been awarded the contract for the construction of a five-story concrete mill and a one-story warehouse for the Boutwell Milling & Grain Co. on South River St. The estimated cost is $70,000.

+Butler, N. J.—(Official)—Bids will soon be received for the construction of a three-story brick factory for the Pequanoc Rubber Co. The estimated cost is $25,000. Oakley Houman, 6 Park Ave., Paterson, N. J., is Arch. Noted July 1.

East Orange, N. J.—The Crocker & Wheeler Co. plans to build a 62x201-ft. concrete addition to its plant, to cost $18,000.

Newark, N. J.—J. Wiss & Sons Co., 31 Littleton Ave., will build a four-story, 50x75-ft. addition to its plant to cost about $15,000. Frederick A. Phelps is Arch.

Plainfield, N. J.—The Plainfield Storage Warehouse Co. will build a storage warehouse on East Third St. The estimated cost is $30,000.

Philadelphia, Penn.—The Eynon Evans Mfg. Co. will build a three-story, 50x120-ft. foundry and a 51x120-ft. machine shop at 17th and Allegheny St.

+Philadelphia, Penn.—The contract for the construction of a five-story, 35x140-ft. brick and steel factory at 503 Market St. for the Haverford Cycle Club has been awarded to the PHILIP HAIBACH CONTRACTING CO., 26th and Thompson St. Peuckert & Wunder, 310 Chestnut St., is Arch.

+Pittsburgh, Penn.—D. T. RIFFLE has been awarded the contract for the construction of a six-story, 54x110-ft. reinforced-concrete warehouse on Penn Ave. for the George S. Dougherty Co. Noted July 22.

+Baltimore, Md.—The Terminal Freezing & Heating Co. has awarded the contract for the construction of a six-story, 41x142-ft. cold-storage plant at 412-14 South Eutaw St. to the CONSOLIDATED ENGINEERING CO. The estimated cost is $20,000. Noted June 17.

+Baltimore, Md.—The Bartlett Haywood Co., South Charles St., has awarded the contract for the construction of an

addition to its plant to J. HENRY SMITH. The estimated cost is $100,000.

Sparrows Point, Md.—(Baltimore post office)—The Maryland Steel Co. will soon start work on improvements to its marine department to cost about $1,000,000.

Asheville, N. C.—The Azalea Woodworking Co., whose plant was recently destroyed by fire at a loss of $40,000, will be rebuilt. W. D. Riddick is Pres.

Richmond, Va.—The Albermarle Paper Co. will build a factory on Tredegar St., to cost $13,750.

Richmond, Va.—The Baldwin & Brown Co., Richmond, Va., will build a six-story warehouse on 17th St.

✚New Orleans, La.—(Official)—The Board of Port Commissioners has awarded the contract for the construction of a reinforced-concrete wharfhouse and warehouse to JACOB A. ZIMMERMAN, 18 East 41st St., New York, N. Y., at $1,109,000. Ford, Bacon & Davis, 921 Canal St., is Arch. Noted July 1.

Knoxville, Tenn.—The Ross & Republic Marble Co. will rebuild its plant which was recently destroyed by fire at a loss of $75,000. A. M. Glasgow is Vice-Pres. and Gen. Mgr.

✚Cleveland, Ohio—The Cleveland Ry. Co. has awarded the contract for the construction of a one-story, 100x111-ft. reinforced-concrete and brick repair shop to the W. I. THOMPSON & SONS CO. The estimated cost is $35,000.

✚Fostoria, Ohio—The contract for the construction of a packing plant for the Fostoria Provision Co., 106½ Main St., has been awarded to J. J. MYER, Lorain, Ohio, at $31,975. Noted July 15.

Toledo, Ohio—(Official)—Thomas F. Huber, Arch., is preparing preliminary plans for the construction of a building for the American Plumbers Supply Co., to cost approximately $100,000.

Toledo, Ohio—The Herbrand Co. will build a $20,000 addition to its plant.

✚Anderson, Ind.—The contract for the construction of two additions to the plant of the Remy Electric Co. has been awarded to ESHELMAN & SON. Estimated cost, $13,000.

Indianapolis, Ind.—The San-I-Deal Paper Bottle Co., recently incorporated with a capital of $300,000, will build a factory. G. K. Jeffries, Gen. Supt. of the Terre Haute, Indianapolis & Eastern Traction Co., is Pres.

Detroit, Mich.—The Northway Motor Co. will build an addition to its plant at 855-7 West Hancock St., to cost $40,000.

Detroit, Mich.—The Mazer Cigar Mfg. Co. plans the construction of a four-story, 31x103-ft. addition to its plant at Grandy and Theodore St. Jacob Mazer is Secy. and Treas.

✚Detroit, Mich.—The contract for the construction of a three-story addition to the plant of the Hudson Motor Car Co. has been awarded to the BRYANT & DETWILER CO. Albert Kahn, 58 La Fayette Ave. is Arch. Noted July 15.

Grand Haven, Mich.—The Ottawa Leather Co. plans the construction of a 110x180-ft. addition.

✚Ionia, Mich.—The Ypsilanti Reed Co. has awarded the contract to HERMAN & SON, Grand Rapids, Mich., for the construction of a five-story, 110x165-ft. factory.

Lansing, Mich.—The Reo Motor Car Co. will build three additions to its plant, to cost approximately $250,000.

Saginaw, Mich.—(Official)—The Jackson-Church-Wilcox Co. will soon start work on the construction of a $25,000 addition to its plant.

Chicago, Ill.—Swift & Co., Chicago, Ill., will build a seven-story storage plant at the Union Stock Yards, to cost $125,000. B. H. Jielson is Arch.

Chicago, Ill.—The Chicago Title & Trust Co., 69 West Washington St., will build a seven-story reinforced-concrete warehouse at 411 West Ontario St., to cost $150,000. Paul Gerhardt, 64 West Randolph St., is Arch.

Chicago, Ill.—The Hanson & Van Winkle Co., Newark, N. J., and Clinton and Madison St., Chicago, Ill., will build a three-story, 50x70-ft. brick factory at 838 West Erie St., to cost $20,000. Huehl, Schmidt & Holmes, 154 West Randolph St., is Arch.

Chicago, Ill.—D. J. Hauptman, 1307 City Hall Sq. Bldg., will build a 75x125-ft. machine shop at 1744 North Kolmar Ave., to cost $14,000. D. S. Clafter, 64 West Randolph St., is Arch.

Chicago, Ill.—The Cudahy Packing Co. will build a two-story plant at 9101-11 Baltimore Ave., to cost $120,000. R. F. Newberry is Arch.

Chicago, Ill.—The Harder Storage & Van Co. will build an eight-story brick warehouse at 3948 Calumet Ave., to cost $25,000. S. H. Dunford is Arch.

Granite City, Ill.—The National Enameling & Stamping Co. plans to spend $200,000 for improvements to its plant. Thomas K. Niedringhaus is Vice-Pres.

Milwaukee, Wis.—The Northwestern R.R. Co. will build a grain elevator on Kinnickinnic Ave., to cost $500,000.

Monticello, Wis.—Edward Witter & Bros. plans the construction of a four-story, 50x100-ft. reinforced-concrete cold-storage warehouse at the Illinois Central R.R. tracks. The estimated cost is $32,500.

Des Moines, Iowa—Bids will soon be received by the Clemens Auto Co. for the construction of a four-story, reinforced-concrete warehouse at Tenth and Mulberry St., to cost about $40,000.

✚Omaha, Neb.—BUSK & WIND has been awarded the contract for the construction of a five-story, 66x132-ft. brick and concrete building at 15th and Jones St. for the Western Newspaper Union, at $90,000. John McDonald, Omaha National Bank Bldg., is Arch.

✚Kansas City, Mo.—GARDNER BROS. has been awarded the contract for the construction of a two-story, 49x90-ft. brick warehouse at 1905-7 Wyandotte St. for A. B. Stevens. The estimated cost is $17,000.

El Paso, Tex.—The Riverside Cement Co. plans the construction of a $300,000 plant.

Houston, Tex.—The Walker-Smith Grocery Co. plans the construction of a two-story, 100x100-ft. reinforced-concrete warehouse at Wood and Willow St., to cost $30,000.

San Antonio, Tex.—The International & Great Northern R.R. Co. has purchased a 108-acre tract on which it will build shops and roundhouses. The estimated cost is $500,000.

Seattle, Wash.—Bids will be reecived about Sept. 1 for the construction of a five-story, 72x242-ft. building to cost $500,000, or an eight-story building of the same dimensions to cost $850,000, for the Times Publishing Co. Bebb and Gould, Denny Bldg., is Arch.

Spokane, Wash.—Bids will soon be received for the construction of a $75,000 machinery warehouse at Monroe and Lincoln St. for the International Harvester Co.

Spokane, Wash.—The McClintock Trunkey Co., Washington and Stevens St., will build a five-story, concrete building on Stevens St., to cost $50,000.

Tacoma, Wash.—The Friddle Motor Car Co. will build a plant, estimated to cost $50,000. James A. Friddle is Pres.

✚Roseburg, Ore.—The contract for the construction of a saw-mill for Kendall Bros., Pittsburg, Penn., has been awarded to the ALLIS-CHALMERS CO., Milwaukee, Wis. The estimated cost is $350,000. Noted May 20.

✚Los Angeles, Calif.—The Hollywood Fireproof Storage Co., incorporated by C. E. Toberman, has awarded the contract for the construction of a two- and three-story, 55x140-ft. reinforced-concrete warehouse on Highland Ave. to the F. O. ENGSTRUM CO. E. P. Parcher is Arch. John F. Blee, 509 Union League Bldg., is Engr. Noted Mar. 11.

✚San Fernando, Calif.—(Official)—The contract for the construction of a lemon packing plant for the San Fernando Lemon Association has been awarded to H. T. KEMP, Pasadena, Calif., at $17,650. Other bids were: F. O. Engstrum Co., $20,540; Hall Martin Co., $26,766; John Simpson Co., $26,300; Alta Planing Mill Co., $20,985; William Loesch, $21,500. H. A. Hamm, 100 North Daisy Ave., La Manda Park, Calif., is Arch. Noted July 1.

FEDERAL GOVERNMENT WORK

Riprap—New London, Conn.—Bids will be received until 2 p.m., Aug. 10, at the U. S. Engineer Office, for furnishing and placing about 2000 long tons of riprap for the repair of breakwaters at Duck Island Harbor and at the mouth of the Housatonic River, Conn.

Post Office—Gouverneur, N. Y.—Bids will be received by James A. Wetmore, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Sept. 19, for the construction of a post office at Gouverneur.

Riprap—New York, N. Y.—The following bids were received by the Lighthouse Inspector, Tompkinsville, for furnishing about 2700 tons riprap at the Coney Island Light Station. Bouker Contracting Co., $2.75 ton; W. J. Scanlon Co., $1.80; O'Brien Bros., Inc., $2.50; W. H. C. Russell, $1.43; R. M. Brown, $1.97; A. M. Hazell, $1.65; A. R. Morrison, $1.80; C. R. Simpson, $1.60. Noted July 8.

Scow and Dredge—New York, N. Y.—All bids received for constructing the scow and dredge "General Gillespie," have been rejected. Noted May 6 and June 17.

✚Dredging—New York, N. Y.—(Borough of Queens)—The contract for dredging in Newton Creek, has been awarded to P. SANFORD ROSS, INC., at 26⅛c. per cu.yd. Noted June 3 and July 29.

★Stone—Cold Spring, N. J.—Bids will be received until 11 a.m., Aug. 20, at the U. S. Engineer Office, Old Federal Bldg., Wilmington, Del., for repairs to Cold Spring Inlet.

Storehouse—Indianhead, Md.—Bids will be received until 11 a.m., Aug. 28, by William M. Smith, Act. Ch. Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a corrugated steel storehouse at the naval proving ground.

Underground Cable and Motor Apparatus—Washington, D. C.—Bids will be received by the Commissioners, District of Columbia until 2 p.m., Aug. 24, for furnishing underground signal and telephone cable, and until Aug. 9, for furnishing four automobiles. Specifications may be obtained of the Purchasing Officer, 320 District Bldg.

✚Building—Radio, Va.—The contract for constructing a brick office building has been awarded to W. E. MOONEY, Washington, D. C., at $6966. Noted Apr. 22.

Post Office—Charlotte, N. C.—All bids received for the construction, of the U. S. post office and court house at Charlotte, have been rejected. Noted May 27 and July 29.

Bulkhead—Charleston, S. C.—Bids will be received by the Light House Inspector, until noon Aug. 10, for constructing timber bulkhead at site of new Charleston light house depot on the Ashley River.

Buildings and Incinerator—Port Royal, S. C.—Bids will be received by William M. Smith, Act. Ch., Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Aug. 28, for the construction of buildings and incinerator at Paris Island, Port Royal.

✚Jetties—New Orleans, La.—The contract for furnishing and placing on jetty at Southwest Pass, Mississippi River, about 12,000 tons of stone has been awarded to A. F. ALEXANDER, New Orleans, La., at $47,640. Noted July 8.

★Light Station—New Orleans, La.—Bids will be received by the Lighthouse Inspector, until 2 p.m., Sept. 10, for the construction of a light station and five lighted beacons for the Atchafalaya Entrance.

★Fuel Flats and Barges—Cincinnati, Ohio—Bids will be received at the U. S. Engineer Office, 405 Customhouse, until 2 p.m., Aug. 31, for constructing and delivering four steel fuel flat and two steel barges.

Breakwater and Pierhead—Conneaut, Ohio—The lowest bid submitted for the construction of the pierhead and rubble mound breakwater at Conneaut Harbor, was that of the Coast & Lakes Contracting Co., 1836 Euclid Ave., Cleveland, Ohio. Noted July 8.

✚Dredging—Grand Marais, Mich.—The contract for dredging at Grand Marais has been awarded to the DULUTH-SUPERIOR DREDGING CO., Duluth, Minn., at $5940. Noted July 29.

Excavation—Newell, S. D.—Bids will be received by the U. S. Reclamation Service, Washington, D. C., until 4 p.m., Aug 27, for the construction of the North Canal extension and laterals, Belle Fourche project, in the vicinity of Newell. The work involves the excavation of about 65,900 cu.yd. of material in open cut.

Bridge—Great Falls, Mont.—Bids will be received by the U. S. Reclamation Service, Washington, D. C., until 2 p.m., Sept. 8, for furnishing and erecting a steel bridge of three 100-ft. spans and a structural steel movable crest with operating machinery for the Vandalia dam of the Milk River project.

✚Irrigation—Great Falls, Mont.—A contract has been awarded the TWO-MIRACLE CONCRETE CORPORATION, at $31,383, for the construction of laterals A and 31-A, on the Flathead Irrigation Project.

Post Office—Fulton, Mo.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Sept. 7, for the construction of the post office at Fulton.

Post Office—Webb City, Mo.—The following bids were received for the construction of the post office at Webb City: (a) limestone; (b) sandstone: R. S. Moore, Lafayette, Ind., (a) $55,920; Frank L. Johnson, Duluth, Minn., (a) $54,696; Kreipke & Schafer Construction Co., El Reno, Okla., $59,000; W. H. Fissell & Co., St. James Bldg., New York, $53,000, (b) $56,000; W. G. Carter Co., Chicago, Ill., (a) $56,535, (b) $61,035; G. W. Miller & Co., Carthage, Mo., (a) $59,900, (b) $69,900; E. A. Steininger Construction Co., St. Louis, Mo., (a) $56,700; Southern Construction Co., Overland, Mo., (a) $59,205, (b) $63,500; George A. Shaul, Seneca, Kan., (a) $50,742; Callahan-Mandl Co., Chicago, Ill., (a) $53,885, (b) $56,885; Barnes Bros., Logansport, Ind., (a) $53,700, (b) $59,700; Dieter & Wenzel Construction Co., Wichita, Kan., (a) $55,987; Algernon Blair, Montgomery, Ala., (a) $51,408; Colonial Construction & Supply Co., Inc., Charlottesville, Va., (a) $53,997; (b) $56,997; Thomas W. Cissell, Wooster, Ohio, (a) $58,000, (b) $61,000; Rogers & Kaiser, People's Gas Bldg., Chicago, Ill., (a) $55,448; (b) $58,977; G. W. Stiles Construction Co., Rookery Bldg., Chicago, Ill., (a) $57,875; Mayben & Freuchtel, Gadsden, Ala., (a) $56,763; Hiram Lloyd Building & Construction Co., Odd Fellows' Bldg., St. Louis, Mo., (a) $53,176; (b) $58,176. Noted June 17.

Post Office and Courthouse—Amarillo, Tex.—Bids will be received by James A. Wetmore, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Aug. 31, for the construction of a post office and courthouse at Amarillo.

✚Building—Marlin, Tex.—The contract for the construction of a post office has been awarded to VOLNEY E. TAYLOR, Ennis, Tex., at $44,750. Noted May 13.

Reclamation Service—Provo, Utah—According to press reports the following bids were received for constructing 13 miles of lateral canals of the Strawberry valley reclamation project in Goshen valley: Heuser & Sims, Salt Lake, $73,547; G. H. Gilkerson, Salt Lake, $74,342; Mendenhal, Straw & Bird, Springville, $93,111. Noted July 1.

✚Extension to Jetties—Portland, Ore.—The contract for enlarging and repairing receiving wharves and tramways and extending jettys at mouth of Siuslaw River, has been awarded to the MIAMI QUARRY CO., Portland, at $176,570. Noted July 29.

★Light Station—Navassa Island, West Indies—Specifications for the construction of the light station are on file at the office of "Engineering News" 10th Ave. and 36th St. New York. Noted July 22.

MISCELLANEOUS

★Dredging—Boston, Mass.—(Official)—Bids will be received by Edward L. McSweeney, Chn., Dirs. of the Port of Boston, until noon, Aug. 11, for dredging at Pleasant Park Yacht Club, Winthrop, Orients Heights Yacht Club, East Boston, and Wessagusset Yacht Club, North Weymouth. Bids will also be received at the same time for dredging at Malden Bridge in the Mystic River, Charlestown.

Dredging—Boston, Mass.—The following are the bids received by the Harbor and Land Commission for dredging Wellfleet, Barnstable and Nobscusset harbors. For the work at Barnstable the bids were as follows:

	Dredging and Small Boulders, (cu.yd.)	Large Boulders, (cu.yd.)	Filling in on Shore, (cu.yd.)
John H. Gerrish		$6.00	$0 163
J. S. Packard Dredging Co.	$0.299	7.00	.237
Eastern Dredging Co.	.23	9.50	.29
J. P. O'Riordan	.19	10.00	.....
John R. Burke	.24	10.00	.....
Bay State Dredging Co.	.23	10.00	.....

The Nobscusset (Dennis harbor) bids were:

	Dredging and Small Boulders, (cu.yd.)	Large Boulders, (cu.yd.)
Bay State Dredging Co.	$ 315	$10.00
J. S. Packard Dredging Co.	.2689	8.00
John H. Gerrish	.213	8.00
Eastern Dredging Co.	.1945	10.00
John P. O'Riordan	.255	10.00
John R. Burke	.28	10.00

John H. Gerrish also submitted an alternate bid, stating that if awarded the Barnstable contract he would do the dredging at Nobscusset for $0.183c. per cu.yd. The Wellfleet bids were:

	Dredging and Small Boulders, (cu.yd.)	Large Boulders, (cu.yd.)
Bay State Dredging Co.	$.20	$10.00
J. S. Packard Dredging Co.	.239	.239
John H. Gerrish	.143	6.00
Eastern Dredging Co.	.205	9.50
J. P. O'Riordan	.255	10.00

✚Dredging—Boston, Mass.—(Official)—The contract for dredging 15,000 cu.yd. in the channel of the Aberjona River has been awarded to COLEMAN BROS., Chelsea, Boston, at $13,500. Other bids were Lawler Bros., $33,000; John P. Cavanagh Co., $26,250; Bay State Dredging Co., Ltd., $20,850; Eastern Dredging Co., $13,725; William R. Farrell, $13,650. John R. Rablin is Ch. Engr. Noted July 22.

★✚Subway—New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for the construction of Section No. 3, Route No. 12, of the Eastern Parkway subway has been awarded to RODGERS & HAGGERTY, Harlem River and 152d St., at $2,170,652. Noted July 15 and 29.

★Subway—New York, N. Y.—(Borough of Brooklyn)—(Official)—The following are the bids received by the Public Service Commission for the construction of Section No. 2, Route No. 29 of the Nostrand Ave. Subway: Dock Contractor Co., Union Sq. Park, New York, $1,692,370; D. Donegan Co., $1,849,286; T. A. Gillespie Co., $1,879,998; Newman & Carey, $1,953,097; Rodgers & Hagerty, Inc., $2,010,207; Underpinnig & Foundation Co., $2,110,057; Oscar Daniels Co., $2,112,924; Mason & Hanger Co., Inc., $2,150,242; E. E. Smith Contracting Co., $2,184,360; John J. Creein, $2,811,475. Noted July 15.

Hose Reel Carts—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by J. T. Fetherston, Comr., Dept. of Street Cleaning, until noon, Aug. 9, for furnishing and delivering 100 hose reel carts.

✚Lamp Posts—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for furnishing and delivering c.-i. lamp posts with steel shafts for the Department of Water Supply, Gas and Electricity, has been awarded to the J. L. MOTT CO., 118 Fifth Ave., New York, at $39,568. Noted July 29.

✚Automobile Runabouts—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for furnishing and delivering 20 automobile runabouts to the Fire Department has been awarded to the FORD MOTOR CO., 1723 Broadway, New York, at $8465. Noted July 22 and 29.

★✚Subway—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for the construction of Section No. 3, Routes Nos. 4 and 36, a part of the Broadway subway, has been awarded to the HOLBROOK, CABOT & ROLLINS CORPORATION, 52 Vanderbilt Ave., New York, at $3,730,913. Noted July 15 and 29.

★Subway Station—New York, N. Y.—(Borough of Queens)—(Official)—Bids were received by the Public Service Commission, 154 Nassau St. (Borough of Manhattan), for the construction of the station finish on Route No. 50 of the Queensboro Subway extension, and Section Nos. 1 and 3, Route Nos. 36 and 37, of the Corona Elevated R.R. from Snare & Triest Co., 233 Broadway, New York, $611,563, and Marble Arch Co., 216th St. and Broadway, New York, $750,000. The above figures are the unofficial totals. Noted July 15.

Elimination of Grade Crossing—Passaic, N. J.—The Lackawanna R.R. has entered into agreement with the Acquackanonk Township Committee for the elimination of its grade crossing at River Road, Delawanna, by the construction of a bridge over the tracks and depressing the roadway at William St.

★Grading—Trenton, N. J.—(Official)—Bids will be received by E. J. Edwards, Comptroller, State House, Trenton, until noon, Aug. 17, for about 60,000 cu.yd. of grading and filling in the rear of the Capitol.

Motor Fire Apparatus—Edwardsville, Penn.—The City Council has passed an ordinance appropriating $15,000 for the purchase of motor fire apparatus.

Dredging, Etc.—Philadelphia, Penn.—Bids will be received by John Meigs, Dir., Dept. of Wharves, Docks and Ferries, until Aug. 16 for dredging in Delaware River Channel also for constructing a temporary bulkhead in the Schuylkill River.

★✚Wharf and Warehouse—Augusta, Ga.—The contract for constructing the reinforced-concrete wharf and steel warehouse, has been awarded by the City Council to the GEORGIA CONTRACTING CO., Augusta, at $27,956. Noted June 24 and July 15.

Drainage—New Albany, Miss.—It is reported that bids will be received by the Big Creek Drainage District, New Albany, until Aug. 9 for drainage work, requiring about 276,822 cu.yd. of excavation.

Drainage—Selmer, Tenn.—Press reports state that bids will be received until Aug. 12 by the Cypress Creek Drainage District, No. 9, for the construction of a Canal 4.8 miles long.

Terminal Improvements—Louisville, Ky.—It is planned to improve the water front by the construction of a terminal system. The Board of Trade is interested.

✚Grand Stand—Louisville, Ky.—The contract for the erection of the concrete grandstand on the athletic field of the high school, has been awarded to ORVID NORELL, Louisville at about $15,000.

Ditch—Morganfield, Ky.—The contract for the construction of the O'Nan Public ditch will soon be awarded. The plans call for about 13½ miles of ditch, requiring 622,000 cu.yd. of excavation. Norman R. Arcutt, Morganfield, is Ch. Engr.

Motor Fire Apparatus—Bellaire, Ohio—Bids will be received by the Director of Public Service until Aug. 11 for furnishing two fire trucks, and one tractor for a chemical and hose cart. Noted July 1.

Elimination of Grade Crossings—Cleveland, Ohio—According to press reports work will start about Sept. 15 on the elimination of grade crossings in Cleveland by the New York, Chicago & St. Louis Ry. Noted Mar. 18.

✚Ditch—Defiance, Ohio—The contract for the Lost Creek Ditch Improvement No. 437 has been awarded to GILMORE BROS. and EDWARD BODETT, Toledo, Ohio, at $46,000. There will be 528,422 cu.yd. of dredging required. Noted Mar. 18.

Dredging—Lima, Ohio—According to press reports, plans have been prepared for improving and dredging the Ottawa River.

✚Motor Fire Apparatus—Martins Ferry, Ohio — The contract for furnishing two motor fire engines has been awarded to the AHERNS-FOX CO., Cincinnati, at $10,800. Noted May 13.

Track Elevation Work—Ft. Wayne, Ind.—Bids will be received by H. W. Becker, Clk., Dept. of Pub. Wks., until Aug. 12 for constructing the city's portion of work under Track Elevation Resolution No. 12.

✚Dredging—Indianapolis, Ind.—The contract for dredging the Lagoon in Garfield Park, has been awarded by the Board of Park Commissioners to the S. M. TIMBERLAKE CO., American Central Life Bldg., at cost plus 40%. Noted July 15.

Drainage—Oak Creek, Wis.—Bids will be received by the Town Board until 10 a.m., Aug. 19, for the construction of the Oak Creek tile drain. P. J. Hurtgen, Burlington, Wis., is Engr.

Drainage—Corydon, Iowa—Surveys are being made in the Eighth Ward for the construction of a drainage system. The estimated cost is $200,000. Warren W. Reed, Morgan City, Iowa is Engr.

Drainage—Ft. Madison, Iowa—It is reported that plans are being prepared for the construction of levees and drains at an estimated cost of $348,000; also for the erection of a pump house, at an estimated cost of $47,000. Edmund T. Perkins, Chicago, Ill., Engr.

River Improvement—Villisca, Iowa—The County Commissioners plan to straighten the West Nodway River. Surveys are being made.

Ditch—Mankato, Minn.—It is reported that bids will be received by C. L. Kennedy, County Audr., until Aug. 16 for constructing Ditch No. 37. The estimated cost is $11,856.

✚Mausoleum—Wichita, Kan.—The contract for the construction of a stone and marble mausoleum 60x136 containing 400 crypts for the Highland Cemetery Association has been awarded to the PEOPLE'S MAUSOLEUM CO. Waterloo, Iowa, at $60,000.

Motor Fire Apparatus—Omaha, Neb.—The City Council has approved of spending $66,500 for the purchase of motor fire apparatus and the installation of a fire alarm system.

Pavilion—Excelsior Springs, Mo.—At a recent election the citizens voted in favor of issuing $20,000 in bonds, for the construction of a pavilion.

✚Improvement to Creek—Kansas City, Mo.—The contract for deepening and widening Turkey Creek Channel has been awarded to the GEORGE H. SEIDHOFF CONSTRUCTION CO., on a percentage basis. The estimated cost is $15,000. Curtis Hill, City Hall, is City Engr.

✚Ditches—Poplar Bluff, Mo.—The contract for constructing nine drainage ditches has been awarded by the County Commissioners to the NORTHERN CONSTRUCTION CO., Elkhart, Ind., at 6.6c. and 6.95c. per cu.yd. Noted July 15.

Dock—St. Joseph, Mo.—Plans are being prepared by the Board of Public Works for the construction of a dock. Charles Campbell is City Engr.

Addition to Pier—Camden, Ark.—Bids will be received by the Commissioners of Martin Free Bridge until Aug. 9 for building additions and reinforcing the pivot pier. I. A. Baum is Engr.

Elimination of Grade Crossing—Dallas, Tex.—The City Commission has appointed John F. Wallace, Consult. Engr., Chicago, Ill., to prepare a plan for grade crossing elimination in the streets of Dallas.

Wharves and Docks—Orange, Tex.—A bond issue of $150,000 has been voted for the construction of wharves and docks. Noted June 10.

Drainage—Counne, Utah—At a recent election the citizens voted in favor of a bond issue of $175,000 for the construction of ditches to drain 12,000 acres in Bear River valley.

Bulkhead—Seattle, Wash.—The Seattle Cedar Lumber Mfg. Co. plans to construct a bulkhead on Shilshone Ave., estimated to cost $100,000.

Mausoleum—Covina, Calif.—Lyman Farwell, Arch., Story Bldg., Los Angeles, is preparing plans for a mausoleum to be erected in Oakdale cemetery, Covina, for the Mausolos Mausoleum Co. The structure will be 50x152 ft., and will contain 320 crypts. It will be of reinforced concrete construction with terra cotta facing, marble and terra cotta interior finish, bronze work, etc., and will cost $35,000.

★Piers—Honolulu, Hawaii—(Official)—Bids will be received by Charles R. Forbes, Chn., Board of Harbor Commissioners, until 2 p.m., Sept. 22, for the construction of reinforced-concrete piers Nos. 8, 9 and 10, at the foot of Fort St.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous."

Rumford, Maine—The town of Rumford has voted to construct a municipal building to cost $70,000.

Boston, Mass.—Plans have been prepared by G. Hewie Desmond, Arch., 15 Beacon St., for the constrction of a hotel at Tremont and Mason St. The estimated cost is $1,300,000.

✚Boston, Mass.—The contract for the construction of the St. Matthews Church on Stanton St., has been awarded to McGAHEY & O'CONNOR, 318 Washington St. Charles R. Greco, 8 Beacon St., is Arch.

✚Boston, Mass.—The contract for the construction of the Dawes Memorial Lodging House for men has been awarded to HORTON & HEMENWAY, 683 Atlantic Ave. The estimated cost is $100,000. Brown & Walcott, 19 South La Salle St., Chicago, Ill., is Arch.

✚Boston, Mass.—John A. Keliher, Chn. of State House Com., 505 State House, has awarded the contract for the construction of an addition to the state house to WILLIAM CRANE, at $304,750. Other bids were: McGahey & O'Connor, $307,234; Norcross Bros. Co., $308,500; George B. Long, $313,707; Conners Bros. Co., $321,251; Casper Ranger Construction Co., $329,000; Cunningham Construction, $332,480; Marr Bros. & Stewart, $329,981; Leighton Mitchell, $321,736; G. B. H. Macomber Co., $337,900; P. O'Hearn, $397,318; W. A. & H. A. Root, Inc., $319,440; Whiton & Haynes Co., $329,621. Noted July 8.

✚Cambridge, Mass.—The contract for the construction of a six-story, 75x122-ft. apartment house on Massachusetts Ave. has been awarded to J. B. BYRNE, INC., 162 Sydney St. The estimated cost is $160,000. Henry Mears, 6 Beacon St., Boston, Mass., is Arch.

Medford, Mass.—F. W. Norris will build a three-story, 70x245-ft. brick block on Forest St. Charles R. Greco, 8 Beacon St., Boston, Mass., is Arch.

Milford, Mass.—Bids will soon be received for the construction of a two-story, 82x110-ft. brick school to cost $75,000. Collin & Phillips is Arch.

Pittsfield, Mass.—Mrs. Frederick S. Soolidge has donated to the city $100,000 for the construction of a tuberculosis hospital as a memorial to her husband.

Worcester, Mass.—George H. Clemens, Arch., Walker Bldg., has prepared plans for the construction of a police station on Waldo St. George C. Halcott, Room 35, City Hall, is Supt. of Pub. Bldgs.

Burrillville, R. I.—(Harrisville post office)—The state will build a tuberculosis hospital to cost about $120,000. Gilbert P. Parker, State House, Providence, R. I., is Secy. of Bd. of Control and Supply. Walter F. Fontaine, 285 Main St., Woonsocket, R. I., is Arch.

✚Providence, R. I.—The P. J. TROTTER BUILDING CO., East Providence, R. I., has been awarded the contract for the construction of a brick and granite church for St. Charles congregation on Lester St. The estimated cost is $75,000. W. F. Fontaine, Woonsocket, R. I., is Arch. Noted June 24.

Providence, R. I.—Bids will be received about Sept. 1 for the construction of a two-story brick grammar school on Charles St. The estimated cost is $150,000. William R. Walker & Son, 17 Cusotm House St., is Arch. Noted June 24.

Little Falls, N. Y.—Bids will be received until 8 p.m., Aug. 31, for the construction of a municipal building at Little Falls. The estimated cost is $100,000. M. A. Leahy is City Clk. and William N. Smith, 101 Park Ave., New York, is Arch. Noted May 27 and June 24.

New York, N. Y.—(Borough of Brooklyn)—(Official)—N. Serracino, Arch., 1170 Broadway, New York, is preparing plans for the construction of a hotel and restaurant at Ocean Parkway and Neptune Ave., Brighton Beach, for Felix Miserocchi, 29 West 27th St., New York.

New York, N. Y.—(Borough of Brooklyn)—Lewis F. Pilcher, State Arch., Capitol, Albany, is preparing plans for the construction of an addition to the patients' building at the Long Island State Hospital. The estimated cost will be $400,000.

New York, N. Y.—(Borough of Manhattan)—Herbert Lucas, Arch., 340 Madison Ave., is preparing plans for the construction of an apartment house at Fifth Ave. and 63rd St. on the site of the Progress Club. The estimated cost is $2,500,000.

New York, N. Y.—(Borough of Manhattan)—Work will soon be started on the construction of a 12-story apartment house at 80th St. and West End Ave. for J. C. Mayer and M. G. Mayer. The estimated cost is $250,000. Noted Feb. 11.

Asbury Park, N. J.—The Directors of the Seacoast National Bank plan to construct an auditorium. Estimated cost, $300,000. James M. Ralston is Pres. of the bank and F. H. Dodge, Allenhurst, is Arch.

East Orange, N. J.—Bids will be received until 8:30 p.m., Aug. 9, by Warren A. Clapp, Secy., Bd. of Education, Winans St., for alterations to the Eastern School. Guilbert & Betelle, 665 Broad St., Newark, is Arch.

Kearney, N. J.—The Common Council has arranged for an ordinance authorizing the issuing of $73,000 in bonds. The proceeds will be used for improvements to schools in Kearney.

Newark, N. J.—The Market &. Beaver Realty Co. will rebuild the Newark Theater, 193 Market St. The cost is estimated at $750,000.

Paterson, N. J.—The Board of Estimate of the Board of Education will construct a new school in the Riverside Section instead of an addition to Public School No. 10 as previously mentioned. The estimated cost is $125,000. Noted July 1.

✚Perth Amboy, N. J.—HANS GREISON & SONS, 223 Jefferson St., Perth Amboy, has been awarded the contract for the construction of Public School No. 9. Noted Apr. 15 and 22.

Secaucus, N. J.—An election will be held Aug. 11 to vote on the question of isuing $40,000 in bonds. The proceeds will be used for the construction of an addition to Public School No. 1.

✚Elizabethtown, Penn.—(Official)—The contract for the construction of a three-story hospital for the Philadelphia Free Masons has been awarded to the POMEROY CONSTRUCTION CO., 1609 Ranstead St., Philadelphia, at $44,000. Guy King & Co., 1513 Walnut St., Philadelphia, is Arch. Noted June 3 and July 8.

✚Harrisburg, Penn.—JOHN F. BARNHART, 1727 North Third St., Harrisburg, at $63,778, has been awarded the contract for the construction of a school at Fifth and Mahontongo St. Noted June 24.

Harrisburg, Penn.—Bids will be received until 2 p.m., Aug. 10, by the State Board of Commissioners of Public Grounds and Buildings, Harrisburg, for the completion of a new fireproof main building (the first floor and basement having been

(Continued on page 107)

RAPID TRANSIT SYSTEM—NEW YORK, N. Y.

Section No. 3—Route Nos. 4 and 36

✚Bids were received July 27 by the Public Service Commission for the construction of Section No. 3, Route Nos. 4 and 36, a part of the Broadway Subway from (A) HOLBROOK, CABOT & ROLLINS CORPORATION (awarded contract), (B) Oscar Daniels Co., (E) MacArthur Bros, Co., (F) Underpinning & Foundation Co., (G) Degnon Contracting Co., (H) T. A. Gillespie Co., (I) Rapid Transit Subway Construction Co. The item bids were as follows:

	A	B	C	D	E	F	G	H	I
107,400 cu.yd. earth excavation above mean high water	$3.25	$5.25	$5.45	$3.80	$4.25	$5.50	$5.75	$6.00	$6.00
3570 cu.yd. earth excavation for sewers, pipes, etc	3.25	5.25	5.45	3.80	4.00	5.50	5.75	6.00	6.00
Rock Excavation									
195,400 cu.yd. station 210+60 to 219+75 and 223+00 to 243+80	5.25	5.25	5.45	7.00	6.25	5.50	6.50	7.00	7.50
26,300 cu.yd. station 219+75 to 223+00	5.30	12 00	9.50	10.00	15.00	11.00	15.00	12.00	9.00
9600 cu.yd. rock excavation for sewers, pipes, etc	5.50	6.00	8.00	8.00	6.00	5.50	6.50	7.00	7.50
Underpinning Buildings									
1785 lin.ft. less than seven stories	100.00	15.00	50.00	60.00	40.00	60.00	40.00	60.00	50.00
915 lin.ft. from seven to twelve stories, inclusive	175.00	15 00	60.00	90.00	75.00	80.00	88.00	80.00	75.00
100 lin.ft. over twelve stories	250.00	150.00	100.00	100.00	125.00	100.00	150.00	100.00	150.00
1025 lin.ft. maintaining, protecting, etc., buildings	50.00	15 00	45.00	25.00	30.00	60.00	25.00	40.00	30.00
Maintaining Knickerbocker Hotel (lump sum)	25,000.00	20,000.00	10,000.00	6,000.00	12,000.00	12,000.00	30,000.00	20,000.00	15,000.00
Maintaining Times Building (lump sum)	5,000.00	7,500.00	10,000.00	6,000.00	17,000.00	10,000.00	10,000.00	10,000.00	5,000.00
Maintaining Longacre Building (lump sum)	25,000.00	20,000.00	15,000.00	6,000.00	21,000.00	12,000.00	7,500.00	10,000.00	10,000.00
Maintaining Comfort Station (lump sum)	5,000.00	4,500.00	3,000.00	6,000.00	2,500.00	5,000.00	7,500.00	2,000.00	3,000.00
4000 cu.yd. tunnel excavation for sewers	15.00	12.00	8.00	8.00	10.00	8.00	12.00	10.00	13.00
44,300 cu.yd. concrete masonry	9.00	10.00	8.25	9.50	10.00	9.00	9.00	10.50	11.00
5600 cu.yd. protective concrete	8.00	10.00	8.25	9.50	10.00	9.00	9.00	10.50	11.00
3200 cu.yd. rubble stone masonry	6.50	7.00	7.50	5.00	5.00	9.00	8.00	8.00	8.00
50 cu.yd. dry stone masonry	4.00	5.00	7.50	4.00	4.00	8.00	5.00	3.00	6.00
110 cu.yd. brick masonry	15.00	15.00	25.00	15.00	15.00	25.00	15.00	15.00	16.00
Placing column C-27 (lump sum)	1,000.00	500.00	2,000.00	1,500.00	1,200.00	1,500.00	500.00	1,000.00	560.00
50 cu.yd. hollow terra-cotta masonry	15.00	15.00	25.00	15.00	15.00	40.00	15.00	15.00	15.00
4000 bbl. grout of Portland cement	4.00	3.00	3.50	2.50	2.50	4.00	4.00	3.00	3.50
500 sq.yd. resurfacing concrete	1.50	2.00	2.00	.40	1.20	2.50	2.00	.50	3.00
100 lin.ft. timber piles	2.00	.25	1.00	.50	.40	.50	.25	.50	.75
2 M ft. b.m. timber foundations	80.00	40.00	100.00	40.00	60.00	40.00	50.00	45.00	75.00
50 cu.yd. broken stone or gravel	2.75	3.00	3.00	1.60	2.50	3.00	2.00	1.50	2.50
13,000 sq.yd. waterproofing, 1 ply	.32	.40	.50	.30	.45	.55	.50	.50	.50
100 sq.yd. waterproofing, 2 ply	.50	.65	.70	.60	.60	1.00	.75	.65	.75
27,300 sq.yd. waterproofing, 3 ply	.75	.90	1.00	1.00	.95	1.50	1.00	.90	1.50
100 sq.yd. waterproofing, 4 ply	1.00	1.25	1.20	1.30	1.20	1.85	1.50	1.00	2.00
100 sq.yd. waterproofing, 5 ply	1.50	1.60	1.50	1.60	1.50	2.30	1.75	1.30	2.50
600 sq.yd. waterproofing, 6 ply	1.75	2.00	1.75	1.80	1.80	2.70	2.00	1.60	2.75
100 sq.yd. waterproofing, dry ply	.20	.40	.50	.30	.30	.50	.40	.30	.50
1800 cu.yd. brick in asphalt mastic	25.00	25.00	25.00	27.00	25.00	35.00	20.00	25.00	30.00
100 lin.ft. 12-in. vitrified pipe	.70	.85	1.50	1.00	.90	.85	.80	.80	.80
100 lin.ft. 10-in. vitrified pipe	.65	.75	1.50	.80	.80	.75	.60	.60	.70
3800 lin.ft. 8-in. vitrified pipe	.55	.60	1.25	.60	.50	.60	.50	.40	.60
100 lin.ft. 6-in. vitrified pipe	.50	.50	1.00	.60	.40	.45	.40	.30	.50
100 lin.ft. 4-in. vitrified pipe	.45	.45	1.00	.30	.25	.30	.30	.20	.40
100 lin.ft. 6-in. c.i. pipe	.70	1.25	1.25	1.25	1.20	1.30	1.50	.80	1.10
4000 lin.ft. 4-in. c.i. pipe	.75	.60	1.00	.50	.75	.85	1.00	.60	.80
100 lin.ft. 10-in. c.i. pipe	1.25	2.50	1.60	1.50	2.00	2.20	2.25	1.60	2.00
50 lin.ft. 3-in. c.i. pipe, extra heavy, specials	1.00	1.25	1.50	1.00	.90	.85	1.00	.60	1.00
100 lin.ft. 4-in. c.i. pipe, extra heavy, specials	1.25	1.50	1.60	1.25	1.00	1.15	1.00	.70	1.25
150 lin.ft. 6-in. c.i. pipe, extra heavy, specials	1.50	1.75	1.75	2.00	1.40	1.75	1.50	1.10	1.70
50 lin.ft. 8-in. c.i. pipe, extra heavy, specials	2.00	3.00	2.00	2.25	2.00	2.35	2.00	1.40	2.00
229,200 duct ft. tunnel ducts	.10	.12	.15	.08	.12	.17½	.15	.11	.18
Riveted steel									
2630 ton Station 210+60 to 219+75 and 223+00 to 243+80	80.00	60.00	65.00	60.00	70.00	92.00	60.00	55.00	80.00
470 ton Station 219+75 to 223+00	90.00	70 00	100.00	60.00	125.00	106.00	85.00	75.00	90.00
75 ton cutting removal and disposal, old steel	50.00	100.00	100.00	12.00	45.00	50.00	65.00	50.00	50.00
Steel beams and shapes									
2740 ton Station 210+60 to 219+75 and 223+00 to 243+80	75.00	55.00	57.50	55.00	65.00	85.00	60.00	53.00	70.00
470 ton Station 219+75 to 223+00	85.00	65 00	100.00	55.00	90.00	95.00	80.00	73.00	75.00
1000 hole drilling holes in steel	1.00	1.00	1.50	.50	.25	.50	.75	.50	3.00
120 ton steel rods and bars	90.00	60.00	85.00	60.00	55.00	100.00	55.00	36.00	80.00
30 ton miscellaneous iron castings	75.00	70.00	100.00	50.00	65.00	100.00	50.00	55.00	75.00
2 ton miscellaneous iron furnishings	75.00	100.00	100.00	50.00	70.00	100.00	50.00	60.00	75.00
1000 lb. special wire forms	.10	.10	.15	.20	.10	.40	.15	.12	.10
5200 lin.ft. 1¾-in. oak or ash handrail	.25	.30	.50	.25	.40	.50	.50	.40	.60
10,000 sq.ft. steel gratings	1.50	2.00	1.50	1.40	1.50	1.50	1.25	1.30	1.50
4300 sq.ft. vault lights	2.00	1.75	1.50	1.10	1.40	1.40	1.25	1.20	1.50
6300 sq.yd. street surface restored within curbs	2.00	2.50	2.50	2.00	1.75	3.00	2.00	1.00	2.75
24,000 sq.yd. street surface, asphalt	2.50	2.50	3.50	3.00	2.70	3.00	3.00	1.80	3.00
850 sq.yd. street surface, granite block	2.00	2.00	3.50	2.00	2.50	2.00	3.00	1.00	4.00
100 lin.ft. street surface, New Blue Street curb	1.00	1.00	1.50	2.00	.90	1.50	1.50	1.00	2.00
100 lin.ft. street surface, 8-in. granite curb	1.50	1.50	2.50	2.00	1.20	3.00	1.75	2.00	2.50
7150 lin.ft. w.i. electric conduit, ¾ in	.20	.20	.20	.20	.12	.20	.40	.16	.25
800 lin.ft. w.i. electric conduit, 1½ in	.25	.30	.45	.35	.25	.45	.50	.31	.40
450 lin.ft. w.i. electric conduit, 2 in	.30	.35	.55	.40	.30	.60	.60	.38	.50
6800 lin.ft. w.i. electric conduit, 1 in	.25	.25	.35	.30	.18	.30	.45	.23	.30
980 c.i. outlet boxes	1.00	1.50	1.00	1.00	1.00	2.00	.75	.70	1.00
12 c.i. pull boxes	1.50	2.00	2.00	2.00	2.00	2.00	6.00	.70	5.00
450 lin.ft. extra heavy c.i. pipe and fittings, 6 in	2.00	1.75	2.00	1.75	1.50	2.00	1.50	.90	2.00
150 lin.ft. extra heavy c.i. pipe and fittings, 3 in	1.50	1.25	1.50	1.00	.90	.90	1.00	.40	1.00
375 lin.ft. 12-in. vitrified pipe sewer	3.00	2.75	2.00	3.00	3.00	3.50	4.00	1.10	4.50
1720 lin.ft. 15-in. vitrified pipe sewer	3.00	3.00	3.00	3.50	3.50	4.40	4.50	1.50	5.00
100 lin.ft. 18-in. vitrified pipe sewer	3.00	3.50	3.50	4.00	4.00	5.25	5.00	2.00	6.00
100 lin.ft. 24-in. vitrified pipe sewer	4.70	5.50	5.00	4.50	4.80	7.00	5.50	3.00	7.00
12 ton c.i. sewer pipe, straight	40.00	50.00	60.00	70.00	45.00	58.00	60.00	45.00	50.00
4 ton c.i. sewer pipe, special	80.00	80.00	100.00	80.00	75.00	110.00	80.00	65.00	80.00
1800 lin.ft. egg-shaped sewer, brick or concrete, 3 ft., 6 in., x 2 ft., 4 in	4.50	7.00	8.00	6.00	6.00	7.30	9.00	6.00	9.00
1440 lin.ft. egg-shaped sewer, brick or concrete, 4 ft., 0 in. x 2 ft., 8 in	6.00	8.00	10.00	7.00	7.00	8.75	10.00	6.20	10.00
25 lin.ft. egg-shaped sewer, brick or concrete, 5 ft., 0 in., x 3 ft., 4 in	7.50	9.00	20.00	8.00	8.50	13.00	11 00	7.00	15.00
60 lin.ft. circular sewer, brick or concrete or reinforced concrete, 3 ft., 6 in	4.00	8.00	10.00	7.00	7.00	15.00	9.00	6.50	9.00
220 lin.ft. circular sewer, brick or concrete or reinforced concrete, 4 ft., 0 in	5.00	9.00	12.00	8.00	8.00	15.00	10.00	7.00	10.00
1100 lin.ft. circular sewer, brick or concrete or reinforced concrete, 4 ft., 9 in	7.00	10.00	12.00	9.00	9.20	21.00	11.00	8.00	15.00
70 lin.ft. circular sewer, brick concrete or reinforced concrete, 5 ft., 6 in	10.00	11.00	20.00	10.00	10.50	25.00	12.00	10.00	20.00
7120 lin.ft. street surface railroad, underground trolley	20.00	12.00	20.00	17.00	7.00	5.00	12.00	6.00	12.00
Support, etc., M. B. R. T. R.R. (lump sum)	103,000.00	200,000.00	25,000.00	201,000.00	125,000.00	50,000.00	75,000.00	214,000.00	50,000.00
830 lin.ft. 6-in. water pipe	.75	.50	1.50	1.00	.80	.45	1.50	1.10	1.25
100 lin.ft. 10-in. water pipe	2.00	.75	2.00	1.25	1.40	.75	1.75	1.60	1.50
650 lin.ft. 12-in. water pipe	2.25	1.00	2.50	3 00	1.60	.90	2.00	2.00	2.00
100 lin.ft. 16-in. water pipe	3.00	1.50	5.00	3.50	2.00	1.20	2.50	2.25	3.00
1000 lin.ft. 20-in. water pipe	4.35	2.00	6.00	4.00	2.50	1.45	3.00	2.50	4.00
200 lin.ft. 48-in. water pipe	16.00	5.00	15 00	5.00	6.00	3.50	8.00	8.00	12.00
50 service connections, water	25.00	25.00	20.00	20.00	12.00	25.00	25.00	20.00	20.00
100 lin.ft. 3-in. gas pipe	.50	.25	.50	80	.60	.30	1.00	.80	.75
870 lin.ft. 4-in. gas pipe	.65	.35	1.00	1.00	.75	.35	1.00	1.00	1.00

RAPID TRANSIT SYSTEM, NEW YORK—(Continued)

	A	B	C	D	E	F	G	H	I
2400 lin.ft. 6-in. gas pipe	1.15	.60	1.50	1.50	1.00	.45	1.25	1.50	1.25
800 lin.ft. 8-in. gas pipe	1.25	.75	1.60	1.75	1.30	.60	1.50	1.75	1.50
390 lin.ft. 10-in. gas pipe	2.00	1.00	1.80	2.00	1.50	.75	1.75	2.00	1.75
500 lin.ft. 12-in. gas pipe	2.75	1.00	2.50	2.50	1.80	.90	2.00	2.50	2.00
100 lin.ft. 16-in. gas pipe	3.50	1.50	5.00	3.00	2.40	1.15	2.20	3.50	2.25
350 lin.ft. 20-in. gas pipe	4.35	2.00	5.00	4.00	3.00	1.45	2.50	5.00	3.00
100 lin.ft. 30-in. gas pipe	9.00	3.50	7.00	6.00	4.30	2.20	3.00	6.00	5.00
6650 lin.ft. 8-in. w.i. by-pass pipe	3.50	3.50	6.00	3.00	3.00	5.00	4.00	2.50	5.00
100 lin.ft. 16-in. w.i. by-pass pipe	9.00	5.00	10.00	8.00	3.50	7.00	5.00	5.00	8.00
100 lin.ft. 20-in. w.i. by-pass pipe	10.00	6.00	12.00	10.00	4.50	10.00	6.00	7.50	12.00
150 lin.ft. 24-in. w.i. by-pass pipe	12.00	7.00	15.00	13.00	6.00	15.00	7.00	9.00	15.00
200 lin.ft. 16-in. w.i. by-pass pipe above street surface	9.00	5.00	10.00	9.00	5.00	7.00	5.00	5.00	12.00
300 lin.ft. 20-in. w.i. by-pass pipe above street surface	10.00	6.00	15.00	11.00	6.00	10.00	6.00	7.00	16.00
250 lin.ft. 8-in. w.i. by-pass pipe above street surface	4.00	3.00	7.00	3.00	3.00	5.00	4.00	2.75	8.00
250 lin.ft. trestle for by-pass pipe	2.00	5.00	8.00	4.00	3.00	4.00	2.00	5.00	5.00
500 lin.ft. cable suspension, 16-in. pipes and over	7.50	5.00	8.00	2.00	6.00	4.00	2.00	4.00	5.00
200 lin.ft. cable suspension for 16-in. pipes and less	7.50	5.00	8.00	2.00	5.00	4.00	2.00	3.00	3.00
100 lin.ft. 4-in. w.i. gas pipe	2.00	.75	1.00	1.00	1.00	1.00	1.00	1.00	1.25
100 lin.ft. 6-in. w.i. gas pipe	3.00	1.25	1.50	1.50	1.20	1.50	1.50	1.50	1.50
100 lin.ft. 8-in. w.i. gas pipe	4.00	2.50	1.60	2.00	1.50	2.00	2.00	2.00	2.00
370 lin.ft. 10-in. w.i. gas pipe	5.00	3.00	1.80	2.50	1.70	2.50	2.25	3.00	2.25
100 lin.ft. 12-in. w.i. gas pipe	6.00	4.00	2.50	3.00	2.50	3.00	2.50	3.50	2.50
50 service connections, gas	15.00	25.00	25.00	15.00	12.00	25.00	25.00	25.00	20.00
105 ton new c.i. hub and spigot straight pipe	30.00	30.00	50.00	60.00	35.00	58.00	40.00	35.00	45.00
100 lin.ft. new standard weight w.i. gas pipe, 4 in	.75	.75	.50	.80	.75	1.00	1.00	1.50	1.25
100 lin.ft. new standard weight w.i. gas pipe, 6 in	1.00	1.25	.70	1.00	1.00	1.50	1.50	2.00	1.50
100 lin.ft. new standard weight w.i. gas pipe, 8-in	1.25	2.50	1.00	1.25	1.25	2.00	2.00	2.50	2.00
100 lin.ft. new standard weight w.i. gas pipe, 10 in	1.50	3.00	1.50	2.25	1.70	2.50	2.25	3.00	2.50
100 lin.ft. new standard weight w.i. gas pipe, 12 in	2.00	4.00	2.00	2.75	1.90	3.00	2.50	3.50	3.00
45 ton new c.i. hub and spigot special pipe	60.00	65.00	100.00	75.00	70.00	110.00	60.00	60.00	80.00
100 lb. new m.i. fittings for gas pipe	.10	.20	.25	.50	.08	.20	.15	.10	.20
200 lin.ft. 8-in. high pressure water pipe	1.95	1.00	2.00	2.50	1.60	6.00	2.00	2.50	3.00
660 lin.ft. 12-in. high pressure water pipe	3.50	1.50	3.00	3.00	2.50	9.00	3.00	3.00	4.50
100 lin.ft. 16-in. high pressure water pipe	6.35	2.00	4.00	3.50	3.50	12.00	4.00	3.70	6.00
740 lin.ft. 24-in. high pressure water pipe	10.00	3.00	5.00	4.50	5.50	18.00	5.00	4.50	8.00
25 ton new c.i. hub and spigot straight high pressure water pipe	30.00	40.00	50.00	50.00	35.00	58.00	40.00	40.00	50.00
20 ton new c.i. hub and spigot special high pressure water pipe	75.00	60.00	100.00	70.00	70.00	110.00	60.00	40.00	80.00
100 lin.ft. 6-in. air pipe in place	.30	1.00	2.00	1.50	1.25	2.50	1.00	1.00	3.00
50 lin.ft. 6-in. air pipe, new	1.00	1.50	2.00	1.00	1.25	3.00	1.00	1.00	5.00
100 lin.ft. 8-in. mail tube, in place	5.00	1.50	3.00	4.00	1.60	3.00	3.00	20.00	5.00
20 lin.ft. 8-in. mail tube, new, straight	10.00	2.50	8.00	6.00	1.60	4.00	3.00	20.00	10.00
30 lin.ft. 8-in. mail tube, new, special	25.00	5.00	10.00	12.00	2.50	25.00	5.00	20.00	20.00
23,000 duct. ft. electric ducts and conduits	.75	.75	1.00	.10	.50	.15	1.00	.30	.75
6000 lin.ft. w.i. pipe electric ducts and conduit, 2½ in	.60	.75	.50	.10	.40	.15	1.00	.30	.55
46,000 lin.ft. w.i. pipe electric ducts and conduit, 3 in	.70	.75	.60	.10	.45	.15	1.00	.30	.60
400 lin.ft. w.i. pipe electric ducts and conduit, 3½ in	.75	.75	.90	.10	50	.15	1.00	.30	.65
100 lin.ft. w.i. pipe electric ducts and conduit, 4 in	.80	.75	1.25	.10	.55	.15	1.00	.30	.70
100 lin.ft. w.i. pipe electric ducts and conduit, 4½ in	.90	.75	1.75	.10	.60	.15	1.00	.30	.80
100 lin.ft. w.i. pipe electric ducts, 2 in. Edison	1.00	.75	.50	.10	.45	.15	1.00	.90	.50
200 lin.ft. w.i. pipe electric ducts, 2½ in. Edison	1.25	.75	.50	.10	.50	.15	1.00	1.00	.60
300 lin.ft. w.i. pipe electric ducts, 3 in. Edison	1.50	.75	.60	.10	.60	.15	1.00	1.10	.75
100 lin.ft. w.i. pipe electric ducts, 1¼ in. Edison	.90	.75	.50	.10	.35	.15	1.00	.80	.30
200 lin.ft. w.i. pipe electric ducts, 2 in	.50	.75	.50	.10	.35	.15	1.00	.40	.50
90 lin. ft. service connections, electric	25.00	25.00	20.00	10.00	15.00	25.00	25.00	10.00	25.00
Extended totals	$3,740,913	$3,755,118	$3,814,808	$3,953,416	$3,958,975	$3,987,371	$4,166,934	$4,231,474	$4,444,118

STATE HIGHWAYS-CALIFORNIA

Bids were received July 19 by the State Highway Commission, Sacramento, Calif., for constructing highways in Los Angeles, Santa Clara and Alameda Counties, from (A) Homer R. Kennedy and Frank Williams, Los Angeles; (B) Peter L. Ferry, Tropico; (C) Andrew Holloway, Pasadena; (D) White & Gaskill, Long Beach; (E) Leigh G. Garnsey, Los Angeles; (F) Tryon & Brain, Los Angeles; (G) C. T. Solato and H. A. Taylor, Los Angeles; (H) Rogers Bros. Co., Los Angeles; (I) M. R. Co., Los Angeles; (J) Fred Hoffman, Long Beach; (K) Palmer & McBryde, San Francisco; (L) Bates Borland & Ayer, Oakland; (M) Highway Paving & Construction Co., San Francisco; (N) C. H. & A. W. Gorrill, San Francisco; (O) John W. McDonald, Jr., San Jose; (P) Marin Rock Co., San Anselmo; (Q) Commary Peterson Co., San Francisco; (R) Ransome & Crummy Co., Oakland; (S) Peterson & Brier, San Francisco; (T) Tieslau Bros., San Francisco; (U) Raisch Improvement Co., San Francisco; (V) Blanchard-Brown Co., San Francisco; (W) M. Blumenkranz, Davis; (W-1) Spring Construction Co., Berkeley; (X) H. G. Vaughn Construction Co., San Francisco; (X-1) Parrott Bros., Co., Salt Lake City, Utah; (Y) P. H. Hoare, Oakland; (Y-1) W. B. Hunt & Sons, Alameda; (Z) W. J. Schmidt, Berkeley; (Z-1) Engineer's Estimate. The item bids were as follows:

Los Angeles County	A	B	C	D	E	F	G	H	I	J	(Z-1)
21,570 cu.yd. excavation, unclassified	$1.00	$0.60	$0.51	$1 00	$0.70	$0.70	$0.55	$0.72	$0.815	$0.75	$0.40
26 lin.ft. 12-in. corrugated iron pipe	.50	1.00	.40	.75	.40	.50	1.00	1.00	.50	.40	.40
516 lin.ft. 18-in. corrugated iron pipe	.70	1.50	.50	1.00	.60	.70	1.50	1.00	.65	.75	.55
402 lin.ft. 24-in. corrugated iron pipe	.80	2.00	.75	1.00	.75	.85	2.00	1.00	.80	1.00	.70
485 cu.yd. concrete, Class B, for culverts and monuments	17.00	11.00	8.00	15.00	16.47	10.00	14.00	10.00	15.00	15.00	12.00
4800 cu.yd. concrete, Class B, for pavement	5.00	4.50	3.67	5.00	4.28	4.45	5 52	5.80	4.75	5.20	3.55
3612 lin.ft. guard rail	.75	1.00	.40	.75	.50	.45	.45	.40	.40	.50	.40
72 monuments	1.50	1.00	1.00	2 00	1.00	1.50	1.00	2 00	1.00	1.00	.50
Extended totals	$57,328	$45,165	$34,583	$56,635	$46,130	$43,758	$48,451	$50,753	$49,841	$51,090	$38,576

Santa Clara County	K	L	M	N	O	P	Q	R	S	T	U	V	(Z-1)
14,500 cu.yd. excavation, unclassified	$0.80	$0.92	$0.625	$0.70	$3.30	$0.57	$0.60	$0.75	$0.72	$0.90	$0.84	$0.90	$0.75
72 lin.ft. 12-in. corrugated iron pipe	.50	.60	.50	.60	.50	.50	.50	.60	.50	.50	.65	.50	.50
230 lin.ft. 18-in. corrugated iron pipe	.70	.75	.50	.70	.60	.70	.65	.80	.70	.75	.84	.72	.70
38 lin.ft. 24-in. corrugated iron pipe	.90	1.25	.60	.80	.75	.85	.75	1.00	1.00	1.00	1.00	.97	.80
100 cu.yd. concrete, Class B, for culverts and monuments	12.00	10.00	9.00	10.00	10.00	9.50	10.00	10.00	12.00	11.00	8.00	11.25	8.00
12,380 cu.yd. concrete, Class B, for pavement	3.65	2.85	2.84	3.00	3.30	2.77	2.94	2.90	3.30	3.60	2.60	3.24	2.75
800 lin.ft. guard rail	.40	.50	.40	.20	.40	.35	.40	.50	.35	40	.35	.27	.30
79 monuments	1.00	.50	1.00	.50	1.00	1.50	1.00	2.00	2.00	1.50	2.00	1.80	.50
Extended totals	$58,617	$50,326	$45,695	$48,724	$90,305	$44,135	$46,710	$48,600	$51,929	$59,403	$45,884	$54,882	$53,161

Alameda County	K	L	N	P	Q	S	T	V	W	(W-1)	X	(X-1)	Y	(Y-1)	Z	(Z-1)
13,800 cu.yd. excavation	$0.75	$0.90	$0.60	$0.50	$0.65	$0.70	$0.75	$0.70	$0.55	$0.60	$0.515	$0.60	$0.65	$0.60	$0.70	$0.60
2800 cu.yd. burrow excavation	.60	.45	.65	1.45	.90	.55	1.00	.35	.75	.65	.515	.80	.70	.60	.70	.50
300 lin.ft. 12-in. corrugated iron pipe	.50	.50	.60	.50	.60	.50	.50	.52	.50	.50	.75	.40	.30	.40	.50	50
140 lin.ft. 15-in. corrugated iron pipe	.60	.60	.70	.60	.70	.60	.60	.63	.55	.63	1.00	.60	.40	.50	.50	.60
290 lin.ft. 18-in. corrugated iron pipe	.70	1.00	.75	.70	.80	.70	.75	.73	.65	.72	1.25	.75	.50	.55	.50	.70
110 lin.ft. 21-in. corrugated iron pipe	.80	1.00	.85	.75	.90	.80	.90	.87	.75	.80	1.50	.90	.60	.65	.50	.75
36 lin.ft. 24-in. corrugated iron pipe	.90	1.50	.90	.85	1.00	1.00	1.00	1.00	.80	1.10	2.00	1.00	.70	.75	.75	.80
100 lin.ft. 30-in. corrugated iron pipe	1.00	1.50	1.25	1.00	1.00	1.10	1.25	1.35	.90	1.50	2.50	1.25	1.00	.85	.75	1.10
215 cu.yd. concrete, Class B, for culverts and monuments	15.00	10.00	9.50	9.50	12.50	12.00	11.00	11.80	10.50	10.00	9.75	10.00	12 00	10.00	9.50	8.00
7100 cu.yd. concrete, Class B, for pavement	3.35	3.40	3.68	3.15	3.30	3 40	3.70	3.73	3.55	2.79	2.59	3 00	3.55	3.15	3.35	3.25
10,500 cu.yd. guard rail	.30	.35	.30	.35	.40	.30	.38	.27	.55	.29	.40	.30	.40	.40	.30	.30
37 monuments	1.00	1.00	1.50	1.50	1.00	2.00	1.50	1.80	1.00	1.50	1.00	1 50	2 00	.60	.50	.50
Extended totals	$42,884	$44,520	$42,222	$39,748	$42,589	$41,815	$46,542	$43,284	$43,581	$35,884	$34,485	$37,857	$43,471	$39,230	$41,138	$44,047

RAPID TRANSIT SYSTEM—NEW YORK, N. Y.
Section No. 3—Route No. 12

Bids were received July 27 by the Public Service Commission for the construction of Section No. 3, Route No. 12 of the Eastern Parkway Subway from (A) Rodgers & Haggerty, Inc., (B) Charles Cooper, (C) T. A. Gillespie Co., (D) Dock Contractor Co., (E) A. L. Guidone & Son, Inc., (F) Battery Engineering & Construction Co. and Frazer & Burchenall, Inc., (G) Mason & Hanger Co., (H) Connex Engineering & Construction Co., (I) Joseph E. Gaffney, (J) W. H. Gahagan, Inc., (K) Degnon Construction Co., (L) John J. Creem. The item bids were as follows:

	A	B	C	D	E	F
471,800 cu.yd. earth excavation above mean high water	$1.40	$1.63	$1.50	$1.73	$1.79	$1.55
9100 cu.yd. earth excavation above and below mean high water sewers	1.75	1 63	1.50	2.00	1.50	1.55
146 maintaining, protecting and preserving trees (per tree)	25.00	10.00	10.00	70.00	10.00	70.00
21 replacing trees, (per tree)	100.00	10.00	50.00	100.00	10.00	70.00
77,500 cu.yd. concrete masonry	7.00	6.50	7.00	6.50	7.00	6.50
3450 cu.yd. concrete masonry for reinforced concrete El. R.	8.00	6.50	12.00	12.50	8.00	10.00
2530 sq.yd. tooling concrete surface of R. concrete on El. R.	.60	.90	.50	1.00	.63	.25
4600 cu.yd. protective concrete masonry outside of water proofing	7.00	6.50	7.00	6.50	7.00	6.50
20 cu.yd. rubble stone	3.00	6.50	8.00	7.00	4.50	4.50
20 cu.yd. dry rubble	3.00	6.50	3.50	7.00	3.50	3.50
35 cu.yd. brick masonry	15.00	12.00	12.00	15.00	12.00	20.00
3 cu.yd. vitrified brick masonry	30.00	20.00	25.00	35.00	15.00	25.00
50 cu.yd. hollow terra cotta brick or tile masonry	15.00	15.00	12.00	20.00	12.00	15.00
1000 grout of Portland cement	1.00	2.50	2.70	1.00	2.50	2.50
1000 lin.ft. timber piles	.01	.01	.40	.20	.40	.20
2 M ft. b.m. timber foundations	20.00	.01	45 00	40.00	50.00	25.00
20 cu.yd. broken stone or gravel	2.00	2.00	2.20	1.00	2.00	2.00
7000 sq.yd. waterproofing, 1 ply	.35	.50	.50	.40	.25	.35
100 sq.yd. waterproofing, 2 ply	.60	.75	.50	.70	.38	.60
33,000 sq.yd. waterproofing, 3 ply	.75	1.00	.90	1.00	.50	.90
100 sq.yd. waterproofing, 4 ply	1.25	1.20	1.00	1.25	.75	1.10
100 sq.yd. waterproofing, 5 ply	1.50	1.40	1.20	1.75	1.00	1.25
200 sq.yd. waterproofing, 6 ply	2.00	1.60	1.50	2.00	1.25	1.50
100 sq.yd. waterproofing, dry ply	.35	.45	.30	.20	.25	.30
840 cu.yd. brick laid in asphalt mastic	20.00	20.00	18.00	23.00	18.00	21.00
50 lin.ft. 12-in. vitrified drain pipe	.75	.70	.80	1.50	.60	.75
50 lin.ft. 10-in. vitrified drain pipe	.65	.60	.60	1.30	.50	.60
50 lin.ft. 8-in. vitrified drain pipe	.50	.50	.40	1.20	.40	.45
50 lin.ft. 6-in. vitrified drain pipe	.45	.40	.30	1.10	.30	.35
380 lin.ft. 4-in. vitrified drain pipe	.40	.30	.20	1.50	.25	.25
50 lin.ft. 6-in. c.i. drain pipe	1.00	1.00	.80	1.50	.75	1.25
50 lin.ft. 4-in. c.i. drain pipe	.50	.60	.60	1.00	.60	1.00
50 lin.ft. 10-in. c.i. drain pipe	1.75	1.50	1.60	2 00	1 50	2.25
50 lin.ft. 3-in. c.i. pipes and fittings (extra heavy)	1.00	1.00	.60	.85	.75	.80
1950 lin.ft. 4-in. c.i. pipes and fittings (extra heavy)	1.25	1.25	.72	1.25	.80	1.00
150 lin.ft. 6-in. c.i. pipes and fittings (extra heavy)	1.50	1.50	1.10	1.35	1.00	1.50
150 lin.ft. 8-in. c.i. pipes and fittings (extra heavy)	2.50	2.00	1.40	2.00	1.25	2.00
354,600 duct ft. tunnel ducts	.10	.09	.11	.11½	.10	.08
92,200 duct ft. railroad ducts	.14	.12	.30	.15	.11	.12
5550 ton riveted steel	55.00	48.00	54.00	55.90	52.95	60.00
6100 ton steel beams and shapes	55.00	48.00	51.00	49.15	46.70	55.00
950 ton steel rods and bars	55.00	48.00	40.00	44.00	70.00	60.00
40 ton miscellaneous iron castings	60.00	70.00	56.00	30.00	60.00	70.00
1 ton miscellaneous iron furnishings	100.00	70.00	61.00	100.00	75.00	70.05
200 special wire forms	.10	.12	.12	.20	.08	.10
14,200 lin.ft. 1¾-in. seasoned oak or ash hand rail	.30	.30	.40	.22	.25	.35
310 lin.ft. 1½-in. galvanized iron pipe railings	.30	.70	.40	.50	.35	1.00
8300 sq.ft. steel gratings for ventilation, including frames	1.50	1.30	1.30	1.40	1.35	1.50
890 sq.ft. vault lights	1.00	1.30	1.30	1.30	1.25	1.30
40 sq.yd. sidewalk restored, including curbs	1.50	1.00	1.00	1.00	1.00	1.50
50 sq.yd. roadway restored (macadam)	1.00	1.00	.60	1.00	.50	1.00
1955 sq.yd. roadway restored (asphalt)	2.50	2.50	2.00	1.50	2.25	2.25
6660 sq.yd. roadway restored (granite block)	.75	2.00	.25	.50	1.25	2.50
180 sq.yd. roadway restored (Belgian block)	.75	.80	.25	1.00	.25	.70
540 sq.yd. roadway restored (asphalt block)	2.50	2.50	3.00	2.00	2.50	3.00
100 lin.ft. new Bluestone curb	1.00	1.00	1.00	1.00	.90	1.50
100 lin.ft. new 8-in granite	1.50	1.50	2.00	1.00	1.25	1.50
50 sq.yd. roadway restored (brick pavement)	3.00	2.00	2.00	1.80	1.80	2.00
25,000 sq.yd. roadway restored macadam and asphalt bound	1.50	1.50	.75	.50	.85	1.40
1690 sq.yd. park surface restored	.50	1.20	.50	1.00	1.00	1.00
4600 lin.ft. ¾-in. w.i. electric conduits	.15	.20	.16	.18	.10	.20
625 lin.ft. 1½-in. w.i. electric conduits	.25	.40	.31	.32	.20	.30
675 lin.ft. 2-in. w.i. electric conduits	.30	.60	.38	.40	.30	.40
6075 lin.ft. 1-in. w.i. electric conduits	.20	.30	.23	.24	.20	.25
700 c.i. outlet boxes	1.00	1.50	.70	.50	.75	1.00
12 c.i. pull boxes	1.50	1.50	.70	3.50	1.25	1.50
160 lin.ft. 6-in. c.i. pipes and fittings (extra heavy) in stations	1.50	2.00	.90	3.00	1.25	1.50
125 lin.ft. 3-in. c.i. pipes and fittings (extra heavy) in stations	1.00	1.00	.40	2.75	1.00	1.00
100 lin.ft. 12-in. vitrified sewer pipe	2.40	3.00	1.20	3.70	1.40	2.00
100 lin.ft. 18-in. vitrified sewer pipe	3.25	4.00	2.00	4.00	2.10	3.00
540 lin.ft. 24-in. vitrified sewer pipe	5 00	5.00	3.80	4.80	3.00	4.50
11 ton c.i. straight sewer pipe	40.00	40 00	45.00	50.00	40.00	45.00
5 ton c.i. special sewer pipe	75.00	50 00	65.00	70.00	75.00	90.00
1030 lin.ft. 3ft., 6 in. x 2 ft., 4 in. egg-shaped sewer brick or concrete	6.00	7.00	5 50	5.00	6.25	6.00
780 lin.ft. 4 ft., 6 in. circular sewer	8.00	10 00	6.50	6.00	7.00	10.00
400 lin.ft. electric overhead trolley	2.00	10 00	6.00	.50	1.00	5.00
100 lin.ft. 6-in. water pipe	.05	1.00	1.10	2.00	80	1.10
550 lin.ft. 8-in. water pipe	.05	1.30	1.50	2.00	1.00	1.50
100 lin.ft. 36-in. water pipe	.05	3.50	5.00	7.00	5.00	5.00
10 service connection for water pipes (all sizes)	.05	20.00	20.00	10.00	10.00	20.00
100 lin.ft. 4-in. gas pipe	.05	.60	.75	.90	.75	.60
700 lin.ft. 6-in. gas pipe	.05	.75	1.00	1.00	.85	1.00
150 lin.ft. 8-in. gas pipe	.05	1.00	1.25	1.15	1.00	1.50
2840 lin.ft. 12-in. gas pipe	.05	1.50	1.50	.75	1.25	1.75
100 lin.ft. 30-in. gas pipe	.05	3.00	3.00	4.00	2.00	5.00
450 lin.ft. 6-in. w.i. by passing pipe upon or below street service	.05	3.00	2.00	1.00	1.30	2.50
2435 lin.ft. 12-in. w.i. by passing pipe upon or below street service	.05	5.00	3.15	1.50	2.00	4.00
300 lin.ft. 12-in. w.i. by passing pipe on trestle	.05	5.00	4.00	1 50	1.00	5.00
150 lin.ft. 24-in. w.i. by passing pipe on trestle	.05	12 00	6.00	3.00	2.40	10.00
390 lin.ft. 6-in. w.i. by passing pipe on trestle	.05	3 00	2.75	1 00	.50	3.00
600 lin.ft. trestle to support by passing pipes	.05	4 00	3.00	1.50	.75	4.00
10 service connection for gas pipes (all sizes)	.05	20.00	15.00	10.00	10.00	15.00
10 ton new c.i. hub and spigot pipe (straight)	20.00	50 00	35.00	45.00	40.00	40.00
10 ton new c.i. hub and spigot pipe (special)	40.00	70.00	70.00	70.00	60.00	70.00
3300 duct ft. electric ducts and conduits	.05	.50	.65	.90	.40	.60
1300 lin.ft. 2-in. Edison w.i. electric ducts and conduits	.05	1.00	.50	.60	.40	1.50
200 lin.ft. 2½-in. Edison w.i. electric ducts and conduits	.05	1.00	.65	.80	.45	2.00
100 lin.ft. 3-in. Edison w.i. electric ducts and conduits	.05	1.00	.65	1.00	.50	2.50
10 service connection for electric ducts	.05	20.00	10.00	25.00	15.00	15.00
600 duct ft. wooden electric ducts and conduits	.05	.50	.65	.60	.50	.75
Extended totals	$2,170,652	$2,192,301	$2,204,674	$2,271,167	$2,284,901	$2,287,243

CATALOG NOTICES

Stephens-Adamson Mfg. Co., Aurora, Ill. Section 5, General Catalog No. 19. Gravel washing plants, screens, cars, hoists, etc. Illustrated, 622 pp., 6x9 in.

Picher Lead Co., Chicago, Ill. Catalog. Protective coatings for structural metals. Illustrated, 46 pp., 6x9 in.

Corrugated Bar Co., Buffalo, N. Y. Catalog. Corr-Mesh and Corr-Mesh lath, Corr-Bar-O waterproofing products. Illustrated, 64 pp., 6x9 in.

Westinghouse Electric & Mfg. Co. (Heavy Traction Dept.) East Pittsburgh, Penn. Circular No. 1505. Results of Electrification. Illustrated, 72 pp., 8½x11½ in.

RAPID TRANSIT SYSTEM, NEW YORK, N. Y.—(Continued)

	G	H	I	J	K	L
471,800 cu.yd. earth excavation above mean high water	$1.75	$2.15	$1.75	$1.70	$1.85	$3 10
9100 cu.yd. earth excavation above and below mean high water sewers	1.75	4.00	2.00	1.70	3.00	3 0
146 maintaining, protecting and preserving trees (per tree)	25.00	10.00	20.00	50.00	30 00	50 00
21 replacing trees, (per tree)	60.00	100.00	100.00	100.00	100 00	50 00
77,500 cu.yd. concrete masonry	7.00	7 00	7.25	7.75	7.50	8 00
3450 cu.yd. concrete masonry for reinforced concrete El. R.	8.75	8.00	9.50	12 00	10.00	10 00
2530 sq.yd. tooling concrete surface of R. concrete on El. R	.65	2 00	.70	2 00	2.00	1.00
4600 cu.yd. protective concrete masonry outside of water proofing	7.00	6.50	7 25	7.50	7.50	8.00
20 cu.yd. rubble stone	6.00	5.00	7.50	7.00	6.00	8.00
20 cu.yd. dry rubble	5.00	4.00	6.00	7.00	5.00	6.00
35 cu.yd. brick masonry	15 00	15 00	17.00	20 00	15 00	15.00
3 cu.yd. vitrified brick masonry	17.00	15 00	25 00	30 00	20 00	30.00
50 cu.yd. hollow terra cotta brick or tile masonry	15.00	15 00	15.00	16 00	15.00	15.00
1000 grout of portland cement	2.50	2.00	2.75	1.00	1.50	2.50
1000 lin.ft. timber piles	.50	.20	.40	01	50	.35
2 M ft. b.m. timber foundations	50 00	25.00	50.00	50 00	50.00	50.00
20 cu.yd. broken stone or gravel	2.50	1.75	2 00	2.50	2.00	2.00
7000 sq.yd. waterproofing, 1 ply	.45	.30	.45	.27	.50	.40
100 sq.yd. waterproofing, 2 ply	.60	.47	70	.50	.75	.65
33,000 sq.yd. waterproofing, 3 ply	.95	.75	1 10	.75	1.00	1.00
100 sq.yd. waterproofing, 4 ply	1.20	.90	1.30	1.00	1.25	1.25
100 sq.yd. waterproofing, 5 ply	1.50	1.12	1.70	1.25	1.50	1.50
200 sq.yd. waterproofing, 6 ply	1.80	1.32	2 30	1.50	1.75	2.50
100 sq.yd. waterproofing, dry ply	.30	.30	.40	.15	.40	.30
840 cu.yd. brick laid in asphalt mastic	25.00	19 00	28 00	20 00	20.00	25.00
50 lin.ft. 12-in. vitrified drain pipe	.90	.75	1 00	1 20	.80	.70
50 lin.ft. 10-in. vitrified drain pipe	.80	.65	.85	1 00	.60	.60
50 lin.ft. 8-in. vitrified drain pipe	.50	.55	70	.80	.50	.50
50 lin.ft. 6-in. vitrified drain pipe	.40	.45	.60	70	.40	.40
380 lin.ft. 4-in. vitrified drain pipe	.25	.40	.50	.50	.30	.30
50 lin.ft. 6-in. c.i. drain pipe	1.20	.75	1.50	1.50	1.50	1.00
50 lin.ft. 4-in. c.i. drain pipe	.75	.50	1.00	1 00	1.00	.60
50 lin.ft. 10-in. vitrified c.i. drain pipe	2.00	1.20	2.25	2 00	2.25	1.50
50 lin.ft. 3-in. c.i. pipes and fittings (extra heavy)	.90	.60	.75	1.00	1.00	.75
1950 lin.ft. 4-in. c.i. pipes and fittings (extra heavy)	1.00	.80	1.25	1.00	1.00	1.00
150 lin.ft. 6-in. c.i. pipes and fittings (extra heavy)	1.40	.90	1.50	1.50	1.50	1.25
150 lin.ft. 8-in. c.i. pipes and fittings (extra heavy)	2.00	1.20	1.60	2.00	2.00	2.00
354,600 duct ft. tunnel ducts	.10	.09	.10	.10	.15	.11
92,200 duct ft. railroad ducts	.13	11	.14	.16	.20	.16
5550 ton riveted steel	55.00	51.50	58.00	60 00	58.00	63.00
6100 ton steel beams and shapes	48.00	45 00	52.00	53 00	55.00	57.00
950 ton steel rods and bars	50 00	35.00	60.00	60.00	50.00	50.00
40 ton miscellaneous iron castings	65.00	40 00	80.00	70 00	50.00	50.00
1 ton miscellaneous iron furnishings	70.00	90.00	110.00	100 00	50.00	50.00
200 special wire forms	.10	.06	.11	.25	.15	.10
14,200 lin.ft. 1¾-in. seasoned oak or ash hand rail	.40	.15	.20	.25	.50	.50
310 lin.ft. 1½-in. galvanized iron pipe railings	.40	1.25	1.15	.50	.70	1.50
8300 sq.ft. steel gratings for ventilation, including frames	1.50	1.10	1.50	1.20	1.50	1.50
890 sq.ft. vault lights	1.40	1.00	1.40	1.10	1.25	1.50
40 sq.yd. sidewalk restored, including curbs	1.75	.75	1.00	4.00	2.00	2.00
50 sq.yd. roadway restored (macadam)	1.25	.30	.75	2.00	1.75	1.50
1955 sq.yd. roadway restored (asphalt)	2.65	.75	2 50	2.00	2.50	2.50
6660 sq.yd. roadway restored (granite block)	1.80	.30	2 35	.0Z	3.50	2.50
180 sq.yd. roadway restored (Belgian block)	2 25	.30	1.10	2.50	2.50	.75
540 sq.yd. roadway restored (asphalt block)	3.00	.30	2.50	2 00	2.50	2.55
100 lin.ft. new Bluestone curb	1.00	.60	1 10	1.20	1.50	1.00
100 lin.ft. new 8-in granite	1.25	1.20	1.35	2.20	1.75	2.00
50 sq.yd. roadway restored (brick pavement)	2.25	1.80	2.50	2.50	2 50	3.00
25,000 sq.yd. roadway restored macadam and asphalt bound	1.50	.35	1.25	1 50	1.00	1.50
1690 sq.yd. park surface restored	1.50	.50	.50	1.00	2.00	1.00
4600 lin.ft. ¾-in. w.i. electric conduits	.12	.20	.20	.40	.40	.20
625 lin.ft. 1¼-in. w.i. electric conduits	.25	.31	.30	.30	.50	.30
675 lin.ft. 2-in. w.i. electric conduits	.30	.45	.50	.30	.60	.40
6075 lin.ft. 1-in. w.i. electric conduits	.18	.29	.25	.25	.45	.25
700 c.i. outlet boxes	1.00	1.00	1.25	1.00	.75	1.00
12 c.i. pull boxes	2.00	1.30	5.00	10.00	6.00	5.00
160 lin.ft. 6-in. c.i. pipes and fittings (extra heavy) in stations	1.50	1.00	1.50	1.50	1.50	1.50
125 lin.ft. 3-in. c.i. pipes and fittings (extra heavy) in stations	.90	.70	1.10	1 00	1.00	.75
100 lin.ft. 12-in. vitrified sewer pipe	3.00	3.50	3.00	3.00	3.00	3.25
100 lin.ft. 18-in. vitrified sewer pipe	4.00	4.00	4.00	4.00	4.00	3.75
540 lin.ft. 24-in. vitrified sewer pipe	4.80	5.00	5.50	5 00	4.50	4.50
11 ton c.i. straight sewer pipe	45.00	40.00	60 00	50 00	60.00	40.00
5 ton c.i. special sewer pipe	75.00	80.00	80 00	100.00	80.00	70.00
1030 lin.ft. 3ft., 6 in. x 2 ft., 4 in. egg-shaped sewer brick or concrete	6.20	6.00	10 00	7.00	8.00	5.75
780 lin.ft. 4 ft., 6 in. circular sewer	7.40	9.00	13 00	12.00	10.00	8.65
400 lin.ft. electric overhead trolley	5.00	1.00	10.00	10.00	5.00	5.00
100 lin.ft. 6-in. water pipe	.75	.50	1.00	.80	1.50	1.00
550 lin.ft. 8-in. water pipe	1.00	.60	1.40	1.25	1.75	1.25
100 lin.ft. 36-in. water pipe	4.50	2.00	7.50	10 00	6.00	6.35
10 service connection for water pipes (all sizes)	12.00	20.00	25.00	25 00	25.00	15.00
100 lin.ft. 4-in. gas pipe	.75	.40	.75	.60	1.00	.75
700 lin.ft. 6-in. gas pipe	1.00	.50	1.25	.80	1.25	1.00
150 lin.ft. 8-in. gas pipe	1.20	.60	1.40	.90	1.50	1.25
2840 lin.ft. 12-in. gas pipe	1.75	1.00	2 00	1.70	2.00	1.75
100 lin.ft. 30-in. gas pipe	4.50	2.00	6.75	8 00	3.00	6.00
450 lin.ft. 6-in. w.i. by passing pipe upon or below street service	2.00	2 00	3.00	2.00	3.50	3.00
2435 lin.ft. 12-in. w.i. by passing pipe upon or below street service	3.00	3.20	4 50	3.00	4.00	4.00
300 lin.ft. 12-in. w.i. by passing pipe on trestle	4.00	2.75	6.00	4.00	4.00	4.50
150 lin.ft. 24-in. w.i. by passing pipe on trestle	6.00	3.00	12.00	8.00	7.00	8.00
390 lin.ft. 6-in. w.i. by passing pipe on trestle	2.00	1.75	3.75	3.00	3.50	3.00
600 lin.ft. trestle to support by passing pipes	2.00	2.25	5.00	2 00	1.50	3.50
10 service connection for gas pipes (all sizes)	15.00	20.00	20.00	30.00	25.00	10.00
10 ton new c.i. hub and spigot pipe (straight)	35.00	40.00	60.00	40.00	30.00	35.00
10 ton new c.i. hub and spigot pipe (special)	70.00	70.00	95.00	80.00	60.00	65.00
3300 duct ft. electric ducts and conduits	.50	.40	.50	.75	1.00	.50
1300 lin.ft. 2-in. Edison w.i. electric ducts and conduits	.45	.50	.70	.65	1.00	1.25
300 lin.ft. 2½-in. Edison w.i. electric ducts and conduits	.50	.60	.85	.70	1.00	1.50
100 lin.ft. 3-in. Edison w.i. electric ducts and conduits	.60	.70	1.10	.75	1.00	1.75
10 service connection for electric ducts	15.00	20.00	25.00	25.00	50.00	15.00
600 duct ft. wooden electric ducts and conduits	.50	.30	.45	.50	1.00	.60
Extended totals	$3,237,046	$2,414,460	$2,438,618	$2,441,221	$2,541,136	$3,196,207

(Continued from page 103)

constructed under a former contract) on the State Arsenal Grounds, at 18th and Herr St., Harrisburg. The Board has revised the plans. Samuel B. Rambo, Capitol Bldg., is Supt.

✚Baltimore, Md.—The B. F. BENNETT BUILDING CO., 23 South Howard St., Baltimore, has been awarded the contract for the construction of a two-story addition and alterations to the Union Square M. E. Church, Calhoun and Lombard St. Haskell & Barnes, 301 North Charles St., is Arch.

Meridian, Miss.—At an election held July 23 the citizens voted in favor of the question of issuing $40,000 in bonds. The proceeds will be used for the construction of a city hall and jail.

Hornbeck, La.—At an election held July 21 the citizens voted in favor of issuing $40,000 in bonds. The proceeds will be used for the construction of a school.

✚Louisville, Ky.—The contract for the construction of a four-story, 116x154-ft. mercantile building on Fourth St., for the Speed Realty Co., has been awarded to the ALFRED STRUCK CO., Louisville. Loomis & Hartman, 51 Todd Bldg., is Arch. Noted July 8.

Cleveland, Ohio—Preliminary plans have been prepared by Hubbell & Benes, Arch., 4500 Euclid Ave., for the construction of a 112x290-ft. auditorium and lodge building at 3515 Euclid Ave. for the Al Koran Temple, Nobbles of the Mystic Shrine. The estimated cost is $200,000. Noted Dec. 31.

Newburg, Ohio—(Cleveland post office)—The Board of Administration, Newburg State Hospital, plans the construction of two additions to the hospital. Estimated cost, $50,000.

Springfield, Ohio—The Link Hotel Co. will construct a six-story 99x120-ft. hotel at Main and Limestone St. Estimated cost, $500,000. A. C. Link, J. B. Cartmell, Constantine Link and others are interested.

Tiffin, Ohio—The Pennsylvania R.R., the Baltimore & Ohio R.R., and the Cleveland, Cincinnati, Chicago & St. Louis Ry. plan to construct a Union Station at Tiffin.

Woodsfield, Ohio—Bids will be received until noon, Aug. 26, by F. W. Pollack, Clk., Bd. of Education, for the construction of a fireproof high school. Howard & Merriam, 8 East Broad St., Columbus, is Arch. Noted May 27.

✚Youngstown, Ohio—The contract for the construction of a hospital near the main south entrance to the Youngstown Sheet & Tube Co. has been awarded to HELLER BROS., Youngstown. Estimated cost, $75,000. C. F. Owsley is Arch. The company also plans the construction of a six-story brick office building and a modern laboratory. The estimated cost of both is $500,000.

Brazil, Ind.—The School Board has purchased a site at North Forest Ave. and Kruzan St. upon which to construct a high school. The estimated cost is $80,000.

✚Marion, Ind.—The Board of Directors of the Grant County Hospital Association has awarded the contract for the construction of a three-story modern hospital building to BARLEY & BOWMAN, Marion.

✚Muncie, Ind.—The contract for the construction of an office building for Ball Bros. Mfg. Co. has been awarded to CHARLES MORROW. Estimated cost, $75,000. Noted July 22.

Detroit, Mich.—Bids will be received until 4:15 p.m., Aug. 10, by Charles A. Gadd, Secy., Bd. of Education, 50 Broadway, for the construction of a 20-room school at Montclair and Meadowbrook Ave. Noted Feb. 4.

Chicago, Ill.—Wilkin J. Kohn, Chicago, plans to construct a 36-apartment building at Albany Ave. and Blaine Pl. The estimated cost is $110,000.

Chicago, Ill.—Henry L. Newhouse, Arch., 4630 Prairie Ave., is preparing plans for the construction of a ten-story hotel with a four-story 105x150-ft. wing at Grand Blvd. and 51st St. The estimated cost is $1,400,000. Work will soon begin on the wing.

Chicago, Ill.—A site has been purchased at Grand and Oakwood Blvd. by Thomas A. Collins, 133 West Washington St. for the construction of an apartment house. The estimated cost is $100,000.

✚Appleton, Wis.—The HACKWORTHY CONSTRUCTION CO., 814 College Ave., Appleton, has been awarded the contract for the construction of a two-story bank building for the Citizens National Bank. Cooledge & Hodgson, 134 South La Salle St., Chicago, Ill., is Arch. Estimated cost, $65,000. Noted June 17 and July 29.

Milwaukee, Wis.—Martin Tullgren & Son, Arch., Manhattan Bldg., is preparing plans for the construction of a four-story 90x150-ft. brick and concrete building at 1131 Sycamore St. for St. Catherine's Home for Working Girls. The estimated cost is $85,000. Noted July 22.

✚Superior, Wis.—The general contract for the construction of an orphan asylum for the Catholic Diocese of Superior, at Superior, has been awarded to TOMILSON & EGAN, Ashland, at $101,431. Noted Apr. 15 and July 1.

Forest City, Iowa—(Official)—Bids will be received until 2 p.m., Aug. 25, by H. R. Irish, Pres., of the Independent School District, for the construction of a high and grade school. Alban & Lockhardt, 347 Endicott Bldg., St. Paul, Minn., is Arch. Noted June 10 and July 8.

Crosby, Minn.—An election was held Aug. 2 to vote on the question of issuing $100,000 in bonds. The proceeds will be used for the construction of a school.

✚Duluth, Minn—The contract for the construction of an office building and a laboratory for the Minnesota Steel Co. has been awarded to the LOUNSBERRY-McLEOD CO., Duluth. Estimated cost, $100,000.

Fowler, Kan.—Bids will be received until Aug. 15 for the construction of a one- and two-story, 75x200-ft. brick bank and store building for the State Bank of Fowler. The estimated cost is $40,000.

Laramie, Wyo.—Bids will be received until noon, Aug. 10, by F. S. Burrage, Secy., Bd. of Trustees of the University of Wyoming, for the construction of a dormitory for the women on the campus. William Du Bois, 1614 Capitol Ave., Cheyenne, is Arch.

✚Lewiston, Mont.—STANTON & SMITH, Lewiston, at $45,787, has been awarded the contract for the construction of a church on Brooks Island, at Main St. Link & Haire, 413 Stapleton Blk., Billings, is Arch. Noted Apr. 29.

Warmspring, Mont.—The State of Montana is considering the construction of an asylum at Warmsprings. The estimated cost is $80,000.

Carthage, Mo.—An election will be held Sept. 14 to vote on the question of issuing $100,000 in bonds. The proceeds will be used for the construction of a sanitarium for the treatment of tubercular patients.

Dodson, Mo.—The Hillcrest Country Club plans to construct a clubhouse at 81st and Hickman Mill Rd. W. M. Beebe, 1012 East Armour Blvd., Kansas City, is Pres. Estimated cost, $40,000.

Kansas City, Mo.—Plans have been prepared by Owen & Payson, Arch., 713 Scarritt Bldg., for the construction of a church at 5137 Main St. for the Church of Visitation. The estimated cost is $50,000.

✚Kansas City, Mo.—The contract for the construction of a seven-story reinforced concrete building, to be known as the Ridge Arcade, at 916-18 Walnut St. for the Ridge Estate, New Ridge Bldg., has been awarded to the GEORGE A. FULLER CONSTRUCTION CO., 2218 Grand Ave., Kansas City. Estimated cost, $100,000. Smith, Rea & Lovitt, 601 Finance Bldg., is Arch. Noted July 1.

✚Kansas City, Mo.—The contract for the construction of a six-story, 70x117-ft. reinforced-concrete building at 201 East 22nd St., for the Morbros Investment Co., has been awarded to AIKEN & THAYER. John W. McKecknie, 1023 Gloyd Bldg., is Arch. Noted July 22.

Kansas City, Mo.—Plans have been prepared by Smith, Rea & Lovitt, Arch., 602 Finance Bldg., for the construction of a three-story fireproof building to be known as Hotel Rieger, at 1922 Main St. The estimated cost is $40,000.

✚Kansas City, Mo.—HARVEY STIVERS, 2447 Trost Ave., Kansas City, has been awarded the contract for the construction of a seven-story, 49x105-ft. business building at 1533-35 Walnut St. for W. F. Hall and F. G. Crowell. J. C. Sunderland is Arch. Estimated cost, $75,000. Noted July 22.

Palestine, Tex.—The City Commission has commissioned Sanguinet, Staats & Gottleib, Arch., 624 First National Bank Bldg., Houston, to prepare plans for the construction of a high school. The estimated cost is $100,000. Noted July 22.

San Diego, Tex.—(Official)—The Commissioners of Duval County have cancelled the election which was to have been held July 20 to vote on the question of issuing $100,000 in bonds for the construction of a courthouse. Charles Meirl, is Secy. of the San Diego Commercial Club. Noted July 1.

✚Enid, Okla.—WELLER & REARDON, Enid, at $41,000, has been awarded the contract for the construction of the State School for Feeble Minded. R. W. Shaw is Arch.

Norman, Okla.—The State Board of Affairs has approved and accepted plans prepared by Hawk & Parr, Arch., Security Bldg., Oklahoma, for the construction of the Science Hall at the University of Oklahoma. The Legislature has appropriated $100,000 for this work. Stratton D. Brooks is Pres. of the university.

Perry, Okla.—Bids will soon be received for the construction of a four-story, 76x98-ft. courthouse. The estimated cost is $100,000. W. T. Faris is County Clk. and J. W. Hawk, Oklahoma, is Arch. Noted May 27.

✚Vinita, Okla.—The contract for the construction of a three-story brick and reinforced-concrete building at the State Hospital for the Insane has been awarded to the KREIPKE-SCHAFER CONSTRUCTION CO., El Reno. Estimated cost, $50,000. Charles W. Dawson, 412 Iowa Bldg., Muskogee, is Arch.

Las Cruces, N. M.—Plans are being prepared by Trost & Trost, Box 271, El Paso, Tex., for the construction of a two-story hotel to be known as Hotel Hidalgo. The estimated cost is $65,000.

Salt Lake City, Utah—The Fraternal Order of Eagles, Salt Lake Aerie No. 67, plan to construct a three-story, brick clubhouse at Fourth South and West Temple St. N. Edward Liljenberg, 402 Newhouse Bldg., is Arch. The estimated cost is $50,000.

Miami, Ariz.—Preliminary plans have been prepared by Trost & Trost, Arch., Box 271, El Paso, Tex., for the construction of a three-story brick and reinforced-concrete hotel. The estimated cost is $100,000.

Grand Mound, Wash.—Bids will soon be received by the State Board of Control, Olympia, for the construction of a building at the State School for Girls. The estimated cost is $60,000. Watson Vernon, 1 Gabrielson & Holmer Bldg., Aberdeen, is Arch. Noted July 29.

Medical Lake, Wash.—Julius A. Zittel, Arch., 507 Jamieson Bldg., Spokane, has prepared plans for the construction of a group of buildings for the Institute of the Feeble Minded. The group will include an administration building, custodial building, two ward buildings, power house and laundry. Estimated cost, $292,000.

✚Seattle, Wash.—The contract for the construction of an 11-story 90x110-ft. fireproof office building at Third Ave. and Stewart St. for the Washington Securities Co., has been awarded to M. J. HURSON CO., Globe Bldg., Seattle. Estimated cost, $400,000.

Sedro Woolley, Wash.—Bids are being received by the State Board of Control, Olympia, for the construction of reinforced-concrete ward buildings and an auditorium at the Northern Hospital for the Insane. The estimated cost is $150,000. Heath & Gove, National Realty Bldg., Tacoma, is Arch.

Los Angeles, Calif.—Work will soon begin on the construction of a seven-story, 60x80-ft. addition at Olive and Sixth St. for the Pacific Mutual Life Insurance Co. of California. The estimated cost is $200,000. Col. D. Moore is Secy. Noted June 24.

Santa Barbara, Calif.—Palmer, Hornbostel & Jones, Arch., 63 William St., New York, N. Y., has been commissioned to prepare plans for the construction of a Carnegie Library. The estimated cost is $50,000. Francis W. Wilson, 717½ State St., Santa Barbara, is Superv. Arch.

San Pedro, Calif.—The Cresmer Mfg. Co., Riverside, at $92,000, submitted the lowest bid on the general contract for the construction of a brick and concrete school at 307 Fifth St. Joseph Bell De Remer, 622 Title Insurance Bldg., Los Angeles, is Arch. Noted Mar. 11.

Visalia, Calif.—Bids will be received until Aug. 16 by the Board of Supervisors of Tulare County for the construction of a steel and concrete bridge over the Kings River at Kingsbug, the estimated cost of which is $18,000.

Montreal, Que.—Bids are being received for the construction of a motion picture theater for the Independent Amusement Co., Ltd. The estimated cost is $100,000. D. J. Crighton, Jacobs Bldg., is Arch.

The Snare & Triest Co., of New York City, announced on July 29 its purchase of the business, good will, plans and records of R. P. & J. H. Staats Inc., a firm which has for 27 years been prominent in the construction of piers, docks and harbor work in New York and vicinity. R. P. Staats, the senior member of the firm retires from active business but Mr. J. H. Staat has purchased an interest in the Snare & Triest Co., and will be Vice-President of that organization.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

JULY BUILDING RETURNS

The steady gain recorded in the building industry in the Eastern States continued during July. The total operations in 11 cities were practically the same as in the corresponding month last year. For the first seven months there was a gain of about 4%. From now on the results will be more favorable.

In the Central States there was a decrease of slightly more than 10% in the 18 cities. This was due to the sharp drop in Chicago, where there have been labor troubles. A falling off of $1,000,000 in Houston was the cause of a decrease from $6,028,000 last year to $4,925,000 this year.

In the Western States there was a sharp falling off in the Northwest due to the stagnation in the lumber industry. In the following table is given the estimated cost of contemplated buildings from plans filed with the various building inspectors:

EASTERN STATES

	Month of July		First Seven Months of Year	
	1915	1914	1915	1914
Baltimore, Md	$2,099,989	$1,577,601	.....	.....
Boston, Mass	804,841	298,500	$14,872,145	$12,895,350
Bridgeport, Conn	1,061,290	313,945	5,271,662	2,486,083
Buffalo, N. Y	1,494,000	985,000	7,091,000	7,549,006
Hartford, Conn	441,767	311,985	3,205,694	2,685,356
Hoboken, N. J	48,078	166,100	544,398	728,002
Jersey City, N. J	345,913	460,592	3,146,649	2,417,845
Newark, N. J	584,703	1,172,043	5,225,669	5,244,280
New York, N. Y.				
Bronx	1,874,000	2,123,465	17,771,500	16,076,068
Brooklyn	3,682,765	3,314,700	15,950,010	25,918,850
Manhattan	4,093,080	4,605,305	43,731,800	30,882,090
Queens	2,438,065	2,339,662	12,453,611	13,139,829
Philadelphia, Penn	3,659,940	4,661,850	22,726,330	25,767,570
Rochester, N. Y	762,123	1,067,101	5,519,791	6,095,625
Total	$23,390,554	$23,397,849	$157,510,259	$151,888,954

CENTRAL STATES

	Month of July		First Seven Months of Year	
	1915	1914	1915	1914
Akron, Ohio	$1,133,395	$382,015	$2,650,085	$2,355,085
Chicago, Ill	6,455,630	9,148,760	46,728,680	54,007,960
Cincinnati, Ohio	1,056,625	1,055,230	6,724,289	6,044,000
Cleveland, Ohio	2,319,280	2,532,050	20,546,159	17,221,415
Columbus, Ohio	504,095	503,351	3,053,955	3,724,206
Des Moines, Iowa	181,405	140,690	1,074,520	1,158,364
Duluth, Minn	201,422	266,259	1,571,910	1,946,841
Evansville, Ind	34,080	128,645	858,459	946,814
Indianapolis, Ind	598,078	1,140,000	3,858,824	6,096,405
Kansas City, Kan	77,177	188,005	617,968	779,125
Kansas City, Mo	418,060	1,012,055	6,334,495	8,012,930
Milwaukee, Wis	916,625	887,889	5,673,485	6,398,666
Minneapolis, Minn	1,474,256	1,326,095	9,200,151	11,099,690
Omaha, Neb	556,780	402,605	3,211,210	3,269,298
Peoria, Ill	178,500	193,100	.....	.....
St. Louis, Mo	615,148	1,287,859	7,069,851	9,105,911
St. Paul, Minn	770,018	1,053,100	6,398,570	8,971,788
Toledo, Ohio	534,012	569,579	4,564,216	4,413,217
Total	$19,024,586	$22,217,287	$127,136,827	$145,551,711

SOUTHERN STATES

	Month of July		First Seven Months of Year	
	1915	1914	1915	1914
Atlanta, Ga	$613,146	$495,902	$2,744,837	$3,495,699
Birmingham, Ala	223,987	468,385	.....	.....
Dallas, Tex	656,124	941,580	2,180,639	4,425,143
Houston, Tex	149,343	1,054,911	988,005	2,878,397
Louisville, Ky	548,740	482,390	2,336,835	3,040,245
Memphis, Tenn	245,285	333,006	1,746,778	2,347,888
New Orleans, La	513,510	505,392	1,869,200	1,933,382
Richmond, Va	328,667	461,949	2,063,329	2,561,770
Tampa, Fla	222,590	92,545	.....	.....
Washington, D. C	1,424,207	1,192,883	6,664,366	6,820,702
Total	$4,925,599	$6,028,943	$18,593,989	$27,503,226

WESTERN STATES

	Month of July		First Seven Months of Year	
	1915	1914	1915	1914
Oakland, Calif	$410,322	$430,665	$2,793,070	$2,869,170
Portland, Ore	373,375	870,745	3,013,135	5,051,655
Salt Lake City, Utah	174,550	238,750	1,269,891	1,635,064
San Francisco, Calif	1,500,206	2,068,537	8,066,473	22,746,212
San Diego, Calif	57,790	579,558	714,177	2,366,238
Seattle, Wash	231,095	2,520,590	3,505,205	8,404,445
Spokane, Wash	66,263	229,635	771,134	775,297
Tacoma, Wash	31,161	884,649	494,675	1,572,747
Total	$2,804,762	$7,823,129	$20,627,760	$45,420,828

RAILWAYS—STEAM AND ELECTRIC

Massachusetts—Bay State St. Ry. Co.—According to press reports this company will soon start work on the extension of its lines in Methuen. R. S. Goff, Boston, is Vice-Pres. and Gen. Mgr. Noted May 6.

Connecticut—Connecticut Co.—The Public Utilities Commission of Connecticut has granted this company permission to extend its lines in New Britain from Main to Myrtle St., Grove, Broad, Washington St. and Farmington and Commonwealth Ave., about 7200 ft. F. L. Beardsley, New Britain, is Supt. Noted July 8.

New Jersey—Pennsylvania R.R.—The Board of Public Utility Commissioners has approved a bond issue of $65,000,000 of the Pennsylvania R.R., to be used for the improvement of the company's lines and system in New Jersey. A. C. Shand, Philadelphia, is Ch. Engr.

Maryland—Baltimore & Ohio R.R. Co.—According to press reports this company plans to construct a railroad from Hagerstown to Security, to the plant of the Security Cement & Lime Co. The estimated cost is $100,000. F. L. Stuart, Baltimore, is Ch. Engr.

Maryland—United Ry. & Electric Co.—This company will extend its double track line on Columbus Ave., Gwynn's Falls, (Baltimore), the present terminus, to Lansdowne, Md., a distance of 2100 ft. Mason D. Pratt, Baltimore, is Ch. Engr.

✚**West Virginia**—Western Maryland R.R.—This company has awarded the contract for the construction of the Helen's Run extension to O. L. ANDERSON & BROS., INC., Altoona, Penn., at $400,000. H. R. Pratt, Baltimore, is Ch. Engr.

North Carolina—Virginia-Carolina Ry.—Plans are being considered by this company for the extension of its line from Todd to Boone, N. C., about 16 miles. G. D. Johnson, Abington, Va., is Pres. and Gen. Mgr.

North Carolina—Southern Ry.—Seaboard Air Line Ry.—Press reports state that these companies plan to extend their lines to Rutherfordton, N. C. W. D. Faucette, Norfolk, Va., is Ch. Engr., Seaboard Air Line Ry., and B. Herman, Washington, D. C., is Ch. Engr., Southern Ry.

North Carolina—Statesville Air Line R.R.—Bonds for $1,250,000 will be sold. The proceeds will be used to complete the line from Statesville to Mt. Airy. D. M. Ausley is Treas. and Gen. Mgr.

South Carolina—Columbia, Newberry & Laurens R.R.—This company plans to construct a line from Newberry southward via Saluda and Edgefield, S. C., to Augusta, Ga., a distance of 65 miles. J. F. Livingston, Columbia, is Pres.

South Carolina—Carolina, Atlantic & Western Ry.—This company will, according to press reports, start work about Sept. 1 on the construction of its proposed extension from Charleston, S. C., to Savannah, Ga., about 85 miles. William Moncure, Raleigh, N. C., is Ch. Engr. Noted Feb. 4 and June 17.

South Carolina—Atlantic Coast Line R.R.—Plans are being considered by this company for the construction of a railway from St. Stephens to Yemassee via Ridgeville and Walterboro, S. C., about 75 miles. E. P. Pleasants, Wilmington, N. C., is Ch. Engr.

Florida—A franchise has been granted to E. W. Parker, Tampa, for the construction of an electric railway in Clearwater, Fla. Noted Aug. 5.

Mississippi—Jackson & Eastern Ry.—This company has been incorporated to construct a steam or electric railway from Jackson, Miss., to Union ,Miss. S. A. Neville, R. W. Harriss and C. J. Currie, Meridian, Miss., are interested.

Tennessee—Chattanooga Traction Co.—This company plans to extend its lines from Chattanooga to Hixson. W. T. Jones, Chattanooga, is Vice-Pres. and Gen. Mgr. Noted Jan. 23.

Ohio—Cincinnati, Lawrenceburg & Aurora Electric St. R.R. Co.—This company plans to construct an electric railway from Anderson's Ferry, (Cincinnati) the present terminus, through the business section of Cincinnati. C. E. Hoover, Cincinnati, is Treas. and Gen. Mgr.

Ohio—Cleveland Ry.—This company will extend its line on East 79th St. from Kensman Rd. to Broadway Ave., Cleveland. George L. Radcliffe, Cleveland, is Gen. Mgr.

Ohio—Dayton & St. Mary's Traction Co.—This company has been incorporated to construct an electric railway from Dayton to St. Marys, Ohio. Dennis Dwyer, Dayton, Julius Boesel, Thomas J. Brennan and C. V. Ruenke are interested. Noted July 15.

Michigan—The Council has been petitioned for a franchise to construct an electric railway from Mt. Clemons to Armada. A. Jacobson, Detroit, is interested.

Illinois—Kankakee & Urbana Traction Co.—Plans are being considered by this company for the extension of its line from Ludlow to Paxton, Ill. William J. Laffell, Urbana, is Gen. Mgr. and Pur. Agt.

South Dakota—Electric Short Line Ry. Co.—This company plans to construct about 45 miles of new line at an estimated cost of $440,000. De Koven Hunter, Minneapolis, is Gen. Mgr.

Missouri—Chicago, Burlington & Quincy R.R.—A franchise has been granted this company to extend its lines along First, Deer and Elk St., St. Joseph, and along Florence Rd. and the intervening alleys. W. L. Breckenridge, Chicago, Ill., is Ch. Engr.

Arkansas—According to press reports work will soon be started on the construction of an electric railway from Columbus to Washington, Ark., about seven miles. Rufus S. Stout, Pine Bluff, is interested. Noted May 6.

Texas—Northern Texas Traction Co.—The City Commission has authorized this company to extend its electric railway on Fairmont Ave. and Willing St., Ft. Worth, Tex. George H. Clifford, Ft. Worth, is Vice-Pres. and Gen. Mgr.

Texas—Preliminary arrangements are being made and contracts will soon be awarded for the construction of the proposed railway from Rockport to Seymour, Tex., about 350 miles. Edward Cowper-Thwaite, London, Eng., is interested.

Oklahoma—La Kemp & Northwestern Ry. Co.—This company has been incorporated to construct an electric railway from Gage northwest to Ivanhoe, about 25 miles. The incorporators are I. K. Edwards, George C. Warlick, J. W. Steffen, W. B. Lehman and E. W. Lehman all of La Kemp.

Oklahoma—Tulsa—Sand Springs Interurban Ry. Co.—This company plans to extend its line to the coal mines, about eight miles. W. B. Craig, Tulsa, is Gen. Mgr.

Utah—A petition has been presented to the Council by Harry S. Joseph asking for a franchise to construct an electric railway in Bingham Canyon to connect with the Salt Lake & Utah R.R.

+Arizona—Tucson, Cornelia & Gila Bend R.R.—This company has awarded the contract to J. H. MAXEY, Yuma, Ariz., for all culvert and trestle work and general construction on its railway from Gila Bend to a point near Ajo, about 38 miles. Noted June 3.

Washington—C. J. Erickson, Downs Block, Seattle, plans the construction of a standard gage railroad from his mills at MacDonald Creek, near Sequim, Wash., into timber holdings, a distance of eight miles.

+Oregon—Oregon-Washington R.R. & Navigation Co.—This company has awarded the contract for the construction of an extension to its line from Riverside to Crane Creek Gap, Ore., about 30 miles, to TWOHY BROS., Portland. Estimated cost, $1,500,000. J. R. Holman, Portland, Ore., is Ch. Engr. Noted July 1.

Oregon—The Du Bois Lumber Co. will, according to press reports, construct a railway from Astoria, Ore., to its timber lands in Clatsop and Tillamook Counties.

+Oregon—Roseburg & Eastern Ry. Co.—This company has awarded the contract for the construction of a railway from Roseburg to the boundary of the Cascade National Forest, about 30 miles, to KENDALL BROS., Pittsburgh, Penn.

+New Brunswick—Canadian Government Ry.—This company has awarded a contract to the JOHN W. McMANUS CO., LTD., Memramcook, N. B., for the construction of a spur line of railway from the Intercolonial Ry. to Bathurst, N. B.

Manitoba—Plans are being prepared for the construction of a gasoline-operated street car line from Winnipeg to Transcona, about ten miles. H. W. Adcock, Winnipeg, is interested. Noted July 1.

LIGHT, HEAT AND POWER

North Gorham, Maine—The Cumberland County Power & Light Co., Portland, plans to construct a new dam, about 300 ft. long, across the Presumpscot River. The estimated cost is $40,000. The dam will develop about 2700 hp. A. H. Ford, Portland, is Gen. Mgr.

Milton, N. H.—It is reported that a company to be known as the Milton Electric Co. is now being organized. The old Worster Mill site has been secured for the location of the power house. The city is said to have entered into a contract for street-lighting. J. B. Giguere is interested.

Brockton, Mass.—Local citizens have filed a petition with the Board of Aldermen asking for the appointment of a commission to investigate the feasibility and probable cost of the establishment of a municipal electric-light plant.

Holyoke, Mass.—The Board of Public Works has voted the sum of $10,000 for the construction of a boiler house for the new isolation hospital now in course of construction. W. J. Howes is Arch.

Medfield, Mass.—(Official)—Bids will be received until noon, Aug. 19, by the State Board of Insanity, Room 36, State House, Boston, for heating, plumbing and electrical work in a new dispensary building at the State Asylum. James H. Ritchie, 8 Beacon St., Boston, is Arch. Michael J. O'Meara, M. D., is Chn. Bd. of Insanity.

Westfield, Mass.—At a recent town meeting, the sum of $25,000 was appropriated for extensions and improvements to the municipal gas and electric plant.

+Hartford, Conn.—The Hartford Electric Light Co. has awarded the contract for the construction of an addition to its power station at Dutch Point to the STONE & WEBSTER ENGINEERING CORPORATION, Boston, at about $35,000. The building will be 28x44 ft., three stories.

Lestershire, N. Y.—Endicott, Johnson & Co., manufacturer of boots and shoes, plans to double the output of its main power plant in Lestershire, including the installation of a 2000-kw. steam turbine.

Oswego, N. Y.—The city has appointed a committee to engage an engineer to prepare plans and supervise the development of a waterpower on the Oswego River at High Dam on a site belonging to the City of Oswego.

Bloomfield, N. J.—Press reports state that the Westinghouse Lamp Co. contemplates the construction of an addition to its power house in the Watsessing section.

Kinston, N. C.—It is reported that the City Council contemplates improving the municipal electric-light plant at an estimated cost of $40,000. J. E. Weyher is Mgr. and Supt.

Springfield, Tenn.—The city has sold bonds amounting to $15,000, the proceeds of which will be used for building an addition to the municipal power plant. G. B. Shawver is Supt.

Dawsonsprings, Ky.—It is reported that a company is being organized for the purpose of establishing an electric-light and power plant. It will be known as the Dawson Light & Power Co. Brent Hart is interested.

Dayton, Ohio—It is reported that the Board of Commissioners of Montgomery County has adopted a resolution providing for the construction of a new power house and the installation of new boilers at the Montgomery County Children's Home. The estimated cost of the improvements is $10,000.

Delaware, Ohio—(Official) — Bids will be received until ncon, Aug. 26, by W. V. Aldrich, Audr. of Delaware County, for installing a heating plant under the county jail, conducting the same to the courthouse, and furnishing and installing the proper radiation.

Spencerville, Ohio—(Official)—Bids will be received until noon, Aug. 20, by the Village Board of Public Affairs for the construction of an addition to the power station, and for furnishing steam and electrical equipment for the same. Charles S. Fryer is Clk. of Bd. The Rae-Woulfe Engineering Co., Engineers' Bldg., Cleveland, is Engr.

Corunna, Mich.—It is reported that the Corunna plant of the Consumers' Power Co., Owosso, was recently destroyed by fire at a loss of about $15,000. C. W. Tippy, Jackson, is Gen. Mgr. of the Consumers' Power Co.

Wyandotte, Mich.—The City Commission has approved of an estimated expenditure of $29,625 for proposed improvements to the municipal electric-light plant. A. S. McClenehan is Supt. of the plant.

Rockford, Ill.—The City Council has instructed Ross P. Beckstrom, Supt. of Water-Works, to investigate and report on the cost of installing a municipal electric-light plant, which will also supply power for the operation of the city pumping station.

Upper Alton, Ill.—Bids will be received until 3 p.m., Aug. 23, by Frank D. Whipp, Fiscal Supvr., Springfield, for the construction of a power house at the Alton State Hospital.

Hardwick, Minn.—Bids will be received until Aug. 17 by the Village Recorder for the construction of an electric transmission line and distribution system for the Village of Hardwick. Earle D. Jackson, Capitol Bank Bldg., St. Paul, is Consult. Engr.

Minneapolis, Minn.—Bids will be received until Aug. 20 by G. A. Sandberg, Pur. Officer of the University of Minnesota, Minneapolis, for the installation of two 350-hp. return water-tube boilers complete with stokers.

Wheaton, Minn.—Bids will be received until Aug. 16 by the Board of Education, Wheaton, for plumbing, heating, ventilating and electric wiring of a gymnasium and manual training building. E. F. Broomhall, 710 Alworth Bldg., Duluth, is Arch.

+Larned, Kan.—The City Council has awarded contracts for the construction of an electric-light plant and pumping station as follows: Construction of building to McCOY & TAYLOR, Ft. Scott, Kan., at $12,120; for motor pumps at $4115, and engines, generators, boilers and conduits at $22,055 to the MERKLE-HINES MACHINERY CO., Scarritt Bldg., Kansas City, Mo.; poles, to LARSON BROS., Larned, at $4318; switchboard and electrical equipment to McCOY & TAYLOR at $7496; hardware and transformers to the UNITED ELECTRIC CO., 120 West 13th St., Kansas City, Mo., at $15,808; chimney stack to the HEINICKE CHIMNEY CO., 147 Fourth Ave., New York, N. Y. Noted July 15.

Franklin, Neb.—At a recent election the citizens voted in favor of issuing $7000 in bonds for the purpose of installing an electric-light plant.

Glasgow, Mont.—A special election will be held Oct. 4 to vote on the question of issuing $18,000 in bonds, the proceeds of which will be used for extending the present electric-lighting system. H. D. Palmer is City Clk.

San Angelo, Tex.—It is reported that the San Angelo Water, Light & Power Co. will soon advertise for bids for power plant equipment to cost about $50,000. W. A. Guthrie is Vice-Pres., Mgr. and Cont. Agt.

Albion, Idaho—A special election will be held Aug. 23 to vote for a bond issue of $8000, the proceeds of which will be used for the installation of a municipal electric-light plant.

Redding, Calif.—The plant of the Redding Electric Light & Power Co., a subsidiary of the Northern California Power Co., San Francisco, was destroyed by fire recently. Loss, $8000.

Sherbrooke, Que.—The City Council has decided to build a municipal gas plant to cost about $70,000. Thomas Tremblay is Engr.

Athens, Ont.—The City Council has instructed A. M. Lee to have plans prepared for the installation of a new electric-light and power plant. The estimated cost is $25,000.

Madoc, Ont.—It is reported that the Madoc Mining Co. will soon begin the construction of a brick and concrete power house at Goudreau, Ont. The estimated cost is $75,000.

Palmerston, Ont.—The City Council has instructed H. Hyndman to prepare plans and ask for bids for a new hydro-electric plant and distribution system. The estimated cost is $30,000.

BRIDGES

+Concord, N. H.—The State Highway Commission has awarded the contract for the construction of the Mosquito Bridge over Winnisquam Lake between the towns of Tilton and Belmont to the UNITED CONSTRUCTION CO., Albany, N. Y., at $46,266. F. E. Everett is Acting Comr. Noted July 15 under Winnisquam, N. H.

+Montpelier, Vt.—(Official)—The City Council has awarded the contract for the construction of a steel girder bridge with concrete floor at State St. to JAMES E. CASHMAN, Burlington, at $16,805. Five other bids were received. George A. Reed is City Engr. Noted July 29.

+Boston, Mass.—The Public Works Department has awarded the contract for cleaning and painting the Cambridge Bridge over the Charles River between Boston and Cambridge, to the CONNERS BROS. CO., at $6200. Other bidders were: Albert D. Howlett Co., $9000; Maurice M. Devine, $11,465; Martin A. Feeley, $12,450; George T. Rendle Co., $14,099; D. Dugan & Son, $16,280; W. L. Waples Co., $16,800.

★**Greenwich, N. Y.**—(Official)—Bids will be received until 1 p.m., Aug. 20, by the Towns of Greenwich and Easton, at the office of N. S. Langdon, Greenwich, Washington County, for the construction of three concrete-steel arches over the Battenkill River at Greenwich Village, Middle Falls and at Clarks Mills. The Concrete-Steel Engineering Co., Park Row Bldg., New York, is Engr.-in-Charge. R. S. Skinner is Town Supt. of Greenwich. Jacob Pratt is Town Supt. of Easton.

★✚**Oswego, N. Y.**—(Official)—The County Superintendent of Highways has awarded the contract for the construction of a concrete-steel bridge across the Oswego River at Minetto to LARKIN & SANGSTER, Seneca Falls, at $65,000. Other bidders were: Oswego Construction Co., $92,000; Woolsey Construction Co., $78,000. Noted July 22.

✚**Far Hills, N. J.**—The Board of Chosen Freeholders of Somerset County, Somerville, has awarded the contract for the construction of a concrete bridge over the Raritan River at Far Hills to the J. L. LACOMPT CO., Lakewood, at $10,876. The second lowest bid was that of Hickey & Houghton Co., Raritan, at $11,044.

Raven Rock, N. J.—The Board of Chosen Freeholders of Hunterdon County, Flemington, has decided to replace the covered bridge over Hoffman's Creek at Raven Rock with a new structure. It will be about 100 ft. long with a 20-ft. concrete roadway.

Lebanon, Penn.—Bids will be received until 5 p.m., Aug. 20, by D. M. Sharp, City Clk., for the construction of three reinforced-concrete or steel bridges. T. R. Crowell is City Engr.

★**Media, Penn.**—(Official)—The Commissioners of Delaware County rejected all bids received Aug. 2 for the construction of a bridge over Muckinapatus Creek at Glenolden Ave., Glenolden Borough, Darby Township. The work will be readvertised. Noted July 29.

★**Philadelphia, Penn.**—(Official)—Bids for the construction of four bridges were received by the Department of Public Works on Aug. 2 and 4, as follows: Bridge at Cambria and A St., James D. Dorney, $54,686; T. F. Reilly, $61,700; Carl R. Camp, $51,349; C. P. Bower, $55,500; F. J. Boas, $58,862; M. & J. B. McHugh, $60,300; Peoples Bros., Inc., $56,000; American Paving & Construction Co., $67,500; Richard Walsh & Sons, Inc., $52,675. Holme Ave. Bridge, McNichol Paving & Construction Co., $67,857; J. E. Brenneman, $75,994; Peoples Bros., Inc., $79, 242; Richard Walsh & Sons, Inc., $108,340; Philadelphia Paving Co., $111,421; Day & Zimmermann, $128,214. Whitby Ave. Bridge, F. J. Boas, $34,731; Richard Walsh & Sons, Inc., $41,925; Thomas F. Reilly, $38,815; Monaghan & Losse, $40,569; Carl R. Camp, $35,982. Front St. Bridge, Philadelphia Paving Co., $11,792; Frank Mark Contracting Co., $12,515; Daniel J. Lynch, $12,704; Day & Zimmermann, $19,223; Richard Walsh & Sons, Inc., $12,900; Monaghan & Losse, $19,740; F. J. Boas, $14,587; William A. Mundy, $15,757. M. L. Cooke is Dir. of Pub. Wks. Noted July 29.

Pittsburgh, Penn.—(Official)—Bids will be received until noon, Aug. 20, by Hyatt M. Cribbs, Controller of Allegheny County, for repairs to trestle approach, steel, street car rails and floor of Bridge No. 6 over the Youghiogheny River. J. G. Chalfant is County Engr.

✚**Sunbury, Penn.**—The Commissioners of Northumberland County have awarded the contract for the construction of a bridge over Mahanoy Creek in East Cameron Township to WHITTAKER & DIEHL, Harrisburg, at $4629.

Uniontown, Penn.—Bids will be received until Aug. 26 by Harry Kisinger, Controller of Fayette County, for constructing abutments and wing walls and repairing several bridges.

Isle of Wight, Va.—It is reported that the Commissioners of Isle of Wight County contemplate the construction of seven new bridges at an estimated cost of $75,000.

Leesburg, Va.—(Official)—The State Highway Commission, Richmond, has awarded the contract for the construction of two bridges in Loudoun County to the LUTEN BRIDGE CO., York, Penn., at $3600 for the two. W. D. Hempstone is Clk. of the Loudoun County Court. Noted July 29.

Stuart, Va.—(Official)—Bids will be received until noon, Aug. 20, by the Clerk of the Circuit Court of Patrick County for the construction of a 90-ft. bridge across the Dan River. G. P. Coleman, Richmond, is State Highway Comr.

★**Wilson, N. C.**—(Official)—Bids will be received until 3 p.m., Aug. 28, by Lawrence Brett, Engr., Bd. of Drainage Comrs., Mattamuskeet Drainage District, for the construction of a single-leaf plate girder Scherzer rolling lift bridge.

St. Francisville, La.—The Police Juries of East and West Feliciana Parishes have appropriated the sum of $24,000 for the construction of a bridge across Thompson Creek on the line between the two parishes.

✚**Calvin, Ky.**—The Fiscal Court of Bell County, Pineville, has awarded a contract for the construction of a bridge across the Cumberland River at Calvin to the VINCENNES BRIDGE CO., Vincennes, Ind., at $7060. The contract for the substructure was awarded to MARTIN GREEN, ROBERT VANBEVER and EDWARD PURSIFULL, all of Pineville, at $2541.

Elizabethtown, Ky.—The Bridge Commission, appointed by the Fiscal Courts of Bullitt County, Shepherdsville and Hardin County, Elizabethtown, has decided to build the new intercounty bridge over the Rolling Fork River at Wooldridge's Ferry. The estimated cost of the bridge is $16,000, of which Hardin County will pay 60%, and Bullitt County the remainder.

Akron, Ohio—Bids will be received until 11 a.m., Aug. 27, by C. L. Bower, Clk. of Summit County, for building approaches and paving the Louis Young Bridge over the Ohio Canal, Manchester Rd., Coventry Township.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Sept. 3, by the Board of Commissioners of Hamilton County for rebuilding a culvert in the Cleves Rd. from Miami Ave., Cleves, to the Blue Rock Pike in Colerain Township. Albert Reinhardt is Clk. of Comrs.

Cleveland, Ohio—Bids will be received until noon, Aug. 18, by the Commissioner of Purchases and Supplies, 511 City Hall, for the construction of two concrete box culverts in the Woodland Hills-Garfield division of East Blvd., south of Kinsman Rd.

✚**Cleveland, Ohio**—The contract for placing a floor on the new Clark Ave. Bridge has been awarded by the Board of Control to EDWARD A. WEILAND, 376 Rockefeller Bldg., Cleveland, at $78,682.

✚**Columbus, Ohio**—The Board of Commissioners of Franklin County has awarded the following contracts for bridge work: Construction of the Eberly Rd. Bridge over Alum Creek, substructure to the FRITZ-RUMER-COOKE-GRANT CO., Columbus, at $9092, superstructure to the CASE-CRANE ENGINEERING CO., at $9271; approaches to the Schrock Bridge to PURDUM & SCHWARTZ at $15,014. Noted July 15.

Delaware, Ohio—(Official)—Bids will be received until noon, Aug. 30, by W. V. Aldrich, Audr. of Delaware County, for the construction of the substructure and superstructure of the Winter St. Bridge.

Hamilton, Ohio—On Aug. 2 the Common Pleas Court permanently enjoined the Commissioners of Butler County from awarding a contract to the A. J. Yawger Co., Indianapolis, Ind., for the construction of the Columbia Bridge at Wood St. The contract price was $96,000. The injunction was made on the grounds that the substructure and superstructure were not divided in the bid, that the specifications permitted a modification of the contract after being signed, and because the bid for the substructure exceeded the estimate. New bids will be asked for this bridge. W. W. Crawford is County Audr. Noted May 20 and July 8.

Hillsboro, Ohio—(Official)—Bids will be received until 11:30 p.m., Sept. 6, by the Board of Commissioners of Highland County for the construction of a steel bridge over Rocky Fork Creek near the County Infirmary. B. O. Pratt is County Surv.

Marion, Ohio—(Official)—Bids will be received until noon, Aug. 18, by the Board of Commissioners of Marion County for reflooring county Bridges Nos. 17, 22 and 23 with creosoted wood block. V. Perle Garfield is Clk. of Comrs.

New Philadelphia, Ohio—Bids will be received until Sept. 1 by the Board of Commissioners of Tuscarawas County for repairing the stone substructure and constructing a new steel superstructure with a 20-ft. roadway, of a bridge over Sugar Creek Falls, Franklin Township. R. H. Nussdorfer is County Audr.

North Randall, Ohio—The Board of Commissioners of Cuyahoga County, Cleveland, has instructed the County Surveyor to prepare plans for the construction of a bridge over the tracks of the Erie R.R. near North Randall. The estimated cost is $40,000.

Ravenna, Ohio—Bids will be received until noon, Aug. 30, by the Board of Commissioners of Portage County for the construction of a 75-ft. steel bridge with concrete or wood block floor over the North Mahoning River in Charlestown Township.

✚**Crown Point, Ind.**—(Official)—The Commissioners of Lake County have awarded the contract for the construction of a Scherzer rolling lift bridge to the PHEE CONSTRUCTION CO., Chicago, Ill., at $76,000; the same company will build a temporary bridge at $3512. Noted July 22.

Washington, Ind.—It is reported that bids will be asked some time in September by the Commissioners of Daviess County for the construction of one 60-ft. steel bridge and four others ranging from 25 to 30 ft. in length. All will have reinforced-concrete abutments and floors. L. S. Core is County Audr. and W. J. Shanks is Surv.

✚**Paris, Ill.** — (Official) — The County Superintendent of Highways of Edgar County has awarded the contract for the construction of a reinforced-concrete bridge over Sugar Creek on the Chicago Rd. to ALAN JAY PARRISH, Paris, at $7600. Other bidders were: East St. Louis Bridge Co., East St. Louis, $8000; Chrisman Contracting Co., Chrisman, $7900; Zimmerly Bridge Co., Paris, $8295. Noted July 29.

Watseka, Ill.—(Official)—Bids will be received until 1:30 p.m., Aug. 18, by Benjamin Jordan, County Supt. of Highways of Iroquois County, for the construction of two reinforced-concrete bridges in Pigeon Grove Township. The estimated cost of the two bridges is $6575.

Orange City, Iowa—Bids will be received until 2 p.m., Sept. 6 (extension of date from Aug. 3), by the Auditor of Sioux County for the construction of a bridge over the Sioux River, on the state line two miles south of Hudson, S. D.

✚**Waukon, Iowa**—(Official)—The Board of Supervisors of Allamakee County has awarded the contract for the construction of reinforced-concrete bridges and culverts to ELT B. FOWLER, Lansing, Iowa, at about $14,000. Noted July 29.

✚**Webster City, Iowa**—The Board of Supervisors of Hamilton County has awarded contracts for bridge construction as follows: A. W. MERRICK, Boone, $11,423 for five bridges; CLINTON BRIDGE WORKS, Clinton, $6607 for three bridges; ALBERT SWANSON, Webster City, $6671 for three bridges. Noted July 8.

Mankato, Minn.—Bids will be received until 2 p.m., Aug. 18, by the Commissioners of Blue Earth County for the construction of a 120-ft. concrete arch in Shelby Township. C. L. Kennedy is County Audr.

Wadena, Minn.—Bids will be received until 2 p.m., Aug. 23, by Eugene Rose, Audr. of Wadena County, for the construction of State Bridge No. 1551 on the county road at Twin Lakes in the Town of Shell River.

Girard, Kan.—Bids will be received until noon, Aug. 18, by the Commissioners of Crawford County for the construction of ten steel or reinforced-concrete bridges. Charles C. Everett is County Clk. Noted July 8 and 22.

✚**Junction City, Kan.**—The contract for two new spans of the North Washington St. Bridge over the Republican River, to replace those washed out by the recent floods, was awarded to the LEAVENWORTH BRIDGE CO., Leavenworth, at about $6000. The spans will be of reinforced concrete.

★**Lawrence, Kan.**—(Official)—Bids will be received until noon, Oct. 6, by Herman Broecker, Clk. of Douglas County, for the construction of a reinforced-concrete bridge over the Kansas River at Lawrence. Hedrick & Cochran, Kansas City, Mo., is Consult. Engr.

Oskaloosa, Kan.—Bids will be received until noon, Aug. 19, by L. P. Sheldon, Clk. of Jefferson County, for the construction of 13 steel and reinforced-concrete bridges, and for the repair of various bridges.

Topeka, Kan.—The lowest bid received by the city for the construction of a reinforced-concrete bridge across Shunganunga Creek at Kansas Ave. and 20th St. was that of Arthur E. Allen, Topeka, at $15,468. Noted July 8.

Fremont, Neb.—Bids will be received until Aug. 24 by John O'Connor, Clk. of Dodge County, for the construction of county bridges during the ensuing year.

St. Paul, Neb.—(Official)—Bids will be received until noon, Sept. 3, by K. D. Bahensky, Clk. of Howard County, St. Paul, for the construction of a high truss steel bridge across the Loup River about two miles south of St. Paul. It will have five 145-ft. spans with a 16-ft. roadway.

Medora, N. D.—Bids will be received until Aug. 23 by the Auditor of Billings County for the construction of a steel bridge on concrete piers over the Little Missouri River at Medora. Noted Apr. 29 and May 13.

✚**Florence, Mont.**—(Official)—The Commissioners of Ravalli County, Hamilton, have awarded the contract for the construction of a bridge across the Bitter Root River to O. E. PEPPARD, Missoula, at $9700. Noted July 29.

Carrollton, Mo.—(Official)—The proposed special election in Carroll County, which was to have been called for the purpose of voting for a bond issue of $250,000 for building new bridges, has been indefinitely postponed. J. W. Hollister is County Clk. Noted July 8.

Greenville, Mo.—(Official)—Bids will be received until 2 p.m., Aug. 18, by A. W. Copeland, Highway Engr. of Wayne County, Greenville, for the construction of a steel bridge across Big Lake Creek on the Greenville-Patterson Rd. near Greenville.

✚**Louisiana, Mo.**—The contract for the construction of a reinforced-concrete bridge across Buffalo Creek has been awarded to the MISSOURI BRIDGE & IRON CO., St. Louis, at $5974. Seven other bids were received.

✚**Clinton, Ark.**—The contract for the construction of a steel bridge over the Little Red River has been awarded to the GREENBERG IRON CO., Terre Haute, Ind., at $9500.

Little Rock, Ark.—It is reported that the Chicago, Rock Island & Pacific Ry. is preparing to build a reinforced-concrete viaduct over its tracks on East Second St. It will be about 70 ft. long and 46 ft. wide. The estimated cost is $30,000. The work will be done under the supervision of Henry Levinson, City Engr.

Searcy, Ark.—Bids will be received until 1 p.m., Aug. 19, by J. A. Marsh, County Judge of White County, for the construction of a bridge across the Little Red River.

Canadian, Tex.—Bids will be received until Aug. 23 by the Commissioners Court of Hemphill County for the construction of a bridge over the Canadian River. The estimated cost is $74,000.

Houston, Tex.—(Official)—Bids will be received until 10 a.m., Aug. 16, by H. L. Washburn, Audr. of Harris County, for the construction of a bridge across Halls Bayou on the Houston and Aldine Rd.

✚**Antlers, Okla.**—(Official)—The Commissioners of Pushmataha County have awarded the contract for the construction of five bridges to the ILLINOIS STEEL BRIDGE CO., Jacksonville, Ill., at $44,940. Other bidders were: Vincennes Bridge Co., $47,728; Missouri Valley Bridge Co., $48,450; Missouri Bridge & Iron Works, $46,728; Canton Bridge Co., $45,115; Federal Bridge Co., $50,575. C. A. Heere is County Clk. Noted July 29.

Fairview, Okla.—The Board of Commissioners of Major County is reported to be contemplating the construction of about 40 new bridges. The estimated cost is $10,000. G. A. Newton is County Clk.

✚**Ft. Towson, Okla.**—A contract for the construction of a steel bridge with concrete piers and abutments, has been awarded to the PLUMMER-ADAMS CONSTRUCTION CO., Springfield, Mo., at $15,000.

Kingfisher, Okla.—Bids will be received until Aug. 16 by the Commissioners of Kingfisher County for the construction of 17 steel and concrete bridges. The estimated cost is $21,500. C. R. Steel is Engr. William G. Newer is County Clk. Noted June 3.

Gila Bend, Ariz.—See item under "Railways."—Arizona.

Aberdeen, Wash.—The City Council has engaged C. E. Fowler, Engr., Central Bldg., Seattle, to prepare plans for rebuilding the West Toll Bridge over the Chehalis River. It will be a 240-ft. span, and the estimated cost is $15,000.

✚**Seattle, Wash.**—The Board of Public Works has awarded contracts for the construction of two bridges over Lake Washington Canal as follows: Bridge at 15th Ave., N. W., complete structure to HANS PEDERSON, Madison Block, Seattle, at $242,620; Fremont Ave. Bridge, superstructure, BEERS BUILDING CO., Pittock Bldg., Portland, Ore., at $154,601; substructure to the PACIFIC STATES CONSTRUCTION CO., Burke Bldg., Seattle, at $111,916. Both bridges will be of the double-leaf bascule trunnion type. Noted July 1 and 29.

Salem, Ore.—Bids will be received until Aug. 16 by the County Court of Marion County for the construction of a bridge across the Little North Fork of the Santiam River on the road between Gates and Cold Creek. The estimated cost is $10,000. Max Gehler is Clk.

Dunsmuir, Calif.—Bids will be received until 2 p.m., Aug. 23, by the State Highway Commission, Forum Bldg., Sacramento, for the construction of a reinforced-concrete bridge over the Sacramento River near Dunsmuir. It will have one arch 180 ft. long, and two arches of 114 ft. each. Austin B. Fletcher is State Highway Engr. Noted Aug. 5.

✚**Eureka, Calif.**—The Board of Supervisors of Humboldt County has awarded the contract for the construction of a suspension bridge across the Salt River at Ballou's Ford to FRANK L. SMITH, at $16,490. Other bidders were: Elsemore & Jacobs, $18,487; Joseph H. Moore & J. N. Lentell, $19,972; Mercer-Fraser Co., $21,316.

✚**Sacramento, Calif.**—The State Highway Commission has awarded a contract for the construction of two bridges across Boulder Creek and Shotgun Creek in Shasta County, to A. F. ROLANDI, San Francisco, at $5450.

San Jose, Calif.—(Official)—Bids will be received until 11 a.m., Aug. 23, by the Board of Supervisors of Santa Clara County for the construction of a two-span girder type reinforced-concrete bridge over Bodfish on the Bodfish Rd., and for slab type reinforced-concrete culvert on the Shannon Rd. Henry M. Ayer is Chn., Bd. of Supvrs. Henry A. Pfister is Clk.

✚**Ukiah, Calif.**—The Board of Supervisors of Mendocino County has awarded a contract for bridge work to V. M. PRICE, at $6000.

WATER SUPPLY—IRRIGATION

★**South Braintree, Mass.**—(Official)—Bids will be received until Aug. 21 for furnishing c.-i. water pipe and appurtenances and for laying water mains. W. E. Maybury is Supt. of Water Wks.

★**Hartford, Conn.**—Bids were received by the Board of Water Commissioners, Aug. 3 for the construction of the dam of the compensating reservoir in connection with the Nepaug water system, as follows: Charles W. Blakeslee & Sons, New Haven, $357,766; Larkin & Sangster, Seneca Falls, N. Y., $396,990; Winston & Co., Brown Station, N. Y., $399,540; Coleman Bros., Chelsea, Mass., $414,940; T. Stuart & Sons Co., Newton, Mass., $426,290; Peter F. Connolly & Co., Boston, Mass., $433,195; Brune & Petitti, Boston, Mass., $438,750; Hugh Nawn Co., Boston, Mass., $442,805; H. S. Kerbaugh, New York, N. Y., $449,646; Fred T. Ley Co., Springfield, Mass., $461,190; Piersen Engineering & Construction Co., Hartford, Conn., $465,285; Walsh Construction Co., Davenport, Iowa, $485,539; J. F. Cogan Co., New York, N. Y., $486,970; Bates & Rogers Construction Co., Chicago, Ill., $512,767 and James A. Hart Co., New York, N. Y., $723,860. Noted July 15.

Buffalo, N. Y.—The Council contemplates issuing bonds for $250,000, the proceeds of which will be used for the extension of its water system. George H. Norton is Act. Comr. of Pub. Wks.

✚★**Ilion, N. Y.**—(Official)—The contract has been awarded to CHARLES A. CHATHAM, 119 University Ave., Syracuse, at $12,832, for constructing a diverting dam and appurtenances. Other bidders were: George & Bove, $13,202; Ralph F. Relly, $12,759; Charles R. Lewis, $14,875; F. W. Johnston, $16,279; Thomas McGreger, $13,849 and A. Harper, $13,538. George Rasbach is Clk. Noted July 22.

✚**Lockport, N. Y.**—(Official)—The contract will be awarded to the C. B. WHITINGE CO., Lockport, at $15,090, for laying water mains after the money has been received for the water bonds William G. Spaulding is Clk., Bd. of Water Supply. Noted July 29.

✚**Camden, N. J.**—The contract has been awarded to the CAMDEN IRON WORKS, Philadelphia, Penn., at $12,000, by the Water Commission of the City Council for two 5,000,000-gal. centrifugal pumps. Noted May 6 and July 29.

Trenton, N. J.—Governor Fielder has officially approved the plans of the State Water Supply Commission for the development of the Wanaque watershed for the joint use of the municipalities in the northern part of the state which have joined in the project.

West Orange, N. J.—An election will be held Aug. 16 to vote on the question of purchasing the water system of the West Orange Water Co. The amount will not exceed $300,000. Carroll P. Bassett is Pres. of the company. Noted July 15.

Allentown, Penn.—A report has been submitted by Charles D. Weirbach, City Engr., on the installation of pumps at the pumping station. The estimated cost is $27,500 to $48,500, according to pumps used.

Hatfield, Penn.—Bids will be received until Aug. 16 by Jonas S. Moyer, Town Clk., for laying about two miles of water mains. Noted Apr. 8.

✚**Langhorne, Penn.**—(Official)—The contract has been awarded to the AMERICAN WATER SOFTENER CO., 1011 Chestnut St., Philadelphia, for installing a filtration plant. Noted July 8 and 15.

✚★**Mifflinburg, Penn.**—(Official)—The contract has been awarded to F. H. GIMBERLING, Selins Grove, at $3979, by the borough for constructing a 500,000-gal. reinforced-concrete reservoir. Alexander Potter, 50 Church St., New York, N. Y., is Consult. Engr. Noted May 27 and July 22.

Tamaqua, Penn.—Plans have been prepared for the construction of a 357,000,000-gal. reservoir. The estimated cost is $100,000. Noted Nov. 19, 1914.

Keedysville, Md.—The water mains of the Boonsboro Water Co., Boonsboro, will be extended to the town limits.

North East, Md.—The Maryland Water Co. has been granted permission to issue $40,000 in bonds, the proceeds of which will be used for the extension of its system.

Columbia, Tenn.—The Columbia Water & Light Co. plans to construct a filtration plant. W. H. Weiss, Kansas City, Mo., is Consult. Engr. Noted June 10.

Madisonville, Tenn.—(Official)—We have been advised that the city does not contemplate making extensions to the water system this year. Noted Aug. 5.

Louisville, Ky.—Bids will be received about Sept. 1, according to press reports, by the Louisville Water Co. for laying a 48-in. water main. James B. Wilson is Ch. Engr.

Brewster, Ohio—Bids will be received until Aug. 20 by L. S. Lash, Village Clk., for constructing a municipal water system. The W. H. Sherman Co., Toledo, is Engr. Noted Feb. 4.

Cleveland Heights, Ohio—(Warrensville post office)—Bids will be received by H. H. Canfield, Clk., until noon, Sept., 7, for the construction of an 8-in. water main in Derbyshire, Kent, Lennox, Norfolk and Surrey Rd. The F. A. Pease Engineering Co., Marshall Bldg., Cleveland, is Engr.

Farmersville, Ohio—According to press reports bids will be received about Aug. 20 by the city for the installation of a water system. The estimated cost is $14,500. A. S. Gilbert is Village Clk. Noted June 10.

Oberlin, Ohio—The city plans to construct a 10,000,000-gal. reservoir.

East Chicago, Ind.—The State Board of Health recommends the installation of a filtration plant for the East Chicago and Indiana Harbor Water Works Co.

Topeka, Ind.—The Topeka Water Co., recently incorporated with $8000 capital, will install a water system. A. D. Ritter is interested.

+Frankfort, Ill.—(Official)—The contract has been awarded to the CHICAGO BRIDGE & IRON WORKS, Chicago, at $4950, for constructing a water tank and tower. Noted July 22.

+Joliet, Ill.—(Official)—The contract has been awarded to ROBERT SHANNON, 421 Pleasant St., at $38,516, for laying water mains.

+Murphysboro, Ill.—The contract has been awarded to the NEW YORK CONTINENTAL JEWEL FILTRATION CO., New York, N. Y., for constructing a filtration plant for the Water Works, Electric Light & Gas Co. Noted July 29.

+★Rockford, Ill.—(Official)—Bids were received July 27 for furnishing pumping equipment for well No. 8 as follows: Rotary Type: LAYNE & BOWLER CORPORATION, Los Angeles, Calif., Proposal No. 1, 60 doz., $4882 (awarded contract); American Well Works, Aurora, 105 doz., $5739; Layne & Boyler Corporation, Proposal No. 2, 60 doz., $5782; Byron Jackson Co., San Francisco, Calif., $5833. Reciprocating Type: American Well Works, Aurora, 150 doz., $9600; and International Steam Pump Works, Chicago, 105 doz., $9900. Noted July 15 .

Springfield, Ill.—The construction of locks at the dam in the Sangamon River is under consideration by the Council.

Watertown, Ill.—Bids will be received until 3 p.m., Aug. 16, by Frank D. Whipp, Fiscal Supv., Springfield, for laying c.-i. water mains at the Watertown State Hospital. Martin C. Schwab, Mallers Bldg., Chicago, is Consult. Engr.

+Ellsworth, Wis.—The contract has been awarded to HECTOR COOLSAET, Marshall, Minn., at $5865, for making extensions to the water system. Noted June 10 and July 22.

+West Allis, Wis. — (Official) — The contract has been awarded to HERMAN HOBONSEE, Milwaukee, at $1.04 per ft. for water pipe and $0.79 per ft. for sewer pipe. Noted Mar. 11.

Germania, Iowa—Bonds for $10,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system. M. S. Stoddard is City Clk.

+Kingsley, Iowa—(Official)—The contract has been awarded to the DES MOINES BRIDGE CO., Des Moines, at $4350, for constructing water tanks. Noted July 29.

+Ogden, Iowa—The contract has been awarded to the ALAMO ENGINE & SUPPLY CO., Omaha, Neb., at $9378, for furnishing 18,000 ft. of 4-in. water pipe and specials. Noted July 22.

Forest Lake, Minn.—An election will be held to vote on the question of issuing $20,000 in bonds, the proceeds of which will be used for the construction of a water system and storm water drains. J. F. Druar, St. Paul, is Engr.

West St. Paul, Minn.—(St. Paul post office)—An election will be held to vote on the question of issuing $35,000 in bonds, the proceeds of which will be used for the extension of the water system. J. F. Druar, St. Paul, is Engr.

Cortland, Neb.—The citizens contemplate installing a water system.

Syracuse, Neb.—Bids will be received until Aug. 19 by William Stanbro, Village Clk., for making inprovements to the water system. C. O. Martz, Lincoln, is Engr. The estimated cost is $8500. Noted June 10 and July 15.

+Watertown, S. D.—(Official)—The contract has been awarded to the AMERICAN CAST IRON PIPE CO., Birmingham, Ala., at $7875, for furnishing c.-i. pipe and castings. Other bidders were the United States Cast Iron Pipe & Foundry Co., $7925 and the Crane Co., $9425. Noted July 29.

Columbia Falls, Mont.—A franchise has been granted to James A. Talbot, according to press reports, for the construction of a water system. A. L. Jaqueth, Kalispell, is Engr.

Macon, Mo.—At a recent election the citizens voted in favor of issuing bonds for $30,000, the proceeds of which will be used for the extension of the water system and for the installation of a filtration plant. Harper & Stiles, Grand Ave. Temple, Kansas City, is Engr. Noted Dec. 10, 1914.

Heber Springs, Ark.—Plans have been prepared and accepted for the construction of water and sewer systems. The estimated cost is $80,000. Noted Feb. 18.

+Dallas, Tex.—The contract has been awarded to the NEPTUNE METER CO., 90 Worth St., New York, N. Y., at about $72,000 for furnishing water meters.

Elgin, Tex.—(Official)—Bids will soon be received for the construction of a water system, the estimated cost of which is $11,000. J. W. Thomas is City Secy. Noted July 2.

Galveston, Tex.—Bids will be received until Aug. 26 by John D. Kelley, City Secy., for furnishing and erecting an air pumping engine at the Alta Loma pumping station.

Caddo, Okla.—At a recent election the citizens voted in favor of issuing bonds for $20,000, the proceeds of which will be used for the construction of a water system.

Grand Junction, Colo.—The citizens contemplate holding a special election to vote on the question of a bond issue for $15,000, the proceeds of which will be used for the improvement of the water system. H. F. Vorbeck is Water Comr.

Pueblo, Colo.—According to press reports the Cuchavas Irrigation Co. will issue $1,200,000 in bonds, the proceeds of which will be used to complete its irrigation system. Devine & Preston, Pueblo, is Representative.

Brigham, Utah—It is reported that plans are being prepared for the construction of an irrigation system to water the beet sugar lands on the west side of Bear River for the Utah Idaho Sugar Co.

Salt Lake City, Utah—The Sand Point Irrigation Co. plans to build a pumping plant on Utah Lake. Jay Dinsmore is Mgr.

Spanish Fork, Utah—Bids will soon be received for the construction of an irrigation system to water 5000 acres of land in the Sand Point project. Jay and B. F. Dinsmore, Salt Lake City, is Arch.

+Phœnix, Ariz. — Contracts have been awarded to the PITTSBURGH-DES MOINES STEEL CO., at $3240 and to the CHARLES C. MOORE ENGINEERING CO., San Francisco, Calif., at $4475 for installing water tube boiler and steel tower and tank at the Asylum, State Prison and State House.

Hillyard, Wash.—Bonds for $6000 have been voted by the citizens, the proceeds of which will be used for the construction of a new water system. Noted July 29.

Paulsbo, Wash.—Plans are being prepared for the construction of a water system by G. N. Miller & Son, Burke Bldg., Seattle. The estimated cost is $10,000. Noted June 17.

Seattle, Wash.—Water mains will be laid in East 54th St., and in Bradner St. A. H. Dimock is City Engr.

Seattle, Wash. — Plans have been approved by the City Council for the sealing of the Cedar River impounding dam. A. H. Dimock is City Engr. Noted Apr. 22 and June 17.

Stanwood, Wash.—Plans have been prepared by the Coast Engineering Co., White Bldg., Seattle, for the construction of an auxiliary water system to furnish water for fire protection. The estimated cost is $10,000.

Halfway, Ore.—Press reports state that a permit has been granted for the use of the Makinson Spring for a municipal water supply. A plant will be constructed at an estimated cost of $20,000.

+Modesto, Calif.—The contract for the construction of a concrete flume across Dry Creek on the main canal of the Modesto Irrigation District has been awarded to ERNEST GREEN, Modesto, at $60,602.

Matheson, Ont.—Bonds for $20,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system. F. W. Rockall is Clk.

East Kildonan, Man.—A bylaw has been passed by the Municipal Council for $41,000, the proceeds of which will be used for the construction of water mains.

Regina, Sask.—Bids will be received until Sept. 6 by J. W. Mackay, Supt. of Water Wks., for furnishing and installing a 7,000,000-gal. pumping unit at the power house.

SEWERS

Boston, Mass.—Bids will be received until Aug. 13 by the Department of Public Works for the construction of sewers and drains in various streets from Yarmouth to West Newton St. Edward F. Murphy is Comr.

+Boston, Mass.—The contract for the construction of sewers in Jamaicaway, Parkton Rd., Pondway Ave., Moraine and Halifax St. has been awarded to WILLIAM L. DOLAN, at $5700.

Boston, Mass.—Bids will be received until 1:30 p.m., Aug. 18, by the Metropolitan Water and Sewerage Board for 170 tons of 84-in. diam. bell and socket c.-i. pipe and 140 tons of special c.-i. pipe ranging from 48- to 84-in. diam.

East Gardner, Mass.—(Gardner post office)—Bids will be received until Aug. 18 by the State Board of Insanity, Room 36, State House, Boston, for the construction of a sewer system at the Gardner State Colony.

Worcester, Mass.—The Sewer Department contemplates the construction of extensions to the double sewer system in the Chandler St. Section. The estimated cost is $32,600. Mathew Gault is Supt. of Sewers.

+Hartford, Conn.—The contract for the construction of sewers in Ridgefield St. and Westboune Parkway has been awarded to EDGAR T. DUNCAN, at $9982. Other bids were: O'Neil Bros., $10,451; W. T. Ryan Construction Co., $11,715; A. W. Bryne, $12,050; Joseph Manocchio, $12,264; Louis Rogers & Co., $12,266; Antonio Lambo, $12,395; C. H. Slocomb & Co., $12,586; N. C. Casciano, $12,949; Berardino & Tomassetti, $12,272.

+Wallingford, Conn.—(Official)—The contract for the construction of tile pipe sewers and for the completion of the high level sewer has been awarded to O'NEIL BROS., Hartford, at $5647. Other bids were: N. C. Cascino, Hartford, $7251; E. F. Kavanaugh, Wallingford, $7726; Thomas F. Mahr, New Haven, $9107; Berdino & Tomsetti, Meriden, $9492. Noted July 29.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received by Marcus M. Marks, Borough Pres., for the relocation and reconstruction of sewers in Rector St., from: Melrose Construction Co., $16,246; P. J. Kearn, $16,414; Lawrence Contracting Co., 2409 Walton Ave., New York, N. Y., $11,886; E. A. Mathew, $21,522; Kingsbridge Contracting Co., $14,518; U. S. Drainage & Irrigation Co., $30,221; A. Spooner & Sons, $14,130; Casperini & DeBlasio, $19,246; P. Reilly, $20,569; Paconi Contracting Co., $14,551; Briggs & McLaughlin, $16,792; E. J. Granites Co., $13,570. Noted July 29.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 2 p.m., Aug. 16, by Marcus M. Marks, Borough Pres., for the construction of sewers in Ellwood St. from Nagle to Sherman Ave.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 2 p.m., Aug. 18, by Marcus M. Marks, Borough Pres., for the alterations and improvements to the sewer in First Ave., and to the outlet sewer at Dyckman St. and the Hudson River, including the construction of a submerged outlet and screening chamber.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., Aug. 19, by Maurice E. Connolly, Borough Pres., for the construction of sewers and appurtenances in Atlantic Ave., Fourth Ward, and for the construction of inlet basins in Webster Ave., First Ward.

+New York, N. Y.—(Borough of Richmond)—(Official)—The contract for the construction of temporary sanitary sewers in Kissel, Castleton, Henderson Ave. and in Brighton Blvd. has been awarded to JOSEPH JOHNSON SONS, at $20,907. Noted July 22.

+Syracuse, N. Y.—(Official)—The contract for the construction of storm water sewers in the northeastern section of the city has been awarded to FRANK SPOSATTO, 124 Noxon St., Syracuse, at $43,804. Noted July 29.

Atlantic Highlands, N. J.—At a recent election the citizens voted to issue $25,000 in bonds. The proceeds will be used for the improvement and extension of the sewer system. Noted June 10.

+Hackensack, N. J.—The contract for the construction of a sewer system and a sewage-disposal plant has been awarded to MILLER & PIZZIMENTI, Caldwell, at $87,912. Noted July 22.

Jersey City, N. J.—Bids will be received until 4 p.m., Aug. 17, by the Board of Commissioners for the installation of a sewer system in West 12th St. William P. Lee is City Clk.

Franklin, Penn.—(Official)—No sewer work is contemplated by the city at present. Noted Aug. 5.

Wilkes-Barre, Penn.—Joseph Banks, Wilkes-Barre, at $5329, submitted the lowest bid for the construction of sewers in Cedar and Grant St. and in Lincoln Ave.

+Baltimore, Md.—The contract for the construction of an additional section of sanitary sewers has been awarded to RAYN & REILLY, at $96,483. Noted July 29.

Richmond, Va.—Charles G. Bolling, City Engr., has been authorized to prepare plans for the construction of a metropolitan sewer system in the annexed territory on the north side of the Chesapeake & Ohio R.R. tracks to Hermitage Rd.

Parkersburg, W. Va.—Bids will be received until Aug. 18 by Frank Good, City Clk., for the construction of five sewers in various streets.

Albemarle, N. C.—The City Commissioners have approved plans prepared by J. G. Spinks, City Engr., for the construction of a sewer system. Noted Mar. 25.

Ayden, N. C.—An election will be held Aug. 20 to vote on the question of issuing $15,000 in bonds. The proceeds will be used for the construction of a sewer system.

Atlanta, Ga.—An election will be held Sept. 16 to vote on the question of issuing $1,000,000 in bonds. The proceeds will be used for the construction of sewers and sewage-disposal plants. Noted Aug. 5.

Ocala, Fla.—Plans are being prepared for the construction of a sewer system by J. B. McCrary Co., Atlanta, Ga. Noted June 17.

Cloverdale, Ala.—At a recent election the citizens voted to issue $30,000 in bonds. Part of the proceeds will be used for the construction of a sewer system. Noted July 8.

★Paducah, Ky.—Bids were received Aug. 3 by the Commissioner of Public Works for the construction of the outfall sewer, District No. 3, Contract No. 1 from: Yancy & Johnson, Paducah, at $49,361, and Winston Bros., Minneapolis, Minn., at $45,834. Noted July 8.

Chardon, Ohio—Bids will be received until noon, Aug. 19, by R. S. Parks, Clk., Village Council, for the construction of a sewage treatment plant and approximately eight miles of 6- to 12-in. vitrified pipe sewers. E. A. Fiedler is Village Engr.

Cincinnati, Ohio—The lowest bid received for the construction of sewers in South Canal St. and in county property was that of Thomas Strach, 31 Goodall Bldg., Cincinnati, at $6400. Noted July 15.

Cleveland, Ohio—Bids will be received until noon, Aug. 19, by the Commissioner of Purchases and Supplies for the construction of sewers in various streets. Robert Hoffman is City Engr.

Cleveland Heights, Ohio—(Warrensville post office)—Bids will be received until Sept. 7 by H. H. Canfield, Clk., for the construction of storm and sanitary sewers in Derbyshire, Kent, Norfolk and Surrey Rd. F. A. Pease Engineering Co., 804 Marshall Bldg., Cleveland, is Engr.

Hamilton, Ohio—The lowest bid submitted for the construction of sanitary sewers was that of John L. Walker & Co., at $35,000.

Lima, Ohio—W. H. Dittoe, Ch. Engr. of the State Bd. of Health, has recommended to the City Council the establishing of a scientific sewer system and the construction of a reservoir.

+Toledo, Ohio—(Official)—The contract for the construction of local sanitary sewers in District No. 18 in Lucas County has been awarded to J. N. BICK, Toledo. Noted July 29.

Kendallville, Ind.—The City Council has retained Smith & Boulay, Consult. Engr., Toledo, Ohio, to prepare plans for the construction of a sanitary sewer system.

+Alma, Mich.—The contract for the construction of sewers in Gratiot, Woodworth and the Rockingham divisions has been awarded to THOMAS SAMPSON, Mount Pleasant, at $6090.

+Escanaba, Mich.—The contract for extending the sewer system has been awarded to JOHN F. LINSAY, Escanaba, at $33,271.

Alton, Ill.—Plans are being prepared for the construction of a sewer system and a sewage-disposal plant for the Alton State Hospital.

Berwyn, Ill.—Bids will be received until 8 p.m., Aug. 17, by the Board of Local Improvements for the construction of sewers in various streets . Oscar N. Lindahl is Secy., Bd. of Local Imp.

Evanston, Ill.—The Commissioner of Public Works is preparing plans for the construction of a sewer system in the southwesterly section of the city. The estimated cost is $324,400.

+Joliet, Ill.—(Official)—The contract for the construction of the Third Ward sewer system has been awarded to ROBERT SHANNON, 421 Pleasant St., Joliet, at $51,868. Other bids were: Curtis & Tyndall, $61,653; Monahan Bros., $57,460; Foley Construction Co., $59,053; Newkirk & Powers, $54,850; Embankment Co., $53,424. Noted July 22.

+Wenona, Ill.—(Official)—The contract for the construction of a sewer system with septic tanks has been awarded to DRISCOLL & O'BRIEN, Decatur, at $17,366. Noted July 29.

+Beaver Dam, Wis.—(Official)—The contract for the construction of sewers in various streets has been awarded to E. P. SYKER, Minneapolis, Minn. Noted July 22.

Madison, Wis.—Bids will be received until Aug. 13 by E. E. Parker, City Engr., for the construction of approximately 17,050 ft. of 20-in. c.-i. pipe sewers.

Milwaukee, Wis.—The City Council has been requested by the Sewer Commission to provide for a bond issue of $1,500,000 for the proposed sewer construction for 1916.

Neenah, Wis.—Plans are being prepared by E. L. Spencer for the construction of a sewer system.

+West Allis, Wis.—(Official)—The contract for the construction of sewers in various streets has been awarded to HERMAN HOHENSON, Milwaukee. Noted July 22.

Ames, Iowa—The Council plans to construct approximately 22,500 ft. of 8-in., 1850 ft. of 10-in. pipe sewers, 35 flush tanks and 40 manholes.

Brooklyn, Iowa—Surveys are being made and plans will be prepared for the construction of a sewer system.

+Carroll, Iowa—The contract for improving the sewage treatment plant has been awarded to the OFFERMAN CONSTRUCTION CO., South Omaha, Neb., at $13,600.

Clinton, Iowa—The lowest bid received for the construction of sewers in the Fourth Ward was that of Thomas Carey & Son, Clinton, at $27,017. J. G. Thorne is City Engr. Noted Aug. 5.

Elliott, Iowa—Preliminary surveys have been made by Theodore S. De Lay, Creston, for the construction of a sewer and drainage system.

Ft. Madison, Iowa—The City Council contemplates the construction of a sewer system in the section west of Spring Creek.

+Grinnell, Iowa—The contract for the construction of approximately one mile of storm sewers has been awarded to BASH & JANES, Joplin, Mo., at $4177.

+Laporte City, Iowa—(Official)—The contract for the construction of sewers has been awarded to BASH & JANES, Joplin, Mo., at $11,751. Other bids were: Anderson & Empie, Manhattan, $15,135; D. E. Keeler Co., Davenport, $14,176; M. S. Jackson, Cedar Rapids, $14,008; W. D. Yeager, Cedar Rapids, $14,596; Dearborn Construction Co., Waterloo, $13,520; Moore-Sieg Construction Co., Waterloo, $12,882. Noted July 29.

Mason City, Iowa—Plans are being prepared by Frederick Bass, Consult. Engr., Minneapolis, Minn., for the construction of a sewage-disposal plant of the Imhoff type. The estimated cost is $70,000.

Oskaloosa, Iowa—The city contemplates the construction of septic tanks and improving the sewage-disposal plant. The estimated cost is $10,000 H. C. Hawkins is City Engr.

+Sioux City, Iowa—The contract for the construction of the Cresent Park storm sewer has been awarded to CADY & SAVONELL.

Sandstone, Minn.—Bids will be received until Aug. 23 by C. Rudisuhe, Village Recdr., for the construction of sewers. Noted Aug. 5.

Stillwater, Minn.—Bids will be received until Aug 17 by the City Council for the construction of sewers in Churchill and South Fourth St. Lewis W. Clarke is City Engr.

+Virginia, Minn.—The contract for the construction of storm sewers has been awarded to the EVELETH CONSTRUCTION CO., Eveleth, at $27,011. Noted July 1.

Chanute, Kan.—Bids will be received until Aug. 20 by C. G. Wood, City Clk., for the construction of a sewage-disposal plant and septic tanks. Noted Apr. 22.

+Norton, Kan.—(Official)—The contract for the construction of main, intercepting and lateral sewers and a sewage-disposal plant has been awarded to the GORDON & TAYLOR CONSTRUCTION CO., Denver, Colo., at $32,821. Other bids were: T. M. Torson, Kansas City, $38,442; M. W. Holben, Attica, Ind., $32,643; W. W. Cook, Junction City, $26,002; O'Neil Construction Co., Leavenworth, $43,103. Noted July 29.

Wichita, Kan.—The contract for the construction of approximately ½ mile of storm sewers will be awarded about Sept. 1. The estimated cost is $4500. Noted July 29.

+Bridgeport, Neb.—(Official)—The contract for the construction of sewers has been awarded to C. J. BURK & SON, Kearney, at $5747. Noted July 29.

Valentine, Neb.—Bids will be received until 8 p.m., Aug. 14, by W. E. Haley, Village Clk., for the construction of sewers. The estimated cost is $5000.

+Aberdeen, S. D.—The contract for the completion of the First Ave. sewer has been awarded to the ARTHUR A. DOBSON CO., Lincoln, Neb., at $24,027.

Fargo, N. D.—Bids will be received by A. R. Watkins, City Audr., until 10 a.m., Aug. 18, for the construction of lateral sewers in District Nos. 1 and 3.

Bozeman, Mont.—Bids will be received until 5 p.m., Aug. 19, by C. A. Spieth, City Clk., for the construction of storm sewers in District Nos. 98 and 99.

+Wibaux, Mont.—The contract for the construction of a sewer system has been awarded to the HAGGERT CONSTRUCTION CO., Fargo, N. D., at $12,998. Noted July 22.

Kansas City, Mo.—The Board of Public Works has instructed the Engineering Department to prepare plans for the construction of sewers in East 27th St. Curtis Hill is City Engr.

Springfield, Mo.—At an election held Aug. 2 the citizens for the third time voted against the question of issuing $50,000 in bonds. The proceeds was to have been used for the construction of sewers and repairing the old sewers. Noted July 22.

Heber Springs, Ark.—Plans have been approved by the City Council for the construction of a sewer system and waterworks. The estimated cost is $80,000. Noted Feb. 11.

Waco, Tex.—An election will soon be held to vote on the question of issuing $60,000 in bonds, the proceeds of which will be used for the construction of a sewage-disposal plant. Henry G. Elrod, Dallas, is Engr.

Colorado Springs, Colo.—The city contemplates the construction of a conduit in 17th St. to carry off the flood waters in West Colorado Springs. The estimated cost is $30,000.

Seattle, Wash.—Plans have been approved by the Board of Public Works for the construction of sewers in Sixth Ave., N. W. The estimated cost is $90,000. L. B. Young is Chn. of Bd. of Pub. Wks.

Enterprise, Ore.—The City Council has passed an ordinance providing for the construction of lateral sewers estimated to cost $25,000. Noted July 29.

✚Portland, Ore.—The contract for the construction of sewers in East Alder St. from East Second St. to the harbor line has been awarded to the ALEXIS CONTRACT CO., Portland, at $21,106. Noted Aug. 5.

✚Los Angeles, Calif.—(Official)—The contract for the construction of sewers in Temple St. from Oxford Ave. to Kingsley Drive and in other streets has been awarded to J. CHUTUK, Los Angeles, at $39,118. Other bids were: Peter S. Tomich, $40,500; Peter Janicich, $44,300; Zarubica & Wusetich, $45,879; John Radich, $48,500; Waltoon & Spicer, $42,000; James Kennedy, $42,588; Charles Chutuh, $47,575; John Sutals, $53,400; Paic H. Howland, $64,473. Noted July 29.

✚Sacramento, Calif.—The contract for the construction of Unit No. 6 of the sewer system has been awarded to A. TEICHERT & SON, at $71,476.

Sausalito, Calif.—Bids will soon be received by the Board of Trustees for the installation of a sewer system for the South Side. The estimated cost is $12,500.

Elmira, Ont.—H. J. Bowman, Court House, Berlin, Ont., is preparing plans for the construction of a sewer system. The estimated cost is $30,000.

Matheson, Ont.—The city contemplates the construction of a sewer system. F. W. Rockall is City Clk.

Mimico, Ont.—Plans are being prepared for the construction of a sewage-disposal plant and a pumping station. The estimated cost is $50,000.

Toronto, Ont.—Bids will be received until noon, Aug. 17, by T. L. Church, Chn., Bd. of Control, for the construction of sewers in Catfish Pond.

Toronton, Ont.—Charles J. Hastings, Medical Health Officer, and R. C. Harris, Comr. of Pub. Wks., have, after a thorough investigation of the sewer system, reported that all experiments for the improvement of the existing system are without results. They recommend the installation of Imhoff tanks which will cost $600,000, or if installed without the sprinklers will cost approximately $328,700.

GARBAGE

Ottawa, Ont.—Bids will be received until Aug. 26 by the Secretary of the Board of Control for the construction of an incinerator.

✚Transcona, Man.—The contract has been awarded to the IDEAL INCINERATOR CO., at $18,875, for constructing an incinerator.

STREETS AND ROADS

Portland, Maine—Bids will be received until noon, Aug. 13, by the Commissioner of Public Works for paving Auburn St. with bituminous macadam or concrete.

✚Beverly, Mass.—The contract for repaving Rantoul St. from Bow to Chestnut St. has been awarded to M. McDONOUGH, Swampscott, at $40,000. Noted July 29.

✚Boston, Mass.—Contracts have been awarded for constructing 5300 lin.ft. of road in Ashburnham to the ALCO CONSTRUCTION CO., Boston, at $8169 and 5300 lin.ft. of road in Chelmsford to J. E. WATKINS, Amesbury, at $12,094. Noted July 29.

✚Hartford, Conn.—A contract has been awarded by the State Highway Commissioner for the construction of about 14,960 lin.ft. of graded road in Ashford Township to the CONNECTICUT GOOD ROADS & CONSTRUCTION CO., New Britain, at approximately $21,765.

★Albany, N. Y.—(Official)—Bids will be received until 1 p.m., Aug. 24, by Edwin Duffey, State Highway Comr., for repairing and constructing highways in various counties.

★Albany, N. Y.—(Official)—Bids will be received until 1 p.m., Aug. 26, by Edwin Duffey, State Highway Comr., for improving and constructing highways in various counties.

✚★Albany, N. Y.—(Official)—Contracts have been awarded for constructing Road No. 5498, Cornwall-West Point Rd., Parts 1 and 2, Orange County, 4.03 miles to the JOHN L. HAYES CONSTRUCTION CO., Yonkers, $273,737; Road No. 5573, Cornwall-West Point Rd., Part 3, Orange County, 1.17 miles to NORDONE & PETRILLI, Mt. Vernon, $13,342. Noted July 29.

★Albany, N. Y.—(Official)—Bids were received Aug. 3 by Edwin Duffey, State Highway Comr., for repair highways in various counties as follows:

Repair Contract No. 825, Broome County, 1.76 miles: Charles E. Haney, Camillus, $12,690; Port Jervis Construction Co., Port Jervis, $13,386.

Repair Contract No. 820, Chemung County, 2.33 miles: Frank K. Liberatore, Elmira, $12,198; John C. Bradley, Corning, $13,532; Charles E. Haney, Camillus, $13,528; McGreevey, McGuigan & Baum Construction Co., Elmira, $13,620; Kennedy Construction Co., Albany, $13,698; Peter F. Connolly Co., Horseheads, $14,245; J. W. Brennan Construction Co. Inc., Geneva, $14,929; F. L. Breese Construction Co., Elmira, $15,246; Clyde Construction Co., Albany, $14,303; E. Styring, Syracuse, $15,347.

Repair Contract No. 830, Chenango County, 3.55 miles: Smith & Stoll, Port Crane, $13,391; Paddleford & King, Sherburne, $14,441; Charles E. Haney, Camillus, $14,614; Nash & Griffin, Norwich, $14,951; Ruddy-Saunders Construction Co., Troy, $16,090.

Repair Contract No. 822, Clinton County, 1.99 miles: James Conway, Plattsburgh, $7806; A. Florentine & Son, Plattsburgh, $7863; Richard Hopkins, Troy, $7972; L. S. Derossia & Co., Massena, $7989; Gruner & Hallenbeck, Harriman, $8542.

Repair Contract No. 816, Columbia County, 9.26 miles: Olin T. Benedict, Pittsfield, Mass., $15,426; Crowe & Walsh, Pittsfield, Mass., $16,499; William Doyle, Saugerties, $16,833; Marks Kearney, Hudson, $16,868; Faille & Shackett, Troy, $17,033; Thomas H. Karr, Troy, $17,284; James J. Rigney, Rensselær, $18,032.

Repair Contract No. 834, Dutchess County, 4.12 miles: Henry Clinton, Poughkeepsie, $12,950; Thomas H. Karr, Troy, $14,495; Conway Bros. & Kennedy, Eddyville, $14,793; Tri-County Construction Corp., Mt. Vernon, $14,794; Ruddy-Saunders Construction Co., Troy, $14,850; William Doyle, Saugerties, $14,870; Abner M. Harper, Inc., Newburgh, $14,900; Thomas J. Martin, Beacon, $14,974; Belmar Contracting Co., Inc., Troy, $17,140.

Repair Contract No. 827, Putnam and Dutchess Counties, 13.47 miles: Thomas H. Karr, Troy, $9939; R. B. Strang, Cold Springs, $9995; Edward Hartney, Modena, $10,721; William Doyle, Saugerties, $10,757; Thomas J. Martin, Beacon, $10,977; Amos D. Bridges Sons, Inc., Hazardville, Conn., $12,082.

Repair Contract No. 828, Erie County, 0.87 mile: Union Paving Co., Schenectady, $13,503; Langan Construction Corporation, Albany, $13,594; J. F. Driscoll, Buffalo, $15,252; Henry P. Burgard Co., Buffalo, $17,577.

Repair Contract No. 819, Herkimer County, 5.46 miles: R. D. Cooper, Little Falls, $6715; Richard Hopkins, Troy, $7482; Newport Construction Co., Herkimer, $7852.

Repair Contract No. 637, Monroe County, 0.56 mile: Crouch Bros., Rochester, $12,377; Whitmore, Rauber & Vicinus, Rochester, $12,412; Morrison & Quinn, Inc., Rochester, $12,867; I. M. Ludington Sons, Inc., Rochester, $13,455; Shaw & Lakin, Jamestown, $14,205.

Repair Contract No. 817, Montgomery County, 10.91 miles: Charles Scott, Fort Plain, $4004; Nash & Griffin, Norwich, $4248; John P. Dugan & Co., Amsterdam, $4400; Richard Hopkins, Troy, $4486; Huntoon & Ferguson, Hudson Falls, $4506; Clarence Welsh & Co., Gloversville, $4694; Headley Good Roads Co., Philadelphia, Penn., $4973; William G. Fox, Saratoga Springs, $5170.

Repair Contract No. 823, Otsego County, 1.88 miles: Newport Construction Co., Herkimer, $19,192; Fulton Engineering Co., Inc., Albany, $19,992; Michael O'Brien, Cortland, $20,595; John H. Gordon, Albany, $21,335; Nash & Griffin, Norwich, $21,496; W. E. Bennett, Lanesboro, $21,500; William G. Fox, Saratoga Springs, $21,653; Belmar Contracting Co., Inc., Troy, $21,795; L. F. Bannon Plumbing, Heating & Contracting Co., Kingston, $21,878; Sherman Contracting Co., Inc., Oneonta, $21,994; Newman Concrete Road Co., Athens, Penn., $22,255; R. D. Cooper, Little Falls, $24,190.

Repair Contract No. 818, St. Lawrence County, 5.5 miles: Orlando Beede, Keene Valley, $26,145; Weed & Walsh, Mechanicville, $26,578; Arthur F. McConville, Ogdensburg, $27,865; Richard Hopkins, Troy, $29,128; Thomas Grady, Rochester, $29,632; L. S. DeRossia & Co., Massena, $29,668; Rock-Griffin Co., Massena, $33,186.

Repair Contract No. 815, St. Lawrence County, 19.32 miles: Clarence E. Walker, Troy, $3344; Atlantic Refining Co., Philadelphia, Penn., $3736; Richard Hopkins, Troy, $3756; Pathfinder Construction Co., Inc., Fulton, $3880; Harry W. Roberts & Co., Utica, $3880; Nash & Griffin, Norwich, $3921; John M. Hackett, Dunkirk, $4128; Rock-Griffin Co., Massena, $4128; American Car Sprinkler Co., Worcester, Mass., $4382; P. J. Kennedy, Brasie Corners, $4952.

Repair Contract No. 814, St. Lawrence County, 15.88 miles: Clarence E. Walker, Troy, $2662; Pathfinder Construction Co., Inc., Fulton, $2739; Richard Hopkins, Troy, $2739; Atlantic Refining Co., Philadelphia, Penn., $2754; Harry W. Roberts & Co., Utica, $2860; Nash & Griffin, Norwich, $3043; Rock-Griffin Co., Massena, $3043.

Repair Contract No. 824, Schoharie County, 0.104 mile: J. J. Malloy, Schenectady, $2149; H. A. Knapp, Delmar, $2281; W. J. Cowhig, Albany, $2284; William R. Kimmey, Albany, $2284; Huntoon & Ferguson, Hudson Falls, $2340; S. B. Easton, Albany, $2368; Belmar Contracting Co., Inc., Troy, $2392; Michael O'Brien, Cortland, $2394; Chas. Rose & Son, Cobleskill, $2457.

Repair Contract No. 832, Steuben County, 1.14 miles: Charles E. Haney, Camillus, $6314; Kennedy Construction Co., Albany, $6334; McGreevey, McGuigan & Baum Construction Co., Elmira, $6504; Sweeney & Boland, Rochester, $6782; Peter F. Connolly Co., Horseheads, $7026; Greenfield Construction Co., Hornell, $7145; Clyde Construction Co., Albany, $7287; E. Styring, Syracuse, $7447.

Repair Contract No. 831, Sullivan County, 2 miles: Armstrong & Trowbridge, Roscoe, $12,984; Ruddy-Saunders Construction Co., Troy, $13,343; Port Jervis Construction Co., Port Jervis, $13,470; John A. Jova, Inc., Newburgh, $14,514.

Repair Contract No. 833, Tompkins County, 17.10 miles: Richard Hopkins, Troy, $7637; William Hasard, Trumansburg, $8989; John H. Gordon, Albany, $9204; Nash & Griffin, Norwich, $9387; Headley Good Roads Co., Philadelphia, $9428; E. Styring, Syracuse, $10,226; Patrick D. Conley, Ithaca, $10,244; Peter F. Connolly Co., Horseheads, $10,605.

Repair Contract No. 835, Warren County, 14.37 miles: Defiance Corporation, Ticonderoga, $5046; Kellogg & Boynton, Keeseville, $5138; Huntoon & Ferguson, Hudson Falls, $5139; William G. Fox, Saratoga Springs, $5706.

Repair Contract No. 821, Westchester County, 2.22 miles: Delta Contracting Co., Inc., Jamaica, $3996; Tri-County Construction Corporation, Mt. Vernon, $4104; Thomas H. Karr, Troy, $4198; William Doyle, Saugerties, $4287; Miguel L. Hauck, White Plains, $4440; Frank G. Fowler Construction Co., Mt. Kisco, $4508; White & Colligan, Purchase, $4347.

Repair Contract No. 826, Westchester County, 0.54 mile: Tri-County Construction Corporation, Mt. Vernon, $3454; Thomas H. Karr, Troy, $3494; White & Colligan, Purchase, $3744; Delta Contracting Co., Inc., Jamaica, $3779; Frank G. Fowler Construction Co., Mt. Kisco, $3629; William Doyle, Saugerties, $3924; Miguel L. Hauck, White Plains, $4023.

✚Lockport, N. Y.—The contract for constructing 1.91 miles of the Shawnee Rd. has been awarded to the STAINTHORPE CO., Lockport, at $20,000.

New York, N. Y.—(Borough of Bronx)—(Official)—Bids were received Aug. 3 by Douglas Mathewson, Borough Pres., for improving Victor St. from Van Nest to Rhinelander Ave., as follows: J. Di Menna, $8301; Burnside Contracting Co., $8024; Frank C. Rose, $8252; Thomas Tenore, $7740; Fred Sneider, $8423; P. Costello, $9845; De Minna & De Blasic, $8109; W. H. Callahan & Son, $8028; Delson Contracting Co., $8677; S. Amanna & Sullivan, $8995; Briggs & McLoughlin, $9893; Joseph Gallick, $9036. Noted July 29.

✚New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for regulating, grading, curbing and laying sidewalks on 81st St. from 19th to 21st Ave. has been awarded to M. PACONI, at $5002. Noted July 15 and 29.

✚New York, N. Y.—(Borough of Brooklyn)—(Official)—Contracts for improving Skillman St. from Park to Myrtle Ave., Myrtle Ave. from Franklin to Nostrand Ave., Nostrand Ave. from Stockton St. to 75 ft. south of Willoughby Ave. and Vernon Ave. from Nostrand to Marcy Ave. has been awarded to the BOROUGH ASPHALT CO., $26,519. Noted July 22 and Aug. 5.

✚New York, N. Y.—(Borough of Brooklyn)—(Official)—Contracts for improving East Ninth St. from Ave. O to Ave. Q, East 19th St. from Ave. L to Ave. M and East 39th St. from Ave. I to Ave. K. have been awarded to the BROOKLYN ALCATRAZ ASPHALT CO., 407 Hamilton Ave., Brooklyn, at $11,779, $4428 and $8974 respectively. Noted July 29.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 11 a.m., Aug. 18, by L. H. Pounds, Borough Pres., for regulating, grading, curbing and laying sidewalks on various streets.

✚New York, N. Y.—(Borough of Manhattan)—(Official)—Contracts have been awarded for improving 68th St. from Park to Fifth Ave. to the ASPHALT CONSTRUCTION CO., $7098; 100th St. from Central Park West to Amsterdam Ave. to the SICILIAN ASPHALT CO., $35,642; 100th St., from West End Ave. to Riverside Drive to the AZTEC ASPHALT CO., $4036; Riverside Drive from 177th to 181st St. to P. J. DUFFY, $6043. Noted July 22.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., Aug. 19, by Maurice E. Connolly, Borough Pres., for improving Grand St. from the main line of the Long Island R.R. to Hoffman Blvd.

New York, N. Y.—(Borough of Richmond)—(Official)—Bids will be received until noon, Aug. 17, by Calvin D. Van Name, Borough Pres., for constructing concrete sidewalks on both sides of Guyon Ave., from the Staten Island Ry. tracks to Mill Rd.

✚Niagara Falls, N. Y.—A contract for constructing about 500,000 sq.ft. concrete sidewalks has been awarded to THOMAS McPHERSON, Niagara Falls, at $0.115 per sq.ft.

Bayonne, N. J.—Bids will be received until Aug. 17 for paving a number of streets with asphalt.

★Elizabeth, N. J.—(Official)—Bids will be received until 3 p.m., Aug. 26, by Thomas E. Collins, City Engr., for resurfacing telford streets with 26,000 sq.yd. of asphalt concrete, and also for 8600 sq.yd. of new granite block pavement on a 6-in. concrete foundation.

Irvington, N. J.—Bids will be received until 2 p.m., Aug. 23, by the Board of Chosen Freeholders of Essex County, Newark, for improving Lyon Ave.

Jersey City, N. J.—Bonds for $250,000 have been sold, the proceeds of which will be used for improving the Newark Turnpike.

✚Newark, N. J.—The contract for paving South Orange Ave. with asphalt block has been awarded to RALPH SANGIOVANNI, at $27,826. Noted July 8 and 22.

New Brunswick, N. J.—Bids will be received until 2:30 p.m., Aug. 23, by the Board of Chosen Freeholders of Middlesex County for constructing the South Amboy-Keyport Rd., from the South Amboy City line to the Monmouth County line, in two sections: from South Amboy line to Morgan Station, with vitrified brick on concrete base; Morgan Station to Monmouth County line, bituminous concrete on old macadam base. Alvin B. Fox, Perth Amboy, is County Engr.

✚Weehawken, N. J.—The contract for improving Columbia Terrace by paving with asphalt block has been awarded to the CLINTON CONTRACTING CO., West Hoboken, at $9414. Noted July 15.

✚West New York, N. J.—Contracts have been awarded for paving 13th St. to HORNUNG & BLAIR, and Adams St. to PATRICK CURTIN.

✚Philadelphia, Penn.—Contracts have been awarded for paving as follows: Fairmount Ave., with asphalt, UNION PAVING & CONSTRUCTION CO., Thirteenth and Locust St., $40,939; Pasayunk Ave., with wood block, EDWIN H. Vare, Lincoln Bldg., $98,004; Fourth and Fifth St., with wood block, to McNICHOL PAVING & CONSTRUCTION CO., 1923 Cherry St., at $9874 and $10,147 respectively.

Georgetown, Del.—The contract for constructing 20 miles of concrete road from Georgetown to Shelbyville will soon be awarded. Charles Upham is Engr.

✚Baltimore, Md.—The contract for paving Hillen, Gold and East St. has been awarded to P. FLANIGAN & SONS, at $34,447.

Bel Air, Md.—(Official)—Bids will be received until noon, Aug. 16, by the Commissioners of Harford County for constructing a section of State Aid road in Harford County, about 1.3 miles. W. A. Wheeler is Clk. of the Comrs.

Hagerstown, Md.—(Official)—Bids will be received until noon, Aug. 17, by the Commissioners of Washington County for constructing a section of State Aid highway in Washington County. Barry M. Hartle is Clk.

✚Havre de Grace, Md.—According to press reports, the City Council has awarded a contract to the BALTIMORE BLOCK & TILE CO., at $4895, for paving a number of streets.

Princess Anne, Md.—(Official)—Bids will be received by the Commissioners of Somerset County until noon, Sept. 7, for constructing 2.01 miles of State Aid highway in Somerset County.

Independence, Va.—The Commissioners of Grayson County contemplate constructing 80 miles of road, at an estimated cost of $150,000.

✚Broad Oaks, W. Va.—(Clarksburg post office)—(Official)—The contract for grading, curbing and paving with brick on concrete base Bridge, Point, Harrison, Marshall, Main and Daisy St. and Buckhannon Pike has been awarded to CHARLES K. HOYT, Washington, D. C., at $32,322. Other bids were: Todd & Baker, $32,650; C. Kennedy & Sons, $32,866; Wayne Allen, $33,353; Keeley Bros., $34,895; Hoiner & Hoiner, $35,478. Noted June 24 and July 15.

Hinton, W. Va.—An election will be held Aug. 23 in Talcott District, Summers County, for the purpose of voting on the question of issuing $100,000 in bonds. Part of the proceeds will be used for constructing roads.

Bainbridge, Ga.—The Commissioners of Decatur County contemplate the construction of 100 miles of road, the estimated cost of which is $10,000.

Leesburg, Ga.—The Commissioners of Lee County plan to construct 15 miles of road. Bonds for the purpose were voted. Noted July 29.

Pinellas Park, Fla.—All bids received July 6 for paving various streets have been rejected. Noted July 1.

Cloverdale, Ala.—At a recent election the citizens voted in favor of issuing $30,000 in bonds, part of the proceeds of which will be used for improving streets.

✚Huntsville, Ala.—The City Commissioners have awarded the contract to the GULF PAVING CO., Chattanooga, Tenn., for paving West Clinton St.

Edwards, Miss.—At a recent election the citizens voted in favor of issuing $15,000 in bonds, the proceeds of which will be used for improving roads.

Jackson, Miss.—The citizens of the Second District of Hinds County voted in favor of issuing $15,000 in bonds, the proceeds of which will be used for constructing roads.

Hornbeck, La.—A special election will be held Aug. 17 to vote on the question of issuing $35,000 in bonds, the proceeds of which will be used for constructing roads in Sabine Parish Rd., District No. 3.

✚New Orleans, La.—(Official)—The contract for constructing a highway from the Rigolets to Chef Menteur has been awarded to A. G. THOMAS, New Orleans. Noted July 15 and Aug. 5.

Elizabethton, Tenn.—Press reports state that an election will be held Aug. 16 to vote on the question of issuing $365,000 in bonds, the proceeds of which will be used for constructing and improving roads in Carter County. Noted June 24.

Memphis, Tenn.—The City will pave South Main St. from Linden to Calhoun Ave. with wood block. J. H. Weatherford is City Engr.

Rutledge, Tenn.—Press reports state the Grainger County Court contemplates holding an election for the purpose of voting on the question of issuing $200,000 in bonds, the proceeds of which will be used for constructing roads.

Carrollton, Ky.—At an election held Aug. 5 the citizens voted in favor of issuing $50,000 in bonds, the proceeds of which will be used for the construction of roads.

Lexington, Ky.—An election will be held Sept. 30 to vote on the question of issuing $300,000 in bonds, the proceeds of which will be used for road construction in Fayette County.

✚Louisville, Ky.—The contract for improving 34th St. north of Broadway has been awarded to the AMERICAN STANDARD ASPHALT CO., at $28,500.

✚Pineville, Ky.—A contract for grading six miles of road from Pineville to Calvin has been awarded to GREEN, VANDEVER & PURSIFULL, Pineville.

Winchester, Ky.—The Commissioners of Clark County plan the reconstruction of two miles of road under State-Aid law. The approximate cost of the work is $28,000.

✚Cincinnati, Ohio—Contracts have been awarded for paving a portion of Marshall Ave. with macadam to C. W. DANENHOWER, at $11,428; Herbert Ave. with macadam to HENKEL & SULLIVAN, at $5550.

Columbus, Ohio—(Official)—Bids will be received until noon, Aug. 27, by the Board of Trustees of the Ohio State University for constructing the roadway in Neil Ave.

✚Columbus, Ohio—Contracts have been awarded by Clinton Cowen, State Highway Comr., for improving a number of highways in various counties, as follows: Belmont County, Section M, Barnesville-Hendrysburg Rd., 2.56 miles of brick to the OHIO VALLEY CONSTRUCTION CO., Cincinnati, $55,997. Licking County, Columbus-Millersburg Rd., 2.71 miles of water-bound macadam to LAMB & McNEAL, Thornville, $24,800. Lorain County, Section D, Milan-Elyria Rd., 4.4 miles of waterbound macadam to KNEPPER, BURR & JACOBS, Tiffin, $28,500. Shelby County, Section C, Sidney-Wapakoneta Rd., 2.75 miles of waterbound macadam to JOHN F. HIPSKIND, Richmond, $26,800. Trumbull County, Section P, Youngstown-Sharon Rd., 3.84 miles of bituminous macadam to EVANS & WALTERS, Hubbard, $37,973. Noted Aug. 5.

✚Dayton, Ohio—The contract for paving King and Church St. with trinidad lake asphalt has been awarded to the ANDREWS ASPHALT PAVING CO., Hamilton, at $42,340.

Dayton, Ohio—(Official)—Bids will be received until noon, Aug. 13, by James E. Barlow, Dir. Pub. Ser., for paving Grand Ave. with brick.

✚Martins Ferry, Ohio—The contract for paving Adams St. from Broadway to Virginia St., Eighth St. from Hanover to Walnut St. and Catawba St. from Fayette to Vine St. has been awarded to ARCHER & SHAMMFELT, Bellaire.

Shaker Heights, Ohio—(Cleveland post office)—(Official)—Bids will be received until noon, Sept. 7, by C. A. Palmer, Village Clk., for improving Manchester Rd. from Coventry Rd. to South Woodland Rd. by grading, draining, curbing and paving with brick, concrete, asphalt or bituminous macadam and constructing sidewalks.

✚Toledo, Ohio—Contracts have been awarded for paving Garnet St. to the ASPHALT BLOCK CO., $5189; Lennox St., North Richardson Drive, Cherry St., to the PETERS BROS., $8046; Miami St. to HARRIS & TANSEY, $15,525.

✚West Alexandria, Ohio—The contract for paving Dayton and Main St. with brick on a 6-in. concrete foundation has been awarded to STROCTBECK BROS., Middletown, at $29,819.

✚Auburn, Ind.—A contract for constructing a road on the Spencer-Concord Township line, De Kalb County, has been awarded to N. B. PERTMAN, Marion, at $19,897.

✚Greenfield, Ind.—(Official)—A contract for constructing a gravel road in Center and Jackson Townships has been awarded to EVERETT McMAHAN, Fortville, Ind., at $7979.

✚Jeffersonville, Ind.—A contract for building a road in Oregon Township has been awarded to WORLE & PASS, Sellersburg, Ind.

✚Winchester, Ind.—A contract for constructing a road in Greene Township has been awarded to J. L. SINK, Bryant, at $12,296.

Deerfield, Mich.—(Official)—Bids will be received until Aug. 19 by Heman A. Pool, Township Clk., for constructing 12.5 miles of macadam road. Clarence Munson, Deerfield, is Township Highway Comr. Coleman & Tyler, Detroit, is Engr.

Howell, Mich.—Bids will be received until Aug. 17 by Lyle J. Pettibone, City Clk., for paving a portion of Grand River St. George Champs, Toledo, Ohio, is Engr.

Saginaw, Mich.—The City Council contemplates an expenditure of $150,000 for street pavement.

Joliet, Ill.—Bids will soon be received for paving Raynor Ave. from West Jefferson to Granite St. with asphaltic concrete. The estimated cost of the work is $20,000.

Woodstock, Ill.—(Official)—Bids will be received until 1 p.m., Aug. 14, by the Board of Local Improvements for constructing concrete pavements on Newell St., Madison St. and McHenry Ave. A. J. Olson is Pres. of the Bd.

✚Glenwood, Iowa—A contract for improving certain streets has been awarded to SAMUEL FRIEDMAN, Omaha, at approximately $20,000.

✚Mason City, Iowa—A contract for laying 16,000 sq.yd. of pavement and constructing 5500 lin.ft. of curb has been awarded to the BRYANT ASPHALT PAVING CO., Waterloo.

Shakopee, Minn.—Bids will be received until 11 a.m., Aug. 23, by A. J. Mayer, Audr. of Scott County, for improving State Road No. 13, at an estimated cost of $14,000.

✚Ft. Scott, Kan.—(Official)—A contract for paving three miles of the Coleman Rd. with macadam has been awarded to C. A. SIMONS, Ft. Scott, at $9490. Other bids were: Coe & Emmerson, Ft. Scott, $9675; A. L. Cook, Ottawa, $9491. Noted July 8.

Newton, Kan.—Bids will soon be received for paving portions of First, South, Second, South Main and North Main St.

Olathe, Kan.—Bids will be received until Sept. 8 for improving 52nd St. W. J. Moore is County Clk.

Lincoln, Neb.—(Official)—Bids will be received until 2 p.m., Aug. 18, by H. E. Wells, County Clk., for paving in District No. 8.

Omaha, Neb.—Bids will soon be received for paving portions of 38th St. with asphalt, Hickory St. with brick and Hickory, 34th, Francis, Ninth and Miami St. and Frontenelle Blvd. with concrete.

Bozeman, Mont.—Press reports state that bids will be received by C. A. Spieth, City Clk., for grading, curbing and paving in District No. 104.

✚Lewistown, Mont.—Contracts for paving in Special Improvement District No. 22 has been awarded to J. C. McGUIRE, at $8418, for concrete and at $10,427 for brick.

✚De Soto, Mo.—The contract for reconstructing and improving parts of the Bonne Terre-De Soto Rd. has been awarded to the DE SOTO CONSTRUCTION CO., De Soto, at $10,240.

Excelsior Springs, Mo.—A special election will soon be held to vote on the question of issuing $150,000 in bonds, the proceeds of which will be used for constructing rock roads within a radius of 10 miles of Excelsior Springs.

✚Kansas City, Mo.—A contract for paving 7450 sq.yd. of Cleveland Ave. from 31st to 35th St. with concrete has been awarded to the A. JAICKS PAVING CO., 510 American Bank Bldg., at $6258. Other bids were: E. F. Wilcox, 424 Dwight Bldg., $6258; Brown Bros., 11th and Muncie Blvd., Kansas City, Kan., $6301; F. P. McCormick, $6481; Kennedy Bros., 710 Midland Bldg., $6630; A. R. Mense, 4126 Norledge Pl., $6779; J. C. Lyle, 609 Grand Ave. Temple Bldg., $7156; James O'Connor & Son, 8000 East 11th St., $7156; M. J. Stack & Co., $7215; Cleveland Trinidad Paving Co., 1927 Vine St., $7599.

Maryville, Mo.—An election will be held Aug. 23 to vote on the question of issuing $35,000 in bonds. Part of the proceeds will be used for constructing roads.

✚Conway, Ark.—A contract for constructing 5500 yd. of concrete pavement in District No. 2 has been awarded to HOLTER & McCULLOUGH, Conway, at $4551.

Perryville, Ark.—The Commissioners of Perry County contemplate the construction of 30 miles of road, at an estimated cost of $90,000.

Russellville, Ark.—At a recent election the citizens of Road Improvement District No. 1 voted in favor of issuing $150,000 in bonds, the proceeds of which will be used for constructing a macadam road from Russellville to Hector.

✚Russellville, Ark.—A contract for constructing 26 miles of macadam road in Road District No. 1 has been awarded to W. C. JUCKSCH, Little Rock, at $100,000.

Houston, Tex.—(Official)—Bids will be received until 10 a.m., Aug. 16, by the Commissioners of Harris County for resurfacing the Wallisville Rd. from Cushing Ave. to Hunting Bayou.

Lampasas, Tex.—The City Council will construct about eight miles of concrete sidewalks.

Livingston, Tex.—At a recent election the citizens voted in favor of issuing $17,000 in bonds, the proceeds of which will be used for street improvements.

Port Lavaca, Tex.—At a recent election the citizens voted in favor of issuing $17,000 in bonds, the proceeds of which will be used for improving streets. Noted July 15.

Temple, Tex.—The City Council contemplates an expenditure of $200,000 for street paving.

Woodville, Tex.—An election will be held Aug. 28 to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for constructing and improving roads in Road District No. 1.

Eufaula, Okla.—An election will be held Aug. 20 to vote on the question of issuing $25,000 in bonds, the proceeds of which will be used for constructing roads.

Deming, N. M.—An election will be held Sept. 14 to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for constructing highways.

✚Port Angeles, Wash.—A contract for grading and constructing concrete sidewalks in the eastern part of the city has been awarded to ANTONIO DELGUZZO and C. W. COIT, at $95,805.

✚Seattle, Wash.—The contract for improving Permanent Highway No. 11 has been awarded to the ALBIEN ENGINEERING CO., American Bank Bldg., Seattle, at $40,328.

Hillsborough, Calif.—At a special election the citizens voted in favor of issuing $40,000 in bonds, the proceeds of which will be used for street improvements.

Los Angeles, Calif.—Press reports state that the City Council plans to pave Pacific Ave.

✚Sacramento, Calif.—The City Commission has awarded a contract for street paving to the CLARK-HENERY CONSTRUCTION CO., at $10,000.

✚San Francisco, Calif.—The Board of Public Works has awarded a contract for the paving of Vermont St. from 17th to Mariposa St., to FLINN & TREACY, at $7204.

Santa Barbara, Calif.—Press reports state an election will be held in Santa Barbara County, Aug. 30, to vote on the question of issuing $893,000 and $95,000 in bonds, the proceeds of which will be used for road improvements and constructing the Cuyuna Rd. respectively.

INDUSTRIAL WORKS

Boston, Mass.—Bids are being received for the construction of a $40,000 ice storage building for the Boston Ice Co. Mortensen & Co., 405 Lexington Ave., New York, N. Y., is Arch. and Engr.

Brockton, Mass.—The Diamond Shoe Co. plans the construction of a four-story, 40x175-ft. factory on Spark St., to cost $15,000. W. F. Barlow, 80 North Main St., is Arch.

✚Greendale, Mass.—(Worcester post office)—The FISKE-CARTER CONSTRUCTION CO., 11 Foster St., has been awarded the contract for the construction of a one-story, 160x200-ft., brick and reinforced-concrete factory on New Bond St. for the Heald Machine Co. Lockwood, Green & Co., 60 Federal St., Boston, Mass., is Engr.

✚Holyoke, Mass.—The contract for the construction of an addition to the plant of the American Writing Paper Co., Main St., has been awarded to the CASPER-RANGER CONSTRUCTION CO.

Lowell, Mass.—The Wamesit Power Co. will build a 173x185-ft. reinforced-concrete garage at Watson and Whipple St. The estimated cost is $12,000.

Lowell, Mass.—The Waterhead Mills, Lawrence St., will build a four-story, 52x83-ft. addition to its plant to cost $20,000.

✚Springfield, Mass.—FRED T. LEY CO. has been awarded the contract for the construction of a one-story brick and steel storehouse for the New England Westinghouse Co. The estimated cost is $37,000.

✚Springfield, Mass.—The Somers Creamery Co. has awarded the contract for the construction of a two-story brick plant on Locust St. to E. F. CARLSON, 106 Granada Terrace. The estimated cost is $70,000. B. E. Geckler, 335 St. James Ave., is Arch.

Bridgeport, Conn.—The Lake Torpedo Boat Co. has purchased a 22-acre site and plans the construction of a plant for the manufacture of submarines.

Bridgeport, Conn.—The Bridgeport Brass Co. plans the construction of a one-story addition to its plant to cost approximately $70,000.

✚Hartford, Conn.—A. L. HILLS, 847 Main St., has been awarded the contract for the construction of a four-and-one-half-story, 83x129-ft. brick storehouse on Main near Windsor St. for Garber Bros., Pleasant St. George Zunner is Arch. The estimated cost is $30,000. Noted Mar. 25.

New Haven, Conn.—(Official)—Bids will be received until Sept. 1 by R. W. Foote, Arch., 424 Chamber of Commerce Bldg., for the construction of a three-story, 60x75-ft. brick and steel garage for Cowles Tolman. Noted Aug. 5.

Buffalo, N. Y.—Revised bids are being received for the construction of a three-story, 30x150-ft. storehouse for Adam J. Menges, 224 Washington Market. Joseph J. Geigand, 346 Herman St., is Arch. The estimated cost is $12,000. Noted July 1.

✚New York, N. Y.—(Borough of Brooklyn)—THE NATIONAL BRIDGE WORKS, 1123 Broadway (Borough of Manhattan), has been awarded the contract for the construction of a one-story, 100x150-ft. reclaiming plant for the By-Products Reclaiming Co., 129 Front St. The estimated cost is $10,000.

+Niagara Falls, N. Y.—The MONARCH ENGINEERING CO., Chamber of Commerce Bldg., Buffalo, N. Y., has been awarded the contract for the construction of storage bins for the Shredded Wheat Co. The estimated cost is $20,000.

+North Tonawanda, N. Y.—The Buffalo Bolt Co. has awarded the contract for the construction of additions to its plant at Oliver St. and the New York Central and Erie R.R. tracks, to MORRIS & ALLEN, Builders Exchange, Buffalo, N. Y. The estimated cost is $250,000.

Peekskill, N. Y.—Bids were received for the construction of a storage house at the State Camp, as follows: Wiberley & Baxter, Peekskill, $22,896; F. E. Young, Syracuse, $25,588; James C. Nolan, Albany, $23,940; Alba Building Co., Albany, $26,587; Peekskill Construction Co., Peekskill, $27,437; Catskill Supply Co., Catskill, $19,890; Peter Keeler Building Co., Albany, $24,522; L. F. Bannon Plumbing & Heating Co., Kingston, $19,966.

+Port Chester, N. Y.—F. R. Davis, Mgr., Wilford Hall Laboratories, has awarded the contract for the construction of a three-story, 83x103-ft. chemical factory to SULLIVAN & McNALLY, Paterson, N. J. Noted Apr. 22 and 29.

+Split Rock, N. Y.—The Semit Solvay Co. has awarded the contract for the construction of two storage buildings to T. H. McHALE & SON, Cahill Bldg., Syracuse, N. Y. Taylor & Bonton, Gurney Bldg., Syracuse, N. Y., is Arch.

Tarrytown, N. Y.—Bids will soon be received for the construction of a two-story factory for the Chevrolet Automobile Co. W. C. Durant, 816 11th St., New York, N. Y., is Pres. The estimated cost is $40,000.

+West Sand Lake, N. Y.—The contract has been awarded to J. J. FINN & SONS, Albany, N. Y., for the construction of a three-story, 66x110-ft. factory for the McLaren Knitting Co. C. G. Ogden, 159 State St., Albany, N. Y., is Arch. Noted June 24.

Absecon, N J.—The contract will soon be awarded for the construction of a two-story, 50x150-ft. and a one-story, 50x70-ft. building for the Acme Film Producing Co., care of A. Jacoby, Sheen Bldg., Atlantic City, N. J. Vaughn Mathis, Guarantee Trust Bldg., Atlantic City, is Arch. The estimated cost is $25,000.

Bound Brook, N. J.—The Cott-a-lap Co., Somerville, N. J., has awarded the contract for the construction of three 40x80-ft. buildings adjoining the Central R.R. to RUNYON FIELD.

Bound Brook, N. J.—The Independent Chemical Co., 72 Front St., New York, N. Y., plans the construction of a factory fronting on the Central R.R. Warren C. King is Pres.

Hammondton, N. J.—The contract will soon be awarded by Charles H. Strunk, Treas., Figueroa Cut Glass Co., for the construction of a two-story, 32x110-ft. factory to cost $12,000. William S. Hewitt, Guarantee Trust Bldg., Atlantic City, N. J., is Arch.

+Newark, N. J.—(Official)—J. Wiss & Sons Co., 31 Littleton Ave., has awarded the contract for the construction of a four-story, 50x75-ft. addition to its plant to EUSTICE BROS., 45 Clinton St. The estimated cost is $15,000. Frederick A. Phelps is Arch.

Plainfield, N. J.—The Sauer Motor Co. plans the construction of a two-story, 120x120-ft. brick and concrete addition to its plant, to cost $30,000. John G. Brown, Witherspoon Bldg., is Arch. Noted May 6 and May 20.

Trenton, N. J.—The Hill Refrigerator Co. will soon award the contract for the construction of a one-story, 100x500-ft. plant, at an estimated cost of $40,000. Abram Swan, Jr., Broad Street Bank Bldg., is Arch.

Philadelphia, Penn.—The L. H. Gilmer Co., 52 North Seventh St., plans the construction of a two-story, 50x150-ft. factory. The estimated cost is $25,000. Bart Tourison, Land Title Bldg., is Arch.

Philadelphia, Penn.—John Scott & Co. will build a four-story, 50x122-ft. warehouse at American and Diamond St.

+Philadelphia, Penn.—BARCLAY, WHITE & CO., Perry Bldg., has been awarded the contract for the construction of a one- and two-story, 50x480-ft. freight house for the Pennsylvania R.R. Co. William H. Cookman, Broad St. Station, is Arch. The estimated cost is $75,000.

Philadelphia, Penn.—The Walls Ice Mfg. Co. will build a two-story, 100x100-ft. factory at Ninth and Master St.

Philadelphia, Penn.—The contract will soon be awarded for the construction of a one-story, 142x165-ft. factory at Ninth and Bailey St. for the Wood Mfg. Co. Peuckert & Wunder, 310 Chestnut St., is Arch.

Reading, Penn.—(Official)—Bids are being received by William S. Markley for the construction of a $50,000 plant at Penn and Queen St. Noted July 29.

+Baltimore, Md.—THE CONSOLIDATED ENGINEERING CO., Calvert Bldg., has been awarded the contract for the construction of two one-story, 52x86-ft. factories. The estimated cost is $15,000. James R. Edmunds, Jr., 12 East Read St., is Arch.

+Baltimore, Md.—The C. J. Youse Co., Inc., 23-25 South Gay St., has awarded the contract for the construction of a three-story, 100x130-ft. factory to WALTER E. BURNHAM, 403 Law Bldg. Archer & Allen, 3 East Lexington St., is Arch. The estimated cost is $50,000.

Alexandria, La.—The Federal Oil & Refining Co. will build a refinery, estimated to cost $120,000. W. W. Whittington, Mayor of Alexandria, is Pres.

Maysville, Ky.—The Independent Loose Leaf Tobacco Co. contemplates the construction of a one-story warehouse to cost $15,000. W. H. Robb is Secy.

Maysville, Ky.—The Maysville Cotton Mills plans the construction of a one-story warehouse to cost $10,000. R. A. Cochran, 237 West Second St., is Secy.

Ashland, Ohio—Hess & Clark plans the construction of a three-story, 55x90-ft. factory to cost $30,000. Vernon Redding, 301 Bird Bldg., is Arch. W. Thomas is Mgr.

Cincinnati, Ohio—The City Ice Delivery Co., Canal and Race St., will build a two-story, 100x100-ft. ice plant to cost $75,000. Lester Blair is Secy. B. T. Wisenall, 518 First National Bank Bldg., is Arch.

+Cincinnati, Ohio—The H. & S. Pogue Co., Fourth and Race St., has awarded the contract for the construction of a $300,000 addition to its warehouse to the STONE WEBSTER ENGINEERING CO. Hake & Kuck, Telephone Bldg., is Arch.

Cincinnati, Ohio—The R. K. Le Blond Machine Tool Co., 4609 Eastern Ave., plans the construction of a plant near the Norfolk & Western Ry. to contain 500,000 sq.ft. of floor space. Zettel & Rapp, Johnston Bldg., is Arch.

Cleveland, Ohio—The Halle Bros. Co. has purchased a site at East 22nd and Chester St., and plans the construction of a storage building. Estimated cost, $50,000.

Cleveland, Ohio—The Lederer Milling Co., 6318 Kinsman Rd., S. E., will build a mill on Riverbed St., to cost about $200,000.

Cleveland, Ohio—Plans have been prepared by Marriott, Allen & Hall, Arch., Hayden-Clinton Bldg., Columbus, Ohio, for the construction of a two-story laundry at the Cleveland State Hospital. The estimated cost is $40,000.

Cleveland, Ohio—Plans have been completed by the Forest City Engineering Co., 515 Hippodrome Bldg., for the construction of a warehouse at Lakeside and East 22nd St. for the Union Paper & Twine Co., 115 St. Clair Ave. Estimated cost, $100,00.

+Cleveland, Ohio—(Official)—The contract for the construction of a five-story, 200x200 ft., brick and reinforced-concrete factory for the B. F. Goodrich Co., Akron, Ohio, has been awarded to the CARMICHAEL CONSTRUCTION CO., Akron, Ohio. The Osborn Engineering Co., 740 Engineers Bldg., is Arch. Noted July 22.

Greentown, Ohio—The Greentown Aluminum Co. will build a one-story, 36x114-ft. factory to cost $10,000. G. B. Townsend is Secy. W. C. Owen & Co., 449 Leader-News Bldg., is Arch.

+Detroit, Mich.—The contract for the construction of a four-story factory at McKinstry Ave. and the Wabash R.R., for the Paige-Detroit Motor Car Co., has been awarded to the ALBERT A. ALBERECHT CO. John Scott & Co. is Arch.

+Detroit, Mich.—The contract for the construction of a two-story factory at East Grand Blvd. and Oakland Ave. for the Schlieder Mfg. Co., 45 East Fort St., has been awarded to W. S. POCOCK. Preston, Brown & Walker, is Arch. Noted July 15.

Grand Rapids, Mich.—Bids are being received by George T. Appleyard, Arch., 415 Widdicomb Bldg., for the construction of a two-story, 111x165-ft. warehouse for Walter Clark, Ionia and Prescott St.

+Chicago, Ill.—The contract for the construction of a five-story addition to the warehouse of Anderson Bros., 945 Belmont Ave., has been awarded to the H. D. MORELAND CO., 105 North Clark St. S. H. Dunford, 10 South La Salle St., is Arch. Noted June 24.

Chicago, Ill.—Bids are being received by George C. Nimmons, Arch., 122 South Michigan Ave., for the construction of a six-story addition to the printing building of Sears, Roebuck & Co.

Chicago, Ill.—The Union Transfer, Storage & Bldg. Co., recently incorporated, will build a six-story, 95x160-ft. reinforced-concrete storage building on East Wilson St. Moores & Dunford is Arch.

Milwaukee, Wis.—The Phoenix Knitting Co. plans the construction of a $40,000 plant at Jackson and Chicago St.

+Sioux City, Iowa—DUBEL & ANDERSON, 514 Jackson St., has been awarded the contract for the construction of a three-story, 40x126-ft. brick factory at Perry Creek and West Third St. for L. W. Mallory. The estimated cost is $20,000.

+Sioux City, Iowa—The contract for the construction of a two-story, 84x150-ft. warehouse for W. L. Ogden, 307 Pearl St., has been awarded to HOUX & SON, Second and Water St. F. E. Colby, 510 Davidson Bldg., is Arch. The estimated cost is $10,000.

+Minneapolis, Minn.—C. H. Wheeler & Son, 820 Palace Bldg., has awarded the contract to JAMES LECK & CO., 311 South Seventh St., for the construction of a six-story warehouse.

Omaha, Neb.—Plans have been prepared by Albert Kahn, Arch., 58 La Fayette Ave., Detroit, Mich., for the construction of a six-story, 130x160-ft. reinforced-concrete assembling plant at 16th and Cumming St. for the Ford Motor Co., Detroit, Mich. The estimated cost is $275,000.

+Omaha, Neb.—The National Printing Co., 509 South 12th St., has awarded the contract for the construction of a plant to KIENE & MAYSTRICK. The estimated cost is $40,000. W. E. Stockham, 426 Range Bldg., is Arch. Noted June 17.

Kansas City, Mo.—The Shukert Fur Co., 1113 Grand Ave., will soon start work on the construction of a five-story, 75x166-ft. brick warehouse on Warwick Blvd., to cost $32,000, and a four-story, 75x115-ft. brick warehouse on Walnut St., to cost $25,000. E. Shukert is in charge.

+Kansas City, Mo.—The Bachelor Laundry, 2028 Broadway, has awarded the contract for the construction of a two-story, 50x120-ft. brick laundry to S. D. EICHE, 3035 Flora Ave., at $20,000. Madorie & Birdsall, 832 Reserve Bank Bldg., is Arch. Noted June 17.

+Kansas City, Mo.—The contract for the construction of a two-story, 32x137-ft. brick building at 2-4-6 West 27th St. for the Higby Cleaning & Dyeing Co., Lincoln, Neb., has been awarded to the GEORGE H. SIEDHOFF CONSTRUCTION CO., 301 Finance Bldg. Smith, Rea & Lovitt, 601 Finance Bldg., is Arch.

Kansas City, Mo.—Bids are being received by J. Oliver Hogg, Arch., 946 New York Life Bldg., for the construction of a two-story, 49x117-ft. warehouse for the Freeman & Duncan Realty & Transfer Co.

Houston, Tex.—Plans have been prepared by Moore & Dunford, Arch., Chicago, Ill., for the construction of an eight-story, 160x365-ft. warehouse for the Houston Terminal Warehouse Co., A. F. Coleman is Mgr. The estimated cost is $800,000.

Laredo, Tex.—Samuel Mackin, Mgr., Consumers' Ice Co., is receiving bids for the construction of a two-story, 50x75-ft. ice and cold-storage plant. The estimated cost is $12,000. The McCandlish Engineering Co., 724 Midland Bldg., Kansas City, Mo., is Arch.

San Benito, Tex.—Plans have been prepared for the construction of a $15,000 plant for the San Benito Creamery Co.

Salt Lake City, Utah—The Jennings-Hanna Investment Co. will build a three-story, 137x166-ft. reinforced-concrete warehouse at Second and South St., at an estimated cost of $90,000. A. Kletting is Arch.

Seattle, Wash.—The Carstens Packing Co. will build a four-story, 100x500-ft. warehouse at an estimated cost of $50,000. P. S. Coombs & Son is Arch.

✚**San Francisco, Calif.**—The American Can Co., Mills Bldg., has awarded the contract for the construction of a plant at Kentucky and 22nd St. to the LINDGREN CO., at $199,000. Noted Feb. 18.

Regina, Sask.—The Robert Simpson Co., Toronto, Ont., will build a warehouse at an estimated cost of $150,000.

Chatham, Ont.—The Defiance Iron Works will expend $20,000 for improvements to its plant.

Toronto, Ont.—The Canada Metal Co., Fraser Ave., will build a $15,000 addition to its factory.

Toronto, Ont.—The Dunlop Tire Co. will build a three-story addition to its factory, to cost $30,000.

FEDERAL GOVERNMENT WORK

Steerage Barracks and Storehouse—Portland, Maine—Bids will be received until 3 p.m., Sept. 2, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing complete the steerage barracks and storehouse for the U. S. quarantine station at Portland.

Hot-Water System—Newport, R. I.—Bids will be received until 11 a.m., Aug. 28, by William M. Smith, Act. Ch. of Bureau, Yards and Docks, Navy Dept., Washington, D. C., for installing a hot-water piping system at the naval hospital, Newport.

Buildings—Ft. Mifflin, Penn.—Bids will be received until 11 a.m., Aug. 21, by William M. Smith, Act. Ch. of Bureau, Yards and Docks, Navy Dept., Washington, D. C., for constructing buildings at the U. S. naval magazine, Ft. Mifflin.

Mechanical Equipment—Baltimore, Md.—Bids will be received until 3 p.m., Aug. 31, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for mechanical equipment, except elevators, for the U. S. immigration station.

★**Steel Cylinder Gates**—Washington, D. C.—Bids will be received until 2 p.m., Sept. 2, by A. P. Davis, Ch. Engr., U. S. Reclamation Service, Washington, for furnishing four steel cylinder gates and accessories for the spillway at Elephant Butte Dam, Rio Grande project, New Mexico and Texas.

✚**Mechanical Equipment**—Washington, D. C.—Contracts have been awarded for mechanical equipment for the Interior Department Building as follows: JOHN H. PARKER CO., mechanical equipment, WILLIAM GORDON CORP., elevators. Noted July 29.

★**Dredging**—Norfolk, Va.—Bids were received Aug. 4, by the Engineer Officer, Norfolk, for dredging inland waterway from Norfolk to Beaufort Inlet, N. C., a total of 850,000 cu.yd., place measurement, as follows: Norfolk Dredging Co., Norfolk Dredging Co., Norfolk, 19.65c.; Day & Zimmerman, 611 Chestnut St., Philadelphia, Penn., 20c.; Atlantic, Gulf & Pacific Co., Park Row Bldg., New York, N. Y., 21.9c.; Maryland Dredging & Contracting Co., Fidelity Bldg., Baltimore, Md., 23½c.; F. Sanford Ross, Inc., Jersey City, N. J., 14c.; Coastwise Dredging Co., Norfolk, 15¼c.; Central Dredging Co., Cleveland, Ohio, 17½c.; and Bowers Southern Dredging Co., Galveston, Tex., 16c. Noted July 8.

✚**Post Office**—Opelika, Ala.—The contract for the construction of a post office at Opelika has been awarded to GEORGE A. CLAYTON, Atlanta, Ga., at $84,364. Noted June 10 and July 22.

★**Shore Protection**—Rock Island, Ill.—Bids were received July 31 for shore-protection work on various sections of the Mississippi River. Low bidders were as follows: Kirchner Contracting Co., Dubuque, Iowa; Builders' Sand & Gravel Co., Davenport, Iowa; A. V. Fetter Co., Quincy, and J. W. McMurry Contracting Co., Kansas City, Mo. Noted July 8.

Post Office—Ft. Atkinson, Wis.—The low bidder for constructing a post office at Ft. Atkinson is the Clark Construction Co., Danville, at $39,350 for limestone and $41,100 for sandstone. Noted July 1.

★**Earth Work**—Ft. Laramie, Wyo.—Bids will be received until 2 p.m., Sept. 8, by A. P. Davis, Ch. Engr., U. S. Reclamation Service, Tramway Bldg., Denver, Colo., for constructing earthwork on about ten miles of main canal at Ft. Laramie unit.

Floors—St. Louis, Mo.—Bids will be received until 3 p.m., Sept. 1, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing new terrazzo floors in the U. S. post office at St. Louis.

★**Screening and Weatherstripping**—Ft. Bliss, Tex.—Bids will be received until 11 a.m., Sept. 2, by the Quartermaster, El Paso, for screening and weatherstripping for about 35 quarters and barracks at Ft. Bliss.

Post Office and Court House—Tulsa, Okla.—Bids will be received until 3 p.m., Sept. 27, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing complete the U. S. post office and court house at Tulsa.

Buildings—Bremerton, Wash.—Bids will be received until 11 a.m., Sept. 11, by William M. Smith, Act. Ch. of Bureau, Yards and Docks, Navy Dept., Washington, D. C., for constructing buildings at the Naval Magazine, Puget Sound.

Wharf Extension—San Francisco, Calif.—Bids will be received until 11 a.m., Aug. 21, by H. R. Stanford, Ch. of Bureau, Yards and Docks, Navy Dept., Washington, D. C., for extending the wharf at the Naval training station, San Francisco.

Freight Elevators—Pearl Harbor, Hawaii—Bids will be received until 11 a.m., Aug. 28, by William M. Smith, Act. Ch. of Bureau, Yards and Docks, Navy Dept., Washington, D. C., for installing three hydro-pneumatic freight elevators at the Naval station.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., Aug. 13, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., Aug. 20, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

MISCELLANEOUS

✚**Dredging**—Boston, Mass.—According to press reports the contract for dredging about 15,000 cu.yd. in the Abejona River has been awarded to COLEMAN BROS., Chelsea, at $13,500. Noted July 22.

✚**Dredging**—Boston, Mass.—The contract for dredging at Wellfleet, Barnstable and Nobscussett Harbors, has been awarded to JOHN H. GERRISH. Noted Aug. 5.

✚**Enlarging Breakwater**—Boston, Mass.—The contract for enlarging the breakwater at Vineyard Haven Harbor, Tisbury, has been awarded to the BAY STATE DREDGING CO., LTD., 247 Atlantic Ave., Boston, at $1.34 for each ton and $5 for each clamp. Other bids were from Rockport Granite Co., $1.43; $5.60, and E. S. Belden & Sons, $1.43; $7. William F. Williams, State House, is Ch. Engr.

✚**Coal Pocket**—Boston, Mass.—(Correction)—We have been advised by Adolph Suck, Consult. Engr., Hyde Park, that the following contracts have been awarded in connection with the construction of the coal pocket for Batchelder Bros.: Foundations to W. A. NORTON CO., South Boston; steel structure, BOSTON BRIDGE WORKS; machinery contract, JOHN H. PROCTOR CO., Boston. Noted July 29.

✚**Coal Pocket**—Palmer, Mass.—(Official)—The contract for the construction of the reinforced-concrete coal pocket at Palmer has been awarded to the FLYNT BUILDING & CONSTRUCTION CO., Palmer, Mass. Adolph Suck, Arlington St., Hyde Park, Mass., is Consult. Engr.

Guard Railing—Hartford, Conn.—Bids will be received by Charles J. Bennett, State Highway Comr., until 2 p.m., Aug. 16, for constructing about 14,264 lin.ft. of standard wood guard railing.

River Improvement—Jamestown, N. Y.—Plans are being prepared by F. P. Williams, Rochester, Division Engr., State Dept. of Pub. Works, for improving the Chadokoin River. An appropriation of $100,000 has been made for the work. Frank M. Williams is State Engr.

Elimination of Grade Crossing—New York, N. Y.—(Borough of Bronx)—(Official)—At a joint meeting of the First and Second Districts of the Public Service Commission an order was passed providing for the removal of grade crossings and other obstructions on the lines of the New York & Harlem R.R. (New York Central) and the New York, New Haven & Hartford R.R. near 241st St. It also orders a shifting of the tracks and the construction of a viaduct to carry the street. The New York & Harlem Co. is ordered to construct a new station at 241st St. The entire cost, except that of the construction of the new viaduct, shall be paid by the railroad companies, the cost of the viaduct being apportioned according to the provisions of the Railroad Law.

✚**Field House**—New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for the general construction and completion of a field house at the Betsy Head Memorial Playground, Brownsville, has been awarded to T. J. BUCKLEY, 303 Fifth Ave., New York, at $14,995. Noted June 24 and July 8.

Dredging—New York, N. Y.—(Borough of Brooklyn)—(Official)—The following are the bids received for dredging in Newtown Creek Canal at and in the canal and basin included within the boundaries of Johnson, Montrose, Morgan Ave. and Varick Ave., also in the Stagg St. basin, and in Newtown Creek near the intersection of Scott and Metropolitan Ave.: William Beard, $7500; R. G. Packard, $7800; John & Joseph McSpirit, 118 Wayne St., Jersey City, N. J., $7200. Noted July 29.

Riprap—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by Cabot Ward, Pres. Park Board, until 3 p.m., Aug. 19, for furnishing and placing 10,000 tons of riprap along the Shore Road, between Latting Place and Ft. Hamilton.

Fence—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 3 p.m., Aug. 19, by Cabot Ward, Pres. Park Board, Municipal Bldg., for erecting a wrought-iron fence and settling artificial granite gate posts around Morningside Park.

Road Supplies—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by Cabot Ward, Pres. Park Board, until 3 p.m., Aug. 19, for furnishing and delivering the following: 75,000 gal. of refined coal tar; 75,000 gal. of tar road oil; 5500 cu.yd. of trap-rock screenings; 3000 cu.yd. of grits.

Duct Line—New York, N. Y.—(Official)—The following are the bids received by the Public Service Commission for the construction of the duct line for the Queensboro Rapid Transit railroad: Goodwin Contracting Co., $45,750; James A. McElroy, $50,617; Kingsbridge Contracting Co., $42,000; Soraci Contracting Co., $42,897; James O'Leary, $54,000; Thomas Crimmins Contracting Co., $49,948; T. H. Reynolds Construction

Co., $45,416; E. C. Moore, (no total); J. M. Gest, $52,000; W. A. Mitchell, $39,000; Beaver Engineering Co., $38,918; Hanover Contracting Co., $39,000; Knight & DiMicoo, 4441 Park Ave., New York, $38,887; H. E. Fox Construction Co., $43,000.

★**Subway Station**—New York, N. Y.—(Borough of Queens)—(Official)—The following are the bids received by the Public Service Commission for the construction of the station finish on Section No. 2, Route Nos. 36 and 37 of the Astoria Elevated R.R.: Charles Meads & Co., 38 Park Row, New York, $268,102; Snare & Triest Co., $274,096; Simon Russek, Inc., $285,250. Noted July 15.

★**Plumbing and Drainage**—Ossining, N. Y.—(Official)—Bids will be received by John B. Riley, Supt., State Prisons, Capitol, Albany, until 2:30 p.m., Aug. 20, for plumbing and drainage in the power house at Sing Sing prison.

Park Improvements—Jersey City, N. J.—The Board of Chosen Freeholders of Hudson County has sold $300,000 in bonds for the construction and improvement of county parks.

✚**Stone Wall**—Ford City, Penn.—The contract for constructing about 3000 ft. of stone wall along the Allegheny River, for the Pittsburgh Plate Glass Co., has been awarded to the FOUNDATION CO., Woolworth Bldg., New York, N. Y.

✚**Plaza**—Philadelphia, Penn.—The contract for constructing the Broad St. plaza, has been awarded to E. H. VARE, Lincoln Bldg., at $123,000. Noted June 24 and July 22.

✚**Steamers**—Wilmington, Del.—The contract for the construction of two tank steamers, for the Standard Oil Co., and one steamer for the Wilson Line, has been awarded to the HARLAN & HOLLINGSWORTH CORPORATION, Wilmington. The estimated cost is $1,250,000.

Drainage—Anderson, S. C.—The Drainage Commissioners of Rocky River Drainage District No. 1 have sold $19,500 in drainage bonds. Watkins & Allen, Bleckley Bldg., Anderson, is Attorney.

Motor Fire Apparatus—Atlanta, Ga.—The City Council has decided to hold an election to vote on the issuance of $133,500 in bonds for the purchase of motor fire apparatus.

✚**Pier and Warehouse**—Augusta, Ga.—The contract for constructing a reinforced-concrete pier and warehouse has been awarded by the City Council to the GEORGIA CONTRACTING CO., Augusta, at $27,958. Nisbet Wingfield is City Engr.

Wharf Improvement—Jacksonville, Fla.—(Official)—Contracts will soon be awarded for the construction of about 6074 lin.ft. of wharf front at Commodores Point on the St. Johns River, for the Commodores Point Terminal Co. The wharves will be of the longitudinal type, paralleling the channel. The improvement includes 304 lin.ft. of wooden construction, 700 lin.ft. of steel sheet piling, and about 5070 lin.ft. of concrete steel. All the frontage will be filled in solid with sand dredged from the St. Johns River. The river will be dredged to 30 ft. along the face of the wharves and to 12 ft. in the slip at each end. The top of the fill will be 4 ft. above mean low tide. Herbert D. Mendenhall, 216 Parker St., Jacksonville, is Consult. Engr.

Excavation—Palm Beach, Fla.—Press reports state that bids will be received by the Florida East Coast Hotel Co. for 5000 to 15,000 cu.yd. rock excavation, 30,000 to 80,000 cu.yd. muck and sand excavation, 160,000 cu.yd. hydraulic sand fill (suction works). J. R. Brooks, Palm Beach, is Engr. in Charge.

★**Drainage Work**—Tallahassee, Fla.—(Official)—Bids will be received by the Board of Commissioners, Everglades Drainage District, until 10 a.m., Aug. 24, for the construction of three locks and drains.

Drainage—Abbeville, Miss.—At a recent election the citizens voted in favor of a bond issue of $21,000 for the drainage of several thousand acres in Younds Coulee Drainage District.

Drainage—Gueydan, La.—Preliminary plans and surveys for the construction of ditches, etc., for the drainage of 65,000 acres of low land here are being made. W. V. Reed, City Engr., Morgan City, La., is Superv. Engr. Noted Aug. 5 under Corydon, Iowa.

Levees—New Orleans, La.—Bids will be received by the State Board of Engineers, until Aug. 19, for levee work in various districts.

Levee—Greenville, Miss.—Bids will be received by A. L. Thompson, Ch. Engr., Board of Mississippi Levee Commissioners, until Aug. 17 for levee work, as follows: Upper Vermillion Spur Enlargement, 24,000 cu.yd.; Black Bayou Spur Enlargement, 7000 cu.yd.; Upper Avon Banquette Enlargement, 23,000 cu.yd.; Lower Avon Banquette Enlargement, 20,000 cu.yd.; Moon Lake Enlargement, 200,000 cu.yd.; Mayersville to Baleshed Enlargement, 262,000 cu.yd.

✚**Raising Steamer**—Chicago, Ill.—The contract for raising the steamer "Eastland," which recently capsized in the Chicago River, has been awarded to the DUNHAM TOWING & WRECKING CO., Chicago, at $34,500.

Fireboat Hull—Cleveland, Ohio—Bids will be received until Aug. 25, by A. A. Benesch, Dir. of Pub. Ser., City Hall, for the construction of a hull for the fireboat, "Clevelander." The estimated cost is $26,000.

Park Improvements—Cleveland Heights, Ohio—(Warrensville post office)—Bids will be received by H. H. Canfield, Clk., until noon Sept. 7, for the purchase of $100,000 in bonds for the improvements of parks.

✚**Memorial**—Niles, Ohio—The contract for the construction of a memorial to President William McKinley has been awarded to JOHN A. PARKER CO., 315 Fourth Ave., New York, N. Y., at about $240,000. Georgia marble will be used in the construction.

Park Improvements—Rocky River, Ohio—An election will be held in November, to vote on issuing $35,000 in bonds for park improvements.

Channel—East St. Louis, Ill.—It is reported that bids will be received by the East Side Levee and Sanitary District for constructing a channel for Cohokia Creek. The work requires about 115,000 cu.yd. of excavation and the clearing of about 20 acres. G. T. Tarlton is Pres.

Piers, Etc.—Evanston, Ill.—Bids will be received by John H. Moore, Comr. of Pub. Works, until Aug. 16, for the construction of 18 piers. Noted June 3.

Improvement to Creek—Sioux City, Iowa—The Board of Supervisors has decided to deepen and widen Wolf Creek, for a distance of two miles. The estimated cost is $17,000.

✚**Ditches**—Marshall, Minn.—Contracts have been awarded to the following by the County Commissioners for ditch construction: Ditch 15, to HECTOR COOLSAER, Marshall, at $9038; Ditch 16 and Ditch 13 (tile work), to ANDERSON & ARTHUR, Tracy, at $55,600 and $18,047 respectively; Ditch 13 (open work), to AJAX DREDGE CO., Glencoe, at $6800. E. S. Shepard is County Audr. Noted July 22.

Ditch—Montevideo, Minn.—Bids will be received by J. J. Stennes, Audr., until 2 p.m., Aug. 18, for constructing Ditch No. 18. The cost will be about $29,000.

✚**Ditches**—Windom, Minn.—The following contracts have been awarded by the County Commissioners for the construction of ditches: No. 9 to L. P. ALEXSEN, Clear Lake, Iowa, at $110,000; No. 13 to JOHN PEDERSEN, Clear Lake, Iowa, at $3417; No. 14 to MICHELS & SANDLIN, Bingham Lake, at $5145, and HADLEY & FLAHERTY, Ft. Dodge, Iowa, at $13,841. S. A. Brown is County Audr.

✚**Barge**—Kansas City, Kan.—The contract for constructing a barge for the Kaw Valley Drainage Board has been awarded to the MORRISON MACHINE WORKS, Baldwinsville, N. Y., at about $65,000. A subcontract has been let to GEORGE GEDNEY, Kansas City.

✚**Levees**—Dumas, Ark.—The contract for about 350,000 cu.yd. of levee work in the Linwood and Auburn Levee District has been awarded to LANA BROS., Dumas, at 14.85c. per cu.yd. The cost is about $60,000. Gus. Waterman is Chn. of the Board.

✚**Levee**—McGhee, Ark.—The contract for about 345,000 cu.yd. of levee work, has been awarded by the Commissioners of Red Ford. Levee District to DENNISON & RODGERS BROS., Memphis, Tenn., at 13.75c. per cu.yd. Noted June 17.

✚**Levees**—Pine Bluff, Ark.—The contract for the construction of four miles of levees at Farrelly Lake has been awarded to HALLECK & YHOM, Little Rock, Ark., at $35,000.

Levee—Ft. Worth, Tex.—F. J. Von Zuben, City Engr., is preparing plans for the construction of the proposed levee around the city pumping plant. It is estimated to cost $16,000.

Wharves, Docks, Etc.—Orange, Tex.—At a recent election the citizens voted in favor of issuing $150,000 in bonds for the construction of municipal wharves, docks, schools, and for the improvements of streets. Noted June 17.

Drainage—Corinne, Utah—Bids will be received until Aug. 21, by the Board of Supervisors, for about eight miles of open ditches. W. M. Bostaph, 204 Kearns Bldg., Salt Lake City is Engr. C. G. Adney is Secy. of Drainage District.

Ditch—North Yakima, Wash.—According to press reports, the Yakima County Commissioners will soon hold an election to vote on issuing $50,000 in bonds for the purpose of constructing two branches to the present West Side drain. O. E. Brashears is County Engr.

Coal Bunkers—Seattle, Wash.—Plans for construction of coal bunkers on Puget Sound are being prepared by J. R. West, Ch. Engr., Seattle Port Commission. The bunkers will be at the Smith's Cove improvement and will be of steel and frame construction, costing about $25,000.

✚**Pier**—Portland, Ore.—The contract for constructing a pier at the Hill terminals has been awarded to G. A. McEACHERN CO., Seattle. The pier will be 30x420 ft. and is estimated to cost $15,000.

Pier—Redondo Beach, Calif.—Leyden & Ortseifen, Flagstaff, Ariz., submitted the lowest bid at $108,800 for the construction of a reinforced-concrete pier at Redondo Beach from plans prepared by George W. Harding, Engr., 1118 Washington Bldg., Los Angeles. Noted July 15.

Retaining Wall—Montreal, Que.—The City Council has voted $360,000 for the construction of a retaining wall on the north side of the enlarged viaduct.

Grandstand—Quebec, Que.—Bids will soon be called for the construction of a grandstand on the exhibition grounds to cost about $25,000. Taaguay & Lebon, 20 D'Aguillon St., Quebec, is Arch.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Portland, Maine—Plans are being prepared by Miller & Mayo, Arch., Fidelity Trust Bldg., for the construction of a three-story, 190x250-ft. brick and stone high school to cost $300,000. Mayor William M. Ingraham is Chn. of Com.

Boston, Mass.—The Kenmore Realty Trust will soon award the contract for the construction of a nine-story apartment block on Commonwealth Ave. to cost $300,000. Blackhall, Clapp & Whetmore is Arch.

✚**Boston, Mass.**—The contract for the construction of a six-story brick building on High St. for James Donahue, 35 Congress St., has been awarded to WILLIAM BAILEY, 88 Broad St. Monks & Johnson, 78 Devonshire St., is Arch.

Brookline, Mass.—A special town meeting, July 29, appropriated $110,000 for alterations and additions to the high school.

Dedham, Mass.—Bids were received by Samuel H. Capen, Chn. of Bldg. Com., for the construction of a high school as follows: C. S. Cunningham Sons Co., Boston, $102,300; L. B. Taylor, Athol, $103,775; George B. Long, Worcester, $104,650; George Howard Son Co., Brockton, $106,000; F. C. Alexander, Boston, $106,843; William Hansom, Brockton, $107,300; John W. Duff & Co., Boston, $107,719; McGee & O'Connor, Cambridgeport, $108,986; Walsh Bros., East Cambridge, $109,283; J. L. Slotnick, Chelsea, $109,292; J. J. Powers, Cambridge, $110,889; C. S. Cunningham Construction Co., Boston, $112,176; Daniel L. Sheppard, Boston, $115,547; John A. Logatelli Co., Boston, $15,587, and H. L. Hemenway Co., Boston, $119,292. Killiane & Hopkins, 9 Park St., Boston, Mass., is Arch. Noted July 29.

Nahant, Mass.—A special town meeting July 29th appropriated $38,600 for the construction of a school. William Waters is Town Clk.

Southbridge, Mass.—Bids are being received by Peabody & Stearns, Arch., 53 State St., Boston, Mass., for the construction of a high school. Noted Oct. 29, Apr. 1 and June 10.

+Warren, R. I.—The contract for the construction of a school has been awarded to the EASTERN CONSTRUCTION CO., Woonsocket, R. I., at $44,873.

Hartford, Conn.—The Rev. Stanislaus Lozowski has plans for the construction of a $70,000 church on Governor St.

Albany, N. Y.—Feeney & Sheehan Building Co., 164 Montgomery St., Albany, at $162,000, submitted the lowest bid for the construction of additions and alterations to the State House on Eagle St Noted May 6 and July 8.

Buffalo, N. Y.—Bids will be received until 11 a.m., Aug. 19, by Francis G. Ward, Comr. of Pub. Wks., Buffalo, for the construction of a public school on Amherst St. and North Lincoln Blvd.

+Mineola, N. Y.—The Nassau County Trust Co. has awarded the general contract for the construction of a bank building to HOGGSON BROS., 7 East 44th St., New York Estimated cost, $50,000.

New York, N. Y.—(Borough of Bronx)—J. C. Corker, Arch., 2017 Fifth Ave., has prepared plans for the construction of a two-story, 60x148-ft. fireproof theater at Fordham Rd. and Morris Ave. for H. U. Singhi. The estimated cost is $100,000.

New York, N Y.—(Borough of Bronx)—B. H. & C. N. Whinston, Arch., 148th St. and Third Ave., has prepared plans for the construction of a five-story hospital at 959-61 Whitlock Ave. for the Bronx Maternity Hospital, 956 Whitlock Ave. The estimated cost is $50,000.

New York, N. Y.—(Borough of Bronx)—Bids are being received by the Home of the Holy Comforter, Riverside Drive and 139th St., for the construction of a four-story, 103x148-ft., fireproof brick and stone building as a Home for Incurables on the Grand Boulevard and Concourse and 196th St. John B. Snook Sons, 261 Broadway, is Arch. Noted July 29.

+New York, N. Y.—(Borough of Brooklyn)—The contract for the construction of a five-story brick store and loft building at 471 Fulton St. for Oppenheim, Collins & Co., 35 West 34th St., New York, has been awarded to CHARLES A. COWEN & CO., 1123 Broadway, New York.

New York, N. Y.—(Borough of Manhattan)—Plans have been prepared by Warren & Wetmore, Arch., 16 East 47th St., for the construction of a 17-story apartment house on Park Ave., from 55th to 56th St., for the 420 Park Avenue Co. The estimated cost is $800,000. S. Fullerton Weaver is Pres. of the company. Noted July 1.

New York, N. Y.—(Borough of Manhattan)—Walter Cook, Arch., 3 West 29th St., has prepared plans for the construction of a church at Amsterdam Ave. and 92d St. for the Central Baptist Church. The estimated cost is $200,000. Frank Goodchild is Pastor and I. W. Cokefair, 10 Maiden Lane, is Chn. of Bldg. Com. Noted June 17.

+New York, N. Y.—(Borough of Manhattan)—The general contract for the construction of a nine-story, 90x150-ft. fireproof hotel at 3 West 67th St. for the Hotel Des Artistes, Inc., 33 West 67th St., has been awarded to the WILLIAM J. TAYLOR CO., 5 East 42d St., New York. The estimated cost will be $800,000. George Mort Pollard, 127 Madison Ave., is Arch. Noted Feb. 18.

Syracuse, N. Y.—Charles D. Wilsey, Arch., 611 S. A. & K. Bldg., is preparing plans for the construction of a three-story business block and apartment building on East Fayette St. for Joseph A. Griffin, care of L. Vinney. Co., 130 South Salina St. The estimated cost is $50,000.

Syracuse, N. Y.—Bids will be received until Aug. 16, by D. R. Roney, Secy., Bd. of Contract and Supply for the construction of the Delaware School on Delaware and Geddes St. The estimated cost is $225,000. Noted May 27 and July 15.

Newark, N. J.—The Board of Freeholders is planning to hold an election to vote on the question of issuing $135,000 in bonds. The proceeds will be used for the construction of additions and improvements at the county penitentiary and jail.

+South Orange, N. J.—The contract for the construction of a railroad station for the Delaware, Lackawanna & Western R.R. has been awarded to F. H. HYDE, 90 West St., New York, N. Y. Estimated cost, $40,000.

Dormont, Penn.—Contracts will be awarded about Aug. 15, by J. A. Long, Arch., Pittsburgh, for the construction of a three-story, 56x102-ft. store and lodge building for the South Hills Hall Association. Estimated cost, $50,000. Noted July 22.

+Lock Haven, Penn.—THOMAS M. LEEDS, JR., 1207 Race St., Philadelphia, has been awarded the contract for the construction of a three-story nurses' home at the Lock Haven Hospital. Harris & Rush, 130 South 15th St., Philadelphia, is Arch. Estimated cost, $40,000.

+Muncy, Penn.—The contract for the construction of an administration building and four cottages at the State Industrial Home for Women has been awarded to METZGER & FISHER, Denckla Bldg., Philadelphia, at $178,500. Horace Trumbauer, Land Title Bldg., Philadelphia, is Arch., and Frank Smith, Harrisburg, is Secy., State Bd. of Charities. Noaed June 24 and July 22.

+Philadelphia, Penn.—The contract for the construction of an eight-story, 36x144-ft. reinforced-concrete loft building at 831-35 Cherry St. for Benjamin Linker has been awarded to WILLIAM LINKER CO., 1215 Filbert St., Philadelphia. Estimated cost, $100,000. Noted May 27.

Philadelphia, Penn.—Ballinger & Perrott, Arch., 6th floor, Methodist Bldg., is preparing plans for the construction of a church at 58th and Springfield Ave. for the Springfield Avenue Methodist Episcopal Church. The estimated cost is $60,000.

Philadelphia, Penn.—Bids will be received until Aug. 16 for the construction of a building at 1234 North 54th St. for the West Philadelphia General Homeopathic Hospital. Magaziner & Potter, 137 South Fifth St., is Arch.

+Philadelphia, Penn.—HENRY E. BATON, 10th and Sansom St., Philadelphia, has been awarded the contract for the construction of a one-story, 54x200-ft. brick ward building at Holmesburg for Philadelphia County. The estimated cost is $90,000. Philip Johnson is Arch.

+Philadelphia, Penn.—The contract for the construction of a two-story school on Hutchinson St. near Cambria St. for the St. Bonaventura's Church has been awarded to MELODY & KEATING, Bailey Bldg., Philadelphia. Estimated cost, $40,000.

Pittsburgh, Penn.—The Baltimore & Ohio R.R. Co. plans to complete the remodeling of its passenger station at Smithfield and Water St. F. L. Stuart, Baltimore, Md., is Ch. Engr.

+Scranton, Penn.—The contract for the construction of a two-story, 60x100-ft. bank building for the First National Bank has been awarded to S. SYKES SONS, 218 Larch St., Scranton. The cost is estimated at $190,000. Belin & Snyder, Title Guarantee Bldg., is Arch.

+Sharon, Penn.—(Official)—WALLIS & CARLEY CO., Sharon, has been awarded the general contract for the construction of the Kimberly Nurses' Home, adjoining the C. H. Buhl Hospital. The estimated cost is $60,000. C. F. Owsley, Youngstown, Ohio, is Arch. Noted July 29.

South Bethlehem, Penn.—The Bethlehem Steel Co., South Bethlehem, is planning the construction of an office building. Estimated cost, $500,000.

+Wilmington, Del.—(Official)—The contract for the construction of a four-story 85x183-ft. brick and stone addition to the Wilmington High School has been awarded to A. S. REED & BRO. CO., Wilmington, Del., at $123,733. Wallace E. Hance is Arch. Noted July 8 and 29.

Baltimore, Md.—Irwin & Leighton Co., 126 North 12th St., Philadelphia, Penn., submitted the lowest bid for the construction of an addition to the Drovers and Mechanics National Bank at Fayette and Eutaw St. Joseph Evans Sperry, 409 Calvert Bldg., is Arch.

Baltimore, Md.—Plans have been prepared by Cram, Goodhue & Ferguson, Arch., 15 Beacon St., Boston, Mass., for the construction of a church at Eutaw and Madison St. for the Mt. Calvary Protestant Episcopal Church. The estimated cost is $200,000.

Baltimore, Md.—Parker, Thomas & Rice, Arch., has prepared plans for the construction of an office building at Lexington and Liberty St. for the Consolidated Gas, Electric Light & Power Co. The estimated cost is $1,000,000. Noted Apr. 29.

Baltimore, Md.—Bids will be received until Aug. 16 by the Board of Awards for the improvement and repairing of various public schools in Baltimore. The entire cost is estimated at $100,000.

+Weston, W. Va.—The State Board of Control, Charleston, has awarded the contract for the construction of a building at the Weston State Hospital for the Insane to the DAWSON CONSTRUCTION CO., May Bldg., Pittsburgh, Penn., at $66,870. Other bids were: Acme Construction Co., Charleston, $79,495; J. F. Barbour & Sons, Roanoke, Va., $74,000; James Cain, Elkins, $80,332; J. L. Crouse, Greensboro, N. C., $81,475; Dayton & Francis, New Martinsville, $104,800; Foreman & Putnam, Marietta, $89,300. Harris & Spindler, Wheeling, $80,925; King Lumber Co., Charlottesville, Va., $81,772; Longest & Tessier, Greensboro, N. C., $90,819; Rose & Beaman, Goldsboro, N. C., $71,500; Richman Construction Co., Moorestown, N. J., $83,445; Showers & Taylor, Crooksville, Ohio, $91,448; C. Harrison Smith, Huntington, $89,675; Tyree & Thomas, Charleston, $84,287. Noted July 15.

+Wheeling, W. Va.—The KITCHEN CO. has been awarded the general contract for the construction of the Scottish Rite Cathedral. The cost is estimated at $110,000. Noted May 27.

Wilmington, N. C.—Plans are being prepared by Kenneth McMurchison, Arch., 101 Park Ave., New York, N. Y., for the construction of a ten-story hotel for J. H. Hinton, Wilmington. Noted July 22.

Atlanta, Ga.—An election will be held Sept. 30 to vote on the question of issuing $3,358,000 in bonds. A part of the proceeds will be used for the construction of schools and a hospital. I. M. Ragsdale is Mayor.

Meridian, Miss.—At a recent election the citizens voted in favor of issuing $65,000 in bonds. The proceeds will be used for the construction of a city hall and jail. Noted Aug. 5.

+New Orleans, La.—The contract for remodeling the Citizens Bank & Trust Co. building on Gravier St. has been awarded to LIONEL FAVRET, New Trleans. Estimated cost, $50,000.

+New Orleans, La.—The contract for the construction of a brick church at the Loyola University has been awarded to the JEFFERSON CONSTRUCTION CO., at $138,000. Hugh McCloskey and W. P. Burke are Trustees.

Chattanooga, Tenn.—Plans have been prepared by Barnwell & Barnwell, Arch., 516 Hamilton Bank Bldg., for the construction of a ten-story, 100x137-ft. office building at Ninth and Dewey St. and Georgia Ave. for the Volunteer State Life Insurance Co.

Memphis, Tenn.—I. D. Block, of the Dry-Block Mercantile Co., has purchased a site at Calhoun Ave. and Mulberry St. upon which to construct a five-story brick hotel. The estimated cost is $50,000.

Nashville, Tenn.—Asmus & Norton, Arch., 505-8 Cole Bldg., is preparing plans for the construction of a five-story, 50x150-ft. addition to the St. Thomas' Hospital. The estimated cost is $200,000.

Nashville, Tenn.—Plans are being prepared by Ludlow & Peabody, Arch., 101 Park Ave., New York, N. Y., for the remodeling of the bank building for the First and Fourth National Bank of Nashville. The estimated cost is $75,000.

Louisville, Ky.—Bids will be received about Aug. 20 by S. X. Murphy & Bro., Arch., Louisville, for the construction of a ten-story reinforced-concrete addition to the Tyler Hotel. The estimated cost is $200,000. Noted June 24.

Camden, Ohio—Bids will be received until noon, Aug. 20, by G. W. Homsher, Clk., Bd. of Education, for the construction of an eight-room high school with an auditorium and a gymnasium. E. Rufus Thompson, Arch., 524 Belmont Ave., Youngstown, has prepared the plans. Noted June 10.

Cleveland, Ohio—Plans are being prepared by Hubbell & Benes, Arch., 4500 Euclid Ave., for the construction of a two-story commercial building at Euclid Ave. and East 102d St. for the Cutler Realty Co. Estimated cost, $60,000.

+Cleveland, Ohio—The contract for the construction of a three-story commercial building at Detroit and West 65th St. for Charles A. Conners has been awarded to the A. B. LOOMIS CONSTRUCTION CO. W. S. Ferguson Co., 1900 Euclid Ave., is Arch. Estimated cost, $50,000.

+Cleveland, Ohio—The contract for the construction of a five-story commercial building at 1903 East 19th St., near Euclid Ave., for Mrs. Amanda Corlett, has been awarded to the WALTHERS ENGINEERING CO., East 66th St., Cleveland. W. S. Ferguson Co., 1900 Euclid Ave., is Arch. Estimated cost, $125,000.

Cleveland, Ohio—The Immanuel Baptist Church is planning to construct a church on Parkwood Drive. Estimated cost, $50,000.

+Cleveland, Ohio—The contract for the construction of a church on East 93rd St. for the St. Catharine congregation has been awarded to EMIL CONVERSE, Massillon. Estimated cost, $60,000. E. J. Schneider, 606 Cuyahoga Bldg., is Arch.

Cleveland, Ohio—Plans have been prepared by Hubbell & Benes, Arch., 4500 Euclid Ave., for alterations and improvements to the Pearl Street Savings & Trust Co. Building, West 25th St. and Clark Ave. Estimated cost, $40,000.

Cleveland, Ohio—Plans have been prepared by Emil M. Ulrich, Arch., 1900 Euclid Ave., for the construction of a school on Aetna Rd. for the Congregation of Christ. Estimated cost, $40,000.

Cleveland, Ohio—Preliminary plans have been prepared by Harry A. Cone, Arch., 1228 Schofield Bldg., for the construction of a five-story reinforced-concrete commercial building on Euclid Ave., near East 17th St. for M. G. Glauber. Estimated cost, $125,000.

Cleveland, Ohio—The St. George's Lithuanian Church, 1389 East 21st St., will construct a church and school building at East 67th St. and Superior Ave., N. E. The estimated cost is $150,000. Joseph Halaburda is Pastor.

Columbus, Ohio—A commission will soon be appointed by Governor Willis to plan for the construction of a state office building on the Capitol Square. The estimated cost is $1,000,000. A. V. Donahey is State Audr. and D. M. Hough is Adjutant General. Noted Mar. 25.

Columbus, Ohio—Plans are being prepared by Richards, McCarty & Bulford, Arch., for the construction of a clubhouse for the Scioto Country Club. Estimated cost, $50,000.

Columbus, Ohio—Plans are being prepared by J. N. Bradford, Arch., for the construction of a school building for the Ohio State University. The estimated cost is $150,000. Noted May 6.

Columbus, Ohio—Bids will be received until noon, Aug. 16, by Ben. W. Hough, Adjutant Gen., for the construction of additions and alterations to the fourth floor of the Ohio State Capitol Annex. Karl I. Best, State House, Columbus, is Arch.

Gratis, Ohio—Bids will be received until noon, Aug. 16, by J. T. Street, Clk., Bd. of Education of the Gratis School Dist., for the construction of a two-story fireproof school. Albert Pretzinger and Edward P. Musselman, Archs., 1155 Feibold Annex, Dayton, have prepared the plans.

Lakewood, Ohio—Preliminary plans are being prepared by Charles W. Hopkinson, Arch., 900 Rose Bldg., Cleveland, for the construction of a high school at Lakewood. Estimated cost, $175,000. Noted Apr. 15.

+Lisbon, Ohio—The School Board has awarded the contract for the construction of a high school to the CULLEN & VAUGHN CO., Hamilton. The estimated cost is $60,000.

Monroe, Ohio—Plans are being prepared by Rush & Sheets, Arch., Columbus, for the construction of a grade and high school. The estimated cost is $45,000.

+Niles, Ohio—The contract for the construction of a building for the National McKinley Birthplace Memorial Association has been awarded to JOHN H. PARKER CO., 315 Fourth Ave., New York, N. Y., at $240,000. Noted Apr. 15 and May 13.

+Springfield, Ohio—The contract for the construction of a five-story hotel on East High St. for Frank G. Warden has been awarded to the CONCRETE STEEL CONSTRUCTION CO. The estimated cost is $200,000.

Toledo, Ohio—Bids will be received until noon, Aug. 23, by the Clerk of the Board of Education, for the construction of the Mott School at Colorado and Worthington St. Edwin M. Gee is Arch. and George L. McKesson is Dir. of Schools.

Toledo, Ohio—Bids will be received until 10 a.m., Aug. 27, by Charles J. Sanzenbacher, Clk. of Lucas County Commission, for the construction of an addition to dormitory No. 2 at the Hospital for Tuberculosis. David L. Stine, 405 Valentine Bldg., is Arch.

+Youngstown, Ohio—The contract for the construction of an office building and laboratory for the Youngstown Sheet & Tube Co. has been awarded to the STONE & WEBSTER ENGINEERING CO., 1161 Massachusetts Ave., Boston, Mass. The estimated cost is $300,000. Noted Aug. 5.

Gary, Ind.—E. O. Selby, 220 South Sixth St., Coshocton, Ohio, will construct a one-story, 125x125-ft. motion picture theater and store building. The estimated cost is $50,000. Work will begin in the spring.

+Detroit, Mich.—The contract for the construction of a 12-story hotel building at Cass and Peterboro St. for the Buckingham Hotel Co. has been awarded to the THEODORE STARRETT CO., 712 Free Press Bldg., Detroit. E. R. Dunlap is Arch. Noted July 15.

Grand Rapids, Mich.—Lee De Camp and Frank L. Wade, Archs., 26 Empress Bldg., are preparing plans for the construction of a three-story, 132x132-ft. theater. The estimated cost is $225,000.

Muskegon, Mich.—The Directors of the Occidental Hotel Co. plan to construct a four-story addition to the hotel on Third St. Estimated cost, $50,000. John G. Emery, Jr., is Pres. and John Q. Ross is Secy.

+Kenosha, Wis.—The general contract for the construction of a school has been awarded to GOTTLIEB SCHAEFFER, Kenosha, at $77,000. Noted June 10.

Stevens Point, Wis.—The Board of Regents of the Normal Schools has received bids for the construction of a dormitory at the Stevens Point Normal School, as follows: Hans P. Knudsen, Waupaca, 47$,525; Immel Construction Co., Fond du Lac, $49,483; General Construction Co., Milwaukee, $43,761; J. F. Weyenberg Construction Co., Grand Rapids, $58,486; J. B. Cullen Co., Janesville, $65,619; Appleton Construction Co., Appleton, $44,999; C. R. Meyer & Sons Co., Oshkosh, $49,680. Noted July 8.

Des Moines, Iowa—Plans have been prepared by Watrous & Sawyer, Arch., 303 Watrous Bldg., for the construction of a union station for the Chicago, Rock Island & Pacific Ry. The estimated cost is $1,000,000. Noted under East Des Moines, Iowa (Des Moines post office), Jan. 28.

Granite Falls, Minn.—Bids will be received until Aug. 18 by Downer Mullen, Secy., Bd. of Control, St. Paul, for the construction of a two-story tuberculosis sanatorium. Estimated cost, $40,000. Sund & Dunham, 512 Essex Bldg., Minneapolis, is Arch. Noted Feb. 18.

Minneapolis, Minn.—A. R. Van Dyck, Arch., 740 McKnight Bldg., has prepared plans for the construction of a two-story, 42x127-ft. building for the Maternity Hospital, 2201 Western Ave. The estimated cost is $50,000. Mrs. T. C. Nickels is Pres. Noted July 29.

+Minneapolis, Minn.—The contract for the construction of a 12-story, 88x159-ft. hotel and store building at Hennepin Ave. and Second St. for the Union City Mission has been awarded to MADSEN BROS., 753 Plymouth Bldg., Minneapolis. Estimated cost, $200,000. C. E. Bell, 310 Security Bank Bldg., is Arch. Noted June 10.

St. Peter, Minn.—Plans are being prepared by C. H. Johnston, Arch., 715 Capital Bank Bldg., St. Paul, for the construction of an addition to the Criminal Insane Bldg. The estimated cost is $55,000. Downer Mullen, St. Paul, is Secy., Bd. of Control.

Chanute, Kan.—Plans are being prepared for the construction of a lodge building for the Royal Arch Masons, Chapter No. 21. The estimated cost is $50,000.

Wichita, Kan.—Work will soon begin on the construction of a two-story, 115x120-ft. theater. The estimated cost is $80,000. L. M. Miller is Mgr. and Carl Boller & Bro., 7 Gayety Theater Bldg., Kansas City, Mo., is Arch. Noted June 17.

+Kearney, Neb.—(Official)—W. F. CROSSLEY, Kearney, at $57,867, including heating, plumbing and wiring, was awarded the contract for the construction of an auditorium for the State Normal School. Other bids, not including the heating, plumbing and wiring, were as follows: J. P. Riddle, $53,700; Walter Kuntzen, $53,333; F. P. Gould & Son, $51,750; Hester Construction Co., $57,000. Noted July 29.

+Sioux Falls, S. D.—The contract for the construction of a four-story, 135x166-ft. brick and reinforced-concrete building on First Ave. between 10th and 11th St. for Haley & Lang Building Co., has been awarded to COWLES & VANDANAKER, St. Paul, Minn. Estimated cost, $100,000. Joseph Schwarz is Arch.

Sioux Falls, S. D.—The State Board of Regents has approved and accepted the plans prepared for the construction of a dormitory at the Brookings College. Estimated cost, $75,000.

Jefferson City, Mo.—An election will be held on Oct. 19 by the Court of Cole County to vote on the question of issuing $100,000 in bonds. Part of the proceeds will be used for the construction of a jail and a tuberculosis hospital.

Marshall, Mo.—Bids will be received about Aug. 15, by J. H. Felt & Co., Arch., 800 Grand Ave., Kansas City, for the construction of a two-story, 60x140-ft. cottage at the Missouri Colony for Feeble Minded. The estimated cost is $65,000.

St. Joseph, Mo.—Bids will soon be received for the construction of a three-story office building to be used by physicians and surgeons, at Seventh and Francis St. The estimated cost is $50,000. Walter Boschen, Tottle Bldg., is Arch.

St. Louis, Mo.—Plans are being prepared by Thomas P. Barnett Co., Arch., 724 Central National Bank Bldg., for the construction of a 16-story, 83x100-ft. hotel for W. K. Bixby, Lindell and Kingshighway Blvd.

St. Louis, Mo.—The Burdeau Real Estate Co. is having plans prepared for the construction of a commercial building at 16th and Chestnut St. The estimated cost is $100,000.

Beaumont, Tex.—Bids will be received until Aug. 14, by the School Board of the South Park Independent School District, for the construction of an addition to the South Park School. The estimated cost is $50,000. Sanguinet, Staats & Gottlieb, 624 First National Bank Bldg., Houston, is Arch. Noted July 1.

Corsicana, Tex.—Bids will be received about Aug. 15 for the construction of a hospital dormitory for the Texas State Orphans Home Association. The estimated cost is $89,000. C. H. Page & Bro., 348 Austin National Bank Bldg., Austin, is Arch. Noted July 22.

+Dallas, Tex.—The contract for the construction of a five-story, 75x90-ft. brick addition to the St. Paul Sanitarium for the Daughters of Charity of St. Vincent de Paul has been awarded to H. J. CURTIS, Dallas. Estimated cost, $200,000. J. E. Overbeck, 708 Wilson Bldg., is Arch. Noted Apr. 8.

Johnson City, Tex.—Plans are being prepared by Henry T. Phelps, Arch., San Antonio, for the construction of a court house. The estimated cost is $50,000.

Orange, Tex.—At a recent election the citizens voted in favor of issuing $150,000 in bonds. The proceeds will be used for the construction of schools. Noted June 10 and 24.

San Antonio, Tex.—Bids will be received until Aug. 20, by J. S. Davis, County Judge, for the construction of the two-story, 125x125-ft. reinforced-concrete Robert B. Green Memorial Hospital. The estimated cost is $235,000. Noted July 22.

Norman, Okla.—Bids will be received until Aug. 20 for the construction of a four-story reinforced-concrete Science Hall at the University of Oklahoma. The estimated cost is $90,000. Hawk & Parr, 501 Security Bldg., Oklahoma, is Arch. Noted Aug. 5.

Bellingham, Wash.—Bids will be received about Sept. 1 for the construction of an addition to the North Side High School. The estimated cost is $90,000. T. F. Doan, 217 Sunset Bldg., is Arch. and Heath & Gove, National Realty Bldg., Tacoma, is Assoc. Arch. Noted July 22.

Portland, Ore.—Bids will soon be received for the construction of an auditorium on the Market Blk. Whitehouse & Fouilhoux, Arch., 809-13 Wilcox Bldg., has prepared plans. The estimated cost is $600,000. Noted July 29.

Salem, Ore.—Bids were received by the Board of Trustees for the construction of a building at the State Normal School, as follows: Bingham & Shelly, Portland, $39,497; Southwick & Hendrick, Salem, $39,741; Snook & Traver, Salem, $40,988; E. B. White, Portland, $41,286; James P. Taylor, Portland, $41,987; N. E. Hoover, Albany, $43,279; John Almeter, Portland, $42,804; W. C. Arthur & Co., Portland, $45,372; Wechter & Wood, Salem, $46,249; C. Van Patten, Salem, $51,308; J. F. Mollecop, Salem, $44,843; L. D. Horn, Portland, $45,950; H. E. Doering, Portland, $46,263; Palmer & Ellison, Portland, $46,536; A. F. Peterson, Portland, $44,567; A. W. Kutsche, Portland, $46,800; F. A. Erickson, Salem, $42,248; J. H. Tillman, Portland, $44,600; C. C. Johnson & Son, Portland, $45,776.

+Fresno, Calif.—The contract for the construction of a two-story business block for Olender Bros. has been awarded to RIGGINS & PALMER. The estimated cost is $60,000.

Fresno, Calif.—R. F. Hotchkin, Arch., has been commissioned to prepare plans for the construction of an edifice for the Christian Science congregation. The estimated cost is $75,000. Henry Gundelfinger is Chn. of Bldg. Com.

Los Angeles, Calif.—The F. O. Engstrum Co., Fifth and Seaton St., at $92,127, submitted the lowest bid for the construction of the brick and reinforced-concrete auditorium, library and music buildings at the Lincoln High School. Needham & Cline, 615 Brockman Bldg., is Arch. Noted Mar. 11.

Los Angeles, Calif.—The Concordia Country Club has been incorporated at $200,000 and will construct a clubhouse west of Los Angeles. Edelman & Barnett, Arch., 729 Black Bldg., has prepared the plans.

Iriquois Falls, Ont.—The Abitibi Pulp & Paper Co. will construct 75 cottages, estimated to cost $60,000.

London, Ont.—Preliminary plans are being prepared by Lee De Camp and Frank L. Wade, Archs., 26 Empress Bldg., Grand Rapids, Mich., for the construction of a four-story, 110x267-ft. hotel, theater and store building. The estimated cost is $300,000. S. H. Bangs, 110 Dundas St., London, is interested.

Toronto, Ont.—The Civic Property Committee has been commissioned to approve the construction of a two-story brick dormitory at the Women's Industrial Farm. Estimated cost, $40,000.

+St. Boniface, Man.—The contract for the construction of a school on Youville St. has been awarded to the PROGRESS CONSTRUCTION CO., LTD. The estimated cost is $100,000.

SEWER EXTENSION—BOSTON, MASS.
Section 105

+Bids were received July 28 by the Metropolitan Water and Sewerage Board for the construction of sewers in Section No. 105 of the high level sewer, South Metropolitan System, in Needham and Wellesley from (A) Bruno & Petitti, (B) M. Russo & Son, (C) Henry Spinach Contracting Co., (D) Michael Meehan, (E) Coleman Bros., (F) George M. Bryne, (G) HUGH NAWN CONTRACTING CO., Roxbury (awarded contract). The item bids were as follows:

	A	B	C	D	E	F	G
4425 lin.ft. earth excavation and refilling in trench and embankment 24 in. x 27 in. concrete sewer	$9.00	$7.84	$7.75	$7.50	$6.00	$4.50	$3.00
60 cu.yd. portland brick masonry in manholes	16.00	17.00	20.00	20.00	18.00	16.00	18.00
2000 cu.yd. portland concrete masonry in trench	8.50	9.00	8.00	8.50	8.00	8.00	7.50
100 cu.yd. rock excavation in trench	6.00	4.50	10.00	8.00	6.00	4.00	3.65
Extended totals	$58,385	$54,162	$52,493	$52,187	$44,230	$37,272	$29,655

The Commercial Construction Co. has changed its name to the Bickel Co., Engineers-Contractors, and has moved from its former quarters in the Reliance Bldg., Kansas City, Mo., to the Interstate Bldg. The capital stock has been doubled but the officers and policy of the company are the same.

The Metals Coating Co. of America, 122 South Michigan Ave., Chicago, Ill., has opened offices at 30 Church St., New York, in charge of Mr. Edward McFarlan, and at 100 Summer St., Boston, Mass., in charge of Mr. Herbert Jaques, Jr. This company is prepared to furnish information and to demonstrate to interested manufacturers the Schoop Metal Coating Process.

The Gardner Governor Co., Quincy, Ill., manufacturer of pumping machinery, has recently been awarded contracts calling for three carloads of pumps ranging in size from the very smallest to the largest water works type; also received contracts from Indo-Burma calling for two small water works pumps.

SEWER—NEWARK, N. J.

Bids were received July 29 by the city for the construction of the Bound Creek and Frelinghuysen Ave. sewer from (A) John W. Heller, Newark, (B) Peter D'Amato, Newark, (C) O'Gara & Maguire, Newark, (D) Charles Ippolito, Montclair, (E) Averill Mathews, Montclair, (F) Harrison & Craig, Newark, (G) P. L. Braunworth, (H) Frisco Construction Co., Newark. The item bids were as follows:

	A	B	C	D	E	F	G	H
2050 ft. 4x6 ft. concrete sewer	$9.50	$11.75	$8.88	$26.99	$9.95	$13.00	$12.00	$9.00
1300 ft., 18-in. pipe sewer	1.40	3.65	1.68	2.54	1.70	2.00	1.52	1.75
2700 ft., 15-in. pipe sewer	1.25	3.98	1.29	2.22	1.45	1.50	1.25	1.50
1470 ft., 12-in. pipe sewer	.80	1.79	.79	1.53	.50	1.00	.48	1.00
110 ft. 16-in. c. i. pipe	6.00	5.00	3.30	4.49	5.50	3.00	4.86	3.00
60 ft., 12-in. c.i. pipe	2.50	3.00	2.75	5.00	3.50	2.50	2.70	2.00
7 basins	100.00	100.00	70.00	85.00	85.00	100.00	55.00	100.00
26 manholes over pipe sewer	40.00	55.00	41.00	50.00	35.00	50.00	45.00	50.00
12 manholes over concrete sewer	30.00	25.00	27.50	30.00	25.00	40.00	30.00	50.00
2 pumps	400.00	200.00	380.00	650.00	250.00	600.00	183.00	500.00
75,000 ft. b.m. timber	40.00	45.00	34.75	50.00	32.00	32.00	40.00	60.00
450 piles	12.00	9.00	5.25	3.75	8.00	8.00	3.40	10.00
Extended totals	$37,956	$53,194	$33,175	$76,661	$36,377	$44,930	$38,164	$39,295

FIFTEENTH AVE., N. W., BRIDGE, SEATTLE, WASH.

Bids were received July 23 by A. H. Dimock, City Engr., Seattle, Wash., for the construction of the superstructure of a bridge over Lake Washington Canal at 15th Ave., N. W., from: (A) Standifer-Clarkson Co., (B) Beer's Building Co., (C) Booker, Kiehl & Whipple. Bids for the substructure of the same bridge were received from: (A) Booker, Kiehl & Whipple; (B) Hans Pederson; (C) Beer's Building Co.; (D) Twohy Bros. Co. The item bids were as follows:

Superstructure	A	B	C
23,000 lb. machinery, furnishing and erecting	$0.11½	$0.128	$0.1112
1,900,000 lb. structural steel, furnishing and erecting	.0465	.043	.0416
Furnishing 300,000 lb. structural steel, erected by contractor for substructure	.0325	.032	.0333
390 cu.yd. furnishing, placing and adjusting gravel concrete counterweight	7.50	5.00	5.50
280 cu.yd. furnishing, placing and adjusting cinder concrete counterweight	8.00	7.00	5.50
1 cinder concrete test block, furnishing and weighing	10.00	10.00	11.00
1 gravel concrete test block, furnishing and weighing	10.00	10.00	11.00
890 sq.yd. roadway floor on movable leaves	5.60	2.85	5.25
410 sq.yd. roadway floor, including reinforcement, on fixed portion	4.25	2.45	3.30
265 sq.yd. sidewalk floor on movable leaves	1.25	.50	1.00
130 sq.yd. sidewalk floor on fixed portion	1.35	1.25	1.20
90 sq.yd. concrete floor, including reinforcement, on machinery platforms	2.40	1.00	1.20
10,000 lb. reinforcing bars in concrete counterweight	.0325	.0275	.03
Electric equipment complete in place (lump sum)	13,936	14,946	14,132
4 operators' houses and 2 toilet rooms complete (lump sum)	6000	600	5300
Meneely fog bell in place (lump sum)	120.00	100.00	90.00
2 copper ball vessel signals in place	25.00	15.00	70.00
80 lin.ft. iron pipe hand rails below deck of bridge	1.25	.50	1.65
Wooden steps and railings for access to machinery platforms (lump sum)	35.00	200.00	125.00
4 double-arm roadway gates complete in place	300.00	300.00	302.50
14 oak buffer blocks	5.00	3.00	5.00
Extended totals	$148,945	$146,029	$146,366

Substructure	A	B	C	D
5200 cu.yd. excavation	$3.20	$5.10	$2.66	$8.65
2700 cu.yd. Class A concrete (deposited under water)	8.52	6.60	8.00	7.80
4600 cu.yd., Class C, concrete in piers (above water)	5.65	7.00	8.00	6.90
7300 cu.yd. concrete in unwatered foundations (alternate to two preceding items)	12.00	7.00	8.65	7.15
850 cu.yd., Class B, concrete	6.70	12.00	6.00	7.60
127,000 lb. reinforcing steel	.032	.028	.0275	.0265
Placing and painting structural steel, grillages and anchor bolts, including grouting, 300,000 lb	.0078	.004	.0465	.006
2 fir bumping logs	22.00	25.00	10.00	25.00
4200 lin.ft. peeled piles in protection work	.20	.20	.15	.40
8 M ft. b.m. timber in protection work	25.30	25.00	14.00	20.00
325 lin.ft. chains on dolphins	.30	.30	.30	.30
560 sq.ft. surface treatment of panels	.22	.03	.06	.18
400 sq.ft. brick pattern work	.66	.20	.20	.20
16 pendants, 1 part cement, 3 parts sand	16.50	10.20	5.00	3.00
4 test piles	44.00	25.00	10.00	20.00
8 eye bolts in shafts of anchor piers	3.30	2.00	15.00	.60
750 cu.yd. extra excavation below elevation —35	5.50	2.00	2.00	4.00
750 cu.yd. extra concrete below elevation—35	11.00	4.00	6.00	7.80
750 cu.yd. alternate to preceding item in case foundations are unwatered	13.00	5.00	6.00	7.80
Extended totals	$92,145	$97,556	$101,987	$120,556
Alternates	$132,401	$99,386	$106,732	$119,951

CATALOG NOTICES

Kerr Turbine Co., Wellsville, N. Y. Bulletin No. 54. Economy turbo-generators. Illustrated, 32 pp., 6x9 in.

Theodore Smith & Sons Co., Jersey City, N. J. Catalog. Clam shell and orange peel buckets, stone grapplers, dredges. Illustrated, 44 pp., 6x9 in.

De Laval Steam Turbine Co., Trenton, N. J. Catalog F. Centrifugal blowers and compressors. Illustrated, 64 pp., 6x9 in.

Contracts to Be Let

Bids received until Sept. 7, 1915.

Sewage Pumping Stations

Albany, N. Y.

Sealed proposals for the construction, and separate sealed proposals for the equipment of two sewage pumping stations will be received by the Board of Contract and Supply of the City of Albany, N. Y., at its office in the City Hall, until 3 o'clock P. M., Tuesday, September 7, 1915, at which place and time the proposals will be publicly opened and read.

The contract for construction of the stations will include, among other items:

Excavation approximately	15,000 cu. yds.
Embankment approximately	16,000 cu. yds.
Concrete approximately	5,000 cu. yds.

Superstructures for a main pumping station, gate house, tool house and auxiliary automatic pumping station.
Railroad track, storage battery locomotive, electrically operated locomotive crane, Venturi meter, etc.

There will be separate contracts also for the necessary plumbing, heating and ventilating, and electrical wiring and fixtures.

The contract for the equipment of the pumping stations will include among other items, the design, construction, delivery and erection of three 10,000,000-gallon daily, three 15,000,000-gallon daily, and two 1,500,000-gallon daily motor-operated centrifugal pumps, switchboards, suction and discharge piping, etc.

Each proposal must be accompanied by a certified check, as a guarantee for the execution of contract and bond, in amount as follows:

For pumping station construction	$10,000
For pumping station equipment	$10,000
For plumbing	$200
For heating and ventilating	$150
For electrical wiring and fixtures	$250

Plans and specifications may be obtained by addressing Frank R. Lanagan, City Engineer, and depositing $25.00 for each complete set or part thereof. Said deposit will be refunded upon return of the plans and specifications in good condition within two weeks after date of opening of bids.

The Boa.·d reserves the right to reject any or all bids.

ISADORE WACHSMAN,
Secretary of the Board.

Bids received until Aug. 18, 1915.

Submerged Outfall Pipe at West 58th Street Sewage Treatment Works

Cleveland, Ohio.

Sealed proposals will be received at the office of the Commissioner of Purchases and Supplies, Room No. 511 City Hall, until 12 o'clock noon, August 18th, 1915, for the construction of a concrete open channel outfall sewer approximately 630 feet in length supported on piling and a submerged outfall pipe line approximately 3600 feet long.

Copies of plans and specifications and blank proposals can be obtained at the office of the Commissioner of Engineering, Room Nos. 403 and 417 City Hall, after August 4th, 1915, upon the deposit of Five ($5.00) Dollars, the same to be refunded upon the return of the plans in good condition.

The proposal must contain the full name of the party or parties making the same and all persons interested therein and must be accompanied by a proposal bond signed by a surety company authorized to do business in the State of Ohio or by a certified check for Five Thousand ($5000.00) Dollars payable to the City of Cleveland on a solvent bank, as a surety that if the bid be accepted a contract will be entered into and the performance of it properly secured.

No proposal will be entertained unless made on the blanks furnished by the Commissioner of Engineering and delivered at the office of the Commissioner of Purchases and Supplies, Room No. 511 City Hall, previous to 12 o'clock M. on the day specified.

The City reserves the right to reject any or all bids.

A. R. CALLOW,
Commissioner of Purchases and Supplies.

U. S. ENGINEER OFFICE, 508 Federal Bldg., Chicago, Ill.—Sealed proposals will be received here until 10 A.M., August 17, 1915, and then opened, for dredging in Calumet River, Ill. Further information on application.

Bids received until Sept. 8, 1915.

Strauss Bascule Trunnion Bridge

Matawan, N. J.

Sealed proposals for the furnishing of all labor, tools and materials for the construction of a Strauss Bascule Trunnion Bridge, over Matawan creek, on the road from South Amboy to Keyport, in the County of Monmouth, State of New Jersey, in accordance with the plans and specifications prepared therefor and heretofore approved by the Board of Chosen Freeholders of the County of Monmouth, State of New Jersey, will be received by the Board of Chosen Freeholders of the County of Monmouth, at their rooms, Court House, Freehold, New Jersey, on Wednesday, September 8th, 1915, at the hour of eleven o'clock in the forenoon of said day, and then and there publicly opened and read.

All proposals must be submitted in a sealed envelope, be endorsed with the name and address of the bidder and the name of the work bid on.

Plans and specifications can be seen on any day, excepting holidays and Sundays, between the hours of nine a.m. and four p.m., at the office of George D. Cooper, County Engineer, 60 Broad St., Red Bank, N. J., at the office of the Clerk of the Board of Chosen Freeholders of the County of Monmouth, Chas. E. Close, 41 Main Street, Matawan, N. J.; and at the office of the Collector of the County of Monmouth, Court House, Freehold, N J., or can be obtained upon application to the Strauss Bascule Trunnion Bridge Company, 104 South Michigan Avenue, Chicago, Ill.

All proposals must be accompanied by a certified cheque, drawn in the sum of five thousand dollars ($5000.00) to the order of the Collector of the County of Monmouth, or a bid bond for said amount of five thousand dollars, given by a surety company authorized to do business in the State of New Jersey, to said Collector.

The Board of Chosen Freeholders of the County of Monmouth reserves the right to reject any or all bids, if deemed to the best interests of the County of Monmouth so to do.

Each bidder must submit with his or their bid a certificate that he or they have visited the location of the proposed work and have made themselves acquainted with the local conditions in connection therewith, and that his or their bid is submitted in strict compliance with the requirements of Chapter 253, Laws of New Jersey, 1913.

No alternate proposal or a proposal on any other plan and specifications other than the plans and specifications heretofore approved by the Board of Chosen Freeholders of the County of Monmouth will be received or considered by the Board of Chosen Freeholders of the County of Monmouth.

Any proposal not complying with the above requirements or the requirements of the specifications as to the submission of bids or proposals will not be considered by the Board of Chosen Freeholders of the County of Monmouth.

No proposal will be received before the hour advertised to receive same, nor will any proposal be received after the hour advertised to receive same.

Dated Freehold, N. J., August 9th, 1915.

J. M. CORLIES, Director.

Attest: C. E. CLOSE, Clerk of Board.

Bids received until Aug. 17, 1915.

Filling and Grading

OFFICE OF THE COMPTROLLER OF THE STATE OF NEW JERSEY

State House, Trenton, N. J.

Sealed proposals for about twenty thousand cubic yards of filling and grading on lands of the State of New Jersey in the rear of the State Capitol, Trenton N. J., will be received at this office at twelve o'clock noon, August 17th, 1915, and then publicly opened.

Plans and specifications on application to the Commissioner of Charities and Corrections, State House, Trenton, N. J.

E. I. EDWARDS, Comptroller,
Secretary, State House Comn.

PROPOSALS FOR AIR COMPRESSORS, ETC.—U. S. Engineer Office, Pittsburgh, Pa.—Sealed proposals for furnishing and installing air compressors, gas engine, turbine, electric light plant, etc., at Lock 6, Monongahela River, will be received at this office until 12 M. (Eastern Standard Time), August 21, 1915, and then opened. Information on application.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS—STEAM AND ELECTRIC

Maine—Fred B. Teeling, Litchfield, Maine, is interested in a project to construct an electric railway from Topsham to Monmouth, Maine, a distance of 33 miles.

New York—Preliminary surveys have been made for the construction of an electric railway along public highways between the towns of Sea Cliff, Glen Cove, Oyster Bay and Roslyn to connect with the New York & North Shore Traction Co. P. Clingman, 33 Pine St., New York, N. Y., is interested.

New York—Hornell Traction Co.—This company will double-track its line on Main St. and part of Broad St. D. A. Proctor, Hornell, is Gen. Mgr., Supt. and Pur. Agent.

New York—Schenectady Ry.—This company has been authorized to extend its line from Nott St. and Wendell Ave., Schenectady, the present terminus, along Nott St. to the Grand Blvd. at East Alley and then along the Grand Blvd. on a private right-of-way in the Town of Niskayuna. James F. Hamilton, Schenectady, is Gen. Mgr

New Jersey—Public Service Ry. Co.—This company is considering the construction of a railway from Woodbridge to Roosevelt. R. E. Danforth, Newark, is Gen. Mgr.

Pennsylvania—Pittsburgh & Lake Erie R.R.—This company plans to double-track its line from New Castle to Sharon. J. A. Atwood, Pittsburgh, Penn., is Ch. Engr.

Pennsylvania—Press reports state that a right-of-way is being secured for a railway to be constructed from Bedford through the Black Valley to Chaneysville, Penn., thence to Little Orleans, Md. New York Central R.R. is interested.

Virginia—Norfolk Water Front Belt Line Corporation—This company has been incorporated to construct a belt-line railroad from the tracks of the Norfolk & Western Ry. at Lambert's Point to the Atlantic City ward of Norfolk. A. P. Jones, D. Lawrence Groner and D. F. Watt, all of Norfolk, are the incorporators.

✚**Virginia**—Petersburg & Appomattox Ry.—This company has awarded the contract for the construction of an electric railway from Petersburg to City Point, about 10 miles, to the VAUGHN CONSTRUCTION CO., Roanoke, Va. The estimated cost is $200,000.

Virginia—Richmond & Rappahannock River Ry. Co.—According to press reports, this company plans to extend its line to Urbanna. Charles L. Ruffin, Richmond, is Vice-Pres. and Gen. Supt.

✚**North Carolina**—Southern Ry.—This company has awarded contracts for double-tracking its line as follows: Concord to Rocky River, N. C., about six miles, to H. H. THRASHER, Knoxville, Tenn.; Hayne, N. C., to Greer, S. C., about 17 miles, to the CORNELL-YOUNG CO., Greenville, S. C.; Greer to Greenville, S. C., about 13 miles, to the MORROW CONSTRUCTION CO., Atlanta, Ga. The estimated cost is $1,428,000.

Georgia—Hawkinsville & Western R.R.—This company has been leased by the Ocilla Southern R.R., which plans to improve same. D. C. Smith, Ocilla, Ga., is Gen. Mgr., Ocilla Southern R.R.

Florida—An election will be held in Miami, Sept. 21, to vote on the question of issuing $40,000 in bonds. The proceeds will be used to construct a railway from the west shore of Biscayne Bay to connect with the Florida East Coast Ry.

Mississippi—Meridian & Deepwater Ry.—This company will, according to press reports, start work about Dec. 1 on the construction of a railway from Meridian, Miss., to Myrtlewood, Ala., about 50 miles. S. A. Neville, Meridian, is Vice-Pres.

✚**Tennessee**—Tennessee Ry.—A contract has been awarded by this company to the HARRIMAN CONSTRUCTION CO., Harriman, Tenn., for the extension of its line from Oneida to Petros, Tenn., about eight miles, with three miles of branches. C. W. Butts, Oneida, is Ch. Engr.

Tennessee—H. H. Thrasher, Knoxville, Tenn., is interested in the construction of a railroad spur from Halls Station on the Southern Ry. to a marble quarry near Nebberts Springs. Estimated cost, $60,000.

Tennessee—Tennessee Electric R.R. Co.—This company has been organized to construct an electric railway about 275 miles long. Lee Baker and William Myers are interested.

Kentucky—Cumberland Traction Co.—This company has been incorporated to construct an electric railway from Hodgenville to Edmonton, Ky.

Ohio—Toledo-Detroit R.R. Co.—This company, formerly the Toledo, Ann Arbor & Jackson R.R. Co., will sell $523,000 in bonds. The proceeds will be used to complete the line from Toledo, Ohio, to Dundee, Mich.

North Dakota—Chicago, Milwaukee & St. Paul Ry.—According to press reports, this company plans to extend its Ortonville-Fargo branch to Grand Forks, N. D. C. F. Loweth, Chicago, Ill., is Ch. Engr.

Montana—Julius Rosholt, Fairmount, N. D., is interested in the construction of a railroad from Three Forks to Radersburg, Mont.

Missouri—Metropolitan St. Ry. Co.—This company will soon receive bids for extending its line about nine miles. J. M. Egan, Kansas City, is Pres. and Gen. Mgr.

Texas—Corpus-Christi-Ward Island Interurban Ry.—This company has been granted a franchise to construct an electric railway from Corpus Christi to Ward Island. The estimated cost is $1,000,000. J. H. Caswell, San Diego, Calif., is interested. Noted July 15.

Texas—El Paso Electric Ry. Co.—This company plans to construct a railway on Piedras St. from Tularosa St. to Alameda Ave., El Paso. L. C. Bradley, Dallas, is Asst. Dist. Mgr.

Texas—Marshall & East Texas Ry.—According to press reports, this company will be taken over by B. F. Yoakum and associates, who will extend the line from Elysian Fields, Tex., to New Orleans, La., about 300 miles, and from Winnsboro to Paris, Tex., about 50 miles.

Texas—Misouri, Oklahoma & Gulf Ry. Co.—This company plans to build additional yards at Denison, Tex. W. Kenefick, Kansas City, Mo., is Pres.

Texas—According to press reports, the Dallas Southwestern Traction Co. and the Dallas Northwestern Traction Co. will soon start work on the construction of a system of interurban lines. This will include a trunk line from Dallas to Austin, with branches to San Angelo, Brownwood, Lockhart, San Antonia and Denton. Noted Mar. 4 and Apr. 22.

Oklahoma—The Central States Construction Co. has been incorporated to construct an electric interurban railway to connect Joplin, Mo., and Miami, Tulsa and Collinsville, Okla. John R. Rose and J. R. Eldridge, Oklahoma, are interested. Noted Aug. 5.

✚**Washington**—Bellingham, Mt. Baker & Spokane R.R.—This company has awarded the contract for the construction of a railroad from Bellingham to Spokane, a distance of 228 miles, to E. J. FADER, New Westminster, B. C.

California—California Southern Ry.—This company has applied to the State Railroad Commission for permission to increase its capital stock from $400,000 to $1,000,000 and to create a bonded indebtedness of $750,000. The company plans to construct a railway from Blythe Junction on the Santa Fé River to the Town of Blythe in the Palo Verde Valley. G. W. Rice, Blythe Junction, is Ch. Engr.

LIGHT, HEAT AND POWER

Manchester, N. H.—The Manchester Traction, Light & Power Co. has taken out a permit for a new power house at Brook and Pennacook St., and also for the enlargement of its substation at Kelley's Falls. J. Brodie Smith is Vice-Pres. and Gen. Mgr. Noted May 6 and June 17.

New London, Conn.—It is reported that plans are being prepared for the construction of a new generating station and boiler plant for the Connecticut Power Co. in New London. It is stated that the present buildings will be removed and replaced by new structures. V. E. Bird, New London, is Mgr.

New London, Conn.—Revised plans are being prepared for the construction of a power station on William St. for the Shore Line Electric Ry. The plans call for a brick building 45x80 ft., and from 25 to 35 ft. high.

New York, N. Y.—(Borough of Queens)—Bids will be received until Aug. 23 by C. B. J. Snyder, Supt. of School Bldgs., Park Ave. and 59th St., Borough of Manhattan, for electrical equipment for new Public School 97, Yarmouth and Shipley St., Woodhaven, Borough of Queens.

Newark, N. J.—It is reported that the James A. Banister Co., manufacturer of shoes, will build a new brick power house at its factory on Orange St.

Keyser, W. Va.—The Keyser Electric Light Co. contemplates the installation of new equipment in its plant and increasing the present output. N. J. Crooks is Mgr., Supt. and Cont. Agt.

New Orleans, La.—Press reports state that the City Council has decided to establish a municipal electric-light plant. The estimated cost is $6,000,000. W. J. Hardee is City Engr.

Lancaster, Ky.—The City Council is considering the installation of a municipal electric-light plant.

Ludlow, Ky.—(Official)—Bids will be received until noon, Aug. 22, by the Board of Education for the installation of a heating and ventilating plant in the present school building, and also in the new building to be located about 35 ft. west of the present building. W. F. Matteson is Pres., and H. J. Ordelmundt, 137 Oak St., Ludlow, is Secy., Bd. of Education.

Cleveland Heights, Ohio—(Warrensville post office)—(Official)—Bids will be received until noon, Aug. 26, by Ezra K. Bryan, Clk. Bd. of Education, for heating system, plumbing, marble work, etc., in the new Cleveland Heights High School at Lee Rd. and Euclid Blvd. Walker & Weeks, 1900 Euclid Ave., Cleveland, is Arch.

✚**Painesville, Ohio**—The Board of Control has awarded the contract for new machinery equipment for the municipal electric-light plant to the KERR TURBINE CO., Wellsville, N. Y., at $9850. Noted July 8 and 15.

Shaker Heights, Ohio—(Cleveland post office)—(Official)—Bids will be received until noon, Sept. 7, by Carl A. Palmer, Clk. Bd. of Education, Shaker Heights Village School Dist., for alterations and additions to the heating plant of the school building at Coventry and Southington Rd.

Toledo, Ohio—Bids will be received until noon, Aug. 30, by A. M. Stowe, Pres. Bd. of Trustees, Toledo University, for new heating and ventilating systems in the University Building, 11th and Illinois St. Schreiber & Beelman, 812 Second National Bank Bldg., Toledo, is Arch.

Appleton, Wis.—The Wisconsin Traction, Light, Heat & Power Co. has engaged Woodmansee & Davidson, Consult. Engr., Chicago and Milwaukee, to prepare plans and supervise the construction of a 75x100-ft. addition to its steam-power plant. A. K. Ellis is Gen. Mgr.

✚Madison, Wis.—The Madison Gas & Electric Co. has awarded the contract for the construction of a power transmission station on Blount St. to the T. C. McCARTHY CO., Madison, at $17,000. Energy will be secured from a hydro-electric plant on the Wisconsin River at Kilbourn City, Wis.

✚Stevens Point, Wis.—(Official)—The Board of Regents of the Stevens Point Normal School has awarded contracts in connection with the construction of a new dormitory as follows: Heating equipment, HARRY SOHNS, $5587; plumbing, STEVENS POINT PLUMBING & HEATING CO., $8700; electrical work, NATWICK ELECTRIC CO., Stevens Point, $1574.

Marathon, Iowa—A special election will be held in September, at which the question of issuing $12,000 in bonds for the purpose of installing a municipal electric-light plant will be submitted to the voters.

Sergeant Bluff, Iowa—Bids will be received until 2 p.m., Aug. 23, by the Town Board for the construction of a transmission line from Sioux City to Sergeant Bluff, for a distribution system, street-lighting system, and building for switchboard and storage room. H. J. Ryan, Sioux City, is Engr.

Rochester, Minn.—It is reported that bids will soon be asked for the construction of a municipal electric-light plant. The estimated cost is $110,000. A. F. Wright is City Clk.

Manhattan, Kan.—The Manhattan Ice, Light & Power Co. contemplates the purchase of about $30,000 worth of new equipment for its plant, including a Diesel engine, alternator, exciter and a new switchboard. E. A. Wright, is Mgr.

Sharon Springs, Kan.—Plans are being prepared by W. E. Hulse & Co., Engr., Hutchinson, for remodeling the municipal electric-light plant. The estimated cost is $10,000.

Barnston, Neb.—The State Railway Commission has granted permission to George W. Steinmyer, Holmesvile, Neb., for the construction of a hydro-electric plant on the Blue River near Barnston.

Blair, Neb.—Bids will be received until Aug. 30 by the Village Clerk for the construction of a municipal electric-light plant. The Martz Engineering Co., First National Bank Bldg., Lincoln, is Engr.-in-Charge.

Shelton, Neb.—Bonds for $8000 have been voted, the proceeds of which will be used for the construction of a municipal electric-light and power plant in Shelton.

Denton, Tex.—The Lone Star Gas Co., Ft. Worth, has made application to the Commissioners Court of Denton County for permission to build a natural gas pipe line through the county.

Devine, Tex.—The Devine Light, Power & Ice Co., recently organized with a capital stock of $35,000, will build an electric-light and power plant and an ice factory. J. W. Fullerton is interested.

Terrell, Tex.—The Commercial Club is promoting a plan for building a gas manufacturing plant and installing a distribution system in Terrell. Local citizens will hold a part of the stock of the new company.

✚Yuma, Colo.—The city has awarded a contract for electrical equipment and supplies to the FAIRBANKS-MORSE CO. and the WESTINGHOUSE ELECTRIC CO., both of Denver, at $7140.

Everett, Wash.—A special election will be held Aug. 24 to vote on the question of authorizing the City Council to investigate the feasibility of establishing a municipal power plant. It is proposed to utilize the water of the Sultan River. J. Webster Hoover is City Engr.

Hanford, Calif.—It is reported that the Board of Education will install a new heating system in the grammar school building. The estimated cost is $7000. Henri Deriot is Arch.

St. Hilaire, Que.—Bids will be received until Aug. 23 by J. E. M. Desrochers for the construction of a new electric-lighting system. The estimated cost is $25,000.

Harriston, Ont.—The ratepayers have passed a bylaw providing for the installation of a hydro-electric system. John Patterson is Engr.

Southampton, Ont.—Plans are being prepared by J. C. Eskford for the construction of a new hydro-electric system. Bids will soon be asked. The estimated cost is $25,000.

Regina, Sask.—Bids will be received until Sept. 6 by the City Commissioners for furnishing two turbine pumps each capable of delivering 3,500,000 gal. per day. George Beach is Clk.

BRIDGES

Nashua, N. H.—The Board of Aldermen has voted in favor of a loan order of $15,000, to be used for bridge construction and repairs. James B. Crowley is Mayor.

✚Boston, Mass.—(Official)—Bids for the construction of a concrete bridge over Blacks Creek, Furnace Brook Parkway, Quincy, were opened by the Metropolitan Park Commission Aug. 10, as follows: Henry Spinach Contracting Co., Boston, $33,857; John P. Cavanaugh Co., Dorchester, $27,874; Coleman Bros., Chelsea, $26,000; Bay State Dredging Co., Ltd., Boston, $25,500; Lawler Bros., Charlestown, $25,333; HUGH NAWN CONTRACTING CO., Roxbury, $24,900 (awarded contract); William L. Miller Co., Charlestown, $18,842. Noted Aug. 5.

Norfolk, Mass.—Bids will be received until 8 p.m., Aug. 21, by A. Schuyler Clapp, City Engr., for the construction of a reinforced-concrete slab bridge in Lawrence St.

✚Woonsocket, R. I.—(Official)—The Board of Aldermen has awarded the contract for the construction of two reinforced-concrete bridges on Clinton St. to G. F. AUSTIN, Providence at approximately $6670. Noted June 17 and Aug. 5.

★Bridgeport, Conn.—(Official)—All bids received Aug. 7 for the construction of a reinforced-concrete bridge with a bascule span at Stratford Ave. were rejected. Charles C. Blackham is Secy. of the Stratford Ave. Bridge Commission. George M. Baldwin is Clk. Bd. of Contract and Supply. Noted July 22.

★Bridgeport, Conn.—(Official)—Bids will be received until noon, Sept. 4, by the Stratford Ave. Bridge Commission for the construction of a reinforced-concrete girder bridge with a double-leaf bascule channel span, and all substructures and approaches. Greiner & Whitman, Fidelity Bldg., Baltimore, Md., is Consult. Engr. See preceding item.

Hartford, Conn.—(Official)—The Board of Contract and Supply has awarded the contract for the construction of a concrete bridge with stone facings across the Park River to the SPAULDING CONSTRUCTION CO., Suffield, at $15,098. Other bidders were: C. H. Slocomb & Co., $15,793; W. T. Ryan Construction Co., $16,908; Howard J. Cole, $17,563; J. E. Goodrich, $17,755; Wise & Upson, $18,039. R. N. Clark is City Engr. Noted Aug. 5.

★Westport, Conn.—Bids were received Aug. 10 by the State Highway Commissioner, Hartford, for the construction of a bridge over the Saugatuck River, Westport. The bridge will be about 510 ft. long, including the draw. It will consist of twelve 35-ft. spans. Alternate bids were for (a) granite masonry; (b) brown stone masonry; (c) rubble masonry. The bidders were: Charles A. Sibley, 902 Chapel St., New Haven, (a) $131,026, (b) $119,546, (c) $110,936; Henry E. Fox, 81 East 125th St., New York, N. Y., (a) $112,203, (b) $115,073, (c) $100,006; Hudson River Co., Inc., New York, N. Y., (a) $133,980, (b) $126,805, (c) $112,455; Barker-Bonner, Inc., 18 East 41st St., New York, N. Y., (a) $154,148, (b) $145,538, (c) $152,713; Barzaghi-Vought Co., Inc., 299 Madison Ave., New York, N. Y., (a) $98,401, (b) $100,912, (c) $90,508; McHarg-Barton Co., 171 Madison Ave., New York, (a) $101,162, (b) $101,162, (c) $96,857; Thomas A. Scott Co., New London, (a) $169,954, (b) $161,129, (c) $155,489; Lathrop & Shea Co., New Haven, (a) $145,341, (b) $145,341, (c) $141,754; North Eastern Construction Co., 255 Fifth Ave., New York, (a) $133,101, (b) $125,567, (c) $124,491; Connecticut Good Roads & Construction Co., New Britain, (a) $156,633, (b) $145,153, (c) $149,458; Jobson-Gifford Co., 30 East 42d St., New York, (a) $137,051, (b) $126,001, (c) $112,656; A. L. Guidone & Sons, Inc., 131 East 23d St., New York, (a) $120,613, (b) $114,873, (c) $105,545; Daniel F. Toomey, South Norwalk, (a) $181,378, (b) $177,073, (c) $174,203. Noted June 10 and Aug. 5.

✚Westport, Conn.—The State Highway Commission has awarded the contract for the construction of the Saugatuck River Bridge to the McHARG-BARTON CO., 171 Madison Ave., New York, N. Y., at $101,162, using granite ashlar masonry. See preceding item.

Albany, N. Y.—Bids will be received until noon, Sept. 8, by W. W. Wotherspoon, State Supt. of Pub. Wks., Capitol Bldg., for the construction of the substructures, superstructures and approaches to the Gorham St. Bridge, Waterloo, and the Kingdom Rd. Bridge between Waterloo and Seneca Falls, under Contract L, Cayuga and Seneca Canal. The estimated cost of the work is $71,469.

★Delanco, N. J.—(Official)—Bids will be received until noon, Sept. 1, by the Board of Chosen Freeholders of Burlington County, Mt. Holly, for repairing the superstructure of the Delanco Draw Bridge over the Rancocas River at Delanco and Riverside. A. I. Davis is Dir. Bd. of Freeholders. James Logan is County Engr.

★Matawan, N. J.—(Official)—Bids will be received until 11 a.m., Sept. 8, by the Board of Chosen Freeholders of Monmouth County, Court House, Freehold, for the construction of a Strauss bascule trunnion bridge over Matawan Creek on the South Amboy-Keyport Rd. George D. Cooper, 60 Broad St., Red Bank, is County Engr. C. E. Close, 41 Main St., Matawan, is Clk. Bd. of Freeholders. Noted July 8 and 15.

New Brunswick, N. J.—Bids will be received until 2:30 p.m., Aug. 23, by the Board of Chosen Freeholders of Middlesex County for the construction of a reinforced-concrete culvert over Mill Brook on the Metuchen-Bonhamton Rd. Alvin B. Fox, Perth Amboy, is County Engr.

New Brunswick, N. J.—The Board of Chosen Freeholders of Middlesex County contemplates rebuilding the drawbridge over the canal at Albany St. Alvin B. Fox, Perth Amboy, is County Engr.

Bethlehem, Penn.—The County Commissioners of Lehigh and Northampton Counties will shortly advertise for bids for repairing and strengthening the Lehigh River Bridge at Bethlehem. The estimated cost is $40,000. R. S. Rathbun, Allentown, is County Engr. of Lehigh County.

✚Coatesville, Penn.—The County Controller and the Commissioners of Chester County, West Chester, have awarded the contract for the construction of a two-span reinforced-concrete bridge over the west branch of the Brandywine Creek in East Fallowfield Township, south of Coatesville, to DUNLEAVY BROS., Coatesville, at $6500. Other bidders were: Bender Construction Co., $7098; Corcoran Construction Co., $6989; McCormick & Son, $6781; Bean & Need, $6744.

Easton, Penn.—Bids will be received until Sept. 3 by the Commissioners of Northampton County for the construction of Bridge No. 1822 over Jacoby Creek in Upper Mt. Bethel Township. It will be of reinforced concrete.

✚Harrisburg, Penn.—(Official)—The Commissioners of Dauphin County have awarded the contract for a concrete bridge over the tracks of the Philadelphia & Reading Ry. at 19th St. to the FERRO CONCRETE CO., Harrisburg, at $17,866. Other bidders were: Stucker Construction Co., $19,430; Whittaker & Diehl, $18,630; H. R. Reimard, $18,722; S. W. Shoemaker & Son, $19,177. C. M. Hershey is County Engr. Noted Aug. 5.

Johnstown, Penn.—Revised plans for the proposed Horner St. Bridge have been submitted to the State Water Supply Commission for approval. The plans provide for a single span 225 ft. long. The cost will be approximately $50,000. Lee Masterton is City Engr.

✚★Philadelphia, Penn.—The Department of Public Works has awarded the contract for a reinforced-concrete bridge to carry Whitby Ave. over the tracks of the Philadelphia, Baltimore & Washington R.R. to F. J. BOAS, Philadelphia, at $34,741; the contract for a bridge on Front St. over the Municipal Hospital Drive was awarded to the PHILADELPHIA PAVING CO., at $11,792. List of bidders noted Aug. 12.

Luray, Va.—(Official)—Bids will be received until noon, Aug. 25, by the Clerk of the Circuit Court of Page County for the construction of a 143-ft. steel bridge over Naked Creek between Page and Rockingham Counties.

Charleston, W. Va.—The County Court of Kanawha County has instructed Frank G. Burdette, Engr., to prepare plans for a bridge about 150 ft. long over Davis Creek. New bridges will also be built over Morris Creek, just below Montgomery, and over Upper Creek, near Handley. These two bridges will cost about $8000 for the two.

Middlebourne, W. Va.—(Official)—Bids will be received until 1:30 p.m., Aug. 28, by the County Court of Tyler County for the construction of a reinforced-concrete arch at the Pollard crossing of Elk Fork Creek, Ellsworth District. J. E. Smith is Clk. of Court.

Dalton, Ga.—The Commissioners of Whitfield County plan to build a reinforced-concrete bridge across Coarulla Creek.

Jesup, Ga.—It is reported that the Commissioners of Liberty County, Hinesville, and Wayne County, Jesup, plan the construction of an inter-county bridge over the Altamaha River.

Miami, Fla.—An election will be held Sept. 21 to vote on the question of a bond issue for the construction of two bridges over the Miami River; one at Ave. D, costing $75,000, and one at Ave. G to cost $25,000. B. H. Klyce is City Engr. Noted July 15.

Elizabethtown, Ky.—(Official)—Bids will be received some time in October by R. P. Frankle, Road Engr. of Hardin County, Elizabethtown, for the construction of the Wooldridge Ferry Bridge. The estimated cost is $17,651, including abutments and fill, or $16,800 without them. J. S. Irwin is Clk. of Hardin County. Noted Aug. 12.

Lexington, Ky.—The Commissioners of Fayette and Madison Counties plan, according to press reports, to build a $150,000 bridge across the Kentucky River between the two counties.

Lexington, Ky.—It is reported that the Louisville & Nashville R.R. will build new approaches to its viaducts on Jefferson and Main St., Lexington. W. H. Courtenay, Louisville, is Ch. Engr.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Aug. 24, by Philip Fosdick, Dir. of Pub. Ser., for rebuilding the bridge on Wehrmann Ave. over the tracks of the Cincinnati, Lebanon & Northern Ry.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Aug. 27, by Philip Fosdick, Dir. of Pub. Ser., for the reconstruction of all existing bridges on Este and Clinton Springs Ave. Parke S. Johnson is Secy., Dept. of Pub. Ser.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Sept. 3, by the Board of Commissioners of Hamilton County for the construction of a concrete bridge and culverts on Ridgeway Ave., Springfield Township, Specification No. 807, and for a concrete bridge on Rapid Run Rd., west of Neeb Rd., Delhi Township, Specification No. 810. Albert Reinhardt is Clk. of Comrs.

Grand Rapids, Ohio—Bids will be received until 10 a.m., Sept. 3, by Charles J. Sanzenbacher, Audr. of Lucas County, Toledo, for constructing a creosoted wood block floor and painting the bridge over the Maumee River at Grand Rapids, Wood and Lucas Counties. C. E. Stinebaugh, Bowling Green, is Audr. of Wood County.

Niles, Ohio—Bids will be received until Aug. 23 by the Board of Commissioners of Trumbull County, Warren, for the construction of the substructure and superstructure of the Summit St. Bridge. W. R. Harrington is County Audr.

Bedford, Ind.—(Official)—Bids will be received until 1 p.m., Aug. 28, by the Board of Commissioners of Lawrence County for the construction of four county bridges. Ezra W. Edwards is County Audr.

Crawfordsville, Ind.—The Board of Commissioners of Montgomery County has appropriated $4000 for rebuilding Remley Bridge over Offield Creek.

Richmond, Ind.—Bids will be received until 11 a.m., Aug. 21, by L. S. Bowman, Audr. of Wayne County, for the construction of the Spruce St. Bridge over Paddy's Run in the town of Centerville; a concrete culvert about one mile south of Centerville; the North 12th St. Bridge over the White Water River in the city of Richmond, and repairing the Short Creek Bridge on the Richmond and Liberty Pike in Wayne Township.

Detroit, Mich.—Bids will be received until Sept. 1 by the Department of Public Works for repairing the Belle Isle Bridge at a cost not to exceed $100,000. George H. Fenkell is Comr. of Pub. Wks. Noted June 17 and July 22.

✚Dixon, Ill.—(Official)—The Superintendent of Highways of Lee County has awarded the contract for reflooring the Grand Detour Bridge between Lee and Ogle Counties to the FREEPORT BRIDGE CO., Freeport, at $7778. Other bidders were: North Steel & Concrete Co., Freeport, $8386; Meffley & Son, Galena, $9010; Wellingford Co., Prophetstown, $8962; Bilmore Co., Ashton, $8834; Winamac Construction Co., Winamac, Ind., $7759; E. B. Lloyd, Dixon, $7580; McAlpine Co., Dixon, $8378; Cox & Johnson, Dixon, $7995. Noted Aug. 5.

✚Audubon, Iowa—(Official)—The Board of Supervisors of Audubon County has awarded the contract for the construction of five concrete culverts and two bulkheads to the JENSEN CONSTRUCTION CO., Kimballton, Iowa, at $4013. Other bidders were: Lang Construction Co., $4225; Kimballton Construction Co., $4250. C. D. Forsbeck is County Engr. Noted Aug. 5.

Des Moines, Iowa—Plans are being prepared by John W. Budd, County Engr. of Polk County, for the construction of about 20 bridges and culverts to cost from $500 to $1000 each. Bids will soon be asked. F. J. Alber is County Audr.

Guthrie Center, Iowa—(Official)—Bids will be received until 1 p.m., Aug. 24, by the Auditor of Guthrie County for the construction of three county bridges.

Austin, Minn.—Bids will be received until 4 p.m., Sept. 10, by the Commissioners of Mower County for the construction of 19 bridges. O. J. Simmons is County Audr.

Ellinwood, Kan.—(Official)—Bids will be received until noon, Sept. 7, by C. F. Younkin, Clk. of Barton County, Great Bend, for the construction of a reinforced-concrete bridge across the Arkansas River between Lakin and Comanche Townships, about one mile south of Ellinwood. The bridge will be about 400 ft. long with a 24-ft. roadway. Noted July 22.

Ellsworth, Kan.—Bids will be received until Sept. 18 by the Commissioners of Ellsworth County for the construction of a 280-ft. reinforced-concrete bridge, for repairing a 250-ft. steel bridge, and for building eight miles of roads and culverts in Garfield and Empire Townships. A. J. Klingenschmidt is County Clk. G. R. Wolf is County Engr.

✚Wichita, Kan.—(Official)—The Commissioners of Sedgwick County have awarded the contract for a reinforced-concrete bridge over the drainage canal on 21st St. to the GLOBE CONSTRUCTION CO., Wichita, at $3797. Other bidders were: Canton Bridge Co., $4155; Missouri Valley Bridge & Iron Co., $3823. An appropriation of $4000 is available for the work. H. B. Barrett is County Clk. Noted July 29.

✚Ft. Yates, N. D.—(Official)—The Commissioners of Sioux County have awarded the contract for the construction of two steel bridges to the D. D. BIDWELL CO., Hazelton, N. D., at $3960. Other bidders were: M. A. Adams & Co., $4196; Linton Bridge Construction Co., $4260; Fargo Bridge & Iron Co., $4085; Iowa Bridge Co., $3996. Noted July 22.

Chillicothe, Mo.—It is reported that the Livingston County Court will soon ask bids for replacing bridges destroyed by the recent floods. The estimated cost is $75,000.

Llano, Tex.—It is reported that the Commissioners Court of Llano County has ordered plans prepared for a new bridge over the Colorado River. James T. Powers, Dallas, is Engr.

Lawton, Okla.—The Board of Commissioners of Comanche County has appropriated $15,000 for the construction of a number of small concrete and steel bridges. S. A. Joyner is Engr.

✚Tucumcari, N. M.—James A. French, State Engr., Santa Fé, has awarded the contract for the construction of five bridges in Quay County to the MISSOURI VALLEY BRIDGE & IRON CO., Kansas City, Mo., at $10,710.

Walla Walla, Wash.—(Official)—Bids will be received until 2 p.m., Sept. 10, by the Commissioners of Walla Walla County for the construction of the Swegle Bridge. It will consist of a 102-ft. steel span or two 50-ft. reinforced-concrete arches. G. C. Cookerly is County Engr. Noted Aug. 5.

✚Baird, Calif.—(Official)—The State Highway Commission, Sacramento, has awarded the contract for a 395-ft. reinforced-concrete bridge across the Pit River to the ROSS CONSTRUCTION CO., Sacramento, at $28,235. Noted Aug. 5.

Berkeley, Calif.—(Official)—The lowest bid received by the City Council on Aug. 3 for the construction of a concrete bridge across Codornices Creek on Walnut St. was that of D. McDonald, Livermore, Calif., at $5675. Noted July 22.

✚Bradley, Calif.—The Board of Supervisors of Monterey County, Salinas, has awarded the contract for a reinforced-concrete bridge across the Salinas River at Bradley to W. L. GILLHAM & SON, at $14,400.

✚Burlingame, Calif.—The City Trustees have awarded a contract for the construction of 10 bridges to CHRIS LARSEN, Easton, Calif., at $20,575.

El Monte, Calif.—The lowest bid received by the Supervisors of Los Angeles County, Los Angeles, for the construction of a steel bridge over the San Gabriel River near El Monte was that of Mesmer & Rice, Marsh-Strong Bldg., Los Angeles, at $93,000. Noted July 29.

Fairfield, Calif.—It is reported that the Board of Supervisors of Solano County will receive bids in September for the construction of three bridges, one over Pleasant Valley Creek in Bacaville Township, and two over Green Valley Creek, one near Cordelia and the other near Nightingale Ranch.

✚Martinez, Calif.—The City Trustees have awarded the contract for the construction of two bridges across Alhambra Creek to MAGEE & LAYAS, San Francisco, at $18,000.

Red Bluff, Calif.—(Official)—Bids were opened Aug. 2 by the Board of Supervisors of Tehama County for the construction of three bridges. The lowest bids were: Ross Construction Co., Sacramento, at $109,000 for the Sand Slough Bridge; McLeran & Peterson at $14,000 and $17,000 respectively for the Samson Slough and Paynes Creek Slough Bridges. H. S. Kuhn is County Clk. Noted July 22.

Ventura, Calif.—Bids will be received until Aug. 25 by the Board of Supervisors of Ventura County for constructing the south abutment and approach to the Saticoy Bridge, Saticoy, and for the construction of the Conejo Bridge near Camarillo, to consist of eight 30-ft. spans. J. R. McCloskey is County Clk.

Ventura, Calif.—It is reported that plans are being prepared by the County Surveyor for replacing 12 bridges and culverts destroyed by the floods of last year. The estimated total cost is $45,000.

★China—(Official)—Bids will be received until 10 a.m., Sept. 25, by Robert W. Hunt & Co., Consult. Engr., Monongahela Bank Bldg., Pittsburgh, Penn., for supplying about 845 tons of steel bridges for the Hankow-Ichang Section of the Chinese Hankow-Szechuan Government Ry.

WATER SUPPLY—IRRIGATION

Jamestown, N. Y.—(Official)—Plans are being prepared by Chapman & Graham, Gokey Bldg., Jamestown, for the construction of a 32,500-gal. covered concrete reservoir, pumping station and pipe line for the Atlas Marvel & Level Furniture Companies of Jamestown.

★New York, N. Y.—(Official)—Bids were received Aug. 10 by the Board of Water Supply for making six borings at the Hudson siphon of the Catskill aqueduct in Fishkill as follows: E. J. Longeer Co., $13,445; Harper Machine Co., $12,163; Sulli-

van Machine Co., $12,145; Pennsylvania Drilling Co., $13,343; W. G. Stearns, $22,078; S. A. Knowles, $14,702; Sprague & Henry, $13,041, and Giles Clark, $16,454. Noted July 22.

New York, N. Y.—(Official)—Bids will be received until 11 a.m., Aug. 31, by the Board of Water Supply, Municipal Bldg., for furnishing and erecting water-pipe equipment for operating valves in the shafts of the city tunnel of the Catskill Aqueduct.

+New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract has been awarded to the JOHN H. HEARN CONSTRUCTION CO., 63 West 46th St., New York, at $20,000, for constructing the New Utrecht pumping station at 14th St., Borough of Brooklyn. Noted July 1.

East Orange, N. J.—(Official)—Bonds for $125,000 have been sold, the proceeds of which will be used for the construction of a distributing system. Lincoln E. Rowley is City Clk. Noted July 22.

Gloucester City, N. J.—Bids will be received until Aug. 20 by the city for furnishing and installing equipment for the water-works and driving a deep well. A. Blatchley, Drexel Bldg., Philadelphia, Penn., is Engr. and J. F. Lenny is City Clk.

Pitman, N. J.—The Board of Public Utility Commissioners has ordered the Pitman Water Supply Co. to install fire hydrants in the borough.

+Easton, Penn.—The contract has been awarded by the South Easton Water Co. to the R. T. & C. D. STEWART CO., Easton, for constructing about a mile of water mains from 23rd St. to the Eilden tract in Palmer Township.

Johnstown, Penn.—The Johnstown Water Co. plans to build an 800,000,000-gal. reservoir on Laurel Run.

Annapolis, Md.—The Annapolis Water Co. has decided to install a liquid chlorine plant. Noted May 20.

Bloomington, Md.—The Piermont Water-Works Co. plans to install a liquid chlorine plant.

Silver Spring, Md.—The installation of a water system is under consideration by the Commissioners of Montgomery County.

Orange, Va.—An election will be held Aug. 31 to vote on the question of issuing $10,000 in bonds, the proceeds of which will be used for the improvement of the water system.

South Boston, Va.—(Official)—Bonds have been voted by the citizens, the proceeds of which will be used for the installation of a water system. As soon as the bonds are sold, the work will be advertised. W. L. Penick is Mayor. Noted Feb. 11 and Aug. 5.

Apex, N. C.—A franchise has been granted to the Municipal Service Corporation to construct and operate water, sewer and electric-light systems.

Lumberton, N. C.—The improvement of the water system and electric-light plant is contemplated by A. E. White, Mayor. The estimated cost is $25,000. Gilbert C. White, Charlotte, is Consult. Engr. Noted Dec. 3, 1914.

Raeford, N. C.—The citizens voted in favor of issuing bonds for $30,000, the proceeds of which will be used for the construction of water and sewer systems.

Salisbury, N. C.—Bonds for $125,000 have been voted by the citizens, the proceeds of which will be used for the construction of a pumping plant on the Yardkin River. Noted May 6 and July 15.

Atlanta, Ga.—An election will be held Sept. 30 to vote on the question of issuing $750,000 in bonds, the proceeds of which will be used for the improvement of the water system. R. M. Clayton is Chn. of Construction. Noted Aug. 5.

Boston, Ga.—Plans are being prepared by W. Hopson Goobloe, Macon, for the extension of the water system. The estimated cost is $25,000. Noted July 29.

Salerno, Fla.—According to press reports a company will be incorporated with $200,000 capital by B. W. Mulford and others and will construct a water system and electric-light system.

Gretna, La.—Bids will soon be received for the construction of a water system. Plans have been prepared by Frank T. Payne, City Engr. The estimated cost is $45,000. Noted July 15 and 22.

South Fulton, Tenn.—(Fulton post office)—An election will be held Sept. 4 to vote on the question of issuing $5000 in bonds, the proceeds of which will be used for the construction of a water system.

+Shelbyville, Ky.—The contract has been awarded to the CONTINENTAL JEWEL FILTRATION CO., New York, N. Y., at $15,000, by the Kentucky Utilization Co. for the installation of a filtration plant. Noted Apr. 29.

Attica, Ohio—Bids will be received the latter part of September for the construction of a filtration plant. The estimated cost is $9000. John Schoppler is City Clk. Noted July 22.

Cleveland, Ohio—Bids will be received until noon, Aug. 20, by A. R. Callow, Comr. of Pur. and Supplies, for making borings at the site of the proposed Kirkland filter plant and for excavating test pits.

East View, Ohio—(Warrensville post office)—(Official)—Bids will be received until noon, Aug. 30, by Charles E. Burger, Clk., for constructing a 6-in. water main in Allen and Elm St. The Pease Engineering Co., Marshall Bldg., Cleveland, is Engr. Noted July 29.

Kings Mills, Ohio—The Peters Arms Co. will install a cold water system at its plant. About 4500 ft. of pipe will be required.

Middletown, Ohio—The citizens voted in favor of issuing bonds for $120,000, the proceeds of which will be used for the construction of a water system.

Wellington, Ohio—The low bidder for constructing a water system was Gangla & Shannon, Akron, at $35,615. The Kennicott Co., 134 South La Salle St., Chicago, Ill., was low bidder at $5000 for filter equipment. Noted July 15.

Indianapolis, Ind.—The Board of Public Works has authorized the laying of water mains in portions of Beechwood Ave., Ohio and Gale St. and in Hemlock Ave.

New Albany, Ind.—Bids will soon be received by the New Albany Water Works Co. for the construction of a filtration plant.

Chicago, Ill.—Bids will be received until Aug. 20 by W. R. Moorhouse, Comr. of Pub. Wks., for constructing a chlorinating plant at the 22nd St. pumping station.

Monticello, Ill.—(Official)—Bids will be received until 7 p.m., Sept. 7, by the City Clerk, for furnishing and installing a deep well pump and service pumps.

St. Charles, Ill.—Bids will be received about Sept. 1 by the Local Improvement Board for making extensions to the water system. About three miles of water mains will be laid. John W. Wilson, Haines Blk., St. Charles, is Engr.

Sparta, Ill.—Bids will be received until Aug. 24 by J. F. Swain, City Clk., for constructing a water system. Noted June 3.

Jefferson, Wis.—(Official)—Bids will be received until 2:30 p.m., Aug. 30, by the Water & Light Department, for the construction of two steel tainter gates, each 16x6½ ft. with gate hoists and three concrete piers. C. B. Stewart, Madison, is Consult. Engr.

Kewaunee, Wis.—Plans have been prepared for the construction of a new water system. Bonds for $30,000 have been voted for the construction of the water system.

Manitowoc, Wis.—The city plans to install two pumps at the water-works. Arthur Reichert is City Clk.

Milwaukee, Wis.—The Council contemplates spending $7500 to make an investigation including test borings of feasibility of extending the Linwood Ave. intake water tunnel 2500 ft.

Arcadia, Iowa—Bonds for $7500 have been voted by the citizens. The proceeds will be used for the construction of a water system.

Chariton, Iowa—(Official)—Bids will be received until 2 p.m., Aug. 24, by W. H. Householder, City Clk., for constructing an earth dam of about 55,000 cu.yd. of embankment, pump house, gravity filter plant, pumps, motors, engines and 12,800 ft. of 10-in. force main. M. G. Hall, Centerville, is Engr. Noted July 1 and Aug. 5.

+Denison, Iowa—(Official)—Bids were received Aug. 12 for drilling a well as follows: W. H. GRAY & BRO., Chicago, Ill., at $6000 (awarded contract); R. F. Shirkliff, Robinson, Ill., $6450; S. B. Geiger, Chicago, Ill., $6800; W. H. Cater Contracting Co., Chicago, Ill., $6900; C. P. Brandt Co., Indianapolis, Ind., $8300, and Cambridge Drilling Co., Cambridge, Ill., $8500. Noted July 15 and 29.

+Riverside, Iowa—The contract for the laying of water mains was awarded to BASH & JONES, Joplin, Mo., at $8474. Other bidders were: Alamo Engine & Supply Co., Omaha, Neb., $8778; Public Service Construction Co., Omaha, Neb., $9339; the Bickel Co., Kansas City, Mo., $9021; Ludlow Valve Co., Chicago, Ill., $9085; Theodore Becker, Geneseo, Ill., $9988; C. W. Roland & Co., Des Moines, $9362. The contract for the construction of an elevated tank was awarded to the DES MOINES BRIDGE & IRON CO., Des Moines, at $12,351. The Chicago Bridge & Iron Co., Chicago, Ill., at $13,200, was the only other bidder. Noted July 22.

Shelby, Iowa—Plans are being prepared by J. H. Mayne, Council Bluffs, for the construction of a water system.

Traer, Iowa—A special election will be held to vote on the question of issuing $6000 in bonds, the proceeds of which will be used for the enlargement of the water system. Noted May 27.

+Duluth, Minn.—The contract has been awarded to SIMON JOHNSON, at $6012, by the City Council, for laying water and gas mains in Minnesota Ave.

Luverne, Minn.—(Official)—Bids will be received until Aug. 24 by S. C. Rea, City Recdr., for constructing a reinforced-concrete reservoir.

Oswego, Kan.—The citizens contemplate issuing bonds, the proceeds of which will be used for the extension and improvement of the water system.

Milligan, Neb.—Bids will be received until 10 a.m., Aug. 24, by the City Clerk for constructing a water system. The estimated cost is $9800. The Martz Engineering Co., Lincoln, is Engr. Noted June 10.

Pleasanton, Neb.—Bonds for $9000 have been voted. The proceeds will be used for the construction of a water system. E. H. Morey, Kearney City, is Engr.

Missoula, Mont.—(Official)—The citizens, at a recent election, voted against the question of issuing bonds, the proceeds of which was to have been used for the construction of a water system. Noted July 1.

Eldorado Springs, Mo.—An election will be held Aug. 24 to vote on the question of issuing $15,000 in bonds, the proceeds of which will be used for the extension of the water system. O. E. Siders is City Clk.

Plattsburg, Mo—Plans are being prepared by E. B. Murray, 920 Walnut St., Kansas City, for the construction of a water system, the estimated cost of which is $28,000.

Adkadelphia, Ark.—A filter will be constructed on Ouachita River by the Arkansas Light & Power Co. The estimated cost is $75,000. Noted Oct. 1.

Sparkman, Ark.—The construction of a water system is under consideration.

Walnut Ridge, Ark.—The city plans to construct a water system, the estimated cost of which is $40,000. W. E. Beloate is Comr. Noted June 3.

Mineral Wells, Tex.—At a recent election the citizens voted against the question of issuing bonds for $74,000. The proceeds was to have been used for the purchase of Lake Pinto and for the construction of a water system. Noted July 8.

Hill City, Idaho—A water system will be installed by H. Scruggs, Hill City, according to press reports.

Hollister, Idaho—A water system will be installed by the Townsite Co. R. E. Shepherd is interested.

Pocatello, Idaho—An election will be held to vote on the question of issuing $400,000 in bonds, the proceeds of which will be used for the construction of a municipal water system.

St. Maries, Idaho—(Official)—Bids will be received until noon, Aug. 23, by Charles R. Schulte, City Clk., for laying and relaying wood and steel water mains and constructing a small concrete dam. A. L. Jaqueth is Engr. The estimated cost is $37,000. Noted July 22 and Aug. 5.

Bingham Canyon, Utah—(Official)—Bonds for $17,000 have been sold. The proceeds will be used for the improvement of the water system. F. W. Quinn is Town Clk. Noted July 29.

Aberdeen, Wash.—Bonds for $500,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system. Noted Aug. 5.

Bremerton, Wash.—Bonds for $40,000 have been voted by the citizens, the proceeds of which will be used for the improvement of the water system.

Hillyard, Wash.—Plans will be prepared by Sawyer Bros., White Bldg., Seattle, for the construction of a reservoir. The estimated cost is $8000. Noted Aug. 12.

✚Pateros, Wash.—The contract has been awarded to A. E. WIDLAND, Pateros, at $7196, for the construction of a water system. Noted July 22.

Portland, Ore.—The City Commission has granted authority to Commissioner Daly, Dept. of Pub. Utilities, to make a preliminary investigation for supplying the suburban part of St. John, recently annexed to Portland, with water.

Portland, Ore.—D. D. Clark, Water Engr., is making surveys for the construction of a pumping station, reservoirs and laying mains in Linnton addition.

✚West Lynn, Ore.—The contract has been awarded to the OREGON ENGINEERING & CONSTRUCTION CO., Oregon City, at $65,000, for constructing a distributing system. Noted July 8.

Los Angeles, Calif.—The State Water Commission has been petitioned by the city to allow 12 years for the completion of the water-supply project. E. P. Scattergood is Engr.-in-Charge.

Chatham, N. B.—A reservoir will be constructed at an estimated cost of $20,000. A. N. McKay is Engr.

Beauceville, Que.—Bids will soon be received by the Town Council for the construction of water, drainage and electric-light systems. F. Mignault, Sherbrooke, is Engr. Noted June 17.

SEWERS

Rochester, N. H.—Bids will be received until Aug. 31 by the Water and Sewer Committee for the construction of approximately 8100 ft. of 8- to 12-in. pipe sewers. F. Hussey is Clk. of the Water and Sewer Com.

✚Boston, Mass.—(Official)—Bids were received Dec. 23 by the Department of Public Works for the construction of the Faneuil Valley Brook Conduit in Faneuil and Oakland St. from H. F. SPINACH, at $16,584 (awarded contract); A. Cefalo, $16,661; J. Landis, $17,193; McCarthy & Walsh, $17,297; M. De Sisto, $17,390; James J. Conway, $17,391; West Roxbury Trap Rock Co., $17,567; M. H. Kelley, $17,962; J. Driscoll Son, $17,978; Merrimack Construction Co., $18,149; A. Barufaldi, $18,445; William L. Dolan, $18,979; J. McCourt Co., $22,539; Engineer's estimate, $18,928. Noted Dec. 17.

✚Pittsfield, Mass.—The contract for the construction of 17 new filter beds at the sewage-disposal plant has been awarded to R. W. EMERSON, Pittsfield, at $21,544. Noted July 29.

★Woonsocket, R. I.—(Official)—Bids will be received until 4:45 p.m., Aug. 24, by the Board of Sewer Commissioners for the construction of approximately 4400 ft. of 8-in. and 500 ft. of 15-in. sanitary sewers and appurtenances. Frank H. Mills is City Engr.

Brockport, N. Y.—Bids will be received until Aug. 25 by F. E. Reynolds, Village Clk., for the construction of a sewage-disposal plant. The estimated cost is $25,000. Noted June 3.

Buffalo, N. Y.—The City Council will construct sewers in Texas and Babcock St.

★Buffalo, N. Y.—(Official)—Bids will be received until 2:30 p.m., Aug. 25, by the State Hospital Commission, Albany, for the renewal of sewer lines at the Buffalo State Hospital. E. S. Elwood is Secy. State Hospital Comn.

✚New York, N. Y.—(Borough of Bronx)—(Official)—The contract for the construction of sewers and appurtenances in Randall, Metcalf and Bronx River Ave. has been awarded to RODGERS & HAGGERTY. Noted July 22.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 11 a.m., Aug. 25, by L. H. Pounds, Borough Pres., for the construction of sewers in Clara, 54th, East 26th St., Kenmore Pl., Dumont and Rochester Ave.

✚New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for the relocation and reconstruction of sewers in Rector St. has been awarded to the LAWRENCE CONTRACTING CO., 2409 Walton Ave., New York, at $11,886. Noted Aug. 12.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received Aug. 16 by Marcus M. Marks, Borough Pres., for the construction of sewers in Ellwood St. and Sherman Ave., from: Di Menna & De Paola, $6269; C. E. Farrell Co., $5005; Knight & Di Micca, $5812; Lawrence Contracting Co., $5452; J. J. Haiduvan, $5706; Carafagno & Dragonetti, $5187; Casperino & De Blasio, $6068; Briggs & McLaughlin, $5348; Patrick Reilly, $5717; Joseph L. Brennan, $5964; Di Menna & De Blassia, $5005; Melrose Construction Co., $5297; W. F. Elray, 1640 Maconds Rd., New York, $3512. Noted Aug. 12.

New York, N. Y.—(Borough of Richmond)—(Official)—Bids will be received until noon, Aug. 24, by Calvin D. Van Name, Borough Pres., for the reconstruction of sewers in Taylor St.

★Oswego, N. Y.—(Official)—Bids will be received until 2 p.m., Aug. 20, by the Department of Public Works for sewer construction. Charles W. Linsley is Comr. of Pub. Wks.

★Yorktown Heights, N. Y.—(Official)—Bids will be received until 2:30 p.m., Aug. 31, by William B. Osgood Field, Pres. of Bd. of Mgrs., New York State Training School for Boys, for the construction of sewers and a sewage-disposal plant at the New York State Training School for Boys.

Jersey City, N. J.—Bids will be received until 11 a.m., Aug. 26, by the city for constructing sewers in Jackson Ave. from Woodlawn Ave. and Warner St. M. I. Fagen is City Clk.

Newark, N. J.—Bids will be received until 3:30 p.m., Aug. 26, by the Board of Street and Water Commissioners for the construction of Section No. 1 of the Meadowbrook Outlet Sewer. M. R. Sherrerd is Engr.

South Orange, N. J.—Bids will be received until 8 p.m., Sept. 7, by the Township Committe for the construction of sanitary sewers in Millburn Ave. Edmund R. Halsey is Engr.

✚Erie, Penn.—The contract for the construction of sewers in Ash and Third St. has been awarded to the CENTRAL OHIO CONSTRUCTION CO., at $4503.

Lebanon, Penn.—Bids will be received until 5 p.m., Aug. 25, by T. R. Crowell, City Engr., for the construction of a sewage-disposal plant with a capacity of 900,000 gal. Noted July 29.

Sellersville, Penn.—Bids will be received until Aug. 30 by H. J. Zane, Borough Secy., for the construction of approximately 22,640 ft. of 8-, 10- and 12-in. sewers. Bascom & Sieger, Room 505, Allentown National Bank Bldg., Allentown, is Engr.

West Chester, Penn.—Bids will be received until Aug. 24 by the city for the construction of a sewage-disposal plant and 1500 ft. c.-i. force mains. Remington & Vosburg, Camden, N. J., is Consult. Engr. Noted July 29.

Rockville, Md.—Plans are being prepared for the construction of a sewer system and a sewage-disposal plant in the Little Falls Branch District. The estimated cost is $125,000. Noted July 8.

Silver Springs, Md.—(Official)—The State Board of Health has instructed the County Commissioners of Montgomery County to install sewer and water systems.

Towson, Md.—The city contemplates the construction of a sewer system and a sewage-disposal plant. The estimated cost is $40,000.

Harrisonburg, Va.—(Official)—An Imhoff sewage-disposal plant and filter beds will be constructed by the city forces. The estimated cost is $6000. J. H. Downing is Mayor. Noted Aug. 5.

Philippi, W. Va.—At a recent election the citizens voted to issue $20,000 in bonds. Part of the proceeds will be used for the construction of sewers.

Salisbury, N. C.—At a recent election the citizens voted to issue $20,000 in bonds. Part of the proceeds will be used for the construction of sewers. Noted July 15.

✚★Greenville, S. C.—(Official)—The contract for the construction of sanitary sewers has been awarded to CASE & COTHRAN, Atlanta, Ga., at $11,006. Other bids were: Slattery & Henry, Greenville, $12,607; Sullivan, Long & Hagerty, Bessemer, Ala., $11,617; Porter & Boyd, Charlotte, N. C., $14,338; B. F. Meeks Construction Co., Atlanta, Ga., $12,603; Dysard Construction Co., Atlanta, Ga., $11,206; Smallwood Construction Co., Chattanooga, Tenn., $15,057; J. R. Lawrence & Son, Greenville, $11,569. Noted Aug. 5.

Dunedin, Fla.—An election will be held Sept. 14 to vote on the question of issuing $5500 in bonds. The proceeds will be used for the construction of sanitary sewers and a sewage-disposal plant. Walter Bull is Mayor. Noted Aug. 5.

Miami, Fla.—An election will be held Sept. 21 to vote on the question of issuing $50,000 in bonds, the proceeds of which will be used to pay the city's share of the cost of constructing sanitary sewers. Noted July 8.

Ocala, Fla.—(Official)—Bids will be received until Sept. 14 by J. M. Meffert, Pres. of the Council, for the construction of a sewer system and a sewage-disposal plant. The estimated cost is $100,000. Noted Aug. 12.

Akron, Ohio—Bids will be received until noon, Aug. 21, by C. P. Parker, Dir. of Pub. Wks., for the construction of sewers in La Croix, Gertrude, Abel and Thornton St.

Alliance, Ohio—Bids will be received about Sept. 10 by the city for the construction of a sewage-disposal plant. The estimated cost is $40,000. W. P. Barnum is Mayor.

Cincinnati, Ohio—Bids were received July 27 by the Director of Public Service for the construction of sewers in (a) Pogue Ave., (b) Seegar and Waverly Ave., from: Runck Bros., (a) $5701; M. J. McCarthy, (a) $6035; Evan Evans, (a) $6260, (b) informal; John Ruebel, (a) $6731; Wagner & Boehning, (a) $7637, (b) $1744; Welling & Franz, (b) $1614; Cavanaugh & Connelly, (b) $1842. Noted Aug. 22.

Cincinnati, Ohio—Bids will be received until noon, Aug. 26, by Philip Fosdick, Dir. of Pub. Ser., for the construction of sewers in Knorr Ave. and Pinckney St. and right-of-way.

✚Cincinnati, Ohio—The contract for the construction of sewers in South Court St. has been awarded to THOMAS P. STRACK, at $5623.

Findlay, Ohio—The City Council will construct 10- and 12-in. sewers in various streets. The estimated cost is $8174.

✚Hamilton, Ohio—Contracts for sewer construction have been awarded by the Board of Control to CHARLES F. SMITH CO., Dayton, at $21,389, for constructing sanitary sewers in District No. 1 and to JOHN L. WALKER CO., Hamilton, at $22,507, for constructing sanitary sewers in District No. 2.

Mansfield, Ohio—At a recent election the citizens voted to issue $100,000 in bonds, the proceeds of which will be used for the construction of a sewage-disposal plant. Noted May 6.

Toledo, Ohio—Bids will be received until 10 a.m., Aug. 31, by Charles J. Sanzenbacher, Clk. of the Bd. of Lucas County Comrs., for the sale of $20,000 in bonds. The proceeds will be used for the construction of local Sanitary Sewer No. 20 in Lucas County.

Youngstown, Ohio—Bids will be received until noon, Aug. 23, by the Director of Public Service for the construction of sewers in Halvin, Poplar and Hamburg St. H. C. Fox is City Clk.

Lafayette, Ind.—(Official)—Bids will not be received this year for the construction of storm and sanitary sewers. H B. Overesch, Jr., is City Engr. Noted Aug. 5.

Logansport, Ind.—Plans are being prepared by the City Engineer for the construction of sewers in the eastern section of the city. The estimated cost is $350,000.

Muncie, Ind.—Plans are being prepared by B. F. Deardorff, City Engr., for the construction of a sewer system in the Congerville and Industry Sections. The estimated cost is $50,000.

✚Fenton, Mich.—The contract for the construction of a sanitary sewer system has been awarded to WHALEY & EDWARDS, Milan, at $19,368.

Grand Rapids, Mich.—The city has been granted an extension of time, by the Supreme Court, until Jan. 3, 1916, in which to stop the pollution of the Grand River by constructing a sewage-disposal plant. Hoad & Decker is Engr. Noted July 15.

Chicago, Ill.—Bids will be received until 11 a.m., Aug. 20, by the Board of Public Works for the construction of sewers in various streets.

✚Galesburg, Ill.—The contract for the construction of sewers in North West and various other streets has been awarded to D. E. KEELER CO., Davenport, at $25,225.

Salem, Ill.—Plans are being prepared by the Caldwell Engineering Co., Jacksonville, for the construction of a sewer system. The estimated cost is $50,000.

Kenosha, Wis.—The City Council contemplates the construction of sewers estimated to cost $100,000.

✚Racine, Wis.—The contract for the construction of the Augusta St. sewer has been awarded to E. R. HARDING, at $5800.

Racine, Wis.—Bids will be received until 10 a.m., Aug. 21, by the Board of Public Works for the construction of sewers in Munroe, Washington, Wright and Lathrop Ave.

✚Waukesha, Wis.—The contract for the construction of sewers in Delafield, Prospect, Bidwell, Ellis and Farewell St. has been awarded to FRANK CAYLL, at $0.96 per lin. ft.

Clinton, Iowa—Bids will be received until 8 p.m., Sept. 1, by the city for the construction of 8-, 24-, 30- and 54-in. sewers in various streets.

Clinton, Iowa—(Official)—Bids will be received until Sept. 14 by the city for the construction of sewers in the Fourth Ward. J. G. Thorne is City Engr. Noted Aug. 12.

✚Fairfield, Iowa—(Official)—The contract for the construction of sanitary sewers has been awarded to the ADAMS-MARTIN CONSTRUCTION CO., Centerville, at $15,605. Noted July 29.

✚Hampton, Iowa—The contract for the construction of approximately 38 miles of tile sewers has been awarded to the PLYMOUTH CLAY PRODUCTS CO., Ft. Dodge, at $165,000.

✚McGregor, Iowa—The contract for the construction of approximately 6350 ft. of 6- and 12-in. vitrified pipe sewers has been awarded to the MOORE-SIEG CONSTRUCTION CO., Waterloo, at $4341.

✚Mason City, Iowa—The contract for the construction of ateral sewers has been awarded to the A. L. WILLSON CO.

Primghar, Iowa—Bids will be received about Sept. 6 by the city for the construction of a sewer system. Bruce, Standevan & Boynton, 430 Bee Bldg., Omaha, Neb., is Engr. Noted July 22.

✚Spencer, Iowa—(Official)—The contract for the construction of approximately 6000 ft. of 8-, 10- and 12-in. sewers has been awarded to P. N. KRUSE, Spencer, at $4500. Other bidders were: M. A. Camery, Harlan; Dearborn Construction Co., Waterloo; A. L. Chesley, Minneapolis, Minn.; W. C. Fraser, St. Paul, Minn.; Anderson & Empir, Marshalltown. Noted Aug. 5.

✚Webster City, Iowa—A. J. Petersen, Audr. of Hamilton County, has awarded the contract for tile to the NATIONAL SEWER PIPE CO., Webster City, at $6576, and for the construction of Nail Drain No. 173 to L. E. NELSON, Ft. Dodge, at 10,228.

✚Duluth, Minn.—The City Council has awarded the contract for the construction of sewers in 37th St. to the PASTORET CONSTRUCTION CO., at $18,124.

✚St. Paul, Minn.—(Official)—The contract for the construction of storm and sanitary sewers in various streets to be included in part of the Snelling-Como sewer system has been awarded to THORNTON BROS., at $263,000. Noted erroneously in the issue of Aug. 5 as having been awarded to Thomson Bros.

Crofton, Neb.—(Official)—Bids will be received until 2 p.m., Sept. 3, by Joseph P. Kuehn, Village Clk., for the construction of a sewer system and septic tanks. J. D. C. Smith, Hartigan, is Engr. Noted Aug. 5.

Kearney, Neb.—The city contemplates the reconstruction and extension of the sewer system.

✚Omaha, Neb.—The contract for the construction of a storm sewer from 45th and Jones St. to Saddle Creek has been awarded to E. T. DONAHUE, at $4461.

✚Mitchell, S. D.—(Official)—The contract for the construction of sewers in various streets has been awarded to R. J. BURNHAM, Mitchell. Noted July 22.

✚Watertown, S. D.—The contract for c.-i. pipe and special castings for the sewage pumping station and 4850 ft. of c.-i. outlet of Class A pipe has been awarded to the AMERICAN CAST IRON PIPE CO., Birmingham, Ala., at $7875. Noted July 29.

Fargo, N. D.—Bids will be received until 10 a.m., Aug. 25, y A. R. Watkins, City Audr., for the construction of lateral ewers in 12th St. and in Sewer District No. 1.

Plattsburg, Mo.—Plans are being prepared by E. B. Murray, Consult. Engr., 920 Walnut St., Kansas City, for the construction of a sewer system and sewage-disposal works. The estimated cost is $21,000.

Heber Springs, Ark.—An election will soon be held to vote on the question of issuing $25,000 in bonds. The proceeds will be used for the construction of a sewer system. Noted Aug. 12.

Walnut Ridge, Ark.—It is reported that plans are being prepared for the construction of a sewer system. The estimated cost is $20,000. W. E. Lane is interested. Noted May 27.

Beeville, Tex.—Bonds for $15,000 have been sold, the proceeds of which will be used for the extending of the sewer system. Noted Aug. 5.

✚Bartlesville, Okla.—The contract for the construction of vitrified tile sewers has been awarded to W. F. POWER, Chelsea, at $30,170.

✚Steamboat Springs, Colo.—(Official)—The contract for the construction of a sanitary sewer system has been awarded to CONRAD WALKER, North Platte, Neb., at $59,129. Noted Aug. 5.

Dexter, N. M.—The city contemplates the construction of a sewer system.

✚Richfield, Utah—(Official)—The contract for the construction of sewers has been awarded to BROWN & KLEINSCHMIDT, Salt Lake City. The estimated cost is $25,000 Noted Aug. 5.

✚Salt Lake City, Utah—(Official)—The contract for the construction of the main trunk sewer has been awarded to GIBBONS BROS. and REED & ROCHE, Salt Lake City, at $296,509. Other bids were: Thomas J. Shea, $364,300; P. J. Moran, Inc., $340,543; Earl C. Ulen, $338,790; James Kennedy, $335,535; Parrott Bros., $323,148. Noted July 22.

Elko, Nev.—At a recent election the citizens voted to issue $40,000 in bonds, the proceeds of which will be used for the construction of a sewer system. Noted June 17.

Seattle, Wash.—The Board of Public Works has approved plans for the construction of sewers in North and West 48th and North and West 50th St. The estimated cost is $12,000 and $53,000, respectively. L. B. Youngs is Chn., Bd. Pub. Wks.

Forest Grove, Ore.—(Official)—Plans have been prepared by R. E. Koon, Consult. Engr., Portland, and A. A. Kirkwood, City Engr., and approved by the City Council and State Board of Health for the construction of sewers and a sewage-disposal plant. Binds will be received early in September. The estimated cost is $90,500.

Portland, Ore.—The Council contemplates the construction of sewers in East 28th St. from Tillamook to Knott St. The estimated cost is $12,000.

Los Angeles, Calif.—Adam Dalmation, at $10,975, submitted the lowest bid for the construction of sewers in Fountain Ave. from Western Ave. to Hobart Blvd. and in various other streets.

Dartmouth, N. S.—The town Council will construct sewers and water mains in Eskine St. A. Elliott is Clk.

Ottawa, Ont.—The city will construct sewers in Carruthers and other streets by day labor. The estimated cost is $9769.

Preston, Ont.—The Town Council contemplates the construction of sewers estimated to cost $8200. C. S. McKenzie is Engr.

Simcoe, Ont.—Plans have been prepared for the construction of sewage-disposal beds. W. C. McCall is Town Clk.

Sudbury, Ont.—The Council contemplates extending the sewer system. W. J. Ross is Town Clk.

Thorold, Ont.—Bids will be received until Aug. 25 by D. J C. Munro, Town Clk., for the construction of a sanitary sewer system and a sewage-pumping station in St. Andrews Ward. Chipman & Powers, Mail Bldg., Toronto, is Engr.

GARBAGE

✚Union, N. J.—(Weehawken post office)—The contract has been awarded to JOHN MULLER, North Bergen, at $25,000, for removing garbage and ashes for a five-year period. Noted July 1 and July 22.

Decatur, Ill.—(Official)—Bids will be received soon by the Alfs Garbage Co. for the construction of an incinerator.

Victoria, Tex.—A garbage incinerator, estimated to cost $7000, will be constructed in Victoria. J. H. Fleming is Mayor. Noted June 17.

STREETS AND ROADS

..oston, Mass.—(Official)—Bids will be received until noon, Aug. 24, by the State Highway Commission for constructing 6900 lin.ft. of road in Marlborough, 5900 lin.ft. of road in Lincoln Township and 11,400 lin.ft. of road in Weymouth Township.

Boston, Mass.—(Official)—Bids will be received until noon, Aug. 24, by the State Highway Commission for constructing 19,000 lin.ft. of state highway in Shrewsbury and Northboro Townships.

✚Boston, Mass.—The contract for constructing 10,900 lin.ft. of road in Northampton has been awarded to the PHILPOTT CONSTRUCTION CO., Melrose, at $18,572. Other bids were: R. F. Hudson, Melrose, $20,017; J. C. McCormick, East Providence, $22,224; A. Williams, Boston, $22,443; Columbia Construction Co., $25,580; D. O'Connell's Sons, Holyoke, $26,393; Lane Contracting Co., Meriden, Conn., $26,963. Noted Aug. 5.

Boston, Mass.—Press reports state that the Board of Public Works has authorized the widening of Armory St., at an estimated cost of $40,000.

Boston, Mass.—Bids will be received until Aug. 23 by the Board of Public Works for paving Prince and Aspen St. and Blue Hill Ave. with asphalt on bitulithic pavement.

✚★Albany, N. Y.—(Official)—Contracts have been awarded for repaving roads in varous counties as follows:

Repair Contract No. 825, Broome County, 1.76 miles: CHARLES E. HANEY, Camillus, $12,690. Repair Contract No. 820, Chemung County, 2.33 miles: FRANK K. LIBERATORE, Elmira, $12,198. Repair Contract No. 830, Chenango County, 3.55 miles: PADDLEFORD & KING, Sherburne, $14,441. Repair Contract No. 822, Clinton County, 1.99 miles: JAMES CONWAY, Plattsburg, $7806. Repair Contract No. 816, Columbia County, 9.26 miles: OLIN T. BENEDICT, Pittsfield, $15,426. Repair Contract No. 834, Dutchess County, 4.12 miles: HENRY CLINTON, Poughkeepsie, $12,950. Repair Contract No. 827, Putnam and Dutchess Counties, 13.47 miles;

THOMAS H. KARR, Troy, $9939. Repair Contract No. 828, Erie County, 0.87 mile: UNION PAVING CO., Schenectady, $13,503. Repair Contract No. 819, Herkimer County, 5.46 miles: R. D. COOPER, Little Falls, $6715. Repair Contract No. 637, Monroe County, 0.56 mile: CROUCH BROS., Rochester $12,377. Repair Contract No. 817, Montgomery County, 10.91 miles: NASH & GRIFFIN, Norwich, $4248. Repair Contract No. 823, Otsego County, 1.88 miles: NEWPORT CONSTRUCTION CO., Herkimer, $19,192.73. Repair Contract No. 818, St. Lawrence County, 5.50 miles: ORLANDO BEEDE, Keene Valley, $26,145. Repair Contract No. 815, St. Lawrence County, 19.32 miles: CLARENCE E. WALKER, Troy, $3344. Repair Contract No. 814, St. Lawrence County, 15.88 miles: CLARENCE E. WALKER, Troy, $2662. Repair Contract No. 824, Schoharie County, 0.104 miles: J. J. MALLOY, Schenectady, $2149. Repair Contract No. 832, Steuben County, 1.14 miles: CHARLES E. HANEY, Camillus, $6314. Repair Contract No. 831, Sullivan County, 2 miles: ARMSTRONG & TROWBRIDGE, Roscoe, $12,984. Repair Contract No. 833, Tompkins County, 17.10 miles: RICHARD HOPKINS, Troy, $7637. Repair Contract No. 835, Warren County, 14.37 miles: DEFIANCE CORPORATION, Ticonderoga, $5046. Repair Contract No. 821, Westchester County, 2.22 miles: TRI-COUNTY CONSTRUCTION CORPORATION, Mt. Vernon, $3980. Repair Contract No. 826, Westchester County, 0.54 miles: TRI-COUNTY CONSTRUCTION CORPORATION, Mt. Vernon, $3454. Noted July 15 and Aug. 12.

Buffalo, N. Y.—The City Council has voted to pave a number of streets.

✚New York, N. Y.—(Borough of Bronx)—(Official)—The contract for improving Victor St. from Van Nest to Rhinelander Ave. has been awarded to THOMAS TENORE, at $7740. Noted July 29 and Aug. 12.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received Aug. 11 by L. H. Pounds, Borough Pres., for regulating and repaving with permanent grade No. 1 granite pavement on a 6-in. concrete foundation the roadway of Jamaica Ave. from Broadway to the borough line as follows: W. J. Scanlon Co., $115,151; J. J. B. LaMarsh, $106,469; M. T. Mark, $110,161; Empire Construction Co., $108,930; Rosenthal Engineering Co., $109,034; H. J. Mullen Contracting Co., Fulton St., Jamaica, $105,297; Lawrehoe Contracting Co., $122,164; T. J. Gallagher $120,590; Robertson Construction Co., $114,973. Noted Aug. 5.

New York, N. Y.—(Borough of Richmond)—(Official)—Bids will be received until noon, Aug. 24, by Calvin D. Van Name, Borough Pres., for regulating, grading, curbing and laying sidewalks on various streets.

Jersey City, N. J.—Bids will be received by the City Commissioners until 11 a.m., Aug. 26, for repaving a portion of Storms Ave. and Concord St. with Belgian block. M. I. Fagen is City Clk.

Jersey City, N. J.—The Board of Commissioners plans to improve Grove St., with granite block paving laid in concrete. Henry Byrne is Comr.-in-Charge of street improvements.

Newark, N. J.—The Board of Public Works has voted to improve Sussex Ave., by paving with asphalt.

Newark, N. J.—Bids were received Aug. 5 by the Board of Public Works for paving (a) Linsdale Pl. from Washington to Chester Ave., (b) Tyler St. from Chestnut to Malvern St., (e) Oxford St. from Fleming to Passaic Ave., (d) Vesey St. from Pacific to McWhorter St., (e) Yates Ave. from Osborne Terrace 346 lin.ft. easterly, (f) Read St. from Market St. to Passaic Ave., as follows: Northern Construction Co., (a) $6974, (b) $2271, (c) $7107, (d) $6261, (e) $3559, (f) $6499; Continental Public Works Co., (a) $7239; Glenfield Construction Co., (a) $7371, (b) $2276, (c) $7103, (d) $6150, (e) $3845, (f) $6529; Uvalde Asphalt Co., (a) $8665; Jackson Contracting Co., (b) $2289, (c) $7369, (d) $6252; Newark Paving Co., (b) $2329, (c) $7141, (d) $6141, (e) $3525, (f) $6546; Standard Bitulithic Co., (b) $2346, (c) $7233, (d) $6299, (e) $3615, (f) $6631; Ralph Sangiovanni, (c) $6153, (d) $3331; McMahon Construction Co., (f) $6539. Noted July 29

Newark, N. J.—Bids will be received until 11 a.m., Aug. 20, by the Board of Contract and Supply for improving a portion of Excelsior Ave.

New Brunswick, N. J.—Bids will be received until 2:30 p.m., Aug. 30, by the Board of Chosen Freeholders of Middlesex County for improving the New Brunswick-Old Bridge Turnpike from the New Brunswick City line to Commercial Ave. with bituminous concrete on present macadam base. Alvin B. Fox, Perth Amboy, is County Engr.

New Brunswick, N. J.—Bids will be received until 2:30 p.m., Aug. 30, by the Board of Chosen Freeholders of Middlesex County for improving Rahway Ave. from the Roosevelt Woodbridge Rd. to the Blazing Star Rd. with bituminous concrete pavement on a concrete base. Alvin B. Fox, Perth Amboy, is County Engr.

✚Summit, N. J.—The contract for paving Ridgewood Ave. has been awarded to the GARAFANO CONSTRUCTION CO., at $16,000.

West New York, N. J.—The Town Council is considering paving 18th and 21st St. with some type of noiseless pavement.

✚West New York, N. J.—The Town Council has awarded contracts for improving 11th St. to R. T. EMMERSON and Seventh St. to HORNUNG & BLAIR.

✚Allentown, Penn.—The contract for paving Hanover Ave. has been awarded to the BARBER ASPHALT CO.

✚Fullerton, Penn.—The contract for paving Third St. has been awarded to FRANK McINERNEY, Easton.

Greensburg, Penn.—(Official)—Bids will be received until noon, Aug. 30, by the County Controller for constructing and improving sections of the highway in Mt. Pleasant Township. Noted July 22 and Aug. 5.

✚Harrisburg, Penn.—Contracts have been awarded for constructing roads as follows: Stroudsburg Rd. to the FRANKLIN CONSTRUCTION CO., 52 Vanderbilt Ave., New York, $45,624; Muncy Rd. to DWYER & CO., Philadelphia, Penn., $41,877; Milton Rd. to FOGEL & CO., Hollidaysburg, $28,144. Noted July 29.

Philadelphia, Penn.—Bids will be received until noon, Aug. 23, by M. L. Cook, Dir. Pub. Ser., for repairing asphalt pavements.

Scranton, Penn.—The City Council plans to pave Wyoming and Monsey Ave. and to construct sidewalks on Brook St., at an estimated cost of $22,000.

Wilkinsburg, Penn.—(Official)—Bids will be received until 2 p.m., Aug. 21, by Frease & Sperling, Borough Engr., for regrading, recurbing and repaving a number of streets.

Baltimore, Md.—The city plans to repave Hamilton Ave. from Harford Rd. to Franklin Ave.

✚Lake Montibello, Md.—(Baltimore post office)—A contract for paving a number of streets has been awarded to the CONSOLIDATED ENGINEERING CO., Baltimore, at $14,280.

Lovington, Va.—(Official)—Bids will be received until noon, Sept. 1, by the Commissioners of Nelson County for the sale of $35,000 in bonds, the proceeds of which will be used for constructing and improving roads.

Janelew, W. Va.—An election will be held Aug. 23, to vote on the question of issuing $15,000 in bonds, the proceeds of which will be used for improving a number of streets.

Philippi, W. Va.—At a recent election the citizens voted in favor of issuing $20,000, part of the proceeds to be used for street paving. Noted July 29.

✚Bakersville, N. C.—The contract for constructing 8½ miles of road in Grassy Creek Township has been awarded to C. B. GEER & CO.

Gastonia, N. C.—At a recent election the citizens voted in favor of issuing $150,000 in bonds, the proceeds of which will be used for constructing roads in Gaston County. Noted June 24.

Newbern, N. C.—Press reports state that the Commissioners of Craven County will improve the Central Highway from Ft. Barnwell to Newbern, about 22 miles.

Greenwood, S. C.—At a recent election the citizens voted in favor of issuing $100,000 in bonds, the proceeds of which will be used for permanent street paving. Noted June 10.

Palatka, Fla.—An election will be held Sept. 14 to vote on the question of issuing $208,000 in bonds, the proceeds of which will be used for constructing brick roads.

Tallahassee, Fla.—Bids will be received until 4 p.m., Sept. 9, by A. H. Williams, City Clk., for improving various streets. Isham Randolph & Co., Heard Bldg., Jacksonvile, is Engr.

Geneva, Ala.—Bids will be received until Aug. 27 by the Commissioners of Geneva County for sand-claying roads, at an estimated cost of $4616.

Grove Hill, Ala.—Bids will be received until Aug. 31 by the Commissioners of Clarke County for constructing sand-clay roads, at an estimated cost of $15,600.

New Orleans, La.—(Official)—Bids will be received until noon, Sept. 7, by the Board of State Engineers, New Orleans Court Bldg., for surfacing about five miles of improved earth highways in Caldwell Parish.

New Orleans, La.—(Official)—Bids will be received until noon, Sept. 8, by the Highway Department of the Board of State Engineers, New Orleans Court Bldg., for constructing 8.1 miles of improved earth highway in Red River Parish.

Livingston, Tenn.—At a recent election, the question of issuing $160,000 in bonds, the proceeds of which was to have been used for road construction was defeated.

Hopkinsville, Ky.—The City Council contemplates paving West Seventh St. with tarvia.

Louisville, Ky.—Bids will be received until Aug. 26 by the Board of Public Works for paving a number of streets.

✚Winchester, Ky.—The contract for improving Lexington Ave. has been awarded to the BICKEL ASPHALT PAVING CO., Louisville, at $32,201. Noted July 29.

✚Antwerp, Ohio—A contract for constructing 20,000 sq.yd. of pavement has been awarded to the MOLLERING CONSTRUCTION CO., Ft. Wayne, Ind., at $38,000.

✚Ashtabula, Ohio—Contracts have been awarded for paving Booth, East, Spencer and Todd St., Starkweather and Grove Ave. to THOMAS P. FITZGERALD.

Bexley, Ohio—Bids will be received until Sept. 4 by Chester A. Miller, Village Clk., for the sale of $63,000 in bonds, the proceeds of which will be used for improving College and Drexel Ave.

✚Cincinnati, Ohio—The contract for paving Morgan St. from Dover St. to Reading Rd., with brick has been awarded to HENKEL & SULLIVAN, at $9378.

Cleveland, Ohio—Bids will be received until noon, Aug. 25, by the Commissioner of Purchases and Supplies for improving and repaving Lorain Ave. from West 73rd to West 98th St. Robert Hoffman is City Engr.

Columbus, Ohio—(Official)—Bids will be received until 2 p.m., Aug. 20, by Clinton Cowen, State Highway Comr., for improving roads in various counties.

East View, Ohio—(Warrensville post office)—Bids will be received until noon, Aug. 30, by Charles E. Burger, City Clk., for improving and constructing sidewalks on Helen St. from Kinsman Rd. to the village limits. Noted July 29.

✚Findlay, Ohio—The contract for paving East Hardin St has been awarded to C. B. HALL & SON, at $6046.

Gates Mills, Ohio—Bids will be received until noon, Sept. 11, by F. J. Wilson, Clk. of Mayfield Township, for the sale of $22,000 in bonds, the proceeds of which will be used for improving Mayfield and Som Center Roads in Mayfield Township.

✚Mt. Gilead, Ohio—(Official)—The contract for improving and macadamizing the Sexon-Thatcher Rd. in Gilead and Canaan Township Rd. has been awarded to the FOREST CONSTRUCTION CO., Ada., at $14,544. Noted July 15.

New Hampshire, Ohio—An election will be held Aug. 23 to vote on the question of issuing $11,000 in bonds, the proceeds of which will be used for paving portions of various streets.

Niles, Ohio—(Official)—Bids will be received until 1 p.m., Aug. 18, by the Commissioners of Road District No. 2 for improving Watson Rd.

Port Clinton, Ohio—Bids will be received until noon, Aug. 30, by W. H. Williamsen, Village Clk., for improving Depot St.

Silverton, Ohio—Bids will be received until noon, Aug. 28, by A. A. Sprague, Village Clk., for constructing concrete sidewalks on various streets.

Toledo, Ohio—Bids will be received until 10 a.m., Aug. 23, by the Commissioners of Lucas County, for improving Lake St. in Washington Township.

Woodsfield, Ohio—(Official)—Bids will be received until noon, Aug. 28, by the Village Council for paving South Main St. with hard burned vitrified brick. George P. Dorr is Clk. of the Council.

Xenia, Ohio—(Official)—Bids will be received until noon, Aug. 31, by C. W. Whitmer, Dir. Pub. Ser., for paving a portion of Third St.

Youngstown, Ohio—Bids will be received until noon, Aug. 23, by the Director of Public Service for grading Hylda St. from Hillman St. to the Youngstown & Southern Ry. H. C. Fox is City Clk.

Columbus, Ind.—(Official)—Bids will be received until 2 p.m., Sept. 14, by the Commissioners of Bartholomew and Shelby Counties for constructing a road on the county line.

Indianapolis, Ind.—(Official)—Bids will be received until 10 a.m., Sept. 3, by the Board of Public Works for improving a number of streets.

Mt. Clemens, Mich.—All bids received July 19 for paving Grand Ave. from Washington to Elredge St. were rejected. Noted July 15.

Carlinville, Ill.—Press reports state that the Board of Local Improvements has voted to pave First North St., at an estimated cost of $20,591.

Elgin, Ill.—Bids will be received until Aug. 26 by the Board of Local Improvements for constructing 18,763 lin.ft. of concrete combined curb and gutter. M. H. Brightman is Secy. of the Bd.

St. Charles, Ill.—(Official) — Bids will be received until Sept. 1, for improving various streets. John W. Wilson, Haine Blk., St. Charles, is Engr.

Springfield, Ill.—(Official)—Bids will be received until 11 a.m., Aug. 18, by the State Highway Commission for constructing a brick road near Dwight in Livingston County. The estimated cost of construction is $17,974.

Grand Rapids, Wis.—Bids will be received until 2 p.m., Aug. 27, by the Board of Public Works for paving Grand Ave. E. L. Brown is City Clk.

+Janesville, Wis.—(Official)—The contract for paving Wisconsin, South Bluff St. and Milton Ave. has been awarded to GUND GRAHAM CO., Freeport, Ill. Noted July 15.

+Racine, Wis.—(Official)—The contract for paving West Blvd. from Washington to Kinzie Ave. has been awarded to the WESTERN IMPROVEMENT CO., Racine, Wis., at $13,657. Noted July 22.

Creston, Iowa—(Official)—Bids will be received until 8 p.m., Aug. 23, by Carl Davenport, City Clk., for improving a number of streets. Theodore S. Delay is City Engr.

+Mt. Gregor, Iowa—The contract for paving Main St. from Front to Center St. has been awarded to JAMES F. LEI, Dubuque.

+Duluth, Minn.—The contract for paving Colorado St. has been awarded to J. JOHNSON, at $9750.

Ellsworth, Kan.—See item under "Bridges."

Herington, Kan.—According to press reports, bids will soon be received for laying 6000 sq.yd. of brick and asphaltic concrete pavement. C. N. Hull is City Clk.

Mulberry, Kan.—Bids will soon be received by J. Pedroja, City Clk., for paving Military St.

+College View, Neb.—The contract for paving in Districts Nos. 1 and 2 has been awarded to ABEL & ROBERTS, First National Bank Bldg., Lincoln, at $90,000.

Missoula, Mont.—(Official)—Bids will be received until 10 a.m., Aug. 25, by L. E. Harris, City Clk., for improving Pine St. E. S. Hathaway is City Engr.

+Fornfelt, Mo.—A contract for laying 28,000 sq.yd. of pavement has been awarded to the CENTURY CONSTRUCTION CO., Chicago, Ill., at $33,400.

+Kansas City, Mo.—The contract for paving Brush Creek Blvd. from Main to Oak St. has been awarded to J. C. LYLE, 609 Grand Ave., at $10,234.

+Kansas City, Mo.—The contract for improving Benton Blvd. from 45th St. to Brush Creek Blvd. has been awarded to J. O. WEST.

Kansas City, Mo.—The Park Board plans to improve the Swope Park Blvd. from 49th to 63rd St.

Rockport, Mo.—Press reports state that the citizens contemplate holding a special election for the purpose of voting on the question of issuing $250,000 in bonds, the proceeds of which will be used for constructing rock roads.

St. Louis, Mo.—(Official)—Bids will be received until noon, Aug. 27, by the city for improving a number of streets.

Sedalia, Mo.—Bids will be received until Aug. 24 for resurfacing approximately 2½ miles of rock road in Sedalia Special Road District. W. H. Powell is Secy.

+Springfield, Mo.—A contract for resurfacing two miles on the South Campbell St. road with asphaltic macadam has been awarded to the PLUMMER-ADAMS CONSTRUCTION CO., at approximately $15,000.

+McKinney, Tex.—A contract for street paving has been awarded to LEVY & LEVY, Dallas, Tex., at $58,605.

+Seguin, Tex.—The contract for constructing seven miles of the Zorn-Redweed Rd. has been awarded to W. K. DAVIS, San Antonio, at $15,000.

Weatherford, Tex.—At a recent election the question of issuing $60,000 in bonds, part of the proceeds of which was to have been used for constructing roads was defeated. Noted July 1.

Colbert, Okla.—Press reports state that a special election will be held for the purpose of voting on the question of issuing bonds, the proceeds of which will be used for constructing roads.

+Silver City, N. M.—Press reports state that a contract for constructing concrete pavements has been awarded to LEYDEN ORTSEIFEN, Chicago, Ill., at $22,408. Other bids were: Jennings & Wood, El Paso, $22,740; V. E. Wave, El Paso, $23,344.

Salt Lake City, Utah—(Official)—Bids will be received until 10 a.m., Aug. 24, by the Board of Commissioners for paving Ninth South St. from 13th East St. to Fairview Ave., 15th East St. from Ninth South St. to Yale Ave., Fairview Ave. from Ninth South St. to Michigan Ave. and Michigan Ave. from 15th East St. to Fairview Ave.

Wendover, Utah—Bids will be received until Aug. 23 by the State Road Commission for constructing about 25 miles of highway from Wendover to Knolls.

Kingman, Ariz.—At a recent election the citizens of Mohave County voted in favor of issuing $100,000 in bonds, the proceeds of which will be used for constructing and improving roads. Noted July 8.

Everett, Wash.—Bids will be received until 2 p.m., Aug. 23, by M. Weatherbee, Audr. of Snohomish County, for constructing Permanent Highways No. 19 and 20. Noted July 29.

La Conner, Wash.—Bids will be received until Sept. 1 by the Town Council for constructing concrete pavement on First St. from Commercial to Morris St.

Olympia, Wash.—Bids will be received until Aug. 30, by William R. Roy, State Highway Comr., for improving the Inland Empire Highway from Union Flat Creek south in Whitman County.

+Seattle, Wash.—(Official)—The contract for paving Permanent Highway No. 5A has been awarded to the WASHINGTON PAVING CO., Tacoma, at $76,549.

Seattle, Wash.—The City Council has decided to postpone the improvement of Railroad Ave. until early next year.

Walla Walla, Wash.—H. L. Wilson & Co., Walla Walla, at $11,566 was the lowest bidder for paving First Ave.

+McMinnville, Ore.—The contract for improving 5½ miles of the Sourgrass Cut-Off Rd. has been awarded to the TILLAMOOK BAY CONSTRUCTION CO., Bay City, at $18,863.

Martinez, Calif.—The Board of Supervisors of Contra Costa County will soon receive bids for the construction of 3 miles of highway out of Martinez, at an estimated cost of $38,665. E. E. Arnold is County Surv.

+Oroville, Calif.—The City Trustees have awarded a contract for street work to the CLARK-HENERY CO., Sacramento, at $15,700.

+Pescadero, Calif.—The contract for constructing a highway from Pescadero to the Santa Cruz County line has been awarded to L. G. HARE, at $29,234.

+San Jose, Calif.—The Board of Supervisors of Santa Clara County has awarded contracts for improving White, Tully and San Felipe Roads to the RANSOME CRUMMEY CO., Oakland, at $31,854; Ford Rd., Phelan and Fontasso Ave. to J. W. McDONALD, Jr., San Jose, at $14,887.

Santa Cruz, Calif.—The City Trustees will soon receive bids for paving Bay St., from Continental to King St., at an estimated cost of $20,000.

Belleville, Ont.—The City Council plans to pave various streets with granolithic. J. W. Evans is City Engr.

+Niagara Falls, Ont.—The contract for paving Queen St. with vitrified brick has been awarded to C. H. KUNMEYER, Niagara Falls, at $9244. Noted June 10.

+Niagara Falls, Ont.—The contract for paving Robert St. with reinforced concrete has been awarded to P. A. LORENZO, at $4215.

INDUSTRIAL WORKS

Lawrence, Mass.—The Lenox Motor Car Co., 18 Columbus Ave., Boston, Mass., will build a reinforced-concrete factory to cost $100,000. Gilman & Ames, 8 Congress St., Boston, Mass., is Arch.

Somerville, Mass.—The American Tube Co. will build a one-story, 178x248-ft., brick addition to its plant at 140 Somerville St., to cost $58,000.

Springfield, Mass.—The Dickinson Realty Trust, 131-137 Main St., will build a brick garage to cost $25,000.

Springfield, Mass.—The Bausch Machine Tool Co. will build a 41x50-ft. addition to its plant to cost about $44,000.

Winthrop, Mass.—The contract will soon be awarded by C. A. & F. N. Russell, Arch., 50½ Warren St., Boston, Mass., for the construction of a one-story, 72x132-ft. garage for J. W. Silver, 18 Tremont St., Boston, Mass. The estimated cost is $25,000.

Pawtucket, R. I.—Bids are being received for the construction of a three-story, 70x100-ft. brick mill for the Philips Insulated Wire Co., Central Ave. Jenks & Ballou, Grosvenor Bldg., Providence, R. I., is Arch.

+Pawtucket, R. I.—The BENJAMIN F. SMITH CONSTRUCTION CO. has been awarded the contract for the construction of a four-story, 27x160-ft. factory with a one-story, 60x67-ft. extension for the Acme Finishing Co. The estimated cost is $18,000.

+Providence, R. I.—The Metal Products Corp., Thurbur Ave., has awarded the contract for the construction of a one-story, 60x212-ft. and a two-story, 45x60-ft. addition to WILLIAM H. HAMLYN & SON, 78 Mawny St.

Providence, R. I.—The Terminal Warehouse Co. will build a five-story, 100x250-ft. warehouse by day labor. The estimated cost is $100,000. William M. Harris, 546 Atwells Ave., is Pres. Warren & Gerrish, 53 State St., Boston, Mass., is Arch. Noted June 10.

+Hartford, Conn.—The Hartford Rubber Works, Park St., has awarded the contract for the construction of a two-story, 75x140-ft. warehouse to the J. H. CROZIER CO., 721 Main St. Lockwood, Green & Co., 60 Federal St., Boston, Mass., is Engr.

+Hartford, Conn.—THOMAS MALCOMBE, 118 Asylum St., has been awarded the contract for the construction of a

three-story, 42x110-ft. factory for the Jacobs Mfg. Co. Greenwood & Noer, 847 Main St., is Engr. Noted June 3 and 10.

Hartford, Conn.—William Beck, 107 Albany Ave., will build a two-story, 62x88-ft. garage to cost about $20,000. Fred C. Walz, 118 Asylum St., is Arch.

Hartford, Conn.—Bids are being received by Charles Harris, 1026 Main St., for the construction of a two-story, 58x90-ft. garage to cost $20,000. Burton A. Sellew, 756 Main St., is Arch.

✚Torrington, Conn.—The Turner & Seymour Co. has awarded the contract for the construction of a 30x170-ft. brick and concrete addition to its plant to the TORRINGTON BUILDING CO.

✚Albany, N. Y.—Fuller & Robinson, Arch., 95 State St., has awarded the contract for the construction of a three-story, 72x75-ft. addition to the garage of the Albany Garage Co., Howard and Lodge St., to the W. S. HAMMILL CO., Carl Bldg., Troy, N. Y. The estimated cost is $60,000. Noted June 24.

✚Buffalo, N. Y.—(Official)—The TURNER CONSTRUCTION CO., Prudential Bldg., has been awarded the contract for the construction of a ten-story, 105x141-ft. reinforced-concrete cold-storage warehouse at Perry and Columbia St. for the Buffalo Cold-Storage Co. D. E. Knowlton is Pres. Noted June 14.

Buffalo, N. Y.—The Buffalo Copper & Brass Rolling Mills has obtained permits for the construction of two one-story additions to its plant at 44 Sayre St., to cost $160,000.

Elmira, N. Y.—Bids will soon be received by Pierce & Bickford, Arch., 118 Lake St., for the construction of a five-story, 53x70-ft., reinforced-concrete warehouse for Barker, Rose & Clinton. A. Clinton, 109 Lake St., is in charge.

Fulton, N. Y.—The Hunter Arms Co. contemplates the construction of two factories to cost about $30,000. Thomas Hunter is in charge.

New York, N. Y.—(Borough of Bronx)—The Coryell Bldg. Co., Inc., 1414 Vyse Ave., will build a one-story, 75x170-ft. brick garage on 176th St., to cost $12,000. Carl Demmerle, 1510 Bryant Ave., is Arch.

New York, N. Y.—(Borough of Brooklyn)—Bids will soon be received by Thode & Harvie, Arch., 406 Ninth St., for the construction of a two-story, 50x164-ft. brick laundry on Prospect Ave. for the Anchor Laundry Co., 361 Seventh Ave. The estimated cost is $60,000. F. L. Roth is Pres.

✚New York, N. Y.—(Borough of Brooklyn)—FRANK M. WALSH, 374 Hamilton Ave., has been awarded the contract for the construction of a two-story, 90x99-ft. garage at 1203-1209 Atlantic Ave., for Charles Cooper, 157 Remsen St. The estimated cost is $19,000. J. Sarsfield Kennedy, 157 Remsen St., is Arch.

✚New York, N. Y.—(Borough of Brooklyn)—McAvoy & Smith, 858 71st St., has awarded the contract for the construction of a one-story, 50x100-ft. garage at Bedford Ave. and Robinson St. to MEYER & SWEENY, 607 Flatbush Ave. Slee & Bryson, 154 Montague St., is Arch. The estimated cost is $10,000.

New York, N. Y.—(Borough of Brooklyn)—William O. Ostheimer, 11th St. and Fifth Ave., will build a three-story, 50x95-ft. brick garage on 11th St., to cost about $15,000. S. L. Behen, 161 Ninth Ave., is Arch.

New York, N. Y.—(Borough of Manhattan)—James J. Riordan, 1 East 14th St., will build a three-story, 93x225-ft. printing building at 438-454 West 18th St. James S. Maher, 431 West 14th St., is Arch.

✚New York, N. Y.—(Borough of Manhattan)—The Monmouth Garage Co., 126 East 54th St., has awarded the contract for the construction of a five-story, 50x100-ft., concrete garage at 226-228 East 54th St. to FRED T. LEY & CO., INC., 52 Vanderbilt Ave. The estimated cost is $100,000. Ballinger & Perrot, 1211 Arch St., Philadelphia, Penn., is Arch.

New York, N. Y.—(Borough of Manhattan)—The contract will soon be awarded by M. W. Del Gaudio, 1910 Webster Ave. (Borough of Bronx), for the construction of a three-story, 50x96-ft. brick factory on 106th St. for Imperato & Camera, 2107 First Ave. The estimated cost is $15,000.

✚New York, N. Y.—(Borough of Manhattan)—William Koenig, 122d St. and St. Nicholas Ave., has awarded the contract for alterations to his garage to JOHN M. MAC ADAM & CO., 29 West 34th St. The estimated cost is $16,000. L. P. Santangela, 2364 Eighth Ave., is Arch.

✚New York, N. Y.—(Borough of Manhattan)—JOHN COLLINS, 418 West 42d St., has been awarded the contract for rebuilding the factory of the Tegetmeier & Riepe Co., 781 First Ave. J. M. Baker, 9 Jackson Ave. (Borough of Queens), is Arch. The estimated cost is $20,000. Noted Apr. 8.

Seneca Falls, N. Y.—Bids will be received about Sept. 1 by Willard Case & Co., 17 Battery Pl., New York, N. Y., for the construction of a $100,000 plant for the Seneca Falls Mfg. Co.

✚Syracuse, N. Y.—The New Process Gear Co., 500 Plum St., has awarded the contract for the construction of a four-story, 55x160-ft. addition to its factory to the R. H. HOWES CONSTRUCTION CO., 105 West 40th St., New York, N. Y. The estimated cost is $50,000. Day & Zimmerman, 611 Chestnut St., Philadelphia, Penn., is Arch.

Utica, N. Y.—The Oneita Knitting Mills will build a $25,000 addition to its plant. N. T. Devereux is Pres.

✚Ampere, N. J.—The contract for the construction of a 60x200-ft. reinforced-concrete factory for the Crocker-Wheeler Co. has been awarded to the AMERICAN CONCRETE STEEL CO., Newark, N. J.

✚Bloomfield, N. J.—The AMERICAN CONCRETE STEEL CO., Newark, N. J., has been awarded the contract for the construction of a 400x500 ft., concrete factory for the International Arms Co. Noted July 22.

✚Butler, N. J.—JOHN PROVOST has been awarded the contract for the construction of a three-story, 47x142-ft. reinforced-concrete addition to the factory of the Pequanoc Rubber Co. The estimated cost is $28,000. M. Howman, 6 Park Ave., Paterson, N. J., is Arch. Noted July 1 and Aug. 5.

Garwood, N. J.—The Powers & Robinson Foundry & Machine Co. plans the construction of a 50x200-ft., reinforced-concrete factory.

Hackensack, N. J.—The American & British Mfg. Co., Bridgeport, Conn., has purchased a 26-acre site and plans the construction of a plant.

✚Harrison, N. Y.—The DAVID HENRY BUILDING CO., 207 Market St., Newark, N. J., has been awarded the contract for the construction of a two-story, 100x100-ft. warehouse for the H. J. Heinz Co., 256 West St., New York, N. Y.

✚Jersey City, N. J.—The contract for the construction of a two-story, 54x234-ft. and a one-story, 60x104-ft. printing plant on Maple Ave. for the Jersey City Printing Co., 37 Montgomery St., has been awarded to the JOHN W. FERGUSON CO., 152 Market St., Paterson, N. J.

✚Kingsland, N. J.—The Canadian Car & Foundry Co., 120 Broadway, New York, N. Y., has awarded the contract for the construction of two storehouses to SHIRE & WOODS, Lyndhurst, N. J.

Newark, N. J.—The Celluloid Co. will build a two-story reinforced-concrete and brick building at 70 Westcott St. Estimated cost, $15,500.

Newark, N. J.—The Butterworth-Judson Co. will build a one-story, 40x300-ft. factory on Ave. R, to cost approximately $15,000.

✚Newark, N. J.—M. Basch, Basch & Greenfield Co., 67 Seventh Ave., has awarded the contract for the construction of a three-story, 43x99-ft. brick factory at 15-17 Stone St. to ANDREW GRANO, 57 New St. The estimated cost is $15,000. Hyman Rosensohn, 800 Broad St., is Arch.

✚Newark, N. J.—THE FACTORY CONSTRUCTION CO., 70 Westcott St., has been awarded the contract for the construction of a two-story, 47x100-ft. factory for the Celluloid Co., 290 Ferry St. The estimated cost is $15,500.

✚New Brunswick, N. J.—The JOHN W. COWPER CO., Fidelity Bldg., Buffalo, N. Y., has been awarded the contract for the construction of a two-story, 70x100-ft. addition to the factory of the Simplex Automobile Co. The estimated cost is $20,000.

Plainfield, N. J.—(Official)—The contract will soon be awarded by John G. Brown, Arch., Witherspoon Bldg., Philadelphia, Penn., for the construction of a two-story, 120x120-ft. brick and concrete addition to the plant of the Sauer Motor Co. The estimated cost is $30,000. Noted May 6 and 20 and Aug. 12.

Union Hill, N. J.—(Weehawken post office)—Bids are being received by Philip H. Dilmer, Arch., 128 Humboldt St., for the construction of a two-story, 53x97-ft. brick dairy on Fulton St. for William Jordan. The estimated cost is $15,000.

Berwick, Penn.—The American Car & Foundry Co. plans the construction of an 80x480-ft., brick addition to its plant to cost $90,000.

✚Croyden, Penn.—(Bridgewater post office)—(Official)—The contract for the construction of a one-story, 40x250-ft. dairy for Joseph R. Grundy, Bristol, Penn., has been awarded to C. Z. STRODLING, Oxford Valley, Penn. Heacock & Hokanson, 1218 Chestnut St., Philadelphia, Penn., is Arch. Noted July 1.

Haverford, Penn.—Bids are being received by H. Brooks Price, Arch., 105 West 40th St., New York, N. Y., for the construction of a two-story, 34x89-ft. garage for Archibald G. Thomson, New Stock Exchange Bldg., Philadelphia, Penn. The estimated cost is $25,000.

✚Philadelphia, Penn.—Frank F. Leflan has awarded the contract for the construction of a one-story, 55x244-ft. garage to HARRY BROCKLEHURST, 512 Norris St. The estimated cost is $13,000.

Philadelphia, Penn.—Bids are being received by John Scott & Co., American and Diamond St., for the construction of a four-story, 50x122-ft. addition to its warehouse to cost $50,000. M. Ward Easby, 1420 Chestnut St., is Arch. Noted Aug. 12.

Zelienople, Penn.—H. C. Eilholtz contemplates the construction of a two-story, 58x100-ft. commercial garage to cost $12,000.

✚Wilmington, Del.—Philip Johnson has awarded the contract for the construction of additions and alterations to his warehouse to CHARLES J. DOUGHERTY. Roscoe C. Tindall, Equitable Bldg., is Arch.

Wilmington, Del.—The contract will soon be awarded by Brown & Whiteside, Arch., Du Pont Bldg., for the construction of a one-story, 32x240-ft. warehouse for the Electric Hose & Rubber Co. The estimated cost is $15,000.

Baltimore, Md.—C. Warner Storck, Charles and Franklin St., plans the construction of a two-story warehouse, to cost $25,000. E. H. Glidden, Garrett Bldg., is Arch.

✚Baltimore, Md.—John F. Hancock & Son, 4 South Howard St., has awarded the contract for the construction of a three-story, 22x60-ft. addition to its warehouse to CHARLES H. BROOKS, 923 North Carey St. The estimated cost is $10,000.

Baltimore, Md.—Bids are being received by E. E. Ottenheimer, 327 Law Bldg., for the construction of a one-story, 30x65-ft. garage. The estimated cost is $10,000. F. E. Beall, 306 St. Paul St., is Arch.

Baltimore, Md.—The Baltimore Lumber Co., Baltimore, Md., will build a four-story warehouse on Watson St. George R. Callis, Jr., is Arch.

✚Baltimore, Md.—The contract for the construction of a 334x176-ft. factory on Hull St. for G. Ober & Sons has been awarded to the SANFORD & BROOKS CO., at $55,000.

✚Washington, D. C.—IRWIN & LEIGHTON, 12th and Cherry St., Philadelphia, Penn., has been awarded the contract for the construction of a six-story, 100x300-ft. service building for the Ford Motor Co., Detroit, Mich. The estimated cost is $600,000. Kohn & Wilby, 58 La Fayette Ave., Detroit, Mich., is Arch.

✚Washington, D. C.—Peter M. Dorsch, 1811 Seventh St., N. W., has awarded the contract for the construction of a two-story, 48x60-ft. bakery to A. M. POYNTON, 715 14th St.,

N. W. The estimated cost is $15,000. Simmons & Cooper, Corcoran Bldg., is Arch.

Richmond, Va.—Bids are being received by Baldwin & Brown, 1557 East Main St., for the construction of a six-story warehouse to cost $30,000. Carmeal & Johnson, Chamber of Commerce Bldg., is Arch. Noted Aug. 5.

Columbia, S. C.—The Carolina Veneer Co., Biltmore, N. C., will build a factory. Joseph E. Kocka is Pres. Estimated cost, $50,000.

Dothan, Ala.—The Farmers' Union Warehouse Co. will build a warehouse, to cost $75,000.

Dothan, Ala.—The Central Warehouse & Gin Co., recently incorporated, will build a warehouse. Estimated cost, $75,000.

Fayetteville, Tenn.—The Elk Cotton Mills will build a mill. The estimated cost is $90,000. J. E. Sirrine, Greenville, S. C., is Arch. and Engr.

Johnson City, Tenn.—The Clinchfield Products Co. plans the construction of a $500,000 plant.

Canton, Ohio—The United Steel Co. plans the construction of a $2,000,000 plant.

Cleveland, Ohio—The Commercial Flour & Milling Co., 1253 Superior Viaduct, will build a five-story, brick warehouse on Scranton Rd. William J. Mahnke is Pres. Estimated cost, $25,000.

Cleveland, Ohio—Bids will be received until Oct. 1 by the W. W. Hodges Co., Arch., 1216 Schofield Bldg., for the construction of a one-story, 100x132-ft. factory for the J. D. Ryan Co., 211 High Ave. The estimated cost is $15,000.

✚**Cleveland, Ohio**—The contract for the construction of a four-story factory at 4223 Hamilton Ave., for the Elwell-Parker Electric Co., has been awarded to the MASTER-MULLEN CONSTRUCTION CO., 454 Rose Bldg. George S. Rider & Co., 512 Century Bldg., is Arch. Estimated cost, $50,000.

Cleveland, Ohio—The City Auto & Supply Co., 2352 Euclid Ave., will build a two-story garage and service station at East 23d and Chester St. Estimated cost, $25,000.

Cleveland, Ohio—The Vlchek Tool Co. will build an addition to its plant at 10,709 Quincy Ave., to cost $18,000.

✚**Cleveland, Ohio**—The Chandler Motor Car Co., East 31st St. and St. Clair Ave., has awarded the contract for the construction of a plant to the BOLTON-PRATT CO., 802 Columbia Bldg. Ernest McGeorge, 853 Leader-News Bldg., is Arch. Noted July 22.

✚**Cleveland, Ohio**—W. I. THOMPSON & SON, 6110 Euclid Ave., has been awarded the contract for the construction of a four-story, 100x120-ft. factory for the Russ Co., 5700 Walworth Ave. W. W. Hodges, 1216 Schofield Bldg., is Arch.

✚**Cleveland, Ohio**—The Harshaw, Fuller & Goodwin Co., 712 Electric Bldg., has awarded the contract for the construction of a two-story, 60x109-ft. addition to its factory to SAMUEL AUSTIN & SON CO., 14,230 Euclid Ave. The estimated cost is $30,000.

Indianapolis, Ind.—S. Ringold will build a garage at Capitol and Vermont St., to cost $12,600.

Battle Creek, Mich.—H. L. Kneeland plans the construction of a $100,000 garage.

Detroit, Mich.—The Hyatt Roller Bearing Co. will build a three-story, reinforced-concrete warehouse to cost $30,000.

Hastings, Mich.—The contract will soon be awarded for the construction of a 150x300-ft. machine shop for the Consolidated Press Co. Frank D. Chase, Peoples Gas Bldg., Chicago, Ill., is Arch.

✚**Alton, Ill.**—The Western Cartridge Co. has awarded the contract for the construction of a two-story factory to the WIMMER CONSTRUCTION CO., Victoria Bldg., St. Louis, Mo. Theodore Masel is Arch.

Chicago, Ill.—Bids will be received about Sept. 1 by Price & McLanahan, Arch., Bellevue Court Bldg., Philadelphia, Penn., for the construction of a five-story, 500x800-ft. freight storage building for the Pennsylvania R.R. Co., Pittsburgh, Penn. The estimated cost is $2,000,000.

Chicago, Ill.—Bids are being received by Paul Gerhardt, 64 West Randolph St., Arch., for the construction of a six-story, 200x300-ft. warehouse for the Wheeling Corrugating Co. The estimated cost is $200,000.

✚**Chicago, Ill.**—The Michigan Central Ry., La Salle St. Station, has awarded the contract for the construction of a one-story freight house to the LEYDEN, ORTSEIFEN CO., 53 West Jackson Blvd. The estimated cost is $12,000. A. T. Hawk, 139 West Van Buren St., is Arch.

Chicago, Ill.—Revised bids are being received by A. S. Alschuler, 28 East Jackson Blvd., Arch., for the construction of a six-story, 108x120-ft. printing plant for the Regensteiner Colortype Co., 1201 West Jackson Blvd.

Chicago, Ill.—The contract will soon be awarded for the construction of a three-story, 41x116-ft. factory for the Republic Box Co., 913-31 North Halsted St. Holabird & Roche, 104 South Michigan Ave., is Arch.

✚**Chicago, Ill.**—(Official)—The Chicago Title & Trust Co., 69 West Washington St., has awarded the contract to the O. W. ROSENTHAL CO., 80 East Jackson Blvd., for the construction of a seven-story reinforced-concrete warehouse at 411 West Orange St. The estimated cost is $150,000. Paul Gerhardt, 64 West Randolph St., is Arch. Noted Aug. 5.

✚**Madison, Wis.**—The Union Transfer & Storage Co. has awarded the contract for construction of a six-story warehouse, office and plant, costing about $120,000, to N. E. BREDE, Chicago, Ill. Noted Apr. 29.

Milwaukee, Wis.—The Linde Air Products, 42d St. Bldg., New York, N. Y., plans the construction of a one-story, 150x250-ft. factory at 38th and National St. The estimated cost is $50,000.

Milwaukee, Wis.—Bids will soon be received by Kirchhoff & Rose, Arch., 1312 Majestic Bldg., for the construction of a six-story, 70x150-ft., brick and concrete addition to the plant of the Phœnix Knitting Co., 208 Broadway. The estimated cost is $100,000.

Minneapolis, Minn.—The Lansing Co. will build a five-story warehouse at 519-21 Third St., to cost $40,000.

St. Paul, Minn.—The Equity Coöperative Grain Exchange plans the construction of a reinforced-concrete grain elevator to cost $150,000.

Garden City, Kan.—The Alfalfa Milling Co. will expend $175,000 to increase the capacity of its plant.

St. Louis, Mo.—The Pulitzer Publishing Co., 212 North Broadway, contemplates the construction of a five-story publishing house, to cost $200,000. Barnett, Haynes & Barnett, Century Bldg., is Arch.

St. Louis, Mo.—Bids are being received by J. M. Dunham & Co., Arch., Dunham Bldg., for the construction of a two-story warehouse for the Hafner Mfg. Co., Main and Dock St. The estimated cost is $25,000.

✚**St. Louis, Mo.**—The Pavely Dairy Co., 3301 Park Ave., has awarded the contract for the construction of a $50,000 dairy plant to the GILSONITE CONSTRUCTION CO., Wainwright Bldg. Leonhard Haeger, 3844 Utah Pl., is Arch. Note June 17.

Troy, Mo.—The Racket Store Co. will build a two-story ice-storage building to cost $20,000. J. M. Dunham & Co., Chemical Bldg., St. Louis, Mo., is Arch.

Orange, Tex.—The plant of the Lutcher & Moore Lumber Co., which was recently destroyed by fire at a loss of $150,000, will be rebuilt.

Post, Tex.—Plans are being made to increase the capacity of the Post Cotton Mills Co. by enlarging the plant to four times its present size. The estimated cost is $1,500,000.

San Benito, Tex.—Plans are being prepared for the construction of a two-story, brick refrigeration plant for the Rio Grande Valley Ice Co. The estimated cost is $25,000.

Oklahoma Cty, Okla.—The contract will be awarded about Sept. 1 for the construction of an assembling plant for the Ford Motor Co., Detroit, Mich. Albert Kahn, 58 La Fayette Ave., Detroit, Mich., is Arch. J. A. Deignan is Local Mgr. Noted July 29.

Denver, Colo.—The contract will soon be awarded for the construction of a four-story, 65x65-ft. warehouse for the Turner Co. S. H. Dunford, 10 South La Salle St., Chicago, Ill., is Arch.

Gold Hill, Ore.—The Beaver Portland Cement Co. will soon start work on the construction of a $600,000 plant. J. C. Burch, Portland, Ore., is Mgr.

Giant, Calif.—The Atlas Powder Co. plans to expend $500,000 in remodeling and enlarging its plant. W. J. Webster is Pres.

✚**Ingersoll, Ont.**—JOHN HAYMAN & SONS, LTD., London, Ont., has been awarded the contract for the construction of a $50,000 factory for the Borden Mills Co.

Regina, Sask.—Bids are being received by the Robert Simpson Co., Queen and Yonge St., Toronto, Ont., for the construction of a brick and reinforced-concrete warehouse, to cost $150,000. Noted Aug. 12.

FEDERAL GOVERNMENT WORK

Post Office—Gardiner, Maine—Bids were received Aug. 13 by the Acting Supervising Architect, Treasury Dept., Washington, D. C., for the construction of a post office at Gardiner (a) limestone, (b) standstone, as follows: Potters Lumber Co., East Liverpool, Ohio (a) $66,899; E. T. Abbot Construction Co., New York, N. Y., (a) $58,920, (b) $61,200; Otto Nelson Co., Bangor, (a) $61,554, (b) $63,292; William H. Fissell & Co., New York, N. Y., (a) $55,000, (b) $60,000; Conners Bros. Co., New York, N. Y., (a) $64,450, (b) $66,956; C. M. Leach, Boston, Mass., (a) $68,873, (b) $75,759; James Devault, Canton, Ohio, (a) $63,431, (b) $66,900; George W. Lane & Co., Lewiston, (a) $69,874; Thomas W. Cissel & Co., Wooster, Ohio, (a) $60,000, (b) $63,000; Westchester Engineering Co., White Plains, N. Y., (a) $60,000, (b) $65,000, and T. F. Moreau, Lewiston, (a) $59,894, (b) $61,674. Noted July 8.

Miscellaneous Supplies—Boston, Mass.—Bids will be received until 10 a.m., Aug. 24, by the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing miscellaneous supplies at the navy yard, Boston.

Post Office—North Attleboro, Mass.—Bids were received Aug. 12 by the Acting Supervising Architect, Treasury Dept., Washington, D. C., for the construction of a post office at North Attleboro, Mass., as follows: N. J. Magnan & Co., North Attleboro, (1) $54,428, (2) $54,728, (3) $55.128, (4) $55.448; C. M. Leach, Boston, (1) $52,873, (2) $53,983, (3) $54,000, (4) $55,200; E. T. Abbot Construction Co., New York, N. Y., (1) $51,900, (2) $52,700, (3) $52,600, (4) $53,300; George Howard & Sons Co., Brockton, (1) $51,000, (2) $51,400, (3) $52,000, (4) $52,400; W. H. Fissell & Co., New York, N. Y., (1) $47,990, (2) $48,890, (3) $48,359, (4) $49,337; Torbert Construction Co., Hampton, Va., (1) $50,249, (2) $50,749, (3) $51,119, (4) $51,619; R. G. Monroe & Co., North Attleboro, (1) $53,191, (2) $53,491, (3) $54,231, (4) $54,531; Potters Lumber Co., East Liverpool, Ohio, (1) $55,000, (2) $55,800, (3) $55,300, (4) $56,100; Westchester Engineering Co., White Plains, N. Y., (1) $50,700, (2) $52,500, (3) $52,000, (4) $54,000; Conners Bros. Co., New York, N. Y., (1) $54,450, (2) $55,450, (3) $55,250, (4) $55,750; James Devault, Canton, Ohio, (1) $52,270, (2) $53,000, (3) $53,517, (4) $54,000; James A. Munroe, North Attleboro, (1) $47,817, (2) $48,100, (3) $48,900, (4) $49,200, and Charles W. Wright, Lynn, (1) $54,875, (2) $55,773, (3) $56,273, (4) $56,873. Noted July 8.

★**Repairing Breakwater**—Buffalo, N. Y.—Bids will be received until 11 a.m., Sept. 1, by the U. S. Engineer, Buffalo, for furnishing and placing riprap and repairing concrete superstructure on Buffalo breakwater.

✚**Dredging**—New York, N. Y.—The contract has been awarded to the MARYLAND DREDGING & CONTRACTING CO., Produce Exchange, New York, at 12.45c. per cu.yd., for dredging in the Hackensack River, N. J., and in channel north of Shooters Island, N. Y. Noted June 24.

✚**Mechanical Stokers**—New York, N. Y.—The contract has been awarded by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., to the WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburgh, Penn., at $49,332, for installing new mechanical stoker equipment in the boiler plant at the Navy Yard.

Dredging—Baltimore, Md.—Bids will be received until 2:30 p.m., Sept. 15, by the U. S. Engineer, 309 Custom House, Baltimore, for dredging in certain rivers and harbors on the east shore of the Chesapeake Bay.

✚**Boiler Plant**—Indian Head, Md.—The contract has been awarded by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction and equipment of an extension to the boiler plant at Indian Head Naval Proving Grounds to JOHN W. DANFORTH CO., Buffalo, N. Y., at $153,931. Noted June 3 and July 15.

Fuel Oil Storage Plants—Norfolk, Va.—Bids will be received until Oct. 16 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of fuel oil storage plants at the navy yard and station.

Post Office—Wellsburg, W. Va.—Bids were received Aug. 11 by the Acting Supervising Architect, Treasury Dept., Washington, D. C., for the construction of a post office at Wellsburg, as follows: James Devault, Canton, Ohio, $42,600; Olin Gerlach, Frostburg, Md., $43,692; McFeely Bros., Steubensville, Ohio, $52,990; Westchester Engineering Co., White Plains, N. Y., $43,868; Carl M. Everson, Brilliant, Ohio, $45,779; Callahan-Mandl Co.,Chicago, Ill., $43,476; Thomas W. Cissel, Wooster, Ohio, $42,500; J. L. Crouse, Greensboro, N. C., $44,863; Potters Lumber Co., East Liverpool, Ohio, $43,800; A. S. Craig & Co., Follansbee, $55,214; W. H. Batson, Moundsville, $43,890; Deitrick Construction Co., Washington, D. C., $43,948; W. H. Fissell & Co., New York, N. Y., $42,700; J. S. Rogers Co., Moorestown, N. Y., $43,200; George A. Shaul, Seneca, Kan., $44,924; John G. Unkefer & Co., Minerva, Ohio, $42,700; Barnes Bros., Logansport, Ind., $42,400; Colonial Construction & Supply Co., Charlottesville, Va., $41,500; W. J. Brent Construction Co., Norfolk, Va., $48,950; Algernon Blair, Montgomery, Ala., $44,266; Perkins & Jackson, Wheeling, $50,494, and Harris & Spindler, Wheeling, $43,798. Noted July 8.

★**Lock Gates**—Montgomery, Ala.—Bids will be received until noon, Sept. 20, by the U. S. Engineer, Montgomery, for furnishing lock gates.

Metal Work—Milwaukee, Wis.—Bids will be received until 2 p.m., Aug. 25, by the Lighthouse Inspector for furnishing metal work for two steel towers.

Irrigation—Cheyenne, Wyo.—Bids will be received until Sept. 8 at the office of the U. S. Reclamation Service, Denver, Colo., for irrigation work in Goshen Park, Wyo., and Neb., for the first 10 miles of the Ft. Laramie Reclamation. The estimated cost is $1,500,000.

✚**Post Office**—Webb City, Mo.—The contract for the construction of a post office at Webb City has been awarded to GEORGE A. SHAUL, Seneca, Kan., at $51,542. Noted June 17 and Aug. 5.

Dam—Elephant Butte, N. M.—Bids will be received until 2 p.m., Sept. 2, by A. P. Davis, Ch. Engr., U. S. Reclamation Service, Washington, D. C., for furnishing four cylinder gates and accessories for the spillway at the Elephant Butte Dam, Rio Grande Project.

✚**Reclamation**—Provo, Utah—The contract for the construction of Div. 9 of the High Line Canal, Strawberry Valley irrigation project, has been awarded to HOUSER, SIM & VORKINK, Salt Lake City, at $35,505. The work comprises 25,000 cu.yd. of excavation and the placing of 2600 cu.yd. of reinforced concrete. Noted July 1.

Dredging—Bremerton, Wash.—The low bidder for dredging both sides of Piers Nos. 6 and 7 of the Puget Sound Navy Yard, the work comprising the dredging of approximately 22,500 cu.yd. was the Ericson Construction Co., Seattle, at $0.60 per cu.yd.

Fuel Oil Storage Plants—Bremerton, Wash.—Bids will be received until Oct. 16 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of fuel oil storage plants at the navy yard and station.

Fuel Oil Storage Plants—Mare Island, Calif.—Bids will be received until Oct. 16 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of fuel oil storage plants at the navy yard.

Fuel Oil Storage Plants—San Diego, Calif.—Bids will be received until Oct. 16 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of fuel oil storage plants at the navy yard and station.

Seven Buildings—San Diego, Calif.—The low bidder for constructing seven buildings at the radio station was the James H. Jacobs Construction Co., Hellman Bldg., Los Angeles, at $41,010. Noted Apr. 8 and June 24.

Locomotives—Panama—The only bid received by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., Aug. 16, for furnishing 12 electric towing locomotives with additional motors and spare parts was the General Electric Co., Schenectady, N. Y., at $16,800 each. Noted June 17 and July 1.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., Aug. 27, by Maj. F. C. Boggs, Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., Aug. 31, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

★**Miscellaneous Equipment**—Balboa, Panama—Bids will be received until 10:30 a.m., Sept. 13, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing motor-driven capstans, switchboards, cables and miscellaneous equipment for Dry Dock No. 1, Balboa Terminals.

MISCELLANEOUS

✚★**Dredging**—Boston, Mass.—The contract for dredging the channels at the Pleasant Park Yacht Club, Winthrop; Orient Heights, East Boston; Wessagussett, North Weymouth, and at the Mystic River in the vicinity of Malden Bridge has been awarded to J. P. O'RIORDAN, Boston. Noted Aug. 5.

★**Earth and Concrete Dam**—Wallingford, Conn.—(Official)—Bids will be received by F. A. Wallace (R. Wallace & Sons Co.) until 3 p.m., Aug. 18, for the construction of an earth and concrete dam and appurtenances, at the Rose Farm, Wallingford.

Shed—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier A, Battery Pl., Manhattan, until noon, Aug. 23, for building a freight shed on the pier near the foot of 29th St.

★✚**Subway**—New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for the construction of Section No. 2, Route No. 29 of the Nostrand Ave. subway, has been awarded by the Public Service Commission to the DOCK CONTRACTOR CO., Union Sq., New York, N. Y., at $1,692,370. Noted July 15 and Aug. 5.

★✚**Subway Station**—New York, N. Y.—(Borough of Queens)—(Official)—The contract for the construction of the station finish on Route No. 50 of the Queensboro subway extension and Section Nos. 1 and 3, Route Nos. 36 and 37 of the Corona Elevated R.R. has been awarded by the Public Service Commission to SNARE & TRIEST, 233 Broadway, New York, at $750,000. Noted July 15 and Aug. 5.

✚**Machinery and Appurtenances**—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for coal hoisting machinery and appurtenances (omitting head house), part of the coal handling plant for O. H. Perry & Son, Inc., foot of East 19th St., has been awarded to the GUARANTEE CONSTRUCTION CO., New York, N. Y. Charles H. Higgins, 30 Church St., New York, N. Y., is Consult. Engr.

Barge Canal Work—St. Johnsville, N. Y.—Bids will be received by W. W. Wotherspoon, State Superintendent of Public Works, Capitol, Albany, N. Y., until noon, Sept. 8, for constructing a harbor and dockwall on the north side of the Mohawk River east of the highway bridge at St. Johnsville. The engineer's estimate is $27,963.

Motor Fire Apparatus—Philadelphia, Penn.—According to press reports, the city plans to motorize the fire department. The City Council has appropriated $100,000 and bids will soon be asked.

Dry Dock Improvements, Etc.—Baltimore, Md.—The Baltimore Dry Docks & Shipbuilding Co. will spend $200,000 for additions and improvements to its plant at Locust Point. H. A. Evans is Vice Pres.

Dam—Toccoa, Ga.—Bids will be received by H. J. Cox, City Clk., for constructing a sectional concrete dam. H. M. Nabstedt is Engr.

Drainage—Cruger, Miss.—M. L. Culley, Jackson, Miss., is making surveys for the Abiaca Drainage District. J. L. Lundy is Comr.

Levees—Alexandria, La.—Bids will be received by the Red River, Atchafalaya and Bayou Bouef Levee Board until Sept. 10 for the following levee construction: White Place to Wilso Point, 140,000 cu.yd.; Simmsport to Deer Range, 130,000 cu.yd.; Alto Crevasse to Crooked Bayou, 325,000 cu.yd. H. B. Gist, Alexandria, is Secy.

✚**Wharves**—New Orleans, La.—The contract for the reconstruction of the Julia St. wharf and for extending the Girod St. wharf has been awarded to the JEFFERSON CONSTRUCTION CO., New Orleans, at $71,498.68. Noted July 22.

Speedway—Louisville, Ky.—George L. Martin, Louis Seelbach, Patrick J. Hanlon and other Louisville men, together with Carl G. Fisher, Pres., Indianapolis Motor Speedway, plan to construct a speedway in Louisville at a cost of $250,000.

Motor Fire Apparatus—Bellaire, Ohio—The following are the bids received for furnishing motor fire apparatus: G. C. Hale, Kansas City, triple combination truck, $8150; combination, $4950; tractor, $4000; total $18,000. Ahrens-Fox, triple combination, $10,000; according to specifications, $9000. J. H. McGraw & Sons, Federal Truck Co., tractor, $2475; tractor M., $2490. Robinson Fire Apparatus Co., triple combination, $10,000; combination, $5500; tractor, $2950; total, $16,320. Boyd Truck Co., triple combination, $8580; combination, $5500; total, $13,800. Eagraves Co., triple combination, $9000; combination, $5000; total, $14,000. American La France, J. F. Johnson, triple combinations at $8500, $9000 and $10,000; combination, $5500; tractor, $4500.

Dredging—Canton, Ohio—W. E. Sarver, City Engr., is preparing plans for dredging and improving East Creek from Tuscarawas St., East, for about two miles.

Subway Approaches—Cleveland, Ohio—The County Commissioners will hold a $2,000,000 bond sale to be used for the construction of subway street car approaches at the Detroit-Superior high level bridge. W. A. Stinchcomb is County Engr.

Tunnel—Columbus, Ohio—Bids will be received by Charles E. Steb, Secy., Board of Trustees, Ohio State University, for constructing a brick and concrete tunnel 6½x6½ ft. and 430 ft. long.

✚**Ore Unloaders**—Conneaut, Ohio—The contract for the construction of two 15-ton ore unloaders for the United States Steel Corporation has been awarded to the WELLMAN-SEAVER-MORGAN CO., Cleveland, Ohio, at $250,000.

Ditch—New Philadelphia, Ohio—Bids will be received by the Joint Board of County Commissioners, Holmes and Tuscarawas Counties, until Sept. 1, for constructing a joint county ditch. R. H. Nassdorfy is Secy. of the Joint Board.

Drainage—Sturgis, Mich.—The lowest bid submitted for constructing Hallwood drain was that of Smith & Nickelson, Sturgis, at $15,500.

Park Improvements—Kenosha, Wis.—The City Council has ordered a $120,000 bond issue, to be used for park improvements, etc.

Elevators—Madison, Wis.—Bids will be received by Lew F. Porter, Secy., Capitol Commission, until Aug. 24 for elevator work in north and final wing of new state capitol. George B. Post & Co., New York, N. Y., is Arch.

Telegraph System—West Allis, Wis.—Bids will be received by George Mahoney, City Clk., until 7:30 p.m., Aug. 20, for the installation of a fire and police alarm telegraph systems.

Drainage—Fort Madison, Iowa—It is reported that plans are being prepared by Edmund T. Perkins, Chicago, Ill., for a drainage district in Green Bay Township. The estimated cost of the proposed work is $348,000.

Tank—Shenandoah, Iowa—Bids will be received until Sept. 2, by C. M. Conway, City Clk., for the construction of a 400,000-gal. elevated tank.

+Drainage—Webster City, Iowa—The following contracts have been awarded by the County Board of Supervisors: Cleaning Castner-Williams-Askland ditch approximately 245,000 cu.yd. to MULGREW-BOYCE & CO., Dubuque, Iowa, at 94.2c. per cu.yd.; Nail Ditch excavation to L. E. NELSON, Webster City, at $5984; tile work to NATIONAL SEWER PIPE CO., Webster City at $10,228.

Score Board—St. Paul, Minn.—Plans are being prepared for the construction of an electric score board for the Twin City Motor Speedway. The estimated cost is $16,000. Samuel Kandel, Chicago, Ill., is Arch.

Dock and Warehouse—St. Louis, Mo.—It is reported that the city will construct a municipal dock and warehouse at the Chain of Rocks to cost about $250,000.

Speedway—St. Louis, Mo.—Press reports state that a speedway is planned for Maxwelton, a suburb of St. Louis. The cost is estimated at $500,000. Frank Arcutt is interested.

+Levee—Cummins, Ark.—The contract for 355,000 cu.yd. of levee work at the Linwood and Auburn levee district has been awarded to LANNAN BROS. & TANSEY, Minden, La., at .1485c. per cu.yd. Noted July 29.

+Levee—Hannaberry, Ark.—The contract for constructing Farrelly Lake Levee, about four miles in length, has been awarded to HALLECK & THOM, Little Rock, at about $35,000.

+Levee—Austin, Tex.—The contract for about 360,000 cu.yd. of earth work for levee construction has been awarded to CHARLES NORDSTROM, Bryan, at 18.85c. per cu.yd. J. L. Nagle is Imp. Engr.

+Levee—Caldwell, Tex.—The contract for about 360,000 cu.yd. of levee embankment, including the construction of ditches, etc., has been awarded to CHARLES NORDSTROM, Bryan, Tex., at .1885c. per cu.yd. J. C. Nagle, Austin, is Engr. Noted July 15.

+Dry Dock—Galveston, Tex.—Plans for the construction of a dry dock on Pelican Spit are nearly completed. The estimated cost is $500,000. J. P. McDonough and associates are the owners. The contract for grading, dredging and bulkhead work has been awarded to JOHN JACOBSON, Texas City; machinery and iron work to the CRANDALL ENGINEERING CO., East Boston, Mass. P. N. Crowell is Engr. in charge of construction. Bartholow-Willits Engineering Co., Galveston, Tex., is Arch.

+Wharf, Dredging, Etc.—Houston, Tex. — Press reports state that the following contracts have been awarded: Wharf, sheds and track to HORTON & HORTON, at $139,000; dredging to L. T. GAYLORD, at $50,000; two elevated tanks, to the SOUTHERN ENGINE & PUMP CO., at $7000. E. E. Sands is City Engr.

+Motor Fire Apparatus—Temple, Tex.—The contract for furnishing motor fire apparatus has been awarded to the AMERICAN LA FRANCE FIRE ENGINE CO., at $18,500. Noted June 17.

Park—Phoenix, Ariz.—The City Commission has authorized an expenditure of $75,000 for the establishment of a park. George Young is Mayor.

Dike—Cathlamet, Wash.—It is reported that the County Commissioners have approved the plans for diking District No. 1. G. A. Kyle, Portland, has prepared plans. The cost is about $160,000.

Dock—Everett, Wash.—W. H. Hoover, City Engr., is preparing plans for a dock, 25 ft. wide and 200 ft. long, with a 150-ft. float.

+Drainage—North Yakima, Wash.—The contract for construction work in Drainage District No. 25, under Schedule 1 has been awarded to E. M. MOORE, 524 Sheridan Ave., Tacoma, at $17,305 and under Schedule 2, to DUNN & HOGAN, North Yakima, at $7148; J. O. Greenway is Drainage Engr.

Bulkhead—Seattle, Wash.—Press reports state that the County Commissioners have approved the plans for filling and bulkheading East Marginal Way. The cost is estimated at $50,000.

+Steamer—Seattle, Wash.—The contract for the construction of a 600-ton steel steamer for the New York & Cuba Mail Steamship Co. has been awarded to the SEATTLE CONSTRUCTION & DRY DOCK CO., Seattle, Wash.

★Piers—Honolulu, Hawaii — Bids will be received by Charles B. Forbes, Chn., Harbor Comrs., until 2 p.m., Sept. 22, for constructing reinforced-concrete piers. For further information see advertisement under "Contracts to Be Let."

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

+Orono, Maine—The contract for the construction of a dormitory for the University of Maine has been awarded to JOHN W. BURROWS & CO., 112 Preble St., Portland, Maine. C. Parker Crowell, 41 Central St., Bangor, Maine, is Arch.

+Amherst, Mass.—The contract for the construction of a laboratory building at the Massachusetts Agricultural College has been awarded to HOOPER & CO., 101 Tremont St., Boston, Mass. J. H. Ritchie, 8 Beacon St., Boston, Mass., is Arch. Noted July 8.

+Billerica, Mass.—The contract for the construction of a three-story, 60x176-ft., brick high school has been awarded to the LEIGHTON-MITCHELL CO., 95 Milk St., Boston, Mass. Brainerd & Leeds, 89 Franklin St., is Arch. The estimated cost is $90,000. Noted July 29.

Boston, Mass.—Fred Holdsworth and Robert D. Farrington will build a 12-story office building at 9-11 Beacon St.

+Cambridge, Mass.—The contract for the construction of St. Paul's Church on Arrow and De Wolfe St. has been awarded to JOHN B. BYRNE, 162 Sidney St. E. T. P. Graham, 20 Beacon St., Boston, Mass., is Arch.

Fitchburg, Mass.—A theater will be built on Main near Olivers St. George A. Whitney is Arch.

+Holyoke, Mass.—The contract for the construction of a five-story, 65x122-ft., brick business block and theater for James Baker has been awarded to P. J. KENNEDY & CO., INC. George P. B. Alderman & Co., 437 High St., is Arch.

North Adams, Mass.—The City Council plans the construction of a two- and three-story, 90x200-ft. high school to cost $168,000.

Roxbury, Mass.—Plans have been prepared by A. J. Carpenter, Jr., Arch., for the construction of a four-story commercial building at Warren Ave. and Claredon St. Estimated cost, $50,000.

Albany, N. Y.—The Trustees of the Albany Medical College, 58-64 Eagle St., contemplate the construction of a hospital, to cost about $265,000.

+Hudson, N. Y.—CAMPBELL & DEMPSEY, Kingston, has been awarded the general contract for the construction of a jail in the rear of the courthouse. The estimated cost is $50,000. William J. Beardsley, 49 Market St., Poughkeepsie, is Arch.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 3 p.m., Aug. 23, by C. B. J. Snyder, Supt. of School Bldgs., Park Ave. and 59th St., New York, for the general construction of additions and alterations to Public School No. 89 at Newkirk Ave., between East 31st and East 32nd St. Noted May 27.

New York, N. Y.—(Borough of Manhattan)—Plans have been prepared by Warren & Wetmore, Arch., 16 East 47th St., for the construction of a 12-story fireproof apartment house on Park Ave. between 50th and 51st St. for the Park Avenue Improvement Co., Inc. The estimated cost is $700,000. Harry Fischel is Pres. of the company.

+New York, N. Y.—(Borough of Manhattan)—The general contract for the construction of a 16-story bank and office building at Fifth Ave. and 43d St. for the Five Hundred and Eleven Fifth Avenue Corporation has been awarded to the COLUMBUS CIRCLE CONSTRUCTION CO., 15 Columbus Circle, New York. York & Sawyer, 50 East 41st St., is Arch.

New York, N. Y.—(Borough of Manhattan)—Plans have been prepared by Neville & Bagge, Arch., 105 West 40th St. for the construction of a 12-story apartment house at 99th St. and West End Ave. The estimated cost is $500,000. Noted July 22.

New York, N. Y.—(Borough of Manhattan)—The Pan-American States Association, McAlpin Hotel, Broadway, 33d and 34th St., contemplates the construction of a 42-story building to be known as the "All America's Building." L. F. Strickland, 516 Hume-Mansur Bldg., Indianapolis, Ind., is Mgr.

+New York, N. Y.—(Borough of Manhattan)—A. L. MORDECAI & SON, INC., 30 East 42d St., New York, has been awarded the general contract for the construction of a 12-story apartment house on Park Ave. from 51st to 52d St. for the Three Hundred and Thirty Park Avenue Co. Warren & Wetmore, 16 East 47th St., is Arch.

Rensselaer, N. Y.—Plans have been prepared for the construction of a two-story school to replace Public School No. 1 on Third St. The estimated cost is $50,000. William Baker is Chn., Finance Com. of Common Council. Noted July 15.

+Rochester, N. Y.—The general contract for the construction of a two-story, 98x109-ft. brick, store and loft building at East Ave. and Scio St. for Dr. Sumner Hayward has been awarded to E. L. ALBRIGHT, Insurance Bldg., Rochester. Estimated cost, $50,000.

+Scarsdale, N. Y.—The contract for the construction of a two-story brick and stone high school containing an auditorium has been awarded to GEORGE T. KELLY, 20 John St., Yonkers. Estimated cost, $64,000. H. C. Lakin is Clk., Bd. of Education and Guy Lowell, 225 Fifth Ave., New York, is Arch. Noted July 15.

+Troy, N. Y.—The Troy Gas Co. has awarded the general contract for the construction of a five-story, 53x83-ft. office building to CHARLES CROWLEY & CO., 114 Third St., Troy. The cost is estimated at $100,000.

White Plains, N. Y.—(Official)—Bids will be received until 10 a.m., Aug. 31, by the Westchester County Building Commission, Robert W. Brewster, Chn., for a $500,000 addition to the courthouse at White Plains for the County of Westchester. Benjamin W. Morris, 101 Park Ave., New York, is Arch. Plans can be had from the Commission at White Plains. Noted July 15 and 29.

White Plains, N. Y.—Bids will be received about Sept. 1 by Robert S. Brewster, Chn., Westchester County Bldg. Comn., for the construction of the three-story brick and stone county workhouse and penitentiary at East View. The estimated cost is $500,000. Noted May 20 and July 22.

Yonkers, N. Y.—Plans are being prepared by F. J. Berlenbach, Arch., 260 Graham Ave., Brooklyn, for the construction of a brick parochial school on Convent Ave. for the monastery of the Blessed Sacrament. The estimated cost is $50,000.

Bayonne, N. J.—Bids will soon be received by the City Commissioners for the construction of a school to replace Public School No. 5 on 13th St. Noted June 24 and July 29.

East Rutherford, N. J.—(Rutherford post office)—Bids will be received about Aug. 20, for the construction of a two-story, 61x84-ft. brick school on Vreeland Ave. near Paterson St. E. P. Hutton is Secy., Bd. of Education and John Simpson, 1224 Essex Bldg., Newark, is Arch. Noted July 15.

+Fort Lee, N. J.—The J. E. VROMAN CONSTRUCTION CO., North Bergen, has been awarded the general contract for the construction of a one-story, 150x190-ft. motion picture studio for the New Jersey Studios Co. Estimated cost, $40,000. Andrew Hayek, Edgewater, is Arch.

+Fort Lee, N. J.—The general contract for the construction of a brick and terra cotta studio and administration building for the Paragon Film Co., Inc., 31 East 27th St., New York, N. Y., has been awarded J. B. ROBERTS CO., 1 Madison Ave., New York, N. Y. The estimated cost is $60,000. Ernest Flagg, 109 Broad St., New York, N. Y., is Arch.

Paterson, N. J.—Bids will soon be received by Lee & Hewitt, Arch., 1123 Broadway, New York, N. Y., for the construction of a brick and stone edifice at Broadway and East 27th St. for the Church of the Covenant. Estimated cost, $100,000. Contracts will be awarded about Sept. 15.

+Princeton, N. J.—The MATTHEWS CONSTRUCTION CO., Princeton, has been awarded the general contract for the construction of a dining hall at the Princeton University. The entire cost is estimated at $300,000. Noted May 27.

Erie, Penn.—B. E. Briggs, City Engr., has plans for the construction of a union depot and subways at Peach and Sassafras St. The cost is estimated at $1,800,000. A. T. Hardin, New York, N. Y., is Vice-Pres. of the New York Central R.R.

+Philadelphia, Penn.—The contract for the construction of a two-story public school at Cheltenham Ave. and Rising Sun Lane has been awarded to W. R. DOUGHERTY, 1608 Sansom St., Philadelphia, at $68,000.

+Pittsburgh, Penn.—(Official)—The contract for the remodeling of the passenger station at Smithfield and Water St. has been awarded to EDWARD BRADY & SON. M. A. Long is Arch. Noted Aug. 12.

Madison, W. Va.—(Official)—The time for receiving bids has been extended to Aug. 24, for the construction of a courthouse for Boone County. Elmer Nelson is County Clk. Noted July 22.

+Parkersburg, W. Va.—The ROCHE BRUNER BUILDING CO., 609 Johnston Bldg., Cincinnati, Ohio, at $234,026, has been awarded the general contract for the construction of a three-story, 182x235-ft. high school. Noted July 22.

Charlotte, N. C.—Plans are being prepared by Louis H. Asbury, Arch., for the construction of a brick and stone church for the Hawthorn Lane M. E. Church. The estimated cost is $40,0^0.

New Orleans, La.—Plans are being prepared by Baccich & De Monthuzen, Arch., for the construction of a building containing 50 rooms to be used as a Jesuit Retreat House and Chapel for the Jesuit Order. The estimated cost is $50,000. John D. Foulkes, S. J., is Representative.

Lexington, Ky.—The City Commissioners plan to hold an election in November to vote on the question of issuing $100,000 in bonds. The proceeds will be used for the construction of two schools.

Louisville, Ky.—The Bankers' Realty Co. will construct a five-story office building at Fourth and Market St. Estimated cost, $125,000. George G. Summers is interested.

Cincinnati, Ohio—Elzner & Anderson, Arch., Ingalls Bldg., has prepared plans for the construction of additions to buildings at the Longview Hospital. The estimated cost is $250,000. Noted July 1.

Cincinnati, Ohio—Bids will be received about Sept. 15, for the construction of a group of buildings for the Walnut Hills High School on Madison Rd., Hyde Park. The estimated cost is $1,000,000. Garber & Woodward, Union Central Bldg., is Arch. Noted June 3.

Cincinnati, Ohio—Bids will be received until noon, Sept. 12, by the Clerk of the Board of Education, third floor, City Hall, for the remodeling of the Lincoln Public School, Delta and Golden Ave., and the Washburn Public School, Clinton and Linn St. C. W. Handman is Business Mgr.

Cleveland, Ohio—The congregation of the St. Wendelen's Slovak Church, 2281 Columbus Rd. S. W., contemplates the construction of a group of buildings at Columbus Rd. and Freeman Ave. S. W. The group will include a church, school parsonage and sisters' home, and will cost about $175,000. Augustine Tomaseek is Pastor.

Cleveland, Ohio—Preliminary plans have been prepared for the construction of a commercial building at 1601 Euclid Ave. near East 16th St. through to Dodge Court. The estimated cost is $100,000. E. C. Beach, Williamson Bldg., is interested.

Columbus, Ohio—Bids will be received until noon Aug. 27, by Charles E. Steel, Secy., Bd. of Trustees, for the construction of a building for the College of Homeopathic Medicine and for the Home Economics Bldg., at the Ohio State University. Noted July 29.

Dayton, Ohio—Pretzinger & Musselman, Arch., is preparing plans for the construction of a five-story reinforced-concrete building at Third and Jefferson St. for the B. P. O. E., Lodge No. 58. The estimated cost is $250,000.

Van Wert, Ohio—George H. Marsh has purchased the school building in the Fourth Ward and plans to remodel it for hospital purposes. The estimated cost is $40,000.

Bloomington, Ind.—Bids will be received about Oct. 1 by R. P. Daggett & Co., Arch., 956 Lemcke Annex, Indianapolis, for the construction of a gymnasium at the Indiana University. The estimated cost is $150,000. Noted May 6 and 20.

Indianapolis, Ind.—Plans have been prepared for the construction of an apartment house at 16th and Meridian St. for the Hampton Court Realty Co. The estimated cost is $175,000.

Indianapolis, Ind.—The business men plan to construct an armory for the Indiana National Guard. The cost is estimated between $300,000 and $500,000.

Rockport, Ind.—The Spencer County Board of Commissioners has decided to appropriate $150,000 to be used for the construction of a county courthouse.

Albion, Mich.—The Albion College will construct a two-story physics laboratory building. Estimated cost, $40,000.

Kalamazoo, Mich.—Bids will be received until Oct. 1, by the Kalamazoo State Hospital for the construction of a three-story, brick building to be used by the employees of the hospital. The estimated cost is $56,000. Wernette-Bradfield-Mead Co., Grand Rapids, is Arch. Noted July 22.

Aurora, Ill.—The Island Improvement Co. plans to construct a hotel on an island which was recently added to the city. The cost is estimated at $200,000.

Chicago, Ill.—Plans are being prepared by Henry L. Newhouse, Arch., 4630 Prairie Ave., for the construction of a store, theater and apartment building on Broadway near Granville Ave. for J. M. Browarsky, 30 North La Salle St. The estimated cost is $130,000. Noted May 27.

Monmouth, Ill.—Plans are being prepared by Temple & Burrows, Arch., McManus Bldg., Davenport, Iowa, for the construction of a three-story city hall. The estimated cost is $50,000.

RAPID TRANSIT SYSTEM—NEW YORK, N. Y.

Section No. 1—Route No. 49

Bids were received July 20 by the Public Service Commission for the construction of Section No. 1, Route No. 49, a part of the Culver Rapid Transit R.R. from: (A) Post & McCord, (B) Phœnix Bridge Co., (C) A. L. Guidone & Son, Inc., (D) Cooper & Evans, (E) Connex Engineering & Construction Co., (F) Rodgers & Hagerty, Inc., (G) Frawley-Kaufman Contracting Co., (H) Oscar Daniels Co., (I) McClintic-Mashall Co., (J) Underpinning & Foundation Co., (K) Ft. Pitt Bridge Works, Pittsburgh, Penn., (L) Snare & Triest Co. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L
21,900 cu.yd. column excavation	$1.15	$1.40	$1.45	$2 50	$2.00	$1.00	$1.40	$1.20	$1.35	$1.75	$1.25	$1.50
12,900 cu.yd. railroad duct excavation	1.10	1.00	1.50	1.00	.75	1.35	1.40	1.00	1.25	2.00	1.35	1.30
8500 cu.yd. concrete masonry	5.85	5.65	7.00	5.00	8 00	6 00	6.00	5.00	5.85	7.00	6.00	5.50
10 cu.yd. brick masonry	15.00	20.00	15.00	20.00	10 00	15 00	20.00	15.00	15.00	25.00	15.00	20.00
500 lin.ft. timber piles	.35	.50	1.00	1.00	.10	10	.50	.30	.40	1.00	.35	.50
2 M ft. timber foundations	60.00	60.00	54.00	50.00	10.00	40.00	60.00	50.00	75.00	45.00	60.00	60.00
320 lin.ft. vitrified pipe, 4 in	.20	.50	.20	.60	1.00	.40	.50	.50	.30	1.00	.25	.50
329,000 duct ft. railroad ducts	.12	.10½	.14	.10½	.09½	.15	.15	.14	.11½	.17	.12	.21
14,500 tons riveted steel (painted and erected)	46.50	48.00	46.00	47.85	49.00	48 00	47.70	49.00	50.40	45.50	49.80	49.80
600 tons steel beams and shapes	46 50	48.00	46.00	47.85	49.00	48.00	48.00	49.00	45.60	45.50	48.40	49.80
5 tons steel rods and bars in concrete	60.00	42.00	60.00	40.00	60.00	50.00	60.00	60.00	50.00	100.00	60.00	54.00
180 ton miscellaneous iron castings	55.00	45.00	60.00	36.00	55.00	50.00	50.00	41.00	41.00	80.00	50.00	56.00
3000 sq.yd. street surface restored	3 00	2.50	2.50	2.50	.50	2.50	1.50	2.75	1.50	3 00	2.50	2.00
300 lin.ft. 5-in. blue stone curb	1.00	.90	1.00	1.25	1 00	1.00	1.00	.90	1 10	1 50	1.00	1.25
100 lin.ft. 4-in. blue stone curb	1.00	.70	.90	1.00	1 00	1.00	1 00	.80	1.00	1.25	.90	1.10
4000 lin.ft. restoring old curb	.20	.25	.25	.25	.25	.15	.25	.20	.20	.75	.25	.30
13,500 lin.ft. electric overhead trolley	1.20	.70	1.00	.60	.25	1.00	1 00	1.00	1 00	1 10	2.00	2.40
100 lin.ft. depressing street surface R.R.	.50	2.00	4.50	5.00	.50	4.00	4.00	5.15	4.00	2.00	2 00	4.00
200 lin.ft. lateral movement of turnout tracks	.50	2.50	4.50	4.00	1.00	3.00	5.00	5 15	2 50	3.00	2.50	3.00
8800 lin.ft. lateral movement of surface tracks	.50	1.25	1.30	1.50	.25	2.40	2.00	2 75	2.00	2 50	2.15	2 75
1800 lin.ft. removing street surface tracks	.30	.45	.60	1.00	.10	.50	1.00	50	.50	2 00	.55	1 50
1600 lin.ft. rebuilding street surface tracks	.85	.70	.90	1.00	.25	1 25	2 00	1.00	3.00	2 50	2 25	2 50
100 lin.ft. 4-in. water pipes	.50	.90	.50	1.00	.10	.40	.75	1 50	.80	1 25	.70	60
100 lin.ft. 6-in. water pipes	.75	1.00	.50	1.25	.10	.50	1.00	2 00	1 00	1 50	.80	1 00
100 lin.ft. 8-in. water pipes	1.00	1.10	.50	1.50	.10	.75	1 50	2 50	1 25	2 00	1 00	1 25
100 lin.ft. 20-in. water pipes	2 00	2.50	1.50	3 00	.10	2.00	2 00	3 00	4.25	5 00	1.75	2 00
100 lin.ft. 36-in. water pipes	7.00	6.00	4.00	5.00	.10	3.00	4.00	3 00	10.00	8.00	4.50	3.00
100 lin.ft. 4-in. c.i. gas pipes	.50	.70	.45	1.00	.10	.40	.75	1.25	80	1 25	.70	.60
100 lin.ft. 6-in. c.i. gas pipes	.75	1.00	.45	1.25	.10	.50	1.00	1.75	1.05	1 50	.80	1 00
100 lin.ft. 8-in. c.i. gas pipes	1.00	1.10	.50	1.50	.10	.75	1.50	2 25	1.35	2 00	1.00	1.25
100 lin.ft. 12-in. c.i. gas pipes	1.50	1.80	.75	2.00	.10	1.00	2.00	2 75	1.75	2 50	1.50	1 75
60 lin.ft. 6-in. w.i. gas pipes	1.00	1.05	1.00	2.00	.10	1.50	1 00	75	1 25	2 50	.50	1 00
60 lin.ft. 8-in. w.i. gas pipes	1 00	1 15	1.00	3 00	.10	2 50	1.50	1 00	1 50	3 00	80	1.50
4 ton c.i. hub and spigot straight pipe	50.00	35.00	65.00	70.00	60.00	30.00	40 00	30 00	60 00	50 00	40 00	40 00
50 lin.ft. standard weight 6-in. w.i. gas pipe	1.00	1.00	1.10	2.00	1 00	1.50	1.00	1.40	1.25	2 50	70	1 50
50 lin.ft. standard weight 8-in. w.i. gas pipe	1.00	1.10	1.40	3.00	1 20	2 50	1.50	2.00	1.50	3.00	1 00	2 00
10 ton c.i. hub and spigot pipe special casting	70.00	60.00	65.00	70.00	80.00	65.00	70.00	60.00	60.00	100.00	70.00	60 00
100 lb. new malleable fittings for w.i. gas pipe	.10	.10	.05	1.00	.10	.20	.10	.20	25	15	05	10
2000 duct ft. electric ducts and conduits	.35	.25	.40	.40	.50	.50	.50	.50	.25	1.00	30	40
100 lin.ft. 2¼ in. w.i. pipe electric ducts and conduits	.30	.70	.45	1.00	.50	1.00	1.00	.50	.50	1.50	40	60
100 duct ft. wooden ducts and conduits	.30	.60	.90	1.00	.50	1.00	1 00	50	50	1.50	.35	60
100 duct ft. fibre electric ducts and conduits	30	.60	.40	1.00	.60	1 00	1 00	50	50	1 50	40	60
5 electric ground connection to railroad structure	50.00	40.00	100.00	75.00	25 00	50.00	10.00	100.00	50 00	30 00	90 00	50 00
Extended totals	$877,959	$894,554	$904,437	$914.732	$915,172	$924,853	$926,895	$931,690	$947,358	$947,410	$959 803	$971,175

Eau Claire, Wis.—(Official)—Bids will be received until noon, Sept. 1, by J. C. Fennessey, City Clk., for the construction of a city hall. George Awsumb, Arch., 14 East Jackson Blvd., Chicago, Ill. has prepared plans. Noted July 15 and 29.

Milwaukee, Wis.—The Board of School Directors has commissioned Van Ryn & De Gelleke, Arch., 726 Caswell Blk., to prepare plans for the construction of a three-story brick and stone addition to the West Division High School, 23rd and Prairie St. Estimated cost, $50,000. Frank M. Harbach is Secy, of the Bd.

+Milwaukee, Wis.—The contract for the construction of a ten-story, 80x135-ft. reinforced-concrete and terra cotta, mercantile and office building on West Water St. near Grand Ave. for the Ticonic Investment Co., 927 Wells Bldg., has been awarded to the DAHLMAN CONSTRUCTION CO., 912 Majestic Bldg., Milwaukee. Estimated cost, $125,000. Noted Apr. 29.

Milwaukee, Wis.—N. Stone plans to construct a four-story, 75x120-ft. hotel and store building at Third and Sycamore St. The estimated cost is $100,000.

Milwaukee, Wis.—A group of Chicago promoters plan to construct an apartment house on Wisconsin St. opposite the Northwestern station. The estimated cost is $400,000.

Milwaukee, Wis.—Work on the construction of a block to replace the Plankinton House will begin about Sept. 15. Charles Somers, Cleveland, Ohio, is interested. The estimated cost of the entire project is $2,000,000. Noted Oct. 15.

Montello, Wis.—Bids will be received until Aug. 16, by the County Clerk for the construction of a two-story courthouse and jail. Parkinson & Dockendorf, Linken Bldg., La Crosse, is Arch. Noted July 22.

Sparta, Wis.—The School Board has passed a resolution providing for a $75,000 bond issue. The proceeds will be used for the construction of a high school.

+Stevens Point, Wis.—(Official)—The contract for the construction of a dormitory at the Stevens Point Normal School has been awarded to the J. F. WEINBERG CONSTRUCTION CO., Grand Rapids, at $58,486. Noted Aug. 12.

Grundy Center, Iowa—At a recent election the citizens voted in favor of issuing $85,000 in bonds. The proceeds will be used for the construction of a school.

Jefferson, Iowa—Plans are being prepared by Proudfoot, Bird & Rawson, Arch., 810 Hubbell Bldg., Des Moines, for the construction of an 80x120-ft. courthouse for Greene County. The estimated cost is $150,000.

+Sioux City, Iowa—The contract for the construction of a two-story, 85x114-ft. brick church at 19th and Nebraska St. for the First M. E. Church has been awarded to DUBEL & ANDERSON, 514 Jackson St., Sioux City, at $65,000. Other bids were: Cromer & Small, $70,000; Andrew Ostling, $76,873; Babue & Son, $79,385; Bankers Realty & Investment Co., Omaha, Neb., $67,390; Anton Zwack, Dubuque, $75,459; Egley, Payette Construction Co., $71,451. Beuttler & Arnold, Davidson Auto Block, is Arch. Noted June 17.

Tipton, Iowa—Bids will be received until Sept. 2, by T. C. Moffet, County Audr., for the construction of a county house to cost about $50,000. Charles A. Dieman & Co., Granby Bldg., Cedar Rapids, is Arch. Noted July 29.

Crosby, Minn.—(Official)—Bids will be received until 2 p.m., Aug. 27, by J. E. McCoy, Clk., Bd. of Education, Ironton, for the construction of a two-story brick high school. The estimated cost is $100,000. Noted Aug. 5.

Duluth, Minn.—Plans are being prepared by F. G. German, Arch., 411 American Exchange Bank Bldg., for the construction of a building for the Y. M. C. A. The estimated cost is $60,000.

Minneapolis, Minn.—The First Baptist Church plans to construct a temple on 11th St. near Hennepin St. The building will contain a four-story auditorium with two 12-story wings and cost about $1,000,000. William B. Riley is Pastor.

Minneapolis, Minn.—Bids will be received until Sept. 1, by A. L. Van Dyck, Arch., 741 McKnight Bldg., for the construction of a three-story, 42x120-ft. building for the Maternity Hospital at 2201 Western Ave. The estimated cost is $50,000. Noted July 29 and Aug. 12.

Atchison, Kan.—The Kansas Avenue Methodist Church plans to construct an edifice. Estimated cost, $40,000.

Emporia, Kan.—Plans have been prepared by C. H. Chandler, Arch., State House, Topeka, for the construction of a four-story, brick and reinforced-concrete addition to the State Normal School. The estimated cost is $175,000.

+Hays, Kan.—The contract for the construction of a two-story, 50x100-ft. brick hospital for the St. Agnes Sisters has been awarded to the JACOBS CONSTRUCTION CO., Hays. The estimated cost is $70,000. Noted June 24.

Hays, Kan.—The State Board of Administration has approved and accepted the plans prepared by C. H. Chandler, State Arch., for the construction of a three-story, fireproof building at the Fort Hays Kansas Normal School. The structure will be known as the Sheridan Coliseum and will cost about $100,000.

+Independence, Kan.—The contract for the construction of a five-story, 92x183-ft. brick and stone office building for the Prairie Oil and Gas Co. has been awarded to the THOMPSON-STARRETT CO., 49 Wall St., New York, N. Y. The estimated cost is $300,000. Madorie & Birdsall, 832 National Reserve Bank Bldg., Kansas City, Mo. is Arch. Noted Apr. 8.

Kansas City, Mo.—Preliminary plans have been prepared by Wilder & Wight, Arch., 400 First National Bank Bldg., for the construction of a reinforced-concrete hospital for crippled and blind children to be known as the Non-Sectarian Mercy Hospital at Independence and Highland Ave. The estimated cost is $200,000.

Kansas City, Mo.—Plans are being prepared by Shepard, Farrar & Wiser, Arch., 1202 R. A. Long Bldg., for the construction of a two-story, 105x106-ft. brick church at 12th St. and Bales Ave. for the Bales Baptist Church. The estimated cost is $50,000. E. D. Hogan, 4916 Agnes St., is Chn. of Bldg. Com.

+Kansas City, Mo.—The contract for the construction of a building at Linwood Blvd. and Prospect Ave. for the St. Joseph's Hospital has been awarded to the GEORGE A. FULLER CONSTRUCTION CO., 2218 Grand Ave., Kansas City. The estimated cost is $500,000. Wilder & Wight, 400 First National Bank Bldg., is Arch. Noted July 1.

+Minneapolis, Kan.—The School Board has awarded the contract for the construction of a two-story, 60x100-ft. brick school to the KEARN-BOWER CO., Topeka. Estimated cost, $40,000. Noted June 17 and 24.

Fairbury, Neb.—Plans are being prepared for the construction of a fire-proof motion picture theater to cost about $65,000. T. W. Van Leich and W. S. Weertser, Chicago, Ill. and C. W. Bartlett, Fairbury, are interested.

+Omaha, Neb.—The contract for the construction of a church at 16th and Center St. has been awarded to O. F. NELSON, 600 Barker Blk., Omaha, at $40,000.

+Omaha, Neb.—The contract for the construction of a hospital at 25th and Douglas St. has been awarded to the HOME BUILDERS CO., Omaha. James T. Allen, Brandeis Theater Bldg., is Arch. and Dr. Michael J. Ford is in charge. The estimated cost is $150,000. Noted July 22.

Cheyenne, Wyo.—Bids will be received until Sept. 6, by H. B. Gates, State Treas. for the construction of additions and alterations to the State Capitol. The estimated cost is $150,000. William Du Bois, 1614 Capitol Ave., is Arch. Noted Mar. 11.

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FREMONT AVE. BRIDGE, SEATTLE, WASH.

Bids were received July 23 by A. H. Dimock, City Engr., Seattle, Wash., for the construction of the superstructure of a bridge over Lake Washington Canal at Fremont Ave. from: (A) Booker, Kiehl & Whipple; (B) J. R. Wood; (C) Beer's Building Co. Bids for the substructure of the same bridge were received from: (A) Pacific States Construction Co.; (B) Hans Pederson; (C) Beer's Building Co. The item bids were as follows:

Superstructure	A	B	C
260,000 lb. machinery, furnishing and erecting	$0.112	$0.115	$0.1245
2,050,000 lb. structural steel, furnishing and erecting	.041	.042¾	.0423
Furnishing 305,000 lb. structural steel, erected by contractor for substructure	.0333	035	.0325
700 cu.yd. furnishing, placing and adjusting gravel concrete counterweight	5.65	7.00	5.00
10 cu.yd. furnishing, placing and adjusting cinder concrete counterweight	5.65	10 00	7.00
1 gravel concrete test block. furnishing and weighing	11.00	25 00	10.00
1 cinder concrete test block, furnishing and weighing	11.00	25 00	10 00
1010 sq.yd. roadway floor on movable leaves	5.25	5.35	2.85
400 sq.yd. roadway floor, including reinforcement, on fixed portion	3.30	3.40	2.40
490 sq.yd. sidewalk floor on movable leaves	1.00	75	.50
172 sq.yd. sidewalk floor on fixed portion	1.20	1.00	1 25
20,000 lb. reinforcing bars in concrete counterweight	.03	04	0275
Electrical equipment complete in place (lump sum)	13,819	11,950	13,288
4 operators' houses and 2 toilet rooms complete (lump sum)	6890.00	8000 00	600 00
Meneely fog bell in place (lump sum)	90.00	125 00	100 00
2 copper ball vessel signals in place	70.00	175 00	15 00
4 double-arm roadway gates complete in place	302.50	300.00	300.00
Wooden steps and railings and angle iron bracket supports for access to machinery at sides of trusses	125.00	25 00	200 00
2 pairs steel ladders for access to counterweight pit pumps	50.00	35 00	60 00
2 pit pumps complete	429 00	175 00	425 00
2 iron gratings over counterweight pit pumps	25.00	15.00	20.00
60 lin.ft. black iron pipe railings on stairways and platforms below deck	1.65	.75	.50
2 machinery houses complete	450.00	450.00	300.00
130 lin.ft. galvanized iron pipe railings at sides and rear of anchor piers	2.00	1.25	.50
14 oak buffer blocks	5.00	5.00	3.00
Extended totals	$159,890	$163,618	$154,601

Substructure	A	B	C
Removing existing structures and debris (lumpsum)	$2000 00	$3500.00	$1000 00
15,000 cu.yd. excavation	2.00	2.80	2.50
3500 cu.yd., Class A, concrete deposited under water	7.00	6.60	7.50
3200 cu.yd.. Class C, concrete in piers above water	6.65	7.00	7.50
6700 cu.yd., Class C, concrete in unwatered foundations and piers (alternate to two preceding items)	6.75	7 00	8.15
1100 cu.yd., Class B, concrete	10.00	12.00	6 00
300 cu.yd., Class D, mortar	20 00	15.00	10.00
155,000 lb. reinforcing steel	.03	.028	.0275
Placing and painting structural steel, grillages and anchor bolts, including grouting, 305,000 lb	0075	.004	.0437
2 fir bumping logs	23 00	25 00	10.00
7000 lin.ft. peeled piles in protection works	.20	20	15
9 M ft. b.m. timber in protection works	25 00	25 00	14 00
570 lin.ft. chains on dolphins	30	30	.30
4 test piles	1 00	5 00	10.00
1200 cu.yd. extra excavation below elevation—35	1 50	2 00	2.00
1200 cu.yd. extra, Class A, concrete below elevation—32	6 00	4 00	6.00
1200 cu.yd. extra, Class C, concrete in case foundations are unwatered (alternate to preceding item)	5.85	5 00	6.00
8 eye bolts is shafts of anchor piers	2 50	2 00	15.00
Extended totals	$112,651	$123,422	$127,068
Alternates	$111,916	$126,024	$131,423

BUILDINGS—Continued from Page 138

Billings, Mont.—Bids will soon be received for the construction of an edifice for the First Presbyterian Church. The estimated cost is $40,000.

+Great Falls, Mont.—The contract for the construction of a three-story, concrete office building to be known as the Tribune Bldg. has been awarded to the NESS-THEISON CONSTRUCTION CO., Great Falls, at $76,200. Noted May 20.

Ozark, Mo.—An election will be held Oct. 30 to vote on the question of issuing $50,000 in bonds. The proceeds will be used for the construction of a courthouse for Christian County. Noted July 15.

St. Joseph, Mo.—The School Board is having plans prepared for the construction of the Bliss Ward School to cost about $65,000 and for the North St. Joseph High School, estimated to cost $150,000.

St. Louis, Mo.—Plans are being prepared by John M. Dunham Co., Arch., 1018 Chemical Bldg., for the construction of a five-story, reinforced-concrete, fireproof building at 410 Washington Ave. for Joseph J. Foster. The estimated cost is $73,000.

+St. Louis, Mo.—The contract for the construction of a two-story mercantile building at 1100-4 North Sixth St., for the Biddle Estate, has been awarded to N. SCHWEGLER, at $40,000.

St. Louis, Mo.—The Mercantile Trust Co. plans to construct an addition to its building at Eighth and Locust St. The cost is estimated at $500,000.

Coldspring, Tex.—Lane & Dowdy, Arch., 710 Paul Bldg., Houston, is preparing plans for the construction of a courthouse for San Jacinto County. The estimated cost is $40,000. Noted May 20.

College Station, Tex.—(Official)—Bids will be received about Oct. 1 for the construction of a group of buildings at the Agricultural and Mechanical College. The group will include a $50,000 hospital, $40,000 stock judging pavilion, a dairy, laundry and barn. R. Adelspeyer is Arch. and J. K. Ashburn is Publicity Agent. Noted July 22 and 29.

Dallas, Tex.—Plans are being prepared by William B. Ithner, Arch., 408 Board of Education Bldg., St. Louis, Mo., for the construction of a school. The estimated cost is $120,000.

Nacogdoches, Tex.—An election will soon be held to vote on the question of issuing $45,000 in bonds. The proceeds will be used for the construction of a school.

San Angelo, Tex.—(Official)—Bids will be received until Aug. 25, for the construction of a three-story brick high school. Ross & Cason, 1509 Amicable Bldg., Waco, is Arch. Noted May 27.

Tahoka, Tex.—At a recent election the citizens voted in favor of issuing $60,000 in bonds, the proceeds of which will be used for the construction of a courthouse and jail for Lynn County. Noted July 29.

+Oklahoma, Okla.—The general contract for the construction of the Oklahoma State Capitol has been awarded to JAMES STEWART & CO., INC., 30 Church St., New York, N. Y. The estimated cost of the project is $1,500,000. John H. Frederickson is the Western Mgr. of the company. Noted June 24.

Clarkdale, Ariz.—At a recent election the citizens voted in favor of issuing $45,000 in bonds. The proceeds will be used for the construction of a high school.

Kingman, Ariz.—At a recent election the citizens voted in favor of issuing $60,000 in bonds. The proceeds will be used for the construction of a school.

Medical Lake, Wash.—The State Board of Control has approved and accepted the plans prepared by Julius A. Zittel, Arch., 507 Jamieson Bldg., Spokane, for the construction of five buildings at the Medical Lake School for Feeble-Minded. The entire cost is estimated at $500,000. Noted Aug. 5.

Seattle, Wash.—S. Benson has donated $100,000 to be used for the construction of the first unit of a School of Trades for Boys and Girls. The School Board will appropriate $100,000 toward this work.

Seattle, Wash.—Bids have been received for the construction of an apartment and hotel building at Fourth and Marion St. as follows: Woeck & Behrens, Arcade Bldg., $84,187; Grant Smith & Co., Henry Bldg., $82,950; Pacific States Construction Co., Burke Bldg., $80,000; Sound Construction & Engineering Co., Lowman Bldg., $79,879; Booker, Kiehl & Whipple, Central Bldg., $79,500; Kieburtz & Smith, Railway Exchange Bldg., $77,300; Ferro Concrete Co., Empire Bldg., $76,392; Brandt Construction Co., 2327 5th N. St., $75,867; Butler Construction Co., Central Bldg., $75,100; Erickson & Larson, 5011 Meridian St., $75,025; Washington Construction Co., Northern Bldg., $74,302; Jenkins & Jones, Transportation Bldg., $74,000; J. H. Tolman, Haight Bldg., $73,572; Nettleton-Bruce-Eschbach Co., American Bank Bldg., $73,500; Franklin Engine Co., Alaska Bldg., $73,200; Pearson Construction Co., New York Blk., $71,887; F. Forrestal, 312 20th Ave. S., $71,700; A. U. Quist & Co., Hoge Bldg., $71,525; Martin & Dugan, Northern Bank Bldg., $71,300; Syliessan & Sando, Downs Bldg., $71,000; Finne & Gjarde, Northern Bank Bldg., $66,559; McRae Bros., American Bank Bldg., $67,182. W. R. Willcox, Boston Blk., is Arch.

Vancouver, Wash.—The State Board of Control has approved and accepted the plans prepared for the construction of an administration building at the School for the Blind. Estimated cost, $75,000. Noted June 10 and July 22.

Portland, Ore.—Bids will soon be received for the construction of a business and office building at Grand Ave. and East Alder St. for the East Side Holding Co. and the Citizens Bank. The estimated cost is $50,000.

Sacramento, Calif.—The Legislature has appropriated $2,000,000 to be used for repairing, enlarging and developing state buildings in California. The appropriation includes $195,000 for additional buildings at the Norwalk State Hospital for the Insane, Norwalk; $50,000 for cottages at the Southern California State Hospital; $50,000 for exposition buildings in Los Angeles Agricultural Park; $60,000 for cottages at Whittier State School; $52,000 for two cottages at the Ventura School for Girls.

+Sacramento, Calif.—The contract for the construction o a seven-story bank building for the Capitol National Bank has been awarded to the McGILLIVRAY CONSTRUCTION CO. Estimated cost, $200,000.

San Francisco, Calif.—M. M. O'Shaughnessy, City Engr. is preparing plans for the construction of the Forest Hill Station on the line of the Twin Peaks Tunnel. The estimated cost is $250,000.

+The Narrows, Man.—The contract for the construction of a school has been awarded to PIGOTT & HEALEY, Battleford, Sask. Estimated cost, $43,000. Noted July 1.

+Rothesay, N. H.—The Consolidated School Board has awarded the general contract for the construction of a school to W. H. HENDERSON, Rothesay. The estimated cost is $70,000.

SEWER EXTENSION—BOSTON, MASS.

Section 106

+Bids were received July 28 by the Metropolitan Water and Sewerage Board for the construction of sewers in Section No. 106 of the high level sewer, South Metropolitan System, in Needham and Wellesley from (A) Bruno & Petitti, (B) M. Russo & Son, (C) Michael Meehan, (D) Henry Spinach Contracting Co., (E) George M. Bryne, (F) Coleman Bros., (G) HUGH NAWN CONTRACTING CO., Roxbury, (awarded contract). The item bids were as follows:

	A	B	C	D	E	F	G
4330 lin.ft. earth excavation and refilling in trench and embankment 24 in. x 27 in. concrete sewer	$10.00	$7.84	$6.00	$6.00	$6.00	$4.70	$2.75
25 lin.ft. earth or rock excavation in tunnel, 24 in. x 27 in. concrete sewer	25.00	14.00	25.00	25.00	25.00	20.00	6.00
60 cu.yd. portland brick masonry in manholes	16.00	17.00	20.00	20.00	16.00	17.00	18.00
1950 cu.yd. portland concrete masonry in trench	8.50	9.00	8.50	8.00	8.00	8.00	7.50
15 cu.yd. portland concrete masonry in tunnel	15.00	12.00	15.00	15.00	10.00	12.00	10.00
Extended totals	$61,685	$53,047	$44,605	$43,630	$43,315	$37,651	$27,912

RAPID TRANSIT SYSTEM—NEW YORK, N. Y.

Section No. 2, Route No. 29

Bids were received July 28 by the Public Service Commission for the construction of Section No. 2, Route No. 29, a part of the Nostrand Ave. Subway from (A) Dock Contractor Co., (B) D. Donegan Co., (C) T. A. Gillespie Co., (D) Newman & Carey, (E) Rodgers & Hagerty, Inc., (F) Underpinning & Foundation Co., (G) Oscar Daniels Co., (H) Mason & Hanger Co., Inc., (I) E. E. Smith Contracting Co., (J) John J. Creem. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
262,800 cu.yd. earth excavation above main high water (ex. S. & D.)	$1.73	$1.80	$2 20	$1.90	$2.40	$2.00	$2.50	$2.30	$2.65	$4.00
19,000 cu.yd. earth excavation below main high water (Ex. S. & D.)	1.73	2.25	2 20	3.50	2.40	7.00	3.00	2.30	3.50	4.00
46,200 cu.yd. earth excavation above and below main high water S. P. & D.	1.73	2.00	2.20	1.90	2.40	2.00	2.50	2.30	2.65	4.00
80 lf.ft. underpinning buildings under seven stories	85.00	20.00	50.00	60 00	50.00	100.00	50.00	40.00	40.00	42 00
1000 lf.ft. maintaining, protecting and securing buildings	69.00	20.00	10.00	20 00	1.00	50.00	20.00	25.00	1.00	26 00
53,000 cu.yd. concrete masonry in place	6.25	7.00	7.00	7.50	7.50	6.50	8.00	8 00	8.00	8.00
8100 cu.yd. concrete masonry outside of waterproofing	6.25	7 00	7.00	6.50	7.50	6.50	8 00	8.00	7.00	8 00
50 cu.yd. rubble stone masonry	6.00	6.00	8.00	10 00	3.00	6.50	12 00	6.50	7.00	8.00
50 cu.yd. dry rubble masonry	5.50	6.00	3.50	10.00	2.00	6.00	7.00	5.00	6 00	6.00
60 cu.yd. brick masonry	14.00	18.00	14.00	20 00	15.00	25.00	12.00	15.00	15 00	15 00
2 cu.yd. vitrified brick masonry	20.00	25.00	25.00	50 00	30.00	25.00	20.00	17.00	20.00	30 00
60 cu.yd. hollow terra cotta brick or tile masonry	12 00	15.00	15.00	15.00	15.00	25.00	15.00	15.00	15.00	15.00
1000 bbl. grout of Portland cement	1.00	2.00	2.70	2 65	.90	2.00	1.00	2.50	2.50	2.50
1000 lin.ft. timber piles, in place and prepared	.20	.60	40	60	.15	70	.30	.50	50	30
2 M ft. b.m. timber foundations placed and fastened	45.00	40.00	45.00	60 00	20.00	50.00	50.00	65.00	50.00	50.00
50 cu.yd. broken stone or gravel in place	1.00	3.00	2 20	3 00	2.00	3.00	2.00	2 50	2 50	2 00
36,100 sq.yd. waterproofing, one-ply	.33	.45	.50	.40	.35	.45	.35	45	.50	45

	A	B	C	D	E	F	G	H	I	J
100 sq.yd. waterproofing, two-ply	.57	.85	.50	85	.60	.90	.70	.60	.75	.30
28,600 sq.yd. waterproofing, three-ply	.80	1.00	.90	1.20	.80	1.35	.90	.95	1.00	1.05
100 sq.yd. waterproofing, four-ply	1.04	1.40	.98	1.60	1.15	1.75	1.40	1.20	1.25	1.20
100 sq.yd. waterproofing, five-ply	2.28	1.80	1.20	1.90	1.40	2.25	1.70	1.50	1.50	1.50
100 sq.yd. waterproofing, six-ply	2.52	2.10	1.50	2.30	2.00	2.65	2.00	1.80	1.75	2.50
100 sq.yd. waterproofing, dry-ply	.19	.40	.30	.25	.35	.40	.35	.30	50	.30
5400 cu.yd. brick in asphalt mastic	19.00	23.00	20.00	30.00	20.00	25.00	20.00	25.00	17.00	25.00
50 lin.ft. drain pipe, 12-in. vitrified	.70	.80	.80	.60	.75	1.20	1.00	.90	1.00	.70
50 lin.ft. drain pipe, 10-in. vitrified	.65	.60	.60	.50	.65	1.00	.80	.80	.88	.60
50 lin.ft. drain pipe, 8-in. vitrified	.60	.50	.40	.45	.50	.80	.70	.50	.75	.50
50 lin.ft. drain pipe, 6-in. vitrified	.55	.40	.30	.40	.45	.60	.60	.40	.65	.40
50 lin.ft. drain pipe, 4-in. vitrified	.50	.40	.20	.30	.40	.40	.60	.25	.55	.30
50 lin.ft. drain pipe, 6-in. c.i.	.85	.75	.80	1.00	1.00	2.50	1.00	1.20	2.00	1.00
50 lin.ft. drain pipe, 4-in. c.i.	.55	.50	.60	.90	.50	1.60	.60	.75	1.50	.60
50 lin.ft. drain pipe, 10-in. c.i.	1.25	1.50	1.60	2.20	2.50	3.00	1.70	2.00	4.00	1.50
100 lin.ft. 3-in. c.i. pipe and fittings "extra heavy"	.75	.50	.60	.75	1.00	1.50	.60	.90	1.00	.75
100 lin.ft. 4-in. c.i. pipe and fittings "extra heavy"	1 00	.75	.72	1.20	1.25	1 60	.70	1.00	1.50	1.00
200 lin.ft. 6-in. c.i. pipe and fittings "extra heavy"	1.10	1.00	1.10	1.60	1.50	2.50	1.10	1.40	2.00	1.25
200 lin.ft. 8-in. c.i. pipe and fittings "extra heavy"	1 60	1.20	1.40	2.00	2.50	3.00	1.35	2.00	3.00	2.00
254,800 duct ft. tunnel ducts in place as regulated by section 107	.10	.11	.11	.12	.11½	.15	.10	.10	.10	.11
1650 ton riveted steel, painted and erected	55 50	54.00	58.00	65.00	55.00	70.00	55.00	60.00	65.00	63.00
4050 ton steel beams and shapes	4 00	54.00	55.00	55 00	55.00	60.00	51.00	55.00	55.00	57.00
410 ton steel rods and bars built in concrete	38.00	50.00	40.00	47.00	50.00	80 00	55.00	50.00	45.00	50.00
35 ton miscellaneous iron castings	50 00	70.00	55 00	75.00	60.00	100 00	60 00	65.00	60.00	50.00
10 ton miscellaneous iron furnishings	60.00	70.00	60.00	75.00	100.00	100.00	60.00	70.00	60.00	50.00
300 lb. special wire forms, in place	.09	.30	.12	.30	.10	.40	.15	.10	.25	.10
9670 lin.ft. 1¾-in. seasoned oak or ash hand rail	.22	.30	.40	.30	.30	.35	.27	.40	.30	.50
9080 sq.ft. steel gratings for ventilation	1.22	1.50	1.30	1.60	1.50	1.10	1.50	1.50	1.50	1.50
525 sq.ft. vault lights, in place	.90	1.50	1.30	1.30	1.25	1.10	1.00	1.40	1.50	1.50
3920 sq.yd. sidewalks restored	.90	1.50	1 00	3.00	1.35	1.48	2.25	1.75	1.60	2.00
1700 sq.yd. repavement of roadways, asphalt pavement	1.50	2.50	1 70	2.50	2.50	2.42	2.50	2.70	2.00	2.50
23,800 sq.yd. repavement of roadways, granite block	.42	1.00	.25	1.00	.30	.88	1.40	2.00	.70	1.75
12,100 sq.yd. repavement of roadways, Belgian block	.42	1.00	.25	.40	.30	.88	1.40	2.00	.70	1.35
100 lin.ft. new bluestone curb, in place	1.00	1.00	1.00	1.50	1.00	2.00	.80	.90	1.50	1.00
100 lin.ft. new 8-in. granite curb, in place	1.00	2.00	2.00	2.50	1.50	2.50	1.10	1.20	2.50	2.00
12,000 lin.ft. ¾-in. w.i. electric conduits	.14	.20	.16	.19	.15	.30	.12	.12	.30	.20
600 lin.ft. 1½-in. w.i. electric conduits	.26	.40	.31	.30	.25	.40	.27	.25	.40	.30
350 lin.ft. 2-in. w.i. electric conduits	.33	.50	.38	.45	.30	.50	.35	.30	.55	.40
3500 lin.ft. 1-in. w.i. electric conduits	.19	.30	.23	25	.20	.30	.16	.18	.35	.25
1000 c.i. outlet boxes, in stations	.25	1.00	.70	1.00	1.00	1.50	1.00	1.00	.80	1.00
6 c.i. pull boxes in stations	1.50	2.00	.70	1.25	1.50	1.50	1.50	2.00	5.00	5.00
260 lin.ft. 6-in. "extra heavy" c.i. pipe and fittings station	1.00	2.00	.90	1.60	1.50	2.50	1.10	1.50	2.00	1.50
200 lin.ft. 3-in. "extra heavy" c.i. pipe and fittings in station	.75	1.00	.40	.75	1.00	1.50	.60	.90	1 00	.75
1850 lin.ft. sewer pipe, 12-in. vitrified	2.26	1.25	1.50	2.40	2.40	3.60	2.20	3.00	2.75	3.50
3570 lin.ft. sewer pipe 15-in. vitrified	2.56	1.50	2.00	2.75	2.75	2.80	2.60	3.50	3.25	3.80
1150 lin.ft. sewer pipe, 18-in. vitrified	3.00	2.00	2.00	3.20	3.25	5.00	3.20	4.00	3.75	4.20
2110 lin.ft. sewer pipe, 20-in. vitrified	3.30	2.25	2 50	3.50	4.00	5.00	3.50	4.20	4.25	4.53
775 lin.ft. sewer pipe, 22-in. vitrified	3.70	2.50	3 00	3.75	4.50	5.00	3.75	4.60	4.75	4.84
440 lin.ft. sewer pipe, 24-in. vitrified	4.05	3.00	3.80	4.15	5.00	6.00	4.50	4.80	5.25	5.17
66 ton c.i. sewer pipe (straight)	38.00	50.00	45 00	50 00	40.00	50.00	38.00	45.00	35.00	50.00
11 ton c.i. sewer pipe (special)	55.00	75.00	65.00	100.00	75.00	100.00	70.00	75.00	75.00	80.00
50 lin.ft. egg-shaped brick or concrete sewer 3 ft., 6 in., x 2 ft. 4 in	5.40	5.00	5.50	5.00	6.00	8.00	4.50	6.20	7.25	5.50
410 lin.ft. circular brick or concrete sewer, 4 ft., 0 in. diameter	5.70	10.00	6 50	6.00	6.00	9.00	5.50	7.00	8.25	6.50
610 lin.ft. circular brick or concrete sewer, 4 ft., 6 in. diameter	7.50	14 00	6 50	7.50	7.50	10.00	7.00	7.40	9.25	7.60
2625 lin.ft. circular brick or concrete sewer, 4 ft., 9 in. diameter	8.50	15.00	7 25	8.25	8.50	11 00	7.50	7.70	10.00	8.60
1010 lin.ft. circular brick or concrete sewer, 5 ft., 3 in. diameter	9.30	18.00	8 00	9.00	9.25	15.00	8.00	8.30	11.00	11.30
970 lin.ft. circular brick or concrete sewer, 6 ft., 3 in. diameter	11.00	20 00	9 50	11 00	11 00	16.00	9.00	9.50	12 50	13.70
2 14-in. special sluice gates with spigots	75.00	75.00	90 00	75.00	50.00	200.00	75.00	120.00	60.00	75.00
2 8-in. special sluice gates with spigots	60.00	50 00	35 00	50 00	25.00	100.00	30.00	80.00	50.00	40.00
2 20-in. special sluice gates with spigots	100.00	100 00	175 00	125.00	75.00	300.00	150.00	170.00	100.00	100.00
13,500 lin.ft. for support, etc., of electric (overhead trolley) R.R., 1 track	2.28	2.00	1.00	2.25	6.00	.50	3.00	5.00	3.00	10 00
150 lin.ft. water pipe, 4-in	.50	.30	.75	.35	.30	.60	.60	.65	.75	.75
1650 lin.ft. water pipe, 6 in	.60	.50	1.10	.35	.40	.90	.80	.75	.90	1.00
600 lin.ft. water pipe, 8-in	.75	.60	1 50	.50	.50	1.20	1.00	1.00	1.15	1.25
450 lin.ft. water pipe, 16 in	1.00	1.20	2 00	.85	.90	2.40	1.25	1.80	2.00	2.50
6200 lin.ft. water pipe, 20-in	1.00	1.50	3.00	1.20	.25	3.00	1.50	2.25	2.40	2.75
100 service connections for water pipes, all sizes	20.00	15.00	20.00	12.00	5.00	20.00	15.00	12.00	5.00	15.00
200 lin.ft. gas pipe, 3 in	.40	.30	.50	.35	.30	.50	.60	.65	.75	.50
50 lin.ft. gas pipe, 4 in	.60	.30	.75	.35	.40	.60	.70	.75	.90	.75
800 lin.ft. gas pipe, 6 in	.75	.60	1.00	.35	.50	.90	.80	1.00	1.15	1.00
1150 lin.ft. gas pipe, 8 in	.80	.80	1 25	.50	.60	1.20	1.00	1.20	1.40	1.25
900 lin.ft. gas pipe, 10 in	1.00	1.00	1 50	.60	.70	1.50	1.20	1.50	1 65	1.50
50 lin.ft. gas pipe, 12 in	1.25	1.25	1 75	.75	.75	1.80	1.50	1.75	2.00	1.75
8380 lin.ft. 6 in. w.i. by-passing pipe, upon or below street	1.20	1.25	2 00	1 20	1 25	3.00	3.00	2.00	3.50	3.00
4800 lin.ft. 8-in. w.i. by-passing pipe, upon or below street	1.45	2.00	2 75	1.50	2.00	3.00	3.25	2.30	5.00	3.25
350 lin.ft. 4-in. w.i. by-passing pipe, upon or below street	1 05	1.00	1 00	1 40	1 00	2 50	2 75	1.50	2 50	2.50
120 lin.ft. 12-in. w.i. by-passing pipe, on trestle	5.00	3 00	4 00	3 50	3.50	3 50	3.00	4.00	7 00	4.50
120 lin.ft. 6-in. w.i. by-passing pipe, on trestle	2.75	2.00	2 75	1.70	2 00	3 00	2.50	2.00	6 00	3.00
270 lin.ft. 18-in. w.i. by-passing pipe, on trestle	6 00	5 00	6 00	5 50	5.00	5.50	4 00	5.00	10.00	7.00
200 lin.ft. catenary for over 16-in. by-passing pipe	5.50	2.00	3 00	2.25	2.50	3.00	5.00	2.50	7 00	4.50
180 lin.ft. catenary for 16 in. and under by-passing pipe	5.50	2.00	3 00	2 25	2.50	3 00	5.00	2.00	5 00	2.25
250 lin.ft. service connections for gas pipes	10 00	10 00	20 00	6 25	5 00	20 00	12.00	12 00	10 00	10.00
75 tons new c.i. hub and spigot straight pipe	45 00	40.00	35 00	35 00	30 00	50 00	30.00	35.00	33 00	35.00
20 ton new c.i. hub and spigot special pipe	70.00	70.00	70.00	80 00	65.00	100 00	60.00	70 00	75 00	65.00
2300 duct ft. electric ducts and conduits, in place	.60	.50	.65	.40	.50	.75	.30	.50	.50	.54
100 lin.ft. 2½ in. w.i. pipe, electric conduits	.80	1.00	.65	.35	.75	1.00	.40	.40	.50	.65
100 lin.ft. 3 in. w.i. pipe, electric conduits	.90	1.00	.65	.40	.75	1 00	.40	.45	.60	.70
100 lin.ft. 3½-in. w.i. pipe, electric conduits	1 00	1.00	.65	.50	.75	1 00	.40	.50	.70	.75
100 lin.ft. 4-in. w.i. pipe, electric conduits	1.10	1 00	.65	.75	.75	1.00	.40	.55	.80	.80
100 lin.ft. 4½-in. w.i. pipe, electric conduits	1.20	1.00	.65	1.00	.75	1.00	.40	.60	.90	.85
100 lin.ft. 2-in. Edison conduit	.60	1.00	.65	.35	.75	1.00	.40	.45	1.00	1.25
100 lin.ft. 2½-in. Edison conduit	.80	1.00	.65	.35	.75	1.00	.40	.50	1.25	1.50
100 lin.ft. 3-in. Edison conduit	1.00	1.00	.65	.40	.75	1.00	.40	.60	1.50	1.75
20 service connections for electric ducts	15.00	20 00	10.00	10.00	25.00	25.00	15.00	15.00	25.00	15.00
300 duct ft. wooden electric ducts and conduits	.60	.70	.65	.25	.75	1.00	30	.50	.50	.60
Extended totals	$1,692,370	$1,849,286	$1,879,998	$1,953,097	$2,010,207	$2,110,057	$2,112,924	$2,150,242	$2,184,360	$2,811,475

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS—STEAM AND ELECTRIC

Massachusetts—Bay State St. Ry.—This company has asked the Council for a franchise to double track its line on Sutton St., North Andover. R. S. Goff, Boston, is Vice-Pres. and Gen. Mgr.

New Jersey—Salem-Pennsgrove Ry.—This company has been incorporated to construct an electric railway to connect Salem and Pennsgrove, N. J. Arthur B. Smith, Isaac C. Smashey, H. G. Hart and James S. Wheeler are among the incorporators. Noted Aug. 5.

Pennsylvania—Dover, Millersburg & Western Ry.—This company plans to start work soon on the construction of its proposed railway to Millersburg, Penn. G. T. Prior, Sheffield, Penn., is interested.

Pennsylvania—A movement is being agitated for the construction of an electric railway from Washington to connect with the mining communities of Ellsworth, Cokeburg, Bentleyville and adjoining districts, about 11 miles. The proposed line would join the Pittsburgh Rys. line in Washington and the terminus of the Bentleyville-Charleroi St. Ry at Cokeburg.

✚**Pennsylvania**—Pennsylvania R.R.—This company has awarded the contract for the construction of a single-track extension of the Yellow Creek branch on the Conemaugh line, about four miles, to A. L. ANDERSON & BRO., Altoona.

North Carolina—Southern Ry.—This company has reached an agreement with the Aluminum Co. of America concerning the construction of the proposed railway from Bushnell, N. C. to Chilhowee, Tenn., about 25 miles. B. Herman, Washington, D. C., is Ch. Engr.

South Carolina—Seaboard Air Line Ry.—This company has sold $22,893,000 in bonds. Part of the proceeds will be used to extend the line from Charleston, S. C., to Savannah, Ga., a distance of 85 miles. W. D. Faucette, Norfolk, Va., is Ch. Engr.

South Carolina—Southern Ry.—This company will soon receive bids for double tracking its line from Greenville to Greer, S. C., about 26 miles. B. Herman, Washington, D. C., is Ch. Engr.

Alabama—Atlanta & St. Andrews Bay Ry.—According to press reports this company plans to construct a railway north from Dothan via Eufaula, Ala., to Columbus, Ga., about 85 miles. B. W. Steele, Dothan, Ala., is Gen. Mgr.

Tennessee—At a recent election the citizens of De Kalb County voted in favor of the question of issuing $150,000 in bonds. The proceeds will be used for the construction of an electric railway from Nashville to Smithville. Noted Aug. 5.

Kentucky—Louisville & Nashville R.R.—This company plans to extend its line from Harlan, Ky., into Virginia, to connect with its Middlesboro & Norton branch. W. H. Courtney, Louisville, is Ch. Engr.

Ohio—Cincinnati Traction Co.—A bond issue of $3000 has been authorized by the Council of Cincinnati to improve and extend Reading Road to allow the construction of this company's extension to Bond Hill. C. Burckmyer is Pur. Agt. Noted June 17.

Ohio—According to press reports a railway to be known as the Cleveland & Ohio Central Electric Ry. will be constructed from Cleveland to Wooster, Ohio. C. E. Sherman, Dept. of Engr., Ohio State University, is interested.

Indiana—Ft. Wayne, Decatur & Southern R.R.—This company has been incorporated to construct an interurban railway out of Decatur. M. Gerke, C. Oetting and C. Dirkson are the incorporators.

Illinois—Rapid Transit Co. of Illinois—This company has been incorporated to construct a system of interurban lines out of East St. Louis southeast via Chester, Murphysboro and Carbondale and northeast through the coal fields. J. Vannahme, D. P. Roberts, C. B. Vonnahme and M. Harned, East St. Louis, and L. T. Holltman, Collensville, are the incorporators.

Michigan—Pere Marquette Ry. Co.—This company plans to construct a belt line for the western and northwestern section of Detroit, about three miles long.

Minnesota—Twin City Rapid Transit Co.—This company plans to construct a double track line from the Snelling-Minnehaha line to the new motor speedway, about 1¼ miles. J. J. Canfield, Minneapolis, is Gen. Supt.

Kansas—According to press reports a company is being organized to construct an interurban railway from Salina, Kan., to Fairbury, Neb., via Concordia and Belleville, Kan., The proposed line will connect with the Arkansas Valley Interurban Ry. at Salina.

Montana—Helena & Southern Ry.—This company has been incorporated to construct a railway from Helena to Yellowstone Park. E. A. Tennis, Salina, Kan., is interested.

Missouri—United Rys.—This company has been granted a new 28-year franchise by the Council of Webster Groves and plans to improve its line on Lockwood Ave. from Summit Ave. to Rock Hill Rd., about 1 mile. Estimated cost, $80,000. Robert McCulloch, St. Louis, is Pres., Gen. Mgr. and Pur. Agt.

Arkansas—According to press reports an electric railway will be constructed from Nettleton to Jonesboro. Franz Weisbord, Indianapolis, Ind., is interested.

Oklahoma—Press reports state that a company is being organized at Blackwell, Okla., to construct a railway out of Blackwell to connect with the St. Louis & San Francisco Ry. at Peckham and with the Santa Fe System at Braman.

Oklahoma—Clinton, Oklahoma & Western Ry.—Surveys are being made by this company for a railway from Clinton to Chickasha. Guy V. McClure, Oklahoma City, is Ch. Engr. Noted July 23.

Oklahoma—Ft. Smith & Western R.R.—Surveys are being made by this company for the extension of its line from Warwick to Oklahoma City, Okla. B. F. Beckman, Ft. Smith, is Ch. Engr.

Oklahoma—Frisco Lines—This company has secured a right-of-way for the construction of a railway from Depew to Drumright, Okla., via the Cushing oil fields, a distance of 20 miles.

Washington—W. D. Peters, Bremerton, has petitioned the Council of Bremerton and Charleston for a franchise to construct an electric railway in both towns.

California—Castro Point & Terminal Ry.—This company will issue $89,000 in bonds. Part of the proceeds will be used for the construction of a railway from San Pablo Quarry to connect with the Richmond Belt Ry.

California—Pacific Electric Ry.—Surveys are being made by this company for a line between Los Angeles and Corona. J. McMillan, Los Angeles, is Gen. Mgr.

California—South San Francisco R.R. & Power Co.—This company has applied for a franchise to construct and operate a single-track or double-track standard gage railway in South San Francisco. W. J. Martin, South San Francisco, is Pres.

LIGHT, HEAT AND POWER

✚**Manchester, N. H.**—The Manchester Traction, Light & Power Co. has awarded the contract for the construction of a concrete dam and spillway on the Piscataquog River to the H. WALES LINE CO., Meriden, Conn. It will replace a wooden structure, and will be 25 ft. high with 35-ft. abutments and a spillway 192 ft. long.

Readsboro, Vt.—It is reported that the Deerfield River Power Co. will develop 4000 hp. at this point, and will install electrical machinery for the manufacture of paper.

Chicopee, Mass.—It is reported that the Fisk Rubber Co., Chicopee, will build a five-story, 110x600-ft. mill, to be equipped with electrically-driven machinery. The total cost will be about $300,000.

Sterling, Mass.—The City of Sterling contemplates the extension of its municipal electric-lighting and power service to Lake Washacum. The cost of the work is estimated at $11,000. H. W. Rugg is Supt., Mgr. and Cont. Agt. of the municipal system.

✚**Worcester, Mass.**—The Worcester Electric Light Co. has awarded the contract for the construction of a two-story brick, 81x104-ft. addition to its power house on Webster St., to H. R. KENT & CO., 141 Broadway ,New York, N. Y. The estimated cost is $50,000. Noted June 3.

★**Albany, N. Y.**—(Official)—Bids will be received until noon, Sept. 8, by the Trustee of Public Buildings, Executive Chamber, Capitol, for alterations and additions to the State House, plumbing and drainage for the Court of Appeals. Lewis F. Pilcher is State Arch.

Attica, N. Y.—It is reported that the Attica Water, Gas & Electric Co. will soon purchase one 75-kw., two-phase, 60-cycle, 1100-volt generator with exciter and ammeters, voltmeters and switches. R. W. Harris is Mgr.

✚**East Syracuse, N. Y.**—The Board of Education has awarded the contract for new heating and ventilating systems for the local schools to the LEAVERY HEATING & VENTILATING Co., Syracuse, at $12,285. Ten bids were received for the work.

★**Letchworth Village, N. Y.**—(Thiells post office)—(Official)—Bids will be received until noon, Sept. 7, by Frank A. Vanderlip, Pres., Bd. of Mgrs., Letchworth Village, Room 215, 55 Wall St., New York, N. Y., for heating, plumbing, drainage, electrical work, etc., in attendants' home, laundry building, and service building; for electric service connections for Cottages A, B, C and D at Letchworth Village, Thiells. Franklin B. Kirkbride, 55 Wall St., New York, is Secy., Mgrs. of Letchworth Village. Lewis F. Pilcher, Albany, is State Arch.

✚**Rochester, N. Y.**—The Managers of St. Mary's Hospital have awarded the contract for the construction of a new boiler house and engine room to the GORSLINE & SWAN CONSTRUCTION CO., Rochester. The building will be 44x113-ft., 37 ft. high, with a 125-ft. chimney. Gordon & Madden is Arch.

Burlington, N. J.—The City Council has engaged W. E. Temple, Elec. Engr., Philadelphia, Penn., to prepare plans for changing the motive power of the drainage system from steam to electricity. It will cost from $6000 to $7000.

Newark, N. J.—The Standard Metal Mfg. Co., 237 Chestnut St., will build an addition to the boiler house of its plant.

Duncannon, Penn.—A company has been organized to construct a dam across the Juniata River about four miles above Duncannon. It will be of stone and concrete, with a head of 15 ft., and is expected to develop from 2000 to 3000 hp. of energy which will be transmitted to Duncannon to operate a mill for the manufacture of felt roofing paper and an asphalt refinery. Frank M. Waring, Tyrone, and R. J. Redick, York, are interested in the company which will be capitalized at $500,000.

Hazard, Ky.—Press reports state that the Kentucky River Power Co. will establish a hydro-electric plant at Hazard to cost about $300,000.

Henderson, Ky.—The City Council is considering the construction of a new power house for the municipal electric-light plant. L. P. Hite is Supt. of the municipal plant.

✚Cleveland Heights, Ohio—(Warrensville post office)—(Official)—The Board of Education has awarded the contract for heating and ventilating equipment of a grade school to the CHAPPELL-WARREN CO., Cleveland, at $7850. See item under "Buildings."

Columbus, Ohio—(Official)—Bids will be received until 2 p.m., Sept. 10, by A. F. Shepherd, Pres., Ohio Bd. of Administration, Oak and Ninth St., Columbus, for nine automatic side-feed, self-cleaning stokers for the Institution for Feeble-Minded, Columbus, and for two 400-hp. water tube boilers and two 400-hp. stokers at the Ohio Hospital for Epileptics, Gallipolis, Ohio. H. S. Riddle, Columbus, is Consult. Engr., Ohio Bd. of Administration.

East Liverpool, Ohio—Bonds will be issued for the construction of a municipal electric-light plant. The estimated cost is $60,000. J. C. Kelley is City Engr.

Painesville, Ohio—(Official)—Bids will be received until noon, Aug. 31, by Martin A. Tuttle, Dir. of Pub. Ser., for one surface condenser and equipment for the municipal electric light department of the City of Painesville. O. W. Kile is Secy. of the Electric Light Dept. H. Whitford Jones & Co., 1303 Citizens' Bldg., Cleveland, is Consult. Engr.

✚Troy, Ohio—The Board of Commissioners of Miami County has awarded the contract for the construction of an addition to the county power plant to GRIMES & THOMPSON, Piqua, at $4948. It will be one-story, 38x61 ft.

Uhrichsville, Ohio—The City Council has authorized the City Clerk and City Solicitor to investigate the feasibility of establishing a municipal electric-light plant. Should the report be favorable, the question of a bond issue will be submitted to the voters at the regular November election.

Galena, Ill.—The Interstate Light & Power Co. plans to add new equipment to the Galena plant within the next two or three months. A new 3500-hp. turbine will be installed with additional boilers and pumps. The automatic stokers will be improved. F. H. Rickemann is Mgr.

Peoria, Ill.—The committee appointed to investigate the feasibility of establishing a municipal electric-plant has submitted a report estimating the cost at $38,389. The committee also recommends submitting the question to the voters. E. D. Jeffries is City Engr.

Dane, Wis.—Preparations are being made for the installation of a municipal electric-light plant in Dane. Vaughn, Meyer & Sweet, Majestic Bldg., Milwaukee, is Consult. Engr.

Solon, Iowa—Press reports state that a franchise will be granted to the Iowa Ry. & Light Co. for the installation of an electric-lighting system in Solon. A transmission line will probably be built from Mt. Vernon to supply energy. This line will also serve farms along the route. S. C. Dows, Cedar Rapids, is Pur. Agt.

Virginia, Minn.—(Official)—Bids will be received until 8 p.m., Sept. 6, by the Water and Light Commission for a mixed pressure steam turbine with exciters, condensers and switchboard. Alternate bids will be received for either a 1000-kw. or a 1500-kw. turbine and alternator. Max Lewis is Secy. of the Comn. C. T. Harding is Engr.

✚Warren, Minn.—It is reported that the contract for additions and improvements to the municipal electric-light plant has been awarded to J. G. ROBERTSON, 2542 University Ave., St. Paul. Bids were opened July 22. Noted July 1 and 15.

Broken Bow, Neb.—(Official)—Bids will be received until 6 p.m., Sept. 2, by the Mayor and City Council for the construction of a complete electric-light plant and for the construction of new wells for an extension to the water-works system. The engineer's estimate for the entire work is $17,000. R. E. Thompson is City Clk.

Grand Island, Neb.—(Official)—The Grand Island Electric Co. is building a hydro-electric plant on the Loup River at a cost of $750,000. It will develop 4500 hp. The L. E. Myers Co., Chicago, Ill., is in charge of the construction work. Erroneously noted June 17 as about to build a hydro-electric plant on the Platte River.

Hastings, Neb.—The city will soon purchase for the municipal electric-light plant, a 750-kw. steam turbo-generator and condensing plant and steam-flow integrating meters; also an electrically-driven, deep-well centrifugal pump, with a capacity of 1000 gal. per minute. H. H. Cloyd is Mgr.

Hysham, Mont.—It is reported that the Town Council has engaged the Billings Engineering & Contracting Co., Billings, to prepare plans for a municipal electric-light plant and water-works system.

Pickering, Mo.—At a special election held July 27 the citizens voted in favor of issuing bonds for the purpose of installing a municipal electric-light plant.

Adamson, Okla.—It is reported that bids will be received until Sept. 20 by the City Council for the construction of a municipal electric-light plant.

Colorado Springs, Colo.—It is reported that the City Commissioners have decided not to consider the establishment of a municipal electric-light and power plant at the present time. Tentative estimates place the cost at about $1,000,000.

Dexter, N. M.—It is reported that the City Council contemplates the installation of a municipal electric-light and power plant.

Olympia, Wash.—Bids will be received until noon, Aug. 31, by E. S. Emigh, Secy., State Bd. of Control, Olympia, for the installation of a 300-hp. horizontal tube boiler equipped with automatic underfeed stokers in the power plant of the Eastern State Hospital at Medical Lake.

Winnipeg, Man.—It is reported that plans have been prepared by W. P. Brereton, City Engr., for building an addition to the heating and power plant of the municipal hospital.

BRIDGES

Woonsocket, R. I.—(Official)—Competitive plans will be received until 8 p.m., Sept. 1, by the Board of Aldermen for two bridges on Hamlet Ave. and one on Fairmount St., Woonsocket. George H. Emmott is Chn., Bd. of Aldermen. Frank H. Mills is City Engr. Noted May 6.

Hartford, Conn.—(Official)—Bids will be received until 11 a.m., Aug. 31, by the Board of Contract and Supply for the construction of a three-span reinforced-concrete bridge over the Park River at Capitol Ave. It will be 160 ft. long and 55 ft. wide. Joseph Buths is Secy., Bd. of Contract and Supply.

Binghamton, N. Y.—The City Council has authorized the issue of bonds for the construction of six bridges. The estimated cost is $30,000. John A. Giles is City Engr.

★Olean, N. Y.—(Official)—Bids will be received until 5 p.m., Sept. 7, by the Common Council for the construction of a highway bridge over the Allegany River at 11th St., Olean. Bids will be accepted for a concrete bridge of three 140-ft. spans, or for a steel structure of two 200-ft. spans. A. G. Harvey is Supt. of St.

✚Gillette, N. J.—The Board of Chosen Freeholders of Morris County, Morristown, has awarded the contract for the construction of a bridge over the Passaic River at Gillette to JAMES J. HICKEY, at $7333.

Newark, N. J.—The Board of Chosen Freeholders of Essex County has voted to make repairs and improvements to the Jackson St. Bridge. The estimated cost is $20,000. Frederick A. Reimer is County Engr.

Trenton, N. J.—Bids will be received until 2:30 p.m., Aug. 26, by John J. Powers, Dir., Bd. of Chosen Freeholders of Mercer County, for the construction of a reinforced-concrete and stone arch over Sanhican Creek at Willow St., Trenton. Theodore Tobish is County Engr.

✚Trenton, N. J.—(Official)—The Board of Chosen Freeholders of Mercer County has awarded the contract for a bridge over Doctor's Creek to BROWN & MACKENTHUM, Windsor, N. J., at $6149; contracts for a bridge over Beedens Brook and one over Assunpink Creek were awarded to the GINDER CONSTRUCTION CO., Trenton, at $2019 and $1408 respectively. Noted July 29.

Ebensburg, Penn.—Bids will be received until Aug. 30 by the Commissioners of Cambria County for the construction of a 36-ft. concrete girder bridge over Chest Creek on the Loretto and Carrolltown Rd., between Allegheny and East Carroll Townships, and for a 40-ft. concrete arch over Yellow Run in Adams Township. George M. Wertz is County Controller.

★Media, Penn.—(Official)—Bids will be received until 10 a.m., Sept. 9, by the Commissioners of Delaware County for the construction of a reinforced-concrete bridge on Glenolden Ave., over Muckinapatus Creek, Glenolden Borough and Darby Township. J. Miller Quinn is Dep. County Controller.

Norristown, Penn.—(Official)—Bids will be received until 11 a.m., Aug. 30, by the Commissioners of Montgomery County for repairing the following bridges: Bridge over Wissahickon Creek in Upper Gwynedd Township; over Humphreys Run in Lower Gwynedd Township; over Towamensing Creek in Upper Gwynedd Township; creosoted block floor on the Royersford and Spring City Bridge over the Schuylkill River; three concrete piers to be placed under the bridge at Walnut Hill Station, over Pennypack Creek in Abington Township. John N. Jacobs is County Controller.

Sunbury, Penn.—Bids will be received until Aug. 27 by Aaron Baker, Controller of Northumberland County, for the construction of a bridge over Mahanoy Creek in East Cameron Township, known as Hornbergers Bridge.

Courtland, Va.—(Official)—Bids will be received until noon, Sept. 3, by the Clerk of the Circuit Court of Southampton County for the construction of a 465-ft. steel bridge with concrete and pile substructure, over the Nottaway River. G. P. Coleman, Richmond, is State Highway Comr.

Farmville, Va.—(Official)—Bids will be received until noon, Aug. 31, by the Clerk of the Circuit Court of Prince Edward County for the construction of a steel bridge over Falling Creek. G. P. Coleman, Richmond, is State Highway Comr.

Richmond, Va.—See item under "Miscellaneous."

Berkeley Springs, W. Va.—Bids will be received until Sept. 11 by M. S. Harmison, Clk. of County Court of Morgan County, for the construction of a concrete bridge across Sleepy Creek. Alternate bids will be accepted for a 90-ft. single span or two spans of 50 ft. each, with a 14-ft. roadway.

Charleston, W. Va.—Bids will be received until Aug. 30 by M. P. Malcolm, Pres. Kanawha County Court, for the construction of two bridges in Cabin Creek District, one over Morris Creek and the other over Upper Creek. F. G. Burdett is County Road Engr. Noted Aug. 12.

Clarksburg, W. Va.—(Official)—Bids will be received until noon, Aug. 28, by the Harrison County Court for the construction of abutments and piers for a steel bridge across the West Fork River at Zeising. C. C. Fittro is County Road Engr.

Jefferson, N. C.—The State Highway Engineer is preparing plans for the Commissioners of Ashe County for a 360-ft. steel bridge with 14-ft. roadway. The estimated cost is $6000. W. A. Scott is Chn., County Comrs.

Titusville, Fla.—It is reported that the Commissioners of Brevard County have decided to build a concrete pile bridge across the Indian River estimated to cost $100,000. There will be a 55-ft. draw span. C. M. Rogers, Daytona, is Consult. Engr.

Columbus, Miss.—Bids will be received until Sept. 6 by the Board of Supervisors of Lowndes County for three steel bridges, one 40-, one 80- and one 100-ft. span, and for one 50-ft. concrete arch. G. E. Hauser, Jr., is County Engr.

✚St. Francisville, La.—(Official)—The Police Juries of East and West Feliciana Parishes have awarded the contract for a bridge over Thompson Creek on the line between the two parishes to AUSTIN BROS., Dallas, Tex. The estimated cost is $24,000. Noted Aug. 12.

Covington, Ky.—The City Commissioners have approved plans for a bridge across the Licking River to carry the emergency water main from Campbell County to Latonia where it will connect with the Covington system. The bridge will be 725 ft. long and 16 ft. wide, to be later increased to 24 ft. The estimated cost is $47,375. The cost of submerging two mains will be about $40,000. The bridge will not be built until necessary legislation can be obtained from the General Assembly which convenes next January. Noted June 10.

✚**Maysville, Ky.**—The Fiscal Court of Mason County has awarded the contract for the construction of three concrete bridges to E. K. NEWELL & CO., Maysville.

Nicholasville, Ky.—(Official)—Bids will be received until noon, Sept. 7, by the Fiscal Court of Jessamine County for the construction of a reinforced-concrete bridge across Hickman Creek on the Chrisman Mill Rd. C. S. Woodward is Road Engr. of Jessamine County.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Sept. 17, by the Board of Commissioners of Hamilton County for the construction of two concrete bridges on the New Haven and Venice (Willey) Rd. Albert Reinhardt is Clk., Bd. of Comrs.

Cincinnati, Ohio—It is reported that the County Engineer is preparing plans for the construction of four bridges to be located at Miamisburg, West Carrollton, Union and Shoups Mills respectively. The estimated cost is approximately $150,000.

Hamilton, Ohio—(Official)—Bids will be received until 10 a.m., Sept. 13, by W. W. Crawford, Audr. of Butler County, for the construction of a bridge over the Miami River at Chestnut St., Hamilton. Alternate bids may be submitted on either steel or concrete construction. F. M. Hammerle is County Surv.

Malvern, Ohio—Bids will be received until Sept. 11 by the Commissioners of Carroll County, Carrollton, for repairs to the Main St. Bridge in Malvern.

Marion, Ohio—Bids will be received until Sept. 8 by the Board of Commissioners of Marion County for a 160-ft. steel bridge known as the Clark Bridge, over the Scioto River in Section No. 19, Montgomery Township. V. Perle Garfield is Clk. of Bd.

Zanesville, Ohio—(Official)—Bids will be received until 11 a.m., Sept. 7, by the Board of Commissioners of Muskingum County for the construction of the superstructure of the Swingle Bridge over Turkey Run in Brush Creek Township. Fred C. Werner is Clk. of County Comrs.

Brazil, Ind.—(Official)—Bids will be received until 10:30 a.m., Sept. 7, by the Board of Commissioners of Clay County for the construction and repair of county bridges. George A. Sheehan is County Engr. William O. Graeser is County Audr. Noted July 8.

Covington, Ind.—(Official)—Bids will be received until 2 p.m., Sept. 7, by the Board of Commissioners of Fountain County for the construction of two bridges, the Ed Martin Bridge in Troy Township, and the County Line Bridge in Richland Township and Montgomery County. Himan W. Newlin is County Audr.

✚**Lebanon, Ind.**—(Official)—The Commissioners of Boone County have awarded contracts for bridge construction to the following: J. A. SWOPE, Lebanon, three bridges; SHEATS & ABERGAST, Frankfort, Ind., two bridges; CENTRAL STATES BRIDGE CO., Indianapolis, one bridge. Noted July 22.

South Bend, Ind.—Press reports state that the Commissioners of St. Joseph County plan the construction of a $40,000 bridge on the Lincoln Highway in the county.

✚**Flint, Mich.**—The contract for the construction of the West Court St. Viaduct has been awarded to the ILLINOIS BRIDGE CO., Chicago, Ill., at $12,977.

Joliet, Ill.—It is reported that the Chicago, Ottawa & Peoria Ry. contemplates the construction of two new bridges, one to have four 43-ft. spans and the other, two spans of 35 ft. each. F. E. Fisher, Joliet, is Gen. Supt.

✚**Watseka, Ill.**—(Official)—The Highway Superintendent of Iroquois County has awarded the contract for the construction of two reinforced-concrete bridges in Pigeon Grove Township to JOSEPH KLEIN, Freeburg, Ill., at $5700. Other bidders were: Bresee Mfg. Co., Mattoon, $6400; Walesby & Gammie, Chicago, $5890; Fred A. Smith Lumber Co., Cissna Park, Ill., $5878. The engineer's estimate was $6575. Noted Aug. 12.

Appleton, Wis.—The City Council plans the construction of a 105-ft. concrete bridge over the South Channel of the Fox River. It will have three spans. A. C. Remley is City Engr.

✚**Burlington, Iowa**—The City Council has awarded the contract for the fabrication and erection of a 2555-ft. bridge over the Mississippi River to the WISCONSIN BRIDGE & IRON CO., Milwaukee, Wis. It will cost approximately $200,000. Noted June 24 and July 22.

Mankato, Minn.—(Official)—The Commissioners of Blue Earth County have postponed the award of contract for a 120-ft. concrete bridge in Shelby Township until the latter part of September. Bids were advertised to be received on Aug. 18. C. L. Kennedy is County Audr. Noted Aug. 12.

Mankato, Kan.—(Official)—Bids will be received until noon, Sept. 14, by the Commissioners of Jewell County for the construction and repair of a number of bridges in various townships of the country. Plans on file with the County Clerk, Mankato, and with the State Engineer, Manhattan.

Ogden, Kan.—Bids will be received until Sept. 1 by the Commissioners of Riley County, Manhattan, for the repair of the bridge over the Kansas River at Ogden. The estimated cost is $10,000.

Alma, Neb.—Bids will be received until noon, Aug. 31, by A. B. Shoemaker, Clk. of Harlan County, for bridge construction in the county for a period of one year.

✚**Chinook, Mont.**—The Board of Commissioners of Blaine County has awarded the contract for the construction of a steel bridge over the Milk River to O. E. PEPPARD, Missoula, at $6600.

Dillon, Mont.—Bids will be received until 11 a.m., Sept. 10, by Jay S. Baker, Clk. of Beaverhead County, for the construction of a 170-ft. steel bridge across the Big Hole River, and for a 42-ft. steel bridge across the slough near Browne's Station.

Benjamin, Tex.—The voters of Knox County have approved the issue of $50,000 in bonds, the proceeds of which will be used to build two bridges over the Brazos River; one at Brock Crossing, and the other at Coffman Crossing.

Kingfisher, Okla.—(Official)—The Commissioners of Kingfisher County have postponed indefinitely the awarding of contracts for the construction of 17 bridges in the county. Bids were advertised for Aug. 16. William G. Newer, Kingfisher, is County Clk. Noted Aug. 12.

Lehigh, Okla.—(Official)—The award of contracts for the construction of seven steel bridges in Coal County, bids for which were advertised until Aug. 14, has been deferred to a later date. Richard Bunch, Coalgate, Okla., is County Clk. Noted Aug. 5.

✚**Sulphur, Okla.**—The Commissioners of Murray County have awarded a contract for the construction of two bridges over the Washita River to the WESTERN BRIDGE CO., Sherman, Tex.

Denver, Colo.—It is reported that plans are being prepared for a new bridge over the Platte River near Woolhurst, about five miles from Denver. The estimated cost is $6000. T. J. Ehrhart, Denver, is State Highway Comr.

Aberdeen, Wash.—(Official)—The West Toll Bridge over the Chehalis River will be rebuilt at once without the delay of calling for bids. The work includes the construction of a new 260-ft. span and repairing the approaches. The estimated cost is $25,000. C. E. Fowler, Central Bldg., Seattle, is Engr.-in-Charge. P. F. Clark is City Clk. Noted Aug. 12.

✚**Olympia, Wash.**—(Official)—Bids were received Aug. 9 by the State Highway Board for the construction of the Skokomish River Bridge on the Olympic Highway in Mason County, from the following: Washington Construction Co., Seattle, $12,562; J. R. Wood, Seattle, $11,831; Quigg Construction Co., Seattle, $13,600; A. H. Cox & Co., Seattle, $12,457; Minneapolis Steel & Machinery Co., Spokane, $12,830; R. E. Mieth, Portland, Ore., $11,778; YELVERTON & WOLF, Olympia, $11,253 (awarded contract); Portland Bridge & Iron Co., Portland, Ore., $13,650; Coast Bridge Co., Portland, Ore., $14,305; Beer's Building Co., Portland, Ore., $11,777; Weymouth Construction Co., Seattle, $13,756; Howard S. Wright, Everett, $12,940; George H. Griffin, Inc., Seattle, $12,308. Noted July 29.

✚**Walla Walla, Wash.**—The Commissioners of Walla Walla County have awarded a contract for the construction of three steel bridges to C. L. GRAVES, Spokane, at $8434.

Grants Pass, Ore.—The County Court of Josephine County has rejected all bids for a steel bridge over Sucker Creek as being too high. New bids will be asked at once.

✚**Portland, Ore.**—It is reported that the Park Commission has awarded the contract for the construction of the Back Bay Blvd. Bridge to FORGIONE & ROMANO, Fidelity Bldg., Portland, at $21,450.

✚**Fresno, Calif.**—The Board of Supervisors of Fresno County has awarded the contract for the construction of a reinforced-concrete bridge on the Elkhorn grade to J. E. MITCHELL, Fresno, at $11,974.

✚**Martinez, Calif.**—The Board of Supervisors of Contra Costa County has awarded a contract for the construction of a bridge over Pacheco Slough on the Martinez-Bay Point Rd., to the HEALY-TIBBETTS CO., San Francisco, at $6932, and for placing 1100 ft. of trestle piling over Pacheco Slough to the HYDE-HARJESS CO., Stockton, at $8778.

✚**Modesto, Calif.**—The Board of Supervisors of Stanislaus County has awarded a contract for the construction of a bridge across the Tuolumne River at Roberts Ferry to the ROSS CONSTRUCTION CO., Sacramento, at $29,870. Noted July 29.

✚**Oroville, Calif.**—The Board of Supervisors of Butte County has awarded a contract for the construction of a concrete bridge over Butte Creek, on the State Highway, to EDWARD SHARP, Chico, at $11,723.

✚**San Diego, Calif.**—The San Diego & Arizona Ry. Co. has awarded the contract for the erection of a steel bridge across Campo Creek at the end of Tunnel No. 4 to the CHARLES W. CORBALEY CO., I. W. Hellman Bldg., Los Angeles; the contract for furnishing the steel was awarded to the LLEWELLYN IRON WORKS, Los Angeles.

✚**San Luis Obispo, Calif.**—The Board of Supervisors of San Luis Obispo County has awarded the contract for the construction of a reinforced-concrete bridge over San Luis Obispo Creek to ALLISON & COLE, San Francisco, at $8199.

✚**Santa Rosa, Calif.**—(Official)—The Board of Supervisors of Sonoma County has awarded contracts for the construction of reinforced-concrete bridges to the BAILEY-COMSTOCK CO., Santa Rosa, at $1542 for a bridge on the Alexander Valley Rd., and to the GILDERSLEEVE CONTRACTING CO., Napa, at $5600 for a bridge on the Petaluma Rd. Noted Aug. 5.

Yreka, Calif.—The Board of Supervisors of Siskiyou County contemplates the construction of a bridge at the mouth of the Scott River. The estimated cost is $10,000.

Halifax, N. S.—Bids will be received until noon, Aug. 28, by the Road Commissioner, Halifax, for the construction of 217 culverts of permanent material on several roads in the County of Antigonish.

Halifax, N. S.—Bids will be received until noon, Sept. 4, by the Road Commissioner, Halifax, for the construction of 171 culverts of permanent material on various roads in several counties.

Mt. Pleasant, Ont.—The Works Committee of the City Council, Toronto, has approved plans for the construction of a bridge at Mt. Pleasant. Bids will be asked as soon as the plans are approved by the Railway Board. It will be of either plain or reinforced-concrete construction.

✚Swan River, Man.—The Provincial Highway Commissioner has awarded contracts for the construction of two reinforced-concrete bridges over the Swan River to S. C. HILL & CO., Winnipeg, for the substructures, and to the ALGONA STEEL BRIDGE CO. for the steelwork. The estimated cost of the two bridges is $15,000.

WATER SUPPLY—IRRIGATION

✚Pittsfield, Mass.—The General Electric Co. has awarded the contract for the construction of a reservoir at Perinne Ave. to GILBERT H. HARRIES, Boston. The estimated cost is $100,000. Noted July 29.

✚★Hartford, Conn.—(Official)—The contract has been awarded to C. W. BLAKESLEE & SON, New Haven, at $357,767, by the Board of Water Commissioners for constructing under Contract No. 10 a compensating reservoir. Noted Aug 12.

Attica, N. Y.—The Village Trustees contemplate constructing a water system, the estimated cost of which is $125,000.

Centerville, N. Y.—(Official)—Bids were received Aug. 17 for the construction of a water system as follows: Abner M. Harper, Inc., $10,630; Partridge & Burke, $25,541; P. L. Braunworth, $15,606; R. F. Relly, $16,223. Noted July 22 and 29.

✚New York, N. Y.—(Official)—The SULLIVAN MACHINE CO., 123 South Michigan Ave., Chicago, Ill., at $12,145, has been awarded the contract for making six borings at the Hudson siphon of the Catskill Aqueduct in Fishkill. Noted July 22 and Aug. 19.

★Watervliet, N. Y.—(Official)—The Lincoln, Steele, Fleming Co., New York, at $424,670, was low bidder for constructing a water system. Solomon, Norcross & Keis is Engr. Noted July 22.

Yonkers, N. Y.—The city will expend about $3,000,000 for the construction of a new water system and for the improvement of the old one. Noted Aug. 21, 1913 and Nov. 26.

Butler, N. J.—The State Water Supply Commission has granted the Butler Water Co. permission to extend its water system to Lake Keiko. Noted June 17.

✚Gloucester City, N. J.—The contract for furnishing and installing equipment for the water-works has been awarded to L. T. EDWARDS, Philadelphia, Penn., at $21,218. A. Blatchley, Drexel Bldg., Philadelphia, Penn., is Engr. Noted Aug. 19.

Newark, N. J.—George W. Knight has been retained by the City Council to prepare plans for the construction of a water supply system at the almshouse at Ivy Hill. The estimated cost is about $5000.

West Orange, N. J.—At an election held Aug. 16 the citizens voted in favor of purchasing the water system of the West Orange Water Co. William B. Fuller is Consult. Engr. Noted July 15 and Aug. 12.

Wilmington, Del.—Press reports state that the city plans to construct another reservoir beside the present reservoir on the Concord Turnpike.

Altavista, Va.—The citizens contemplate constructing a water system.

Crewe, Va.—Plans have been prepared by Anderson & Christie, Commercial Bldg., Charlotte, N. C., and an election will soon be held to vote on the question of issuing $80,000 in bonds, the proceeds of which will be used for the construction of a water system. E. C. Bradshow is Comr. of Pub. Wks.

Fairmont, W. Va.—The city plans to install a new water and sewerage system. Ira L. Smith is Comr., Water Works and Sewerage.

Cartersville, Ga.—(Official)—Bonds for $5000 have been voted by the citizens, the proceeds of which will be used for making extensions to the water mains. W. W. Daniel is City Engr. Noted July 22.

Macon, Ga.—The Water Commissioners are considering the construction of a reservoir on Ft. Hawkins, East Macon.

Bradentown, Fla.—The citizens voted against the question of issuing $10,000 in bonds, the proceeds of which was to have been used for the extension of the water system. Noted July 22.

Amite, La.—Surveys are being made for the construction of a water and sewerage system. M. L. Culley, Jackson, Miss., and X. Kramer, Magnolia, Miss., are Engrs. Noted July 22.

De Ridder, La.—Bonds for $24,000 have been sold, the proceeds of which will be used for the construction of a municipal water system.

Lenoir City, Tenn.—An election will be held to vote on the question of issuing $10,000 in bonds, the proceeds of which will be used for the completion of the water system.

Belleville, Ohio—(Official)—Bids will be received until Sept. 14 by Glenn L. Shaffer, Village Clk., for the construction of a water system. The work will include deep well pumps, gas engines, five miles of distributing mains and a storage reservoir. The Smith & Boulay Co., 320 The Nasby, Toledo, is Engr.

✚Columbus, Ohio—The contract has been awarded to the COLUMBUS SUPPLY CO., for furnishing 72,000 lb. of lead pipe at $5.28½ per cwt.

✚Coshocton, Ohio—The contract for the construction of a 3,000,000-gal. reservoir has been awarded to KISSNER & SONS, at $35,652. Noted Mar. 11 and 25.

Farmersville, Ohio—(Official)—Bids will be received until Sept. 1 by A. F. Gilbert, Village Clk., for constructing a water system. Noted June 10 and Aug. 12.

Silverton, Ohio—Bids will be received until Aug. 28 by A. A. Sprague, Village Clk., for constructing 6-in. water mains in portions of various streets.

✚South Charleston, Ohio—The contract has been awarded to ARTHUR GEISLER, Dayton, at $35,000, for constructing a water system. Noted June 3.

✚Wellington, Ohio—(Official)—The contract for the construction of a water system has been awarded to GANGLA & SHANNON, Akron. The estimated cost is $35,000. The W. J. Sherman Co., Toledo, is Engr. Noted July 15 and Aug. 19.

✚West Park, Ohio—(Official)—The contract for the extension and improvement of the water system has been awarded to SEATONWOOD & MAYER, Cincinnati, at $10,460. Other bidders were: Otis & Co., Cleveland, $10,213; Stacy & Brown, Toledo, $10,173; Tillstron & Wolcott Co., Cleveland, $10,027. Noted July 22.

Xenia, Ohio—The State Board of Health has approved the plans of the Xenia Water Co. for the improvement of the water system. Noted May 13.

Miller, Ind.—The citizens have voted in favor of issuing bonds for $14,000, the proceeds of which will be used for the construction of a water system. Noted Aug. 5.

✚Christopher, Ill.—The contract has been awarded to the KATZ CONSTRUCTION CO., Omaha, Neb., at $18,500, for constructing a pumping station. Noted Apr. 1.

Nekoosa, Wis.—Bonds have been voted by the citizens, according to press reports, the proceeds of which will be used for the construction of a water system.

Oshkosh, Wis.—Plans have been prepared by Henry A. Allen, Consult. Engr., Chicago, Ill., for the construction of a filtration plant with a daily capacity of 4,000,000 gal. The estimated cost is $100,000. Noted Aug. 5.

Humboldt, Iowa—(Official)—Bids will be received until 6 p.m., Sept. 6, by J. A. Parker, Town Clk., for furnishing a centrifugal pump and motor, triplex pump and motor, switchboard panel, switches and instruments. Harper & Stiles, Kansas City, Mo., is Engr.

Shelby, Iowa—An election will be held Aug. 30 to vote on the question of issuing $12,000 in bonds, the proceeds of which will be used for constructing a water-works system.

Sidney, Iowa—Bids will be received about Sept. 1 by T. T. Hatton, Mayor, for the extension of the water system. Noted July 29.

Virginia, Minn.—(Official)—Bids will be received until 8 p.m., Sept. 6, by the Water and Light Commission, for constructing a mixed pressure steam turbine. C. T. Harding is Engr.

Spearville, Kan.—Bonds for $25,000 have been voted by the citizens, the proceeds of which will be used for the construction of a water system.

Broken Bow, Neb.—(Official)—See item under "Light, Heat and Power."

✚Omaha, Neb.—The contract has been awarded to the OFFERMAN CONSTRUCTION CO., South Omaha, at $6336, for laying water mains.

✚Powell, Wyo.—According to press reports contracts have been awarded to J. E. FISHER CO., Denver, Colo., at $61,000, for constructing a water system. Noted July 1.

✚Chouteau, Mont.—(Official)—The contract for the construction of a municipal water system has been awarded to the F. E. EVANS CONTRACTING CO., Chouteau, at $31,215. Other bidders were: Security Bridge Co., Billings, $32,893; W. D. Lovel, Minneapolis, Minn., $33,104; Gordon & Taylor Co., Denver, Colo., $33,690; George Kemper, Minot, N. D., $33,443. Swearingen & McCulloh, Chouteau, is City Engr. Noted June 24 and July 29.

Hysham, Mont.—Plans are being prepared for the construction of a water system. The Billings Engineering & Construction Co., Billings, is Engr.

✚Roundup, Mont.—Contracts have been awarded to the SECURITY BRIDGE CO., at $3781 and $7509, for constructing water mains.

St. Joseph, Mo.—Bids will be received about Sept. 1 by the Board of Public Works for the extension of the water mains on Shade Ave. from St. Joseph Ave. to Fifth St.

✚St. Louis, Mo.—The contract for the reconstruction of the Compton Hill Reservoir has been awarded to the HIRAM LLOYD BUILDING & CONSTRUCTION CO., at $280,187. Other bidders were: McCormick-Combs Construction Co., $287,506; Hammick Quarry & Construction Co., $290,316; Carmichael-Cryden Co., $292,812; Herman Construction Co., $294,717; Fruin-Colnin Construction Co., $307,220; Prendergast-Clark Construction Co., $326,991; James Stewart Co., $329,010; American Contracting Co., $407,890. Noted Aug. 5.

✚Argenta, Ark.—The contract for furnishing the machinery and equipment for the new pumping station has been awarded to the HENRY R. WORTHINGTON PUMP CO., St. Louis, Mo., at $9000.

Benton, Ark.—Bonds for $85,000 have been sold. The proceeds will be used for the construction of a water and sewer system. Noted July 8.

El Dorado, Ark.—The Arkansas Light & Power Co., recently the El Dorado Light & Water Co., plans to improve the water system at El Dorado.

El Campo, Tex.—The Central Service Co. plans to install a water system. About 14,000 ft. of pipe will be required. T. J. Hardy is Pres.

Harlingen, Tex.—Bids will be received by the Cameron County Irrigation District No. 1 until Sept. 2 for the construction of two flumes.

Mart, Tex.—Bonds for $21,000 have been voted by the citizens, the proceeds of which will be used for the extension of the water system.

Kusa, Okla.—(Henryetta post office)—According to press reports the Kusa Townsite & Improvement Co. plans to build a water system.

Santa Rosa, N. M.—Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., has been engaged to prepare plans for the construction of a municipal water system and electric-light plant.

Colorado Springs, Colo.—The citizens plan to hold a special election to vote on the question of issuing $175,000 in bonds. The proceeds will be used for the improvement of the water system.

Caldwell, Idaho—Surveys are being made by the Succor Creek Irrigation District for a project to reclaim 10,000 acres of land. The work will include a diversion dam, storage

reservoir and distribution system. The estimated cost is $110,000.

Council, Idaho—An election will soon be held to vote on the question of issuing $18,000 in bonds, the proceeds of which will be used for the construction of a municipal water system.

✚Mountain Home, Idaho—The Mountain Home Coöperative Irrigation Co. has awarded the contract for the construction of an irrigation system to MANEY BROS., Boise, at $62,000.

✚Bingham Canyon, Utah—(Official)—The contract for the improvement of the water systems has been awarded to KEELER BROS., Denver, Colo., at $17,000. John Duser, Salt Lake City, is City Engr. Noted July 29 and Aug. 19.

Newport, Ore.—The city has been granted a permit for the use of the waters of Spencer Creek for the construction of a municipal water system. The work will include the construction of a dam, concrete reservoir and a pipe line about 10 miles long. The estimated cost is $24,000. John H. Lewis is State Engr.

✚Arcadia, Calif.—The MERCHANTS REALTY & INVESTMENT CO., Van Nuys Bldg., Los Angeles, at $12,456, has been awarded the contract for the construction of two concrete reservoirs.

Arcadia, Calif.—Bids will be received until Sept. 2 by the City Trustees for digging and backfilling about 20 miles of water main trenches. George E. Grimes is City Clk.

Lindsay, Calif.—According to press reports plans are being considered for the formation of the Lindsay-Strathmore Irrigation District to irrigate 18,550 acres. The estimated cost is $1,568,169.

✚Orosi, Calif.—The contract has been awarded to MICHAEL J. CARROLL, Exeter, for constructing a water system at East Orosi.

Portersville, Calif.—The Deer Creek Irrigation District, recently organized, plans to construct an irrigation system at an estimated cost of $1,000,000. Stephen E. Kieffer, San Francisco, is Ch. Engr.

Matheson, Ont.—Plans are being prepared by McAustan & Anderson, Engr., North Bay, for the construction of a water system. Bonds for $20,000 have been voted for this purpose. Noted Aug. 12.

✚Perth, Ont.—THE ROBERTS FILTER MFG. CO., Philadelphia, Penn., at $15,000, has been awarded the contract for the installation of a filtration plant.

SEWERS

Briarcliff Manor, N. Y.—Plans are being prepared by Clyde Potts, Consult. Engr., 30 Church St., New York, for the construction of approximately six miles of vitrified pipe sewers, settling tanks, sand filters and a sewage pumping station.

Farmingdale, N. Y.—Plans have been prepared for the construction of a sewage-disposal plant at the New York State Farm School of Agriculture. The estimated cost is $35,000.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 11 a.m., Sept. 1, by L. H. Pounds, Borough Pres., for the construction of sewer basins in New Jersey, Hegeman, Glenmore, Williams Ave., West, Pine and Hemlock St.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received Aug. 18 by Marcus M. Marks, Borough Pres., for the alterations and improvements to the sewers in (a) First Ave., (b) outlet sewer at Dyckman St. and the Hudson River, including the construction of a submerged outlet and screening chamber, as follows: C. E. Farrell Contracting Co., (a) $5940; P. Reilly, (a) $4999; Lawrence Contracting Co., (a) $6051; Melrose Construction Co., (a) $4537, (b) $36,561; J. H. Haidwvan, (a) $4595; P. J. Kearns Contracting Co., (a) $5041, (b) $48,185; Casperine & DeBlasio, 357 East 116th St., New York, (a) $4457, (b) $51,250; Fitzgerald & Brennen, (a) $5158; E. J. Grannis, (a) $4999; Kingsbridge Contracting Co., (b) $35,380; Merrill Ruckgaber Co., (b) $44,397; H. E. Fox Construction Co., 81 East 125th St., New York, (b) $32,040; P. J. Duffy, (b) $53,530. Noted Aug. 12.

✚New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for the construction of sewers in Ellwood St. and Sherman Ave. has been awarded to W. F. ELRAY, 1640 Maconds Dam Rd., New York. Noted Aug. 19.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., Sept. 1, by Maurice E. Connolley, Borough Pres., for the construction of sewers and appurtenances in Maspeth, Perry, Maurice, Grant, Clark Ave. and Rust St., Second Ward.

New York, N. Y.—(Borough of Queens)—(Official)—Bids were received Aug. 12 by Maurice E. Connolly, Borough Pres., for the construction of sewers and appurtenances in Atlantic Ave., Fourth Ward, as follows: Murphy Bros. $31,811; Frank Paino, $32,676; Green Contracting Co., $38,836; L. E. Kelly, $41,264; Clancy & Van Alst, $39,948; Peace Bros., $40,385; H. J. Mullen Contracting Co., $37,641; Rosenthal Engineering & Contracting Co., $43,389; Joseph L. Segretti Co., $41,828; Stanhope Contracting Co., $36,891; A. Paino, 67 Bay 47th St., Brooklyn, $31,460. Noted Aug. 12.

Schenectady, N. Y.—At a recent election the citizens voted to issue $80,000 in bonds, the proceeds of which will be used for completing the sewage-disposal plant and constructing trunk sewers to connect with the intercepting sewer.

✚Skaneateles, N. Y.—The contract for the construction of a sewer in Elizabeth St. has been awarded to SAMUEL BONN, Syracuse. The estimated cost is $5000.

✚Utica, N. Y.—The contract for the construction of segment block storm relief sewers in Jay St. and Kossuth Ave. has been awarded to N. D. PETERS & CO., at $11,874. Noted July 29.

✚Yonkers, N. Y.—Contracts for sewer construction have been awarded to JOHN O. WESTON, at $8349, for constructing McLean and Wakefield Ave. sewer; C. I. PEARSALL, at $7745, for reconstructing the Hawthorne and Warburton Ave. outlet sewers at Wells Ave.

South Boundbrook, N. J.—Plans are being prepared by Clyde Potts, Consult. Engr., 30 Church St., New York, N. Y., for the construction of approximately five miles of 8- to 15-in. vitrified sewers and settling tanks.

✚Wildwood, N. J.—The contract for the construction of a sewage-disposal plant has been awarded to STANLEY KALBACK, Wildwood, at $36,044.

Sunbury, Penn.—The city contemplates the construction of a sewer system. The estimated cost is $500,000.

Baltimore, Md.—The Sewerage Commission has appropriated $5000 for the construction of sewers in 26th St. and Huntington Ave.

Altavista, Va.—The city contemplates the construction of sewer and water systems. The estimated cost is $35,000.

Crewe, Va.—The city contemplates the construction of approximately 5½ miles of sewers. J. K. Ord is Mayor.

Richmond, Va.—Bids will soon be received for the construction of a sewer system in Scotts Addition. The estimated cost is $55,000.

South Boston, Va.—At a recent election the citizens voted to issue $100,000 in bonds. Part of the proceeds will be used for the construction of sewers. W. L. Penick is Mayor. Noted Aug. 5.

Albemarle, N. C.—(Official)—The estimated cost of the proposed sewer system is $25,000. Bids will be received by the City Commissioners. J. W. D. Spinks is City Engr. Noted Aug. 12.

Raeford, N. C.—The city contemplates the construction of sewer and water systems. The estimated cost is $40,000.

✚Warrenton, N. C.—(Official)—The contract for the construction of approximately 7½ miles of sewers has been awarded to W. M. WILKES, Atlanta, Ga. Noted July 22.

Cartersville, Ga.—(Official)—At a recent election the citizens voted to issue $60,000 in bonds, the proceeds of which will be used for the construction of a sewer system. Noted July 22.

Eustis, Fla.—(Official)—An election will be held Oct. 5 to vote on the question of issuing $20,000 in bonds. The proceeds will be used for the construction of approximately three miles of sanitary sewers and Imhoff tanks. Noted July 29.

Leesburg, Fla.—An election will be held Sept. 11 to vote on the question of issuing $35,000 in bonds. The proceeds will be used for the construction of sewers. L. M. Johnson is City Clk.

New Iberia, La.—It is reported that the city contemplates the construction of a sewer system.

North Chattanooga, Tenn.—The city contemplates issuing $50,000 in bonds, the proceeds of which will be used for the construction of a sewer system.

Bardwell, Ky.—The city contemplates the construction of a sewer system.

Owensboro, Ky.—The Council has appropriated $6000 for the construction of a sewer in the Old Ravine on West Second St.

★Paducah, Ky.—(Official)—All bids received Aug. 3 by L. A. Washington, Comr. of Pub. Wks., for the construction of the outfall sewer, District No. 3, Contract No. 1, were rejected. New bids will not be received until after the election in November at which the citizens will vote on a bond issue. Noted Aug. 12.

✚Cincinnati, Ohio—The contract for the construction of a sewer in Hoge St. has been awarded to M. J. McCARTHY, at $8310.

✚Cuyahoga Falls, Ohio—The contract for the construction of the Portage St. sewer has been awarded to B. R. BREEN, Akron, at $7641.

✚Hamilton, Ohio—(Official)—The contract for the construction of sanitary sewers has been awarded to the JOHN L. WALKER CO., Hamilton, at $22,507. Noted Aug. 12.

Mansfield, Ohio—The city contemplates the construction of sewers in various streets, estimated to cost $7700. W. J. Hazeltine is City Engr.

Portsmouth, Ohio—Preliminary plans are being prepared by George S. Wilhelm, City Engr., for the construction of sewers in the northern and eastern sections of the city extending into Lawsons Run.

Indianapolis, Ind.—The Board of Public Works plans to construct a sanitary sewer interceptor to connect the Warman Ave. sewer with the Harding St. interceptor. The estimated cost is $25,000. B. J. T. Jeup is City Engr.

Logansport, Ind.—(Official)—Bids will be received about Jan. 1 for the construction of sewers in the eastern section of the city. The estimated cost is $35,000. William Pickett is Clk. Noted Aug. 19.

Detroit, Mich.—Plans are being prepared by Mason L. Brown, Engr., for the extension of the Ford Village sewer system into new subdivisions.

Mason, Mich.—An election will be held Sept. 14 to vote on the question of issuing $34,000 in bonds, the proceeds of which will be used for the completion of the lateral and trunk sewers and for the construction of a sewage-disposal plant.

Aurora, Ill.—Plans are being prepared by Myron Tarble, City Engr., for the construction of septic tanks at sewer outlets. One septic tank will be constructed each year at an estimated cost of $10,000.

Appleton, Wis.—Plans have been prepared by A. C. Bemley, City Engr., for the construction of approximately 16,000 ft. of trunk sewers.

✚Mayville, Wis.—The contract for the construction of a sewer system has been awarded to DAVID VON STELLE CO., Sheboygan, Wis., at $31,450. Noted July 15.

Superior, Wis.—The City Commission has authorized the construction of sewers in Cadotte Ave. and West 12th St. The estimated cost is $10,000.

Sioux City, Iowa—Plans have been prepared by T. H. Johnson, City Engr., for the construction of approximately 15,500 ft. of 8-in. sewers. Bids will be received about Sept. 1. The estimated cost is $12,000. P. J. Wells is City Clk.

Ely, Minn.—The Council has instructed the City Engineer to prepare plans for the construction of a settling tank with a capacity of 600,000 gal.

Lincoln, Neb.—The city contemplates the construction of a sewer system in the region bounded by O St., the high school, 21st St. and the Antelope Channel. The estimated cost is $11,000. Adna Dobson is City Engr.

+Watertown, S. D.—(Official)—The contract for sewer construction has been awarded to the OFFERMAN CONSTRUCTION CO., South Omaha, Neb., at $79,289. Noted July 29.

Thermopolis, Wyo.—Bids will be received until 2 p.m., Sept. 6, by A. J. Lowry, Town Clk., for the construction of a sewer system.

Bozeman, Mont.—The city contemplates the construction of sewers in South Sixth and Church Ave. The estimated cost is $14,000.

Columbus, Mont.—The city contemplates the construction of a sewer system in the business section.

Carthage, Mo.—Plans are being prepared by C. B. Newton, City Engr., for the construction of sewers in two districts.

Liberty, Mo.—It is reported that an election will soon be held to vote on the question of issuing $20,000 in bonds. The proceds will be used for extending the sewers.

+Poplar Bluff, Mo.—(Official)—The contract for the construction of sewers in Sanitary Sewer District No. 2 has been awarded to V. E. KOCH, Joplin, at $16,749. Noted Aug. 5.

+St. Louis, Mo.—The contract for the construction of the Florissant Ave. public sewer extensions in Sections Nos. 1 and 2 has been awarded to the MYERS CONSTRUCTION CO., St. Louis, at $6623. Noted Aug. 15.

+Argenta, Ark.—The contract for two 14,000-gal. sewage pumps, two 60 hp. slow speed motors and other equipment has been awarded to HENRY R. WORTHINGTON, 115 Broadway, New York, N. Y. Noted Aug. 5.

+Fordyce, Ark.—The contract for the construction of a sewer system has been awarded to WILLIAM S. McDOWELL, at $20,000.

Little Rock, Ark.—The city will construct, by day labor, a main sewer interceptor from the 19th St. viaduct to Fourche Bayou. The estimated cost is $5000.

Midvale, Utah—The city contemplates the construction of sewer and water systems.

Richfield, Utah—At a recent election the citizens voted to issue $25,000 in bonds, the proceeds of which will be used for the construction of a sewer system. Noted Aug. 19.

Bellingham, Wash.—The city contemplates the construction of a trunk sewer in Ellis St. The estimated cost is $12,000.

Pullman, Wash.—Bids will be received until 8 p.m., Sept. 7, by the city, for the construction of sewers in Improvement District No. 24. The estimated cost is $12,000. L. V. Edwards is City Engr. Noted June 24.

Seattle, Wash.—Bids will soon be received for the construction of the Ballard trunk sewer. The estimated cost is $436,182. A. H. Dimock is City Engr. Noted June 10.

Forest Grove, Ore.—(Official)—Plans are being prepared for the construction of storm sewers. The estimated cost is $15,000. A. A. Kirkwood is City Engr.

Auburn, Calif.—An election will be held Sept. 14 to vote on the question of issuing $22,000 in bonds. Part of the proceeds will be used for extending the sewer system. Noted July 1.

+Los Angeles, Calif.—The contract for the construction of sewers in Fountain Ave. has been awarded to ADAM DALMATION, at $10,975. Noted Aug. 19.

Santa Barbara, Calif.—Bids will be received until Sept. 16 by the City Clerk for the construction of sewers. The estimated cost is $21,000. A. B. Cook is City Engr.

+Santa Cruz, Calif.—The City Council has awarded the contract for the extension of the sewer system to W. J. TOBIN, Santa Cruz, at $9842.

Toronto, Ont.—Bids will be received until noon, Aug. 31, by T. L. Church, Chn., Bd. of Control, for the construction of sewers in Dundas, Erie, Clair and Russel Hill St.

GARBAGE

Akron, Ohio—The Director of Public Service is receiving bids for the collection and disposal of garbage for one year. Estimated cost, $20,000 to $24,000.

Mansfield, Ohio—At a recent election the citizens voted in favor of the question of issuing $10,000 in bonds, the proceeds of which will be used for enlarging the garbage crematory.

Rock Island, Ill.—Bids will be received until 2 p.m., Sept. 1, for the installation of a 24-ton garbage incinerator.

STREETS AND ROADS

Boston, Mass.—(Official)—Bids will be received until noon, Aug. 31, by the State Highway Commission for the construction of 5200 lin.ft. of state road in Chelmsford Township.

Boston, Mass.—(Official)—Bids will be received until noon, Aug. 31, by the State Highway Commission for constructing 13,600 lin.ft. of state highway in Ware and Palmer Townships.

+Greenwich, Conn.—(Official)—The contract for resurfacing a portion of Putnam Ave. has been awarded to the CHARLES T. EASTBURN CO., 104 West Sidney Ave., Mt. Vernon, N. Y.

Hartford, Conn.—Bids were received by the State Highway Commissioner, Aug. 16, for state road work as follows: Southington Township, about 6200 lin.ft. 2-in. bituminous macadam on the Misery Brook Rd., Leonardo Suzio, Meriden, $8976; Berardino & Tomasetti Construction Co., Inc., Meriden, $12,208; Robert D. Daley Co., New Haven, $12,599; Thomas Kearney, Meriden, $10,191; H. L. & W. L. Immich, Meriden, $10,406; A. D. Bridge's Sons, Inc., Hazardville, $9897; Lane Construction Corporation, Meriden, $10,191; Louis Longhi & Bro., Torrington, $10,866. North Haven Township, about 4950 lin.ft. trap rock macadam on the Mount Carmel Rd. A. D. Bridge's Sons, Inc., Hazardville, $6932; Lawrence Bruce, North Haven, $8908; John Arborio, 172 Congress Ave., New Haven, $7195; Robert D. Daley Co., New Haven, $7104; Thomas Kearney, Meriden, $7032; H. L. & W. L. Immich, Meriden, $7006; Stafford & Mather, Hartford, Conn., $7547. Waterford Township, about 5937 lin.ft. native stone macadam on the Hartford-New London Turnpike, Framingham Construction Co., South Framingham, Mass., $9822; Louis Longhi & Bro., Torrington, $12,012; Stafford & Mather, Hartford, $10,545; Goodman & Trumbull Co., Litchfield, $10,543; Robert G. Miller Contracting Co., Hartford, $10,926; Doan O'Connor, 803 Main St., Hartford, $12,480; Frank A. Wilcox, Norwich, $11,175; Archie B. Cadwell, New Britain, $10,750; A. D. Bridge's Sons, Inc., Hazardville, $13,480; John Arborio, 172 Congress Ave., New Haven, $12,398. Middlefield Township, about 4940 lin.ft. 2-in. bituminous macadam resurfacing on the Middlefield Rd., F. Arrigoni & Bro., Middletown, $7570; A. Brazos & Sons, Middletown, $8903. Noted Aug. 5.

+Hartford, Conn.—The contract for constructing about 2590 lin.ft. of amiesite pavement on Main St., Killingly Township, Danielson post office, has been awarded to the CONNECTICUT & RHODE ISLAND CO., Meriden, at approximately $8825. Noted Aug. 5.

New York, N. Y.—(Borough of Bronx)—(Official)—Bids will be received until 10:30 a.m., Aug. 31, by Douglas Mathewson, Borough Pres., for regulating, grading, curbing and laying sidewalks on a number of streets.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received Aug. 18 by L. H. Pounds, Borough Pres., for improving 83rd St. from Seventh to 12th Ave., as follows: Uvalde Asphalt Paving Co., $14,936; Cranford Co., $15,191; Brooklyn Alcatraz Asphalt Co., $13,812; Barber Asphalt Paving Co., $15,272. Noted Aug. 12.

+New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for regulating and repaving Jamaica Ave. from Broadway to the borough line has been awarded to the H. J. MULLEN CONTRACTING CO., Fulton St., Jamaica, at $105,297. Noted Aug. 5 and 19.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 2 p.m., Aug. 31, by Marcus M. Marks, Borough Pres., for regulating, grading, curbing and laying sidewalks on various streets.

New York, N. Y.—(Borough of Queens)—(Official)—Bids were received Aug. 19 by Maurice E. Connolly, Borough Pres., for regulating and repaving with improved granite blocks on a concrete foundation, Grand St. from the main line of Long Island R.R. to Hoffman Blvd., as follows: Lanford Co., $32,617; W. J. Scanlon Co., $29,244; Clancy & Nuhn, $29,895; Charles Puckelwaldt, $34,013; J. B. La Marsh, $32,918; H. J. Mullen Contracting Co., $28,809; Evergreen Construction Co., $29,998; Peace Bros., $34,084; Rosenthal Engineering & Contracting Co., $30,467. Noted Aug. 12.

Belleville, N. J.—(Official)—Bids will be received until 8:30 p.m., Aug. 31, by the Board of Commissioners of Belleville for paving Belmont Ave., Heckel St. and Overlook Ave. Frank T. Shepard is Town Engr.

Collingswood, N. J.—The Borough Council has voted to improve the important streets with coatings of asphalt oil.

Englewood, N. J.—(Official)—Bids will be received until noon, Sept. 7, by the Board of Chosen Freeholders of Bergen County, Hackensack, for improving Palisade Ave. from Engle Ave. to the entrance to Interstate Park.

Jersey City, N. J.—Bids will be received until Sept. 2 by the Board of Commissioners for repaving Garfield Ave. from Bay View Ave. to Merritt St.

Jersey City, N. J.—(Official)—Bids will be received until 11 a.m., Sept. 2, by the Board of City Commissioners for repaving Arlington and Bay View Ave. Michael I. Fagen is City Clk. and Charles A. Van Keuren is City Engr.

Jersey City, N. J.—Bids will be received until 11 a.m., Sept. 9, by the Board of City Commissioners for repaving Pine St. and Communipaw Ave. Michael I. Fagen is City Clk.

Jersey City, N. J.—Bids will be received until Sept. 2 by the Board of Commissioners for improving Columbia Ave.

+Keyport, N. J.—The City Council has awarded a contract to CHARLES E. BURD, Red Bank, at $11,034, for the improvement of Broad St. with concrete pavement. Noted June 24 and July 15.

Long Branch, N. J.—The Board of Freeholders of Monmouth County, Freehold, plans to resurface Atlantic Ave.

★Montclair, N. J.—(Official)—Bids will be received until 8 p.m., Sept. 13, by Harry Trippett, Town Clk., for constructing concrete curb on either side of Valley Rd. from Church St. to Normal Ave., a distance of approximately 17,000 lin.ft.

Newark, N. J.—(Official)—Bids will be received until 3:30 p.m., Sept. 7, by the Board of Chosen Freeholders of Essex County for improving Central Ave., East Orange, and Washington Ave., Nutley. Frederic A. Reimer is County Engr.

Newark, N. J.—The Board of Freeholders has approved the construction of a new road at Overbrook Hospital to cost $12,780. Frederic A. Reimer, County Engr., will prepare plans and specifications.

Newark, N. J.—Bids were received Aug. 12 for repaving Belleville Ave. from Broad St. to Bloomfield Ave., as follows: Newark Paving Co., $15,346; Glenfield Construction Co., $15,386; Jackson Contracting Co., $15,744; Van Keuren & Son, $15,750; John S. Geiger & Son, $15,860; Alexander J. Milmoe, $16,243; Ralph Sangiovanni, $16,329.

+Summit, N. J.—The contract for paving Morris Ave. has been awarded to C. H. WINANS & CO., Elizabeth, at $16,029.

Union, N. J.—(Weehawken post office)—(Official)—Bids will be received until 8 p.m., Sept. 7, by the Town Council for remaking, improving and repaving portions of Fulton St. and Bergenline Ave. Emil Bantz is Town Clk.

Bethlehem, Penn.—The City Council will soon receive bids for paving Broad St. from the western borough limits to First Ave., Linden St. from Broad St. to the northern borough limits, South Main St. from Eagle Hotel to Chapel, North Main St. from Garrison to Goepp St. and Prospect Ave. from Hanover St. to Hanover Ave.

Bloomsburg, Penn.—Bids will be received until Aug. 31 by W. H. Eyer, City Engr., for improving Market St.

Harrisburg, Penn.—(Official)—Bids will be received until noon, Aug. 30, by W. H. Lynch, Supt. of Sts. and Pub. Imp., for constructing approximately 8000 sq.yd. of sheet asphalt, 8500 sq.yd. of bituminous concrete and 4900 lin.ft. of 6-in. granite or granolithic curbing on 10 streets.

★**Marcus Hook, Penn.**—(Official)—Bids will be received until 8 p.m., Sept. 6, by Jesse Devonshire, Pres. of the Borough Council, for constructing approximately 7000 sq.yd. of pavement and 800 sq.yd. of concrete gutter. Charles Upham is Ch. Engr.

Philadelphia, Penn.—(Official)—Bids will be received until Aug. 31 by the Department of Public Works for improving a number of streets.

Philadelphia, Penn.—The McNichol Paving Co., 1723 Cherry St., at $212,500, submited the lowest bid for improving Delaware Ave. from Queen to Vandalia St.

✚**York, Penn.**—The contract for paving Newberry, West Poplar and West Philadelphia St. with asphalt has been awarded to the GENERAL SUPPLY & CONSTRUCTION CO., York, at $21,275.

✚**Georgetown, Del.**—A contract for constructing 20 miles of concrete road from Georgetown to Shelbyville has been awarded to the UTILITY CONSTRUCTION CO., New Brunswick, N. J., at approximately $35,544. Noted Aug. 12.

★**Wilmington, Del.**—All bids received Aug. 10 for improving a number of streets were rejected. Noted Aug. 5.

Monterey, Va.—Press reports state that the City Council will pave Main St. with macadam. Bonds for this purpose have recently been voted.

South Boston, Va.—At an election held Aug. 10, the citizens voted in favor of issuing $25,000 in bonds, the proceeds of which will be used for improving streets. Noted Aug. 5.

Parkersburg, W. Va.—The City Council has voted to pave Levee Drive, Ann St. and Murdoch Ave. with brick, 16th, 13th, Covert and other streets with concrete.

Wheeling, W. Va.—Bids will be received until 10 a.m., Aug. 27, by George W. Steenrod, County Rd. Engr., for macadamizing various county roads.

Angier, N. C.—At an election held Aug. 7 the citizens of Black River Township voted in favor of issuing $25,000 in bonds, the proceeds of which will be used for constructing roads.

Dobson, N. C.—At a recent election the citizens voted in favor of issuing $30,000 in bonds, the proceeds of which will be used for constructing roads in Shoals Township, Surry County.

Franklin, N. C.—An election will be held Sept. 11 to vote on the question of issuing bonds, the proceeds of which will be used for improving roads in Ellajay Township.

Florence, S. C.—Bonds for $40,000 have been sold, the proceeds of which will be used for improving streets. Noted June 17.

Gaffney, S. C.—Press reports state that the City Council contemplates an expenditure of $10,000 for street paving. John Jenkins is Engr.

Sumter, S. C.—An election will be held Sept. 7 to vote on the question of issuing $225,000 in bonds, the proceeds of which will be used to improve streets.

Cartersville, Ga.—(Official)—At a recent election the citizens voted in favor of issuing $15,000 in bonds, the proceeds of which will be used for street paving. Noted July 1 and Aug. 5.

Savannah, Ga.—An election will be held Sept. 21 to vote on the question of issuing $375,000 in bonds, the proceeds of which will be used for constructing a road from Savannah to Tybee, Chatham County.

Bradentown, Fla.—At a recent election the question of issuing $9000 in bonds, the proceeds of which was to have been used for paving Ware Creek Causeway and various streets, was defeated. Noted June 24.

Eustis, Fla.—(Official)—An election will be held Oct. 5, to vote on the question of issuing $40,000 in bonds, the proceeds of which will be used for street paving. Noted Jan. 21 and Mar. 11.

Pinellas Park, Fla.—All bids received for paving various streets with brick have been rejected. Noted July 1.

Sanford, Fla.—Press reports state that an election will be held Sept. 6 to vote on the question of issuing $250,000 in bonds, the proceeds of which will be used for hard surfacing 35 miles of road in Seminole County.

Vernon, Ala.—The Commissioners of Lamar County contemplate an expenditure of $150,000 for constructing roads throughout Lamar County.

Oberlin, La.—Bids will be received until Sept. 13 by C. Lindsley, Clk. of the Police Jury, for the sale of $150,000 in bonds, the proceeds of which will be used for constructing roads and bridges in Road District No. 5.

✚**Chattanooga, Tenn.**—The contract for paving Market St. from Ninth to Main St. and East Ninth St. from Market to A St. with wooden blocks has been awarded to the SOUTHERN PAVING & CONSTRUCTION CO., at $58,833. Noted June 24.

✚**Waverly, Tenn.**—A contract for constructing Humphreys County Highway has been awarded to the OLIVER HILL CONSTRUCTION CO., at approximately $200,000.

Columbia, Ky.—A special election will be held Sept. 11 to vote on the question of issuing $25,000 in bonds, the proceeds of which will be used for building roads in Adair County.

Nicholasville, Ky.—(Official)—Bids will be received until noon, Sept. 7, by the Fiscal Court of Jessamine County for constructing approximately 1½ miles of turnpike known as the Thomas Beaumont Rd. C. S. Woodward is Rd. Engr. of Jessamine County.

Ashland, Ohio—Press reports state that the City Council plans to pave West Sandusky St.

Carrollton, Ohio—Press reports state that the City Council plans to sell $35,000 in bonds, the proceeds of which will be used for paving Malvern St.

Cincinnati, Ohio—Contracts have been awarded for paving Rittenhouse St., Walter Ave. from Gilbert Ave. to its northern terminus to the KIRCHNER CONSTRUCTION CO., at $9613 and $6208 respectively; Ridgeway Ave. from Fredonia to Drexel St., to S. M. TANNER, at $2266.

Columbus, Ohio—(Official)—Bids will be received until Sept. 10 by Clinton Cowen, State Highway Comr., for improving roads in various counties.

✚**Cuyahoga Falls, Ohio**—The contract for paving Portage St. has been awarded to WINDSOR BROS., at $33,673. Noted July 15.

✚**Dayton, Ohio**—(Official)—The contract for paving Grand Ave. with brick has been awarded to CLIFTON HOOLIHAN, River St., Dayton. Noted Aug. 12.

East Liverpool, Ohio—(Official)—Bids will be received until noon, Sept. 2, by the Board of Trustees of St. Clair Township for constructing and improving several roads.

✚**Hudson, Ohio**—A contract for paving a number of streets has been awarded to WATTERS & DOWNS, Akron, at $35,000.

Lisbon, Ohio—(Official)—Bids will be received until noon, Aug. 30, by the Trustees of Center Township, Columbiana County, for improving roads. R. T. Morris is Clk. of the Trustees.

Lorain, Ohio—(Official)—Bids will be received until noon, Sept. 8, by L. B. Johnston, Dir. Pub. Ser., for paving East 28th St. from Broadway to the west approach of the subway.

Newark, Ohio—(Official)—Bids will be received until noon, Sept. 8, by the Commissioners of Licking County for constructing Sections 2 and 3 of the Granville and Croton Pike.

Salem, Ohio—Bids will be received until Sept. 2 by the Director of Public Service for paving Goshen Ave. and Tenth St. with brick.

Toledo, Ohio—Bids will be received until noon, Aug. 31, by Albert Neukom, Dir. Pub. Ser., for paving a number of streets.

Indianapolis, Ind.—Bids will be received until 10 a.m., Sept. 3, by the Board of Public Works for improving Winthrop Ave., 42nd and 22nd St.

★**La Porte, Ind.**—(Official)—The contract for paving Lincolnway and Lincolnway East with Danville repressed paving block with asphalt filler, 1½-in. sand cushion and 6-in. concrete foundation, has been awarded to FRANK J. KING, La Porte, at $20,988.

✚**South Bend, Ind.**—(Official)—A contract for constructing a concrete road in Penn Township has been awarded to TABER & HULLIHAN, Wabash, $53,936. Noted July 22.

✚**Howell, Mich.**—(Official)—The contract for paving Grand River Blvd. has been awarded to WILLIAM H. RYAN, Lansing, at $25,379. Other bids were: Victor Seger, Saginaw, $24,652; Henry Vanderveen, Grand Rapids, $25,089; A. H. Prange, $27,392; Herman & Green, $26,558; Clamer & Johnson, Hicksville, $27,182. Noted Aug. 12.

✚**Pontiac, Mich.**—A contract for constructing 7150 lin.ft. of concrete road has been awarded to the R. D. BAKER CONSTRUCTION CO., Detroit, at $16,355.

✚**Chicago, Ill.**—A contract for street paving has been awarded to the R. F. CONWAY CO. and the AMERICAN PAVING CO. at approximately $360,000.

Mattoon, Ill.—The Board of Local Improvements has approved plans for paving South 18th St., at an estimated cost of $25,848.

✚**Woodstock, Ill.**—(Official)—The contract for constructing concrete pavements on Newell St., Madison St. and McHenry Ave. has been awarded to LOGAN & GIERTZ, Elgin, at $21,700. Noted Aug. 12.

Boscobel, Wis.—Bids will be received until noon, Sept. 2, by the City Clerk for improving various streets.

Green Bay, Wis.—Bids will be received until 2 p.m., Aug. 30, by the City Clerk for paving Emilie St. from Jackson to Van Buren St. with reinforced concrete.

Reedsburg, Wis.—Bids will be received until 7:30 p.m., Sept. 14, by the City Clerk for paving North Albert Ave.

✚**Burlington, Iowa**—The contract for paving one mile of the Agency Rd. with concrete has been awarded to CAMERON, JOYCE & CO., Keokuk, at $15,000.

✚**Valley Junction, Iowa**—A contract for constructing 22,100 lin.ft. of curbing has been awarded to RAYMOND H. WHITE & CO., at $0.277 per lin.ft. Noted July 8.

Northfield, Minn.—At a recent election the citizens voted in favor of issuing $19,000 in bonds, part of the proceeds of which will be used for street paving. Noted Aug. 5.

Pipestone, Minn.—The City Council plans to pave approximately 30 blocks of street with concrete, at an estimated cost of $100,000.

Atchison, Kan.—(Official)—Bids will be received until 5 p.m., Sept. 6, by Victor L. King, City Clk., for paving a portion of Mound St.

Great Bend, Kan.—Bids will be received until 1 p.m., Sept. 1, by F. A. Moses for constructing 20,671 sq.yd. of asphaltic concrete pavement.

✚**Mitchell, S. D.**—The contract for paving West Fourth St. has been awarded to C. H. ATKINSON.

✚**Watertown, S. D.**—A contract for paving a number of alleys has been awarded to C. H. ATKINSON, Watertown, at $4912.

✚**Missoula, Mont.**—The contract for paving Pattee St. has been awarded to J. C. McGUIRE, Butte, at $21,252. Other bids were: G. H. Nash & Co., $22,324; M. F. Rohn Construction Co., Butte, $23,592.

✚Kansas City, Mo.—The contract for grading 39th St. from Jackson to Indiana Ave. has been awarded to A. W. WOOLEY, 2819 Belleville St., at $4027.

✚Kansas City, Mo.—The contract for grading Woodland Ave. from 43rd St. south to Swope Parkway has been awarded to NORTON BROS., 3517 Main St., at $11,895. Other bids were: W. C. Mullins, 24th and Wyandotte St., $17,955; J. O. West, 916 Charlotte St., $18,855; Edward Meegan, 23rd St. and Hardesty Ave., $19,920.

St. Joseph, Mo.—Bids will be received until Sept. 1 by the Board of Public Works for grading Commercial St. from 22nd to 29th St. and 29th St. from Commercial St. to Valley Rd.

✚Houston, Tex.—(Official)—The contract for resurfacing the Wallisville Rd. from Cushing Ave. to Hunting Bayou has been awarded to HANSON & SONS, Galveston, at $6412. Noted Aug. 12.

Ingleside, Tex.—At a recent election, the citizens of Aransas County Road District No. 3 voted in favor of issuing $75,000 in bonds, the proceeds of which will be used for constructing roads.

Liberty, Tex.—Press reports state that a special election will be held Sept. 22 to vote on the question of issuing $200,000 in bonds, the proceeds of which will be used for constructing the Cleveland precinct link of the Lufkin-Livingston-Houston Highway.

Port Lavaca, Tex.—Bids will be received until Sept. 1 by H. C. Innis, Mayor, for the sale of $17,000 in bonds, the proceeds of which will be used for street improvements. Noted July 15 and Aug. 12.

✚Vernon, Tex.—A contract for street paving has been awarded to the TAYLOR BUILDING CO., Ft. Worth, Tex., at $14,800.

Woodville, Tex.—An election will be held Aug. 28 to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for road construction in District No. 1, Tyler County.

American Fork, Utah—Bids will soon be received by the Commissioners of Utah County, Provo, for constructing about two miles of road from American Fork to Pleasant Grove.

Solomonsville, Ariz.—A special election will be held in the fall to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for constructing roads in Graham County.

Auburn, Wash.—The City Council has passed an ordinance authorizing the paving of approximately 19 blocks in the residential section, at an estimated cost of $30,266.

✚Bellingham, Wash.—The contract for paving D St. with asphalt has been awarded to the WASHINGTON PAVING CO., Tacoma, at $9384.

Calumet, Wash.—Bids will be received until 1 p.m., Sept. 7, by the Auditor of Wahkiakum County for improving portions of State Road No. 19.

✚Centralia, Wash.—The Lewis County Commissioners has awarded a contract for surfacing a section of the road on Jackson Prairie to SPEAKER & McKEE, at $5927.

✚Colfax, Wash.—The contract for constructing Permanent Highways Nos. 9-A and 9-B has been awarded to W. G. MULLIGAN & CO., Spokane, at $20,800. Noted Aug. 5.

✚Olympia, Wash.—The contract for constructing the Inland Empire Highway from Colville to Spokane has been awarded to E. G. MINER, Sandpoint, Idaho, at $11,560. Noted July 29.

Olympia, Wash.—Bids will be received until 2 p.m., Sept. 8, by W. R. Roy, State Highway Comr., for surfacing three miles of National Park Highway from Ashlock to Frances in Pacific County.

Puyallup, Wash.—Bids will soon be received for grading and graveling Fifth St. in Southwest Hill District. The estimated cost of the work is $18,050.

Tacoma, Wash.—Bids will be received until 11 a.m., Aug. 28, by the Commissioners of Pierce County for improving 5.574 miles of the Pacific Highway. T. N. Morris is Clk. of the Comrs.

✚Walla Walla, Wash.—The contract for paving First St. with bitulithic has been awarded to the WARREN CONSTRUCTION CO., Portland, Ore., at $15,098.

✚Coquille, Ore.—A contract for constructing one mile of hardsurfaced road has been awarded to S. C. SMALL, Marshfield.

✚Portland, Ore.—The contract for paving Washington St. from 20th St. to City Park has been awarded to the OREGON INDEPENDENT CO., Portland, at $8782. Noted July 29.

✚Los Angeles, Calif.—The contract for improving Westminster Ave. has been awarded to the CALIFORNIA-ARIZONA CONSTRUCTION CO., at $8432.

✚Martinez, Calif.—The Board of Supervisors of Contra Costa County has awarded a contract for the construction of a macadam road from the tunnel at the county line to Byron, a distance of three miles, to the RAISCH IMPROVEMENT CO., of San Francisco, Calif., at $35,625. Noted Aug. 19.

✚Richmond, Calif.—The City Council has awarded a contract for street work to GALBRAITH & JANES, at $6209.

✚Sacramento, Calif.—The California State Highway Commission has awarded contracts for highway construction as follows: Tulare County, between Goshen and Visalia, a distance of 6.4 miles, to WHITE & GASKILL, Long Beach, at $30,37; Tulare County, from the westerly boundary to the Southern Pacific grade, 3.9 miles, to WHITE & GASKILL, at $13,812; San Luis Obispo County, between Atascadero and Paso Robles, 10 miles, to JOHN D. MARSH, Bakersfield, at $67,809; Monterey County, between Greenfield and Camphora, 11.7 miles, to the HIGHWAY PAVING CO., San Francisco, at $54,507; Santa Barbara County, between Gaviota and Zaca Station, 11.4 miles, to C. H. HUDSON, Los Angeles, at $54,586; Colusa County, through the town of Arbuckle, 0.3 mile, to the CLARK & HENERY CONSTRUCTION CO., Sacramento, at $5778; Marin County, between Burdell and St. Vincent, 4 miles, to R. B. MARBLE, JR., San Francisco, at $21,255. Noted July 22 and Aug. 5.

✚Stockton, Calif.—The City Council has awarded a contract for street improvements to EATON & SMITH, 407 11th St., San Francisco, at $84,556.

INDUSTRIAL WORKS

✚Portland, Maine—FORGIONE & ROMANO has been awarded the contract for the reconstruction of the six-story 52x90-ft. Galt Block Warehouse, Commercial and Thames St

Springvale, Maine—The E. E. Wentworth Corp. will construct a plant for the manufacture of automobiles. The estimated cost is $50,000.

✚Derry, N. H.—The contract for the construction of a three-story, 40x200-ft. factory for the Woodbury Shoe Co. has been awarded to CYRUS A. MARTIN. Noted June 17.

✚Blackstone, Mass.—The Blackstone Cotton Co. has awarded the contract for the construction of a two-story, 90x120-ft., brick addition to its mill to the J. W. BISHOP CO., Worcester, Mass.

✚Somerville, Mass.—The contract for the construction of a rolling mill for the American Tube Works, 19 Oliver St., Boston, Mass., has been awarded to E. A. ABBOTT, 141 Milk St., Boston, Mass. Noted Aug. 19.

✚Esmond, R. I.—The Esmond Mills has awarded the contract for the construction of two, two-story, 62x89-ft., brick storehouses to O. D. PURRINGTON & CO., Providence, R. I.

✚Providence, R. I.—The B. B. Lederer Estate has awarded the contract for the construction of an auto sales and service building on Broad St., to F. L. PIERCE, 74 Weybosset St. Noted Apr. 15.

✚Bristol, Conn.—The New Departure Mfg. Co. has awarded the contract for the construction of a one-story, 120x252-ft. factory to LEVERING & GARRISON. The estimated cost is $65,000. W. P. Crabtree, New Britain, Conn., is Arch.

Waterbury, Conn.—Plans have been prepared by Joseph T. Smith, Arch., for the construction of a four-story 64x135-ft. building at Grand and Canal St. for the Waterbury Democrat.

✚Amsterdam, N. Y.—JOHN J. TURNER & SONS has been awarded the contract for the construction of a two-story, 35x40-ft. garage for Harvey Chalmers. The Fuller & Robinson Co., 95 State St., Albany, N. Y., is Arch. The estimated cost is $15,000.

Amsterdam, N. Y.—F. P. Sheldon, Arch., is preparing plans for four-story addition to the plant of the Shuttleworth Mills Co.

Buffalo, N. Y.—The Kellogg Structural Steel Co. has purchased a site at Bailey Ave. and Stone St., and will build a 55x185-ft. fabricating shop.

New York, N. Y.—(Borough of Bronx)—Plans have been prepared by C. Demmerle, 1510 Bryant Ave., for the construction of a one-story, 75x170-ft. garage for the Ciryell Building Co., 1414 Vyse Ave. The estimated cost is $12,000.

New York, N. Y.—(Borough of Brooklyn)—The Consumers' Biscuit Mfg. Co. plans the construction of a four-story, 100x200-ft. garage to cost $100,000. William J. Dilthey, Union Sq. West (Borough of Manhattan), is Arch.

New York, N. Y.—(Borough of Manhattan)—Plans have been prepared by J. Graham Glover, Arch., 222 Navy St. (Borough of Brooklyn), for the construction of a seven-story, 61x84-ft. cold-storage warehouse for the Manhattan Refrigerating Co., Gansevoort St. The estimated cost is $80,000.

Pearl River, N. Y.—Bids will soon be received by William E. Austin, Arch., 46 West 24th St., New York, N. Y., for the construction of a three-story addition to the Lederle Laboratories to cost $30,000.

Richfield Springs, N. Y.—Harold Brockway plans the construction of a two-story, 40x132-ft. garage.

✚Rochester, N. Y.—The contract for the construction of a factory for the Crowther Motor Co., Philadelphia, Penn., has been awarded to WILLIAM F. MARTENS.

Rochester, N. Y.—The Vacuum Oil Co. will build a two-story, 54x92-ft. addition to its plant by day work. The estimated cost is $45,000.

✚Union, N. Y.—The Union Forging Co. has awarded the contract for the construction of a one-story, 115x136-ft. factory to the MITCHELL CO., 74 State St., Binghamton, N. Y.

Camden, N. J.—The New Jersey Auto Supply Co. will build a two-story, 80x129-ft. garage. J. C. Jeffries, 1001 Chestnut St., Philadelphia, Penn., is Arch.

East Orange, N. J.—The Nitram Mfg. Co. will build a one-story, 40x160-ft. factory on Lang St. The estimated cost is $10,000.

✚Elizabeth, N. J.—The Waclark Wire Works has awarded the contract for the construction of a one-story factory to the ALMON ENGINEERING & CONSTRUCTION CO. The estimated cost is $16,000.

Allentown, Penn.—Bids are being received by Owen Clauss, 1340 Linden St., for the construction of a one-story, 30x60-ft. garage to cost $10,000. A. W. Leh, South Bethlehem, Penn., is Arch.

Allentown, Penn.—C. P. Clauser, Secy., Allentown Dairy Co. is receiving bids for the construction of a two-story, 20x75-ft. pasteurizing plant to cost $10,000.

Gettysburg, Penn.—George F. Eberhart will build a two-story, 57x180-ft. garage on Chambersburg St.

New Kensington, Penn.—Bids are being received by H. S. Shaw for the construction of a two-story, 60x120-ft. garage. The estimated cost is $15,000. W. J. Laughlin is Arch.

Philadelphia, Penn.—Henon & Boyle, Arch., 10 South 18th St., has prepared plans for the construction of a one-story, 37x200-ft. garage for Felt Bros.

✚Philadelphia, Penn.—R. W. Harvey has awarded the contract to JAMES JOHNSON, 1721 Ludlow St., for the construction of a one-story, 17x70-ft. garage, to cost $16,000.

Pittsburgh, Penn.—The contract will soon be awarded by Carlton Strong, Arch., Union Bank Bldg., for the construction of a one- and two-story, 40x93-ft. garage for the Bellefield Dwellings. The estimated cost is $12,000.

Pittsburgh, Penn.—Bids will soon be received by the F. L. Schmeltz Co., Arch., First National Bank Bldg., for the construction of a six-story, 60x80-ft. garage for E. W. Proeger. The estimated cost is $80,000.

Sharon, Penn.—Bids are being received by the E. E. Clepper & Cowles Co., Arch., 1005 Mahoning Bldg., Youngstown, Ohio, for the construction of a one- and two-story, 125x125-ft. garage for W. C. De Forest & Son.

Wheeling, W. Va.—The National Tube Co. contemplates the construction of a $5,000,000 plant.

✚Albemarle, N. C.—The Wiscassett Mills Co. has awarded the contract for the construction of a three-story 100x125-ft. mill to HOLDBROOKS & BRADSHAW, Salisbury, N. C. The estimated cost is $125,000.

Edenton, N. C.—The Edenton Cotton Mills plans the construction of a $20,000 addition to its plant.

Granite Falls, N. C.—The Falls Mfg. Co. will build a $100,000 mill. D. W. Warlick is interested.

✚Maysville, Ky.—The January & Wood Co. has awarded the contract for the construction of a three-story 70x116-ft. factory to HARDING & SIMONS.

Cleveland, Ohio—Plans have been prepared by the Samuel Austin & Son Co., Arch., 14,230 Euclid Ave., for the construction of an addition to the plant of the Kessler Mfg. Co., 1000 Newberg Ave. The estimated cost is $14,000.

Cincinnati, Ohio—Bids are being received by Max Kau, Arch., 2241 Stratford Ave., for the construction of a one-story, 50x106-ft. garage for the Park Garage Co. The estimated cost is $10,000.

Indianapolis, Ind.—The National Motor Car Co. will build a factory at 22d and Yandes St., to cost $30,000.

Mishawaka, Ind.—Revised plans have been prepared by the Mishawaka Woolen Mfg. Co. for the construction of a four-story, 100x235-ft. and a one-story 100x167-ft. addition to its plant.

Grand Rapids, Mich.—The Grand Rapids Paper Co.,231 Fulton St., W., will build a four-story 83x163-ft. brick plant at Bond Ave., N. E., and Fairbanks St.

Chicago, Ill.—J. J. Purcell, New York Life Bldg., will build a public garage at 4071 Broadway to cost $15,000. Doerr Bros., 28 East Jackson Blvd., is Arch.

Milwaukee, Wis.—The William Frankfurth Hardware Co., 119 West Water St., will build a two-story, 50x125-ft. warehouse. W. A. Kleinsteuber, 2912 State St., is Arch.

✚Sioux City, Iowa—The Watson Automobile Co., 523 Sixth St., has awarded the contract for the construction of a two-story, 100x150-ft. garage to JAMES B. ROBINSON. The estimated cost is $25,000. F. A. Frogh, Farmers' Loan & Trust Bldg., is Arch.

Sioux City, Iowa—The Haley, Neeley Co., Second and Pierce St., will build a four-story, 100x135-ft. cold-storage warehouse to cost $75,000. William L. Steele, United Bank Bldg., is Arch.

Albert Lea, Minn.—Bids are being received by the Albert Lea Hide & Fur Co. for the construction of a one- and two-story, 40x120-ft. warehouse to cost $12,000. Hoffman & Mosse, Rochester, Minn., is Arch.

✚Topeka, Kan.—The contract for the construction of a two-story 25x150-ft. reinforced-concrete warehouse at Second St. and Kansas Ave. for Whittelsey Bros. has been awarded to F. M. SPENCER & SON, Mulvane Bldg., at $10,000.

Wichita, Kan.—The Wichita Creamery Co. will build a three-story, 50x120-ft. creamery, at a cost of $20,000. B. F. Copley, 202 North Handley Ave., is Arch.

Omaha, Neb.—Bids are being received by Albert Kahn, Arch., 58 La Fayette Ave., Detroit, Mich., for the construction of a six-story, 132x264-ft. assembling plant for the Ford Motor Co. The estimated cost is $250,000. C. L. Gould, 1916 Harney St., is Res. Mgr. Noted Aug. 12.

Caruthersville, Mo.—It is reported that the Caruthersville Cotton Oil Co. will build a $15,000 grain elevator.

Kansas City, Mo.—The Duff-Repp Furniture Co. plans the construction of a five-story, 99x132-ft. warehouse on Locust St.

✚Kansas City, Mo.—The SWENSON CONSTRUCTION CO. has been awarded the contract for the construction of a five-story 47x115-ft. concrete warehouse at 2029 Grand Ave. for the Studebaker Wagon Mfg. Co., South Bend, Ind.

Galveston, Tex.—It is reported that plans are being prepared for the construction of a $60,000 cotton storage warehouse for W. L. Moody & Co.

Texas City, Tex.—The Texas City Co., recently incorporated with a capital of $1,370,000, will build an iron and steel plant. Harvey A. Thomas, Texas City, is interestd.

Portland, Ore.—Plans are being prepared by Sutton & Whitney, Arch., for the construction of a two-story warehouse for Mrs. Fannie E. Brown. The estimated cost is $45,000.

Medford, Ore.—The Western Beet Sugar Co. plans the construction of a factory to cost about $600,000. Noted Jan. 28.

FEDERAL GOVERNMENT WORK

★Dredging—Portland, Maine—Bids were received Aug. 16, at the U. S. Engineer Office, Portland, for dredging in the St. Crois River, as follows: Eastern Dredging Co., East Boston, 53.83c. per cu.yd.; Coastwise Dredging Co., Norfolk, Va., 54,25c.; John H. Gerrish, Boston, Mass., 54.7c.; J. S. Packard Dredging Co., Providence, R. I., 66.9c.; Bay State Dredging Co., Ltd., Boston, Mass, 59c. Noted July 22.

★Moving Guard Station—Arverne, N. Y.—Bids will be received until 2 p.m., Sept. 15, by the U. S. Coast Guard, Treasury Dept., Washington, D. C., for moving the Rockway Coast Guard Station. E. P. Bertholf is Capt.

★Coal—New York, N. Y.—Bids will be received until noon, Sept. 24, at the U. S. Engineer Office, Room 707, Army Bldg., 39 Whitehall St., New York, for furnishing and trimming into U. S. dredges during period ending Sept. 30, 1916, 9000 to 25,000 tons of bituminous coal.

✚Dredging—New York, N. Y.—The contract for dredging in Hempstead and Huntington Harbors, N. Y., has been awarded to P. SANFORD ROSS, Jersey City, N. Y., at $15,000. Noted July 15.

Buildings—Ft. Mifflin, Penn.—Bids were received Aug. 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of buildings at the Naval Magazine, Ft. Mifflin, (a) shell house, (b) fixed ammunition house, (c) magazine, (d) re-forming plant extension, (e) work complete, all buildings, (f) additional price for each interior bay of shell house, as follows: Penn Bridge Co., Washington, D. C., (e) $67,437, (f) $2300; Edward Fay & Son, 2 South Mole St., Philadelphia, (a) $28,990, (b) $12,990, (c) $12,990, (d) $6990, (e) $61,960, (f) $2000; Charles D. Burns, Norristown, (a) $26,832, (b) $12,997, (c) $12,517, (d) $6044, (e) $55,686, (f) $2259; Monagan & Lasse, Philadelphia, (a) $31,168, (b) $20,527, (c) 19,808, (d) $6556, (e) $65,357, (f) $2146; Edward F. Fonder, Philadelphia, (a) $34,157, (b) $19,996, (c) $19,321, (d) $6400, (e) $67,338, alternate, $56,400, (f) $1590; Charles Gilpin, Harrison Bldg., Philadelphia, (a) $12,587, (b) $5290, (c) $24,998, (d) $11,996, (e) $53,749, (f) $1495; Armstrong & Latta, Philadelphia, (a) $33,421, (b) $16,723, (c) $15,736, (d) $7110, (e) $65,576, (f) $1600. Noted Aug. 12.

Post Office and Courthouse—Harrisburg, Penn.—Bids will be received until 3 p.m., Sept. 28, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for making extensions and remodeling the post office and courthouse at Harrisburg.

★Post Office—Smyrna, Del.—Bids will be received until 3 p.m., Sept. 29, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing the post office at Smyrna. Noted Apr. 22.

Barracks—Norfolk, Va.—Bids will be received until 11 a.m., Sept. 25, at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a three-story brick marine barracks building at Norfolk. William M. Smith is Act Ch. of Bureau.

✚★Dredging—Norfolk, Va.—The contract for dredging inland waterway from Norfolk to Beaufort, N. C. has been awarded to P. SANFORD ROSS, Jersey City, N. J., at $119,000 Noted July and Aug. 12.

★Dredging and Rock Excavation—Norfolk, Va.—Bids will be received until noon, Sept. 23, at the U. S. Engineer Office, Custom House, Norfolk, for dredging and rock excavation in the James River.

✚Post Office—Quitman, Ga.—The contract for constructing complete the U. S. post office has been awarded to the WESTCHESTER ENGINEERING CO., White Plains, N. Y., at $38,891. Noted June 24.

Attendants' Quarters—Tampa, Fla.—Bids will be received until 3 p.m., Sept. 20, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing attendants' quarters, disinfecting shed, oil house and wharf at the quarantine station at Tampa Bay.

★Machinery—Cincinnati, Ohio—Bids will be received at the U. S. Engineer Office, until 2 p.m., Sept. 24, for furnishing and installing operating machinery, etc., at Dam No. 29, Ohio River.

✚Post Office—Albion, Mich.—The contract for the construction of a post office at Albion has been awarded to the CALLAHAN-MANDL CO., Chicago, Ill., at $52,609. Noted June 24.

Post Office—Ypsilanti, Mich.—Bids were received Aug. 20, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Ypsilanti, (a) limestone; (b) sandstone, as follows: Rogers & Kaiser, Chicago, Ill., (a) $55,768, (b) $59,768; Callahan-Mandl Co., Chicago, Ill., (a) $53,815, (b) $56,000; J. S. Wahlman, Ishpeming, (a) $49,330, (b) $50,685; Westchester Engineering Co., White Plains, N. Y., (a) $55,400, (b) $58,900; George W. Stiles Construction Co., Chicago, Ill., (a) $55,839; Potters' Lumber Co., East Liverpool, Ohio, (a) $56,756; Frank L. Johnson & Co., Duluth, Minn., (a) $48,746; W. G. Carter Co., Chicago, Ill., (a) $53,340, (b) $54,540; James Devault, Canton, Ohio, (a) $57,000, (b) $60,100; Barnes Bros., Logansport, Ind., (a) $54,629; Dieter & Wenzel Construction Co., Wichita, Kan., (a) $54,982; Charles W. Gindele Co., Chicago, Ill., (a) $52,500; A. W. Lane, Chicago, Ill., (a) $56,505; W. H. Fissell & Co., New York, (a) $53,990, (b) $58,800; Christ Kanzler & Son, Evansville, Ind., (a) $58,496; R. S. Moore, Lafayette, Ind., (a) $55,590, (b) $60,090; Balkin Construction Co., Chicago, Ill., (a) $53,011, (b) $57,743; Colonial Construction & Supply Co., Charlottesville, Va., (a) $52,497, (b) $57,409. Noted July 15.

✚Breakwater—Chicago, Ill.—The contract for the construction of a rubble mound breakwater in the Chicago Harbor has been awarded to the GREAT LAKES DREDGE & DOCK CO., Chicago, Ill., at $480,000. Noted July 8.

★Structures—Malta, Mont.—Bids will be received until 2 p.m., Sept. 20, at the office of the U. S. Reclamation Service, for structures, Nelson Reservoir South Canal, Milk River Project.

★**Revetment**—Kansas City, Mo.—Bids will be received until noon, Sept. 20, at the U. S. Engineer Office, for constructing about 13,000 lin.ft. of standard revetment on Missouri River, about two miles from Hartsburg, Mo.

✚**Post Office**—Longview, Tex.—On account of the refusal of the contract by V .E. Taylor, Ennis, at $36,250, the contract has been reawarded to GEORGE A. SHAUL, Seneca, Kan., at $38,790. Noted Apr. 29 and June 10.

Post Office—Blackwell, Okla.—Bids were received Aug. 19 by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Blackwell, (a) limestone, (b) sandstone, as follows: George A. Stiles Construction Co., Chicago, Ill., (a) $36,800; Potter's Lumber Co., East Liverpool, Ohio, (a) $39,634, (b) $40,000; Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $42,313, (b) $43,313; Algernon Blair, Montgomery, Ala., (a) $36,441; Newport Contracting & Engineering Co., Newport News, Va., (a) $40,615; W. H. Fissell & Co., New York, N. Y., (a) $40,976, (b) $41,776; Dieter & Wenzel Construction Co., Wichita, Kan., (a) $39,505; George A. Shaul, Seneca, Kan., (a) $38,505; W. D. Lovell, Minneapolis, Minn., (a) $41,800; Tom Lovell's Sons, Weatherford, Tex., (a) $41,174. Noted Aug. 12.

Barracks—Mare Island, Calif.—Bids will be received until 11 a.m., Sept. 25, at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a three-story, reinforced-concrete marine barracks building at Mare Island. William M. Smith is Act. Ch. of Bureau.

✚**Buildings**—San Diego, Calif.—The contract for the construction of seven buildings at the Naval Radio Station, has been awarded to the JACOBS CONSTRUCTION CO., Los Angeles, at $39,950. Noted Apr. 8 and June 24.

Wharf Extension—San Francisco, Calif.—Bids were received Aug. 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for an extension to the receiving ship wharf at the Naval Training Station, San Francisco, extension to be 300 ft. long by 40 ft. wide, and to be of creosoted piles and creosoted braces supporting a timber deck as follows: Hyde, Harjes Co., 110 Market St., $9341; Mervey, Elwell Co., Oakland, $10,975; Tibbetts Pacific Co., 16 California St., $11,980; Thompson Bridge Co., 105 Market St., $9980; San Francisco Bridge Co., 14 Montgomery St., $10,347; C. E. Lamburth 110 Jesse St., $12,650; Healy-Tibbetts Construction Co., 9 Main St., $9730. All bidders of San Francisco unless otherwise specified. Noted Aug. 12.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., Sept. 2, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

✚**Dredging**—Pearl Harbor, Hawaii—The contract for dredging at the Pearl Harbor Naval Station has been awarded to the LORD-YOUNG ENGINEERING CO., Honolulu, Hawaii, at $0.43½ per cu.yd. Noted June 24.

Officers' Quarters—Pearl Harbor, Hawaii—Bids were received Aug. 21 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of four wooden officers' quarters at the Naval Station, Pearl Harbor from: Lord-Young Engineering Co., Honolulu, Hawaii, $27,254, and Boller & Ingvorsen, Honolulu, Hawaii, $19,890. Noted July 8.

MISCELLANEOUS

Shore Protection—Boston, Mass.—Bids will be received until Aug. 31 by the Metropolitan Park Commission, for the construction of a concrete shore protection in Revere. John R. Rablin, 14 Beacon St., is Ch. Engr.

Abutments, Etc.—Salem, Mass.—Bids will be received until Aug. 30 by the Rebuilding Commission for building abutments and pile piers for the Congress St. extension. Edmund W. Longley is Chn. of Comn.

✚**Guard Railing**—Hartford, Conn.—The contract for the construction of about 34,009 lin.ft. of wood guard railing in the towns of Columbia, Cornwall, Danbury, Old Lyme, Ridgefield, Rocky Hill, Somers, Waterbury, Wethersfield, Winchester and Woodbury has been awarded to WEBSTER & WEBSTER, East Hartford, Conn., at $6036. Noted Apr. 15.

★✚**Barge Canal Work**—Albany, N. Y.—(Official)—The following are the bids received under Terminal Contract No. 46 for a dockwall and approach on the south side of the Seneca River, west of the Weedsport Bridge: Eastover Construction Co., Utica, $17,736; Scott Bros., Rome, N. Y., $13,658; Oswego Construction Co., Fulton, N. Y., $17,435; Frank M. Skene, Rochester, $15,556; Robert Provo, Syracuse, $14,887; Chesley, Earl & Humback, Buffalo, $14,695; Shaw & Lachon, Jamestown, N. Y., $15,139; M. Fitzgerald, Hoosick Falls, $16,641. The contract for constructing a harbor and dockwall on the south side of the Mohawk River at Canajoharies, under Contract No. 37, has been awarded to HOLLER & SHEPARD, Rochester, N. Y., at $32,572. Other bids were: A. M. Hazell, 90 West St., New York, $36,152; Champlain Engineering Contracting Corporation, Saratoga Springs, N. Y., $38,116; Lupfer & Remick, Buffalo, 3$2,940; Eastover Construction Co., Utica, N. Y., $36,427; American Pipe & Construction Co., Philadelphia, Penn., $36,227. Noted July 29.

★**Subway Station**—New York, N. Y.—(Borough of Bronx)—(Official)—The following are the bids received by the Public Service Commission for the station finish work for parts of the Seventh Ave., Lexington Ave. and White Plains Rd. Transit Railroads: Snare & Triest, $908,864; Post McCord, $1,414,505; Conners Bros., $972,789; Marble Arch Construction Co., $960,373; W. H. Egan, $971,387; Station Construction Co., $944,268; Altoria Realty & Construction Co., 3 East 44th St., New York, $860,636. Noted July 29.

✚**Dredging**—New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for dredging in Newtown Canal and in the canal and basin included within the boundaries of Johnson Ave., Montrose Ave., Morgan Ave., Varick Ave., and also in the Stagg St. Basin, and in Newton Creek near the intersection of Scott and Metropolitan Ave. has been awarded to JOHN & JOSEPH McSPIRIT, 118 Wayne St., Jersey City, N. J., at $7200. Noted July 29 and Aug. 29.

Ballast—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by the Public Service Commission, 154 Nassau St., until 12:15 p.m., Sept. 10, for furnishing the supply of ballast for use in the construction of Rapid Transit Railroads.

Track Supplies—New York, N. Y.—(Borough of Manhattan)—(Official)—The following are the bids received by the Public Service Commission for a supply of track materials: Tie plates, Type "A"—Herbert W. Lockwood, 260 West St., New York, $123,975; Jones & Laughlin, $125,628; L. D. Rockwell, $132,240; Elyria Iron & Steel Co., $148,770; Pennsylvania Steel Co., $157,035; Lackawanna Steel Co., $165,300; tie plates, Type "B"—L. D. Rockwell, $13,267; Herbert W. Lockwood, $13,496. The following bids are for the supply of special work, Order No. 4, for use in the construction of Rapid Transit Railroads: William Horton, Jr., Co., Inc., $41,907; Pennsylvania Steel Co., $46,684; Ramapo Iron Works, $47,130; for the supply of special work, Order No. 3, for use in the construction of Rapid Transit Railroads: Ramapo Iron Works, 30 Church St., New York, $54,960; Pennsylvania Steel Co., $61,665; William Horton, Jr., Co., Inc., $58,920; cast iron: American Brake Shoe & Foundry Co., 30 Church St., New York, $10,528; Foran Foundry & Manufacturing Co., $13,130; Central Foundry Co., $15,830; Eastern Malleable Iron Co., $21,331. Noted July 29.

Track Materials—New York, N. Y.—(Borough of Manhattan)—(Official)—The following are the bids received by the Public Service Commission for furnishing untreated ties and timber: J. H. Burton & Co., $1,273,856; Long Leaf Pine Co., Inc., $1,276,858; Alfred R. Sax Lumber Co., $1,332,961; Frawley-Kaufman Contracting Co., $1,612,149; Rapid Transit Subway Construction Co., $1,656,643; Church E. Gates & Co., two bids, $1,852,874, $1,856,746; Hirsch Lumber Co., $2,863,740; treated ties and timber: Long Leaf Pine Co., Inc., $100,362; Eppinger & Russell, $101,484; Republic Creosoting Co., $102,589; Alfred R. Sax Lumber Co., $116,278. Noted July 29.

Fence—New York, N. Y.—(Borough of Manhattan)—(Official)—The following are the bids received for erecting a w.-i. fence and setting artificial granite gate posts around Morningside Park: William Werner, $17,450; W. H. Egan, $17,700; Amana & DeBalso, $15,470; L. C. Maxwell Co., $17,760; G. B. Wells Co., $17,760; Kelly & Kelly, $15,900; S. Rosen, $20,200; L. Weschler, $18,290; T. J. Buckley, 303 Fifth Ave., New York, $14,890; Wallade Konop, $13,904 (informal); D. Donegan, $19,760. Noted Aug. 12.

Barge Canal Work—St. Johnsville, N. Y.—The date for receiving bids for construction work at St. Johnsville has been extended to Sept. 14. Noted Aug. 19.

Jetties—Atlantic City, N. J.—According to press reports the City Commissioners have decided to construct two jetties in the Chelsea section.

Fire Station—Secaucus, N. J.—Bids will be received until 8 p.m., Aug. 31, by the Borough Council for constructing a fire station. Adrian Post is Borough Clk.

Flood Protection—Erie, Penn.—The City Council plans to issue bonds for the reconstruction of Mill Creek in the flood area. B. E. Briggs is City Engr.

Improvements to Piers and Bulkhead—(Official)—Philadelphia, Penn.—Bids will be received by John Meigs, Dir., Dept. of Wharves, Docks and Ferries, until Aug. 30, for the following: Schedule "A," composition roofing at Race St. pier, Delaware River; Schedule "B," resurfacing with concrete-gun Delaware River, bulkhead wall between Callowhill and South St.; Schedule "C," resurfacing concrete upper decks of Chestnut and Race St. piers on Delaware River.

★**Subway**—Philadelphia, Penn.—(Official)—The following are the bids received for constructing subway and station under Filbert St., City Hall and South Penn Sq.; Foundation Co., $1,763,870; Snare & Triest Co., $2,787,240; Frederick L. Cranford, Inc., and Smith, Hauser & MacIsaac, Inc., $2,404,770; New York & New Jersey Construction Co., $2,486,980; Keystone State Construction Co., Pennsylvania Bldg., Philadelphia, $1,737,320; Arthur McMullen Co., $2,286,060. Noted Mar. 18, July 8 and 15.

Subway—Philadelphia, Penn.—(Official)—The following are the bids received for constructing foundations in Front St., Kensington and Frankford Ave. from Callowhill St. to Unity St.: Edward Fay & Son, $188(278; Robert Lombardi $155,150; Keystone State Construction Co., $185,970; Peoples & Ruch, $235,240; American Paving & Construction Co., $315,640; Oscar Daniels Co., $225,815; Millard & Lupton Co., $273,150; James D. Darney, 204 East Montgomery Ave., Philadelphia, $149,235; New York & New Jersey Construction Co., $290,450; A, L, Guidone & Son, Inc., $202,334. Noted July 15.

Pier—Philadelphia, Penn.—(Official)—The following are the bids received by John Meigs, Dir. of Dept. of Wharves, Docks and Ferries, for the construction of substructure of Pier No. 78 and its adjacent bulkhead shed in the Delaware River, betwen McKean St. and Snyder Ave.: Snare & Triest Co., 233 Broadway, New York, N. Y., $516,700; Daniel S. Bader, Philadelphia, Penn., $539,000; Arthur McMullen Co., 149 Broadway, New York, $554,662; American Paving & Construction Co., Philadelphia, Penn., $569,000; Underpinning & Foundation Co., Philadelphia, Penn., $584,000; Armstrong & Latta Co., Philadelphia, Penn., $610,000. Noted June 24 and July 22.

✚**Dredging, Etc.**—Philadelphia, Penn.—(Official)—The following are the bids received for (a) dredging the Delaware River Channel opposite Port Richmond coal piers and (b) constructing a temporary bulkhead, Schuylkill River: E. H. VARE, Lincoln Bldg., Philadelphia, (b) $65,966 (awarded contract); Pugh & Hubbard, (b) $67,015; Peoples Bros., (b) $83,585; J. E. Brennen, (b) $87,212; Bowers Southern Dredging Co., Galveston, Tex., (a) $103,761; American Dredging Co., Philadelphia, (a) $108,486; Maryland Dredging Co., Baltimore, Md., (a) $111,510. Noted Aug. 5.

Pier—Baltimore, Md.—The Baltimore & Ohio R.R. will erect a coal pier at Curtis Bay to cost about $1,000,000.

✚**Retaining Wall, Bridges, Etc.**—Richmond, Va.—The Administrative Board has awarded the contract for the construction of a concrete retaining wall, two bridges, a covered flume, etc., to SAVILLE & CLAIBORNE, at $55,000.

✚**Dock and Warehouse**—Sanford, Fla.—The contract for constructing a dock and warehouse for the Clyde Steamship Co. has been awarded to S. D. SHINHOLSE, Jacksonville, at about $15,000.

Wharf—Tuscaloosa, Ala.—Press reports state that George Jacob Davis, Jr., has been engaged by the City Commission to prepare plans for constructing a municipal wharf.

Sea Wall—Bay St. Louis, Miss.—Bids will be received by the Board of Seawall Commissioners of District No. 1 for furnishing plans and specifications for a seawall about 8000 ft. long on the beach at Waveland.

Fire Boat Hull—Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, Room 511, City Hall, until noon, Sept. 1, for furnishing a new steel hull for the fireboat "Clevelander" and for installing equipment. Specifications may be obtained of A. A. Benesh, Dir. of Pub. Ser.

Fire Station—Cleveland, Ohio—The City Council will construct a fire station at East 116th and Kinsman Rd., to cast about $17,000. A. A. Benesch, 207 City Hall, is Dir. of Pub. Ser.

Comfort Stations—Columbus, Ohio—Bids will be received until Sept. 7 by George A. Borden, Dir. of Pub. Ser., for the construction of two comfort stations on the state grounds on High St. The estimated cost is $35,000.

Park Improvements—Zanesville, Ohio—The citizens have voted bonds for $26,500 for park improvements. John S. Dennis is City Engr. Noted Apr. 22.

Levee Improvements—Mound City, Ill.—Bids will be received by Charles Christmann, Secy., Rivers and Lakes Comn., 905 State Bldg., until Sept. 1, for levee repairs in Mound City. W. H. Moyers is Engr.

Drainage—Des Moines, Iowa—Jacob H. Harmon, Peoria, Ill., is making a survey for draining 23,000 acres of land in Polk, Jasper and Story Counties. The estimated cost is $400,000.

Levee Improvement—Glenwood, Iowa—Bids will be received by R. E. Humphrey, County Audr., until Sept. 7, for cleaning channel and repairing levees on Pony Creek Ditch. Seth Dean is Engr.

✚Park Improvement—Austin, Minn.—Press reports state that the contract for the removal of about 73,000 cu.yd. of earth has been awarded to the GREAT NORTHERN BRIDGE CO., Minneapolis, at 19,95c. per cu.yd.

✚Ditch—International Falls, Minn.—The contract for constructing Judicial Ditch No. 15 in Koochiching County, has been awarded by the County Commissioners to the Northern Minnesota Drainage Co., Little Fork, at $57,330.

Ditch—Morris, Minn.—Bids will be received by C. R. Wolltham, County Audr., until Sept 2 for constructing County Ditch No. 15. The estimated cost is $35,889.

Police and Fire Station—West Duluth, Minn.—Plans are being prepared by F. G. German, Arch., Duluth, for the construction of a police and fire station.

Dikes—Kansas City, Kan.—Bids will be received until 10 a.m., Sept. 3, by the Board of Directors, Kaw Valley Drainage District, 719 Osage Ave., Kansas City, for the construction of about 3500 lin.ft. of reinforced-concrete dikes. T. E. Myers is Pres.

Motor Fire Apparatus—Omaha, Neb.—The City Council plans to motorize the fire department; also install a fire alarm system.

Levees—Austin, Tex.—An election will be held soon to vote on a $120,000 bond issue for reclaiming about 120,000 acres in County Levee District No. 2. Arthur A. Stiles is State Reclamation Engr.

Drainage—Waxahachie, Tex.—The Commissioners of Ellis County Drainage District No. 2 contemplate draining about 20,000 acres of land.

Sanitarium, Bath House, Etc.—Manitou Springs, Colo.—The Manitou Mineral Water Co. is having plans prepared for a marble bath house, sanitarium and an open air swimming pool. The estimated cost is $500,000.

✚Drainage—Monte Vista, Colo.—The Rio Grande Drainage District Commissioners have awarded the contract for drainage work to ROBERT M. QUIGLEY, Denver, Colo. The estimated cost is $30,000. E. O. Cramer is Secy. Noted July 29.

✚Steamship—Seattle, Wash.—The New York & Cuban Mail Steamship Co. has awarded a contract to the SEATTLE CONSTRUCTION & DRYDOCK CO. for the construction of a 6000-ton steel steamship.

✚Sprinkler System—Tacoma, Wash.—The contract has been awarded to the PACIFIC FIRE EXTINGUISHER CO., Colman Bldg., Seattle, for the installation of 7000 Grinnell sprinkler heads and a fire protection system in the warehouses and elevators of the Tacoma Grain Co. and Sperry Flour Mills, both at Tacoma, same being combination system for two establishments. Estimated cost, $35,000.

✚Pier—Flavel, Ore.—The contract for the construction of an additional pier to the Hill Terminal has been awarded to the J. A. McEACHERN CO., Seattle, Wash., at about $15,000.

Esplanade—San Francisco, Calif.—According to press reports, the City Engineer has completed plans for the construction of an esplanade near the Cliff House to cost about $50,000.

✚Pier—San Francisco, Calif.—The State Board of Harbor Commissioners has awarded a contract for the construction of Pier 22, near the foot of Bryant St., to the TIBBETTS-PACIFIC CO., at $48,877.

★Cemetery Plans—Cochrane, Ont.—(Official)—Bids will be received until Sept. 15 by the Clerk, for furnishing plans and prices for work in laying out burial plots of a cemetery 466⅔ ft. by 466⅔ ft.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous."

✚Manchester, N. H.—The contract for the construction of a synagogue for the Congregation Anshay Sfard has been awarded to ALPHONSE GRENIER, to cost about $40,000.

Nashua, N. H.—George Markarian plans the construction of a four-story, brick business block on West Pearl St. The estimated cost is $50,000.

✚Amherst, Mass.—The Building Committee has awarded the contract for the construction of a $120,000 high school to the CASPER RANGER CONSTRUCTION CO., Holyoke, Mass. C. P. Hoyt is Arch. Noted Apr. 1.

✚Dedham, Mass.—(Official)—Samuel H. Capen, Chn. of Bldg. Com., has awarded the contract for the construction of a high school to L. B. TAYLOR, Athol, Mass., at $103,775. Noted July 26 and Aug. 12.

Fitchburg, Mass.—(Official)—The contract will soon be awarded by W. S. Bullock, for the construction of a theater on Main near Oliver St. George A. Whitney is Arch.

✚North Grafton, Mass.—The State Board of Insanity has awarded the contract for the construction of a two-story, 70x114-ft. dining-room and service building at the Grafton Colony to J. P. KEATING, Westboro, Mass.

Southbridge, Mass.—All bids were again rejected by the School Commission for the construction of a high school. The plans will be revised. F. E. Corbin is Secy. of the School Com.

✚Newport, R. I.—The DARLING-SLADE CONSTRUCTION CO. has been awarded the contract for the construction of the John Clark school on Mary St., to cost $68,500. Thomas Weaver is Arch. Noted June 3.

Providence, R. I.—Bids have been received for the construction of an 18-room school at Beaufort St. and Mt. Pleasant Ave. as follows: Famiglietti Bros. Co., $148,600; J. W. Bishop Co., $145,829; Norcross Bros. Co., $153,800; Hope Building Co., $144,435; Willmarth-Mackillop, Inc., $149,980; William Hamlyn & Son, $147,900; Charles B. Maguire Co., $133,279; Cruise & Smiley Construction Co., $147,000; Gilbane Building Co., $149,898; William Williams, $144,000. Murphy, Hindle & Wright, 146 Westminster St., is Arch. Noted Apr. 29.

Providence, R. I.—Bids will be received about Sept. 1 for the construction of a 16-room school at Cole and Luzon Ave. Stone, Carpenter & Sheldon, 802 Industrial Trust Bldg., is Arch.

✚Albany, N. Y.—(Official)—The contract for the construction of additions and alterations to the State House on Eagle St. has been awarded to the FEENEY & SHEEHAN BUILDING CO., 164 Montgomery St., Albany, at $162,000. Noted Aug. 12.

Albany, N. Y.—Bids will soon be received for the construction of a three-story brick parochial school and convent at Madison Ave. and Ontario St. for St. Vincent de Paul Congregation, Madison Ave. and Partridge St. The estimated cost is $175,000. Noted July 20.

✚Binghamton, N. Y.—The PARSONS CONSTRUCTION CO., at $147,775, has been awarded the contract for the construction of a school on Helen and New St. Sanford O. Lacey, 415 Phelps Bldg., is Arch. Noted June 17.

✚Buffalo, N. Y.—Contracts for the construction of a three-story, 135x147-ft. infants' home and mortuary building, at South Park Ave. and Ridge Rd. for Our Lady of Victory Church has been awarded to the PROGRESSIVE STEEL CO., Builders' Exchange, Buffalo, for the structural steel and E. S. JORDON, Lackawanna, for the masonry. The entire cost is estimated at $155,000.

New York, N. Y.—(Borough of Manhattan)—Work will soon be started on the construction of a 16-story jail, court and detention home for women at 133 West 30th St. Griffin & Wynkoop, Arch, 30 Church St., has prepared the plans. The cost is estimated at $365,000. Noted Mar. 25.

New York, N. Y.—(Borough of Manhattan)—Plans have been prepared by Emery Roth, Arch., 405 Lexington Ave., for the construction of a 12-story, 107x140-ft. apartment house at 1002-6 Park Ave. for the Fenlo Realty Co. The estimated cost is $450,000.

Rochester, N. Y.—(Official)—Bids will be received about Jan. 1 for the construction of a one- and two-story, 200x250-ft. brick and reinforced-concrete armory on Culver Rd. Noted July 29.

Jersey City, N. J.—Plans are being prepared by C. V. Fairweather, Arch., for the construction of a 12-story apartment building on the Boulevard near Bergen St. for John Swenson.

Trenton, N. J.—A site has been acquired on Taylor St. upon which to construct a chemical laboratory building to be used by the State Geological Survey and by the State Road Department. George S. Drew, State Arch., is preparing plans.

✚Allentown, Penn.—The contract has been awarded to OCHS & SONS, at $79,125, for the construction of the Fourteenth Ward Bldg.

✚Harrisburg, Penn.—The contract for the construction of a new building at the State Arsenal has been awarded to the BEARD CONSTRUCTION CO., Reading, at $38,480. Noted Aug. 5.

Leighton, Penn.—Contracts will be awarded about Oct. 15 for the construction of a two-story, 122x132 ft. brick and stone school. The estimated cost is $75,000. Edward Z. Scholl, 31 North Sixth St., Reading, is Arch. Noted May 27.

✚Oil City, Penn.—The contract for the construction of the Junior High School has been awarded to H. E. SHERWOOD, Oil City, at $96,500.

Philadelphia, Penn.—Bids will be received until Sept. 6 by the State of Pennsylvania Armory Board, Harrisburg, for the construction of a two-story 210x350-ft. armory on 32d St. and Lancaster Ave. Philip H. Johnson, Land Title Bldg., is Arch. Noted May 20.

Philadelphia, Penn.—The lowest bid received for the construction of a two-story, 72x142-ft. brick and stone school in Highland Park was submitted by Daniel McNamee, 1621 North 15th St., Philadelphia, at $46,900. Shore & Dodge, 608 Chestnut St., Philadelphia, is Arch.

Philadelphia, Penn.—Contracts will soon be awarded for the construction of a seven-story 56x100-ft. hospital building with two 44x108-ft. wings at Cedar Ave., between 53d and 54th St., for the Sisters of Mercy. Noted Apr. 1 and July 15.

Philadelphia, Penn.—Bids will soon be received for the construction of a ten-story addition to the Central Y. M. C. A. building on Cherry St.

Philadelphia, Penn.—Work will be started about Sept. 16 on the construction of the Central Free Library at 19th and Vine St. The estimated cost is $3,500,000. Henry R. Edmunds is Pres. of Free Libraries.

+Philadelphia, Penn.—The Board of Inspectors of the Philadelphia County Prisons has awarded the contract for the construction of a two-story 36x43-ft. hospital building, one-story 27x284-ft. ward building, and for alterations to the present building to H. E. BATON, Philadelphia, at $88,870.

+Philadelphia, Penn.—The Pennsylvania R.R. has awarded the contract for the construction of an immigrant station at Washington Ave. and the Delaware River to JOHN N. GILL & CO., Heed Bldg., Philadelphia. The estimated cost is $70,000. Noted July 22 and 29.

Baltimore, Md.—The Hebrew Orphan Asylum, Rayner Ave. and Poplar Grove St., will construct a building to cost $150,000.

Asheville, N. C.—An election will be held Nov. 2 by the City Commissioners to vote on the question of issuing $250,000 in bonds. The proceeds will be used for the construction of schools.

+Hayti, S. C.—The contract for the construction of a county courthouse has been awarded to the GRAY CONSTRUCTION CO., Watertown, at $56,872.

Louisville, Ky.—Plans are being prepared by Brinton B. Davis, Arch., Inter-Southern Bldg., for the construction of a five-story reinforced-concrete office building at Fourth and Market St. for the Bankers' Realty Co. Noted Aug. 19.

Paducah, Ky.—Plans are being considered for the construction of a ten-story steel addition to the Palmer House. The estimated cost is $200,000. John W. Keller is Mgr.

Cincinnati, Ohio—Bids will be received until noon, Sept. 12, by the Clerk of the Board of Education, City Hall, for the construction of a manual training building at the Oyler Public School, Storrs and Burns St. C. W. Handman, 511 West Court St., is Business Mgr.

Cleveland, Ohio—Theodore Schmitt, of Lehman & Schmitt, Arch., Electric Bldg., has purchased a site at Detroit Ave. and West 116th St. upon which to construct a theater, store and office building. The estimated cost is $75,000.

Cleveland, Ohio—The Thompson-Schactel Co. recently incorporated plans to construct a theater and store building at Altoona Ave. and West 35th St., Brooklyn. Estimated cost, $50,000. C. G. Thompson and S. M. Schactel of the Victor Film Service, are owners.

Cleveland, Ohio—Plans have been prepared by Koehl & Van Rensselaer, Arch., 906 Park Bldg., for the construction of a theater on Hower Ave. near Superior St. for W. A. Barnes. Estimated cost, $40,000.

Cleveland, Ohio—Bids are being received by the Cuyahoga County Commissioners for the construction of a three-story detention home for boys at Franklin and West 28th St. The estimated cost is $65,000. William S. Lougee, 500 Marshall Bldg., is Arch. Noted Mar. 25 and July 1.

Cleveland, Ohio—Plans have been prepared by O. K. Stapf, Arch., 1017 Rose Bldg., for the construction of a three-story addition and alterations to the Chamber of Industry Bldg., at Franklin and West 25th St. Estimated cost, $40,000.

Cleveland, Ohio—The Directors of the Hollenden Hotel Co., Superior and East Sixth St., contemplate the construction of a 13-story addition on East Sixth St. and Vincent Ave. The cost is estimated at $200,000.

Cleveland, Ohio—J. H. Donahey will construct a three-story building at 2002 Euclid Ave. The estimated cost is $50,000.

+Cleveland Heights, Ohio—(Warrensville post office)—(Official)—The contract for the construction of a grade school has been awarded to JAMES H. WELLS, Marshall Bldg., Clevland; at $70,167. Noted July 22.

Cleveland Heights, Ohio—(Warrensville post office)—The Cleveland Telephone Co., Telephone Bldg., Cleveland, plans to construct an exchange building on Cedar Rd. to cost about $50,000.

Crawfordsville, Ind.—Bids will be received until 1 p.m., Aug. 28, by E. W. Rean, School Trustee, for extending the wings of the high school building.

Hammond, Ind.—The Board of School Trustees has rejected all bids received Aug. 2 for the construction of the Hammond Industrial High School. The plans are being revised by J. T. Hutton & Sons, Arch., Hammond Bldg., and new bids will be received until Sept. 1. Noted July 29.

Detroit, Mich.—Plans have been prepared by Albert Kahn, Arch., Detroit, for the construction of a three-story temple at Lafayette Blvd. and Cass Ave. for the Detroit Lodge No. 34, B. P. O. E. The estimated cost is $150,000.

Detroit, Mich.—Plans have been prepared by Smith, Hinchman & Grylls, Detroit, for the construction of an eight-story addition to the building of Crowley, Milner & Co., at Monroe and Library Ave. The estimated cost is $100,000. Noted July 22.

Monmouth, Ill.—Plans prepared by Temple & Burrows, Arch., McManus Bldg., Davenport, Iowa, for the construction of a two-story city hall, have been accepted. The estimated cost is $50,000. Noted Aug. 19.

Milwaukee, Wis.—Plans are being prepared by Fernekes & Creamer, Arch., 1304 Pabst Bldg., for the construction of an addition to the armory of Troop A, Wisconsin National Guard. The estimated cost is $40,000. Noted July 8.

Milwaukee, Wis.—The Board of Education contemplates an expenditure of $1,100,000 for the construction of school buildings throughout the city.

Milwaukee, Wis.—Bids will be received about Sept. 15 for the construction of a three-story brick and stone addition to the West Dixision High School, 23d and Prairie St. The estimated cost is $50,000. Van Ryn & De Gelleke, 726 Caswell Block, is Arch. and Frank M. Harbach is Secy. Bd. of School Dirs. Noted Aug. 19.

St. Croix Falls, Wis.—Bids will be received until 5 p.m., Aug. 31, by J. C. Heglund, Village Clk., for the construction of auditorium buildings. Hartford & Hausler, St. Paul, Minn., is Arch.

+Superior, Wis.—The contract for the construction of a church and parochial school for the St. Stanislaus Polish Catholis Parish has been awarded to R. J. CHENEY, at $46,701.

West Allis, Wis.—Preliminary arrangements are being made by the Holy Assumption congregation for the construction of a church and parish house. The estimated cost is $50,000.

Charter Oak, Iowa—Bids will be received until Sept. 7 by the Board of Education for the construction of a two-story brick school. The estimated cost is $45,000. Edward L. Barber is Arch. Noted July 22.

+Des Moines, Iowa—The contract for the construction of a 12-story reinforced-concrete hotel for M. Brown has been awarded to J. C. MARDIS. The estimated cost is $150,000.

Des Moines, Iowa—Plans are being prepared by N. T. Vorse, Arch., Des Moines, for the construction of a brick building for the Grocers' Wholesale Co. The estimated cost is $50,000. Noted July 29.

Grinnell, Iowa—(Official)—At a recent election the citizens defeated the question of issuing $100,000 in bonds, the proceeds of which will be used for the construction of a high school. Noted July 29.

+Sheldon, Iowa—The contract for the construction of the O'Brien County Courthouse has been awarded to J. E. LOVEJOY, Des Moines, at $118,312.

+Milaca, Minn.—The contract for the construction of a two-story high school has been awarded to STROMBERG & SAMUELSON, Milaca. Estimated cost, $40,000. Noted June 17.

Wisner, Neb.—Plans are being prepared by John Latenser, Arch., 626 Bee Bldg., Omaha, for the construction of a school. The estimated cost is $40,000. Noted June 24.

+Casper, Wyo.—The contract for the construction of the Chicago, Burlington & Quincy R.R. depot has been awarded to GEORGE W. STILES, Chicago, Ill., at $87,000.

+Butte, Mont.—The contract for the construction of additions and alterations to the high school has been awarded to H. L. HANSON, Butte, at $94,640. Noted May 20.

+Miles City, Mont.—(Official)—The contract for the construction of an addition to the high school has been awarded to the EDWARD SEERIE CO., Billings, at $47,242. Other bids were: Cleanman & Co., Miles City, $47,450; Horton & Willits, Great Falls, $49,480; Lloyd Construction Co., St. Louis, Mo., $51,353; N. P. Nelson, Miles City, $51,300; W. G. Reed, Dillon, $51,475. Noted July 22.

Kansas City, Mo.—E. W. Shields, Kansas City, will construct a five-story commercial building at 2029 Grand Ave. The estimated cost is $80,000.

St. Louis, Mo.—Plans are being prepared for the construction of a brick and steel church at Margatetta and Fair Ave. for the Independent Evangelical congregation. The estimated cost is $70,000. A. Meyer, Central National Bank Bldg., is Arch.

Cleveland, Tex.—Bids will be reecived until noon, Aug. 28, by G. O. Bartle, Pres., School Bd., for the construction of a brick and concrete school. Noted June 17.

+Pharr, Tex.—The contract for the construction of a high school has been awarded to CRAWFORD & HORN, Yookum, at $48,000. M. L. Weller Co., Ft. Worth, is Arch.

Salt Lake City, Utah—Plans have been prepared and bids will soon be received by the School Board for the construction of the Granite High School. The estimated cost is $45,000. Cannon & Fetzer, 506 Temple Bldg., is Arch.

+Davenport, Wash.—The contract for the construction of a two-story brick school has been awarded to JAMES SHERIDAN, Spokane, at $40,000. Noted July 1.

Grand Mound, Wash.—Bids will be received until Aug. 31 by E. S. Emigh, Secy., State Bd. of Control, Olympia, for the construction of a two-story concrete and brick building at the State School for Girls. The estimated cost is $60,000. Noted Aug. 5.

Mt. Vernon, Wash.—At a recent election the citizens voted to issue $60,000 in bonds, the proceeds of which will be used for the construction of a school.

Seattle, Wash.—Bids will be received about Sept. 1 for the construction of the five- and eight-story buildings at Westlake, Fourth, Stewart and Olive St. The estimated cost is $500,000 and $850,000 respectively. Bibb & Gould, Denny Bldg., is Arch.

+The Dalles, Ore.—The contract for the construction of terminal buildings for the Oregon, Washington R.R. & Navigation Co. has been awarded to NETTLETON, BRUCE & ESHBACH, Seattle, Wash. The cost is estimated at $100,000. Noted June 24.

+Portland, Ore.—The contract for the foundation work of the construction of the First National Bank Bldg. has been awarded to F. H. MILES. The estimated cost of the entire building is $400,000. Noted Apr. 29.

+Los Angeles, Calif.—FRED W. SIEGEL has been awarded the contract for the construction of the two-story 150x170-ft. building on Wilshire Blvd. for the Marlborough School for Girls. The estimated cost is $70,000. John C. Austin, 1125 Baker-Detwiler Bldg., is Arch.

Los Angeles, Calif.—Preliminary plans are being prepared by George Low, County Supt. of Const., for the construction of an eight-story, 110x175-ft. building at Temple and New High St. The estimated cost is $350,000.

Pasadena, Calif.—Plans are being prepared by Elmer Grey, Arch., for the construction of a three-story chemical laboratory for the Throop College of Technology. The estimated cst is $60,000.

San Bernardino, Calif.—Plans are being prepared by Jeffrey & Schafer, Arch., Wesley Roberts Bldg., for the construction of a building for the First Congregational Church. The estimated cost is $50,000.

Santa Clara, Calif.—The San José Film Co. contemplates the construction of a motion-picture studio. The estimated cost is $40,000. Ellis & Skilling, San José, is Arch.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

PRICE CHANGES AND THE BUSINESS OUTLOOK

General improvement in trade has continued throughout the month of August with practically no diminution of volume in any line, and in many branches of industry, there has been a distinct quickening. In fact in so many varied endeavors has the improvement been marked, that it may be said to be general. It is of course less in evidence in the engineering and contracting field than in any other, for in these fields of large enterprises, things always move slowly.

Special activity is noted in the iron trade. The leading manufacturer of iron and steel is operating to 90% of capacity, some of the smaller companies are practically at a maximum. It is evident that the steel makers have entered on a period of prosperity, and from the number of orders booked for future delivery, and the premiums paid for prompt shipments, it is more than likely that this boom will continue for many months at least. An ambition program of steel mill construction and extensive improvement has started by manufacturers in and around the Youngstown district, and in the South, too, there is more activity. It is evident that some steps are being taken to bring to New York harbor some of the iron minufacturing of the country.

In the general trade there has been many lines of improvement which is encouraging. The market for securities showed a decided improvement, and as this is often taken as an indication of other improvements, the omen is considered a good one. Manufacturers of other lines of material report more business. The lumber trade shows a slight improvement. In the cement industry, the new prices seem full maintained.

New enterprises are springing up in all parts of the country. Efforts are being made to stimulate many lines of manufacture such as were never before thought of in this country, and should the manufacturers of Europe be so occupied with other affairs for another year or more, they will find a large part of their business controlled by United States manufacturers. It is especially noticeable that foreign trade in the United States is increasing by leaps and bounds, particularly export business. While a large share of this is to the belligerent nations in Europe, there is still enough business to South America and other parts of the globe where men are occupied in peaceful pursuits to indicate that American manufacturers are at last securing a fair foothold.

The outlook for crops is most excellent. A large wheat crop is already assured. Corn crops will also be satisfactory, and from present indications it is evident that the cotton crop will be large enough to cause some trouble in handling to the growers.

Buying by the railroads has been light. They have steadfastly kept out of the market, and even the more prosperous trunk lines are unwilling to make expenditures for improvements until it is determined just how far legislation is going to effect them.

Trade in munitions of war in all lines is especially active. The machine shops that make munitions and supplies for the warring nations have all the business they need.

Financial conditions were scarcely ever more satisfactory to American manufacturers, and the promotion of many American enterprises has been successful. There is a plethora of gold in the country to be used as a basis for obtaining credit, and the only difficulty seems to be that credit may be established more rapidly than actually needed. It is to be remarked in this connection, however, that the bankers seem disposed to put a curb on any but sound enterprises, and even these cannot be financed by borrowed money.

Construction of subways and rapid transit railway extensions in New York continue without any halt. The amount of labor necessary can be obtained. The supply of labor seems sufficient for all needs, and although there have been several strikes during the month, most of them have occurred in plants where munitions of war are being manufactured, and in places where, due to unusual circumstances, there was a great demand for labor. The general rough labor supply seems unusually large.

The metal trade suffered a severe reverse during the month, the price of copper being slightly reduced, spelter dropping down and other metals losing prices almost as fast as they gained in the early spring. Toward the end of the month, a steady demand was evident, and it seems likely that the low spot was reached during the last half of the month.

CEMENT, LIME AND BRICK

Portland Cement—Business continues fairly active and there has been an increase in price. In New York to contractors it is now $1.57, including the charge for bags. For contractors the following prices are for cargo lots and include the usual charge for bags:

Chicago	$1.56	Boston	$1.72
Detroit	1.65	Cleveland	1.69
Jersey City	1.51	Duluth	1.86
New York	1.57	Minneapolis	1.83
St. Paul	1.83	Pittsburgh	1.56

Brick—The market shows firmness. There have been some labor troubles at Haverstraw but shipments continue as usual. The demand has strengthened and prices have increased. Quotations in New York are $5.75 to $6.

Labor—There seems to be an exceptional demand for unskilled labor for highway and railway work. Formerly a charge of $1.65 to $1.75 was made for such work, but now such men are scarce at $2. This is for a 10-hr. day. Due to the volume of work handled by the machine shops in this country, labor of this type is practically impossible to secure at from $3.50 to $4.50. Under ordinary conditions such could be had at from $2.50 to $3.50. There is scarcely any call for building laborers.

Crushed Stone—Among the principals in this field there seems to be a lot of price cutting. In fact, there is so much of this being done that dealers hesitate at quoting any price as firm. Bids on the Public Service contract calling for 300,000 yd. of ballast showed such a wide range of difference that as a result all bids were rejected. This contract is now being readvertised and bids will be opened on Sept. 10. In general, it may be said that business is fair. Quotations have been made as low as 60c. on several contracts. A rumor has been floating around to the effect that several of the larger companies were about to merge with the view of creating a more stable market.

IRON AND STEEL

Pig Iron—A rapid increase in the demand not only for steel-making irons but for foundry irons was evidenced all through the month, and at the end premiums were paid for early deliveries of steel-making irons, manufacturers having refused to take orders for prompt shipments unless some business was included in it, and many of them refused to quote on any 1916 business. As an example, some of the manufacturers in the Birmingham district demanded as high as $12.50 for 1916 shipments. Not more than two months ago, No. 2 Southern Birmingham was selling at $9.50. Steel-making iron advanced just as rapidly. There is a very small accumulation of iron, and practically all the producing factories in the country are manufacturing iron, but in spite of this, consumption is more rapid than production. Prices are considerably higher than last month, and in lots of 100 tons and over prices are as follows: Cincinnati Southern Foundry No. 2, $13.90 to $14.40; Cincinnati Northern Foundry No. 2, $16.26 to $16.51; Cincinnati Northern Foundry No. 3, $15.01 to $15.26; New York Northern Foundry No. 2 plain, $15.25 to $15.50; New York Southern Foundry No. 2, $15.75 to $16; New York Northern Foundry No. 2, $15.50 to $15.75. In Chicago, Northern Foundry No. 2, $13.50 to $14; in Birmingham, Southern Foundry No. 2, $11 to $11.50. In Pittsburgh, bessemer iron is $16.45 and basic is $15.45. These quotations include the freight charge from the valley to the Pittsburgh district.

Steel Rails—Business is slack. Domestic demand is very small and the foreign demand is not anywhere up to the capacity of the country. Railroads have bought very sparingly, and there is little prospect that they will buy much more for this year's delivery. Improvements are being made in rolling-mill construction, and one of the subsidiaries of the United States Steel Corporation is building a mill which will be able to roll sections up to 150 lb. per yd. The Russian order was finally placed, and this calls for a thousand tons a day until the entire order of 75,000 tons is placed. Quotations are without change, and for lots of a thousand tons or over prices are as follows: Standard sections of bessemer are $28; openhearth, $30; both per gross ton f.o.b. Pittsburgh. Girder rails in 30-ft. lengths are $36.40 per ton; in 60-ft. lengths, $38.40 per gross ton, both f.o.b. New York. Other quotations f.o.b. Pittsburgh, for large lots, prices given in cents per lb., ars as follows: Standard sections, bessemer, 1.25c.; openhearth, 1.34c.; 20- to 30-lb., 1.125c.; 15- to 20-lb., 1.175c.; 12- and 14-lb., 1.225c.; 8- and 10-lb., 1.275c.

Track Supplies—The chief interest in the market for track supplies has been the Russian order for 75,000 kegs of spikes, which are slightly different from the ordinary American spikes, and so far the samples have not met the requirements of the engineers. It is evident, however, that they will be met. This buying has been sufficient to advance quotations. Spikes are now held at $1.60 per keg. Track bolts and square nuts are 1.90 to 2c., both in carload lots. Angle bars are quoted at the unchanged price of 1.50c., Chicago. These prices are given in cents per lb. Tie plates are $2 per ton higher and $28 per net ton f.o.b. the mill in the Chicago district.

Structural Materials—Business shows a gain. The Bridge Builders Society reports its operations as about 80% of the capacity of the American shops. A great deal of business has been taken during the last few months. There have been rush orders for mill building, and some of these have been fabricated with astonishing rapidity. Railroads are building some bridges, and there has been quite a little state and county work, but the heavy bridge building and the large office buildings have been conspicuous by their absence. Prices are a dollar per ton higher than last month, and are as follows: I-beams 3- to 15-in., channels 3- to 15-in., angles 3- to 6-in., T's 3-in. and over, are 1.30c. Cutting to specified lengths is charged at the following rates: 2 ft. to 3 ft. inclusive, 25c.; 2 ft. to 1 ft., 50c.; under 1 ft., $1.55. No charge is made for cutting to specified lengths above 3 ft. In Philadelphia, the base price is $1.51; in San Francisco, $2.15; in New York, $1.52. All of these quotations are per 100 lb.

Plates—The mills rolling plates have had considerable business for shipbuilding yards, but as yet there has been very little business booked by car manufacturers. Makers of riveted water pipe have also shown little disposition to come into the market. There seems to be every indication that the shipyard capacity of the country, especially on the Atlantic Coast, will be increased in the near future, and the manufacturers of plates are looking forward to the next session of

Congress with considerable interest, to say the least, in an endeavor to ascertain what the program of naval construction will be. Prices are higher, as follows: Minimum, Pittsburgh, $1.30. This is equivalent to $1.44 Chicago, $1.51 Philadelphia and $1.47 New York. The above quotations are per 100 lb.

Pipe—Prices hold fairly steady. The market for galvanied pipe has diminished slightly, resulting in an increased discount. For carload lots f.o.b. Pittsburgh, the discounts are as follows:

	Black	Galvanized
¾- to 2-in. steel, butt welded	79%	63½%
2½- to 6-in. steel, lap welded	78%	62½%
7- to 12-in. steel, lap welded	76%	58½%

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
¾-in.	2.43	4.19	5-in.	32.56	55.50
1-in.	3.57	6.20	6-in.	42.24	72.00
1¼-in.	4.83	8.39	7-in.	57.12	98.77
1½-in.	5.77	10.03	8-in.	60.00	$1.03
2-in.	7.77	12.55	9-in.	82.80	1.43
2½-in.	12.87	21.93	10-in.	98.99	1.70
3-in.	16.83	28.68	11-in.	$1.11	1.92
4-in.	23.98	40.87	12-in.	1.21	2.10

Cast-Iron Pipe—The exceptional demand for pig iron has caused some concern among the pipe manufacturers and there is a hesitancy to quote on deliveries running into 1916. Although municipal contracts have not been so numerous, manufacturers are fairly busy. Prices are firm and $1 higher in some markets. In New York prices are steady, 6-in. pipe, Class B, being quoted at $23.50 to $24, Class A pipe $24.50 to $25; and the same price applies to gas pipe. In Birmingham quotations f.o.b. yard are as follows: 4-in., $21.50; 6-in. and upward, $19.50. Gas pipe is $1 per ton higher. In Chicago 4-in. pipe is $26; 6- to 12-in., $24; 15-in. and upward, $23.50.

Old Materials—Continued activity characterizes the market. Prices are still climbing upward, and some of the specialties have jumped as high as $2 to $2.25 per ton. Dealers in New York furnish quotations as follows:

	Per Gross Ton
Heavy-melting steel scrap	$12.00 to $12.25
Pipes and flues	7.50 to 7.75
No. 1 railroad wrought	13.50 to 14.00
Stove plate	9.75 to 10.00
No. 1 machinery cast	12.75 to 13.00
Wrought turnings	7.50 to 7.75

In Chicago the advance in prices has been so decided and such rapid sales were made that it is believed that business in this line has about reached a turning point, and at present general conditions point to an easier market. The Steel Corporation has made a purchase of 10,000 tons of steel for its Duluth plant. Some of the railroads have made very large purchases of railroad scrap, and current quotations are $11.75 to $12.25. In the Chicago market quotations have made a decided advance over last month, as follows:

	Per Gross Ton
Heavy-melting steel scrap	$11.75 to $12.25
	Per Net Ton
No. 1 railroad wrought	$11.00 to $11.50
No. 2 railroad wrought	10.50 to 10.75
No. 1 cash scrap	10.00 to 10.50
Pipes and flues	8.75 to 9.25
Agricultural malleable	9.00 to 9.50
Railroad malleable	10.50 to 11.00

Chain—Prices are steady and without change, as follows. These prices are per 100 lb., f.o.b. Pittsburgh:

5/16 in.	$7.50	½ and 9/16 in.	$3.00
¼ in.	4.95	5/8 and 11/16 in.	2.90
5/16 in.	3.95	¾ and 13/16 in.	2.80
⅜ in.	3.40	⅞ and 15/16 in.	2.70
7/16 in.	3.20	1 to 1¼ in.	2.60

EXTRAS TO ABOVE LIST PER 100 POUNDS

	For BB	For BBB
3/16-in. and ¼-in.	$1.50	$2.00
5/16-in. and larger	1.25	1.75

Wire Rope—Business is good, but prices for galvanized rope are unchanged. Discount off list for galvanized is 40 and 5%; for bright it is 55 and 5; and special brands of bright are sold at 50 and 5. At the above discounts the net price of wire rope at the mills is as follows:

Diameter in Inches	Price per Foot Cast Steel	Crucible Steel	Plow Steel
2½	$0.75	$0.90	$1.07
2¼	0.61	0.73	0.86
2	0.47	0.57	0.67
1¾	0.39	0.49	0.58
1½	0.28	0.34	0.40
1¼	0.20	0.24	0.27
1	0.13	0.15	0.18
¾	0.08	0.09	0.11
⅝	0.06	0.07	0.08

Merchant Steel—A number of small orders are cropping up and business shows an increase. In most of the following shapes there have been decided advances in price. The following are quotations from jobbers' store:

	Cents Per Pound
Refined iron:	
1 to 1⅞ in., round and square	1.85
1½ to 4 in. x ⅜ to 1 in.	1.85
1½ to 4 in. x ¼ to 1/16 in.	2.05
Norway bars	4.00
Burdens bar iron	3.15
Soft steel:	
¾ to 3 in., round and square	2.05
1 to 6 in. x ⅜ to 1 in.	2.05
1 to 6 in. x ¼ and 5/16	2.20
Rods—⅝ and 11/16 in.	2.15
Bands—1½ to 6x1/16 in. to No. 8	2.35
Beams and channels—3 to 15 in.	2.10
Angles:	
3 in. x ¼ in. and larger	2.10
3 in. x 5/16 in. and ⅛ in.	2.55
1½ to 2¾ in. x 3/16 in. and thicker	2.20
1½ to 2½ in. x ⅛ in.	2.30
1 to 1¼ in. x 3/16 in.	2.30
1 to 1¼ in. x ⅛ in.	2.35
Tees:	
1½ to 2½x¼ in.	2.25
1½ to 2½x3/16 in.	2.35
3 in. and larger	2.20

Triangle Mesh—Prices over last month remain unchanged, the following quotations, however, being approximate:

PRICE PER 100 SQ.FT.

Style No.	Cross Sec. Area per Ft. Width	Plain Material—Carload Lots	Plain Material—Less Than Car Lots and Over 10,000 Sq.Ft.	Galvanized—Carload Lots	Galvanized—Less Than Car Lots and Over 10,000 Sq.Ft.
†4	0.102	$1.00	$1.23	$1.12	$1.34
5	0.077	0.80	0.97	0.89	1.00
6	0.058	0.63	0.77	0.71	0.84
†7	0.041	0.49	0.60	0.55	0.66
†23	0.170	1.69	2.05	1.88	2.24
24	0.142	1.46	1.77	1.62	1.93
25	0.124	1.29	1.57	1.43	1.71
†26	0.110	1.17	1.42	1.30	1.55
†27	0.085	0.96	1.17	1.07	1.28
28	0.066	0.80	0.97	0.89	1.06
29	0.049	0.66	0.80	0.73	0.87
31	0.261	2.49	3.02	2.76	3.29
32	0.225	2.16	2.62	2.40	2.86
33	0.196	1.93	2.34	2.14	2.55
34	0.140	1.48	1.80	1.64	1.96
35	0.109	1.17	1.42	1.30	1.55
36	0.075	0.87	1.05	0.97	1.15
38	0.380	3.55	4.30	3.93	4.68
†39	0.325	3.05	3.70	3.38	4.03
40	0.283	2.68	3.25	2.97	3.54
41	0.208	2.05	2.48	2.27	2.70
42	0.151	1.55	1.88	1.72	2.05
†43	0.101	1.10	1.34	1.23	1.46

†This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths of rolls are 150, 300 and 600 ft. Cutting to special length is charged extra.

Bars, Concrete Reinforcing—Although the demand for structural shapes is rather slack at the mills, the market is still very strong because of the number of orders for war supplies. In the Pittsburgh district there has been an exceptional volume of business for the warehouse men, and the price as a result has jumped. In New York no improvement is noticeable and the quotations remain the same as a month ago. Prices are as follows:

Size	Cents per Pound—Mill Shipments, Pittsburgh	*Warehouse, Pittsburgh	Delivered from Warehouse, New York
¾ in. and longer	1.30	1.65	2.05 to 2.10
⅝ in.	1.35	1.70	2.10 to 2.15
½ in.	1.40	1.75	2.25 to 2.30
⅜ in.	1.55	1.90	2.35 to 2.40
¼ in.	1.80	2.15	2.70 to 2.75

*Bars from warehouse are cut to desired length without extra charge. These prices are for carload lots.

Steel Sheet Piling—Conditions are unchanged and prices remain steady at 1.55 to 1.60 per 100 lb. f.o.b. Pittsburgh.

Freight Rates—The freight rate on finished steel products in the Pittsburgh district, inculding plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, black sheets (except planished), chain, etc., are as follows in cents per 100 lb.; Boston, 18.9; Buffalo, 11.6; Baltimore, 15.4; Cleveland, 10.5; Cincinnati, 15.8; Chicago, 18.9; Denver, 68.6; New Orleans, 30c.; New York, 16.9; Philadelphia, 15.9; St. Louis, 23.6; Minnesota and St. Paul, 32.9. Pacific Coast (all rail), 80c

CLAY PRODUCTS

Flue Lining—There has been no improvement in business over last month, and prices remain unchanged, with a discount of 80% off list. At this rate, prices are as follows:

FLUE LINING PRICE PER FOOT

Size	Weight in Lb.	Price per Ft.	Size	Weight in Lb.	Price per Ft.
4½x8½-in.	14	$0.07	8½x18-in.	45	$0.18
4½x13-in.	20	0.09	13x13-in.	45	0.17
7x7-in.	15	0.08	13x18-in.	57	0.24
8½x8½-in.	18	0.09	18x18-in.	75	0.40
8½x13-in.	28	0.13			

Sewer Pipe—With the close of the summer season near at hand there seems to be an improvement in the demand for this material. However, the following discounts still remain effective: On 3 to 24 in., 82% off list; 27 to 30 in., 72%; 30 to 36 in., 67%. At these discounts, prices are as follows:

PRICE OF SEWER PIPE PER FOOT

Size		Size	
3-in.	$0.045	18-in.	$0.342
4-in.	0.045	20-in.	0.405
5-in.	0.072	22-in.	0.54
6-in.	0.072	24-in.	0.585
8-in.	0.099	27-in.	1.26
10-in.	0.144	30-in.	1.54
12-in.	0.18	33-in.	2.06
15-in.	0.243	36-in.	2.31

METALS

Copper—Dullness prevailed in the copper market during the greater part of the month. This condition was caused, no doubt, by the excessive production and the falling off in demand. Prices were pressed steadily during the greater portion of the month until the quotations for electrolytic reached 16c. For two months consumers neglected the market to such an extent that the price receded from over 21c. to 16c. During the last days of the month electrolytic copper advanced 18c. for both spot and 30 days delivered, but inquiry failed to reveal any great volume of business done at the high price. Numerous small transactions were reported, but most of the buyers were speculators. Some inquiries for round lots from domestic consumers were in evidence, but no large transactions were consummated. In some quarters it is intimated that the increase in price from 16c. to 18c. was a result of manipulation on the part of producers who have come to the conclusion that the metal must be supported until production can be curtailed.

Tin—While fluctuations in the tin market during August were not marked, in general the tendency towards lower quotations showed a strong undertone. In some quarters improvement in the demand for both spot and future metal is expected, it being felt that the August statistics will show a smaller visible supply with heavier deliveries into consumption. Arrivals into this market during August amounted to 3841 tons and stocks afloat for ports in the United States amount to 4439 tons. The price of tin at the beginning of the month was 35c. and at the close the quotation was the same, although during the interval prices had been as low as 33¼c.

Lead—Until late in the month prices for lead were steadily downward. The month opened with a market quotation of 5.75c., but by the middle of the month prices were depressed to 4.5c. per pound. Buying was limited to small quantities and producers failing to observe renewed orders from foreign sources and manufacturers of war munitions began throwing stock on the market. Consumers did not evince much interest even at the lower prices until well towards the end of the month, when an abrupt change took place and prices advanced rapidly to 4.75c. Consumers became interested as usual when prices advanced, and while production is reported to be in excess of the demand it is felt among sellers that the surplus will be easily absorbed.

Spelter—There was a steady decline in spelter during the entire month until the last week, when quotations were advanced sharply. The spot price at the beginning of the month was 19c. and the decline continued until 11c. was the ruling basis for trading. However, during the last week of the month a fairly good demand brought an upward turn and the market closed strong at 15c. The impression prevailed that a short interest had attempted to cover and found extreme difficulty without paying advancing prices. But this element did not account for all of the rise, and no doubt consumers and speculators contributed their share in the change of prices and sentiment.

Old Metals—During the month old metals have been strong and fairly active. The selling prices are quoted approximately as follows, in cents per pound:

Copper, heavy cut and crucible	15⅞
Coper, heavy and wire	15⅜
Copper, light and bottoms	14⅛
Heavy machinery composition	12⅜
Brass, heavy	10¼
Brass, light	9½
No. 1 clean brass turnings	13¾
No. 1 composition turnings	11⅜
Lead, heavy	4¾
Tea lead	4
Zinc scrap	11⅜

MISCELLANEOUS

Swedish (Norway) Iron—The market at present is practically exhausted. Efforts are being made by some of the dealers to pick up any small lots obtainable, but with little success.

Asphaltum—Through the South and Middle West there has been a considerable amount of business. One of the leading interests has started a new plant in Louisiana to aid in supplying these sections. Due to the increased volume of work and the strong demand for Mexican asphalt petroleum, the price has been increasing. At present sheet paving asphalt per ton in packages f.o.b. refinery is quoted at $13 to $15.

Blue Stone—Dealers were able to maintain the same prices during the month, due to the fact that production was decreased. Some of them cut a cent or two on the present prices, but the following are fairly steady: Bronx flagging sells at 17c. per sq.ft. and Manhattan, 18c. per sq.ft. Curbing 5x16 in. sells at 40c. per lin.ft., 5x20 in., at 45c.; sewer bottoms 5x5 ft. by 3 in. at 25c. per sq.ft.; Belgian bridging 5x24 in., 65c., per lin. ft.

Railway Ties—One of the larger interests closed contracts with two or three of the principal roads, and it is now believed that conditions have reached the turning point and business will improve. There have been a number of European inquiries received but few orders are coming from the other side. Freight rates are still high, which tends to hold prices at about the following level: First-class standard ties 7x9 in. by 8 ft. 6 in. sell at 73c.; 6x8 in. by 8 ft. at 61c., these prices being f.o.b. New York.

CATALOG NOTICES

Templeton, Kenly & Co., Ltd., 1020 South Central Ave., Chicago, Ill. Bulletin Catalog No. 115. Simplex jacks. Illustrated, 24 pp., 6x9 in.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin No. 130. Lubrication of Pneumatic Tools. Illustrated, 8 pp., 6x9 in.

Burd High Compression Ring Co., Rockford, Ill. Directory of piston ring sizes for trucks, tractors, engines, etc. Illustrated, 134 pp., 4½x7 in.

Studebaker Corp., South Bend Ind. Catalog No. 1005. Bottom dump wagons and dump boxes. Illustrated, 32 pp., 5x8 in.

Kaustine Co., Inc., Ellicott Square, Buffalo, N. Y. Catalog. Kaustine private sewage disposal systems. Illustrated, 16 pp., 6x9 in.

Sweet's Steel Co., Williamsport, Penn. Catalog. Light and heavy steel tee rails, angle bars, concrete reinforcing bars, etc. Illustrated, 10x12 in.

The Globe Iron Roofing & Corrugating Co., Cincinnati, Ohio. Catalog H. Sheet metal building materials. Illustrated, 166 pp., 7x10 in.

The Raymond W. Dull Co., Chicago, Ill. Catalog. Sand and gravel washing plants. Illustrated, 80 pp., 7x10 in.

American Pulverizer Co., East St. Louis, Ill. Catalog No. 21. Pulverizers, air separators. Illustrated, 12 pp., 3½x9 in.

Berlin Mills Co., Portland, Maine. Pamphlet. "Structural Wood and its Preservation from Decay." Illustrated, 26 pp., 6x9 in.

J. W. Fiske Iron Works, 78-80 Park Place, New York. Catalog. Wrought iron railing entrance gates, wire fencing. Illustrated, 64 pp., 8x10½ in.

Lea-Courtney Co., Newark, N. J. Catalog H-2. Centrifugal pumps. Illustrated, 64 pp., 6x9 in.

Cornell Iron Works, 26th St. & 11th Ave., New York. Catalog. Rolling steel shutters. Illustrated, 16 pp., 6x9 in.

The Emerson Pump & Valve Co., Alexandria, Va. Catalog. Steam pumps. Illustrated, 79 pp., 6¼x9½ in.

Templeton, Kenly & Co., Ltd., 1020 South Central Ave., Chicago, Ill. Catalog. Simplex Jacks. Illustrated, 23 pages, 6x9 in.

INDUSTRIAL NOTES

Charles B. Burger, Principal Assistant Engineer to George W. Fuller, Consulting Engineer, 170 Broadway, New York, has resigned to accept a position as Consulting Engineer with the Atlantic Refining Co., Philadelphia, Penn.

The Keuffel & Esser Co., Hoboken, N. J., has been awarded the Grand Prizes at the Panama Pacific International Exposition, for its exhibit of drawing materials, slide rules, surveying instruments, telescopic sights and periscopes.

The Pacific Tank & Pipe Co., Portland, Ore., has changed its name to the National Tank & Pipe Co. The personnel of the new corporation remains the same, and the business policy of the company will be directed along the same lines as it has been during the past.

Arthur M. Torrey, formerly with the soliciting department of Hildreth & Co., recently resigned to take charge of the Engineering Contract Department of W. S. Barstow & Co., 50 Pine St., New York.

The Virginia Bridge & Iron Co., Roanoke, Va., has opened a branch office in the First National Bank Bldg., Denver, Colo. A. R. Peyton, who has been associated with this company for some years as Contracting Engineer, will be in charge.

The Duff Mfg. Co., Pittsburgh, Penn., is building an extension 125x150 ft. to its main factory. A five-ton bridge transfer crane and monorail conveying system is also being installed.

The New Process Gear Corporation has recently acquired the plant of the Monarch Typewriter Co., Syracuse, N. Y. Alterations to this plant will be made so as to devote its use to the manufacture of automobile differentials. C. G. Meachem is Vice-Pres.

The Nelson-Blank Mfg. Co., manufacturing machinist, Clay and Dubois St., Detroit, Mich., has consolidated with the American Pattern Works. The new concern will continue in the manufacture of wood and metal patterns, the Nelson Two Spindle Adjustable Drill Head, and will also machine all kinds of automobile parts. Joseph F. Buhr is Mgr., and Arne T. Nelson is Supt.

RAILWAYS—STEAM AND ELECTRIC

Massachusetts—Worcester Consolidated St. Ry.—This company has applied to the City Council for a franchise to relocate its track on Main St., Westborough. H. C. Page, Worcester, is Gen. Mgr.

New York, N. Y.—(Borough of Brooklyn)—Brooklyn Rapid Transit Co.—According to press reports this company has been granted a franchise to construct a two-track street railway on Atlantic Ave. from Flatbush Ave. to Shepherd Ave., about five miles. A connection will be made with the existing tracks at Atlantic and Fifth Ave.

New Jersey—Public Service Ry.—This company will construct a railway from Port Reading Junction to Carteret, via Chrome. The proposed line will connect with the Newark-Perth Amboy Fast Line. R. E. Danforth, Newark, is Gen. Mgr.

Maryland—Cumberland Valley R.R.—According to press reports this company plans to expend approximately $1,000,000 for the improvement of its line in Hagerstown. T. B. Kennedy, Chambersburg, Penn., is Engr. Noted Mar. 25.

Maryland—Mayor Preston has presented a plan to the City Planning Commission for a municipal electric belt railway connecting with the lines of the Pennsylvania, Baltimore & Ohio, Western Maryland and Maryland & Pennsylvania R.R. in Baltimore, also for a new Union Station at the Fallsway and Biddle St. and a tunnel system. William H. Maltbie and Daniel B. Banks are interested.

West Virginia—Kanawha Valley Traction Co.—This company has applied to the City Council for a franchise to double track its line on Murdock Ave., Parkersburg. S. Miller Gallaher, Charleston, W. Va., is Pur. Agt. and Ch. Engr.

West Virginia—Monongahela Traction Co.—This company contemplates the construction of an extension from Fairmont to Glenville. S. B. Miller, Fairmont, is Ch. Engr.

North Carolina—Central Carolina R. R.—Surveys are being made by this company for the construction of a railway from Lillington to Swansboro, N. C., about 125 miles. W. J. Edwards, Sanford, N. C., and J. R. Baggett, Lillington, N. C., are interested. Noted Sept. 3.

South Carolina—Southern Ry.—Bids will be received until Sept. 3 by W. H. Wells, Ch. Engr., Washington, D. C., for double tracking this company's line from Greenville to Greer, S. C., about 26 miles. Noted Aug. 26.

Alabama—L. Beck Musgrove and associates, Jasper, Ala., are interested in a project to construct an interurban railway from Jasper to Birmingham, via Ensley, about 35 miles.

Mississippi—Meriden & Gulf R.R.—This company plans to construct a railway from Columbus to Okolona, Miss., thence to Aliceville, Ala. G. A. Heard, Brooksville, Miss., is interested.

Louisiana—Alexandria Electric Ry.—This company has been sold to the city for $30,000, which plans to improve and extend the line.

Tennessee—Morgan-Fentress Ry.—This company will, according to press reports, extend its line from Harriman beyond the Obed River, about 10 miles. T. H. Enright, Harriman, is Vice-Pres. and Gen. Mgr.

Tennessee—Nashville & Eastern R.R.—Preliminary surveys are being made by this company for the construction of an electric railway from Nashville to Smithville, about 55 miles. Charles Edwards, Smithville, is interested. Noted Aug. 5 and Aug. 26.

Ohio—Columbus Ry., Power & Light Co.—This company plans to relay its tracks on Long and Main St., Columbus. Harold W. Clapp, Columbus, is Gen. Supt.

Ohio—Lake Shore Electric Ry. Co.—This company plans to double track its line on West Erie Ave. between Ashland Ave. and the city limits in Lorain. L. K. Burge, Sandusky, is Gen. Supt.

+Ohio—Cleveland & Ohio Central Electric Ry.—This company, recently incorporated, has awarded a contract for the first 55 miles of its proposed railway from Cleveland to Wooster, Ohio, to the LATHROP-SHEA & HENWOOD CO., Buffalo, N. Y. Noted Aug. 26.

Ohio—The Tiffin Chamber of Commerce has been asked to raise a bond issue of $2000 toward the cost of making a preliminary survey for the proposed electric railway between Tiffin and Bucyrus, Ohio. A. W. Nyquist is interested.

Indiana—Evansville & New Harmony Traction Co.—Press reports state that this company will soon start work on the construction of its proposed electric railway from Evansville to New Harmony, Ind., about 30 miles. C. J. Siebert, Evansville, is Gen. Mgr. Noted July 15.

Wisconsin—A. E. Appleyard, Ashland, is interested in the construction of an electric railway from Ashland to Bayfield, Wis.

Kansas—Kansas City Southern Ry.—This company has been granted a 20-year franchise for trackage rights by the Kansas City Commission for which the company agrees to replace its low pier bridge across the Kaw River with a new two-pier high-line bridge and to pay part of the cost of viaducts for eliminating the grade crossings at Fifth, Seventh and 12th St. C. E. Johnston, Kansas City, is Ch. Engr.

Kansas—Newton, Kansas & Nebraska R.R.—This company will, according to press reports, soon start work on the construction of its proposed railway from Newton through Harvey, McPherson, Dickinson, Saline, Clay and Washington Counties, about 142 miles. S. O. Waddell, Newton, is Ch. Engr. Noted July 15.

South Dakota—Yankton & Northern Ry.—This company has been incorporated to construct a railway from Yankton to Watertown, S. D., about 145 miles. E. S. Johnson, W. J. Gantle and W. E. Heaton, all of Yankton, are the incorporators.

Wyoming—The Popsia Coal Co., Hudson, plans to construct a railway from Shoshone to the northwestern coal fields. H. O. Barber is Mgr.

Montana—Press reports state that North Country farmers and the American Society of Equity contemplate the construction of an electric railway from Opheim to Nashua, Mont., to gain a more efficient means of transportation to the line of the Great Northern Ry.

Texas—Crosbyton-South Plains R.R.—This company, it is reported, has been taken over by the Santa Fé System, which plans to extend same. A. B. Spencer, Crosbyton, is Gen. Mgr.

Texas—Rio Grande Ry.—This company has agreed to convert the railway which runs between Brownsville and Point Isabel, a distance of 22 miles, into a standard-gage line and to make other improvements including the operation of an electric street railway in Brownsville and the dredging of a deep-water channel to connect with the outer deep water of the gulf, provided a bonus of $75,000 is raised toward the proposed work. The entire cost of the project is $400,000. John J. Harden is Chn. of the Bonus Com.

Oklahoma—Tulsa Traction Co.—This company, recently incorporated, will take over the Union Traction Co. and construct an extension to Sapulpa, about 15 miles. Plans are also being considered for an extension to Okmulgee, via Bixby, about 35 miles. A. J. Biddison, I. F. Crow, G. C. Stebbins, W. E. Bennett and J. S. Pearce, all of Tulsa, are the incorporators.

Washington—Washington Electric Ry.—This company has secured a right-of-way about 15 miles southeast of Chehalis, in Lewis County, where it plans to construct an electric railway. H. C. Coffman, Chehalis, is Pres. and Gen. Mgr.

Ontario—The Hydro-Electric Power Commission is having surveys made for the construction of a railway from Hamilton to Port Dover and other points on Lake Erie. F. Gaby, Toronto, is Ch. Engr.

LIGHT, HEAT AND POWER

Binghamton, N. Y.—The City Council has authorized the sale of $148,000 in bonds, the proceeds of which will be used for the construction of a municipal electric-light and power plant. D. W. Foster is City Clk.

+Syracuse, N. Y.—The Globe Malleable Iron Works, 108 Greenway Ave., has awarded the contract for a 34x52-ft., one-story power house to the W. J. BURNS CO., Syracuse, at $4000.

Millville, N. J.—The City Commissioners have passed a resolution to ask for bids for the installation of a municipal electric-light plant. Plans for the proposed plant have been approved. N. B. Wade is City Engr.

Tarentum, Penn.—The Borough Council has authorized the expenditure of $21,000 for improvements to the municipal electric-light plant. Sidney B. Martin, Penn Bldg., Pittsburgh, is Engr.-in-Charge.

Baltimore, Md.—It is reported that plans are being considered for the establishment of a municipal electric-light plant, power to be obtained from Jones Falls. The estimated cost is $200,000. Ezra B. Whitman, Fidelity Bldg., is Consult. Engr.

Baltimore, Md.—The Bartlett-Hayward Co. will build a one-story boiler house and power building at Scott and Ramsay St. to cost about $4000. The building will be fireproof, 43x62-ft. Motors of 5000-hp. capacity will be installed, while the boilers will aggregate 1000 hp.

+Nebo, N. C.—The Morganton Light & Power Co., Morganton, N. C., has awarded the contract for the construction of a dam across the Catawba River at a point near Nebo to the ELLIOTT BUILDING CO., Hickory, N. C., at about $110,000.

Anniston, Ala.—The City Council has granted a franchise to the Alabama Power Co. to extend its gas mains to Oxford, a distance of three miles. Estimated cost, $11,000. The company is also extending its mains to Blue Mountain, a suburb, at a cost of $5000. A. L. Kenyon is Mgr.

Hazard, Ky.—The Kentucky River Power Co., recently organized, will build a power plant, to cost $300,000, to develop about 5000 hp. to serve the coal-mining district of the state. A 25-mile transmission system, costing $25,000, will be constructed. R. L. Cornell, Hazard, is Mgr. and Engr. Noted Aug. 26.

+Akron, Ohio—The Falls Rubber Co. has awarded the contract for the construction of a power house to the AKRON STORAGE & CONTRACTINC CO., at about $5000.

Batavia, Ohio—It is reported that the Village Council has decided to close down the municipal generating station, and will purchase energy for operating the municipal system from the Cincinnati, Georgetown & Portsmouth Traction Co., Cincinnati.

Northfield, Ohio—An election will be held Sept. 20 to vote on the question of issuing $12,000 in bonds, the proceeds of which will be used for the installation of a municipal electric-light system in Northfield.

LaFayette, Ind.—The General Service Co. will shortly begin the construction of a condensing plant to cost about $150,000 at present, and about $300,000 when fully equipped. One 2500-kw. unit will be installed at once, and the building will have an ultimate capacity of 10,000 kw. Thomas Donohue is Mgr. and Ch. Engr.

+Dowagiac, Mich.—The Board of Public Works has awarded the contract for a new generator and switchboard for the municipal electric-light plant to the WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburgh, Penn., at $5725.

Kalamazoo, Mich.—An election will be held Sept. 7 to submit to the voters the question of issuing $350,000 in bonds for extensions and improvements to the municipal electric-light plant. Clarence L. Miller is City Clk.

Lakefield, Minn.—(Official)—See item under "Water Supply—Irrigation."

Waseca, Minn.—It is reported that the installation of a gas plant in Waseca, to cost between $65,000 and $75,000, is under consideration.

+Haviland, Kan.—The contract for constructing and equipping an electric-light plant has been awarded to the F. D. MARTIN CONSTRUCTION CO., Rialto Bldg., Kansas City, Mo., at $4295. E. T. Archer & Co., New England Bldg., Kansas City, Mo., is Engr.-in-Charge. Noted July 29.

South Haven, Kan.—It is reported that the South Haven Electric Light Co. will soon install a new generating unit, and will purchase a 25-hp. oil engine, one 30-kw. generator and exciter. J. R. Britton is Mgr.

Edgar, Neb.—Bids will be received until 1 p.m., Sept. 3, by the Mayor and City Council for the construction of a municipal-electric light plant, including some electrical material, construction of pole line, and adapting the city pump and well to electric drive. The estimated cost is $6000. W. J. Breckenridge is City Clk.

Willow Lake, S. D.—B. H. Lamont, Willow Lake, contemplates the establishment of an electric-lighting system to serve Clark County. A 24-hr. service will be furnished.

✚**Knobnoster, Mo.**—It is reported that the Johnson County Light & Power Co., recently incorporated, has awarded the contract for the construction of a $10,000 electric-light plant to the STANDARD ENGINEERING CO., Kansas City. J. J. Freundlich, 509 Republic Bldg., Kansas City, is Official-in-Charge.

Corning, Ark.—George A. Booser, owner of the local electric-light plant, is considering changing the system from direct to alternating-current, and building transmission lines to Success and Datto.

✚**Denton, Tex.**—The contract for the construction of a power plant for the College of Industrial Arts has been awarded to J. F. JOHNSON at $7500.

✚**Huntsville, Tex.**—The contract for heating and plumbing equipment in the Sam Houston Normal School has been awarded to KENNISON BROS., at $28,473.

✚**San Marcos, Tex.**—The contract for heating and plumbing equipment in the Southwest Texas Normal School has been awarded to DONNELLY & WHITE, at $40,798.

Lewiston, Idaho—The Lewiston Commercial Club is considering a plan to build a dam and power plant on either the Snake or the Clearwater River, to furnish energy for lighting and other purposes. Robert S. Erb is Pres. of the Commercial Club.

Stanwood, Wash.—The City Council has granted a franchise to George W. Kunze, Arlington, for furnishing electricity to the town for a period of 50 years. It is reported that Mr. Kunze will purchase the local plant, owned by C. A. Query, at $12,250, and will establish a lumber mill to be driven by electricity.

✚**Portland, Ore.**—The contract for installing heating and ventilating equipment in the Franklin High School has been awarded to J. F. SHEA, at $22,928. Noted July 29.

Eureka, Calif.—It is reported that the Western States Gas & Electric Co. will spend $12,000 in enlarging its plants in Humboldt County. H. L. Jackman, Eureka, is Mgr. and Cont. Agt.

Merced, Calif.—It is reported that the San Joaquin Light & Power Co., Fresno, will build a $65,000 substation at Merced. H. H. Adams is Local Mgr. and Gen. Supt. at Merced.

Ontario, Calif.—The Ontario-Upland Gas Co. will enlarge its plant and lay new mains at an estimated cost of $20,000.

Liverpool, N. S.—T. R. Bartling, Town Engr., has been authorized to prepare plans and call for bids at once for improvements to the municipal electric-light plant to cost about $15,000.

BRIDGES

Manchester, N. H.—Plans for the new bridge at South Elm St. will soon be completed. Its cost, about $75,000, will be divided as follows: The city will pay $40,000, the Boston & Maine R.R., $24,000, and the Manchester St. Ry., $12,000. S. J. Lord is City Engr. Noted July 15.

✚**Lawrence, Mass.**—(Official)—Bids were received Aug. 16 by the Commissioners of Essex County for rebuilding the Loring St. Bridge over the Shawsheen River, Lawrence, from the following: Hyde Park Construction Co., Boston, $13,714; William Francis Fitzgibbon, Beverly, $15,784; Hynes Construction Co., Wales, $16,929; LAWLER BROS., Charlestown, $20,051 (awarded contract); Michiel L. Camarco, Lee, $22,656; William L. Miller Co., Boston, $22,769; W. N. Pike & Sons, Lawrence, $22,149 (unsigned bid). Noted Aug. 5.

Bristol, Conn.—Plans are being prepared by Carleton W. Buell, City Engr., for a steel bridge over the Pequabuck River on Broad St.

★**Westport, Conn.**—(Official)—Bids will be received until 2 p.m., Sept. 22, by the State Highway Commissioner, Capitol, Hartford, for the construction of a single-leaf deck lift bridge over the channel of the Saugatuck River, Westport, and for electrical equipment necessary to operate the bridge. C. J. Bennett is State Highway Comr.

Elizabeth, N. J.—Bids will be received until Sept. 7 by the Board of Chosen Freeholders of Union County for the construction of two bridges, one on the Lower Rd., Rahway, and the other on Hussa St., Linden.

Bangor, Penn.—(Official)—Bids will be received until 10 a.m., Sept. 17, by George F. P. Young, Controller of Northampton County, Easton, for the construction of a reinforced-concrete bridge over Martin's Creek in the Borough of Bangor, known as County Bridge No. 48.

Halifax, Penn.—The State Water Supply Commission has approved the application of the Pennsylvania R.R. for permission to build a bridge over Armstrong Creek near Halifax. A. C. Shand, Philadelphia, is Ch. Engr.

Jenkintown, Penn.—Plans are being prepared for a new bridge over the tracks of the Philadelphia & Reading Ry. on Switchville St., Jenkintown. It will be a 110-ft. steel span. The estimated cost is $40,000. John N. Jacobs, Norristown, is Controller of Montgomery County.

✚**Johnsonburg, Penn.**—The Town Council has awarded the contract for the construction of a reinforced-concrete bridge over the East Branch of the Clarion River to HARRY KOONS, Johnsonburg, at $6300.

✚**Pittsburgh, Penn.**—(Official)—The Commissioners of Allegheny County have awarded the contract for repairs to approaches and floor of Bridge No. 6 over the Youghiogheny River, to C. W. HAGGART, 323 Fourth Ave., Pittsburgh, at $18,425. Noted Aug. 12.

Uniontown, Penn.—Bids will be received until noon, Sept. 28, by Harry Kisinger, Controller of Fayette County, Uniontown, and by the Controller of Westmoreland County, Greensburg, for the construction of a plate girder bridge with concrete substructure and floor, over Jacobs Creek at West Overton, between the two counties.

Courtland, Va.—(Official)—The Board of Supervisors of Southampton County announces that it is not in a position to build the proposed Cary Bridge over the Nottaway River at present, and the advertisement for bids to be received until Sept. 3 has been recalled. Noted Aug. 26.

Richmond, Va.—Press reports state that the Administrative Board has directed the City Engineer to prepare plans for the construction of a bridge over Grace St. from Taylor's Hill (22d St.) to Memorial Hospital. The cost is tentatively estimated at $250,000. Charles E. Bolling is City Engr.

Keyser, W. Va.—Bids will be received until Sept. 14 by J. V. Bell, Clk. of Mineral County, for the construction of two reinforced-concrete bridges, one 30-ft. span over Georges Run, and one 50-ft. span over Beaver Run, both with 14-ft. roadways.

✚**Athens, Ga.**—The Commissioners of Clarke County have awarded the contract for repairing the Princeton Bridge to the EAST ST. LOUIS BRIDGE CO., East St. Louis, Ill., at $4357. Noted July 15.

✚**Dalton, Ga.**—(Official)—Bids will be received until 1:30 p.m., Sept. 11, by H. J. Wood, Ordinary and Chn. of County Bd. of Whitfield County, for the construction of a reinforced-concrete bridge across Coahulla Creek. It will have one 80-ft. and one 25-ft. span. Noted Aug. 19.

Jesup, Ga.—(Official)—Plans will be completed about Sept. 10 for the construction of a bridge across the Altamaha River between Wayne and Liberty Counties. Ira M. Raybon, Jesup, is Clk. Bd. of Comrs. of Wayne County. Noted Aug. 19.

Macon, Ga.—It is reported that the Central of Georgia Ry. will build a concrete viaduct on Plum St. between Fifth and Sixth St., to cost about $75,000. The work will be done in connection with the new union passenger station at the foot of Cherry St. J. M. Fitzgerald, Macon, is Supvr. of Bridges and Bldgs., Central of Georgia Ry.

✚**Johnsonville, Tenn.**—The Nashville, Chattanooga & St. Louis Ry. has awarded the contract for a new steel drawbridge over the Tennessee River in Johnsonville, to H. M. GOULD, Nashville.

Lancaster, Ky.—The Fiscal Court of Garrard County has voted to build a bridge across White Creek in the Point Lick section.

Akron, Ohio—Bids will be received until Sept. 17 by the Board of Commissioners of Summit County for the construction of the substructure of the Gichrist Bridge in Springfield Township. C. L. Bower is Clk. of Comrs.

Ashland, Ohio—(Official)—Bids will be received until noon, Sept. 17, by the Board of Commissioners of Ashland County for the construction and repair of five county bridges. H. C. Westover is County Audr. B. Welty is Clk. of Comrs.

Cleveland, Ohio—Bids will be received until noon, Sept. 16, by the Commissioner of Purchases and Supplies, Room 511, City Hall, for foundations, approaches and structural steel work for the Union Ave. grade crossing. Robert Hoffman is City Engr.

Dayton, Ohio—The Directors of the Miami Conservancy District have approved the plans of the Pennsylvania R.R. for a bridge over the Miami River replacing the one washed away by the flood of 1913. It will cost about $300,000. The Big Four and the Cincinnati, Hamilton & Dayton lines will also use the bridge.

✚**Marysville, Ohio**—The Board of Commissioners of Union County has awarded bridge contracts to the CAPITOL CONSTRUCTION CO., Columbus, at $4676 for the Ford Bridge, and to the BELLEFONTAINE BRIDGE & IRON CO., Bellefontaine, at $3197 for the Jones Bridge.

Warren, Ohio—Bids will be received until Sept. 13, by the Board of Commissioners of Trumbull County for the construction of the Griswold St. Bridge, Warren. W. R. Harrington is County Audr.

Brownstown, Ind.—(Official)—Bids will be received until Sept. 7 by the Commissioners of Jackson County for the construction of nine bridges. Albert Leudtke is Audr.

Corydon, Ind.—(Official)—Bids will be received until 2 p.m., Sept. 7, by the Commissioners of Harrison County for the construction of three steel bridges. J. L. O'Bannon is Audr.

Crawfordsville, Ind.—(Official)—Bids will be received until 10 a.m., Sept. 7, by the Commissioners of Montgomery County for the construction of several bridges. B. B. Engle is Audr.

✚**Crown Point, Ind.**—It is reported that the contract for the construction of a concrete bridge on the Lincoln Highway in Lake County has been awarded to the ENGINEERING CONSTRUCTION CO., 106 North LaSalle St., Chicago, Ill., at $10,990.

Danville, Ind.—(Official)—Bids will be received until 10 a.m., Sept. 11, by the Commissioners of Hendricks County for the construction of five bridges and the repair of others. L. W. Borders is Audr.

Hartford City, Ind.—(Official)—Bids will be received until 2 p.m., Sept. 6, by the Commissioners of Blackford County for the construction of two concrete bridges. J. L. McGeath is Audr.

Hartford City, Ind.—The City Council plans the construction of two new bridges over Little Lick Creek at Jefferson St. and Spring St., estimated to cost $4000 and $2000 respectively.

Indianapolis, Ind.—Bids will be received until 10 a.m., Sept. 3, by the Board of Park Commissioners for the construction of a trestle over Pleasant Run at Michigan St.

Peru, Ind.—(Official)—Bids will be received until noon, Sept. 8, by the Commissioners of Miami County for the construction of a concrete bridge in Richland Township. F. K. McElheny is Audr.

Rensselaer, Ind.—(Official)—Bids will be received until 2 p.m., Sept. 7, by the Commissioners of Jasper County for the construction of several bridges. J. P. Hammond is Audr.

✚Richmond, Ind.—(Official)—The Board of Commissioners of Wayne County has awarded the contract for the construction of four bridges to ISAAC E. SMITH, Richmond, at $23,000 for the four. The work includes the North 12th St. Bridge in the City of Richmond; the Short Creek Bridge; the Centerville Bridge and the McConaha Bridge. Noted Aug. 19.

Warsaw, Ind.—(Official)—Bids will be received until 10 a.m., Sept. 9, by the Commissioners of Kosciusko County for the construction of nine bridges. V. D. Mock is Audr.

Lansing, Mich.—Under the terms of the new trunk line highway law, passed by the last legislature, the State Highway Commission will spend about $80,000 this year for constructing new bridges. Frank F. Rogers is State Highway Comr.

Richland Center, Wis.—Plans are being prepared by H. A. Abbott, Div. Engr., State Highway Comn., for three steel bridges with concrete floors and abutments, 40-, 60- and 80-ft. spans respectively, in Richland Center. R. Sutt is City Clk.

Brainerd, Minn.—Bids will be received until 2 p.m., Sept. 7, by C. W. Mahlum, Audr. of Crow Wing County, for a bridge over the Pine River to consist of three 30-ft. spans on reinforced-concrete abutments; also for the construction of two-reinforced-concrete bridges.

✚Crookston, Minn.—The Commissioners of Polk County have awarded contracts for the construction of 14 steel bridges in various townships to GRUND & NORDQUIST, Pitt, Minn., at $19,991.

Mankato, Minn.—It is reported that the city of Mankato has retained Donald Price, Omaha, Neb., to prepare plans for a reinforced-concrete bridge across the Minnesota River at Mankato. It will be about 560 ft. long, and the cost must not exceed $80,000. J. H. A. Brahtz, Consult. Engr., St. Paul, will supervise the construction work.

✚Wadena, Minn.—(Official)—The Commissioners of Wadena County have awarded the contract for the construction of State Bridge No. 1551 to the MINNEAPOLIS BRIDGE CO., Minneapolis, at $4875. Other bidders were: Hennepin Bridge Co., $5376; Great Northern Bridge Co., $5350; Illinois Steel Bridge Co., $4950; Plymouth Construction & Repair Co., $5660. Noted Aug. 12.

✚Girard, Kan.—(Official)—The Commissioners of Crawford County have awarded contracts for the construction of four steel girder bridges to the CONCRETE STEEL & CONSTRUCTION CO., Joplin, Mo., at $3510, and for one concrete bridge to the TOPEKA BRIDGE & IRON CO., Topeka, at $1060. Noted Aug. 12.

Kansas City, Kan.—It is reported that plans prepared by R. L. McAlpine, County Engr. of Wyandotte County, for a single-deck bridge with 27-ft. roadway and double car tracks over the Kaw River on Central Ave., were not approved by the War Department. New plans will be prepared by Harrington, Howard & Ash, Consult. Engr., Orear-Leslie Bldg., Kansas City, Mo. The estimated cost is $450,000, to be divided between Wyandotte County and the Metropolitan St. Ry. Co., Kansas City, Mo. Noted May 27 and July 8.

✚Mound City, Kan.—The Board of Commissioners of Linn County has awarded the contract for the construction of four bridges to the TOPEKA BRIDGE & IRON CO., Topeka, at $9925.

✚Topeka, Kan.—The city has awarded the contract for the construction of a bridge across Shunganunga Creek on Lincoln St. to ALLEN & FULTON, Topeka, at $11,524. Other bidders were: Fred Luttjohann, $11,900, and the Topeka Bridge Co., $13,850. Noted July 8.

✚Fremont, Neb.—(Official)—The Commissioners of Dodge County have awarded the contract for all county bridge construction for a period of one year to the STANDARD BRIDGE CO., Omaha. Five other bids were received. Noted Aug. 12.

✚Medora, N. D.—The National Park Transcontinental Highway Association has awarded the contract for the construction of a bridge over the Little Missouri River at Medora to the ILLINOIS STEEL BRIDGE CO. at $17,000, including approaches and riprapping. Noted May 13 and Aug. 12.

Kansas City, Mo.—It is reported that bids will be received about Sept. 14 by the Board of Park Commissioners for the construction of a reinforced-concrete viaduct at 77th St. and the Paseo. The estimated cost is between $40,000 and $50,000. Harrington, Howard & Ash, Orear-Leslie Bldg., Kansas City, is Engr.-in-Charge. Noted Feb. 4.

Perryville, Mo.—Bids will be received until Sept. 7 by Thomas J. Killian, Road and Bridge Comr. of Perry County, for the construction of a steel bridge with wood floor and stone or concrete abutments and a steel bridge with concrete floor and abutments.

Dallas, Tex.—It is reported that plans are being prepared by the Stone & Webster Engineering Corporation, Boston, Mass., for a viaduct between Dallas and Oak Cliff. The estimated cost is $50,000. J. M. Preston is City Engr.

✚Menard, Tex.—The Commissioners Court of Menard County has awarded the contract for the construction of two low-water bridges across the San Saba River to AUSTIN BROS., Dallas, at $6550.

Lawton, Okla.—(Official)—Bids will be asked in about 60 days by the Commissioners of Comanche County for the construction of county bridges to cost about $5000. S. A. Joyner is County Engr. Noted Aug. 19.

Mt. Vernon, Wash.—The Commissioners of Pierce County plan to build an 80-ft. Howe truss span bridge across Diasbud Creek on State Rd. No. 11. The work will be done by county forces from plans prepared by A. L. Strong, County Engr.

✚Berkeley, Calif.—The City Council has awarded the contract for the construction of a bridge across Cordornices Creek to D. McDONALD at $5675. Noted July 22 and Aug. 19.

Oroville, Calif.—Bids will be received until Sept. 11 by the Board of Supervisors of Butte County for the construction of a number of county bridges. The estimated cost is $14,400. C. M. Polk is County Surv.

✚Placerville, Calif.—The Board of Supervisors of Eldorado County has awarded the contract for the construction of a bridge across the South Fork of the American River to BLUXOME & CO., Monadnock Bldg., San Francisco, at $11,470, including a macadam covering on the floor, or $11,250 without the macadam. Noted Aug. 5.

Rail Road Flat, Calif.—The Supervisors of Calaveras County, San Andreas, have approved plans for a 670-ft. steel bridge across the Moklumne River at Rail Road Flat.

Red Bluff, Calif.—The Board of Supervisors of Tehama County will soon ask bids for the construction of a reinforced-concrete bridge across Mill Creek in Los Molinos Colony.

✚Visalia, Calif.—The Board of Supervisors of Tulare County has awarded the contract for a bridge over Kings River to the TURNER CO., Los Angeles, at $14,333. Other biders were: Boardman Construction Co., $17,019; Johnson Bros., $15,680; Settelwell Co., $23,000; Mesmeyer Co., $17,753; Mercereau Bridge & Construction Co., $18,681; C. E. Cotton, $17,469; Manning Bros., $21,400; Parlier Construction Co., $19,336; Munoz & Munoz, $18,998; California Construction Co., $15,700. Noted Aug. 5.

Halifax, N. S.—(Official)—Bids will be received until noon, Sept. 11, by E. H. Armstrong, Comr. Pub. Wks. and Mines, for the construction of 174 culverts of permanent material on several roads.

WATER SUPPLY—IRRIGATION

Madison, Maine—The purchase of the property rights and franchises of the Madison Water Co. is being considered by the city.

Boston, Mass.—Bids will be received until Sept. 9 by the Public Works Department for laying 11,500 ft. of 10- and 12-in. water mains in several streets in East Boston. Edward F. Murphy is Comr.

Boston, Mass.—The Commissioner of Public Works plans to construct a high pressure fire service pumping station at Dorchester Ave. and Summer St.

Hartford, Conn.—Bonds for $10,000 have been sold. The proceeds will be used toward the construction of the Nepaug water system. Noted Aug. 12 and 26.

New Britain, Conn.—Plans are being prepared by William H. Hall, City Engr., for the construction of the Burlington Reservoir. Noted Mar. 25.

Windsor, Conn.—(Official)—Bids were received Aug. 20 for the construction of a water system as follows Antonio Lambo, Waterbury, $34,560; A. D. Ambrosio, Hartford, $34,704; Sussi & Williams, Boston, Mass., $35,872; Bernardino & Tomassetti Construction Co., Meriden, $39,069; A. W. Byrne, Hartford, $39,166; Abbott & Bowes, Cohoes, N. Y., $39,623; Hanson Construction Co., Boston, Mass., $40,455; Louis D. Gregory, New York, $40,813; Cordener & Montague, Springfield, Mass., $41,405; T. F. Foley Co., South Norwalk, $42,374; Piersen Engineering & Construction Co., Hartford, $42,671; Way & Collilli, Springfield, Mass., $43,633; F. N. Lewis, New York, $46,412; Daly & Merritt, Portchester, N. Y., $47,163; Middlesex Contracting Co., Franklin, Mass., $48,581. H. R. Turner is Supt. of Water Wks. Noted Aug. 5.

Hudson Falls, N. Y.—Charles E. Perry, Consult. Engr., Albany, who was retained by the village to estimate the cost of a water system has made the following report: Three pond conduit, $6453, intake reservoir, $8501, conduit, $77,485, distributing system, $78,932, fire hydrants, gate valves, and other valves, $27,500. The total estimated cost is $270,000.

★Manchester, N. Y.—(Official)—Bids will be received until Sept. 15 by the Board of Village Trustees, for constructing a water system. Noted May 27 and June 17.

✚North Collins, N. Y.—The contract for the construction of a water system has been awarded to SHIPMAN & LINCOLN, Gowanda. Bonds for $35,000 have been voted for this purpose.

✚★Watervliet, N. Y.—Contracts have been awarded by the Board of Water Commissioners for constructing the municipal water system as follows: Section No. 1, storage reservoir, dam and pumping station to N. R. PORTERFIELD, New York; Section No. 2, supply main and service reservoir to LINCOLN, STEELE FLEMING CO., New York; Section No. 3, filtration plant to AMERICAN WATER SOFTENER CO., Philadelphia, Penn., and Section No. 4, distribution system to BEAVER ENGINEERING & CONTRACTING CO., New York. The total amount of contract is $418,000. Noted July 22 and Aug. 26.

✚★Wellsville, N. Y.—(Official)—Bids were received Aug. 25 for making improvements to the water system as follows: JAMES H. HAVENS, Olean, at $39,588 for piping and $36,027 for constructing a reservoir (awarded contract); Suburban Construction Co., New York, $83,474; J. F. Calahan, Jamestown, $41,087; A. M. Scoerson, Erie, Penn., $36,900; J. D Kieher, $49,500 and Knight & Sayre, Wellsville, $40,981. Charles C. Hopkins is Engr. Noted July 29.

Cranford, N. J.—The Township Committee contemplates the construction of a water system. The estimated cost is $300,000.

Long Branch, N. J.—Morris R. Sherrerd, Newark, who was retained by the City Commission to estimate the cost of constructing a municipal water system, has reported that a system can be installed at an estimated cost of $500,000.

Newark, N. J.—Bids will be received until 2:30 p.m., Sept. 3, by the Committee on Public Buildings of the Common Council of the City of Newark, City Hall, for the construction of a water supply system at the almshouse at Ivy Hill. The George W. Knight Co. is Engr. A. Archibald is City Clk. Noted Aug. 26.

✚Newark, N. J.—The contract has been awarded to JOHN L. REID, Newark, at $11,555, by the Board of Chosen Freeholders of Essex County for drilling a well and for pumps. compressors at the new county hospital at Overbrook.

Brownsville, Penn.—(Official)—The State Board of Health has approved the plans for the construction of a filtration plant in South Brownsville. Noted July 22.

Media, Penn.—The bond issue of $70,000 which was recently voted for the improvement of the water system has been declared illegal. Another election will be held in November. Noted June 17 and 24.

Reynoldsville, Penn.—An election will soon be held to vote on the question of issuing $100,000 in bonds, the proceeds of which will be used for the purchase of the Reynoldsville Water Co.

Ayden, N. C.—At a recent election the citizens voted in favor of issuing $50,000 in bonds. Part of the proceeds will be used for the construction of a water system.

Lumberton, N. C.—Bids will soon be received by A. E. White, Mayor, for the installation of a filtration plant at the municipal water system. The estimated cost is $10,000. Gilbert C. White, Consult. Engr., Charlotte, has prepared the plans. Noted Dec. 3 and Aug. 19.

✚Warrenton, N. C.—The contract for the construction of a water system has been awarded to M. M. WILKES, Atlanta, Ga. Bonds for $50,000 have been sold for this purpose. Gilbert C. White, Charlotte, is Engr. Noted June 17 and July 22.

Macon, Ga.—According to press reports the Water Commissioners contemplate an expenditure of $10,000 for the improvement of the distilling plant at the Riverside Station.

Coolidge, Fla.—At a recent election the citizens voted in favor of issuing bonds, the proceeds of which will be used for the construction of a water system. S. C. Neswith is City Clk. Noted July 29.

Pass Christian, Miss.—X. A. Kramer, Consult. Engr., Magnolia, Miss., has been retained to make a survey and prepare plans for the construction of a water system. Estimated cost, $10,000.

Philadelphia, Miss.—Plans are being prepared by M. L. Culley, Engr., Jackson, for the construction of a water system. Noted June 24.

White Castle, La.—On Aug 19 the citizens voted in favor of issuing $25,000 in bonds, the proceeds of which will be used for the construction of a water system and electric-light plant. X. V. Kramer, Magnolia, Miss., is Engr. Noted Aug. 22.

Lenoir City, Tenn.—At a recent election the citizens voted against the question of issuing $10,000 in bonds, the proceeds of which was to have been used for the completion of the water system. Noted Aug. 26.

Brewster, Ohio—(Official)—The only complete bid received for the construction of a municipal water system was that of David Eshelman & Son, Anderson, Ind., at $23,333. The W. H. Sherman Co., Toledo, is Engr. Noted Feb. 4 and Aug. 12.

✚★Cambridge, Ohio—(Official)—The contract has been awarded to C. P. O'REILLY, St. Louis, Mo., and the PITT CONSTRUCTION CO., Pittsburgh, Penn., for making improvements at the water system. Noted July 22.

✚Maumee, Ohio—The contract has been awarded to T. C. BROOKE & SON, Jackson, Mich., at $49,753, for constructing a water system. Noted July 23.

Medina, Ohio—(Official)—Bids will be received until Sept. 15 by the Board of Public Affairs for furnishing 12,336 ft. of 4-in. pipe, 37 4-in. valves, 15 hydrants and 6800 lb. of specials. B. E. Elkard is City Clk.

Middletown, Ohio—S. G. Pollard, Cincinnati, is preparing plans for the construction of a water system. Bonds for $120,000 have been voted for this purpose. Noted Aug. 19.

Tiffin, Ohio—According to press reports plans have been prepared for the enlargement of the water system. O. E. Williams, Boston, Mass., is Pres. Tiffin Water Wks. Co. Noted June 24.

West Park, Ohio—Bids will be received until noon, Sept. 13, by M. J. Spooner, Clk., Bd. of Pub. Affairs, for constructing water mains in nine streets.

Bloomington, Ill.—The Commercial Club of Bloomington has filed a petition with the Public Service Commission to make a survey of the water system and to have plans prepared for the needed improvements. Elmer Folsom is City Engr.

✚Clinton, Ill.—The contract has been awarded to the DAVIS EWING CONCRETE CO., Bloomington, at $6644, for constructing a reservoir.

Fairbury, Ill.—Plans are being prepared for the construction of a well at the water works. The proposed well will have a depth of 1000 to 2000 ft. of 20-in. pipe. T. W. Burns is Supt. of Water Wks.

Wheaton, Ill.—The construction of a new steel standpipe on a site higher than the present one is under consideration. L. J. Ruddock is City Engr.

Manitowoc, Wis.—(Official)—Plans have not yet been completed for the installation of two pumps at the water works. William Miller is City Clk. Noted Aug. 19.

Monticello, Wis.—Bids will be received until Sept. 7 by H. O. Babler, Village Clk., for the construction of 2300 ft. of 6-in. water main.

Oshkosh, Wis.—Bids will be received until 2 p.m., Sept. 7, by the Board of Public Works, for laying 2600 ft. of 2-in. and 1200 ft. of 1¼-in. water pipe in the new cemetery. R. A. Hollister is Chn. of Bd. Noted Aug. 5 and 26.

Dubuque, Iowa—The Water Department plans to lay about 1800 ft. of water mains on Broadway from Diagonal to Putnam St. B. F. Stedman is Supt. of Water Wks.

✚Lakefield, Minn.—(Official)—The contract has been awarded to the STERLING ELECTRIC CO. and the DES MOINES BRIDGE & IRON WORKS, at $26,325 and $4105 respectively for making improvements to the water and electric-light systems. E. Anderson is City Clk. Noted July 15.

Minneapolis, Minn.—The Water Works Commission has authorized the laying of 31,762 ft. of 6-in., 5838 ft. of 8-in. and 6058 ft. of 12-in. water pipe. The estimated cost is $75,142. William R. Young is Water Wks. Supt.

Attica, Kan.—Bonds for $30,000 have been voted by the citizens, the proceeds of which will be used for the construction of water and electric-light systems. Noted July 29.

✚Milligan, Neb.—(Official)—The contract has been awarded to F. B. BENTLEY, Geneva, at $5463, for constructing a water system. E. J. Kotes is City Clk. Noted Aug. 19.

Whitehall, Mont.—(Official)—Bids will be received until Sept. 23 by F. E. McCall, Town Clk., for constructing water and sewer systems.

Macon, Mo.—(Official)—Bids will be received until 1 p.m., Sept. 14, by J. L. Martin, City Clk., for making improvements to the water system. Noted Aug. 12.

Heber Springs, Ark.—According to press reports the city will construct water and sewerage systems. The estimated cost is $80,000. B. R. Brown is Recdr.

✚Caddo, Okla.—(Official)—The contract for the construction of a pumping station and filtration plant has been awarded to F. W. KEENEY, Oklahoma Bldg., Oklahoma City, at $20,000. The work will include two 8x10-in. triplex pumps, two 4-in. centrifugal pumps, two 50-hp. oil engines, one gravity filter with a daily capacity of 250,000 gal., power house, settling basin and clear water well. Noted Aug. 12.

Pauls Valley, Okla.—An election will soon be held to vote on the question of issuing $16,000 in bonds, the proceeds of which will be used for the extension of the water system.

Myton, Utah—(Official)—Bids will be received until Sept. 29 by R. B. Crois, Town Clk., for constructing a water system.

✚Salt Lake City, Utah—The contract for the construction of the high line canal in Division No. 9 of the Strawberry Valley Irrigation project has been awarded to HEUSER, SIM & VORKINK, Salt Lake City, at $35,504.

Everett, Wash.—At an election held Aug. 24 the citizens voted in favor of the question of issuing $1,700,000 in bonds. Part of the proceeds will be used for the construction of a pipe line to carry the waters of Sultan basin to the city limits, about 24 miles, and for the purchase of the present water works.

Olympia, Wash.—A recent decision of the Supreme Court has rendered illegal the $90,000 bond issue recently voted for the purchase of the local water plant. Noted Mar. 11 and May 6.

Ridgefield, Wash.—Bonds for $10,000 have been voted by the citizens, the proceeds of which will be used for the construction of a municipal water system.

Wenatchee, Wash.—Press reports state that an election will be held Sept. 11 to vote on the question of issuing $500,000 in bonds. The proceeds will be used for the construction of a new irrigation system and for the improvement of the old one.

Halfway, Ore.—Bonds for $20,000 have been voted by the citizens. The proceeds will be used for the construction of a gravity water system. Noted Aug. 12.

Hood River, Ore.—An election will be held Sept. 7 to vote on the question of issuing $50,000 in bonds, the proceeds of which will be used for the construction of an irrigation system near the Hood River.

Roseburg, Ore.—The City Council will be petitioned to issue $250,000 in bonds, the proceeds of which will be used for the construction of water and electric-light systems.

Venator, Ore.—Surveys have been made by George Waggoner, Eugene, for the construction of a water system.

✚San Francisco, Calif.—The contract has been awarded by the Spring Valley Water Co. to JAMES H. O'BRIEN & GEORGE A. BOS, at $5250, for concrete work at the Lake Honds reservoir.

Stockton, Calif.—An election will be held Oct. 16 to vote on the question of the formation of the West Side Irrigation District. The proposed district plans to irrigate 11,000 acres at an estimated cost of $285,000.

Quebec, Que.—Bids will be received until noon, Sept. 7, by O. Lefebvre, Ch. Engr., of the Quebec Streams Commission, Parliament Bldg., for constructing a storage dam at the outlet of Lake St. Francis.

SEWERS

Haverhill, Mass.—The city will construct sewers in various streets. Estimated cost, $5000.

Lawrence, Mass.—The City Council has authorized an expenditure of $30,000 for the construction of sewers.

✚Woonsocket, R. I.—(Official)—The contract for the construction of approximately 4400 ft. of 8-in. and 500 ft. of 15-in. sewers and appurtenances has been awarded to the EASTERN CONSTRUCTION CO., Woonsocket. Noted Aug. 19.

✚Hockanum, Conn.—(Official)—The contract for the construction of 9300 ft. of 12-, 10- and 8-in. sewers has been awarded to A. D'AMBROSIO, Hartford, at $8060. Other bids were: Skeketoff & Roger, $8652; D. O'Connor, $8907; A. W. Bryns, $8942; A. Lambo, $10,540; Bonadies & Monocchio Co., $13,593. Noted Aug. 5.

Lakeville, Conn.—Preliminary plans are being prepared by Virgil Ehle for the construction of a sewer system. The estimated cost is $43,000.

★Buffalo, N. Y.—(Official)—The lowest bid received for the renewal of sewer lines at the Buffalo State Hospital was that of Kelly & Wheeler, 537 Norwood Ave., Buffalo, at $6295. E. S. Elwood is Secy. State Hospital Comn. Noted Aug. 19.

East Syracuse, N. Y.—At a recent election the citizens defeated the question of issuing $36,000 in bonds, the proceeds of which was to have been used for the construction of sewers and a sewage-disposal plant.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received Aug. 25 by L. H. Pounds, Borough Pres., for the construction of sewers in (a) Clara St., (b) Kenmore Pl., (c) 54th St., (d) East 26th St., (e) Dumont Ave., (f) Roch-

erter Ave., from Frank Spinella, (a) 89%, (b) 93%, (c) 90%, (d) 95%; F. L. Pelligrino, (a) 85.32%, (e) 83.97%, (f) 116.5%; S. Pacone & Sons, 969 20th St., Brooklyn, (a) 80%, (b) 74%, (c) 76.50%, (d) 66%, (e) 70%; Bigeleo Contracting Co., (a) 123.75%, (c) 135%; B. Pacone & Sons. (a) 79%, (b) 99%, (c) 90%, (d) 62%, (e) 100%, (f) 145%; Joseph Jennings, (a) 90%, (b) 106%, (c) 95.12%, (d) 88.72%, (e) 92.20%, (f) 164%; F. Merrindino, Inc., 556 17th St., Brooklyn, (a) 88.44%, (b) 80%, (c) 83.40%, (d) 80%, (f) 92%; Murphy Bros., (a) 93.3%, (b) 97%, (c) 97%, (d) 92%; Backus & Gelardi, (a) 81%, (b) 93%, (c) 86%, (d) 80%, (e) 98%, (f) 111%; Egelardi Contracting Co., (a) 83%, (b) 125%, (c) 83%, (e) 150%, (f) 150%. Noted Aug. 19.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Borough Pres., Borough Hall, until 11 a.m., Sept. 8, for the construction of sewers in various streets.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., Municipal Bldg., until 2 p.m., Sept. 9, for the construction of a sewer in Ellwood St. between Nagle and Sherman Ave.

New York, N. Y.—(Borough of Richmond)—(Official)—Bids will be received by Calvin D. Van Name, Borough Pres., Borough Hall, St. George, until noon, Sept. 7, for the construction of a sewage-disposal plant at the Richmond County Jail.

✚★Oswego, N. Y.—(Official)—Contracts for sewer construction have been awarded as follows: BRODERICK & FINGERHUT, at $1734, for Tallman, Niagara and West Second St. sewer; SAMUEL BONN, Syracuse, at $7872, for West Albany St. sewer; L. TREMITI, at $2853, for East Mohawk, Duer, Bonner, Hamilton and East Eighth St. sewers; RALPH RELLY, Utica, at $8792, for West Oneida and Dublin St. sewer, and at $14,764, for West Mohawk, Singleton and Liberty St. sewer. Noted Aug. 19.

Linden, N. J.—Bids will be received until Sept. 20 by the city for the construction of a sewer system in Elizabeth, Ziegler and Maple Ave., and in Roselle, Price and 13th St.

Newark, N. J.—Bids were received Aug. 26 by the Board of Street and Water Commissioners for the construction of Section No. 1 of the Meadowbrook Outlet Sewer from Matteo Ronaldo, $7554; Donato Fusco, $5275; Cardell & Romano, $10,060; Averill-Matthews Co., $9730; Peter D'Amato, $10,385; M. Stefanelli, $10,028. Noted Aug. 19.

Prospect Park, N. J.—(Paterson post office)—Plans have been prepared by Harold J. Harder, Engr., for the construction of a sewage-disposal plant. Noted June 10.

Pittsburgh, Penn.—The city contemplates the construction of a surface water sewer in the Five Mile Run drainage basin and the improvement of sewers in the Saw Mill Run. The estimated cost is $201,000 and $150,000 respectively.

Wilmington, Del.—Bonds for $50,000 have been sold, the proceeds of which will be used for the construction of sewers along Brandywine Creek from Henry Clay. Noted July 15.

Huntington, W. Va.—Bids will be received until Sept. 6 for the construction of sewers in various streets. O. H. Wells is Engr.

Ayden, N. C.—At a recent election the citizens voted to issue $15,000 in bonds, the proceeds of which will be used for the construction of sewers. Noted Aug. 12.

Raeford, N. C.—The citizens voted to issue $30,000 in bonds, the proceeds of which will be used for the construction of sewer and water systems. Noted Aug. 26.

Macon, Ga.—Plans have been prepared by J. J. Gaillard, City Engr., for the construction of sewers to take the place of the old Vineville branch.

✚Ft. Myers, Fla.—The contract for the construction of approximately 1½ miles of sewers has been awarded to the SOUTHERN CLAY MFG. CO., Chattanooga, Tenn.

✚Cloverdale, Ala.—The contract for the construction of a sewer system has been awarded to SULLIVAN, LONG & HAGERTY CO., Bessemer, Ala. The estimated cost is $30,000. Noted Aug. 12.

Philadelphia, Miss.—Plans are being prepared by M. L. Cully, Engr., Jackson, for the construction of a sewer system.

Hammond, La.—Bids will be received until Sept. 4 for the construction of a sewer system. The estimated cost is $40,000. X. A. Kramer, Magnolia, Miss., is Consult. Engr. Noted July 15.

Louisville, Ky.—An election will be held in November to vote on the question of issuing $350,000 in bonds. The proceeds will be used for the construction of sewer system and a sewage-disposal plant.

Owensboro, Ky.—(Official)—The Council has not appropriated $6000 for the construction of a sewer in the Old Ravine on West Second St. as was noted in the issue of Aug. 26. H. M. Talboth is City Engr.

Bowling Green, Ohio—Plans are being prepared for the construction of a sewage-disposal plant.

✚Cincinnati, Ohio—(Official)—The contract for the construction of the Pogue Ave. sewer has been awarded to RUNCK BROS., at $6040. Noted Aug. 19.

✚Cincinnati, Ohio—(Official)—The contract for the construction of sewers in McDowell, Strafer St. and in Columbia Ave. has been awarded to M. J. McCARTHY, Cincinnati, at $4865. Noted Aug. 5.

Cleveland, Ohio—(Official)—Bids were received Aug. 18 by the Commissioner of Purchases and Supplies for the construction of a concrete open channel outfall sewer approximately 630 ft. long and a submerged outfall pipe line about 3600 ft. long, from: Great Lakes Dredge & Dock Co., $95,671; American Construction Co., $109,985; Merritt & Chapman Derrick & Wrecking Co., $125,513; Charles Fath & Co., $125,915; Cleveland Engineering & Construction Co., $137,230. Noted Aug. 5.

Cleveland, Ohio—(Official)—Bids were received Aug. 19 by Robert Hoffman, City Engr., for the construction of sewers in various streets from: Manson Construction Co., $67,272; John Wagner, $71,847; W. P. Gibbons, $75,025; Hoag & Zullo, $78,036; Central Ohio Construction Co., $80,436. Noted Aug. 19.

Cleveland, Ohio—Bids will be received until noon, Sept. 9, by the Commissioner of Purchases and Supplies for the construction of sewers in West 110th St. from Lorain to Overlook Ave.; Parkhurst Drive from Bosworth Rd. to West 110th St.; Overlook Ave. from West 110th St. to Bosworth Rd.; storm sewer in Bulkley Blvd. from West 25th to West 28th St. Robert Hoffman is City Engr.

Hillsboro, Ohio—It is reported that plans are being prepared by H. L. Maddocks, Newark, for the construction of a sewer system and a sewage-disposal plant.

Mansfield, Ohio—(Official)—Bids will be received about Oct. 15 by Secretary of the Board of Control for the construction of additions to the sewage-disposal plant. The estimated cost is $110,000. W. J. Hazeltine is City Engr. Noted Aug. 19.

Indianapolis, Ind.—Preliminary plans are being prepared for the construction of a sewage-disposal plant. The estimated cost is $1,500,000.

Princeton, Ind.—Bids will be received about Sept. 13 for the construction of a sanitary sewer system.

✚South Range, Mich.—The contract for the construction of a sewer system has been awarded to HALL & LABBY, at $6900. Noted Apr. 29.

✚Berwyn, Ill.—(Official)—The contract for the construction of sewers in various streets has been awarded to T. H. IGLEHART, Chicago, at $5878. Noted Aug. 12.

Salem, Ill.—(Official)—Bids will be received in about 90 days for the construction of a sanitary sewer system. The Caldwell Engineering Co., Jacksonville, is Engr. Noted Aug. 19.

Springfield, Ill.—Wade Seeley, City Engr., estimates the cost of constructing a branch sewer and a sewage treatment plant at $120,000.

Appleton, Wis.—(Official)—Bids will be received until 9 a.m., Sept. 23, by the City Clerk for the construction of approximately 2300 ft. of 66- and 72-in. sewers of vitrified segment block or concrete in tunnel. A. C. Bemley is City Engr. Noted Aug. 26.

✚Madison, Wis.—(Official)—Contracts for sewer construction have been awarded to WEBER & GAY, at $28,865, 20-in. force mains; J. F. ICKE, at $24,700, interceptor; J. W. MITCHELL, at $12,100, pumping station.

★Milwaukee, Wis.—(Official)—Bids will be received until 10:30 a.m., Sept. 17, by Fred G. Simmons, Comr. of Pub. Wks., for the construction of the Lake St. sewer including the tunnel section, all shafts, manholes and the outfall section.

Racine, Wis.—Plans have been prepared by the Board of Public Works and submitted to the Council for extending the outlets of the English and 16th St. sewers into the lake such a distance that the outlets shall be submerged. The estimated cost is $10,000 and $5680 respectively. Noted May 20.

Randolph, Wis.—Plans have been prepared by W. S. Shields, Chicago, Ill., for the construction of a sanitary sewer system.

Keokuk, Iowa—Bids will be received until Sept. 9 by J. F. Winters, City Engr., for the construction of a sewer system.

Waterloo, Iowa—Plans are being prepared for the construction of a sewer system across the Black Hawk Creek and a sewage-disposal plant and lift station. The estimated cost is $75,000. Burns & McDonnell, 825 Scarritt Bldg., is Engr.

Brainerd, Minn.—Bids will be received until Sept. 20 by A. Mahlum, City Clk., for the construction of lateral sewers in District Nos. 4 and 7.

✚Sanstone, Minn.—(Official)—The contract for the construction of approximately 9025 ft. of 8- and 6-in. sewers has been awarded to CHARLES EKLUND & CO., Duluth, at $8289. Noted Aug. 5.

✚Stillwater, Minn.—The contract has been awarded to McGEE & NOLAN, Stillwater, at $7689, for the construction of sewers in Churchill, Fourth, Second and South Fourth St. Noted Aug. 12.

Chanute, Kan.—All bids received Aug. 20 by C. G. Wood, City Clk., for the construction of a sewage-disposal plant and septic tanks have been rejected. New bids will be received. Noted Aug. 12.

Coffeyville, Kan.—Plans are being prepared by the City Engineer for the enlargement of the sewer system.

Grand Island, Neb.—Plans are being prepared by Grant & Fulton, Lincoln, for the construction of a storm and sanitary sewer system.

✚Omaha, Neb.—The contract has been awarded to the OFFERMAN CONSTRUCTION CO., South Omaha, at $6947, for the construction of 800 ft. of 18-in. pipe sewers, 48 Y's 6x18-in., four manholes and 407 lb. of cast iron.

Aberdeen, S. D.—The city contemplates the construction of an addition to the sewage-disposal plant.

Centerville, S. D.—(Official)—Bids will be received until Sept. 20 by S. Christensen, City Audr., for the construction of a sewer system. The estimated cost is $25,000. Noted Aug. 5.

Whitehall, Mont.—Bids will be received until Sept. 18 by the city for the installation of a sewer system. George E. Bayer, Whitehall, is Consult. Engr. Noted June 24.

Harrisonville, Mo.—Plans have been prepared for the construction of a sewer system. The estimated cost is $17,000. W. B. Rollins, Kansas City, is Consult. Engr. Noted June 3.

★St. Louis, Mo.—(Official)—Bids will be received until noon, Sept. 14, by E. R. Kimsey, Pres. Bd. of Pub. Ser., for the construction of sewers in Des Peres Sewer District No. 3, Harlem Creek Sewer District Nos. 12 and 13, Penrose Joint Sewer District, and in Baden Sewer District No. 2.

Heber Springs, Ark.—(Official)—Bids will soon be received for the sale of $90,000 in bonds, the proceeds of which will be used for the construction of water and sewer systems. B. R. Brown is Recdr. Noted Aug. 19.

★**Dallas, Tex.**—Bids were received Aug. 23, by J. B. Winslett, City Secy., for the construction of improved sewerage works, (a) Contract No. 5, North Interceptor, (b) Contract No. 6, pumping station, 36-in. force main and Oak Cliff trunk line across the Trinity River, (c) Contract No. 7, disposal works including 36-in. force main from Station No. 5 plus 88.7 to the disposal works as follows: General Construction Co., Ft. Worth, (a) $119,843; F. B. Horton & Son, Houston, (a) $109,423; Bailey, Reeder & Co., Mobile, Ala., (a) $80,708, (c) $417,058; Tarrant Construction Co., Ft. Worth, (a) $108,373; Winslett-Eldridge Co., Dallas, (a) $119,080; T. A. Garvin, San Antonio, (a) $81,195; Roach-Manigan Paving Co., Dallas, (a) $128,887, (b) $98,434, (c) $515,401; James Stewart & Co., Houston, (a) $131,484, (b) $107,630, (c) $527,269; Mayfield & Shaw, El Paso, (c) $545,988; H. C. Gass, San Antonio ,(c) $467,274. Noted July 29.

Claremore, Okla.—At a recent election the citizens defeated the question of issuing $25,000 in bonds, the proceeds of which was to have been used for the construction of storm sewers.

Bonners Ferry, Idaho—The city contemplates the construction of a sewer system estimated to cost $20,000.

✚**Lewiston, Utah**—The contract for the construction of a sewer system has been awarded to the WHEELWRIGHT CONSTRUCTION CO., Ogden, at $41,000.

✚**Logan, Utah**—The contract for the construction of sewers in Improvement District No. 2 has been awarded to PARROTT BROS., at $10,200.

Roslyn, Wash.—Bids will be received until 8 p.m., Sept. 13, by George T. Wake, City Clk., for the construction of sewers in local improvement Districts Nos. 1, 2, 3 and 4. Noted July 15.

Portland, Ore.—The city contemplates the construction of sewers in Water and Mill St. The estimated cost is $16,486. A. L. Barbur is City Audr.

Huntington Beach, Calif.—Bids will be received until Sept. 7 by the City Clerk for the construction of sewers in various streets including Tenth, 11th St. and Arcadia Ave.

✚**Los Angeles, Calif.**—The contract for the construction of the Myra Ave. sewer has been awarded to LAWRENCE SKOCHELICH, at $25,389.

✚**San Francisco, Calif.**—The Board of Public Works has awarded the contract to F. ROLANDI, at $4761, for grading and constructing sewers in Balba St.

Stockton, Calif.—Bonds for $550,00 have been sold. The proceeds will be used for the construction of storm water and sanitary sewer systems. Noted June 24.

Berlin, Ont.—Bids will be received until Sept. 7 by the city for the construction of sewage-disposal works, comprising tanks, filters, sludge beds and a pumping station. Chipman & Power, 204 Mail Bldg., Toronto, is Consult. Engr., and H. Johnston is City Engr. Noted July 22.

✚**South Vancouver, B. C.**—Contracts for sewer pipe have been awarded to McNEILL, WELCH & WILSON and to EVANS, COLEMAN & EVANS at $9000, and to the DOMINION GLAZED PIPE CO., at $20,000.

GARBAGE

Green Bay, Wis.—C. F. Hunter Co., Chicago, Ill., has undertaken a campaign to promote the construction of a garbage incinerator for the city. The estimated cost is $20,000.

✚**San Antonio, Tex.**—The contract has been awarded to the SAN ANTONIO MACHINERY & SUPPLY CO., at $11,985, for installing a Decarie incinerator.

✚**Victoria, Tex.**—The contract has been awarded to the SAN ANTONIO MACHINERY & SUPPLY CO., San Antonio, at $7050 for furnishing one 6-ton 10-hour incinerator. Noted Aug. 19.

STREETS AND ROADS

✚**Tiverton, R. I.**—The contract for constructing the Stafford Rd. has been awarded to L. H. CALLAN, Bristol, R. I., at $5780. Noted June 24.

✚**Hartford, Conn.**—Contracts for state road work have been awarded as follows: Waterford Township, a section of native stone macadam on the Hartford-New London Turnpike, to the FRAMINGHAM CONSTRUCTION CO., South Framingham, Mass., at $8000; Southington Township, a section of 2-in. bituminous macadam on Meriden Ave., to LEONARDO SUZIO, Meriden, at $8506; Durham Township, a section of 2-in. bituminous macadam on the Middlefield Rd., to FRANK ARRIGONI & BRO., Middletown, at $7360; North Haven Township, about 4950 lin.ft. trap rock macadam on the Mt. Carmel Rd., to A. D. BRIDGE'S SONS, INC., Hazardville, at $6412. Noted Aug. 5 and 26.

✚**Albany, N. Y.**—(Official)—Bids were received Aug. 24 by the State Highway Commission, Lancaster St., Albany, and contracts awarded for the construction of highways by state aid, as follows:

Road No. 1322, Allegany County, 7.29 miles: JOHN H. GORDON, Albany, $71,137 (awarded contract); Sullivan Construction Co., Syracuse, $74,584; Greenfield Construction Co., Hornell, $75,853; Bison City Engineering & Contracting Co., Inc., Buffalo, $77,301; W. C. Evans, Ambler, Penn., $82,556.

Road No. 52141-A, Broome County, 3.15 miles: LANE CONSTRUCTION CORPORATION, Meriden, Conn., $37,832 (awarded contract); F. P. Mecks, Long Pond, Penn., $38,254; Port Jervis Construction Co., Port Jervis, $41,723.

Road No. 1305, Cattaraugus County, 5.379 miles: DUNKIRK CONSTRUCTION CO., Dunkirk, $75,507 (awarded contract).

Road No. 1310, Chemung County, 4.02 miles: SULLIVAN CONSTRUCTION CO., Syracuse, $40,537 (awarded contract); Atlanta Construction Co., Atlanta, $40,867; F. L. Breeze, Elmira, $41,371; E. W. Walsh, Elmira, $41,382; McGreevey, McGuigan & Baum, Elmira, $42,336; Peter F. Connelly Co., Horseheads, $43,650; W. C. Evans, Ambler, Penn., $47,350.

Road No. 1311, Chemung County, 6.87 miles: J. W. BRENNAN CONSTRUCTION CO., INC., Geneva, $78,420 (awarded contract); Peter F. Connelly Co., Horseheads, $78,800; Sullivan Construction Co., Syracuse, $78,989; Weed & Walsh, Mechanicsville, $82,091; F. P. Meckes, Long Pond, Penn., $85,184; John Johnson Construction Co., Buffalo, $85,949; P. H. Murray, Rochester, $89,390.

Road No. 5585, Chenango-Madison County, 6.18 miles: CONROY & NIXDORF, Oneida, $47,814 (awarded contract); James Anderson, Menands, $50,472; Mondo Construction Co., Inc., Syracuse, $50,554; Newport Construction Co., Herkimer, $50,563; Paddelford & King, Sherburne, $50,629; Joseph McCormick, East Providence, R. I., $50,820; Charles O. McComb, Syracuse, $50,979.

Road No. 5574, Columbia County, 1.17 miles: BELMAR CONTRACTING CO., Troy, $31,786 (awarded contract); F. L. Bannin Plumbing, Heating & Contracting Co., Kingston, $33,676; Marks Kearney, Hudson, $34,603; Russell Parker Construction Co., Hudson, $34,762.

Road No. 1162, Dutchess County, 5.16 miles: CAIRNIE-ST. GEORGE CO., New York, $51,750 (awarded contract); DeGraff & Hogeboom, Kingston, $51,985; Amos D. Bridge's Sons, Inc., Hazardville, Conn., $52,066; Gruner & Hallenbeck, Harriman, $53,144; Abner M. Harper, Newburgh, $54,106; Conway Bros. & Kennedy, Eddyville, $54,536; Schunnemunk Construction Co., Highland Mills, $55,791; Samuel Beskin, Beacon, $55,893; Stanley Construction Co., Buffalo, $57,139.

Road No. 1163, Dutchess County, 6.18 miles: RUDDY-SAUNDERS CONSTRUCTION CO., Troy, $78,776 (awarded contract); Amos D. Bridges Construction Co., Hazardvile, Conn., $82,067; Cairnie-St. George Co., New York, $83,501; Stanley Construction Co., Buffalo, $84,263; Weed & Walsh, Mechanicsville, $85,007; Frank G. Fowler Construction Co., Mt. Kisco, $85,274; DeGraff & Hogeboom, Inc., Kingston, $85,508; H. B. Sproul Construction Co., Inc., Peekskill, $86,647; Abner M. Harper, Newburgh, $87,784; Ward & Tully, Inc., Brooklyn, $88,204.

Road No. 1235, Dutchess County, 5.44 miles: SCHUNNEMUNK CONSTRUCTION CO., Highland Mills, $52,327 (awarded contract); S. B. Van Wagonen, Rondout, $53,303; Henry Clinton, Poughkeepsie, $54,572; Samuel Beskin, Beacon, $54,729; Gruner & Hallenbeck, Harriman, $54,812; R. G. Miller Contracting Co., Hartford, Conn., $55,092; Port Jervis Construction Co., Port Jervis, $56,673; Pierson Engineering & Construction Co., Hartford, Conn., $56,952; H. B. Sproul Construction Co., Inc., Peekskill, $62,985.

Road No. 1312, Dutchess County, 6.81 miles: RUDDY-SAUNDERS CONSTRUCTION CO., Troy, $62,826 (awarded contract); Marks Kearny, Hudson, $63,376; Amos D. Bridge's Sons, Inc., Hazardville, Conn., $67,739; Juniata Co., Philadelphia, Penn., $70,271; H. B. Sproul Construction Co., Inc., Peekskill, $70,687; Langan Construction Co., Albany, $74,228; DeGraff & Hogeboom, Inc., Kingston, $74,564; Stanley Construction Co., Buffalo, $76,005; Samuel Beskin, Beacon, $76,997; John J. Guinan Contracting Co., Brooklyn, $71,921.

Road No. 1313, Dutchess County, 6.86 miles: A. C. STEINBERG, JR., West Hartford, Conn., $64,341 (awarded contract); James Anderson, Menands, $68,092; John J. Guinan Contracting Co., Brooklyn, $69,137; John De Michael & Bro., Torrington, Conn., $69,737; Juniata Construction Co., Philadelphia, Penn., $70,377; Samuel Beskin, Beacon, $70,919.

Road No. 1314, Dutchess County, 5.37 miles: AMOS D. BRIDGE'S SONS, INC., Hazardville, Conn., $44,956; John Arborio, New Haven, Conn., $45,994; Weed & Walsh, Mechanicsville, $47,299; Blankfield & Donovan, Kingston, $47,782; Samuel Beskin, Beacon, $48,627; H. B. Sproul Construction Co., Inc., Peekskill, $49,261; Juniata Co., Philadelphia, Penn., $49,489; R. G. Miller Contracting Co., Hartford, Conn., $50,907.

Road No. 1304, Erie County, 1.17 miles: SHAW & LAKIN, Jamestown, $26,878 (awarded contract); O. M. Severson, Erie, Penn., $27,736; William H. Ring Contracting Co., Ogdensburg, $29,147; William C. Evans, Ambler, Penn., $28,431.

Road No. 5583, Greene County, 4.77 miles: CATSKILL CONSTRUCTION CO., Catskill, $43,833 (awarded contract); S. V. Van Wagonen, Rondout, $45,552; Gruner & Hallenbeck, Harriman, $47,688; George H. McEvoy, Creek Locks, $46,284; Marks Kearney, Hudson, $45,980; Richard Hopkins, Troy, $48,929; James Anderson, Menands, $50,755.

Road No. 1318, Livingston County, Road No. 1319, Monroe County, 1.88 miles: RIBSTEIN-HOLTER CO., INC., Rochester, $42,565 (awarded contract); Whitmore-Rauber & Vicinius, Rochester, $43,393; Charles O. McComb, Syracuse, $44,660; Langan Construction Co., Albany, $45,196; Chambers & Barnes, Rochester, $45,228.

Road No. 1321, Livingston County, 8.34 miles: AIBERT GAFFEY, Syracuse, $100,840 (awarded contract); Atlanta Construction Co., Atlanta, $109,477; P. H. Murray, Rochester, $116,432; J. M. Ludington Sons, Inc., Rochester, $120,191.

Road No. 5586, Madison County, 7.91 miles: SULLIVAN CONSTRUCTION CO., Syracuse, $64,126 (awarded contract); Conroy & Nixdorf, Oneida, $65,491; Mondo Construction Co., Inc., Syracuse, $67,918; James Anderson, Menands, $69,459; Newport Construction Co., Herkimer, $71,509; Joseph McCormick, East Providence, R. I., $74,343.

Road No. 5539, Monroe County, 7.31 miles: NEWPORT CONSTRUCTION CO., Herkimer, $69,481 (awarded contract); William H. Madden, Rochester, $70,704; Frank V. Brotsch Co., Rochester, $71,209; P. H. Murray, Rochester, $71,666; Michael H. Ripton, Rochester, $72,434; Thomas Grady, Rochester, $72,870; Cleveland & Sons, Brockport, $72,907; Harradine Bros. Co., Inc., Spencerport, $74,138; Michael Murphy, Rochester, $74,977; Morrisson & Quinn, Inc., Rochester, $75,135.

Road No. 5581, Monroe County, 0.14 mile: MORRISSON & QUINN, INC., Rochester, $10,827 (awarded contract); Dodge Construction Co., Inc., Rochester, $11,160; Whitmore-Rauber & Vicnius, Rochester, $11,211; Public Service Construction Co., Niagara Falls, $11,327; Wood & Tompkins, Hilton, $11,615; W. C. Evans, Ambler, Penn., $11,754.

Road No. 5576, Ontario County, 4.69 miles: SWEENEY & BOLAND, Rochester, $2641 (awarded contract); Richard Hopkins, Troy, $2849.

Road No. 5428, Rockland County, 0.99 mile: PAUL SANGER, Monsey, $5371 (awarded contract).

Road No. 5388, Rockland County, 2.16 miles: HASTINGS PAVEMENT CO., New York, $15,200 (awarded contract); John A. Jova, Inc., Newburgh, $18,995; Schunnemunk Construction Co., Highland Mills, $19,359; Paul Gsanger, Monsey, $20,721.

✚**Albany, N. Y.**—(Official)—Bids were received Aug. 24 by the State Highway Commission, Lancaster St., Albany, and contracts awarded for the repair of highways by state aid, as follows:

Repair Contract No. 850, Road No. 592, Cayuga County, 2.35 miles: RICHARD HOPKINS, Troy, $13,267 (awarded contract); J. H. Weidman, Syracuse, $13,374; M. J. Gleason, Syracuse, $13,634; Dana W. Robbins, Inc., New York, $13,987; Brayer Bros., Auburn, $14,138; Sweeney & Boland, Rochester,

$14,228; Edward S. Spyring, Syracuse, $14,835; Flood & Van Wirt Co., Hudson Falls, $14,937; Arthur F. McConvill, Ogdensburg, $15,181.

Repair Contract No. 849, Road No. 1016, Cayuga County, 3.14 miles: RICHARD HOPKINS, Troy, $21,550 (awarded contract); M. J. Gleason, Syracuse, $21,554; Semper Bros., Watertown, $22,527; W. J. Young, Locke, $22,757; Flood & Van Wirt Co., Hudson Falls, $22,790; Dana W. Robbins Co., Inc., New York, $22,933; Brayer Bros., Auburn, $23,794.

Repair Contract No. 846, Road No. 589, Columbia County, 3.81 miles: GEORGE HOLLER, Albany, $8814 (awarded contract); Thomas J. Martin, Beacon, $8886; William Doyle, Saugerties, $9135; Richard Hopkins, Troy, $9578; Jerry Sweeney, New Brighton, $9745.

Repair Contract No. 836, Road No. 376, Fulton County, 2.38 miles: CLARENCE WELCH & CO., Gloversville, $12,134 (awarded contract); John P. Dugan & Co., Amsterdam, $12,497.

Repair Contract No. 845, Road No. 436, Nassau County, 2.50 miles: EVERGREEN CONSTRUCTION CO., Long Island City, $8366 (awarded contract); Delta Contracting Co., Inc., Jamaica, $9416; William Doyle, Saugerties, $9364; Murray & Gardner, Center Moriches, $9708.

Repair Contract No. 842, Road No. 207, Ontario County, 0.60 mile: J. W. BRENNAN CONSTRUCTION CO., INC., Geneva, $12,284 (awarded contract); Connors & Gallivan Co., Elmira, $12,436; Schroder-Hicks Contracting Co., Rochester, $12,632.

Repair Contract No. 840, Road No. 228, Ulster County, 4.82 miles: JOHN F. GALLIVAN, Kingston, $18,812 (awarded contract); Blankfield & Donovan, Kingston, $20,441; Port Jervis Construction Co., Port Jervis, $20,759; L. F. Bannin Plumbing, Heating & Contracting Co., Kingston, $20,871; Gruner & Hallenbeck, Harriman, $21,641; DeGraff & Hogeboom, Kingston, $22,355.

Repair Contract No. 851, Road No. 694, Suffolk County, 3 miles: Murray & Gardner, Inc., Center Moriches, $10,186; Teconic Construction Co., Port Jervis, $11,880; MUNICIPAL ASPHALT CO., New York, $9125 (awarded contract).. Noted Aug. 12.

Albany, N. Y.—(Official)—Bids were received Aug. 26 by the State Highway Commission, 55 Lancaster St., Albany, for the construction of highways by state aid, as follows:

Road No. 5588, Greene County, 3.95 miles: James M. Hamilton & Co., Gardner, $98,639; St. Lawrence Construction Co., Inc., Albany, $115,940; Abner M. Harper, Inc., Newburgh, $117,149; James Anderson, Menands, $117,469; Stanley Construction Co., Buffalo, $120,523; George H. McAvoy, Creek Locks, $122,058; William G. Fox, Saratoga Springs, $122,311; Ward & Tully, Inc., Brooklyn, $125,264; Fulton Engineering Co., Albany, $125,785.

Road No. 5579, Herkimer County, 6.55 miles: Newport Construction Co., Herkimer, $63,077; James Anderson, Menands, $63,357; Joseph McCormick, East Providence, R. I., $67,782.

Road No. 5584, Herkimer County, 4.21 miles: Joseph McCormick, East Providence, R. I., $46,423; Newport Construction Co., Herkimer, $48,957.

Road No. 773, Niagara County, 2.38 miles: F. J. Mumm Contracting Co., Buffalo, $23,424.

Road No. 799, Niagara County, 4.21 miles: Arthur F. McConville, Ogdensburg, $53,156; Greenfield Construction Co., Hornell, $54,245; Joseph Brumver, Buffalo, $54,909; Woolsey Construction Co., Poughkeepsie, $55,178; Garradine Bros. Co., Inc., Spencerport, $57,253; F. J. Mumm Contracting Co., Inc., Buffalo, $59,255.

Road No. 1315, Niagara County, 8 miles: Joseph Brumver, Buffalo, $97,340; Serviss & Mackey, Youngstown, $101,902; Thomas F. Shaughnessy, Albany, $104,380; Cold Spring Construction Co., Buffalo, $105,307; Woolsey Construction Co., Poughkeepsie, $112,286.

Road No. 1153, Niagara County, 1.27 miles: Greenfield Construction Co., Hornell, $69,644; Caleb Hyatt, Yonkers, $70,101; Langan Construction Corporation, Albany, $71,184; Public Service Contracting Co., Niagara Falls, $73,694; C. N. Stainthorpe, Lockport, $74,353; C. B. Whitmore Co., Lockport, $78,476.

Road No. 5408, Oswego County, 0.36 mile: Oswego Construction Co., Fulton, $16,490; William H. Ring Contracting Co., Ogdensburg, $16,495; J. E. Bishop, Syracuse, $16,866; F. P. Meckes, Long Pond, Penn., $17,261; Bison City Engineering & Contracting Co., Inc., Buffalo, $17,284; J. J. Cashin, Fayetteville, $17,326; E. S. Spyrting, Syracuse, $17,639.

Road No. 817, Saratoga County, 3.57 miles: John Arborio, New Haven, Conn., $34,960; Weed & Walsh, Mechanicsville, $35,092; John B. Dower, Ballston Spa, $35,700; Thomas H. Karr, Troy, $36,437; D. J. Snell & Co., Canajoharie, $36,783; William G. Fox, Saratoga Springs, $38,158; Juniata Co., Philadelphia, Penn., $38,316.

Road No. 1320, Schuyler County, 2.75 miles: Patrick D. Conley, Ithaca, $25,380; Richard Hopkins, Troy, $26,804; James Rossney, Buffalo, $27,202; John H. Gordon, Albany, $28,267; Bison City Engineering & Contracting Co., Buffalo, $28,750; McGuigan, McGreevey & Baum, Elmira, $29,260; Hendrickson-McCabe Construction Co., Spencerport, $30,838.

Road No. 5575, Schuyler and Tompkins Counties, 4.12 miles: Patrick D. Conley, Ithaca, $35,160; James Rossney, Buffalo, $36,808; Sullivan Construction Co., Syracuse, $37,784; Bison City Engineering & Contracting Co., Inc., Buffalo, $38,255; Hendrickson-McCabe Construction Co., Inc., Spencerport, $40,026; John H. Gordon, Albany, $40,054; W. C. Evans, Ambler, Penn., $41,911.

Road No. 5577, Schoharie County, 7.96 miles: Weed & Walsh, Mechanicsville, $91,046; Newport Construction Co., Herkimer, $91,697; James Anderson, Menands, $94,459.

Road No. 5253-E, Steuben County, 5.52 miles: Kennedy Construction Co., Albany, $38,796; Greenfield Construction Co., Hornell, $41,320; John C. Bradley, Corning, $43,573; T. H. Gill Co., Binghamton, $43,71[illegible] Bison City Engineering & Contracting Co., Buffalo, $47,555; [illegible]. H. Murray, Rochester, $47,809; W. C. Evans, Ambler, Penn., 4$9,068; Thomas Grady, Rochester, $49,978.

Road No. 1076, Tioga County, 4.29 miles: Dana W. Robbins Co., Inc., New York, $35,354; T. H. Gill Co., Binghamton, $35,841; Richard Hopkins, Troy, $36,166; Sullivan Construction Co., Syracuse, $36,190; Atlanta Construction Co., Atlanta, $36,210; F. P. Meckes, Long Pond, Penn., $36,963; Lane Construction Corporation, Meriden, Conn., $37,369.

Road No. 1077, Tioga County, 4.72 miles: Lane Construction Corporation, Meriden, Conn., $36,148; T. H. Gill Co., Binghamton, $39,279; Dana W. Robbins, Inc., New York, $39,508; Sullivan Construction Co., Syracuse, $39,559; Richard Hopkins, Troy, $39,796; Atlanta Construction Co., Atlanta, $39,916; Peter F. Connolly Co., Horseheads, $40,826.

Road No. 1109, Washington County, 2.06 miles: William L. Sherrill, Hudson Falls, $16,975; Juniata Co., Philadelphia, Penn., $17,831; Kellogg Boynton, Keeseville, $17,966; Thomas H. Karr, Troy, $18,128; A. G. & D. T. Perry, Brattleboro, Vt., $18,663.

Road No. 5578, Washington County, 1.89 miles: William G. Fox, Saratoga Springs, $29,582; Thomas H. Karr, Troy, $31,491; John B. Dower, Ballston Spa, $32,058; Kellogg Boynton, Keeseville, $32,365.

Road No. 1306, Westchester County, 5.72 miles: Pierson Engineering & Construction Co., Hartford, Conn., $66,010; Frank G. Fowler Construction Co., Mt. Kisco, $68,307; Harris-Rose Construction Corporation, New York, $68,619; John De Michael & Bro., Torrington, Conn., $70,904; Amos D. Bridge's Sons, Inc., Hazardville, Conn., $71,630; Gruner & Hallenbeck, Harriman, $73,922; H. B. Sproul Construction Co., Inc., Peekskill, $78,068.

Road No. 1307, Westchester County, 1.89 miles: James Ciascia & Vincent Cartesi, Mt. Vernon, $22,231; Frank G. Fowler Construction Co., Mt. Kisco, $25,276; H. B. Sproul Construction Co., Peekskill, $27,428.

Road No. 1308, Westchester County, 2.15 miles: James Garofano & Son, Mt. Vernon, $24,738; James Ciascia & Vincent Cartesi, Mt. Vernon, $25,700; John De Michael & Bro., Torrington, Conn., $26,040; Frank G. Fowler Construction Co., Mt. Kisco, $26,109; Caesar A. Rossi, Harrison, $26,253; White & Colligan, Purchase, $26,256; H. B. Sproul Construction Co., Inc., Peekskill, $26,531.

Road No. 1309, Westchester County, 6.63 miles: Henry Clinton, Poughkeepsie, $67,954; Conway Bros. & Kennedy, Eddyville, $71,653; H. B. Sproul Construction Co., Inc., Peekskill, $73,168; Frank G. Fowler Construction Co., Mt. Kisco, $76,788.

Road No. 1323, Westchester County, 4.62 miles: Frank G. Fowler Construction Co., Mt. Kisco, $49,183; H. B. Sproul Construction Co., Inc., Peekskill, $51,389; William F. McCabe Construction Co., Inc., White Plains, $58,528.

Road No. 1325, Westchester County, 2.81 miles: H. B. Sproul Construction Co., Inc., Peekskill, $25,795; James Garofano Sons, Inc., Mt. Vernon, $25,841; Frank G. Fowler Construction Co., Mt. Kisco, $26,277; Amos D. Bridge's Sons, Inc., Hazardville, Conn., $26,710; James Ciascia & Vincent Cartesi, Mt. Vernon, $26,973; Gruner & Hallenbeck, Harriman, $27,702; Harris-Rose Construction Corporation, New York, $28,135.

Road No. 1324, Westchester County, 3.02 miles: H. B. Sproul Construction Co., Inc., Peekskill, $28,858; Caesar A. Rossi, Horicon, $28,071; Gruner & Hallenbeck, Harriman, $29,120; James Garofano & Son, Inc., Mt. Vernon, $29,129; Frank G. Fowler Construction Co., Mt. Kisco, $29,827; Harris-Rose Construction Corporation, New York, $30,113; John A. Jova, Inc., Newburgh, $30,834.

Albany, N. Y.—(Official)—Bids were received Aug. 26 by the State Highway Commission, 55 Lancaster St., Albany, for the repair of highways by state aid, as follows:

Repair Contract No. 839, Road No. 463, Herkimer County: J. J. Malloy, Schenectady, $18,797; Huntoon & Ferguson, Hudson Falls, $20,088; Michael O'Brien, Cortland, $20,321; Newport Construction Co., Herkimer, $20,366; B. J. Gaffney, Saratoga Springs, $22,127; Port Schuyler Construction Co., Inc., Oneida, $22,161; R. D. Cooper, Little Falls, $22,224.

Repair Contract No. 852, Road No. 359, Herkimer County: John P. Dugan & Co., Amsterdam, $10,360; Newport Construction Co., Herkimer, $10,569; Harry W. Roberts Co., Utica, $10,990; Phelan & Sullivan, Utica, $11,242; Dana W. Robbins, Inc., New York, $11,361.

Repair Contract No. 848, Road No. 71, Oneida County: Harry W. Roberts & Co., Utica, $13,649.

Repair Contract No. 841, Road No. 733, St. Lawrence County: Arthur F. McConville, Ogdensburg, $20,551; Kellogg Boynton, Keeseville, $21,878.

Repair Contract No. 844, Road No. 640, Schenectady County: J. J. Malloy, Schenectady, $8706; John P. Dugan Co., Amsterdam, $8923; Huntoon & Ferguson, Hudson Falls, $8936; Brown & Lowe Co., Schenectady, $10,196.

Repair Contract No. 837, Roads Nos. 795, 823 and 824, Sullivan County: George Mesler, Liberty, $4518; L. F. Bannin Plumbing, Heating & Contracting Co., Kingston, $4839; Port Jervis Construction Co., Port Jervis, $4857; Nash & Griffin, Norwich, $5011; Kelly & Wheeler, Buffalo, $5190; Armstrong & Trowbridge, Middletown, $6065; Thomas J. Martin, Beacon, $7230.

Repair Contract No. 843, Road No. 5223, Sullivan County: Armstrong & Trowbridge, Middletown, $41,492; George Mosler, Liberty, $42,327; Jackson Bros., Cuddebackville, $43,376; Port Jervis Construction Co., Port Jervis, $44,500.

Repair Contract No. 838, Road No. 503, Westchester County: Malloy & Murray Contracting Co., Yonkers, $96,2434; Lewis Petrillo, Mt. Vernon, $97,517; Caleb Hyatt, Yonkers, $98,515; Borough Asphalt Co., Brooklyn, $101,302.

Repair Contract No. 847, Road No. 19, Westchester County: James Garofano & Son, Inc., Mt. Vernon, $11,359; White & Colligan, Purchase, $11,755; William F. McCabe Contracting Co., Inc., White Plains, $12,576; Miguell Houck, White Plains, $12,687; John A. Jova, Inc., Newburgh, $12,963. Noted Aug. 12.

+Clifton Springs, N. Y.—A contract for constructing approximately 1100 lin.ft. of road with curb and gutters has been awarded to THOMAS MURRAY, Le Roy, at $5447.

+Cohoes, N. Y.—The contract for paving Garner St. from Johnston Ave. to the New York Central R.R. viaduct has been awarded to the THOMAS F. GRATTON CONSTRUCTION CO., Cohoes, at $21,199.

Dunkirk, N. Y.—James McNamara, Dunkirk, submitted the lowest bid for paving Woodrow Ave. (Bass St.) from Fourth to Sixth St.

Farmingdale, N. Y.—Bids will be received by James T. Hoile, Secy., Bd. of Trustees, 16 Court St., New York, N. Y. (Borough of Brooklyn), until Sept. 8, for constructing concrete walks at the New York State School of Agriculture.

New York, N. Y.—(Borough of Bronx)—(Official)—Bids will be received by Douglas Mathewson, Boro. Pres., Municipal Bldg., 177th St. and Third Ave., until 10:30 a.m., Sept. 8, for road improvements on Haviland Ave.

✚New York, N. Y.—(Borough of Manhattan)—The contract for paving with asphalt 25th, 55th, 65th, 67th, 80th and 85th St., has been awarded to the SICILIAN ASPHALT PAVEING CO., 41 Park Row, at $56,500.

✚Niagara Falls, N. Y.—The contract for paving 14th St. from Pine to Terry Ave. has been awarded to McKINNEY & MAGUIRE, at $15,000.

Oneonta, N. Y.—(Official)—Bids will be received until 8 p.m., Sept. 6, by Sheldon H. Close, City Clk., for paving a number of streets with concrete.

✚Rochester, N. Y.—Contracts have been awarded for paving Aberdeen and Marion St. with asphalt, to WHITMORE, RAUBER & VICINUS, at $9332 and $9252 respectively; Oneida St. with brick to the FLOWER CITY CONTRACTING CO., at $4776.

✚Schenectady, N. Y.—Contracts have been awarded for paving Watt St. to the SCHENECTADY CONSTRUCTION CO., Schenectady, at $14,641; Maplewood and 19th Ave. to the UNION PAVING CO., Schenectady, at $17,997.

✚Syracuse, N. Y.—The contract for paving Euclid Ave. and Pine St. has been awarded to the SCHENECTADY PAVING CO., Schenectady, at $7598 and $8850, respectively.

Watertown, N. Y.—The Board of Public Works has authorized the construction of 14 additional ft. of concrete pavement on Coffeen St. from Cedar St. to a point 50 ft. below Fair St. Bids for this work were received from Guy H. Miller, $4924; Gooley & Willard, $5102; A. F. Nims, Philadelphia, $5073; Burns Bros. & Haley, $4955.

Newark, N. J.—Bids were received Aug. 26 for paving Eckert Ave. from Seymour Ave. to Osborne Terrace as follows: Northern Construction Co., $5072; Uvalde Asphalt Co., $5719; Continental Public Works Co., $5463. Noted July 22.

✚Roseland, N. J.—The contract for paving Portland St. with macadam has been awarded to ROBERT DORIETY, 166 Ridge St., Newark.

★Bethlehem, Penn.—(Official)—Bids will be received until noon, Sept. 11, by Milton M. Mitman, Chn. of Street Com., 403 South Main St., for paving Linden St., Broad St., Main St. and Prospect Ave. A. M. Cawley, First National Bank Bldg., is Borough Engr. Noted Aug. 26.

Harrisburg, Penn.—(Official)—Bids will be received by the State Highway Department until 10 a.m., Sept. 15, for reconstructing 22,999 lin.ft. of road in Henderson Township, Huntingdon County, and 11,987 lin.ft. of road in East Marboro Township, Chester County.

✚Lewisburg, Penn.—The contract for paving Market St. has been awarded to WILLIAM LYONS, Sunbury, at $6000.

Philadelphia, Penn.—The lowest bids received for the repair of asphalt pavements were those of the Barber Asphalt Paving Co., at $5535 and $55,762. Noted Aug. 19.

✚Philadelphia, Penn.—The Department of Public Works has awarded the contract for repaving Chelton Ave. to the McMAHON ESTATE, Germantown, at $23,000.

Pittsburgh, Penn.—(Official)—Bids will be received until 10 a.m., Sept. 9, by Hyatt M. Crilbs, County Controller, for improving the Elkhorn and Monongahela City Rd., Lincoln Way Extension and Round Road Hill Rd.

Reading, Penn.—Press reports state that the City Council contemplates an expenditure of $19,000 for paving various streets. Edmond Ulrich is City Engr.

Saxonburg, Penn.—(Official)—Bids will be received until 7 p.m., Sept. 7, by E. L. Rudert, Borough Clk., for improving Main St.

✚Wilkinsburg, Penn.—(Official)—A contract for regrading, recurbing and repaving a number of streets has been awarded to A. V. PURNELL, 507 Jackson St., Allegheny, at $38,890. Noted Aug. 19.

Wilmington, Del.—The City Council has authorized a bond issue of $200,000, the proceeds of which will be used for improving a number of streets.

✚Cecilton, Md.—The contract for constructing a stone road from Warwick to Cecilton has been awarded to the JUNIATA PAVING CO., Philadelphia, Penn., at $37,000.

Denton, Md.—(Official)—Bids will be received until noon, Sept. 21, by the Commissioners of Caroline County for constructing a section of State Aid Highway in Caroline County along the Marydel and Templeville Rd. between Marydel and Templeville, for a distance of 2.06 miles.

Hagerstown, Md.—A contract for paving 1.86 miles of State Aid Highway in Washington County with macadam has been awarded to HOLLINGER & DENNIS, Clear Springs, Md., at $7981. Noted Aug. 12.

Accomac, Va.—Bids will be received until Sept. 7 by John D. Grant, Jr., Clk., County Bd. of Superv., for the sale of $30,000 in bonds. The proceeds will be used to improve the roads in Atlantic, Lee and Pungoteague Districts.

★Charleston, W. Va.—(Official)—Bids will be received until noon, Sept. 7, by B. A. Wise, City Mgr., for paving certain streets and alleys in the city of Charleston.

Wellsburg, W. Va.—Bids will be received until Sept. 4 by the County Court of Brooke County for paving the county road from the north end of Follansbee to the south end of Follansbee to the south end of Bates' Bridge. M. E. Boyd is Engr.

✚Concord, N. C.—The contract for paving West Depot St. from the intersection of Spring St. to the depot and Church St. from East Corbin to the east depot has been awarded to R. M. HUDSON, Atlanta, at $40,000.

Gastonia, N. C.—(Official)—Bids will be received until noon, Sept. 9, by the Commissioners of Gaston County, for the sale of $150,000 in bonds, the proceeds of which will be used for constructing roads in Gaston County. Noted June 24 and Aug. 19.

Roxboro, N. C.—Bonds for $15,000 will be sold. The proceeds will be used for improving a number of streets.

✚Arcadia, Fla.—The Commissioners of De Soto County have awarded the contract to the ALABAMA PAVING CO., Birmingham, Ala., for constructing 11½ miles of rock roads in the Wauchula-Bowling Green Rd. District.

Clearwater, Fla.—At a recent election the citizens voted in favor of issuing $715,000 in bonds, the proceeds of which will be used for constructing 78 miles of brick highway.

Ft. Myers, Fla.—According to press reports a road will be constructed between Ft. Myers and Naples and between Naples and Marco. Bonds for $177,500 have been voted for this purpose. Noted May 27.

✚Ft. Myers, Fla.—A contract for paving three miles of streets with brick has been awarded to the Southern Clay Mfg. Co., Chattanooga, Tenn.

Gulfport, Fla.—An election will be held Oct. 19 to vote on the question of issuing $10,000 in bonds, part of the proceeds of which will be used for constructing two miles of modified asphalt streets.

✚Kissimmee, Fla.—A contract for constructing three miles of brick road has been awarded to the ALABAMA PAVING CO., Orlando, Fla., at $28,000. Bonds for this purpose have been voted. Noted Aug. 5.

Kissimee, Fla.—At a recent election the citizens voted in favor of issuing $12,000 in bonds, the proceeds of which will be used for paving Main St.

Tallahasse, Fla.—An election will be held in Leon County, Sept. 21, to vote on the question of issuing $200,000 in bonds, the proceeds of which will be used for constructing various roads, including $100,000 for the Dixie Highway. J. C. Moore is Chn. of the Comrs. of Leon County.

✚Tarpon Springs, Fla.—The contract for widening and repaving Orange St. with brick has been awarded to the J. B. McCRARY CO., Atlanta, Ga.

West Palm Beach, Fla.—Bids will be received until Sept. 7 by the Commissioners of Palm Beach for constructing and hard surfacing the main county line in District No. 5. F. E. Encell is Chn. of the Comrs.

Carrollton, Ala.—Bids will be received until Sept. 22 by the Pickens County Commissioners for grading, draining and surfacing with gravel or sand-clay a portion of the Carrollton and Reform Rd., at an estimated cost of $11,159.

Gadsden, Ala.—Press reports state that the Commissioners of Etowah County will construct 7½ miles of the Turkeytown Rd. The work will be done by convict force.

Linden, Ala.—Bids will be received until Sept. 7 by A. L. Hasey, Comr. of Marengo County, for the construction of approximately 40 miles of sand-clay road in Marengo County. S. W. Gaines, Jr., Selma, is Engr.

Montgomery, Ala.—Bonds for $152,000 will soon be sold. The proceeds will be used for street improvements.

Russellville, Ala.—At a recent election the citizens of Franklin County voted in favor of issuing $145,000 in bonds, the proceeds of which will be used for building a pike road.

Clarksdale, Miss.—Bids will be received until Sept. 6 by S. S. Carr, Chancery Clk., for constructing two miles of gravel road in Supervisors' District No. 1, Coahoma County.

Columbus, Miss.—The construction of a road from Columbus, Miss., to Vernon, Ala., is contemplated by the Commissioners of Lamar and Lowndes Counties.

Macon, Miss.—Bids will be received until Sept. 6 by John A. Tyson, Chancery Clk., for improving roads in Noxubee County.

Magnolia, Miss.—Bids will be received until Sept. 6 by Charles E. Brumfield, Clk., County Bd. of Superv., for the sale of $100,000 in bonds, the proceeds of which will be used for improving the roads in Fourth Supervisors District.

Lake Charles, La.—Bids will be received by E. C. House, Clk., Police Jury, until Sept. 7, for constructing 6½ miles of gravel road on Highway No. 6 and 5 miles on Highway No. 8.

Dickson, Tenn.—At a recent election, the question of issuing $250,000 in bonds, the proceeds to be used for constructing roads in Dickson County, was defeated.

Clarksville, Tenn.—Bonds for $50,000 have been sold, the proceeds of which will be used for improving and constructing roads in Montgomery County.

Huntsville, Tenn.—At a recent election the citizens of Scott County voted in favor of the question of issuing $300,000 in bonds, the proceeds of which will be used for improving various roads.

Maryville, Tenn.—At a recent election the citizens of Blount County voted in favor of issuing $300,000 in bonds, the proceeds of which will be used for constructing roads, pikes and macadamizing roads already graded. Noted Feb. 11 and June 24.

Rogersville, Tenn.—Bids will be received until Sept. 6 by H. B. Stamps, Chn., County Court, for the sale of $250,000 in bonds, the proceeds of which will be used for improving a number of roads.

Rutledge, Tenn.—An election will be held Sept. 9 to vote on the question of issuing $200,00 in bonds, the proceeds of which will be used for constructing roads in Grainger County. Noted Aug. 12.

Louisville, Ky.—(Official)—Bids will be received until 2 p.m., Sept. 7, by the Board of Public Works for improving various streets.

✚Whitesburg, Ky.—The contract for grading and draining the road from Whitesburg to Corbin has been awarded to M. A. WHEELER at $42,000.

✚Bowling Green, Ohio—Contracts have been awarded for grading, draining and macadamizing Snell Rd. to N. L. DECKARD, Bowling Green, at $8943; Minning Rd., to OTTO BROUGH, Genoa, at $8611; Kearning Joint Rd. to THOMAS CONSTRUCTION CO., Sandusky, at $8994. Noted July 29.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Sept. 7, by Philip Fosdick, Dir. Pub. Ser., for improving Gest St. from Freeman Ave. to Baymiller St.

+Cleveland, Ohio—(Official)—The contract for improving Lorain Ave. from West 73rd to West 98th St. has been awarded to ROEHL BROS., Thompson Bldg., Cleveland, at $62,893. Noted Aug. 19.

Columbus, Ohio—Bonds for $100,500 have been sold. The proceeds will be used for improving various roads.

Columbus, Ohio—Bids will be received until noon, Sept. 7, by George A. Borden, Dir. Pub. Ser., for paving Nelson Rd. and Rhoades Ave.

+Columbus, Ohio—Bids were received Aug. 20 by Clinton Cowen, State Highway Comr., and contracts awarded for road construction in various counties as follows: Fulton County, Archbold-Fayette Rd., 1 mile of macadam to the KELLY CONSTRUCTION CO., $7400. Fulton County, Toledo-Angola Rd., 2.52 miles of waterbound macadam to GRAY BROS., Bowling Green, $20,500. Guernsey County, Cambridge-Caldwell Rd., bituminous macadam to PETROS & PALMER, Marietta, $27,400. Lucas County, Toledo-Napoleon Rd., 3.11 miles of waterbound macadam to C. W. RYAN, Maumee, to L. L. ALLEN, La Rue, $9159. Delaware County, Columbus-Sandusky Rd., 1.44 miles of waterbound macadam to JOHN McNAMARA, JR., Delaware, $8130. Noted Aug. 19.

+Columbus, Ohio—Contracts for road improvements have been awarded by the Franklin County Commissioners as follows: Mock Rd. to B. F. PATTERSON, Columbus, $59,250; Manhattan Ave., Linden, to R. W. McCOY, Columbus, $9135; McDonald Rd., Truro Township, to H. E. BARTHMAN, Columbus, $10,087; Harl Rd., Sharon Township, W. O. JEWETT, Columbus, $11,095. Noted Aug. 5.

Elyria, Ohio—Bids will be received until 1 p.m., Sept. 8, by F. L. Ellenburger, Clk. of the Lorain County Comrs., for resurfacing the La Grange-North Center Rd. with bituminous bound macadam.

Northfield, Ohio—(Official)—Bids will be received until 7:30 p.m., Sept. 7, by C. S. Machwart, Village Clk., for improving the Brandywine Rd. from the Brecksville-Macedonia Rd. to the intersection of the Lock Rd.

Oakharbor, Ohio—Bids will be received until Sept. 7 by the Village Clerk for paving 2500 sq.yd. with brick or asphaltic concrete.

+Toledo, Ohio—The contract for paving Miami St. has been awarded to NAVARRE HARRIS & TANSEY, Toledo, at $15,523.

Uhrichsville, Ohio—Bonds for $25,000 have been sold. The proceeds will be used for paving Dawson St.

Warren, Ohio—(Official)—Bids will be received until noon, Oct. 2, by George T. Hecklinger, City Audr., for the sale of $19,800 and $7800 in bonds, the proceeds of which will be used for paving Homewood Ave. and East Franklin St., respectively.

Woodsfield, Ohio—Bids will be received by the County Commissioners until Sept. 8 for the sale of $20,000 in bonds, the proceeds of which will be used for improving a number of roads.

Wooster, Ohio—Bids will be received until noon, Sept. 10, by Peter C. Given, Dir. Pub. Ser., for paving North Buckeye St. with brick.

Zanesville, Ohio—Ayers & Kappes, Zanesville, at $128,555, submitted the lowest bid for improving Adamsonville Rd.

+Brownstown, Ind.—A contract for paving approximately 17 blocks with concrete has been awarded to H. E. KATTMAN, Brownstown, at $19,931. Noted July 29.

+Ft. Wayne, Ind.—A contract for constructing a stone road in Perry Township has been awarded to J. C. O'CONNOR & SON, Delphi, at $12,385.

Indianapolis, Ind.—The Board of Public Works plans to resurface Capitol Ave. from Indiana Ave. to Tenth St. Estimated cost, $62,984.

Mt. Vernon, Ind.—Bids will be received until Sept. 7 by the County Commissioners for constructing two gravel roads in Black Township. J. R. Haines is County Audr.

New Albany, Ind.—According to press reports the County Commissioners contemplate the construction of a road between New Albany and Indianapolis to connect with proposed Dixie Highway.

Adrian, Mich.—Press reports state that Fairfield Township plans to construct a seven-mile stone road as part of a trunk line connection Adrian with northern Ohio.

+Belding, Mich.—(Official)—A contract for paving a number of streets with metropolitan wire cut lug block on a 6-in. concrete foundation with concrete curb and grout filler has been awarded to A. H. PRANGE, Grand Rapids, at $39,196.

+Deerfield, Mich.—The contract for constructing 12.5 miles of macadam roads has been awarded to W. H. KNAPP, Monroe, at $66,010. Noted Aug. 12.

+Lansing, Mich.—A contract for paving the drives at the Capitol with cresoted wood blocks has been awarded to WILLIAM H. RYAN, Lansing.

+Aurora, Ill.—The contract for paving South St. with brick has been awarded to J. E. SALFISBERG & CO., at $14,639. Noted July 22.

+Champaign, Ill.—A contract for constructing 11,200 sq.yd. of brick pavement with asphalt filler has been awarded to STIPES & PILCHER, 108 North Walnut St., Champaign, at $33,000.

+East Dubuque, Ill.—The contract for paving Sinsinawa Ave. has been awarded to the MIDWEST CONSTRUCTION CO., Chicago, at $14,000.

Freeport, Ill.—Plans have been received by Oscar G. Hiveley, Supt. of Stephenson County, for improving Globe Ave., estimated cost $7819.

+Glenellyn, Ill.—A contract for paving various streets with granite has been awarded to the ILLINOIS HYDRAULIC STONE & CONSTRUCTION CO., Elgin, at $74,000. Noted June 17.

+Kankakee, Ill.—The contract for paving North Fifth St. with brick has been awarded to F. L. SHIDLER, at $17,944.

+Mt. Carmel, Ill.—A contract for grading and graveling 19 miles of road in the Mt. Carmel Rd. District has been awarded to HOFFMAN, TOWNSEND & PARKS, Mt. Carmel, at $57,020. Noted Aug. 5.

+Peoria, Ill.—The A. D. THOMPSON CO., Peoria, at $14,321, has been awarded a contract for paving with brick a part of Frye Ave.

Columbus, Wis.—Bids will be received until 3 p.m., Sept. 14, by Benjamin Paepke, City Clk., for improving a portion of Madison Rd.

West Allis, Wis.—Bids will be received until 7.30 p.m., Sept. 3, by the Acting Board of Public Works for paving portions of Mitchell St., 60th Ave., Greenfield Ave. and National Ave. George Mahoney is City Clk.

Des Moines, Iowa—Bids will be received until 10 a.m., Sept. 8, by A. H. Davis, Secy., Executive Council State Capitol, for grading grounds and streets of extended capitol grounds.

Guthrie Center, Iowa—Bids will be received until Sept. 30 by Seth B. Weeks, Town Clk., for paving approximately 30 blocks with sheet asphalt, asphaltic concrete, bitulithic, vitrified brick or concrete.

Idagrove, Iowa—At a recent election the citizens voted in favor of the question of issuing $15,000 in bonds, the proceeds of which will be used for paving a number of streets.

+Duluth, Minn.—The contract for paving 21st Ave. from Fourth St. to Seventh Alley has been awarded to HILLIARD & JULIEN, at $5522.

St. Paul, Minn.—The City Council has authorized bond issues for $6500 and $20,000, the proceeds of which will be used for paving Fourth St. from St. Peter St. to the Seven Corners and Fifth St. from Broadway to St. Peter St. respectively.

Junction City, Kan.—Bids will be received until Sept. 7 by the Commissioners of Geary County for constructing one mile of concrete road.

Kearney, Neb.—An election will be held Sept. 7 to vote on the question of issuing $50,000 in bonds, the proceeds of which will be used for street paving.

+Lincoln, Neb.—(Official)—A contract for street paving in District No. 8 has been awarded to the BURKE-COCHRANE CO., Lincoln. Noted Aug. 12.

+Sioux Falls, S. D.—The contract for paving Main St. from Fifth to 13th St. with bitulithic has been awarded to WARREN BROS., Boston, Mass.

Jefferson City, Mo.—An election will be held Oct. 19 to vote on the question of issuing $100,000, in bonds, the proceeds to be used for road construction in Cole County.

Kansas City, Mo.—Bids will be received about Sept. 14 by the City Council for improving portions of a number of streets.

+Sedalia, Mo.—(Official)—The contract for surfacing approximately 2½ miles of rock road in Sedalia Special Rd. District has been awarded to LEE CARPENTER, Sedalia. Noted Aug. 19.

+Russellville, Ark.—A contract for constructing 26 miles of macadam road from Russellville to Hector has been awarded to W. C. JUCKSCH, Little Rock, at approximately $100,000. Bonds for this purpose were recently voted. Noted Aug. 12.

+Dallas, Tex.—The contract for paving Davis, Hines and Canty St. has been awarded to the STANDARD ENGINEERING CO., at $35,000.

+Dallas, Tex.—The contract for paving Fitzhugh St. has been awarded to the TEXAS BITULITHIC CO., at $11,854.

McKinney, Tex.—A bond issue of $200,000 has been approved by the Attorney General. The proceeds will be used for the construction of roads in District No. 8.

Lawton, Okla.—(Official)—Bids will be asked in about 60 days by the Commissioners of Comanche County for the construction of county highways, estimated to cost $5000. S. A. Joyner is County Engr.

Salt Lake City, Utah—(Official)—Bids will be received until 10 a.m., Sept. 15, by Karl A. Scheil, City Recdr., for paving 13th East St. from 11th South St. to Westminster Ave.

+Tacoma, Wash.—The contract for paving South O. St. from Sixth Ave. to South 11th St. has been awarded to the McHUGH CONSTRUCTION CO., Tacoma, at $9989.

Tacoma, Wash.—Bids will be received until Sept. 10 by Thomas N. Norris, County Audr., for improving Permanent Highway No. 7.

Walla Walla, Wash.—Press reports state that the City Commissioners have voted to pave Howard and Chestnut St. The estimated cost is $15,000.

Berkeley, Calif.—Press reports state that the City Council plans to improve a number of streets at an estimated cost of $100,000.

+Compton, Calif.—The contract for paving Main St. and Compton Ave. to the city limits has been awarded to GEORGE B. CURTIS, Los Angeles.

+Los Angeles, Calif.—The contract for improving Court St. from Alvador to Lake St. has been awarded to E. A. BAKER, at $4653.

Oakland, Calif.—(Official)—Bids will be received until 10 a.m., Sept. 7, by George E. Gross, Clk. of Bd. of Supvrs. of Alameda County, for grading and paving with bitulithic the county roads in Murray Rd. District, Murray Township.

San Francisco, Calif.—See item under "Sewers."

+Dunnville, Ont.—The contract for paving Canal St., E., with tarvia has been awarded to McRAE & CAMPAIGNE, Niagara Falls, Ont., at $10,460.

+Port Coquitlam, B. C.—The contract for grading and paving Dewdney Trunk Rd. has been awarded to the COLUMBIA BITULITHIC CO., Port, Coquitiam, at $22,000.

INDUSTRIAL WORKS

+Allston, Mass.—Dwight Baldwin has awarded the contract for the construction of a one-story, 55x190-ft. public garage to NATHAN HURWITZ, 26 Wolcott St., Boston, Mass. John T. Spofford, 15 Beacon St., Boston, Mass., is Arch. The estimated cost is $25,000.

+Boston, Mass.—W. F. Smith has awarded the contract for the construction of a one- and two-story, 65x131-ft. building to McDONALD & KIVELL, 155 Milk St. The estimated cost is $40,000. Stebbings & Watkins, 164 Federal St., is Arch. Noted July 1.

+Lawrence, Mass.—(Official)—The Lenox Motor Car Co. will build a reinforced-concrete factory by day work. The estimated cost is $100,000. Gilman & Ames, 8 Congress St., Boston, Mass., is Arch. Noted Aug. 19.

+Springfield, Mass.—The Bausch Machine Tool Co. has awarded the contract for the construction of a 41x50-ft. addition to its plant to J. G. ROY. The estimated cost is $11,000.

+Worcester, Mass.—The Graton & Knight Mfg. Co., Franklin and Suffold St., has awarded the contract for the construction of a three-story, 67x200-ft., brick addition to its plant to F. W. MARKS, 4 Walnut St. The estimated cost is $50,000.

Worcester, Mass.—A. A. Ridyard, 7 Chandler St., plans the construction of a $60,000 garage.

+Providence, R. I.—The CRUISE & SMILEY CONSTRUCTION CO., Pawtucket, R. I., has been awarded the contract for the construction of a two-story garage for the Merchants' Cold-Storage & Warehouse Co., Inc., Kinsley Ave. The estimated cost is $25,000. Jenks & Ballou, Grovesnor Bldg., is Arch.

+Bridgeport, Conn.—The Remington Arms—Union Metallic Cartridge Co. has awarded the contract for the construction of three factories to the T. J. PARDY CONSTRUCTION CO. The estimated cost is $500,000.

+Bristol, Conn.—The contract for the construction of a 127x252-ft. addition to the factory of the New Departure Mfg. Co. has been awarded to LEVERING & GARRIQUES, 552 West 23rd St., New York, N. Y.

+Amsterdam, N. Y.—The Amsterdam Silk Mills has awarded the contract for the construction of a $10,000 addition to its plant to P. B. MACHOLD.

+Amsterdam, N. Y.—The contract has been awarded to JOHN J. TURNER & SONS for the construction of a two-story, 35x40-ft. garage for Harvey Chalmers. The estimated cost is $15,000.

+Auburn, N. Y.—The contract has been awarded to E. K. FENNO, Rosemblum Bldg., Syracuse, N. Y., for the construction of a two-story, 48x100-ft. plant for the Auburn Button Works. The estimated cost is $20,000. G. W. Thompson, Gurney Bldg., Syracuse, N. Y., is Engr.

Mt. Vernon, N. Y.—The Benford Mfg. Co. will build an addition to its plant to cost $15,000.

New York, N. Y.—(Borough of Brooklyn)—The Grand Union Tea Co., 68 Jay St., will build a ten-story, 51x100-ft. brick and steel factory at Jay and Front St., to cost $100,000.

+New York, N. Y.—(Borough of Manhattan)—STERRETT & GOSS, 103 Park Ave., has been awarded the contract for the construction of a five-story, 150x200-ft. factory for the Gryphon Rubber Co. Frank E. Newman, 1123 Broadway, is Arch.

New York, N. Y.—(Borough of Manhattan)—The Manhattan Refrigerating Co., 521 West St., plans the construction of a seven-story, 62x84-ft. cold-storage warehouse at 94-97 Gansevoort St., to cost $80,000.

Rochester, N. Y.—C. W. Brownyard, Mill St., will build a one-story, 100x100-ft. factory by day labor. The estimated cost is $20,000.

+Rome, N. Y.—The Rome Brass & Copper Co. has awarded the contract to PARRY & JONES for the construction of a one-story, 140x200-ft. brick and steel addition to its casting shop.

Syracuse, N. Y.—Bids are being received by Gaggin & Gaggin, Arch., University Bldg., for the construction of a one-story, 110x140-ft. foundry for the Syracuse Malleable Iron Works, 101 North Geddes St.

+Camden, N. J.—The contract has been awarded to the TURNER CONCRETE STEEL CO., 1713 Sansom St., Philadelphia, Penn., for the construction of a three-story, 96x100-ft. factory for E. & R. Preisendanz. J. C. Jefferis, 1001 Chestnut St., Philadelphia, Penn., is Arch. Noted July 8.

+Hackensack, N. J.—The STEWART CONSTRUCTION CO., 1705 University Ave., New York, N. Y., has been awarded the contract for the construction of a $5,000,000 plant for the American & British Mfg. Co., Bridgeport, Conn. Noted Aug. 19.

+Newark, N. J.—The contract has been awarded to the ESSEX CONSTRUCTION CO., 85 Academy St., for the construction of a one-story, 53x150-ft. chemical factory for the Consolidated Color Chemical Co., Lister Ave. The estimated cost is $15,000. Marshall N. Shoemaker, 9 Clinton St., is Arch.

+Plainfield, N. J.—TALLAMY BROS., 548 West Front St., has been awarded the contract for the construction of a three-story, 75x100-ft. warehouse for the Plainfield Storage Warehouse Co., W. Manning, 106 Depot Pl. The estimated cost is $30,000. Noted Aug. 5.

+Lancaster, Penn.—The National Biscuit Co., care F. G. Johns, 318 North Arch St., has awarded the contract for the construction of a one-story, 39x180-ft. storage building to C. F. & B. G. STAUFFER. The estimated cost is $10,000.

+Oil City, Penn.—(Official)—S. C. BOQUIN has been awarded the contract for the construction of a one-story, 38x150-ft. brick and reinforced-concrete carbarn with a 16x100-ft. wing for the Citizens Traction Co. Day & Zimmerman, 611 Chestnut St., Philadelphia, Penn., is Arch. Noted Apr. 8 and May 13.

Philadelphia, Penn.—Bids are being received by Spencer Roberts, Arch., 1524 Chestnut St., for the construction of a six-story, 39x68-ft. factory for Felton, Shibley & Co., 136 North Fourth St. The estimated cost is $50,000.

+Philadelphia, Penn. — WILLIAM STEELE & SONS CO., 1600 Arch St., has been awarded the contract for the construction of a one-story, 107x183-ft. factory for the National Umbrella Frame Co., 30th and Thompson St. The estimated cost is $36,000.

Philadelphia, Penn.—Bids are being received by F. P. Woll & Co., Church and Tacony St., for the construction of a one-story, 60x95-ft. factory to cost $25,000.

Philadelphia, Penn.—The contract will soon be awarded for the construction of a five- and six-story addition to the packing plant of J. J. Felin & Co., 4142 Germantown Ave. The estimated cost is $90,000.

+Philadelphia, Penn.—(Official)—The contract for the construction of a one-story 142x165-ft. factory at Ninth and Bailey St. for the Wood Mfg. Co. has been awarded to FRANK TURNER, 828 Broadway, Camden, N. J. The estimated cost is $30,000.

Pittsburgh, Penn.—The Republic Electric & Mfg. Co., Jenkins Arcade Bldg., plans the construction of a four-story, 54x147-ft. factory to cost $200,000. H. Hornbostel, Pittsburgh Bank for Savings Bldg., is Arch.

Security, Md.—The Security Cement & Lime Co. will expend $100,000 for additions to its plant.

Fayetteville, Tenn.—(Official)—We are advised by J. E. Sirrine, Engr., Greenville, S. C., that work has been postponed indefinitely on the proposed mill for the Elk Cotton Mills. Noted Aug. 19.

Memphis, Tenn.—D. Canale & Co., Front and Huling St., will build a three-story warehouse to cost about $50,000. G. M. Shaw & Co., Tennessee Trust Bldg., is Arch.

+Akron, Ohio—The AKRON STORAGE & CONTRACTING CO., 215 South Broadway, has been awarded the contract for the remodeling of the one-story, 66x88-ft. laundry of Lawrence Halter, 669 South Main St. The estimated cost is $10,000.

+Akron, Ohio—The William Foundry & Machine Co., 62 Cherry St., has awarded the contract for the remodeling of its two-story, 92x125-ft. machine shop to the CARMICHAEL CONSTRUCTION CO., Hamilton Bldg. The estimated cost is $16,000.

Cleveland, Ohio—Bids are being received by W. J. Carter, Engr., 1423 Illuminating Bldg., for the construction of a two- three- and four-story, 100x120-ft. addition to the factory of the Van Dorn & Dutton Co., F. W. Sinram, Secy., 2714 East 79th St.

Cleveland, Ohio—J. H. Donahey, Hillside Ave., East Cleveland, plans the construction of a three-story, 54x189-ft. factory at 2002 Euclid Ave. The estimated cost is $50,000.

Cleveland, Ohio—The Perfection Spring Co., will build an addition to its plant at 6501 Central Ave., to cost $15,000.

Cleveland, Ohio—The West Ninth Street Terminal Warehouse Co. will build terminals on West Ninth St. A. A. Mudge, Home Financing Co., Williamson Bldg., is interested. Estimated cost, $2,000,000.

+Steubenville, Ohio—The La Belle Iron Works has awarded the contract for the construction of a $2,000,000 by-product coking plant to the KOPPERS CO., Pittsburgh, Penn. The plant will consist of 96 ovens.

+Toledo, Ohio—SPEAR, MOYLAN & LASLEY has been awarded the contract for the construction of a one-story, 107x145-ft. dry kiln for the Willys Overland Co., Central Ave. The estimated cost is $30,000. Mills, Rhines, Bellman & Nordhoff, 1234 Ohio Bldg., is Arch.

+Toledo, Ohio—(Official)—The Castleton Co. has awarded the contract for the concrete pile foundation for its proposed building at St. Clair and Adams St., to the MacARTHUR CONCRETE PILE & FOUNDATION CO., 11 Pine St., New York, N. Y. Mills, Rhines, Bellman & Nordorff, Ohio Bldg., Toledo, Ohio, is Arch.

Evansville, Ind.—C. Shopbell & Co., Arch., 707 Furniture Exchange Bldg., has prepared plans for the construction of a five-story 48x150-ft. factory for the Anchor Supply Co., Water and Vine St. Louis Dana is Pres.

+Detroit, Mich.—The Metal Products Co. has awarded the contract for the construction of a four-story, 60x100-ft. factory to FULLER & CO., 320 Penobscot Bldg. Nettleton & Weaver, 1405 Penobscot Bldg., is Arch.

+Detroit, Mich.—The contract for the construction of a two-story, 131x152-ft. warehouse for A. Y. Malcomson, 116 La Salle Ave., has been awarded to A. A. ALBRECHT & CO., Penobscot Bldg. Malcomson & Higginbotham, 404 Moffat Bldg., is Arch.

+Chicago, Ill.—O. W. ROSENTHAL & CO., 80 East Jackson Blvd., has been awarded the contract for the construction of a six-story, 108x120-ft. printing plant for the Regensteiner Colortype Co., 1201 West Jackson Blvd. A. S. Alschuler, 28 East Jackson Blvd., is Arch. Noted Aug. 19.

+Madison, Wis.—The Gisholt Machine Co. has awarded the contract to the WORDEN-ALLEN CO., Milwaukee, Wis., for the construction of two steel and brick buildings.

+Des Moines, Iowa—The contract for the construction of a five-story, 100x250-ft. brick publishing building at 20th and Grand Ave. for J. H. Pierce has been awarded to the WERTZ CONSTRUCTION CO., 711 Mulberry St. The estimated cost is $250,000.

Wichita, Kan.—The Wichita Creamery Co., 202 North Handley Ave., will soon award the contract for the construction of a three-story, 50x120-ft. reinforced-concrete and brick creamery to cost $20,000. G. E. Moser, Chicago, Ill., is Arch B. F. Copley is Pres.

Scottsbluff, Neb.—It is reported that the Scottsbluff Creamery Co. plans the construction of a $15,000 plant.

✚**Independence, Mo.**—The contract has been awarded to WILLIAM CRICK, 1601 West Short St., for the construction of a two-story 50x165-ft. reinforced-concrete garage at 314-16 West Lexington Ave. for Smith Bros., 214 West Maple St., at $10,000.

Argenta, Ark.—The Arkansas Fertilizer Co., will build a sulphuric acid plant, to cost $90,000.

Wiley, Colo.—The Denver Alfalfa Milling Co. plans the construction of a mill to cost $50,000.

✚**Portland, Ore.**—The Dock Commission has awarded the contract for the construction of a 176x330-ft. reinforced-concrete warehouse to the BRAYTON ENGINEERING CO., at $86,990. Other bids were: Anton Teller, $88,684; J. M. Ambrose, $106,895; Parker & Banfield, $100,884; Freiburg, McLennan Co., $102,837; Palmer, Ellis & Co., $87,133; Portland Bridge & Building Co., $91,434; Beers Building Co., $87,474; John Almeter, $94,215; Boyajohn-Arnold Co., $93,829.

✚**Regina, Sask.**—(Official)—The Robert Simpson Co., Queen and Yonge St., Toronto, Ont., has awarded the contract for the construction of a $150,000 warehouse to the WELLS BROS. CO., 53 West Jackson Blvd., Chicago, Ill. Noted Aug. 12 and 19.

FEDERAL GOVERNMENT WORK

Alterations—Boston, Mass.—Bids will be received until 3 p.m., Sept. 14, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for alterations, and partitions at the U. S. Custom House, Boston.

Building—Boston, Mass.—Bids will be received until 3 p.m., Oct. 8, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing the U. S. appraisers' stores at Boston.

✚**Buildings**—Ft. Mifflin, Penn.—The contract has been awarded to CHARLES GILPIN, Philadelphia, at $60,000, for constructing four magazine buildings at Ft. Mifflin. Noted Aug. 26.

Custom House—Wilmington, Del.—Bids will be received Oct. 9, according to press reports, for the construction of the U. S. custom house at Wilmington.

Building—Indian Head, Md.—Bids were received Aug. 28, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of one steel frame cotton storehouse covered with corrugated iron, concrete floor and foundation from: John H. Nolan Construction Co., Washington, D. C., $4353 and Penn Bridge Co., Washington, D. C., $4320. Noted Aug. 5.

Desks—Washington, D. C.—Bids will be received until 3 p.m., Sept. 15, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for furnishing bronze and wood desks.

Power Plant—Washington, D. C.—Bids will be received until Nov. 17 by the Treasury Department, Washington, for constructing and equipping a power plant at the foot of 14th St. The appropriation is $1,494,104.

★**Retaining Wall**—Washington, D. C.—Bids will be received until 2 p.m., Sept. 20, by the Commissioner of Public Buildings and Grounds, Washington, for constructing a retaining wall along the west side of Meridian Hill Park.

★**Steel Derrick Boat**—Washington, D. C.—Bids were received Aug. 23 by the U. S. Engineer for furnishing a steel derrick boat as follows: Spedden Shipbuilding Co., Baltimore, Md., $43,770; Ellicott Machine Corporation, Baltimore, Md., $34,742; Dravo Contracting Co., Pittsburgh, Penn., $23,750 and Valk & Murdock. Noted July 20.

Vessel—Washington, D. C.—Bids were received Aug. 25, by the Coast and Geodetic Survey, Dept. of Commerce, Washington, D. C., for the construction of a survey vessel for the Survey as follows: Spedden Shipbuilding Co., Baltimore, Md., $266,700; Ellicott Machine Corporation, Baltimore, Md., $224,800; Anderson Steamboat Co., Seattle, Wash., $211,790; Pusey & Jones, Wilmington, Del., $242,472; Manitowoc Shipbuilding and Dry Dock Co., Manitowoc, Wis., $189,000 and Seattle Construction & Dry Dock Co., Seattle, Wash., $210,000. Estimates were also submitted by four United States Navy Yards but these do not provide for bond or for liquidated damages: Philadelphia, Penn., $244,245; Portsmouth, N. H., $163,250; Puget Sound, Wash., $229,784 and Norfolk, Va., $220,000. Bids were opened at the same hour at San Francisco.

✚**Post Office**—Wellsburg, W. Va.—The contract has been awarded to the COLONIAL CONSTRUCTION & SUPPLY CO., Charlottesville, Va., at $41,500, for constructing the post office. Noted Aug. 19.

Buildings—Port Royal, S. C.—Bids were received Aug. 28 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a guardhouse, six double quarters for noncommissioned and petty officers, brick wall for command barracks, garbage incinerator and nine sleeping porches at the Naval Disciplinary Barracks, Port Royal: A. S. Bacon & Sons, 2 Bay St., E., Savannah, Ga. $41,075; Simons-Mayrant Co., Peoples Office Bldg., Charleston, S. C., $44,287; Algernon Blair, 11 South Lawrence St., Montgomery, Ale., $38,685; Newport Contracting & Engineering Co., Newport News, Va., $34,676; Cox & Doke, 303 34th St., Savannah, Ga., $35,151; N. Christenson & Son, Beaufort, $66,666; R. W. Wimbish, 1106 Bull St., Savannah, Ga., $43,515 and Henry Monk, 314 West Belmont St., Pensacola, Fla., $49,040. Noted Aug. 5.

★**Barges** — Vicksburg, Miss. — The bid of the American Bridge Co., Pittsburgh, Penn., at $7500 per barge for furnishing six steel barges has been recommended for acceptance. Noted July 22.

★**Miscellaneous Work**—Marblehead, Ohio—Bids will be received until 2 p.m., Sept. 21, by the U. S. Coast Guard, Treasury Dept., Washington, D. C., for constructing a boathouse, crew's quarters and launchway, moving present building and removing old launchway at the Marblehead Coast Guard Station.

Lumber—Detroit, Mich.—Bids will be received until 2 p.m., Sept. 9, by the Lighthouse Inspector, Detroit, for furnishing about 75,000 ft. of hardwood timber for Charity Island Lighthouse Reserve.

✚★**Dredging**—Chicago, Ill.—The contract has been awarded to the FITZ SIMONS & CONNELL DREDGE & DOCK CO., Chicago, at $31,651 for dredging in Calumet River. Noted July 29.

Pipe—Newell, S. D.—Bids will be received until 4 p.m., Sept. 16, by the U. S. Reclamation Service, Newell, for constructing approximately 3285 ft. of 60-in. and 450 ft. of 24-in. continuous wood stave pipe for the Belle Fourche Project.

★**Canal Work**—St. Ignatius, Mont.—Bids were received Aug. 18 for constructing (a) laterals and (b) sublaterals as follows: Two Miracle Concrete Corporation, Kalispell, (a) and (b) $33,389; Wilson Bros., Polson, (a) $10,945; Percy M. Ross, Polson, (a) part, $4168 and J. E. Hilton, Billings, (a) and (b) $30,254. Noted July 22.

✚**Post Office**—Cuero, Tex.—The contract for the construction of a post office at Cuero has been awarded to RICHARDSON ENGINEERING & CONSTRUCTION CO., Bainbridge, Ga., at $53,470. Noted May 13 and July 1.

Buildings—Isabel, Tex.—Bids were received Aug. 28, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of power house and one operator's quarters at the Naval Radio Station, Isabel, as follows: C. O. Eure, Hattiesburg, Miss., $12,561; Newport Contracting and Engineering Co., Newport News, Va., $14,200; James McCoy, Brownsville, $9500. Noted July 22.

Mechanical Equipment—Tulsa, Okla.—Bids will be received until 3 p.m., Sept. 30, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for installing mechanical equipment, except lighting fixtures, at the U. S. post office.

★**Post Office**—Grand Junction, Colo.—Bids were received Aug. 24, by the Acting Supervising Architect, Treasury Dept., Washington, D. C., for the construction of a post office at Grand Junction, (a) limestone, (b) sandstone: George W. Stiles Construction Co., Chicago, Ill., (a) $112,294; George A. Whitmeyer Co., Ogden, Utah, (a) $108,006; William O'Neill & Son Co., Faribault, Minn., (a) $112,819; Norman Ker, New York, N. Y., (a) $121,000, (b) $128,000; King Lumber Co., Charlottesville, Va., (a) $96,140, (b) $100,000; Campbell Building Co., Salt Lake City, Utah, (a) $107,500, (b) $112,500; Dieter & Wenzel Construction Co., Wichita, Kan., (a) $100,821; J. H. Wiese, Omaha, Neb., (a) $109,723; M. Yeager & Sons, Danville, Ill., (a) $108,943, (b) $112,943. Noted July 22.

Cylinder Gates—Elephant Butte, N. M.—We have been advised that bids will not be opened on Sept. 2 for furnishing cylinder gates for spillway at the Elephant Butte Dam. The work will be readvertised. Noted Aug. 19.

✚**Dredging**—Bremerton, Wash.—The contract for dredging about 20,000 cu.yd. of material at the Puget Sound Navy Yard has been awarded to ERICKSON CONSTRUCTION CO., Seattle, at 60c. per yd. Noted Aug. 19.

Stable—Bremerton, Wash.—Bids will be received until 11 a.m., Sept. 25, by William M. Smith, Act. Ch. of Bureau, Bureau of Yards and Docks, Washington, D. C., for constructing a stable at the Puget Sound Navy Yard.

Engines—Portland, Ore.—Bids will be received until 2 p.m., Sept. 20, by the Lighthouse Inspector, Portland, for furnishing oil engines and compressors for Slip Point Station.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., Sept. 10, by Maj. F. C. Boggs, Gen. Pur. Agt., Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

Elevators—Pearl Harbor, Hawaii—Bids were received Aug. 28 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the installation of three hydropneumatic freight elevators at the Naval Station, Pearl Harbor, Hawaii: Otis Elevator Co., Washington, D. C., $8484; A. Kieckhefer Elevator Co., Milwaukee, Wis., $8600. Noted Aug. 12.

MISCELLANEOUS

Retaining Wall—Quincy, Mass.—The Fore River Shipbuilding Co. will build a sea wall 1200 ft. long and 40 ft. high.

✚**Barge Canal Work**—Albany, N. Y.—The contract for the construction of the terminal dock, under Contract 46, at Weedsport, has been awarded to SCOTT BROS., Rome, N. Y., at $13,658. Noted Aug. 26.

Barge Canal Work—Albany, N. Y.—(Official)—Bids will be received until Sept. 9 by W. W. Witherspoon, Capitol, Albany, for improving Three Mile Harbor in Suffolk County and the dredging of Sawyer Creek. Bids will be also opened at the same time for furnishing and delivering about 2,000,000 ft. of timber and plank.

Retaining Wall—Buffalo, N. Y.—The Mayor has signed a resolution authorizing a bond issue of $50,000 for the construction of a retaining wall at the foot of Ferry St.

Swimming Pool—Buffalo, N. Y.—The city plans to construct a swimming pool at the municipal water-works plant. The estimated cost is $10,000.

✚**Jetty**—Atlantic City, N. J.—The contract for lengthening the jetty at the foot of Tennessee Ave. has been awarded to the ATLANTIC CITY CONSTRUCTION & SUPPLY CO., at $13,427. Noted Aug. 26.

★**Hardware**—Newark, N. Y.—(Official)—Bids will be received by Mrs. Sarah F. S. Armstrong, Pres., Board of Trustees, New York State Custodial Asylum for Feeble Minded Women, until noon, Sept. 15, for furnishing hardware for the cottage and hospital building.

Jetties and Bulkhead—New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received by Cabot Ward, Dept. of Parks, Municipal Bldg., Manhattan, until 3 p.m., Sept. 9, for the construction of timber jetties and bulkhead, also extending existing jetties to new penetration on the beach at Seaside Park, Rockaway.

Retaining Wall and Fencing—Aspinwall, Penn.—Bids will be received by S. R. Chase, Clk., 230 First St., until 7:30 p.m., Sept. 6, for the construction of a concrete retaining wall, and 250 lin.ft. of iron-pipe fencing. Specifications may be obtained of A. G. Shaw, 808 Magee Bldg., Pittsburgh, Penn., Engr.

Coal Pocket—Philadelphia, Penn.—The Koelle, Speth & Co., will erect a 34x124-ft. coal pocket on Water St., to cost $8000.

★✚**Subway**—Philadelphia, Penn.—(Official)—The contract for constructing the subway and station, under Filbert St., City Hall and South Penn Sq., has been awarded to the KEYSTONE STATE CONSTRUCTION CO., Penn Bldg., at $1,700,000 (lump sum bid). Noted Aug. 26.

✚**Subway**—Philadelphia, Penn.—(Official)—The contract for constructing foundations in Front St., Kensington and Frankford Ave. from Callowhill St. to Unity St. has been awarded to JAMES D. DORNEY, 1204 East Montgomery Ave., at $142,590 (lump sum bid). Noted Aug. 26.

✚**Levee**—Greenville, Miss.—The Board of Mississippi Levee Commissioners awarded contracts for the construction of levees as follows: Mayersville to Baleshed enlargement, 262,000 cu.yd. to R. T. CLARK & CO., at $44,671; Upper & Lower Avon banquette to BURT, BOND & McMURRAY, at $6020; Moon Lake enlargement, 200,000 cu.yd. to R. T. CLARK & CO., at $34,100; Upper Vermillion Spur enlargement to R. T. CLARK & CO., at $5000; new Shiloh levee, 200,000 cu.yd., to W. T. & E. M. LAWRENCE & CO., at $29,780. Noted Aug. 12.

Wharf—New Orleans, Miss.—Plans have been prepared for the construction of a wharf between First St. and Sixth St. The estimated cost is $69,000. Bids will be advertised for as soon as plans are approved by Board of Port Commissioners.

✚**Levees**—New Orleans, La.—The State Board of Engineers awarded the contract for the enlargement of Hermitage Levee, Parish of Iberville, to the HAMERON WHITE CO., LTD., at 19.9c. per cu.yd. The total cost amounted to about $29,850.

✚**Drainage**—Selmer, Tenn.—The Directors of Cypress Creek Drainage District have awarded the contract for the construction of a canal 8.4 miles long to the SWAMP DREDGE CO., Tupelo, Miss., at 8¼c. per cu.yd. Noted Aug. 5.

Retaining Wall—Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, Room 511, City Hall, until noon, Sept. 8, for the construction of a retaining wall in Rockefeller Park. Specifications may be obtained of the Park Engineer, 318 City Hall.

✚**Breakwater**—Conneaut, Ohio—The contract for the construction of a pier head and rubble mound breakwater at Conneaut Harbor has been awarded to the COAST & LAKES CONTRACTING CORPORATION, Cleveland, at $99,007.

✚**Ditch**—Richmond, Ind.—The contract for the construction of the Nettle Creek Ditch has been awarded to HORTON & MOSELEY, Marquette Bldg., Chicago, Ill., at $11,390. Other bidders were: Henry P. Johnson, Sterling, Ill., $12,330; Clyde A. Walb,. La Grange, $12,708; Marbaugh Bros., Monterey, $12,360; T. F. Foohey Dredging Co., Fort Wayne, $2360. Noted July 29.

✚**Drainage**—Fairbury, Ill.—According to press reports, the contract for constructing a drainage ditch for Momence and Yellow Head Drainage District has been awarded to H. & J. A. McWILLIAMS, Chicago. The estimated cost is $38,000.

Drainage—Jefferson, Iowa—The contract for furnishing tile, to be used in drainage work, has been awarded to the JEFFERSON CEMENT PRODUCTS CO., Jefferson, Iowa, at $58,555. Other bidders were: McHose Co., Boone, Iowa, $61,289; Cement Products Co., Salt Lake City, Iowa, $62,077; Lehigh Clay Products Co., $63,475. S. G. Nelson is Engr.

Drainage—Mount Aye, Iowa.—The Ringold County Board of Supervisors, according to press reports, plan to drain 7952 acres along Platte River.

Ditch—Breckenridge, Minn.—Bids will be received by P. E. Truax, County Audr., until Sept. 14, for constructing ditch No. 6 at an estimated cost of $12,364.

✚**Ditch**—Montevideo, Minn.—Contracts have been awarded for the construction of County Ditch No. 18 to P. HALSEY, Willmar, at $5494 for open work and to the MAYNARD TILE, STONE & CEMENT CO., Maynard, at $19,494 for tile work. Noted Aug. 12.

Ditch—Redwood Falls, Minn.—Bids were received Aug. 12, for the construction of County Ditch No. 20 as follows: James Girding, Fox Lake, $36,957; Kircher Bros., St. Paul, $37,300; Parish & Sedgley, Worthington, $37,525. L. P. Larson is County Audr.

Drainage—Wichita, Kan.—J. J. Jones and A. E. Munich, Wichita are forming a company for the purpose of draining the Big Slough west and south of Wichita. The cost of the work is estimated at $25,000.

✚**Drainage**—Tekamah, Neb.—The contract for the construction of about 1,000,000 cu.yd. of ditches in the Burt-Washington Drainage District has been awarded to W. E. CALLAHAN CO., at 6.45c. per cu.yd., and EDWARD PETERSEN CO., at 6.48c. per cu.yd. Other bidders were: Stevens & Long, 8.2c.; Pollard, Campbell & Crane, 7.5c.; Phalen & Shirley, 6.7c.; I. C. D. Campbell, 7.73c.; R. S. Morrow, Boyce & Briggs, 7.5c.; J. H. Flick, 7.2c.; Munn Riese Co., 7.5c. Noted July 29.

Drainage—Poplar Bluff, Mo.—Surveys are being made and bids will soon be called for the construction of drainage ditches in Ripley County. John H. Gleason is Engr.

Dock—St. Louis, Mo.—The Mayor's Commission has voted to recommend an appropriation of $250,000, for the construction of a dock.

✚**Drainage**—Marion, Ark.—Press reports state that the contract for the construction of 5,022,000 cu.ft. of ditches has been awarded by the Commissioners of Drainage District No. 2 of Crittenden County to McWILLIAM BROS., at 7.59c. per cu.yd.

✚**Drainage**—Pine Bluff, Ark.—According to press reports, the contract for drawing about 40,000 acres of land in the Waterloo Drainage District, has been awarded to STEANBERG BROS., Pine Bluff. The work is estimated to cost $235,000.

Drainage—Alief, Tex.—Bids will be received until 10 a.m., Sept. 10, by H. L. Washburn, County Audr, Houston, for the construction of drainage ditches; also for cleaning present ditches.

Drainage—Bay City, Tex.—It is reported that the County Commissioners have engaged E. N. Gustafson, Engr., for making surveys for draining about 10,000 acres in Drainage District No. 6.

✚**Dredging**—Galveston, Tex.—Press reports state that the contract for dredging, bulkheading and grading preparatory to the construction of the $50,000 dry dock on Pelican Island, has been awarded to JOHN JACOBSON, Texas City.

Drainage—Crook, Colo.—The city contemplates the construction of a drainage system to reclaim about 3600 acres of land.

Drainage—Las Animas, Colo.—It is reported that about 14 miles of drainage ditches will be constructed near here for the Mutual Carey Irrigating Co.

Ditch—Phœnix, Ariz.—J. B. Girand, City Engr. has completed plans for removing town ditch which requires carrying ditch under Van Buren St. from Seventh St. to Seventh Ave., 5400 ft.; three different types of construction are called for in the plans. A concrete conduit, 7 ft. diam., covered 4 ft.; an ingot iron conduit and a wood stave conduit.

Canal Work—Selah, Wash.—It is reported that the Directors of the Selah Canal Co. have ordered an assessment of $30,000 to construct steel flumes, ditches, etc.

Elimination of Grade Crossing—Portland, Ore.—The Oregon, Washington R.R. & Navigation Co. plans to eliminate the grade crossing from Sullivans Gulch to the city limits. The estimated cost is $750,000.

Steamer—Portland, Ore.—Plans are being prepared for the construction of a 120-ft. steamer for Captain Smith, S. S. "Sacajawea," Portland, Ore. The estimated cost is $20,000.

★**Bulkhead Shed**—San Juan, Porto Rico—(Official)—Bids will be received by Manuel V. Momenech, Chn., San Juan Harbor Board, until 11 a.m., Oct. 1, for the construction of a bulkhead shed.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous."

✚**Holyoke, Mass.**—The contract for the construction of a two-story, 120x125-ft. high school has been awarded to the CASPER RANGER CONSTRUCTION CO., at $73,816.

Bridgeport, Conn.—The Sons of St. George plan the construction of a three-story, 60x133-ft., brick home on Stratford Ave. The estimated cost is $40,000. Ernest G. Southey, 983 Broad St., is Arch.

Albany, N. Y.—Albany Chapter No. 12 of the Eastern Star plans the construction of a three-story chapter house at Lark St. and Hudson Ave., to cost $40,000. James S. Shattuck is Arch.

New York, N. Y.—(Borough of Brooklyn)—Plans are being prepared by N. Serracino, 1170 Broadway, New York, N. Y. (Borough of Manhattan), for the construction of a hotel for the Brighton Beach Development Co. at Brighton Beach. Noted July 29.

✚**Little Falls, N. Y.**—(Official)—The contract for the construction of a four-story bank and office building for the National Herkimer County Bank has been awarded to WELLS BROS. CO., 366 Fifth Ave., New York, N. Y., at $115,000. Noted July 15.

New York, N. Y.—(Borough of Brooklyn)—Plans have been prepared by W. T. McCarthy, Arch., 16 Court St., for the construction of two four-story apartment buildings on Ave. C and East Fourth St., for the De Haven Building Corporation. The estimated cost is $90,000.

New York, N. Y.—(Borough of Manhattan)—Edmund K. Stallo and daughters plans the construction of a 31-story hotel on 42d St., between Broadway and Seventh Ave.

Rochester, N. Y.—Plans are being prepared by Foster & Gade, 15 West 38th St., New York, N. Y., for the construction of a building for the Rochester Chamber of Commerce. The estimated cost is $200,000.

Rochester, N. Y.—Bids will be received for the construction of a Y. M. C. A. building at Lake and Driving Park Ave. The estimated cost is $50,000. James G. Cutler is Chn. of Building Com. and Claude Bragdon is Arch. Noted June 24 and July 29.

Schenectady, N. Y.—The Masonic Hall Association has purchased the site at 828-830 State St., and will build a $100,000 temple.

✚**Syracuse, N. Y.**—The contract for the construction of the Masonic Temple on Montgomery St. has been awarded to FREDERICK A. CASWELL, Watertown, N. Y., at $97,000.

✚**Syracuse, N. Y.**—(Official)—The contract for the construction of the Delanare School has been awarded to the KING LUMBER CO., Charlotte, Va.; at $221,122. Noted Aug. 12.

Asbury Park, N. J.—Plans are being prepared for the construction of a hotel for J. A. Havercamp.

✚**Atlantic City, N. J.**—The contract for the construction of a six-story, 112x176-ft., reinforced-concrete addition to the Hotel Rudolph, New Jersey Ave. and the Boardwalk, has been awarded to ALEXANDER CHAMBLAY, 243 North Tenth St., Philadelphia, Penn. E. M. Henderer and V. B. Smith are Archs.

Atlantic City, N. J.—Bids will be received Sept. 8 for the construction of a three-story, brick school. Stout & Riebenack is Arch.

Hopewell, N. J.—Revised plans are being considered by the Board of Education for the construction of an addition to the township high school.

Jersey City, N. J.—Bids will be received until 3 p.m., Sept. 9, by the Board of Chosen Freeholders of Hudson County for the construction of a county jail. Walter O'Mara is Clk.

Passaic, N. J.—The Passaic General Hospital plans to construct a new sanitarium. The estimated cost is $300,000

RAPID TRANSIT SYSTEM—NEW YORK, N. Y.

Section Nos. 1 and 2—Route Nos. 16 and 18

Bids were received Aug. 18 by the Public Service Commission for the station finish work for parts of the Seventh Ave., Lexington Ave. and White Plains Rd. Transit R.R., Section Nos. 1 and 2, Route Nos. 16 and 18 from: (A) Altoria Realty & Construction Co., 3 East 44th St., (B) Snare & Triest Co., 233 Broadway, (C) Station Construction Co., 407 445th St., Brooklyn, (D) Marble Arch Co., 216th St. and Broadway, (E) William H. Egan, 147 East 25th St., (F) Connors Bros. Co., 644 West 88th St., (G) Post & McCord, 101 Park Ave. The item bids were as follows:

	A	B	C	D	E	F	G
6000 lin.ft. stairways—wood, street to mezzanine	$1.00	$1.00	$0.85	$0.90	$1.25	$0.90	$1.03
10,800 lin.ft. stairways—wood, mezzanine to platform	1.00	1.00	.86	.90	1.25	.85	1.03
8000 lin.ft. stairways—iron, mezzanine to platform	2.624	2.80	2.18	1.90	2.85	2.60	2.21
2000 sq.ft. stair landings—wood, straight (street to mezzanine)	1.08	1.00	.85	.90	1.05	1.10	1.14
1400 sq.ft. stair landings—offset (street to mezzanine)	1.08	1.10	.85	.90	1.05	1.20	1.14
1900 sq.ft. stair landings—offset (mezzanine to platform)	1.13	1.10	.90	.90	1.15	1.20	1.19
2050 sq.ft. straight or offset with steel checkered platform	2.25	2.00	1.78	1.90	2.15	2.35	2.21
950 lin.ft. concrete stairways, self supporting stairways	2.00	1.10	.96	3.00	1.25	1.60	2.00
900 sq.ft. concrete stairways, self supporting stairway landings	.80	.80	.50	.50	.40	.40	.60
50 cu.yd. concrete stairways, concrete walls under street, Section 295	6.00	16.00	18.00	10.00	15.00	13.00	19.00
50 ton steel columns hangers, etc., supporting stairways	88.00	80.00	83.00	70.00	90.00	80.00	80.00
2400 sq.ft. concrete street landings	.50	.90	.75	.40	.90	.70	.30
70 cu.yd. concrete foundations for columns	10.00	16.00	8.00	6.00	15.00	11.00	9.00
30 concrete or brick manholes	36.00	55.00	25.00	150.00	50.00	45.00	53.00
10 cu.yd. rock excavations	10.00	10.00	10.00	5.00	15.00	5.00	9.00
10,600 lin.ft. oak handrails	.48	.55	.40	1.00	.55	.46	.49
11,500 sq.ft. canopies over stairways (street to mezzanine)	.65	.70	.70	.80	.68	.75	.83
48 canopies over street landings	70.00	75.00	175.00	50.00	75.00	125.00	55.00
193,000 sq.ft. canopies over side train platforms	.40	.37	.41	.40	.36	.47	.48
56,000 sq.ft. canopies over island train platforms	.40	.35	.40	.30	.34	.47	.44
15,500 sq.ft. canopies, special over side train platforms (concrete stations)	.42	.40	.44	.90	.38	.48	.44
3900lin.ft. type "A" railings—stairs, street to mezzanine	3.00	4.00	3.91	4.00	3.70	3.40	3.87
3500 sq.ft. type "B" grille railings on stairs	1.00	1.00	1.30	1.10	1.10	1.15	1.59
200 lin.ft. type "C" railing	3.00	4.00	2.91	4.00	3.50	3.57	2.87
350 lin.ft. type "D" railing	3.00	4.00	3.01	4.00	5.00	3.30	2.97
3200 lin.ft. "E" railing around stair wells	3.57	4.40	4.51	4.00	4.70	3.57	4.47
1000 lin.ft. "F" low level railings	3.57	5.00	3.41	4.00	5.00	5.60	3.37
3300 sq.ft. "G" high railings	.75	.90	.84	1.00	1.20	.60	.84
8800 lin.ft. "K" train platform railings	3.57	4.00	4.51	3.50	4.00	3.57	4.47
10 additional high posts 2½ in. tubing	8.50	13.00	9.05	20.00	9.00	9.00	9.00
350 lin.ft. pipe railings	1.10	1.10	1.03	2.00	2.00	1.30	1.16
40 metal screens for stave recesses	10.00	12.00	12.00	15.00	10.00	10.00	13.00
800 lin.ft. type "L" bevel railings	3.05	3.75	3.41	3.00	3.40	3.25	3.37
100 lin.ft. type "M" service railings	3.57	5.00	4.00	5.00	5.00	4.75	3.91
350 lin.ft. type "O" railings newel posts on stairways	3.25	4.40	4.16	5.00	4.00	3.50	4.12
200 lin.ft. type "P" railings newel posts on stairways	3.25	4.40	3.96	5.00	4.00	3.50	3.92
3 grilles at Bedford Park boulevard station	10.00	25.00	50.00	20.00	15.00	25.00	22.50
15,000 lin.ft. wind screen drop sash train platform	4.92	4.90	5.10	4.50	8.50	5.20	6.00
500 standards on railings on train platforms	15.00	16.00	23.20	18.00	20.00	27.00	15.10
75 free standing standards on island platform	23.00	30.00	28.30	22.00	32.00	42.00	32.16
315,000 sq.ft. wood floor for train platform	.20	.22	.20	.22	.59	.22	.22
18,300 sq.ft. 8-in. concrete slab floor, including water proofing, etc.	.58	.60	.65	.70	.60	.57	.71
14,600 sq.ft. 11½-in. concrete slab floor, including water proofing	.68	.70	.75	.75	.80	.72	.83
100 cu.yd. concrete encasing columns, beams and girders	1.00	1.00	.70	1.00	1.00	1.25	.60
200 cu.yd. concrete copings	.95	.80	.55	1.50	1.00	1.00	.90
200 sq.ft. additional cement finish, section 148	.15	.25	.15	.30	.20	.10	.16
1600 lin.ft. platform edge construction supported on steel angles	.79	.90	1.72	.50	.80	1.60	.80
2000 lin.ft. platform edge construction supported on wood facia	.20	.80	1.62	.50	.80	.60	.80
5000 sq.ft. water proofing protective concrete wood, etc., existing concrete slab	.41	.28	.22	.40	.40	.30	.40
53,000 sq.ft. asphalt floor, including wood floor	.30	.30	.23	.50	.40	.30	.42
100 sq.ft. 8-in. concrete slab 3-in. finish	.60	.60	1.00	1.00	.60	.50	.57
8600 sq.ft. 6-in. concrete slab, 3-in. finish	.45	.50	.50	.50	.50	.45	.54
100 sq.ft. 11½-in. concrete slab, 3-in. finish	.70	.70	1.00	.60	.80	.65	.72
6500 sq.ft. cement wainscot or base	.17	.22	.12	.20	.20	.18	.20
36,500 sq.ft. concrete track floor over mezzanine, including water proofing rods, etc	.45	.46	.55	.52	.45	.55	.71
1200 sq.ft. flooring for passageways	.30	.25	.20	.50	.30	.23	.40
620 ferrules for mezzanine roof, including flanges	1.80	2.50	2.38	2.00	2.50	2.20	3.00
30 trap doors or scuttles	2.00	20.00	10.00	3.00	25.00	60.00	20.00
54,000 sq.ft. 3-in. cement floor finish	.12	.12	.13½	.15	12	.12	.15½

Wildwood, N. J.—Bids will be received until Sept. 14 for the construction of a three-story, brick school. Clyde S. Adams is Arch.

Allentown, Penn.—The contract will soon be awarded for the construction of a six-story brick and stone Y. M. C. A. building, estimated to cost $100,000. Louis E. Jallade, 37 Liberty St., New York, N. Y., is Arch.

✚Freehold, Penn.—The contract for the construction of a church for the St. Johns Slovak Congregation has been awarded to ANDREW BRESLIN, Summit Hill, at $50,000.

Mount Union, Penn.—The contract will soon be awarded by George W. Morgan, Borough Secy., for the construction of a 2½-story, brick and concrete municipal building on Market St. D. W. Dillman, 47-49 Altoona Trust Bldg., Altoona, Penn., is Engr.

✚Natrona, Penn.—GEORGE SCHENK & CO., Butler, Penn., has been awarded the contract for the construction of a school for Harrison Township. Noted Apr. 22 and June 17.

✚Philadelphia, Penn.—CRAMP & CO., Denckla Bldg., has been awarded the contract for the construction of a 13-story, 48x230-ft. office building at 1416 Chestnut St., for the Franklin National Bank. The estimated cost is $600,000.

Washington, Penn.—Bids will be received until 9 a.m., Sept. 6, by Adjutant General Thomas J. Stewart, Harrisburg, for the construction of an armory on West Maiden St.

✚Guilford, Md.—WALTER E. BURNHAM, Baltimore, Md., has been awarded the contract for the construction of a school, at $51,337. Smith & May is Arch.

Madison, W. Va.—Bids have been received for the construction of a courthouse as follows: George F. Gates, Charleston, $190,000; Acme Construction Co., $120,990; P. Q. Shrake & Son, $96,200; Dayton & Francis, $128,450; King Lumber Co., $118,400; J. L. Crouse, $126,159; Longest & Tessier Co., $120,000; Tyree & Thomas, $137,393; Peter C. Minnotti, Logan, $99,875. Noted Aug. 19.

✚Louisville, Ky.—The contract for the construction of a five-story office building has been awarded to the SELDENBRECK CONSTRUCTION CO., St. Louis, Mo. The estimated cost is $100,000. Noted Aug. 19 and 26.

Cincinnati, Ohio—Plans have been prepared by Elzner & Anderson, Arch., for the construction of a 12-story Y. M. C. A. building. The estimated cost is $405,000.

Cleveland, Ohio—The First Church of Christ contemplates the construction of a church at Euclid Ave. and East 111th St. The estimated cost is $125,000.

Cleveland, Ohio—Bids will soon be received for the construction of a three-story building at Euclid Ave. and East 30th St. for the Adams-Oakland Co. The estimated cost is $50,000. W. S. Ferguson Co. is Arch. and H. M. Adams is Mgr.

✚Cleveland, Ohio—The contract for the construction of an addition to the Hotel Statler has been awarded to the GEORGE W. FULLER CO., 111 Broadway, N. Y., $300,000.

✚Cleveland, Ohio—The contract for the construction of a two-story building for the Ohio State Telephone Co. has been awarded to the RUTHERFORD CO., 2160 East 18th St., Cleveland. The estimated cost is $50,000.

Cleveland, Ohio—The city contemplates the construction of a jail. The estimated cost is $1,000,000.

Columbus, Ohio—Preliminary plans are being prepared by Richards, McCarty & Bulford, Arch., Columbus, for the construction of a bank and office building at Gay and High St. for the Citizens Trust & Savings Co., 16 East Broad St.

Findaly, Ohio—Bids will be received until 1 p.m., Sept. 15, by Jean C. Copeland, Clk. Bd. of Hamcosk County, for the sale of $100,000 in bonds. The proceeds will be used for the construction of a county infirmary building.

Fremont, Ohio—Plans are being prepared for the construction of a temple for the Masonic Lodge. The estimated cost is $75,000.

Lorain, Ohio—The Lorain Hotel Co. will construct a hotel at Broadway and Eighth St.

✚Springfield, Ohio—The contract for the construction of the Shawnee Hotel has been awarded to CALDWELL & BLAKE, LaFayette, Ind. The estimated cost is $300,000.

Steubenville, Ohio—Bids will be received about Sept. 20 by the Board of Education for the construction of a school on North St. W. S. McClauslen is Clk.

Toledo, Ohio—Bids were received Aug. 27 for the construction of the Mott School from John Proch Co., $104,838; A. Bentley & Son, $105,000; H. J. Spieker Co., $106,950; Walls, Bock, Kuhlman Co., $109,000. George L. McKesson is Dir. of Schools. Noted Aug. 12.

RAPID TRANSIT SYSTEM, NEW YORK, N. Y. (Continued)

	A	B	C	D	E	F	G
43,000 sq.ft. external walls of mezzanine stairways, including oak finish interior and copper finish exterior	$0.95	$0.90	$0.80	$1.00	$0.90	$1.10	$0.86
8500 sq.ft. external walls of mezzanine copper finish, including exterior tile finish interior	.85	.90	.76	.80	.85	1.20	.72
6100 sq.ft. external walls of mezzanine copper finish exterior, unfinished interior	.80	.80	.70	.80	.80	.95	.72
26,000 sq.ft. wood partition, including doors, windows, sheating	.56½	.60	.65	.50	.60	.60	.63
2000 lin.ft. copper gutters	1.00	.70	1.02	1.00	.90	1.57	.90
270 lin.ft. low sliding gates	8.00	9.00	7.91	10.00	9.00	12.50	8.10
160 lin.ft. high sliding gates	12.00	13.00	14.20	12.00	13.00	16.00	14.50
20 lin.ft. folding gates	11.00	10.00	3.95	12.00	11.00	7.30	4.25
15 lin.ft. low swing gates	10.00	8.00	8.10	12.00	11.00	12.50	8.45
26 gate controls	25.00	25.00	15.25	20.00	20.00	10.50	16.00
66 c.i. gate posts and cross frames	28.00	25.00	40.60	30.00	30.00	32.00	60.00
10 floor boxes (additional)	8.00	8.00	3.50	12.00	9.00	5.00	3.50
900 lin.ft. 1½-in. galvanized c.i. pipe for gate ropes	.30	.25	.31	.50	.30	.25	.33
1000 lin.ft. 1-in. square steel tubing, including c.i. pulleys	.57	.50	.47	.60	.55	.60	.48
20,000 sq.ft. roofs over mezzanine and pass beyond main stairway roof on train platform	.55	.62	.60	.50	.60	.50	.45
3000 sq.ft. roofs over existing structure at Woodlawn station, Section 295	.60	.35	.65	.40	.40	.35	.56
14,500 lin.ft. 3-in. corrugated galvanized iron leaders	.25	.25	.24½	.25	.30	.40	.25
870 lin.ft. 3-in. c.i. leaders	.50	.60	.37½	.60	.60	.35	.39
575 lin.ft. 3-in. w.i. leaders	.55	.80	.67½	.60	.75	.90	.93
5100 lin.ft. 3½-in. w.i. leaders	.60	.85	.77½	.60	.80	1.05	1.08
1350 lin.ft. 3-in. copper leaders	.50	.60	.55	.60	.55	.65	.44
2000 lin.ft. smoke flues from stove recesses	.38	.60	.30	.50	.60	1.50	.45
450 lin.ft. smoke flue protectors on platforms	1.00	1.20	1.00	1.00	1.00	1.00	.60
40 ton steel framing shapes, connections	70.00	80.00	78.50	70.00	90.00	80.00	75.00
1 ton riveted steel girders, columns and brackets	125.00	80.00	80.00	100.00	100.00	75.00	75.00
400 lin.ft. steel ladders	1.70	1.25	1.90	2.00	1.50	1.80	1.90
10 sq.ft. steel ladders, platforms	1.50	2.00	1.08	4.00	1.00	1.65	1.08
10,000 drill holes existing structure	.25	.30	.20	.25	.25	.30	.35
150 sq.ft. frames for enameled signs on mezzanine	1.50	1.70	2.50	2.00	1.60	1.65	2.52
1 frame and reflect type "A" illuminated sign on brackets attached columns	100.00	50.00	50.00	60.00	60.00	27.00	30.50
3100 sq.ft. sign frames on train platform railings	1.00	1.30	1.50	1.50	1.25	1.65	2.68
40 sign frames illuminated N. T. I.'s train platform, including seat	95.00	140.00	200.00	150.00	170.00	250.00	172.00
8000 sq.ft. enameled sign plates	.30	.35	.40	.25	.35	.35	.30
4000 vertical in. copper letter for signs	.12	.15	.12	.15	.15	.12	.15
4 frames and reflectors, type "B," illumined attached to concrete structure	45.00	60.00	45.00	50.00	50.00	75.00	35.00
34 sign frames illuminated, N. T. I.'s platform, metal panel	100.00	120.00	136.00	70.00	165.00	150.00	125.00
18 sign frames between columns on special canopies	12.00	20.00	25.00	25.00	20.00	20.00	92.00
3 marquises over entrance doors Gun Hill road station	125.00	110.00	177.00	200.00	150.00	155.00	165.00
8 marquises over entrance doors Woodlawn station	220.00	160.00	302.00	200.00	300.00	210.00	293.00
13,500 sq.ft. non-slip treads without wood block and anchor	.70	.90	.45	.80	.90	.70	.65
1600 sq.ft. non-slip treads with wood block and anchor	.80	1.00	.62	.85	.95	.85	.70
2200 sq.ft. stamped sheet metal in booths on mezzanine	.14	.13	.15	.15	.14	.20	.11
4000 sq.ft. metal lath without steel furring	.09	.12	.10	.15	.10	.06	.10
1900 sq.ft. metal lath with steel furring	.16	.18	.20	.15	.20	.13	.19
100 sq.ft. special wire forms	.25	.20	.10	.25	.40	.60	.20
11 type "B" ticket booth	440.00	400.00	600.00	400.00	400.00	430.00	467.00
11 type "D" ticket booth	550.00	500.00	725.00	400.00	500.00	650.00	725.00
3 type "E" ticket booth	525.00	500.00	720.00	400.00	600.00	525.00	625.00
700 lin.ft. oak seats in waiting rooms	3.00	3.00	3.00	3.00	3.00	3.45	3.00
77 oak doors, type "GG" for toilet stalls	10.00	12.00	10.00	12.00	12.00	8.00	9.00
750 sq.ft. windows in masonry portable wall fixed transom sash	.83	1.20	1.25	1.00	1.50	.75	1.25
735 sq.ft. windows in masonry exterior d.h. sash	1.00	2.00	1.50	1.00	1.50	.75	1.56
3800 sq.ft. windows in masonry exterior wall casement sash	1.00	1.50	1.20	1.00	1.10	.75	1.11
9000 sq.ft. windows in masonry portable exterior wall drop sash	1.00	1.10	1.40	1.00	1.10	.75	1.05
100 sq.ft. street in masonry exterior wall hinged sash	1.00	1.80	2.00	1.00	1.10	.75	.96
32 sewer connections, Section 257	125.00	140.00	95.00	100.00	125.00	95.00	100.00
33 water connections, Section 257	80.00	110.00	60.00	100.00	100.00	60.00	90.00
Concrete work, 161st street station, Section 295 (lump sum)	10,455.00	13,500.00	22,744.00	14,100.00	13,500.00	19,969.00	24,800.00
Concrete work, Gun Hill road, Section 295 (lump sum)	4,037.00	7,500.00	11,000.00	13,125.00	4,200.00	9,515.00	26,000.00
Concrete work Bedford Park boulevard, Section 295 (lump sum)	4,144.00	4,500.00	8,625.00	9,000.00	8,300.00	4,811.00	9,600.00
Brick chimney, Woodlawn station, Section 295 (lump sum)	70.00	200.00	150.00	300.00	250.00	166.00	217.06
Copper covered ceiling, Woodlawn station, Section 195 (lump sum)	125.00	400.00	1,210.00	2,000.00	350.00	378.00	540.00
Enclosed ramp East 180th street station, Section 295 (lump sum)	5,185.00	6,000.00	19,226.00	12,000.00	6,000.00	7,914.00	6,886.00
Extended totals	$860,636	$908,684	$944,347	$960,373	$971,387	$972,789	$1,414,305

St. Joseph, Mich.—The citizens voted to bond the city for the construction of a school to cost $100,000.

Chicago, Ill.—Plans have been prepared by Graham, Burnham & Co., Arch., for the construction of a 16-story office building at Wabash and Jackson Blvd., for the W. W. Kimbal Piano Co. The estimated cost is $1,250,000.

Ames, Iowa—The contract will soon be awarded for the construction of a dormitory and science hall at the Iowa State College. The estimated cost is $125,000.

Davenport, Iowa—Plans are being prepared for the construction of a four-story, 50x110-ft. addition to St. Ambrose College. The estimated cost is $100,000.

Harlan, Iowa—An election will be held Sept. 3 to vote on the question of issuing $120,000 in bonds, the proceeds of which will be used for the construction of schools.

New Hampton, Iowa—Plans are being considered for the construction of a hospital for the Sisters of the Holy Ghost. Estimated cost, $75,000.

Sioux City, Iowa—Plans are being prepared by Beuttler & Arnold, Security Bank Bldg., for the construction of a Masonic building at Douglas St. The estimated cost is $100,000. D. M. Brownlee is Chn. of Bldg. Com.

Duluth, Minn.—Plans are being prepared by F. G. German, Arch., for the construction of a church for the Pilgrim Congregational Church. The estimated cost is $100,000.

Minneapolis, Minn.—Plans are being prepared by Hewett & Brown, Arch., for the construction of a school for the Northorp Collegiate School. The estimated cost is $150,000.

Virginia, Minn.—Preliminary plans are being prepared by C. E. Nystrom, Arch., for the construction of a Trade School for the City of Virginia. Estimated cost, $100,000.

✚Omaha, Neb.—The contract for the construction of a gymnasium for Creighton University, Burt and 24th St., Omaha, has been awarded to the SELDON-BRECK CONSTRUCTION CO., at $117,000.

Havre, Mont.—It is reported that plans are being prepared for the construction of a Masonic Temple. The estimated cost is $100,000. Frank Bossmont, Havre, and Lincoln Halve, Helena, are Archs.

St. Louis, Mo.—W. J. Holbrook, 812 Olive St., is interested in a project to construct a $500,000 hotel at 12th and Locust St.

St. Louis, Mo.—The Glennon Club plans the construction of a $100,000 clubhouse on Laclede Rd.

✚Beaumont, Tex.—(Official)—The contract for the construction of an addition to the South Park School has been awarded to the GENERAL CONSTRUCTION CO., Beaumont, at $38,000. Noted Aug. 12.

Dallas, Tex.—Plans are being prepared by Stone & Webster, Engr., Commonwealth Bldg., for the construction of a Union Interurban Passenger Station. The estimated cost is $700,000.

El Paso, Tex.—Plans are being prepared for the construction of a four-story building on North Stanton St. for J. S. Lanier. The estimated cost is $72,000.

San Angelo, Tex.—(Official)—Bids will be received until Sept. 6 by the San Angelo School Board for the construction of a high school. The estimated cost is $65,000. Noted July 29 and Aug. 19.

✚San Antonio, Tex.—(Official)—The contract for the construction of a reinforced-concrete hospital to be known as the Robert B. Green Memorial has been awarded to the H. N. JONES CONSTRUCTION CO., Moore Bldg., San Antonio, at $245,000. Noted July 22.

Denver, Colo.—Plans have been prepared by Fisher & Fisher, Arch., for the construction of a five-story hotel on the two blocks bounded by 10th and 11th Ave and Lincoln and Grant St. The estimated cost is $1,500,000.

Denver, Colo.—Plans are being prepared for the construction of a national sanitarium. The estimated cost is $250,000. L. F. Bartols, Denver, is interested.

✚Florence, Ariz.—The contract for the construction of the Florence Union High School has been awarded to ALBRECTH ANDERSON, Phoenix, at $43,865. Other bids were: T. L. Edens, Phoenix, $44,075; Sparks & Hale, San Diego, $44,350; Lutguding & Egan, Phoenix, $44,478; Hughes & Toncray, Phoenix, $44,648; J. A. Tucker, Phoenix, $44,886; Clinton Campbell, Phoenix, $46,750. Noted June 3 and July 8.

RAPID TRANSIT SYSTEM—NEW YORK, N. Y.

Section No. 2, Route Nos. 36 and 37

Bids were received Aug. 4 by the Public Service Commission for the construction of the finish station on Section No. 2, Route Nos. 36 and 37, of the Astoria Elevated R.R., from: (A) Charles Meads & Co., 38 Park Row, New York, (B) Snare & Triest Co., 233 Broadway, New York, (C) Simon Russek, Inc., 261 Broadway, New York. The item bids were as follows:

	A	B	C
2300 lin.ft. stairways, wood, street to mezzanine	$1 60	$1 00	$1 40
3760 lin.ft. stairways, wood, mezzanine to platform	1 60	1 00	1 40
415 sq.ft. stair landings, wood, straight (street and mezzanine)	1 60	1 20	1 40
460 sq.ft. stair landings, wood, offset (street and mezzanine)	1 60	1 20	1 40
740 lin.ft. stair landings, wood, mezzanine to platform	1 60	1 20	1 40
10 ton stair supports, columns, hangers, etc	90 00	90 00	92 00
430 sq.ft. street landings, concrete	1 00	90	40
2200 cu.yd. columns foundations	6 00	4 00	13 20
30 brick or concrete manholes	50	55	55
6 cu.yd. rock excavation	10 00	10 00	10 00
2500 lin.ft. hand rails	50	55	70
3200 sq.ft. canopies, stairs, street to mezzanine	70	70	85
13 canopies, street landings	40 00	80 00	53 00
36,800 sq.ft. canopies, train platforms (side)	44	40	38
18,200 sq.ft. canopies, train platforms (island)	44	35	38
840 lin.ft. railing, type "A"	3 00	4.00	4 90
570 sq.ft. railing, type "B"	1 00	1 20	1 20
120 lin.ft. railing, type "C"	3 00	3 50	5 70
10 lin.ft. railing, type "D"	3 00	4 00	4 90
1100 lin.ft. railing, type "E"	3 60	4 70	4 00
50 lin.ft. railing, type "F"	3 60	4 50	4 00
2910 sq.ft. railing, type "G"	80	90	95
2340 lin.ft. railing, type "K"	3 00	4 50	3 90
2 additional posts	15 00	20 00	4 00
140 lin.ft. pipe railing	1 00	1 20	1 00
24 metal screens for stove recess	10 00	12 00	12 00
2450 lin.ft. wind screen with drop sash on train platform	5 00	5 00	7 00
185 standards on railings on train platform	16 00	23 00	7 60
50 free standing standards on island train platform	25 00	34 00	24 00
29,200 sq.ft. wood floors on train platforms	28	20	28
5340 sq.ft. 8-in. concrete water proofing and wood	70	.65	60
3730 sq.ft. 11½-in. concrete water proofing and wood	.80	75	70
1060 lin.ft. platform edge supported on steel angles	80	90	87
23,200 sq.ft. asphalt floor, including wood floor	.45	32	35
2450 sq.ft. 8-in. concrete slab, 3-in. finish	.60	.50	.60
1500 sq.ft. cement wainscot and base	.20	.22	12
12,630 sq.ft. connecting track floor over mezzanine water proofing rods, etc	60	.45	50
300 sq.ft. flooring for passageways	50	25	.20
125 ferriles for mezzanine roof	3 00	2 40	3.00
13,700 sq.ft. external walls of mezzanine stairway enclosure coping exterior interior wood	1 20	95	95
600 sq.ft. external walls of mezzanic coping exterior tile interior	1 40	90	.90
18,160 sq.ft. wood partition walls including doors, windows, etc	70	60	.75
1750 lin.ft. copper cutters in place	1 00	90	90
55 lin.ft. low sliding gates	10 00	10 00	11 00
110 lin.ft. high sliding gates	12 00	14 00	14 50
12 gate controls	20 00	25 00	5.00
24 c.i. gate posts and cross frame	40 00	30 00	42.00
715 lin. ft. 1-in. sq. steel tubing for gate ropes, etc	50	.60	1 00
9570 sq.ft. roof over mezzanine and passway beyond main structure	.60	.60	60
4840 lin.ft. 3-in. corrugated galvanized iron leaders	.30	.30	.30
10 lin.ft. 3-in. c.i. leaders	1.00	.60	60
540 lin.ft. 3-in. w.i. leaders	.50	75	.70
540 lin.ft. 3½-in. w.i. leaders	.60	.85	80
20 lin.ft. 3-in. copper leaders	1.00	.60	.70
930 lin.ft. smoke flues from stove recesses	.40	60	.55
180 lin.ft. smoke flue protectors on platforms	1 00	1.20	2 50
1880 lb. c.i. fenders for structural columns	10	.05	05
41 ton steel framing and shapes	70 00	70 00	75 00
80 ton riveted steel girders, columing and bracing	80 00	70 00	80 00
25 lin.ft. steel leaders	2 00	2 00	2 50
10 sq.ft. steel leaders, platforms	2 00	1 00	1 20
1050 drilling holes in steel (existing structure)	40	30	40
185 sq.ft. frames for enlarged sign in mezzanine	1 60	1 60	2 30
3 frames and repeators for illuminated signs on brackets attached to columns	40 00	45 00	30 00
660 sq.ft. sign frames on train platform railing	70	1 20	1 15
24 sign frames illuminated N.T.'s on island platforms, seat	60 00	170 00	130 00
1700 sq.ft. enameled sign plates	30	40	25
5 sign frames for illuminated N.T.'s on island plumbing metal	40 00	170 00	70 00
3500 sq.ft. non-slid treads without wood blocks and anchors	80	95	.70
400 sq.ft. non-slid treads with wood blocks and anchors	1 00	1 00	80
980 sq.ft. stamper sheet metal in booths on mezzanine	.20	15	20
50 sq.ft. metal lath without steel furring	.40	14	10
8 type "B" ticket booth	400 00	450 00	400 00
2 type "B-B" ticket booth	700 00	800 00	700 00
240 lin.ft. oak seats in waiting rooms	4 00	3 00	3 50
24 type "G-G" oak doors toilets	12 00	13 00	12.00
95 hardware doors to toilet rooms, waiting rooms and closets	12 00	22 00	19.00
55 double hung sash	3.00	3 00	3.00
440 casement sash in mezzanines	4 00	5 00	4 00
44 casement in toilet and rooms and inclosure between stations	4 00	4 00	3.80
470 drop sash	2 00	1.20	1 40
140 hinged sash (top or bottom)	2.00	2.80	1.80
24 for toilet stall doors. type "G.G."	10.00	12.00	10 00
37 doors p. board and s. board boxes	2.00	2 00	2 00
4 sliding doors to transformer closets	10.00	7.50	6 00
16 vent doors	3.00	2 50	2 00
24 additional hardware, door checks	6.00	3.50	3.50
70 door stops	2.00	1.50	1.50
20 rubber covered chains	2 00	1.20	1.50
26 push plates	2.00	2.00	2.00
26 door pulls	2 00	2 50	2.50
53 kick plates	8.00	6 00	6.00
53 push bars	6.00	4 50	4.30
44 casement sash adjuster for single sash	4 00	2 50	2.30
4 casement sash adjuster for gang of two	10 00	8 50	8.50
6 casement sash adjuster for gang of three	12.00	11 00	11 00
8 casement sash adjuster for gang of four	16.00	13 50	13.00
40 casement sash adjuster for gang of five	16.00	16 00	16.00
35 casement sash adjuster for gang of six	20 00	16 00	16.00
16 sq.yd. plaster coat on masonry surface and for second coat on metal lath	1.00	1.50	.70
30 sq.yd. first or scratch coat on metal lath	1 00	1.50	.50
470 cu.ft. common brick	80	.50	.50
100 cu.ft. hollow terra cotta tile	.80	.50	.45
24 for connecting stove recesses including all appurtenances except metal screens in place	30 00	35 00	4.50
2150 sq.ft. ⅜ in. galvanized wainscot and trim on walls	1.20	1.50	1.30
280 sq.ft. ¾-in. galvanized chamber partitions	1 40	1.60	1.60
40 sq.ft. ¾-in. shelves	2 00	1.60	1.60
600 sq.ft. ¾-in. stall partitions	1 60	1.70	1.60
100 sq.ft. 1-in. floor slabs	2 00	2.70	2 50
435 lin.ft. curved corners and angles of glass	1.40	1.60	2.50
20 sq.ft. soap stone wainscoting and trim on wall	1 00	1.50	1.00
300 sq.ft. soapstone pipe chamber partitions	1 00	1.30	.90
75 sq.ft. soapstone shelves	1.50	1.40	1.00
75 sq.ft. soapstone stall partitions	1.50	1.40	1.00
20 sq.ft. soapstone floor slabs	1 00	1.50	1.10
50 lin.ft. curved corners and angles of soapstone	1.00	1.20	1.00
24,050 cu.ft. portable enclosures between stations	.18	.22	.23
20 wooden ladders	6 00	2.50	11.00
28 water closet bowls	45 00	60.00	47.00
24 lavatories in stations	30 00	44 00	29 00
3 lavatories in enclosure between station	30.00	40.00	27.00
28 urinals	75.00	85 00	80.00
13 slop sink	60.00	64 00	62.00
Rough plumbing work complete for all stations (lump sum)	6,400 00	10,600.00	7,000.00
Rough plumbing work complete for all enclosure between stations (lump sum)	1,000.00	700 00	1,240.00
90 posts (in toilet rooms)	6.00	15 00	9.80
180 lin.ft. top rails (in toilet rooms)	1.00	1.20	1.00
8 wall flanges (in toilet rooms)	1.00	1 50	2.00
12 register faces and frames in pipe chamber part	10 00	12.00	3.50
12 c.i. vent louvres in walls or ports, etc	10.00	18 00	4.50
3700 lb. glass and soapstone steel support	10	.08	.07
30 coat and hat hooks in toilet rooms	2 00	1.50	.50
24,275 lin.ft. ¾-in. electric conduits	.12	.14	.14
6000 lin.ft. 1-in. electric conduits	15	.17	.17
2400 lin.ft. 1¼-in. electric conduits	20	22	.21
250 lin.ft. 2-in. electric conduits	30	.30	.30
200 lin.ft. 2½-in. electric conduits	40	.40	.43
100 lin.ft. 3-in. electric conduits	60	.55	.60
750 lin.ft. ¾-in. flexible conduit	.16	.20	.20
6 placing ferrules in walls other than masonry walls	5.00	1 00	1 00
1575 c.i. outlet boxes	1.00	1 20	1.00
25 c.i. pull boxes, 6 in. x 6 in. x 6 in.	4 00	3 00	3 10
6 c.i. pull boxes, 12 in. x 12 in. x 6 in.	8 00	7 50	8 00
6 c.i. pull boxes, 18 in. x 12 in. x 6 in.	10 00	9 50	10 00
6 13 in. x 20 in. x 4 in. boxes hinges, covers and locks	20 00	14.00	15 00
12 c.i. heater boxes	15 00	14 00	15.00
16 steel panel boxes, 25 in. x 60 in. x 5½ in.	20 00	16 00	17.00
6 steel panel boxes, 25 in. x 48 in. x 5½ in.	20 00	14 00	15.00
12 steel panel boxes, 25 in. x 36 in. x 5½ in.	20.00	12 00	14 00
3 steel switch boxes	20.00	15 00	15.00
17,700 sq.ft. painting two coat work on plaster and cement surface	.02	.02	.02
Painting structure of existing structure as required by section 291 (lump sum)	1,500 00	3,200.00	700 00
6900 sq.ft. tile 3 in. x 6 in. straight	.40	.60	.50
400 sq.ft. tile 1-in. radius	.80	1.20	1.00
700 sq.ft. tile 2½ in. radius	1 00	1.20	1.20
26 sewer and water connections, section 257 sewer	80 00	200 00	80.00
10 sewer and water connections, section 257 water (lump sum)	80 00	100.00	80.00
Wires, cables, poles, trees, section 13 and 295	7,000.00	10,500.00	3,500.00
44,160 cu.ft. recreation building at Ditmars Ave. Station. section 295	.12½	.20	.15
Extended totals	$268,102	$274,096	$285,249

EAST SIDE SEWER—TOPEKA, KAN.

Bids were received July 22 for the construction of the East Side sewer, from, (A) Engineer's Estimate, (B) T. M. Torson, (C) JAMES A. PRINGLE (awarded contract), (D) Commercial Construction Co. The item bids were as follows:

	A	B	C	D
62,770 ft. 8-in. vitrified clay pipe	$0 65	$0.57	$0.60	$0.58
22,543 ft. 10-in. vitrified clay pipe	76	.64	.75	.75
10,966 ft. 12-in. vitrified clay pipe	.95	.75	.87	.90
4682 ft. 15-in. vitrified clay pipe	1 52	1.06	1.46	1.50
3988 ft. 18-in. vitrified clay pipe	1.67	1.38	2 00	2.00
2947 ft. 21-in. vitrified clay pipe	2.44	1.55	2.46	2.50
2992 ft. 24-in. vitrified clay pipe	3.96	2 50	3.90	4.00
281 ft. 27-in. vitrified clay pipe	5 50	4.60	4.68	5.00
36 ft. 20-in. c.i. pipe	5 00	4 00	5.00	4.00
33,100 ft. 1-in. galvanized pipe	20	.20	20	.22½
98 flush tanks	65 00	58 00	65.00	75.00
248 manholes	45.00	35.00	45.00	45 00
200 cu.yd. concrete	7.00	8 00	8 00	8.00
25 M b.m. sheeting	30 00	30.00	30.00	30.00
Extra excavation	.50	.50	50	.50
Extended totals	$129,191	$105,715	$125,834	$127,374

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

AUGUST BUILDING OPERATIONS

Returns of proposed building operations from plans filed for August throughout the country show a decided increase over the same period one year ago.

The total increase from the figures given below is $6,126,039, or about 12½%. Throughout the Eastern States there was a gain of about 18½%, in the South about 18%, in the Central States about 20%, and a loss of about 35% throughout the West. This loss is accounted for by the large amount of building which was done at the Expositions a year ago.

For the past 8 months building has shown a gain throughout the Eastern States of about $2,500,000 and compared with July of this year has increased about $3,000,000, or 11%, which is an improvement for this season of the year.

Below is given a table of contemplated building operations from representative cities throughout the country.

EASTERN STATES

	Month of August 1915	Month of August 1914	First Eight Months of Year 1915	First Eight Months of Year 1914
Albany, N. Y.	$249,745	$479,685	$2,678,495	$5,056,150
Bridgeport, Conn.	842,725	147,063	6,114,387	2,633,146
Buffalo, N. Y.	1,175,000	950,000	8,266,000	8,499,006
Elizabeth, N. J.	94,748	91,190	781,589	979,313
Hartford, Conn.	528,934	185,990	3,734,628	2,871,346
Hoboken, N. J.	21,565	2,727	565,964	730,727
Jersey City, N. J.	404,856	401,804	3,551,505	2,819,649
Newark, N. J.	569,441	3,196,000	5,795,110	8,440,280
New Bedford, Mass.	197,260	175,550	2,334,554	2,052,802
New Haven, Conn.	440,274	500,567	4,096,323	2,719,791
New York, N. Y.				
Bronx	1,558,750	1,206,900	19,330,250	17,282,968
Brooklyn	3,999,697	3,974,000	19,949,707	29,892,850
Manhattan	7,260,500	3,608,950	50,992,300	34,491,040
Queens	2,345,400	903,716	14,799,011	14,043,545
Paterson, N. J.	182,827	221,958	1,100,843	1,300,415
Philadelphia, Penn.	3,993,625	2,642,810	26,719,955	28,410,380
Pittsburgh, Penn.	740,265	1,127,069	6,132,203	11,978,217
Reading, Penn.	181,150	29,400	820,425	1,043,200
Rochester, N. Y.	772,174	808,457	6,291,965	6,904,625
Scranton, Penn.	88,779	185,388	1,206,899	937,852
Springfield, Mass.	400,095	489,290	4,106,039	4,026,189
Utica, N. Y.	235,985	86,670	1,509,090	1,117,045
Totals	$26,283,795	$21,415,184	$190,877,242	$188,230,536

CENTRAL STATES

	Month of August 1915	Month of August 1914	First Eight Months of Year 1915	First Eight Months of Year 1914
Akron, Ohio	$499,010	$555,120	$3,149,095	$2,910,205
Canton, Ohio	115,125	314,500	1,192,315	1,317,505
Cedar Rapids, Iowa	125,000	282,000	1,312,000	2,217,000
*Chicago, Ill.	9,513,150	5,769,450	56,241,830	58,834,810
Cincinnati, Ohio	3,048,475	1,128,060	9,772,764	7,172,060
Cleveland, Ohio	1,987,520	2,318,470	22,533,679	19,539,885
Columbus, Ohio	544,895	647,325	3,598,850	4,371,531
Des Moines, Iowa	151,500	111,150	1,226,020	1,269,514
Detroit, Mich.	3,217,490	2,171,085	18,926,130	21,859,830
Duluth, Minn.	262,051	238,023	1,833,961	2,184,864
Indianapolis, Ind.	463,972	472,436	4,322,796	6,568,841
Kansas City, Kan.	91,665	80,863	709,633	859,988
Kansas City, Mo.	725,830	527,395	7,060,325	8,540,325
Milwaukee, Wis.	1,073,079	626,681	6,746,564	7,025,347
Minneapolis, Minn.	1,031,070	943,975	11,231,221	8,197,700
Oak Park, Ill.	238,755	123,000	.....	.....
Omaha, Neb.	350,610	521,065	3,561,820	3,790,363
Peoria, Ill.	114,810	243,081	.....	.....
St. Louis, Mo.	932,446	797,165	8,002,297	9,903,076
St. Paul, Minn.	1,066,026	646,921	7,464,596	9,618,709
Toledo, Ohio	747,083	490,047	5,311,299	4,903,264
Youngstown, Ohio	154,815	261,565	1,753,037	2,275,826
Totals	$16,941,277	$13,499,927	$119,708,396	$124,525,833

SOUTHERN STATES

	Month of August 1915	Month of August 1914	First Eight Months of Year 1915	First Eight Months of Year 1914
Atlanta, Ga.	$370,600	$372,033	$3,115,437	$3,867,732
Birmingham, Ala.	137,615	314,549	.....	.....
Chattanooga, Tenn.	46,540	128,810	332,798	879,620
Dallas, Tex.	155,117	220,175	2,335,756	4,645,318
Ft. Worth, Tex.	127,265	301,100	800,652	1,612,831
Houston, Tex.	89,193	137,610	1,077,198	3,016,007
Louisville, Ky.	203,900	426,860	2,540,735	3,467,105
Memphis, Tenn.	273,295	175,661	2,020,073	2,533,549
Norfolk, Va.	75,632	241,625	1,276,675	1,812,415
Richmond, Va.	197,019	183,410	2,260,348	2,745,280
San Antonio, Tex.	181,260	170,050	.....	.....
Washington, D. C.	742,773	491,576	7,407,139	7,312,278
Totals	$2,600,209	$3,163,459	$23,166,811	$31,882,135

* Not included in totals.

WESTERN STATES

	Month of August 1915	Month of August 1914	First Eight Months of Year 1915	First Eight Months of Year 1914
Oakland, Calif.	$506,041	$411,889	$3,299,111	$3,281,059
Portland, Ore.	728,897	409,390	3,732,032	5,461,045
Salt Lake City, Utah	213,300	480,045	1,483,191	2,115,109
San Francisco, Calif.	970,090	1,415,271	9,036,563	24,161,483
San Diego, Calif.	62,770	208,408	776,947	2,573,646
Seattle, Wash.	454,960	1,565,525	3,960,165	9,969,970
Spokane, Wash.	50,335	31,455	821,469	806,752
Tacoma, Wash.	54,378	139,460	549,053	1,712,207
Totals	$3,040,771	$4,661,443	$23,658,531	$50,081,271

RAILWAYS

Maine—Harvey D. Eaton, Waterville, Maine, is interested in a project to construct an electric railway from Athens to Skowhegn, Maine, about 13 miles.

Massachusetts—Bay State St. Ry.—The Massachusetts Highway Commission has approved the new location and relocation of the tracks of this company in Washington St. from Hanover to Lloyd St., Lynn, and the relocation of tracks on Myrtle, Winter and Howard St., Saugus. M. S. Goff, Boston, is Vice Pres. and Gen. Mgr. Noted July 8.

Massachusetts—Springfield St. Ry. Co.—This company has petitioned the Council for a franchise to relocate its tracks on Mill St., Westfield, from West Silver St. to Court St. R. W. Reynolds, Springfield, is Mgr.

Pennsylvania—Southern Pennsylvania Traction Co.—This company has petitioned the Council for a franchise to extend its line from Chester to Eddystone. T. M. Wilson, Wilmington, Del., is Vice-Pres. and Gen. Mgr.

Maryland—Cumberland Electric Ry. Co.—This company will double track its line on Baltimore St. from the Western Maryland Ry. to the Baltimore & Ohio R.R. W. M. Roberts, Jr., is Mgr., Supt. and Pur. Agt.

Virginia—Norfolk & Western Ry.—This company plans to double track its City Point branch. J. E. Crawford, Roanoke, is Ch. Engr. Noted Feb. 11.

Georgia—The Chamber of Commerce, Rome, Ga., is promoting the construction, by the Seaboard Air Line Ry., of a railway from Rome south to Fish, about 14 miles.

Georgia—Southern Ry.—Surveys have been made by this company for a spur from Dalton to the Crown Cotton Mills. B. Herman, Washington, D. C., is Ch. Engr.

Alabama—The State Legislature has passed a bill authorizing the City of Mobile to issue bonds for the construction of a belt line railway.

Alabama—Alabama Great Southern R.R.—This company is securing a right-of-way for double tracking its line through DeKalb and Etowah County. Plans are also being considered for an extension to Gadsden. C. Dougherty, Cincinnati, Ohio, is Ch. Engr.

Alabama—New Orleans, Mobile & Chicago R.R.—This company has been reorganized and plans to revive the project of extending the line to Beaumont, Miss., to connect with the Louisville & Nashville R.R. B. V. Wright, Laurel, Miss., is Ch. Engr.

Louisiana—New Orleans Ry. & Light Co.—A petition has been presented to the City Council by the residents of upper South Claiborne Ave., asking that the New Orleans Ry. & Light Co. be permitted to proceed with the extension of the South Claiborne Ave. line from Broadway to Carrollton Ave., New Orleans. M. S. Sloan, New Orleans, is Gen. Mgr.

Louisiana—Shreveport Traction Co.—The Council has granted this company a franchise to double track its Highland Ave. Fair Grounds line from Marshall to Creswell St. on Stoner Ave. and from Stoner Ave. to the end of Herndon Ave. W. A. Sullivan, Shreveport, is Gen. Mgr. and Pur. Agt.

✚**Tennessee**—Morgan-Fentress Ry.—This company has awarded a contract for a section of its proposed railway to the CUMBERLAND CONSTRUCTION CO., Harriman.

Kentucky—According to press reports an electric railway will be constructed from Burkesville to Edmonton, Ky., about 22 miles.

Ohio—Cleveland Ry. Co.—This company will extend its line on East 123rd St. from St. Clair Ave. to Superior St. G. L. Radcliffe, Cleveland, is Gen. Mgr.

Ohio—Wheeling & Lake Erie R.R.—This company plans to connect its main lines with the United Steel plant and the proposed new blast furnace. W. L. Rohbock, Cleveland, is Ch. Engr.

Ohio—New York Central R.R.—Cincinnati, Chicago & St. Louis Ry.—According to press reports these companies have secured a site at Noble upon which they plan to construct yards. G. C. Cleveland, Cleveland, is Ch. Engr., New York Central R.R. and C. A. Paquette, Cincinnati, is Ch. Engr., Cleveland, Cincinnati, Chicago & St. Louis Ry.

Michigan—A special election will be held in Detroit Nov. 2 to vote on the question of the city purchasing the street car system owned by the Detroit United Ry. Co.

Michigan—Pennsylvania R.R.—This company plans to extend its line to Detroit, Mich. The estimated cost is $20,000,000. A. C. Shand, Philadelphia, is Ch. Engr.

Illinois—Alton, Granite & St. Louis Traction Co.—This company plans to relay its tracks on the north and south end of its Second St. line. O. C. Macy, Alton, is Supt.

Illinois—Lee County Electric Ry.—This company plans to relocate its tracks in Amboy and abandon its line on Main St. in order to build a line from Binghamton to Blackstone St. The proposed new line will give the company direct connection with both the Illinois Central Electric Ry. and the Burlington Ry. & Light Co.

Illinois—Peoria Ry. Co.—A franchise has been granted this company to double track its line on Frye Ave. from Wisconsin to Pacific St., Peoria. R. W. Bailey, Peoria, is Gen. Supt.

✚Minnesota—Electric Short Line Ry. Co.—A contract has been awarded by this company to H. F. BALCH & CO., Minneapolis, for the construction of an electric railway from Winsted to Hutchinson, Minn., about 45 miles. De Koven Hunter, Minneapolis, is Gen. Mgr.

Wisconsin—Ettrick & Northern R.R.—The State Railroad Commission has granted this company permission to construct a railway through Ettrick and Preston to a connection with the Green Bay & Western R.R. John C. Gaveney is Pres. Noted July 8.

South Dakota—Huron & Northwestern Ry.—According to press reports work will soon be started by this company on the construction of its proposed railway to connect Huron, S. D. and Hankinson, N. D. F. W. Henderson, Summit, S. D., is interested. Noted Apr. 29 and June 24.

South Dakota—Aberdeen R.R. Co.—This company, recently incorporated, will take over the existing system of the city and improve and extend it. Charles A. Howard, S. C. Hedger and Charles N. Harris are the incorporators.

Oklahoma—St. Louis & San Francisco R.R.—This company plans to extend its line from Depew northward into the coal field to connect with the Oil Field and Santa Fé line. F. G. Jonah, St. Louis, is Ch. Engr.

California—Pacific Electric Ry. Co.—This company has asked the Council for a franchise to construct a single track line on certain portions of Figuero St., Denver Ave., Hoover St., Menlo and Vermont Ave. J. McMillan, Los Angeles, is Gen. Mgr.

LIGHT, HEAT AND POWER

✚Pawtucket, R. I.—The Rhode Island Power & Transmission Co. is building a 30x100-ft. brick and concrete power station which will ultimately be capable of generating 30,000 kw. A contract has been awarded to the GENERAL ELECTRIC CO., Schenectady, N. Y., for transformers and a five-panel switchboard. The Connecticut River Transit Co., Worcester, Mass., is Engr.-in-Charge.

New York, N. Y.—(Borough of Manhattan)—Bids will be received until 2:30 p.m., Sept. 24, by E. S. Elwood, Secy. State Hospital Comn., Capitol, Albany, for the construction of a one-story brick and concrete power house at the Manhattan State Hospital, Wards Island. The estimated cost is $200,000. Lawis F. Pilcher is State Arch.

Tarentum, Penn.—Bids will be received until 7 p.m., Sept. 13, by the City Clerk for one 500-kw. alternating current steam turbine generating unit, surface condensing equipment, one switchboard and two motor-driven centrifugal pumps. Sidney B. Martin, Penn Bldg., Pittsburgh, is Consult. Engr. Noted Sept. 2.

Baltimore, Md.—The Consolidated Gas, Electric Light & Power Co. will build additions to its substation on Monument St. near Front St., consisting of two two-story wings, 48x135 ft. and 47x142 ft. respectively, of brick and reinforced concrete. E. D. Edmondston is Gen Supt.

Hickory, N. C.—(Official)—Bids will be received until 10 a.m., Oct. 12, by S. C. Cornwell, City Mgr., for a 30-year franchise to operate electric-light and power, fuel and heating plants.

Summit, Ga.—It is reported that the towns of Summit and Graymont, Emanuel County, will vote for a bond issue of $5000 to be used for installing an electric-light plant to serve both towns.

Chattanooga, Tenn.—It is reported that the Nashville, Chattanooga & St. Louis Ry. will purchase power equipment for the operation of an inclined railway on Lookout Mountain, Chattanooga. H. McDonald, Nashville, is Ch. Engr.

Cynthiana, Ky.—It is reported that the Kentucky Utilities Co., Lexington, contemplates purchasing the plant of the Cynthiana Electric Light Co. It will be improved and enlarged. G. E. Hyde, Lexington, is Mgr. and Engr. of the Kentucky Utilities Co.

Junction City, Ky.—The establishment of a municipal electric-light plant is under consideration.

Providence, Ky.—At the November election the question of issuing $20,000 in bonds will be submitted to the voters. The proceeds will be used for the establishment of a municipal electric-light plant.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Oct. 1, by the Board of Commissioners of Hamilton County for remodeling the heating system of the Ohio National Guard Armory on Freeman Ave., Cincinnati. Albert Reinhardt is Clk. of Comrs.

Kent, Ohio—(Official)—Bids will be received until noon, Sept. 25, by J. A. McDowell, Secy. Bd. of Trustees of the Kent State Normal School, for two water-tube boilers with breeching and all enclosures, and with all piping from the heating plant to three school buildings; also for all radiation, fans, motors, galvanized iron work and temperature regulation for heating the auditorium, office and library building, the administration building, and the agricultural and training building. George F. Hammond, 4220 Prospect Ave., Cleveland, is Arch.

Wellsville, Ohio—No bids were received Aug. 7 for the $60,000 worth of city bonds, the proceeds of which would have been used for the installation of a municipal electric-light plant. The project will be postponed for a time. Noted July 15.

Crawfordsville, Ind.—It is reported that within six months, the Crawfordsville Electric Light & Power Plant (municipal) will purchase one 1500-kw. turbo-generator with condenser pump, switchboard and steam heater. F. Miller is Mgr. and Supt.

Kalamazoo, Mich.—It is reported that F. W. Ballard, Ch. Engr., of the municipal electric-light plant of Cleveland, Ohio, has made a survey of the municipal plant of Kalamazoo, and has recommended that $350,000 in bonds be issued for the purpose of extending and improving the present system. Andrew Lenderink is City Engr.

✚Bloomington, Ill.—Illinois Wesleyan University has awarded contract for two 350-hp. water-tube boilers in its new heating plant to the SPRINGFIELD BOILER & MFG. CO.

Elizabeth, Ill.—Bids will be received until 2:30 p.m., Sept. 13, by the Elizabeth Light & Power Co. for building three miles of transmission line, a substation and distribution system. Dr. A. J. Nichols, Elizabeth, is interested.

Upper Alton, Ill.—The lowest bid received by the State Hospital Commission, Springfield, for the construction of a power house at the Alton State Hospital was that of J. J. Wuellner & Sons, Alton, at $55,400. Noted Aug. 12.

Thief River Falls, Minn.—A special election will be held Sept. 30 by the city to vote on a bond issue of $38,000 for the purpose of improving and extending the municipal electric-light plant. E. J. Overland is City Clk.

✚Cherokee, Iowa—The contract for plumbing and heating equipment in the Cherokee High School has been awarded to SWANSON & BETSWORTH, Cherokee, at $12,873.

Perry, Iowa—It is reported that the Iowa Ry. & Light Co., Cedar Rapids, contemplates rebuilding its plant at Perry. Estimated cost, $60,000. William G. Dows, Cedar Rapids, is Pres. and Gen. Mgr.

Tekamah, Neb.—The city is preparing to build a new power house for the municipal electric-light plant, and will purchase one 150-hp. corliss-type engine, two boilers, a 100-kw. generator and a switchboard. A. G. Howard is Mgr. of the plant. Noted June 10.

Austin, Tex.—It is reported that the city has issued $40,000 in bonds for the purpose of enlarging and improving the municipal electric-light plant. A. P. Wooldridge is Mayor.

Denison, Tex.—It is reported that the Texas Power & Light Co. has purchased a site on the Red River near Denison for a hydro-electric plant. Estimated cost, $750,000. The plant will furnish power to operate a part of the lines of the Texas Traction Co., and for lighting and other purposes in northern Texas and southern Oklahoma by the use of high-tension transmission lines. Noted July 17, 1913, and July 8, 1915.

Galveston, Tex.—It is reported that the Galveston Gas Co. will make improvements in its gas manufacturing plant to cost about $150,000.

Kyle, Tex.—The Kyle Light & Power Co. is being organized for the purpose of establishing an electric-light and power plant. W. W. Giessen, San Marcos, is interested.

Socorro, N. M.—The Socorro Light & Power Co. has been organized with a capital stock of $50,000. It will build an electric-light plant. C. T. Brown is interested.

Pocatello, Idaho—It is reported that the Oregon Short Line R.R. will install a heating plant in its roundhouse at Pocatello. Plans are being prepared by C. C. Kennicott, Salt Lake City, Utah.

Peach Springs, Ariz.—(Nelson post office)—Epes Randolph, Tucson, and associates, have received permission from the Department of the Interior to make preliminary surveys for the dams they plan to build across the Colorado River near Peach Springs, and for the series of hydro-electric plants to develop a total of 400,000 hp. The first dam and plant will be located in Diamond Cañon, and will develop about 50,000 hp. J. B. Girard, City Engr. of Phoenix, is interested in the project, and will have charge of the surveys to be made.

Toronto, Ont.—The Toronto Hydro-Electric Commission plans to build a substation at the St. Lawrence Market, Toronto. The building will be of steel.

BRIDGES

Augusta, Maine.—Bids were received Aug. 26 by the State Highway Commission for the construction of the Milo Bridge as follows: (a) lump sum, (b) extra concrete, per cu.yd., (c) extra fill, per cu.yd.; E. T. Hartwell, Oldtown, (a) $5427, (b) $9, (c) 75c.; Hobart & Richardson, Oldtown, (a) $7016, (b) $12, (c) 85c.; John Connor, Oldtown, (a) $4832, (b) $6.50, (c) 75c.; Cyr Bros., Waterville, (a) $4900, (b) $10, (c) $1; Small & Ingalls, Bar Harbor, (a) $5350, (b) $12, (c) $1.50; H. A. Brown, Foxcroft, (a) $6500, (b) $10, (c) 83c.; Sanders Engineering Co., Portland, (a) $5980, (b) $14, (c) 75c.; Noyes & Campbell, Augusta, (a) $7790, (b) $20, (c) $1. The lowest bid for the Frankfort Bridge was that of Cyr Bros., at $2792; for the Montville Bridge, E. L. Gerald, Clinton, at $2164.

✚Providence, R. I.—(Official)—The Department of Public Works has awarded the contract for building abutments of the Randall St. Bridge to the BRIGGS ENGINEERING & CONSTRUCTION CO., at $11,624. Other bidders were: Cruise & Smiley Construction Co., $12,918; Valley Co., $13,132; Farnighetti Bros. Co., $11,738.

Buffalo, N. Y.—(Official)—Bids will be received until 11 a.m., Sept. 15, by the Grade Crossing Commission, 436 Ellicott Sq., for a 162-ft. riveted truss through span on Bailey Ave. over the tracks of the Pennsylvania R.R. Edward B. Guthrie is Ch. Engr., Grade Crossing Comn.

✚★Greenwich, N. Y.—(Official)—The towns of Greenwich and Easton have awarded contracts for construction of three concrete-steel bridges at Greenwich Village, Middle Falls and Clarks Mills to N. R. PORTERFIELD, 17 Battery Pl., New York, at $41,000. Other bidders were: K. O. Guthrie, Schenec-

tady, $44,000; Woolsey Construction Co., Poughkeepsie, $47,500; Flood & Van Wirt, Hudson Falls, $46,000. Foster Construction Co., Newark, N. J., $46,074. Noted Aug. 12.

✚Trenton, N. J.—The Board of Chosen Freeholders of Mercer County has awarded the contract for the construction of a bridge over Sanhican Creek at Willow St. to WHITTAKER & DIEHL, Harrisburg, Penn., at $8176. Other bidders were: F. W. Schwiers, Jr., Co., $8300; Foster Construction Co., $8873; Reese Taylor Co., $9018; Ginder Construction Co., $9670; Antonio Celentino, $10,619; American Paving & Construction Co., $11,475; G. B. Henderson & Son, $11,500; Charles T. Eastburn, $11,750. Noted Aug. 5 and 26.

Harrisburg, Penn.—The State Water Supply Commission has approved plans for the construction of the following bridges: Bucks County, bridge across Fall Creek on the Bridgetown-Revere Rd., Bridgetown Township, bridge over Trout Run, on the Pebble Hill Rd., Doylestown Township; Armstrong County, bridge over Cowanshannock Creek in Rayburn Township; Schuylkill County, bridge over Mahonoy Creek on road from Maizeville to Frackville, bridge over Mahonoy Creek at Gilberton.

✚★Philadelphia, Penn.—The Department of Public Works has awarded the contract for the Holme Ave. Bridge to the McNICHOL PAVING & CONSTRUCTION CO., at about $72,000. Noted July 29 and Aug. 12.

✚Clarksburg, W. Va.—(Official)—Harrison County Court awarded contract for abutments and piers of bridge across West Fork River to McPHERSON BROS., Edgeworth, Penn., at $1.90 per sq.yd. for brick on concrete base. Other bidders were: Frech & Allen, $1.96; Keeley Bros., $1.95; Cisler & Morris, $2.08; W. F. Allen, $2.12; Charles H. Hoyt, $2.19. Noted Aug. 26.

✚★Wilson, N. C.—(Official)—The Board of Drainage Commissioners, Mattamuskeet Drainage District, has awarded contract for a single-leaf plate girder Scherzer rolling lift bridge to the CHAMPION BRIDGE CO., Wilmington, Ohio. Noted Aug. 12.

Arcadia, Fla.—The Board of Commissioners of De Soto County contemplates the construction of a new bridge over the Kissimmee River. The estimated cost is $10,100.

✚Clearwater, Fla.—The Commissioners of Pinellas County have awarded the contract to the EDWARDS CONSTRUCTION CO., Tampa, for several bridges in connection with new road construction. The reported cost of the bridges is $45,000.

Akron, Ohio—(Official)—Commissioners of Summit County awarded contract for approaches and paving the Louis Young Bridge in Coventry Township to W. E. BURK & SON, Akron, at $4150. Other bidders were: D. E. Bowers, $4695; Ruhlin Bros., $4260; Portage Engineering Co., $4270. Noted Aug. 12.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Sept. 17, by Commissioners of Hamilton County for a bridge and retaining wall on Four Mile Rd., Anderson Township. Albert Reinhardt is Clk. of Comrs.

Cleveland, Ohio—(Official)—Bids will be received until 11 a.m., Sept. 22, by the Board of Commissioners of Cuyahoga County for bridge work, Report No. 3567. W. A. Stinchcomb is County Surv. E. G. Krause is Clk. of Comrs.

Cleveland, Ohio—(Official)—Bids will be received until 10 a.m., Sept. 25, by E. G. Krause, Clk. of Comrs. of Cuyahoga County, for bridge work, Report No. 3591.

Columbus, Ohio—(Official)—Bids will be received until noon, Sept. 17, by the Board of Commissioners of Franklin County for the following bridge work: Paving east approach to the Schrock Bridge, Blendon Township; foot bridge over the Scioto River on Mound St., Columbus; hand-rail on the Agler Bridge over Alum Creek, Mifflin Township. John Scott is Clk. of Comrs.

Dayton, Ohio—The City Commission has passed ordinances for the issuance of $338,000 for rebuilding the Fifth St. Bridge across the Miami River, and the Webster St. Bridge across the Mad River, at an estimated cost of $200,000 and $138,000 respectively. Both these bridges were destroyed in the flood of 1913. G. C. Cummin is City Engr.

✚Delaware, Ohio—The Commissioners of Delaware County have awarded the contract for the steelwork of the Winters St. Bridge to the DELAWARE BRIDGE CO., at about $17,500. The contract for the wood block floor was awarded to the ELKHART BRIDGE & IRON CO., Elkhart, Ind. Noted Aug. 12.

Delphos, Ohio—Bids will be received until noon, Sept. 22, by H. J. Lawlor, Audr. of Allen County, Lima, for two bridges over Flat Fork, one on Franklin and the other on Fifth St., Delphos.

Hamilton, Ohio—At the request of the Miami Conservancy Board, the Commissioners of Butler County have instructed the County Auditor to withdraw the advertisement for bids to be received Sept. 13 for the construction of the Columbia Bridge at Chestnut St. This action is taken until plans for flood prevention in Hamilton shall have been completed and adopted. It is expected that these plans will be finished in about 30 days. F. M. Hammerle is County Engr. Noted Aug. 12 and Aug. 26.

Milford, Ohio—The Commissioners of Clermont County, Batavia, have sold $8000 worth of bridge bonds, the proceeds of which will be used for the construction of a bridge across the East Fork of the Miami River in South Milford.

✚Mt. Gilead, Ohio—(Official)—Commissioners of Morrow County have awarded contract for Beatty Bridge, Cardington Township, to E. M. SCULLY, Columbus, at $3750. Noted July 29.

✚New Philadelphia, Ohio—(Official)—The Commissioners of Tuscarawas County have awarded the contract for a bridge over Sugar Creek Falls in Franklin Township to the MASSILLON BRIDGE CO., Massillon, at $2300 for the steel span, and $3.98 per sq.yd. for the floor. Noted Aug. 12.

Norwalk, Ohio—Bids will be received until 10:30 a.m., Sept. 14, by Charles E. Bloomer, Audr. of Huron County, for a concrete bidge in Clarkfield Township.

✚Ravenna, Ohio—(Official)—The Commissioners of Portage County have awarded the contract for a 75-ft. steel bridge over the North Mahoning River in Charlestown Township to E. PINNEY, Ravenna. Noted Aug. 12.

Steubenville, Ohio—(Official)—Bids will be received until noon, Sept. 17, by the Commissioners of Jefferson County for the construction of Bridge No. 33 in Warren Township, known as the Weatherston Bridge. It will be a concrete arch. John L. Means is County Audr.

✚Bedford, Ind.—(Official)—The Commissioners of Lawrence County have awarded the contract for four county bridges to the INTERNATIONAL STEEL & IRON CO., Evansville, at $5200. Other bidders were: Bedford F. & M. Co., $6728; Herman S. Fox, $5743; East St. Louis Bridge Co., $7859; Central States Bridge Co., $7164; Vincennes Bridge Co., $6446. Noted Aug. 19.

✚Allegan, Mich.—The Drain Commissioner of Allegan County has awarded contract for three new bridges over the Gun River Drain to the ELKHART BRIDGE & IRON CO., Elkhart, Ind., at $4419. They will be of steel with concrete floors.

Grand Rapids, Mich.—The lowest bid received by the Board of Public Works for a bridge over the tracks of the Grand Trunk Ry. on College Ave., N. E., was that of D. W. Boyes, Grand Rapids, at $12,908. The engineer's estimate was $14,998. L. E. Stevens is City Engr.

✚Green Bay, Wis.—(Official)—The Committee on Streets and Bridges has awarded the contract for a Strauss bascule bridge across the East River at Main St. to the GREILING BROS. CO., Green Bay, at $56,815. Other bidders were: Adolph Green, Green Bay, $56,815; Worden-Allen Co., Milwaukee, $58,400; Seims-Carey Co., St. Paul, Minn., $58,500; Edward E. Gillen Co., Milwaukee, $65,900. Noted Aug. 5.

✚Milwaukee, Wis.—The County Board of Milwaukee County has awarded the contract for a concrete bridge over the Root River in the Town of Franklin on the Kilbourn Rd. to JOSEPH UBBICK, at $9704.

✚Nekoosa, Wis.—The contract for a four-span 875-ft. bridge across the Wisconsin River has been awarded to the WAUSAU IRON WORKS, Wausau, at $42,889.

St. Paul, Minn.—It is reported that the City Council has adopted an emergency ordinance demanding that the Great Northern Ry. at once rebuild the Jackson St. Bridge over its tracks. Oscar Claussen is City Engr.

Ft. Riley, Kan.—It is estimated that the cost of replacing the bridge across the Republican River, which was washed out by the June floods, will be $30,000. The post authorities have petitioned the War Department to build a reinforced-concrete bridge of two 150-ft. spans and a 20-ft. roadway.

✚Ogden, Kan.—(Official)—The Commissioners of Riley County, Manhattan, received bids Sept. 1 for the repair of a bridge over the Kansas River at Ogden, as follows: CANTON BRIDGE CO., Kansas City, Mo., $10,800 (awarded contract); Leavenworth Bridge Co., $12,500; Western Bridge Co., $11,773. The engineer's estimate was $12,097. W. S. Gearhart, State Highway Engr., is Engr.-in-Charge. Noted Aug. 26.

✚Alma, Neb.—(Official)—The Commissioners of Harlan County have awarded the contract for bridge construction for a period of one year to the MONARCH ENGINEERING CO., Falls City, Neb. Noted Aug. 26.

Fairbury, Neb.—The Commissioners of Jefferson County contemplate constructing a 700-ft. bridge in Fairbury to replace present structure. Estimated cost, $30,000.

Tekamah, Neb.—(Official)—Bids will be received until noon, Sept. 18, by the Board of Directors of the Burt-Washington Drainage District, S. S. Breckenridge, Secy., for the construction of seven 100-ft. bridges and other smaller bridges in the district. The Towl Engineering Co., 1122 City National Bank Bldg., Omaha, is Drainage Engr.

✚Medora, N. D.—(Official)—Billings County and the State Highway Commission have awarded the contract for a bridge over the Little Missouri River to the ILLINOIS STEEL BRIDGE CO., St. Paul, Minn., at $14,580. Other bidders were: Security Bridge Co., $15,698; Fargo Bridge & Iron Co., $16,100; Continental Bridge Co., $16,400; Iowa Bridge Co., $15,300; Midland Bridge Co., $17,500; Minneapolis Bridge Co., $16,000. Noted Aug. 12 and Sept. 2.

Roundup, Mont.—Bids will be received until Sept. 10 by the Commissioners of Musselshell County for four steel bridges over the Musselshell River as follows: Ryegate, 140-ft. span; Delphia, 140-ft. span; Gage, 123-ft. span; Absher, 140-ft. span on 175-ft. base with two piers. Ray E. Bushnell is County Surv.

Gallatin, Mo.—The Board of Commissioners of Daviess County plans to rebuild bridges destroyed by recent floods at a loss of about $40,000.

Joplin, Mo.—The city has recently voted a bond issue of $13,000 to pay its share of the cost of a viaduct over the tracks of the Kansas City Southern Ry. The city will bear one-third the expense, and the Kansas City Southern and the Missouri, Kansas & Texas Ry. will pay the remainder. Plans have been prepared by the railway companies. Noted Feb. 25 and June 3.

✚Devall Bluff, Ark.—The Commissioners of Road District No. 1 have awarded the contract for four new bridges to M. KELLY, Little Rock.

El Dorado, Ark.—(Official)—Bids will be received until 10 a.m., Sept. 25, by the Commissioners of Union County for the construction of a bridge across Beech Creek on the El Dorado and Mt. Holly Rd., on the site of the old bridge. W. H. Hawkins is Chn. of Comrs.

Laredo, Tex.—It is reported that bonds for $15,000 have been issued by the city, the proceeds of which will be used for bridge construction. E. J. Foster is City Engr.

Rockport, Tex.—A special election will be held Sept. 18 to submit to the voters the question of issuing $300,000 in bonds, the proceeds of which will be used for building a reinforced-concrete causeway across Aransas Bay between Lamar and Live Oak peninsulas. Roy Jackson is Judge of the Aransas County Commissioners Court.

Chandler, Okla.—Bids will be received until Sept. 13 by J. C. Pringey, Clk. of Lincoln County, for the construction of 12 steel bridges in the county.

+Oklahoma, Okla.—The contract for a four-span steel suspension bridge over the Canadian River has been awarded to the BAKER CONSTRUCTION CO., at $60,000.

+★Tulsa, Okla.—(Official)—The Commissioners of Tulsa County have awarded the contract for the construction of an 18-span reinforced-concrete bridge over the Arkansas River to the MISSOURI BRIDGE & IRON CO., Leavenworth, Kan., at $160,000. Other bidders were: Midland Bridge Co., Kansas City, Mo., $19,345; Winston Bros. Co., Minneapolis, Minn., $165,-984; Kansas City Bridge Co., Kansas City, Mo., $190,167; H. G. Glass, San Antonio, Tex., $185,297; Joseph T. Luntey, Tulsa, $164,422. Noted July 22 and Aug. 5.

Artesia, N. M.—The Commissioners Court of Eddy County and James A. French, State Engr., Santa Fé, have authorized the extension of the bridge across the Pecos River at Artesia.

Hailey, Idaho—Bids will be received until Sept. 13 by the Commissioners of Blaine County for the construction of a bridge across the Malad River.

+Pocatello, Idaho—The Commissioners of Bannock County have awarded the contract for removing old bridge, and constructing a new one across the Snake River near Tilden to the MIDLAND BRIDGE CO., Kansas City, Mo., at $7250.

+Clifton, Ariz.—The Board of Supervisors of Greenlee County has awarded contract for driving 500 piles for the protection of the new Duncan Bridge to the EL PASO BRIDGE CO., El Paso, Tex., at $19.95 per pile.

+Dunsmuir, Calif.—Bids were received Aug. 23 by the State Highway Commission, Sacramento, for the construction of a reinforced-concrete bridge over the Sacramento River near Dunsmuir, as follows: F. H. GREEN, Eureka, $22,600 (awarded contract); P. J. Lechner, Alameda, $23,994; Moffett & Mead, San Francisco, $24,750; Pacific Coast Construction Co., Fresno, $27,300. The engineer's estimate was $22,267. Noted Aug. 5 and 12.

+El Monte, Calif.—The Supervisors of Los Angeles County, Los Angeles, have awarded the contract for a reinforced-concrete bridge over the San Gabriel River at El Monte to MESMER & RICE, Marsh-Strong Bldg., Los Angeles, at $93,000. Noted July 29 and Aug. 19.

+Santa Barbara, Calif.—The City Trustees have awarded the contract for the construction of a bridge at Carillo and Castillo St. to MUNOZ & MUNOZ, Los Angeles, at $18,000. Noted Apr. 29.

+Ventura, Calif.—(Official)—The Board of Supervisors of Ventura County has awarded the contract for the Conejo Bridge near Camarillo to MUNOZ & MUNOZ, Central Bldg., Los Angeles, at $7733. The contract for the approach to the Saticoy Bridge was awarded to the BOARDMAN CONSTRUCTION CO., W. P. Story Bldg., Los Angeles, at $6000, and for the abutment for the same structure to the PUTNAM STONE CONSTRUCTION CO., Pasadena, at $10,811. Noted Aug. 19.

Yreka, Calif.—(Official)—No bids will be received by the Superivisors of Siskiyou County for the construction of a bridge over the Scott River as the work is to be done under an emergency act. W. J. Neilon is County Clk. Noted Aug. 26.

WATER SUPPLY—IRRIGATION

+Boston, Mass.—The contract has been awarded to the STANDARD CAST IRON PIPE & FOUNDRY CO., Bristol, Penn., at $12,633, for furnishing water pipe.

+Centerville, N. Y.—Contracts have been awarded to ABNEY HARPER CO., Inc., Newburgh, at $8277, for laying water mains and to R. D. WOOD & CO., Philadelphia, Penn., at $10,-883, for furnishing water mains and specials. Noted July 29 and Aug. 26.

New York, N. Y.—(Official)—Bids were received Aug. 31 by the Board of Water Supply for water-pipe equipment for operating valves in the shafts of the city tunnel of the Catskill Aqueduct as follows: F. N. Lewis, 411 Manhattan Ave., New York, $13,411; D. C. Serbe & Lassette & Murphy, $13,814; Conners Bros. Co., $15,858 and H. E. Fox, $17,405. Noted Aug. 19.

Trumansburg, N. Y.—The construction of a municipal water system has been postponed as the majority of the citizens are not in favor of it. Noted May 6.

East Orange, N. J.—F. N. Lewis, New York, N. Y., at $41,-911, was low bidder for making extension to the water distributing system, materials to be furnished by the city. Noted Aug. 19.

New Brunswick, N. J.—The installation of a filtration plant at the water-works is under consideration by the city.

Peapack, N. J.—The Borough Council plans to issue $55,000 in bonds, the proceeds of which will be used for the construction of a water system. Noted Feb. 26.

Allentown, Penn.—Bids will be received about Sept. 15 by the City Council for furnishing new equipment at the pumping station. The estimated cost is about $30,000. Joseph A. Schmidt is City Clk. Noted Aug. 12.

+Bradford, Penn.—The contract has been awarded to M. APPLEGATE & Son, for laying water mains. The contract for furnishing pipe has been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO.

Wheeling, W. Va.—An election will be held in the fall, according to press reports, to vote on the question of issuing $300,000 in bonds, the proceeds of which will be used for the construction of a well system for the water-works. Noted July 8.

Baconton, Ga.—Bonds for $5500 have been voted by the citizens, the proceeds of which will be used for the construction of water and electric-light systems. J. B. Miller is Mayor. Noted Aug. 5.

Helena, Ga.—The city contemplates spending $8000 for the construction of a water system.

+Phenix City, Ala.—(Phœnix post office)—The contract has been awarded to the SCHOFIELD'S IRON WORKS, Macon, Ga., at $5100, for constructing a 180,000-gal. standpipe for the water system. Noted Apr. 29.

Wesson, Miss.—M. L. Culley, Jackson, has been retained by the city to prepare plans for the construction of a water system.

Covington, Ky.—Bids will be received until Sept. 16 by J. Mason Howk, Comr. Pub. Property, for trenching in Licking River. Noted Aug. 5.

Hawesville, Ky.—The Hawesville Water & Light Co., recently incorporated with $12,000 capital by W. H. Williams and others, will construct a water system.

+Bluffton, Ohio—The contract has been awarded to THEODORE G. SCHEILD, Lima, at $15,523, for making improvements to the water system. Noted May 6.

Oberlin, Ohio—Press reports state that bids will be received until Sept. 10 by the City Clerk for constructing a 10,000,000-gal. reservoir. Noted Aug. 12.

+Silverton, Ohio—(Official)—The contract has been awarded to W. D. MEGRUE, Pleasant Ridge, Cincinnati, for laying 6-in. water main in various streets. Noted Aug. 26.

Miller, Ind.—Bids will be received until Sept. 15 by the Town Clerk for constructing a water system. The estimated cost is $14,000. W. J. Fulton, Gary, is Engr. Noted Aug. 26.

South Lyon, Mich.—The citizens at a recent election voted against the question of isuing bonds for $16,000, the proceeds of which was to have been used for the construction of a water system. Noted June 3.

Amboy, Ill.—(Official)—Bids will be received until 2 p.m., Sept. 27, by F. N. Vaughan, Mayor, for constructing a steel water tank. F. A. Flach is City Clk.

Lemont, Ill.—An election will be held Sept. 14 to vote on the question of issuing $8000 in bonds, the proceeds of which will be used for the extension of the water system. M. Keough is Chn. Bd. of Trustees.

Mackinaw, Ill.—The water plant of the Mackinaw Water Co. will be purchased by the city. An appropriation of $8500 has been made for this purpose. An election will be held Sept. 10 to vote on the question of issuing bonds, the proceeds of which will be used for the enlargement of the system.

Oshkosh, Wis.—Plans are being prepared for the construction of a filtration plant at the water-works. J. C. Walter is Asst. City Mgr. Noted Aug. 26.

Akron, Iowa—Bonds for $5000 have been voted by the citizens, the proceeds of which will be used for the improvement of the water system.

+Chariton, Iowa—Contracts have been awarded for constructing a water system as follows: MALEY & KELLEY, Kansas City, Mo., at $38,000, for constructing an earth dam; J. W. TURNER IMPROVEMENT CO., Des Moines, Iowa, at $11,000, for constructing a pumping station and at $18,699, for constructing a pipe line and to the PITTSBURGH FILTER CO., at $4637, for equipment. Noted Aug. 19.

+Le Mars, Iowa—The contract has been awarded to the DES MOINES BRIDGE & IRON CO., at $4350, for constructing a water tower.

Salix, Iowa—Press reports state that bids will be received until Sept. 15 by J. M. Huck, Village Clk., for constructing a water system. W. L. Bruce, Yankton, S. D., is Engr. The estimated cost is $10,000. Noted June 3.

Carlton, Minn.—The Council contemplates installing a water system. The estimated cost is $16,000.

+Hopkins, Minn.—The contract has been awarded to the SYKES CO., Minneapolis, for constructing water mains in 12th Ave. N. and in Seventh Ave. N.

+St. James, Minn.—The contract has been awarded to J. G. ROBERTSON, St. Paul, for constructing a water system.

Watkins, Minn.—An election will be held to vote on the question of issuing bonds, the proceeds of which will be used for the construction of a water system. Noted May 20.

Attica, Kan.—The city has retained E. T. Archer & Co., Kansas City Mo., to prepare plans for the construction of a water system. The estimated cost is $30,000. J. C. McCaddon is City Clk. Noted Sept. 2.

Elkhorn, Kan.—An election will be held to vote on the question of issuing bonds, the proceeds of which will be used for the construction of a water system.

Hillsboro, Kan.—The city contemplates constructing water and sewer systems at an estimated cost of $30,000. H. H. Beck is Mayor.

Russell, Kan.—Plans are being prepared for the construction of about two miles of water mains. W. B. Rollins & Co., Midland Bldg., Kansas City, Mo., is Engr.

Spearville, Kan.—Bids will be received until Sept. 15 by R. E. Wood, City Clk., for constructing a water system. Rollins & Co., Kansas City, Mo., is Engr. Noted Aug. 26.

Bayard, Neb.—At a recent election the citizens voted in favor of issuing bonds, the proceeds of which will be used for the construction of a municipal water system.

Hastings, Neb.—Bids will be received until 2 p.m., Sept. 13, by W. S. Watson, Comr. of Light and Water, for driving 24-in. wells about 130 ft. deep and for furnishing a 24-in. motor driven centrifugal turbine pump.

+Syracuse, Neb.—Contracts have been awarded to the CHICAGO BRIDGE & IRON WORKS, Chicago, Ill., at $3990, for water tower and to the ELKHORN CONSTRUCTION CO., Fremont, at $3788, for water mains.

Aberdeen, S. D.—About 500 water meters will be purchased by the City Commissioners.

Gayville, S. D.—Bonds have been voted by the citizens. The proceeds will be used for the construction of a water system.

Sioux Falls, S. D.—Water service connection will be constructed in Spring Ave. from Third St. to 18th St. Walter C. Leyse is City Audr.

Hankinson, N. D.—While plans are being prepared for the construction of a water system, the construction will not take place for some time to come.

Baggs, Wyo.—Plans are being prepared for the construction of a water system and an electric-light system by E. Carlisle, Cheyenne, Wyo.

✚St. Joseph, Mo.—(Official)—The contract has been awarded to ST. JOSEPH WATER CO., St. Joseph, for making extensions to the water system. Noted Aug. 26.

Beaumont, Tex.—All bids received for the improvement of the water system have been rejected. New bids will soon be received. Noted Aug. 5.

Longview, Tex.—Permission has been granted to the city by the State Board of Water Engineers to divert 1,000,000 gal. of water daily from the Sabine River to supply the local water system. A pumping plant will be installed. Noted Mar. 14, 1914.

Mineola, Tex.—The Mineola Ice, Light & Water Co. has been purchased by the city. Improvements, estimated to cost $25,000, will be made. Noted May 6.

Grove, Okla.—Bonds for $10,000 have been voted by the citizens, the proceeds of which will be used for the extension of the water system. Noted Aug. 5.

Jones, Okla.—Bonds for $10,000 have been voted by the citizens, the proceeds of which will be used for the construction of water and electric-light systems. The Benham Engineering Co., Concord Bldg., Oklahoma, is Engr. Noted July 8.

Kusa, Okla.—(Official)—We have been advised that the town will not construct a water system before 1916. Noted Aug. 26.

Marshall, Okla.—Bids will be received about Sept. 15 by the City Clerk for constructing a water system. The estimated cost is $25,000. The Benham Engineering Co., Oklahoma City, is Engr. Noted Aug. 5.

Pueblo, Colo.—Press reports state that bids will soon be received for the construction of a dam across the Arkansas River. The Pueblo Water-Works No. 2 is in charge.

Platteville, Colo.—An election will be held Sept. 14 to vote on the question of issuing $30,000 in bonds, the proceeds of which will be used for the construction of a water system.

Hailey, Idaho—Plans are being prepared, according to press reports, for the construction of a concrete dam in Dry Creek. The estimated cost is $100,000. The Blaine County Investment Co. is the owner.

✚St. Maries, Idaho—(Official)—The contract has been awarded to W. L. GEIST, St. Maries, at $29,110, for laying water mains and for constructing a concrete dam. Other bidders were: James C. Broad, $30,065; Carlson, Chindahl & Anderson, $29,394; W. G. Mulligan Co., $33,212; Two Miracle Concrete Corp., $31,172; P. Agrios, $33,831; Security Bridge Co., $29,085 and C. A. Burnette, $31,917. Charles R. Schulte is Clk. Noted Aug. 19.

Myton, Utah—(Correction)—Bids will be received until 1 p.m., Sept. 20, by R. B. Croix, Town Clk., for constructing a water system. Noted Sept. 2.

Newport, Wash.—The city plans to construct a 10-mile pipe line from Spencer Creek to Newport. The estimated cost is $24,000.

Bend, Ore.—The Bend Water, Light & Power Co. contemplates making extensions to its water system.

Milwaukee, Ore.—Bonds for $25,000 have been voted by the citizens, the proceeds of which will be used for the completion of the municipal water system. Noted July 29.

Portland, Ore.—(Official)—We have been advised that the city does not contemplate the construction of a pumping station, reservoirs and laying water mains in the Linnton Addition. D. Clarke is Engr. Water Bureau. Noted Aug. 19.

Los Angeles, Calif.—Arrangements have been made by the Public Service Commission for the purchase of the Union Hollywood Water Co.'s system. The estimated cost is $575,000.

Cochrane, Ont.—Bids will soon be received for the extension of the water system. H. J. Brown is City Clk.

Listowel, Ont.—A water system will be constructed at an estimated cost of $5400. W. Bright is Town Clk.

✚Drumheller, Alta.—The contract for constructing a water system has been awarded to E. R. LEVERTON, Calgary, at $5170.

New Westminister, B. C.—Extensions will be made to the upper reservoirs. The estimated cost is $15,000. J. W. Blackman is Engr.

Prince George, B. C.—An expenditure of $80,000 will be made for the improvement of the water system.

SEWERS

Peak Island, Maine—(Portland post office)—The State Board of Health has instructed the city to install a complete sanitary sewer system.

Rochester, N. H.—(Official)—Bids were received Aug. 31 by the Water and Sewer Committee for the construction of approximately 8100 ft. of 8- and 12-in. pipe sewers as follows: Henry Spinach Construction Co., $13,948; M. A. Gammins, $13,844; Susi & Williams, $10,894; Sorells & Prohenno, $11,737; W. M. Ames, $10,525; William J. Donovan, $13,102; Bull & Cassidy, $16,781; L. E. Scinton, $12,455; C. W. Foss Co., $8,253; M. Russo & Co., $14,465; Fred W. Stowers, $13,357; M. De Sisto, $9,674; Luchini & Mangani, $14,061; A. Michelini, $16,521; Mayo Construction Co., $13,637; Sacco & Wood, $10,347. F. Hussey is Clk. of the Water and Sewer Com. Noted Aug. 19.

✚Boston, Mass.—The contract for the construction of sewers in Albany and Dover St. and Massachusetts Ave. has been awarded to WILLIAM BARRETT & CO., at $36,415.

Boston, Mass.—Bids will be received until Sept. 17 by the Board of Public Works for the construction of sewers and drains in Lanark Rd. and Telford St., Brighton District. Edward F. Murphy is Comr. of Pub. Wks.

Lawrence, Mass.—(Official)—The city will construct sewers by day labor. The estimated cost is $30,000. Noted Sept. 2.

Hamden, Conn.—Preliminary plans have been prepared by Clyde Potts, Engr., 30 Church St., New York, N. Y., for the construction of a sewer system and a sewage-disposal plant. The estimated cost is $246,000. Noted May 13.

Stratford, Conn.—The city contemplates the construction of a sewer system.

Albany, N. Y.—The city contemplates the construction of a new interceptor sewer which will extend from the main intercepting sewer in Front St. through North Jay St., South Ave., Romeyn St., Myers Alley, Park Pl. to Union St. and thence to connections with prospective sewers.

Brookport, N. Y.—All bids received Aug. 25 by F. E. Reynolds, Village Clk., for the construction of a sewage-disposal plant have been rejected. New bids will be received. The estimated cost is $25,000. Charles C. Hopkins, Culter Bldg., Rochester, is Engr. Noted Aug. 19.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received Sept. 1 by L. H. Pounds, Borough Pres., for the construction of sewer basins in (a) Glenmore and Railroad Ave., Pine and Hemlock St., (b) New Jersey and Hegeman Ave., (c) William and Vienna Ave., (d) West St. as follows: Frank Merridino, 556A 17th St., Brooklyn, (a) 84%, (b) 98%, (c) 84.91%, (d) 95%; Pellegrino Construction Co., 6802 New Utrecht Ave., Brooklyn, (a) 109.45%, (b) 96.95%, (c) 112.7%, (d) 119%; Joseph Jennings, (a) 130%, (b) 130%, (c) 130%, (d) 140%; Murphy Bros., 25th St. and Cropsy Ave., Brooklyn, (a) 91%, (b) 88%, (c) 84%; S. Paconi, (b) 118%, (c) 125%, (d) 135%. Noted Aug. 26.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Pres., until 11 a.m., Sept. 15, for constructing a sewer in East Eighth St., from Ave. L to Ave. M.

✚New York, N. Y.—(Borough of Manhattan)—(Official)—Contracts for sewer construction have been awarded to CASPERINE & De BLASIO, 357 East 116th St., New York, at $4457, First Ave. sewer, and to the H. E. FOX CONSTRUCTION CO., 81 East 125th St., New York, at $32,040, for outlet sewer at Dyckman St. and the Hudson River, including the construction of a submerged outlet and screening chamber. Noted Aug. 26.

New York, N. Y.—(Borough of Queens)—(Official)—Bids were received Sept. 1 by Maurice E. Connelly, Borough Pres., for the construction of sewers and appurtenances in (a) Maspeth Ave. from Newton Creek to Rust St., Rust, Creek and Clark St., Second Ward, (b) Grand St., Second Ward, (c) Perry Ave. from Clark to Maurice Ave. and in Maurice Ave. from Perry to Hull Ave., Second Ward, as follows: Peace Bros., (a) $141,315, (b) $87,625, (c) $113,410; F. B. Smith, (a) $111,750, (b) $78,775, (c) $94,805; Kingsbridge Contracting Co., 30 East 42d St., New York, (a) $81,542, (b) $74,198, (c) $92,761; Ward & Tully, Inc., (a) $105,770, (b) $73,655, (c) $94,199; Joseph L. Sigretto, (a) $116,900, (b) $75,254, (c) $83,000; U. S. Drainage & Irrigation Co., (a) $106,915, (b) $84,493, (c) $92,739; A. L. Guidone & Son, (a) $110,442, (c) $87,933; J. F. Cogan Co., (a) $105,747, (b) $86,180, (c) $92,662; J. E. Consalus Co., (a) $107,169; Clancy & Van Alst, 401 Broadway, Long Island City, (b) $73,655, (c) $85,568; Murphy Bros., (b) $96,600, (c) $83,955; Lawrence Contracting Co., (c) $89,730; Rosenthal Engineering & Contracting Co., (c) $93,404; Anabell Construction Co., (c) $90,548; William M. Stanton, (c) $78,837; Leo E. Kelly, (c) $84,056. Noted Aug. 26.

Newark, N. J.—(Official)—Bids were received Aug. 31 by the Passaic Valley Sewerage Commissioners for the construction of the superstructure of the Newark Bay pumping station, Section No. 5 as follows: J. H. Steele & Son, Paterson, N. J,. $149,997; Cramp & Co., New York, N. Y., $148,490; Becker Construction Co.,Newark, N. J., $145,990; Joseph Jewkes & Sons Co., Jersey City, N. J., $143,250; Frederick Kilgus, Inc., Newark, N. J., $140,400; E. M. Waldron & Co., Newark, N. J., $140,000; Simon Russek, Inc., New York, N. Y., $139,900; Connors Bros. Co., New York, N. Y., $139,400; Cauldwell-Wingate & Co., New York, N. Y., $137,709; E. M. Waldron Inc., Newark, N. J., $128,000; D W. McGee Construction Co., Newark, N. J., $128,000; D. W. McGee Construction Co., Newark, N. J., $123,383; A. L. Guidone & Sons, Inc., New York, N. Y., $122,330; Essex Construction Co., Newark, N. J., $114,289; William G. Sharwell & Co., Newark, N. J., $109,638. Noted July 8.

Riverside, N. J.—The city contemplates the construction of a sanitary sewer system and a sewage-disposal plant. Joseph H. Weston is Clk.

Verona, N. J.—Bids will be received until Sept. 25 by the city for the construction of a sewer system and a sewage-disposal plant. Robert Chesney is City Clk. Noted May 20.

Allentown, Penn.—The City Council contemplates the construction of a sewer system. Charles D. Weirbach is City Engr.

Lebanon, Penn.—The lowest bid received for the construction of a sewage-disposal plant was that of the Pitt Co., Lebanon. The estimated cost is $50,000. T. R. Crowell is City Engr. Noted Aug. 19.

✚Sellersville, Penn.—(Official)—The contract for the construction of approximately 22,640 ft. of 8-, 10- and 12-in. sewers has been awarded to DWYER & CO., 1524 Chestnut St., Philadelphia, at $20,620. Other bids were: Cantrell Construction Co., Philadelphia, $25,970; G. W. Ensign, Harrisburg, $26,690; Antonio Celentino, Trenton, N. J., $27,830; J. M. Hamilton, Jr., Oakmont, $28,525; James Ferry & Sons, Baltimore, Md., $29,625. Noted Aug. 19.

✚West Chester, Penn.—(Official)—The contract for the construction of a sewage-disposal plant and 1500 ft. c.-i. force mains has been awarded to M. & T. E. FARRELL, West Chester, at $6290. Other bids were: Manwaring & Cummins, Philadelphia, $6997; Lewis & Roth, Philadelphia, $7688; Kelley-McFeeley Co., Camden, N. J., $6638. Noted Aug. 19.

✚Wilkinsburg, Penn.—The contract for the construction of storm and sanitary sewers in portions of Wood St. has been awarded to A .V. PURNELL, 507 Jackson St., Allegheny, at $38,890.

✚Farmville, Va.—The contract for the construction of a sewer system has been awarded to the J. B. McCRARY CO., Atlanta, Ga.

Richmond, Va.—The city contemplates the construction of a sewer system in Ginter Park with outlets into Griffin and Shoekee Creek. M. O. Hankins is Mayor.

High Point, N. C.—The city contemplates the construction of an outfall sewer system. The estimated cost is $5000.

✚West Asheville, N. C.—(Asheville post-office)—The contract for the construction of approximately one mile of sewers has been awarded to REED & WELLS, Asheville.

Winston-Salem, N. C.—Plans are being prepared for the construction of a sewer system. The estimated cost is $8000.

Macon, Ga.—Plans have been prepared by J. J. Gaillard, City Engr., for the construction of sewers to take the place of the old Vineville branch. Noted Sept. 2.

Daytona, Fla.—Bids will soon be received for the sale of $150,000 in bonds, the proceds of which will be used for sewer construction.

Henderson, Tenn.—Bids will soon be received by J. I. Galbraith, Mayor for the construction of a sewer system. The estimated cost is $14,000.

✚Canton, Ohio—The contract for the construction of the Shrivers Run Sewer has been awarded to NEWTON E. WISE, Canton, at $32,297.

✚Chardon, Ohio—Contracts for sewer construction have been awarded to the KENT CONSTRUCTION CO., at $12,346, sewage-disposal plant; J. B. SHEETS & CO., Pittsburgh, Penn., at $32,447, sewer system. Noted Aug. 12.

✚Cincinnati, Ohio—The contract for the construction of sewers in Lossing, Randolph and Duluth St. has been awarded to THOMAS P. STRACK, at $4377. Noted July 22.

Cleveland, Ohio—Bids will be received until noon, Sept. 15, by the Commissioner of Purchases and Supplies for the construction of two reinforced-concrete tanks and appurtenances for the sewage treatment works. Robert Hoffman is City Engr.

✚Columbus, Ohio—Contracts for sewer construction have been awarded by the Board of Control as follows: Jackson and Cherry St. sewer to RUSSELL & JENNISON CO., at $34,086; and $8998 respectively; City Blvd. sewer to H. P. STREICHER CO., at $26,332; Monroe St. sewer to HARRIS & TANSEY, at $15,735; Camden St. sewer to the ASPHALT BLOCK PAVEMENT CO., at $10,693; Ogden Ave. sewer to McKINNEY BROS., at $21,663. Noted Aug. 5.

Mansfield, Ohio—(Official)—The contract for the construction of sewers in various streets will be awarded about Nov. 1. The estimated cost is $6500. W. J. Hazeltine is City Engr. Noted Aug. 26.

Portsmouth, Ohio—(Official)—Bids will not be received this year for the construction of sewers in the northern and eastern sections of the city extending into Lawsons Run. The estimated cost is $90,000 and $35,000 respectively. Noted Aug. 26.

Springfield, Ohio—The City Commission will issue $6271 in bonds for the construction of storm water sewers in Lowry Ave. from State to Clark St.

Hammond, Ind.—All bids received for the construction of the Van Buren St. sewer have been rejected. New bids will be received by the Board of Public Works.

Kendallville, Ind.—The city contemplates the construction of sewers in the southern and western sections of the city. The estimated cost is $18,000. Willis Sawyer is City Engr.

Grand Rapids, Mich.—Preliminary plans have been prepared for the construction of a sewage-disposal plant. The estimated cost is $10,000. J. R. Rumsey, Grand Rapids, is Engr.

✚Hastings, Mich.—The contract for the construction of an Imhoff tank has been awarded to J. H. SULLIVAN, Grand Rapids.

Reed City, Mich.—Bids will be received by the Sewer Committee until 3 p.m., Sept. 14, for the construction of approximately 19,500 ft. of 6- to 18-in. pipe sewers with manholes, reinforced-concrete settling tank, sludge filter and 3180 ft. of 8- to 18-in. storm sewers with inlet basins and connections. W. G. Potter, 1201 Hartman Bldg., Chicago, Ill., is Engr.

Aurora, Ill.—Bids will soon be received for the construction of a sewer system in the northeastern section of the city. The estimated cost is $12,700. M. Tarble is Engr.

Chicago, Ill.—Bids will be received until 11 a.m., Sept. 13, by the Board of Local Improvements for the construction of sewers in various streets. Edward J. Glackin is Pres., Bd. Local Impv. Noted Aug. 19.

✚Quincy, Ill.—The contract for the construction of a sanitary sewer in the northeasternly section of the city has been awarded to HENRY REES, Quincy, at $14,549. Noted June 24.

Kenosha, Wis.—Bids will be received by the Street Assessment Committee until 2 p.m., Sept. 17, for the construction of sewers in various streets. Noted Aug. 19.

Madison, Wis.—Plans have been prepared by E. E. Parker, City Engr., for improvements to the sewage-disposal plant including new force main, sub-pumping station in the Ninth Ward and intercepting sewer in Murray St. The estimated cost is $125,000.

Racine, Wis.—No bids were received by the Board of Public Works for the construction of sewers in La Fayette Ave. The work will be done by city forces. P. H. Connolly is City Engr.

Randolph, Wis.—(Official)—Bids will be received about Nov. 1 for the construction of a sanitary sewer system. W. S. Shields Co., Chicago, Ill., is Engr. Noted Sept. 2.

Superior, Wis.—The lowest bid submitted for the construction of a main sewer in West 13th St. and Cadott Ave. was that of the Pastoret Construction Co., at $6159. Noted Aug. 26.

✚Ft. Dodge, Iowa—The contract for the construction of sewers in District Nos. 1, 2 and 4 has been awarded to BENSON & REED.

Sioux City, Iowa—Bids will be received until Sept. 18 by Paul J. Wells, City Clk., for the construction of approximately 15,500 ft. of 8-in. pipe sewers and 43 manholes. T. H. Johnson is City Engr. Noted Aug. 26.

Waterloo, Iowa—Plans have been prepared by C. A. Roby, City Engr., and submitted to the City Council, for the construction of sewers in the Westfield, Galloway, Hagerman and Downing additions. The estimated cost is $61,369. Burns & McDonnell, Kansas City, Mo., is Consult. Engr. Noted July 8.

Excelsior, Minn.—Plans are being prepared for the construction of a storm sewer system. Abbott & Budd, Kasota Bldg., Minneapolis, is Engr.

Herman, Minn.—Plans have been prepared by J. E. Cole, Engr., for the construction of a sewer system. F. C. Anderson is Village Recdr.

Hillsboro, Kan.—The city contemplates the construction of a sewer system. H. H. Beck is Mayor.

✚Topeka, Kan.—The contract for the construction of sanitary sewers in District No. 45 has been awarded to JOHN S. HARRINGTON, 2519 West 18th St., Topeka, at $4309. Noted Aug. 5.

Grand Island, Neb.—Bids will be received about Sept. 20 for the construction of storm sewers. The estimated cost is $100,000. William Grant, Lincoln, is Consult. Engr., and H. E. Clifford is City Clk. Noted Sept. 2.

✚Bozeman, Mont. — (Official)—The contract for the construction of storm sewers in District Nos. 98 and 99 has been awarded to the WARREN CONSTRUCTION CO., Bozeman. Noted Aug. 12.

Whitehall, Mont.—Bids will be received Sept. 23 instead of Sept. 18 by F. E. McCall, Clk., for the construction of a sewer system and an Imhoff disposal tank. George E. Baker is Consult. Engr. Noted Sept. 2.

✚★Dallas, Tex.—(Official)—Contracts for sewer construction have been awarded as follows: Contract No. 5, North Interceptor, Contract No. 7, disposal works including 36-in. force main from Station No. 5 plus 88.7 to disposal works to BAILEY, REEDER & CO., Mobile, Ala., at $80,708 and $204,976 respectively; Contract No. 6, pumping station, 36-in. force main and Oak Cliff trunk line across the Trinity River to the ROACH-MANIGAN PAVING CO., Dallas, at $98,434. Noted July 29 and Sept. 2.

Cushing, Okla.—An election will soon be held to vote on the question of issuing $30,000 in bonds. The proceeds will be used for the construction of a main intercepting sewer system. The Benham Engineering Co., Oklahoma City, is Engr.

Marlow, Okla.—An election will be held Sept. 16 to vote on the question of issuing $15,000 in bonds, the proceeds of which will be used for the construction of a main sanitary sewer system. The Benham Engineering Co., Concord Bldg., Oklahoma City, will prepare plans and supervise the construction work.

✚Sand Springs, Okla.—(Official)—The contract for the construction of approximately 1½ miles of storm sewers has been awarded to the CONNELLY CONSTRUCTION CO., El Reno, at $5025. Noted Aug. 5.

Bonners Ferry, Idaho—Preliminary plans are being prepared by Sawyer Bros., Spokane, Wash., for the construction of a sewer system. The estimated cost is $20,000. Noted Sept. 2.

Mountain Home, Idaho—It is reported that plans are being prepared for the construction of sewers in two districts. The estimated cost is $10,000. F. G. Ticknor is Town Clk.

✚Anacortes, Wash.—The contract for the construction of the O St. sewer has been awarded to NELS ERICKSON, at $5012.

Spokane, Wash.—The City Council is considering the forming of a new sewer district in the northern section of the city and constructing sewers. The estimated cost is $70,000.

Forest Grove, Ore.—Bids will be received until 8 p.m., Sept. 21, by M. R. Markham, City Recdr., for the construction of a sanitary sewer system and a sewage-disposal plant. J. B. & R. E. Koon, Portland, is Consult. Engr. Noted Aug. 19.

Portland, Ore.—(Official)—Bids will be received until Sept. 14 by A. L. Barbour, City Audr., for the construction of sewers in Water and Mill St. The estimated cost is $15,700. Philip H. Dater is City Engr. Noted Sept. 2.

Marysville, Calif.—At a recent election the citizens voted to issue $18,000 in bonds, the proceeds of which will be used for the construction of a sewer system in the Ellis Lake District. Noted Aug. 5.

Cochrane, Ont.—Bids will soon be received for the construction of a sewer system. H. J. Brown is City Clk.

Ft. Frances, Ont.—The city contemplates the construction of sewers in Sinclair, Victoria and Armit St. J. W. Walker is Clk.

Owen Sound, Ont.—The city will construct sewers in Fourth and Eighth Ave. Charles Gordon is Clk.

Toronto, Ont.—Bids will be received until Sept. 14 by the Board of Control for the construction of sewers in various streets. R. C. Harris is Comr. of the Pub. Wks.

GARBAGE

Springfield, Mass.—Plans have been prepared for the construction of an incinerator at the South End yards. The estimated cost is $8000.

Moline, Ill.—The citizens contemplate installing an incinerator A. Stouffer is Comr.

Duluth, Minn.—The city will construct an incinerator at an estimated cost of $8360. Noted May 13.

Salina, Kan.—The installation of an incinerator is under consideration by the citizens.

✚Hillsboro, Tex.—The City Council has awarded a contract to J. W. STOKES, Waxahachie, at $4760, for constructing a new garbage crematory. Noted Apr. 22.

STREETS AND ROADS

✚Boston, Mass.—The contract for the construction of 11,000 lin.ft. of road in Northampton has been awarded to the PHILADELPHIA CONSTRUCTION CO., Melrose, at $18,572. Noted Aug. 5.

Franklin, Mass.—According to press reports plans are being considered for widening West Central St. between Union St. and the State Highway. Estimated cost, $4000.

✚Danielson, Conn.—The contract for the construction of approximately 2590 ft. of amiesite pavement has been awarded to the CONNECTICUT & RHODE ISLAND CO., at $8825.

✚Albany, N. Y.—(Official)—Contracts have been awarded for the repair of highways in various counties as follows: Repair Contract No. 839, Road No. 463, Herkimer County: J. J. MALLOY, Schenectady, $18,797; Repair Contract No. 852, Road No. 359, Herkimer County: JOHN P. DUGAN & CO., Amsterdam, $10,360; Repair Contract No. 848, Road No. 71, Oneida County: HARRY W. ROBERTS & CO., Utica, $13,649; Repair Contract No. 841, Road No. 733, St. Lawrence County: ARTHUR F. McCONVILLE, Ogdensburg, $20,551; Repair Contract No. 844, Road No. 640, Schenectady County: J. J. MALLOY, Schenectady, $8706; Repair Contract No. 837, Road No. 795, 823, 824, Sullivan County: GEORGE MESLER Liberty, $4518: Repair Contract No. 843, Road No. 5223, Sullivan County: GEORGE MESLER, Liberty, $42,327; Repair Contract No. 848, Road No. 503, Westchester County: MALLOY & MURRAY CONTRACTING CO., Yonkers, $96,243; Repair Contract No. 847, Road No. 19, Westchester County: JAMES GAROFANO & SON, INC., Mt. Vernon, $11,359. List of bidders noted Sept. 2.

✚Albany, N. Y.—(Official)—Contracts have been awarded for the construction of highways in various counties as follows: Road No. 5588, Greene County, 3.95 miles: JAMES M. HAMILTON & CO., Gardner, $98,639; Road No. 5579, Herkimer County, 6.55 miles: NEWPORT CONSTRUCTION CO., Herkimer, $63,077; Road No. 5584, Herkimer County, 4.21 miles: JOSEPH McCORMICK, East Providence, R. I., $46,423; Road No. 773, Niagara County, 2.38 miles: F. J. MUNN CONTRACTING CO., Buffalo, $23,342; Road No. 799, Niagara County, 4.21 miles: ARTHUR F. McCONVILLE, Ogdensburg, $53,156; Road No. 1315, Niagara County, 8 miles: JOSEPH BRUMVER, Buffalo, $97,340: Road No. 1153, Niagara County, 1.25 miles: GREENFIELD CONSTRUCTION CO., Hornell, $69,644; Road No. 5408, Oswego County, 0.36 mile: OSWEGO CONSTRUCTION CO., INC., Futlon, $16,490; Road No. 817, Saratoga County, 3.57 miles: WILLIAM G. FOX, Saratoga Springs, $38,158; Road No. 1320, Schuyler County, 2.75 miles: PATRICK D. CONLEY, Ithaca, $25,380; Road No. 5575, Schuyler and Tompkins Counties, 4.12 miles: PATRICK D. CONLEY, Ithaca, $35,160; Road No. 5577, Schoharie County, 7.96 miles: WEED & WALSH, Mechanicsville, $91,046; Road No. 5253-E. Steuben County, 5.52 miles: KENNEDY CONSTRUCTION CO., Albany, $38,796; Road No. 1076, Tioga County, 4.29 miles: DANA W. ROBBINS CO., INC., New York, $35,354; Road No. 1077, Tioga County, 4.72 miles: LANE CONSTRUCTION CORPORATION, Meriden, Conn., $36,148; Road No. 1109, Washington County, 2.06 miles: W. L. SHERRILL, Hudson Falls, $16,975; Road No. 5578, Washington County, 1.89 miles: WILLIAM G. FOX, Saratoga Springs, $29,582; Road No. 1306, Westchester County, 5.72 miles: PIERSON ENGINEERING & CONSTRUCTION CO., Hartford, Conn., $66,010; Road No. 1307, Westchester County, 1.89 miles: JAMES CLASIA, Mt. Vernon, $22,231: Road No. 1308, Westchester County, 2.15 miles: JAMES GAROFANO & SON ,Mt. Vernon, $24,738; Road No. 1309, Westchester County, 6.63 miles: HENRY CLINTON, Poughkeepsie, $67,954; Road No. 1323, Westchester County, 4.62 miles: FRANK G. FOWLER CONSTRUCTION CO., Mt. Kisco, $49,183: Road No. 1325, Westchester County, 2.81 miles: H. B. SPROUL CONSTRUCTION CO., INC., Peekskill, $28,858. List of bidders noted Sept. 2.

Medina, N. Y.—Press reports state that an appropriation of $22,500 has been made for paving West Central St. with asphalt block.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Pres., Borough Hall, until 11 a.m., Sept. 15, for the grading, paving, etc., of various streets in the borough.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Pres., Municipal Bldg., until 2 p.m., Sept. 15, for regulating, grading and paving various streets.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received by Marcus M. Marks, Borough Pres., for regulating, grading, curbing and laying sidewalks (a) Madison St. from Roosevelt St. to New Chambers St., (b) Broadway from 47th St. to Columbus Circle, 48th St. from Broadway to Eighth Ave., (c) 49th St. from Sixth to Seventh Ave. and from Eighth to Ninth Ave., (d) 59th St. from Madison Ave. to a point 238 ft. east of the east curb line, (e) 212th St. from Harlem River to the east side of 10th Ave., (f) Exterior St. from 76th to 77th St., (g) 104th St. from Central Park West to Manhattan Ave. The lowest bids submitted for the following were: (a) (f) W. J. Fitzgerald, 547 West 54th St., $3185 and $4384; (b) Asphalt Construction Co., 208 Broadway, $8171; (c) Aztec Asphalt Co., 90 West St., $7863; (d) (g) Sicilian Asphalt Co., 41 Park Row, $7510 and $3057; (e) Barber Asphalt Co., Woolworth Bldg., $8171. Noted Aug. 26.

✚Phelps, N. Y.—The contract for paving Church St. with brick has been awarded to LAKE SHORE CONSTRUCTION & SUPPLY CO., at $6443.

✚Quogue, N. Y.—The contract for the construction of the Quogue Rd. from Quogue to Riverhead has been awarded to the PECONIC CONSTRUCTION CO., Riverhead, at $11,000.

✚Troy, N. Y.—Contracts have been awarded for grading and improving the alley between Fourth and Fifth Ave. and 13th and 14th St.; laying sidewalks, curbing and drains in 12th St. and Seventh and Eighth Ave. to SHEKAN & HEISLER, at $791 and $4942 respectively; grading Second St. and Fifth and Sixth Ave. and laying a short sewer in Sixth Ave. to D. KNOWER & CO., at $2491.

Yonkers, N. Y.—The O'Rourke Construction Co., 12 North Broadway, at $25,887, submitted the lowest bid for paving with macadam a portion of Park Ave., and Kearns & Hart, 280 Neperhan Ave., at $17,081, for Palisade Ave.

Bayonne, N. J.—The City Commissioners have passed an ordinance authorizing the improvement of eight streets.

Bridgeton, N. J.—The City Council plans to pave a number of streets of the city.

✚Garfield, N. J.—A contract for the improvement of Gaston Ave., Morrell Pl. and Irving Pl. has been awarded to the DI NAPOLI & TORELLI CONSTRUCTION CO., Hackensack, at $10,718.

Irvington, N. J.—Bids were received by the Board of Chosen Freeholders, Newark, for improving Lyon Ave. as follows: Glenfield Construction Co., Newark, $58,061; Standard Bitulithic Co., $63,464; Newark Paving Co., $64,769; Van Keuren & Son, $68,811. Noted Aug. 12.

Newark, N. J.—The Board of Street and Water Commissioners plans to pave Chelsea Ave. with asphalt.

✚Newark, N. J.—Bonds for $300,000 have been sold. The proceeds will be used for paving a number of streets.

New Brunswick, N. J.—Bids were received Aug. 23 by the Board of Chosen Freeholders of Middlesex County for constructing the South Amboy-Keyport Rd., from the South Amboy City line to the Monmouth County line, in two sections: (a) from South Amboy line to Morgan Station; (b) from Morgan Station to Monmouth County line as follows: (a) T. H. Riddle, New Brunswick, $37,949; Meagher & Smith, Perth Amboy, $39,704; Abraham Kelin, New Brunswick, $41,121; Newark Paving Co., Newark, $42,148; (b) A. Jelin, $40,886; T. F. Dunigan, $42,838; Franklin Construction Co., $43,651; Utility Construction Co., New Brunswick, $44,304. Alvin B. Fox, Perth Amboy, is County Engr. Noted Aug. 12.

Pittsburgh, Penn.—(Official)—Bids will be received by Hyatt M. Cribbs, County Controller, until 10 a.m., Sept. 23, for improving the Painters Run Rd.

✚York, Penn.—A contract for paving with asphalt North Newberry, West Poplar and West Philadelphia St. has been warded to the GENERAL SUPPLY & CONSTRUCTION CO., York, at $21,275.

Wilmington, Del.—The contract for the construction of the Du Pont Blvd. between Selbyville and Frankford has been awarded to the McNERNEY CO., Canton, Penn., at $46,817. Other bidders were: E. C. Evans, Philadelphia, Penn., $54,095; Utility Construction Co., New Brunswick, N. J., $48,847; Juniata Construction Co., $46,987. Noted June 10.

Baltimore, Md.—The Board of Estimate plans to improve the Alamede Rd. between Harford Rd. and the Garrett property. The estimated cost is $22,900.

Eastville, Va.—Bids will be received until Sept. 27 by the Eastville District Road Board of Northampton County for the construction of 55 miles of sand clay roads. Noted June 3.

Hinton, W. Va.—At a recent election the citizens of Summers County, Talcott District, voted in favor of the question of issuing $100,000 in bonds, the proceeds of which will be used for constructing roads. Noted Aug. 12.

✚Huntington, W. Va.—Contracts have been awarded for constructing eight miles of the Kanawha and James River Turnpike and one mile of the Harveytown and Wayne County Pike to the BRUBAKER CONSTRUCTION CO., Huntington; four miles of the Hamlin Pike and one mile of the Ohio River Rd. to GEORGE HINKLE. Noted July 15.

✚Moundsville, W. Va.—A contract for paving Fifth St. between Jefferson and Grant Ave. has been awarded to R. J. McFADDEN. Noted July 22.

✚Welch, W. Va.—A contract for the construction of 34 miles of roads has been awarded to S. G. WALKER & CO. Noted July 29.

Farmville, N. C.—An election will be held in Pitt County, Farmville Township, Sept. 21, to vote on the question of issuing $50,000 in bonds. The proceeds will be used for improving various roads.

Hickory, N. C.—According to press reports the city will construct 3000 yd. of concrete sidewalks.

Mt. Airy, N. C.—At a recent election the citizens voted in favor of the question of issuing $30,000 in bonds. The proceeds will be used for the construction of graded sand clay roads in Westfield and Shoal Townships.

Pittsboro, N. C.—Bonds for $20,000 have been sold. The proceeds will be used for improving the roads in Haw River Township. Noted Apr. 8.

Raleigh, N. C.—The city plans an expenditure of $10,000 for the construction of sidewalks.

✚Clearwater, Fla.—The Commissioners of Pinellas County have awarded the contract for the construction of 73.34 miles of brick roads to the EDWARDS CONSTRUCTION CO., Tampa.

De Land, Fla.—According to press reports an election will soon be held in New Smyrna District to vote on the question of issuing $250,000 in bonds. The proceeds will be used for constructing roads.

Miami, Fla.—Press reports state that the City Council has authorized paving with asphalt various streets and avenues of the city.

Pensacola, Fla.—Bids will soon be received for paving with wood block three streets around the Pensacola Hospital. L. E. Thornton is City Engr.

Birmingham, Ala.—The Board of Commissioners plans to pave Clairmont and 10th Ave., 39th, 40th, 41st and 42d St. The estimated cost is $50.000. J. Kendrick is City Engr.

Monroe, La.—According to press reports the city plans to gravel several streets.

✚Port Allen, La.—A contract for the construction of 27 miles of road has been awarded to S. A. GANO, Jackson, Miss., at $37,735.

Winnfield, La.—Bonds for $50,000 have been voted. The proceeds will be used for constructing roads in Winn Parish.

Bluff City, Tenn.—Bids will be received until Sept. 29 by W. D. Lyons, Chn., County Road Comrs., for grading, draining and macadamizing pike roads.

Bristol, Tenn.—The Commissioners of Sullivan County plan to improve three miles of the Bristol-Kingsport-Knoxville Pike between Eden Ridge and Kingsport. Bonds for $100,000 were recently voted for highway improvements. Noted June 3.

Dayton, Tenn.—The Commissioners of Rhea County plan an expenditure of $500,000 for the construction of highways. Part of this amount will be used for constructing about 32 miles of the Dixie Highway. J. H. Hoskins is Ch. Engr., County Highway Comrs.

Sweetwater, Tenn.—An election will be held Sept. 30 to vote on the question of issuing $5000 in bonds, the proceeds of which will be used for improving a number of streets.

Albany, Ky.—The citizens have voted in favor of issuing $50,000 in bonds, the proceeds of which will be used for the construction of the Dixie Highway through Clinton County.

Jamestown, Ky.—At an election held Aug. 21 the citizens voted in favor of the question of issuing $100,000 in bonds. The proceeds will be used for constructing roads.

+Madisonville, Ky.—A contract for the construction of one mile of macadam road has been awarded to N. E STONE, Madisonville, at $5413

+Vanceburg, Ky.—A contract has been awarded to W. T. COOPER & CO., at $25,121, for grading and shaping the river road.

Bexley, Ohio—Bonds for $124,000 have been sold. The proceeds will be used for improving a number of streets. Noted July 22.

Bowling Green, Ohio—Bonds for $26,000 have been sold. The proceeds will be used for improving the roads in Wood County.

Dayton, Ohio—Bids will be received until noon, Sept. 21, by Walter H. Aszling, Clk., Bd. of County Comrs., for the purchase of $30,000 in bonds, the proceeds of which will be used for improving a number of highways.

Fostoria, Ohio—Bonds for $13,290 have been sold. The proceeds will be used for improving a number of streets of the city.

+Lima, Ohio—A contract for paving State St. between Cole St. and Woodlawn Ave. has been awarded to HENRY S. ENCK, at $8614.

+Marion, Ohio—Contracts have been awarded for paving the Marion-Bucyrus Pike to P. DRAKE & SONS at $20,227; resurfacing the main road from Prospect to the Delaware County line to S. M. WOOLEY, at $2828.

+Miamsburg, Ohio—The contract for paving North Main St. with Carlisle brick block has been awarded to BIGLER BROS., Middletown, at $19,599.

+Middeltown, Ohio—Contracts have been awarded for paving First St. with asphalt to the ANDREWS ASPHALT CO., Hamilton, at $15.869; constructing concrete pavement on Woodlawn Ave. to STRODTBECK BROS., Middletown, at $21,860.

New Washington, Ohio—Bonds for $11,000 have been sold. The proceeds will be used for improving a number of streets.

+Rawson, Ohio—C. B. HALL & SON, at $9000, has been awarded the contract for paving Main St.

+Toledo, Ohio—Contracts have been awarded for paving seven miles of the Mominee Road in Jerusalem and Oregon Township to GARRIGAN BROS., at $67,988; Marengo St., Adams Township and Lake St., Washington Township, to DOAN & LANGENDERFER, at $3302 and $2375 respectively. Noted Aug. 19 and 26.

Uhrichsville, Ohio—Bonds for $12,000 have been sold. The proceeds will be used for paving one mile of the Newport Rd., beginning at the Uhrichsville corporation line.

Westerville, Ohio—Bids will be received until Sept. 23 by R. D. Bennett, Village Clk., for the purchase of $23,000 in bonds. The proceeds will be used for improving Winter St. from State to Vine St., Vine St. from Broadway to the County line and West Home St. from State to West St. Noted July 8.

+Zanesville, Ohio—The contract for improving Adamsonville Rd. with nonbituminous slag macadam has been awarded to AYERS & KAPPES, Zanesville, at $127,099. Noted Sept. 2.

Anderson, Ind.—Bids will be received by the Commissioners of Madison County until 10 a.m., Sept. 15, for the construction of a concrete road in Anderson Township. J. B. Benefiel is Audr.

Danville, Ind.—Bids will be received by G. Macomber, Treas. Hendricks County, until Sept. 15 for the purchase of $21,600 and $13,600 in bonds. The proceeds will be used for improving various highways.

Delphi, Ind.—At a recent election the citizens voted in favor of the question of issuing $50,000 in bonds. The proceeds will be used for improving a number of roads in Carroll County.

Frankfort, Ind.—Bonds for $31,280 have been sold The proceeds will be used for improving a number of roads.

+Goshen, Ind.—AMANDUS M. SMITH, Elkhart, at $57,775, has been awarded the contract for paving the Elkhart-Goshen Rd. with concrete in Concord Township.

Lafayette, Ind.—The City Council has passed an ordinance authorizing the Board of Public Works to improve 16th St. between Salem and Union St. and to construct cement sidewalks on both sides of Erie St. between Ferry and North St.

Noblesville, Ind.—Bids will be received until 10 a.m., Sept. 11, by the Commissioners of Hamilton County for the construction of a road in Noblesville Township. W. O. Horton is Audr.

+South Bend, Ind.—A contract for paving Franklin St. with brick has been awarded to C. H. DeFREES, South Bend, at $13,518.

South Bend, Ind.—Bids will be received until Sept. 14 by Fred W. Martin, Treas. St. Joseph County, for the sale of $56,000 in bonds. The proceeds will be used for improving various highways.

+Amboy, Ill.—A contract for paving Plant St. has been awarded to HENRY ZOLPHER & SONS, Mendota, at $9385.

+Bloomington, Ill.—The Board of Local Improvements has awarded the contract for paving Beecher St. and Franklin Ave. to I. D. LAIN, Bloomington, at $15,715.

Bloomington, Ill.—Bids will soon be received for paving Beecher St. between East and Park St. and Franklin Ave. between Beecher and Division St.

Decatur, Ill.—Bids will be received about Sept. 16 for constructing a combined curb and gutter and for 17,000 sq.yd. of brick pavement on a 5-in. concrete foundation.

Edwardsville, Ill.—Plans are being considered by the city for paving with brick, on a 6-in. concrete and combination curb, Randle, Center and Buchanan St. G. Schaffer, Bohn Bldg., is Engr.

Herrin, Ill.—Bonds for $75,000 have been voted. The proceeds will be used for the construction of hard roads in Herrin Township.

Jacksonville, Ill.—The Board of Local Improvements contemplates reparing West State St.

Mattoon, Ill.—(Official)—The City Council has decided to postpone the paving of South 18th St. until next year. John A. Goetz is City Engr. Noted Aug. 26.

Maywood, Ill.—Bonds for $26,000 have been sold. The proceeds will be used for street improvements

Springfield, Ill.—The Board of Local Improvements of Pleasure Driveway and Park District plan to pave Grand Blvd. with asphalt. Estimated cost, $12,000.

+Grand Rapids, Wis.—(Official)—The Board of Public Works has awarded the contract for paving Grand Ave. to GEORGE R. KERCHIE, Madison, Wis., at about $7000. E. L. Brown is City Clk. Noted Aug. 19.

+Neodesha, Wis.—The contract for paving Wisconsin, Osage, Iowa, Ninth and Church St. has been awarded to the VAN HAFFTEN CONSTRUCTION CO., Joplin, Mo., at $19,383.

Ames, Iowa—The City Council has voted to pave various streets and avenues of the city.

+Duluth, Minn.—A contract for paving Colorado St. has been awarded to J. JOHNSON, at $9750.

+Shakopee, Minn.—(Official)—The contract for improving State Rd. No. 13 has been awarded to J. J. MERGEUS, Excelsior, at $11,400. A. J. Mayer is County Audr. Noted Aug. 12.

Cherryvale, Kan.—The city contemplates paving Liberty St. with vertical fiber block on rolled cinder foundation.

Independence, Kan.—Bids will soon be received for improving a number of streets of the city. The work will include 4655 cq.yd. of vitrified brick pavement on a 6-in. macadam base, 2900 ft. of cement curb and gutter and 1700 sq.yd. of grading. George E. Weaver is City Engr.

Pittsburg, Kan.—Bids will soon be received for paving with brick, concrete or national pavement 12 blocks on Walnut and College Ave. L. E. Curfman is City Engr.

Wichita, Kan.—According to press reports bids will be asked in about 60 days for the construction of eight miles of 20-ft. sand clay road with a 16-ft. crown of hard dirt in Sedgwick County. Edgar V. Moore is County Engr.

+Butte, Mont.—A contract for paving 6000 sq.yd. of Main St. has been awarded to J. R. SILVER, Butte, at $3.25 per sq.yd. Noted July 15.

+Missoula, Mont.—(Official)—A contract for improving Pine St. has been awarded to J. C. MAGUIRE, State Bank Bldg., Butte, at $13,400. Noted Aug. 19.

Missoula, Mont.—The City Council plans to pave East Front St. in Special District No. 37. L. E. Harris is City Clk.

+Joplin, Mo.—The contract for paving East Eighth St. from Main St. to the St. Louis & San Francisco R.R. with concrete has been awarded to V E. KOCH, Joplin, at $8206.

Kansas City, Mo.—According to press reports the Board of Public Works will pave McGee St. from 15th to 20th St. with creosoted wood blocks.

Mansfield, Mo.—At a recent election the citizens voted in favor of the question of issuing $15,000 in bonds. The proceeds will be used for constructing roads.

Seymour, Mo.—At a recent election the citizens voted in favor of the question of issuing $30,000 in bonds, the proceeds of which will be used for the construction of roads.

Paragould, Ark.—A petition has been presented to the City Council to form a new paving district to include about 10,000 sq.yd. of paving.

Angleton, Tex.—A bond issue of $103,000 for the construction of roads in Road District No. 3 has been authorized by the Commissioners Court.

Beaumont, Tex.—Bids will be received until 10 a.m., Oct. 5, by J. G. Sutton, City Secy, for the sale of $85,000 in bonds. The proceeds will be used for improving various streets. Noted Apr. 22 and June 10.

Brazoria, Tex.—At a recent election the citizens voted in favor of issuing $150,000 in bonds. The proceeds will be used for constructing roads in Brazoria Road District.

Bryan, Tex.—Bonds for $400.000 have been sold. The proceeds will be used for constructing roads.

Cleveland, Tex.—Bonds for $200.000 have been voted. The proceeds will be used for constructing roads in Cleveland Road District.

Dallas, Tex.—The Board of City Commissioners has authorized the paving of Victor St. from Renderson to Lowell St. J. M. Preston is City Engr.

Liberty, Tex.—A bond issue of $25.000 has been approved by the Attorney General. The proceeds will be used for constructing roads in Road District No. 1.

Taylor, Tex.—The city plans to pave a number of streets at an estimated cost of $300,000. W. E. Dozier is City Engr.

Cœur d'Alene, Idaho—E. M Booth, State Engr., and the County Commissioners contemplate the construction of a permanent highway from the city to the Shoshone County line. The estimated cost is $24,000.

Cottonwood, Idaho—The Board of City Trustees plans to pave the main business streets of the city Estimated cost between $12,000 and $18,000.

Soda Springs, Idaho—The City Council has passed an ordinance authorizing the construction of concrete sidewalks in Improvement District No. 21. Estimated cost, $50,000. Paul Tipton is City Clk.

+Park City, Utah—The City Council has awarded the contract for paving in District No. 5 to JOHN NYMAN.

Globe, Ariz.—At a recent election the citizens voted in favor of the question of issuing $50,000 in bonds. The proceeds will be used for the construction of roads in Gila County.

+Olympia, Wash.—A contract for improving 14 miles of McClellan Pass Highway between Natches and Summit in Yakima County has been awarded to REJOTTE, FOBERT & WINTERS, Spokane, at $27,536. Noted July 29.

Pasco, Wash.—Plans are being prepared by the J. W. Hamilton Co., Engr., for macadamizing about 10 miles of county highway.

Seattle, Wash.—The Puget Sound Bridge & Dredging Co., Central Bldg., at $92,250, submitted the lowest bid for improving Alki Ave.

Seattle, Wash.—Plans are being considered by the City Council for paving with asphalt a portion of Bailey, Vale, 42d and 43d St. and 12th Ave.

+Tacoma, Wash.—The contract for improving Permanent Highway No. 5-A has been awarded to the WASHINGTON PAVING CO., Savage-Scofield Bldg., Tacoma, at $76,549. Noted Aug. 5.

Walla Walla, Wash.—The City Council has voted to pave and construct concrete sidewalks on Fourth St. at an estimated cost of $16,000.

Oregon City, Ore.—The City Council plans to pave portions of various streets with asphaltic concrete.

Salem, Ore.—According to press reports the city plans to pave the fair ground road with asphaltic concrete at an estimated cost of $10,000.

Anaheim, Calif.—Bids will be asked in about 90 days for paving with asphalt on a concrete base and foundation Broadway, East Broadway and West Broadway. Estimated cost, $92,400. W. E. Stewart is City Engr.

Eureka, Calif.—Press reports state that a highway will be constructed through Humboldt County by state aid. Estimated cost, $300,000.

+Livermore, Calif.—Press reports state that the contract for paving East First St. has been awarded to the CALIFORNIA BITULITHIC CO., at $14,225.

Los Angeles, Calif.—The Brashear-Burns Co., at $12,949, submitted the lowest bid for improving Jefferson Ave. between Montana Ave. and Montecito Ave.

+Stockton, Calif.—The City Council has awarded the contract for the improvement of East St. between Poplar and North St. to the FEDERAL CONSTRUCTION CO., at $9348.

Stockton, Calif.—The City Council plans to improve Market St. between Fair Oaks Ave. and Filbert St., at an estimated cost of $300,000.

Venturi, Calif.—At a recent election the citizens voted in favor of the question of issuing $1,000,000 in bonds. The proceeds will be used for constructing roads

+Ottawa, Ont.—The contract for paving Preston St. with asphalt has been awarded to the OTTAWA CONSTRUCTION CO., Central Chambers, Ottawa, at $103,000.

INDUSTRIAL WORKS

Holyoke, Mass.—The Holyoke Supply Co. plans the construction of a three-story, 100x120-ft. building at Appleton and Race St., to cost $50,000.

New Bedford, Mass.—J. C. Rhodes & Co. will build a three-story addition to its factory at 123 Front St.

Spencer, Mass.—The Spencer Wire Co. will build a four-story, 48x110-ft. brick mill. H. W. Goddard is Pres.

+Springfield, Mass.—The CASPER RANGER CONSTRUCTION CO. has been awarded the contract for the construction of a one-story, 170x300-ft. addition to the Bosch Magneto Co., to cost $75,000.

+Springdale, Mass.—J. W. BISHOP & CO., Worcester, Mass., has been awarded the contract for the construction of a brick dyehouse for the Springdale Finishing Co. The estimated cost is $50,000.

+Springfield, Mass.—FRED T. LEY & CO. has been awarded the contract for the construction of a brick and steel warehouse on Atlantic Ave. for the Loose-Wiles Biscuit Co. The estimated cost is $10,000.

Wollaston, Mass.—The Tubular Rivet Co., Linden St., plans the construction of a 50x178-ft., brick addition to its plant, to cost $12,000.

+Worcester, Mass.—The EDWARD F. MINER CO., 25 Foster St., has been awarded the contract for the construction of a two-story, 80x100-ft., brick warehouse for the Pratt & Inman Co.

Bridgeport, Conn.—The Royal Equipment Co., Bostwick Ave., will add a third story to its 60x200-ft., brick factory.

+Bristol, Conn.—The Bristol Mfg. Co. has awarded the contract for the construction of a six-story, 53x143-ft., brick factory to the TORRINGTON BUILDING CO., Torrington, Conn.

Bristol, Conn.—The Bristol Brass Co., Bristol, Conn., will build a one-story, 125x300-ft. addition to its plant, to cost $30,000.

Chicopee Falls, Mass.—The Lamb Knitting Machinery Co. will build a brick and reinforced-concrete addition to its plant on Bridge St. The estimated cost is $10,000.

Derby, Conn.—The Union Fabric Co. plans the construction of a three-story addition to its plant on Housatonic Ave.

Stamford, Conn.—Plans have been prepared by the Harris Construction Co., Arch., for the construction of a two-story, 100x100-ft., tile and concrete garage on Summer St. for the Mechaley Auto Co.

+Woonsocket, R. I.—The J. W. BISHOP CO., Worcester, Mass., has been awarded the contract for the construction of a two-story, 90x130-ft., brick addition to the plant of the Blackstone Mfg. Co.

New York, N. Y.—(Borough of Brooklyn)—The Consumers Biscuit & Mfg. Co., 517 W. 19th St. (Borough of Manhattan), will build a three-story, 100x110-ft., brick factory at 45-53 Clinton Ave., to cost $100,000.

Rochester, N. Y.—The Vacuum Oil Co. will build an 80x96-ft. warehouse on Exchange St., to cost $18,000.

+Camden, N. J.—The contract for the construction of a one-story, 42x163-ft. factory at Ninth and Bailey St., for the Wood Mfg. Co., has been awarded to FRANK TURNER. Peuckert & Wunder, 310 Chestnut St., Philadelphia, Penn., is Arch. Estimated cost, $30,000.

Cape May, N. J.—The Bethlehem Steel Co. plans the construction of a munitions factory to cost $30,000.

+Allentown, Penn.—(Official)—C. P. Clauser, Secy., Allentown Dairy Co., has awarded the contract for the construction of a pasteurizing plant to SHAFFER & LANDENSLAGER, 112 North 5th St. Noted Aug. 26.

+Beaver Falls, Penn.—JOHN M. HUGHES has been awarded the contract for the construction of a plant for the O. O. & E. P. Townsend Mfg. Co., Fallston, Penn., to replace the one destroyed by fire at a loss of $100,000.

+Philadelphia, Penn.—The contract for the construction of a 110x180-ft. factory at Belfield and Stenton Ave. for the National Umbrella Frame Co., has been awarded to the WILLIAM STEELE & SONS CO., 1600 Arch St.

+Philadelphia, Penn.—The contract for the construction of a cooper shop and pump-house at Delaware Ave. and Mifflin St., for the Berg Distilling Co., has been awarded to the JOSEPH LEVIN CO.

Pittsburgh, Penn.—The Packard Motor Co. will build a three-story, brick and stone building at Baum Blvd. and Enfield St., to cost $300,000.

Pittsburgh, Penn.—The Painter-Dunn Co. will build a three-story, 125x180-ft. garage and auto sales building on Center Ave.

+Reading, Penn.—L. H. FOCHT & SON has been awarded the contract for the construction of a three-story, 135x137-ft., brick mill at Ninth and Cotton St. for Joseph Bancroft & Sons. The estimated cost is $30,000.

Baltimore, Md.—The contract will soon be awarded for the construction of a one-story, 100x105-ft., brick warehouse on North Ave. for Linwood Clark.

+Baltimore, Md.—The Baltimore Drydocks & Shipbuilding Co. has awarded the contract for the construction of a shop to the CHESAPEAKE IRON WORKS. The estimated cost is $100,000.

+Hagerstown, Md.—Peuchert & Wunder, Arch., 310 Chestnut St., Philadelphia, Penn., has awarded the contract to the CONSOLIDATED ENGINEERING CO., Baltimore, Md., for the construction of a two-story, 100x190-ft., brick and reinforced-concrete factory for the Pangborn Corporation. The estimated cost is $60,000. Noted July 1, 8 and 22.

+Portsmouth, Va.—The Seaboard Air Line Ry. has awarded the contract to the CHRISTIAN CONSTRUCTION CO., Durham, N. C., for the rebuilding of its shops which were destroyed by fire. The estimated cost is $200,000.

+Gastonia, N. C.—J. A. JONES, Charlotte, N. C., has been awarded the contract for the construction of a two-story, 60x200-ft., brick addition to the Arlington Mills. The estimated cost is $20,000.

+Winston-Salem, N. C.—The P. H. Hanes Knitting Co. has awarded the contract for the construction of a two-story, 127x300-ft., brick and steel mill to the TRAVERS-WOOD CO.

Newman, Ga.—The Newman Cotton Mills will build a three-story, 60x60-ft., brick mill to cost about $10,000. J. E. Sirrine, Greenville, S. C., is Engr.

+Maysville, Ky.—The Maysville Cotton Mills has awarded the contract to HARDING & SIMONS for the construction of a three-story, 70x116-ft. warehouse. J. E. Sirrine, Greenville, S. C., is Arch. Noted Aug. 12.

Akron, Ohio—Plans have been prepared by the Osborn Engineering Co., 740 Engineers Bldg., for the construction of a three-story factory for the Western Tire & Rubber Co., to contain 940,000 sq.ft. of floor space. M. O. Neil is Pres.

Cleveland, Ohio—The Independent Towel Supply Co., 1822 Central Ave., will build a two-story addition to its factory. The estimated cost is $25,000. E. F. Gibbons, 510 Erie Bldg., is Arch.

Cleveland, Ohio—Plans have been prepared by W. J. Carter, Arch., 1423 Illuminating Bldg., for the construction of a six-story warehouse at Rockwell and East Sixth St., for the W. M. Pattison Supply Co., St. Clair St. Estimated cost, $125,000.

+Dayton, Ohio—The Platt Iron Works, Keowee St., has awarded the contract for the construction of a 125x300-ft. addition to its plant to the CONCRETE STEEL CONSTRUCTION CO. The estimated cost is $35,000.

Indianapolis, Ind.—The Pathfinder Co. plans the construction of a 60x400-ft. addition to its plant.

+Kalamazoo, Mich.—The Rex Paper Mills Co. has awarded the contract for the construction of four buildings to the HAUSER-OWEN-AMES CO., Grand Rapids, Mich. The estimated cost is $68,000.

Chicago, Ill.—Edgar G. Frady, Pres., Cole Motor Co. of Illinois, plans the construction of a four-story, 50x160-ft. building at 2326-28 Indiana Ave., to cost about $70,000.

Chicago, Ill.—The Republic Box Co. will build a three-story factory at 913 North Halsted St. Holabird & Roche, 104 South Michigan Ave., is Arch.

Chicago, Ill.—The Empire Fireproof Storage & Van Co., 72nd Pl., will build a seven-story storage warehouse on Stony Island Ave., to cost $100,000.

✚West Duluth, Minn.—(Duluth post office)—The contract for the construction of an $18,000 addition to the factory of the Western Rug Co. has been awarded to EMIL J. ZAUFT. A. W. Puck is Arch.

Wichita, Kan.—The Standard Oil Co. has purchased a site and will build a plant at an estimated cost of $100,000.

Lincoln, Neb.—The Plattner-Yale Mfg. Co. will build a plant at 22nd and X St., to cost $50,000.

✚Chillicothe, Mo.—The contract for the construction of a three-story garage on South Locust St. for the Chillicothe Automobile & Supply Co. has been awarded to S. E. SHULTZ, at $38,785. Other bidders were: C. B. Crosby, $39,317; Dumas Construction Co., $41,200; G. W. Miller, $40,295;. Ray & Son, $45,600.

Pine Bluff, Ark.—It is reported that plans are being prepared for the construction of a $50,000 mill for the Marco Milling Co. Elmo Marsh is Pres.

El Paso, Tex.—Swift & Co., Chicago, Ill., will rebuild its plant which was recently destroyed by fire. J. S. Thompson is Local Representative. The estimated cost is $30,000.

West Tulsa, Okla.—The Tulsa Boiler Co. will build a factory at an estimated cost of $60,000.

Portland, Ore.—W. B. Glafke plans the construction of a cold-storage plant and warehouse at East Third and East Alder St., to cost about $50,000. Camp & Du Puy is Arch.

✚Portland, Ore.—The contract has been awarded to Q. L. KILGREEN for the construction of a warehouse for Mrs. Fannie E. Brown, at $25,000. Sutton & Whitney is Arch. Noted Aug. 26.

✚The Dalles, Ore.—The Oregon-Washington R.R. & Navigation Co. has awarded the contract for the construction of a roundhouse, machine shop and power plant to NETTLETON, BRUCE & ESCHBACH, Seattle, Wash. The estimated cost is $50,000.

✚Ford City, Ont.—WELLS & GREY has been awarded the contract for the construction of a $60,000 addition to the plant of the Ford Motor Co., Detroit, Mich.

FEDERAL GOVERNMENT WORK

✚Post Office—Gardiner, Maine—The contract for the construction of a post office at Gardiner has been awarded to W. H. FISSELL & CO., New York, N. Y., at $55,000. Noted Aug. 19.

Buildings—Portland, Maine—Bids were received Sept. 2 by the Acting Supervising Architect, Treasury Dept., Washington, D. C., for the construction of buildings at the Quarantine Station, Portland, (a) barracks, (b) storehouse, as follows: King Lumber Co., Charlottesville, Va., (a) $72,385, (b) $2500; Forgione & Romano, Portland, (a) $63,322, (b) $2950; J. Kresse Co., New York, N. Y. (a) $65,000, (b) $2400; F. W. Cunningham Co., Portland, (a) $62,712, (b) $3615; Mahoney Construction Co., Portland, (a) $66,533, (b) $3315. Noted Aug. 12.

★✚Dredging — Portland, Maine — The contract has been awarded to the EASTERN DREDGE CO., East Boston, Mass., at $37,250, for dredging in the St. Crois River. Bids were opened Aug. 16. Noted Aug. 26.

Hot-Water System—Newport, R. I.—Bids were received Aug. 28 by the Bureau of Yards and Docks, Washington, D. C., for installing a hot water-piping system at the Naval Hospital as follows: John F. Dalton, 1745 Amsterdam Ave., New York, N. Y., $3877; Ridout, Chandler & Joyce, Boston, Mass., $4324; Ray B. Wilson, Jr., 14 W. Broadway, Newport, $4970, and Detroit Plumbing Co., Washington, D. C., $6500. Noted Aug. 12.

Post Office—Naugatuck, Conn.—Bids will be received until 3 p..m, Oct. 13, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing a post office at Naugatuck.

★Repairing Breakwater—Buffalo, N. Y.—Bids were received Sept. 1 for repairing the breakwater at Buffalo as follows: Great Lakes Dredge & Dock Co., Buffalo, $22,870; H. S. Kerbaugh, Inc., Buffalo, $14,605; Lake Shore Contracting Co., Cleveland, Ohio, $22,280 and the Coast & Lakes Contracting Corporation, New York, $14,055. Noted Aug. 19.

Miscellaneous Supplies—New York, N. Y.—Bids will be received until 2 p.m., Sept. 16, by the Lighthouse Inspector, Tompkinsville, for furnishing miscellaneous supplies for the fiscal year 1916.

Dredging—Philadelphia, Penn.—All bids received Aug. 9 for dredging in the Delaware River on Bellevue and Cherry Island light-house ranges have been rejected on account of being excessive. Noted July 15.

★Air Compressors—Pittsburgh, Penn.—Bids were received Aug. 21 by Lieut.-Col. Francis R. Shunk, Pittsburgh, for installing air compressors, engines and turbines as follows: Foos Gas Engine Co., Springfield, Ohio, Lot 2, $3575; Bruce-Macbeth Engine Co., Cleveland, Ohio, Lot 2, $3705; Turner Fricke Mfg. Co., Pittsburgh, Lot 2, $3850; Combination Engine & Compressor Co., Bradford, Lot 1, $6000; Hope Engineering & Supply Co., Mt. Vernon, Ohio, Lot 2, $3100; Hall Steam Pump Co., Pittsburgh, Lot 1, $4444. Noted July 29.

★Houses—Pittsburgh, Penn.—Bids were received Aug. 25 by Lieut.-Col. Francis R. Shunk, Pittsburgh, for constructing two brick lockkeepers' houses at Dam No. 10, Ohio River as follows: Guy Johnston Contracting Co., Toronto, Ohio, $11,400; Earl N. Everson, Brilliant, Ohio, $22,200; McFeely Bros., Steubenville, Ohio, $12,900; Schutz, Schreiner & Clyde Co., Pittsburgh, $13,250. Noted July 29.

★Lock Gates—Pittsburgh, Penn.—Bids were received for furnishing steel lock gates, valves and operating machinery at Lock No. 6, Monongahela River, as follows: Simonds Mfg. Co., Pittsburgh, $11,723; Ellicott Machine Corporation, Baltimore, Md., $9488; Union Foundry & Machine Co., Pittsburgh, $23,931; Thomas Carlin's Sons Co., Pittsburgh, $7600; Whitehead & Kales Iron Works Detroit, Mich., $29,984; Rosedale Foundry & Machine Co., Pittsburgh, $11,095; Penn Bridge Co., Beaver Falls, $23,790; Independent Bridge Co., Pittsburgh, $14,500; H. P. Gazzam Machine Co., Pittsburgh, $9995 and J. & J. B. Milholland Co., Pittsburgh, $7995. Noted July 29.

Building—Baltimore, Md.—Bids were received as follows Aug. 31, by the Acting Supervising Architect, Treasury Dept., Washington, D. C., for the construction, mechanical equipment and elevators at the U. S. Immigration Station, Baltimore, Md., (a) construction, exclusive of wharf, (b) construction, exclusive of wharf and administration building, (c) wharf: Construction: Irwin & Leighton, Philadelphia, Penn., (a) $294,800, (b) $266,500, (c) $11,500; William Dall Co., Cleveland, Ohio, (a) $267,688, (b) $241,516, (c) $10,500; Consolidated Engineering Co., Baltimore, (a) $298,700, (b) $271,500, (c) $11,000; Norcross Bros. Co., Worcester, Mass., (a) $305,000, (b) $275,000, (c) $6000; George E. Wyne, Washington, D. C., (a) $333,000, (b) $301,000, (c) $10,100; David M. Andrew Co., Baltimore, (a) $292,300, (b) $264,300, (c) $11,500; Singer Pentz Co., Baltimore, (a) $286,113, (b) $260,807; Morrow Bros., Baltimore, (a) $284,100, (b) $256,000, (c) $10,370; A. L. Guidone & Sons, New York, N. Y., (a) $277,000, (b) $265,450, (c) $10,350; J. Henry Miller & Co., Baltimore, (a) $219,700, (b) $291,100; (c) $12,000; Henry Smith & Sons Co., Baltimore, (a) $307,000, (b) $278,000, (c($11,000; Henry S. Ripple, Baltimore, (a) $309,-800, (b) $281,000, (c) $9500; McLean Contracting Co., Baltimore, (c) $14,125; M. Yeager & Sons, Danville, Ill., (a) $279,-893, (b) $256,893, (c) $11,500. Mechanical Equipment: Walter E. Hill & Co., Baltimore, $97,380; W. G. Cornell Co., Washington, D. C., $87,884; Enterprise Steam & Hot Water Heating Co., Baltimore, $95,376; Crook-Kries & Co., Baltimore, $92,200; Louis F. Andrae & Co., Baltimore, $95,600; Hanley-Casey Mechanical Equipment Co., Chicago, Ill., $98,000; Fitzpatrick & Hoepfner, Columbus, Ohio, $98,800; S. Faith & Co., Philadelphia, Penn., $98,700; Riggs, Distler & Stringer, Baltimore, $91,-175; Almirall & Co., New York, N. Y., $109,677. Elevator equipment: Otis Elevator Co., Washington, D. C., $12,721; Standard Plunger Elevator Co., Worcester, Mass., $10,950; Robert Wetherill & Co., Chester, Penn., $18,580. Noted Aug. 12.

Post Office—Wilkesboro, N. C.—Bids will be received until 3 p.m., Oct. 14, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing the U. S. post office at Wilkesboro.

★Post Office—Palatka, Fla.—Bids were received Aug. 27 by the Acting Supervising Architect, Treasury Dept., Washington, D. C., for the construction of a post office at Palatka, Fla., (a) limestone; (b) sandstone, as follows: A. Bassford, Tampa, (a) $48,321; (b) $49,321; Rogers & Kaiser, Chicago, Ill., (a) $42,582, (b) $45,038; Algernon Blair, Montgomery, Ala., (a) $41,428; Westchester Engineering Co., White Plains, N. Y., (a) $39,652, (b) $42,500; Potters' Lumber Co., East Liverpool, Ohio, (a) $43,200; Miles & Bradt, Atlanta, Ga., (a) $44,900; J. L. Crouse, Greensboro, N. C., (a) $40,935, (b) $41,660; Dieter & Wenzel Construction Co., Wichita, Ken., (a) $47,523; George Becking, Chattanooga, Tenn., (a) $41,000; Frank M. Weakley, Portsmouth, Va., (a) $52,942; H. H. Brown, Dothan, Ala., (a) $45,200, (b) $45,800; W. H. Fissell & Co., New York, N. Y., (a) $42,300, (b) $44,800; J. S. Rogers Co., Moorestown, N. J., (a) $44,999, (b) $46,299; Dabbs & Wetmore, Meridian, Miss., (a) $40,589, (b) $41,337; Newport Contracting & Engineering Co., Newport News, Va., (a) $44,301. Noted July 22.

Post Office—Logan, Ohio—Bids will be received until 3 p.m,. Oct. 14, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for constructing a one-story and basement brick, terra cotta and stone-faced post office at Logan.

✚Post Office—Ft. Atkinson, Wis.—The contract for the construction of a post office at Ft. Atkinson has been awarded to CLARKE CONSTRUCTION CO., Danville, Ill., at $40,100. Noted Aug. 12.

Wood Stave Pipe—Newell, S. D.—Bids will be received until 4 p. .m., Sept. 16, by the U. S. Reclamation Service, Newell, for constructing about 3285 ft. of 60-in. and 450 ft. of 24-in. wood stave pipe.

Floors—St. Louis, Mo.—Bids were received Sept. 1 by the Acting Supervising Architect, Washington, D. C., for floor work in the U. S. Customhouse as follows: Kansas City Marble & Tile Co., Kansas City, $10,800; American & Venetian Marble Co., Kansas City, $7800; N. O. Nelson Mfg. Co., St. Louis, $12,888. Noted Aug. 12.

✚Post Office—Corpus Christi, Tex.—The contract for the construction of a post office at Corpus Christi has been awarded to BARNES BROS., Logansport, Ind., at $115,000. Noted May 20.

✚★Miscellaneous Work—Denver, Colo.—The contract has been awarded to the NORMAN KER CO., 1123 Broadway, New York, N. Y., at $9305, for furnishing flag poles, and miscellaneous bronze and iron work at the Denver post office. Noted Sept. 2.

✚Reclamation—Yakima, Wash. — The contract has been awarded to DUNN & HOGAN, North Yakima, Wash., for furnishing sand and gravel along the canals of the Outlook Irrigation District, Sunnyside Unit, Yakima Irrigation project, Wash., at $5601.

✚Wharf—San Francisco, Calif.—The contract has been awarded to HYDE, HARJES & CO., San Francisco, at $9341, for constructing a wharf at the Naval Training Station, San Francisco. Noted Aug. 26.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., Sept. 22, by Maj. F. C. Boggs, Gen. Pur. Agt. Panama Canal, Washington, D. C., for furnishing miscellaneous supplies.

✚Building—Pearl Harbor, H. T.—The contract has been awarded to BOWLER & INGVERSON, Honolulu, at $19,890, for constructing officers' quarters at the Naval Station. Noted Aug. 26.

MISCELLANEOUS

Shore Protection—Boston, Mass.—The lowest bid submitted to the Park Commission for the construction of concrete shore protection in Revere was from Coleman Bros., Chelsea at $19,853. Noted Aug. 26.

Barge Canal Work—Albany, N. Y.—(Official)—Bids will be received by W. W. Wotherspoon, State Supt. of Pub. Wks., until Sept. 28 for the following under: Terminal Contract No. 47 for increasing the height of dockwalls, grading and paving the terminal sites on the north and south sides of the barge canal, east of the Main-Delaware Ave. bridge at Tonawanda and under Terminal Contract No. 49, grading a terminal site in the village of Spencerport.

Elimination of Grade Crossing—Buffalo, N. Y.—Bids will be received by Edward B. Guthrie, Ch. Engr., 436 Ellicott Sq., Buffalo, until 11 a.m., Sept. 15 for the construction of a grade crossing in Bailey Ave., over the Pennsylvania R.R. tracks.

+Subway Station—New York, N. Y.—(Borough of Bronx)—(Official)—The contract for station finish work for parts of the Seventh Ave., Lexington Ave. and White Plains Rd. Transit Railroads has been awarded to the ALTORIA REALTY & CONSTRUCTION CO., 3 East 44th St., New York, at $860,636. Noted July 29 and Aug. 26.

Duct Line—New York, N. Y.—(Borough of Bronx)—Bids will be received by the Public Service Commission, 154 Nassau St., until 12:15 p.m., Sept. 17, for the construction of a duct line under a portion of East 153d St. for the Seventh Ave.-Lexington Ave. Rapid Transit.

Freight Shed—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by R. A. C. Smith, Comr., Docks and Ferries, Pier A, Battery Pl., until noon, Sept. 17, for building a freight shed near the foot of 30th St., Brooklyn.

+★Subway Station—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for the construction of the station finish on Section No. 2, Route Nos. 36 and 37 of the Astoria Elevated R.R. has been awarded to CHARLES MEADE & CO., 38 Park Row, New York, at $268,102. Noted July 15 and Aug. 12.

+Track Supplies—New York, N. Y.—(Borough of Manhattan)—(Official)—Contracts have been awarded by the Public Service Commission for furnishing track materials and supplies as follows: Untreated ties and timber, J. H. BURTON & CO., at $1,273,856; treated ties and timber, LONG LEAF PINE CO., INC., at $100,362; special work, order No. 3, RAMAPO IRON WORKS, at $54,960; special work, order No. 4, WILLIAM WHARTON JR., & CO., at $41,907; cast iron, AMERICAN BRAKE SHOE & FOUNDRY CO., at $10,528; screw spikes, AMERICAN IRON & STEEL MFG. CO., at $25,741; malleable iron, FORAN FOUNDRY & MFG. CO., $36,118; tie plates type A, HERBERT W. LOCKWOOD, at $123,975; also tie plate type "D" $8239; tie plates, types, "E", "F", "G" and "H" $17,139 and cut track spikes, at $34,338; tie plates, type "B" L. D. ROCKWELL, at $13,267; also type "C", $5,140; bolts and nuts, OLIVER IRON & STEEL CO., at $117,911. Noted July 29, and Aug. 26.

Jetties—Stone Harbor, N. J.—Press reports state that the City Council has authorized the construction of V-shaped jetties on the channel front between Tuxedo Point and Shelter Haven Inlet.

Coal Pier—Baltimore, Md.—The Pennsylvania R.R. Co. will revise plans for the construction of its coal pier. A. C. Stand, Philadelphia, is Ch. Engr.

Flood Protection—Augusta, Ga.—According to press reports the City Council has passed a resolution to call for bids on the purchase of $250,000 flood protection bonds.

+Pier Sheds—Savannah, Ga.—The contract for constructing pier sheds (exclusive of steel frame and foundations) has been awarded by the Ocean Steamship Co., Savannah, to IRWIN & LEIGHTON, 126 North 12th St., Philadelphia. J. G. Basinger, 52 Broadway, New York, N. Y., is Engr.

Embankment—Fernwood, Miss.—Bids will be received by the Chief Engineer, Fenwood & Gulf R.R. Co., for placing 38,000 cu.yd. of embankment. The work is to be completed in five months.

Pile Foundations, Etc.—New Orleans, La.—Bids will be received by Ernest M. Loeb, Pres. Bd. of Comrs., 200 New Orleans Courthouse Bldg., until 2 p.m., Sept. 15, for constructing the pile foundations for the workhouse, annex, drier house, boiler and transformer house, and connections, for the public grain elevator, at the foot of Bellecastle St. Ford, Bacon & Davis, 921 Canal St., New Orleans, La., is Arch.

Speedway—Louisville, Ky.—The Louisville Automobile Speedway Co., Louisville, will be organized with a capital of $250,000 to construct a speedway of creosoted oak.

Retaining Wall—Cincinnati, Ohio—Bids will be received by the Board of County Commissioners until noon, Sept. 17, for the construction of a bridge and retaining wall on Four Mile Rd.

+Fire Boat Repairs—Cleveland, Ohio—The contract for the rebuilding and repairing of the fire tug "Clevelander" has been awarded to the MANITOWOC CO., at $33,500. A. A. Benesch, is Dir. of Pub. Ser.

Elimination of Grade Crossing—Cleveland, Ohio—Press reports state that preliminary plans have been approved by the City Engineering Commission for the elimination of the grade crossing between Fulton Rd. and Detroit Ave. on the New York, Chicago & St. Louis R.R. The total cost of the elimination will be $2,900,000. The city's portion is $765,000.

Park Improvement—Massillon, Ohio—(Official)—Bids will be received by R. J. Krisher, City Audr., until noon, Sept. 20, for the purchase of $25,000 in park improvement bonds.

Retaining Wall—Steubenville, Ohio—Bids will be received by John L. Means, County Audr., until Sept. 17, for constructing a retaining wall on Long Run, Mt. Pleasant.

Retaining Wall—Youngstown, Ohio—Bids will be received by the County Commissioners, until 10 a.m., Sept. 10, for constructing a retaining wall on McCartney Rd.

Flood Prevention—Muncie, Ind.—It is reported that the city plans to improve the White River for a distance of four miles to prevent floods.

Drainage—Adrian, Mich.—Press reports that the county will spend about $85,000 for draining the eastern section of the county.

Drainage—Aledo, Ill.—Bids will be received by the Central States Engineering Co., Room 402 Hershey Bank Bldg., Muscatine, Iowa, until 7:30 p.m., Sept. 24, for the construction of three sections of tile drains in Mercer County, Ill.

Drainage—Des Moines, Iowa—According to press reports, the Harmon Engineering Co., Peoria, Ill., has been engaged to prepare plans for reclaiming about 23,000 acres of land along Skunk River, in Polk, Story and Jasper counties.

Drainage—Muscatine, Iowa—Bids will be received by the Central States Engineering Co., Room 402, Hershey Bldg., until Sept. 24 for constructing three contract sections of drainage aggregating about 47 miles.

River Improvement—St. Louis, Mo.—Press reports state that the Board of Aldermen has been requested to call a special election for the purpose of issuing $5,500,000 in bonds for improving the River des Peres.

Drainage—Lonoke, Ark.—Plans have been prepared for the drainage of about 10,000 acres in Indian Bayou District No. 2 and bids will soon be called for. The Charles Miller Engineering Co., Southern Trust Bldg., Little Rock, Ark., is Engr. The estimated cost is $40,000.

Smokestack—El Paso, Tex.—It is reported that the El Paso Smelter Co. plans the erection of a 300-ft. smokestack to cost about $250,000.

Drainage—Houston, Tex.—It is planned to issue $140,000 in bonds for the construction of a drainage system.

Natatorium—Aberdeen, Wash.—Plans have been completed for a swimming pool to be of corrugated iron, and a club house for the Aberdeen Brewing Co. The estimated cost is $15,000.

Dike—Cathlamet, Wash.—Bids will be received by the Com-Commissioners of Diking District No. 1, until 2 p.m., Oct. 1, for constructing a system of dikes, including automatic tide gates, pumping stations, etc. G. H. Kyle, 718 Spalding Bldg., Portland, Ore., is Engr. Noted May 27 and Aug. 19.

Drainage—North Yakima, Wash.—The city will soon hold an election to vote on $80,000 in bonds for the construction of the West Side Drainage District. L. O. Meigs is City Atty.

Elimination of Grade Crossing—Portland, Ore.—Proceedings will be started for a general grade crossing elimination project along the line of the Oregon-Washington R.R. & Navigation Co. from the head of Sullivan Gulch to the city limits. The work will cost about $750,000, and plans have been completed. A. L. Barbur is Audr.

Retaining Walls—St. John, N. B.—The City Council plans to construct retaining walls on Main, Moore and Rockland St. at an estimated cost of $16,300. H. E. Wardroper is Clk.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works," "Federal Government Work" and "Miscellaneous"

Fulton, N. Y.—Plans are being prepared by Clarence Brazer, Arch., 1133 Broadway, New York, for the construction of a church and parish house for the Zion Episcopal Church. Estimated cost, $50,000. M J. Peters is Pastor and Chn. of Bldg. Com.

Ithaca, N. Y.—Bids are being received by the Civil Engineering Department of Cornell University on the general contract for the construction of a one-story reinforced-concrete and tile observatory near the Agricultural College. The estimated cost is $50,000. Le Roy P. Burnham, 3 Central Ave., is Arch.

New York, N. Y.—(Borough of Bronx)—Plans are being prepared by Gustave E. Steinbach, Arch., 15 East 40th St., New York, for the construction of a 1½-story church on Tinton Ave. near 155th St. for the St. Anselm Church. The estimated cost is $60,000 Bernard Kevenhoester, 673 Tinton Ave., is Pastor.

New York, N. Y.—(Borough of Bronx)—Bids will be received about Nov. 1, by Anthony F. A. Schmitt, Arch., 604 Courtland Ave., for the construction of a one-story, 100x151-ft. church at College Ave. and 145th St. for St. Rita's Church. The cost is estimated at $75,000.

New York, N. Y.—(Borough of Brooklyn)—Plans are being prepared by Nelson & Van Wagenen, Arch., 15 West 38th St., New York, for the construction of a church at Bedford Ave. and Hawthorne St. for the Congregational Church of the Evangel. The estimated cost is $40,000.

New York, N. Y.—(Borough of Manhattan)—Plans have been prepared by Shape & Bready, Arch., 220 West 42d St., for the construction of a seven-story building at 42d St. and Second Ave. for the New York College of Dentistry. The estimated cost is $50,000.

New York, N. Y.—(Borough of Manhattan)—The Oceanic Investing Co. plans to construct a 20-story building to be known as the Astor Trust Co. Bldg., at Fifth Ave. and 42d St. The cost is estimated at $1,000,000. Montague Flagg, 2d, 109 Broad St., is Arch.

New York, N. Y.—(Borough of Manhattan)—Edgar A. Levy will build an apartment house at a cost of $500,000. Schwartz & Gross, 347 Fifth Ave., is Arch.

New York, N. Y.—(Borough of Queens)—The Long Island Loft Corporation has had plans prepared for the construction of a five-story, 54x187-ft., brick loft building at Wilbur Ave. and Sunswick St., Long Island City. The cost is estimated at $90,000.

New York, N. Y.—(Borough of Richmond)—Mason R. Strong, Arch., 7 Wall St, New York, has prepared plans for the construction of a three-story, 75x147-ft., orphan asylum at Ft. Wadsworth, S. I., for the Bethlehem Orphans' Home, College Point, L. I. The estimated cost is $100,000. Noted Mar. 25.

Syracuse, N. Y.—Preliminary plans are being prepared by James I. Meehan Co., Arch., 1611 First North St., for the construction of a five-story clubhouse. The estimated cost is $100,000.

White Plains, N. Y.—(Official)—Bids were received for the construction of a workhouse and penitentiary at East View, for the Westchester County as follows: Wells Bros. Construction Co., 366 Fifth Ave., New York, $543,000; John H. Parker Co., 315 Fourth Ave., New York, $547,695; John T. Brady & Co., 103 Park Ave., New York, $548,840; Norcross Bros. Co., 103 Park Ave., New York, $556,500; George A. Fuller Co., 111 Broadway, New York, $560,785. Thomas F. Cox, Jr., is Clk. of Westchester County Bldg. Comn. Noted July 22 and Aug. 19.

Newark, N. J.—The Common Council has petitioned the Finance Committee to appropriate $40,000 to be used for repairs to the Central Market.

.. **Carbondale, Penn.**—Plans are being prepared by E. H. Davis, Arch., Scranton, for the construction of a two-story, brick and concrete high school. The estimated cost is $100,000.

Indiana, Penn.—The Indiana State Normal School plans to expend $50,000 on alterations and additions to its buildings. James E. Ament is in charge of construction.

+Philadelphia, Penn.—(Official)—WILLIAM R. DOUGHERTY, 1608 Sansom St., Philadelphia, has been awarded the general contract for the construction of a seven-story, 45x179-ft., building with four 45x175-ft. wings at 54th St. and Cedar Ave. for the Miserecordia Hospital. E. F. Durang & Son, 12th and Chestnut St., is Arch Noted Apr. 1 and July 15.

+Philadelphia, Penn.—(Official)—The contract for the construction of an immigrant station at Reed St. Yards, South Wharfs, for the Pennsylvania R.R. has been awarded to JOHN N. GILL & CO., 1213-15 Filbert St., Philadelphia, at $84,995. Other bidders were: Fred A. Havens & Co., 845 North 19th St., $93,017; Brann & Stuart Co., Arcade Bldg., $87,511; Barclay, White & Co., $97,377; Armstrong & Latta Co., North Land Title Bldg., $87,354; William R. Dougherty, 1608 Sansom St., $98,633. Noted July 22 and 29.

+Pittsburgh, Penn.—The Finance Committee of the Board of Public Education has awarded the general contract for the construction of the South Hills High School on Ruth St. to GOLDEN & CRICK, 3512 Fifth Ave., Pittsburgh, at $224,008. Noted June 10.

+Pittsburgh, Penn.—The contract has been awarded to the THOMPSON-STARRETT CO., at $232,950, for the construction of the Bailey High School, at Ruth, Harwood and Eureka St. and Secane St. Noted June 10.

Pittsburgh, Penn.—The Americus Republican Club plans the construction of a seven-story clubhouse at Penn Ave. and Fourth St., to cost about $150,000. F. J. Osterling, 316 Fourth Ave., is Arch.

Akron, Ohio—Plans have been prepared by George J. Ball, Arch., Crosier St., for the construction of a two-story home for nurses at the People's Hospital. The cost is estimated at $50,000. Noted May 13.

Cleveland, Ohio—Bids will be received until noon, Sept. 27, by the Clerk of Board of Education, Rockwell and East Sixth St., for the construction of a school at Almira Ave. and West 98th St. Frank G. Hogan is Dir. of Schools.

Evansville, Ind.—The Hotel Building Co., will build an eight-story hotel, to be known as the Hotel McCurdy, at a cost of $500,000.

Indianapolis, Ind.—A. M. Glossbrenner, Chn., Organization Com. of Indianapolis Armory Bldg. Assoc., has prepared tentative plans for the construction of an armory for the Indiana National Guard. Noted Aug. 19.

+Albion, Mich.—The FRANK L. SHOEMAKER CONSTRUCTION CO., Kalamazoo, has been awarded the general contract for the construction of a two-story physics building at the Albion College. Estimated cost, $40,000. Noted Aug. 19.

Marquette, Mich.—The Board of Education plans the construction of a three-story, brick and stone high school. John D. Chubb, 109 North Dearborn St., Chicago, Ill., is Arch. The estimated cost is $120,000. Noted May 27.

Chicago, Ill.—The Cole Motor Co. of Illinois will build a four-story display house at 2326 Indiana St., to cost $70,000. Edgar C. Frady is Pres.

Chicago, Ill.—Harry W. Rubloff plans the construction of a three-story theater and office building at 69th and Green St. Estimated cost, $100,000.

+Chippewa Falls, Wis.—The contract for the construction of an office building for the Edward Rutledge Charity Corporation, has been awarded to W. J. KINGSLEY, Faribault, Minn., at $41,300. Noted July 8 and 15.

Madison, Wis.—Claude & Starck, Arch., has prepared plans for the construction of a two-story, 75x115-ft., brick school to cost $60,000.

+Montello, Wis.—The general contract for the erection of the new Marquette county courthouse and jail, estimated to cost $60,000, has been awarded to S. D. KNUDSEN and F. D. BURGESS, Waupaca, Wis. Noted July 22 and Aug. 19.

Sheboygan, Wis.—The Board of Public Works will soon award the contract for the construction of a three-story, 56x150-ft., brick and stone city hall. Herman W. Buemming, 521 Jackson St., Milwaukee, Wis., is Arch. The estimated cost is $115,000.

+Ames, Iowa—The State Board of Education has awarded the general contract for the construction of a dormitory for girls at the Iowa State College to the J. B. EVANS CONSTRUCTION CO., Mexico, Mo. The estimated cost is $60,000. Noted Sept. 2.

Ames, Iowa—All bids received for the construction of a science building at the Iowa State College have been rejected by the State Board of Education. New bids will soon be received. The cost is estimated at $60,000. Noted Sept. 2.

+Cherokee, Iowa—The general contract for the construction of the Cherokee High School has been awarded to PAYANT & BRASS, Faribault, Minn., at $67,805. Noted June 17.

Mason City, Iowa—The Brotherhood of America organization plans to construct a permanent home for the order at Mason City. The cost is estimated at $250,000.

Sioux City, Iowa—Preliminary plans have been prepared by Beuttler & Arnold, Arch., Davidson Auto Blk., for the construction of a Masonic Temple at Ninth and Douglas St. for the York Rite Bodies. The estimated cost is $100,000. Noted Sept 2.

+New Duluth, Minn.—The Minnesota Steel Co. has awarded the contract to GEORGE H. LOUNSBERRY, Duluth, Minn., for the construction of a brick and concrete office building and chemical laboratory. The estimated cost is $100,000.

+St. Paul, Minn.—(Official)—The contract for the construction of a 12-story, 150x200-ft., brick and stone hotel to be known as the Hillcrest at Dale St. and Grand Ave. for the Booth Hotel Co. has been awarded to the WELLS BROS. CO., 407 Lowry Bldg., St. Paul. The cost is estimated at $2,000,000. Mark Fitzpatrick, 17 West Ninth St., is Arch.

+Coffeyville, Kan.—The contract for the construction of a two-story 96x143-ft. brick and steel terminal building for the Union Traction Co. has been awarded to CLEMENTS & LAVERY. The estimated cost is $40,000. Austin Allen, 1212 Scarritt Bldg., Kansas City, Mo., is Arch.

+Salina, Kan.—The general contract for the construction of a two-story, 108x122-ft., brick and concrete church for the First M. E. Church has been awarded to J. O. BROWN, Arkansas City, at $40,000. A. G. Bennett is Pastor. Wm. T. Schmitt, Oklahoma City, is Arch. Noted July 22.

Omaha, Neb.—Plans are being prepared by George B. Prinz, Arch., Omaha National Bank Bldg., for the construction of a seven-story Masonic Temple at 19th and Douglas St. The estimated cost is $350,000. Noted June 10.

+Grand Forks, N. D.—The contract for the construction of an addition to the Y. M C. A. building has been awarded to DINNIE BROS., Grand Forks Estimated cost, $40,000. Noted May 27.

Fulton, Mo.—At a recent election the citizens voted in favor of issuing $55,000 in bonds. The proceeds will be used for the construction of a school.

Jennings, Mo.—(St. Louis post office)—Plans are being prepared by Barnett, Haynes & Barnett, Arch., 949 Century Bldg., St. Louis, for the construction of a group of buildings near Jennings for the Jesuit Province of Missouri. The cost is estimated at $400,000.

Kansas City, Mo.—It is reported that plans are being drawn for the construction of a brick and reinforced-concrete hotel at 2223-25 Grand Ave. for the Frederick Realty & Investment Co. Fred C. Merry, 1009-11 Walnut St., is Pres. The estimated cost is $150,000.

+Kansas City, Mo.—The contract for the construction of a three-story, 77x113-ft., brick and reinforced-concrete hotel at 1416 Central St., for Neuer Bros., 1326-28 Main St., has been awarded to AIKEN & THAYER, 501 Shukert Bldg., at $60,152. Frederick H. Michaelis, 113 McGee St., is Arch.

Cleveland, Tex.—(Official)—All bids have been rejected by G. O. Bartle, Pres., School Bd., for the construction of a school. Noted June 17 and Aug. 26.

Lubbock, Tex.—The Commissioners' Court has ordered an election for Sept. 18 to vote on issuing $100,000 bonds, the proceeds to be used for building a new court house.

Nacogdoches, Tex.—At a recent election the citizens of Nacogdoches Independent School District voted in favor of a bond issue of $45,000. The proceeds will be used for the construction of a school. Noted Aug. 19.

+Edmond, Okla.—The contract for the construction of a library and classroom at the Central State Normal School has been awarded to KREIPKE & SCHAFER, El Reno, Okla., at $46,500.

Colorado Springs, Colo.—Plans are being prepared for the construction of an addition to the Union Printers Home, for the International Typographical Union. Marsden G. Scott is Pres. The estimated cost is $50,000.

Denver, Colo.—The Directors of the Children's Hospital plan to construct a four-story hospital at 19th and Downing St. Estimated cost, $210,000. Mrs Edith M. Burger is Pres. of the hospital.

+Miami, Ariz.—E. GARFIELD has been awarded the contract for the construction of a high school. Trost & Trost, Mills Bldg., El Paso, Tex., is Arch. The estimated cost is $70,000. Noted May 20.

Seattle, Wash.—Bids will soon be received by George W. Lawton, Arch., Alaska Bldg., for the construction of a three-story, brick and terra cotta Masonic temple to cost $125,000.

Tacoma, Wash.—Plans have been prepared by Luther Twitchell, Arch., Savage-Scofield Bldg., for the construction of a three-story, reinforced-concrete addition to the Bankers Trust Bldg., Pacific Ave. The estimated cost is $65,000.

+Walla Walla, Wash.—The contract for the construction of St. Mary's Hospital has been awarded to W. J. BEEZER. The estimated cost is $250,000. Noted May 6, June 3 and July 15.

The Walter A. Zelnicker Supply Co., St. Louis, Mo., has purchased the goodwill and stock of the Bintliff Supply Co. The latter company did a general railroad, mill and factory supply business and specialized in the manufacture of railroad track tools.

The Webster & Perks Tool Co., Springfield, Ohio, has consolidated with the Bauroth Machine & Tool Co., Toledo, Ohio, and has moved the machinery and equipment of the latter plant to Springfield.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS—STEAM AND ELECTRIC

New York—Columbus & Mayville R.R. Co. granted franchise for railway through Columbus Township, Mayville. C. P. Northrup, Corry, Penn., Pres.

New York—New York State Rys. asked for franchise to extend Elm St. Line, Utica. B. E. Tilton, Utica, Gen. Mgr. Noted Aug. 5.

Pennsylvania—Eastern Pennsylvania Rys. Co. plans expenditure of $216,000 for improvements, including two-mile extension from Nichols St., Pottsville, to St. Clair. W. B. Rockwell, Pottsville, Mgr. and Pur. Agt.

Maryland—Chambersburg, Greencastle & Waynesboro St. Ry. Co. plans extension from Blue Ridge Summit to either Thurmont or Emmitsburg, eight or 10 miles. D. B. Fretz, Chambersburg, Penn., Pres.

Maryland—Hagerstown & Frederick Ry. Co. considering proposition to extend line from Thurmont to Emmitsburg, Md., about seven miles. E. L. Coblentz, Frederick, Pres.

Virginia—Chester & City Point Electric Ry. Corporation incorporated to construct railway from Chester to Hopewell and City Point, nine miles. H. D. Eichelberger, Pres.

West Virginia—Monongahela Traction Co. has made preliminary survey for extension from Fairmont to Glenville. S. B. Miller, Fairmont, Ch. Engr. Noted Sept. 2.

North Carolina—Watauga & Yadkin River R.R. contemplates extension from Darby to either Blowing Rock or Boone. H. C. Landon, North Wilkesboro, Gen. Mgr.

Georgia—Adams & Sturm, Columbus, Ohio, is interested in proposed Atlanta-Carolina Electric Ry. from Atlanta to Augusta, Ga.

Alabama—Alabama & Mississippi R.R. plans to extend line from Vinegar Bend, Ala., to Evanston, Miss. N. E. Turner, Vinegar Bend, Pres.

Louisiana—Krause & Managan Lumber Co. plans tramroad, 3½ miles long with two miles of spur track, on timber land at Gillis.

Kentucky—Louisville & Nashville R.R. is surveying for a line from Ermine along Colly Creek to coal and timber tracts. W. H. Courtenay, Louisville, Ch. Engr.

Ohio—Cleveland Ry. has asked for a franchise for a line on State Road through Brooklyn Township. G. L. Radcliffe, Cleveland, Gen. Mgr.

Ohio—West End Rapid Transit Co., recently incorporated, will construct railway from Anderson's Ferry to the intersection of Third and Vine St., Cincinnati, to furnish an entrance to the city for the Cincinnati, Lawrenceburg & Aurora Electric St. R.R. Co.

Indiana—Plans being considered for an electric railway from Fisher's Station to Marion, via Noblesville, Perkinsville and Elwood.

Wisconsin—S. C. Lingelbach, Milwaukee, is interested in railway from Green Bay to Sheboygan via Manitowoc.

✚**Wisconsin**—Badger Ry. & Light Co. awarded contract for completing local and interurban street railway system to C. E. COON & CO., Cleveland, Ohio.

Minnesota—St. Paul Southern Electric Ry. Co. asked to construct a railway from Inver Grove to St. Paul Park, northward to Red Rock. W. L. Sonntag, St. Paul, Gen. Mgr.

North Dakota—Midland Continental R.R. plans to extend line from Wimbledon to Grand Forks. J. M. Mall, Pres.

South Dakota—Great Northern Ry. plans railway from Sioux Falls to Denver, Colo. A. H. Hogeland, St. Paul, Minn., Ch. Engr.

✚**Montana**—Chicago, Milwaukee & St. Paul Ry. awarded contract for railway from Three Forks to Radersburg, Mont., to CLIFTON, APPLEGATE & CO., Spokane, Wash. C. F. Loweth, Chicago, Ch. Engr.

Montana—Great Falls & Southwestern Ry. incorporated to construct railway from Ulm to Hound Creek, east of Great Falls, about 60 miles.

Montana—Surveys being made for a railway from Nye to Cook, Mont.

Missouri—Ozark Ry. Co. will issue $125,000 bonds and $250,000 stock for line from Missouri to Arkansas.

Missouri—Project for Nevada, Lebanon & Eastern R.R. between Lebanon and Nevada is being revived. S. W. Thompson interested.

Oklahoma—St. Louis & San Francisco R.R. plans to enlarge its yards at Afton. F. G. Jonah, St. Louis, Ch. Engr.

Texas—Galveston, Harrisburg & San Antonio Ry. granted permission for industrial track over C. H. Milby property. W. B. Scott, Houston, Pres.

Arizona—Atchison, Topeka & Santa Fé Ry. will construct line from Seligman to Bagdad district, tapping Hillside mining district. J. A. Jaeger, Prescott, Ch. Engr.

Washington—Oregon-Washington R.R. & Navigation Co. plans railway between Point Defiance Line and Olympia. Estimated cost, $500,000. J. R. Holman, Portland, Ore., Ch. Engr.

Washington—O. R. Vahl is interested in a railway from Chelan to Aurelia Crown Mine near Stehekin.

California—Oakland, Antioch & Eastern Ry. plans to extend line to Martinez. H. A. Mitchell, San Francisco, Sec. and Gen. Mgr.

California—Right-of-way being secured by Hermosa Beach Chamber of Commerce for railway to connect with Pacific Electric Ry. at Belvidere.

California—McCloud Lumber Co. will extend its logging road six miles to a point near Pummoce Mountain, Bartle.

California—Mammoth Copper Co. considering plans for a two-mile electric line.

California—Mineral Products Co. will construct railway from Patterson to Red Mountain through Del Puerto Canyon to Magnesite and Manganese Mines.

LIGHT, HEAT AND POWER

Bar Harbor, Maine—Town has decided to establish municipal electric-light plant.

✚**North Gorham, Maine**—Cumberland County Power & Light Co., Portland, awarded contract for 300-ft. dam across the Presumpscot River at North Gorham to H. P. CUMMING CONSTRUCTION CO., Ware, Mass. Noted Aug. 12.

✚**Bridgeport, Conn.**—Bridgeport Projectile Co. awarded contract for one-story, brick and steel boiler house on Connecticut Ave. to SAMUEL AUSTIN & SONS CO. Cost, about $20,000.

★**Buffalo, N. Y.**—(Official)—Bids will be received until 2:30 p.m., Sept. 24, by E. S. Elwood, Secy., State Hospital, Conn., Capitol, Albany, for additional boiler and heating work at Buffalo State Hospital.

★**New York, N. Y.**—(Official)—Bids will be received until 11 a.m., Sept. 28, by Board of Water Supply, Municipal Bldg., for electrical operating equipment for gang-driven valves and sluice gates at Ashokan, Kensico, Hill View and Silver Lake reservoirs. Charles Strauss is Pres., Bd .of Water Supply.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by the Department of Public Charities, Municipal Bldg., until 10:30 a.m., Sept. 22, for steam heating system at Greenpoint Hospital.

Niagara Falls, N. Y.—Niagara Falls Power Co. is preparing plans for three additional units to its power plant. Estimated cost, $1,000,000.

Rochester, N. Y.—Taylor Instrument Co. will build 58x70-ft. boiler house at 95 Ames St. Estimated cost, $10,000. A. S. Crocker, Arch.

Bloomfield, N. J.—International Arms & Fuse Co. has plans for a power plant in connection with its new factory on Grove St.

Winchester, Va.—Reported that a municipal electric-light plant is under consideration. Dr. Hunter H. McQuire is Chn. of Light Com.

Columbus, Ga.—City considering municipal electric-light plant. W. C. Campbell is City Engr.

✚**Cincinnati, Ohio**—Building Commission of new courthouse awarded contract for mechanical equipment, including complete power plant and other electrical equipment, to STANDARD ENGINEERING CO., at $203,855. S. Franklin Gardner, Engr.-in-Charge.

✚**Shelby, Ohio**—Contract for a municipal electric-light and heating plant awarded to JOSEPH L. SKELDON, Toledo.

Mt. Pleasant, Mich.—City Council considering the purchase of plant and equipment of the Consolidated Light & Power Co.

Ashland, Wis.—Plans being prepared by Henry Wildhagen, Arch., for new electric-light plant for Ashland Light, Power & St. Ry. Co. Estimated cost, $75,000.

Davenport, Iowa—City Council granted permission to People's Lighting Co. to lay pipe for entire new steam heating system in the business section.

Jolley, Iowa—Council contemplates a municipal electric-light plant.

Maquoketa, Iowa—Citizens will vote Sept. 28 on franchise for the newly organized Consumers' Electric Co. L. B. Carson is interested.

Redwood Falls, Minn.—Wherland Electric Co. contemplates enlargement of its plant. R. F. Wherland, Secy. and Mgr.

Slayton, Minn.—Slayton Power Co. will enlarge its plant. Equipment will include 100-hp. engine, either oil, steam or gas-producing, generator and switchboard, and six miles of transmission line. F. H. Eddy is Mgr.

Marion, Kan.—Plans completed for a municipal power house to replace one recently destroyed by fire. Estimated cost, $5,000.

Milan, Kan.—City Council has engaged Nathan L. Jones, Smith Bldg., Wellington, to prepare plans for contemplated municipal electric-light plant.

Laurel, Neb.—Citizens voted to issue $12,000 bonds for a municipal electric-light plant.

Mason City, Neb.—Bids will be received until Sept. 17 by John T. Wood, Village Clk., for a brick power station, 25-hp. oil engine, 15-kw., 125- to 250-volt direct-current generator, switchboard and storage battery.

Towner, S. D.—C. S. Rygh, Alexandria, Minn., has asked a 20-year franchise for an electric-light plant, city to have the privilege of purchasing plant at the end of that period.

Leola, S. D.—Town contemplates an electric-lighting system.

Alexander, N. D.—Citizens contemplate an electric-light system.

Flaxton, N. D.—Franchise granted to Harley E. Potter, Bowbells, N. D., for electric-light plant.

Douglas, Wyo.—Franchise granted to H. G. Hess for gas plant. Plans being prepared. Estimated cost, $50,000.

✚Canyon, Tex.—Contract for heating and plumbing equipment in West Texas Normal School awarded to DONNELLY & WHITE, at $63,318.

✚Denton, Tex.—Contract for power plant for North Texas Normal School awarded to J. A. JOHNSON at $12,700; contract for heating and plumbing awarded to KENNISON BROS., at $14,327.

Spire, Okla.—Bonds for $10,000 sold for a gas plant and laying mains.

Pocatello, Idaho—North American Power & Light Co. purchased plant of Pocatello Gas Co. and will expend about $100,000 to enlarge and improve it. William A. Baehr, Gen. Mgr.

Albion, Utah—Citizens voted $8,000 bonds for light and power plant.

Calexico, Calif.—Plans being prepared by Holton Power Co. for new substation to replace present one. W. F. Holt, Redlands, Pres.

✚Hull, Que.—City Council awarded contract for hydro-electric plant to CANADIAN GENERAL ELECTRIC CO., 23 Sparks St., Ottawa, Ont., at $38,840.

Beeton, Ont.—Town Council contemplates purchase of new boilers and power house equipment. Joseph Wright, Clk.

Brigden, Ont.—C. C. Watson, Brigden, preparing plans for improving electric-light plant including new engine, dynamo and other equipment. Estimated cost, $10,000.

Chatham, Ont.—Reported that J. G. Jackson, Mgr. of Chatham Hydro-Electric System, has recommended purchase of electrically-operated equipment for water pumping station.

Granton, Ont.—Town Council plans a new hydro-electric system. Cost, about $5,000. W. D. Stanley, Clk.

St. Thomas, Ont.—Hydro-Electric Commission will build new power house and transmission station on Gas St.

BRIDGES

✚Berlin Mills, N. H.—City awarded contracts for reinforced-concrete bridge to H. P. CUMMINGS CONSTRUCTION CO., Ware, Mass., for masonry, and to BOSTON BRIDGE WORKS, 47 Winter St., Boston, Mass., for steelwork. Cost, $25,000.

Holyoke, Mass.—Reported that city will build new bridge over tracks of Boston & Maine R.R. at foot of Dwight St. T. J. McCarthy, City Engr.

✚Salem, Mass.—City Council awarded contracts for abutments and piers of a bridge across the South River to GEORGE T. RENDLE, Boston, at $28,404.

★✚Bridgeport, Conn.—Bids for the concrete girder bridge with double-leaf bascule span at Stratford Ave. received Sept. 5 as follows: Toole & Sunderlin, Bridgeport, $468,570; Empire Construction Co., New York, N. Y., $469,198; H. P. Converse Co., Boston, $471,483. Bids for bascules only were: Toole & Sunderlin, $91,753; Strebel Steel Construction Co., $95,800; Empire Construction Co., $109,265. Noted July 22 and Aug. 19.

✚Hartford, Conn.—(Official)—Board of Contract and Supply awarded contract for three-span, reinforced-concrete bridge over Park River at Capitol Ave. to W. T. RYAN CONSTRUCTION CO., 129 Barker St., Hartford, at $39,420. Noted Aug. 26.

Hartford, Conn.—Bids will be received until 11 a.m., Sept. 21, by Board of Contract and Supply for reinforced-concrete bridge at Montowese St. R. N. Clark, City Engr.

Buffalo, N. Y.—Common Council opened bids Sept. 3 for rebuilding Chicago St. Viaduct as follows, (a) complete in six months, (b) complete in nine months: Lackawanna Bridge Co., Buffalo, (a) $211,000, (b) $209,500; Lupfer & Remick, Buffalo, (a) $198,500, (b) $197,500; American Bridge Co., Buffalo, (a) $204,500, (b) $202,900; Strobel Steel Construction Co., Chicago, Ill., (a) $184,700, (b) $183,000. Noted June 24.

Montgomery, N. Y.—Town taxpayers defeated an appropriation of $4000 for a bridge across Tin Brook in Town of Walden.

New Brunswick, N. J.—(Official)—Bids will be received until 2 p.m., Sept. 20, by Edward Burt, County Collector, for $69,000 bridge bonds.

Curwensville, Penn.—Reported that Clearfield & Mahoning R.R. will build a bridge over Anderson Creek near Curwensville.

✚Doylestown, Penn.—Commissioners of Bucks County awarded contract for bridge over Trout Run and one over Fall Creek to S. J. CLARK, Morrisville.

Harrisburg, Penn.—(Official)—Citizens will vote at November election on $300,000 bonds for viaduct over tracks of Pennsylvania R.R. at Walnut St. Noted July 8.

✚Lebanon, Penn.—City Council awarded contract for three concrete bridges and one iron girder bridge to FRICK & SONS, Guilford St., Lebanon, at $5860. Noted Aug. 12.

Philadelphia, Penn. — State Water - Supply Commission granted permission to the city to build a bridge across Frankford Creek at Torresdale Ave. M. L. Cooke, Comr. of Pub. Wks.

✚Uniontown, Penn.—Commissioners of Fayette County awarded contracts for bridge work as follows: CONNELLSVILLE IRON WORKS, steel superstructures of bridge over Middle Run at Gates in German Township, and bridge over Dunlap's Creek at Merrittstown in Luzerne Township; LOUIS COSTA, Dickerson Run, substructure of Merrittstown Bridge, and bridge over Dickerson Run at Vanderbilt; J. M. RAMAGE, Uniontown, bridge at Gates. Noted Aug. 12.

Chester, Va.—Chester & City Point Electric Ry. Co., H. D. Eichelberger, Pres., contemplates a 185-ft. drawbridge across the Appomattox River.

Beaufort, S. C.—(Official)—Bids will be received until 10 a.m., Oct. 12, by W. H. Hull, Secy., County Bd. of Comrs., for repairs to two piers of Whale Branch Bridge, and for new 120-span steel or concrete highway bridge between St. Helena and Ladies Islands. Shand Engineering Co., Columbia, S. C., Engr.-in-Charge.

Macon, Ga.—(Official)—Central of Georgia Ry. will build concrete subway to carry Pine St. under its tracks. Estimated cost, $81,000. Noted Sept. 2.

✚Johnsonville, Tenn.—(A correction)—Nashville, Chattanoga & St. Louis Ry. awarded contract for the superstructure of a steel drawbridge over the Tennessee River to LOUISVILLE BRIDGE AND IRON CO., Louisville, Ky., and contract for erection of the bridge to GOULD CONTRACTING CO., Nashville. Noted Sept. 2.

Eaton, Ohio—Bids will be received until noon, Sept. 25, by G. W. Rehfuss, Audr., Preble County, for substructure and superstructure of bridge over Little Creek on the new Parrish and Eldorado Rd. near Mackey and Braggs, Jefferson Township.

New Lexington, Ohio—(Official)—Board of Commissioners, Perry County, to build bridge over South Fork of Jonathan Creek on New Lexington and Zanesville Inter-County Rd. at Stringtown in Harrison Township. Clyde M. Foraker, County Audr.

✚Portsmouth, Ohio—Commissioners of Scioto County awarded contract for floor and approaches of new Scioto County Bridge to COLEGROVE & WEST, at $16,410.

Indianapolis, Ind.—Council of Marion County will be asked, at its September meeting, to appropriate the sum of $100,000 for bridge over Fall Creek at Senate Ave.

Detroit, Mich.—Lowest bid received for the temporary Belle Isle Bridge was that of Bohland Structural Steel Co., Detroit, at $43,075. Noted Aug. 19.

✚Grand Rapids, Mich.—(Official)—Contract for bridge over tracks of Grand Trunk Ry. at College Ave., N. E., awarded to D. W. BOYES, Grand Rapids, at $12,908. Noted Sept. 9.

Benton, Ill.—Bids will be received until 1 p.m., Sept. 17, by State Highway Commissioner, Springfield, for four bridges in Franklin County, 30 to 75 ft. long. George F. Hampton, Benton, County Supt. of Highways.

✚Carlinsville, Ill.—(Official)—State Highway Commission, Springfield, awarded contract for the Sitton Bridge in County Line Township, Macoupin County, to ILLINOIS STEEL BRIDGE CO., Jacksonville, at $6430.

✚Chippewa Falls, Wis.—Contract for a double-arch reinforced-concrete bridge at East Spring St. awarded to THOMAS E. WOOLEY, LaCrosse, at $7,947.

Grand Rapids, Wis.—Bids will be received until 1:30 p.m., Sept. 18, by B. M. Vaughn for nine highway bridges in Wood County Drainage District, to be of concrete, reinforced concrete or steel. Estimated cost, $14,000.

✚Orange City, Iowa—(Official)—Supervisors of Sioux County awarded contract for bridge over Sioux River on the state line, two miles below Hudson, S. D., to DES MOINES BRIDGE AND CONSTRUCTION CO., Des Moines, at $7637. Noted Aug. 12.

✚Brainerd, Minn.—(Official)—Commissioners of Crow Wing County awarded contract for three bridges to MINNEAPOLIS BRIDGE CO., Minneapolis, at $4,459 for all three. Noted Sept. 2.

Granada, Minn.—Bids will be received until 8 p.m., Sept. 25, by E. W. Lasby, Village Recdr., for bridge across Center Creek.

✚Auburn, Kan.—Commissioners of Shawnee County, Topeka, awarded contract for bridge over West Wakarusa Creek, one mile from Auburn, to TOPEKA BRIDGE AND IRON CO., Topeka, at $6000.

✚Ellinwood, Kan.—(Official)—Commissioners of Barton County awarded contract for 400-ft. reinforced-concrete bridge across Arkansas River to MISSOURI CONSTRUCTION & BALLAST CO., Eldon, Mo., at $20,642. Noted July 22 and Aug. 19.

Leavenworth, Kan.—Bids will be received until Sept. 28 by J. E. Voorhees, Clk. of Leavenworth County, for 26 bridges. Estimated cost, $30,000. M. Thomas, County Engr.

✚St. Paul, Neb.—Commissioners of Howard County awarded contract for high truss steel bridge across the Loup River to CENTRAL STATES BRIDGE CO., Indianapolis, Ind., at $27,936. Noted July 29 and Aug. 12.

Camden, Ark.—Commissioners of Ouachita County are receiving bids for repairs to Martin Bridge, over Ouachita River. E. B. McCall, County Judge.

Little Rock, Ark.—Reported that Commissioners of Pulaski County will soon ask bids for widening and strengthening the Main St. Bridge.

✚Canadian, Tex.—Commissioners Court of Hemphill County awarded contract for 2,550-ft. bridge across Canadian River to CANTON BRIDGE CO., Kansas City, Mo., at $66,170. Noted Aug. 12.

✚Sherman, Tex.—Contract for 100-ft. bridge over Post Oak Creek near Sherman awarded to WESTERN BRIDGE CO., Sherman.

✚Terell, Tex.—Road Commissioners awarded contract for bridges and culverts to W. W. FULLER at $26,814. Bartlett Ranney, San Antonio, is Engr.-in-Charge.

Enid, Okla.—Bids will be asked about Sept. 27 by County Commissioners for 15 small bridges. Estimated cost, $20,000. Benjamin Lewis is Engr. of Garfield County.

✚Okmulgee, Okla.—Commissioners of Okmulgee County awarded contract for six small bridges to MISSOURI VALLEY BRIDGE & IRON CO., Leavenworth, Kan., at $13,444.

✚Silver City, N. M.—Commissioners of Grant County awarded contract for steel bridge across Gila River near Old Ft. West, to EL PASO BRIDGE & IRON CO., El Paso, Tex., at $15,747. Noted July 29.

Tucson, Ariz.—Plans being prepared for new concrete bridge across Santa Cruz River. Estimated cost, $50,000. J. M. Ruthrauff, City Engr. Noted Nov. 26 and Dec. 3, 1914.

Wallace, Idaho—Plans completed for rebuilding bridges in Shoshone County. Estimated cost, $24,000. E. M. Booth, Boise, State Highway Comr.

✚Igo, Calif.—County Supervisors have awarded contract for reinforced-concrete bridge across Clear Creek to WILLIAM STEPHENS, Redding, at $6,166. Noted July 29.

✚Kennett, Calif.—Supervisors of Shasta County awarded contract for steel bridge across Sacramento River at Kennett to PORTLAND BRIDGE CO., Portland, Ore., at $15,976. City will furnish steel costing $1,750. Noted Aug. 5 under Redding.

✚Kingsburg, Calif.—Contract for bridge across Kings River at Kingsburg awarded to JOHNSON CO., Los Angeles, at $15,780. Noted Aug. 5 under Visalia, Calif.

✚Kincardine, Ont.—Council of Kincardine Township awarded contract for two bridges to DAVID KEYES, Kincardine, at $7,650.

✚Ottawa, Ont.—City Council awarded contract for substructure of Pretoria Ave. Bridge to RODERICK BREWDER, 317 Lyon St., Ottawa. Estimated cost of bridge, $31,000.

WATER SUPPLY—IRRIGATION

Kennebunk, Maine—Filters will be installed by York County Water Co. in Kennebunk, Kennebunkport and Wells. George M. West, Mgr.

✚South Braintree, Mass.—Contract awarded to HAMILTON FLOOD, Wollaston, for extensions to water system. Noted Aug. 12.

✚Windsor, Conn.—Contracts awarded to TIPPETT & WOOD, Phillipsburg, N. Y., at $12,170, for steel stand pipe, to A. LAMBO, Waterbury, at $40,112, for water mains and to F. H. HAYES MACHINERY CO., Boston, Mass., at $5,401, for pump. Noted Sept. 2.

Albion N. Y.—Plans prepared for new water supply at Eagle Harbor. J. F. Witmer, Buffalo, Consult. Engr.

★Jamestown, N. Y.—(Official)—Bids will be received until noon, Sept. 23, by Board of Water and Light Commissioners, for ten 11-in. driven wells, about 185 ft. deep, and for equipment.

✚Manhasset, N. Y.—Contract awarded to W. G. FRITZ CO., Newark, N. J., at $24,422, by Carle Park Water Co. for water system.

New York, N. Y.—(Official)—Bids will be received by the Board of Water Supply, Municipal Bldg., until 11 a.m., Sept. 28, for electrical operating equipment for gang-driven valves and sluice gates at Ashokan, Kensico, Hill View and Silver Lake Reservoirs under Contract No. 11.

Oneida, N. Y.—Report of J. Wagner for soft water supply accepted by Water Commissioners. Estimated cost, $479,000.

✚Rotterdam, N. Y.—Contract awarded to H. J. CORBIN, New York, at $24,690, for pumping station.

Westbury, N. Y.—W. E. Sexton, Mineola, prepared plans for water district in Carle Place. Russel Suther, Conservation Comn., is in favor.

Collingswood, N. J.—Borough Council contemplates water system.

Green Lane, Penn.—Surveys being made for rebuilding Klondike dam.

✚Hatfield, Penn.—Contract awarded to PUGH & HUBBARD CO., Philadelphia, at $8,995 for water plant. Noted Aug. 12.

Philadelphia, Penn.—Bids will be received until Sept. 30 by Department of Public Works for turbo-centrifugal pumps at Shawmont Pumping Station and stokers' equipment at Queen Lane Pumping Station.

Reynoldsville, Penn.—Citizens voted $100,000 bonds for purchase or construction of water system. Noted Sept. 2.

★Tamaqua, Penn.—(Official)—Bids will be received until noon, Oct. 5, by John M. Harris, Comr. of Water-Wks., for reservoir in Owl Creek, Rahn Township. Noted Aug. 12.

✚Youngsville, Penn.—Contract awarded to L. A. COATES & CO., Warren, at $22,000, for water-works.

Easton, Md.—Plans being prepared by Public Utilities Commission of Easton for improvements to pumping station. Estimated cost, $5,000.

Keyser, W. Va.—Citizens defeated bond issue of $35,000 for water system. Noted Aug. 5.

Wilson, N. C.—Bonds for $95,000 will be sold Sept. 20 for water mains. T. A. Hinnant, Clk. Bd. Town Comrs.

Coolidge, Ga.—(Official)—W. Hopson Goodloe, Engr., Macon, retained to prepare plans for water system and improvements to electric-light system.

✚Macon, Ga.—Contract awarded to SCHOFIELD IRON WORKS, Macon, at $5,100, for 180,000-gal. stand pipe.

Mt. Dora, Fla.—City Council will be petitioned by F. L. Barrett, Houghton, Mich., for franchise for water system.

Kosciusko, Miss.—Bonds for water and light systems voted. M. L. Culley, Jackson, Engr. W. G. Campbell, Mayor.

Oakdale, La.—City contemplates water system. R. E. L. Ricketts, Secy. of Comm.

Benton, Tenn.—Citizens will vote Oct. 30 on $10,000 bonds for water system. E. T. Switzer, Pres.

✚Maryville, Tenn.—Contract awarded to SOUTHERN CONSTRUCTION CO., Kansas City, Mo., at about $51,000, for water system.

Bellville, Ohio—(Official)—Bids will be received until Nov. 9 by the city for water system. Smith & Boulay Co., Toledo, Engr. G. Shaffer, Clk. Noted Aug. 26.

Brewster, Ohio—Bids will be readvertised for water system. Estimated cost, $21,000. Noted Sept. 2.

Cleveland, Ohio—Hydraulic Pressed Steel Co. will build pump house at 3020 East 61st St. Estimated cost, $5,000.

Farmersville, Ohio—(Official)—Bids will be received about Sept. 20 for water system. A. F. Gilbert, Clk. Noted Aug. 26.

✚Miamisburg, Ohio—Contract awarded to W. C. KERCHNER CO., Dayton, at $9,626, by Bd. of Public Affairs for water mains in Sennett St. and West Side.

✚Napoleon, Ohio—Contract awarded to G. W. DOERZBACH & CO., Sandusky, at about $35,000, for new filtration plant.

✚Silverton, Ohio—Contract awarded to JOHN KOEHL, Reading, for 6-in. water main in Alta Ave. and other streets.

Weston, Ohio—Citizens will vote Nov. 2 on bonds for water system.

Wilberforce, Ohio—(Official)—Bids will be received until 10 a.m., Oct. 1, by Board of Trustees, for improvements to water system. Richards Engineering Co., Wilberforce, Engr. W. A. Galloway, Pres.

Cairo, Ill.—City contemplates purchasing plant of Cairo Water Co. Estimated cost, $342,000.

Sparta, Ill.—Contract awarded to CARSON-PAYSON CO., Danville, at $17,000, for pumping and filtration plants. Noted Aug. 19.

Marcus, Iowa—Citizens voted in favor of $25,000 bonds for completion of water system.

✚Shenandoah, Iowa—Contract awarded to DES MOINES BRIDGE & IRON WORKS, Des Moines, at $12,300, for 400,000-gal. tank and tower.

Traer, Iowa—(Official)—Bids will be received until 8 p.m., Sept. 20, by T. F. Stoakes, Town Clk., for 200,000-gal. concrete storage reservoir and water mains. Charles P. Chase, Clinton, Engr. Noted Aug. 19.

Urbana, Iowa—(Official)—Bids will be received until 7 p.m., Sept. 20, by city for 60,000-gal. tank on 100-ft. steel tower and about 2,200 ft. of water mains, and pumping station. Ralph B. Slippy, Waterloo, Engr. J. Dean Burrell, Town Clk.

Carlton, Minn.—Plans prepared by Ferguson Engineering Co. for water system. Noted Sept. 9.

St. Cloud, Minn.—Plans have been prepared by C. H. West, City Engr., for extensions to water system.

Fromberg, Mont.—Bids will be received until Sept. 18 by C. J. Jones, Village Clk., for water system. B. C. Lillis, Billings, Engr. Estimated cost, $17,000. Noted July 29.

✚Judith Gap, Mont.—Contract awarded to C. H. KELLEY, Judith Gap, at $13,855, for water and sewer systems.

Plattsburg, Mo.—Citizens voted $50,000 bonds for improvements to water system and for three sewage-disposal plants. E. B. Murray, 820 Walnut St., Kansas City, Engr. Noted Aug. 19.

Lancaster, Tex.—Election will be held Sept. 27 to vote on $15,000 bonds, for water and sewer systems. J. V. Griffin, Mayor.

Lufkin, Tex.—City contemplates $4,000 for improvements to water system. H. B. Satterfield, Secy.

Albion, Idaho—Bonds for water system will be sold Sept. 25. Thomas E. Harper, Village Clk.

Salt Lake City, Utah—Plans being prepared for dam in Parley's Cañon for water storage. Estimated cost, $100,000.

Aberdeen, Wash.—(Official)—City will build water system. P. F. Clark, City Clk. Noted Aug. 19.

✚Harrington, Wash.—Contract awarded to SAWYER BROS., Spokane, at $10,000, for water and sewer systems.

Raymond, Wash.—Raymond Water Co. purchased by city. Plans being prepared for extensions. Estimated cost, $10,000.

Ridgefield, Wash.—(Official)—We have been advised that election will be held in fall for $10,000 bonds for water system. J. W. Blackburn, Town Clk. Noted Sept. 2.

La Grande, Ore.—Dam at intake of Beaver Creek will be built by day labor. L. F. Howland, City Engr. Estimated cost, $10,000.

✚Arcadia, Calif.—(Official)—Contract awarded to R. F. WARE, 1001 Marsh Strong Bldg., Los Angeles, for backfilling 20 miles of water main trenches. Noted Aug. 26.

Oakdale, Calif.—Oakdale and South San Joaquin Irrigation Districts plan reservoir. Estimated cost, $1,250,000.

San Rafael, Calif.—Citizens of Marin County voted $3,000,000 bonds for purchasing water systems in southern part of county. Noted July 29.

Santa Monica, Calif.—City plans to purchase water companies at estimated cost of $712,000. Election will be held Dec. 7.

St. Hyacinthe, Que.—City will install two pumps, boilers, motors at water-works. H. E. Wardroper, Clk. Estimated cost, $75,000.

Chatham, Ont.—City will install two electrically driven centrifugal pumps of 2,000,000 and 3,000,000 gal. capacity at water-works. Estimated cost, $4,000.

Galt, Ont.—Citizens voted $40,000 bonds for water system.

Owen Sound, Ont.—Council contemplates spending $5,000 for high pressure water main from Eighth St. west to 14th St. Charles Gordon, Clk.

Stratford, Ont.—City Council has authorized steel standpipe and pumping plant. Estimated cost, $50,000. Noted June 17.

Prince George, B. C.—Citizens voted in favor of $80,000 bond issue for water system. Noted Sept. 9.

SEWERS

✚Amherst, Mass.—Contract awarded to JAMES L. BRINE, Boston, for south outlet of river sewer system; contract for pipe to R. D. WOOD & CO., Philadelphia.

East Gardner, Mass.—(Gardner post office)—All bids received Aug. 18 for sewer system for Gardner State Colony by State Board of Insanity, State House, Boston, have been rejected. Work will be done by superintendent. Noted Aug. 12.

Leominster, Mass.—Plans being prepared by John J. Van Valkenberg, Framingham, for sewage-disposal plant.

Southington, Conn.—Citizens voted $25,000 bonds for completing sewer system.

Brockport, N. Y.—(Official)—Bids will be received until 8 p.m., Sept. 17, by Board of Trustees for sewage-disposal works. Charles C. Hopkins, Cutler Bldg., Rochester, Engr. Estimated cost, $25,000. Noted Aug. 9 and Sept. 9.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received Sept. 8 for repairs to Foster Ave. sewer as follows: Pelgrine Construction Co., $2,052; D. J. Donlin, $3,150, and O'Conner Co., $3,700, and for sewer basin at E. 13th St. and Ave. P, Murphy Bros., 25th St. and Cropsey Ave. Brooklyn, 4%. Noted Sept. 2.

✚New York, N. Y.—(Borough of Brooklyn)—(Official)—Contracts awarded to FRANK MERRIDINO, 556 A 17th St., Brooklyn, for sewers in Glenmore and Railroad Ave., Pine and Hemlock St., William and Vienna Ave., and West St., and to MURPHY BROS., 25th St. and Cropsey Ave., Brooklyn, for sewers in New Jersey and Hegeman Ave. Noted Sept. 9.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by C. B. J. Snyder, Supt. School Bldgs, Park Ave. and 59th St., until 3 p.m., Sept. 20, for sewers and water mains at Manhattan Trade School for Girls, Lexington Ave. and East 22nd St.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received Sept. 9 for sewer in Ellwood as follows: Walton Contracting Co., 147 East 125th St., New York, $4,939; Di Minno & De Blasio, $4,997 and Briggs & McLaughlin, $4,984. Noted Sept. 2.

New York, N. Y.—(Borough of Richmond)—Bids were received Sept. 7 for sewage-disposal plant at Richmond County Jail: Joseph Johnsons Sons, 455 Broadway, West New Brighton, Borough of Richmond, $4,434; J. E. Donovan, $6,691; F. N. Lewis, $5,373. Noted Sept. 2.

Seaside Park, N. J.—Bids will be received until Sept. 24 by Borough Council for sewers and disposal plant. Remington & Vosburg, 501 Market St., Camden, Engr. Frank Brockway, Clk.

✚South Orange, N. J.—(Official)—Contract awarded to PASQUALE MAURIELLO, 122 Center St., Orange, at $11,000, for sanitary sewers in Milburn Ave. Noted Aug. 19.

✚Philadelphia, Penn.—Contracts awarded to FRANK MARKS CONSTRUCTION CO., at $65,000, for extension of Gunner's Run relief sewer in Indiana St. and to ROBERT HIGGINS, at $27,000, for sewer in Adams Ave.

✚Philadelphia, Penn.—Contract awarded to R. P. BENNIS CONSTRUCTION CO., Philadelphia, at $18,500, for sewer in Broad St. from 68th to 69th St.

Philadelphia, Penn.—Plans completed for improving sewage-disposal system for Oak Lane District. George N. Webster, Ch. Bureau of Surveys. Estimated cost, $91.500.

Rockville, Md.—Ezra B. Whitman, Fidelity Bldg., Baltimore, retained to prepare plans for sewer systems in Friendship Heights, Somerset, Drummond, Bethesda, Woodmont, Edgewood and Chevy Chase. Estimated cost, $83,000.

Richmond, Va.—Administrative Board contemplates expenditure of $47,000 for completing sewer system in Scott's Addition. Charles E. Bolling, City Engr.

Suffolk, Va.—Council contemplates issuing $70,000 bonds for sewer system, paving, school and fire department.

Keyser, W. Va.—Citizens defeated $35,000 bonds for sewer in New Creek. Noted Aug. 5.

✚Asheville, N. C.—Contract awarded to REED & WELLS for three lines of sewers.

✚Winston-Salem, N. C.—Contract awarded to L. B. BRECKENSTEIN, at $5,500 for sewers in West Salem sewer district. Noted Sept. 9.

Columbia, S. C.—Election will be held Oct. 5 to vote $300,000 bonds for sewers.

Greer, S. C.—Citizens voted $10,000 bonds for extending sewer system.

Athens, Ga.—City contemplates septic tank for sewer system. J. W. Barnett, City Engr.

Miami, Fla.—Bonds for $50,000 for sewers and streets sold. Noted Aug. 19.

✚Hammond, La.—(Official)—Contract awarded to J. R. SUTHERLIN & CO., Kansas City, Mo., at $40,000, for sewer system. Noted Sept. 2.

New Iberia, La.—Election will be held to vote $100,000 bonds for sewer system. Noted Aug. 26.

Lexington, Ky.—Election will be held in November to vote $350,000 bonds for sewer system. J. Ernest Cassidy, Mayor.

Akron, Ohio—(Official)—McAlonan Bros., Akron, low bidder at $4,110, for sewer work. J. A. Gehres, City Engr. Noted Aug. 19.

Cincinnati, Ohio—Bids will be received until noon, Sept. 24, by Philip Fosdick, Dir. of Pub. Ser., for sewer in Duck Creek, Intercepter No. 3.

✚Cleveland, Ohio—Contract awarded to BROOKSIDE CONSTRUCTION CO., at $17,529, for sewer in Bessemer Ave., S. E., and in East 65th St.; contract also to MANSON CO., at $67,282, for sewers.

✚Cleveland, Ohio—(Official)—Contract awarded to GREAT LAKES DREDGE & DOCK CO., Williamson Bldg., at $92,900, for concrete open channel outfall sewer about 3,600 ft. long. Noted Sept. 2.

Cuyahoga Falls, Ohio—Council will build sanitary sewers and laterals in Stow, Front and East Broad St.

Glendale, Ohio—(Official)—Bids will be received until noon, Sept. 27, by Ernst Von Bargen, City Pur. Agt., for sewage-disposal system for Boys' Opportunity Farm.

Lancaster, Ohio—Plans for sewers in Cherry St. and Bank Alley submitted to Council. Jacob Lutz, Chn. Sewer Com.

Sandusky, Ohio—E. Wagner, City Engr., recommends building intercepting sewer No. 2 Estimated cost, $98,000.

Springfield, Ohio—Press reports state bids will be received about Sept. 25 for storm sewer in Lowry Ave. Estimated cost, $6.500. Noted Sept. 9.

Toledo, Ohio—Bids will be received until noon, Sept. 24, by Charles J. Zanenbacher, Audr., Bd. of Lucas County Comrs., for local sanitary sewer No. 12 in Sub-district No. 1.

✚Toledo, Ohio—Contract awarded to CLEVELAND CONTRACTING CO., at $4,578, for five sewers and to GESSNER & COTHRED, at $5,210, for one sewer. Noted July 29.

Peru, Ind.—Plans prepared for Tippecanoe St. sewer.

Ann Arbor, Mich.—(Official)—Bids will be received until Sept. 22 by Board of Public Works for 17,500 ft. of 8- to 12-in. and 2,500 ft. of 15- to 36-in. sewers and 1,300 ft. of concrete culvert. Manley Osgood, City Engr.

New Baltimore, Mich.—Citizens contemplate sanitary and storm water sewer systems. C. F. Meeks, Health Officer.

Alton, Ill.—City plans East Side trunk sewer.

✚Christopher, Ill.—Contract awarded to C. M. HANES, Jerseyville, at about $50,000, for sewer system.

Ashland, Wis.—Bids being received by Board of Public Works for 4,200 ft. 8-in. vitrified pipe sewer.

✚Racine, Wis.—Contract awarded to E. R. HARDING & CO., for sewers in various streets. Noted Aug. 19.

Ames, Iowa—Bids will be received until 7 p.m., Sept. 20, by A. B. Maxwell, City Clk., for 20,000 ft. of storm sewers in various streets, and for purchase of 11,000 ft. of vitrified clay sewer pipe. Noted Aug. 12.

✚Decorah, Iowa—Contract awarded to MOORE-SIEG CONSTRUCTION CO., Waterloo, at $101,789, for sewer system and sewage-disposal plant. F. M. Hughes, City Clk.

Lyle, Minn.—Bids will be received until Sept. 27 by Village Council for 12,246 ft. of 8- to 15-in. sewers. G. A. Martin, Village Recdr.

✚Chanute, Kan.—Contract awarded to SOUTHERN CONSTRUCTION CO., Wichita, at $23,917, for sewage-disposal plant. Noted Aug. 12 and Sept. 2.

✚Hutchinson, Kan.—Contract awarded to EVERETT & BURKE, at $4,668, for two miles sewers. Noted July 29.

✚Independence, Kan.—Contract for sewer system awarded to GREEN & CULLEN, Independence, at $6,637. George E. Weaver, City Engr.

✚Crofton, Neb.—Contract awarded to SCHREIBER & PETERSON, Bee Bldg., Omaha, at $6,553 for sewer system and disposal plant. Noted Aug. 19.

✚Norfolk, Neb.—Contract awarded to NORFOLK BRIDGE AND CONSTRUCTION CO., Norfolk, at $15,000, for storm sewers.

Minot, N. D.—Plans prepared for storm sewers in various streets. Estimated cost, $13,708.

✚Judith Gap, Mont.—See item under "Water Supply-Irrigation."

Austin, Tex.—Citizens contemplate issuing $50,000 bonds for sewers.

Beaumont, Tex.—Citizens voted $40,000 bonds for sewers.

Lancaster, Tex.—Election will be held Sept. 27 to vote $15,000 bonds for extending sewer and water systems. J. V. Griffin, Mayor.

Weleetak, Okla.—Citizens voted $37,000 bonds for sanitary sewer system.

Seattle, Wash.—Bids will soon be received for sewers in North and West 48th St. Estimated cost, $10,435. Noted Sept. 19.

Seattle, Wash.—Council contemplates sewers in Block 69, Mt. Baker Park. A. H. Dimock, City Engr.

Marysville, Calif.—Bonds for $18,000 voted for sanitary improvements in Ellis Lake district.

✚San Francisco, Calif.—Contract awarded to F. OLANDI, at $29,554, by Board of Public Works for sewer in Islais Creek.

Montreal, Que.—City Council contemplates appropriating $10,000 for preparation of plans for trunk sewer. Estimated cost, $1,500,000.

Berlin, Ont.—Plans being prepared by Herbert Johnston, Berlin, for sewer extensions. Estimated cost, $75,000.

Preston, Ont.—Plans being prepared for sanitary sewer in King St. H. G. Edgar, Clk.

GARBAGE

Greystone Park, N. J.—Bids will be received until Sept. 22 by O. M. Bowen, Warden, New Jersey State Hospital, for incinerator.

Morris Plains, N. J.—Bids will be received until 11 a.m., Sept. 22, by Board of Managers of New Jersey State Hospital, for incinerator.

Americus, Ga.—City contemplates building incinerator.

✚Rock Island, Ill.—It is reported contract awarded to SPARKS CREMATORY CONSTRUCTION CO., Memphis, Tenn., at $12,200 for incinerator. Noted Aug. 26.

Marble Falls, Tex.—City will build incinerator.

STREETS AND ROADS

Augusta, Maine—James McGregor, Rumford, at $11,883, submitted lowest bid for 2.1 miles of state highway in Poland.

Boston, Mass.—Bids will be received until Sept. 21 by State Highway Commission, 15 Ashburton Pl., for 12,400 lin.ft. of road in Granby and South Hadley. Arthur W. Dean, Ch. Engr.

Boston, Mass.—Bids will be received until noon, Sept. 24, by Park Board for grading, walks, etc., in Renah Park, Dorchester.

Boston, Mass.—Bids will be received until noon, Sept. 20, by Edward F. Murphy, Comr. of Pub. Wks., for artificial stone sidewalks on Cushing Ave., Jerome St. and Windermere Rd., Dorchester.

Boston, Mass.—Bids will be received until Sept. 16 by Board of Public Works for paving Montebello Rd., West Roxbury.

+Boston, Mass.—State Highway Commission awarded contract for highway in Ware and Palmer Townships to PERINI CONSTRUCTION CO., Ashland, at $11,772. Noted Aug. 26.

Hartford, Conn.—Bids will be received until 2 p.m., Sept. 22, by State Highway Commission for the following state road improvements: Colebrook Township, 7,600 lin.ft.; Orange Township, 13,805 lin.ft.; Stamford Township, 30,080 lin.ft.; North Haven Township and City of New Haven, 10,418 lin.ft.; Newington Township, 5,400 lin.ft.; Brookfield Township, 16,850 lin.ft.; Litchfield Township, two sections macadam on Torrington Rd. Charles J. Bennett, State Highway Comr.

Dobbs Ferry, N. Y.—Town voted $150,000 bonds for paving with brick Albany Post Rd. through town.

New York, N. Y.—(Borough of Richmond)—(Official)—Bids were received Aug. 24 by Calvin D. Van Name, Borough Pres., for sidewalks as follows: Joseph Johnson Sons, $24,183; C. Vanderbilt, $21,986; J. E. Donovan, $21,779. Noted Aug. 19.

+Potsdam, N. Y.—Contract for paving Depot St. awarded to ARTHUR McCONVILLE, Ogdensburg, at $6,000.

+Utica, N. Y.—Contract for concrete pavement in Kenyon Court awarded ROBERTS & CO., Utica.

Yonkers, N. Y.—(A correction)—We have been advised that it was O'Rourke Contracting Co., Inc., 12-14 North Broadway, Yonkers, instead of O'Rourke Construction Co., which was awarded contract for paving Park Ave. Noted Sept. 9.

+East Orange, N. J.—Board of Chosen Freeholders of Essex County awarded contract for resurfacing Central Ave. with bitulithic to NORTHERN CONSTRUCTION CO. at $56,975. Noted Aug. 26.

Montvale, N. J.—Bids will be received by J. Ernest Thier, Mayor, until Sept. 17 at School No. 2 for improving Magnolia and Grand Ave.

+Newark, N. J.—JOHN DORER, Irvington, at $6225, awarded contract for rebuilding Main St. from Millburn line to Morris Ave.

+Nutley, N. J.—Board of Chosen Freeholders of Essex County awarded contract for bitulithic paving on Washington Ave. to STANDARD BITULITHIC CO., Newark, at $76,489. Noted Aug. 26.

Ardmore, Penn.—Commissioners of Lower Merion Township appropriated $50,000 for road construction and repairs in that township.

+Fayette City, Penn.—Borough Council awarded contract for 2600 ft. brick paving on Connellsville Ave. to CROSSAN CONSTRUCTION CO., Brownsville, at $9516.

+Pittsburgh, Penn.—(Official)—Controller of Allegheny County awarded contracts for road improvement as follows: J. W. BUTLER, Elizabeth, Lincoln Way Extension, Elkhorn and Monongahela City Rd.; JOHN F. HOWLEY & CO., Pittsburgh, Round Hill Rd.; RIDGE BROS. CO., Pittsburgh, Scotia Hollow Rd. Noted Sept. 2.

+Saxonburg, Penn.—(Official)—Contract for improving Main St. awarded to HARRY HALL & CO., Homestead, Penn., at $12,765. Noted Sept. 2.

Baltimore, Md.—Commissioners for Opening Streets submitted plans to Board of Estimate for establishment of Ellicott Driveway. Estimated cost, $69,100.

Baltimore, Md.—Commissioners plan to widen St. Paul St. from Courthouse to Hamilton St.

Portsmouth, Va.—F. H. Murray, Engr., State Highway Comn., Richmond, submitted cost of improving four toll roads with concrete and gravel at $134,600; macadam, gravel and sand clay, $198,600.

+Vinton, Va.—Contract for 2,500 lin.ft. cement sidewalk awarded to TINSLEY CONSTRUCTION CO., Roanoke.

Janelew, W. Va.—Citizens voted to issue $15,000 bonds for improving streets and roads. Noted Aug. 19.

Parkersburg, W. Va.—City sold $200,000 bonds for street improvements.

Pineville, W. Va.—Citizens voted to issue $550,000 bonds for constructing roads in Wyoming County.

+Asheville, N. C.—Contract for 9000-ft. sidewalk on Maywood and Beverly St. awarded to REED & WELLS.

Newbern, N. C.—Craven County voted to issue $100,000 bonds for roads. Noted Aug. 19.

+Winston-Salem, N. C.—Contract for grading street in Buena Vista County awarded to SHORE TRANSFER CO., Winston-Salem.

Miami, Fla.—County will vote on issuing $275,000 bonds for county's portion of Tamiami Trail.

St. Petersburg, Fla.—Citizens voted to issue $715,000 bonds for highways.

+Grove Hill, Ala—Contract for two roads in Clarke County awarded to CENTRAL ALABAMA CONSTRUCTION CO., at $15,579. Noted Aug. 19.

Scottsboro, Ala.—Bids will be received until Sept. 25 by the Commissioners of Jackson County for grading part of Woodville and Limrock Rd. Estimated cost, $11,158.

Jennings, La.—Jefferson Davis Parish, Ward No. 2, will vote Oct. 19 to issue $125,000 bonds for roads.

Natchitoches, La.—Ward Nine, Road District No. 13 voted to raise $50,000 for gravel road through the ward.

Plaquemine, La.—Iberville Parish Police Jury will issue $16,000 bonds for roads.

Decatur, Tenn.—Meigs County Commissioners will issue $100,000 bonds for road from Decatur to adjoining counties.

+Greeneville, Tenn.—Contract for asphaltic concrete paving awarded to SOUTHERN ASPHALT & CONSTRUCTION CO., Birmingham, Ala., at $60,000.

Memphis, Tenn.—Bids were received for improving South Main St. between Linden and Calhoun Ave., as follows: Koehler Bros.-Fowler Construction Co., $22,204; E. J. Wetterstrom, $22,563; M. E. Larkin, $22,748. Noted Aug. 1.

Rogersville, Tenn.—(Official)—All bids rejected for sale of $250,000 bonds. New bids will be received Oct. 2. Noted Sept. 2.

Albany, Ky.—Citizens will issue $50,000 bonds for roads in Clinton County.

Bardwell, Ky.—Contract will soon be awarded by Commissioners of Carlisle County for six miles of proposed Bardwell-Mayfield Rd. E. C. Walker, Jr., Clinton, Engr.

+Glasgow, Ky.—Contract for four-mile rock road in Barren County awarded to J. H. NEWMAN, Tompkinsville, and C. S. DAVIS, Nashville, Tenn., at $13,386.

Hindman, Ky.—City will vote on issuing $30,000 bonds for macadam streets.

Hyden, Ky.—Citizens will vote Oct. 23 on issuing $75,000 bonds for a road from Hyden to Hazard.

Somerset, Ky.—Citizens of Pulaski County will vote to issue $200,000 bonds for roads.

+Akron, Ohio—Contract for paving highways in Norton Township awarded to McALONAN BROS., at $30,000.

Bexley, Ohio—Bids will be received until noon, Sept. 27, by Chester A. Miller, Clk., for paving Ridge Ave. Jennings, Lawrence & Lindsay, 509 Hartman Bldg., Columbus, Engr.

Cadiz, Ohio—City Council awarded contract for paving several streets with brick to COSS & MEYER, Wheeling, W. Va., at $14,877.

+Columbus, Ohio—Service Director awarded contracts for street improvements as follows: MONARCH CONSTRUCTION CO., Como Ave., brick, $15,959; ANDREWS ASPHALT PAVING CO., asphalt, Reynolds Ave., $6757; New York Ave., $9460; Sheldon Ave., $13,365; A. W. BURNS & CO., brick, Perry St., $5573; Kent St., $8590; Wall St., $10,423; Blenkner St., $4163; GEORGE GEIGELE & SON, brick, alley north of Tiffin St., $1450; Avon Court, $2248; CLEVELAND TRINIDAD PAVING CO., asphalt, Main St., $8114; A. G. PUGH, asphalt, Forrest St., $44,547.

Dayton, Ohio—Bonds for $70,000 will be sold Sept. 21 for improving Eaton and Old Troy Pikes.

+Eaton, Ohio—Contract for tarvia pavement on West Main St. awarded to H. W. CURRY & CO., Eaton, at $6200.

Findlay, Ohio—Bids will be received by J. C. Copeland, County Clk., until noon, Oct. 2, for repair of county road.

+Girard, Ohio—Contract for paving East Main St. awarded to TURNER & OLSEN CO., Youngstown, at $12,500.

Ironton, Ohio—(Official)—City will sell $14,000 bonds Oct. 7 for improving streets in District No. 11.

Lisbon, Ohio—Columbiana County sold $194,999 bonds for road improvements.

+Newark, Ohio—(Official)—Contract for paving Section 2 and 3 of Granville and Croton Pike awarded SCHILLING CONSTRUCTION CO., Youngstown, Ohio, at $9142.

+Salem, Ohio—(Official)—Contract for paving on Goshen Ave. and 10th St. awarded to J. D. PAXSON, Salem. Noted Aug. 26.

Steubenville, Ohio—Bids will be received until 1 p.m., Sept. 18, by Trustees of Island Creek Township, for grading road at Laurel Hill, Jefferson County.

Toledo, Ohio—(Official)—Bids will be received by the Board of County Commissioners of Lucas County, Court House, until 10 a.m., Sept. 17, for Stone Road Improvement No. 72.

Toledo, Ohio—Bonds for $131,000 sold for street improvements.

+Troy, Ohio—SWEENEY, ROBBINS & McDANIELS, at $7422, awarded contract for Shellsberger Rd. in Union Township.

+Warren, Ohio—Board of Control awarded contract for paving Homewood Ave. to TURNER & OLSON; contract for Franklin St. awarded to JAMES McCRACKEN. Noted Sept. 2.

+Washington C. H., Ohio—Contract for brick pavement on Leesburg Ave. awarded G. H. HECNER & SONS Celina.

+Xenia, Ohio—(Official)—Contract for paving portion of Third St. awarded to ANDREWS ASHPHALT PAVING CO., Middletown. Noted Aug. 19.

Youngstown, Ohio—(Official)—Bids will be received until 2 p.m., Sept. 27, by D. J. Jones, City Audr., for city paving bonds.

+Angola, Ind.—Contract for roads in Steuben County awarded to W. S. GORDON & SON, Liberty Center, Bluffton, at $39,152.

Brazil, Ind.—(Official)—Bids will be received until 10:30 a.m., Oct. 5, by William O. Graeser, Audr., Clay County, for gravel road between Jackson and Cass Townships.

Franklin, Ind.—Bids will be received until 2:30 p.m., Oct. 8, by the Commissioners of Johnson and Marion Counties for two county line roads.

Goshen, Ind.—(Official)—Bids will be received until 2 p.m., Oct. 4, by John W. Brown, Audr. of Elkhart County, for concrete road in Harrison Township.

Logansport, Ind.—Resolution passed by Board of Work for paving West Broadway, Wheatland Ave., Linden Ave. and Race St.

Michigan City, Ind.—(Official)—Bids will be received until 10 a.m., Sept. 27, by Board of Public Works for paving Charles St. Alex. Spychalski, City Clk.

Muncie, Ind.—(Official)—Bids will be received until 10 a.m., Oct. 6 ,by F. M. Williams, Audr., Delaware County, for gravel or macadamized road in Center and Liberty Townships.

✚Riverside, Ind.—Contract for Ashland Ave. curb and gutter awarded WILLIAM BIRCH & CO., Muncie.

✚Detroit, Mich.—Contract to pave Evaline Ave. and part of Jacob Ave. awarded R. D. BAKER CO., at $10,809 and $6861 respectively.

✚Eaton Rapids, Mich.—Contract for about 11 blocks of concrete-asphalt pavement awarded to GLOBE CONSTRUCTION CO., Kalamazoo, at $1.32 per sq.yd. Noted July 1.

Chicago, Ill.—International Paved Way Association organized at Chicago to promote an automobile highway from the Mexican to Canadian border. Estimated cost, $20,000,000.

✚Elgin, Ill.—Contract for curb and gutter in Ryerson Ave. and other streets awarded L. Z. BARCUS & CO., La Porte, at $8606. Noted Aug. 19.

✚Havana, Ill.—JANSEN & ZOELLER, Pekin, awarded contract for improvements in District C. Noted July 15.

✚Peoria, Ill.—Board of Local Improvements awarded contract for brick paving on Maryland St. to DOUGLAS A. MYERS at $5,985.

✚Peoria, Ill.—Contract for paving North Adam St. awarded to CANTERBURY BROS., Peoria, at $17,157.

★St. Charles, Ill.—(Official)—Bids will be received until 8:30 p.m., Sept. 20, by Board of Local Improvements for improving parts of East Main and West Main St. and other connecting streets. John W. Wilson, Engr.

Virginia, Ill.—Cass County plans to expend about $13,785 for highway improvements.

✚Boscobel, Wis.—(Official)—City awarded contract for improving various streets to EDWARD BARTLETT, Watertown, Wis., at $1.41 per sq.yd. Noted Aug. 26.

✚Aitkin, Minn.—Contract for state rural highway No. 10B awarded SMALL & OLSON, Aitkin, at $43,390.

✚St. Paul, Minn.—Contract for repaving University Ave. from Rice to Dale St. with creosoted block awarded to FIELDING & SHEPLEY, St. Paul, at $55,300.

Walker, Minn.—(Official)—Bids will be received by County Auditor until Sept. 25 for grading and graveling 30 miles of highway. Estimated cost, $80,000. George Ralph, St. Paul, Engr.

✚Great Bend, Kan.—(Official)—Contract for 20,671 sq.yd. paving awarded to WATTS & AMMERMAN, Salina, at $1.27 per sq.yd. for trinidad asphalt. Noted Aug. 26.

✚Junction City, Kan.—(Official)—County Commissioners awarded contract for one mile of concrete road to ZIEGLER BROS., Junction City, at $1.10 per sq.yd. Noted Sept. 2.

✚Olathe, Kan.—Contract for 3800 sq.yd. vertical fiber brick paving awarded to J. H. COSGROVE, Olathe, at $7,613.

Kearney, Neb.—(Official)—Citiens voted to issue $50,000 bonds for improving streets. Noted Sept. 2.

✚Bozeman, Mont.—Contract for paving in Districts 98 and 99 awarded to WARREN CONSTRUCTION CO., Portland, Ore., at $42,302.

Great Falls, Mont.—Resolution adopted by Council to create improvement district to improve North, Third, Fourth, Sixth, Seventh, Eighth and Ninth St. and Fifth Ave. Estimated cost between $38,470 and $63,435.

Harrisonville, Mo.—Dolan Township, Special Road District, Taft County, plans nine miles of rock road.

Kansas City, Mo.—Bids will be received by Park Commissioners until Sept. 28 for grading Meyer Blvd. and the Paseo.

Liberty, Mo.—Clay County Commissioners will be asked to vote on issuing $50,000 bonds for roads.

✚St. Louis, Mo.—Board of Public Service awarded contracts for street improvements as follows: G. A. HEMAN, Florissant Ave., asphalt, at $82,067; Marcus Ave., two sections, brick, $29,708 and $21,027; GRANITE BITUMINOUS PAVING CO., Ashland Ave., asphalt, $5,844; WEBB KUNZE CONSTRUCTION CO., Skinker Rd., wood block, $84,712; KYERMANN CONSTRUCTION CO., repaving on Market St., wood block, $17,225; PERKINSON CONSTRUCTION CO., Milburn Ave., brick, $7,651; RUECKING CONSTRUCTION CO., Chariton St., brick, $7,614; HANICK QUARRY AND CONSTRUCTION CO., Duncan Ave., brick, $13,480; Arlington Ave., brick, $15,494. Noted Aug. 19.

St. Louis, Mo.—(Official)—Bids will be received until noon, Oct. 5, by Board of Public Service for the following street improvements: Marcus Ave., estimated cost, $8500; Tower Grove Ave., cost $16,000; Spring Ave., cost, $15,000; Soulard St., cost, $25,000. E. R. Kinsey, Pres. Bd. Pub. Ser.

St. Louis, Mo.—Bids will be received until noon, Sept. 23, by Pitzman Co., Surv. and Engr., 615 Chestnut St., for approximately 600,000 cu.yd. grading and excavating for University Park Realty Co.

Austin, Tex.—Citizens contemplate issuing bonds for $425,000 for streets and bridges.

Clarksville, Tex.—City will sell $100,000 bonds Sept. 28 for roads and turnpikes in Road District No. 1.

Galveston, Tex.—County Commissioners plan to repair seawall boulevard. R. M. Slas, County Engr. and Supvr.

✚Lufkin, Tex.—Contract for three blocks of paving awarded to TEXAS BITULITHIC CO., Dallas, at $10,000.

Lufkin, Tex.—Agelina County will vote on issuing $200,000 bonds for roads.

Sulphur Springs, Tex.—City will issue $10,000 bonds for improving streets.

Woodville, Tex.—Citizens voted against issuing $100,000 bonds for roads in Tyler County, Road District No. 1. Noted Aug. 26.

Oklahoma, Okla.—County plans to expend $140,000 for improving roads.

Salt Lake City, Utah—County Commissioners plan concrete highway on State St. from southern limits of city to Murray city line.

✚Salt Lake City, Utah—(Official)—P. J. MORAN, INC., Salt Lake City, awarded contract for paving various streets at $48,025. S. Q. Cannon, City Engr. Noted Aug. 19.

Wendover, Utah—(Official)—No bids were received for 25 miles of highway. E. R. Morgan, State Rd. Engr. Noted Aug. 19.

Anacortes, Wash.—Contract will soon be awarded for paving Commercial Ave. to county road.

✚Auburn, Wash.—(Official)—Contract for paving 19 blocks awarded to WASHINGTON PAVING CO., Tacoma, at $24,979. Noted Aug. 26.

✚Bellingham, Wash.—Contract for pavement on Harris Ave. awarded to K. SAUSET, at $11,148.

✚Chehalis, Wash.—SPEAKER & McKEE, at $5,928, awarded contract for one mile of road on Jackson Prairie.

Hoquiam, Wash.—Resolution has been passed for improving Simpson Ave. Estimated cost, $47,672.

✚Olympia, Wash.—Bids opened Aug. 30 by State Highway Commission for highway from Nemah to Nasel River in Pacific County. Three lowest bids were: BURNETT CONSTRUCTION CO., 909 Second Ave., Seattle, $36,955 (awarded contract); Elliott Contracting Co., Portland, Ore., $39,305; L. H. Goerig, 1027 Bellevue Court, Seattle, $37,428.

✚Olympia, Wash.—(Official)—Bids opened Aug. 30 by State Highway Commission for road from Union Flat Creek south in Whitman County as follows: W. G. Mulligan & Co., 302 Eagle Bldg., Spokane, $7955; H. C. ROOT, South 525 Madison St., Spokane, $7784 (awarded contract); H. L. Wilson Co., Walla Walla, $8292; General Construction Co., Spokane, $9164. Noted Aug. 19.

Seattle, Wash.—A. H. Dimock, City Engr., submitted cost of paving 47th Ave., N. E., $27,893; First Ave., $20,539; grading Eloise Terrace, $10,870.

Seattle, Wash.—City Council authorized improvement of 51st Ave. and other streets. Estimated cost, $54,394.

Tacoma, Wash.—Surveys will soon be made for 10.6 miles of Mountain Rd. Estimated cost between $100,000 and $140,000.

✚Tacoma, Wash.—Commissioners of Pierce County awarded contract for paving 5.57 miles of Pacific Highway with bitulithic on concrete base to WASHINGTON PAVING CO., Tacoma, at $79,375. Noted Aug. 26.

Walla Walla, Wash.—Council passed resolution for paving South Second St. Estimated cost, $12,000.

✚Waterville, Wash.—Commissioners of Douglas County awarded contract for 2¾ miles of Permanent Highway No. 3 to BAILEY & O'CONNOR, Wenatchee, at $17,985.

✚Medford, Ore.—Contract for Pacific Highway from Tolo to Josephine County Line awarded to C. NATWICK, at $16,659.

Salem, Ore.—Bond issue for $10,000,000 for state roads has been proposed.

Dunsmuir, Calif.—City plans to lay 1¼ miles of concrete pavement. P. M. Lau is City Engr.

✚East San Diego, Calif.—Contract for improving Hugo Ave. awarded to OLAF NELSON, at $40,532.

✚Eureka, Calif.—Supervisors of Humboldt County awarded contract for Hoopa Valley Rd. to HARTNEY & McNAUGHTON, at $11,974.

Los Angeles, Calif.—Bond issue for $3,000,000 proposed for extension of county highway system.

✚Los Angeles, Calif.—D. D. CHAPMAN, 216 North Johnstone St., Los Angeles, at $11,472, awarded contract for improving roads in District No. 3. Noted July 22.

Marysville, Calif.—District No. 10 plans to gravel three miles of road. Estimated cost, $5,600.

Modesto, Calif.—Plans have been prepared by G. E. Freitas, City Engr., for street work estimated to cost $20,664.

Nevada City, Calif.—City Council is considering improving sidewalks of city.

✚Oakland, Calif.—(Official)—Board of Supervisors awarded contract for bitulithic paving on county roads in Murray Road District to CALIFORNIA BITULITHIC CO., care of Hutchinson Co., Oakland, at $14,235. Noted Sept. 2.

✚Redwood City, Calif.—Contract for road from Pescadero to Santa Cruz County Line awarded to LOU G. HARE, Salinas, at $29,000.

✚Riverside, Calif.—Contract for 8.67 miles of highway awarded to CONNER CONTRACTING CO., Los Angeles, at $28,910.

Sacramento, Calif.—(Official)—Bids were received Aug. 23 by the State Highway Commission for highway in Siskiyou County, Division 2, Route 3, Section A, as follows: P. J. Lechner, Alameda, $23,944; Moffett & Mead, San Francisco, $24,750; F. H. Green, Eureka, $22,600.

✚San Francisco, Calif.—Contract for paving boulevard between Lincoln and Presidio, including sidewalks and sewers awarded to CITY IMPROVEMENT CO., San Francisco, at $65,000.

✚San Francisco, Calif.—Board of Public Works awarded contract for paving part of Fulton St. to OWEN McHUGH, at $11,188.

✚San Francisco, Calif.—Board of Public Works awarded contract for grading on 37th Ave. to BLANCHARD-BROWN CO., at $5931.

+San Mateo, Calif.—RANSOME-CRUMMEY CO., Oakland, at $70,850, awarded contract for pavement at upper end of San Mateo Park.

+San Mateo, Calif.—Contract for paving several streets awarded to FEDERAL CONSTRUCTION CO., San Francisco, at $77,800.

+Santa Ana, Calif.—Contract for 5½ miles of Santiago Blvd. awarded FRED HOFFMAN, at $19,498.

+Santa Ana, Calif.—MAX L. HUBERMAN, at $10,695, awarded contract for Yorba Linda Rd.

Santa Cruz, Calif.—Plans are being considered for paving King St., Ocean View, Branciforte and Soquel Ave. Estimated cost, $75,000. W. J. Thompson, City Engr.

+Santa Cruz, Calif.—Contract for paving Mission St. awarded to C. GREENFIELD, at $25,831.

Stockton, Calif.—City Council authorized paving North Center, Maple and Ash St. Estimated cost, $26,000. H. T. Compton, City Engr.

+Venice, Calif.—Contract for 29,000 ft. of asphalt concrete pavement awarded to BRAUN, BRYANT & AUSTIN, Santa Monica.

Yreka, Calif.—Board of Supervisors plans to grade and pave road to Ft. Jones and Scott Valley. Estimated cost, $60,000.

INDUSTRIAL WORKS

+Lubec, Maine—American Can Co., New York, N. Y., awarded contract for concrete addition to its plant at Lubec to CUMMING CONSTRUCTION CO., Boston, Mass. Cost, $100,000.

+Holyoke, Mass.—Bosch Magneto Co., Chicopee, awarded contract for a new plant at Holyoke to CASPER RANGER CO. Cost, about $100,000.

+Lowell, Mass.—Contract for 10-story, brick and reinforced-concrete 92x132-ft. storage warehouse for Appleton Co., Jackson and Revere St., awarded to NEW ENGLAND CONCRETE CONSTRUCTION CO., 201 Devonshire St., Boston. Cost, $125,000.

+South Boston, Mass.—M. F. Cahill Co. awarded contracts for four-story, 107x134-ft., brick and mill constructed factory to APTED & McDUFFEE, Malden, general contract, and TYSON, WEARE & CO., Old South Bldg., Boston, foundations. Cost, $75,000.

Springfield, Mass.—New England Westinghouse Co., Page Bldg., will build brick woodworking shop. Cost, $50,000.

+Pawtucket, R. I.—Phillips Insulated Wire Co. awarded contract for three-story brick and mill constructed 70x100-ft. wire mill to WILLMARTH & MacKILLOPP, INC., Pawtucket, at $25,000. Noted Aug. 19.

Bridgeport, Conn.—Loban Bros. plans a five-story, fireproof 103x108-ft. warehouse on Housatonic Ave.

+South Windham, Conn.—Smith & Winchester Co. awarded contract for two-story, 60x127-ft. foundry addition to H. WALES LINES CO., Meriden, at $20,000.

+Unionville, Conn.—J. Broadbent & Son, Inc., awarded contract for four-story brick and mill constructed factory to R. J. JONES, Hartford.

Buffalo, N. Y.—Curtis Aëroplane Co. will build the fourth addition this year to its factory at Churchill Ave. and New York Central R.R. Estimated cost, $50,000.

Buffalo, N. Y.—American Radiator Co. will build two one-story additions to its plant at 110 Ledger St. Cost, $55,000.

Buffalo, N. Y.—Lehigh Valley R.R. will build repair shops and yards at Tifft St., Hamburg Turnpike and City Ship Canal to cost about $250,000.

+Buffalo, N. Y.—William H. Walker Co. awarded contract for 11-story warehouse and distributing station at Franklin and Erie St. to TURNER CONSTRUCTION CO., Prudential Bldg., Buffalo.

+Jamestown, N. Y.—Struthers-Wells Co., Warren, Penn., awarded contract to McCLINTIC-MARSHALL CO., Pittsburgh, Penn., for one-story, 200x200-ft. concrete blacksmith shop in Jamestown. Cost, $50,000.

Rochester, N. Y.—Folding Barrel Co., 220 Broadway, New York, N. Y., will build a $12,000 factory in Rochester. F. J. Pomeroy, 23 Farraday St., is Factory Mgr.

+Tonawanda, N. Y.—The McKinnon Chain Co. awarded contract for one-story, 80x90-ft., brick and concrete addition to its plant to MORRIS & ALLEN, Builders Exchange, Buffalo, at $10,000.

+Harrison, N. J.—Hyatt Roller Bearing Co., Middlesex St., awarded contract for six-story, 90x110-ft. addition to its plant to AMERICAN CONCRETE STEEL CO., Newark. It will be of reinforced concrete, brick veneer.

Lambertsville, N. J.—Lambertsville Rubber Co. will soon award contracts for three-story, 60x110-ft. brick plant.

Allentown, Penn.—Allentown Ice & Cold Storage Co. has taken out permit for one-story brick addition. Cost, $28,000.

Ardmore, Penn.—Autocar Co. will build five-story, reinforced-concrete, 64x77-ft., factory addition. Stearns & Castor, Stephen Girard Bldg., Philadelphia, Arch.

Chester, Penn.—Keystone Casting Co. will build a fireproof brick addition. Cost, $30,000.

Harrisburg, Penn.—Kelker & Johnson, Union Trust Bldg., receiving bids for reinforced-concrete and brick, 74x11-ft., warehouse for Montgomery & Co.

+Philadelphia, Penn.—Contract awarded to FIDELITY CONSTRUCTION CO. for seven-story, reinforced-concrete, 62x100-ft., cold storage warehouse, and 28x55-ft. smokehouse for John J. Felin Co., 4142 Germantown Ave. Cost, $100,000 and $15,000 respectively. Noted Sept. 2.

+Philadelphia, Penn.—Bennett & Aspden Co., Leverington and Baker St., awarded contract for four-story factory at Pechin St. and Krams Ave. to WILLIAM STEEL SONS CO., 1600 Arch St., Philadelphia. Estimated cost, $100,000.

Pittsburgh, Penn.—Murdock Storage & Transfer Co. will build five-story storage and office building at Fifth Ave. and Craig St.

+Baltimore, Md.—Curtis Bay Distillery Co. has awarded contracts for its denatured alcohol distillery as follows: Fabrication and erection of steel, PORTHOFF CONSTRUCTION CO., Cincinnati, Ohio; concrete work, CURTISS WOODRUFF CO., Brooklyn, N. Y.; copper work and machinery, ANSONIA COPPER & IRON WORKS, Cincinnati; grading and well-digging, WILLIAM G. GISHEL CO., Curtis Bay.

+Baltimore, Md.—Poole Engineering Co. has awarded contract for its war munitions plant addition to COWEN BUILDING CO. It will be of brick and steel, 100x290 ft.

Baltimore, Md.—Kennedy Foundry Co., South Charles St., will build a three-story addition, covering 24,000 sq.ft., for a core and patternshop. Joseph P. Kennedy is Pres.

+Baltimore, Md.—Baltimore Dry Docks & Shipbuilding Co. awarded contract for one-story, 60x200-ft. shipbuilding plant to CHESAPEAKE IRON WORKS. It will be of steel, corrugated iron and reinforced concrete.

Parkersburg, W. Va.—Modern Flint Glass Co. will build glass plant to cost $50,000. James O. Gill, Philadelphia, Penn., is interested.

Charlotte, N. C.—Reported that the Ford Motor Co., Detroit, Mich., will build an assembling plant in Charlotte.

Akron, Ohio—Osborn Engineering Co., 740 Engineers' Bldg., Cleveland, receiving bids for a three-story factory on East Market St. extension, Akron, for Western Tire & Rubber Co. M. O'Neil, Pres. Noted Sept. 9.

+Cleveland, Ohio—(Official)—Contract for plant of the Kessler Mfg. Co. awarded to SAMUEL AUSTIN SON CO., Euclid Ave., Cleveland. Noted Aug. 26.

Evansville, Ind.—Evansville Packing Co. will build plant to cost $150,000.

Kokomo, Ind.—Haynes Motor Car Co. will build three reinforced-concrete additions to its plant. Cost, $250,000. Company has also purchased a brick factory building for a tool plant.

Chicago, Ill.—The Baltimore & Ohio Chicago Terminal R.R., Fifth Ave. and Harrison St., will build a two-story brick roundhouse and machine shops on West 14th St. Cost, $245,000. M. A. Long, Arch.

Chicago, Ill.—Armour & Co., Union Stockyards, will build a seven-story brick and concrete canning factory. Cost, $325,000. R. A. Clark, Arch.

+Chicago, Ill.—(Official)—Contract for a factory for Republic Box Co. awarded to JAMES SHEDDEN & CO., Chicago, at $31,500. Noted Aug. 19.

+Milwaukee, Wis.—John Wolleager Auto Co., 417 Wells St., awarded contract for two- and three-story, 62x90-ft. addition to its garage to A. MONSTED CO., Pabst Bldg., Milwaukee.

Milwaukee, Wis.—The Linde Air Products Co., New York, N. Y., contemplates an 80x100-ft. brick and concrete factory at 38th and National Ave.

Waterloo, Iowa—Plans are being prepared for four-story factory and distributing plant for Waterloo Overland Motor Co. Estimated cost, $40,000.

Lincoln, Neb.—Star Van & Storage Co. will build a 50x70-ft. fireproof addition to its warehouse at 818 Q St. Cost, $12,000.

Springfield, Mo.—Rhodes Produce Co. will build a store and warehouse on South Campbell St. Estimated cost, $20,000. C. L. Rhodes, Pres.

Golden, Colo.—Sanitary Brick Co. will build an addition to its plant. Estimated cost, $25,000. L. A. Copeland, Mgr.

Trinidad, Colo.—Swift & Co., Chicago, Ill., having plans prepared for cold-storage plant. Estimated cost, $30,000.

+Spanish Forks, Utah—The Utah-Idaho Sugar Co. awarded contract for a $500,000 sugar factory to E. H. DYER CONSTRUCTION CO., Salt Lake City.

Spokane, Wash.—Powell-Sanders Co. has plans for six-story, 100x110-ft. office building and warehouse. Cost, $50,000. John K. Dow, Arch.

Saskatoon, Sask.—Macdonald-Crawford, Ltd., will build four-story warehouse. Approximate cost, $50,000.

FEDERAL GOVERNMENT WORK

Wharf—Ft. Constitution, N. H.—Bids will be received until noon, Sept. 25, by A. G. Frick, Quartermaster, for addition to wharf.

+Breakwater—Buffalo, N. Y.—Contract awarded to COAST & LAKES CONTRACTING CO., New York, at $14,055, for riprap and repairing concrete superstructure on Buffalo breakwater. Noted Sept. 9.

+Dredging—Port Chester, N. Y.—Contract awarded to EASTERN DREDGING CO., at $7277, for dredging in Port Chester Harbor. Noted July 8.

★Building—Tompkinsville, N. Y.—Bids will be received until 2 p.m., Sept. 30, by Lighthouse Inspector, Tompkinsville, for building third story and permanent roof of reinforced concrete on carpenter shop at General Lighthouse, Tompkinsville.

Repairs Hospital—Pittsburgh, Penn.—Bids will be received until 3 p.m., Sept. 20, by U. S. Public Health Service, U. S. Marine Hospital, Pittsburgh, for repairs to U. S. marine hospital at 40th St. and Penn Ave., Pittsburgh.

+Steam Engine—Pittsburgh, Penn.—Contract awarded to NORDBERG MFG. CO., Milwaukee, Wis., at $4,500, for steam engine for experimental station, Bureau of Mines.

Heating and Ventilating—Washington, D. C.—Bids were received Sept. 7 by Commissioners of District of Columbia for heating and ventilating in Park View school as follows:

Riggs, Distler & Stringer, Baltimore, Md., $13,678; Standard Engineering Co., Washington, $14,650 and W. G. Cornell Co., Washington, $15,200.

✚Laboratory—Washington, D. C.—Contract for chemical laboratory at Bureau of Standards, Washington, awarded to WELLS BROS., New York, N. Y., at $188,556. Noted July 8.

Lumber—Washington, D. C.—Bids will be received until 2 p.m., Sept. 22, by Commissioners of District of Columbia, for 95,078 sq.ft. of Georgia pine bridge lumber.

Machine Tools—Washington, D. C.—Bids will be received until 10 a.m., Oct. 5, by Paymaster-General, U. S. N., Washington, for machine tools as follows: Schedule 8,780, 2 geared head lathes, 18-in.x8 ft., 1 geared head lathe, 16-in.x6-ft., 1 trimming press, for delivery at Washington Navy Yard; Schedule 8,781, 1 turn table lathe, 2½x26, for delivery at Boston Navy Yard; Schedule 8,782, 2 upright drills, 21-in., 2 double emery grinders, 12-in., 2 engine, screw-cutting lathes, 2 crank shapers, 16-in., for Boston and Philadelphia navy yards.

Plumbing—Washington, D. C.—Bids were received Sept. 7 by Commissioners of District of Columbia for plumbing for Park View School as follows: Isidor Freund, Washington, $5,770; Ribbs, Distler & Stringer, Baltimore, Md., $5,796 and F. C. Stelzer, Washington, $6,347.

★Dredging—Norfolk, Va.—Bids will be received until noon, Sept. 23, by U. S. Engineer, Custom House, Norfolk, for dredging and rock excavation in James River.

Post Office—Norton, Va.—Bids will be received until 3 p.m., Oct. 19, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for post office at Norton.

Post Office—Charlotte, N. C.—Bids were received Sept. 7 by Acting Supervising Architect, Washington, D. C., for post office as follows: (a) limestone, (b) sandstone, John G. Unkefer & Co., Minerva, Ohio, (a) $192,692; J. A. Jones, Charlotte, (b) $207,000 (low bidders). Noted July 29 and Aug. 5.

★Post Office—Wilkesboro, N. C.—Bids will be received until 3 p.m., Oct. 14, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for post office at Wilkesboro.

Officers' Quarters—Wilmington, N. C.—Bids will be received until 3 p.m., Oct. 7, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for medical officers' quarters at U. S. Marine Hospital, Wilmington.

✚Buildings—Port Royal, S. C.—Contract awarded to NEWPORT CONTRACTING & ENGINEERING CO., Newport News, Va., at $34,676, for buildings at Naval Station, Port Royal. Noted Aug. 5 and Sept. 2.

Repairing Wharf—Ft. De Soto, Fla.—Bids will be received until 10 a.m., Oct. 1, by Jacob Frank, Act. Quartermaster, Ft. Dade, for repairing wharf at Ft. De Soto.

Dredge—Jacksonville, Fla.—Bids will be received until noon, Nov. 8, at the U. S. Engineer Office, Jacksonville, for steel hull 3½ and 7 yard dipper dredge or for leasing, subject to purchase.

Cement, Sand and Gravel—New Orleans, La.—Bids will be received until 11 a.m., Sept. 22, at the U. S. Engineer Office, Custom House, New Orleans, for cement, sand and gravel at Southwest Pass, Mississippi River.

✚Timber—Detroit, Mich.—Contract awarded to DUNCAN LUMBER CO., Portland, Ore., at $6,051, for 236,000 ft. of fir timber. Noted June 24.

Post Office—Fulton, Mo.—Bids were received Sept. 7 for post office: (a) limestone and (b) sandstone, Balkan Construction Co., Chicago, Ill., (a) $46,337, (b) $46,703 (low bidder). Noted Aug. 5.

✚Buildings—Point Isabel, Tex.—(Isabel post office)—Contract awarded to JAMES McCOY, Brownsville, at $9,500 for operator's quarters at Naval Radio station. Noted Sept. 2.

✚Post Office—Blackwell, Okla.—Contract awarded to ALGERNON BLAIR, Montgomery, Ala., at $37,616, for post office at Blackwell. Noted Aug. 12 and 26.

★Cement—Portland, Ore.—Bids will be received until 11 a.m., Oct. 7, at the U. S. Engineer Office, Second District, Portland, for cement.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., Sept. 24, by Maj. F. C. Boggs, Gen. Pur. Agt., Washington, D. C., for miscellaneous pipe and manufactured metal supplies.

MISCELLANEOUS

Dredging—Boston, Mass.—Bids will be received until Sept. 22 by State Harbor and Land Commissioners, State House, for dredging of Lewis Bay. William F. Williams, Ch. Engr.

✚Shore Protection—Boston, Mass.—Contract awarded to COLEMAN BROS., Chelsea, at $19,854, for shore protection at Revere Beach. Noted Aug. 6 and Sept. 9.

✚Retaining Wall—Quincy, Mass.—Contract awarded to HOLBROOK CABOT & ROLLINS CO., 6 Beacon St., Boston, at about $100,000 for retaining wall for Fore River Shipbuilding Co. Noted Sept. 2.

✚Dike—Springfield, Mass.—Contract awarded to H. I. PEER, Springfield, for 3,200 ft. of dike.

Dredging—Waltham, Mass.—Bids will be received until noon, Sept. 21, by State of Massachusetts for dredging in Charles River from Elm St. to Bleachory dam. Metropolitan Park Commission, 14 Beacon St., Boston, Engr.

Barge Canal Work—Albany, N. Y.—Bids were received for improvement of Sawyer's Creek at North Tonawanda: H. S. Kerbaugh, Inc., Buffalo, $9,800; Eastover Construction Co., Inc., Utica, $10,200. H. V. Berry, Ft. Plain, at $12,685 was low bidder for timber for canals in Eastern division; William J. Dowdle, Oswego, at $15,400 low bidder for Middle division and G. Elias & Bro., Inc., Buffalo, at $21,699, for Western division.

Ballast—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received Sept. 10 for ballast for Rapid Transit Ry. (a) about 243,000 cu.yd. of trap rock or hard limestone: Upper Hudson Stone Co., $228,010, Haverstraw Crushed Stone Co., $250,240 and (b) about 325,500 cu.yd. 3-in. ballast, trap rock, hard limestone or field stone, Haverstraw Crushed Stone Co., $26,325; Upper Hudson Stone Co., $27,625. Noted Aug. 26.

Pier Shed—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by Commissioner of Docks, Pier A, Battery Pl., until noon, Sept. 21, for pier shed at West 23rd St., North River, under Contract No. 1471.

✚Duct Line—New York, N. Y.—(Official)—Contract awarded to E. C. MOORE, 154 Nassau St., at $34,006, for duct line for Queensboro Rapid Transit Ry. Noted Aug. 12.

Elimination of Grade Crossing—Sloan, N. Y.—Plans submitted to New York Public Service Commission, Albany, by Delaware, Lackawanna & Western R.R. for elimination of grade crossing at Sloan. Estimated cost, $329,471.

✚Sprinkler System—Hoboken, N. J.—Contract awarded to ROCKWOOD SPRINKLER CO., at $15,000, by Hoboken Land & Improvement Co. for sprinkler system in new building at 15th St.

Waterway—Trenton, N. J.—New Jersey State Commerce and Navigation Board will construct Barnegat Bay-Manasquan River Inland Waterway. About $23,000 is available to start work.

✚Tunnel—Bloomsburg, Penn.—Contract awarded to PORTLAND CONTRACTING CO., for tunnel 1,400 ft. long, by Lehigh Valley Coal Co.

★Superstructures—Philadelphia, Penn.—(Official)—Bids will be received until noon, Oct. 19, by A. M. Taylor, Dir., Pub. Ser., 754 Bourse Bldg., for steel superstructures for elevated railway.

✚Steamships—Newport News, Va.—Contracts awarded to NEWPORT NEWS SHIPBUILDING AND DRY DOCK CO., at $1,000,000 each for two steamships for Crowell & Thurlow Steamship Co., Boston, Mass.

✚Drainage—Goldsboro, N. C.—Contract awarded to A. V. WILLIS & SONS, Pittsfield, Ill., at $56,399, for dredging in canal for drainage.

Drainage—Dade City, Fla.—Plans being prepared by Hiram McElroy, Dade City, for drainage district.

Harbor Channel and Piers—Miami, Fla.—Bids will be received soon, for harbor channel and piers for Miami. Isham Randolph, Harbor Engr. Noted July 8.

Barges—Mobile, Ala.—Pratt Consolidated Coal Co. will build 16 barges and one steam boat for coal transportation. Estimated cost, $71,200.

Levees—Shreveport, La.—Bids will soon be received, according to press reports, for levees at Upper Missionary, West Egypt, Thompson's Cedar Bluff, Long Point, Loggy Lea and Campo Bello reaches.

Park Improvements—Cincinnati, Ohio—Citizens will vote on $1,250,000 bonds for park improvements at November election.

Drainage—Kenton, Ohio—(Official)—Morgan Engineering Co., Memphis, Tenn., retained as engineer to prepare plans for protection of about 25,000 acres on the Upper Scioto Drainage and Conservation District, Hardin County.

Elimination Grade Crossing—Madisonville, Ohio—Plans approved by Pennsylvania Lines West of Pittsburgh for elimination of grade crossing at Erie Ave., Madisonville. Philip Fosdick, Cincinnati, City Engr. Estimated cost, $140,000.

✚Ditch—New Philadelphia, Ohio—Contract awarded to W. A. SHIRE, Ashland, at $0.09 per cu.yd. for ditch in Tuscarawas and Holmes Counties. Noted Aug. 19.

✚Drainage—Toledo, Ohio—Contract awarded to GILMORE BROS., Toledo, at $50,000, for drainage in Defiance County.

Drainage—Liverpool, Ill.—Liverpool Drainage and Levee District contemplates draining 3,500 acres. G. R. Wilcoxen, Secy., Comrs.

Barges—Princeton, Ill.—Morton Salt Co. will build barges for use on Illinois Waterway as soon as completed.

Drainage—Atlantic, Iowa—Bids will be received until Sept. 20 by C. E. Kringel, Audr. of Cass County for Indian Creek Drainage Ditch No. 1. Estimated number of cubic yards, 129,000.

✚Ditch—Des Moines, Iowa—Contract awarded to JOHN ATWOOD, Mingo, for drainage ditch No. 17 in Clay Township.

✚Ditch—Grand Rapids, Minn.—Contracts awarded to BARNARD, LATVALA & FREDERICKS, Minneapolis, at $104,89 for 36-mile ditch in Itasca County.

Ditch—Slayton, Minn.—Bids will be received until Sept. 21 by E. V. O'Brien, County Audr., for ditches, 40, 42, 43, 10 and 11. Estimated cost, $122,020.

Ditch—Worthington, Minn.—Bids will be received until Sept. 25, by G. Swanberg, County Audr., for ditch No. 12. Estimated cost, $23,073.

Levees—Concordia, Kan.—Bids will be received until Sept. 20 by James McCahn for ten sections of Lawrence Township levee. S. Doran, County Engr.

Elimination of Grade Crossing—Hutchinson, Kan.—Arkansas Valley Interurban and Rock Island & Santa Fé Ry. plan to eliminate grade crossing at Ave. B and Lorain St. Estimated cost, $50,000. R. F. Rockefeller, Division Engr. of Rock Island Ry., Engr.

Levees—Malden, Mo.—Bonds for $40,000 have been sold. Levees will be constructed in St. John's Drainage District. Bids will be received about Oct. 1.

★Drainage—Marion, Ark.—(Official)—Bids will be received until noon, Sept. 22, by Willis E. Ayres, Randolph Bldg., Memphis, Tenn., for purchase of $160,000 drainage bonds.

Canal Improvements—Twin Falls, Idaho—Twin Falls Canal Co. contemplates enlarging highline canal and replacing siphons in Rock Creek district. Estimated cost, $125,000.

Drainage—Plain City, Utah—Surveys being made by W. P. Thomas, County Agricultural Agent, of water-logged lands near Plain City and Hooper with a view to drainage.

Dams—Salt Lake City, Utah—Bids will be received until Oct. 1 by S. Q. Cannon, City Engr., for 105x300-ft. dam in Parley's Canyon. Estimated cost, $100,000.

+Jetty Work—Kelso, Wash.—Contracts awarded to INTERSTATE CONSTRUCTION CO., Portland, Ore., for 400 ft. of Jetty in front of Hill Mill Bar and to ALBERT BURCHAM, Kelso, for furnishing pile.

Steel Rails—Seattle, Wash.—Bids will be received until 1:30 p.m., Sept. 22, by C. E. Remsberg, Secy., Port of Seattle Commission, for steel rails and appurtenances for East Waterway Terminals. Estimated cost, $15,000.

Barge—Windsor, Ont.—Plans being prepared by C. W. Cadwell, Mgr., Cadwells Ltd., for steel barge with 1,600 cu.yd. capacity fully equipped.

Terminals and Sea Wall—Vancouver, B. C.—Canadian Northern Ry. Co. will construct terminals and sea wall at Vancouver. Estimated cost, $5,000,000.

BUILDINGS

Other items relative to Building Construction will be found under the following heads: "Industrial Works;" "Federal Government Work" and "Miscellaneous."

Portland, Maine—Elm Theater Co. will build ground floor theater on Elm St. near Congress St.

+Portsmouth, N. H.—Contract awarded to E. N. McNABB & CO., Portsmouth, at about $50,000, for 2½-story, 36x126-ft. building for Chase Home for Children.

+Amherst, Mass.—Contract awarded to ALLEN BROS., Amherst, for fraternity building for Delta Upsilon Society, Amherst.

Boston, Mass.—Andrew A. Badaracco, 359 Hanover St., will build three-story, 31x282-ft., brick building at Haymarket Sq. Fred A. Norcross, 46 Cornhill, Arch. Estimated cost, $90,000.

+Boston, Mass.—Contract awarded to L. P. SOULE & CO., 40 Central St., for eight-story office building at Tremont and Boylston St. Blackall, Whittemore & Clapp, 20 Beacon St., Arch.

Cambridge, Mass.—Walsh Bros., 150 Hampshire St., Cambridge, at $78,000, low bidder for hospital and boiler house for City of Cambridge.

Danvers, Mass.—All bids received for Essex County Independent Agricultural School have been rejected. New bids will be received. Estimated cost, $50,000. Noted June 24.

Lawrence, Mass.—Municipal Council will build 12-room school on Jackson Terrace. Estimated cost, $90,000.

North Adams, Mass.—Bids will be received about Sept. 17 for 80x269-ft. brick high school. E. C. & G. C. Gardner, Springfield, Arch. Estimated cost, $175,000. Noted Aug. 19.

Springfield, Mass.—Board of Aldermen voted to have plans prepared for addition to Howard St. school.

+Springfield, Mass.—Contract awarded to M. MALONEY, Springfield, at about $50,000 for memorial building for E. K. Wilcox, Post 16, G. A. R.

Wellesley, Mass.—Wellesley College will build dormitory. Coolidge & Carlson, 89 State St., Boston, Arch.

+Pawtucket, R. I.—Contract awarded to B. F. SMITH CONSTRUCTION CO., Pawtucket, for one-story brick addition to Industrial Trust Co.'s Bank.

East Hartford, Conn.—Wilson Potter, New York, N. Y., has been retained by High School Commission to prepare plans for high school. Estimated cost, $75,000.

New Haven, Conn.—Bids will be received until noon, Sept. 25, by General Hospital Society of Connecticut for three-story and basement, 50x144-ft. administration building. Estimated cost, $100,000.

The National Tube Co., Pittsburgh, Penn., was awarded the Grand Prize at the Panama Pacific Exposition for the general excellence of its tubular products and fittings.

The Pneumatic Placing Co., Inc., has moved from its quarters at 45 Broadway to larger quarters at 2 Rector St., New York.

Albany, N. Y.—Bids will soon be received by M. T. Reynolds, Arch., 100 State St., for six-story, 57x234-ft. office building at 124 State St. for Municipal Gas Co., 112 State St. Estimated cost, $400,000. Noted July 1.

Middletown, N. Y.—Bids will be received about Sept. 24 for five-story bank and office building at North and King St. for Merchants National Bank. Estimated cost, $100,000. D. H. Canfield, Argus Bldg., Arch. Noted June 3.

New York, N. Y.—(Borough of Bronx)—Edifice will be built for Church of Our Lady of Mt. Carmel at Belmont Ave. and 187th St. Estimated cost, $70,000. Rev. D. Burke, Pastor.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by the Department of Public Charities, Municipal Bldg., until 10:30 a.m., Sept. 22, for additions and alterations to the Greenpoint Hospital.

New York, N. Y.—(Borough of Manhattan)—George Backer Construction Co. will build 16-story store and loft building at 31st St. and Madison Ave. Summerfield & Steckler, Arch. Estimated cost, $1,000,000. Noted July 22.

New York, N. Y.—(Borough of Manhattan)—Plans prepared by G. F. Pelham, Arch., 30 East 42nd St., for six-story apartment at Riverside Drive and 149th St. for West Side Construction Co., 200 West 72nd St. Estimated cost, $200,000. Jacob Axelrod, Pres.

New York, N. Y.—(Borough of Manhattan)—Gaetan Ajello, Arch., 1 West 34th St., is preparing plans for 13-story apartment at Riverside Drive and 108th St. for Anthony A. Paterno Construction Corporation, 272 West 84th St.

New York, N. Y.—(Borough of Manhatan)—St. Bernard's Parish plans five-story, fireproof school on 13th St. near Hudson St. Estimated cost, $130,000.

New York, N. Y.—(Borough of Manhattan)—Montague Flagge, 2nd., New York, prepared plans for 20-story store, bank and office building at Fifth Ave. and 42nd St., for Oceanic Investing Co. Estimated cost, $1,000,000. Noted Sept. 9.

New York, N. Y.—(Borough of Queens)—Degnon Contracting Co., New York, will build office building at Van Alst Ave. and Fourth St., Long Island City.

Riverhead, N. Y.—Supervisors of Suffolk County plan two-story office building for County Clerk and Treasurer. Tooker & Marsh, New York, Arch. Estimated cost, $42,500.

Southampton, N. Y.—Citizens plan addition to Southampton Hospital.

+Troy, N. Y.—Contract awarded to A. E. STEVENS CO., 101 Park Ave., New York, N. Y., for dining hall and dormitories at Rensselaer Polytechnic Institute. Estimated cost, $200,000. Noted May 27.

Camden, N. J.—A Special Committee of Bd. of Education will retain architect to prepare plans for new Manual Training High School at Baird Ave. and Boulevard, Forest Hill Park. Estimated cost, $400,000. Noted Apr. 8.

Elizabeth, N. J.—Bids will be received until 8 p.m., Sept. 30, by Board of Education for two schools. C. Godfrey Poggi, 2 Julian Pl., Arch. Noted July 8.

Elizabeth, N. J.—At meeting of Mayor and Finance and Charities Committees of Council it was voted to remodel almshouse and to recommend to Council that bids be asked. Cost, $40,500.

SUBWAY—PHILADELPHIA, PENN.

Foundations

Bids were received Aug. 16 by A. M. Taylor, Dir. of Dept. of City Transit, for constructing foundations in Front St., Kensington and Frankford Ave. from: (A) Edward Fay & Son, 2 South Mole St., Philadelphia; (B) Robert Lombardi, 600 Lincoln Bldg., Philadelphia; (C) Keystone State Construction Co., 704 Pennsylvania Bldg., Philadelphia; (D) Peoples & Ruch, 237 Commercial Trust Bldg., Philadelphia; (E) American Paving and Construction Co., 211 South Ninth St., Philadelphia; (F) Oscar Daniels Co., 233 Broadway, New York, N. Y.; (G) Millard & Lupton Co., East Allegheny Ave. and Tulip St., Philadelphia; (H) James D. Dorney, 1204 East Montgomery Ave., Philadelphia; (I) New York & New Jersey Construction Co., 30 East 42nd St., New York, N. Y.; (J) A. L. Guidone & Son, Inc., 131 East 23rd St., New York, N. Y. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
100 cu.yd. excavation	$2.50	$2.75	$2.00	$1.50	$4.00	$2.50	$10.00	$1.90	$3.50	$1.50
100 cu.yd. concrete masonry	8.00	5.75	5.00	4.00	6.50	7.00	15.00	6.90	7.50	7.50
1,000 sq.ft. precast reinforced concrete planking	1.00	.45	.30	.23	.50	.25	1.00	.10	.20	2.20
100 cu.yd. brick masonry	10.00	9.00	15.00	13.00	20.00	12.00	15.00	14.50	15.00	15.00
100 cu.yd. rubble stone masonry	5.25	5.75	5.00	6.00	6.00	9.00	8.00	5.50	6.50	6.00
10 concrete piles	2.00	35.00	15.00	30.00	33.00	30.00	100.00	35.00	35.00	60.00
M ft. yellow pine lumber	49.00	35.00	80.00	55.00	60.00	40.00	100.00	48.00	60.00	54.00
1,000 lb. steel work	.05	.04	.04	.04	.04	.035	.10	.04	.04	.03
1,000 lb. iron castings	.10	.03	.04	.035	.06	.03	.10	.0325	.04	.03
100 lin.ft. 5 in. or 6 in. vitrified clay pipe	.70	.25	.20	.55	1.00	.30	.75	.30	.50	.40
100 lin.ft. 8 in. or 10 in. vitrified clay pipe	1.00	.35	.40	.55	1 00	.40	1.50	.40	.75	.60
100 lin.ft. 12-in. vitrified clay pipe	1.30	.45	.80	1.10	1 50	.60	2.00	.50	1 00	1.00
100 lin.ft. 15-in. or 18-in. vitrified clay pipe	1.75	.60	1.20	1.25	1 90	.80	2.50	.75	1 25	1.25
100 sq.yd. stone block invert lining or sewer paving	4.00	2.00	2.50	7.00	3 00	2.50	3.00	2.99	3 00	4 00
100 sq.yd. vitrified brick invert lining	4.00	2.00	2.00	7.00	3 00	2 00	3 00	2.00	4 00	2.50
10 taking out existing sewer inlets	20.00	10.00	20.00	6.00	10.00	20 00	50.00	15.00	50.00	45.00
10 taking out and rebuilding inlets	80.00	50.00	70.00	75.00	90 00	100 00	150.00	70.00	100.00	140.00
10 building new inlets	100.00	75.00	80.00	75.00	100 00	150 00	100 00	75.00	50.00	140 00
10 moving gas lamp and posts	10.00	6.00	10.00	10.00	10 00	20 00	25.00	16.00	15.00	6 00
100 lin.ft. steel bound granolithic curb	.79	1.60	1.00	.75	1.00	1 20	1.00	.60	.70	.50
100 lin.ft. resetting stone curb	.25	.20	.30	.20	.20	.25	.50	.25	.25	.20
100 sq.yd. brick and flagstone sidewalk repaving	.60	2.00	.50	1.00	.50	1 75	1.50	.45	1.50	1.50
100 sq.yd. granolithic sidewalk repaving	1.50	1.50	1.50	1.45	1.50	2.00	2.00	1.40	1.50	1.50
100 sq.yd. granite block repaving on gravel base	1.50	.75	.50	.25	.70	1.50	1.50	.45	1.50	3 00
100 duct ft. terra-cotta Conduits	.45	.50	.20	.40	.20	30	.25	.15	.15	15
100 lin.ft. moving and relaying gas or water mains	6.00	1.50	1.00	10.00	1.00	2 00	5.00	2.75	2.00	3 00
100 new curb stop boxes or vent boxes	4.00	.40	1.00	2.00	1 00	5.00	1.00	.45	2.00	10 00
Extended totals	$188,278	$155,150	$185,970	$235,240	$315,640	$225,815	$273,150	$149,235	$290,450	$202,334

Pleasantville, N. J.—Bids will be received until Sept. 28 by S. Hudson Vaughn, Guarantee Trust Bldg., Atlantic City, Arch., for three-story, 105x130-ft. high school. Estimated cost, $40,000.

Carbondale, Penn.—Bids will be received until Oct. 1, by Secretary, Board of Education, for four-story, 80x150-ft. high school. E. H. Davis, Scranton, Arch. Estimated cost, $200,000. Noted Sept. 9.

Hanover, Penn.—City plans high school. Estimated cost, $85,000. Noted Apr. 15.

✚Johnstown, Penn.—Contract awarded to W. H. FISSEL & CO., Broadway and 34th St., New York, N. Y., for superstructure for passenger station for Pennsylvania R.R. Sub-bids desired.

✚Philadelphia, Penn.—Contract awarded to CRAMP & CO., Philadelphia, at $100,000 for seven-story commercial and loft building at 315 Arch St. for Charles Schmidt. Noted June 10.

✚Philadelphia, Penn.—Contract awarded to FIDELITY CONSTRUCTION CO., at $139,951, for cavalry squadron armory. Noted Aug. 26.

Baltimore, Md.—Bids will be received about Sept. 20 for 18-story office building at Lexington and Liberty St. for Public Service Building Co. Estimated cost, $1,600,000. Noted Aug. 12.

✚Baltimore, Md.—Contract awarded to W. E. BURNHAM, Law Bldg., at $51,337, for school on Cold Spring Lane near Old York Rd.

✚Washington, D. C.—Contract awarded to JAMES L. MARSHALL, 700 Tenth St., for office building on Pennsylvania Ave., between 13th and 14th St. for Federal City Construction Co. Noted July 29.

✚Danville, Va.—Contract awarded to LONZO B. FLORA, Danville, for Stonewall Jackson School.

Bethany, W. Va.—Plans being prepared by W. H. Nicklas, 1900 Euclid Ave., Cleveland, Ohio, for brick and stone building for Presbyterian Church. Estimated cost, $50,000.

Charleston, W. Va.—Paul Eagan, Charleston, prepared plans for three-story brick, stone and terra cotta office building on State St. for A. H. Boyd. Estimated cost, $40,000.

Charleston, W. Va.—Plans being prepared by David Dick, Arch., Citizens' Bank Bldg., for two-story, 84x90-ft. addition to courthouse for Kanawha County. Estimated cost, $90,000.

Fairmont, W. Va.—Plans being prepared by W. H. Nicklas, Euclid Bldg., Cleveland, Ohio, for one-story church for First Presbyterian Church. J. W. Barnes, Chn., Bldg. Comm. Estimated cost, $75,000.

Huntington, W. Va.—Plans prepared by McMichael & Cain, Lyric Bldg., Richmond, Va., for two-story church for Huntington Institutional Baptist Congregation. Estimated cost, $100,000.

✚Spartanburg, S. C.—Contract awarded to WILLARD-BOGGS CONSTRUCTION CO., Spartanburg, at about $100,000, for remodeling passenger station of Southern Ry. Co.

Akron, Ohio—Bids will soon be received by Lauer & Young, Arch., Akron, for two-story, 99x76-ft. Sunday school and church for North Hill M. E. Congregation. Estimated cost, $40,000.

Bellaire, Ohio—Plans being prepared by Charles W. Bates, Board of Trade Bldg., Wheeling, W. Va., for bank, office and apartment at 32nd and Union St., for Farmers & Merchants' National Bank. Estimated cost, $40,000.

Cincinnati, Ohio—Plans being prepared for three-story college building for St. Xavier College. J. G. Steinkamp & Bro., 414 Walnut St., Cincinnati, Arch. Estimated cost, $200,000.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Sept. 20, by Clerk, Bd. of Education, City Hall, for bridge, tower and buildings A, B, C, D and E of new East Side High School at Madison Rd. and Erie Ave. Noted July 29.

Cleveland, Ohio—Bids will be received until Sept. 21 by George H. Smith, Arch., Colonial Arcade, for administration building for White Sewing Machine Co., East 78th St. and St. Clair Ave. Estimated cost, $90,000.

Cleveland, Ohio—Charles W. Somers, Cleveland, will build six-story building at Euclid Ave. and East Ninth St. Estimated cost, $300,000.

Cleveland Heights, Ohio—(Warrensville post office)—Chas. S. Schneider, 2248 Euclid Ave., Cleveland, prepared plans for church on Cedar Rd. for Plymouth Congregational Church. Estimated cost, $75,000.

✚Columbus, Ohio—Contract awarded to B. F. SMITH, Columbus, at $45,000, for country club at Arlington Ave. near storage dam. Noted Aug. 12.

✚Columbus, Ohio—Contract awarded to R. H. EVANS & CO., Columbus, at $116,000, by Board of Trustees of Ohio State University for Home Economics Building. Noted Aug. 19.

Columbus, Ohio—Bids will be received about Oct. 10 by C. E. Steeb, Secy., Ohio State University, for one- and two-story and basement, 120x250-ft. shop building for Ohio State University. Noted Aug. 12.

✚Dayton, Ohio—Contract for nine-story hotel at Fifth and Wilkerson St., for William C. Myers, awarded to T. A. GRAHAM, Springfield, at about $300,000.

Deshler, Ohio—Baltimore & Ohio R.R. and Cincinnati, Hamilton & Dayton Ry. will build new depot at Deshler.

Eaton, Ohio—Plans have been prepared by Thies & Thies, Arch., Dayton, for courthouse. Election will be held in November to vote on $250,000 bonds.

Lancaster, Ohio—Election will be held to vote on $100,000 bonds for high school.

Madison, Ohio—Plans being prepared by Franz C. Warner, Arch., Cleveland, for two-story and basement, 62x100-ft. high school. Estimated cost, $55,000.

Toledo, Ohio—(Official)—Bids will be received until noon, Oct. 1, by A. W. Stowe, Pres., Bd. of Dir.; Toledo College, for addition to Toledo University.

Xenia, Ohio—Election will be held in November to vote on $135,000 bonds for manual training school and playground.

✚Youngstown, Ohio—Contract for business block on West Federal St. for Ernest Salow has been awarded to HELLER BROS. CO.

✚Hammond, Ind.—(Official)—Contract awarded to JOHN H. McCLAY, Hammond, at $139,190, for Hammond Industrial High School. Noted Aug. 26.

Marion, Ind.—Bids will be received about Oct. 27 for high school for city. Hiram Elder, Marion, Arch. Estimated cost, $150,000.

Detroit, Mich.—Joseph L. Gwizdowski, Detroit, prepared plans for building at Junction and Michigan Ave. for Polish Union Society of Detroit. Estimated cost, $50,000.

Lake Linden, Mich.—Plans being prepared by John D. Chubb, Arch., Chicago, Ill., for three-story and basement, 98x170-ft. high school. Estimated cost, $100,000.

✚Chicago, Ill.—Contract for three-story, 350x700-ft. marble building for Marshall Field Museum of Natural History awarded to NORCROSS BROS. CO., 103 Park Ave., New York, N. Y., at $5,000,000. Noted July 29.

East St. Louis, Ill.—Newton P. Storey, Arch., East St. Louis, preparing plans for four-story hotel at Third St. and Broadway for John J. Wies.

Evanston, Ill.—Northwestern University and Garrett Biblical Institute will build new theological group on university campus. First building will be dormitory. Estimated cost, $150,000.

SUBWAY—PHILADELPHIA, PENN.

Bids were received Aug. 16 by A. M. Taylor, Dir. Dept. of City Transit, for the construction of subway and station under Filbert St., City Hall and South Penn Sq. from: (A) Foundation Co., 233 Broadway, New York, N. Y.; (B) Snare & Triest Co., Pier No. 40, South Wharves, Philadelphia; (C) F. L. Cranford, Inc., and Smith, Hauser & MacIsaac, Inc., Mail St. and Broadway, New York, N. Y.; (D) New York and New Jersey Construction Co., 30 East 42nd St., New York, N. Y.; (E) Keystone State Construction Co., 704 Pennsylvania Bldg., Philadelphia; (F) Arthur McMullen Co., 149 Broadway, New York, N. Y. The item bids were as follows:

	A	B	C	D	E	F
1,000 cu.yd. excavation above elevation zero	$4.00	$3.00	$4.00	$5.00	$3.00	$5.00
1,000 cu.yd. excavation below elevation zero	10.00	5.00	25.00	7.50	7.00	5.00
100 vertical ft. c.-i. cylinder columns, 4 ft. 6 in. diameter	100.00	50.00	40.00	80.00	50.00	100.00
10,000 lb. riveted steel columns	.06	.035	.05	.06	.05	.04
100 cu.yd. class A concrete	10.00	10.00	8.00	12.00	12.00	10.00
100 cu.yd. class C concrete	8.00	7.00	7.00	10.00	10.00	9.00
1,000 sq.ft. concrete sheathing	.50	1.00	.60	.20	.50	.15
1,000 cu.yd. backfilling	.40	1.00	1.00	.50	.50	.01
100 cu.yd. brick masonry	16.00	12.00	20.00	16.00	25.00	15.00
100 bbl. grout	3.00	4.00	5.00	3.00	5.00	2.00
2 M. ft. b.m. yellow-pine lumber	80.00	50.00	100.00	50.00	100.00	50.00
10,000 lb. steel girders	.045	.035	.04	.05	.03	.04
10,000 lb. steel beams	.045	.035	.035	.05	.03	.04
10,000 lb. steel rods	.035	.03	.05	.03	.05	.03
1,000 sq.ft. steel sheathing	1.00	1.00	.60	.50	1.50	.40
1,000 sq.ft. 1-ply waterproofing	.10	.06	.06	.04	.10	.05
1,000 sq.ft. 2-ply waterproofing	.12	.10	.09	.06	.20	.07
100 sq.ft. safety treads	.90	1.50	1.50	1.00	1.00	.50
1,000 lin.ft. 5-in. or 6-in. vitrified clay pipe	.50	.40	1.50	.50	.60	.20
1,000 lin.ft. 8-in. or 10-in. vitrified clay pipe	.70	.60	1.50	.75	1.00	.40
1,000 lin.ft. 12-in. vitrified clay pipe	1.00	.80	1.60	1.00	1.20	.75
1,000 lin.ft. 15-in. or 18-in. vitrified clay pipe	1.20	1.00	1.75	1.25	1.80	1.25
10,000 lb. c.-i. pipe	.03	.02	.03	.03	.03	.03
1,000 lb. steel gratings	.06	.06	.07	.08	.15	.06
2,000 sq.ft. vault lights	2.00	1.20	1.50	1.50	1.50	2.00
1,000 duct ft. electric ducts	.20	.12	.20	.10	.20	.12
100 sq.yd. wood block paving	3.50	3.50	4.50	3.50	4.50	3.00
100 sq.yd. asphalt paving	3.50	2.50	4.00	3.00	3.50	3.00
100 sq.yd. granolithic paving	2.25	2.00	3.00	2.50	2.70	2.00
500 lin.ft. resetting granite curb	.50	.60	.50	.60	.20	.50
Extended totals	$1,763,870	$2,787,240	$2,404,770	$2,486,980	$1,737,320	$2,286,060

Rockford, Ill.—Bids will be received until Sept. 20 by Board of Education for two-story, 115x130-ft. brick school. Frank A. Carpenter, Rockford, Arch. Estimated cost, $80,000.

Springfield, Ill.—Bids will be received until Sept. 20 by Louis G. Stevenson, Secy. of State, for remodeling south and north wing of State Capitol. James B. Dibelka, 130 North Fifth Ave., Chicago, Arch.

De Pere, Wis.—St. Norberts College will build an addition. Estimated cost, $70,000.

+Madison, Wis.—Contract awarded to WISCONSIN CONSTRUCTION CO., Chippewa Falls, at about $110,000, for physics building at University of Wisconsin. Arthur Peabody, Arch.

Milwaukee, Wis.—Plans prepared by Kirchoff & Rose, Arch., Milwaukee, for six-story commercial building at Chicago and Milwaukee St. Estimated cost, $100,000.

Milwaukee, Wis.—Bids being received by John Paul, Arch., St. Francis, for edifice for Polish National Catholic congregation, at Sixth and Hayes Ave. Estimated cost, $45,000.

+Milwaukee, Wis.—Contracts awarded for new building at Milwaukee Infants Home and Hospital at Hartford Ave. and Bradford Pl., to S. J. BROCKMAN, mason work; F. ERDMANN, carpenter work; JESKE & BRO., sheet metal; C. HENNECKE CO., iron; and WINDING & GEZELSCHAP, roofing. Fitzhugh Scott, 424 Jefferson St., Arch.

Chatfield, Minn.—Tyrie & Chapman, Arch., Auditorium Bldg., Minneapolis, preparing plans for two-story high school. Estimated cost, $50,000.

Maynard, Minn.—Plans being prepared for three-story school by E. F. Broomhall, Duluth. Estimated cost, $40,000.

Lincoln, Neb.—Bids will be received until 4 p.m., Sept. 25, by Board of Regents of University of Nebraska, for botany and zoology building. Estimated cost, $180,000. J. S. Dales, Secy.

Omaha, Neb.—P. H. Philbin, Omaha, plans 14-story hotel at 16th and Douglas St.

STATE HIGHWAYS—CALIFORNIA

Bids were received by the State Highway Commission, Sacramento, Calif., for constructing highways in Tulare, Division VI, Route 10, Section A, Tulare, Division VI, Routes 4 and 10, Sections D and E, Contra Costa, Glenn and Tehama Counties, from (A) Shattuck & Nimmo Warehouse Co., Bakersfield; (B) Rogers Bros. Co., Los Angeles; (C) Highway Paving & Construction Co., San Francisco; (D) Bent Bros., Los Angeles; (E) White & Gaskill, Long Beach; (F) John D. Marsh, Bakersfield; (G) M. Blumenkranz, Davis; (H) Taylor & Berliner, Los Angeles; (I) F. Rolandi, San Francisco; (J) Contra Costa Construction Co., Berkeley; (K) James Fitzpatrick, Sacramento; (L) Theodore Maretas and Thomas H. Muller, San Francisco; (M) J. H. Falconer, Pinole; (N) O'Brien Bros., Martinez; (O) Spring Construction Co., Berkeley; (P) W. A. Bechtel, Alton; (Q) W. B. Hunt & Sons, Alameda; (Q-1) Hard Bros., Ukiah; (R) A. C. McLean Construction Co., San Francisco; (R-1) W. J. Schmidt, Berkeley; (S) Palmer & McBryde, San Francisco; (S-1) Richard Rothwell, Los Angeles; (T) Urban Construction Co., San Francisco; (T-1) Blanchard Brown Co., San Francisco; (U) Bates Borland & Ayer, Oakland; (U-1) Occidental Construction Co., Los Angeles; (V) Fairbanks & Baechtel, Willits; (V-1) G. W. Conners, Eureka; (W) L. F. Gerdetz, San Francisco; (W-1) Marin Rock Co., San Anselmo; (X) H. G. Vaughan Construction Co., San Francisco; (X-1) C. H. & A. W. Gorrill, San Francisco; (Y) P. H. Hoare, Oakland; (Y-1) H. H. & C. M. Harlan, Williams; (Z) Engineer's Estimate. The item bids were as follows:

Tulare County, Division VI, Route 10, Section A

	A	B	C	D	E	F	Z
2970 cu.yd. excavation	$0.50	$1.25	$0.65	$0.70	$0.55	$0.70	$0.60
2220 cu. d. burrow excavation	.50	1.25	.85	.75	.55	.70	.60
210 lin.ft. 12-in. corrugated iron pipe	.50	1.00	.60	.60	.65	.60	.40
174 lin.ft. 18-in. corrugated iron pipe	.60	1.00	.70	.72	.75	.80	.50
11 cu.yd. concrete, Class B, for culverts and monuments	10.00	16.00	10.00	15.60	14.00	20 00	10.00
3840 cu.yd. concrete, Class B, for pavement	3.80	4.20	3.45	4.00	3.00	2.90	2.85
16 monuments	1.00	5.00	1.00	1.00	1.00	1.00	.50
Extended totals	$17,522	$23,255	$17,439	$19,542	$14,812	$15,270	$17,933

Tehama County

	I	K	S	(S-1)	(V-1)	(Y-1)	Z
83,400 cu.yd. excavation unclassified	$0.445	$0.45	$0.49	$0.59	$0.49	$0.46	$0.45
2268 lin.ft. 12-in. corrugated iron pipe	.50	.45	.40	.50	.40	.40	.40
670 lin.ft. 18-in. corrugated iron pipe	.60	.55	.50	.50	.50	.50	.50
288 lin.ft. 24-in. corrugated iron pipe	1.00	.70	.70	.75	.60	.75	.65
700 cu.yd. concrete, Class B, for culverts, monuments and slope paving	12.00	11.00	15.00	12.00	12.00	11.00	110.00
120 cu.yd. concrete, Class B, retaining walls	10.00	9.00	12.00	12.00	10.00	11.15	8.00
236 monuments	1.00	1.00	1.00	1.00	1.00	1.50	.50
Extended totals	$48,773	$48,136	$54,485	$60,967	$52,117	$49,214	$54,093

Contra Costa County

	I	J	K	L	M	N	O	P	Q	(Q-1)	R
65,000 cu.yd. excavation unclassified	$0.47	$0.44	$0.45	$0.45	$0.47	$0.43	$0.46	$0.57	$0.48	$0.65	$0.47
640 lin.ft. 12-in. corrugated iron pipe	.50	.50	.45	.90	.50	.40	.53	.50	.80	.80	.40
680 lin.ft. 15-in. corrugated iron pipe	.60	.60	.50	1.10	.60	.50	.63	.50	.80	.90	.50
470 lin.ft. 18-in. corrugated iron pipe	.70	.70	.55	1.30	.70	.80	.75	.50	.80	1.00	.60
92 lin.ft. 21-in. corrugated iron pipe	.90	.80	.55	1.50	.75	1.00	.85	.50	.80	1.00	.75
370 lin.ft. 24-in. corrugated iron pipe	1.00	.90	.75	1.80	1.00	1.20	1.05	.50	.80	1.00	1.00
72 lin.ft. 30-in. corrugated iron pipe	1.25	1.00	1.00	2.00	1.10	1.60	1.50	.50	.80	1.00	1.20
555 cu.yd. concrete, Class B, culverts and monuments	12.50	10.00	15.00	12.50	13.05	10.50	11.50	12.50	12.00	12.00	15.00
147 monuments	1.00	2.00	1.00	1.60	2.00	1.00	1.50	1.00	.85	1.00	1.00
Extended totals	$39,234	$35,979	$39,008	$39,306	$39,662	$35,547	$38,198	$45,297	$39,844	$51,185	$40,425

	(R-1)	S	(S-1)	T	(T-1)	U	(U-1)	V	(V-1)	Z
65,000 cu.yd. excavation unclassified	$0.43	$0.58	$0.40	$0.36	$0.40	$0.39	$0.47	$0.40	$0.455	$0.50
640 lin.ft. 12-in. corrugated iron pipe	.50	.50	.40	.40	.48	.50	.55	.50	.40	.50
680 lin.ft. 15-in. corrugated iron pipe	.60	.60	.40	.50	.55	.60	.65	.5i	.50	60
470 lin.ft. 18-in. corrugated iron pipe	.60	.70	.65	.50	.65	75	.75	.65	.60	.70
92 lin.ft. 21-in. corrugated iron pipe	.60	.80	.70	.60	.75	1.00	.85	.60	.75	.75
370 lin.ft. 24-in. corrugated iron pipe	.75	.90	.75	.70	1.00	1.25	.90	.75	1.00	.80
72 lin.ft. 30-in. corrugated iron pipe	1.00	1.00	1.00	1.00	1.50	1.50	1.00	.70	1.00	1.10
555 cu.yd. concrete, Class B, culverts and monuments	12.00	15.00	12.00	9.00	17.00	11.50	12.00	12.00	11.00	12.00
147 monuments	.50	1.00	1.00	1.50	1.00	1.00	1.00	1.00	1.00	.50
Extended totals	$36,098	$47,708	$34,054	$29,832	$37,116	$33,623	$38,987	$34,189	$37,216	$46,344

Tulare County, Division VI, Routes 4 and 10, Sections D and B

	A	B	C	D	E	F	G	H	Z
14,350 cu.yd. excavation	$0.60	$1.00	$0.60	$0.70	$0.45	$0.60	$0.60	$0.70	$0.50
2000 cu.yd. burrow excavation	.60	1.00	.70	.80	.50	.59	.75	.70	.75
210 lin.ft. 12-in. corrugated iron pipe	.50	1.00	.55	.60	.65	.50	.50	.50	.40
130 lin.ft. 18-in. corrugated iron pipe	.60	1.00	.60	.72	.75	.60	.60	.60	.55
195 lin.ft. 24-in. corrugated iron pipe	.70	1.50	1.00	.84	.85	.70	.75	1.00	.70
248 cu.yd. concrete, Class B, culverts and monuments	10.00	16.00	9.00	10.55	14.00	10.00	12.25	10.00	10.00
6350 cu.yd. concrete, Class B, pavement	3.00	3.75	3.20	3.58	2.85	2.68	4.25	4.00	2.90
1500 lin.ft. guard rail	.50	.50	.30	.35	.60	.50	.60	.50	.40
51 monuments	1.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	.50
Extended totals	$32,460	$45,666	$33,451	$37,953	$30,778	$30,409	$41,415	$40,504	$35,060

Glenn County

	C	H	Q	W	(W-1)	X	(X-1)	Y	Z
14,700 cu.yd. excavation unclassified	$0.625	$0.60	$0.58	$0.50	$0.60	$0.54	$0.55	$0.70	$0.65
300 lin.ft. 12-in. corrugated iron pipe	.55	1.00	.60	.75	.45	1.00	.50	.40	.40
210 lin.ft. 18-in. corrugated iron pipe	.60	1.50	.60	1.00	.65	1.50	.60	.60	.50
120 lin.ft. 24-in. corrugated iron pipe	1.00	2.00	.60	1.25	.75	2.00	.75	.75	.60
176 cu.yd. concrete, Class B, culverts and monuments	9.00	10.00	10.00	9.00	9.00	9.75	9.00	12.50	10.00
9190 cu.yd. concrete, Class B, pavement	3.10	2.40	3.00	3.00	2.85	2.645	2.95	3.45	2.75
440 lin.ft. guard rail	.30	.60	.40	.40	.35	.75	.35	50	.35
62 monuments	1.00	1.00	.50	1.00	1.50	1.00	1.00	2.00	1.00
Extended totals	$39,865	$38,817	$38,441	$37,327	$37,204	$35,209	$37,362	$44,875	$42,665

Devils Lake, N. D.—Masonic Lodge will build temple. Estimated cost, $45,000.

Great Falls, Mont.—Bids will soon be received for St. Marys Academy at Fourth Ave., North and Seventh St. George Shanley, Arch. Estimated cost, $40,000.

✚Kansas City, Mo.—Contract awarded to KANSAS CITY CONSTRUCTION CO., at $60,000, for two-story brick hospital and chapel at 2800 Main St. for Sisters of St. Mary. Victor J. Klutho, Syndicate Trust Bldg., St. Louis, Arch.

St. Joseph, Mo.—Bids will be received about Oct. 1 by Walter Boschen, St. Joseph, Arch., for three-story, 60x120-ft. physicians' and surgeons' building for W. F. Kirkpatrick. Noted Aug. 12.

St. Louis, Mo.—Plans have been approved by Director of Public Welfare for house of detention at 14th St. and Clark Ave. Estimated cost, $120,000. Noted Dec. 10 and Jan. 7.

Amarillo, Tex.—Citizens contemplate Carnegie library. W. H. Coon, Chn. Civic Com. of Bd. of City Develop. Estimated cost, $40,000.

Austin, Tex.—Citizens contemplate issuing $250,000 bonds for school buildings.

Afton, Okla.—Election will be held Sept. 28 to vote on $75,000 bonds for county court house.

Choteau, Okla.—Election will be held to vote on $200,000 bonds for county court house and four bridges across Grand River.

Oklahoma, Okla.—Oklahoma Amusement Co. will build theater at 19 North Robinson St. Estimated cost, $75,000.

BARGE CANAL WORK—ALBANY N. Y.

Contract No. 37

✚Bids were received Aug. 17 by W. W. Witherspoon, Supt. of Pub. Wks., for the construction of a harbor and dockwall on the south side of the Mohawk River at Canajoharies under Terminal Contract No. 37, from, (A) Engineers Estimate, (B) A. M. Haell, 90 West St., New York, N. Y., (C) Champlain Engineering & Contracting Corporation, Saratoga Springs, N. Y., (D) Lupfer & Remick, Buffalo, N. Y., (E) HOLLER & SHEPARD, Rochester, N. Y., (awarded contract), (F) Eastover Construction Co., Utica, N. Y., (G) American Pipe & Construction Co., Philadelphia, Penn. The item bids were as follows:

	A	B	C	D	E	F	G
24,000 cu.yd. excavation	$0.40	$0.48	$0.60	$0.30	$0.38	$0.45	$0.45
900 cu.yd. embankment	.12	.20	.12	.12	.12	.12	.12
4.2 M ft. b.m. creosoted lumber	65.00	100 00	60 00	75 00	65 00	65.00	65.00
1300 lin.ft. foundation piles	.25	.30	25	.30	.25	.30	.30
5300 lin.ft. reinforced concrete sheet piles	2.40	2.51	2 40	2 47	2.30	2.40	2.50
250 cu.yd. first class reinfosced concrete	13.00	11.00	11.00	13.00	12.00	15.00	13.00
110 cu.yd. second class reinforced concrete	9.00	8.00	8.00	10.00	8.00	10.00	9.00
2400 sq.yd. concrete slab pavement	1.50	1.50	1.45	1.80	1.50	1.80	1.75
300 cu.yd. third class rip-rap	2.50	3.00	2.30	2.50	2.50	2.50	2.50
21,000 lb. structural steel	.04	.04	.05	045	.04	.04	.04
19,000 lb. metal reinforcement	.035	.035	.04	.04	.025	.035	035
2700 lb. ison castings—plain	.04	.04	.035	.04	.04	.04	04
420 lin.ft. malleable c.i. nosing	1.25	1.00	1.25	1.25	1.25	1.25	1.25
65 fender fastenings	1.20	1.10	1.25	1.20	1.20	1.20	1.20
Extended totals	$33,832	$36,152	$38,115	$32,940	$32,572	$36,427	$36,227

✚**Pocatello, Idaho**—Contract awarded to LeDOUX & LeDOUX, Portland, Ore., at about $75,000, for four-story, 60x140-ft., steel and brick building for local Order of Elks. Houghtaling & Dougan, Henry Bldg., Portland, Arch.

Medical Lake, Wash.—Bids will be received until Sept. 21 by State Board of Control for three-story administration building, custodian building, two ward buildings and laundry and power building for Institution for Feeble Minded. Estimated cost, $200,000. Noted Aug. 5 and 19.

Sedro Woolley, Wash.—Bids will be received until 1 p.m., Sept. 21, by State Board of Control, Olympia, for buildings at Northern Hospital at Norlum, near Sedro Woolley. Noted Aug. 5.

Vancouver, Wash.—(Official)—Bids will be received until noon, Sept. 21, by Board of Control, Olympia, for State School for Blind. D. Nichols and J. A. Zittel, Spokane, Arch. Estimated cost, $75,000. Noted Aug. 19.

Portland, Ore.—Plans are being prepared for six-story and basement building for Loyal Order of Moose. B. E. Yeumans, Deputy Supreme Dictator of Oregon.

Los Angeles, Calif.—Plans have been prepared by Norman F. Marsh, Broadway Central Bldg., for group of high school buildings at Hooper and Compton Ave. and 38th St., to be known as Jefferson High School. Estimated cost, $200,000. Noted Mar. 11.

SEWER—CLEVELAND, OHIO

Bids were received Aug. 18 by the Commissioner of Purchases and Supplies for the construction of a concrete open shannel outfall sewer approximately 630 ft. long and a submerged outfall pipe line about 3600 ft. long, from, (A) Great Lakes Dredge & Dock Co., (B) American Construction Co., (C) Merritt & Chapman Derrick & Wrecking Co., (D) Charles Fath & Co., (E) Cleveland Engineering & Construction Co. The item bids were as follows:

	A	B	C	D	E
2185 lin.ft. 60-in. steel pipe	$18.00	$18.75	$22.62	$24.00	$28.00
2185 lin.ft. 60-in. c.i. pipe	20.45	22.00	34.50	26.00	34.00
2185 lin.ft. 60-in. concrete pipe	.....	27.00	.....	.....	.....
410 lin.ft. 72-in. c.i. pipe	28.75	22 00	46 50	34.00	35 00
410 lin.ft. 72-in. concrete pipe	25 00	25.00	51.50	40.00	38.00
1 tapered section of steel pipe	500 00	800.00	2120.00	6500.00	.....
1 special "Y" connection	500.00	.....	1950.00	.....	600.00
1 head chamber	650.00	.....	1390.00	.....	800.00
5700 lin.ft. wood piling 32 ft. or less long	.33	.40	.40	.45	.35
7200 lin.ft. wood piling more than 32 ft. long	.30	.45	.45	.45	.40
300 lin.ft. wood anchor piling	.38	1.75	.80	1.50	.50
25 timber supports	25.00	40.00	25.00	25.00	20.00
22 M ft. m.b. timber for caps and stringers	75.00	82.00	75.00	90.00	100.00
1250 cu.yd. concrete	10.50	15.00	10.00	14.00	8.00
1100 sq.yd. brick invertment	1.75	1.50	4.30	2.50	3.00
40,000 lb. steel reinforcing	.03½	.04	.06	.03½	.05
1275 lin.ft. iron pipe railing	.95	.90	.47	1.00	1.00
1 connections to present sewer	600.00	200.00	800.00	500.00	1500 00
Extended totals	1$95,671	$109,985	$175,513	$125,915	$137,230

The Gardner Governor Co., Quincy, Ill., reports a large increase in its business, especially in the export field. The company has recently received several carload orders from Japan, Cuba and Russia. The contracts call for almost every type of pump from small boiler feeders to general-service, sugar-house and water-works pumps.

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has recently changed the officers of the company as follows: A. Q. Tucker, president; W. G. Beebe, vice-president; Frank B. McMillin, general manager and secretary; and M. W. Spear, treasurer. Dr. N. Tucker has been made a director.

TEALL AVE. SEWER EXTENSION, SYRACUSE, N. Y.

✚Bids were received Aug. 5 by the Syracuse Intercepting Sewer Board, Syracuse, N. Y., for the construction of the Teall Ave. Sewer Extension or Drainage Ditch, from: (A) FRANK S. SPOSATTO, Syracuse (awarded contract); (B) Frank George; (C) John C. Schrade; (D) Samuel Renn; (E) Whiting Construction Co.; (F) C. T. Hookway Construction Co.; (G) Mondo Construction Co.; (H) Charles Bonn & Nicholas Marnell; (I) J. F. Leary Construction Co. The item bids were as follows:

	A	B	C	D	E	F	G	H	I
Clearing (lump sum)	$600 00	$300 00	$500.00	$300.00	$100.00	$200.00	$400.00	$250.00	$100.00
11,200 cu.yd. excavation	.45	.45	.55	.49	.60	.50	.49	.50	.50
165 cu.yd. lining	2.00	2.00	3.00	1.74	.285	1.50	3.00	3.00	1.50
1030 lin.ft. 60-in. reinforced concrete pipe sewer, Sect. A	5 80	8.00	8.00	6.95	8.25	7.50	6.30	7.75	8.00
1030 lin.ft. 60-in. horseshoe connecting sewer, Sect. A (alternate)	6 25	9.00	9 00	....	6.17	7.50	6.00	....	8.00
1030 lin.ft. 60-in. U-shaped connecting sewer, Sect. A (alternate)	7.60	9 00	8.00	6.64	7.38	7.40	6.20	8.10	9.00
1630 lin.ft. 60-in. reinforced concrete pipe sewer, Sect. B	9.75	11 00	11 50	15.14	14.50	15.00	17 00	16.30	17.00
1630 lin.ft. 60-in. horseshoe connecting sewer, Sect. B (alternate)	9 50	11 35	12 00		12.54	15 00	16 00	....	17.00
1630 lin.ft. 60-in. U-shaped connecting sewer, Sect. B (alternate)	9 45	11 35	11 00	13.55	13.60	14.00	17 00	13.50	18.00
Mildred Ave. junction (lump sum)	235.00	282 00	500 00	475.00	620 00	400 00	300.00	350.00	800.00
Horn Ave. junction (lump sum)	550.00	526 00	500 00	675.00	900.00	500.00	300.00	500.00	1000.00
210 lin.ft. 10-in. vitrified pipe sewer	.75	65	.50	.90	1.00	.80	1 00	.50	.60
60 lin.ft. manholes	3 00	3.00	5.00	4.75	5 00	5.00	5.00	4.50	6.00
5 manhole frames and covers	9.00	10.00	10 00	10 00	10.00	10.00	10.00	10.00	10.00
7 receivers	15.00	20 00	40 00	15 00	20 00	25.00	35.00	15.00	15.00
50 cu.yd. concrete, Class A	7.00	10.00	9.00	8.00	9.00	8.50	8 00	10.00	8.00
270 cu.yd. concrete, Class B	6.75	6.50	8.00	8.00	8.00	8.00	7.00	9.00	7.00
3000 lb. metal reinforcement	.05	.04	.05	.03	.05	.03	.05	.05	.05
40 sq.yd. cobblestone paving	1.00	.50	1.50	.90	1.50	.80	.90	1.00	1.00
960 sq.yd. rubble paving	2.00	1.75	2.00	2.25	2.45	2.60	1.10	3.75	2.50
960 sq.yd. concrete paving	2.00	1.50	2.00	1 55	1.80	2.40	1.10	2.50	1.50
13 M ft. b.m. timber and lumber	40.00	45.00	45.00	49 00	50.00	42.00	35.00	70.00	40.00
1050 posts	.45	45	.30	.55	.60	.60	.50	.54	.50
10,500 lin.ft. wire fencing fabric (per 100 ft.)	4.00	5.00	2.50	2.39	3.70	3.50	4.00	5.00	2.75
Extended totals	$34,804	$38,984	$40,962	$42,419	$42,522	$44,637	$44,980	$45,234	$49,592

SAUGATUCK RIVER BRIDGE, WESTPORT, CONN.

✚Bids were received Aug. 10 by Charles J. Bennett, State Highway Commissioner, Hartford, Conn., for the construction of a concrete bridge across the Saugatuck River at Westport, Conn., from: (A) Charles A. Sibley, 902 Chapel St., New Haven; (B) Henry E. Fox, 81 East 125th St., New York; (C) Hudson River Co., Inc., New York; (D) Barker-Bonner, Inc., 18 East 41st St., New York; (E) Barzhagi-Vought Co., Inc., 299 Madison Ave., New York; (F) McHARG-BARTON CO., 171 Madison Ave., New York (awarded contract on alternate 1); (G) Thomas A. Scott Co., New London; (H) Lathrop & Shea Co., New Haven; (I) North Eastern Construction Co., 225 Fifth Ave., New York; (J) Connecticut Good Roads & Construction Co., New Britain; (K) Jobson-Gifford Co., 30 East 42nd St., New York; (L) A. L. Guidone & Sons, Inc., 131 East 23rd St., New York; (M) Daniel F. Toomey, South Norwalk. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M
3000 cu.yd. excavation below mean low water	$4.50	$2.50	$3.00	$4.40	$2.75	$1.20	$2.76	$2.75	$3.45	$2.50	$3 50	$3.50	$1 50
4650 cu.yd. excavation above mean low water	.75	1.50	1.00	3.00	1.00	1.20	1.54	1.50	2.82	2.00	1.50	1.25	1.50
Piles delivered on work													
1800 ft. (a) 10 to 20 ft. length	.08	.14	.10	.40	.12	.12	.1536	.14	.13	.12	.12	.11	14
1600 ft. (b) 20 to 30 ft. length	.10	.14	.10	.33	.12	.17	.1536	.16	.13	.12	.15	.115	14
12,000 ft. (c) 30 to 50 ft. length	.15	.17	.10	.25	.12	.17	.1842	.20	.16	.14	.20	.14	.18
20,000 ft. (d) 50 to 70 ft. length	.22	.20	.15	.23	.17	.17	.2088	.50	.18	.20	.25	.20	50
Piles driven in place													
1800 ft. (a) 10 to 20 ft. length	.20	.40	.20	.35	.31	.15	.43	.15	.18	.30	.13	.12	.29
1600 ft. (b) 20 to 30 ft. length	.22	.40	.20	.21	.16	.15	.21	.25	.15	.30	.15	.12	40
12,000 ft. (c) 30 to 50 ft. length	.27	.40	.20	.17	.10	.15	.187	.30	.10	.40	.16	.14	60
20,000 ft. (d) 50 to 70 ft. length	.30	.40	.20	.14	.075	10	.155	.35	09	.35	.20	.18	1.00
100 tons Riprap in place	2.00	2.00	1.00	2.00	2.00	1.00	3.68	2.50	2 40	3 00	1.75	2.25	1.50
590 cu.yd. 1:3:5 concrete	7.50	7.00	14.00	12.90	8.00	15.00	25.36	9.50	6.80	41.00	8.00	10.00	18 00
1435 cu.yd. Granite ashlar masonry (alternate 1)	28.00	20.50	30.00	33.00	15.75	24.00	35.87	25.50	30 00	30.00	35.00	30.00	28 00
1435 cu.yd. brown stone ashlar masonry (alternate 2)	20.00	22.50	25.00	27.00	17.50	24.00	29 72	25.50	24.75	22.00	27.30	26.00	25 00
1435 cu.yd. granite rubble masonry (alternate 3)	14.00	12.00	15.00	32.00	10.25	21.00	25.79	23.00	24.00	25 00	18 00	19 50	23 00
1.5 M. timber fender piling	60.00	60.00	100.00	80.00	70.00	55.00	80.00	65.00	60 00	150.00	105.00	55 00	70 00
2182 cu.yd. 1:2:4 concrete	12.50	9.00	14.00	13.70	10.75	9.00	19.04	17.50	13.20	12.00	12 50	9.50	20 00
233,300 lb. reinforcement	.03	.03	.04	.032	.03	.025	.046	.04	.03	.035	.03	.03	05
832 ft. parapet wall	4.25	6.00	3.00	2.70	3.00	2.50	4.29	4 80	5 00	3.00	4 00	3.00	5.00
10,675 sq.ft. concrete walk	.13	.12	.15	.18	.15	.18	.21	.15	.19	.20	.20	.14	.23
1625 ft. concrete curb	.45	.40	.60	.80	1.00	.80	.68	.35	.35	1.00	.60	.50	.75
100 ft. resetting curb	1.00	.30	.20	.12	.50	.15	.37	.25	1.00	.60	.25	.25	.20
1300 gal. pitch waterproof	.30	.30	.25	.18	.50	.25	.307	.20	.20	20	.20	.30	.30
735 cu.yd. fill on bridge	1.25	1.00	1.50	1.00	1.00	1.00	1 84	.65	75	1 00	.75	.20	75
Remove old bridge (lump sum)	$850	$1000	$3000	$7000	$1000	$800	$1228	$2950	$2000	$1000	$1000	$700	$1000
Temporary foot bridge (lump sum)	3000	4000	4000	3000	3000	2500	3267	3000	3500	3000	2500	4500	4000
Extended total—Alternate 1	$131,026	$112,203	$133,980	$154,148	$ 98,401	$101,162	$169,954	$145,341	$133,101	$156,633	$137,057	$120,613	$181,378
Alternate 2	119,546	115,073	126,805	145,538	100,912	101,162	161,129	145,341	125,567	145,153	126,001	114,873	177,073
Alternate 3	110,936	100,006	112,455	152,713	90,508	96,857	155,489	141,754	124,491	149,458	112,656	105,545	174,203

PIER NO. 78—PHILADELPHIA, PENN.

Bids were received Aug. 9 by the Department of Wharves, Docks and Ferries for the construction of the substructure of Pier No. 78 and its adjacent bulkhead shed in the Delaware River from, (A) Snare & Triest Co., 253 Broadway, New York, N. Y., (B) Daniel S. Bader, 1345 Arch St., Philadelphia, (C) Arthur McMullen Co., 149 Broadway, New York, N. Y., (D) American Paving & Construction Co., 211 South Ninth St., Philadelphia, (E) Underpinning & Foundation Co., 290 Broadway, New York, N. Y., (F) Armstrong & Latta Co., Land Title Bldg., Philadelphia. The item bids were as follows:

	A	B	C	D	E	F
Rip rap for revetting the front of the sheet piling, per ton of 2,000 lb	$1.00	$1.25	$1.50	$1.75	$2.00	$1.60
Vertical or bearing piles	17.00	25 00	18 00	15.00	19.00	16.50
Inclined or spur piles	19 00	33 00	18.00	16 00	37.00	23.00
12-in. sheet piling, per horizontal lin.ft. of driven piling	21.00	32.00	20 00	32.00	35.00	26.00
8-in. sheet piling, per horizontal lin.ft. of driven piling	15 00	19 00	13.00	20 00	19.00	17.50
Sawed timber 6-in. thick and under, per M ft. b.m	55 00	80 00	50 00	65 00	55.00	60.00
Sawed timber, dimension sizes above 6 in. in thickness, per M ft. b.m	55 00	80 00	50 00	65 00	65.00	54.00
White oak for fenders, per M ft. b.m	60 00	100 00	50 00	65 00	91.00	66.00
No. 1 concrete, per cu.yd	6 00	7.50	10.00	12 00	14.00	13.00
No. 2 concrete, per cu.yd	10.00	7.00	9 00	9 00	9.00	8.00
Master Builders' finish on concrete paving, per sq.yd	.60	.70	.50	.65	1.30	1.00
Cement finish on concrete paving, curbs, etc., per sq.yd	.40	.35	50	50	1.17	.65
Structural steel, per ton	55 00	82.00	51.00	50 00	66.30	56.00
Reinforcing steel, per ton	55.00	100 00	60.00	50.00	65.00	55.00
Nails, spikes, bolts, nuts and washers, per lb	.03	.05	.02	.05	.06	.03½
Cast steel column bases, per lb	.03	.04½	.03	.03	.06	.03¼
Mooring posts, complete	125.00	75.00	100.00	78.00	65.00	125.00
Bollards, complete	45.00	75.00	75 00	40.00	15 00	75.00
12-in. drains, c.i	7.00	5.00	6.00	10.00	3.25	8.00
6-in. drains, c.i	5.00	5 00	4.00	10 00	2.00	5.00
Bolt sockets, tackle rings, foot holds and miscellaneous steel work, per lb	.05	.05	.10	.05	.10	.05
No. 1 Trus-Con curb bar, complete, per lin.ft	.18	.20	.15	12	.15	.15
No. 2 Trus-Con curb bar, complete, per lin.ft	.20	.20	.15	11	.15	.13½
Structural steel curbing, including fastenings, per lb	03	.05	.03½	.06	.05	.03½
8-in. c.i. drain pipe, per lin.ft	1.00	1.25	1.00	1 00	2 00	1.50
Both armor plates, complete, including fastenings	500 00	1500 00	1200 00	1000 00	1750.00	1300.00
Universal safety treads, per lin.ft	1.00	1.40	1 20	50	.75	1.50
65-pound 7-rails per ton	36 00	40 00	40 00	28 00	60 00	35.00
No. 6 splices for 85-pound rail, complete, with bolts, nuts and nut locks	2 00	2.50	2 00	16.00	3.00	2.25
9-in. girder rail, per ton	46 00	40 00	50 00	28.00	75.00	43.00
Splice bars, complete, for 9-in. girder rail, including bolts, nuts and nut locks	3 00	3.00	4.00	10 00	10 00	12.00
Tie rods with nuts complete	.75	.75	.70	5.00	25.00	1.60
Standard track spikes, per lb	.03	.05	02	.03	.05	.02½
White oak ties, 7x9 in. sawed or hewn, to be set in stone ballast	1.50	1.50	2.00	1.50	3.00	2.70
White oak sawed ties and switch timber, per M ft. b.m	40.00	100.00	45.00	70.00	110 00	50.00
Stone ballast for railway tracks, per cu.yd	1.75	2.00	2.50	3 00	3.00	2.25
Iron ladders	10.00	25 00	10 00	50.00	35.00	10.00
6-in. concrete base for granite block paving, per sq.yd	.80	1.00	1.00	.90	1.75	.85
Granite block paving with sand cushion, per sq.yd	2.40	3.00	2.40	3.00	3 00	3.25
8-in. straight cut granite curb, per lin.ft	2.00	2.00	.90	2.50	3.50	2.00
8-in. curved cut curb, per lin.ft	2.50	3.50	1.50	2.75	7.00	2 85
5-in. bluestone curb, per lin.ft	.75	1.00	.80	1.00	2 50	.75
No. 3 open-mouth inlet, complete	75.00	110.00	50 00	80.00	150 00	125.00
No. 3 grate-top inlet, complete	75.00	110.00	50.00	80 00	75.00	115.00
12-in. vitrified clay pipe, per lin.ft	1.00	.75	.25	1.00	1 50	.60
Concrete sidewalk paving, per sq.yd	1.10	1.50	1.00	1.50	2.00	1.80
Cinder filling, per cu.yd	.20	.70	.35	.70	2.00	.50
Grading for paving, per cu.yd	.10	.75	.35	1.50	1.00	.30
Laborers with tools, including superintendence, per hour	.35	.20	.30	.25	.50	.35
Mechanics with tools, including superintendence, per hour	.80	.70	.50	.50	1.00	.75
Extended totals	$516,700	$529,000	$554,662	$569,000	$584,000	$610,000

Contracts to Be Let

Bids received until Sept. 25, 1915.

Filter Plant, Pumping Station, Pumps, Boilers, Force Mains, Stand Pipe and Appurtenances

East Liverpool, Ohio, Sept. 9, 1915.

Sealed Proposals for the construction of a Six (6) Million Gallon Mechanical Filter plant, River Intake, Pumping Station, Pumps, Boilers, Chimney, Stand Pipe, Electric Light Generators, Auxiliary Equipment, Force Mains and other appurtenances, will be received by the Director of Public Service of the City of East Liverpool, Ohio, at his office, Supervision of Water, Water-Works Department, Fourth Street, in said City, until twelve o'clock Noon, Central Standard Time, on Saturday, September 25th, 1915, and will then be opened and read publicly.

All bids shall be made upon the official proposal blanks attached to the instructions to bidders, specifications, and form of contract and bond, which may be seen at the office of the Director of Public Service, East Liverpool, Ohio, or may be had by bona fide bidders upon application to Chester & Fleming, Engineers, Union Bank Building, Pittsburgh, Pennsylvania, on deposit of a certified check for Fifty ($50.00) Dollars, which will entitle bidder to one set of plans and two copies of the specifications, covering the item on which he intends to bid. Proper receipt for each such deposit will be given and the money will be refunded provided plans and specifications are returned in good condition within Ten (10) days after reception of bids.

Each proposal shall be accompanied by a certified check made payable to the order of the Treasurer of the City of East Liverpool, Ohio, of not less than 3% of the total amount of the bid, but in no case shall this check be less than One Hundred ($100.00) Dollars. This check is to be conditioned that if the bid is accepted, a contract will be entered into and the performance of same secured within ten (10) days after notification of acceptance of the bid. In case bid is rejected, or contract entered into, check will be returned. Successful bidders will be required to furnish a corporate surety bond in an acceptable Surety Company, in the full amount of the contract, in accordance with the plans and specifications and further in accordance with Ordinance Number 1470 of the City of East Liverpool, Ohio.

The right is reserved to reject any or all bids.

E. J. SMITH, Director of Public Service.

CHESTER & FLEMING, Engineers,
Union Bank Building, Pittsburgh, Pa.

Bids received until Sept. 24, 1915.

Additional Boiler Capacity

Buffalo, N. Y.

Sealed proposals for Additional Boiler Capacity, Heating Work, at the Buffalo State Hospital, Buffalo, N. Y., will be received by the State Hospital Commission, Capitol, Albany, N. Y., until 2:30 o'clock P.M., Friday, September 24, 1915, when they will be publicly opened and read. Proposals shall be enclosed in an envelope, furnished by the State Architect, sealed and addressed, and shall be accompanied by a certified check in the sum of $625. The contractor to whom the award is made will be required to furnish a surety company bond in the sum of 50% of the amount of contract within 30 days after official notice of award of contract and in accordance with the terms of Specification No. 2312. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the Buffalo State Hospital, Buffalo, N. Y., at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposals may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Dated September 1, 1915.

E. S. ELWOOD, Secretary,
State Hospital Commission.

Bids received until Oct. 19, 1915.

Superstructures, etc. for Elevated Railway

DEPARTMENT OF CITY TRANSIT

754 Bourse Building, Philadelphia, Sept. 9, 1915.

Sealed proposals, properly endorsed and addressed to the undersigned at the office above mentioned, will be received until 12 o'clock noon on Tuesday, October 19, 1915, and opened immediately thereafter, for the following:

Contract No. 511—Steel superstructure and appurtenant work for two-track elevated railway in Front Street from Callowhill Street to south of Girard Avenue, comprising about 4074 linear feet of structure.

Contract No. 512—Steel superstructure and appurtenant work for two-track elevated railway in Front Street and Kensington Avenue from south of Girard Avenue to north of York Street, comprising about 7128 linear feet of structure.

Contract No. 513—Steel superstructure and appurtenant work for two-track elevated railway in Kensington Avenue from north of York Street to north of Ontario Street, comprising about 7769 linear feet of structure.

Contract No. 514—Steel superstructure and appurtenant work for two-track elevated railway in Kensington Avenue and Frankford Avenue from north of Ontario Street to south of Unity Street, comprising about 7653 linear feet of structure.

Plans, specifications and blank forms for proposals can be obtained at the office above mentioned, a deposit of $10 (cash or certified check) being required for each set of plans pending return. Certain of the above contracts may be grouped in single bids, for which alternate proposal forms will be supplied if desired.

Bidders must be skilled and regularly engaged in the class of work for which they are competing.

No bid will be considered unless accompanied by a certificate from the City Solicitor that the provisions of an ordinance requiring proposal bonds on all bids exceeding in amount five hundred dollars ($500), approved May 25, 1860, have been complied with.

The Director reserves to himself the right to reject any or all bids, as he may deem best for the interest of the City of Philadelphia.

A. M. TAYLOR, Director.

Bids received unil Oct. 7, 1915.

Drainage System Extensions

Atlantic City, N. J.

Sealed proposals for the construction of extensions to the Storm Water Drainage System for the City of Atlantic City, New Jersey, will be received by the Board of Commissioners of Atlantic City, when called for, at Chambers of the Board in the City Hall, during a meeting to be held by that body on the seventh day of October, A.D. 1915, at which time and place, during the session of the said Board, the proposals will be publicly opened and read.

The work to be done embraces the building of approximately 1,322 feet of reinforced-concrete drains from three to four feet wide; 6,128 feet of brick and concrete drains from 27 inches to 48 inches in diameter; 6,808 feet of terra-cotta drains from 12 inches to 24 inches in diameter; 6,413 feet of terra-cotta inlet pipes from 10 inches to 12 inches in diameter, together with manholes, catch basins, storm-water inlets and the necessary timber and pile foundations.

Each proposal submitted must be accompanied by a Certified Check drawn upon a National or State Bank or Trust Company, and to the order of City Treasurer of Atlantic City, for the sum of Five Thousand Dollars ($5,000.00).

Specifications and blank forms of proposal can be obtained of John W. Hackney, the City Engineer, and a full set of plans can be obtained from him for the sum of Ten Dollars ($10.00), such sum to accompany the order. This sum will be returned upon surrender of the plans in good condition.

The Board of Commissioners reserves the right to reject any or all bids as provided in the "Instructions to Bidders."

J. B. THOMPSON,
Director of Streets and Public Improvements.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS—STEAM AND ELECTRIC

Massachusetts—Bay State St. Ry. Co. has asked City Council of Georgetown, Mass., for franchise to relocate its tracks on West Main St. from entrance to York Grove to Boston & Maine R.R. crossing, Georgetown. R. S. Goff, Boston, Vice-Pres. and Gen. Mgr.

Massachusetts—Merrimac Valley Power & Buildings Co. will finance new branch road with freight yards and terminals at Amesbury, to be built by Boston & Maine R.R. A. B. Corthell, Boston, Ch. Engr., Boston & Maine R.R.

✚**Connecticut**—The Connecticut Co. awarded contract for grading for new North End trolley line in Hartford to LATHROP & SHEA, New Haven. Line will extend on Main, Grove, Broad and Washington St., Farmington and Commonwealth Ave.

New York—Brooklyn syndicate considering plans for railway from Catskill to Richfield Springs, via Middleburg.

New York—United Traction Co., Albany, N. Y., has asked City Council for franchise for single-track line on Madison Ave. from Trinity Pl. to Grand St., and on Grand St. to Hamilton St., Albany. James F. Hamilton, Gen. Mgr.

New York—Town Board of Gorham granted franchise to Sodus & Wayne Electric Co. for electric railway through Gorham to Rushville.

Maryland—Idlewylde Park Ry., Baltimore, Md., will soon begin work on one-mile line on Regester Ave. from York Rd. to Idlewylde Park. Road will connect with line of United Rys. & Electric Co. Harry E. Gilbert, 2 East Lexington St., Baltimore, Pres. Noted June 24 and Aug. 12.

West Virginia—Kanawha Valley Traction & Electric Co., Parkersburg, W. Va., will double-track line from Pottery Junction to 12th St. via 19th St. S. D. Camden, Pres. Noted Sept. 2.

West Virginia—Surveys begun for proposed electric railway from Fayette Station, Fayetteville, W. Va., to Oak Hill and Beckley, 35 miles. H. G. Scott, Gen. Mgr., Virginian Power Co., Charleston, W. Va., is interested.

West Virginia—Pond Fork Ry., incorporated at Huntington with $26,000 capital, will build line from Madison, W. Va., up Pond Fork of Coal River to headwaters of Pond Fork, about 25 miles. R. M. Baker and H. Fitzpatrick, interested.

North Carolina—Graham County Lumber Co. offered to build standard-gage railway from Topton, N. C., on the Southern Ry. to Robbinsville, N. C., about 10 miles, if Graham County will pay $50,000; total cost, about $150,000. County will vote on bonds Oct. 12.

North Carolina—Kinston, Carolina R.R. & Lumber Co. will build extension of its line to Chinquapin, eight miles, or to Maple Hill, about 20 miles. C. I. Millar, Norfolk, Va., Pres.

North Carolina—Reported that Southern Ry. will build additional yard tracks and sidings at Durham, N. C. B. Herman, Washington, D. C., Ch. Engr.

✚**South Carolina**—Contracts reported awarded by Charleston Southern R.R., as follows: GADSDEN CONTRACTING CO., Savannah, Ga., 10 miles near Savannah; L. S. WOOD, Gaffney, S. C., contract near Charleston; M. SCHLITZ, Charlotte, 12 miles south; W. Z. WILLIAMS & CO., Macon, Ga., filling in temporary trestles for two miles, south of Ashepoo River, and two miles, north of Edisto River. W. R. Bonsal, People's Office Bldg., Charleston, Pres.

✚**Louisiana**—Krause & Managan Lumber Co., Westlake, La., awarded contract to W. J. CHASTAIN, Lake Charles, for 3½ miles tram road and two miles of spur tracks on timber land at Gillis. Noted Sept. 16.

Tennessee—Nashville, Chattanooga & St. Louis Ry. will build a belt line at Shelbyville to include the Sylvan Mills, Riverside Mills and Valley Cotton Mills. H. McDonald, Nashville, Ch. Engr.

Ohio—Reported that Dover, Millersburg & Western Electric Ry. will soon begin work on line from Canal Dover to Millersburg, via Sugar Creek, about 25 miles. F. F. Phillips, Canal Dover, interested.

Ohio—Cleveland, Painesville & Eastern R.R. Co., Willoughby, Ohio, will rebuild 2½ miles of track. Has purchased from Lackawanna Steel Co., 500 tons 70-lb. rail, 300 tons for immediate delivery.

Ohio—Youngstown & Southern Ry. Co., Youngstown, Ohio, asked permission of City Council to double-track its line from South Ave. to station on Front St. A. W. Hartford, Youngstown, Gen. Mgr.

Illinois—Elgin & Belvidere Co. contemplates extending its line to Rockford. Hamilton Browne, Chicago, Pres.

Illinois—Chicago & North Western Ry. will build four-track roadbed from Chicago to Sterling, or possibly as far as Mississippi River. W. H. Finley, Chicago, Ch. Engr.

Iowa—Surveys completed by Keokuk-Jefferson City Electric Ry. Co. for its line from Keokuk to Jefferson City. Right-of-way secured as far as Shelbyville. H. W. Knight, Chicago, interested.

Kansas—Plans being prepared for railway through Hutchinson, Reno County and the Huntsville district. City of Hutchinson will vote $100,000 terminal aid bonds. O. P. Byers, Hutchinson, Pres., Anthony & Northern Ry., interested.

✚**Missouri**—Metropolitan St. Ry. Co., Kansas City, Mo., awarded contract for extensions to its lines to COLUMBIA CONSTRUCTION CO., Milwaukee, Wis. Noted Aug. 19.

Arkansas—Reported that St. Louis, Iron Mountain & Southern Ry. (Missouri Pacific System) will spend $40,000 for improvements and repairs between Bergman and Diaz, Ark. E. A. Hadley, St. Louis, Mo., Ch. Engr.

Texas—Surveys begun for interurban line from Houston to Richmond. It is also proposed to extend the line eventually to San Antonio via Gonzales. Edward Kennedy, Houston, interested.

Texas—Southwestern Power, Light & Ry. Co., organized with $12,000,000 capital, will build an interurban line from Denison, Tex., to Oklahoma, Okla., about 150 miles. Power to be furnished by hydro-electric plants built by the company in southern Oklahoma. W. R. Croslen, Denison, Tex., Pres.

Oklahoma—Ft. Smith & Western R.R. secured entrance into Oklahoma City from Ft. Smith by way of Missouri, Kansas & Texas Lines. A. L. Smith, Ft. Smith, Ark., Gen. Engr.

Oklahoma—Mt. Carmel Development Co., Chickasha, Okla., capital stock, $50,000, plans a railway in Leflore County, to coal mines. F. L. Mercer, 301 North Sixth St., Chickasha, interested.

Washington—Federal Light & Traction Co., New York, N. Y., operating urban and interurban lines in Hoquiam and Aberdeen, Wash., contemplates electric line between Willapa Harbor and Grays Harbor. Estimated cost, $1,000,000. Lee Skipwith, New York, N. Y., Pur. Agt.

California—City Trustees granted franchise to Pacific Gas & Electric Co. for extensions on T St., Upper Stockton Rd., Lower Stockton Rd., Cypress Ave., Curtis Ave., Whiskey Hill Rd., Palmetto, Fifth and East Ave., Sacramento. John W. Britton, Gen. Mgr.

California—Southern Pacific Co. applied to Railroad Commission for authority to build spur track at grade across 11th and 12th St., Sacramento, and a team track at grade across F St., Galt, Sacramento County. W. H. Hood, San Francisco, Ch. Engr.

Quebec—Reported that City Council, Quebec, Que., considering steps to compel Quebec Ry., Light & Power Co. to extend its lines in Limoilou, Beauport and Charlesbourg. H. G. Matthews, Quebec, Gen. Mgr.

Ontario—Ontario Railway Board approved plans of Toronto Ry. Co. for extension of its lines along Yonge St. from present northerly terminus to a point near Farnham Ave. R. J. Young, Toronto, Gen. Mgr.

LIGHT, HEAT AND POWER

✚**Milford, N. H.**—Milford Electric Light & Power Co. secured right-of-way for transmission line from Milford to Townsend, Mass., to connect with main line. Contract for line awarded to FREDERICK T. LEY & CO., Springfield, Mass.

Enosburg Falls, Vt.—Electric Light Commissioners will install electric-light system to replace gas lamps now in use. W. J. Redmond, Chn., Comrs.

Buffalo, N. Y.—Delaware, Lackawanna & Western R.R. will build one-story substation at 60 Ohio St., Buffalo. Cost, $8,000.

New York, N. Y.—(Borough of Queens)—Interborough Rapid Transit Co. purchased site on Jackson Ave. near Barn St., Long Island City, for new substation. Estimated cost, $40,000. George H. Pegram, 165 Broadway, New York, Ch. Engr.

New York, N. Y.—(Borough of Queens)—Plans being prepared by New York & Queens Electric & Power Co., Long Island City, for new substation in one of its districts. Work will not begin before next year. Company will also equip about two miles of subway, and requires equipment to provide for 3,000 additional street-lamps. C. G. M. Thomas, Pres.

Starkey, N. Y.—Town granted franchise to E. L. Bailey, owner of Dundee electric-light plant, to furnish electricity in Starkey, and extend service to Lakemont.

Camden, N. J.—C. B. Coles & Co. will build new power plant at its woodworking factory. Equipment will include boilers, engines, generators and auxiliaries.

Flemington, N. J.—Reported that Pennsylvania R.R. contemplates a power plant in connection with the electrification of Flemington-Lambertville line.

Lyndhurst, N. J.—New York Telephone Co. granted 50-year franchise for underground conduit system in certain streets of Lyndhurst.

Newark, N. J.—National Lock Washer Co. will build one-story steel boiler house at its plant on Johnson St.

Paterson, N. J.—Board of estimate appropriated $5,686 for electric-light and power plant in High School building. Equipment will consist of two 135-kw. units.

Perth Amboy, N. J.—The Chesebrough Mfg. Co., manufacturer of vaseline products, will build a pump house at its plant.

Girardville, Penn.—Girardville Gas Co. will soon award contracts for gas plant to be located either in Lansford or Coaldale, to supply surrounding sections. Estimated cost, $600,000.

Baconton, Ga.—Bonds for $12,000 voted for electric-light plant and water-works system.

Madisonville, Tenn.—Town granted franchise to M. C. King and associates, Copperhill, Tenn., for electric-light system in Madisonville.

Athens, Ohio—Athens Electric Co. contemplates rebuilding entire distribution system, and extending new transmission lines throughout the city. Page C. Morris, Vice-Pres. and Gen. Mgr.

Dayton, Ohio—Reported plans under way for hydro-electric plant at Woodsdale to supply electricity to large section of southern Ohio.

Green Camp, Ohio—Village will build 4-mile transmission line and install street-lighting system. H. O. Fisher, Toledo, Engr.

Monroe, Ind.—Reported that Town Board rejected all bids for 6-mile transmission line from Columbia City to Monroe. Bids to be readvertised.

Wakarusa, Ind.—Public Service Commission authorized Hawks Electric Co., Goshen, Ind., to purchase plant of Home Electric Co., Wakarusa, for $10,000. A transmission line from Goshen to Bremen will be built by Hawks Co.

Cheboygan, Mich.—Cheboygan Electric Light & Power Co. will install 250-hp. auxiliary plant adjoining gas plant for emergency use and in low-water periods. F. B. Spencer, Secy. and Mgr.

Detroit, Mich.—Reported Hudson Motor Car Co. purchased site for new power plant and engine room.

✚Iron Mountain, Mich.—Peninsular Power Co. will enlarge and improve its power plant at cost of $50,000. Contract for 2,200-kw. generator awarded to WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburgh, Penn.

Kalamazoo, Mich.—Citizens voted against bond issue of $350,000 for enlargement and improvement of municipal electric-light plant. Noted Sept. 2 and 9.

✚Elizabeth, Ill.—Elizabeth Light & Power Co. awarded contract for three miles transmission line, substation and distribution system to T. G. HAMILTON, Laporte, Ind., at $5,575. Noted Sept. 9.

Chariton, Iowa—Union Service Co., Chariton, granted franchises by towns of Lucas and Woodburn to supply electricity in both towns. Energy to be furnished from Chariton. Reported that company will build new plant in Chariton.

Luverne, Iowa—(Official)—Bids will be received until 6 p.m., Oct. 6, by R. E. Cook, Town Clk., for eight miles transmission line, substation and distribution system. Raasch & Brooks, Ft. Dodge, Engr

✚Sergeant Bluff, Iowa—Town Board has awarded contract for three miles 11,000-volt, single-phase transmission line from Sioux City, and for street-lighting system to A. J. WESTFALL, 608 U. S. Bldg., Sioux City, at $5,934. Noted Aug. 19.

Wall Lake, Iowa—Bonds for $7,500 voted for transmission line from Lake View and distribution system in Wall Lake. Energy will be purchased from Sac City Electric Co.

✚Hallock, Minn.—Village Board awarded contract for power plant, pole line and street-lighting system to J. G. ROBERTSON, St. Paul, at $17,750.

Hanska, Minn.—Village Board granted franchise to Madelia Electric Co., Madelia, to supply electric current to Hanska.

✚Nashwauk, Minn.—Contract awarded to HUGH FAWCETT, Duluth, at about $10,000 for power house at Crosby Mine at this point.

Attica, Kan.—Town voted $30,000 bonds for electric-light and water-works system in Attica. Noted July 29.

Havensville, Kan.—Town will vote for bond issue of $8,000 for electric-light plant in Havensville, and for building transmission line from Centralia.

Ord, Neb.—Reported bids will be received until Oct. 1 by John C. Work, Mayor, for electric-light plant. Estimated cost, $22,700.

Tower, N. D.—City Council contemplates electric-light plant.

✚Seguin, Tex.—Seguin Electric Light & Power Co. awarded contract for two waterwheels, headhouses, 187-kw. generator and switchboards to WALTER TIPS CO., Austin, at $9,797.

Grove, Okla.—City Council considering plans for improving electric-light plant and water-works system. Estimated cost, $10,000.

Soper, Okla.—Bonds for $6,000 voted for electric-light plant. Reported bids will soon be asked.

Ft. Collins, Colo.—Reported that bids being received for power house at State Agricultural College, Ft. Collins. Cost, about $20,000. Fisher & Fisher, Century Bldg., Denver, is Arch.

Republic, Wash.—F. R. Clark will build transmission line from Republic to Danville to connect with power line from Bennington Falls near Danville. Energy will be furnished to operate local mines and stamp mills.

Liverpool, N. S.—Reported bids will soon be received for improvements to municipal electric-light plant. Estimated cost, $15,000. T. R. Bartling, Town Engr.

Toronto, Ont.—Hydro-Electric Power Commission of Ontario decided to construct 60 miles transmission lines as follows: Chatham to Petrolia, thence to Oil City, 24 miles; Granton to Kirkton, thence to Exeter, 25 miles; Lucan to Ailsa Craig, 10 miles. W. W. Pope, Toronto, Secy. Com.

BRIDGES

Augusta, Maine—Bids will be received until 11 a.m., Sept. 29, by State Highway Commission for two concrete abutments at Mattawamkeag River in Haynesville, one at Fish River and two at Higgins Brook in Town of Harmony; bids received at same time for 18,600 ft. b.m. plank on steel bridge in Medway.

Nashua, N. H.—(Official)—Plans being prepared for reinforced-concrete bridge over Pennichuck Brook between Nashua and Merrimack, N. H. George P. Winn, City Engr. Noted Aug. 19.

Providence, R. I.—Bids will be received until 2:15 p.m., Sept. 27, by Department of Public Works for steelwork of Randall St. Bridge. Noted Sept. 9.

Woonsocket, R. I.—Plans prepared by F. A. Mills, City Engr., were accepted for three bridges, one 170 ft. long, one 110 ft. and the third 55 ft. long, all of reinforced-concrete. Bids will soon be asked. Noted Aug. 26.

★✚Bridgeport, Conn.—Stratford Ave. Bridge Commission awarded contract for approaches and superstructure of bridge to HOLBROOK, CABOT & ROLLINS, Boston, at $352,000; bascule span, Strauss type, awarded to EMPIRE CONSTRUCTION CO., New York, N. Y., at $109,265. Noted Aug. 19.

Albany, N. Y.—(Official)—Lowest bid received by State Department of Public Works for substructure, superstructure and approaches of Gorham St. Bridge, Waterloo, was that of Scott Bros., Rome, N. Y., at $59,928. Contract not awarded. Noted Aug. 19.

✚Buffalo, N. Y.—(Official)—Common Council awarded contract for rebuilding Chicago St. Viaduct, to be completed in six months, to STROBEL STEEL CONSTRUCTION CO., Chicago, at $184,700. Noted June 24 and Sept. 16.

✚Buffalo, N. Y.—Grade Crossing Commission, 436 Ellicott Sq., awarded contract for 162-ft. bridge over tracks of the Pennsylvania R.R. on Bailey Ave. to EASTERN CONCRETE STEEL CO., D. S. Morgan Bldg., Buffalo, at $46,272. Noted Sept. 9.

Groveland, N. Y.—Town Boards of Groveland and Sparta voted to spend $4,500 for three concrete bridges between Groveland Station and Dansville-Mt. Morris State Highway.

Rochester, N. Y.—Driving Park Ave. Bridge will be paved with wood block. Herbert W. Pierce is Comr. of Pub. Wks.

Camden, N. J.—City Council and Board of Chosen Freeholders of Camden County are considering lift bridge at State St., in connection with deepening of Cooper River. Span of about 70 ft. proposed.

Freehold, N. J.—Bids will be received until 11 a.m., Oct. 6, by Board of Chosen Freeholders of Monmouth County for bridge on road from Freehold to Hightstown. George D. Cooper, County Engr.

✚Hackensack, N. J.—Contract for bridge on Hopper Ave. between Westwood and Park Ridge, awarded by Board of Chosen Freeholders to CHARLES FIGINI, Lodi, N. J., at $6,600.

Matawan, N. J.—Lowest bid received by Board of Chosen Freeholders of Monmouth County for Strauss trunnion bascule bridge over Matawan Creek on South Amboy-Keyport Rd. was that of Long-Broadhurst Co., Hackensack, at $34,320. Noted Aug. 19.

✚New Brunswick, N. J.—Board of Chosen Freeholders of Middlesex County awarded contract for reinforced-concrete bridge over Ambrose Brook, Piscataway Township, to WILSON CONCRETE CO., Plainfield.

Perth Amboy, N. J.—Bids will be received until 2:30 p.m., Sept. 27, by A. J. Gebhardt, Dir., Bd. of Chosen Freeholders of Middlesex County, New Brunswick, for reinforced-concrete slab bridge on Brace Ave., Perth Amboy. Alvin B. Fox, Perth Amboy, County Engr.

Harrisburg, Penn.—Bids will be received until 10 a.m., Sept. 30, by Robert J. Cunningham, State Highway Comr., for 50-ft. steel bridge in Butler County, and three concrete bridges in Elk County, two of 12 ft. each, and one of 24 ft.

Lewistown, Penn.—Bids will be received until Oct. 8 by Commissioners of Mifflin County for bridge over Kishacoquilla Creek on Dorcas St. extension. Dr. W. M. Baker is Comr.

★✚Media, Penn.—(Official)—Commissioners of Delaware County awarded contract for bridge on Glenolden Ave. over Muckinapatus Creek to WILLIAMS CONSTRUCTION CO., Chester, at $6,600. Noted Aug. 26.

Phoenixville, Penn.—(Official)—Bids will be received until 11 a.m., Sept. 30, by Commissioners of Montgomery County, Norristown, for concrete arch over Schuylkill River between Phoenixville and Mont Clare. John N. Jacobs, Norristown, County Controller.

Sharon, Penn.—Bids will be received until 1:30 p.m., Oct. 5, by Commissioners of Mercer County, Mercer, for either concrete or steel bridge across Shenango River at State St., Sharon. Noted July 29.

✚Wilmington, Del.—Baltimore & Ohio R.R. Co. awarded contract for substructure of bridge to carry Lancaster Ave. across its tracks to JAMES F. BROGAN CO., Philadelphia, Penn.; superstructure awarded to KING BRIDGE CO., Cleveland, Ohio. Bridge to be of steel, 60 ft. wide.

Mt. Washington, Md.—Pennsylvania R.R. will build iron girder bridge over Jones Falls, near Mt. Washington. Work will be done by company forces. A. C. Shand, Philadelphia, Penn., Ch. Engr.

✚Berkeley Springs, W. Va.—(Official)—County Court of Morgan County awarded contract for bridge across Sleepy Creek to CONCRETE STEEL BRIDGE CO., Clarksburg, W. Va., at $4,968. Noted Aug. 26.

✚Huntington, W. Va.—Commissioners of Cabell County awarded contract for bridge over Fudges Creek in Grant District to A. T. THOMPSON, at $9,101.

Keyser, W. Va.—(Official)—Bids will be received until Sept. 27 (extension of date from Sept. 14), by J. V. Bell, Clk. of Mineral County, for two reinforced-concrete bridges, 30-ft. span over Georges Run, and 50-ft. span over Beaver Run. Noted Sept. 2.

Williamson, W. Va.—City contemplates bridge across Tug River to open new road from West Virginia to Kentucky. Estimated cost, $14,450. A. C. Pinson, Mayor.

✚Springfield, Ga.—Commissioners of Effingham and Bulloch Counties awarded contract for steel bridge over Ogeechee River between the two counties to EASTERLING & EASTERLING, Daisy, Ga., at $5,790. Noted Aug. 5.

Arcadia, Fla.—(Official)—Plans will not be completed for several months for bridge over Kissimmee River near Arcadia, as it is county line structure, and arrangements must be made with adjoining county. A. L. Durrance, County Clk., De Soto County. Noted Sept. 9.

+Titusville, Fla.—Commissioners of Brevard County awarded contract for 112-ft. concrete bridge over Crane Creek to CHAMPION BRIDGE CO., Wilmington, Ohio, at $10,500.

Meridian, Miss.—Bids will be received until Oct. 4 by Supervisors of Lauderdale County for 75-ft. steel bridge over Oktibeha Creek at Mayerhoff Switch on New Orleans & Northeastern R.R. W. R. Pistole, Chancery Clk.

Oberlin, La.—Reported that Ward Five, Allen Parish, will soon select engineer for 1,600-ft. light steel bridge across Calcasieu River, and a number of smal steel or concrete bridges. S. M. Lee, Member Parish Police Jury. Noted Aug. 26.

Cleveland, Ohio—Bids will be received until 11 a.m., Oct. 9, by E. G. Krause, Clk. of Cuyahoga County Comrs., for bridge work, Report 3,587. W. A. Stinchcomb, County Engr.

+Marion, Ohio—Commissioners of Marion County awarded bridge contracts as follows: Clark Bridge in Montgomery Township, to CENTRAL CONCRETE & CONSTRUCTION CO., Canton, $6.500; Roberts Bridge in Claridon Township, to MODERN CONSTRUCTION CO., Fremont, $4,800; Tymochtee Bridge, to CHAMPION BRIDGE CO., Wilmington, $2,500. Noted Aug. 26.

Milford, Ohio—(Official)—Bids will be received until noon, Oct. 4, by Cleona Searles, Audr. of Clermont County, Batavia, for raising and repairing abutments, and building steel superstructure and flooring of bridge over East Fork of Little Miami River, Union and Miami Townships. Bids will be received at same time for $10,000 bonds to pay for this work. Noted Sept. 9.

Steubenville, Ohio—Bids will be received until Oct. 15 by Commissioners of Jefferson County for steel superstructure of bridge in Smithfield Township, and reinforced-concrete bridge on State Rd. in Springfield Township.

Xenia, Ohio—Bids will be received until 11 a.m., Oct. 1, by Commissioners of Greene County for new steel bridge, and for laying creosote or other block floor on two other bridges.

Anderson, Ind.—Commissioners of Madison County having plans prepared for repair and extension of Main St. Bridge. Two additional 90-ft. steel spans, reinforced-concrete piers and abutments required. Estimated cost, $9,000. W. O. McVaugh, County Surv.

Crown Point, Ind.—Bids will be received until 10 a.m., Oct. 10, by Edward Simon, Audr., Lake County, for pony truss bridge over Hart Ditch, Brown St., Munster.

Crown Point, Ind.—Bids will be received until 10 a.m., Oct. 28, by Edward Simon, Audr., Lake County, for sale of $116,000 bridge bonds, for bridges in Dyer and Hammond, Ind.

Frankfort, Ind.—(Official)—Bids will be received until 2 p.m., Oct. 4, by Commissioners of Clinton County for repairing the Rice Bridge on Frankfort and Middlefork Rd. Edward Spray, County Audr.

+Joliet, Ill.—(Official)—Chicago, Ottawa & Peoria Ry. awarded contract for two new bridges to JOLIET BRIDGE & IRON CO., Joliet. Noted Aug. 26.

Burlington, Iowa—City of Burlington and private corporation considering bridge over Mississippi River. Plans not yet started. Estimated cost, $2900,000. H. G. Vollmer, City Engr.

Keosauqua, Iowa—Bids will be reecived until Sept. 29 by Board of Supervisors of Van Buren County for 80-ft. steel pony truss bridge, concrete floor and abutments, and 40-ft. steel pony truss bridge, concrete floor on old abutments; both to have 16-ft. roadways.

+Austin, Minn.—Commissioners of Mower County awarded contract for six county bridges to HENNEPIN BRIDGE CO., Minneapolis, at $10,487. Noted Aug. 19.

+Carlton, Minn.—Commissioners of Carlton County awarded contract for county bridges to HEWITT BRIDGE CO.

+Faribault, Minn.—Contract for bridge over Crocker Creek on Seventh St., awarded to JOHN THONET.

+Houston, Minn.—Contract for bridge over Badger Creek awarded to OLE HOGANSON, Houston.

+International Falls, Minn.—Contracts awarded for bridge across Sturgeon River and one over Bear River to IOWA BRIDGE CO., and PLYMOUTH BRIDGE CO., Minneapolis, respectively.

Preston, Minn.—Bids will be received until 2 p.m., Sept. 27, by J. Dunford, Audr. of Fillmore County, for five county bridges.

New Ulm, Minn.—Bids will be received until 2 p.m., Sept. 28, by Commissioners of Brown County for abutment and wings to Cobden Bridge over Big Cottonwood River, about four miles south of Cobden. Louis G. Vogel, County Audr.

+Wacouta, Minn.—(Red Wing post office)—Contract for steel bridge across Bullards' Creek, Wacouta, awarded to HEWITT BRIDGE BUILDING CO., Minneapolis.

+Alma, Kan.—Commissioners of Wabaunee County awarded contract for three bridges to J. A. JOHNSON, Junction City, at $5,800.

Manhattan, Kan.—Bids will be received until Oct. 6 by County Clerk of Riley County for 10 reinforced-concrete bridges, and repairing or replacing several steel bridges. W. S. Gearhart, Manhattan, State Engr.

+Mankato, Kan.—(Official)—County Commissioners awarded contracts for bridge work as follows: LEAVENWORTH BRIDGE CO., one new bridge, 11 repair jobs; WESTERN BRIDGE CO., one new bridge and 11 repair jobs; JOHN BLISS, one new bridge. Noted Aug. 26.

Bismarck, N. D.—Bids will be received until noon, Oct. 5, by F. E. Flaherty, Audr. of Burleigh County, for concrete culverts on section line south of Wing.

Manning, N. D.—Bids will be received until 2 p.m., Oct. 4, by C. H. Gutmann, Audr. of Dunn County, for steel truss bridge between Dunn and Stark Counties.

+Dillon, Mont.—(Official)—Commissioners of Beaverhead County awarded contract for two steel bridges, one 170-ft. and one 42-ft. span, to O. E. PEPPARD, Missoula, at $8,980. Noted Aug. 26.

Gallatin, Mo.—(Official)—Bids will not be asked for rebuilding Daviess County bridges destroyed by recent floods. B. H. Tarwater, County Clk. Noted Sept. 9.

Warrensburg, Mo.—David Mohler, County Engr. of Johnston County, preparing plans for steel bridge. Bids probably asked about Dec. 1. Theodore Hyatt, County Clk.

Lewisville, Ark.—Hugh R. Carter, State Highway Engr., Little Rock, prepared plans for 240-ft. steel bridge across Bodcaw Creek near Lewisville.

Marion, Ark.—Crittenden County Commissioners considering plans for viaduct from approaches of Harahan Bridge, now under construction, to levee, a distance of two miles. Proposed structure to be 16 ft. above ground and 24 ft. wide. Estimated cost, $350,000.

Cleburne, Tex.—City Council contemplates bridge over West Buffalo Creek on Poindexter Ave. It will be concrete, 120 ft. long.

Denison, Tex.—Citizens voted $50,000 bonds at recent election for viaduct over shops and yards of Missouri, Kansas & Texas Ry. Co.

Galveston, Tex.—Reported that Southern Pacific Co., Missouri, Kansas & Texas; Gulf, Colorado & Santa Fé and Galveston, Houston & Henderson Rys., will build jointly, 1,000-ft. addition to the reinforced-concrete archway of the causeway across Galveston Bay. Estimated cost, $1,500,000. A. T. Dickey, City Engr.

+Laredo, Tex.—(Official)—City Council awarded contract for one 85-ft. and one 188-ft. reinforced-concrete bridge to RANNEY CO., San Antonio, at $15,000. Noted Sept. 9.

Minco, Okla.—Commissioners of Grady County, Chickasha, and Canadian County, El Reno, contemplate bridge across Canadian River four miles from Minco. Estimated cost, $45,000 to $50,000, to be divided between two counties. H. A. Cranwell, Chickasha, County Engr. of Grady County.

Las Vegas, N. M.—Bids will be received until 10 a.m., Sept. 30, by Fidel Ortiz, Chn., Comrs. of San Miguel County, for grading and paving bridge over Gallinas River at foot of Bridge St., Las Vegas. George E. Morrison, County Engr.

Aberdeen, Wash.—Bids were received by the City Council Sept. 8 for West Toll Bridge over Chehalis River from: J. R. Wood, 621 Valley St., Seattle, $20,729; Coast Bridge Co., Portland, Ore., $21,218. Noted Aug. 12 and 26.

Hooper, Wash.—The Oregon-Washington R.R. & Navigation Co. has plans for 210-ft., three-span steel bridge over Palouse River near Hooper. S. Murray, Portland, Ore., is Bridge Engr.

Riverside, Wash.—All bids received Sept. 8 for steel bridge over Okanogan River rejected. Reported new bids will be received about Oct. 10 by Commissioners of Okanogan County, Conconully.

Madera, Calif.—Reported that city voted $12,000 bonds for new concrete bridge across Fresno River.

Stockton, Calif.—Supervisors of San Joaquin County contemplate bridge work as follows: Trestle at Woodbridge, $5,400; Lockeford Trestle, $17,500; bridge on Jack Tone Rd., $10,000; on Eight Mile Lane, $2,000; Leonard Rd. Bridge, $4,000; repairing bridges, $1,500; painting steel bridges, $6,000; replacing miscellaneous wooden bridges and culverts, $10,000.

Windsor, Ont.—City Council approved plans for $45,000 bridge on Wyandotte St. over tracks of the Michigan Central R.R. Dominion Ry. Board will be asked to authorize the work.

+Manitou, Man.—Contract for steel cantilever bridge over Nelson River at Manitou Rapids, awarded to J. D. McARTHUR CO., 501 McArthur Bldg., Winnipeg, at $175,000. Subcontracts awarded to CONTRACTORS, LTD., The Pas, for substructure, and to CANADIAN CO., Walkerville, Ont., for steel for superstructure.

WATER SUPPLY—IRRIGATION

+Boston, Mass.—(Official)—Contract for laying water mains in streets in East Boston awarded HENRY SPINACH CONTRACTING CO., Boston, at $7,381. Noted Sept. 2.

Boston, Mass.—(Official)—Bids will be received by the Metropolitan Water and Sewage Board, 1 Ashburton Pl., until 1:30 p.m., Sept. 27, for surface water drains at Spot Pond, Stoneham.

Cambridge, Mass.—Plans being prepared for a municipal filtration plant. George A. Johnson, Boston, Engr.

Pittsfield, Mass.—It has been recommended to City Council to adopt order to provide $10,000 for extension of water system.

+Westbury, N. Y.—Contract for water district in Carle Pl. awarded to WILLIAM G. FRITZ CO., at $25,554. Noted Sept. 16.

+Bordentown, N. J.—Contract for water distributing system in Crosswicks Creek section awarded A. A. KAFER, JR.

Clinton, N. J.—Bids will be received until 1 p.m., Oct. 1, by Board of Managers, Reformatory for Women, for extension of water system.

Collingswood, N. J.—(Official)—Proposition for water system rejected by citizens. Noted Sept. 16.

East Orange, N. J.—W. G. Sharwell Co., Newark, at $109,638, submitted lowest bid for superstructure of Doremus Ave. pumping plant.

+Woodbury, N. J.—Council awarded contract for pumping station to THOMPSON ALLEN, Woodbury.

Coatesville, Penn.—Bids will be received by Borough Council until Oct. 7 for high-pressure system. A. Potter, 50 Church St., New York, N. Y., Engr.

★**Clarksburg, W. Va.**—(Official)—Bids will be received until noon, Oct. 21, by Water-Works and Sewage Board for installing two gas engines and two pumps at pumping station. S. G. Highland, Secy.

★**Lumberton, N. C.**—(Official)—Bids will be received until Oct. 12 by E. White, Mayor, for installation of a filtration plant at municipal water system. Noted Aug. 19 and Sept. 2.

Wilson, N. C.—City engaged Anderson & Christie, Engr., Charlotte, to prepare plans for water system. Noted Sept. 16.

Columbus, S. C.—Citizens will vote Oct. 5 to issue $300,000 bonds for water system.

Spartanburg, S. C.—City plans to expend $25,000 to improve pumping station.

Pass Christian, Miss.—Election will be held to vote on issuing $40,000 to $50,000 bonds. Part of proceeds will be used for water system. Noted Sept. 2.

Lockport, La.—City contemplates water system.

Shreveport, La.—City Commission offered to buy plant of water company for $750,000. If offer is not accepted proposition for municipal water system will be submitted to voters. Bonds for $1,200,000 are available for this purpose.

Elizabethtown, Ky.—City plans to hold an election to vote on issuing bonds for filter. Estimated cost, $7,000 to $10,000.

★**East Liverpool, Ohio**—Bids will be received by E. J. Smith, Dir. Pub. Ser., until noon, Sept. 25, for 6,000,000-gal. filter plant, pumping station, pumps, boilers, force mains, stand pipe and appurtenances. Chester & Fleming, Pittsburgh, Penn., Engr.

East Youngstown, Ohio—City contemplates water system. Estimated cost, $165,000.

Glendale, Ohio—Election will be held to vote on issuing $8,500 bonds for water system.

✚**Maumee, Ohio**—Contracts for water system awarded T. C. BROOKS & SONS, Jackson, Mich., at $49,753.

Mt. Blanchard, Ohio—State Board of Health, Columbus, approved plans for a water system.

Salem, Ohio—(Official)—W. J. Sherman Co., Consult. Engr., 613 The Nasby, Toledo, retained to conduct investigations and make recommendations as to cost of development of increased water supply for city.

✚**West Park, Ohio**—(Official)—Contract for water mains awarded WILHELMI CONSTRUCTION CO., Cleveland, at $9,220. Noted Sept. 2.

Fairbury, Ill.—(Official)—Bids will be received about Oct. 1 for well at water works. T. W. Burns, Supt. Water Wks. Noted Sept. 2.

✚**Quincy, Ill.**—Board of Supervisors, Fabius River Drainage District, awarded contract for pumping station and equipment to PURDY & HENDERSON and UNITED ENGINEERING CO. Estimated cost, $60,000.

✚**Silvis, Ill.**—Contract for reservoir awarded CONRAD SCHAD.

✚**Villa Grove, Ill.**—Contract for water system awarded J. M. DONAHUE, Stevens Point, Wis., at $32,285.

Hayward, Wis.—City Council contemplates filtration plant. Estimated cost, $4,000.

✚**Jefferson, Wis.**—Contract for two steel tainter gates and three concrete piers awarded NORTHWESTERN BRIDGE & IRON CO., Milwaukee, at $4,000. Noted Aug. 19.

Madison, Wis.—City plans to improve water system.

✚**Battle Creek, Iowa**—Contract for improving water system awarded DES MOINES BRIDGE & IRON CO., Des Moines, at $5,000.

Gilmore City, Iowa—City plans to extend water main to Campbell addition.

Holstein, Iowa—Election will be held Oct. 7 to vote on issuing $18,000 bonds for water system.

Lehigh, Iowa—City contemplates new water main across river or repairing old one.

Luverne, Iowa—Bids will be received until Oct. 6 by R. E. Cook, Town Clk., for water system.

Campbell, Minn.—Bids will be received by Herman Reyelts, Village Clerk, until 8 p.m., Sept. 28, for 2,000 ft .of 6-in. and 4,500 ft. of 4-in. water main.

Carlton, Minn.—City contemplates water system. Estimated cost, $16,000.

Proctor, Minn.—Proctor Water & Light Co. granted franchise for water system.

Emporia, Kan.—City contemplates filtration plant.

Ft. Scott, Kan.—City plans to improve water system, including rapid sand filtration plant. Citizens voted $50,000 bonds for this purpose.

Bayard, Neb.—Bids will be received about Jan. 1 for water system. Estimated cost, $12,500. Finley & Selzer, Scotts Bluff, Engr.

✚**Veblen, S. D.**—Contract for water system awarded TANNER BROS., at $25,000. Noted July 29.

Fargo, N. D.—Bids will be received by A. R. Watkins, City Audr., until 10 a.m., Sept. 29, for 1,160 ft. of 6-in. water main.

Minot, N. D.—Bids will be received until Oct. 4 by City Council for two miles of water mains. Estimated cost, $19,253. E. J. Thomas, City Engr.

Chinook, Mont.—Election will be held Nov. 8 to vote on issue of $10,000 bonds for filtration plant.

✚**Eureka, Mont.**—Contract for Glen Lake Irrigation Project awarded C. H. KELLEY, Eureka, at $122,500.

Washington, Mo.—Citizens voted to issue $60,000 bonds for purchase of water system. Plan to issue $35,000 additional bonds for improving same. Noted July 29.

Beeville, Tex.—According to press reports city contemplates water system. Estimated cost between $20,000 and $30,000.

Galveston, Tex.—Plans being prepared by A. T. Dickey, City Engr., for reconstructing 30-in. submerged water main.

Galveston, Tex.—A. M. Lockhart & Co., at $15,945, submitted the lowest bid for air compressor for water works at Alta Loma. Noted Aug. 12.

Sterling, Colo.—Press reports state that dam at North Sterling reservoir will be improved. Estimated cost, $50,000.

Tulsa, Okla.—E. C. Hughes, City Engr., authorized to prepare map of ground of site for dam in Osage Hills which will probably supply city with water.

✚**Edgewater, Colo.**—Contract for water system awarded GREGG & FISHER, at $39,870. Noted July 29.

Idaho Falls, Idaho—Cost of raising dam to increase flow of water at municipal water works estimated at $12,789.

✚**Lava Hot Springs, Idaho** (Dempsey post office)—Contract for water system awarded ANTON JENSEN, Preston, at $13,925.

Everett, Wash.—Burns & McDonnell, Kansas City, Mo., retained as engineer for improving water system. Bonds for $1,700,000 voted for pipe line to carry waters of Sultan Basin to city limits and for purchase of present water system. Noted Sept. 2.

North Yakima, Wash.—Election will be held Oct. 20 to vote $80,000 bonds for West Side drain.

Seattle, Wash.—Contract for laying water mains in East 54th St. and Bradner Pl. awarded to N. FIORTA & BROS., at $1,363; 37th Ave. N. E., CITY CONTRACTING CO., at $8,912. Noted July 5 and Aug. 12.

Wenatchee, Wash.—(Official)—Citizens voted $500,000 bonds for new irrigation system and for improving old one. Noted Sept. 2.

Baker, Ore.—Citizens will vote on issuing $110,000 bonds for improving municipal water system.

Echo, Ore.—Bids will soon be received by the Teal Irrigation District for reclaiming about 20,000 acres. Estimated cost, $800,000.

Fairview, Ore.—An election will be held to vote $12,600 bonds for municipal water system.

Florence, Ore.—Bonds for $10,000 sold for water system.

Hood River, Ore.—Citizens voted $50,000 bonds for irrigation system. Noted Sept. 2.

Salem, Ore.—Sutles Lake Irrigation District plans to issue $600,000 bonds to irrigate 12,000 acres.

✚**West Lynn, Ore.**—Contract for municipal water system awarded J. W. MOFFATT, West Lynn, at $15,000.

Modesto, Calif.—Modesto Irrigation District plans to improve irrigation system. Estimated cost, $50,000.

✚**Pasadena, Calif.**—Contract for furnishing c.-i. pipe awarded to AMERICAN CAST IRON PIPE CO., at $10,000.

✚**Quebec, Que.**—(Official)—Contract for storage dam awarded GEORGE MADDEN, Quebec, at $101,027. Noted Sept. 2.

Toronto, Ont.—Bids will be received until Oct. 12 by T. L. Church, Mayor, for 35-in. stop valves, valve operating mechanism and special castings for pumping station.

SEWERS

✚**Rochester, N. H.**—(Official)—Contract 8,100 ft. of 8- to 12-in. sewer pipes awarded C. W. FOSS CO., Fitchburg, Mass., at $9,163. Noted Aug. 19 and Sept. 9.

Lakeville, Conn.—We have been advised that plans for a sewer system are being prepared by the City-Wastes Disposal Co., 156 Fifth Ave., New York, and not by Virgil Ehle, as noted in the issue of Sept. 2.

✚**Albany, N. Y.**—Board of Contract and Supply awarded contract for sewage pumping stations to FOUNDATION CO., Woolworth Bldg., New York, at $172,772. Noted Aug. 5.

New Rochelle, N. Y.—City Council plans sewer at Hudson Park. Estimated cost, $7,500.

✚**New York, N. Y.**—(Borough of Brooklyn)—(Official)—Contract awarded to MURPHY BROS., 25th St. and Cropsey Ave., for sewer basin in East 13th St. and Ave P. Noted Sept. 2 and 16.

✚**New York, N. Y.**—(Borough of Brooklyn)—(Official)—Contract awarded to B. PACONI & SON, for sewer in East Eighth St. Bids opened Sept. 15. Noted Sept. 9.

✚**New York, N. Y.**—(Borough of Manhattan)—(Official)—Contract awarded to WALTON CONTRACTING CO., 147 East 125th St., at $4,949 for sewer in Ellwood St. Noted Sept. 2 and 16.

✚**New York, N. Y.**—(Borough of Queens)—(Official)—Contracts awarded to WILLIAM M. STANTON, at $78,837, for sewers in Perry Ave. and Maurice Ave., Second Ward; KINGSBRIDGE CONTRACTING CO., 130 East 42nd St., Manhattan, at $81,542, for sewers in Maspeth Ave., Rust, Creek, Clark St., Second Ward and to CLANCY & VAN ALST, 401 Broadway, Long Island City, at $73,655, for sewers in Grand St., Second Ward. Noted Aug. 26 and Sept. 9.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., Sept. 30, by Maurice E. Connolly, Borough Pres., for sewer work in various streets.

New York, N. Y.—(Borough of Richmond)—(Official)—All bids received Sept. 7 for sewage-disposal plant were rejected. New bids will be received until noon, Sept. 28, by Calvin D. Van Name, Borough Pres., for sewage-disposal plant, and sewer outlet at Taylor St. Noted Sept. 2 and 16.

✚**Rochester, N. Y.**—Contract awarded to F. V. BOTSCH, Triangle Bldg., at $20,867, for sewer in Main St.

Schenectady, N. Y.—Bids will soon be received for trunk sewer from interceptor in Front St. to corner of Union Ave. and Union St. Noted Aug. 26.

★**Atlantic City, N. J.**—(Official)—Bids will be received until Oct. 7, by Board of Commissioners for storm water drainage system. J. B. Thompson, Dir. of Streets and Pub. Imp.

Glen Gardner, N. J.—Bids will be received until Oct. 4 by Board of Managers of Sanitorium for Tuberculosis Diseases for additions to sewage-disposal plant.

✚**Newark, N. J.**—(Official)—Contract awarded by Passaic Valley Sewerage Commissioners to WILLIAM G. SHARWELL & CO., Newark, at $109,638, for superstructures for Newark Bay pumping station. Noted Sept. 9.

✚**Perth Amboy, N. J.**—Contract for sewer in connection with Lehigh Valley R.R. property near State St. awarded CARL POULSON and J. W. ROHR.

Plainfield, N. J.—Bonds for $35,000 have been sold to be used for sewers.

Trenton, N. J.—Board of Commissioners contemplates sewers in Fell, Steamboat and George St. and Phillips Ave. Frank Thompson, City Clk.

Vailsburgh, N. J.—(Newark post office)—Board of Works, Newark, plans new sewerage system in Sanford Ave. and adjacent streets. Estimated cost, $30,000.

West Orange, N. J.—Estimated cost of 3-ft. storm sewer from Fairmount Ave. to brook is $12,000. Rufus Mead, Engr.

★**Philadelphia, Penn.**—(Official)—Bids will be received until noon, Sept. 29, by M. L. Cooke, Dir. of Pub. Ser., Rm. 225, City Hall, for Schedule A, branch sewers, B, main sewers and C, bridges.

Sharon, Penn.—Council plans to issue $185,000 bonds for sewage-disposal plant.

Culpeper, Va.—Bids will be received until Oct. 1 by A. W. Pullman, for sewer work.

✚**Richmond, Va.**—Administrative Board awarded contract for sewer in Scott's Addition to LEROY E. NEWTON, at $11,601. Noted Sept. 16.

Richmond, Va.—City plans an expenditure of $50,000 for sewers in East End.

Leesburg, Fla.—(Official)—Citizens defeated $35,000 bond issue for sewers. L. M. Johnson, City Clk. Noted Aug. 26.

Miami, Fla.—Bids will be received until Oct. 7 by City Council for two vertical centrifugal pumps and electric motors in sewage pumping station.

✚**Ocalo, Fla.**—(Official)—Contract awarded to BRYANT & CO., Jacksonville, at $66,700, for sewer work. Noted Aug. 19.

North Chattanooga, Tenn.—(Official)—Bids will be received until 2 p.m., Sept. 27, by Board of Commissioners for sale of $50,000 sewer bonds. Cushman & Farleigh, City Engr. Noted Aug. 26.

Cincinnati, Ohio—(Official)—Bids were received for sewers in Crescent Ave., Athens St. and Missouri Ave. from: Cavanaugh & Connelly, $11,546; Wagner & Boehning, $12,728; John Ruebel Construction Co., $13,001.

Letonia, Ohio—Citizens will vote Nov. 2 to issue bonds for $28,000 for sewage-disposal plant and two trunk-line sewers.

Toledo, Ohio—Bids will be received until noon, Sept. 28, by city for local sanitary sewer No. 20 of Main Sewer District No. 6.

Princeton, Ind.—(Official)—Bids will be received until Sept. 27 for sanitary sewer system. E. M. Miller, City Clk. Noted Sept. 2.

Mason, Mich.—(Official)—Citizens defeated $34,000 bond issue for sewer work. J. E. Welsh, City Clk. Noted Aug. 26.

Elroy, Wis.—Revised plans will be prepared for sewers on West and Cedar St.

✚**Clinton, Iowa**—(Official)—Contracts awarded to THOMAS CAREY & SON, Clinton, at $124,857, for sewer in Fourth Ward. Noted Aug. 12.

Donnellson, Iowa—(Official)—Plans are wanted for septic tank for school. B. F. Warren, Secy. School Bd.

✚**Maquoketa, Iowa**—Contract for sewers awarded W. B. YEAGER, at $4,294.

✚**Austin, Minn.**—Contract for sewers on Euclid Ave. and Third St. awarded CATHERO & CO.

Cokato, Minn.—Bids will be received until 8 p.m. Oct. 5, by M. E. Berg, Village Recdr., for sewer system.

Herman, Minn.—(Official)—Bids will be received until Oct. 8 by Village Council for sewer. Estimated cost, $4,573. J. E. Cole, City Engr. Noted Sept. 9.

Minneapolis, Minn.—Sewer Committee recommended sewer south of 45th St. and west of Nicollet Ave.

St. Paul, Minn.—(Official)—Bids will be received by August Hohenstein, Pur. Agt., Court House, until 10:30 a.m., Sept. 27, for Hazel Park Sanitary Sewer System.

South St. Paul, Minn.—Property owners plan to revive project for extension of sewer system.

Lincoln, Neb.—(Official)—Sewer work planned by city will be done by city forces. A Dobson, City Engr. Noted Aug. 26.

Wausa, Neb.—Citizens voted to issue $12,000 bonds for sewer system and sewage-disposal plant.

Alton, Mo.—Plans being prepared for east and west end trunk sewers.

✚**St. Louis, Mo.**—(Official)—Contracts awarded to ALFRED LEWALD, at $5,431, for sewer in Harlem Creek Sewer District No. 12, at $7,879 in District No. 13, at $5,920 for sewer in Penrose Joint District and to GEORGE G. PRENDERGAST CONSTRUCTION CO., at $37,377, for sewers in Baden Sewer District No. 2. Noted Sept. 2.

Santa Ana, Tex.—City has retained Bradshaw & Enbank, Brownwood, to prepare plans for sewer system. Noted July 29.

Edgewater, Colo.—Bids will be received until Oct. 10 by C. W. Gist, Town Clk., for sewer system. Estimated cost, $32,000.

✚**Pullman, Wash.**—Contract awarded to JAMES C. BROAD, Jamieson Bldg., Spokane, at $12,000, for sewer in Improvement District 34. Noted Aug. 26.

Spokane, Wash.—(Official)—City contemplates making extensions to sewer system by day labor. J. T. McDevitt, Ch. Clk. Noted Sept. 9.

Auburn, Calif.—Bond election for $22,000 for sewers postponed till end of year. M. A. Waleau, City Clk. Noted July 1 and Aug. 26.

✚**Berkeley, Calif.**—Contract awarded to CHAMBERS & HEAFEY, Oakland, at $20,000 by City Council for sewer system.

GARBAGE

✚**Gloucester City, N. J.**—Contract for cleaning city streets, garbage collection and sprinkling for one year awarded as follows: District No. 1, THOMAS O'BRIEN, $223 per month; District No. 2, CHARLES H. EASTLAKE, $180 per month.

Nutley, N. J.—Board of Health plans to install garbage incinerator.

New Orleans, La.—City Engineer will prepare plans for garbage incinerator. Estimated cost, $30,000.

Bellaire, Ohio—City contemplates building garbage-disposal plant. C. Wassman, Mayor.

Sioux City, Iowa—Citizens plan to install incinerator.

★**Houston, Tex.**—(Official)—Bids will be received until 2 p.m., Oct. 8, by city for reinstallation of garbage incinerators, destructors. B. Campbell, Mayor and E. E. Sands, City Engr.

STREETS AND ROADS

✚**Madison, N. H.**—State Highway Commission, Concord, awarded contract for improving road at Madison to J. W. TYLER, Silver Lake.

Boston, Mass.—Bids will be received until noon, Sept. 28, by State Highway Commission, 15 Ashburton Pl., for about 14,300 lin.ft. of highway in town of Norwell.

✚**Boston, Mass.**—Contract for paving Montebello Rd., West Roxbury, awarded to M. De MATTEO, 146 Dudley St., Roslindale, at $8,395. Noted Sept. 16.

✚**Boston, Mass.**—Contract awarded to CHARLES J. JACOBS CO., 107 Terrace St., Roxbury, at about $16,418, by Commissioner of Public Works for paving work on West Roxbury and Glendower Rd. Noted Aug. 5.

✚**Boston, Mass.**—Contracts awarded to JAMES DOHERTY, 133 Calumet St., Roxbury, at $4,487, for artificial stone sidewalks on Gladstone and Bayswater St. and to A. STEPHANO, 284 Summer St., for artificial stone sidewalks.

Shelburne Falls, Mass.—Bids will be received until 1 p.m., Sept. 28, by W. G. Rickett, Shelburne Falls, for rebuilding road in town of Shelburne.

✚**Dunkirk, N. Y.**—Contract for paving awarded to JAMES McNAMARA, at $6,500. Noted Sept. 2.

✚**Glens Falls, N. Y.**—Contract awarded to J. & M. DOYLE, at $16,231, for improving Wayne and 19th St.

✚**Lockport, N. Y.**—City awarded contract for brick paving to C. B. WHITMORE, at $4,800.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 11 a.m., Sept. 29, by L. H. Pounds, Pres., Borough of Brooklyn, for repaving Broadway and Surf Ave. and for furnishing 1,000 cu.yd. of binder stone and 800 tons of limestone.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids were received Sept. 15 for improving Ashland Pl. as follows: Franklin Contracting Co., 52 Vanderbilt Ave., New York, $17,428; Glenmore Ave., Brooklyn Alcatraz Paving Co., 407 Hamilton Ave., Brooklyn, $16,462; Hopkinson Ave., Brooklyn Alcatraz Paving Co., $3,941; Grafton St., Brooklyn Alcatraz Paving Co., $5,475; 64th St., Topeka Paving Co., West 14th St. near Neptune Ave., Brooklyn, $3,873 and 74th St., Topeka Paving Co., $4,613. Noted Sept. 9.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids were received Sept. 15 for paving work on 62nd St.; Aztec Asphalt Co., 90 West St., $15,846; Sicilian Asphalt Co., $18,244 and Barber Asphalt Co., $18,694, and for paving work on 66th St.: Sicilian Asphalt Co., 41 Park Row, $7,171; Aztec Asphalt Co., $7,233 and Asphalt Construction Co., $7,330, and for paving work on Haven Ave.: Asphalt Construction Co., 208 Broadway, $4,673; Sicilian Asphalt Co., $4,993 and Barber Asphalt Co., $5,107. Noted Sept. 9.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., Sept. 30, by Maurice E. Connolly, Borough Pres., for improving Fairview Ave., Parsons Ave., Gerold St., Boulevard, Fifth Ward.

✚**New York, N. Y.**—(Borough of Richmond)—(Official)—Contract for repaving Richmond Terrace awarded to J. E. DONOVAN, 2205 Richmond Terrace, at $21,779. Noted Aug. 12 and Sept. 16.

Rensselaer, N. Y.—City will spend $30,000 for paving work.

Arcola, N. J.—(Warrenpoint post office)—(Official)—Bids will be received until 4 p.m., Sept. 25, by Townshhip Committee of Midland Township, for concrete sidewalks and curbs on Rochelle Ave. Arthur Lozier, Township Clk.

✚★**Elizabeth, N. J.**—Contracts awarded for paving as follows: UNION PAVING CO., Philadelphia, Penn., Anna St. and Murray St., at $8,361 and $15,610, respectively; JOHN E. DONOVAN, Broad St. at $29,775; STANDARD BITULITHIC CO., Newark, four streets, $13,003; UVALDE ASPHALT PAVING CO., Jersey City, Irvington Ave. and Prince St., at $6,862 and West Grand St., $12,825. Noted Aug. 12.

✚**Elizabeth, N. J.**—Contracts awarded to WELDON CONTRACTING CO., at $26,315, for widening St. George's Ave. and to C. H. WINANS CO., at $12,102, for road work on Morris Turnpike.

Hackensack, N. J.—(Official)—Bids will be received until Oct. 1, by Board of Chosen Freeholders of Bergen County for improving road from Godwin, Midland Park to New York State line.

+Hawthorne, N. J.—Contract awarded to WALTER WILLIAMS, for concrete sidewalks on Cedar, Royal and Forest Ave.

Irvington, N. J.—Bids will be received by Board of Freeholders, Newark, N. J., until 3 p.m., Oct. 11, for paving Lyon Ave. Frederic A. Reimer, County Engr.

Jersey City, N. J.—Bids will be received until Oct. 7 by Board of Freeholders for paving work on Passaic Ave., Kearney and Paterson Plank Rd., about 9,366 ft. and 7,705 ft. respectively.

+Jersey City, N. J.—Contract awarded to VAN KEUREN CO., Jersey City, at 88.9% of standard for repaving Storms Ave. Noted Aug. 19.

Jersey City, N. J.—Bids will be received until Oct. 7 by Board of Chosen Freeholders of Hudson County for improving Passaic Ave. and Paterson Plank Rd. Noted July 29.

Jersey City, N. J.—All bids received for repairing portions of Arlington, Bayview and Garfield Ave. were rejected by City Commissioners. New bids will be received. Noted Aug. 26.

Midland Park, N. J.—Bids will be received until Oct. 1 by Board of Chosen Freeholders of Bergen County, Court House, Hackensack, for improving Prospect St., Crescent Ave. and Mowerson Rd.

Newark, N. J.—Bids will be received until Sept. 30 by Board of Works for bitulithic pavement on North Sixth St. Board of Works has also authorized improvement of Washington St.

+Newark, N. J.—Contract awarded by Board of Works to GLENFIELD CONSTRUCTION CO., at $7,023, for improving North 12th St. with asphalt pavement.

West Hoboken, N. J.—Bids will be received until 8 p.m., Oct. 6, by Town Council for improving Palisade and Paterson Ave. and for walls and stairways in old Hillside Rd.

West Paterson, N. J.—Bids will be received until Sept. 27 by Street Commission of Council for macadamizing portions of Garbaldi and Grover Ave. E. A. Mulroony, Clk.

+Bethlehem, Penn.—Borough Council awarded contract for about three miles amiesite paving to R. S. RATHBUN, Allentown. Noted Aug. 28 and Sept. 2.

+Bloomsburg, Penn.—Contract awarded to B. E. BLOOM, Luzerne, at $0.97 per sq.yd. for 11,600 sq.yd. of brick pavement on Market St. Noted Aug. 26.

+Greensburg, Penn.—(Official)—Contracts awarded to JOHN MITCHELL, Tranger, and BELL-BOCKEL CO., Altoona, at $25,000 and $33,000 respectively, for highway in Mt. Pleasant Township. Noted Aug. 19.

+Harrisburg, Penn.—(Official)—Contract awarded to WILLIAM C. EVANS, Ambler, at $86,079, for amiesite road from Huntington to Mill Creek in Huntington County and $34,123 for road work on State Highway Route 131 in Chester County. Noted Sept. 2.

★+Marcus Hook, Penn.—Borough Council awarded contract for 7,000 sq.yd. paving and 800 sq.yd. gutter to EASTERN PAVING CO., Philadelphia, at $11,016. Noted Aug. 26.

+Philadelphia, Penn.—Contract awarded to EDWIN H. VARE, Philadelphia, at $42,836, for improving Passyunk Ave.

Plains, Penn.—(Official)—Bids will be received until 7:30 p.m., Oct. 4, by Board of Commissioners of Plains Township for improving various streets. William Rowlands, Secy., Bd. of Comrs.

+Baltimore, Md.—Contract awarded to P. FLANAGAN & SONS, Baltimore, at $1.32 per sq.yd., for paving Rosedale Ave. and Arunah Ave.

Baltimore, Md.—Bids will be received until noon, Sept. 28, by State Road Commission, Garrett Bldg., for road work under Contract No. CL 13, Carroll County.

+Hamilton, Md.—Commissioners of Baltimore County, Towson, awarded contract for widening and paving Hamilton Ave. to THOMAS R. GATCH & SONS, Raspeburg, Md., at $5,500.

Bland, Va.—Bids will be received until noon, Sept. 27, by R. C. Repass, Clk., Bd. of Supervisors, for 2.46 miles of county road.

Berkeley Springs, W. Va.—Bonds for $15,000 have been voted by citizens for street paving. J. A. Risinger, Mayor.

+★Charleston, W. Va.—Contracts awarded by City Council for paving work as follows: R. M. HUDSON & CO., West Second St., at $1.65 per sq.yd.; GLOVER & KIMBERLIN, Charleston, Crescent Rd. and Bridge St., $1.80; Sixth St., Columbia Blvd., Caroline, Maryland, Pennsylvania Ave., at $1.62 and $1.69 for asphaltic concrete and asphalt respectively; CAREY, REED & CO., Lexington, Ky., Roane St., at $1.74. Noted Sept. 2.

Clarksburg, W. Va.—(Official)—Bids will be received until 7:30 p.m., Sept. 24, by Albert J. Bishop, City Clk., for paving North Fourth St. with vitrified brick or wooden block.

Logan, W. Va.—Citizens of Logan County defeated bond issue for $200,000 road bonds. Noted July 29.

Martinsburg, W. Va.—Bonds for $15,000 voted by citizens for paving Main St. J. A. Rosinger, Mayor.

+Wellsburg, W. Va.—Contract awarded to A. O. HALDERMAN, Wheeling, for 9,500 sq.yd. of brick pavement on Follansbee Rd. Noted Sept. 2.

+Wheeling, W. Va.—Contract awarded to BALL ENGINEERING CO., by Ohio County Commissioners for resurfacing with asphalt National Pike from Stockyard to Rudlers and from Leatherwood to Pleasant Valley.

Greensboro, N. C.—Two miles of macadam road will be built by Guilford County Commissioner from Greensboro to High Point. Estimated cost, $25,000.

Greensboro, N. C.—West Lee and Tate St. will be paved with concrete. Edward M. Myers, City Engr.

Reidsville, N. C.—Main St. will be paved and sidewalks laid.

Rutherford, N. C.—Section of Main St. will be paved at estimated cost of $8,900.

Shelby, N. C.—Election will be held Oct. 16 to vote $30,000 bonds for road work in Cleveland County, No. 3 Township.

Wilson, N. C.—Anderson & Offutt, Charlotte, retained to prepare plans for street improvements. Bonds for $80,000 voted. T. A. Hinnant, Town Clk.

Sumter, S. C.—Bonds for $225,000 voted by citizens for street improvements. D. M. Blanding, Clk. Noted Aug. 26.

Bartow, Fla.—Citizens of Polk County will vote on $1,000,000 bonds for highway work.

Jacksonville, Fla.—Duval County Council of Dixie Highway Association, formed to lay out route of Dixie Highway from Macon, Ga. to Jacksonville. John H. Williams, Chn.

Mayo, Fla.—Citizens will vote on $300,000 bonds for road work in Lafayette Couny.

Palatka, Fla.—Putnam County voted $208,000 bonds for brick roads and concrete bridges. Noted Aug. 26.

Perry, Fla.—Citizens of Taylor County will vote on $500,000 bonds for highway construction.

Sanford, Fla.—Bonds for $450,000 voted by citizens Sept. 7 for highways. Noted Aug. 26.

+Tallahassee, Fla.—Contract awarded to SOUTHERN PAVING CONSTRUCTION CO., Chattanooga, Tenn., at $67,463, for paving various streets with brick. Noted Aug. 26.

West Palm Beach, Fla.—Bonds for $800,000 sold by Palm Beach County for road work.

Marion, Ala.—Bids will be received until Oct. 1 by County Commissioners for 7,800 cu.yd. of clay-gravel for surfacing part of Marion and Uniontown Rd.

Columbus, Miss.—(Official)—Bids will be received until Sept. 28 by Highway Commission of Supervisors District for 36,690 sq.yd. bituminous wearing surface. G. E. Hauser, Jr., Columbus, Engr.

Columbus, Miss.—(Official)—Bids will be received until Oct. 4 by Board of Supervisors of Lowndes County for $90,000 highway bonds.

Columbus, Miss.—(Official)—Contracts will be awarded about Oct. 11 for 48 miles highway improvement. G. E. Hauser, Jr., Engr.

Columbus, Miss.—Bonds for $100,000 voted for road from Columbus, Miss., to Vernon, Ala. W. E. Cox, Superv. Noted Sept. 2.

Derma, Miss.—Bids will be received until Oct. 5 for constructing 1,800 sq.yd. of concrete sidewalks. N. M. Crawford, St. Comr.

West Point, Miss.—Bonds for $20,000 issued by Clay County Supervisors to construct roads.

Donaldsonville, La.—Election will be held Oct. 19 to vote $15,000 bonds and $50,000 bonds for road work in Road Districts No. 2 and 1 respectively.

+Gueydan, La.—Contract awarded to C. L. BAKER, at $7,000, for sidewalks.

+Lake Charles, La.—Contracts awarded by Police Jury to TEXAS GRADING CO., at $16,882, for gravel road near Vinton and to W. M. McCORQUODALE, Lake Charles, at $14,200, for gravel road near Sulphur. Noted Sept. 2.

+New Orleans, La.—Contract awarded to S. A. CANO, Jackson, Miss., at $37,735, by State Highway Department for 26 miles of gravel road in Road District No. 1, West Baton Rouge Parish. Noted July 29.

+New Orleans, La.—Contract awarded by Highway Department of Board of State Engineers to W. E. GREEN, Lafayette, at $14,900, for eight miles of road work in Red River Parish. Noted Aug. 19.

Oberlin, La.—Bonds for $150,000 voted by citizens for gravel roads in Ward Five, Allen Parish. S. M. Lee, Member Police Jury. Noted Aug. 26.

Ponchatoula, La.—Tangipahoa Parish Police Jury will improve Ponchatoula-Madisonville Rd. at estimated cost of $12,000.

+Chattanooga, Tenn.—Contract for paving McCallie Ave. awarded to NOLL CONSTRUCTION CO. at $9,321, and for paving Main St. from Market to Whiteside St. to WEST CONSTRUCTION CO., at $10,418.

Jacksboro, Tenn.—Bids will be received until Oct. 2 by Board of Highway Commissioners for improving roads No. 2, 7 and 8. H. G. Murray, Chn.

Knoxville, Tenn.—Bonds for $200,000 for road work voted by citizens of Grainger County.

Livingston, Tenn.—Citizens of Overton County contemplate holding election Oct. 23 to vote on $160,000 bonds for road work. Noted Aug. 19.

Loudon, Tenn.—Bonds for $12,000 voted by County Court for completion of Dixie Highway to Loudon County line.

+Memphis, Tenn.—Contract awarded to KOEHLER BROS.-FOWLER CONSTRUCTION CO., at $22,204, for improvements to Main St. Noted Aug. 12 and Sept. 16.

Rutledge, Tenn.—Bonds for $200,000 voted by citizens of Grainger County for road work. Noted Sept. 2.

Tazewell, Tenn.—Bids will be received until Oct. 8 for grading and macadamizing 103 miles of road in Claiborne County. J. H. S. Morison, Cumberland Gap, Comr.

Albany, Ky.—Bids will be received about Oct. 15 for Dixie Short Route from Tampa, Fla., via Chattanooga, Tenn., to Cincinnati, Ohio. C. B. Parrigin, County Judge. Noted Sept. 9.

+Brownsville, Ky.—Contract awarded to A. A. SMITH, Mt. Pleasant, Tenn., at $14,000, by Edmonson County Fiscal Court for 3½ miles of turnpike from Brownsville to Rhoda.

Columbia, Ky.—Citizens of Adair County voted $120,000 bonds for road construction. Noted Aug. 26.

✚Elizabethtown, Ky.—Contract awarded to S. P. JOHNSON by Hardin County Fiscal Court for four miles of Dixie Highway from Elizabethtown to Hart County Line.

✚Hopkinsville, Ky.—Contract awarded by Christian County Fiscal Court to D. C. McQUARRY, at $24,611. for six miles of road.

Louisville, Ky.—Chestnut St. from 24th to 26th St. will be paved by city forces. David R. Lyman, City Engr.

Princeton, Ky.—Bids will be received until Sept. 27 by County Commissioners of Caldwell County for two miles of macadam State-Aid highway.

✚Cincinnati, Ohio—Contract awarded to HENKLE & SULLIVAN, at $8,102, by Board of Control for improving Gest St. Noted Sept. 2.

Cleveland, Ohio—County Commissioners contemplate widening Lake Shore Blvd. W. A. Stinchcomb, County Engr.

✚Cleveland, Ohio—Commissioners of Cuyahoga County awarded contract for 5½ miles of road between Bedford and Twinsburg to PACE BROS., Cleveland, at $94,000.

✚Columbus, Ohio—Director of Service awarded contract for paving Heyl Ave. to A. W. BURNS & CO., Columbus, at $4,200; contract for improving Nelson Rd. awarded to A. G. PUGH, Columbus, at $15,000. Noted Sept. 2.

Columbus, Ohio—Bids will be received until Oct. 8 by Board of County Commissioners of Franklin County for improving Frantz Rd. with macadam, McCoy Rd. in Perry Township and Ryan Ave., Franklin Township, Mason Rd. in Marion Township and Cambridge Rd. in Perry Township and Cambridge Rd. in Perry Township. John Scott, Clk., Bd. of County Comrs.

✚Columbus, Ohio—Contracts awarded by State Highway Commissioner for road work as follows: J. A. WESTRICK, Holgate, $25,900; GARVER & WIRTZ, Hamilton, $1,299; KORAH E. KINKLE, Dayton, $7,943; EDWARDS BROS., Sundbury: YUNDT & JACKSON CO., Dayton, $24,900; YUNDT & JACKSON CO., Dayton, $1,200 and $33,640; McARTHUR & FOX, Bellencenter, $9,100; MODERN CONSTRUCTION CO., Fremont, $16,700; MODERN CONSTRUCTION CO., Fremont, $15,700; J. P. WARNICK, Cadiz, $32,776 and EDWARD BEAN, Highland, $4,900. Noted Aug. 26.

✚East Liverpool, Ohio—Contract awarded to PATTERSON & GRAFTON, East Liverpool, for paving 17th St. from Clark to Buckeye Ave.

✚Galion, Ohio—Contract awarded to BROOKS CONSTRUCTION CO., Ft. Wayne, Ind., at $40,095 for paving Church St. with brick.

Gates Mills, Ohio—(Official)—Bonds for $22,000 sold for improving Mayfield and Som Center Rd. in Mayfield Township. F. J. William, Township Clk. Noted Aug. 19.

✚Lorain, Ohio—Contract awarded to OHIO ENGINEERING CO., Lorain, at $37,191, for brick pavement on East 28th St. Noted Aug. 26.

Napoleon, Ohio—Bonds for $45,800 sold for road work in Union County.

✚Oakharbor, Ohio — (Official) — County Commissioners awarded contract for 2,500 sq.yd. brick or asphalt paving to MODERN CONSTRUCTION CO., Fremont, at $5,606. Noted Sept. 2.

✚Painesville, Ohio—Contract awarded to GOULD & MAYBACH, for paving East South and Walnut Ave.

Ravenna, Ohio—(Official)—Bids will be received until noon, Oct. 2, by John S. Mallette, Dir. of Pub. Ser., for improving Pratt St. from Main St. to Riddle Ave.

✚Wooster, Ohio—(Official)—Contract awarded to GRIEST & MARKLEY, Wooster, at $6,175, for paving North Buckeye St. with brick. Noted Sept. 2.

Angola, Ind.—(Official)—Bids will be received until 1 p.m., Oct. 5, by Commissioners of Steuben County for two gravel roads. F. C. Dewey, Audr.

✚Columbus, Ind.—(Official)—Contract awarded to MERIDITH & HAILWAY, Columbus, at $6,124, by Commissioners of Bartholomew and Shelby Counties for road on county line. W. H. Scott, Audr. Noted Aug. 19.

Crawfordsville, Ind.—(Official)—Bids will be received until 10 a.m., Oct. 5, by Commissioners of Montgomery County for road in Ripley Township. B. B. Engle, Audr.

✚English, Ind.—Contract awarded to J. M. FROMAN, Grandsburg, at $7,925, for stone road in Jennings Township.

Franklin, Ind.—(Official)—Bids will be received until 2:30 p.m., Oct. 4, by Commissioners of Johnson County for gravel road in Pleasant Township. H. L. Knox, Audr.

Franklin, Ind.—(Official)—Bids will be received until 2:30 p.m., Oct. 20, by Commissioners of Johnson County for gravel road on Johnson-Marion County line. H. L. Knox, Audr.

Greensburg, Ind.—(Official)—Bids will be received until 1 p.m., Oct. 4, by Commissioners of Decatur County for road in Saltcreek and Washington Townships. L. W. Sands, Audr.

✚Indianapolis, Ind.—Contract awarded to KOKOMO ASPHALT PAVING CO., Kokomo, at $14,826, for paving 18th St. with bituminous concrete.

Lebanon, Ind.—(Official)—Bids will be received until 2 p.m., Oct. 4, by Commissioners of Boone County for gravel roads in Perry and Washington Townships. D. M. Clark, Audr.

Monticello, Ind.—(Official)—Bids will be received until 10 a.m., Oct. 5, by Commissioners of White County for gravel road in Liberty Township. A. G. Fisher, Audr.

✚Mt. Vernon, Ind.—Contract awarded to LAWRENCE J. UTLEY, Mt. Vernon, at $9,164, for two gravel roads in Black Township. Noted Sept. 2.

Muncie, Ind.—Bids will be received until 1 p.m., Sept. 28, by Board of Public Works for concrete sidewalks on 13th, Liberty and Hackley St. John R. Kelly, City Clk.

Plymouth, Ind.—(Official)—Bids will be received until 1:30 p.m., Oct. 1, by Commissioners of Marshall County for gravel roads in German and Center Townships. George F. McCoy, Audr.

✚Rensselaer, Ind.—Contract awarded to THOMAS M. COLLOHAN, Rensselaer, at $13,499, for road in Gillam Township.

Rockport, Ind.—(Official)—Bids will be received until 1 p.m., Oct. 4, by Commissioners of Spencer County for road in Ohio Township. J. T. Stevenson, Audr.

✚Shelbyville, Ind.—Contracts awarded to D. H. FATOUT, Indianapolis, at $5,510 for road in Shelby Township and to KERNODLE, DALE & FULWIDER, at $5,984 and $5,974 for two roads in Liberty Township by Commissioners of Shelby County.

Shoals, Ind.—(Official)—Bids will be received until 1 p.m., Oct. 4, by Commissioners of Martin County, for macadam road in Perry Township. L. D. Haga, Audr.

✚Sullivan, Ind.—Contract awarded to R. R. SINGE, Sandborn, at $10,279, by Commissioners of Sullivan County for gravel road in Hamilton Township.

Tell City, Ind.—(Official)—Bids will be received until 7:30 p.m., Sept. 28, by Common Council for combined concrete curb and gutter on Tenth St. Louis Siebert, Jr., City Clk.

Washington, Ind.—(Official)—Bids will be received until 2 p.m., Oct. 5, by Commissioners of Davies County for pike road in Washington Township. L. S. Core, Audr.

Winamac, Ind.—(Official)—Bids will be received until noon, Oct. 5, by Commissioners of Pulaski County for road in Teppecanoe Township. W. E. Munchenburg, Audr.

Blissfield, Mich.—(Official)—Bids will be received until Sept. 25, by Ralph E. Pletcher, Town Clk., for macadam roads in Blissfield Township.

✚Freedom, Mich.—Contract awarded by Council to McGUIRE & CO. for grading and paving Sixth Ave.

Pontiac, Mich.—County contemplates concrete road five miles long between Pontiac and Detroit.

✚Belleville, Ill.—Contract awarded to REEB BROS., at $18,230, by Board of Local Improvements for paving Busch Ave.

✚Belleville, Ill.—Contract awarded to HOEFFKEN BROS., at $17,399, for paving Olive St.

✚Evanston, Ill.—Board of Local Improvements awarded contract for bituminous macadam on Lyons St. to M. FOLEY CO., at $4,933.

Paris, Ill.—Bids will be received until 2 p.m., Sept. 24, by Commissioners of Highways of Hunter Township for 3,960 ft. of gravel road on Baldwinsville state line road and 5,280 ft. of gravel road on Heelan Rd. Karl J. Barr, County Supt. of Highways.

Paris, Ill.—Bids will be received until 10 a.m., Sept. 25, by E. C. Barkley, Comr. of Highways, Symmes Township, for 1,800 ft. of gravel road on Chicago Rd., 3,000 ft. of gravel road on Asher Rd. and 3,950 ft. of gravel road on Preston Rd.

✚Rock Island, Ill.—Contract awarded to TRI CITY CONSTRUCTION CO., Davenport, Iowa, at $18,977, for paving 24th St. with brick and 16th Ave .

✚Springfield, Ill.—(Official)—State Highway Commission awarded contract for brick road near Dwight, Livingston County, to ALLAN J. PARRISH, Paris, at $17,974. Noted Aug. 19.

✚Columbus, Wis.—(Official)—Contract awarded to BUTLER CONSTRUCTION CO., Waukesha, at $6,826, for improving Madison Rd. Noted Sept. 2.

Fond Du Lac, Wis.—Mt. Calvary Rd. will be improved by County Highway Commission.

✚Milwaukee, Wis.—Contract awarded to CULLIGAN & ROCK, for sidewalks on Greenfield Ave. for Allis-Chalmers Co.

✚Reedsburg, Wis.—(Official)—Contract has been awarded to SWEENEY BROS., Reedsburg, at $1.29 per sq.yd., for paving North Albert Ave. Noted Aug. 26.

✚Des Moines, Iowa—Contract awarded to FRED H. BALTZER & STEPHEN JONES, Des Moines, at $15,000, by State Executive Council for road work in capitol extension. Noted Sept. 2.

Des Moines, Iowa—The graveling of 190 miles of highways in Polk County is advocated by Harry Barquist, Chn. of Polk County Bd. of Supervisors. Estimated cost, $190,000.

✚Dubuque, Iowa—City awarded contract for 5,000 sq.yd. brick paving and 11,000 sq.yd. asphaltic concrete paving to JAMES LEE, 18th and Pine St., Dubuque.

✚Jefferson, Iowa—Contracts for paving, curb and gutter awarded to FORD PAVING CO., Cedar Rapids.

Buffalo, Minn.—Bids will be received until 8 p.m., Oct. 4, by E. O. McGaffey, Village Clk., for grading Lake Shore Rd. F. W. Van Krevelin, Engr.

✚Ely, Minn.—Contract awarded to VICTOR NELSON, Superior, Wis., at $8,780, for concrete sidewalks.

Faribault, Minn.—Bids will be received until 7:30 p.m., Sept. 30, by E. F. Kelley, City Recdr., for filling approach to Second Ave. Bridge.

St. Paul, Minn.—(Official)—Bids will be received until 10:30 a.m., Sept. 27, by August Hohenstein, Pur. Agt., for material for paving Warsaw St.

Walker, Minn.—Bids will be received until 2 p.m., Sept. 25, by C. B. Bacon, County Audr., for State Rural Highway No. 80 in Cass County. A. W. Moulster, Pine River, Engr.-in-charge.

Walker, Minn.—Bids will be received until 2 p.m., Sept. 25, by C. B. Bacon, County Audr., for State Rural Highway No. 82, in Cass and Hubbard Counties. George A. Ralph, Fulton Blk., St. Paul, Engr-in-charge.

Atchinson, Kan.—Construction of 8,000 sq.yd. of brick pavement planned by Council.

Larned, Kan.—City Council plans 25 blocks of pavement.

✚Fremont, Neb.—Contract awarded to A. D. SEARS, Fremont, at $1.34 per sq.yd. for paving Fourth St. with granite concrete.

Great Falls, Mont.—Survey made for eight miles of road between Neihart and other side of Kings Hill Path by Cascade and Meagher Counties and Forestry Service.

+Kansas City, Mo.—Board of Public Works awarded contracts for street work as follows: Asphaltic concrete, 2,393 sq.yd. to F. P. McCORMICK, Kansas City, $4,283; 4,833 sq.yd. of sheet asphalt to CLEVELAND TRINIDAD PAVING CO., Kansas City, at $9,569. Noted Sept. 2.

Lebanon, Mo.—Laclede County and City of Lebanon will spend $30,000 for gravel and rock roads. Isaiah Brown, Box 34, in charge.

St. Louis, Mo.—Bids will be received until 10 a.m., Sept. 28, by Board of Public Service, for paving with brick under 17 contracts. Charles E. Swingley, Secy.

Eureka Springs, Ark.—Construction of highway 24 miles long from Eureka Springs to Seligman is under consideration. John A. Bridgeford, Chn., Comm.

Amarillo, Tex.—Bonds for $50,000 voted by citizens for street paving. Noted Aug. 5.

+Canton, Tex.—Contracts awarded for road work in Van Zandt County as follows: SMITH & LA ROE, Palestine; for main highway; MEEKS & DAVIDSON, Grand Saline, roads in various precincts.

Corsicana, Tex.—Election will be held Oct. 10 to vote on $80,000 bonds for street improvements.

El Paso, Tex.—St. Vrain St. will be paved from San Antonio to Fourth St.

El Paso, Tex.—Election will be held Oct. 12 to vote on $300,000 bonds for road work in El Paso County.

+El Paso, Tex.—Contract awarded to TEXAS BITULITHIC CO., Dallas, at about $45,000, for paving streets in new district.

Orange, Tex.—Election will be held Oct. 16 in Orange County, Fourth Precinct, to vote on $7,000 bonds for shell or gravel road on lower Beaumont Rd.

Paris, Tex.—Grand Ave. will be paved and 15th St. from Bonham to Kaufman St.

Seabrook, Tex.—(Official)—Bids will be received until 10 a.m., Sept. 27, by County Auditor, for repairing roads in Harris County.

Depew, Okla.—Election will be held Oct. 2 to vote $18,000 bonds for road work.

Mannsville, Okla.—Citizens voted $17,000 bonds for road work.

Newby, Okla.—Election will be held to vote $20,000 bonds for roads.

Tishomingo, Okla.—Citizens contemplate election to vote $35,000 bonds for road work.

Tulsa, Okla.—Citizens of Tulsa County will vote on $20,000 bonds for road work.

+Golden, Colo.—Contract for improving Guy Hill Rd. awarded to I. N. JACOBSON and TORE SEVERSON, Boulder, at $5,461.

Santa Fé, N. M.—Bonds for $500,000 sold for road work in various counties.

Burley, Idaho—Bids will be received until Sept. 27 for sale of $50,000 bonds for 54 miles of Idaho-Pacific State Highway in Burley Highway District. Albert Ploeger, Pres., Burley Highway Dist.

Lewiston, Idaho—Plans approved by City Council for paving and sidewalks in Special Improvement District No. 1. Estimated cost, $30,000.

Montpelier, Idaho—City Council will lay sidewalks at estimated cost of $13,821.

St. Maries, Idaho—Contract awarded to TWO MIRACLES CONCRETE CORPORATION, Great Falls, Mont., at $23,411, for improving a number of streets.

+Cathlamet, Wash.—(Official)—Contract awarded to O. P. DOSLAND, Grays River, at $8,497, for portions of State Road No. 19. B. Heron, Audr. Noted Aug. 26.

+Cheney, Wash.—Contract awarded to MITCHELL BROS. & PAYNE, Spokane, at $37,000 for nine miles of concrete sidewalks for paving First St.

Olympia, Wash.—Bids will be received until Oct. 11 by State Highway Commission for 24 miles of state highway. Estimated cost, $38,000. William R. Roy, State Highway Comr.

+Pullman, Wash.—Contract awarded to MITCHELL BROS. & PAYNE, Spokane, at $15,265, for concrete sidewalks.

+Seattle, Wash.—Contract awarded to INDEPENDENT ASPHALT PAVING CO., Northern Bank Bldg., at $234,000, for paving and bridging Admiral Way.

Stevenson, Wash.—All bids received Sept. 2 for Section 2 of Stevenson Carson Rd. rejected. Charles H. Nello, County Audr.

+Tacoma, Wash.—Contract awarded to WASHINGTON PAVING CO., Savage-Scofield Bldg., Tacoma, at $32,243, by Board of County Commissioners for paving on Summer-Buckley Highway, Permanent Highway No. 7. Noted Sept. 2.

+Corona, Calif.—City Trustees awarded contract for street improvements to S. C. CONTRACTING CO., at $18,004.

Lindsay, Calif.—City Trustees have authorized paving of Hermosa and Mt. Vernon Ave.

+Los Angeles, Calif.—Board of Public Works awarded contract for paving Pacific Ave. to FAIRCHILD-GILMORE-WILTON CO., at $92,096. Noted Aug. 12.

+Manhattan, Calif.—Contract awarded to CROWN CONSTRUCTION CO., at $13,794, for improving 18th and 19th St.

+Manhattan, Calif.—Contract awarded to CROWN CONSTRUCTION CO., at $7,312, for improving 20th St.

Ontario, Calif.—Bids will be received until Sept. 27 by Board of City Trustees for improving Euclid Ave.

Sacramento, Calif.—Board of Supervisors of Sacramento County has ordered plans for three miles of concrete highway from Franklin to a point near Hood.

+San Francisco, Calif.—Board of Public Works awarded contract for improving Kansas St. from 19th to 20th St., to SUNSET CONCTRUCTION CO., at $10,144.

+Stockton, Calif.—City Trustees awarded contract for street improvements to RANSOME-CRUMMEY CO., at $26,-025.

Stockton, Calif.—Board of Supervisors contemplates 10 roads at estimated cost of $135,123.

Ventura, Calif.—County Surveyor Petit appointed chief engineer in charge of improved highways for work under bond issue of $1,000,000. Noted Sept. 9.

Peterboro, Ont.—City Council contemplates asphaltic pavement on Hall and Hunter St., and concrete sidewalks on several streets. S. R. Armstrong, Clk.

Saanichton, B. C.—City Council will pave Douglas and George St. Estimated cost, $24,500. H. S. Cooper, City Hall, Royal Oak, B. C., Clk.

INDUSTRIAL WORKS

Portland, Maine—Twitchell-Champlin Co. will rebuild its packing plant. Estimated cost, $86,000.

Boston, Mass.—Racich Asbestos Mfg. Co., 141 Summer St., East Boston, will build public garage on Summer St. Frank T. Eskriggo, 17 Milk St., Arch. Estimated cost, $20,000.

+Cambridge, Mass.—Boston Woven Hose & Rubber Co. awarded contract to STONE & WEBSTER, 147 Milk St., Boston, for four-story and basement, 60x193- and 60x156-ft., concrete factory.

+Chicopee, Mass.—Contract awarded by Bosch Magneto Co., Center St., to CASPER RANGER CONSTRUCTION CO., Holyoke, at about $100,000 for one-story, 170x300-ft. brick factory.

+Greendale, Mass.—(Worcester post office)—Contract awarded to E. J. CROSS CO., Foster St., Greendale, at $18,000, by Norton Co., for two-story brick and steel kiln.

Lowell, Mass.—Bay State Cotton Corporation plans two-story and basement addition to its mill. Estimated cost, $100,000.

+Lowell, Mass.—Contract awarded to NEW ENGLAND CONCRETE CONSTRUCTION CO., 201 Devonshire Co., Boston, for storage warehouse for Appleton Co. on Jackson and Rever St. Estimated cost, $125,000.

Salem, Mass.—Plans prepared by Kilham, Hopkins & Smith, 9 Park St., for brick and concrete factory on Congress St. for Naumkeag Steam Cotton Co. Estimated cost, $53,000.

+Waltham, Mass.—Contract awarded to APTED & McDUFFEE, 235 Pleasant St., Malden, for brick and steel one-story laundry for Waltham Central Hospital.

+Wamesit, Mass.—Contract awarded by Avery Chemical Co., Boston, Mass., to CASPER RANGER CONSTRUCTION CO., 101 Park Ave., New York, N. Y., for chemical plant.

Williamstown, Mass.—John S. Boyd Co. plans addition to bleaching plant.

+Bridgeport, Conn.—Contract awarded to HENRY E. GREEN, for three-story, 60x200-ft., brick addition for the Royal Equipment Co. Noted Sept. 9.

Bridgeport, Conn.—Ashcroft Mfg. Co. will build five-story addition on Nichols St.

Bridgeport, Conn.—Remington Arms-Union Metallic Cartridge Co. will build one-story concrete factory on Arctic St. Estimated cost, $21,000.

+Higganum, Conn.—Cutaway Harrow Co. awarded contract to H. WALES LINES CO., Meriden, for addition to its factory.

+Waterbury, Conn.—Contract awarded to TRACY BROS. CO., by Noera Mfg. Co. for one-story, 56x58-ft., brick addition.

+Amsterdam, N. Y.—(Official)—Contract awarded to TURNER CONSTRUCTION CO., 11 Broadway, New York, by Shuttleworth Bros. Co. for two buildings. One will be six stories, 62x243 ft., other, six stories, 54x170 ft. Noted Aug. 26.

+Binghamton, N. Y.—Contract awarded to B. KEEIN & CO., at about $15,000 for four-story, 40x100-ft. addition to factory of Crandall Stove Co.

Buffalo, N. Y.—Frank J. Offerman will build four-story factory at 299 Broadway. Estimated cost, $50,000.

Buffalo, N. Y.—Archer-Daniels Linsee Co. will build reinforced-concrete, 75x80-ft., grain elevator, on the upper Buffalo River.

Farmingdale, N. Y.—A. J. Mundorf Co., 254 Fourth Ave., New York, plans 100x125-ft. silk mill.

Gloversville, N. Y.—Contract awarded to WILLIAM STEELE & CO., 1600 Arch St., Philadelphia, by G. Levor & Co., for three-story, 70x80-ft. addition to its tannery.

New York, N. Y.—(Borough of the Bronx)—Harlem Transfer Co., Park Ave. and 135th St., will build 10-story concrete warehouse on Mott Haven Canal.

New York, N. Y.—(Borough of Brooklyn)—American Tobacco Co., 111 Fifth Ave., New York, plans six-story brick building, 200x232 ft., at Park and Nostrand Ave. Estimated cost, $750,000.

New York, N. Y.—(Borough of Brooklyn)—P. & L. Contracting Co. has plans for four-story and basement, 94x140-ft., factory at Atlantic and Cleveland St. Estimated cost, $75,000. M. J. Harrison, Arch.

New York, N. Y.—(Borough of Queens)—American Hard Rubber Co. will build one-story, 41x158-ft. addition to its rubber plant on Third Ave. at Fifth St., College Point. Estimated cost, $15,000.

New York, N. Y.—(Borough of Queens)—De Lisi Bertilino Co., 420 East 64th St., New York, will build a macaroni factory on Ely Ave., Long Island City.

Niagara Falls, N. Y.—Defiance Paper Co. has plans for two-story, 60x80-ft., pulp mill on Walnut St. Estimated cost, $12,000.

✚**Peekskill, N. Y.**—Contract awarded to CATSKILL SUPPLY CO., Catskill, at $20,000, for 46x235-ft. storage building for State Armory Commission, Albany.

Rhinebeck, N. Y.—Bids being received by H. T. Lundberg, Arch., 2 West 42d St., New York, for dairy buildings for Vincent Astor. Estimated cost, $100,000.

Rochester, N. Y.—William H. Burt Iron & Steel Co. has secured a site at Scherer and Pomeroy St. and will build a one-story, 100x200-ft. factory.

Rushville, N. Y.—Calder & Son has secured a site and will build brick canning factory.

✚**Syracuse, N. Y.**—Fleischmann Co. awarded contract to HENRY FUNDA for distributing plant on East Genesee St. Noted Aug. 5.

Camden, N. J.—Armstrong Cork Co. will build two-story, 94x226-ft. factory.

Elizabeth, N. J.—Metal Plating Co., 200 Fifth Ave., New York, N. Y., plans factory on North Ave.

Hackensack, N. J.—(Official)—The American British Mfg. Co., Bridgeport, Conn., denies the rumor that it contemplates the construction of a plant here. Noted Aug. 19 and Sept. 2.

✚**Jersey City, N. J.**—(Official)—Contract awarded to TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., by Great Atlantic & Pacific Tea Co., for four-story bakery at Warren, First and Bay St.

Newark, N. J.—Maas & Waldstein, Ave. R and Central R.R., will build three buildings to its plant at estimated cost of $30,000.

Vineland, N. J.—William T. Taubel Hosiery Co. will build addition. Estimated cost, $26,000.

✚**Ardmore, Penn.**—Contract awarded to WILLIAM R. DOUGHERTY, at about $75,000, for five-story factory for Autocar Co. Stearns & Castor, Arch.

Bangor, Penn.—Flory Milling Co. plans addition to flour mill. Estimated cost, $20,000.

Chester, Penn.—Keystone Steel Casting Co. will build addition to its steel plant.

✚**Erie, Penn.**—Contract awarded to HENRY SCHENK CO., at about $90,000, by Erie Silk Mills for one-story, 144x144-ft. steel addition to its mill on West 26th St.

Freemansburg, Penn.—Peuckert & Wunder, 310 Chestnut St., Philadelphia, prepared plans for one- and two-story, 242x75-ft. and 100x75-ft. brick and steel factory for William Shimer & Sons Co.

✚**Norristown, Penn.**—Contract awarded to JACOB MYERS SONS & CO., for four-story, 55x120-ft., laundry for O. P. Duckworth.

Philadelphia, Penn.—American Ice Co. preparing plans for enlarging its manufacturing plant at Belfield Ave. and Reading R.R., Germantown.

Philadelphia, Penn.—Plans prepared for mill on Front and Blair St. for Byrne & Hance.

✚**Philadelphia, Penn.**—Contract awarded to H. C. REA CO., at about $110,000 for six-story factory at 11th and Race St. for Manufacturers Realty Co.

Pittsburgh, Penn.—George Hogg Co. will build oxygen plant at Grant St. and Katz Ave., Verona section. International Oxygen Co., 115 Broadway, New York, N. Y., is interested.

Pottstown, Penn.—Bids will soon be received for two-story, 60x100-ft., brick and concrete ice-cream factory for William S. Markley. Lachman & Murphy, Witherspoon Bldg., Philadelphia, Arch.

Punxsutawney, Penn.—Jefferson Macaroni Co. is having plans prepared for addition to its factory.

South Bethlehem, Penn.—Bethlehem Steel Co. will add three stories to its No. 2 machine shop.

Woodlawn, Penn.—Jones & Laughlin plans pipe mill for manufacture of steel pipe.

Baltimore, Md.—Baltimore Tube Co. has plans for one-story, 77x141-ft., brick addition to its plant on Winomico St. Estimated cost, $100,000.

Baltimore, Md.—Standard Guano Co. will enlarge its factory at estimated cost of $100,000.

Cumberland, Md.—American McKenna Process Co. purchased site along B. & O. tracks on Maryland Ave. and will build factory for manufacture of steel rails. Estimated cost, $150,000.

✚**Norfolk, Va.**—Contract awarded to BAKER & BRINKLEY, at $15,050, by Norfolk Warehouse Corporation for one-story brick warehouse.

Norfolk, Va.—A. B. Rosenkrans plans one-story brick warehouse on Scott St. to be occupied by Gyro Metal Works Co. Estimated cost, $15,000.

Berkeley Springs, W. Va.—Berkeley Springs Sanatorium Co. will build factory for manufacture of hospital supplies.

Wheeling, W. Va.—Wheeling Mold & Foundry Co. plans addition to its foundry.

Wheeling, W. Va.—Wheeling Corrugating Co., Arthington St. and Campbell Ave., will build four-story concrete addition to its factory. Estimated cost, $200,000.

Charlotte, N. C.—Virginia Carolina Chemical Co. plans warehouses.

Charlotte, N. C.—A. A. Shuford Mill Co. has plans for 50x100- and 50x200-ft. brick addition.

Hickory, N. C.—Highland Cordage Co. plans two-story, 75x100-ft. brick cordage factory at estimated cost of $125,000. Charles H. Geitner, Pres.

✚**Winston-Salem, N. C.**—Contract awarded to FISKE-CARTER CO., Greenville, S. C., at about $70,000, by R. J. Reynolds Tobacco Co. for two-story, 176x264-ft. concrete storage plant.

Hogansville, Ga.—International Cotton Mills Co. will double the capacity of its mill. Estimated cost, $300,000.

✚**Savannah, Ga.**—Contract awarded to O. OTTO, Germania Bank Bldg., Savannah, at about $35,000, by National Biscuit Co., for one- and two-story warehouse.

✚**Jacksonville, Fla.**—Contract awarded to HILLYER & SPERRING, at about $31,000, for cotton warehouse for Port Commission.

Mobile, Ala.—Terminal Transfer & Storage Co., according to press reports, will build terminal plant on 32-acre site on water front for cold storage

New Orleans, La.—Plans being prepared for syrup-canning factory for Langhoff Bros. Co. Estimated cost, $100,000. Charles Langhoff, Mgr.

Louisville, Ky.—W. L. Martin Broom & Mop Co., 1010 South Preston St., plans broom factory. Estimated cost, $18,000.

Canton, Ohio—Bonnot Co. will build one-story, 40x160-ft., brick and steel addition to its shop on Mulberry Rd. Estimated cost, $20,000.

Cincinnati, Ohio—Homan Mfg. Co. will build addition to its factory for manufacture of candle-molding machinery.

Cincinnati, Ohio—Citizens' Artificial Ice Co. has plans for 100x100-ft. brick and steel ice factory on Jefferson St. Estimated cost, $45,000. Joseph Reickert, Pres.

Cleveland, Ohio—Weideman Co., West Ninth St. and Mandrake Ave., has taken over business of Miller-Everhard Co. and will build seven-story and basement, 88x90-ft., building for bakers' supplies. Estimated cost, $100,000.

Cleveland, Ohio—Ernest McGeorge, Leader-News Bldg., preparing plans for addition to factory of Oster Mfg. Co., East 61st St. Estimated cost, $40,000.

Cleveland, Ohio—American Express Co. will build one-story, 120x150-ft. garage at Lakeside and 17th St. A. E. Skeel, 20 Second Ave. Bldg., Cleveland, Arch. Estimated cost, $30,000.

Cleveland, Ohio—Bamberger-Teinthal Co., 2621 East Ninth St., will build knitting mill at East 27th St. and Payne Ave. Estimated cost, $100,000.

Columbus, Ohio—J. N. Bradford, Arch. of Ohio State University, has prepared plans for machine shop for Ohio State University. Building will be two stories and basement. Estimated cost, $135,000.

Elyria, Ohio—Elyria Tire & Rubber Co., E. G. Parshall, 845 Bloomfield Ave., Akron, in charge, will build two-story, 60x200-ft., factory.

Elyria, Ohio—Willys-Overland Co. will build factory. Estimated cost, $30,000.

Mogadore, Ohio—Bids being received by Granite Clay Co., W. N. Palmer, Secy., 315 Hamilton Bldg., Akron, for two-story and basement, 125x310-ft. sewer-pipe factory.

Springfield, Ohio—Robert C. Gotwalk, 54 Gotwalk Bldg., receiving bids on one-story, 42x210-ft. foundry addition for Nolte Brass Co., 27 West Jefferson St. Estimated cost, $25,000.

Toledo, Ohio—Gartland Foundry Co. will build one-story brick addition to its foundry at 1811 Starr Ave. Estimated cost, $30,000.

Wooster, Ohio—Wayne China Co. plans 80x400-ft. pottery.

Columbus, Ind.—Plans prepared for four-story, 48x240-ft. addition to the tannery of W. W. Mooney & Sons.

Marion, Ind.—U. S. Specialty Co. plans three-story, 60x157-ft. brick addition to its factory on Factory Ave.

Kalamazoo, Mich.—Fuller & Sons Mfg. Co. plans four-story, 61x100-ft. brick addition to its factory.

Chicago, Ill.—Siegel-Hechinger Packing Co., 910 West 38th St., will build two-story, 56x66-ft. brick packing plant on 38th St. H. P. Henschien, Old Colony Bldg., Arch. Estimated cost, $25,000.

Chicago, Ill.—Pulverized Manure Co., Union Stock Yards, will build one-story, 85x130-ft., brick warehouse at West Morgan and 25th St. Estimated cost, $15,000.

Chicago, Ill.—Wheelock & Shank, 64 West Randolph St., prepared plans for six-story, 125x125-ft., brick and concrete publishing plant for Methodist Book Co. at Superior and Rush St. E. R. Graham, 1018 South Wabash Ave., in charge.

✚**Chicago, Ill.**—(Official)—Contract awarded to MEILING & CO., 139 North Clark St., Chicago, for six-story warehouse for Wheeling Corrugating Co. Noted Aug. 19.

Chicago, Ill.—Weller Mfg. Co. will build two-story warehouse on North Kestner Ave. R. A. Kirkpatrick, Arch. Estimated cost, $20,000.

✚**Peoria, Ill.**—Contract awarded to V. JOBST & SONS CO. by Oakford & Fahnestock Co. for first section of warehouse on Commercial St.

✚**Milwaukee, Wis.**—Contract awarded to BARNETT-RECORD CO., Minneapolis, Minn., at $525,000 for grain elevator on Kinnickimnic River for North Western R.R. Co.

Keokuk, Iowa—G. E. Weissenburger, John Dillon and others, Yonkers, N. Y., are interested in establishment of plant for manufacture of raw steel. Estimated cost, $90,000.

Waterloo, Iowa—Kelly Mfg. Co., Miles and McKinley St., will rebuild its factory, recently destroyed by fire. Estimated cost, $101,000.

✚**Waterloo, Iowa**—Contract awarded to T. S. LEAKE & CO., Chicago, Ill., at $180,000 by Illinois Central R.R. Co. for improvements to its shops.

Minneapolis, Minn.—J. F. McCrea will build two-story, brick and concrete warehouse at 17 Western Ave. Estimated cost, $15,000.

✚**Minneapolis, Minn.**—Contract awarded to BARNET-RECORD CO., Minneapolis, for grain elevator at Second and Fourth Ave. for Pillsbury Flour Mill Co.

Atchison, Kan.—Press reports state Standard Oil Co. plans to build warehouse. Estimated cost, $50,000. J. W. Powers, St. Joseph, Mo., District Mgr.

Billings, Mont.—J. I. Case Threshing Machine Co. will spend $100,000 for construction of two-story addition. O. J. Thomas, Mgr.

Missoula, Mont.—Olson & Johnson Co. contemplates building warehouse. Estimated cost, $20,000.

Hannibal, Mo.—Plans being prepared for plant for Hannibal Wire Fabric Co. Estimated cost, $30,000.

Kansas City, Mo.—White & Dean, 311 Bellefontaine Ave. preparing plans for two-story, 65x100-ft. reinforced-concrete garage on East 17th St. Estimated cost, $20,000.

✚Kansas City, Mo.—(Official)—Contract awarded to C. C. PETERSON & SON, Midland Bldg., Kansas City, at $12,000 for two-story warehouse for Freeman & Duncan Realty & Transfer Co. Noted Aug. 21.

St. Louis, Mo.—Ford Motor Car Co. will build assembling plant at Sarah St. and Forest Park Blvd. Estimated cost, $250,000.

Argenta, Ark.—Bids will soon be received for factory for Arkansas Fertilizer Co. for manufacture of sulphuric acid. Estimated cost, $100,000.

Pine Bluff, Ark.—Texas Co. will build oil distributing plant. Estimated cost, $15,000.

✚Dallas, Tex.—Contract awarded to W. C. HEDRICK CO., at about $40,000 by D. E. Johnson for four-story, brick and concrete storage warehouse.

El Paso, Tex.—James L. Marr is having plans prepared for warehouse. Estimated cost, $65,000.

Galveston, Tex.—Plans being prepared for rebuilding packing plant of Armour Packing Co., recently destroyed by fire. Building will be two stories, reinforced concrete. Estimated cost, $60,000. E. T. Slaton, Mgr.

✚Henrietta, Tex.—Contract awarded to AUSTIN BROS., Dallas, at about $30,000, for factory and warehouse for Henrietta Window Glass Co.

✚Houston, Tex.—Contract awarded to J. STRADLER, at $20,000 for two-story warehouse at Vine and Shea St. for J. F. Garret.

San Antonio, Tex.—Luck Tire & Mfg. Co., according to press reports, will build factory for manufacture of puncture proof tires. Estimated cost, $12,000.

✚Allen, Okla.—Contract awarded to A. F. VANDERSELL, Oklahoma City, at $10,000 for oil refinery for Allen Commercial Club.

Jennings, Okla.—Plans being prepared for oil refinery for Mid-Continent Refinery Co. with capacity of 2,500 bbl. Estimated cost, $100,000. J. J. Fitzpatrick, Pres.

✚Salt Lake City, Utah—Contract awarded to BUELL CONSTRUCTION CO., Chicago, Ill., at about $75,000, for three-story, 137x166-ft. concrete warehouse on Second South St. for Jennings & Hanna Investment Co. Noted Aug. 12.

Seattle, Wash.—(Official)—Bids will be received about Oct. 1 by Bebb & Gould, Arch., for eight-story, 72x242-ft. building for Times Publishing Co. Noted Aug. 5.

Eugene, Ore.—Allen & Lewis Co., Portland, will build two-story warehouse at Fifth and Pearl St. Estimated cost, $25,000.

Portland, Ore.—Oregon Packing Co. purchased 7½ acre site in Kenton factory district and will build fruit and vegetable packing plant. Estimated cost, $125,000.

Oakland, Calif.—California Steel Co. plans steel plant on Harrison St., near First St. E. H. Frisell, Pres.

Pomona, Calif.—Indian Hill Citrus Association will build pre-cooling plant. Estimated cost, $50,000.

Victorville, Calif.—Southwestern Portland Cement Co., El Paso, Tex., will build new plant for manufacture of cement. Estimated cost, $500,000.

Halifax, N. S.—Imperial Oil Co. plans asphalt plant and fuel oil refinery. Estimated cost, $400,000.

Amherstburg, Ont.—Falls Barron Co. has plans for cold-storage plant. Cost, $10,000.

London, Ont.—Wortman & Ward Co. has plans for addition to its pump factory. Estimated cost, $20,000.

FEDERAL GOVERNMENT WORK

Alterations—Boston, Mass.—Bids received Sept. 14 by Acting Supervising Architect, Washington, D. C., for new partitions, alterations, etc., in the U. S. Customhouse, Boston, Mass., from: George A. Fuller Co., Boston, Mass., $11,136; Neptune B. Smyth, Inc., New York, N. Y., $9,889; Conners Bros. Co., New York, N. Y., $10,600. Noted Sept. 2.

Elevator Plant—Boston, Mass.—Bids will be received until 3 p.m., Oct. 8, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for electric elevator plant in U. S. appraisers' stores, Boston, Mass.

✚Post Office—North Attleboro, Mass.—Contract for U. S. post office at North Attleboro, Mass., awarded to JAMES A. MUNROE, North Attleboro, at $50,500. Noted July 8 and Aug. 19.

Telephones, Etc.—New London, Conn.—Bids will be received until 11 a.m., Oct. 2, by H. R. Stanford, Ch., Bureau of Yards and Docks, Navy Dept., Washington, D. C., for four telephones, electric fixtures and wiring at Naval Station, New London.

★Air Compressors—Buffalo, N. Y.—Bids will be received until 2 p.m., Oct. 4, by Lighthouse Inspector, Buffalo, N. Y., for four air-compressor units for fog-signals at Cleveland and Ashtabula, Ohio.

Post Office—Gouverneur, N. Y.—Bids received Sept. 10 by Acting Supervising Architect, Washington, D. C., for post office at Gouveneur, N. Y., (a) limestone, (b) sandstone, from: W. H. Fissell & Co., New York, (a) $54,300, (b) $56,300; James Devault, Canton, Ohio, (a) $52,000, (b) $53,750; William H. Egan, New York, (a) $52,888; (b) $53,900. Noted Aug. 5.

Heating—New York, N. Y.—Bids received Sept. 10 by James A. Wetmore, Act. Superv. Arch., Washington, D. C., for heating alterations in New York post office, from: William J. Olvany, New York, $8,900; Walker & Chambers, New York, $8,760; Almirall & Co., New York, $8,345.

Boathouse—Oswego, N. Y.—Bids will be received until 2 p.m., Oct. 4, by United States Coast Guard, Treasury Dept., Washington, D. C., for boathouse and accessories at Oswego Coast Guard Station, Oswego, N. Y. D. P. Foley, Act. Capt. Commandant, Coast Guard.

★Stone Repairs—Cold Spring, N. J.—Lowest bid received for stone repairs to jetty at Cold Spring Inlet was that of Coast & Lakes Repairing Co., New York, N. Y., at $29,520. Noted Aug. 5.

Post Office—Monongahela, Penn.—Bids will be received until 3 p.m., Oct. 27, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for U. S. post office at Monongahela, Penn.

✚Air Compressors—Pittsburgh, Penn.—Contract for air compressors, gas engine, turbine, electric-light plant, etc., at Lock No. 6, Monongahela River, awarded to HALL STEAM PUMP CO., Pittsburgh, at $4,444. Noted July 29 and Sept. 9.

✚Houses—Pittsburgh, Penn.—Contract for building two brick houses for lockkeepers at Dam No. 10, Ohio River, awarded to E. M. EVERSON, Brilliant, Ohio, at $11,100. Noted July 29 and Sept. 9.

★✚Lock Gates, Etc.—Pittsburgh, Penn.—Contracts for steel lock gates, valves, and lock-operating machinery at Lock No. 6, Monongahela River, awarded to THOMAS CARLIN SONS CO., Pittsburgh, at $7,600 for Section A, and to UNION FOUNDRY & MACHINE CO., Pittsburgh, at $13,557 for Section B. Noted July 29 and Sept. 9.

Dredging—Baltimore, Md.—Bids were received Sept. 15 by U. S. Engineer, Baltimore, for dredging in rivers and harbors on east shore of Chesapeake Bay from: Maryland Dredging and Contracting Co., Baltimore, 26.5c. per cu.yd. (recommended for acceptance); Dorey & Miller Co., Washington, D. C., 27.75c.; River and Harbor Improvement Co., Philadelphia, Penn., 27c.; Norfolk Dredging Co., Norfolk, Va., 29c. Noted Aug. 19.

✚Derrick Boat—Washington, D. C.—Contract for steel derrick boat awarded to DRAVO CONTRACTING CO., Pittsburgh, Penn., at $24,300. Noted July 29 and Sept. 2.

Grading—Washington, D. C.—Bids will be received until 2 p.m., Oct. 4, by Secretary of District Commissioners, Room 509 District Bldg., for approximately 19,500 cu.yd. grading on several streets.

Pumping Unit—Washington, D. C.—Bids will be received until 2 p.m., Oct. 11, by Commissioners of the District of Columbia for one steam turbine-driven, centrifugal pumping unit. Capacity, 5,000,000 gal. in 24 hr.

✚Post Office—Charlotte, N. C.—James A. Wetmore, Act. Superv. Arch., awarded contract for post office at Charlotte, sandstone construction, to J. A. JONES & CO., Charlotte, at $207,000. List of bids noted Sept. 16.

✚Bulkhead and Dock—Charleston, S. C.—Lighthouse Inspector awarded contract for bulkhead and dock for Sixth District lighthouse depot to CHARLESTON ENGINEERING & CONTRACTING CO., Charleston, at $8,745 and $46,418 respectively. Noted Aug. 5.

Cell Fronts, Locking Devices—Atlanta, Ga.—Bids received Sept. 10 by Superintendent of Prisons, Dept. of Justice, Washington, D. C., for steel cell fronts, and mechanical locking device at U. S. Penitentiary, Atlanta, Ga., (a) and (b), from: Mesker Bros. Iron Co., St. Louis, Mo., (a) $17,125, (b) $15,875; Van Dorn Iron Works, Cleveland, Ohio, (a) $25,815, (b) $22,120; A. F. Wagner, Architectural Iron Works, Milwaukee, Wis., (a) $22,415, (b) $21,375.

★✚Post Office—Palatka, Fla.—Contract for post office at Palatka, Fla., awarded to WESTCHESTER ENGINEERING CO., White Plains, N. Y., at $39,562. Noted July 22 and Sept. 9.

Attendants' Quarters—Tampa, Fla.—Bids were received Sept. 20 by Acting Supervising Architect, Washington, D. C., for construction of attendants' quarters, disinfecting shed, oil house and wharf at Tampa Bay from: A. Bassford, Tampa, $53,740; E. Hart, Norfolk, Va., $52,110; Algernon Blair, Montgomery, Ala., $54,000. Noted Aug. 26.

Levee Work—New Orleans, La.—Bids will be received until 11 a.m., Sept. 28, at U. S. Engineer Office, Queen and Crescent Bldg., New Orleans, for about 1,093,400 cu.yd. earthwork in Lower Tensas and Atchafalaya levee districts.

★Post Office—Newcastle, Ind.—Bids will be received until 3 p.m., Oct. 27, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for U. S. post office at Newcastle, Ind.

Post Office—Seymour, Ind.—Bids will be received until 3 p.m., Oct. 30, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for U. S. post office at Seymour.

Structural Steel—Leavenworth, Kan.—Bids received Sept. 10 by Superintendent of Prisons, Dept. of Justice, Washington, D. C., for structural steel, reinforcing material, etc., for cell blocks in Leavenworth Prison, from: Mesker Bros. Iron Co., St. Louis, Mo., $43,575; Crown Iron Works, Minneapolis, Minn., $48,668; St. Paul Foundry Co., St. Paul, Minn., $55,880.

Canal—Powell, Wyo.—Bids will be received until 2 p.m., Oct. 20, by United States Reclamation Service, Powell, Wyo., for canal and structures on the Shoshone Project, Wyoming. Work includes 560,000 cu.yd. excavation, 1,400 cu.yd. reinforced concrete, 9,000 sq.yd. grouted paving and placing in structures about 130 M. ft., b.m., of lumber. A. P. Davis, Ch. Engr., Reclamation Ser.

Building—Kirksville, Mo.—Bids will be received until Oct. 28 by Supervising Architect, Treasury Dept., Washington, D. C., for U. S. public building at Kirksville, Mo.

Remodeling Post Office—Moberly, Mo.—Bids will be received until 3 p.m., Oct. 15, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for extension and remodeling of U. S. post office at Moberly.

★✚**Post Office**—Grand Junction, Colo.—Contract for post office at Grand Junction, Colo., awarded to DIETER & WENZEL CONSTRUCTION CO., Wichita, Kan., at $106,821. Noted July 22 and Sept. 2.

Buildings—Bremerton, Wash.—Bids received Sept. 11 by Bureau of Yards and Docks, Washington, D. C., for one steel shell house, and two brick magazines at Puget Sound Navy Yard, from: Booker, Kiehl & Whipple, Seattle, $33,857; Arvid Levergreen, Seattle, $36,440; Martin & Dugan, Seattle, $34,913. Noted Aug. 12.

Naval Improvements—Pearl Harbor, Hawaii—Bids were received Sept. 18 by Bureau of Yards and Docks, Washington, D. C., for improvements at Naval Station, Pearl Harbor, consisting of wharf, torpedo-boat piers and marine railway. Bids were asked as follows: (a) Wharf complete, (b) piers Nos. 1, 2, 3 and 4; (b1) piers Nos. 1, 2 and 3; (b2) piers Nos. 1 and 2; (b3) price per lin.ft. increase or decrease in length of concrete piles. Bids were received from: Spalding Construction Co., Rialto Bldg., San Francisco, Calif., (a) $163,966; (b) $118,943; (b1) $90,320; (b2) $61,503; (b3) $1.50. Hawaiian Dredging Co., Honolulu, Hawaii, (a) $155,000; (b) $113,953; (b1) $85,870; (b2) $58,800; (b3) $1.40. John Monk, Sharon Bldg., San Francisco, Calif., (b) $134,000; (b1) $119,000; (b2) $86,000; (b3) $1.50.

Town Improvements—Anchorage, Alaska—Townsite of Anchorage, Alaska, under supervision of Alaskan Engineering Commission, contemplates town improvements, water works, electric-power plant, telephone, sewers and street improvements. J. G. Watts, Townsite Engr., would like catalogs and other information.

MISCELLANEOUS

Drydock—Boston, Mass.—Contract will probably be awarded to Holbrook, Cabot & Rollins for drydock by Executive Council.

Barge Canal Work—Albany, N. Y.—(Official)—Bids were received Sept. 14 by W. W. Wotherspoon, State Supt. of Pub. Wks., for Contract L. Cryuga and Seneca Canal: Scott Bros., Rome, at $59,928; Chesley, Earl & Heimbach, Inc., Buffalo, $62,046, and Stanley Construction Co., Buffalo, $63,061; and for Terminal Contract 40: J. E. Bishop, Syracuse, $25,515, was low bidder.

Freight Shed—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until noon, Oct. 1, by R. A. C. Smith, Comr. of Docks, Pier A, Manhattan, for Contract No. 1473 for freight shed on pier near 35th St.

Freight Shed—New York, N. Y.—(Borough of Brooklyn)—(Official)—Snare & Triest, New York, at $213,370, low bidder for dock freight shed on pier at 30th St. Noted Sept .9.

Pier—New York, N. Y.—(Borough of Brooklyn)—Sinking Fund Commission will build new pier near pier at Dreamland Park, Coney Island. R. A. C. Smith, Dock Comr.

✚**Ballast**—New York, N. Y.—(Borough of Manhattan)—(Official)—Contracts awarded by Public Service Commission to UPPER HUDSON STONE CO., at $228,010 for (a), and to HAVERSTRAW CRUSHED STONE CO., at $26,320 for (b), for stone. Contract (c), awarded by Commission to Upper Hudson Stone Co. withdrawn and bids will be readvertised. Noted Sept. 16.

Extending Pier—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until noon, Sept. 28, by R. A. C. Smith, Comr. of Docks, Pier A, Manhattan, for extending Pier 22, near Jay St., North River.

Creek Improvements—North Tonawanda, N. Y.—Bids were received by Superintendent of Public Works for improving Sawyer's Creek: H. S. Kerbaugh, Inc., Buffalo, $9,800, and Eastover Construction Co., Inc., Utica, $10,200.

✚**Jetties**—Atlantic City, N. J.—Contract awarded to J. W. INGERSOLL, at $22,034, for jetties at Iowa and Boston Ave. John W. Hackney, City Engr.

Inland Waterway—Brielle, N. J.—Bids will soon be received by New Jersey State Commerce & Navigation Board for Barnegat Bay-Manasuan River inland waterway, to form link in Cape May canal.

Pier—Camden, N. J.—Harbor Commissioner plans pier at 28th St. L. E. Farnham, City Engr.

Meter Repair Station—Newark, N. J.—Bids will be received until Sept. 30 for meter repair station at 14th Ave. and South Eighth St. for Water Department. M. R. Sherrerd, Ch. Engr. Estimated cost, $21,000.

Bulkhead—Eddystone, Penn.—Baldwin Locomotive Works contemplates bulkhead on Delaware River. Estimated cost, $200,000.

Flood Protection—Erie, Penn.—Surveys being made for improvement of Mill Creek by Farley Gannett, Harrisburg. B. E. Briggs, City Eng. Noted Aug. 26.

Dam—Green Lane, Penn.—State surveyors making surveys for rebuilding Klondike dam, which was recently broken.

Coal Storage—Philadelphia, Penn.—Bids will be received until Sept. 30 for coal storage and appliances for Queen Lane pumping station, at Ridge Ave. and School Lane for Department of Public Works. J. S. Ely, Asst. Engr.

Superstructures—Philadelphia, Penn.—Bids will be received until Oct. 31 by A. M. Taylor, Dir. Dept. of City Transit, for superstructures of Frankford Elevated line.

✚**Tunnel**—Rittersville, Penn.—(Allentown post office)—Contract awarded to W. A. STEIN & CO. for concrete tunnel at State Homeopathic Hospital.

✚**Bulkheads**—Jacksonville, Fla.—Contract awarded to WADE, POWERS & WADE, Jacksonville, for sheet steel piling and wood work for bulkhead for Commodore's Point Terminal Co. Noted Aug. 12.

✚**Canal**—Parish, Fla.—Contract awarded to EDGAR CHAPMAN, Plant City, at about $125,000, for canal work in Gamble Creek Drainage District. Noted July 29.

Barge Line—Shreveport, La.—Press reports state Shreveport contemplates barge line between Shreveport and New Orleans. J. B. Arkis and J. B. Atkins, interested.

Underground Passage—Cincinnati, Ohio—Joseph G. Steinhamp & Bro., Cincinnati, and B. Kingston Hall, New York, N. Y., prepared preliminary plans for underground parking system for automobiles.

Levee Bonds—Portsmouth, Ohio—Bonds for $70,000 for levee work will be sold Oct. 5 by George L. Gableman, City Audr.

Soldiers Monument—Bloomfield, Ind.—Green County Council voted $25,000 bonds for soldiers' monument.

Dock—Peoria, Ill.—Citizens contemplate dock at Cedar St. and river.

Harbor Improvements—Milwaukee, Wis.—Harbor Commission will ask for appropriation of $200,000 for harbor improvements.

Sea Wall—Muscatine, Iowa—Vertical sea wall will be built along Mississippi River. J. Kimball, Davenport, Engr.

Ditch—Mankato, Minn.—County Ditch No. 38 will be built at estimated cost of $98,107. It will be 28 miles long.

Drainage—Strong City, Kan.—Surveys made for drainage district in Chase County.

Drainage—Tekamah, Neb.—(Official)—Bids will be received until noon, Oct. 2, by Towl Engineering Co., Omaha, for 500,000 cu.yd. of excavation on old ditches and 300,000 cu.yd. of new excavation.

Drainage—Harrisonville, Mo.—Citizens of Cass and Bates Counties plan drainage district to drain about 20,000 acres along Grand River. J. H. McCulloh, Garden City, interested. Estimated cost, $250,000.

Flood Protection—Kansas City, Mo.—Surveys will be made for flood protection work on Turkey Creek.

Subway—St. Louis, Mo.—St. Louis Subway & Elevated Corporation being formed and will build subway to downtown section. James D. Houseman, F. E. Niesen, Bank of Commerce Bldg., J. E. Hereford, Pres. Trust Co. of St. Louis County, and others, interested.

Ditches—Pocahontas, Ark.—(Official)—Bids will be received until Oct. 1 by T. Z. Johnson for ditches in Township 18, about 83,371 cu.yd. of earth removal.

Wharf—Beaumont, Tex.—According to press reports bids being received by Wharf & Dock Commission for second unit of Municipal Wharves.

Drainage—Cuero, Tex.—Bonds for $30,000 sold by De Witt County for Drainage District No. 1.

Dock—Maryhill, Wash.—Concrete dock will be built by Portland Dock Commission.

Swimming Pool—Spokane, Wash.—City Council plans swimming pool at estimated cost of $10,000. G. W. Duffy, City Clk.

✚**Dock**—Portland, Ore.—Contract awarded to J. A. BACKSTRAND, at $12,150, for municipal dock at Stark St.

✚**Levees**—Arbuckle, Calif.—Contracts awarded for levee work as follows: ASA KALFSBECK, at $4,502, for work along Baldson lands; W. T. WILKINS & SON, at $8,040, for work from Sachreiter line on Sycamore slough to Hannum bridge, and to W. T. WILKINS, at $4,500 for work in District 108.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous."

✚**Thomaston, Maine**—Contract for municipal building awarded J. W. BISHOP CO., Worcester, Mass. Estimated cost, $50,000.

Boston, Mass.—Bids will be received by City Hospital Department until Sept. 25 for additions to 11 hospitals. Wells & Dana, 29 Central St., Arch.

✚**Boston, Mass.**—Contract for store and office building for High St. Trust awarded JAMES BLACK MASONRY & CONTRACTING CO., Boston. Noted July 29.

★✚**Boston, Mass.**—Contract for Administration Building on Fruit St. for General Hospital awarded NORCROSS BROS., Tremont Bldg., Boston. Estimated cost, $150,000.

Brockton, Mass.—Bids will be received about Oct. 5 for theater, store and office buildnig for Crescent Amusement Co., Boston. Estimated cost, $400,000.

✚**Brockton, Mass.**—Contract for theater at Main and School St. for Empire Theater Co. awarded DAVID IRVING CO., 31 High St. Estimated cost, $40,000.

✚**Cambridge, Mass.**—City of Cambridge awarded contract for hospital and boiler house to WALSH BROS., Cambridge, at $78,000. Noted Sept. 16.

Chelsea, Mass.—Bids will be received by the Mayor until Sept. 30 for three-story addition to Williams School. Estimated cost, $112,000. Wilham & Hopkins, Boston, Arch. Noted July 29.

Chicopee, Mass.—Congregation St. Stanislaus Polish Church will build new school. Lawrence Cyman, Pastor.

Danvers, Mass.—Town plans to build h gh school Estimated cost, $130,000.

Dedham, Mass.—Bids will be received un il Sept. 25 by James G. Hutchison, Arch., 101 Tremont St., Boston, for building for Deham Masonic Lodge. Estimated cost, $40,000.

Foxboro, Mass.—Bids were received for connecting corridor at Foxboro State Hospital for Commonwealth of Massachusetts as follows: James A. Munroe, $42,812; C. S. Cunningham & Sons Construction Co., $42,812; D. L. Shepherd, $44,000.

✚**Lynn, Mass.**—(Official)—Contract for three-story, 104x133-ft., market building for J. B. Blood & Co., Ellis and Silsbee St., awarded TURNER CONSTRUCTION CO., 11 Broadway, New York.

Marlboro, Mass.—School Committee approved plans of J. F. Simpson, Arch., Newark, N. J., for new school. Estimated cost, $40,000.

✚**New Bedford, Mass.**—Contract for Maternity Building at St. Lukes Hospital awarded J. W. BISHOP CO., Worcester Estimated cost, $50,000.

Salem, Mass.—Naumkeag Steam Cotton Co. will build office building at Congress and Lynch St. Estimated cost, $53,000.

Worcester, Mass.—Burgess & Land, Boston, Mass., plans seven-story business block at Federal St. and Allen Court.

✚Providence, R. I.—Contract for 18-room school at Beaufort St. and Mt. Pleasant Ave. awarded HOPE BUILDING CO., 87 Weybosset St., Providence, at $144,435. Noted Aug. 26.

Providence, R. I.—Bids will soon be received for two-story, 128x139-ft., church for Central Baptist Society. Jackson, Robertson & Adams, 1216 Turks Head Bldg., Arch.

★Albany, N. Y.—(Official)—Bids will be received until 3 p.m., Oct. 5, by Trustees of Public Buildings, Executive Chamber, Capitol, Albany, for alterations in Capitol. Noted Aug. 12.

East Aurora, N. Y.—Plans prepared by Harris & Merritt, Arch., Buffalo, for high school. Estimated cost, $110,000.

Hicksville, N. Y.—Plans being prepared by Holmes & Winslow, Arch., 103 Park Ave., New York, for building for Bank of Hicksville.

New York, N. Y.—(Borough of Manhattan)—Plans prepared by William H. Birkmire, Arch., for 12-story mercantile building at 53-57 West 23d St. through to 34 West 24th St. for Nameloc Co. Estimated cost, $300,000.

New York, N. Y.—(Borough of Manhattan)—Plans prepared by Ernest Flagg, Arch., for eight-story hospital on Broad St. Estimated cost, $150,000.

✚New York, N. Y.—(Borough of Manhattan)—(Official)—Contract for office building at 42d St. and Madison Ave. for August Heckscher, 576 Fifth Ave., awarded to RUSSELL B. SMITH, 305 Madison Ave. Estimated cost, $600,000.

✚New York, N. Y.—(Borough of Manhattan)—(Official)—Contract for loft building at 27 Cliff St. for 27 Cliff Street Corporation, 431 West 14th St., awarded STANDARD CONCRETE STEEL CO., 413 East 31st St. J. S. Maher, 431 West 14th St., Arch.

Rochester, N. Y.—Plans being prepared by Komes & Kauzor, Arch., Pittsburgh, Penn., and C. W. Eldridge, Assoc. Arch., Rochester, for parish house and church for Holy Rosary congregation. Estimated cost, $60,000.

Bayonne, N. J.—Board of Education plans to rebuild Public School No. 4. Estimated cost, $130,000. Noted July 29.

Elizabeth, N. J.—National Bank of Elizabeth contemplates new building. Estimated cost, $75,000.

Jersey City, N. J.—Date for receiving bids for county jail for Hudson County extended to 3 p.m., Oct. 7. Noted Sept. 2.

✚Jersey City, N. J.—Contract for Public School No. 5, Smith and Robert St., North Bergen, awarded J. J. MARIONE CONSTRUCTION CO., at $65,480.

Newark, N. J.—Members of Salaam Temple, Nobles of Mystic Shrine, contemplate mosque. Estimated cost, $250,000. A. C. Snyder, Second Ave., Chn. Bldg. Com.

Philadelphia, Penn.—Abel Bottoms & Sons Co., at $59,989, submitted the lowest bid for addition to McIntyre School, 39th and Gordon St.

✚Philadelphia, Penn.—Contract for police and fire station at Huntington Park Ave. and Schuyler St. awarded HARRY H. WEHMEYER, Philadelphia, at $104,000.

Pittsburgh, Penn.—Braddock General Hospital plans three-story addition. Estimated cost, $80,000.

Wilkes-Barre, Penn.—Plans being revised by Sturdevant & Poggi, Arch., Coal Exchange Bldg., for Masonic Lodge Building. Estimated cost, $75,000.

✚Princeton, W. Va.—Board of Education awarded contract for school at Konah and Richie St. to JAMISON & KARNS, Princeton. Estimated cost, $65,000.

Winston-Salem, N. C.—B. S. Womble plans business building on West Fourth St. near Cherry St. Estimated cost, $40,000.

Chattanooga, Tenn.—Plans being considered by Congregational Church for new building. Estimated cost, $50,000. C. H. Meyers, Pastor.

Glasgow, Ky.—According to press reports hotel will be built on Green St. Estimated cost, $50,000.

Canton, Ohio—Bids will be received about Oct. 1 for high school. Estimated cost, $700,000. N. C. Lane, Clk., Bd. of Education.

Cincinnati, Ohio—Bids will be received until Sept. 25 by Harry Hake and Charles H. Kuck, Arch., 1105 Cincinnati & Suburban Bell Telephone Bldg., for bank and office building for Provident Savings Bank & Trust Co. Estimated cost, $100,000.

✚Cleveland, Ohio—JAMES L. STEWART, Cleveland, awarded contract for addition to Hollenden Hotel, Superior and East Sixth St. Estimated cost, $200,000. Noted Aug. 26.

✚Cleveland, Ohio—Contract for school on Aetna Rd. for Congregation of Christ awarded E. CONVERSE, Massillon, at $45,000. Noted Aug. 12.

Dayton, Ohio—Preliminary plans prepared by Albert Pretzinger and Edward P. Musselman, Arch., for three-story school. Estimated cost, $150,000. C. J. Schmidt, Clk., Bd. of Education.

✚Ironton, Ohio—Contract for hotel and store building for Ironton Hotel Co. awarded to REED CONSTRUCTION CO., Charleston, W. Va. Estimated cost, $175,000.

Marion, Ohio—Bids will be received until noon, Oct. 2, by Jeanette L. Hutchinson, Clk., Bd. of Education, for high school. Marriott, Allen & Hall, Columbus, Arch.

Portsmouth, Ohio—Ritter Bates will build hotel on Gallia St. west of Gay St. Estimated cost, $250,000.

Youngstown, Ohio—Plans being prepared by Knox, Elliott, 1248 Rockefeller Bldg., Cleveland, for hotel, theater and store building for Realty Trust Co. Estimated cost, $300,000.

Zanesville, Ohio—Armco Athletic Club contemplates club house and grandstand. Estimated cost, $50,000. C. M. Bowlby, Corry St., Arch.

Columbus, Ind.—Graham & Hill, Arch., Indianapolis, retained to prepare plans for temple for St. Johns Lodge of Masons. Estimated cost, $40,000.

Indianapolis, Ind.—Preliminary plans being prepared by Rubush & Hunter, Arch., for three-story building for Masonic Scottish Rite Temple Association. Estimated cost, $500,000.

Terre Haute, Ind.—Plans being prepared by A. Hubbard, Arch., Champaign, Ill., for building for Masonic Temple Association. Estimated cost, $100,000. J. N. Hickman, 1210 Wabash Ave., Chn. Bldg. Com.

Grand Rapids, Mich.—Bids will be received by State Military Board until 9 a.m., Sept. 29, for armory for Grand Rapids Battalion. Williamson & Crow, Arch.

Chicago, Ill.—Plans prepared for dormitory for Garrett Biblical Institute. Estimated cost, $150,000.

Chicago, Ill.—Plans being prepared by J. B. Dibelka, State Arch., 128 North Fifth Ave., for five-story armory for First Cavalry, I. N. G. Estimated cost, $200,000. Holabird & Roche, 104 South Michigan Ave., Consult. Arch.

✚Galesburg, Ill.—Contract for seven-story office building at Kellogg and Main St. awarded HENRY W. HORST CO., Rock Island.

✚Eau Claire, Wis.—Contract for city hall awarded HOEPPNER & BARTLETT, Eau Claire, at $65,000. Noted Aug. 19.

✚Sheboygan, Wis.—(Official)—Contract for city hall awarded by Board of Public Works to IMMEL CONSTRUCTION CO., Fond du Lac. Estimated cost, $115,000. Noted Sept. 9.

Union Grove, Wis.—State Control Board plans home for feeble-minded. Estimated cost, $200,000.

Watertown, Wis.—Bids will be received by A. Frattinger, Chn., Bldg. Com., until 7 p.m., Oct. 11, for high school. Estimated cost, $100,000. Parkinson & Dockendorff, La Crosse, Arch.

✚Ames, Iowa—(Official)—Contract for science hall at Iowa State College awarded J. B. EVANS CONSTRUCTION CO., Mexico, Mo., at $49,280. W. H. Gemmill, Secy. Noted Sept. 2 and 9.

North Washington, Iowa—Plans being prepared by Anton Dohmen, Arch., 525 First National Bank, Milwaukee, Wis., for 48x84x150-ft. brick church for Immaculate Conception congregation.

Ottumwa, Iowa—Ottumwa Stock Co. plans to build hotel. Estimated cost, $150,000.

Sioux City, Iowa—Plans being prepared by W. L. Steel, Sioux City, and Purcell & Elmslee, Arch., 422 Auditorium Bldg., Minneapolis, Minn., for courthouse for Woodbury County. Estimated cost, $500,000.

✚Tipton, Iowa—County Commissioners awarded contract for county house to GUARANTEE CONSTRUCTION CO., Cedar Rapids, at $44,714. Noted Aug 19.

Waterloo, Iowa—BLACKHAWK CONSTRUCTION CO., Waterloo, at $50,000, awarded contract for freight depot for Waterloo, Cedar Falls & Northern R.R.

Minneapolis, Minn.—Bids being received by Buechner & Orth, Arch., 500 Shubert Bldg., St. Paul, for a theater for M. L. Cohen & Co., 239 Nicolett Ave. Estimated cost, $80,000.

Minneapolis, Minn.—Finkelstein & Rubens will build motion-picture theater . Estimated cost, $75,000.

St. Paul, Minn.—Plans prepared by Buechner & Orth, Arch., 500 Shubert Bldg., for theater hotel and store building for Herman L. Benz, 409 Jackson St.

St. Paul, Minn.—(Official)—Bids will be received about Oct. 15 for a building at Cedar and Central St. for Minnesota State Historical Society. Noted July 1.

Columbia, Mo.—T. B. Hall will build theater at Ninth and Cherry St. Estimated cost, $40,000.

Kansas City, Mo.—Plans being prepared by Carl Boller & Bro., Arch., Gayety Bldg., for business building for Altman Realty Co., 320 Altman Bldg. Estimated cost, $100,000.

✚Argenta, Ark.—Contract for Matthews Building at Second and Main St. awarded L. COLLAMORE, Little Rock, at $75,000.

Beaumont, Tex.—Plans being prepared by Cook & Co., Arch., for seven-story hotel at Pearl and Crockett St. for Likens Ogden. Estimated cost, $85,000.

Corsicana, Tex.—J. C. Joplin & Bros., Houston, at $70,858, low bidder for hospital dormitory for Texas State Orphan's Home Association. Noted Aug. 12.

Galveston, Tex.—Galveston Natatorium Co. being organized with capital stock of $175,000 to build four-story reinforced-concrete natatorium.

Lamesa, Tex.—Taxpayers of Dawson County voted to issue $43,000 bonds for new courthouse.

Waco, Tex.—Work will soon be started on new building for Texas Telephone Co. Estimated cost, $80,000.

Pueblo, Colo.—Election will be held Nov. 2 to vote for $300,000 bonds for new city hall. J. M. Jackson, City Clk.

✚Douglas, Ariz.—(Official)—Contract for two schools and addition to high school awarded to T. B. STEWART, Phoenix, at $70,500. Noted July 8.

Tucson, Ariz.—Plans are being prepared by Sidney Mashbir, Arch., for city hall. Bonds for $50,000 voted for purpose.

Seattle, Wash.—Plans being prepared by F. F. Travis, Arch., for five-story, 120x215-ft., hospital near Seattle.

✚Seattle, Wash.—Contract for seven-story hotel for Imperial Hotel Co. awarded PUGET SOUND CONSTRUCTION CO., Central Bldg., Seattle, at $135,000.

Woodburn, Ore.—Citizens voted to issue $40,000 bonds for school.

Berkeley, Calif.—(Official)—Contracts awarded for building to be known as Benjamin Ide Wheeler Hall at University of California as follows: Excavation and concrete, COLLMAN & COLLMAN, $96,913; steel, PACIFIC ROLLING MILL CO., $49,420; steel erection, CALIFORNIA CONSTRUCTION CO., $11,475. Noted July 29.

Susanville, Calif.—Board of Supervisors awarded contract for courthouse to JAMES L. McLAUGHLIN, San Francisco, at $77,797.

Visalia, Calif.—City plans to build auditorium.

Construction News

Starting with this week's issue we are making under our regular headings subheadings to cover two different classes of work—one to read, "Proposed Work," and the other, "Bids In and Contracts Awarded." The subscriber interested in contracts awarded will therefore not find it necessary to go through the entire list to find out what contracts are closed and what are pending.

RAILWAYS—STEAM AND ELECTRICAL

Proposed Work

Connecticut—Connecticut Co., New Haven, Conn., will extend its double-track line on Main St., East Hartford. C. H. Chapman, Mgr.

New York—Buffalo & Depew Ry. Co. has asked Council for franchise for extension of its line from Ellicott Rd. and Central Ave. to New York Central R.R. tracks. G. A. Ricker, Ch. Engr.

New York—International Ry. Co., Buffalo, N. Y., plans lines as follows: Between Sycamore and William St., in 1916; between William and Seneca St. in 1917; between Sycamore and Ferry St. in 1918 and East Ferry St. and Kensington Ave. in 1919, about three miles in all. E. G. Connette, Pres.

New York—International Ry. Co., Kenmore, N. Y., will double-track its main line in Kenmore. J. C. Sheldon, Buffalo, Pur. Agt.

New York—Western New York & Pennsylvania Traction Co., Olean, N. Y., plans extension from Westons Mills to Cuba Lake. I. W. Miller, Oleon, Gen. Mgr.

New Jersey—Salem-Pennsgrove Traction Co., Salem, N. J., has asked Council for franchise for construction of line between Salem and Pennsgrove. Noted Aug. 26.

Pennsylvania—Phoenixville, Valley Forge & Strafford Electric Co., Phoenixville, Penn., has plans for extension of its line from Valley Forge to a connection with Philadelphia & Western Ry. at Bridgeport, about seven miles. Thomas E. O'Connell, Phoenixville, Pres., and Gen. Mgr.

Virginia—Richmond, Rappahannock & Northern Ry. Co., Richmond, Va., have had surveys made for proposed line from West Point to Urbanna. Warner Moore, Pres. Noted Aug. 19.

West Virginia—Glade Creek Coal Co., Fayetteville, W. Va., will build railway from Ephraim Creek to mine near Landsburg, about 11 miles.

West Virginia—Virginia Ry. Co., Winding Gulf, Va., engaged E. M. Merrill, Raleigh County Bank Bldg., Beckley, W. Va., as engineer for work on Winding Gulf coal property.

North Carolina—Carolina & Northwestern Ry., Newton, N. C., will improve its roadbed by straightening its line and raising tracks. J. W. Fletcher, Jr., Chester, S. C., Ch. Engr.

North Carolina—Virginia Lumber & Box Co., Goldsboro, N. C., will build railway from Sevensprings to Goldsboro. W. L. Muser, Petersburg, Va., Pres.

South Carolina—Blue Ridge Ry. Co., Walhalla, S. C., plans extension from West Union to tunnel through Stumphouse Mt. J. R. Anderson, Anderson, S. C., Supt.

South Carolina—Charleston-Southern Ry. Co., Charleston, S. C., will build steam or electric railway from Charleston to Hutchinson Island, about 86 miles. Bright Williamson, Darlington, Pres.

Georgia—Americus, Hawkinsville & Eastern Ry., Americus, Ga., plans to build a railway from Americus to Hawkinsville via Byromville, about 55 miles. J. S. Morton, Americus, interested.

Georgia—Wrightsville, Odrian & Lyons Ry., Adrian, sold to F. J. Garbutt, Sandersville, Ga. The line will be completed.

Tennessee—H. H. Mayberry, Nashville, Tenn., interested in railway from Edgefield Junction (Edenwold post office) to Springfield.

Kentucky—Yellow Poplar Lumber Co., Pikeville, Ky., will build narrow gage railroad to its lumber mill on Shelby Creek.

Ohio—Mansfield Public Utilities Co. purchased Mansfield Ry., Light & Power Co., Mansfield. Frederick Hertenstein, Cincinnati, Pres.

Indiana—Erie R.R. Co. appropriated $2,000,000 for double-tracking and elimination of surface crossing in Porter County, Ind. R. C. Falconer, New York, N. Y., Supt. of Constr.

Wisconsin—Minneapolis, St. Paul & Saulte Ste. Marie Ry., Minneapolis, Minn., plans to extend its branch line between Stevens Point and Portage to its main line south of Milwaukee, including Madison. C. N. Kalk, Minneapolis, Ch. Engr.

Iowa—Des Moines City Ry. Co., Des Moines, Iowa, will extend its line over the Seventh St. bridge, purchase 25 steel cars and rebuild 20 miles of tracks. Estimated cost, $2,000,000. L. L. Sloss, Des Moines, Supt.

Iowa—Mason City & Clear Lake Ry. Co., Mason City, Iowa, plans to reconstruct two miles of track in Clear Lake. J. F. Hanlon, Pres.

Minnesota—Reports state Great Northern Ry. Co. will build line from Virginia, Minn., to Tower, about 30 miles. A. H. Hogeland, St. Paul, Ch. Engr.

Kansas—Anthony & Northern Ry., Hutchinson, Kan., having surveys made for extension of its line from Trouseale to Kinsley and Larned. O. P. Byers, Hutchinson, Pres.

Kansas—Iola Electric Ry., Iola, Kan., contemplates extension of its lines from Iola to Humboldt. A. G. Paugh, Ch. Engr.

Missouri—Joplin & Pittsburgh Ry. Co., Kansas City, Mo., contemplates purchase of Joplin-Parsons line of Missouri, Oklahoma & Texas Ry. with view of converting it into electric railway. W. A. Satterlee, Gen. Mgr.

Missouri—St. Louis Subway & Elevated Corporation, St. Louis, Mo., will build 4.76 miles of elevated and 3.29 miles of subway. James D. Houseman and T. Hiesen, Bank of Commerce Bldg., interested.

Arkansas—Ozark Ry. Co., Ozark, Ark., recently incorporated, will build line from Greene County to Rothville, Baxter County, Ark. R. S. Wickersham, Springfield, Mo., Secy.

Texas—About 30 miles of electric railway will be built between Temple and Marlin, Tex. S. D. Hanna, Temple, Engr.

Texas—Northern Texas Traction Co., Dallas, Tex., petitioned Board of Commissioners of Dallas for franchise for double-track line on Jefferson St. between Oak Cliff Viaduct and Commerce St. C. E. Hollerder, Pur. Agt.

Texas—Texas & Pacific Ry. plans branch line from either Big Springs, Tex., or Midland to Seminole. G. J. Ganes, Pres.

Oklahoma—Reported that interurban railway from Henryetta to Dewar, about 10 miles, is under consideration.

Oklahoma—Surveys being made for railway to connect Columbus, Galena, Baxter Springs, Miami and Centralia by Oklahoma & Interstate Ry. Co., Miami, Okla. John R. Rose, Oklahoma City, Pres.

Washington—Tacoma Ry. & Power Co., Tacoma, Wash., will extend its line to Steilacoom. G. W. Rounds, Tacoma, Gen. Supt.

California—Bids will be received by Board of Supervisors, San Jose, Calif., for franchise for constructing and operating electric railway. Henry A. Pfister, County Clk.

California—Municipal Ry. of San Francisco, San Francisco, Calif., contemplates extending its line on Union St. through Presidio reservation to Fort Winfield Scott. T. A. Cashin, Supt. and Claim Agt.

California—South San Francisco Ry. & Power Co., South San Francisco, Calif., received franchise from Council and will build and operate single-track or double-track electric line over extension of Grand Ave. Noted Aug. 19. W. J. Martin, South San Francisco, Pres.

Alberta—Edmonton, Dunvegan & British Columbia Ry. will continue construction of its line to Murray's, Alta. J. D. McArthur, Edmonton, Pres.

Bids In and Contracts Awarded

South Carolina—Southern Ry. Co. awarded contract to M. M. ELKAN, Macon, Ga., for second track from Easley to Central and to H. J. DUNAVANT & CO., Knoxville, for second track from Greenville to Easley. W. H. Wells, Easley, Ch. Engr. Const.

Kansas—Cudahy Packing Co., Fowler, Kan., awarded contract to CAMERON, JOYCE & CO., Midland Bldg., Kansas City, Mo., for grading, bridging and laying track for eight miles of railway from Fowler to its silicafe beds.

HEAT, LIGHT AND POWER

Proposed Work

N. H., Georges Mills—Arthur S. Stocker has applied to Public Service Commission for permission to install electric-light system.

Mass., Ludlow—Ludlow Electric Light Co. plans new power house on upper East St.

N. Y., Buffalo—Buffalo Cold Storage Co. will build power house. Estimated cost, $45,000.

N. Y., Warsaw—Warsaw Gas & Electric Light Co. has applied to Public Service Commission to install electric-light plant in Warsaw and Gainesville.

Penn., Confluence—Municipal electric-light plant plans to extend transmission lines to Ursina.

Del., Wilmington—Plans being prepared by Peucket & Wunder, Arch., Philadelphia, Penn., for baking plant, stable and power house for William Freihofer Baking Co.

Md., Baltimore—Carnegie Steel Co. plans storage and power plant building on Wicomico St. between Bush and Elk St.

W. Va., Martinsburg—Martinsburg Power Co. will be reorganized under the name of the Potomac Light & Power Co. Plans being considered for improving four existing dams and five plants of company. Estimated cost, $100,000.

N. C., Granite Falls—Granite Falls Mfg. Co. plans to equip its cotton mill with electrically driven machinery. Estimated cost, $40,000.

N. C., Lumberton—Bids will be received by city until Oct. 12 for improving municipal electric-light system.

Ga., Cornelia—Wafford Shoals Light & Power Co. plans to double transformer capacity of its plant at Wafford Shoals, near Baldwin.

Ala., Fairhope—Citizens voted bonds for municipal electric-light plant.

Tenn., Chattanooga—Chattanooga and Tennessee River Power Co. plans to install four generators at its Hades Bar plant.

Ky., Johnson City—City considering municipal electric-light plant.

Ky., Winchester—Kentucky River Power Co., Hazard, plans new power plant and transmission system. Estimated cost, $325,000.

Ohio, Cleveland—St. Johns Hospital will build boiler house at 7911 Detroit Ave. Estimated cost, $10,000.

Ohio, West Salem—West Salem Light and Ice Co. granted franchise for electric-light plant in connection with its ice factory.

Ind., Portland—City Engineer authorized to prepare estimate of cost of extension to municipal power house to provide space for transformers.

Mich., Morley—A number of Detroit business men are negotiating the purchase of dam and flowage rights of Little Muskegon Power Co. If same is purchased power plant will be built. Estimated cost, $30,000.

Ill., Dixon—Bids will be received until Oct. 18 by Board of Administration, Capitol, Springfield, for power house, laundry building, cold-storage building and bakery on site of State Colony for Epileptics, about three miles north of Dixon.

Wis., Haugen—Franchise granted Wisconsin-Minnesota Light & Power Co. of Eau Claire for electric-light and power plant.

Wis., Maiden Rock—Permission granted L. Mathys to construct and operate electric-light plant.

Iowa, Glidden—J. C. Merritt contemplates electric-light plant. Estimated cost, $5,000.

Iowa, Iowa Falls—Iowa River Light Co. has applied for a franchise to transmit electricity from its plant to Morrison and Reinbeck.

Iowa, Marathon—Citizens voted $12,000 bonds for municipal electric-light plant. Noted Aug. 19.

Iowa, West Union—According to press reports Turkey River Power Co. plans new addition to its plant. Estimated cost, $20,000.

Minn., Butterfield—Citizens voted $8,000 bonds for electric line to connect with line at St. James of Consumers Power Co.

Minn., Waverly—E. G. Howard, St. Cloud, plans to install electric-light plant in Waverly.

Minn., West Concord—Village Council granted franchise to Commonwealth Power Co. of Mankato for electric-light plant.

Kan., Atwood—Plans being prepared by Black & Veach, Engr., 507 Interstate Bldg., Kansas City, Mo., for municipal electric-light plant. Estimated cost, $14,000.

Kan., Goff—Citizens voted $8,000 bonds for transmission line from Centralia.

Kan., South Haven—An additional generating unit will be installed in plant of South Haven Electric Light Co. A 25-hp. oil engine and 30-kw. generator will be required.

S. D., Bradley—E. H. Lewis, Lake Preston, plans to install electric-light plant in Bradley.

Ore., Roseburg—City Council petitioned to issue $225,000 bonds for municipal electric-lighting system.

Calif., Burbank—Election will be held Oct. 12 to vote $30,000 bonds for electric-light plant and distributing system.

Calif., Hanford—Plans prepared for heating and ventilating system to be installed in central school. Estimated cost, $10,000. Noted Aug. 19.

Que., Quebec—Armagh Electric Co. plans to build electric-light plant to supply electricity to five of principal villages in Bellechasse County.

Ont., Ridgetown—Plans will be prepared for hydro-electric power station. Estimated cost, $10,000.

Alta., Calgary—City considering proposal of Alberta Hydro-Electric Power Co. to build electric-light plant and supply electricity to city.

Bids In and Contracts Awarded

N. Y., White Plains—(Official)—Contract for heating and ventilating in new courthouse awarded to TERAN, MAHONEY & MUNRO at $18,000.

Penn., Harrisburg—Contract for electrical work for three buildings to be constructed at State Hospital for Insane at Fairview awarded to FRANCIS BUCHANAN, Philadelphia.

Penn., Philadelphia—Contract for electrical equipment for six-story building at 11th and Race St. awarded to UNITED ELECTRIC CONSTRUCTION CO., Philadelphia.

Tex., San Angelo—(Official)—Contract awarded to BOLLINGER-PESTTY CO., at $13,400, for heating and plumbing equipment in new high school.

BRIDGES

Proposed Work

Maine, Frankfort—State Highway Commission, Augusta, extended date for receiving bids for bridge in Frankfort to Oct. 5.

Conn., Hartford—Bids will be received by State Highway Commissioner until noon, Oct. 11, for superstructure of bridges in New Hartford, Southington and Granby.

Conn., Hartford—State Highway Commisisoner accepted plans for Strauss bascule bridge for the lift draw over the Saugatuck River, Westport.

N. Y., Binghamton—Bids will be received by the County Superintendent of Highways until 10 a.m., Oct. 4, for replacing the bridge over Big Snake Creek near Corbettsville.

N. Y., Binghamton—Bids will be received until 7 p.m., Oct. 1, by County Superintendent of Highways, for bridge over Choconut Creek, Dickinson.

N. Y., Ft. Edward—(Official)—Bids will be received by Alfred Case, Jr., Town Supt., until 2 p.m., Oct. 9, for bridge over the Hudson River at Ft. Edward.

N. Y., Lyons Falls—Plans prepared by Frank Williams, State Engr., Albany, for completing bridge over Blank and Moose Rivers at Lyons Falls. Estimated cost, $59,385.

N. Y., Olean—Common Council rejected all bids received Sept. 7 for highway bridge over the Allegheny River at 11th St., Olean. Noted Aug. 26.

N. Y., Schenectady—Frank Williams, State Engr., Albany, approved plans for bridge across Mohawk River at Schenectady.

Penn., Doylestown—Bids will be received until Oct. 4 by the Commissioners of Bucks County for bridge over Pleasant Springs Creek, Doylestown.

Penn., Glenfield—Bids will be received by W. N. Kratzer, Burgess, until Oct. 27, for reconstructing bridge over Kilbuck Creek, Bridge St.

Va., Goochland—(Official)—Bids will be received until noon, Oct. 4, at the Clerk's Office, Goochland County, for bridge over Byrd Creek, about one mile from Elk Hill. G. P. Coleman, State Highway Comr.

S. C., Greenville—Plans being considered by Southern Ry. for a steel viaduct with concrete pedestals across Saluda River on double track between Greenville and Central. W. H. Wells, Washington, D. C., Ch. Engr. Constr.

Fla., Arcadia—Bids will be received until Oct. 11 by A. L. Durrance, Clk., De Sota County Comrs., for bridges in Special Road and Bridge District No. 1.

Fla., De Land—Election will be held in Volusia County Nov. 9 to vote $110,000 bonds for bridges and roads.

Fla., Miami—Election will be held Oct. 19 in Dade County to vote on organization of special road and bridge district and to issue $275,000 bonds for bridges and road from Miami to Marco.

Miss., Belzoni—Bids will be received until Oct. 4 for reinforced-concrete bridge across Fisk Bayou.

Ohio, Batavia—Bids will be received by C. Searles, County Audr., until noon, Oct. 4, for steel superstructure and flooring over east fork of Little Miami River.

Ohio, Wapakoneta—Bids will be received by F. W. Langhorft, County Audr., until 10 a.m., Oct. 9, for two concrete arches at either end of Hamilton St., Wapakoneta.

Ind., Bedford—An appropriation of $15,000 made by City Council for concrete bridge across Salt Creek.

Ind., Greensburg—City Council plans an expenditure of $12,500 for bridge repairs.

Ind., Monticello—An appropriation of $25,000 made by County Commisisoners of White County for new bridges and for Springboro Bridge.

Mich., Benton Harbor—Election will be held Oct. 11 to vote $53,000 bonds for viaducts on Britain and Edwards Ave. and High St.

Mich., Grand Rapids—According to press reports county and state plan bridge across Plaster Creek at Grand Ave.

Ill., Carmi—(Official)—Bids will be received until 1:30 p.m., Oct. 5, at the County Clerk's Office, for bridge work in Carmi Township, White County. G. H. Brown, Carmi, County Supt., Highways.

Ill., Shelbyville—Plans approved by County Board of Supervisors for bridge over Kaskaskia River between Shelby and Moultrie Counties, about three miles east of Findlay. Estimated cost, $21,000.

Minn., Breckenridge—Bids will be received until Oct. 8 by P. E. Truax, County Audr., for six steel culverts and 11 steel bridges. Estimated cost, $12,228.

Minn., Springfield—Bids will be received by Charles L. Palmer until 1 p.m., Oct. 9, for bridge on public highway over coal mine, Brown County.

Neb., Fairbury—Plans being prepared for a 700-ft. bridge in Fairbury to replace present structure. G. N. Johnson, Lincoln, State Engr.

N. D., Cavalier—County Commissioners considering bridges in Bathgate Township. W. M. Felson, County Audr.

Mont., Hamilton—Bids will be received by F. C. Robbins, County Clk., until 2:30 p.m., Oct. 4, for six bridges in Raville County.

Mont., Hardin—Bids will be received until 2 p.m., Oct. 4, by Board of Commissioners of Big Horn County, for highway bridge over Tongue River, Township 9, South Range 40 East, Big Horn County.

Tex., Dallas—Bids will be received by the County Commissioners until 10 a.m., Oct. 30, for the Commerce St. Viaduct over Trinity River. Estimated cost, $135,000. Noted Aug. 5.

Tex., Rockport—Citizens of Aransas County voted $300,000 bonds for causeway across Aransas Bay between Lamar and Live Oak peninsulars. Noted Sept. 9.

Tex., Waco—Election will be held Oct. 19 to vote $10,000 bonds for bridges.

Okla., Chandler—(Official)—Date for receiving bids for 12 bridges extended to Oct. 4. Noted Sept. 9.

Idaho, Hailey—County Commissioners rejected all bids received Sept. 13 for bridge across Malad River. New bids will be asked. Noted Sept. 9.

Ariz., Holbrook—Election will soon be held to vote $68,000 bonds for bridges on county roads.

Wash., Hoquiam—Citizens defeated $100,000 bond issue for two bridges and paving.

Ore., Portland—Municipal Department of Public Works completed plans for extension of Union Ave. from its present terminus at Bryant St. northward to Columbia Slough Rd. to connect with the interstate bridge approach. A reinforced-concrete viaduct will be required. Estimated cost of viaduct, $33,000, and fill, $13,000.

Calif., Yuba City—County Surveyor instructed to prepare plans for steel draw bridge over Feather River at Nicholaus. Estimated cost, $75,000.

Ont., Trenton—City will build reinforced-concrete bridge across Trent River. Estimated cost, $40,000.

Que., Ste. Martine—Bids will be received by N. Mallette, Secy. and Treas., until 7 p.m., Oct. 4, for steel bridge at the outlet of Beau River, Parish of Ste. Martine, Chateauguay County.

Bids In and Contracts Awarded

Maine, Kingfield—Bids were received by State Highway Commission, Augusta, for bridge in Kingfield as follows: C. H. Barron, Lewiston, $17,263; Edmond Cyr & Co., Waterville, $17,321; H. P. Cummings Co., Portland, $18,487.

N. Y., Albany—Contract for substructure, superstructure and approaches of Gorham St. Bridge, Waterloo, awarded to SCOTT BROS., Rome, at $59,928. Noted Aug. 19 and Sept. 23.

N. J., Matawan—Board of Chosen Freeholders of Monmouth County awarded contract for bridge over Matawan Creek on South Amboy-Keyport Rd. to LONG-BROADHURST CO., Hackensack, at $34,320. Noted Aug. 19 and Sept. 23.

Penn., Bangor—(Official)—Contract for County Bridge No. 48 over Martins Creek, Borough of Bangor, awarded to JACOB STEM, Stroudsburg, at $4,450. Noted Sept. 2.

Ky., Pineville—Contract for bridge across Cumberland River near Brownies Creek awarded to VINCENNES BRIDGE CO., Vincennes, Ind., at $9,021.

Ohio, Cleveland—(Official)—Contract for foundation and approaches of Union Ave. grade crossing awarded to ROBERT GRACE CONTRACTING CO., Pittsburgh, Penn., at $103,373; steel work, KING BRIDGE CO., Cleveland, at $34,892. Noted Sept. 2.

Ohio, Youngstown—Contract for steel bridge across Mahoning River on Fredericksburg Rd., Milton Township, moving and erecting Carson Bridge over Mahoning River, also grading stretch of Palmyra Rd. awarded to MASSILLON BRIDGE & STRUCTURAL CO., Massillon, at about $9,000.

Ind., Logansport—Vandalia R.R. Co. awarded contract for bridge over Wabash River to WISCONSIN BRIDGE & IRON CO., North Milwaukee, at about $60,000.

Iowa, Avoca—Contract for bridge over Nishnabotna River near Avoca awarded to IOWA BRIDGE CO., Des Moines, at $6,965.

Iowa, West Union—WATERLOO CONSTRUCTION CO., Waterloo, at $12,980, awarded contract for steel truss bridge in Oran Township, concrete deck girder bridge in Jefferson Township and concrete box culverts in Oran Township.

Neb., Harrison—Contract for bridge across Hat Creek near Montrose awarded to WESTERN BRIDGE & CONSTRUCTION CO.

N. D., Beach—Contract for bridge on Section 15-142-104 awarded to NORTHERN BRIDGE CO.

Mont., Roundup—(Official)—Contract for three bridges over the Musselshell River at Gage, Delphia and Ryegate awarded to SECURITY BRIDGE CO., Billings, as follows: Gage, $6,988; Delphia and Ryegate, $8,990 each. Contract for Absher Bridge not awarded. Noted Sept. 9.

Mont., Virginia City—Contract for two bridges over Big Hole Creek awarded to O. E. PEPPARD, at $8,980.

Okla., Catoosa—R. W. CANFIELD, at $17,900, awarded contract for bridge over Verdigris River at Claremore.

Calif., Oroville—Contract for eight concrete bridges on State Highway between Durham and Nelson awarded to CHICO CONSTRUCTION CO., Chico, at $12,987.

Ont., Simcoe—Contract for Argyle St. bridge for Lake Erie & Northern Ry. Co. awarded to JOHNSON BROS., Brantford. Estimated cost, $4,600.

Alberta—Contract for superstructure of railway bridge over Smoky River, Alberta, for Dominion, Dunegan & British Columbia Ry. awarded to DOMINION BRIDGE CO., LTD.

WATER-WORKS

Proposed Work

N. Y., Rochester—Common Council authorized bond issue of $100,000 for water system

N. J., Jersey City—City Commissioners will soon ask bids for twin pipe line from Brooksdale to Jersey City. Estimated cost, $1,500,000. Henry M. Byrne, Comr.

Penn., Leighton—Citizens contemplate municipal water system.

Penn., Newport—City considering water and sewage system.

Penn., Pine Grove—Permit granted for storage reservoir and gravity supply main.

Del., Newport—Citizens contemplate water and sewer systems.

Va., South Boston—Anderson & Christie, Charlotte, N. C., is Engr., for water and sewer systems. Bids will probably be received for construction in October. Estimated cost, $125,000. E. U. Hardig, City Clk. Noted Aug. 19.

Ga., Savannah—City plans to improve water system.

La., Shreveport—Water Company declined to accept offer of city of $750,000 for its plant. Election will be held Nov. 4. to vote $1,200,000 bonds for municipal water system. Noted Sept. 23.

Tenn., Lonsdale—(Knoxville post office)—Election will be held Oct. 30 to vote on $30,000 bonds for water system.

Ky., Louisville—Louisville Water Board rejected all bids for laying 48-in. water main and will do the work itself.

Ky., Paducah—Citizens contemplate issuing $250,000 bonds for water system.

Ohio, Byesville—Election will be held in November to vote $40,000 bonds for water system.

Ohio, Cincinnati—Election will be held to vote $400,000 bonds for high-pressure fire service.

Ohio, Cleveland—(Official)—Bids will be received by Commissioner of Purchases and Supplies, Room 511, City Hall, until noon, Oct. 6, for c.-i. adjustable valve boxes for Department of Public Utilities, Division of Water.

Ohio, Farmersville—(Official)—Construction of waterworks will probably be postponed until next year. A. F. Gilbert, Village Clk. Noted Aug. 26 and Sept. 16.

Ohio, Findlay—City Council plans to issue $5,000 bonds to extend water mains to West Park.

Ohio, Middletown—(Official)—Bids will be received until noon, Oct. 6, by City Commissioners, for driving a number of wells.

Ohio, Weston—(Official)—Citizens defeated bond issue for water system. Noted Sept. 16.

Ind., Miller—Date for receiving bids for water system extended to Oct. 20. Estimated cost, $14,000. Noted Aug. 26 and Sept. 9.

Ind., Monticello—Bids will be received until Oct. 12 by City Council for two compound duplex pumps for water-works. F. L. Miner, City Clk.

Mich., McBain—Citizens voted $9,400 bonds for water system.

Mich., Wyandotte—Citizens defeated $30,000 bond issue for water system and electric-light plant.

Ill., Clinton—City Council will purchase high-pressure fire pump. Estimated cost, $4,500.

Ill., East Dundee—Koeppen, Schartow & Ehylert, Dundee, at $7,564, was low bidder for reinforced-concrete reservoir.

Ill., Galesburg—Election will probably be held to vote $100,000 bonds for water system and electric-light plant.

Ill., Jacksonville—Bids will be received until 3 p.m., Oct. 4, by Frank D. Whipp, State Fiscal Superv., for c.-i. water main to be installed at Illinois School for Blind.

Ill., Mackinaw—Citizens voted $8,500 bonds for purchase of water-works. Noted Sept. 9.

Ill., Monticello—Bids will be received until 8 p.m., Oct. 12, by City Clk., for two compound duplex steam pumps with necessary valves, piping, razing steel standpipe and brick tower.

Wis., Cornell—Work will soon be started on new water system.

Iowa, Kanawha—(Official)—Bids will be received by the City Clk. until 2 p.m., Oct. 15, for 30,000-gal. steel tank on an 80-ft. tower and 7,000 ft. of 4- to 6-in. water main.

Iowa, Marcus—Bids will soon be received for pumping station, steel tower and tank and water mains. G. Y. Skeele, Sioux City, Engr. Noted Sept. 16.

Iowa, Sidney—Bids will be received by C. B. Hatton, Town Clk., until 2 p.m., Oct. 5, for improving water system. Noted Aug. 29.

Iowa, Terril—Bonds for $8,500 sold for water system.

Minn., Aurora—Bids will soon be received for concrete reservoir and brick pumping station, also for two 600-gal. pumps.

Minn., Ely—Election will be held to vote on bond issue for improvements to water system.

Minn., Mahnomen—Village Council plans to extend water mains four blocks south on Main St. from Monroe Ave.

Minn., Minneapolis—Bids will be received until 3 p.m., Oct. 7, by Kossuth E. Alexander, City Pur. Agt., for furnishing riveted-steel pipe.

Minn., Red Lake Falls—Bids will be received until 7:30 p.m., Oct. 4, by Joseph Perrault, City Clk., for drilling artesian well.

Minn., St. Paul—(Official)—City will issue $400,000 bonds for 30-million-gal. and seven-million-gal. covered reservoir, 15-million-gal. pumping engine, motor driven, revolving screening equipment with building estimated to cost $10,000 and two Venturi meters with necessary piping.

Minn., St. Paul—Board of Commonwealth ordered water mains laid on Central Ave. from Lexington Ave. to Dunlap St., James St. from Lexington to Summit Ave., Farrington Ave. from Lawson to Oliver St., Hand Ave. from Front to Geranium St., Chestnut St. from Washington to Water St., Water St. from Eagle to St. Clair St., Elm St. from the levee to Mill St. and Mill St. from Elm St. to Smith Ave.

Minn., Sleepy Eye—Bids will be received until 8 p.m., Oct. 5, by H. C. Peterson, City Recdr., for making extensions to water system.

Minn., Thief River Falls—Bids will be received until 8 p.m., Oct. 5, by E. J. Overland, City Clk., for 1,250 lin.ft. 6-in. water mains, three hydrants, three 6-in. tees, two 6-in. gate valves and boxes, and twelve 6-in. plugs.

Kan., Ford—Investigation will be made by Commercial Club regarding possibility of securing water system and electric-light plant.

Kan., Manhattan—Public Utilities Commission has authorized issue of $69,500 bonds for improving water system.

Neb., Pleasantville—Bids will be received until 4 p.m., Oct. 12, by A. E. Pearson, City Clk., for water system.

Neb., Schuyler—Citizens plan to extend water system.

N. D., Minot—(Official)—Bids will be received until 8 p.m., Oct. 4, by Board of City Commissioners for about two miles of 6- to 8-in. watermain, 25 hydrants and 29 gates. Estimated cost, $18,357. E. J. Thomas, City Engr. (See adv.)

Mo., Eldorado Springs—Citizens defeated proposition to issue $15,000 bonds for extension of water system. Noted Aug. 19.

Mo., Lees Summit—Plans being prepared by Henrici, Kent & Lowry Engineering Co., Kansas City, for water system. Estimated cost, $45,000.

Tex., Amarillo—Plans being prepared by Burns & McDonnel, Engr., Kansas City, Mo., for water system.

Tex., Galveston—City Commission applied to War Department for services of Lieut. Col. C. S. Riche, U. S. Army Engr., to supervise permanent water-main between Galveston and Alta Loma plant. Main to be 30 or 36 in. in diameter. Estimated cost, $150,000 to $200,000.

Colo., Platteville—Citizens voted $20,000 bonds for water system. Noted Sept. 9.

Idaho, Council—Election will be held Oct. 11 to vote $20,000 bonds for municipal water system. Noted Aug. 26.

Idaho, Kellogg—Kellogg Water Power Co. received franchise from City Council for constructing and operating water system.

Wash., Ridgefield—Election will be held Oct. 23 to vote $11,000 bonds for water system. Noted Sept. 2 and 16.

Wash, Seattle—Board of Public Works contemplates water mains in Dexeter Ave. Estimated cost, $32,000. C. H. Dimock, City Engr.

Ore., Amity—Ralph Marvin, City Engr., instructed to prepare plans for water system. Estimated cost, $15,000.

Ore., Prineville—Project is on foot to form irrigation district to build reservoirs on Ochoco and Crooked Rivers to obtain sufficient water to reclaim about 25,000 acres of land north of Prineville. E. J. Wilson and H. A. Kelly interested.

Que., East Angus—Extensions will be made to water system. Estimated cost, $5,000. R. C. Cowling, City Clk.

Ont., Markham—E. A. James, Engr., 57 Adelaide St., Toronto, preparing plans for extensions to waterworks system. Cost, $25,000. New mains, tanks, and 60,000-gal. storage basin.

Man., The Narrows—Bids will be received until 2 p.m., Oct. 12, by H. H. Elliott, Town Clk., for improvements to water system. Murphy & Underwood, 8 Bottomley Blk., Saskatoon, Sask., Engr. Noted July 29.

Man., Winnipeg—Board of Control contemplates water main extensions in Centennial Ave. Estimated cost, $5,000. W. P. Brereton, 223 James Ave., Engr.

Bids In and Contracts Awarded

Conn., Haddam—Contract for 4,600 ft. of tarred pipe in connection with water supply for county home and all buildings at Haddam awarded to BROWN BROS., Middletown, Conn.

N. Y., Manchester—(Official)—Contract for water system awarded to BLIVEN & BEALS, Rochester, at $23,418. Noted Sept. 2.

New York, N. Y.—(Official)—Contract awarded to F. N. KEWIS, 411 Manhattan Ave., New York, at $13,411, by Board of Water Supply for water-pipe equipment in shafts of city tunnel of Catskill Aqueduct. Noted Sept. 9.

Penn., Connellsville—Contract for addition to pumping station of Connellsville Water Co. at Bluestone awarded CONNELLSVILLE CONSTRUCTION CO.

Penn., South Bethlehem—Contract for water system at University Heights awarded to STANDARD SUPPLY CO., Philadelphia, at $10,000.

Md., Baltimore—Contract awarded to UNITED STATES CAST IRON PIPE & FOUNDRY CO., Burlington, N. J., at $4,895 for water pipe and fittings.

La., Gretna—J. R. Sutherlin & Co., Kansas City, Mo., at $46,830, submitted the lowest bid for water system.

Ky., Covington—(Official)—Bids were received Sept. 16 for trenching in Licking River, (a) one line, (b) two lines, from: L. Eid Concrete and Steel Co., (a) $23,090, (b) $29,446; Thomas P. Strack, (a) $27,217, (b) $38,930; Claude Harris, (a) $27,952, (b) $39,532. George Hornung & Son, Newport, Consult. Engr. Noted Sept. 9.

Ohio, Brewster—Contract awarded to ROSS-COOK ENGINEERING CO., 193 Brosby St., Akron, at $19,000, for water system. W. J. Sherman Co., Nasby, Toledo, Engr. Noted Sept. 16.

Ohio, Cleveland—Contract for test borings at Kirtland filtration plant awarded to GILBERT & HARTSHORNE CO., at $4,390. Noted Aug. 19.

Wis., Madison—Contract awarded by Board of Public Works to ALLIS-CHALMERS MFG. CO., Milwaukee, at $8,815, for sub-pumping station at Greenbush, near Madison.

Wis., Oconomowoc—Contract awarded to A. J. HEWITT, Milwaukee, at $7,000 for water and sewer systems in Woodland Park for Frederick Pabst.

Wis., Wittenberg—Contracts for water system awarded as follows: Pipe, AMERICAN CAST IRON PIPE CO., at $4,815; valves and hydrants, LUDLOW VALVE CO., at $503; laying pipe, F. C. KAMINSKI, at $3,135. Noted July 29.

Iowa, Traer—Contract for 200,000-gal. storage reservoir and water mains awarded to JOSEPH SEDA, Traer, at $4,560. Noted Sept. 16.

Mont., Chinook—Contract awarded to PITTSBURGH FILTER MFG. CO., Pittsburgh, Penn., at $16,415, for filtration plant. Noted Sept. 23.

Mont., Fromberg—(Official)—Contract for water system awarded to SECURITY BRIDGE CO., Billings, at $15,980. Noted Sept. 16.

Mo., Macon—Contracts for filtration plant and settling basin awarded as follows: MIDDLETON & LUDLOW, Kansas City, $5,990; mechanical equipment for filter plant, PITTSBURGH FILTER MFG. CO., Kansas City, $4,310; steel pipe, FAIRBANKS, MORSE & CO., Kansas City, at $6,018. Noted Aug. 12 and Sept. 2.

Colo., Craig—Contract for water system awarded to J. S. SCHWARTZ, Colorado Springs. Estimated cost, $40,000.

Calif., Chino—Contract for 26-in. well for Chino Land and Water Co. awarded to A. J. OLSON.

Calif., San Francisco—Board of Works awarded contracts to the INGERSOLL-RAND CO. and the RIX COMPRESSED AIR CO. for air-compressing plant and drills for use at Hetch Hetchy project. Karl Erhart at $24,984, submitted lowest bid for clearing a portion of site.

Ont., Hamilton—Contract for new pump house at Beach awarded to JOHN POAG, Westinghouse Ave., Hamilton. New equipment needed.

Ont., Stratford—Public Utilities Commission awarded contract for standpipe, segmental type, to CANADIAN CHICAGO BRIDGE AND IRON WORKS, Sarnia, at $24,800, exclusive of base and two pumps. Noted Sept. 16.

SEWER

Proposed Work

N. H., Manchester—City will build trunk sewer in South Manchester.

Mass., Boston—(Official)—Bids will be received until 1:30 p.m., Oct. 6, by Metropolitan Water and Sewerage Board for Section 1A, Deer Island outfall extension to sewer.

Mass., Cambridge—Committee on Sewers of Council adopted ordinance for sewers in Allston and Leonard St.

Mass., Somerville—Board of Aldermen plans storm water drain across Somerville field, Powderhouse Blvd. and North St.

R. I., Providence—Council plans sewers in Bayard St., River Ave. and Smith St. and in several other streets.

R. I., Providence—Board of Aldermen passed resolution appropriating $6,000 for surface water drain at Carrington Ave. and Maple St.

N. Y., Batavia—Chester & Fleming, Pittsburgh, Penn., retained by city to prepare plans for rebuilding sewage-disposal plant.

N. Y., Buffalo—Common Council authorized tile sewers in Stevens St. and Shenandoah Rd.

N. J., Bound Brook—(Official)—Bids will be received until Oct. 5 by Borough Council for laying storm water sewer in East Main St. Stanley Brampton, Clk.

N. J., Fairview—Bids will be received until 8 p.m., Oct. 6, by Mayor and Council for sanitary and storm sewers in Lincoln and Prospect St. James F. Lyons, Borough Clk.

N. J., Garfield—Board of Chosen Freeholders, Hackensack, appropriated $12,000 for storm drain in Garfield.

N. J., South Boundbrook—(Official)—Bids will be received until 8 p.m., Oct. 11, by Borough Council for 3.8 miles of vitrified-pipe sewers. Peter Merlett, Clk. and Clyde Potts, 30 Church St., New York, N. Y., Engr. Noted Aug. 26. (See adv.)

N. J., Verona—Bonds for $80,000 for sewers and sewage-disposal plant voted. Noted Sept. 9.

Penn, Mt. Pleasant—City Council has authorized sewers in South Hitchman, North Hitchman, North Silver, Oak, Howard and Sycamore St.

La., Bogalusa—Citizens plan to hold election in October to vote on $200,000 bonds for sewers, water and light. G. U. Borde, New Orleans, has made a report.

Ky., Lexington—P. H. Norcross, Atlanta, Ga., retained to prepare plans for sewage-disposal plant. J. Ernest Cassidy, Mayor.

Ohio, Coshocton—Surface drainage sewer system recommended by Mayor to Council.

Ohio, Salem—(Official)—Bids will be received until noon, Oct. 2, by I. N. Russell, Dir. of Pub. Ser., for storm water sewer in East Main St.

Ohio, Zanesville—Election will be held in November to vote on $52,650 sewer bonds.

Ind., Buffington—City contemplates sewer system.

Ind., Indianapolis—Board of Public Works plans sewer in East Michigan St. at estimated cost of $31,000 and sewer in Germania Ave. at cost of $16,000.

Mich., Marquette—Morgan Wright, City Engr., preparing plans for storm sewers in Third and Fourth St.

Ill., Averyville—(Peoria post office)—Citizens plan sanitary sewer system at estimated cost of $55,000.

Ill., Joliet—Citizens in district east of Joliet contemplate sewer system for Spring and Hickory Creek districts. Estimated cost, $500,000.

Wis., Green Bay—Bids will be received until 10 a.m., Oct. 4, by Committee on Sewers and Plumbing of Common Council for various sewers. L. Findeisen is Member of Com.

Wis., La Crosse—Extensions will be made to sewer system at estimated cost of $200,000. George Bradish, City Engr., preparing plans.

Wis., Milwaukee—Citizens defeated bond issue for $1,500,000 for sewer construction. Noted Aug. 12.

Iowa, Algona—Bids will be received until Oct. 5, by S. W. Crowell, City Clk., for sewers in Grove, Dodge, Diagonal and other streets.

Iowa, Des Moines—Bids will soon be reecived for Closes Creek sewer system. Estimated cost, $197,657.

Iowa, Esterville—Bids will be received until noon, Oct. 4, by N. B. Egbert, City Clk., for sewer in North Sixth St.

Iowa, La Mars—City Council contemplates storm water sewer in West Sixth St.

Iowa, Lisbon—City Council will install sewer system.

Iowa, Morningside—(Sioux City post office)—Bids will soon be received for sewer system for North Morningside. Estimated cost, $12,000.

Iowa, Oakland—J. H. Mayne, Engr., prepared plans for sewer system.

Iowa, Sioux City—City will build North Morningside sewer system. Estimated cost, $12,000.

Iowa, West Union—Citizens will build sewer system in 1916.

Minn., Anoka—(Official)—City retained L. P. Wolff, Consult. Engr., St. Paul, to prepare plans for sewer system and sewage-disposal plant.

Minn., Glenwood—Bids will be received until Oct. 5, by City Commission for sewers. N. P. Norling, City Clk.

Minn., St. Paul—City Council plans sewers in various streets. Estimated cost, $136,000.

Minn., Waseco—Plans being prepared by City Engineer for sewer in Ninth St.

Neb., Pender—Surveys being made for sewer system.

S. D., Aberdeen—City Commissioners authorized the preparation of plans for sewers in Second St.

N. D., Fargo—(Official)—Bids will be received until 10 a.m., Oct. 6, by A. R. Watkins, City Audr., for 12-in. lateral sewer in South Terrace.

N. D., Minot—Bids will be received until 8 p.m., Oct. 4, by Board of City Commissioners for sewers in various streets. A. D. Hagenstein, City Audr. Noted Sept. 16.

Mont., Columbus—Plans prepared for sewer system. Estimated cost, $10,000. Noted Aug. 26.

Mo., Alton—Plans will be prepared for sewer to inclose Piasa Creek. J. Beall, Mayor.

Mo., St. Joseph—Citizens contemplate spending $550,000 for improvements to sewer system.

Ark., Derott—(Official)—Bids will be received until 4 p.m., Oct. 8, by Sewer Improvement District No. 2 for sewage-disposal plant. A. C. Blanks, Secy. of Comrs.

Tex., Arlington—Citizens voted $10,000 bonds for extension of sewer system.

Tex., Austin—Improvements will be made to sewer system by city forces. Noted Sept. 16.

Tex., Beaumont—Bids will be received until Oct. 19, by J. G. Sutton, City Secy., for 30,690 ft. of sanitary sewers. C. L. Scherer, City Engr.

Tex., Corsicana—Election will be held Oct. 10 to vote on $20,000 sewer bonds.

Tex., Gatesville—Citizens plan sewer system. Estimated cost, $25,000. T. R. Mears, Mayor.

Tex., Henderson—J. M. Wood, Oberlin, Ohio, granted franchise to construct and operate sewer system.

Tex., Waco—Election will be held Oct. 19 to vote $75,000 bonds for sewers and sewage-disposal plant. Noted Aug. 12.

Okla., Cushing—(Official)—Bonds for $30,000 for intercepting sewers voted. Benham Engineering Co., Oklahoma City, Engr. Noted Sept. 9.

Okla., Marlow—(Official)—Citizens defeated $15,000 bond issue for sanitary sewer system. Noted Sept. 9.

Colo, Boulder—Citizens plan sewer system and street paving at estimated cost of $16,000. George Joslyn, City Engr., and Leonard Metcalf, Boston, Mass., Sewer Engr.

N. M., Deming—(Official)—We have been advised that improvements will not be made to sewer system till 1916. A. A. Tenike, Clk. Noted Aug. 5.

Idaho, Idaho Falls—City contemplates sewers in three districts. Estimated cost, $23,000. W. P. Dawes, City Clk.

Idaho, Mountain Home—(Official)—Bids will be received until Oct. 7 by Sewer Committee for sewer system and sewage-disposal plant. F. E. Austin, Chn. of Com. Noted Sept. 9.

Ariz., Mesa—(Official)—Bids will be received until Oct. 5 by Town Clerk for sewer system including 16 miles of sewers. Estimated cost, $70,000. H. S. Hancock, Phoenix, City Engr. Noted June 24.

Ariz., Tucson—Surveys being made for outfall sewer system. Estimated cost, $50,000.

Wash., Roslyn—Bids will be received until Oct. 11 by George T. Wake, City Clk., for sewer improvements in Local Improvement Districts 1, 2, 3 and 4. Noted Sept. 2.

Wash., Seattle—Board of Public Works plans outfall sewer in Seaview Ave. A. H. Dimock, City Engr., submitted plans. Estimated cost, $452,566.

Ore., Portland—Plans prepared for sewers in various streets. A. L. Barbour, City Clk.

Calif., Visalia—Bids will be received until Oct. 6 by City Trustees for sewer work. Estimated cost, $65,000.

Alta., Edmonton—Election will be held to vote on $250,000 bonds for sewage-disposal plant.

Ont., Galt—Town Council will lay storm and sanitary sewers at estimated cost of $4,000. C. D. Campbell, Engr., and Joseph McCartney, Clk.

Ont., Guelph—Sewers will be laid in Beverly, Harris, Prospect and Johnson St. Estimated cost, $5,188. F. McArthur, Engr.

Bids In and Contracts Awarded

Mass., Boston—(Official)—Contracts awarded to ANTHONY BARNFFALDI, 9 Parker Pl., at $9,071, for sewer in Telford St., and to J. L. PIERCE & CO. at $473, for sewer in Lanark Rd. Noted Sept. 9.

N. Y., Rochester—Contract awarded to MICHAEL RIPTON, at $11,899, for sewer tunnel in Graves St.

N. Y., Schenectady—Contract awarded to THOMAS F. MacGREGOR, at $24,342, for sewers. Noted Sept. 23.

N. Y., Westerlo—Contract awarded to FOUNDATION CO., at $172,772, for sewage pumping station at Westerlo Island.

N. Y., Yorktown Heights—All bids received Aug. 31 for sewage-disposal plant rejected by Board of Managers of New York State Training School for Boys. Noted Aug. 19.

N. J., Bogota—(Hackensack post office)—Contract awarded to AVERILL & MATHEWS, Newark, at $6,349, for sewer extension in River Rd.

N. J., Edgewater—Bids were received for sewer outlet No. 10 as follows: E. C. Humphry, Hackensack, $73,855; John J. McGarry, $52,759, and Edward English, $44,571.

N. J., Montclair—Contract awarded to CESTONE CONSTRUCTION CO., at about $15,000, for storm water drain in Valley Rd.

N. J., Newark—All bids received for Meadow Brook Outlet sewer rejected. Noted Sept. 2.

W. Va., Huntington—Contract awarded to AMOS TRAINOR, at $6,500, for sewer system in First and Second Wards. Noted Sept. 2.

Ohio, Cleveland—(Official)—Contract awarded to W. P. GIBBONS CONTRACTING CO., 3135 Scranton Rd., at $13,456, for sewers. Noted Sept. 9.

Ohio, Medina—Glenn W. Hadley, Canton, at $5,612, low bidder for laying 8,811 ft. of sewer pipe and manholes. George L. McNeal, Village Clk.

Ohio, Portsmouth—Contract awarded to JOHN A. GRIMES, at $4,421, for Sunnyside sewer system.

Ind., Indianapolis—Contract awarded to COLUMBIA CONSTRUCTION CO., at $22,826, by Board of Public Works for intercepting sewer. Noted Aug. 26.

Mich., Grand Rapids—(Official)—Contract awarded to A. H. PRANGE, Grand Rapids, at $10,000, for sewage-disposal plant for East Grand Rapids. Noted Sept. 9.

Mich., Reed City—Contract awarded to ISAAC H. WELLS, Kalamazoo, at $16,884, for storm sewers. Noted Sept. 9.

Wis., Elroy—(Official)—Contract awarded to GORDON & HINES, Elroy, for sewers in West and Cedar St. Noted Sept. 23.

Wis., Milwaukee—(Official)—Contract awarded to A. J HEWITT, 810 Majestic Bldg., Milwaukee, at $37,697, for tunnel sewer in Lake St. Noted Sept. 2.

Wis., South Kaukauna—Contract awarded to GEORGE MULHOLLAND, Kaukauna, at $4,587, for sewers in various streets.

Wis., Superior—(Official)—Contract awarded to PATORET CONSTRUCTION CO., Superior, at $6,159, for sewer work. Noted Sept. 9.

Minn., Brainerd—(Official)—Contract awarded to ILSTRUP & OLSON, Minneapolis, at $1 per ft. for sewers in Lot B, District 4 and $0.93 per ft. for Lot B, Districts 4 and 7. Noted Sept. 2.

Minn., St. Paul—(Official)—Contract awarded to SIEMS-CAREY CO., at $95,000, for Fredericka-Fairmount sewer system.

S. D., Centerville—(Official)—Contract awarded to SCHRUTH & JACKSON, Fargo, N. D., at $24,066, for sewers. Noted Sept. 2.

Wash., Seattle—McDonald & Jones, Seattle, at $15,548, low bidder for overflow sewers in First Ave., N. W.

Calif., Pasadena—Contract awarded to J. E. HADDOCK, 357 North Chester Ave., at $25.900, for storm water conduit in Seco St.

Ont., Berlin—(Official)—Contract awarded to GEORGE B. MOOGK, Weston, for sewer work. Noted Sept. 16.

Ont., London—Contract awarded to JOHN McMURPHY, Hyman Hall, Queen's Pond Park Ave., London, for sewers in Quebec, Reyburn and Salisbury St.

Ont., Toronto—Contract awarded to MOYES CONSTRUCTION CO., at $18,000 for sewer in Dundas St. Sewer in St. Clair Rd. will be built by city forces. Noted Aug. 26.

GARBAGE

Proposed Work

N. Y., Buffalo—Revised plans being prepared by Howard L. Beck, City Arch., for three-story addition to city garbage disposal plant, Hamburg St. and Lake Shore R.R. Estimated cost, $150,000.

Mich., Ishpeming—Installation of garbage incinerator contemplated. Estimated cost, $6,000.

Mo., St. Joseph—Election will probably be held to vote $15,000 bonds for garbage incinerator.

Bids In and Contracts Awarded

Mass., Revere—Contract awarded to W. A. and H. A. ROOT, INC., 1 Beacon St., Boston, at $20,000 for incinerator and boiler house.

N. J., Newark—Board of Works will soon award contract for collection and disposal of garbage.

Ill., Rock Island—(Official)—We have been advised that contract for garbage incinerator has not been awarded as stated in our issue of Sept. 16. Meeting will be held in October to consider award. Noted Sept. 16.

STREETS AND ROADS

Proposed Work

N. Y., Buffalo—Bids will soon be received for paving Exeter Ave. and Galveston Pl. and for repaving Jersey St.

N. Y., Buffalo—Bids will be received until 11 a.m., Oct. 2, by Department of Public Works, 5 Municipal Bldg., for paving northerly and southerly courts to Porter Ave. Pumping Station.

N. Y., Forestburgh—Taxpayers voted bonds for $6,000 for road from Forestburgh to line of town of Thompson.

N. Y., New York—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Borough Pres., Room 2, Borough Hall, until 11 a.m., Oct. 6, for regulating, grading, paving, curbing and laying sidewalks on various streets.

N. Y., New York—(Borough of Manhattan)—Bids will soon be received for repaving a number of streets of the borough.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by the Park Board, Dept. of Parks, Municipal Bldg., until 3 p.m., Oct. 7, for improving the walks of Central and other parks in the borough.

N. Y., New York—(Borough of Queens)—Bids will be received by Maurice E. Connolly, Borough Pres., until 11 a.m., Oct. 5, for improving Jerome Ave. from Boyd Ave. to Greenwood Ave., Fourth Ward, and South Ave. from New York Ave. to Rockaway Turnpike, Fourth Ward; also for furnishing and delivering 200,000 gal. of light road oil or refined tar oil.

N. Y., New Berlin—(Official)—Bids will be received until Oct. 2 by Village Board for 1,800 lin.ft. concrete paving. (See Adv.)

N. J., Cape May C. H.—Board of Chosen Freeholders of Cape May County will build boulevard from mainland into town of Wildwood.

N. J., Freehold—Bids will be received until 11 a.m., Oct. 6, by Board of Chosen Freeholders of Monmouth County for Tennent Gordon's Corner Rd. J. M. Corlies, Dir.

N. J., Hoboken—Bids will be received until 10 a.m., Oct. 13, by the City Commissioners, for improving portions of First, Third and Harrison St.

N. J., Newark—(Official)—Bids will be received by the Board of Street and Water Commissioners until 3:30 p.m., Oct. 7, for paving Chelsea Ave. from South Orange Ave. to the city line and Cypress St. from Fabyan Pl. westerly about 249 ft.

N. J., Newark—Bids will be received until Oct. 7 by Board of Chosen Freeholders of Essex County for resurfacing Sussex Ave. with asphalt. Noted Aug. 19.

N. J., New Brunswick—Bids will be received until 2:30 p.m., Oct. 11, by Board of Freeholders of Middlesex County for Sections 2 and 3 of South Amboy-Keyport Rd. from tracks of New York & Long Branch R.R. at Morgan station to Monmouth County line at Whale Creek. A. J. Gebhardt, Dir. Noted Aug. 12 and Sept. 9.

N. J., Stone Harbor—Bonds for $33,000 sold for boardwalk at Stone Harbor.

N. J., West Hoboken—(Weehawken post office)—Bids will be received by the Town Council, Town Hall, Clinton Ave. and Charles St., until 8 p.m., Oct. 6, for improving Paterson Ave.

Md., Easton—Bids will be received by Commissioners of Talbot County until noon, Oct. 5, for one section of Static Aid highway along Harrison St., extending between the town limits of Easton and Talbot County fair grounds.

Md., Princess Anne—(Official)—All bids received Sept. 7 for 2.01 miles of State Aid Highway in Somerset County were rejected. Noted Aug. 12.

Va., Petersburg—City contemplates road between Petersburg, Hopewell and City Point. Estimated cost, $100,000. Robert Cabinass, Mayor.

Ga., Savannah—Citizens voted $75,000 bonds for road from Savannah to Tybee, Chatham County. Noted Aug. 26.

Fla., DeLand—Election will be held Oct. 9 in Volusia County Road District to issue $110,000 bonds for roads and bridges.

Fla., Dunedin—Citizens voted $8,600 bonds for street paving.

Fla., Starke—City will vote Oct. 6 on $16,000 bonds for street paving. C. F. Hoover, Mayor.

Ala., Dothan—Board of Revenue of Houston County will spend $75,000 for completion of present trunk-lines and additional roads in county.

Tenn., Murfreesboro—Election will be held in November in Rutherford County to issue $175,000 bonds to purchase and maintain turnpikes.

Tenn., Winchester—Franklin County voted $350,000 bonds for road construction.

Ky., Frenchburg—Menifee County Commisisoners contemplate five miles of road from Frenchburg to Rothwell. Estimated cost, $6,000.

Ky., Louisville—Bids will be received by the Board of Public Works until Oct. 4 for paving with asphalt Chestnut St. from 24th to 26th St. Estimated cost, $4,000.

Ky., Stanford—Citizens of Lincoln County defeated $130,000 bond issue for roads.

Ohio, Cincinnati—(Official)—Bids will be received by the Board of County Commissioners until noon, Oct. 8, for improving Wayne Ave. from Stewart Ave. to Martin Rd., Springfield Township.

Ohio, Columbus—(Official)—Bids will be received until 2 p.m., Oct. 8, by Clinton Cowen, State Highway Comr., for macadamizing 1.24 miles of Cleveland-Wooster Rd. Estimated cost, $8,409.

Ohio, East Liverpool—(Official)—Bids will be received by the Board of Trustees of Liverpool Township, City Bldg., Market and Third St., until noon, Oct. 5, for improving a number of public roads.

Ohio, Northfield—(Official)—Only one bid was received for improving Brandywine Rd., which was rejected. Noted Sept. 2.

Ind., Columbia City—Bids will be received until 2:30 p.m., Nov. 5, by the Commissioners of Whitley County, for three highways in Smith Township.

Ind., Columbia City—Bids will be received until 1 p.m., Nov. 5, by the Commissioners of Noble County, for a road on Whitley-Nobel County line.

Ind., Huntington—Bids will be received by the Board of Public Works until 7:30 p.m., Oct. 4, for sidewalks on Ogan St. H. I. Young, City Clk.

Ind., Logansport—(Official)—Bids will be received until Oct. 19 by Board of Works for 43,540 sq.yd. brick, asphalt, mated cost, $103,000. H. H. Thompson, City Engr. Noted mated cost, $103,000. H. H. Thompson, City Engr. Noted Sept. 16.

Ind., Madison—City will pave Main St. from Broadway to Walnut St. with vitrified brick.

Ind., Noblesville—Bids will be received until 10 a.m., Oct. 9, by W. O. Horton, Audr. of Hamilton County, for concrete road in Noblesville Township.

Ind., Shoals—(Official)—Bids will be received until 10 a.m., Oct. 11, by L. D. Haga, Audr. of Martin County, for road in Halbert Township.

Mich, Fremont—Citizens of Sheridan Township voted $55,000 bonds for stone and gravel road.

Wis., Green Bay—Bids will be received until 10 a.m., Oct. 4, by Committee on Streets and Bridges for grading and placing gravel or crushed stone on portions of West Mason St. F. Biemeret, Chn. Com.

Wis., Racine—Bids will be received until Oct. 9 by the Board of Public Works for paving Hamilton Ave. and Mead St.

Minn., Anoka—Bids will be received until 2 p.m., Oct. 7, by Arthur A. Caswell, Audr. of Anoka County, for improving State Rd. Nos. 4, 7 and 9.

Minn., Fergus Falls—Bids will be received until 5 p.m., Oct. 6, by City Council, for grading Laurel St. between Broadway and Buse St.

Minn., Minneapolis—Board of Park Commissioners plan to complete boulevard along north side of Pogues Run between Spades and Brookside Parks and new boulevard along south bank of stream.

Minn., St. Paul—(Official)—Bids will be received until 10 a.m., Oct. 4, by City Clerk, for repaving Robert St. from north side of Sixth St. to south side of Eighth St.

S. D., Grannvalley—(Official)—Bids will be received by the Board of County Commissioners of Buffalo County, until noon, Oct. 5, for grading road on section line between sections 26 and 27-06-68.

N. D., Bellefourche—Bids will be received until Oct. 5 by N. P. Lang, Audr. of Butte County, for Arndt Rd.

N. D., Minot—(Official)—Bids will be received until 8 p.m., Oct. 4, by Board of City Commissioners for about three miles of street improvements. Estimated cost, $32,980. E. J. Thomas, City Engr. (See adv.)

Mont., Hardin—Bids will be received by E. P. Ross, Clk., County Comrs., until Oct. 4, for 4½ miles of road between Big Horn River Bridge and Dry Creek.

Mo., Kansas City—Bids will soon be be received for approximately nine miles of brick paving on Broadway.

Mo., Maryville—Citizens of Nodaway County voted $35,000 bonds for road improvements. F. J. Yeomans, County Clk. Noted Aug. 19.

Mo., Wellington—Election will be held Oct. 8 to vote $55,000 bonds for macadamizing 10 miles of road and for two bridges.

Tex., Beaumont—Bids will be received until Oct. 19 by J. G. Sutton, City Clk., for approximately 90,000 sq.yd. of paving. Estimated cost, $85,000.

Tex., Denison—Contract will soon be awarded for 14,680 sq.yd. of paving.

Tex., Lufkin—(Official)—Voters of Angelina County defeated $200,000 bond issue for road improvements. Reported another election will be called. Noted Sept. 16.

Tex., Terrell—Attorney General's Department has approved an issue of $150,000 bonds for roads in Justice Precinct No. 8, Kaufman County.

Okla., Pawnee—Bids will be received by H. A. Rexford, City Clk., until 7:30 p.m., Oct. 4, for paving approximately 20,000 sq.yd. in business district.

Colo., Lamar—Bids will be received by L. M. Markham, Clk., Comrs. of Powers County, until noon, Oct. 11, for grading and improving Santa Fé Rd.

Idaho, Burley—Citizens voted $75,000 bonds for roads.

Idaho, Cottonwood—(Official)—Bond election will be held in October for paving main streets. E. L. Parker, Chn., Bd. City Trustees. Noted Sept. 9.

Ariz., Tucson—Election will be held Oct. 26 to issue $400,000 bonds for roads.

Wash., Pasco—(Official)—Bids will be received until Nov. 1 by County Commissioners for macadamizing trunk highways. Estimated cost, $35,000. J. W. Hamilton, County Engr. Noted Sept. 9.

Ore., Portland—Bids will soon be received for paving East 10th St. from Going St. to Alberta St. Estimated cost, $6,000.

Ore., The Dalles—Citizens of Wasco County contemplate $262,500 bond issue for road improvements.

Calif., Arcadia—Bids will be received by the Board Trustees until 8 p.m., Oct. 7, for approximately 16 miles of oiled macadam roadway and 10,000 ft. of concrete curb and gutter.

Calif., Bakersfield—Bids will be received until Oct. 7 by Board of Supervisors of Kern County for five miles of concrete pavement of Division 10, Section 15, known as Patch Loop.

Calif., Los Angeles—City Council plans to pave Western Ave. from Temple St. to Fountain Ave.

Calif., Santa Clara—City Engineer estimates cost of paving seven streets at $85,000.

Que., Verdun—Town Council will macadamize Woodland Ave. from La Salle Rd. to Bannantyne Ave.

Ont., Brockville—Council will lay tarvia pavement to cost $14,000.

Ont., Chatham—Town Council contemplates concrete pavement on Louise and Prince St. and granolithic pavement on Violet and Inches St.

Ont., Kingston—Town Council contemplates macadam roads and concrete sidewalks on a number of streets. W. W. Sands, Clk.

Ont., Stamford—Township Council plans water-bound macadam roadway. Estimated cost, $28,000.

Bids In and Contracts Awarded

Mass., Boston—(Official)—State Highway Commission awarded contract for 12,400 lin.ft. road in Granby and South Hadley to LANE CONSTRUCTION CORPORATION, Meriden, Conn., at $16,295. Noted Sept. 16.

Mass., Boston—State Highway Commission awarded contract for 7,400 lin.ft. asphalt macadam in Braintree to E. J. ROURKE, Arlington, at $12,390.

Mass., Boston—JOHN KELLY CO., 5 Ulmer St., Roxbury, awarded contract for paving Rosewood St., at $13,052.

Conn., Hartford—(Official)—Contracts for state road improvements awarded as follows: New Haven-Hartford Turnpike, New Haven and North Haven Townships to UNION PAVING CO., Schenectady, N. Y., at $22,891; Huckleberry Hill Rd., Brookfield Township to LOUIS LONGHT & BRO., Torrington, at $11,191; Orange Township to ROBERT D. DALEY CONTRACTING CO., New Haven, at $28,448; Robertsville Rd., Colebrook Township, to FRANK A. WILCOX, Norwich, at $7,852. Noted Sept. 16.

Conn., Norwalk—Contract for paving Washington St. Bridge awarded to EMPIRE CONSTRUCTION CO., New York, N. Y., at $13,439.

N. Y., New York—(Borough of Brooklyn)—(Official)—Contracts for improving various streets awarded as follows: Glenmore Ave., Grafton St. and Hopkinson Ave., to BROOKLYN ALCARTZ PAVING CO., 407 Hamilton Ave., at $16,462, $5,475 and $3,941 respectively; Ashland Pl. to FRANKLIN CONTRACTING CO., 52 Vanderbilt Ave., at $17,428; 74th St., to TOPEKA PAVING CO., West 14th St., at $4,613; paving 64th St. to TOPEKA PAVING CO., West 14th St., at $3,873. Noted Sept. 9 and 23.

N. Y., New York—(Borough of Manhattan)—Contracts for paving awarded as follows: Haven Ave., ASPHALT CONSTRUCTION CO., 208 Broadway, New York, at $4,673; 62nd St., AZTEC ASPHALT CO., 90 West St., New York, at $15,846; 66th St., SICILIAN ASPHALT CO., 41 Park Row, New York, at $7,171. Noted Sept. 9 and 23.

N. Y., New Rochelle—Public Works Commissioner awarded contract for brick pavement on Webster Ave. to GALBANO CO., at $6,296.

N. Y., Rochester—Board of Contract and Supply awarded contracts for asphalt paving to ROCHESTER VULCANITE CO., on Frank St., at $25,000, and WHITMORE, RAUBER & VICINUS, on Grover St., at $4,101.

N. J., Bloomfield—Contract for repaving Broad St. from Bloomfield Center to Bay Ave. awarded to STANDARD BITULITHIC PAVING CO., at $37,517.

N. J., Montclair—Contract for repaving Valley Rd., Montclair, from Bloomfield Ave. to Passaic County line awarded to STANDARD BITULITHIC PAVING CO., at $86,450. Noted Aug. 26.

N. J., Montvale—(Official)—Contract for improving Magnolia and Grand Ave. will not be awarded this year.

N. J., New Brunswick—Board of Chosen Freeholders awarded contract for macadamizing Rahway Ave. from Roosevelt to Blazing Star Rd., to THOMAS F. DUNNIGAN, Woodbridge, at $26,767. Noted Aug. 19.

Fla., Palm Beach—Contract for paving Clematis Ave. awarded to F. G. PROUDFOOT, at $13,523.

Fla., Tarpon Springs—Contract for 10,000 sq.ft. of concrete sidewalks awarded to HERMAN DANN, St. Petersburg.

Ala., Linden—Commissioners of Marengo County awarded contract for sand-clay and gravel roads to HARVEY & CO., Memphis, Tenn., at $60,000. Noted Sept. 2.

Ky., Carlisle—Contract for Carlisle and Parks Ferry Rd. in Nicholas County awarded to JAMES & JONES, Louisville, at $15,000.

Ky., Carlisle—Contract for Carlisle and East Union Rd. awarded to PHELPS, POST, GUYN & CO., Lexington, at $20,000.

Ky., Louisville—Contract for paving 32nd St. from Grand to Virginia Ave. awarded to L. W. HANCOCK CO., Louisville, at $8,250.

Ky., Louisville—HENRY BICKEL CO., Louisville, at $10,500, awarded contract for paving Dupuy St. from Kentucky to Caldwell St.

Ky., Louisville—Contract for paving Brook St. from Breckenridge to Caldwell St. and Chestnut St. from Fourth to Fifth St. awarded to LOUISVILLE ASPHALT CO.

Ky., Russellville—Contract for 2.7 miles of macadam pike awarded to BYARS OPERATING & CONSTRUCTION CO., Russellville, at $10,410.

Ky., Russellville—Contract for macadam pike in Logan County awarded to RHEA PRICE, Auburn, at $7,496.

Ohio, Conneaut—Contract for improving State St. from Broad St. easterly to west end awarded to JOHN McCORMICK & SON, Erie, Penn., at $29,843.

Ohio, Toledo—(Official)—Contract for improving Stone Road Improvement No. 72 awarded to M. P. HAMMIN, Valentine Bldg., Toledo. Noted Sept. 16.

Ohio, Toledo—Contract for paving Detroit Ave. from Miami and Erie Canal to River Rd. awarded to M. P. HANNAN, at $7,350.

Ohio, Toledo—Board of Control awarded paving contracts as follows: Stickney and Huron St., to H. P. STREICHER & CO., $118,638; Streicher St. to GESSNER & COTHRELL, $27,558; Salem and Princeton St. to PETERS BROS. & CO., $12,829.

Ind., Anderson — (Official) — Commissioners of Madison County awarded contract for concrete road in Anderson Township to GEORGE HOPPS, Anderson, at $6,973. Noted Sept. 9.

Ind., Franklin—Board of County Commissioners awarded contract for gravel roads in Union and Pleasant Townships to EDWARD BARRETT, Bargersville, at $11,500.

Ill., Geneva—Contract for Section G, Route 12, of State Aid roads in Kane County awarded to GROHNE CONTRACTING CO., Joliet, at $11,988.

Ill., Kankakee—Contract for two miles of road in Yellowhead Township awarded to CLYDE DYER, at $10,790.

Ill., Paris—(Official)—Contract for gravel road on Baldwinsville state line road and gravel road on Heelan Rd. awarded to JOHN HEELAN, Paris, at $4,500. Noted Sept. 23.

Ill., St. Charles—(Official)—Bids for street improvements received Sept. 1 as follows: Wisconsin Improvement Co., Racine, Wis., $55,391 (probably awarded contract); Arwen Price, Elgin, $56,698; Logan & Giertz, Elgin, $56,988. John W. Wilson, City Engr. Noted Aug. 19.

Ill., Springfield—Contract for grading on Section F, Route 1, awarded to CAMERON, JOYCE & CO., Keokuk, at $6,195.

Wis., Fennimore—Contract for concrete pavement on Wisconsin Ave. awarded to BARTLETT CONCRETE CO., Watertown, at $11,500.

Wis., Neenah—Contract for concrete base, curb and gutter on Walnut St. awarded to PETER OSKAR, Neenah. Creosote block surface will be laid by city forces. Noted Aug. 5.

Iowa, Mt. Ayr—Contract for paving Taylor St. awarded to JOHNSON REAL ESTATE & CONSTRUCTION CO., at $22,556.

Minn., Floodwood—Board of Fine Lakes Township awarded contract for Nordess Rd. to OSCAR WILSON.

Minn., St. Paul—(Official)—Contract for paving Warsaw St. from Pleasant Ave. to Seventh St. awarded to FIELDING & SHEPLEY, St. Paul, at $17,900.

Minn., Willmar—Contract for grading streets in First Ward awarded to C. PAULSON.

Kan., Chanute—Contracts for paving North Washington Ave. and Fourth St. awarded to PERRY TAYLOR, at $14,709 and $5,129 respectively.

Kan., Garnet—Contract for paving eight or 10 blocks with brick awarded to A. L. COOK, Ottawa. Estimated cost, $50,000.

S. D., Sioux Falls—Contract for grading Willow Ave. from 10th to 12th St. awarded to E. G. LEDYARD.

Mont., Roundup—Contract for concrete sidewalks in Districts 9 and 10 awarded to JOHN TRIPP, at $13,821.

Mo., St. Louis—(Official)—Contract for approximately 60,000 cu.yd. of grading awarded to FRUIN-COLNON CONTRACTING CO., Merchant Laclede Bldg., St. Louis, at 16.6c. per cu.yd. Noted Sept. 16.

Mo., Weston—Contract for 4,000 yd. macadam paving and 100 cu.yd. grading awarded to MALEY & KELLEY, Massachusetts Bldg., Kansas City, Mo.

Tex., Paris—Contract for paving Grand Ave. from Bonham to Kaufman St. awarded to TEXAS BITULITHIC CO., Dallas. Estimated cost, $50,000. Noted Sept. 23.

Tex., San Antonio—Contracts for paving awarded as follows: North Flores St., Dolorosia St. and Military Plaza to ROACH-MANIGAN PAVING CO., Memphis, Tenn., at $32,350; North Presa St., West Commerce St. and Main Plaza to RUSHMORE & GOWDY, San Antonio, at $28,908; Nacogdoches and Nolan St. to TEXAS GRANITOID CO., San Antonio, at $13,620.

Tex., Temple—Contract for paving awarded to LAVY & LEVY, Dallas, at $50,000. Noted Aug. 12.

Idaho, Sandpoint—Council has awarded contract for international cement paving in District No. 4 to SPOKANE BITU-MASS PAVING CO., Spokane, Wash., at $1.32 per sq.yd.

Utah, Provo—Contract for paving awarded to RYBERG BROS., at $30,620.

Wash., Bremerton—Contract for improving Fourth St. awarded to E. H. L. MORRIS, Seattle, at $8,558.

Wash., Everett—Contract for 30-ft. pavement on Rucker Ave. awarded to BANCROFT & MORGAN, Everett, at $30,717. Noted July 29.

Wash., La Conner—Town Council awarded contract for concrete paving to N. W. BALL, Sedro Woolley, Wash., at $13,987. Noted Aug. 19.

Ore., Portland—Contract for paving a portion of East Seventh St. awarded to GIEBISCH & JOPLIN, at $5,841.

Calif., Arbuckle—Contract for improving Fifth St. awarded to CLARK & HENERY CONSTRUCTION CO., at $5,574.

Calif., Los Angeles—Contract for improving Third St. from Vermont to Western Ave. awarded to TRYON & BRAIN, at $72,175.

Calif., Portersville—FEDERAL CONSTRUCTION CO., San Francisco, at $50,000, awarded contract for paving Morton St., Belleview, El. Grainto and Grand Ave.

Calif., Salinas—Board of Supervisors of Monterey County awarded for road work to D. C. HOWARD, Redwood City, at $16,155.

Calif, Santa Ana—OSCAR FORD, Riverside, at $14,769, awarded contract for paving a portion of Riverside Rd.

Calif., Stockton—(Official)—Contract for paving North Center, Maple and Ash St. awarded to W. H. PAUL, Oakland, at $21,969. Noted Sept. 16.

Calif., Visalia—Board of Supervisors of Tulare County awarded contract for Three Rivers Rd. to J. E. HINES, Tulare, at $13,800.

INDUSTRIAL WORKS

Proposed Work

Maine, Biddeford—J. R. Worcester & Co., 79 Milk St., Boston, Mass., prepared plans for three-story, 90x150-ft., tannery for Gobrecht Leather Co., 202 Lincoln St., Boston, Mass.

Maine, Portland—National Biscuit Co. will build plant at Kennebec and Cedar St.

N. H., Keene—Wilkins Toy Co. has plans by Herbert A. Foster for one- and two-story, 90x200-ft., brick plant. Estimated cost, $30,000.

Mass., Amherst—Holyoke St. Ry. Co. will build 100x130-ft. brick car barn and substation. G. E. Pelliser, 317 Springfield St., Engr.

Mass., Boston—Colonial Steel Co., Pittsburgh, Penn., will build steel plant at D and Fargo St., South Boston.

Mass., Boscton—Bids will soon be received for eight-story, 70x110-ft., brick warehouse for P. C. Larkin Co., Buffalo, N. Y. Densmore & Le Clear, 88 Broad St., Engr. Noted July 29.

Mass., Springfield—W. J. Foss Co. will build brick warehouse at Broadway and Wight Ave. Estimated cost, $20,000.

N. Y., Buffalo—J. Prentiss & Co., 132 Michigan Ave., plans to rebuild warehouse, according to press reports. Estimated cost, $20,000.

N. Y., Buffalo—Bids will soon be received by Edwin C. Haas, 558 East North St., for 50x100-ft. foundry and 36x85-ft. machine shop at Grant St. and New York Central R.R. for Unique Brass Foundry Co., 25 Illinois St.

N. Y., Endicott—George F. Johnson & Co. will build shoe factory.

N. Y., Johnson—Endicott, Johnson & Co. plans to build another addition to its shoe factory on Lester Ave.

N. Y., Kingston—Plans being prepared by H. O. Chute, 197 Pearl St., New York, for one-story, 100x150-ft., reinforced-concrete picric-acid plant for Nitro Powder Co. E. Metzger, 50 Broad St., New York, Pres.

N. Y., New York—(Borough of the Bronx)—Tremont Fireproof Storage and Refrigerating Co. plans to combine buildings of Liberty Brewing Co., at 170th St. and Third Ave. and establish warehouse, cold storage plant and ice plant. John H. Ronner is interested.

N. Y., New York—(Borough of Brooklyn)—Chelsea Fiber Mills Co. has plans for four-story brick mill at 1155 Manhattan Ave. and Commercial St. Estimated cost, $30,000.

N. Y., New York—(Borough of Brooklyn)—Plans being prepared by L. Allmendinger, 926 Broadway, for 2½-story, 40x100-ft., brick bottling plant on Myrtle Ave. near Sumner Ave. for Ferdinand Munch Brewing Co. Estimated cost, $20,000.

N. Y., New York—(Borough of Brooklyn)—Sheffield Farms-Slawson-Decker Co. will build six-story, 100x252-ft., dairy at 1368 Fulton St. Estimated cost, $300,000.

N. Y., New York—(Borough of Manhattan)—(Official)—New York City Composite Brick Corporation will build two-story, 100x138-ft., plant at 201 East 129th St. Hopkins & McEntee, 37 East 28th St., Arch.

N. Y., New York—(Borough of Manhattan)—William J. Gilphey, Arch., 1 Union Sq. W., Manhattan, prepared plans for four-story, 100x10-ft., factory for Consumers Biscuit Mfg. Co.

N. Y., New York—(Borough of Queens)—Warren & Wetmore, 16 East 47th St., Manhattan, will prepare plans for four-story, 175x175-ft. warehouse and factory at Borden Ave., Van Alst Ave. and Third St., Long Island City, for American Druggists' Syndicate. H. Loewe, 205 Borden Ave., in charge. Estimated cost, $125,000.

N. Y., New York—(Borough of Queens)—Meuer Bros., 575 Flushing Ave., Brooklyn, will build plant at Haywood Ave. and Third St., Long Island City, for manufacture of steel barrels. Estimated cost, $10,000.

N. Y., New York—(Borough of Richmond)—Valentine & Kissam, 25 Madison Ave., New York, preparing plans for five-story factory near Clifton, Borough of Richmond, for Louis De Jenge & Co., 446 Richmond Turnpike, Tompkinsville.

N. Y., New Rochelle—Star Knitting Works, Grand Rapids, Mich., plans mills in New Rochelle.

N. Y., Norwich—Plans being prepared by Roy Bard, Arch., for two-story, 75x200-ft. factory for Norwich Wire Basket Co. Estimated cost, $10,000.

N. Y., Rochester—Plans prepared by Russell & King, Syracuse, for two-story, 50x90-ft., warehouse for Gibson Drug Co. Estimated cost, $15,000.

N. J., Camden—Bids will soon be received for three-story brick and concrete factory for Taylor-White Extracting Co. Ballinger & Perrot, Philadelphia, Penn., Arch.

N. J., Newark—Balbach Smelting Co., Ave. R and Doremus Ave., will build one-story steel storage building. Estimated cost, $10,000.

N. J., Newark—Joseph Oschwald will build garage at 359 Halsey St. Estimated cost, $20,000.

N. J., Newark—Celluloid Co. will build warehouse at 78 Darcy St. at estimated cost of $30,000.

N. J., Plainfield—Plans prepared for addition to machine-plant of Pond City Machine Tool Co.

N. J., Trenton—Ajax-Grieb Rubber Co. will build three-story, 200x350-ft. addition to its tire plant.

Penn., Beaver Falls—Shelby Steel Tube Co., Ellwood City, will build additions to its plant at estimated cost of $1,500,000. J. J. Dunn, Supt.

Penn., Chester—Stewart Distilling Co., Philadelphia, will build plant on Delaware River. Estimated cost, $500,000.

Penn., Ellwood City—U. S. Steel Corporation will build rolling mills and openhearth furnaces at estimated cost of $1,500,000, according to press reports.

Penn., Pittsburgh—Liquid Fuel Combustion Co. will build two factories at Main and Sycamore St., 84x136 and 96x136 ft. respectively.

Penn., Shamokin—J. H. and C. K. Eagle plan to build addition to their silk mills. Estimated cost, $500,000.

Del., Wilmington—William Freihofer Baking Co. will build bakery, stable and power plant. Peucket & Wunder, 310 Chestnut St., Philadelphia, Penn., Arch.

Md., Baltimore—Carnegie Steel Co. plans storage and power building at its plant on Wicomico St. H. D. Bush, Supt.

Va., Norfolk—Norfolk & Western Ry. will build shops. J. E. Crawford, Roanoke, Ch. Engr.

W. Va., Martinsburg—Adamantine Clay Products Co. will rebuild its plant at North Mountain which was recently destroyed by fire. Estimated cost, $75,000.

N. C., Charleston—Riverside Iron Works Co. will build plant on Metting St. Estimated cost, $25,000.

N. C., Concord—Norcott Mills is having plans prepared for three-story mill. W. G. Broadfoot, Secy.

Ga., Atlanta—Atlanta Warehouse Co. will build cotton warehouse at Stewart Ave. and Glenn St. Estimated cost, $400,000.

Tenn., Murfreesboro—A company will be formed to build three-story brick underwear mill. Charles C. Groat, W. C. Bibro and T. H. Harrison are interested.

Ky., Louisville—Speed Realty Co. will build six-story warehouse for Stewart Dry Goods Co. Estimated cost, $40,000.

Ohio, Ashtabula—Missouri Iron Co., St. Louis, will build foundry. Arthur G. McKee, 1301 Rockefeller Bldg., Cleveland, Arch.

Ohio, Canton—Gordon Rubber Co. will build additions to its factory. Estimated cost, $300,000.

Ohio, Cincinnati—Plans being prepared by Stegner & Hughes, Arch., for six-story, 100x100-ft., addition to factory of Huenefeld Co., Spring Grove Ave., Camp Washington.

Ohio, Cincinnati—Weidman Co. has plans for seven-story warehouse at West Ninth St. and Mandrake Ave., N. W.

Ohio, Cleveland—Steel Products Co. has plans for plant at 2943 Parkwood Drive. Estimated cost, $30,000.

Ohio, Cleveland—Bids being received by Franz C. Warner, Hippodrome Bldg., for three-story and basement, 57x170-ft., and one-story, 54x110-ft. garage and sales building for Hudson Stuyvesant Motor Co., 1914 Euclid Ave. Estimated cost, $60,000.

Ohio, Cleveland—Tropical Oil and Paint Co., Cleveland, is having plans prepared by C. W. Courtney, Leader News Bldg., for factory on West 70th St.

Ohio, Yorkville—Wheeling Steel and Iron Co., Wheeling, W. Va., will make improvements to its tin-plate plant at Yorkville.

Ind., Indianapolis—John B. Bright, Indianapolis, will build a warehouse at 113 South Meridian St. Estimated cost, $30,000.

Ind., Indianapolis—National Motor Co. will build factory at 22 and Yandes St. Estimated cost, $50,000.

Mich., Escanaba—Michigan Tanning and Extract Co. is having plans prepared for 70x900-ft. reinforced-concrete factory near Escanaba.

Ill., Chicago—Hump Hairpin Co. secured a site and will build two-story factory at Prairie Ave. and 20th St. Alfred S. Alschuler, Arch. Estimated cost, $150,000.

Ill., Chicago—William F. Pagels, 19 South La Salle St., has plans for two-story, 50x150-ft., brick warehouse at Grand Ave. and Noble St. Estimated cost, $25,000.

Wis., Hartford—Kissel Motor Car Co., Hartford, plans 75x100-ft. storage building, 70x110-ft. enameling shop and furnace room, four-story, 50x100-ft., office, 44x100-ft. shipping warehouse and two-story, 50x50-ft., body storehouse. O. P. Kissel in charge.

Wis., Wausau—Marathon Shoe Co. plans two-story, 50x120-ft., brick and concrete addition to its factory.

Iowa, Des Moines—Hippee Motor Supply Co. will build two-story, 50x132-ft., warehouse on Mulberry St. C. K. Denman, Arch. Estimated cost, $18,000.

Iowa, Des Moines—Grocers Wholesale Building Co. will build three-story, 66x132-ft., building. E. E. Pech, Mgr.

Minn., Duluth—Haynes Automobile Co. will make extensions. Estimated cost, $250,000.

Minn., Minneapolis—Borne Aëroplane Co. will build factory. Edwin N. Potter and Arthur R. Borne are interested.

Minn., Owatonna—Penhallegon Radiator Co. plans factory. William F. St. Clair, interested.

Minn., St. Paul—Theodore A. Schulze Co. will build factory on Robert St. Estimated cost, $500,000.

Minn., St. Paul—Preliminary plans being prepared for 10-story, 48x150-ft., concrete terminal elevator for Equity Co-Operative Exchange. Foltz Engineering Co., 1410 Pioneer Bldg., Arch. Estimated cost, $125,000. Noted Aug. 19.

Kan., Wichita—Shirley Jocelyn, Beacon Bldg., contemplates three-story, 50x100-ft., brick warehouse. Estimated cost, $15,000.

Mo., Springfield—Press reports state Tucker, Ferguson Warehouse & Transfer Co. will build addition to its warehouse at estimated cost of $25,000. E. G. Tucker, Representative.

Tex., San Antonio—Edward Friedrich, 802 East Commerce St., will build factory at East Commerce and Pine St. Estimated cost, $60,000.

Okla., Sapulpa—International Crude Oil Storage Co. will build oil tank plant.

Colo., Pueblo—Nuckolls Packing Co. will build packing plant at estimated cost of $250,000. G. Harvey Nuckolls, Pres.

Wash., Seattle—Ford Motor Co. will enlarge assembling plant. Estimated cost, $100,000. James Couzens, Treas.

Ore., Gresham—H. M. Squires, Gresham, will build fireworks factory. Estimated cost, $40,000.

Calif., Los Angeles—American Can Co. will build 180x600-ft. factory. Estimated cost, $250,000.

Bids In and Contracts Awarded

Maine, Portland—Contract awarded to CHARLES B. HOWATT & SON, for rebuilding factory for Twitchell Champlin Co., on Commercial St. Noted Sept. 23.

Maine, Saco—Contract awarded to FRED L. EMMONS & CO., Biddeford, at $26,740, for shoe factory for Sears-Roebuck Co.

Mass., Boston—Contract awarded to FRED T. LEY CO., Springfield, for pattern shop for Mead Morrison Co., on Prescott St., East Boston. Estimated cost, $70,000.

Mass., Brockton—Contract awarded to THOMAS F. CROWELL, Brockton, at $155,000, for factory for Diamond Shoe Co. Noted Aug. 12.

R. I., Providence—Contract awarded to CRUISE & SMILEY CONSTRUCTION CO., 12 East Ave., Pawtucket, at about $12,000, for one-story, 41x101-ft., laboratory for Revere Rubber Co., Eastern Ave., Chelsea.

Conn., Hartford—Contract awarded to ROBERT PORTEUS, Hartford, at about $40,000, for factory at Franklin Ave. and Goodrich St. for Asa S. Cook Co.

Conn., New Britain—Contract awarded to B. H. HIBBARD CO., New Britain, by Hartford Auto Parts, Inc., for two-story, 60x210-ft. factory.

N. Y., New York—(Borough of Brooklyn—(Official)—Contract awarded to BORGEA CONSTRUCTION CO., 69 Mills St., Long Island City, at $11,500, for two-story, 39x100-ft. brick factory for Rosario Drago, 404 East 104th St., Manhattan, at Willow Ave. and St. Johns Pl.

N. Y., Poughkeepsie—Contract awarded to EDGAR V. ANDERSON, 39 Market St., for two-story packing plant at 38 Cottage St., for Nelson Morris & Co., 38 Cottage St. Estimated cost, $40,000.

Penn., Pittsburgh—Contract awarded to D. T. RIFFLE, for factory for Wolverine Supply & Mfg. Co., at Page and Fontella St.

Ohio, Akron—Contract awarded to W. A. FRANKLIN for two, two-story factories for Kelly-Springfield Tire & Rubber Co.

Ohio, Cincinnati—Contract awarded to JOHN LACKER by Otto Armleder Co., York Ave. near Western Ave. for commercial garage. Estimated cost, $15,000.

Wis., Beloit—Contract awarded to SCHNEIBERG & DEARHAMMER, Beloit, by Gardner Machine Co. for machine-shop addition.

Wis., Watertown—Contract awarded to F. A. WILLENBOCKEL, 507 Tenth St., Watertown, by Watertown Table Slide Co., Harp St., for one-story, 50x100-ft. shop addition.

Neb., Omaha—(Official)—Contract awarded by Ford Motor Co. to HODGEON CONSTRUCTION CO., St. Paul, Minn., for assembling plant. Noted Aug. 26.

Tex., San Benito—Contract to NYSTROM BROS., by Creamery-Dairy Co., San Antonio, for branch dairy. Estimated cost, $10,000. Noted Aug. 12.

Wash., Tacoma—Contract awarded to CORNELL BROS., Tacoma, at about $250,000, for four steel buildings for Tacoma Smelting and Refining Co.

FEDERAL GOVERNMENT WORK

Proposed Work

Flooring—Boston, Mass.—(Official)—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., for reinforced-concrete floor in pattern shop, Building No. 42, United States Navy Yard.

Dredging—New London, Conn.—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Oct. 2, for dredging at Naval Station, New London.

Riprap—Keansburg, N. J.—(Official)—Bids will be received by J. T. Yates, Lighthouse Inspector, Tompkinsville, N. Y., until 2 p.m., Oct. 4, for riprap bulkhead wall and making repairs to jetty at Point Comfort Light Station, Keansburg.

Post Office—East Pittsburgh, Penn.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 6, for post office at East Pittsburgh.

Riprap—Philadelphia, Penn.—Bids will be received at U. S. Engineer Office, Philadelphia, until noon, Oct. 14, for riprap in the Delaware River at Mifflin Bar Dike. (See Adv.)

Chain Shafts—Washington, D. C.—Bids will be received by A. P. Davis, Ch. Engr., U. S. Reclamation Service, Washington, D. C., until 2 p.m., Nov. 8, for chain shafts and chains for rolling crest of Grand River Diversion Dam, Grand Valley project, Colorado. (See Adv.)

Hoists—Washington, D. C.—Bids will be received until 3 p.m., Oct. 23, at the office of Chief of Engineers, U. S. Army, Washington, D. C., for 12-in. projectile hoists. (See Adv.)

Machinery—Washington, D. C.—Bids will be received by A. P. Davis, Ch. Engr., U. S. Reclamation Service, Washington, D. C., until 2 p.m., Oct. 29, for operating mechanism for two cylinder gates of 12 ft. diameter for Sherburne Reservoir, Milk River Project, Montana, and a duplicate set for Keechelus Reservoir, Yakima Project, Washington. (See Adv.)

Building—Norfolk, Va.—(Official)—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Oct. 23, for school building at St. Helena Navy Yard, Norfolk.

Hangers—Pensacola, Fla.—(Official)—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Oct. 16, for three hangers at U. S. Navy Aëronautic Station, Pensacola.

Dry-Dock Gate—Louisville, Ky.—Bids will be received at U. S. Engineer Office, Louisville, until noon, Oct. 22, for one mitering dry-dock gate of two leaves. (See Adv.)

Post Office—Merrill, Wis.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 1, for post office at Merrill.

Excavation, Etc.—St. Ignatius, Mont.—(Official)—Bids will be received by A. P. Davis, Ch. Engr., Dept. of Interior, U. S. Reclamation Service, St. Ignatius, Mont., until 3 p.m., Oct. 12, for about 10 miles of laterals and appurtenant structures, involving about 43,000 cu.yd. of excavation, 140 cu.yd. of concrete, 430 sq.yd. of paving, placing about 9,800 pounds reinforcing steel and placing in wooden structures of 32,000 ft. b. m. of lumber on east bank of Flathead River, one to seven miles northeast of Dixon.

Granary and Hay Shed—Ft. Bliss, Tex.—Bids will be received at office of Depot Quartermaster, El Paso, until 11 a.m., Oct. 27, for one granary and one hay shed at Ft. Bliss. (See Adv.)

Post Office—New Braunfels, Tex.—Bids will be received until 3 p.m., Nov. 5, by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for post office.

Canal Work—Montrose, Colo.—(Official)—Bids will be received by A. P. Davis, Ch. Engr., Dept. of Interior, U. S. Reclamation Service, Montrose, Colo., until 4 p.m., Oct. 20, for about 11 miles of Ironstone Canal, Uncompahgre Valley project, vicinity of Olathe, Colo.

Crane—Panama—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Nov. 3, for material for a complete locomotive jib crane of 50 gross tons capacity for Dry Dock No. 1, Balbao Terminals, Balboa, Canal Zone, Panama.

Miscellaneous Supplies—Panama—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Oct. 8, for manufactured metal supplies, transformers, etc.

Miscellaneous Supplies—Panama—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Oct. 6, engine lathe, forcing press, bench filing machines, etc.

Storage Plant—Peking, China—(Official)—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Oct. 16, for ice-making and cold-storage plant at U. S. Marine Barracks, Peking, China.

Bids In and Contracts Awarded

Post Office—Gouverneur, N. Y.—Contract for post office at Gouverneur awarded to JAMES DEVAULT, Canton, Ohio, at $52,000. Noted Aug. 5 and Sept. 23.

Inlet Repairs—Cold Spring, N. J.—Contract for stone repair to Cold Spring Inlet awarded to COAST AND LAKES CONSTRUCTION CO., New York, N. Y., at $29,520. Noted Aug. 5 and Sept. 23.

Barracks—Norfolk, Va.—Bids were received at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for brick marine barracks building at Norfolk as follows: Norcross Bros. Co., Worcester, Mass., $199,800; George E. Wyne, Washington, D. C., $207,500; P. F. Gormley, Washington, D. C., $207,222. Noted Aug. 26.

Piling—Louisville, Ky.—(Official)—Bids were received at U. S. Engineer Office, Louisville, for steel sheet piling for Dam No. 43, Ohio River, as follows: Jones & Laughlin Steel Co., Pittsburgh, Penn., $37,804; Carnegie Steel Co., Pittsburgh, Penn., $34,111 (low bidder); Lackawanna Steel Co., Lackawanna, Penn., $35,791.

Post Office—Ypsilanti, Mich.—Contract for post office at Ypsilanti awarded J. S. WAHLMAN, Ishpeming, at $49,330.

Post Office—Fulton, Mo.—Contract for post office at Fulton awarded to BALKAN CONSTRUCTION CO., Monadnock Bldg., Chicago, Ill., at $46,337. Noted Aug. 5 and Sept. 16.

Revetment—Kansas City, Mo.—Contract for 13,000 lin.ft. of revetment on Missouri River awarded to KANSAS CITY BRIDGE CO., Orear-Leslie Bldg., Kansas City, at $106,340. Noted Aug. 26.

Barracks—Mare Island, Calif.—Bids were received at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for marine barracks building at Mare Island from: Pringle, Dunn & Co., San Francisco, $143,543; William A. Newsome, San Francisco, $143,387. Noted Aug. 26.

CANALS—DITCHES AND IRRIGATION

Proposed Work

Barge Canal Work—Albany, N. Y.—(Official)—Bids will be received by W. W. Witherspoon, Supt. Pub. Wks., Capitol, Albany, until noon, Oct. 26, for Terminal Contracts Nos. 20 and 50. (See adv.)

Drainage—Albany, Ill.—Bids will be received by the Commissioners of Meredosia Levee and Drainage District until 4 p.m., Oct. 14, for excavating about 86,960 cu.yd. of earth for 6½ miles of drainage ditch.

Ditch—Ada, Minn.—Bids will be received until 2 p.m., Oct. 2, by Commissioners of Norman County, Court House, for enlarging, cleaning and repairing County Ditch No. 3.

Ditch—Breckenridge, Minn.—Bids will be received by P. E. Truax, County Audr., until 10 a.m., Oct. 6, for Ditch No. 8-A, Wilkinson County. Estimated cost, $12,228.

Ditch—Breckenridge, Minn.—Bids will be received by P. E. Truax, County Audr., until 10 a.m., Oct. 12, for Ditch No. 4-A, Wilkin County. Estimated cost, $19,049.

**Ditch—Fosston, Minn.—Bids will be received by O. M. Brandt, Village Recdr., until 8 p.m., Oct. 4, for clearing and deepening County Ditch No. 48.

Irrigation—Lyman, Wyo.—An irrigation project will be established near Lyman to reclaim 30,000 acres of land. Water will be secured from Black's Fork, a tributary of Green River. Joseph W. Field, Lyman, interested.

Drainage—Marion, Ark.—(Official)—Drainage bonds for $160,000 sold. Noted Sept. 16.

Drainage—Ennis, Tex.—Drainage and Levee District No. 2 voted $125,000 bonds to reclaim 12,000 acres on Trinity River from Slate Rock to cut-off.

Drainage—Victoria, Tex.—Bids will be received by Herman Fisher, Clk., Victoria County, until noon, Oct. 14, for improving Drainage Ditch No. 3. J. G. Johnson, Victoria, Engr.

Irrigation—Cimarron, N. M.—Plans being prepared by James A. French, Engr., for dam on Red River to reclaim about 20,000 acres of land. Costilla Estates Development Co., interested.

Drainage—North Yakima, Wash.—Bids will be received by Commissioners of Yakima County until Oct. 4, for drainage system in Drainage Improvement District No. 27.

Irrigation—Baker, Ore.—Baker Irrigation Ditch Co. will build reservoir, four miles long in Sumpter Valley Cañon, 15 miles south of Baker. Estimated cost, $500,000. S. S. Start, Baker, representative.

Drainage—Santa Ana, Calif.—Westminster Drainage District voted $25,000 bonds for drainage system to reclaim about 5,000 acres of land.

Drainage—Westminster, Calif.—Contract will be awarded about Jan. 1 for ditches for draining about 6,000 acres. Estimated cost, $25,000.

Bids In and Contracts Awarded

Barge Canal Work—Albany, N. Y.—Contract for Terminal Contract No. 40 awarded to J. E. BISHOP, Syracuse, at $25,-515. Noted Sept. 23.

Drainage—Atlantic, Iowa—(Official)—Contracts awarded by Auditor of Cass County for Indian Creek Drainage Ditch No. 1 to LANA CONSTRUCTION CO., Council Bluffs, at 7.5c. per cu.yd. Noted Sept. 16.

Ditch—Bemidji, Minn.—Contracts for Judicial Ditch No. 31 awarded as follows: Clearing and grubbing, G. N. CLIFFORD, Minneapolis, at $7,999; excavation, RIDER & JONES, Minneapolis, at $32,676; road leveling, HARTMAN & BECK, Kelliher, at $7,565.

Ditch—Breckenridge, Minn.—Contract for Judicial Ditch No. 6 awarded to C. W. ROOD CONSTRUCTION CO., Grand Rapids, Wis. Estimated cost, $12,000. oNted Sept. 2.

Ditch—Litchfield, Minn.—Contract for Union Grove ditch awarded to NORTHERN MINNESOTA DRAINAGE CO. Work includes 13,000 cu.yd. of excavation.

Ditch—Victoria, Tex.—Contract for ditch in Drainage District No. 2 awarded to W. D. McCURDY, Lake Pacedo, at $16,000.

Irrigation—Oakdale, Calif.—Trustees of Oakdale Irrigation District awarded contract for steel pipe to WESTERN PIPE AND STEEL CO., San Francisco, at $11,114.

MISCELLANEOUS

Proposed Work

Tunnel—Boston, Mass.—Harvard Improvement Association, Dorchester, is interested in project to extend Washington St. tunnel to Dorchester and probably to Mattapan. Estimated cost, $8,000,000.

Coal Pier—Baltimore, Md.—Plans prepared for coal pier at Curtis Bay, Baltimore, for Baltimore & Ohio R.R. Estimaetd cost, $1,500,000.

Levee—Water Valley, Miss.—Board of Supervisors of Coffeeville passed resolution to join with Panola County to build levee across Yocona bottom, about five miles west of Water Valley.

Barge Line—Shreveport, La.—Election will soon be held to vote $100,000 bonds for barge line between Shreveport and New Orleans. Noted Sept. 23.

Comfort Stations—Cleveland, Ohio—Election will be held in November to vote $100,000 bonds for comfort stations.

Pavilion—Oxford, Ohio—Bids will be received by W. L. Tobey, Chn. Bldg. Com., Miami University, until Oct. 19 for pavilion.

Flood Gates—East St. Louis, Ill.—Press reports state that new flood gates will be constructed at mouth of Cahokia Creek.

Tunnel—Woodward, Iowa—Bids will be received by F. S. Treat, Secy., State Bd. Control, about Oct. 4 for tunnel at State Epileptic Farm. Estimated cost, $20,000.

Levee—Blytheville, Ark.—Board of Commissioners St. Francis Levee District voted $100,000 bonds for levee work.

Levee—South Bend, Ark.—Bids will be received until Oct. 4 by Linwood and Auburn Levee Board, Varner, for levee at South Bend. Work includes about 65,000 cu.yd. of earth. C. C. Price, Dumas, Engr.

Wharves, Docks, Etc.—Orange, Tex.—Plans being prepared for municipal slips, wharves, docks and other improvements. Noted Aug. 5.

Seawall—Port Arthur, Tex.—Preliminary plans being prepared by J. F. Coleman, Consult. Engr., New Orleans, La., for seawall at Port Arthur.

Tunnel—Seattle, Wash.—Construction of Norman St. tunnel to cost $412,590 recommended to Port Commission.

Bulkhead and Walk—Longbeach, Calif.—Plans being prepared by Charles Voorhies, Engr., 188 Montague St., New York, N. Y. (Borough of Brooklyn),, for bulkhead and walk along west beach.

Bids In and Contracts Awarded

Dredging—Barnstable, Mass. Contract awarded to JOHN R. BURKE, 78 Devonshire St., Boston, at $8,424, for dredging in Lewis Bay.

Dredging—Waltham, Mass.—Contract for dredging in Charles River from Elm St. to Bleachery Dam awarded to JOHN R. BURKE, 78 Devonshire St., Boston, at $14,100. Noted Sept. 16.

Pier Shed—New York, N. Y.—(Borough of Brooklyn)—(Official)—Department of Docks and Ferries awarded contract for pier shed at 29th St. to McHARG-BARTON CO., 171 Madison Ave., Borough of Manhattan.

Structural Steel—New York, N. Y.—(Borough of Brooklyn)—Public Service Commission awarded contract to PHOENIX BRIDGE CO., 49 William St. (Borough of Manhattan), for structural steel for third-tracking Myrtle Ave. elevated railroad from Broadway to Wyckoff Ave., at $40.50 per ton.

Pier Shed—New York, N. Y.—(Borough of Manhattan)—(Official)—Contract awarded to T. J. WATERS CO., 271 West 125th St., New York, at $37,000, by Department of Docks and Ferries, for pier shed at 23d St. and North River. Noted Sept. 16.

Barge-Fuel Flats—Cincinnati, Ohio—Contract for four steel fuel flats and two steel barges for Ohio River Improvement, Cincinnati District, awarded STACEY MFG. CO., Cincinnati, at $34,848.

Elimination of Grade Crossiug—Cleveland, Ohio—Contract for excavation work for Union Ave. grade crossing awarded to ROBERT GRACE CO., at $103,273; steel work, to KING BRIDGE CO., at $34,892.

Comfort Stations—Columbus, Ohio—Director of Public Service awarded contract for comfort stations to STANDARD PAVING CO., at $17,818. Noted Aug. 5.

Creek—Crystal Falls, Mich.—Bristol Mining Co. awarded contract for changing course of Briar Hill Creek to HICKS & BARBER, Vulcan.

Steamers—Galveston, Tex.—Contract for salvaging six steamers at Galveston and Texas City awarded to HENDERSON IRON WORKS, Mobile, at $272,000.

Block Signals—Oakland, Calif.—Contract for automatic block-signal system and interlocking plant for San Francisco, Oakland Terminal Rys., awarded to UNION SIGNAL CONSTRUCTION CO., Swissvale, Penn., at $36,500.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Proposed Work

Maine, Portland—School Board revising preliminary plans for high school, and they will be redrawn by Miller & Mayo, Arch. Noted Aug. 12.

Mass., Worcester—Plans being prepared by George C. Halcott, Supt. of Pub. Bldgs., for two-story, brick ward building at Belmont Hospital. Estimated cost, $50,000.

R. I., Providence—Bids will be received until 2:15 p.m., Oct. 4, by city for police station at Wayland Ave. and Sessions St. William C. Pelkey, Clk.

Conn., New Haven—Music building will be built at Yale University as memorial to Albert Arnold Sprague, Chicago, Ill.

N. Y., New York—(Borough of Bronx)—N. Serracino, Arch., 1170 Broadway, Manhattan, prepared plans for church at East 187th St. and Tiebout Ave. for East 187th St. United Presbyterian congregation. Estimated cost, $40,000.

N. Y., New York—(Borough of Brooklyn)—Bids will be received about Nov. 1 by Park Commisison for two-story lecture hall and greenhouse extension for Brooklyn Botanic Garden. McKim, Mead & White, 101 Park Ave., New York, Arch.

N. Y., New York—(Borough of Manhattan)—Plans prepared by Berlinger & Moscowitz, 527 Fifth Ave., for temple for Mount Neboh congregation at 150th St., near Broadway. Estimated cost, $80,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Crow, Lewis & Wickenhoeffer, 200 Fifth Ave., prepared plans for 12-story, 125x125-ft. reinforced-concrete loft at 318 39th St., for 324 West 39th St. Corporation.

N. Y., New York—(Borough of Manhattan)—Plans being prepared by Joseph C. Schaeffler & Co., 38 West 32nd St., for two-story store and office building at 1604 Broadway for Fleischmann Co., 701 Washington St. Estimated cost, $50,000.

N. Y., Syracuse—Bids will be received until Oct. 4 for Delaware school at Delaware and Geddes St. D. R. Roney, Bd. of Contract and Supply. Noted Sept. 2.

N. J., Atlantic City—Bids will soon be received by M. H. Dickinson, Arch., Philadelphia, Penn., for one-story concrete and brick building for Morris Amusement Co. at Chelsea.

Penn., Philadelphia—Bids will be received about Oct. 15 for four-story, brick and marble building at 833 Market St. for Blauner & Co., Inc. Estimated cost, $110,000. Hoffman Co., Arch.

Md., Baltimore—Plans prepared by Joseph Evans Sperry, Arch., Calvert Bldg., for seven-story, 69x141-ft. Y. W. C. A. I. F. Harmon, Secy.

D. C., Washington—Marsh & Peter, 520 14th St., preparing plans for building at Tennallytown Rd and Rockville Pike for Georgetown University. A. J. Donlan, Pres. Estimated cost, $300,000.

Va., Lexington—(Official)—Bids will be received until 10 a.m., Oct. 11, by Building and Grounds Committee of Board of Visitors, Virginia Military Institute for three-story brick building for Virginia Military Institute. M. B. Corse, Secy.

Va., Roanoke—Bids will be received until Oct. 8 by Roanoke Auditorium Co. for one-story and basement, 100x200-ft. auditorium and convention hall. Estimated cost, $50,000. H. M. Miller, Roanoke, Arch.

W. Va., Triadelphia—F. F. Farris, 420 Schmulbach Bldg., Wheeling, preparing plans for two-story and basement school. Estimated cost, $125,000. S. S. Jacob, Jr., Secy., Bd. of Education.

Ga., Macon—(Official)—Bids will be received until Oct. 12 by Alfred Fellheimer, 7 East 42 St., New York, N. Y., for three-story, 84x245 ft. main station, 54x112-ft. baggage building and 54x132-ft. express building for Central of Georgia R.R. Co. Estimated cost, $1,000,000.

Ky., Louisville—Bids will be received until 3 p.m., Oct. 8, by Samuel D. Jones, Bus. Dir., Bd. of Education, for alterations and addition to Central Colored High School at Ninth and Chestnut St. J. Earl Henry, Arch.

Ohio, Akron—(Official)—Bids will soon be received for club house for Firestone Tire & Rubber Co. Building will be four-stories, 125x145-ft. Trowbridge & Ackerman, 62 West 45th St., New York, N. Y., Arch. Estimated cost, $175,000.

Ohio, Cincinnati—Louis Braudy, Pres. of Jumbo Cone Co., will build department store at Plum and Sixth St. Estimated cost, $60,000.

Ohio, Cleveland—Walker & Weeks, 1900 Euclid Ave., Cleveland, has prepared plans for two-story bank and office building at St. Clair Ave. and East 79th St., for Garfield Savings Bank. Estimated cost, $50,000.

Ohio, Columbus—Frank Packard, New Hayden Bldg., Columbus, preparing plans for eight-story office and commercial building at High and Wall St. Estimated cost, $300,000.

Ohio, Findlay—(Official)—Bonds for $100,000 have been sold by county for county infirmary building. Jean C. Copeland, County Comn. Clk. Noted Sept. 2.

Ind., Sulivan—County Council contemplates building courthouse for Sullivan County. Estimated cost, $200,000. John Mattix, Comr.

Wis., Milwaukee—Bids will be received about Oct. 15 by Frank M. Harbach., Secy., Bd. of Education, for public school on 15th Ave. Estimated cost, $80,000.

Wis., Neenah—Plans submitted by Edward Bergstrom, Arch., Los Angeles, Calif., for hotel for Merchants and Manufacturers Hotel Co. Frank J. Sensenbrenner, Pres. Estimated cost, $100,000.

Wis., Oshkosh—Bids will soon be received by State Board of Normal Regents, Madison, for normal school at Oshkosh. Estimated cost, $70,000. William Kittle, Madison, Secy.

Wis., Racine—Methodist Episcopal Conference plans church at University of Wisconsin. Estimated cost, $100,000.

Wis., Waukesha—City Council petitioned by Board of Education to appropriate $75,000 for new high school and $20,000 for grade school and $25,000 for central heating plant for three schools. J. M. Kerr, Secy.

Iowa, Waterloo—School Board plans to rebuild Hawthorne school at estimated cost of $75,000. W. H. Brunn, Secy.

Minn., Duluth—Knights of Columbus will build lodge at econd St. near Third Ave. Estimated cost, $75,000.

Minn., Minneapolis—Frank J. Mackey will build 13-story fireproof hotel on site of Hotel Nicollet.

Kan., Coffeyville—Citizens voted $55,000 bonds for improvements to schools.

Neb., Omaha—Harry Lawrie preparing plans for motion picture theater. Estimated cost, $150,000.

Wyo., Riverton—Plans being prepared for seminary for Episcopal Church of Wyoming. B. S. Thomas, Cheyenne, Bishop. Estimated cost, $100,000.

Mo., Carthage—Citizens of Jasper County voted in favor of $100,000 bond issue for sanitarium for tuberculosis patients. Noted Aug. 5.

Mo., Kansas City—Moshey Zkeniem Society contemplates home for aged. S. M. Cohen, 1425 Locust St., Representative. Estimated cost, $50,000.

Mo., St. Louis—Waterways Committee recommends municipal block. Estimated cost, $250,000.

Tex., Denison—Y. M. C. A. contemplates association building at estimated cost of $100,000.

Utah, Salt Lake City—Plans being prepared for normal and industrial building for University of Utah. Estimated cost, $55,000. J. T. Kingsbury, Pres.

Wash., Seattle—Plans being prepared for five-story, 60x120-ft., reinforced-concrete addition to Raleigh Hotel, Fourth Ave. and Pike St. for Northern Bond & Mortgage Co. Estimated cost, $75,000.

Ore., Marshfield—Plans being prepared by Houghtaling & Dougan, Portland, for three-story brick building for Elks' Lodge. Estimated cost, $60,000.

Ore., Portland—F. A. Naramore, Portland, prepared tentative plans for Benson Polytechnic School for School Board. Estimated cost, $600,000.

Calif., Santa Barbara—Presbyterian Church secured a site on Anapamu St. and will build edifice at estimated cost of $60,000. Bert Moore, C. A. Black and others, Bldg. Com.

Ont., Toronto—International Petroleum Co., Dominion Bank Bldg., will build office building. Estimated cost, $150,000. H. F. Miller, Mgr.

Bids In and Contracts Awarded

N. H., Concord—Contract awarded to HUTCHINSON BUILDING CO., at $63,650 for addition to State Hospital.

Mass., Fall River—Contract awarded to CHARLES E. CURRIER CO., 110 Summer St., Boston, at about $125,000, for hospital for Stephens Clinic Union Hospital, Fall River.

Mass., Milford—Dillon Bros., Milford, at $69,873, was low bidder for brick construction, and P. L. Sarty, Milford, at $77,727, was low bidder for granite construction, for school. Noted Aug. 5.

Conn., Greenwich—Contract awarded to J. W. BISHOP CO., New York, N. Y., for hospital at Lake and Lafayette Pl., for E. C. Benedict as a gift to city and to CALDWELL-WINGATE CO., 381 Fifth Ave., New York, N. Y., for masonry. Estimated cost, $200,000.

Conn., Hartford—Contract awarded to F. KAPLAN & SON, Hartford, at about $40,000, for apartment and store for M. S. Sheketoff.

N. Y., Binghamton—Contract awarded to BINGHAMTON BRIDGE CO., Press Bldg., by Carlton Hotel Co. for five-story hotel at 118 Chenango St. E. W. Rickerman, Perry Bldg., Arch.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to WILLIAM L. CROW CONSTRUCTION CO., 103 Park Ave., at $200,000 for 90x100-ft. church at 92d St. and Amsterdam Ave. for Central Baptist Church. Noted Aug. 12.

N. Y., New York—(Borough of Manhattan)—Contract awarded to MARMAC CONSTRUCTION CO., 316 West 30th St., Manhattan, for three-story, 65x100-ft. loft at 36 West 29th St., for Mrs. M. Aareira, 106 Sixth Ave.

N. Y., White Plains—(Official)—Contract awarded to JOHN T. BRADY & CO., 103 Park Ave., New York, at $494,740, for addition to courthouse. Noted Aug. 19.

N. J., Bayonne—(Official)—Contract will be awarded about Oct. 15 for two-story, 50x70-ft. brick building for New York Telephone Co., 15 Dey St., New York, N. Y., at Broadway and East 39th St., Bayonne H. C. Carpenter, 25 Dey St., New York, N. Y., Arch. Estimated cost, $45,000.

N. J., Englewood—Kelly Construction Co., at $130,000, was low bidder for school on Engle St. near Palisade Ave. for Board of Education.

N. J., Newark—Contract awarded to R. W. PATRICK, 100 Montclair Ave., Newark, for three-story, 50x100-ft., school at 31 Mulberry St., for St. Johns R. C. Church.

Penn., Fairview—Contract awarded to P. J. HURLEY CO., Bayside, N. Y., at about $300,000, for three buildings for Criminal Insane.

Penn., Hanover—(Official)—Contract awarded to O. H. HOSTETTER, Hanover, for high school. Noted Sept. 16.

W. Va., Beckley—Contract awarded to D. J. PHIPPS, Roanoke, Va., by Commissioners of Raleigh County for three-story, 42x80-ft. jail for county. Estimated cost, $40,000.

S. C., Columbia—Contract awarded to GEORGE W. WARING, Columbia, at $97,979, for high school.

Tenn., Nashville—Contract awarded to SOUTHERN FERRO CONCRETE CO., Atlanta, Ga., at about $125,000, for three-story office building for Nashville Property Co.

Ky., Louisville—Contract awarded to BAILEY & KOERNER, Louisville, at about $250,000, for ten-story addition to Tyler Hotel on Jefferson St. Noted Aug. 12.

Ohio, Canton—Contract awarded to J. L. VAN KIRK & SONS, Canton, at about $40,000, for chuck for First Congregational Church.

Ohio, Cincinnati—Contract awarded to J. B. SCHMIDT, Cincinnati, for remodeling Washburn and Lincoln Public School. Noted Aug. 19.

Ohio, Cincinnati—Contract awarded to WILLIAM MILLER & SON, 2023 Elm St., Cincinnati, for addition to manual training department of Oyler School. Noted Aug. 26.

Ohio, Cleveland Heights—(Warrensville post office)—Contract awarded to FATH CONSTRUCTION CO., Illuminating Bldg., Cleveland, at about $100,000, for Masonic Temple at Mayfield and Lee Rd.

Mich., Saginaw—Contract awarded to NELSON & LEWIN, 30 North La Salle St., Chicago, Ill., for Bancroft Hotel.

Ill., Peoria—Contract awarded to KUHNE & MENELEY, Rantoul and Champaign, Ill., at about $45,000 for two-story and basement brick church for Central Christian Congregation.

Wis., Milwaukee—(Official)—Contract awarded to DAHLMAN CONSTRUCTION CO., 912 Majestic Bldg., Milwaukee, for six-story building at Chicago and Milwaukee St. P. F. Leuch, City Clk. Noted Sept. 16.

Wis., Neenah—Contract awarded to FRAZIER-GRIENKE CO., Appleton, for edifice for St. Thomas Episcopal Church.

Wis., West Allis—Contract awarded to ROBERT L. REISINGER & CO., West Allis, for edifice for Holy Assumption congregation. Noted Aug. 26.

Iowa, Hudson—Contract awarded to F. W. CHAPMAN, Waterloo, at $40,000, for school for Consolidated School District.

Iowa, Iowa City—Contract awarded to CHARLES FRANKLIN, Iowa City, at $125,000, for dentistry building for University of Iowa.

Iowa, Orange City—Contract awarded to H. A. MAINE CO., Waterloo, at $40,000 for two-story brick school.

Minn., Minneapolis—Contract awarded to J. & W. A. ELLIOTT, Lumber Exchange, at about $50,000, for three-story, 43x120-ft. brick hospital at 2001 Western Ave. Noted Aug. 12 and 19.

Minn., Minneapolis—Contract awarded to PIKE & COOK, at $125,000, for addition to Ashbury Hospital.

Kan., Paola—Contract awarded to WIMMER CONSTRUCTION CO., Victoria Bldg., St. Louis, Mo., at about $70,000, for three-story, 80x87-ft., building for Ursuline Academy.

Neb., Lincoln—Contract awarded to W. J. ASSANMACHER CONSTRUCTION CO., Lincoln, at $75,000, for two-story, reinforced-concrete theater for Orpheum Theater Co.

Wyo., Cheyenne—Contract awarded to J. W. HOWARD, Cheyenne, at $140,790, for two additional wings to Wyoming State House. Noted Aug. 19.

Mo., Kansas City—Contract awarded to GEORGE L. BROWN & SON, 1300 Rialto Bldg., for home for aged for G. H. Nettleton Home Association near Swope Park, at about $90,000.

Tex., San Angelo—Contract awarded to WILLEKE BROS., at $54,176, for high school. Noted Sept. 2.

Wash., Grand Mound—Contract awarded to S. C. ERICKSON, at $49,741, for brick addition to State School for Girls. Noted Aug. 26.

Calif., Oroville—Western Building & Engineering Co., San Francisco, at $43,843, was low bidder for Hall of Records for county.

Calif., San Pedro—Contract awarded to CRESMER MFG. CO., Riverside, at $79,740, for Fifth St. school. Noted Aug. 5.

Contracts to Be Let

Bids received until Oct. 26, 1915.

Barge Canal Terminals

STATE OF NEW YORK

OFFICE OF SUPERINTENDENT OF PUBLIC WORKS

Albany, September 22nd, 1915.

NOTICE TO CONTRACTORS:—

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Tuesday, October 26th, 1915, at which place and hour they will be publicly opened and read, for the construction of Barge Canal terminals pursuant to the provisions of Chapter 746 of the Laws of 1911, and amendatory laws, as follows:

1. TERMINAL CONTRACT NO. 20

channel to Onondaga lake, piers, dockwalls, a spillway and a highway bridge at Syracuse.

Contract plans, sheets 1 to 29.

2. TERMINAL CONTRACT NO. 50.

For grading a terminal site and approach at Holley.

Contract plans, sheets 1 and 2.

Plans may be seen and detailed specifications, engineer's estimate of quantities proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y.; at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany or the city of New York, issued by a national or state bank, or trust company, in good credit within the State and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds, co-insurance only will be accepted.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the State will be enhanced thereby.

W. W. WITHERSPOON,
Superintendent of Public Works.

Bids received until Oct. 12, 1915.

Water-Works Improvements and Electric Light System

Lumberton, N. C.

Sealed proposals will be received by the Mayor and Board of Commissioners of Lumberton, N. C., at the Town Hall, Lumberton, N. C., until 3 p.m., October 12th, for Waterworks Improvements, and for new Electric Light System.

The Waterworks Improvements consist of two concrete tub filters, brick house, concrete coagulating basin, all pipesand filter equipment, and centrifugal pumps.

The Electric Light System consists of replacing present D. C. system with about six miles of 2200/220 volt primaries and secondaries, series tungstan street light system, switchboard and transformers.

Proposals must be marked "Proposal for Waterworks," or "Proposal for Electric Light System."

Each proposal must be accompanied by a certified check for at least five per cent. of the gross amount of the bid, as an evidence of good faith.

Plans, specifications and Proposal Form may be procured from the office of the Engineer by the payment of Five Dollars ($5.00) which will be returned to those who submit regular bids accompanied by said Plans. Applicants for Plans must state the portion of the work upon which they expect to bid.

Specifications may be seen at the office of the Mayor at Lumberton, N. C., or at the office of the Engineer.

The right is reserved to reject any or all bids.

A. E. WHITE, Mayor.

Engineer: GILBERT C. WHITE, Charlotte, N. C.

Bids received until Oct. 4, 1915.

Steel Bridge

OFFICE OF BOARD OF COMMISSIONERS

Greenville, Pitt County, N. C.

Sealed proposals for a small Steel Bridge, wood floor with concrete abutments on piling will be received by the Commissioners, at their office in the Pitt County Court House, on Monday, October 4, 1915, and there publicly opened.

Plans and Specifications may be obtained from the Clerk of said Board or W. C. Dresbach, Civil Engineer, Greenville, N. C., by leaving a deposit of $2.00, for their return in good condition.

A certified check for 5% of the bid must accompany each proposal as an evidence of good faith, same to be returned to bidder.

The successful Bidder will be required to furnish a satisfactory Bond in the sum of 40% per cent. of the cost of the Bridge for the true performance of the Contract and Specifications.

The right is reserved to reject any or all Bids and to award the Contract upon other considerations than that of price alone.

This, the 25th day of September, 1915.

BRASCOE BELL, Clerk,
Board of Comrs. of Pitt County, Greenville, N. C.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., September 21, 1915.—Sealed proposals will be opened in this office at 3 p.m., November 1, 1915, for the construction complete (including mechanical equipment and approaches) of the United States post office at Merrill, Wis. Two-story-and-basement building; ground area, 5,244 square feet; fireproof construction. Drawings and specifications may be obtained from the custodian of site at Merrill, Wis., or at this office, in the discretion of the Supervising Architect. JAS. A. WETMORE, Acting Supervising Architect.

Construction News

PRICE CHANGES AND THE BUSINESS OUTLOOK

The long-waited-for business improvement which the present Administration has been promising for so long seems as if it is to be forthcoming. Conditions at this time in almost every line are better than for the past year. The railroads are ordering new equipment and are very short of freight cars, which is one of the best indications we have of a general movement in all lines. Building conditions leave much to be desired, particularly in the field of residences and private plants, but this is more than made up by the big amount of business being done in the steel line and all products being used by the Allies.

The successful outcome of the $500,000,000 loan to the Allies gives us an opportunity of getting rid of our surplus in all lines, which would have been a serious matter if it had not been floated. Exports for the past year show that the Allies used over $800,000,000 worth of actual necessities from this country, and if the loan had not been put through the rate of foreign exchange probably would have dropped to such a degree that it would have been almost prohibitive for the Allies to continue purchasing here.

The money situation around New York City is very easy. Domestic trade and industry as well as import and export activities are on such a restricted basis that supplies of funds are altogether in excess of requirements. Arrangements for funds have been made for six months as low as 3%. The crop situation in the West has not affected Eastern money as much as usual, as the Western banks have been so well supplied that they have not found it necessary to call on New York for their balances or advances.

The iron and steel trade are turning out as much stuff as it seems possible to do. The railroads are working on their 1916 requirements for rails, and a great many of them have already placed their orders. Among others, the New York Central has closed for about 120,000 tons. The plate mills are figuring on 12,000 to 15,000 cars for the railroads, besides which the Pressed Steel Car Co. is now filling an order for Russia for 7,000 cars. Shipbuilding seems to be picking up, as pretty nearly all the large concerns are now figuring on jobs which will take from 3,000 to 5,000 tons each besides orders already on hand. The Pittsburgh district reports that the general position of the steel mills is that they have shipping orders in hand for more than one-half of their maximum output to Jan. 1, with orders coming in at a rate fully equal to current shipments, which means that they are assured of being busy for months to come.

This activity in the steel market of course reflects its influence on the pig-iron market. This is shown by the highest price quoted for pig iron for the past two years. Not since the war first started have there been as many rumors as at present of a great variety and number of proposed deals for new industrial combinations and for additions to plant capacity, based upon the large profits growing out of war orders. Practically all of the leading iron and steel companies in the country have been mentioned in connection with some merger or other. In some cases, the stories have been used as a basis for advancing stock prices, and in others have been offered as an explanation for the advance.

The Federal Reserve Board made a report for the last thirty days for their twelve districts showing an improvement in nine of them. Only Philadelphia reflected a pessimistic outlook. The New York district seemed to have a better outlook for fall and winter trade than any of the other districts.

New York City building permits for August, 1915, just about doubled over August of a year ago, with an increase of over $3,500,000. New York State failures decreased 57 in number over a year ago, with $22,000,000 less liabilities. All of these figures tend to show improved conditions. Subway work in New York City is very nearly all under way, about $160,000,000 worth of contracts having been let, which leaves a balance of about $4,000,000 to be let some time in the near future. Some time this month bids will be opened for 80,000 tons of steel. On Oct. 15 the Commission will open bids for the supply of frogs and switches for all new lines, and on the 26th for finished work for stations on the different lines, which will require about 40,000 tons of steel.

Estimates of the crops throughout both the country and the world show that we are having the largest yield ever reported. Figures given by experts show about 600,000,000 more bushels of various grains than last year.

We will have something over 400,000,000 bushels of wheat to sell abroad, provided our credit is arranged soon enough, so that it can be sold before the other countries which have a proportionate increase in crops this year get a chance to market theirs. With this large increase, prices will naturally be lower than last year, but still should net the farmer a good profit.

The brick market seems to be better than for some little time in the past, the market having been pretty nearly cleaned out during the last few days. There has been a small advance in price, with prospect of a further increase. The cement market does not seem to be as steady as a month ago, prices being a little lower, with more cutting by the smaller concerns.

CEMENT, LIME AND BRICK

Brick—During the month the market advanced and declined practically every week. Though no very heavy sales are reported, conditions since last month have improved. At this writing, manufacturers report that further advance is due to take place very shortly. Prices show a decided advance over last month, the following being asked: Hudson River brick, $6.50 to $7; Raritan, $6. These prices are wholesale at the dock, New York.

Portland Cement—Business during the month continues fair although some of the larger manufacturers complain because of the price-cutting done in some territories. In some sections the prices have advanced and are as follows:

Chicago	$1.41	Toledo	$1.34
Pittsburgh	1.41	Milwaukee	1.38
Cleveland	1.45	Minneapolis	1.48
Detroit	1.32	St. Paul	1.48
Indianapolis	1.34	Duluth	1.51
Jersey City	1.06	Peoria	1.29
New York	1.12	Cedar Rapids	1.40
Boston	1.27	Davenport	1.30

The above prices are exclusive of package and are for carload lots, f.o.b. cars at places named. In New York to contractors the price is $1.57, Jersey City $1.51, and at Boston $1.72. These prices are for cargo lots and include the charge for bags.

To dealers, manufacturers quote as follows: In cloth bags f.o.b. Jersey City, $1.46; alongside dock, New York, $1.52; Boston, $1.67.

Labor—On account of the lack of emigration to this country, there is very little supply and a consequent large demand for unskilled labor. Local agencies report that it is almost impossible to get men to go out of town for less than $2 for an 8-hr. day and they are very hard to pick up at this price as there are plenty of opportunities in New York City. There seems to be very little call for experienced men in the building-trades line, and the supply far exceeds the demand. Experienced machine-shop men are almost impossible to obtain without paying a large price, and these are very scarce.

Crushed Stone—Although no decided improvement has been shown in the market, quotations are higher than they were a month ago, and dealers are enabled to maintain a firmer stand. On fair-size contracts calling for immediate shipment for 1½-in. crushed stone the price ranges from 75 to 80c. On ¾-in., 85 to 90c. is asked. Quotations for future shipment are not given for publication, due to the fact that higher prices may be demanded, and dealers do not like to be bound by low-figure contracts. The Public Service awarded two contracts during the month calling for about 300,000 cu.yd. of material. Another contract requiring about 80,000 cu.yd. of traprock of hard limestone which had been awarded on the advice of the engineers, the Commission decided to readvertise the contract, bids for which will be opened on Oct. 15.

Sand and Gravel—Business conditions are very good around New York City, dealers having no complaints to make. Sand is quoted at 45c. per cu.yd., some dealers asking only 40c. Gravel prices are as follows: Subway, 95c. per cu.yd., and paving gravel at 75c. per cu.yd. These quotations are for full cargo lots of 500 cu.yd. delivered alongside of dock New York.

IRON AND STEEL

Pig Iron—The buying of pig iron during the month has been considered very fair, and in practically all districts there have been advances in the price. On future deliveries there is a decided tendency to increase the price, and buyers entering the market now are facing these increased charges. During the latter half of the month, more interest was taken in the purchase of malleable and other irons for the making of railroad supplies. More inquiries are appearing each week for foreign shipments, and some fair-sized orders have developed as a result. In Pittsburgh, buying has not been as heavy as might be expected, but nevertheless prices have shown a slight advance. Bessemer iron is quoted at $16.95 and basic is now $15.95. The above quotations include the freight charges from the valley to the Pittsburgh district. In Cincinnati, prices remain stationary as follows: Cincinnati Southern Foundry No. 2, $14.40 to $15.40; Cincinnati Northern Foundry No. 2, $15.76 to $16.01; Cincinnati Northern Foundry No. 3, $15.51 to $15.76. In New York business has been fair during the month and prices are a little stiffer as follows: Northern Foundry No. 2, plain is $15.75 to $16.00, and No. 2X $16.25 to $16.50. In the Chicago districts, prices have advanced for the last month, and the market is apparently very much stronger. Prices following are f.o.b. furnace, and for switching charge the average is 50c. per ton. Northern Foundry No. 1 is $14.75 to $15.25, and Northern Foundry No. 2 is $14.25 to $14.75. In Birmingham, prices have advanced $1 per ton, and the present situation evidently points to a further increase. For spot and 1916 delivery, f.o.b. furnaces the price for Southern Foundry No. 2 is $12 to $12.50; No. 1 Southern Foundry is selling at $12.50 to $13.

Steel Rails—Very active buying has been noticed in the rail market, and practically all the principal companies have entered orders for fair tonnages and makers look forward to a heavier demand during the coming year. Some railroads are endeavoring to place contracts for delivery late in the year 1916. There has been some foreign demand for light rails, also considerable interest has been shown by the coal-mine operators for these sections. Railroad companies, not yet in the market, are busy working on specifications, and manufacturers are figuring on reserved rolling space. It is estimated that the bookings of the Steel Corporation for the month of September in steel rails amount to somewhere in the neighborhood of 150,000 tons. Quotations, however, are without change, and for lots of 1,000 tons or over, prices are as follows: Standard sections of bessemer, $28; openhearth, $30;

both per gross ton f.o.b. Pittsburgh. Girder rails in 30-ft. lengths are $36.40; in 60-ft. lengths, $38.40 per gross ton, both f.o.b. New York. Other quotations f.o.b. Pittsburgh for large lots, prices given in cents per lb., are as follows: Standard sections bessemer, $1.25; openhearth, $1.34; light rails are quoted as follows: 25- to 45-lb. sections, $1.25; 16- to 20-lb., $1.30; 12- to 14-lb., $1.35; 8- to 10-lb., $1.40. These are for carload or larger lots. An advance of 5c. per 100 lb. is charged for less than carload lots.

Track Supplies—Inquiries are now appearing from many of the railroads for furnishing spikes. Although business has not been as good as might be expected, manufacturers look to a brighter future, and due to the advanced prices of steel, quotations on this material were well maintained during the month. Spikes are now quoted at $1.60 per keg. This is for standard railroad sizes f.o.b. Pittsburgh, small railroad and boat spikes being held at $1.70 per 100 lb. f.o.b. Pittsburgh. Track bolts and square nuts are quoted at $2.10 in carload lots; standard section angle bars are quoted at $1.50 base f.o.b. Pittsburgh. Track bolts at Chicago are quoted at $2.10 to $2.25, and tie plates at $30 to $32.

Plates—Manufacturers report that they are booking more orders and are eagerly looking toward more work in the future. Some business is being placed by the car manufacturers and the government has opened bids for some plate shapes for naval improvement at the different navy yards. Although some makers claim to have made sales at lower figures than are generally quoted, prices show an advance of $1 per ton and are quoted $1.40 at the mill, Pittsburgh. This is equivalent to $1.439 in Chicago. In this city delivery of plates from stock is charged at the rate of $1.85 per 100 lb. Philadelphia is $1.509 to $1.559, New York $1.569. From store the price is $2.05 to $2.10.

Structural Material—A more steady flow of business is apparent and manufacturers are trying to hold to a more steady price. No large size orders are conspicuous, but in general small orders are being turned in with more regularity. Industrial plants are still constructing additions and prices are based on $1.40 Pittsburgh, and at this rate prices in various districts are well maintained. This includes I-beams 3 to 15 in., channels 3 to 15 in., angles 3 to 6 in., T's, 3 in. and over. Cutting to specified lengths is charged at the following rates: 2 to 3 ft. inclusive, 25c.; 2 ft. to 1 ft., 50c.; under 1 ft., $1.55. No charge is made for cutting to specified lengths over 3 ft. In Philadelphia the base price is $1.559. Small lots of stock are selling at least $1 or $2 per ton higher. In New York the base price is $1.559. Small lots are quoted at $2.05, $2.10 from store. In Chicago the delivery from mill is $1.639 and from stock $1.90. In San Francisco the base price is $2. All these quotations are per 100 lb.

Pipe—Although prices remain the same as a month ago, on very desirable orders discounts are very often shaded. This holds especially true for the galvanized material. It is believed that the manufacturers are not operating to over 65% of capacity. For carload lots f.o.b. Pittsburgh, the following discounts hold:

	Black	Galvanized
¾- to 2-in. steel, butt welded	79%	63½%
2½- to 6-in. steel, lap welded	78%	62½%
7- to 12-in. steel, lap welded	76%	58½%

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
¾-in	2.43	4.19	5-in	32.56	55.50
1-in	3.57	6.20	6-in	42.24	72.00
1¼-in	4.83	8.39	7-in	57.12	98.77
1½-in	5.77	10.03	8-in	60.00	$1.03
2-in	7.77	12.55	9-in	82.80	1.43
2½-in	12.87	21.93	10-in	98.99	1.70
3-in	16.83	28.68	11-in	$1.11	1.92
4-in	23.98	40.87	12-in	1.21	2.10

Sheets—The market for sheets is rather fair. The demand in general is only moderate, although from the electrical companies the buying has been a little heavier than usual. It has also been noticed that the demand for blue annealed is more active. In galvanized sheet consumers do not appear to be laying in a supply, and the reason for this seems to be that they are worried over the price of spelter. The quotations below are for large lots of sheets f.o.b. Pittsburgh and small lots from stores in New York.

	Cents per Pound: Large Lots Pittsburgh Black	Large Lots Pittsburgh Galv.	Warehouse Delivery New York Black	Warehouse Delivery New York Galv.
No. 10	1.55	2.60	2.20	....
No. 12	1.55	2.70	2.25	4.15
No. 14	1.60	2.70	2.30	4.15
No. 16	1.65	2.80	2.40	4.25
Nos. 16 and 20	1.70	2.90	2.50	4.60
Nos. 22 and 24	1.75	3.15	2.55	4.55
No. 26	1.80	3.30	2.60	4.70
No. 27	1.85	3.45	2.65	4.90
No. 28	1.90	3.60	2.70	5.00

Cast-Iron Pipe—Prices are well maintained and show a slight advance over last month. Quite a few inquiries are being received, but actual orders and contracts are not being placed in any great number. In New York prices have advanced one dollar and are quotable as follows: On 6-in. Class B and heavier, $24.50 to $25 per net ton tidewater in carload lots; Class A, $25.50 to $26; the latter price also applying to gas pipe. Although in the Birmingham district the prices advanced 50c. per ton, the market is rather dull. Quotations f.o.b. yard are as follows: 4-in., $22; 6-in. and upward, $20; on gas pipe one dollar per ton is added. In Chicago few orders of any importance can be found. Northern prices are stronger and have advanced one dollar per ton. The following are the quotations per net ton, Chicago: 4-in. pipe, $27; 6-in. and larger, $25; for Class A water pipe and gas pipe one dollar extra is added.

Steel Sheet Piling—Conditions are the same as a month ago and prices remain steady at $1.55 to $1.60 per 100 lb., f.o.b. Pittsburgh.

Old Material—On heavy melting steel scrap the transactions toward the end of the month were not so heavy. In some instances prices have shown a slight advance over last month and are apparently very firmly held. It is to be noted, however, that no evidence of real weakness is apparent, although consumers are holding off in an effort to secure lower prices. Dealers in New York furnish the following quotations:

	Per Gross Ton
Heavy-melting steel scrap	$12.25 to $12.50
No. 1 railroad wrought	14.00 to 14.50
Stove plate	9.75 to 10.00
No. 1 machinery cast	12.75 to 13.00
Wrought turnings	8.00 to 8.50
Cast borings	8.00 to 8.50
Railroad malleable cast	10.00 to 10.50
No. 2 heavy cast	11.75 to 12.00

In Chicago very little activity is discernible. Sellers of stock seem very anxious to dispose of it as soon as possible and such being the case the market is held back to a certain extent. Due to the lack of interest some prices have fallen off a little, others remaining practically the same during the month. The following prices hold good in this territory:

	Per Gross Ton
Heavy-melting steel scrap	$11.75 to $12.25
	Per Net Ton
No. 1 railroad wrought	$11.00 to $11.50
No. 2 railroad wrought	10.50 to 10.75
No. 1 cash scrap	10.00 to 10.50
Pipes and flues	9.80 to 9.00
Agricultural malleable	9.00 to 9.50
Railroad malleable	10.25 to 10.75
Cast borings	6.50 to 7.00

Chain—More orders are now appearing, and manufacturers report a heavier volume of business than over the same period last month. Prices, however, remain steady and without change as follows: These prices are per 100 lb. f.o.b. Pittsburgh:

3/16 in.	$7.50	½ and 9/16 in.	$3.00
¼ in.	4.95	5/8 and 11/16 in.	2.90
5/16 in.	3.95	¾ and 13/16 in.	2.80
3/8 in.	3.40	7/8 and 15/16 in.	2.70
7/16 in.	3.20	1 to 1¼ in.	2.60

EXTRAS TO ABOVE LIST PER 100 POUNDS

	For BB	For BBB
3/16-in. and ¼-in.	$1.50	$2.00
5/16-in. and larger	1.25	1.75

Wire Rope—The demand still continues good and the prices remain unchanged from last month. On galvanized the discount is 40 and 5% off list. On bright it is 55 and 5%; special brand brights are selling at 50 and 5% off list. At these discounts, the net price of wire rope at the mills is as follows:

Diameter in Inches	Price per Foot: Cast Steel	Crucible Steel	Plow Steel
2½	$0.75	$0.90	$1.07
2¼	0.61	0.73	0.86
2	0.47	0.57	0.67
1¾	0.39	0.49	0.58
1½	0.28	0.34	0.40
1¼	0.20	0.24	0.27
1	0.13	0.15	0.18
¾	0.08	0.09	0.11
5/8	0.06	0.07	0.08

Freight Rates—The freight rate on finished steel products in the Pittsburgh district, inculding plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, black sheets (except planished), chain, etc., are as follows in cents per 100 lb.; Boston, 18.9; Buffalo, 11.6; Baltimore, 15.4; Cleveland, 10.5; Cincinnati, 15.8; Chicago, 18.9; Denver, 68.6; New Orleans, 30; New York, 16.9; Philadelphia, 15.9; St. Louis, 23.6; Minnesota and St. Paul, 32.9. Pacific Coast (all rail), 73.9.

Merchant Steel—A considerable amount of business was transacted during the month, and in some shapes quotations have advanced. Prices as given below hold very firm, and some dealers hold the opinion that they will be increased very shortly. Below are general base prices for small lots from jobbers' stores:

	Cents Per Pound
Refined iron:	
1 to 1⅞ in., round and square	2.00
1½ to 4 in. x ⅜ to 1 in.	2.00
1½ to 4 in. x ¼ to 5/16 in.	2.20
Norway bars	4.00
Burdens bar iron	3.15
Soft steel:	
¾ to 3 in., round and square	2.05
1 to 6 in. x ⅜ to 1 in.	2.05
1 to 6 in. x ¼ and 5/16	2.20
Rods—⅝ and 11/16 in.	2.15
Bands—1½ to 6x3/16 in. to No. 8	2.35
Beams and channels—3 to 15 in.	2.10

Angles:

3 in. x ¼ in. and larger	2.10
3 in. x ⅜ in. and ⅛ in.	2.55
1½ to 2¾ in. x ⅜ in. and thicker	2.20
1½ to 2½ in. x ⅛ in.	2.30
1 to 1¼ in. x ⅜ in.	2.30
1 to 1¼ in. x ⅛ in.	2.35

Tees:

1½ to 2½x¼ in.	2.25
1½ to 2½x⅜ in.	2.35
3 in. and larger	2.20

Triangle Mesh—Demand continues fair. During the month there was a general revision in price, the following quotations now being effective:

PRICE PER 100 SQ.FT.

Style No.	Cross-Sec. Area per Ft. Width	Plain Material—Carload Lots	Plain Material—Less Than Car Lots and Over 10,000 Sq.Ft.	Galvanized—Carload Lots	Galvanized—Less Than Car Lots and Over 10,000 Sq.Ft.
†4	$0.102	$1.05	$1.16	$1.27	$1.38
5	0.077	0.83	0.92	1.00	1.09
6	0.058	0.66	0.73	0.80	0.86
†7	0.041	0.51	0.57	0.62	0.67
†23	0.170	1.76	1.94	2.12	2.30
24	0.142	1.52	1.67	1.83	1.98
25	0.124	1.35	1.49	1.62	1.76
†26	0.110	1.23	1.35	1.48	1.60
†27	0.085	1.00	1.11	1.21	1.31
28	0.066	0.83	0.92	1.00	1.09
29	0.049	0.69	0.76	0.83	0.90
31	0.261	2.60	2.86	3.13	3.39
32	0.225	2.25	2.48	2.71	2.94
33	0.196	2.01	2.21	2.42	2.62
34	0.140	1.54	1.70	1.86	2.02
35	0.109	1.23	1.35	1.48	1.60
36	0.075	0.91	1.00	1.09	1.18
38	0.380	3.70	4.08	4.45	4.83
†39	0.325	3.19	3.51	3.85	4.16
40	0.283	2.79	3.08	3.36	3.65
41	0.208	2.13	2.35	2.57	2.78
42	0.151	1.62	1.78	1.95	2.11
43	0.101	1.15	1.27	1.39	1.50

†This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths of rolls are 150, 300 and 600 ft. Cutting to special length is charged extra.

Bars, Concrete Reinforcing—Business is very brisk in this line. The mills will only accept orders with a promise for a three- to four-months' delivery under 2 in., and over a 2-in. bar they will not promise anything unless they happen to have it in their warehouses. No orders will be accepted for future delivery only at the mills' convenience. The mills report that everybody for the past year has been holding back on buying until at the present time all dealers are running short and are attempting to fill their stocks at once, which is almost impossible. The market is very strong, both in Pittsburgh and in the New York district, and the mills look for no let-up for months to come. Prices are as follows:

	Cents per Pound—Mill Shipments Pittsburgh	Cents per Pound—F.o.b. Warehouse* Pittsburgh	Cents per Pound—Delivered From Warehouse New York
¾ in. and longer	1.40	2.05	2.05 to 2.10
⅝ in. and longer	1.45	2.10	2.10 to 2.15
½ in. and longer	1.50	2.25	2.25 to 2.30
⅜ in. and longer	1.65	2.35	2.35 to 2.40
¼ in. and longer	1.90	2.70	2.70 to 2.75

*Bars from warehouse are cut to desired lengths without extra charge. These prices are for carload lots.

Expanded Metal Lath—Business is very good in this line, and mills do not seem to be affected as in some other lines connected with the building trade.

Prices are as follows:

Gage	Weight	Carload	1,000 to 5,000	Under 1,000
27	240	$11.00	$12.00	$13.00
26	260	12.00	13.00	14.00
25	300	13.00	14.00	15.00
24	350	14.00	15.00	16.00

These prices are f.o.b. Pittsburgh.

METALS

Copper—The market during the entire month was very weak, and the price remained rather fixed at the low level of 18c. Domestic demands were very light and the few transactions reported show very clearly that consumers do not appear anxious to lay in any supply. For the latter part of the month one large factor cut down production to almost a minimum. Mines are working at a record-breaking point and production far exceeds the consumption. Buying by the foreign powers still continues and it is reported that France and England will soon be in the market for a goodly supply. The price for electrolytic is firmly held at 18c. for cash and 18¼c. for thiry days, delivered.

Tin—The market is clearly disappointing. It has been announced that deliveries for the month of September only totaled 4,300 tons for both Atlantic and Pacific ports. Prices rose and fell during the month, the general tendency of sellers being to hold to a fixed price of 32½c. During the last week prices strengthened, the market being held at 33¼c. Buyers, however, show little interest in the market and the present quotation remains at 33c. With the completion of the British-French loan tin dealers look very hopefully for improvement.

Lead—At the beginning of the month lead opened at 4.9c. per lb., but buying was so limited and in such small quantities that it soon dropped to 4½c. At the end of the month buyers were a little more active, but the demand failed to bring an advance in price. However, the present quotation is more firm, and stronger buying is expected to develop in European markets. Production is so far in excess of demand that dealers are very anxious to find an outlet for their supply.

Spelter—At the beginning of the month the market opened with a fixed price of 15c. per lb., but rapidly dropped and throughout the month remained at 14c. There were occasional flurries in the demand, but the amount of business failed to prompt dealers to advance the price. Toward the latter part of the month there appeared to be an easier tone to the market, due to the offering of speculative blocks. For last quarter deliveries quotations are 13½c., but at this figure very little business is being booked. Ordinary grades of prime western are now selling at 14c. per lb.

Old Metals—The market might be said to be up and down during the month. At times the buyers showed keen interest, then again they would not appear in the market. Toward the end of the month more business was done, and prices were well maintained as follows:

	Cents per Pound
Copper, heavy cut and crucible	15.00
Copper, heavy and wire	14.75
Copper, light and bottoms	12.50
Heavy machine composition	11.50
Brass, heavy	10.00
Brass, light	8.50
No. 1 yellow brass turnings	11.50
No. 1 composition turnings	10.50
Lead, heavy	3.50
Tea lead	3.25
Zinc scrap	8.00

The above are dealers' purchasing prices in New York.

MISCELLANEOUS

Sewer Pipe—With the arrival of fall there is a fair amount of work appearing, and dealers anticipate that conditions will require a considerable supply of this material. Discounts, however, are the same as a month ago, but are more firmly held. On 3- to 24-in., 82% off list is quoted; 27- to 30-in., 72%; 30- to 36-in., 67%. At this rate, prices are as follows:

PRICE OF SEWER PIPE PER FOOT

Size		Size	
3-in.	$0.045	18-in.	$0.342
4-in.	0.045	20-in.	0.405
5-in.	0.072	22-in.	0.54
6-in.	0.072	24-in.	0.585
8-in.	0.099	27-in.	1.26
10-in.	0.144	30-in.	1.54
12-in.	0.18	33-in.	2.06
15-in.	0.243	36-in.	2.31

Flue Lining—While the demand for this material for immediate use is not prevalent, yet some contractors realize that the present quotation is exceptionally low, and are laying in a supply in anticipation of an improvement. Prices have decreased a little since last month, and the present quotation is 83% off list. At this discount, prices are as follows:

FLUE LINING—PRICE PER FOOT

Size in In.	Weight in Lb.	Price per Ft.	Size in In.	Weight in Lb.	Price per Ft.
4½x 8½	14	$0.06	8½x13	28	$0.114
4½x13	20	0.076	8½x18	45	0.153
4½x18	40	0.17	13x13	38	0.144
7 x 7	15	0.068	13x18	57	0.204
8½x 8½	18	0.076	18x18	75	0.34

Bluestone—The sellers do not appear very optimistic over the amount of business appearing, and although the demand continues fair, in general conditions are not as good as a year ago; especially in the City of New York is this noticeable. Subway construction probably has tended to postpone a great many street improvements. Prices are well maintained, and although there may be a little cut on very desirable contracts, the following are general: Bronx flagging, 17c. per sq.ft.; Manhattan, 18c. per sq.ft. Curbing, 5x16 in., 40c. per lin.ft.; 5x20 in., 45c. Sewer bottoms, 5x5 ft. by 3 in., sell at 25c. per sq.ft. Belgian bridging, 5x24 in., is 65c. per lin.ft.

Railway Ties—There is very little business in this line at present, not as much as there was a month ago. All of the railroads are carrying a good stock of railway ties on hand for repair work and there is practically no new work being done. There have been a great many inquiries from foreign countries for railway ties, but up to date, as far as is known, no orders have been placed. Freight rates are a little bit lower than they have been; however, prices are about the same as they were last month. First-class standard ties, 7x9 in. by 8 ft. 6 in. sell at 73c.; 6x8 in. by 8 ft. at 61c., these prices being f.o.b. New York.

Asphaltum—A steady volume of business was felt throughout the month, and the same continued call existed for Mexican asphalt petroleum. Prices, however, remain unchanged, and in packages f.o.b. refinery sheet paving asphalt is quoted at $13 to $15 per ton.

Swedish (Norway) Iron—Supplies are all limited to small lots, and dealers are selling the same at very fancy prices. On all sides there is keen competition and dealers are making every effort to gather any quantity obtainable. Due to such unsettled conditions, quotations have been withdrawn.

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

Maryland—Surveys made by Baltimore & Ohio Ry. Co. for line from Hagerstown to Security, about four miles. J. B. Ferguson & Co., Surveyor. F. L. Stuart, Baltimore, Ch. Engr. Noted Aug. 12.

North Carolina—Directors of Hiawassee Valley Ry. Co. authorized sale of $125,000 bonds for completion of line from Andrews to Haynesville, via Peachtree, about 25 miles. S. E. Cover, interested.

North Carolina—Surveys made for line from Lillington to Swansboro by Central Carolina Ry. Co. W. J. Edwards, Sanford, interested.

North Carolina—Kinston Belt Line Co. has been incorporated with $25,000 capital by J. T. Deal and G. V. Cowper, Kinston, and others to build steam belt-line and electric car line in Kinston.

North Carolina—Seaboard Air Line Ry. Co. plans revision of line and grades between Sanford and Apex. Estimated cost, $200,000. H. C. Pearce, Norfolk, Va., Pur. Agt.

Virginia—See item under Kentucky.

West Virginia—Coal & Coke Ry. Co. contemplates yards at Charleston. R. H. Pembroke, Gassaway, Ch. Engr.

Georgia—Georgia Southern and Florida Ry. Co. will build yard near Cordele. Estimated cost, $25,000. J. B. Munson, Macon, Vice-Pres. and Gen. Mgr.

Georgia—Savannah & Northwestern Ry. Co., according to press reports, is having surveys made for extension of its line from St. Clair to either Thomson, Camak or Norwild, about 30 miles. L. B. Ackerman, Savannah, Ch. Engr.

Alabama—Railway will be built from Andalusia, Ala., to Munson, Fla., about 30 miles. C. K. Lawrence, Savannah, Ga., Ch. Mgr. Central of Georgia Ry. Co., interested.

Mississippi—Reports state Guy M. Walker, New York, N. Y., has purchased McComb Electric Light & Power Co. through S. M. Jones, Laurel, Miss. He contemplates railway from McComb to Summit, Fernwood and Magnolia.

Kentucky—Queen & Crescent Ry. will double-track its line from Somerset to Flat Rock. Surveys have been made for double-tracking from Tateville to Greenwood.

Kentucky—Kentucky & Virginia Ry. subsidiary of Louisville & Nashville Ry., is making surveys for extension from Benham, Ky., to Norton, Va.

Indiana—Lake Erie & Western Ry. Co. plans to spend $50,000 for extension of its yards at Tifton. A. H. Smith, New York, N. Y., Pres.

Illinois—Hillsboro, Synthiana, Bainbridge & Chillicothe Traction Co. plans electric railway between Hillsboro and Chillicothe, about 42 miles.

Wisconsin—Bonds for $75,000 for railway from Etterisk to Blair, about 10 miles, voted by citizens.

Nebraska—Missouri Pacific Ry. Co., recently incorporated, will build main line and three branch lines in Nebraska. C. H. Smith, Wayne, Engr.

South Dakota—South Dakota Short Line Ry. Co. recently incorporated with $2,000,000 capital by C. W. Adams, Council Bluffs, Iowa and others, will build line from Mitchell to Pierre.

Wyoming—Colorado, Wyoming & Eastern Ry. is making preliminary arrangements for extension of its line from Northgate to Elk River then to Yampa River. J. M. Herbert, Laramie, Pres.

Missouri—St. Louis, Iron Mountain & Southern Ry. Co. plans improvement of roadbed between Mollisster, Mo., and Bergman, Ark. Estimated cost, $35,000. E. A. Hadley, St. Louis, Ch. Engr.

Arkansas—Press reports state Missouri Pacific Ry. Co. will make improvements to White River division. Estimated cost, $500,000. E. A. Hadley, St. Louis, Mo., Ch. Engr.

Arkansas—Surveys will be made for electric line from Guion to Melbourne. A. C. Veach, Gravette, promotor. Noted July 29.

Colorado—Union Pacific Ry. Co. plans extension of Wyoming & Eastern Ry. Co. from Coalmont to Steamboat Springs. E. E. Adams, New York, N. Y., Consult Engr.

Washington—Lucerne & Aurelia Crown Co. having survey made for line from Lucerne to Aurelia Crown mines, about 16 miles. O. Robert Dahl, Box 187, Seattle, Pres.

California—Press reports state San Francisco will let contract in two months for construction of 67 miles of railway for Hetch-Hetchy reservoir. M. M. O'Shaughnessy, City Engr. Estimated cost, $1,800,000.

California—Union Lumber Co. plans logging road from Ft. Bragg to Ten Mile River, about 10 miles. C. R. Johnson, Crocker Bldg., San Francisco, Pres.

California—California R.R. Commission ordered Atchison, Topeka & Santa Fé Ry. to build branch from Temecula to Oceanside. E. P. Ripley, Pres.

California—Franchise granted to Tidewater & Southern Ry. Co. for railway through Ceres. J. H. Wallace, Stockton, Ch. Engr. Noted Aug. 5.

Ontario—Ontario Hydro-Electric Commission, Toronto, petitioned by Durham and Northumberland Counties to report on advisability of building electric railway from Peterborough through Campbellford, Seymour, Percy, Alwick, Haldimand and Hamilton Townships to Cobourg.

Ontario—Township Council of Harwick asked Provincial Hydro-Electric Commission, Toronto, Ont., to submit estimate of cost of electric railway between Blenheim and Cedar Springs. G. W. Riseborough, Blenheim, Clk.

Bids In and Contracts Awarded

Virginia—Southern Ry. Co., Washington, D. C., awarded contracts for railway construction as follows: Sycamore to Gretna, four miles to HALL-CRAWFORD CONSTRUCTION CO., Macon, Ga.; Whittles to Dry Fork, nine miles to ROBERT RUSSELL, Danville, Va., and from Arrowhead to Elma, 20 miles to W. W. BOXLEY CO., Roanoke.

Virginia—Contract awarded to J. C. CARPENTER & MAJOR BROS., Clifton Forge by Chesapeake & Ohio Ry. Co. for double-tracking line between Greenlee and Balcony Falls.

LIGHT, HEAT AND POWER

Proposed Work

N. Y., Fredonia—Public Service Commission received application from Niagara & Erie Power Co. for permission to build transmission lines and operate franchises in towns of Sheridan, Pomfret, Portland and Brant and village of Farnham.

N. Y., Rochester—City Council contemplates extending street lighting system.

N. Y., Troy—Plans being prepared for power plant at mill of J. B. Hurst.

N. J., Cape May—Citizens voted bonds for electric-light plant.

N. J., East Orange—City Council plans to improve street lighting system on Central Ave.

Penn., Milton—Election will soon be held to vote to install municipal electric-light plant in Milton.

N. C., Burnsville—Yancey Light & Power Co. contemplates hydro-electric plant. Estimated cost, $16,000.

Ga., Atlanta—Atlanta Electric & Ice Co. has acquired plant of municipal water works and will operate same for five years. Company plans to install new equipment in electric-light and power plant and water works.

Ga., Graymont—Citizens voted $5,000 bonds for electric-lighting system.

Ga., Toccoa—City will build power plant on Toccoa Creek.

La., Colfax—Power plant of Big Pine Lumber Co., recently destroyed by fire, will be rebuilt. New equipment will be required.

Tenn., Henderson—Citizens voted $13,000 bonds for equipment for electric-light plant.

Tenn., Tullahoma—Cumberland Springs Co. plans electric-light plant and other improvements.

Ohio, Lorain—Election will be held in November to vote $350,000 bonds for municipal electric-light plant.

Ohio, Marietta—Election will be held in November to vote $45,000 bond issue for municipal electric-light plant.

Ohio, Martins Ferry—City plans to extend service of municipal electric-light plant to Rotherermund addition.

Ohio, Toledo—Bids will be received by A. M. Stowe, Pres., Bd. of Directors, Toledo University, until noon, Oct. 9, for steam heating and ventilating systems for present building and an addition at Illinois and 11th St.

Mich., Three Rivers—Bids will be received by the city until Oct. 21, for electric-light plant and water system. Plans and specifications may be obtained from Eugene A. Schall, City Clk., or G. Champs and F. H. Froelich, Engrs., National Bank Bldg., Toledo, Ohio.

Mich., Wyandotte—Citizens defeated $30,000 bond issue for municipal electric light plant. Noted Aug. 12.

Ill., Galesburg—Election will soon be held to vote $100,000 bonds for improving electric-light plant.

Ill., Mt. Carmel—Plans being considered by Mt. Carmel Public Utility & Service Co. to extend service to Allendale and St. Francisville.

Wis., Oak Center—According to press reports electric-lighting system in Oak Center is under consideration.

Iowa, Clermont—C. Miller & Sons plans to increase the capacity of its electric-light plant. Estimated cost, $20,000.

Iowa, Kanawha—Election will be held Oct. 20 to vote to construct municipal electric-light plant.

Iowa, Marengo—Iowa Electric Co. plans transmission line for the conducting of electricity.

Iowa, Mondamin—Press reports state that transmission line from Mondamin to Missouri Valley to supply electricity in Modale and Mondamin is contemplated.

Kan., Bucklin—Citizens contemplate $10,000 bond issue for improving electric-lighting system.

Kan., Wichita—Kansas Gas & Electric Co. plans an expenditure of $1,800,000 for improving its properties in Wichita, Pittsburgh and on Independence and eastern Kansas interests.

Neb., Blair—Bids will be received by S. W. Chambers, City Clk., until Oct. 15, for electric-light plant. Estimated cost, $34,000. Martz Engineering Co., Lincoln, Engr. Noted Aug. 19.

Nebr., Fremont—City Council plans to extend electric-lighting system to Lee-Hall addition.

Neb., Norfolk—Plans being prepared by Martz Engineering Co., Lincoln, for improving heating system at State Hospital for Insane.

N. D., Ryder—Construction of electric-light plant in Ryder contemplated by local business men.

Mo., Drexel—City will equip electric plant at Drexel. About $8,000 worth of machinery will be required.

N. M., Mogollon—Earle C. Cleveland plans electric-power plant on Willow Creek.

Tex., Celeste—Local electric-light plant of T. J. Vines & Sons, recently destroyed by fire, will be rebuilt.

Idaho, Blackfoot—F. V. Riley, C. E., Idaho Falls, submitted plan to City Council to install electric-light plant in Blackfoot.

Utah, Salt Lake City—Bids will be received by James Paxton, Clk., Bd. of Education, until 7:30 p.m., Oct. 11, for heating and ventilating system in high school at 14th and 15th St.

Ariz., Tucson—Election to issue $100,000 bonds to complete municipal electric-lighting system contemplated by City Council.

Wash., Colfax—Work will soon be started on substation for Washington Water Power Co.

Ore., Eugene—Water Board has authorized an auxiliary electric plant. Estimated cost, $50,000.

Calif., Martinez—Board of Supervisors received application from Great Western Power Co. of San Francisco for permission to extend its transmission lines from Martinez through Port Costa to Crockett, and from Concord to Walnut Creek.

Ont., Crediton—Town Council contemplates installation of electric-lighting and power distribution system.

Bids In and Contracts Awarded

Kan., Marion—Contract for power house awarded to V. BAUER & SON, Horton. Noted Sept. 16.

Neb., Broken Bow—Contract awarded to ALAMO ENGINE AND SUPPLY CO., Omaha, at $15,954, for water and electric-light systems. Noted Aug. 26.

Neb., Wisner—Contract for heating and plumbing in new Wisner School awarded to WESTERN HEATING & PLUMBING CO., Omaha, at $7,280.

Mont., Plentywood—Contract for new electric light and power plant for Plentywood Electric Co. awarded to SHERIDAN ELECTRIC CO.

Mo., Kansas City—Contracts for electrical work at new St. Joseph Hospital awarded as follows: Electric wiring, including wiring for power plant to F. E. NEWBERRY ELECTRIC CO., St. Louis, at $18,000; one 150-kw., four valve unit and one 100-kw., single valve generator, 220/110 volts, three wire, direct current to RIDGWAY DYNAMO & ENGINE CO., Ridgway, Penn., at $9,000; switchboards to WILLIAM MURDOCK ELECTRIC CO., St. Louis, at $2,100.

Que., Quebec City—Quebec Streams Commission awarded contract for power dam on St. Francis River to GEORGE MADDEN, Quebec, at $101,000.

BRIDGES

Proposed Work

Conn., Shelton—Plans being prepared by C. J. Bennett, State Highway Comr., Hartford, for bridge across Housatonic River between Shelton and Derby.

N. J., Newark—Board of Freeholders of Essex County plans to issue $50,000 bonds, part of which will be used for new approach span to Delleville turnpike bridge.

N. J., Paterson—Bids being received by Board of Freeholders of Passaic County for widening Hope Ave. bridge, Clifton. Estimated cost, $5,500.

Penn., Beaver Springs—Philadelphia & Reading Ry. Co. has plans for steel girder bridge across Susquehanna River at Beaver Springs. Estimated cost, $300,000.

Penn., York—Bids will be received by F. S. Bartenschlager, County Controller, until Oct. 14, for stone arch bridge over Bennett's Run, Newberry Township, and reinforced-concrete arch bridge over west branch of Codorus Creek.

Va., Lynchburg—Plans being prepared by B. N. Davis, Consult. Engr., 17 Battery Pl., New York, N. Y., for bridge across James River.

Ga., Rome—Citizens voted $225,000 bonds for three bridges in Floyd County.

Fla., Miami—Citizens voted to issue bonds for paving, bridges, hospital and channel across bay. Noted Aug. 19.

Ala., Mobile—Bids will be received until 10 a.m., Oct. 11, for wooden bridge.

Ala., Mt. Vernon—Bids will be received by O. A. Alvarez, Clk., County Revenue and Road Commissioners, Mobile, until 10 a.m., Oct. 11, for bridge across Cedar Creek near Mt. Vernon.

Tenn., Chattanooga—Press reports state that Southern Ry. plans bridge over tracks at Oak St. Estimated cost, $12,000.

Ohio, Columbus—(Official)—Bids will be received by John Scott, Clk., Bd. of Commissioners of Franklin County, until noon, Oct. 25, for county bridge construction.

Ohio, Dayton—(Official)—Bids will be received by H. E. Wall, City Acct., until noon, Oct. 11, for the sale of $338,000 bonds for replacing bridges over Miami and Mad Rivers. Noted Sept. 9.

Ind., Lebanon—Bids will be received by Commissioners of Boone County until 10 a.m., Oct. 18, for two reinforced-concrete bridges and repairing of another.

Ind., Martinsville—(Official)—Bids will be received until 2 p.m., Oct. 11, by S. Welton, Audr., Morgan County, for constructing and repairing a number of bridges.

Ill., Ottawa—Board of Supervisors of La Salle County plans bridge across Illinois River at Shippensport. Estimated cost, $140,000.

Ill, Rockford—(Official)—Bids will be received until 1 p.m., Oct. 29, by A. R. Carter, County Supt. of Highways, Courthouse, for bridge in Rockton Township, Winnebago County.

Iowa, Waukon—Bids will be received by Auditor of Allamakee County, until noon, Oct. 12, for steel superstructures for one 80-ft. two 100-ft. and 140-ft. bridge.

Minn., Montgomery—Bids will be received until 1 p.m., Oct. 18, by John Hickey, Town Clk., for two road bridges, Montgomery Township.

Minn., New London—Bids will be received until 3 p.m., Oct. 18, by A. A. Skeie, Township Clk., for bridge across Crow River between Sections 8 and 17, Township 121, Range 34.

Kan., Abilene—Commissioners of Dickinson County plan an expenditure of about $7,000 for bridge repairs.

Kan., Columbus—An expenditure of $8,000 contemplated by County Commissioners for repairing a number of bridges.

Kan., Concordia—County plans expenditure of $15,000 for eight reinforced-concrete bridges and repairing four steel bridges.

Kan., Wichita—Edgar V. Moore, Engr., Sedgewick County, preparing plans for four reinforced-concrete bridges for county.

Mo., Carthage—Bids will be received by Hugh McIndoe, Mayor, until Oct. 9, for sale of $30,000 bonds for viaduct.

Mo., Hillsboro—Election will be held in Jefferson County to vote $500,000 bonds for bridges and roads.

Mo., Joplin—Bids will be received by C. A. Robinson, Coms. of Revenue, until Oct. 9, for sale of $13,500 bonds for North Main St. viaduct.

Mo., St. Louis—Contract will soon be awarded for Chouteau Ave. viaduct.

Tex., Houston—(Official)—Bids will be received until 10 a.m., Oct. 11, by H. L. Washburn, County Audr., for two bridges on Humble and River Rd.

N. M., Roswell—Bids will be received until Oct. 11 by Board of County Commisioners of Chaves County for public highway bridge over the Rio Feliz near Hagerman.

Idaho, Boise—A bridge across Snake River at Grandview is contemplated by County Commissioners. Estimated cost, $5,000.

Idaho, Parma—Press reports state that bridge across Boise River at Parma contemplated. Estimated cost, $17,000.

Ariz., Florence—Commissioners of Pinal County contemplate two concrete bridges across the Gila River near Winkleman. Estimated cost of each $30,000.

Calif., Bloomfield—Bids will be received until Oct. 13 by Board of Supervisors of Sonoma County, Santa Rosa, for concrete bridge near Bloomfield.

Calif., Eureka—Bids will be received by County Supervisors until Oct. 13, for bridge at Field's Landing and culvert near Beatrice.

Calif, Grimes—Board of Supervisors of Sutter and Colusa Counties plan bridge across Sacramento River at Grimes. Estimated cost, $150,000.

Calif., Imperial—An appropriation of $27,500 made by Board of Supervisors of Imperial County for bridges.

Calif., Madera—(Official)—Bids will be received by W. C. Utter, City Clk., until 8 p.m., Oct. 18, for bridge across Fresno River. Estimated cost, $10,500. Noted Sept. 23.

Calif., Modesto—Board of Supervisors provided a fund of $85,000 for bridges over Tuolumne River at Modesto.

Calif., San Bernardino—A new bridge across Mojave River between Victorville and Hesperia planned by County Supervisors.

Calif., Ventura—Bids will soon be received by County Board of Supervisors for La Crosse bridge. Estimated cost, $10,000.

Calif., Visalia—Bids will be received until Oct. 13 by City Clk. for concrete bridge across Mill St.

Ont., Niagara Falls—According to press reports Canadian Northern Ry. plans to build bridge at Niagara Falls.

Bids In and Contracts Awarded

Mass., Norfolk—Contract for bridge in Lawrence St. awarded to JOHN McCOURT CO. Noted Aug. 19.

R. I., Providence—(Official)—Contract for steel work of Randall St. Bridge awarded to LOUIS F. SHOEMAKER & CO., Pottstown, Penn., at $4,869. Noted Sept. 9 and 23.

Conn., Bristol—Contract for bridge over Pequabuck River awarded to PIERSON ENGINEERING CO., Hartford. Noted Sept. 2.

N. Y., Binghamton—Bids were received by Board of Contract and Supply for bridges as follows: Bridge over Pierce Creek at Conklin Ave., Michael Barber, $5,500; Owego Concrete Co., $5,500; Water St. Bridge, Foster Construction Co., $8,658; Eldridge St. Bridge, Foster Construction Co., $12,978. Noted Aug. 26.

Penn., Harrisburg—(Official)—Contract for bridge in Shippen Township, Cameron County, awarded to FARRIER ENGINEERING CO., Pittsburgh, at $4,388, and bridge in Davidson Township, Sullivan County, to WHITTAKER & DIEHL, Harrisburg, at $4,258. Noted Sept. 23.

Penn., Phoenixville—Bids were received by Commissioners of Montgomery County, Norristown, for bridge across Schuylkill River between Phoenixville and Mont Clare as follows: B. A. Sheeler, Potstown, $63,440; Ferre Concrete Co., Harrisburg, $55,400, and C. M. Heed Co., Pittsburgh, $92,800. Noted Sept. 23.

Ga., Macon—Contract of steel viaduct from Bay to Third St. for Central of Georgia Ry. awarded to VIRGINIA BRIDGE AND IRON CO., Roanoke, Va., at about $90,000.

Ind., Hammond—Contract for temporary bridge and permanent structure over Grand Calumet River at Calumet Ave. awarded to PHEE BROS., Chicago, at $72,500.

Ill., Edwardsville—Contract for bridge over Cahokia Creek for Illinois Central R.R. awarded to DECATUR BRIDGE & IRON CO., at $8,000.

Wis., Eau Claire—Contract for bridge on Menomonie St. awarded to STEIN CONSTRUCTION CO., Medford, at $5,477.

Wis., Green Bay—Contract for bridge over East River at Pleasant St. awarded to GRELLING BROS., Green Bay. Noted July 29.

Iowa, Carroll—Contract for bridge and culvert awarded awarded to PICKUS ENGINEERING AND CONSTRUCTION CO., Sioux City, at about $14,000.

Iowa, Harlan—Contract for eight steel bridges in Shelby County awarded to DES MOINES BRIDGE AND IRON WORKS, Des Moines, at $15,500.

Iowa, Red Oak—Contract for bridge across river at Grant awarded to RED OAK BRIDGE AND IRON WORKS, Red Oak, at $6,400.

Kan., Leavenworth—Contract for 21 bridges awarded to LEAVENWORTH BRIDGE CO., at $18,397, and two bridges to J. S. WARD, at $5,735.

Neb., Tekamah—(Official)—Contract for bridges awarded to MINNEAPOLIS STEEL AND MACHINE CO., Minneapolis, Minn., at $14,500. Noted Sept. 9.

S. D., Canton—Contract for bridge across Big Sioux River awarded to DES MOINES BRIDGE AND IRON WORKS.

Mo., St. Louis—Contract for bridge on Olive St. Rd. awarded to MILLER & BORCHERDING, St. Louis, at $4,800.

Ark., Ashdown—Contract for 16 concrete bridges awarded to MILLER & CALDWELL, Texarkana.

Tex., Estelline—Contract for bridge across Red River awarded to AUSTIN BROS., Dallas, at $13,000.

Tex., Orange—Contract for bridge across inter-costal canal near Orange awarded to BLODGETT CONSTRUCTION CO., Galveston.

Okla., Cherokee—Contract for bridge across Salt Fork awarded to KANSAS CITY BRIDGE CO., Kansas City, Mo., at $7,963.

Okla., Claremore—Contract for bridge for Rogers County awarded to R. W. CANFIELD, at $17,900.

Okla., Henryetta—Contract for six steel bridges awarded to MISSOURI VALLEY BRIDGE CO., Kansas City, Mo., at $13,544.

Calif., Fairfield—Contract for bridge on State Highway from Yolo to Solano County awarded to CLINTON FIRE-PROOFING CO., San Francisco, at $30,500.

Calif., Los Angeles—Contract for bridge over Rio Hondo at Garvey Ave. awarded to F. W. STEFFGEN, 116 East Ninth St., Los Angeles, at $4,343.

Calif., Templeton—Contract for concrete bridge over Paso Robles Creek near Templeton awarded to GUTLEBEN BROS., San Francisco, at $11,773.

Calif., San José—Contract for reinforced-concrete bridge across Guadalupe Creek awarded to M. KILCOURSE, San José, at $6,850.

Man., Headingly—Contract for bridge over Assinibone River awarded to BUCHANAN & CO., 408 Builders' Exchange, Winnipeg.

WATER-WORKS

Proposed Work

Maine, Newport—Newport Water Co. plans reservoir on Stuart Hill and pump station. G. M. Barrows, Supt.

R. I., Providence—Frank E. Winser, Providence, appointed Chief Engineer of proposed new water system. Work will include storage reservoir, dam, water shed, filter beds, etc. Estimated cost, $12,000,000.

Conn., Wethersfield—Fire District No. 2 has been created. Hartford Water Works Co. will install water mains.

N. Y., New York—(Official)—Bids will be received by Board of Water Supply, Municipal Bldg., until 11 a.m., Oct. 19, for two steel frame buildings for drainage chambers, Shafts 11 and 21, Catskill Aqueduct, under Contract No. 166. (See Adv.)

N. Y., Niagara Falls—Bonds for $38,000 sold for extension of water mains.

N. Y., Waterloo—Citizens contemplate dam across outlet of Junius Pond for municipal water supply.

N. J., Wildwood—Citizens voted to purchase plant of Wildwood Water-Works Co. and plan to improve same.

Penn., Punxsutawney—City plans municipal water system. E. W. Hess, Clearfield, Borough Engr.

Penn., Ringtown—Election will be held Nov. 2 to vote $12,100 for municipal water system.

Penn., Waynesboro—Waynesboro Water Co. contemplates new reservoir.

Va., Mineral—City plans water system and electric-light plant.

N. C. Asheville—Bee Tree watershed taken over by city. Improvements costing $20,000 contemplated.

N. C., Hertford—Bids will be received until Oct. 12 by City Clk., for water and sewer systems. J. B. McCrary Co., Atlanta, Ga., Engr.

N. C., Wilson—Bonds for $170,000 sold. Proceeds will be used for water system, paving and gas plant. Noted Sept. 16 and 23.

S. C., Orangeburg—City plans to improve and enlarge water system and electric-light plant. Estimated cost, $50,000. Edward Hawes, Jr., City Engr.

Ga., Atlanta—Election to vote $750,000 bonds for improving water system postponed until next year. Noted Aug. 5 and 19.

Ga., Atlanta—Press reports state that approximately 9,000 ft. of 8-in. water main from city limits to park at Lakewood will be laid by city. Estimated cost, $74,000.

Ga., Helene—Citizens voted $8,000 bonds for water system. Noted Sept. 9.

Ga., Wadley—City will build water system. T. B. Johnson, Mayor.

La., Opelousas—City plans to issue bonds for water system.

Tenn., Knoxville—City plans to issue $500,000 bonds for pumping plant and other improvements.

Ohio, Athens—Citizens will vote on $50,000 bonds for extension to water system.

Ohio, East Youngstown—(Official)—Bids will be received until Dec. 1 by Carl R. Anderson, Village Clk., for water system. Estimated cost, $165,000. Noted Sept. 23.

Ohio, Tiffin—Concrete dam will be constructed by Tiffin Water Works Co. next year. Noted Sept. 2.

Ind., Shelbyville—Interstate Public Service Co. will replace 4-in. mains with 6-in. main and install 8- and 10-in. mains.

Ind., Van Buren—Bids will be received until 2 p.m., Oct. 21, by Town of Van Buren, for c.-i. pipe and pumping equipment. (See Adv.)

Mich., Three Rivers—Bids will be received until 1 p.m., Oct. 21, by E. A. Schall, City Clk., for water and electric-light systems.

Ill., North Chicago—Installation of filtration plants under consideration. Estimated cost, $20,000.

Ill., Poplar Grove—Bids will be received by R. S. Reene, Clk., Village Board of Trustees, until Oct. 12, for brick and stone pumping station.

Wis., Brodhead—Plans being prepared by W. G. Kirchoffer, Engr., 31 Vroman Bldg., Madison, for head gates.

Attica, Kan.—Bids will be received by J. C. McCaddon, City Engr., until Oct. 14, for water and electric-light systems. Estimated cost, $30,000. E. T. Archer Co., Kansas City, Mo., Engr. Noted Sept. 2 and 9.

Neb., Broken Bow—See item under "Light, Heat and Power."

Ark., Argenta—City Council will issue $500,000 bonds to purchase plant of Arkansas Water Co. and to improve and enlarge same.

Ark., Beebe—Plans prepared by Lund & Hill, Engr., Southern Trust Bldg., Little Rock, Ark., for water system. Estimated cost, $15,000.

Ark., Morrillton—Water & Electric-Light systems of Morrillton sold to Arkansas Light & Power Co., Arkadelphia, who plan to improve same.

Tex., Galveston—(Official)—Bids will be received by John D. Kelley, City Secy., until Oct. 14, for reconstructing 36-in. submerged water main. Noted Sept. 23.

Tex., Slaton—Bonds for $10,000 voted for water system.

Okla., Grove—Contract will soon be awarded for extension of water system. Bonds for $10,000 sold for this purpose. Noted Aug. 5 and Sept. 9.

Colo., Akron—Election will be held Oct. 19 to vote $20,000 bonds for water system.

N. M., Carlsbad—Bids will be received until Oct. 12 for improving water system. Estimated cost, $60,000.

Idaho, Aberdeen—Citizens contemplate municipal water system.

Idaho, Bonner's Ferry—Bonner's Light and Water Co. plans new water system on North Side. Estimated cost between $12,000 and $15,000.

Idaho, Twin Falls—Public Utilities Commission petitioned by City Council for permission to install municipal water system.

Wash., Colville—New water system contemplated by City Council.

Wash., Raymond—City Council plans to extend water system up South Fork River. Estimated cost, $100,000.

Wash., Seattle—Plans for water mains in Dexter Ave. submitted to Board of Public Works. A. H. Dimock, City Engr. Estimated cost, $32,000. Noted Sept. 30.

Ore., Baker—(Official)—Election will be held Nov. 11 to vote $110,000 bonds for improving water system. L. R. Stockman, City Engr. Noted Sept. 23.

Ore., Milwaukee—Contract will soon be awarded for completion of municipal water system. Noted July 29 and Sept. 9.

Calif., San Francisco—City plans to extend high-pressure service system. About $17,000 available for this purpose.

Ont., Dundas—City will extend water system. Estimated cost, $25,000.

Bids In and Contract Awarded

Maine, Anson—Contract for water system awarded to HANSCOM CONSTRUCTION CO., 70 Kilby St., Boston, Mass. Estimated cost, $35,000.

N. C., Ayden—Contract for water system awarded to J. B. McCRARY CO., Atlanta. Noted Sept. 2.

Ky., Covington—L. Eid Concrete and Steel Co., at $23,090, for one line and $29,446 for two line, was low bidder for excavation for duplicate supply main for Licking River. Noted Sept. 30.

Ohio, Medina—Contract awarded to LYNN & CAHOON, Akron, at $7,884, for extensions to water system. Noted Sept. 16.

Ohio, Oberlin—Contract for reservoir awarded to POWER CONSTRUCTION CO., Cleveland, at $6,833. Noted Aug. 12 and Sept. 9.

Ill., Dundee—Contract for new east side reservoir awarded to LOGAN & GIERTZ, Elgin.

Ill., St. Charles—Contract awarded to H. B. HALLET, Aurora, at $12,113, for extensions to water mains. Noted Aug. 19.

Wis., Monticello—Contract for water system awarded to J. N. ROBERTS, Madison. Noted Sept. 2.

Iowa, Urbana—Contract awarded to DES MOINES BRIDGE & IRON CO., Des Moines, at $5,735, for water system. Noted Sept. 16.

Minn., Carlton—Pastorette Co., Duluth, submitted lowest bid for water system. Noted Sept. 9 and 16.

Minn., Virginia—(Official)—Contract for mixed pressure steam turbine awarded to GENERAL ELECTRIC CO., Chicago, Ill., at $29,200. Noted Aug. 26.

S. D., Gayville—Contract awarded to ELLERMAN, McLAIN CONSTRUCTION CO., Yankton, at $5,577, for water system. Noted Sept. 9.

N. D., Fargo—(Official)—Contract for 1,160 ft. of water main awarded to C. H. PORRITT, Fargo, at $1.15 per ft. F. L. Anders, Engr. Noted Sept. 23.

Mont., Whitehall—(Official)—Contract for water and sewer systems awarded to INDEPENDENT CONTRACTING CO., Bozeman, at $26,013. G. E. Baker, City Engr. Noted Sept. 2.

Mo., Fayette—See item under "Sewers."

Colo., Orchard City—Contract for water system awarded to BUTTERFIELD & MOYNIHAN, Montrose, at $45,000.

Utah, Myton—Contract awarded to J. C. LYMAN, 722 Sixth Ave., Salt Lake City, at $10,350, for water system. Noted Sept. 9.

Ont., Ottawa—(Official)—Low bids for overland pipe work submitted as follows: Pipe, Laurin & Leitch, Montreal, Que., $194,400; specials—42-in., Victoria Foundry Co., Ottawa, $12,455; valves—42-in., General Supply Co., Ottawa, $14,518; pipe trench and laying pipe, Thomas McLaughlin, $63,514; pumps (2) Boving Hydraulic & Engineering Co., Montreal, Que., $10,900 and $15,600 respectively. Noted July 29.

SEWERS

Proposed Work

Mass., Boston—Plans being prepared for automatic pumping station for South End. Estimated cost, $400,000.

Mass., Boston—(Official)—Bids will be received until noon, Oct. 8, by Edward F. Murphy, Comr. of Pub. Wks., for pipe sewers and drains in Lithgow and Patterson St., Dorchester District.

Mass., Boston—(Official)—Bids will be received until noon, Oct. 11, by Edward F. Murphy, Comr. of Pub. Wks., for pipe sewers and drains in Ripley Rd. and Harwood St., Dorchester District.

Mass., New Bedford—City Council has authorized expenditure of $65,000 for intercepting sewers. William F. Williams, City Engr.

R. I., Providence—(Official)—Bids will be received until 2:15 p.m., Oct. 11, by Board of Contract and Supply, for sewers in various streets. Noted Sept. 30.

N. Y., Canadaigua—Board of Public Works will extend sewer system in North Main St.

N. J., Hightstown—Election will be held to vote on $15,000 bonds for water and sewer extensions.

N. J., Seaside Park—(Official)—All bids received Sept. 24 for sewers and sewage-disposal plant have been rejected. New bids will be received until 8 p.m., Oct. 18. Remington & Vosburg, Market St., Camden, Engr. Noted Sept. 16.

N. J., Toms River—Citizens contemplate sewer system.

Md., Baltimore—Sand bed and concrete channel will be built at sewage-disposal plant under Sanitary Contract No. 163. Charles England, Chn. Sewerage Comrs.

Va., Richmond—City Council asked to appropriate $188,915 for completion of sewer system in Manchester district.

N. C., Albermarle—Bids will be received until Oct. 15 by M. J. Harris, Mayor, for sewer system. Anderson & Christie, Charlotte, Engr. Noted Aug. 26.

N. C., Hertford—Bids will be received until Oct. 12 by city for sewer and water system. J. B. McCrary Co., Atlanta, Ga., Engr.

Ga., Atlanta—Bond election to be held Sept. 16 to vote $3,358,000 for municipal improvements postponed until spring. Noted Aug. 12.

Ga., Helena—Bonds for $12,000 voted by citizens for sewer system.

Fla., Jacksonville—Citizens voted to issue $500,000 bonds for sewers.

Tenn., North Chattanooga—(Official)—Bonds for $50,000 for sewer work sold. H. W. Longley, Town Clk. Noted Sept. 23.

Ohio, Cheviot—Bids will be received until Oct. 13 by Albert J. Heusing, Village Clk., for trunk sewer in ravine east of Glenmore Ave., in North Glenmore Ave.

Ohio, Cuyahoga Falls—Election will be held Nov. 2 to vote on $60,000 bonds for sewage-disposal plant.

Ohio, Dayton—(Official)—Bids will be received until noon, Oct. 11, by Hugh E. Wall, City Accountant, for purchase of $40,000 sewer bonds for sanitary sewers in Dist. No. 6.

Ohio, East Liverpool—City Council authorized sanitary sewers in various streets.

Ohio, Mt. Vernon—A. A. Graham, Mt. Vernon, at $11,129, submitted the lowest bid for sanitary sewer in Adams St.

Ohio, Port Clinton—Frank Mannello, Pittsburgh, at $6,952, submitted the lowest bid for sewers in District No. 4.

Ill., Chicago—Bids will be received by John McGillen, Clk., Sanitary District, until noon, Oct. 21, for Section 13 and 14, Calumet Sag Channel.

Ill., Roseville—Village Board retained engineer to prepare plans for a sewer system.

Ill., West Chicago—Construction of sewer system under consideration by City Council.

Wis., Appleton—Bids will be received until 9 a.m., Oct. 10, E. L. Williams, City Clk., for sewers in Richmond St.

Wis., Ashland—Bids will be received until Oct. 14 by W. V. Morris, City Clk., for sewers in various streets. Conrad J. Wadak, City Engr. Noted Sept. 16.

Iowa, Council Bluffs—Bids will be received until Oct. 11 by Charles J. Duff, City Clk., for sewers.

Iowa, Des Moines—(Official)—Bids will be received until 9 a.m., Oct. 13, by Horace Susong, City Clk., for sewer work in various streets.

Iowa, Lisbon—All bids received for sewer system rejected. New bids will be received. T. R. Warriner, Dows Bldg., Cedar Rapids, Engr. Noted Sept. 30.

Iowa, Muscatine—Citizens contemplate sanitary sewer in Mad Creek district. Charles Young, City Engr.

Iowa, Oakland—Bids will soon be received for sewer system. Noted Sept. 30.

Minn., Buhl—Bonds for $70,000 sold. Part of proceeds will be used for sewers.

Neb., Bridgeport—(Official)—Bids will soon be received for about 10,800 ft. of 8-in. vitrified clay lateral sewers. F. A. Roland, 402 Nebraska State Blk. Bldg., Lincoln, Engr.

Neb., Loup City—Plans being prepared by J. Wolf, City Engr., for sewer system. Estimated cost, $10,000.

N. D., Willow City—Board of Regents has authorized improvements to sewer system.

Mo., Cape Girardeau—Surveys made for outlet sewer. Estimated cost, $150,000. Christopher Stiver, City Engr.

Mo., St. Joseph—Citizens defeated bond issue for $1,048,000, for sewers, fire department, parks, electric lights, street improvements, reservoir, garbage disposal, work house, city hospital and asphalt plant.

Tex., Marlin—Citizens voted $120,000 bonds, part of which will be used for sewers.

Tex., San Benito—City will build sewage-disposal plant. V. M. Ehlers, Austin, State Engr.

Okla., Cushing—Benham Engineering Co., Oklahoma City, preparing plans for intercepting sewers in various streets. Estimated cost, $30,000. Noted Sept. 30.

Colo., Hugo—Council has created sanitary sewer district No. 1. Estimated cost of sewers, $12,000. J. C. Halloway, City Clk.

Ore., Portland—Plans will soon be completed for reconstruction of lower end of Tanner Creek trunk sewer. Estimated cost, $50,000.

Calif., Compton—Bids will be received until Oct. 12 by City Clerk, for sewer system. Olmsted & Gillelen, Hollingsworth Bldg., Los Angeles, Engr.

Calif., Pittsburg—Bids will soon be received by Town Trustees for sewer in East Third St.

Calif., Willow—Plans being prepared for sewers in new improvement district. Estimated cost, $20,000. John R. Ryan, Engr.

B. C., Esquimalt—Citizens plan enlarging sewer system in residential sections.

Bids In and Contracts Awarded

N. Y., Brockport—(Official)—Contract awarded to SUBURBAN ENGINEERING CO., 15 West 38th St., New York, at $21,206, for sewage disposal plant. Noted Sept. 16.

N. Y., New York—(Borough of Queens)—(Official)—Bids were received Sept. 30 for sewers under Contract No. 1, 2, 3, 4, 5, 6, 7 and 8. Low bidders are as follows: Joseph L. Sigretto, 20 Curtis Ave., Rchmond Hill, N. Y., $57,720 (1); Green Contracting Co., 292 Fifth Ave., Brooklyn, $22,847, (2); James H. Johnson, Beekman & Cliff St., New York, $15,755, (5); Green Contracting Co., $5,810, (4); J. J. Long & Co., 757 Lexington Ave., New York, $360, (5); Evergreen Construction Co., $135, (6); Peace Bros., $155, (7); and Joseph L. Sigretto, $8,787, (8). Noted Sept. 23.

N. Y., New York—(Borough of Richmond)—(Official)—Bids were received Sept. 28 by Calvin D. Van Name, Borough Pres., for sewage-disposal plant as follows: O'Brien & Fleming, 109 Broad St., Manhattan, $4,374; J. E. Donovan, $4,832 and Joseph Johnson Sons, $4,445. Low bidder for outlet sewers at Taylor St., A. M. Hazell, 90 West St., Manhattan, $2,939. Noted Sept. 23.

N. J., Newark—William G. Sharwell & Co. has abandoned its contract for superstructure for pumping station for Passaic Valley Sewerage Commission, because of mistake in figuring its bid. Noted Sept. 23.

N. C., Ayden—Contract awarded to J. B. McCRARY CO., Atlanta, Ga., at about $15,000, for sewer system. Noted Sept. 2.

Ohio, Norwood—Contract awarded to JOHN DEMPSEY, Norwood, at $7,500, for sewer in Lexington Ave.

Ohio, Toledo—(Official)—Contract awarded to THOMAS J. KELLY, Toledo, for local sanitary sewer No. 12 in Subdistrict No. 1. Noted Sept. 16.

Ind., Princeton—Contract awarded to JOHN L. NEWMAN, Evansville, at $6,126, for sanitary sewer system. Noted Sept. 23.

Mich., Ann Arbor—(Official)—Contracts awarded by Board of Public Works to WILLIAM EDDY & SON, Saginaw, at $3,248 for sewer work in District No. 68, and at $8,955 for Glenn Ave. sewer; to THOMAS JOYCE, Kokomo, Ind., at $205 for District No. 69, $390 for District No. 70, at $217 for District No. 71, and $10,500 for District No. 72. Noted Sept. 16.

Ill., Marion—Contract awarded to HOEFFKEN BROS. CONSTRUCTION AND SUPPLY CO., at $7,267, for sewage-disposal plant.

Wis., Appleton—All bids received Sept. 23 for sewers rejected.

Wis., Kenosha—Contract awarded to JAMES KENNEDY, Fargo, N. D., at about $250,000, for sewers in various streets. Noted Sept. 9.

Wis., Oconomowoc—Contract awarded to A. J. HEWITT, Milwaukee, at $7,000, for sewer and water mains.

Iowa, Ames—Contract awarded to DEARBORN CONSTRUCTION CO., Waterloo, at $24,788 and $13,961 for two sanitary sewers and at $28,937, for storm water sewer. J. T. Wickam, Ames., Engr.

Iowa, Muscatine—Contracts for sewers awarded to WINBERGER & KINSLEY, Mucatine, and INDEPENDENT CONSTRUCTION CO., Davenport, at $1,870 and $4,647 respectively.

Iowa, Webster City—Contract awarded to ZITTERELL & SULLIVAN for sewers in Webster, Broadway and Wauneta Court.

Minn., Eveleth—Contract awarded to LAWRENCE McCANN CO., at $12,000, by City Council for sewer extensions.

Minn., Excelsior—Contract awarded to GRAND FORKS CONCRETE CO., Grand Forks, N. D., for storm sewers. Noted Sept. 9.

Minn., Lyle—(Official)—Contract awarded to WILLIAM DANFORTH, Hackney Bldg., St. Paul, at $14,500, for sewer work. Noted Sept. 16.

Minn., Osakis—Contract awarded to O. C. EVENSON, for septic tank for sewer system.

Minn., St. Paul—(Official)—Contract awarded to O'NEIL & PRESTON, St. Paul, at $24,645, for sanitary sewer system. A. Hohrustein, Pur. Agt. Noted Sept. 23.

Neb., Wayne—Contract awarded to GEORGE L. VLASNIK for sanitary sewer in District No. 4.

Mont., Whitemall—(Official)—Contract awarded to INDEPENDENT CONTRACTING CO., Boxeman, at $26,013, for sewer system and Imhoff tank. Noted Sept. 9.

Mo., Fayette—Contract awarded to MORENO, BROOKS & BURKMAN, Syndicate Trust Co. Bldg., St. Louis, at $35,800, for sewer system and improvements to water system.

Tex., Dallas—Contract awarded to WINSLETT-ELDRIDGE CO., at $4,377, by City Commission for Cedar Creek outfall sewer.

Utah, Richfield—Contract awarded to JAMES KENNEDY, Salt Lake City, at $21,525 for sewer system and septic tank.

Calif., Marysville—Contract awarded to STANELY & OSTRANDER, Sausalito, at $13,500, by City Council, for extending sewers.

Ont., Hull City—Contract awarded to BISSON & CARON, at $10,796, for sewer in Laval St.

Ont., Toronto—Contract awarded to TUSSELL McREYNOLDS CO., 366 Keele St., Toronto, at $475,000, for sewers in Russel Hill Rd.

GARBAGE

Proposed Work

N. J., Atlantic City—Specifications prepared by J. Bacharach, Dept. Parks & Pub. Property, for disposal of garbage for five years.

Ga., Columbus—City will build new incinerator at Ninth St. and Eighth Ave.

Ill., Elgin—City Council contemplates incinerator and disposal plant. Estimated cost, $12,000.

Ark., Pine Bluff—Construction of incinerator under consideration.

STREETS AND ROADS

Proposed Work

Mass., Boston—(Official)—Bids will be received until noon, Oct. 8, by Edward F. Murphy, Comr. of Pub. Wks., 511 City Hall Annex, for artificial stone sidewalks in Penfield St. from Belgrade Ave. to Birch St., West Roxbury.

Mass., Boston—(Official)—Bids will be received by Edward F. Murphy, Comr. of Pub. Wks., 511 City Hall Annex, until noon, Oct. 8, for artificial stone sidewalks in Day St. from Center to Minden St. and Creighton St. from Center to Day St., Roxbury.

Mass., Dorchester—(Official)—Bids will be received by Edward F. Murphy, Comr. of Pub. Wks., Room 511, City Hall Annex, Boston, until noon, Oct. 8 ,for paving St. William St. from Dorchester Ave. to Aukland St.

Mass., New Bedford—City Council passed a loan order of $30,000 for permanent road work. W. F. Williams, City Engr.

Conn., New Britain—Elm St. will be paved at an estimated cost of $27,000.

N. Y., Scarsdale—Village plans to improve and repair a large number of streets and to develop a system by next year for the cars of its 26 miles of improved highways and the development of new roads.

N. Y., Tonawanda—Board of Public Works plans to pave Seymour St. with concrete.

N. J., Montclair—(Official)—Bids will be received by Harry Trippett, Town Clk., until 8 p.m., Oct. 11, for paving Upper Mountain Ave. from Bloomfield Ave. to Jerome Pl. (See adv.)

N. J., Perth Amboy—(Official)—Bids will be received by Board of Chosen Freeholders of Middlesex County, County Record Bldg., New Brunswick, until 2:30 p.m., Oct. 18, for repairing Amboy Ave.

Penn., Bridgeville—City will increase its bonded indebtedness $15,000, part of which amount will be used for paving.

Penn., Greensburg—(Official)—Bids will be received until noon, Oct. 26, by John S. Sell, County Controller, Westmoreland County, for the Scottdale-Tyrone Mills Rd., Section 1, and the Jeanette-Grapeville Rd.

Penn., Philadelphia—(Official)—Bids will be received by Bureau of Highways, Dept. of Pub. Wks., Philadelphia, until Oct. 14, for grading, paving and repaving a number of streets.

Md., Salisbury—Bids will be received until Oct. 12 by Commissioners of Wicomico County for two miles of State-Aid highway upon or along Salisbury-Anderson's Mill Rd.

Va., Monterey—Bids will be received by J. M. Coland, Mayor, until Oct. 19, for paving Main St. Estimated cost, $4,000. Noted Aug. 26.

W. Va., Buckhannon—Election will be held Dec. 30 in Upshur County to vote $250,000 bonds for roads.

W. Va., Morgantown—Citizens of East Morgan district voted to issue $300,000 bonds for road improvements.

W. Va., Moundsville—Bids will be received by O. B. Bonar, City Clk., until Oct. 11, for paving a number of streets.

W. Va., Piedmont—Citizens defeated $36,000 bond issue for street improvements. Noted Aug. 5.

Asheville, N. C.—City plans to pave Gudger St. from Haywood to Hill St.

Fla., Pensacola—Bids will be received by City Commissioners until Oct. 17 for paving streets around Pensacola Hospital. Estimated cost, $10,000. Noted Sept. 2.

Fla., St. Andrew—Bonds for $24,000 voted for street improvements.

Fla., Tallahassee—Citizens of Leon County voted $200,000 bonds for roads. J. C. Moore, Chn., Comrs. of Leon County. Noted Sept. 9.

Tenn., Lonsdale—(Knoxville post office)—Election will be held Oct. 30 to vote $30,000 bonds for paving.

Tenn., Newport—Bids will be received until Oct. 16 by George W. Gorrell, Chn., Pike Com., for grading and macadamizing roads in Cocke County. Estimated cost, $150,900.

Tenn., Park City—(Knoxville post office)—According to press reports Magnolia Ave. will be paved with asphalt.

Tenn., Shelbyville—Election will soon be held in Bedford County to vote $20,000 bonds for roads.

Tenn., Sweetwater—Citizens voted $5000 bonds for street improvements. Noted Sept. 9.

Ky., Georgetown—Commissioners of Scott County considering election to issue $100,000 bonds for roads.

Ohio, Canton—City Council plans to pave Fourth St., S. E., and Sterling Ave., S. E. Estimated cost, $116,000.

Ohio, Cincinnati—(Official)—Bids will be received by Board of County Commissioners of Hamilton County, until noon, Oct. 8, for improving Red Bank Rd. from Wooster Pike to Brotherton Rd., Columbia Township.

Ohio, Cincinnati—(Official)—Bids will be received by Philip Fosdick, Dir. of Pub. Ser., City Hall, until noon, Oct. 14, for improving West Sixth St.

Ohio, Cleveland—Election will be held Nov. 2, to vote $300,000 bonds for improving Carnegie Ave. from East 89th St. to Blvd.

Ohio, Napoleon—Bonds for $15,200 for paving West Main St. will be sold.

Ohio, Woodsfield—Bonds for $20,000 sold for road improvements in Monroe County.

Ohio, Youngstown—(Official)—Bonds for street paving sold. Noted Sept. 16.

Ind., Albion—Citizens voted $50,000 bonds for 54 miles of highway in Noble County.

Mich., Howell—Bids will be received by B. Beurmann, Highway Comr., until 2 p.m., Oct. 11, for 6¾ miles of road in Genoa Township.

Mich., St. Joseph—Bids will be received about Nov. 1 for surfacing 48 miles of road in Berrien County. Estimated cost, $355,000.

Ill., East St. Louis—Board of Local Improvements plans to pave Broadway between Rock Rd. and Third St.

Ill., Lincoln—City plans an expenditure of $25,000 for street paving.

Iowa, Davenport—Board of Local Improvements plans to pave Eighth Ave. between 24th and 29th St.

Iowa, Dubuque—City Council plans to improve Grandview Ave.

Iowa, Ft. Dodge—Bids will soon be asked for constructing a number of sidewalks.

Iowa, Muscatine—Board of Supervisors of Muscatine County plan an expenditure of $12,000 for improving part of Muscatine-Nichols Rd.

Kan., Atchison—(Official)—Bids will be received by Victor L. King, City Clk., until March 1, for paving Main St. from Second to Fourth St. and Ninth St. from Santa Fé to Laramie St. Noted Sept. 23.

Neb., Lincoln—Bids will be received by H. E. Wells, Clk., Lancaster County, until Oct. 27, for construction of paving District No. 9.

Neb., North Platte—Citizens voted $16,000 bonds for paving.

Mo., Hillsboro—Election will soon be held in Jefferson County to vote $500,000 bonds for roads and bridges.

Mo., Jefferson City—Election to vote $150,000 bonds for roads in Cole County scheduled for Oct. 19 postponed until latter part of November. Noted Aug. 5 and Sept. 2.

Ark., Mt. Ida—Cmmissioners of Montgomery County plan to form road district for pike road from Mt. Ida to Hot Springs.

Ark., Pulaski Heights—City Council plans to improve Lee Ave. between intersection of Martin St. and Prospect Ave. and Laurel St.

Tex., Batesville—Election will soon be held in Zavalla County to vote $15,000 bonds for roads.

Tex., Franklin—According to press reports Commissioners of Robertson County, Precinct No. 6, plan to vote $100,000 bonds for roads.

Tex., Hillsboro—(Official)—Bids will soon be received for paving a number of streets.

Tex., Terrell—Bids will be received by F. W. Raley, Secy., Road Dist., until 2 p.m., Oct. 28, for graveling macadam roads. Estimated cost, $200,000.

Okla., Clinton—City plans to pave Frisco Ave.

Okla., Newby—(Official)—Citizens defeated $20,000 bonds for roads. Noted Sept. 23.

Okla., Tishomingo—(Official)—Citizens defeated $35,000 bond issue for road work. Noted Sept. 23.

N. M., Deming—Citizens voted $100,000 bonds for highways. Noted Aug. 12.

Idaho, Boise—Bids will be received by G. R. Barker, Secy. State Highway Comn., until Oct. 15, for seven miles of Idaho-Pacific State Highway. Estimated cost, $8,500.

Ariz., Globe—Election will be held Oct. 19 to vote $500,000 bonds for roads in Gila County.

Ariz., Nogales—Election will be held Oct. 23 in Santa Cruz County to vote $150,000 bonds for highways.

Ariz., Phoenix—Board of Supervisors approved $35,000 bonds for street improvements in School District No. 1

Ariz., Yuma—An appropriation of $110,000 made by Yuma County for improving 110 miles of borderland highway.

Wash., Issaquah—Bids will be received until Oct. 12 by B. Phelps, Clk., Bd. of County Commissioners, Seattle, for Bond Rd. No. 18.

Ore., Coquille—Citizens contemplate an election to vote $440,000 bond issue for roads.

Calif., Corona—Bids will soon be received for paving North Main and River Sts. between the Santa Fé depot and county line.

Calif., Hanford—City Trustees plan to pave Park St. between Irwin St. and city limits.

Calif., Los Angeles—Bids will be received by H. J. Lelande, Clk., County Supervs., until 2 p.m., Oct. 11, for improving a portion of Harbor Truck Blvd.

Calif., Sacremento—Bids will be received until 2 p.m., Oct. 18, by California State Highway Commission, 515 Forum Bldg., for roads in various counties.

Calif, San Francisco—Board of Works plans to pave Beach St. from Hyde to Columbus Ave. and improve 19th Ave. between Vincente and Wawona St. Estimated cost, $4,050 and $8,000 respectively.

Calif., Santa Barbara—Bids will be received by C. A. Hunt, Clk., Bd. of County Supervisors, until Nov. 1, for paving Booths Point Rd. Estimated cost, $17,689.

Bids In and Contracts Awarded

Mass., Boston—Bids were received by State Highway Commission for highway in town of Norwell as follows: WILLIAM F. LOUD & SON, Wollaston, $10,806 (awarded contract); Pallotto & Davis Co., Lowell, $11,145; D. J. Sheehan Co., Lynn, $11,369. Noted Sept. 23.

Mass., Boston—Contract for grading walks, etc., in Ronan Park, Dorchester, awarded to JOHN C. COLEMAN & SONS, Roxbury, at $36,616.

Mass., Malden—Contract for concrete road on North Main St. awarded to HOLLAND CONSTRUCTION CO., Lawrence, at $1.49 per sq.yd.

Mass., Marlboro—Contract for granite block paving on Main St. awarded to SIMPSON BROS., CORPORATION, Boston, at $2.79 per sq.yd.

Conn., Hartford—Contracts for road work awarded by State Highway Commissioner as follows: Torrington Rd., Litchfield Township to LOUIS LONGHI & BRO., Torrington, at $6,870; Hartford Rd., Newington Township to THOMAS KEARNEY, Meridian, at $6,878; Hartford-New Haven Turnpike, Wallingford-North Haven Township to LANE CONSTRUCTION CORPORATION, Meridian, at $24,000; Stamford Township to R. G. MILLER CONTRACTING CO., Hartford, at about $31,000. Noted Sept. 16.

N. Y., New York—(Borough of Brooklyn)—(Official)—Charles A. Myers Contracting Co., Cypress and Willows Ave., Brooklyn, submitted the lowest bid for repaving Broadway from Havemeyer St. to Patchen Ave. at $114,286 and Topeka Paving Co., West 14th St. near Neptune Ave., Brooklyn, for repaving Surf Ave. from West 20th St. to West 37th St., at $43,070. Noted Sept. 23.

N. Y., New York—(Borough of Queens)—(Official)—The lowest bids received by Maurice E. Connolly, Borough Pres., for improving (a) Fairview Ave., (b) Parsons Ave., (c) Boulevard, were as follows: (a) Sicilian Asphalt Co., $1,622; (b) Thomas F. Tuchy, $2,060; (c) H. J. Mullen Contracting Co., $56,010. Noted Sept. 23.

N. Y., Rochester—Julius Friedrich, at $8,680, low bidder for paving Elmwood Ave.

N. J., Belleville—Contract for paving Overlook Ave. awarded to GLENFIELD CONSTRUCTION CO., at $15,042. Noted Aug. 26.

N. J., Newark—Contract for improving Front St. and Saybrook Pl. awarded to ALEXANDER J. MILMOE, Newark, at $23,621.

N. J., Ridgewood—Contract for concrete sidewalks and curbs in Rochelle Ave., Arcola Township, awarded to CHARLES T. MICHAEL, Rochelle Park, N. J., at $7,500. Noted Sept. 23.

N. J., Trenton—Bids were received for paving East Canal St. with granite block from C. A. Reid & Co., at $3.16 per sq.yd., and Easteburn and North Clinton Ave. with bermudez asphalt from Newton Paving Co., Trenton, at $1.52 per sq.yd.

Del., Wilmington—Bids were received for three miles of stone road on Kennett Pike from John F. O'Neill, Mt. Arba, and I. J. Hollingsworth, Elsmere.

Md., Baltimore—American Paving Co., at $0.19 per cu.yd., submitted the lowest bid for grading and paving Ellicott Driveway. Noted Sept. 16.

Md., Baltimore—American Paving Co., at $1.25, submitted the lowest bid for improving the Alamede Rd. between Hartford Rd. and Garrett property. Noted Sept. 9.

Va., Bland—(Official)—Contract for 2.46 miles of county road awarded to J. C. TUGGLE, Rocky Gap, at $6,990. Noted Sept. 23.

W. Va., Clarksburg—(Official)—Contract for paving North Fourth St. awarded to KEELEY BROS., Clarksburg, at $2.25 per sq.yd. A. J. Bishop, City Clk. Noted Sept. 23.

Fla., Clearwater—Commissioners of Pinellas County have declared election held recently to vote $715,000 bonds for brick highway, contract for which was awarded to EDWARDS CONSTRUCTION CO., illegal, and will hold another election. Noted Sept. 2 and 9.

Fla., Clearwater—Contract for concrete curb and gutter awarded to PINELLAS CONSTRUCTION CO., Augusta, Ga., at $6,987.

Fla., West Palm Beach—Contract for rock foundation for county road in District No. 5 awarded to GREYNALDS & MONROE, West Palm Beach; surfacing to EDWARDS CONSTRUCTION CO., Tampa. Noted Sept. 2.

Fla., Winter Park—Contract for brick pavement awarded to SOUTHERN CLAY MFG. CO., Chattanooga, Tenn., at $6,000.

Ala., Camden—Contract for road from Gastonburg to Clarke County line awarded to CENTRAL ALABAMA CONSTRUCTION CO., Selma, at about $70,000.

Ala., Carrollton—Contract for grading, draining and surfacing a portion of the Carrollton and Reform Rd. awarded to W. A. HICKS, Fayette, at $90,402. Noted Sept. 2.

Ala., Scottsboro—Contract for grading part of Woodville and Limrock Rd. awarded to F. D. HARVEY & CO., Woodville, at $9,157. Noted Sept. 16.

Miss., Meridian—Contract for curbs and gitters awarded to J. E. WRIGHT. Estimated cost, $8,000.

La., Coushatta—Contract for eight miles of road in Red River Parish awarded to W. E. GREEN, Lafayette, at $14,900.

Tenn., Dayton—Contract for 100 miles of macadam highway awarded to FREMAN & ROBBINS, Knoxville, at $210,000. Noted Sept. 9.

Tenn., Elizabethton—Contract for about 65 miles of macadam graded road between Elizabethton and Bluff City, to be a part of Memphis-Bristol Highway awarded to OLIVER-HILL CONSTRUCTION CO., Knoxville. Carter County recently voted $265,000 bonds for roads. Noted June 24 and Aug. 12.

Ky., Barbourville—Contract for 2.36 miles of pike awarded to T. J. VERMILLION.

Ky., Princeton—(Official)—Contract for two miles of macadam State-Aid highway awarded to DURRETT CONSTRUCTION CO., Louisville, at about $5,000 per mile.

Ohio, Bexley—Contract for paving Ridge Ave. awarded to H. E. BARTHMAN, Columbus. Noted Sept. 16.

Ohio, Calcutta—St. Clair Township Trustees rejected all bids for improving three roads.

Ohio, Marion—Contract for Winnemac Pike awarded to L. L. ALLEN, at $11,425; Marion and Ogasta Pike to F. M. WOLLEY at $8,175; Morral Pike to E. C. BRADY at $10,506.

Ohio, Ravenna—(Official)—Contract for improving Pratt St. from Main St. to Riddle Ave. awarded to LOWENSOHN & ULE, Ravenna, at $4,000. Noted Sept. 23.

Ohio, Steubenville—All bids for grading road at Laurel Hill, Jefferson County, rejected by Trustees of Island Creek Township. Noted Sept. 16.

Ohio, Van Wert—Contract for improving East Ridge Rd. awarded to McARTHUR & FOX, Belle Center.

Ind., Plymouth—(Official)—Contract for gravel roads in German and Center Townships awarded to MOYER & GOODALL, Laporte, and A. W. O'KEEFE, Plymouth, at $6,380 and $7,338 respectively. Noted Sept. 23.

Ind., Rochester—Contracts for roads awarded by County Commissioners as follows: Henry Township, two gravel roads to M. A. HALE, at $34,848; Bluff Rd. to H. H. STEWART at $13,680; Smith Rd. to HATCH & SARVEY at $9,750.

Mich., Blissfield—(Official)—Contract for macadam roads in Blissfield Township awarded to W. H. KNAPP & CO., Monroe. Noted Sept. 23.

Mich., Jackson—Contract for grading about three miles of Park Drive awarded to W. E. TENCH & CO., Detroit, at 22½c. per cu.yd.

Ill., Atlanta—Contract for paving business district awarded to JOHN E. BRETZ, Springfield, at $24,500.

Ill., Chicago—Lowest bids received by Board of Local Improvements for paving various streets and avenues were as follows: Campbell Ave., 8,200 sq.yd., F. P. McCormick at $1.74 per sq.yd.; Harding Ave., 2,000 sq.yd., R. F. Conway, at $1.78 per sq.yd.; 44th St., 4,800 sq.yd., R. F. Conway, $1.74 per sq.yd.; Leamington Ave., 1,920 sq.yd., American Asphalt Paving Co., at $1.69 per sq.yd.; Stewart Ave., 16,500 sq.yd., American Asphalt Paving Co., at $1.64 per sq.yd.; Ward St., 2,520 sq.yd., R. F. Conway ,at $1.70 per sq.yd.; Yale Ave., 66,800 sq.yd., Frank Proudfoot, at $1.48 per sq.yd.

Ill., Huntley—Contract for paving awarded to FAIR & TAYLOR.

Ill., Jacksonville—Contract for paving South Main St. awarded to INTERSTATE PAVING CO., East St. Louis, at $12,609.

Ill., Kankakee—Contract for paving Station St. from Harrison to Schuyler Ave. awarded to F. P. COUGHLIN CO., at $9,838.

Ill., Monticello—Lowest bids received by State Highway Commission, Springfield, for State Aid work in Platt County were as follows: C. A. Michael, Malloon, $28,250; A. Pfizenmayer, Jr., Terre Haute, $29,350; Granite City Lime and Cement Co., Granite City, $30,399.

Ill., Rockford—Contract for paving Fourth and 13th St. will be awarded about Oct. 20.

Ill., Woodriver—Contract for paving Whitelawn Ave. awarded to H. A. Grabbe, Alton, at $18,127.

Iowa, Clear Lake—Contract for paving awarded to BRYANT ASPHALT PAVING CO., Waterloo, at $86,000.

Iowa, Creston—(Official)—The contract for approximately 12,000 sq.ft. of cement sidewalk awarded to E. KENNEY & SONS, Creston, at $0.12 per sq.ft. Noted Aug. 19.

Iowa, Des Moines—Contract for paving First St. from New York Ave. to Euclid Ave. awarded to BRYANT ASPHALT PAVING CO.

Iowa, Guthrie Center—Remking Construction Co., Des Moines, at $71,000, submitted lowest bid for about 2½ miles of paving. Noted Sept. 2.

Minn., St. Paul—Keough Bros., at $8,300, submitted lowest bid for grading 8th St. in Franklin Addition.

Kan., Hutchinson—Contract for approximately 12,000 sq.yd. concrete paving awarded to McLEOD & CRANDALL, Hutchinson, at $1.17½ per sq.yd.

Mo., Kansas City—Contract for riprapping Blue Mills-Sibley Rd. awarded to DAVISON BROS., at $14,000.

Mo., Nevada—Contract for 12,000 yd. of pavement awarded to CLACK & WIGHT, Nevada, at $1.21 per sq.yd.

Mo., St. Louis—Contract for paving Magnolia Ave. awarded to WEBB-KUNZE CONSTRUCTION CO., at $13,257.

Mo., Sedalia—Contract for 9,200 sq.yd. vertical fiber brick with asphalt filler on Moniteau Ave., Eighth and 18th St. will be awarded about Nov. 1. Estimated cost, $16,100.

Tex., San Antonio—Contract for paving Haymarket and Market Plazas awarded to UVALDE ROCK ASPHALT CO., at $9,200.

Tex., Sulphur Springs—Contract for improving a number of streets awarded to THOGMARTIN & GARDNER. Noted Sept. 16.

Tex., Taylor—Contracts for paving awarded to UVALDE ROCK ASPHALT CO., San Antonio, and KAW PAVING CO., Topeka, Kan. Estimated cost of each, $150,000.

Okla., Ardmore—Contract for paving portion of Third Ave. awarded to SHELBY DOWNARD, at $5,923.

Okla., Poteau—Contract for paving awarded to J. W. ROOKS, McAlester, at $15,768.

Idaho, Pocatello—Contract for 26½ miles of highway in Bannock County awarded to REES & MUNSON, Blackfoot.

Wash., Bellingham—Contract for curbing, paving and guttering Madison and Walnut St. awarded to WASHINGTON PAVING CO., Tacoma, at $16,515.

Wash., Seattle—Contracts for paving awarded as follows: Mill St. to E. ARNOLD & CO., Seattle, at $11,260, and West Massachusetts St. to CASCADE CONSTRUCTION CO., at $33,984.

Calif., Eureka—Contract for grading Harris St. from D to S St. awarded to MERCER-FRASER CO., at $5,069.

Ont., Toronto—Contract for paving Bloor St. from Dundas St. to Indian Rd. and from Pacific to Hill Park Ave. awarded to CONSTRUCTION & PAVING CO., at $13,416 and $7,450 respectively; brick pavement on Bloor St. from Indian Road to Pacific Ave. to J. H. McKNIGHT CONSTRUCTION CO., at $19,004.

INDUSTRIAL WORKS

Proposed Work

Mass., Boston—Daniel P. Collins will build six-story factory at 170 Harrison Ave.

Mass., Springfield—A. G. Spaulding Co. will build three-story addition to its factory. Estimated cost, $20,000.

Mass., Taunton—Magee Range & Furnace Co. plans plant at Taunton.

Mass., Worcester—Norton Grinding Co. plans mill at estimated cost of $50,000. Clarence W. Daniels, Ch. Engr.

Conn., New Haven—Winchester Arms Mfg. Co. will build new structures at estimated cost of $2,500,000.

Conn., Waterbury—Chase Metal Co. has had plans prepared for three, two-story additions.

N. Y., Hornell—Davis Foundry Co. will build two-story, 40x100-ft., addition to its foundry and two ovens, 22x30 ft. each.

N. Y., Lockport—Fibre Corporation has had plans prepared for rebuilding its plant which was recently destroyed by fire. Estimated cost, $60,000.

N. Y., Rochester—George W. Brownyard Co., Inc., plans one- and two-story, 142x153-ft., factory in Winton Rd. near Main St. Estimated cost, $25,000. Noted Sept. 2.

N. Y., Rochester—Eastman Kodak Co. will build two-story, 43x140-ft. and five-story, 80x165-ft. additions.

N. Y., Solvay—Candee Incubator Co. will build one-story, 100x450-ft. factory.

N. J., Bayonne—Texas Co., 17 Battery Pl., New York, N. Y., will build service plant, one and three stories. Estimated cost, $75,000.

Penn., Philadelphia—William Cramp & Sons' Ship and Engine Building Co. plans improvements to its ship yard. Estimated cost, $700,000.

Penn., Philadelphia—Niagara Thread Co. will build one-story, 50x150-ft., factory on Erie Ave.

Penn., Philadelphia—North Broad Street Storage Co. will build six-story brick and reinforced-concrete building. Moores & Dunford, New York, N. Y., Arch.

Penn., Philadelphia—Louis Walker Mfg. Co. will build three-story reinforced-concrete factory on Torresdale Ave. M. Ward Easby, Arch.

Penn., Reading—Carpenter Steel Works will build two-story, reinforced-concrete factory at River Rd. and Exeter St. Estimated cost, $30,000.

Penn., Schuylkill Haven—Schuylkill Haven Foundry & Machine Co. will rebuild plant which was recently destroyed by fire.

Md., Fairfield—United States Alcohol Co. will build four one-story, 188x325-ft., factories.

Va., Lamberts Point—(Norfolk post office)—Norfolk & Western Ry. Co. contemplates grain elevator. Estimated cost, $2,000,000. Joseph E. Crawford, Roanoke, Ch. Engr.

W. Va., Huntington—Stroehmann's Vienna Bakery, Wheeling, will build branch baking plant in Huntington. Estimated cost, $100,000.

W. Va., Huntington—Warehouse Land Co. plans storage warehouse, 100x175 ft.

S. C., Greenville—T. R. Hapgood will build ice plant at Hampton Ave. and Southern R.R. Co. track.

Fla., Kissimmee—Tucker Brick Co. will build brick plant. Estimated cost, $500,000.

Miss., Biloxi—A packing plant will be constructed by International Longshoremen's Association. Estimated cost, $30,000.

Miss., Meridian—Hattiesburg Wood Reduction Co. plans additions. Estimated cost, $25,000.

La., Gueydan—Gueydan Rice Co. having plans prepared for two-story reinforced-concrete factory. Snoddy & Stankovitch, 401 Shubert Bldg., Kansas City, Mo., Arch. Estimated cost, $20,000.

Ohio, Cleveland—Harry Bialosky, 554 Leader News Bldg., and associates will build iron and steel plant on St. Clair Ave. and Babbitt Rd. Estimated cost, $200,000.

Ohio, Cleveland—Cyclone Woven Wire Fence Co. will build five-story factory at East 54th and 55th St. C. J. Lanes, Pres. Estimated cost, $150,000.

Ohio, Cleveland—Revised plans prepared by W. J. Carter, Illuminating Bldg., Cleveland, and bids will soon be received for four-story factory on East 79th St. for Van Dorn & Dutton Co. Estimated cost, $60,000. Noted Sept. 2.

Ohio, Cleveland—(Official)—Bamberger-Teinthal Co. advises that it will not build additions within the year. Noted Sept. 23.

Ohio, Cleveland—Menstock & Reid Co. will build brick addition to its plant at 3261 West 25th St. Estimated cost, $18,000.

Ohio, Marion—Press reports state Interstate Iron & Steel Co., Chicago, Ill., contemplates plant at Marion to replace Cambridge plant.

Ind., Strobe—Julius Strobe Portland Cement Co. has plans by Hunt Engineering Co. of Kansas City for rebuilding its plant. Estimated cost, $500,000.

Mich., Grand Rapids—Keeler Brass Co. will build addition, 150x200 ft., to its factory.

Minn., Minneapolis—National Candy Co. will build plant at 120 Second Ave. Building will be brick, 95x162 ft. and cost $100,000.

Minn., Minneapolis—Northwestern Elevator Co. plans fireproof grain elevator. Charles A. Magnuson, Pres.

Minn., St. Paul—Plans being prepared by Foltz Engineering Co., St. Paul, for flour mill for St. Paul Milling Co. Estimated cost, $100,000.

Mont., Butte—Floyd Hamil & Co., Butte, preparing plans for creamery for city. Building will be two stories, 40x100 ft. Estimated cost, $35,000.

Mo., St. Joseph—St. Joseph Paper Co. plans to remodel its four-story factory at Fourth and Locust St. Estimated cost, $10,000.

Mo., St. Joseph—Western Tablet Co. will build addition at 11th St. and Mitchell Ave. Estimated cost, $30,000.

Mo., St. Louis—Mississippi Valley Cold Storage & Warehouse Co. has plans for addition to its plant at Main and Ashley St.

Tex., San Antonio—(Official)—Bids will be received until Dec. 14 by Walsh & Hutchins, for Luck Tire & Mfg. Co., for factory to manufacture 100 tires daily. Noted Sept. 23.

Okla., Muskogee—Davidson Mill & Elevator Co. will rebuild its grain elevator recently destroyed by fire. Estimated cost, $50,000.

Colo., Denver—Western Chemical Mfg. Co. has plans for factory. Estimated cost, $12,000.

Ore., Albany—Thomas Pulp & Paper Mill Co. plans to build pulp and paper mill. R. Thomas is interested.

Ont., Amherstburg—(Official)—Falls Barron Co. states it will not build cold-storage plant as reported. Noted Sept. 23.

Bids In and Contracts Awarded

Mass., Boston—Contract awarded to JAMES DRISCOLL & SON CO., 95 Washington St., Brookline, for creamery in Camden St., for F. W. Paine.

Mass., Springfield—Contract awarded to ERNEST F. CARLSON CO., for two buildings for Springfield Foundry Co.

Mass., Indian Orchard—Contract awarded to ERNEST F. CARLSON CO., for two one-story, 32x80-ft., buildings for Springfield Foundry Co.

Mass., New Bedford—Contract awarded to TURNER CONSTRUCTION CO., by Merchants' Terminal Warehouse Co., for nine-story, 110x160-ft., warehouse.

Mass., Palmer—Contract awarded to E. D. WARD, for addition to plant No. 14 of Wright Wire Co.

Mass., Springfield—Contract awarded to F. S. VALENTINE CO., Springfield, at $14,000, for two-story, 62x66-ft., brick and concrete garage for M. C. Barrett.

Mass., Williamstown—Contract awarded to CHARLES E. WHITNEY, North Adams, by John S. Boyd Co., for bleach house. Noted Sept. 23.

Conn., New Britain—Contract awarded to B. H. HIBBARD CO., New Britain, for mill for New Britain Chamber of Commerce Building Co. on East Ellis St.

Conn., Waterbury—Contract awarded to CHATFIELD & CHATFIELD CO., 94 Benedict St., for factory for American Brass Co., on Bank St.

N. Y., Buffalo—Contract awarded to MONARCH ENGINEERING CO., Chamber of Commerce Bldg., at about $60,000, for grain elevator for Archer Daniels Co. Noted Sept. 3.

N. Y., Buffalo—Contract awarded to JOHN W. COWPER CO., 620 Fidelity Bldg., for four-story addition to plant of Curtiss Aëroplane Co. Noted Sept. 16.

N. Y., Buffalo—Contract awarded to WESTERN BUILDING CO., Buffalo, at $35,000, for seven-story brick and steel building for Gerhard Lang Brewing Co.

N. Y., Goshen—(Official)—Contract awarded to MILLER-REED CO., 103 Park Ave., New York, at $25,000, for two-story, 60x60-ft. stone garage for R. B. Tweedy.

N. Y., Jamestown—Contract awarded to CHARLES HAAS by D. H. Grandin & Co., Inc., for one-story, 114x210-ft., warehouse.

N. Y., Montour Falls—Contract awarded to COMPTON REALTY CO. by Shepherd Crane & Hoist Co. for one-story brick and steel addition to plant.

N. Y., New York—(Borough of Manhattan)—Contract awarded to GEORGE A. FULLER CO., 111 Broadway, for three-story store and office building at Nassau and Franklin St., for Sun Printing & Publishing Co. Estimated cost, $65,000.

N. Y., Seneca Falls—Contract awarded to T. H. McHALE CONSTRUCTION CO., Syracuse, for plant for Seneca Falls Mfg. Co. Noted Aug. 29.

N. J., Gloucester City—Contract awarded to WILLIAM STEELE & SONS CO. by Welsbach Co. for four three-story buildings. Estimated cost, $500,000.

N. J., Newark—Contract awarded to EDWARD M. WALDRON, INC., for 60x80-ft. factory on Columbia St., near Lafayette St., for Oelkers Mfg. Co. Estimated cost, $15,000.

Penn., Philadelphia—Hess-Bright Mfg. Co. awarded contract to HARRISON C. REA CO. for brick and steel, 40x200-ft. factory. Watson & Huckle, Arch.

Penn., Pittsburgh—Contract awarded to FETZERWINGER CO., at about $80,000, by E. W. Proeger, at 206 Second Ave., for six-story garage and warehouse. Noted Aug. 26.

Penn., Sharon—Contract awarded to WALLIS & CARLEY CO. by Pennsylvania Tank Car Co. for factory to double capacity of its plant.

N. C., Concord—Contract awarded to T. C. THOMPSON BRO., Charlotte, for 106x210-ft., cotton mill for Norcott Mill. Estimated cost, $175,000.

Ga., Atlanta—Contract awarded to GRIFFIN CONSTRUCTION CO., at about $17,000, for three-story, 72x95-ft. factory for E. G. Willingham.

Ga., West Point—Contract awarded to GALLIVAN BUILDING CO., Greenville, S. C., at about $500,000, for addition to mill of West Point Mfg. Co.

Ala., Mobile—Contract awarded to STONE & WEBSTER ENGINEERING CORPORATION, 107 Milk St., Boston, Mass., at about $1,000,000, for buildings and wharves for Terminal Transfer & Storage Co. Noted Sept. 23.

La., New Orleans—Contract awarded to JEFFERSON CONSTRUCTION CO., $38,322, for foundation for municipal grain elevator.

Tenn., Nashville—Contract awarded to FOSTER & CREIGHTON CO., Nashville, by Ford Motor Co., for three-story, 75x170-ft. assembling plant. Noted July 29.

Ohio, Cleveland—Contract awarded to S. W. EMERSON CO., Chamber of Commerce Bldg., for factory at 2206 Parkwood Drive for Steel Products Co. Estimated cost, $30,000. Noted Sept. 30.

Ohio, Cleveland—(Official)—Contract awarded to DE HAMEL CONSTRUCTION CO., at $30,000, for garage for American Express Co. Noted Sept. 23.

Ohio, Mansfield—Contract awarded to ALBERT HANCOCK by Perfection Bed Spring Co. for two-story, 50x140-ft. brick factory at Erie R.R. near Orange St.

Ohio, Youngstown—Contract awarded to UNITED ENGINEERING AND FOUNDRY CO., Pittsburgh, Penn., for two tube mills for Republic Iron and Steel Co. Estimated cost, $500,000. Noted July 29.

Ill., Chicago—Contract awarded to WILLIAM M. HOYT, at about $250,000, for six-story printing plant at 22d and Grove St., for Henneberry Co.

Ill., Springfield—Contract awarded to BUCKBEE & CO., at about $25,000 for reinforced-concrete factory for Havana Metal Wheel Co.

Iowa, Independence—Contract awarded to T. STORK, Cedar Rapids, at $15,842, by State Board of Control for one-story brick laundry.

Neb., Lincoln—Contract awarded to W. J. ASSENMACHER, 2205 Worthington Ave., at $12,000, for three-story addition to warehouse for Star Van and Storage Co., Eighth and R St.

Mo., Kansas City—Contract awarded to JAMES STEWART & CO., New York, N. Y., at about $50,000, for reinforced-concrete superstructure of additional bins for Chicago, Milwaukee & St. Paul Ry. Co. elevator.

Mo., Kansas City—Contract awarded to GEORGE H. SIEDHOFF CONSTRUCTION CO., Finance Bldg., at $48,000, by Standard Oil Co. for garage and for remodeling warehouse.

Tex., Houston—Contract awarded to CENTRAL CONSTRUCTION CO., at $10,000, for rebuilding plant for Fidelity Cotton Oil Co.

Okla., Enid—Contract for brick warehouse for Alton Mercantile Co. awarded to WELLER & REARDON at $10,800.

Okla., Oklahoma—Contract awarded to HODGINS CONSTRUCTION CO., St. Paul, Minn., at about $500,000 for four-story, 140x275-ft., assembling plant on Main St., for Ford Motor Co. Noted Aug. 19.

Ont., Windsor—Contract awarded to WELLS & GRAY, at about $10,000, for 42x111-ft. addition to factory for Kelsey Wheel Co.

FEDERAL GOVERNMENT WORK

Proposed Work

Steamer—Newport, R. I.—Bids will be received at U. S. Engineer Office, Newport, until noon, Nov. 3, for purchase of steamer "Cora." (See Adv.)

Street Lighting System—Ft. Terry, N. Y.—Bids will be received by Constructing Quartermaster, Fort H. G. Wright, for underground street lighting system, including 11 lamps at Ft. Terry. (See Adv.)

Wharf—Ft. Totten, N. Y.—Bids will be received at office of Quartermaster, until 10 a.m., Oct. 8, for repairs to short wharf at Ft. Totten.

Buoy Bodies—New York, N. Y.—(Borough of Richmond)—Bids will be received at office of Light House Inspector, Tompkinsville, N. Y., until 2 p.m., Oct. 11, for 10 acetylene buoy bodies, type S.

Post Office—Salamanca, N. Y.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 12, for U. S. post office at Salamanca.

Shelving—Bedford, Penn.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for shelving in U. S. public building at Bedford.

Interceptor—Washington, D. C.—Bids will be received until 2 p.m., Oct. 12, at office of Commissioners of District of Columbia, Room 509, District Building, for Section 5, Anacostia Main Interceptor, District of Columbia. (See Adv.)

Paving—Washington, D. C.—Bids will be received by Secretary, Bd. of Comrs., Room 509, District Bldg., Washington, D. C., until 2 p.m., Oct. 19, for paving streets. (See Adv.)

Sale of Distilling Plant—Ft. Caswell, N. C.—Bids will be received by Constructing Quartermaster, Ft. Caswell, until Oct. 25, for sale of material for pure water distilling plant. (See Adv.)

Post Office—Sidney, Ohio—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 8, for post office at Sidney.

Post Office—Van Wert, Ohio—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 10, for post office at Van Wert.

Pipe Line Extension—Carlsbad, N. M.—Bids will be received until Oct. 8 by U. S. Reclamation Service, Carlsbad, for Dark Cañon pipe line extension of the Carlsbad project, about two miles south of Carlsbad.

Shelving—Brigham City, Utah—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until Oct. 9, for shelving in U. S. public building at Brigham City.

Shelving—Berkeley, Calif.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for shelving in U. S. public building at Berkeley.

Shelving—Grass Valley, Calif.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for shelving in U. S. public building at Grass Valley.

Shelving—Pasadena, Calif.—Bids will be received by James A. Wetmore, Superv. Arch., Treasury Dept., Washington, D. C., until Oct. 12, for shelving in U. S. public building, Pasadena.

Bids In and Contracts Awarded

Dredging—New London, Conn.—The only bid received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging at Naval Station, New London, was that of Scott Bros., New London, at 39c. per cu.yd. Noted Sept. 30.

Post Office—Harrisburg, Penn.—Bids were received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for making extensions and remodelling the post office at Harrisburg as follows: H. L. Brown Co., Mt. Vernon, N. Y., $127,900; Conners Bros., New York, N. Y., $133,000; Newport Contracting & Engineering Co., Newport News, Va., $128,917.

Post Office—Smyrna, Del.—Bids were received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for post office at Smyrna as follows: E. T. Abbott Construction Co., $26,800; King Lumber Co., Charlottesville, Va., $24,500 (low bidder); Olin Gerlach, Frostburg, Md., $24,974. Noted Aug. 26.

Dredging — Wilmington, Del. — Contract for dredging Murderkill and Mispillion Rivers, Delaware, awarded to RIVER AND HARBOR IMPROVEMENT CO., Philadelphia, Penn., at $5,048.

Dredging—Baltimore, Md.—Contract for dredging in rivers and harbors on east shore of Chesapeake Bay awarded to MARYLAND DREDGING CO., Baltimore. Noted Aug. 19 and Sept. 23.

Retaining Wall—Washington, D. C.—Contract for retaining wall on west side of Meridian Hill Park awarded to BOYLE-ROBERTSON CONSTRUCTION CO., Washington, D. C., at $21,522. Noted Sept. 2.

Vessel—Washington, D.C.—Contract awarded to MANITOWOC SHIPBUILDING AND DRY DOCK CO., Manitowoc, Wis., at $189,000, by U. S. Coast and Geodetic Survey, for vessel. Noted Sept. 2.

Dredging—Norfolk, Va.—Bids were received by U. S. Engineer, Norfolk, for dredging and rock excavation in James River as follows: (a) 15,000 cu.yd. dredging, (b) 2,800 cu.yd. hard rock excavation, (c) total: Norfolk Dredging Co., (a) 70c., (b) $11.50, (c) $42,700; Maryland Dredging Co., (a) 57c., (b) $9.30, (c) $34,590; P. Sandford Ross, Inc., (a) 69c., (b) $10.28, (c) $39,134. Noted Sept. 16.

Cell Fronts, Locking Devices—Atlanta, Ga.—MESKER BROS. IRON CO., St. Louis, Mo., at $17,125, awarded contract for steel cell fronts and mechanical locking device at U. S. Penitentiary, Atlanta. Noted Sept. 23.

Post Office—Live Oak, Fla.—Contract for United States post office at Live Oak awarded to W. H. FISSELL CO., New York, N. Y., at $47,500.

Post Office—New Albany, Ind.—Contract for making extensions and remodeling post office at New Albany awarded to R. P. FARNSWORTH & CO., Owensboro, Ky., at $67,675.

Earthwork—Ft. Laramie, Wyo.—Contracts awarded for earthwork on about 10 miles of main canal at Ft. Laramie unit as follows: Schedules 1 and 2 involving 750,300 cu.yd. excavation and 79,000 cu.yd. of overhaul, WINSTON BROS., Minneapolis, Minn., at $121,347; Schedules 3 and 4 involving 539,700 cu.yd. of excavation and 35,000 cu.yd. overhaul, FRED N. CRANE CO., at $77,960. Noted Aug. 12.

Structures—Malta, Mont.—Contracts awarded for structures, Nelson Reservoir, South Canal, Milk River Project as follows: Schedules 1 and 2 involving 296,100 cu.yd. material and 25,000cu.yd. overhaul, WINSTON BROS., MINNEAPOLIS, Minn., at $41,930; Schedule 3 involving 60,550 cu.yd. of excavation and 5,000 cu.yd. of overhaul, SNELSON BROS., Galscow, at $7,490. Noted Aug. 26.

Post Office—Tulsa, Okla.—Bids were received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for post office at Tulsa as follows: (a) marble, (b) limestone, (c) sandstone; Sound Construction & Engineering Co., Seattle, Wash., (a) $258,995, (b) $213,719; R. E. Campbell, Salt

Lake City, Utah, (a) $258,820, (b) $212,820; W. H. Fissell & Co., New York, N. Y., (a) $238,800, (b) $196,300, (c) $209,300. Noted Aug. 12.

Buildings—Bremerton, Wash.—Contract for one steel shell house and two brick magazines at Puget Sound Navy Yard awarded to CARNEGIE STEEL CO., Philadelphia, Penn., at $35,974. Noted Aug. 12 and Sept. 23.

Light Station—Navassa Island, West Indies—Bids were received by Bureau of Lighthouses, Dept. of Commerce, Washington, D. C., for light house on Navassa Island as follow: (a) metal work, (b) construction, exclusive of metal work: Champion Iron Works, Canton, Ohio, (a) $12,078; T. J. Carlin Construction Co., New York, N. Y., (a) $25,000, (b) $155,000; Ellicott Machine Works, Baltimore, Md., (a) $13,892. Noted Aug. 5.

CANALS—DITCHES—IRRIGATION

Proposed Work

Drainage—Chautauqua, N. Y.—W. W. Warsaw, Drainage Engr., of New York State College of Agriculture, Ithaca, preparing plans for drainage system for Chautauqua County.

Drainage—Savannah, Ga.—Election will be held Oct. 12 to vote $400,000 bonds for drainage.

Ditches—Arcadia, Fla.—Bids will be received until Oct. 11 by Arcadia Drainage District for 12 miles of open ditches. Estimated cost, $24,000. Cravens & Kimmel, Arcadia, Engr.

Drainage—Lake Worth, Fla.—Surveys being made for drainage system for Lake Worth drainage district. Orrin Randolph, Ch. Engr.

Ditch—Fremont, Ohio—County Engineer authorized to prepare plans and estimates for improving Pickerel Creek ditch. Estimated cost, $16,000.

Ditch—Muncie, Ind.—F. Horace Weber, County Surveyor, will prepare plans for Stewart Ditch, about 6,000 ft. of 16-in. and 18-in. tile and the Larue ditch, about 11,000 ft. of 20- and 24-in. shale tile.

Ditch—Winamac, Ind.—Bids will be received until Oct. 16 by C. E. Paul, Const. Comr. for Selmer Ditch, about 16,400 ft.

Drainage—Council Bluffs, Iowa—Petition presented to Board of Supervisors for drainage district along Silver Creek.

Drainage—Ft. Dodge, Iowa—County Supervisors considering establishment of Drainage District No. 201. J. L. Hanrahan, County Audr.

Drainage—Iowa City, Iowa—Board of Supervisors of Johnson County decided to form new drainage district to reclaim part of approximately 4,000 acres of Johnson County, Oxford Township.

Ditch—Blue Earth, Minn.—Bids will be received until 11 a.m., Oct. 22, by Jesse L. Herring, County Audr., Faribault County, for Judicial Ditch No. 10.

Ditch—Breckenridge, Minn.—Bids will be received by B. E. Truax, County Audr., until Oct. 20, for County Ditch No. 20, Wilkin County.

Ditch—Mankato, Minn.—Bids will be received until 2 p.m., Oct. 19, by C. L. Kennedy, County Audr., for Ditch No. 39, Blue Earth County.

Ditch—Montevideo, Minn.—Bids will be received until 2 p.m., Oct. 11, by J. J. Stennes, County Audr., for County Ditch No. 17, Chippewa County.

Ditch—Roseau, Minn.—(Official)—Bids will be received until Oct. 20 by County Auditor, Roseau County, for excavating Judicial Ditch No. 62.

Ditches—Fargo, N. D.—According to press reports two ditches will be constructed through a portion of Kenyon and Noble Township to Red River.

Irrigation—Glendive, Mont.—Plans prepared for Fallon Flat irrigation project by F. A. Hanford, City Engr.

Drainage—Waxahachie, Tex.—Commissioners Court of Ellis County authorized bond issue of $121,000 for drainage and levee system in District No. 2. Noted Aug. 26.

Irrigation—Carey, Idaho—Elmer H. Caldwell, Engr., Salt Lake City, Utah, preparing plans for reservoir and irrigation system for Little Wood River.

Irrigation—Newberry, Wash.—A movement is on foot to organize an irrigation district to irrigate 500,000 acres. R. W. Carter and John W. Sumner interested.

Drainage—Woodburn, Ore.—Preliminary surveys being made for about 75 sq.mi. of land between West Woodburn and Brooks. If report is favorable drainage district will be established.

Irrigation—Porterville, Calif.—Board of Supervisors has approved the plans for formation of Strathmore-Lindsay irrigation district for the purpose of irrigating 20,000 acres. Estimated cost, $2,000,000.

Bids In and Contracts Awarded

Barge Canal Work—Albany, N. Y.—(Official)—Bids were received by W. W. Witherspoon, State Supt., Pub. Wks., for barge canal work under Terminal Contract No. 47 as follows: I. M. Ludington Sons, Inc., Rochester, $38,630; Public Source Contracting Co., Niagara Falls, $39,466; F. J. Mumm Contracting Co., Inc., Buffalo, $40,120. Noted Sept. 9.

Ditch—Holcomb, N. Y.—Contract for drainage ditch in swamp of muck land east of Holcomb awarded to ANTHONY C. SARTORE, Canadaigua.

Ditch—Humboldt, Iowa—Contract for Ditch No. 77 awarded to E. E. EDWARDS, at $35,000.

Ditch—Worthington, Minn.—(Official)—Contracts for Ditch No. 12 (a) open work; (b) tile work, awarded as follows: (a) JAMES McKILLIP at 8⅛c. per cu.yd.; (b) P. L. RIVARD at $12,700. W. H. Saxon, Engr. Noted Sept. 16.

Irrigation—Belle Fourche, S. D.—CURTIS BROS., Columbus, Neb., at $8,771, awarded contract for earth work on North Canal extension and laterals, Belle Fourche Irrigation project.

Drainage—Marion, Ark.—Contract for about 1,600,000 cu.yd. of excavation to drain about 28,000 acres near St. Francis levee awarded to OTTO KOCHITITTZKY, Cape Girardeau, Mo.

Irrigation—Oakdale, Calif.—Contract for steel pipe for Oakdale Irrigation system awarded to WESTERN PIPE AND STEEL CO., at $11,000. Noted Sept. 16.

MISCELLANEOUS

Proposed Work

Steel Furniture—Albany, N. Y.—Bids will be received by Trustees of Public Buildings, Executive Chamber, Capitol, Albany, until 2 p.m., Oct. 12, for steel furniture. (See Adv.)

Retaining Wall—Pittsburgh, Penn.—Bids will be received by Hyatt M. Cribbs, County Controller, until Oct. 12, for concrete retaining wall along Scotia Hollow Rd.

Piers—Baltimore, Md.—According to press reports a movement is being agitated by Mayor Preston, Harbor Board and Way Department for developing water front between Ft. McHenry and Ferry Bay. Work will include construction of eight piers.

Elimination of Grade Crossings—Cleveland, Ohia—Election will be held Nov. 2 to vote $1,600,000 bonds for elimination of grade crossings.

Park Bonds—Massillon, Ohio—Bonds for $25,000 sold for parks.

Flood-Protection Wall—Portsmouth, Ohio—Bids for second section of Portsmouth "Flood-Protection Wall" will be opened the week of Nov. 1 to 6. (See Adv.)

Coaling Station—Chicago, Ill.—Baltimore & Ohio Chicago Terminal R.R. Co. will build coaling station at 1450 South Lincoln St. Estimtaed cost, $25,000.

Harbor Improvements—Milwaukee, Wis.—(Official)—Harbor Commission decided to postpone harbor improvements until next year. Noted Sept. 23.

Wharves, Docks, Etc.—Orange, Tex.—Contract will soon be awarded for wharves, docks, etc. Estimated cost, $150,000. Noted Sept. 30.

Dam—Idaho Falls, Idaho—Plans prepared for improving city dam and bids will soon be asked. Estimated cost, $20,000.

Subway—Seattle, Wash.—Construction of Morman St. tunnel and Lenora St. subway contemplated. A. Chittenden, Seattle, interested.

Flood Protection—Los Angeles, Calif.—According to press reports election will soon be held to vote $6,000,000 bonds for inaugurating works of conservation, flood control and harbor protection.

Grand Stand and Race Track—San Francisco, Calif.—Press reports state that company is being organized to construct grand stand and race track at Tijuana, lower California. Estimated cost, $650,000. A. B. Spreckles interested.

Esplanade—San Francisco, Calif.—Plans for first section of esplanade near Cliff House approved by Board of Public Works. Noted Aug. 26.

Jetty—San Luis Obispo, Calif.—Bids will be received by Board of Supervisors until Oct. 11 for pile jetty along north side of Santa Maria River.

Mausoleum—Whittier, Calif—Pacific Mausoleum Co. plans to build mausoleum at Whittier.

Bulkhead—Vancouver, B. C.—Harbor Commissioners plan bulkhead at False Creek District to reclaim 40 acres of mud flats under Granville Bridge. Estimated cost, $40,000.

Bids In and Contracts Awarded

Dry Dock—Boston, Mass.—Contract for dry dock awarded to HOLBROOK, CABOT & ROLLINS, New York, N. Y. Estimated cost, $3,000,000. Noted Sept. 23.

Dredging—Boston, Mass.—Bids were received by Directors of Port of Boston for dredging 35,000 cu.yd. in Neponset River as follows: J. P. O'Riorden, Charleston, 13⅜c. per cu.yd.; Eastern Dredging Co., East Boston, 20¼c. per cu.yd.; J. S. Packard Dredging Co., Providence, R. I., 23⅞c. per cu.yd.

Pier Extension—New York, N. Y.—(Borough of Brooklyn)—(Official)—Riverside Contracting Co., at $22,366, submitted lowest bid for extending Pier 22, near Jay St., North River. Noted Sept. 23.

Freight Shed—New York, N. Y.—(Borough of Brooklyn)—(Official)—Post & McCord, 101 Park Ave., New York, N. Y. (Borough of Manhattan), at $279,845, submitted lowest bid for freight shed on pier at 35th St. under Contract No. 1473. Noted Sept. 23.

Drain—Newark, N. J.—Board of Freeholders awarded contract for drain in Valley Road to CESTARE CONSTRUCTION CO., at $15,000.

Levee—Alexandria, La.—Contract for levee from White Pl. to Wilson Point, on Red River, awarded to DAMERON-WHITE CO., at about $21,000.

Levee—Glenwood, Iowa—Contract for repair of Pond Creek levee awarded to FRED M. CRANE CO., Omaha, Neb.

Flood Protection—Kansas City, Mo.—(Official)—Contract for flood protection work on Turkey Creek awarded to GEORGE SIEDHOFF CO. Noted Sept. 23.

Pier Shed—San Francisco, Calif.—State Board of Harbor Commissioners awarded contract for shed on Pier No. 35 to HEALY-TIBBITTS CONSTRUCTION CO., at $74,722.

By-Pass—San José, Calif.—Contract for Cancos ByPass awarded to M. KILCOURSE, at $10,230.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Proposed Work

Maine, New Gloucester—New bids being received by state for kitchen and laundry for State School for Feeble-Minded. Estimated cost, $50,000.

Mass., Boston—Bids will be received until 3 p.m., Oct. 14, by city for pavilion on Charles St. for Massachusetts General Hospital. Coolidge & Shattuck, 122 Ames Bldg., Boston, Arch.

Mass., Dorchester—Bids being received by J. Cusher, 544 Beach St., Revere, for one-story, 60x150-ft., store and apartment building. Estimated cost, $60,000.

Mass., Fall River—J. Darling, Arch., preparing plans for remodeling Bay St. Jail for city. Estimated cost, $75,000.

Mass., Hyde Park—Bids will soon be received, according to press reports, for addition to high school. Charles R. Greco, 8 Beacon St., Boston, Arch. Estimated cost, $75,000.

Mass., Jamaica Plain—According to press reports bids being received for four-story and basement, 50x60-ft., brick store and apartment for Y. Kayajiaan, care of H. S. Memoorjian, 340 Main St., Worcester. Estimated cost, $50,000.

Mass., Malden—Bids will be received until 9 a.m., Oct. 9, for tuberculosis hospital for city. Stebbins & Watkins, 164 Federal St., Boston, Arch.

Mass., New Bedford—Protective Order of Elks will build seven-story building as headquarters.

Mass., Salem—John M. Gray, care of James McGinniss, 16 Arlington St., Boston, preparing plans for nine-room brick school addition for city of Salem. Estimated cost, $75,000.

Mass., Waltham—Bids will soon be received for one-story, 62x184-ft., brick and terra cotta church for St. Charles Church. James F. Monaghan, 98 Luke St., Waltham, Arch. Estimated cost, $80,000.

R. I., Providence—Bids will be received about Oct. 11 for school on Cole Ave. Stone, Carpenter & Sheldon, Providence, Arch. Estimated cost, $200,000.

N. Y., Buffalo—Harlow C. Curtiss will build two-story commercial and office building at 292 Delaware Ave. Estimated cost, $60,000.

N. Y., Buffalo—Bank of Buffalo will build four-story bank and office building at Main and North Division St. E. C. McDougal, Pres.

N. Y., East Aurora—(Official)—As soon as plans are prepared election will be held to vote on question of building high school. Harris Merritt. Buffalo, Arch. Harry G. Henshaw, Secy. Noted Sept. 23.

N. Y., New York—See item under "Water-Works."

N. Y., Rochester—Masonic Lodge will build temple on Seneca St. at estimated cost of $50,000.

N. Y., Rochester—Plans prepared by Maurer & Mills, Arch., Schofield Bldg., Cleveland, Ohio, for one-story and basement church. Estimated cost, $60,000.

N. Y., Utica—Edward J. Berg, Arch., preparing plans for three-story school for St. Patrick's Church. Estimated cost, $50,000.

N. Y., Watertown—Frank W. Woolworth, New York, plans 10-story office building at Arsenal St. and Public Sq.

N. Y., Yonkers—Plans prepared by Beersman & Vollmer & Evarts Tracy, 244 Fifth Ave., New York, for four-story masonic temple at Guion St. and South Broadway for Masonic Guild, F. & A. M. Bids will soon be received. Estimated cost, $70,000.

N. J., Bayonne—(Official)—We have been advised that Board of Education is not yet ready for bids for public school No. 4. W. J. Fowley, Secy. Noted Sept. 23.

N. J., Bayonne—Board of Education plans addition to School No. 3. Estimated cost, $75,000.

N. J., Hoboken—Board of Education plans vacation school. William A. Kerr, Secy. Bd.

N. J., Montclair—Starrett & Van Vleck, New York, prepared plans for remodeling old high school. Estimated cost, $50,000.

N. J., Newton—Board of Education considering new high school.

N. J., Perth Amboy—J. N. Pierson & Son, 110 Smith St., preparing plans for two-story office building at Madison and Smith St. for Pratt-Brown Co. Estimated cost, $40,000.

N. J., Trenton—George S. Drew, State Arch., prepared plans for three-story concrete addition to State House of Detention. Estimated cost, $50,000.

N. J., Trenton—(Official)—Bids will be received until noon, Oct. 19, by Alfred Gaskill, Dir. Dept. of Conservation and Development, for building, plumbing and heating and electrical work for laboratory for Department of Conservation and Development. Noted Sept. 30. (See adv.)

N. J., Vineland—Plans prepared by George S. Drew, State Arch., Trenton, for dining and service building for State Home for Feebleminded Women. Estimated cost, $50,000.

N. J., Wildwood—All bids received for two-story and basement school rejected by Board of Education. New bids will be received. Noted Sept. 2.

Penn., Bethlehem—Lodge No. 283, Free and Accepted Masons, will build temple on East Broad St. Estimated cost, $60,000.

Penn., Duquesne—Pennsylvania R.R. Co. will make improvements to its freight terminal. Estimated cost, $250,000. Alex D. Shand, Philadelphia, Ch. Engr.

Penn., Johnstown—Knights of Pythias contemplate lodge building. Estimated cost, $50,000. H. M. Rogers, Johnstown Trust Bldg., Arch.

Penn., Johnstown—Justin-Bergman Co. will build three-story building. Estimated cost, $50,000.

Penn., Lebanon—Bids will soon be received for two-story, 200x200-ft. brick and stone high school. A. Richter, Reading, Arch. Estimated cost, $175,000.

Penn., Logan—Neff & Thomas, Arch., Philadelphia, preparing plans for building for Methodist Episcopal Congregation. Estimated cost, $50,000.

Penn., Philadelphia—Plans being prepared by J. H. Cook, Arch., for three-story addition to school. Estimated cost, $60,000.

Penn., Philadelphia—Neff & Thomas, Arch., preparing plans for one-story stone church for Methodist Episcopal Church at Logan. Estimated cost, $50,000.

Penn., Pittsburgh—Pittsburgh & Lake Erie R.R. Co. will build office and freight warehouse at Smithfield and Carson St.

Penn., Scranton—A. J. and P. J. Casey, Hotel Casey, have plans for brick and steel addition to their hotel, and will soon receive bids. McKenzie, Voorhees & Grenlin, 1123 Broadway, New York, N. Y., Arch.

Penn., Wilkes-Barre—William Stoddard Co. will build three-story building on South Main St. Estimated cost, $50,000.

Penn., Zelienople—Church will be built by Pittsburgh Synod of Evangelical Lutheran Church at its Old People's Home. Estimated cost, $50,000.

Del., Wilmington—According to press reports new free library building will be constructed. Estimated cost, $300,000.

Md., Baltimore—Plans being prepared by Baldwin & Pennington, Arch., for church on Smith Ave. near First St., Mt. Washington, for Sacred Heart Congregation. Estimated cost, $40,000.

Va., Suffolk—Citizens voted $70,000 bonds for police station.

W. Va., Wheeling—Charles W. Bates, Board of Trade Bldg., preparing plans for three-story and basement, 33x80-ft. bank and office building for Farmers & Merchants' National Bank. R. L. Bowman, interested.

W. Va., Wheeling—F. F. Farris, Schmulbach Bldg., preparing plans for two-story and basement school. Estimated cost, $100,000.

N. C., Wilkesboro—A company of which H. H. Rogers is Secy. contemplates hotel at Ninth and B St. Estimated cost, $40,000.

Ga., Savannah—Bonds for $525,000 voted by citizens for public schools.

La., New Orleans—City contemplates six-story office building for Sewage and Water Board. George G. Earl, Supt.

La., New Orleans—Bids will soon be received for club house for Surf Club at Spanish Fort., New Orleans. Estimated cost, $75,000. W. J. Deghers, Deputy City Surveyor, is Dir.

Tenn., Nashville—Board of Education plans to build Elliott School and Pearl School. Estimated cost, $71,800 and $65,200 respectively.

Ky., Dawson Springs—Brinton B. Davis, Inter-Southern Bldg., Louisville, plans hotel at Dawson Springs. Estimated cost, $75,000.

Ky., Louisville—State Department of Agriculture, Frankfort, plans exhibit building at state fair grounds, Louisville. Estimated cost, $150,000.

Ohio, Akron—Philip Robinson, Akron, preparing plans for three-story office building at 980 East Market St. for Howard Realty Co. Estimated cost, $40,000.

Ohio, Canton—Plans prepared by W. S. Epperson, Arch., for three-story, 100x125-ft. graded school. Estimated cost, $60,000.

Ohio, Canton—Plans prepared by W. S. Epperson, Arch., for two-story, 70x125-ft. concrete and brick church for Martin Luther Church. Estimated cost, $40,000.

Ohio, Cincinnati—Plans prepared by John T. Comes, Arch., Pittsburgh, Penn., for church for St. Mary's R. C. Church at Erie Ave. and Shady Lane. Estimated cost, $60,000.

Ohio, Cincinnati—Bids will soon be received for Y. M. C. A. building at Elm and Canal St. Elzner & Anderson, Arch. Estimated cost, $380,000. Noted Sept. 2.

Ohio, Cincinnati—G. W. Drach, Cincinnati, prepared plans for addition to Betheada Hospital. Estimated cost, $40,000.

Ohio, Cleveland—Walter R. McCormack, Bd. of Education, preparing plans for administration building at East Sixth St. and St. Clair Ave. for city. F. G. Hogan, Dir. of Schools. Estimated cost, $1,250,000.

Ohio, Cleveland—Citizens will vote Nov. 2 on $1,000,000 bond issue for schools and improvements to schools.

Ohio, Cleveland—Cleveland Lithuanian Catholics plan clubhouse on East 67th St. and Edna Ave., N. E. Estimated cost, $100,000.

Ohio, Cleveland—Plans prepared by George F. Hammond, Arch., for ten-story addition to Gillsy Hotel. Estimated cost, $150,000.

Ohio, Cleveland—Plans prepared by J. Milton Dyer, Arch., 825 Cuyahoga Bldg., for hotel for John W. Schuster, 1833 East 12th St. Estimated cost, $250,000.

Ohio, Cleveland—Plans being prepared by Knox & Elliott, Arch., for coliseum for J. A. Wigmore & Co., 1330 Williamson Bldg. Estimated cost, $150,000.

Ohio, Cleveland—Revised plans being prepared by O. K. Stapf, Rose Bldg., Cleveland, for three-story addition to Chamber of Industry Building at Franklin and West 25th St. Estimated cost, $40,000. Noted Aug. 26.

Ohio, Dayton—Bids will be asked in about thirty days by Albert Pretzinger and Edward P. Mussleman, Arch., 1155 Reibold Bldg., for building for B. P. O. E., Lodge No. 56. Estimated cost, $75,000.

Ohio, Toledo—Plans being prepared by H. L. Ottenheimer, Arch., 105 West Monroe St., Chicago, for temple at Scottwood and Acklin Ave. Estimated cost, $75,000.

Ohio, Washington C. H.—Baltimore & Ohio Southwestern R.R. is having plans prepared for new station. F. L. Stuart, Baltimore, Md., Ch. Engr.

Ohio, Woodsfield—Citizens, according to press reports, will build school. Estimated cost, $50,000.

Ohio, Youngstown—Salvation Army contemplates industrial relief building. Estimated cost, $40,000.

Ind., Aurora—Baltimore & Ohio Southwestern R.R. is having plans prepared for station at Aurora. F. L. Stuart, Baltimore, Md., Ch. Engr.

Ind., Logansport—David Maurice, J. Balf and others, Lafayette, will build five-story hotel at Third St. and Broadway. Estimated cost, $100,000.

Ind., Owensville—Bids will be received about Nov. 1 by Jacob W. Mauck, Township Trustee, for two-story and basement, 105x175-ft. school. Estimated cost, $65,000. J. W. Gaddis, Vincennes, Arch.

Ind., Richmond—Citizens plan school at estimated cost of $80,000.

Ind., Terre Haute—Board of School Trustees will have plans prepared for school at 25th St. and Fourth Ave. and for school on Kafader site. Estimated cost, $200,000.

Ind., Terre Haute—(Official)—Bids will be received until 3 p.m., Oct. 15, by A. H. Hubbard, care of William K. Hamilton, Terre Haute, for masonic temple. Estimated cost, $90,000. Noted Sept. 23.

Mich., Detroit—Louis Kamper, Detroit, preparing plans for ten-story building at 35 Washington Bldg. for J. B. Book, Jr., Detroit.

Mich., Detroit—(Official)—Bids will be received until 4:15 p.m., Oct. 12, by Charles A. Gadd, Secy., Bd. of Education, for 20-room school on Central and Honorah Ave.

Ill., Chicago—First Baptist Church, 38th St. and South Park Ave., and Immanuel Baptist Church will build church on site of present Immanuel church. Estimated cost, $500,000.

Ill., Chicago—Bids will be received about Oct. 10 for five-story, 400x800-ft., brick and stone building for Pennsylvania R.R. Co. Price & McLanahan, Philadelphia, Penn., Arch.

Ill., Chicago—State Street Theater Co. will build theater on State St. between Jackson Blvd. and Van Buren St. Estimated cost, $600,000.

Ill., Chicago—Methodist Book Co., 1020 South Wabash Ave., will build four-story office building at 730 Rush St. Whitelock A. Shank, Arch. Estimated cost, $200,000.

Ill., Chicago—Auburn Park Masonic Temple Association will build four-story and basement store and lodge. Estimated cost, $100,000.

Ill., Forreston—Winnebago County Board of Supervisors voted $190,000 bonds for improvements and addition to court house. A four-story addition will be built.

Ill., Monmouth—(Official)—Bids will be received until Oct. 20 by W. W. Brent, City Clk., for city hall. Temple & Burrows, Davenport, Iowa, Arch. Noted Aug. 26.

Ill., Rock Island—Bids will be received about Oct. 8 by Board of Education for three-story, 82x130-ft. school at Ninth St. and 12th Ave. Olof Z. Cervin, Arch. Noted July 29.

Ill., Sterling—County Supervisors of Winnebago County authorized addition to Rockford court house at estimated cost of $200,000.

Wis., Faycheedah—State Control Board plans to build reformatory for women. Estimated cost, $175,000.

Wis., Milwaukee—Board of Education will build two-story brick school. Estimated cost, $78,000.

Wis., Superior—Plans being prepared by Van Ryn & De Gelleke, Milwaukee, for three-story and basement training school for State Board of Normal Regents. Estimated cost, $80,000.

Iowa, Mason City—A. L. Rule contemplates seven-story business building. Estimated cost, $200,000.

Iowa, Nevada—Citizens voted $90,000 bonds for new school and for remodeling high school.

Iowa, Rock Rapids—Bids will be received until 9 a.m., Oct. 18, by E. J. Riegel, County Audr., for three-story and basement court house. Joseph Schwartz, Sioux Falls, S. D., Arch.

Iowa, Waterloo—Sacred Heart Church Congregation contemplates parochial school. Estimated cost, $50,000.

Kan., Wellington—Construction of $50,000 Y. M. C. A. building contemplated. G. A. Holliday, Secy.

Kan., Wichita—Board of Education contemplates school Estimated cost, $100,000.

Neb., Clearwater—Bids will be received until noon, Oct. 12, by F. F. Hansen, Secy. School Bd., for high school. R. A. Bradley & Co., Hasting, Arch.

Neb., Hastings—Bids will be received about Oct. 15 by C. W. Way Co., Arch., Hastings, for four-story, 44x120-ft. moving picture theater and office building for William Brach.

S. D., Brookings—Bids will be received until 10 a.m., Oct. 19, by State Board of Regents, State College, for four-story brick dormitory for State College. Joseph Schwarz, Sioux Falls, Arch.

Mont., Butte—Bids will soon be received by Max Daniels, Butte, for motion picture theater for W. H. Swanson, Salt Lake City, Utah. Estimated cost, $200,000.

Mo., Kansas City—Plans prepared by Smith, Rea & Lovitt, Finance Bldg., Kansas City, for one-story and basement, 49½x113½ ft., reinforced-concrete building at 14th and Main St. for Crow-Van Evera Realty Co.

Mo., St. Joseph—Bids will soon be received for Junior high school at Fourth and Highland Ave. R. Meyer, Lincoln Bldg., Arch. Estimated cost, $125,000.

Mo., St. Joseph—Bids will be received until Oct. 28 for three-story, 60x120-ft. office building at Seventh and Francis St. for W. F. Kirkpatrick, 721 Felix St. Walter Boschen, Tootle-Lemon Bank Bldg., Arch. Estimated cost, $50,000.

Mo., St. Louis—City plans election to vote on $450,000 for industrial school and tuberculosis hospital.

Mo., St. Louis—Columbia Novelty Co. secured site at 12th and Clinton St. and will build motion-picture theater.

Ark., Pine Bluff—Frank Blaisdell, Little Rock, preparing plans for Catholic Church. Estimated cost, $50,000.

Tex., Corsicanna—Contract awarded to J. C. JOPLIN & BRO., Beatty Bldg., Houston, at $70,658, for dining hall for State Orphans' Home. Noted Sept. 23.

Tex., Dallas—Edgar Zielian, Dallas, preparing plans for apartment hotel. Estimated cost, $500,000.

Tex., El Paso—Plans being prepared by Gibson & Robertson, Arch., for building for Mt. Franklin Country Club near El Paso. Estimated cost, $40,000.

Tex., El Paso—Plans being prepared by Trost & Trost, El Paso, for nine-story, 30x140-ft. reinforced-concrete hotel for Z. T. White. Bids will be received about Jan. 1. Estimated cost, $150,000.

Tex., Lubbock—(Official)—Citizens voted in favor of $100,000 bonds for court house. E. R. Haynes, County Judge. Noted Sept. 9.

Tex., Marlin—Citizens voted in favor of $120,000 bonds for high school and sewer system.

Tex., Nacogdoches—Bids will be received until Oct. 12 by F. H. Tucker, Pres., Bd. of Education, for high school and addition to ward school. Estimated cost, $45,000. Noted Sept. 9.

Tex., San Angelo—C. H. Powell and associates plan new hotel. Estimated cost, $200,000.

Okla., Norman—Bids will be received until Oct. 27 for four-story and basement, 60x120-ft. science hall for University of Oklahoma. J. W. Hawk and J. O. Parr, Oklahoma City, Archs. Estimated cost, $100,000. Noted Aug. 12.

Ariz., Flagstaff—Bids will soon be received for dormitory at Northern Arizona Normal School by Normal School Board. Estimated cost, $48,000.

Wash., Seattle—Plans being prepared by J. Kingsley, Arch., 1260 Empire Bldg., for addition to Seward School for Board of Education.

Wash., Seattle—Bids being received for two-story and basement settlement home for Council of Jewish Women, 18th Ave., S. and Main St. Marcus B. Pretica, Pantages Theater Bldg., Arch. Estimated cost, $50,000.

Wash., Seattle—Bids will be received until Oct. 27 by Board of Regents, University of Washington, for university building. Estimated cost, $150,000.

Ore., The Dallas—Masonic Lodge will rebuild temple which was recently destroyed by fire. Estimated cost, $100,000.

Calif., Los Angeles—J. Martin Haenke & Co., Van Nuys Bldg., preparing plans for additional buildings for Huntington School for Girls, Oneonta Park. Florence and Mary Housel, owners.

Calif., San Francisco—Cogswell Polytechnic College will rebuild its building at 26th and Folsom St. Estimated cost, $105,000.

Calif., Ventura—Bids will be received until noon, Oct. 18, by W. F. McClure, State Engr., Sacramento, for two cottages and detention building at California School for Girls.

Ont., Scarborough—Scarborough Township will build school. Estimated cost, $40,000.

Ont., Toronto—Board of Education plans school on Bledhill Ave. Estimated cost, $55,395.

Ont., Toronto—Canadian Pacific Ry. Co. will build station at North Toronto. Estimated cost, $125,000. J. T. Arundel, Toronto, Supt.

Ont., Toronto—Standard Oil Co., represented in Canada by Imperial Oil Co., will build eight-story office building at Church and Court St.

Ont., Toronto—Board of Education granted permit for school on Bartlett Ave. Estimated cost, $52,900.

Alta., Cardston—Citizens will build school. Estimated cost, $50,000. James W. Low, Treas.

Bids In and Contracts Awarded

N. H., Jaffrey—Contract awarded to McNALLY BUILDING CO., Gardner, Mass., at about $40,000, for high school.

N. H., Portsmouth—Contract reawarded to LORD & PERKINS, Berwick, Maine, at about $50,000, for 2½-story brick children's home for Chase Home for Children. Noted Sept. 16.

Mass., Brighton—Contract awarded to McGAHEY O'CONNOR, Main St., Cambridge, at about $200,000, for two-story and basement, 87x152-ft., brick school for St. Anthonys Church.

Mass., Dorchester—Contract awarded to JOSEPH M. DOLAN, 194 Sydney St., Cambridge, for parochial school for St. Georges Church.

Mass., Easthampton—Contract awarded to H. WALES LINES CO., Meriden, Conn., at about $175,000, for dormitory and service building for Williston Seminary.

Mass., Gardner—Contract awarded to JOSEPH GARNEAU BALDWINVILLE, Pembleton, at $150,000, for two-story and basement, 85x105-ft., brick store and office building for Robichaud & Mountain. Gardiner.

R. I., Providence—Contract awarded to O. D. PURINGTON & CO., 625 Industrial Trust Bldg., at about $80,000, for alterations to store for M. Misch, Misch Bldg., Providence.

R. I., Providence—(Official)—Contract awarded to NORCROSS BROS. CO., Worcester, Mass., for Central Baptist Church at Wayland and Lloyd Ave. Estimated cost, $150,000. Noted Sept. 23.

N. Y., Cortland—Contract awarded to MITCHELL REYNOLDS CO., Binghamton, at $10,000, by Cortland Carriage Goods Co.

N. Y., New York—(Borough of Brooklyn)—(Official)—Contract awarded to EDWIN OUTWATER, INC., 18 East 41st St., New York, at $150,000, for seven-story, 75x100-ft. storage building for Kirkman Sons Co.

N. J., Newark—Contract awarded to HEDDEN CONSTRUCTION CO., at about $60,000, for two-story office building at 773 Broad St. for Prudential Insurance Co.

Penn., Philadelphia—Contract awarded to ABEL BOTTOMS & SONS CO., 41 South 15th St., at $60,000, for three-story and basement, 32x65-ft. school at 30th and Gordon St. Noted Sept. 23.

Penn., Riverside—Contract awarded to L. H. PECHT & SONS at about $25,000 for two-story, 99x130-ft., brick factory for Carpenter Steel Co.

Md., Baltimore—Contract awarded to CONSOLIDATED ENGINEERING CO., 243 Calvert Bldg., Baltimore, for Hess Memorial Dispensary at Madison St. and Rutland Ave. for Hebrew Hospital. Estimated cost, $40,000.

Ohio, Akron—(Official)—Contract awarded to HUNKER-CONKEY CONSTRUCTION CO., Cleveland, at $175,000, for four-story, 125x145-ft. club house for Firestone Tire & Rubber Co. Noted Sept. 30.

Ohio, Cincinnati—Bids were received by Board of Education for new East Side High School from: Ferro Concrete Construction Co., Cincinnati, $452,519, and Ohio Building Co., $458,860. Noted July 29 and Sept. 16.

Ohio, Cleveland—Contract awarded to REAUGH CONSTRUCTION CO., 2835 East 51st St., Cleveland, at $45,000, for office and warehouse at East 79th St. and St. Clair Ave. for White Sewing Machine Co. Noted Sept. 16.

Ohio, Columbus—Contract awarded to AUGUST ROEHR, Bucyrus, at about $40,000, for two-story addition to Indianola Methodist Episcopal Church at 1887 Summit St.

Ohio, Dayton—Bids were received Sept. 16 by Board of Education for two-story addition to Steele High School as follows: J. Albert Berry, Dayton, $49,575; Structural Concrete Co., Dayton, $46,900, and Ernest Kroemer, Dayton, $44,743.

Ohio, Richwood—Contract awarded to FRANKLIN CONSTRUCTION CO., Columbus, at about $40,000, for school.

Ohio, Steubenville—(Official)—Contract awarded to JAMES A. COYNE, Steubenville, at $63,107, for school. Noted Sept. 2.

Mich., Grand Rapids—(Official)—Contract awarded to HOMER & KELLY, Grand Rapids, at $88,293, for armory for Grand Rapids Battalian. Noted Sept. 26.

Ill., Oblong—Contract awarded to N. S. INKERD, Bedford, Ind., at $46,409, for three-story and basement school by School Board.

Wis., Monroe—Contract awarded to WAGNER & BAUMANN, Monroe, at $53,835, for two-story, 75x115-ft. brick school.

Iowa, Des Moines—Board of Education awarded contract for new dental building to CHARLES FRANKLIN, Iowa City, at $130,800.

Iowa, Grundy Center—Contract awarded to STANDARD CONSTRUCTION CO., Minneapolis, Minn., at $61,000, for school. Noted Aug. 19.

Iowa, Waterloo—Contract awarded to M. BLITSCH for 137x150-ft. warehouse at Center St. and Fairview Ave. for Iowa Real Estate and Investment Co. Estimated cost, $30,000.

Minn., Maynard—Contract awarded to EMIL JOHNSON, Minneapolis, at about $40,000, for three-story school. Noted Sept. 16.

Mont., Glasgow—Contract awarded to G. W. Bell, at about $75,000, by Rundle Land & Loan Co. for three-story, 90x130-ft. brick and concrete business building on Second Ave.

Mo., Kansas City—Contract awarded to FOGEL CONSTRUCTION CO., 515 Reliance Bldg., for five-story reinforced-concrete building at 1600 Oak St. for Southwest News Co., 410 East Ninth St.

Okla., Tulsa—Contract awarded to CHRISTOPHER & SIMPSON, St. Louis, Mo., at about $250,000, for ten-story building at Fourth and Boston St. for S. Gallais.

Wash., Medical Lake—(Official)—Contract awarded to BOYAJOHN-ARNOLD CO., Panama Bldg., Portland, Ore., at $227,000, by State Board of Control for building for Feeble Minded. Noted Sept. 16.

Wash., Seattle—Contract awarded to A. W. QUIST, Hoge Bldg., at about $55,000, for four-story, 45x108-ft., business block for Puget Sount News Co. at Second and Virginia St. Noted July 29.

Wash., Vancouver—(Official)—Contract awarded to S. C. ERICKSON, Tacoma, at $58,654, by Board of Control, Olympia, for state school for blind. Noted Sept. 16.

Calif., Oroville—Contract for Hall of Records for Butte County awarded to WESTERN BUILDING & ENGINEERING CO., San Francisco, at $43,843

Calif., Sacramento—Contract awarded to W. E. KIER CONSTRUCTION CO., American National Bank Bldg., San Diego, at $34,999, for two patients cottages at State Engineering Department.

Ont., Toronto—Contract awarded to PETER LYLE CONSTRUCTION CO., Montreal, Que., for Union Station on Front St. Estimated cost, $3,000,000. M. Griffiths, Supt.

The Austin-Western Road Machinery Co., with general offices in the Karpen Bldg., Chicago, Ill., has opened an office at 314 Bulletin Bldg., Philadelphia, Penn. E. M. Terwilliger has been placed in charge.

The American Locomotive Co., 30 Church St., New York, N. Y., at the last meeting of the Board of Directors appointed J. O. Hobby, Jr., as Treasurer.

The General Waterproofing Co., of Pittsburgh, Penn., has been recently incorporated and has begun business with offices at 550 Century Bldg. The company will sell materials for use in waterproofing work and its contract department will execute work under contract or supervision on all classes of waterproofing construction in general building operations. H. E. Hollingsworth, formerly on the engineering staff of the Palisades Interstate Park Commission at New York City, is Vice-Pres. and Gen. Mgr. of the company.

The Pedrick Tool & Machine Co., 3640 North Lawrence St., Philadelphia, Penn., has recently purchased the business of the Sterling Machine Works, manufacturers of tool grinders, and will continue the businesss after a reorganization.

RECLAMATION PROJECTS FOR 1916

The funds apropriated by Congress for reclamation projects during the fiscal year 1916 have been apportioned to the various projects by the Reclamation Service to the amount of $10,948,834.69. To each project has been allotted the amount of money necessary to carry on this work economically during the period from July 1 1915, to June 30, 1916, as follows: Salt River project, Ariz., $537,054; Yuma project, Ariz-Calif., $659,560; Orland project, Calif., $70,195; Grand Valley project, Colo., $561,284; Uncompahgre project, Colo., $375,423; Boise project, Idaho, $1,039,943; Minidoka project, Idaho, $328,163; Jackson Lake Enlargement, Idaho-Wyo., $475,713; Garden City project, Kan., $1,592; Huntley project, Mont., $120,008; Milk River project, Mont., $422,322; St. Mary Storage, Mont., $473,852; Sun River project, Mont., $719,940; Lower Yellowstone project, Mont.-N. D., $46,923; North Platte project, Neb.-Wyo., $272,053; Ft. Laramie Unit, Neb.-Wyo., $644,231; Truckee Carson project, Nev., $190,069; Carlsbad project, N. M., $102,379; Hondo project, N. M., $4,038; Rio Grande project, N. M., $404,570; Elephant Butte Storage, N. M., $607,387; North Dakota pumping project, N. D., $20,034; Lawton project, Okla., $40,022; Umatilla project, Ore., $294,751; Klamath project, Ore.-Calif., $164,863; Belle Fourche project, S. D., $143,949; Strawberry Valley project, Utah, $392,944; Okanogan project, Wash., $51,008; Yakima storage, Wash., $559,731; Yakima-Sunnyside Unit, $278,076; Tieton Unit, Wash., $51,959; Shoshone project, Wyo., $419,299. Total for primary projects, $10,473,350.26.

In addition the following allotments were made for preliminary investigations, secondary projects: Colorado River Basin, Ariz.-Calif., $25,000; Iron Cañon Coöperation, Calif., $25; Pitts River coöperative work, Calif., $25; Shasta County coöperative work, Calif., $100; Lassen Colunty coöperative work, Calif., $50; General, investigations, Calif., $5,000; Walker River Investigations, Nev., $50; Columbia River coöperation, Ore., $7,500; Pecos River Investigation, Tex., $900; unallotted to specific investigations, $11,325. Total for secondary projects, $50,000.

On July 1, 1915, there were available for immediate expenditure from the bond loan and reclamation fund $10,198,769.44. The expected accretions to the fund from July 1, 1915, to June 30, 1915, will bring this amount up to $17,198,769.44.

CATALOG NOTICES

Busch-Suler Bros. Diesel Engine Co., St. Louis, Mo. Pamphlet. Appleton (Wis.) water works. Combined filtration and Diesel engine pumping station. Illustrated, 20 pp., 7x10 in.

Wettlauer Bros., 99 Oak St., Buffalo, N. Y. Circulars. Heart-shaped mixers for concrete, mortar or plaster. Illustrated.

A. D. Granger Co., 90 West St., New York. Bulletin No. 2. Oswego internally fired water tube boilers. Illustrated, 16 pp., 8x10½ in.

Sullivan Machinery Co., 122 South Michigan Ave., Chicago, Ill. Bulletin No. 72. Sullivan drill sharpener. Illustrated, 24 pp., 6x9 in.

The Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog U. Brownhoist transfer cars and larries. Illustrated, 32 pp., 6x9 in.

Blaw Steel Construction Co., Pittsburgh, Penn. Folder. Blaw steel forms for concrete construction. Illustrated.

Detroit Steel Products Co, Detroit, Mich. Catalog. Lumina solid steel windows, doors and partitions. Illustrated, 48 pp., 8½x11 in.

The Electric Storage Battery Co., Philadelphia, Penn. Hand Book H L. Low voltage isolated electric light and power plants with the Chloride Accumulator. Illustrated, 52 pp., 6x9 in.

Trussed Concrete Steel Co., Youngstown, Ohio. Catalog. Kahn Mesh for reinforcing concrete. Illustrated, 32 pp., 5½x8 in. Bulletin. Fireproof floors and bearing partitions of pressed steel construction. Illustrated, 16 pp., 8½x11 in.

Morse Chain Co., Ithaca, N. Y. "Chain of Evidence." Publication No. 14. Large Power Drives. Illustrated, 20 pp., 6x9 in.

James B. Clow & Sons, Harrison Street Bridge, Chicago, Ill. Catalog. "Wasting a Million A Day—How to Save It." Plumbing fixtures for industrial purposes. Illustrated, 52 pp., 9x12 in.

Austin Bros., Dallas, Tex. Catalog and Handbook. Road-making machinery, steel bridges, structural steel, metal culverts, tanks, etc. Illustrated, 280 pp., 4½x7 in.

Robert W. Hunt & Co., 2200 Insurance Exchange, Chicago, Ill. Series of Booklets. Specifications for highway bridges, paving brick, Portland cement, adopted by the American Society for Testing Materials. Specifications for creosoted wood blocks, adopted by the Association for Standardizing Paving Specifications. Specifications for steel rails.

American Well Works, Aurora, Ill. Bulletin No. 141. Methods of Constructing Large Capacity Deep Wells. Illustrated, 40 pp., 7½x10½ in.

The American Rolling Mill Co., Middletown, Ohio. Catalog. "Armco" iron rust-resisting products. Illustrated, 64 pp., 6x9 in. Pamphlet. "Defeating Rust—The Story of Armco Iron." Illustrated, 46 pp., 6x9 in.

Lansing Co., Lansing, Mich. Catalog No. 12C. Concrete mixers. Illustrated, 36 pp., 9x11 in.

Mead-Morrison Mfg. Co., East Boston, Mass. Pamphlet No. 106. Belt hoists. Illustrated, 4 pp., 6x9 in.

The Baldwin Locomotive Works, Philadelphia, Penn. Record No. 81. Triple articulated compound locomotives. Illustrated, 30 pp., 6x9 in. Record No. 82. Locomotives for export. Illustrated, 32 pp., 6x9 in.

The Tropenas Converter Co., Engineer, 50 Church St., New York, has moved to its new laboratory at 2243 Nostrand Ave., Brooklyn, N. Y. The New York office will be continued, but all business of an executive nature will be transacted at the new address.

RAPID TRANSIT SYSTEM—NEW YORK, N. Y.

Section Nos. 1 and 3, Route Nos. 36, 37 and 50

Bids were received Aug. 3 by the Public Service Commission for the construction of the station finish on Route No. 50 of the Queensboro Subway extension, and Section Nos. 1 and 3, Route Nos. 36 and 37, of the Corona Elevated R.R., from: (A) Snare & Triest Co., 233 Broadway, New York; (B) Marble Arch Co., 216th St. and Broadway, New York. The item bids were as follows:

	A	B
5000 lin.ft. stairways, wood, street to mezzanine	$1 00	$0.50
5700 lin.ft. stairways, wood, mezzanine to platform	1.00	.50
3400 lin.ft. stairways, iron. mezzanine to platform	2.70	1 00
1350 sq.ft. stair landings, wood, straight (street to mezzanine)	.90	.40
320 sq.ft. stair landings, wood, offset (street to mezzanine)	1.10	.40
1250 sq.ft. stair landings, mezzanine to platform	1.10	.40
650 lin.ft. straight or offset with checkered steel plate (mezzanine to platform)	1.90	1.00
31 tons steel column hangers, etc., supporting stairs	85.00	100.00
1300 sq.ft. concrete street landings	.90	.40
40 cu.yd. concrete foundations for columns	15 00	12.00
25 concrete or brick manholes	54.00	30.00
15 cu.yd. rock excavations	10.00	4.00
9600 lin.ft. oak handrails	.55	.80
6800 sq.ft. canopies over stairways	.68	.60
30 canopies over street landings	75.00	60.00
67,400 sq.ft. canopies over side train platform	.36	.60
48,600 sq.ft. canopies over island train platform	.34	.60
36,100 sq.ft. special over side platform (concrete station)	.38	.70
2000 lin.ft. type "A" railing stairs, street to mezzanine	3.75	3.50
900 sq.ft. type "B" grille railing on stairs	1 10	1.30
150 lin.ft., type "C" railing	3 30	4.00
50 lin.ft., type "D", railing	3 80	4.00
2500 lin.ft., type "E," railing around stair wells	4.50	4.00
1050 lin.ft., type "F," low level railings	4.3;	4.00
5800 sq.ft., type "G," high railing	.85	1.25
3550 lin.ft., type "K," train platform railings	4 40	4.00
70 additional high posts, 2½ in. tubing	10.50	10 00
360 lin.ft., pipe railings	1 10	2 00
40 metal screens for stove recesses	12.00	10 00
325 lin.ft., type "L," level railings	3.40	4.00
1500 lin.ft., type "M," service railings	4.30	4.00
6300 lin.ft., type "N," railings on concrete structures	1.60	4.00
4700 lin.ft. wind screen drop sash on train platform	4.70	8.00
320 sq.ft. wind screen, fixed or swing sash, including stairway	.80	1.00
10,800 sq.ft. wind screen drop sash along side track Queensborough Bridge platform	1.65	1.50
235 standards on railings on train platforms	20.00	30.00
25 free standing standards on island train platform	32.00	40 00
12 standards on concrete railings on train platform	27.00	30.00
132,200 sq.ft. wood floors on train platforms	.19	.30
12,800 sq.ft., 8-in. concrete slab floor, including water proofing, etc	.57	.70
230 sq.ft., 11½-in. concrete slab floor, including water proofing, etc	.80	1.00
100 cu.ft. non-encasing columns, beams and girders	1.00	1.00
280 cu.ft. concrete copings	.90	1.00
250 sq.ft. additional cement finish on concrete as required, section 148	.20	.12
1725 lin.ft. platform edge construction supported on street angles	.80	1.00
350 lin.ft. platform edge construction supported on wood facia	.80	1.00
100 sq.ft. water proofing protective concrete wood, etc., existing concrete slabs	.40	1.00
27,200 sq.ft. asphalt floor, including wood floor	.30	.50
4140 sq.ft. 18-in. concrete slab, 3-in. finish	.55	.50
100 sq.ft. 11½-in. concrete slab, 3-in. finish	.70	.70
7800 sq.ft. cement wainscot or base	.20	.25
27,500 sq.ft. concrete track floor over mezzanine, including water proofing rods, etc	.44	.50
250 sq.ft. flooring for passageways	.22	.60
300 ferrules for mezzanine roof, including flanges	2.20	3.00
20 trap doors or scuttles	20 00	15.00
Concrete water proofing mezzanine and track floor, west side station, section 295 (lump sum)	8,900.00	6,000.00
80,000 sq.ft., 3-in. cement floor finish	.12	.15
29,000 sq.ft. external walls of mezzanine and stairways	.90	1.50
9200 sq.ft. external walls of mezzanine and stairways	.85	1.00
20.000 sq.ft. wood partitions. including doors, windows and sheathing	.55	1.00
1000 lin.ft. copper cutters	.90	1.00
330 lin.ft. low sliding gates	9.00	8.00
85 lin.ft. high sliding gates	13.00	10 00
15 lin.ft. folding gates	11.00	8.00
15 lin.ft. high swing gates	11.00	10.00
18 exit turnstiles	240 00	150 00
30 gate controls	25 00	10 00
55 gate posts and cross frames	28.00	30 00
10 floor boxes (additional)	9.00	5.00
800 lin.ft. 1¼-in. galvanized w.i. pipe for gate robes	.30	.20
6600 lin.ft. 3-in. corrugated galvanized iron leaders	.28	.30
240 lin.ft. 13-in. c.i. leaders in place	.60	.30
90 lin.ft. 3-in. w.i. leaders in place	.80	.50
1800 lin.ft. 13½-in. wi.i. leaders in place	.85	.60
460 lin.ft. 3-in. copper leaders in place	.55	.50
1650 lin.ft. smoke flue from stove recesses in place	.60	.50
215 lin.ft. smoke flue protectors on platforms	1.00	.60
2 tons steel framing shapes, connections	90.00	100.00
15 tons riveted steel girders, columns and brackets	74 00	100.00
450 lb. steel for expansion joints, street connecting stations	.10	.10
200 lin.ft. steel ladders	1.50	2.00
60 sq.ft. steel ladders, platforms	1.00	1.00
7000 drill holes in steel existing structure	.25	.15
250 sq.ft. frames for enameled signs on mezzanine	1.60	3.50
4 frames and reflectors, Type "A," illuminated sign on brackets attached to columns	50 00	25.00
940 sign frames on train platform railings	1.30	3.00
50 sign frames suspended from canopies	16 00	20 00
25 sign frames illuminated N. Y. I.'s train platform, including seat	170.00	20.00
4600 sq.ft. enameled sign plates	.35	.50
20 frame and reflectors, type "B," illuminated sign on brackets attached construction structure	45.00	20.00
26 sign frames, illuminated N. T. I.s' platform, including shields	165.00	20.00
7000 sq.ft. non-slip treads without wood blocks and anchors	.90	.80
3000 sq.ft. non-slip treads with wood blocks and anchors	95	1 00
1350 sq.ft. stamped sheet steel in booths on mezzanine	.14	.20
50 sq.ft. metal lath without steel furring	.14	.10
3200 sq.ft. metal lath with steel furring	.20	.10
2, type "B," ticket booths in place	420 00	1,000.00
6, type "BB," ticket booths in place	775 00	1,000.00
5, type "D," ticket booths in place	520 00	1,000.00
4, type "E," ticket booths in place	520 00	1,000.00
4, type "G," ticket booths in place	260 00	1,000.00
4, type "KK," ticket booths in place	260.00	1,000.00
475 lin.ft. oak seats in waiting rooms	3.00	2.00
70 doors, type "GG," for toilet stalls	12.00	10.00
200 hardware doors to toilet room, waiting room and closets	20.00	10.00
25 hardware permanent enclosures between stations	8 00	10.00
270 double hung sash	3.00	4.00
675 casement sash in mezzanine, except in ticket booths	4.60	4.00
100 casement sash in ticket booths enclosed and enclosure between stations	4.00	4.00
320 sliding sash	1.00	3.00
2750 drop sash	1.00	2.00
220 hinged sash (top and bottom)	2 50	2.00
62 toilet stall doors. type "G"	10 00	5.00
69 doors to panel boards and switch board boxes	2.00	5.00
40 vent doors	2.00	5.00
10 on swing doors for transformer columns under t. p.	2.00	5.00
110 additional hardware door checks	3.30	4.00
100 door stops	1.55	2.00
60 rubber covered chains	1.20	1.00
60 push plates	1.85	3.00
60 door pulls	2.55	4.00
100 kick plates	6.00	7.00
100 push bars	4.50	1.00
130 casement sash adjusted for single sash	2.30	5.00
120 casement sash adjusted for gang of 2 sash	2.60	8.00
10 casement sash adjusted for gang of 3 sash	11.00	10.00
20 casement sash adjusted for gang of 4 sash	13.50	12.00
20 casement sash adjusted for gang of 5 sash	16.00	13.00
35 casement sash adjusted for gang of 6 sash	18.40	14.00
45 window guard rods	1.40	20.00
4670 sq.ft. plaster coat on mastic and second coat on metal lath	.90	.50
1850 sq.yd. first or scratch coat on metal lath	.50	.40
2500 sq.yd. stucco finish on soffits and sides of stairways at concrete station	1.50	1.00
290 cu.ft. common brick	.40	1.00
13,300 cu.ft. hollow terra cotta tile	.37	.50
36 concrete stove recess, including all appurtenances excepting metal screen	32.00	50.00
3830 sq.ft. 5-in. glass wainscoting and trim on walls	1.30	2.00
775 sq.ft. 2-in. glass pipe chamber partitions	1.60	2.00
85 sq.ft. 2-in. glass shelves	1.60	2.00
1470 sq.ft. 2-in. stall partitions	1.50	2.00
230 sq.ft. 1-in. glass floor slabs	2.50	2.00
760 lin.ft. curved corners and angles of glass	1.50	2.00
60 sq.ft. soapstone wainscoting and trim on walls	1.10	1.00
280 sq.ft. soapstone pipe chamber partitions	1.30	1.00
50 sq.ft. soapstone shelves	1.30	1.00
190 sq.ft. stall partitions	1.20	1.00
20 sq.ft. soapstone floor slabs	1.50	1.00
30 lin.ft. curved corners and angles of soapstone	1.00	1.00
8650 sq.ft. copper covered walls, including windows and doors	.90	1.00
10,000 sq.ft. crimped galvanized iron on walls and ceilings	.12½	.10
140 sq.ft. galvanized wire screens	.50	.20
3650 sq.ft. concrete floor with cement finish	.40	.50
10 galvanized iron roof vents	12.00	10.00
4000 sq.ft. roof	.50	.60
200 lin.ft. copper gutters	90	1.00
875 sq.ft. partition walls	60	.40
180 sq.ft. wood floor	.30	.25
23,000 cu.ft. portable enclosures between stations	.21	.25
600 sq.ft. wood flooring passageways adjusted to enclosure	.20	.50
50 wood ladders end of platforms	2 50	10.00
71 plumbing fixtures for water closet bowls	57 00	20.00
50 lavatories in stations	41.00	20.00
6 lavatories in enclosures between stations	38 00	20 00
54 urinals	86 00	100.00
28 slop sinks	63.00	30.00
8 floor drains	15 00	10.00
Rough plumbing work complete, all stations (lump sum)	22,000.00	13,000.00
Rough plumbing work complete, all enclosures between stations (lump sum)	15,000.00	6500.00
170 c.i. work in toilet rooms and portable clothing posts	15.00	10.00
420 lin.ft. top rails	1.00	1.00
10 wall flanges	1.50	1.00
40 regulation faces and frames in pipe chamber partitions	10 00	5.00
15 c.i. vent louvres in walls of portable closets	15 00	5.00
7500 lb. glass and soapstone steel supports	07	.20
75 coat and hat hooks in toilet rooms	1 00	.20
52,100 lin.ft. electric conduits, ¾-in	.14	.20
5600 lin.ft. electric conduits, 1 in	.17	.25
6400 lin.ft. electric conduits, 1¼ in	.20	.30
1970 lin.ft. electric conduits, 2 in	.30	.40
100 lin.ft. electric conduits, 2½ in	.40	
100 lin.ft. electric conduits 3 in	.51	.1.70
1750 lin.ft., ¾-in. flexible conduit	20	.20
5 place porcelaine ferrules in extended masonry walls	1.00	5.00
10 place prcelaine ferrules in extended masonry walls, other than masonry walls	1.00	5.00
4250 c.i. outlet boxes	1.00	1.00
38 6 in. x 6 in. x 6 in. c.i. pull boxes	3 00	4.00
12 12-in. x 12-in. x 6-in. c.i. pull boxes	7.50	6.00
18 18-in. x 12-in. x 6-in. c.i. pull boxes	9 50	9.00
2 24-in. x 18-in. x 6-in. c.i. pull boxes	18.50	15.00
75 6-in. x 6-in. x 4-in. c.i. pull boxes	2 60	1.00
15 13-in. x 20-in. x 4-in. c.i. pull boxes	13 80	15.00
20 c.i. heater boxes	14 00	15.00
2 25-in. x 60-in. by 5⅛-in. steepanel board box	16.00	20.00
31 25-in. x 48-in. x 5⅛-in. steel panel board box	14 00	20.00
22 25-in. x 36-in. x 5⅛-in. steel panel board box	12.00	20.00
12 25-in. x 24-in. x 5⅛-in. steel panel board box	11.00	20.00
2 steel switch board boxes	15 00	50.00
184,400 sq.ft. painting, 2-coat work on plaster and cement surface	.01½	.02
Extended totals	$609,885	$735,930

Construction News

SEPTEMBER BUILDING OPERATIONS

Reports for building operations during the month of September show a wonderful increase over the same period of last year, the percentage of gain being slightly over 30%. The only section of the country in which no increase was shown was the Western states and this no doubt is due to the large amount of buildings completed for the exposition last year.

In the Eastern states building operations for the first nine months of the year as compared with the same period of last year show a $9,000,000 increase. In all other sections there has been a decline, especially is this noted in the Western states where there is a falling off of over $34,000,000.

In the following table is given the estimated cost of contemplated buildings from plans filed with the various building inspectors:

EASTERN STATES

	Month of September 1915	1914	First Nine Months of Year 1915	1914
Albany, N. Y.	$340,965	$267,325	$3,019,460	$5,323,475
Baltimore, Md.	595,393	577,692	.....	.....
Boston, Mass.	2,582,417	546,179	18,770,726	14,815,623
Bridgeport, Conn.	720,260	314,890	6,834,647	2,948,036
Buffalo, N. Y.	987.000	761,000	9,253,000	9,260,006
Elizabeth, N. J.	93,834	72,309	875,423	1,051,622
Hartford, Conn.	349,250	129,010	4,083,878	3,000,356
Hoboken, N. J.	9,080	10,000	575,044	740,727
Jersey City, N. J.	224,112	154,467	3,775,617	2,974,116
Newark, N. J.	662,458	231,660	6,457,568	8,671,940
New Bedford, Mass.	462,550	462,225	2,797,104	2,515,027
New Haven, Conn.	1,478,499	431,610	5,574,822	3,337,802
New York N. Y.				
Bronx	1,224,800	1,156,300	20,555,050	18,439,268
Brooklyn	3,495,913	3,206,660	14,445,620	33,099,510
Manhattan	3,739,850	5,109,050	54,732,150	39,600,090
Queens	1,330,175	1,172,540	16,129,186	15,216,085
Passaic, N. J.	96,162	20,860	870,522	774,164
Paterson, N. J.	120,581	72,783	1,221,424	1,373,198
Philadelphia, Penn.	4,731,670	1,811,250	31,451,625	30,221,630
Portland, Maine	122,850	25,020	1,270,129	971,615
Reading, Penn.	62,875	47,150	883,300	1,090,350
Rochester, N. Y.	564,845	666,554	6,856,810	7,570,636
Springfield, Mass.	312,510	255,016	4,418,549	4,281,205
Syracuse, N. Y.	302,315	219,085	3,301,757	2,199,540
Utica, N. Y.	78,565	215,525	1,587,655	1,332,570
Worcester, Mass.	592,735	181,115	3,572,206	3,979,259
Totals	$25,281,664	$18,117,275	$223,312,272	$214,787,850

SOUTHERN STATES

	Month of September 1915	1914	First Nine Months of Year 1915	1914
Atlanta, Ga.	$677,745	$170,804	$3,793,182	$4,038,536
Birmingham, Ala.	157,934	162,315	1,450,375	2,827,860
Chattanooga, Tenn.	51,165	77,387	383,963	957,007
Ft. Worth, Tex.	69,580	72,720	870,232	1,665,533
Houston, Tex.	206,510	104,042	1,283,708	3,120,049
Louisville, Ky.	506,110	267,370	3,046,845	3,734,475
Memphis, Tenn.	209,535	132,160	2,229,608	2,655,709
New Orleans, La.	315,816	159,277	2,624,290	2,329,569
Norfolk, Va.	130,842	58,731	1,407,517	1,871,146
Richmond, Va.	242,763	72,305	2,503,111	2,817,585
San Antonio, Tex.	164,535	188,123	.....	.....
Tampa, Fla.	111,975	61,210	.....	.....
Washington, D. C.	1,850,442	390,511	9,257,581	7,702,789
Totals	$4,694,952	$1,916,955	$28,850,412	$33,720,258

CENTRAL STATES

	Month of September 1915	1914	First Nine Months of Year 1915	1914
Akron, Ohio	$381,925	$267,325	$3,531,020	$3,177,530
Canton, Ohio	340,525	102,200	1,532,840	1,419,705
Cedar Rapids, Iowa	129,000	264,000	2,346,000	1,576,000
Chicago, Ill.	8,569,600	4,925,900	64,811,430	63,760,710
Cincinnati, Ohio	1,224,130	665,608	10,996,894	7,837,668
Cleveland, Ohio	2,356,620	2,132,970	24,890,299	21,672,855
Columbus, Ohio	504,710	491,725	4,103,560	4,863,256
Des Moines, Iowa	218,470	380,650	1,444,490	1,650,058
Duluth, Minn.	285,321	187,829	2,119,282	2,372,693
Grand Rapids, Mich.	205,813	427,624	2,039,316	3,172,664
Indianapolis, Ind.	1,255,792	411,628	5,578,588	6,980,469
Kansas City, Kan.	64,325	62,163	773,958	922,151
Kansas City, Mo.	778,425	565,035	7,838,750	9,105,360
Milwaukee, Wis.	2,961,938	1,162,004	9,708,502	8,187,351
Minneapolis, Minn.	945,730	881,275	12,176,951	12,924,940
Oak Park, Ill.	454,253	129,560	2,388,573	1,758,150
Omaha, Neb.	359,055	312,360	3,920,875	4,102,723
Peoria, Ill.	266,140	133,325	.....	.....
St. Louis, Mo.	800,185	519,639	8,802,482	10,422,715
St. Paul, Minn.	1,038,329	2,811,936	8,502,925	12,430,645
Toledo, Ohio	701,648	360,358	6,012,947	5,263,622
Youngstown, Ohio	164,430	459,025	1,917,467	2,534,851
Totals	$24,006,364	$17,654,139	$185,437,149	$186,136,116

WESTERN STATES

	Month of September 1915	1914	First Nine Months of Year 1915	1914
Denver, Colo.	$194,260	$1,007,130	.....	.....
Los Angeles, Calif.	828,758	1,106,064	$9,212,071	$14,280,932
Oakland, Calif.	474,203	354,262	3,773,314	3,635,321
Portland, Ore.	299,820	309,140	4,031,852	5,770,185
Salt Lake City, Utah	284,309	481,850	1,061,456	2,596,959
San Francisco, Calif.	1,086,912	830,018	10,123,475	24,991,564
San Diego, Calif.	126,347	111,231	903,294	2,684,877
Seattle, Wash.	471,615	547,190	4,431,780	10,517,160
Spokane, Wash.	145,010	42,265	957,479	3,146,633
Tacoma, Wash.	40,613	86,826	589,666	1,799,033
Totals	$3,951,847	$4,875,976	$35,084,387	$69,422,664

RAILWAYS—STEAM AND ELECTRIC
Proposed Work

Connecticut—Torrington, Thomaston Traction Co., recently incorporated, plans railway from Torrington to Thomaston, about ten miles. Hosea Mann, Pres.

New York—Long Island Ry. Co. has applied to Public Service Commission of First District for permission to build line from Flushing to Creedmoor, about 5.4 miles. J. R. Savage, Jamaica, Ch. Engr.

New York—New York Ry. Co. asked Board of Estimate, New York, for franchise for double-track line from Central Park through 86th St. to Broadway.

Virginia—Chesapeake & Ohio Ry. Co. plans branch line from Elko to James River and across Epes Island. B. T. Jellison, Richmond, Pur. Agt.

South Carolina—Chamber of Commerce, Sumter, plans electric line from Sumter to Shiloh to I. Reardon, Sumter, Secy. of Committee, and R. F. McLellan, Ch. Engr.

Florida—Central of Georgia Ry. plans to extend its line to Munson, Fla., to connect with lumber road of Stearns & Culver Lumber Co. C. K. Lawrence, Savannah, Ch. Engr.

Tennessee—Surveys made for proposed Carolina, Greenville & Northern Ry. between Bristol and Knoxville, via Kingsport, Newport and Sieverville.

Kentucky—Cincinnati, New Orleans & Texas Pacific Ry. Co. has had surveys made for double-tracking its line between Somerset and Flat Rock and from Tateville to Greenwood. C. Dougherty, Cincinnati, Ohio, Ch. Engr.

Indiana—New York Central R.R. and city of South Bend contemplate an expenditure of $3,000,000 for separating grades at 20 points in the city. G. W. Kittredge, New York, N. Y., Ch. Engr.

Illinois—Chicago, Milwaukee & St. Paul Ry. Co. at recent meeting decided to electrify all lines in west where power is available. C. F. Loweth, Chicago, Ch. Engr.

Wisconsin—Chicago & Wisconsin Valley Ry. Co. will complete its line between Portage and Madison, Wis.

Wisconsin—Citizens of Ettrick voted $75,000 bonds to aid construction of Ettrick & Northern Ry. Co. line through Ettrick and Preston to line of Green Bay & Western Ry. C. J. Van Tassell, Whitehall, Engr. Noted Sept. 9.

Wisconsin—Illinois Central R.R. plans to extend its line from Champion, Mich., to Madison, Wis. A. S. Baldwin, Chicago, Ill., Ch. Engr.

Minnesota—Duluth & Iron Range Ry. Co. will be extended to Consolidated Vermilion & Extension Co.'s Mud Creek mine. W. A. Clark, Duluth, Ch. Engr.

Minnesota—Minneapolis, St. Paul & Sault Ste. Marie Ry. Co. contemplates line from Duluth or Mahnomen to Carrington, N. D. G. R. Huntington, Minneapolis, Gen. Mgr.

North Dakota—Bids will be received until Oct. 15 by Haynes Coöperative Coal Mining Co. for material to lay 3.4 miles of standard gage track from Haynes, N. D., to coal mine.

Michigan—Oliver H. Lau, Detroit, is back of movement to build electric railway between Pontiac and Owosso.

Montana—Great Northern Ry. Co. will commence construction in spring of line in Winnett section. F. A. Bushnell, St. Paul, Minn., Pur. Agt.

Missouri—Belleview & Western R.R. Co., incorporated to build a railway from Graniteville to Belleview, Mo. William R. Orthwein and Louis Hudson, St. Louis, incorporators.

Missouri—Kansas City Connecting Ry. Co. has applied to Supreme Court for hearing in November on construction of seven miles of track to connect trunk lines in Kansas City to Kansas City stock yards.

Missouri—Missouri Pacific Ry. plans to extend its line from Hollister south to beyond Bergman. E. A. Hadley, St. Louis, Ch. Engr.

Texas—A. R. Cradford, Normangee, and associates plan interurban railway from Beaumont to Waco, via Normangee, Madisonville, Huntsville and Cold Springs, about 200 miles.

Texas—Southwestern Traction Co. having surveys made for its proposed interurban railway between Dallas and Stephenville, via Cleburne and Glen Rose, about 100 miles. W. G. Haack, Temple, Gen. Mgr. and Pur. Agt.

—T. H. Wheelis, Chicago, Ill., and J. Y. Pearce, Ballinger, Tex., are interested in an interurban railway between Ballinger and Robert Lee, via Bronte, about 45 miles.

Oklahoma—Election contemplated by citizens of Henryetta to vote bonds for municipal street car and interurban line, about eight miles. Estimated cost, $185,000. James Liggett, interested. Noted Sept. 30.

Oklahoma—Sapulpa & Oil Field Ry. Co. has been granted franchise and will build line 14 miles long to Drumright in Cushing oil field. S. W. Barnes, Kansas City, Mo., interested.

Colorado—Arkansas Valley Ry. Co. plans to connect towns in Arkansas Valley between La Junta and Cripple Creek with electric line. H. M. Byllesby Co., Chicago, Ill., interested.

Utah—Alta Consolidated Ry. Co. will build narrow gage railway in Utah. H. B. Cole and George Ford, Salt Lake City, interested.

Arizona—Atchison, Topeka & Santa Fé Ry. will soon award contract for branch line from Seligman to Gagdad, tapping Hillside mining district. J. A. Jaeger, Prescott, Ch. Engr. Noted Sept. 16.

California—Board of Supervisors of San Francisco has approved plans for extension of municipal railway from Tenth Ave. to Golden Gate Park, to Fourth Ave. and then to Irving St.

California—Patterson & Western R.R. Co. incorporated to build a railway in Santa Clara and Stanislaus Counties. R. J. Pratt, 3388 Clay St., San Francisco, interested.

California—Southern Pacific Co. will build branch line from Adobe Station, Tulare County, to Rocky and Magnesite Hill. Thomas Hood, San Francisco, Ch. Engr.

Bids In and Contracts Awarded

Kansas—Newton, Kansas & Nebraska R.R. awarded contract for railway from Newton through Harvey, McPherson, Dickinson, Saline, Clay and Washington Counties to NEWTON CONSTRUCTION CO. S. O. Waddell, Newton, Ch. Engr. Noted Sept. 19.

Wyoming—Contract awarded to WATT BROS., Upton, for completing railroad grade into Clearmont.

Oklahoma—Beaver, Mead & Englewood R.R. Co. awarded contract for extension of line from Beaver to Forgan to BEAVER CONSTRUCTION CO.

LIGHT, HEAT AND POWER

Proposed Work

N. Y., Corning—Construction of reservoir to utilize waters of Lake Wayne and Lamoka and hydro-electric plant on shores of Lake Keuka to furnish electricity to Corning, about 24 miles distant, and Hammondsport contemplated. A dam will be constructed on David Smith farm near Savona and electricity transmitted to Savona, Campbell, Bath and other places. Robert O. Hayt, Corning, Engr.-in-Charge.

Penn., Bally—Citizens voted $6000 bonds for municipal electric-light plant.

Md., Salisbury—Eastern Shore Gas & Electric Co., Delaware, has acquired properties of Salisbury, Light, Heat & Power Co., Salisbury, and Cambridge Gas, Electric-Light & Power Co., Cambridge. Plans being considered for extending power plant and transmission lines.

W. Va., Hinton—Plans being considered by Virginia-Western Power Co. for steam electric plant near Hinton to supply electricity to various towns.

N. C., Lenoir—Construction of hydro-electric plant at Poovey Shoals contemplated by Citizens Light & Power Co.

S. C., Orangeburg—See item under "Water Works."

Ga., Cumberland Springs—(Tullahoma post office)—Cumberland Springs Co. contemplates electric-light plant.

Ga., Nicholls—See item under "Water Works."

Ga., Summit—Citizens of towns of Summit and Graymont, Emanuel County, voted $5000 bonds for electric-light plant. Noted Sept. 9.

Ala., Gadsden—Construction of municipal electric-light plant contemplated. W. G. Bellenger, Mayor.

Ohio, Cleveland—A site at East 55th St. and New York Central R.R. secured by Cyclone Woven Wire Fence Co., on which they will build power block. Estimated cost, $150,000.

Ohio, Elyria—Lorain County Engineering Co. submitted report to City Council estimating cost of municipal electric plant at about $200,000.

Ind., Bicknell—Company being organized to construct light and power plant at Apraw Falls. A. L. Brockssmith, interested.

Ind., Goshen—Hawks Electric Co., contemplates new power plant. Estimated cost, $40,000.

Iowa, Ft. Dodge—Burns & McDonnell, Consult. Engr., Scarritt Bldg., Kansas City, Mo., preparing plans for dam in Des Moines River in connection with hydro-electric power plant for Ft. Dodge.

Minn., Bertha—Franchise granted to Bottenmiller Co. for electric-light plant in Bertha.

Minn., Claremont—Claremont Electric-Light Co., granted a franchise for electric-light plant.

Kan., Ford—Municipal electric-light plant and water system contemplated by Commercial Club.

Kan., Havensville—Bonds for $8,000 voted by citizens for transmission line and electric-light system. Noted Sept. 23.

Mont., Terry—Franchise granted to L. H. Gaffney for electric-light plant.

Mo., Bevier—Citizens will vote on bond issue for improving and extending lighting system. Estimated cost, $10,000 to $15,000.

Mo., Columbia—Capacity of electric-light plant will be increased.

Ark., Tuckerman—Construction of electric-light plant contemplated.

Tex., Wharton—Wharton Ice & Power Co. purchased by Texas Southern Electric Co. who plan to improve same.

Okla., Goltry—Election will be held to vote $10,000 bonds for municipal electric-light plant.

Okla., Lahoma—Plans being considered for municipal electric-light plant.

Calif., Orange—City plans municipal electric-light plant.

Ont., Chesley—By-law passed for installation of hydro-electric power and lighting system. H. S. Sanderson, Town Clk.

Ont., Hensall—Town Council plans to install hydro-electric power and lighting systems. Alexander Murdock, Town Clk.

Ont., Toronto—Northern Ontario Power Co. plans to increase capacity of plant at Porcupine. Estimated cost, $500,000.

Bids In and Contracts Awarded

N. Y., New York—(Borough of the Bronx)—(Official)—T. Frederick Jackson, 99 John St., New York, at $12,350 was low bidder for electric equipment for P. S. No. 48 on Spofford Ave.

N. Y., New York—(Borough of the Bronx)—(Official)—Bids were received Oct. 4 by Department of Education for (a) heating and ventilating apparatus, (b) temperature regulating (c) boilers and forced draft apparatus and (d) electric ash hoist in Evander Childs High School on 184th St., near Creston and Morris Ave. (low bidders) Wells & Newton, Ave. B and 17th St., Manhattan, (a) $74,770; Johnson Service Co., 123 East 27th St., Manhattan, (b) $7,515; E. Rutzler Co., 404 East 49th St., Manhattan, (c) and (d) $8,495 and $11,979 respectively.

N. Y., New York—(Borough of Queens)—(Official)—T. Frederick Jackson, 99 John St., New York, N. Y., at $4,928, was low bidder for electric equipment in P. S. No. 41, at Crocheron and Franklin Ave., Bayside.

N. C., Ayden—J. B. McCARY CO., Atlanta, Ga., awarded contract for municipal electric-light plant.

Kan., Louisville—Contract for municipal electric-light plant awarded to FEGAN CO.

Wash., Sedro Wolley—(Official)—Contract for heating and electric work for hospital buildings at Northern Hospital at Norlum awarded as follows: Heating to DUPAR BROS., Bellingham, at $11,435; electric work to AGATTER & CO., Seattle, at $4,022.

BRIDGES

Proposed Work

Conn., New Haven—Plans being prepared for bridge over Quinnipiac River at New Haven. Estimated cost, $400,000. Frederick L. Ford, City Engr.

N. Y., Ft. Edward—Date for receiving bids for bridge over Hudson River at Ft. Edward extended to Oct. 23. Noted Sept. 30.

N. Y., Lyons Falls—Bids will be received until noon, Oct. 19, for completing bridge over Blank and Moose Rivers at Lyons Falls. Estimated cost, $59,385. Frank Williams, Albany, State Engr. Noted Sept. 30.

Penn., Lancaster Junction—(Junction post office)—Bids will be received by County Commissioners until Oct. 19, for bridge at Lancaster Junction.

Penn., Middletown—Ordinance passed by Borough Council for bridge across tracks of Pennsylvania R.R. at West Ann St.

Va., Hampton—(Official)—Bids will be received at the Clerk's Office, Hampton, until 10 a.m., Oct. 27, for bridges over Tidewater Creek, Hawkins Bridge over Long Creek and Holsons Bridge over Long Creek, Elizabeth City County. G. P. Coleman, Richmond, State Highway Comr.

N. C., Wilmington—Election will be held in New Hanover County to vote $250,000 bonds for bridges.

N. C., Winston-Salem—Norfolk & Western Ry. plans steel viaduct in connection with new union station estimated to cost $500,000.

Ga., Doctortown—Construction of a bridge across Morgan Lake and approach to east bank of Altamaha River, connecting Ludowici, in Liberty County, with Doctortown in Wayne County, contemplated. R. D. Brantley, Blackshear, Ga., interested. Estimated cost, $120,000.

Fla., Monroe—Plans prepared by Atlantic Engineering Co., Germania Bank Bldg., Savannah, Ga., for bridge across St. Johns River at Monroe. Michael Sholtz, Daytona, interested.

Tenn., Knoxville—Construction of bridge over Wrinkle's Crossing contemplated by Knoxville, Sevierville & Eastern Ry.

Ky., Lexington—Citizens of Fayette County voted $30,000 bonds for county's share of bridge across Kentucky River between Fayette and Madison Counties. Noted Aug. 19.

Ohio, Akron—Election will be held Nov. 2 to vote $1,200,000 bonds for viaduct on North Main St. and Ryder Ave. from East Market St. to Cuyahoga Falls Ave. and City limits.

Ohio, Connecticut—Plans approved by Cincinnati, New Orleans & Texas Pacific R.R. Co. for viaduct over tracks at Elm St. Philip Fosdick, City Engr.

Ohio, Delphos—Bids will be received by Board of County Commissioners of Van Wert and Allen Counties, Van Wert, until Oct. 29, for bridge across Miami River and Erie Canal, Fifth St., Delphos.

Ohio, Youngstown—A viaduct, estimated to cost $600,000, will be constructed over tracks of Lake Shore & Erie R.R. in East Federal St.

Ind., Sullivan—Commissioners of Sullivan and Green counties contemplate county line bridge on Sullivan-Linton Rd.

Ill., Quincy—Bids will be received by L. L. Boyer, County Highway Supt., until 2 p.m., Oct. 15, for reinforced-concrete bridge in Columbus Township.

Ill., Waukegon—Construction of bridge over Kellogg Ravine contemplated by County Commissioners.

Iowa, Linn Grove—Bridge will be constructed across Little Sioux River at Linn Grove. Estimated cost, $10,000.

Minn., Minneapolis—Construction of concrete bridge on West Lake St. over tracks of Minneapolis & St. Louis and Chicago, Milwaukee & St. Paul R.R. contemplated.

Kan., Concordia—Bids will be received by George C. Guilbert, Clk., County Comr., until Oct. 20, for 11 reinforced-concrete bridges. Noted Oct. 7.

Kan., Hutchinson—Plans being prepared by W. B. Harris, County Engr., for concrete bridge over Arkansas River at Hutchinson.

Nebr., Lincoln—Bids will be received by H. E. Wells, Clk., Comrs. of Lancaster County, until 2 p.m., Oct. 22, for bridge over Oak Creek channel.

Okla., Chickasha—Surveys being made for new bridge, Estimated cost, $50,000. P. E. Colby, City Engr.

Idaho, Grand View—Bids will be received by G. Carlson, Chn., County Comrs., until Oct. 22, for bridge across Snake River at Grand View. Noted Oct. 7.

Idaho, Twin Falls—County Commissioners plan to construct steel bridge over Snake River at Hansen and Shoshone Falls. Estimated cost, $60,000.

Wash., Mt. Vernon—Commissioners of Skagit County plan bridge over Baker River between East and West Concrete at Mt. Vernon. Estimated cost, $60,000.

Ore., Portland—Petition presented to city for bridge across Macleay Park ravine to connect Stark St. with New Linnton Blvd.

Ore., Portland—Bids will soon be received by City for reinforced-concrete viaduct at Holgate St.

Calif., Los Angeles—Plans approved by Public Utilities Board for viaduct over tracks of Pacific Electric Ry. to connect West Boulevard and Sherman Drive. Estimated cost, $40,000.

Bids In and Contracts Awarded

Maine, Augusta—Contracts for bridge in Hayneville awarded as follows: Abutments to WISEMAN & MCPHAIL, Smyrna Mills, at $695; steel superstructure to GROTON BRIDGE CO., Groton, N. H., at $6,900. Noted Sept. 23

Maine, Frankfort—(Official)—Contract for bridge awarded to PENN BRIDGE CO., Beaver Falls, Penn. Noted Sept. 30.

N. H., Nashua—Contract for bridge over Pennichuck Brook awarded to T. J. HINES CO., Ware, Mass. Estimated cost, $8,500. Noted Aug. 19 and Sept. 23.

N. Y., Bronxville—(Official)—Contract for bridge for New York Central R.R. awarded to FT. PITT BRIDGE WORKS, Pittsburgh, Penn. Estimated cost, $10,000.

Penn., Norristown—Whitaker & Diehl, at $5,574, for concrete, and Friend & Metz, at $7,750, for steel girder type, submitted lowest bid for bridge over Towamencin Creek near Kulpsville.

Penn., Philadelphia—Contract for bridge on Sherwood Ave. awarded to F. J. BOAS, at $18,847; bridge on 54th St. over Philadelphia, Baltimore & Washington R.R. awarded to PEOPLES BROS., at $34,500.

Penn., Philadelphia—Contract for bridge across Frankford Creek at Torresdale Ave. awarded to DAY & ZIMMERMAN, at $30,361. Noted Sept. 16.

Penn., Phœnixville—(Official)—All bids received Sept. 30 for bridge across Schuylkill River between Phœnixville and Mont Clare rejected. Commissioners of Montgomery and Chester Counties have retained B. H. Davis, Consult. Engr., Whitehall Bldg., New York, N. Y., as engineer for proposed bridge and the work will be readvertised. Noted Sept. 23 and Oct. 7.

Ohio, New Lexington—Contract for bridge at Stringtown awarded to CAPITOL CONSTRUCTION CO., Columbus, at $5,545. Noted Sept. 16.

Ind., Brownstown—Contract for eight bridges for Jackson County awarded to KATTMAN & HANCOCK, Brownstown, at $8,039. Noted Sept. 2.

Ind., Collamer—Contract for bridge awarded to ELKHART BRIDGE CO., Elkhart, at $5,500.

Ind., Covington—(Official)—Contract for Ed. Martin Bridge in Troy Township, and County Line Bridge in Richland Township and Montgomery County awarded to CHARLES IRWIN, Attica, at $6,100. Noted Aug. 26.

Ind., Richmond—Contract for bridge at Main St. awarded to I. E. SMITH, Richmond, at $5,395.

Ill., Carmi—(Official)—Contract for bridge work in Carmi Township, White County, awarded to JOHN J. O'HERON & CO., Chicago, at $21,960. Noted Sept. 30.

Ill., Peoria—According to press reports contract for concrete viaduct over Dry Run on Elizabeth St. awarded to A. D. THOMPSON, at $4,250.

Iowa, Cedar Rapids—Contract for paving Avenue B bridge awarded to FORD PAVING CO., Cedar Rapids, at $8,960.

Kan., Lawrence—(Official)—Bids were received for reinforced-concrete bridge over Kansas River at Lawrence as follows: Missouri Valley Bridge Iron Co., Leavenworth, $199,910; Monarch Engineering Co., Falls City, Neb., $209,769; Winston Bros., Minneapolis, Minn., $211,052. Hendrick & Cochrane, Kansas City, Mo., Consult. Engr. Noted Aug. 12.

Kan., Oswego—County Commissioners awarded contract for seven bridges to TOPEKA BRIDGE & IRON CO., Topeka, at $8,300.

N. D., Bismarck—(Official)—Contract for concrete culverts on section line south of Wing awarded to WILLIAM FROGESTROM, Bismarck. Noted Sept. 23.

Ark., Yellville—LARIMER & BURGETT, Memphis, Tenn., at $5,000, awarded contract for bridge over Crooked Creek.

Idaho, Boise—Contract for eight reinforced-concrete bridges in Bannock County awarded to LONG & BLODGETT, Gooding, at $4,672.

Wash., Walla Walla—All bids received Sept. 10 for Swegle Bridge rejected by Commissioners of Walla Walla County. New bids will be received. Noted Aug. 5 and 19.

Calif., Hanford—MERCEREAU BRIDGE & CONSTRUCTION CO., Pacific Electric Bldg., Los Angeles, at $32,000, awarded contract for bridges and culverts.

Que., Ste. Martine—(Official)—Contract for bridge at outlet of Beau River awarded to OSIAS BIEL, at $7,840. Noted Sept. 30.

Ont., Trenton—Contract for steel work and substructure of bridge over Trent River awarded to ONTARIO BRIDGE CO., Toronto, at $132,000. Noted Sept. 30.

WATER WORKS

Proposed Work

Mass., Lenox—Lenox Water Co. contemplates new reservoir. G. F. Bouren, Comr.

N. Y., Avon—Bids will soon be received for reservoir. Estimated cost, $6,000. W. H. Clark, Avon, Water Wks., Supt.

N. Y., Huntington—Plans being considered for municipal water system. Walter E. Sexton, interested.

N. Y., Ilion—Bids will soon be received for filtration plant and pipe line. Estimated cost, $18,000. C. C. Hopkins, Rochester, N. Y., Engr.

N. Y., New York—(Official)—Bids will be received by Board of Water Supply, Municipal Bldg., until 11 a.m., Oct. 26, for buildings at Uptake and Downtake chambers of Hill View Reservoir, Yonkers. (See Adv.)

N. Y., Savona—Construction of reservoir and dam across Lamoka Valley, near Savona, contemplated.

N. J., Newark—(Official)—Bids readvertised and will be received until Oct. 21 by Water Department for meter repair station at 14th Ave. and South Eighth St.

N. J., Peapack—(Official)—Bids will be received by Frank Ludlow, Borough Clk., Borough Hall, until 8 p.m., Oct. 26, for water system. Noted Feb. 26 and Sept. 9. (See Adv.)

Del., Newport—(Official)—Election will probably be held in January to vote bonds for water and sewer systems. Noted Sept. 30.

Md., Grantsville—(Official)—See item under "Sewers."

Md., Silver Springs—Harry Stevens, Union Trust Bldg., Washington, D C., preparing plans for water system. Estimated cost, $40,000. Noted Aug. 19.

Va., Altavista—Plans being prepared for water and sewer system. Estimated cost, $35,000. Anderson & Christie, Commercial Bldg., Charlotte, Consult. Engr. Noted Aug. 26.

Va., Norfolk—Board of Control will receive bids for two dams and spillway at Lake Taylor and rebuild clear-water basin. W. H. Taylor, Jr., City Engr. Estimated cost, $36,102.

Va., Petersburg—Council contemplates bond issue for $200,000 for water and sewer mains.

Va., Williamsburg—Bonds for $30,000 voted by citizens for water system. Noted Sept. 23.

S. C., Orangeburg—James E. Salley, City Electrician, preparing plans for enlarging and extending water system and electric-light plant. Estimated cost, $50,000. Noted Oct. 7.

S. C., Spartanburg—Bids will be received until Oct. 19 by city for improvements to pumping station. S. A. Bush, Supt. of Water-Wks. Noted Sept. 23.

Ga. Acworth—City plans to install new water system and electric light plant. George L. Lemon, Mayor.

Ga., Coolidge—W. Hopson Goodlet, Macon, prepared plans for water-works improvements. Estimated cost, $5,000. Noted Sept. 16.

Ga., Fitzgerald—Construction of reservoir contemplated by city.

Ga., Nicholls—Public Utility Co., Waycross, will build water system and electric-light system.

Ala., Citronelle—Citizens voted $15,000 bonds for water system. Edward B. Kay, Tuscaloosa, Consult. Engr.

Ala., Scottsboro—Bonds for $5,000 voted by citizens for extension to water system. W. C. Maples, Clk.

Miss., Philadelphia—Bonds for $30,000 for water system and sewer system voted by citizens. W. D. Gillis, Mayor. Noted Sept. 2.

La., Oakdale—Plans being prepared for water system. Estimated cost, $25,000. R. E. L. Ricketts, City Secy. Noted Sept. 16.

Ohio, Akron—Bids will be received until noon, Oct. 17, by C. P. Parker, for 100 fire hydrants and for dismantling, moving and erecting pumping engine in Wooster Ave.

Ohio, Cincinnati—(Official)—Election will be held Nov. 2, to vote $400,000 bonds for high pressure fire service. Noted Sept. 30.

Ohio, Cincinnati—Bonds for $210,000 sold for stand pipe and equipment in Kennedy Heights.

Ohio, Cleveland—Bids will be received until noon, Oct. 17, by A. R. Callow, Comr. of Purchases and Supplies, for steam mains and for insulation for underground steam mains for filtration plant at Division pumping station.

Ohio, Defiance—Bids will be received until Oct. 23, by Charles J. Thompson, Special Master Comr., for purchase of plant of Defiance Water Co.

Ohio, Fremont—David E. Adams, State Sanitary Engr., recommends filtration plant.

Mich., Watervliet—Election will soon be held to vote $1 ,000 bonds for water system.

Ill., Galesburg—Election will be held Oct. 19 to vote $95,000 bonds for improving water system and electric-light plant. Noted Sept. 30.

Ill., Watertown—Bids will be received until 3 p.m., Oct. 18, by Frank D. Whipp, Fiscal Superv., for steam and motor driven pumps for Watertown State Hospital.

Wis., Hayward—Plans being prepared for improving water system. Estimated cost, $11,000.

Wis., Pulaski—Plans being prepared by Steller Engineering Co., Load & Trust Bldg., Milwaukee, for water and sewage system.

Iowa, Luverne—(Official)—All bids received Oct. 6 for water system rejected. New bids will be received until 3 p.m., Oct. 22, by R. E. Cook, Town Clk. Noted Sept. 23.

Minn., Aurora—Bids will be received by Alfred E. Hill, Village Clk., until Oct. 20, for concrete reservoir and brick pumping station, also for two 660-gal. pumps. Noted Sept. 30.

Kan., Russell—Plans have been approved by State Public Utilities Commission for water system. Estimated cost, $18,000. Noted Sept. 9.

Kan., Soldier—Citizens defeated $10,000 bonds for water system.

S. D., Dallas—Citizens voted $12,000 bonds for water system.

N. D., Bismarck—Bismarck Water Co. plans improvements to its water system.

Wyo., Thermopolis—Election will be held Oct. 19 to vote $40,000 bonds for extension of water system.

Mont., Polson—Bonds for $26,000 for water system sold.

Ark., Stuttgart—City Council plans municipal water and electric-light system.

Tex., Ft. Worth—Homan & Laird preparing plans for completing West Fork reservoir and constructing sewage disposal plant.

Tex., Galveston—(Official)—Col. C. S. Richie, U. S. Army Engr., was unable to accept position to supervise permanent water main between Galveston and Alta Loma plant as War Dept. deemed it contrary to public policy for its officers to do other than government work. Noted Sept. 30.

Tex., Galveston—Bids will be received until 5 p.m., Nov. 4, by John D. Kelley, City Secy., for mechanical equipment of air pumping engine at Alta Loma.

Tex., Lancaster—Citizens voted to issue $15,000 bonds for water and sewer system. Noted Sept. 16.

Tex., Rusk—Bonds for $5,000 for water system approved by Attorney General.

Tex., Whitney—Election will be held Oct. 19 to vote on $15,000 bonds for water system.

Okla., Altus—Citizens plan filtration plant at water system.

Okla., Clinton—Citizens plan to improve water system. Estimated cost, $75,000.

Okla., Jones—Contract will soon be awarded for municipal water system. Estimated cost, $10,000. Benham Engineering Co., Oklahoma, Engr. Noted Sept. 9.

Okla., Tulsa—Election will be held Nov. 2 to vote on $600,000 bonds for storage basin at mouth of Shell Creek.

Colo., Platteville—Plans being prepared by L. L. Stimson, Greeling, for water system. Noted Sept. 9 and 30.

Idaho, Pocatello—Plans being prepared by Bennock Engineering Co., Pocatello, for municipal water system. Estimated cost, $400,000. Noted Aug. 19.

Utah, Salt Lake City—Bids will be received some time in November for dam in Parley's Cañon for water storage. Estimated cost, $100,000. Noted Sept. 16.

Ore., Portland—Construction of concrete dam at Bull Run River headworks contemplated by City. Estimated cost, $110,000.

Que., Lennoxville—Bonds for $40,000 for water system voted by citizens of Lennoxville, Que., and not Lennoxville, Ohio, as stated in our issue of Sept. 30. Noted Sept. 30.

Ont., York—Report submitted to council of York Township by H. Gall, Engr., for water system for southern portion of York Township. Estimated cost, $750,000.

Bids In and Contracts Awarded

N. Y., Albany—Lowest bid received for new wells at Central Islip State Hospital was that of A. J. Connolly, 100 South 10th St., Newark, N. J., at $4,800.

N. Y., Jamestown—(Official)—Contract for 10-in. driven wells awarded to ARTESIAN WELL & SUPPLY CO., Providence, R. I., at $10,175. Noted Sept. 16.

N. Y., New York—(Borough of the Bronx)—Bids were received by Department of Water Supply, Gas and Electricity for laying water mains in Westchester Ave., as follows: Victory Contracting Corporation, 308 East Fourth St., Brooklyn, $37,911; Dominic Tucillo, $37,912 and Beaver Engineering & Contracting Co., $39,287.

N. Y., New York—Contract for electrical operating equipment for gang-driven valves and sluice gates at Ashokan, Kensico, Hill View and Silver Lake Reservoirs under Contract No. 161 awarded to LORD ELECTRIC CO., 105 West 40th St., New York, N. Y., at $32,982. Noted Sept. 16.

Penn., Allentown—Contract for water system for University Heights awarded to HUGH E. CRILLY. Estimated cost, $10,000.

Penn., Philadelphia—(Official)—Contract for turbo centrifugal pumps at Shawmont Pumping Station and stoker's equipment at Queen Lane Pumping Station awarded to M. L. BAYARD, 704 Penn. Bldg., Philadelphia, at $90,000. Noted Sept. 16 .

Ohio, East Liverpool—Contract for river intake pier, river intake line, suction equipment, filter plant, including settling basins and wash tanks awarded to T. A. GILLESPIE CO., Pittsburgh, at $96,502; contract for laying pipe, force mains and valves to J. I. DUCK, Scottdale, Penn., at $94,472. Noted Sept. 23.

Ohio, Hamilton—Bids were received Oct. 5 for c.-i. water pipe as follows: United States Cast-Iron Pipe Co., $23.50; American Cast-Iron Pipe Co., $23.60 and Clamorgan Pipe & Foundry Co., $23.75.

Ohio, Ironton—No bids were received for sale of $100,000 water works bonds.

Wis., Kewaunee—Contract for water system awarded to F. M. GRAY, JR., Milwaukee. Bonds for $30,000 sold for this purpose. Noted Aug. 19.

Iowa, Luverne—Circular Construction Co., Minneapolis, Minn., at $4,426, submitted lowest bid for reservoir.

Iowa, Terrill—Contract for water system awarded to PUBLIC SERVICE CONSTRUCTION CO., at $7,379. Noted Sept. 30.

Kan., Spearville—Contract for water system awarded to BICKELL CO., 700 Interstate Bldg., Kansas City, Mo., at $20,543. Noted Sept. 9.

Neb., Hastings—Contract for driving wells and furnishing motor driven centrifugal turbine pump awarded to HYDRAULIC ENGINEERING & MACHINERY CO., Lincoln, at $4,970. Noted Sept. 9.

N. D., Minot—(Official)—Contract for two miles of water mains awarded to GEORGE W. KEMPER, Minot, at $18,057. Noted Sept. 23.

Ark., Leslie—Contracts for water system awarded as follows: Pipe to AMERICAN CAST IRON PIPE CO., Birmingham, Ala.; hydrants and valves to COLUMBIA IRON WORKS, Chattanooga, Tenn.; pumps to HOSHELL MACHINE CO., Memphis, Tenn.; reinforcing steel work to CORRUGATED METAL CO., Buffalo, N. Y. Bonds for $28,800 sold for this purpose. Noted July 29.

Ark., Malvern—LANE & BOWLER, Stuttgart, awarded conditional contract for drilling several test holes for pure water supply. If successful, bonds will be sold for water system.

Ore., Halfway—Contract for material for gravity water system awarded to CRANE CO., Portland.

B. C., New Westminster—Contract for 4,800-ft. riveted steel pipe awarded to VULCAN IRON WORKS, at about $7,000.

SEWERS

Proposed Work

Conn., Stratford—Board of Finance voted $150,000 bonds for sewer system. Noted Sept. 9.

N. Y., Greenwich—Election will be held Oct. 6 to vote $7,500 bonds for sewer pipe on Elman Ave., Main and Bridge St.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received until 2 p.m., Oct. 19, by Marcus E. Marks, Borough Pres., for repairs to sewer under Pier 40, at Clarkson St., North River.

N. Y., Olean—(Official)—Bids will be received until 5 p.m., Oct. 18, by Common Council for sewers in Stowell Ave. and South Eighth St. A. G. Harvey, Supt. of Streets.

N. Y., Rye—Citizens contemplate sewer extensions. Estimated cost, $150,000. John A. Ehler, Eng.

N. J., Madison—H. King Conklin, 665 Broad St., Newark, is in the market for sewer pipe for Academy Rd. for Madison Realty & Improvement Co.

N. J., Paterson—Plans prepared for sewage-disposal plant and pumping station for borough of Prospect Park. Harold J. Harder, Paterson, Engr. Estimated cost, $100,000.

Penn., Greensburg—Samuel Dixon, Health Comr., authorized sewage-disposal plant. Estimated cost, $250,000.

Penn., Sharon—Election will be held in November to vote $185,000 bonds for sewage disposal plant. Noted Sept. 23.

Penn., Steelton—Edward Lewis, Secy., Bd. of Health, favors sewage-disposal plant. Estimated cost, $12,000.

Md., Crisfield—(Official)—State Board of Health has ordered installation of sewer system.

Md., Grantsville—(Official) — William Harvey, Frostburg, making surveys for installation of sewer and water systems.

W. Va., Parkersburg—Bids will be received until Oct. 20 for 8-in. sanitary sewers in various streets. Frank Good, City Clk.

N. C., Durham—Bids will be received until Oct. 18 for sanitary sewers, manholes and flush tanks. H. W. Kueffner, Engr.

N. C., High Point—City will spend $60,000 for extending sewer outlet. W. P. Pickett, Mayor.

Fla., Starke—(Official)—Bids will be received about Jan. 1 for $26,000 sewer bonds. C. F. Hoover, Mayor. Noted July 29.

Ala., Citronelle—Bonds for $10,000 for sewer system voted by citizens. Edgar B. Kay, Tuscaloosa, Engr.

Miss., Philadelphia—Bonds for $30,000 voted by citizens for sewer and water systems. M. L. Cully, Jackson, Engr. Noted Sept. 2.

La., De Ridder—First Sewerage District plans $41,000 bond issue for sewer extensions. J. E. McMahon, Pres.

Tenn., Cleveland—Bids will soon be received for sewer system. Walter G. Kirkpatrick, Birmingham, Ala., Engr. Estimated cost, $75,000.

Ohio, Bowling Green—Bids will be received by W. A. Mariner, Dir. Pub. Ser., until Oct. 16, for sewer construction.

Ohio, Canton—Bids will be received about Nov. 1, according to press reports, for sanitary sewer system. W. E. Sarver, Engr.

Ohio, East Liverpool—Bids will be received until Oct. 18 for 6-in. sanitary sewer in McKinnon, Smith, Orchard Grove and Fairmount St. E. J. Smith, Dir. of Pub. Ser.

Ohio, Findlay—Council authorized sewer in South Findlay on Chamberlain Hill. Estimated cost, $7,380. J. Stringfellow, City Engr.

Ohio, Xenia—(Official)—Bids will be received until noon, Nov. 2, by City Auditor for sale of $60,000 bonds for sewage-disposal plant.

Ind., East Chicago—Bids will be received until 1:30 p.m., Oct. 15, by Board of Public Works for main sewer in Washington St. T. Y. Richards, City Clk.

Ind., Logansport—Bids will be received until 10 a.m., Oct. 19, by Frank V. Guthrie, Bd. of Pub. Wks., for sewer in Race St., Linden Ave.

Mich., Zeeland—Plans being prepared by J. R. Rumsey, Consult. Engr., Grand Rapids, for extension of sewer system.

Ill., Chicago—Proposition presented to Sanitary District Board by Stock Yards Packing Corporations for improved drainage system to flow into Bubbly Creek. Work will include construction of new sewers.

Ill., Upper Alton—Bids will be received by Frank Whipp, Fiscal Superv., Springfield, Ill., until 3 p.m., Oct. 25, for tunnel work and sanitary storm and water sewers at Alton State Hospital.

Wis., Embarrass—Village plans to install sewer system.

Wis., Ripon—Bids will be received until 4 p.m., Nov. 5, by Board of Public Works for sewer in South Grove St. Jay E. Carter, City Clk.

Iowa, Algona—(Official)—All bids received Oct. 5 for sewers in various streets have been rejected. New bids will be received until Oct. 27. S. W. Crowell, City Clk. Noted Sept. 30.

Iowa, Charles City—W. S. Beattie preparing plans for storm sewer system.

Iowa, Elliott—(Official)—Bids will be received until 8 p.m., Oct. 19, by Town Clerk for sanitary sewer mains. Noted Aug. 12.

Iowa, Pella—Bids will be received by A. C. Kuyper, City Clk., until 5 p.m., Oct. 29, for 14,500 ft. of sanitary sewer.

Iowa, Strawberry Point—M. Tschirgi & Son, American Trust Bldg., Cedar Rapids, preparing plans for sanitary sewers and disposal-plant. Estimated cost, $20,000.

Minn., St. Paul—Plans for sewer in Suburban Ave. and Hester St. approved by City Council.

Kan., Manhattan—Bids will soon be received for sanitary sewer in three districts. George Frank, Comr. of Pub. Utilities.

Mont., Bozeman—Bids will be received until 5 p.m., Oct. 21, by C. A. Speith, City Clk., for sanitary sewer in Special Improvement Dist. No. 106.

Tex., Crockett—Sewer system will be constructed by city. V. M. Ehlers, Engr., and J. W. Young, Mayor.

Tex., Kaufman—City contemplates building sewer system.

Tex., San Benito—Bids will be received until Oct. 20 for sewage-disposal plant. Estimated cost, $5,000. A. T. Agar, San Benito, Engr. Noted Oct. 7.

Tex., Sweetwater—City contemplates sewage-disposal plant.

Tex., Uvalde—Installation of sewage-disposal plant under consideration.

Okla., Muskogee—Bonds for $25,000 voted by citizens for sanitary sewers. Franklin Miller, Mayor.

Colo., Loveland—Council plans construction of west side sewer system.

Calif., Los Angeles—City Council plans sewers in Second Ave. and 36th St.

Calif., Stockton—Bids will soon be received for sewer work. Estimated cost, $18,693. J. Compton, City Engr. Noted Sept. 2.

Bids In and Contracts Awarded

Mass., Boston—Bids were received Oct. 6 by Metropolitan Water and Sewerage Board for Section 1 of Deer Island Outfall sewer as follows: George M. Bryne, 166 Devonshire St., Boston, $43,370; Bay State Dredging & Contracting Co., Boston, $44,358 and J. H. Ferguson, Dorchester, $50,584. Noted Sept. 30.

N. Y., New York—(Borough of Manhattan)—(Official)—W. J. Fitzgerald, 547 West 45th St., New York, was low bidder at $10,692 for receiving basins under contract 1, $11,137 for receiving basins under contract 2, $7,801 for receiving basins under contract 3 and $9,332 for receiving basins under contract 4.

N. Y., New York—(Borough of Richmond)—(Official)—Bids were received Oct. 5 for sanitary sewers in Castleton Ave.: J. E. Donovan, 2205 Richmond Terrace, Port Richmond, $8,823, and Joseph Johnson Sons, West New Brighton, $9,558.

N. Y., New York—(Borough of Richmond)—(Official)—Contract awarded to O'BRIEN & FLEMING, 109 Broad St., New York, at $4,374, for sewage-disposal plant. Noted Oct. 7.

N. Y., Rensselaer—Contracts for sewers on Spruce and Ring St. and Aiken Ave. to JOHN DOYLE, Rensselaer, at $4,020; tile sewer on Hallen Ave. to S. A. FOWLER, at $2,579; sewer from Barnett's Shoddy Mills to river to MICHAEL DOLLARD, at $3,630.

Nutley, N. J.—Contract awarded to JOSEPH CESTONE, at $16,060, for storm sewer in Park and Myrtle Ave. and to JAMES T. BOYLAN, at $5,099, for sanitary sewer in same streets.

Penn., Glen Mills—Latta & Perry, Philadelphia, was low bidder for sewage-disposal plant for Girl's House of Refuge of Pennsylvania. Franklin & Co., Philadelphia, Engr.

Penn., Philadelphia—(Official)—Department of Public Works awarded contracts for sewer work as follows: ADOLPH JAFOLLA, at $16,555, for Cobbs Creek intercepter; JOSEPH LOMBARDI, at $11,623, for Gunners Run relief extension; RICHARD WALSH & SONS, at $61,551 for Lardner St. sewer; ESTATE OF DAVID McMAHON, at $12,198, for North Mt. Pleasant Ave. sewer; C. A. CONAN, at $16,117, for Snyder Ave. sewer; FRANK MARK CONSTRUCTION CO., at $25,570, for Wingohocking extension. Noted Sept. 23.

Penn., Pittsburgh—Contract for sewers in Bilsack St. and Stobner Way awarded to M. O'HERRON CO., First and McKean St., Pittsburgh, at $12,057.

Penn., Wilkes-Barre—Contract awarded to D. M. ROSSER, Kingston, for sewer work.

Va., Charlottesville—Contract awarded to E. L. CAVE, Charlottesville, at $7,500, for sewer work.

Ohio, Port Clinton—(Official)—Contract awarded to REMELSPACH & THOMAS, Fremont, for sewer work. Noted Aug. 5.

Ohio, Toledo—Contract awarded to J. N. BICK, at $14,341, for sewer in Parkside addition.

Ind., Logansport—Contracts awarded to PALMER MOORE & CO., for Humphrey St. sewer and to WALTER GIRTON for Water St. sewer, by Board of Works.

Ill., Anna—SELL & KOILER, Pana, at $9,721, awarded contract for sewage-disposal plant at Southern Hospital for Insane at Anna.

Wis., Fond du Lac—Contracts awarded by Board of Public Works to GEORGE McCABE for storm sewer in Waupun St. and to ROBERT BERNETT for sanitary sewer in Waupun St.

Wis., New Glarus—Contract awarded to J. N. ROHERTY, Madison, for sewer system.

Wis., Wausau—Contract awarded to CARL LOTZ, Wausau, for 12-in. pipe sewer in Grand Ave.

Iowa, Peterson—Contract awarded to H. J. CATHROE, Omaha, Neb., for outlet sewer and lateral sanitary sewers.

Iowa, Peterson—All bids received for sewage-disposal plant have been rejected. J. F. Fastenow, Clk.

Minn., St. Paul—All bids received for sewer in Bay St. have been rejected.

N. D., Minot—(Official)—Contract awarded to GEORGE W. KEMPER, Minot, at $27,000, for sewers in various streets. E. J. Thomas, Engr. Noted Sept. 30.

Mont., Laurel—Contract awarded to SECURITY BRIDGE CO., Billings, for sewers in Districts Nos. 12, 13 and 14.

Mo., St. Joseph—Board of Public Works awarded contract to W. D. KELLEY for sewers in District No. 69.

Tex., Dallas—Contract awarded to JETTMUTHS CONSTRUCTION CO., Montgomery, Ala., at $97,000 for Imhoff sewage-disposal plant.

Calif., San Bruno—HAMLIN & WEHNER, San José, at $22,216, awarded contract for sewer construction.

Calif., Santa Barbara—(Official)—Contract awarded to SAMUEL KRULY, 636 Castelar St., Los Angeles, at $20,300, for sewer work. A. B. Cook, City Engr. Noted Aug. 26.

Ont., London—See item under "Streets and Roads."

GARBAGE

Proposed Work

R. I., Providence—Installation of garbage disposal plant under consideration by Aldermanic Committee on Health.

N. J., Newark—(Official)—Bids will be received until 3:15 p.m., Oct. 21, by Board of Street and Water Commissioners, City Hall, for collection and disposal of refuse for five years. M. R. Sherrerd, Ch. Engr. Noted Sept. 30. (See adv.)

Mich., Ishpeming—(Official)—Bids will be received until Oct. 15 by Board of Public Works for garbage incinerator. R. H. Olds, Recdr. Noted Sept. 30.

Wis., Madison—City Council contemplates two incinerators. Estimated cost, $17,000.

Okla., Batesville—Bonds for $6,500 voted by citizens for incinerator plant.

Bids In and Contracts Awarded

Ill., Rock Island—(Official)—Contract awarded to DECARIE INCINERATOR CO., Minneapolis, Minn., at $20,250, for garbage incinerator. Noted Sept. 30.

STREETS AND ROADS

Proposed Work

Mass., Boston—(Official)—Bids will be received until noon, Oct. 15, by Edward F. Murphy, Comr. of Pub. Wks., for sidewalks in Walk Hill St., in Bourne St. and other streets.

Mass., Taunton—Plans being considered by City Council for paving a number of streets. Estimated cost, $14,300.

Mass., Wareham—(Official)—Bids will be received until 10:30 a.m., Oct. 23, by County Commissions of Plymouth County, care of Massachusetts Highway Commission, Ashburton Pl., Boston, for 8,750 ft. of highway in Wareham.

N. Y., Albany—(Official)—Bids will be received by Edwin Duffey, State Highway Comr., 55 Lancaster St., Albany, until 1 p.m., Oct. 26, for improving various county highways. (See adv.)

N. Y., Albany—(Official)—Bids will be received until noon, Nov. 9, for paving terminal site near North Ferry St., under Terminal Contract 2-P. Estimated cost, $42,869.

N. Y., Buffalo—Bids will soon be received by Francis G. Ward, Comr. of Pub. Wks., for paving Hensey and East Wooddawn Ave. with asphalt, and Spauding and Spenger St.

N. Y., Mohawk—City plans to pave a number of streets. A. H. Wagin, City Clk.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., until 2 p.m., Oct. 19, for improving various streets and avenues of the city.

N. Y., New York—(Borough of Richmond)—(Official)—Bids will be received by Calvin D. Van Name, Borough Pres., Borough Hall, St. George, New Brighton, until noon, Oct. 19, for sidewalks on various streets.

N. J., Jersey City—Bids will be received until 11 a.m., Oct. 21, for improving Spruce St. with belgian block. Michael I. Fagen, City Clk.

N. J., Jersey City—Bids will soon be received for improving Rock St. and Wegman Parkway.

N. J., Pensauken—Contract will soon be awarded for 22,764-ft. of sidewalk. Estimated cost, $15,000.

N. J., Trenton—Bids will be received until Nov. 9 by State Road Commissioner for road from Hightown to Princeton Junction.

Penn., Allentown—Bids will soon be received for about 10,000 sq.yd. of paving on Tenth and Howard St. C. D. Weirbach, City Engr.

Penn., Connelsville—City Council plans to pave section of Wills Rd., Angle and other streets. Estimated cost, $79,200.

Penn., Harrisburg—(Official)—Bids will be received by State Highway Department, Harrisburg, until 10 a.m., Nov. 4, for improving a number of county roads.

Penn., Philadelphia—Ordinance passed by Board of Commissioners of Lower Merion Township appropriating $50,000 for highways.

Md., Baltimore—Plans for paving Water and Mercer St. from Light to Calvert St., also several other streets, approved by Paving Commission and Board of Awards.

Va., Chase City—City contemplates bond issue for street improvements.

W. Va., Adamston—Bids will be received until 7:30 p.m., Oct. 16, by W. V. Hutchinson, Town Recdr., for grading, curbing and paving Pike St.

W. Va., Bath—(Berkeley Springs post office)—City plans an expenditure of $30,000 for paving.

N. C., Elkins—Citizens of Marsh Township voted $25,000 bonds for roads.

N. C., Raleigh—Ordinance passed by City Commissioners authorizing expenditure of $10,000 for sidewalks. Noted Sept. 9.

Fla., Crawfordville—Commissioners of Wakulla County plan to issue $15,000 bonds for roads. J. M. Towles, Clk.

Fla., Fellsmere—Election will be held to vote $50,000 bonds for paving and sidewalks. C. W. Tolmadge, Ch. Engr.

Fla., Starke—(Official)—Citizens voted $16,000 bonds for paving. Bids will be asked about January 1. Noted Sept. 30.

Fla., Tampa—Board of Public Works plans 70,720 sq.yd. of pavement.

Ala., Camden—Bids will be received until Nov. 1 by J. N. Stanford, Chn., Comr. of Wilcox County, for road in Wilcox County.

Miss., Lexington—Citizens of Holmes County, Durant District, voted bonds for roads.

Miss., Magnolia—Bonds for $75,000 sold for improving roads in Fourth District. Noted Sept. 2.

La., New Orleans—Construction of boulevard along 17 St. canal from Metarie Rd. to Lakeside contemplated by Orleans Levee Board.

La., Plaquemine—Contract will soon be awarded for about 12 miles of road on east side of Mississippi River . Estimated cost, $7,000. Noted Sept. 16.

Tenn., Pulaski—Citizens of Giles County contemplate bond issue for roads.

Ky., Lexington—Citizens voted $300,000 bonds for roads in Fayette County. Noted Aug. 12.

Ohio, Akron—Bids will be received by C. P. Parker, Dir. Pub. Ser., until noon, Oct. 17, for paving Huntingdon St., Mason and Nash St. and Rhodes Ave., also for grading Lease and Gage St.

Ohio, Alliance—Bids will be received by Charles O. Silver, City Audr., until Oct. 25, for sale of $33,190 bonds for road improvements.

Ohio, East Liverpool—Bids will be received until Oct. 16 by E. J. Smith, Dir. Pub. Ser., for improving East Sixth St. from Walnut to Sugar St., and Barlow Alley from West Ninth St. to Croxall Alley.

Ohio, Euclid—(Official)—Bids will be received by H. S. Dunlop, Village Clk., Town Hall, until noon, Nov. 8, for improving Chardon Rd.

Ohio, Findlay—Bonds for $20,950 will be sold for street improvements.

Ohio, Independence—Bids will be received by Arthur J. Goudy, Village Clk., until noon, Nov. 1, for sale of $9,500 bonds for sidewalks on Brecksville Rd.

Ohio, Zanesville—City Council plans an expenditure of $22,250 for paving a number of streets.

Ind., Goshen—(Official)—No bids were received for concrete road in Harrison Township. Noted Sept. 16.

Ind., Indianapolis—Bids will be received by Commissioners of Marion County until 10 a.m., Nov. 3, for grading road in Warren Township.

Ind., Newport—Bids will be received until 10 a.m., Nov. 1, by Commissioners of Vermillion County, for gravel roads in Helt and Clinton Townships.

Ind., South Bend—Bids will be received by C. Sedgwick, County Audr., until 11 a.m., Nov. 8, for three gravel roads in Madison Township.

Ind., Williamsport—Bids will be received by Commissioners of Warren County until 2 p.m., Nov. 1, for gravel roads in Jordan and Pike Township.

Mich., Detroit—A. Fenkell, Comr. of Pub. Wks., has recommended paving Whitney Ave. from Linwood to Wildmere St. Estimated cost, $12,500.

Mich., Sault Ste. Marie—Bids will be received by H. A. Osborn, County Rd. Comr., until 3 p.m., Oct. 18, for 7½ miles of gravel roads.

Ill., Dixon—Board of Local Improvements plans an expenditure of $25,502, for macadamizing East Everett, East Water, East Chamberlain, North Jefferson and other streets.

Ill., Des Plaines—Bids will be received by Village Clk. until Oct. 17, 4,500 sq.yd. concrete pavement.

Ill., Murphysboro—County Board of Supervisors plans an expenditure of $16,000 for roads.

Ill., Rock Island—Property owners plan to pave Eighth Ave. between 24th and 29th St. with brick. Estimated cost, $15,000.

Wis., Madison—Plans being considered for paving with ashphalt Regent St. from Park to Monroe St.

Wis., Tomah—Bids will be received by William Koopman. City Clk., until noon, Oct. 16, for approximately 2,000 sq.yd. reinforced-concrete pavement.

Iowa, Des Moines—City Council plans to pave North Ave. and 23rd St.

Iowa, Jefferson—Supervisors of Greene County plan 8½ miles of gravel road.

Minn., Crookston—Bids will be received until 2 p.m., Oct. 26, by H. J. Welte, Audr., Polk County, for improving State Road No. 4.

Minn., St. Paul—Bids will be received by A. Hohenstein, Pur. Agt., until 10:30 a.m., Oct. 18, for grading and improving Edgecombe Rd. from West Seventh St. to Lexington Ave.; Field Ave. from Daven Ave. to Edgecombe Rd.; alley in block No. 13, Boulevard Addition, Stanford Ave. from Prior Ave. to Cleveland Ave.; Wellesley Ave. from Prior to Cleveland Ave.; Berkeley Ave. from Kenneth St. to Cleveland Ave.

Minn., Thief River Falls—Bids will be received by T. P. Anderson, County Audr., until 2 p.m., Oct. 18, for graveling State Rd. No. 1.

Kan., Eldorado—Commisisoners of Butler County plan one mile of rock road.

Kan., Pittsburg—Council passed an ordinance to construct concrete curb and gutter and resurface Broadway from Second to Quincy Ave.

Kan., Topeka—County Commissioners have decided to pave West 10th Ave.

S. D., Bison—Commissioners of Perkins County plan an expenditure of $28,500 for road work.

S. D., Sioux Falls—Plans prepared by A. Howe, City Engr., for paving Main Ave. from Third to Fifth St.

Mont., Anaconda—City Council created Special Improvement District No. 71 to improve Park Ave. from center of Chestnut St. to tracks of Butte, Anaconda & Pacific Ry. Co.

Mont., Livingston—City Council plans an expenditure of $10,000 for paving Park St.

Mo., Kansas City—No bids were received by Board of Park Commissioners for grading Meyer Blvd. and the Paseo. Work will be readvertised. Estimated cost, $275,000. Noted Sept. 16.

Mo., Louisiana—City Council retained J. E. Schwab, Consult. Engr., Alton, Ill., to prepare plans for improving 10 blocks.

Ark., Jonesboro—City plans to gravel and curb Main St. from Nettleton Ave. to southern city limits.

Tex., Denison—(Official)—Bids will be received until 2 p.m., Oct. 19, by Robert Gerlach, City Secy., for approximately 13,000 sq.yd. of paving.

Okla., Eufaula—Citizens defeated $25,000 bond issue for roads. Noted Aug. 12.

Wash., Bellingham—City plans an expenditure of about $16,000 for concrete walks on Chestnut and Grant St.

Wash., Olympia—An expenditure of $48,175 planned by State Highway Commission for clearing and grubbing right-of-way of Olympic Highway.

Wash., Pullman—Bids will be received until Oct. 19 by Matilda F. Gannon, City Clk., for paving in District No. 26. L. V. Edwards, City Engr.

Wash., Waltsburg—City Council plans cement sidewalks on Third and Main St. and Coppel Ave., also to gravel and macadamize Fifth and Orchard St.

Calif., Eureka—County plans to sell $125,000 bonds for highway improvements.

Calif., Los Angeles—City plans to improve Serrano, Mariposa and 53d Ave. and Normandie St.

Ont., Stratford—Town Council plans to lay sidewalks on Mowat and Birmingham St. R. R. Lang, Clk.

B. C., Victoria—City Council plans to pave Blanshard St. C. H. Rust, Engr.

Bids In and Contracts Awarded

Mass., Arlington—Contract for constructing Summer St. Blvd. between Brattle and Forest St. awarded to FRANCIS L. MAGUE, at $6,160.

N. Y., Albany—Contract for grading and sodding cement walks and curbs on boiler-house site awarded to CRAMMOND CONSTRUCTION CO., at $7,445.

N. Y., Kenmore—Contract for paving Cornell Ave. awarded to H. P. BURGARD CO., Buffalo, at $10,500.

N. Y., New Berlin—(Official)—Contract for 1,800 lin.ft. concrete paving awarded to HUGH HEVERIN, Utica, at $10,742. E. F. Musson, Engr. Noted Sept. 30.

N. Y., New York—(Borough of Brooklyn)—(Official)—Lowest bids received by L. H. Pounds, Borough Pres., Oct. 6, for regulating, grading, paving, curbing and laying sidewalks on various streets were as follows: Bay 34th St. from 86th St. to Cropsey Ave., P. Turricano Co., at $12,717; William Ave. from Hegeman to Vienna Ave., Scilian Asphalt Paving Co., 41 Park Row, New York, N. Y. (Borough of Manhattan), at $3,933; 23rd Ave. from Cropsey Ave. to 86th St., J. J. Guinan Contracting Co., 2314 Gravesend Ave., New York, N. Y. (Borough of Brooklyn), at $8,975. Noted Sept. 30.

N. Y., New York—(Borough of Queens)—(Official)—William T. Maxwell, Flushing, N. Y., at $4,885, submitted lowest bid for improving Jerome Ave. from Boyd to Greenwood Ave., Fourth Ward, and Peace Bros., 20 Main St., Flushing, N. Y., at $4,917, for improving South Ave. from New York Ave. to Rockaway Turnpike. Noted Sept. 30.

N. Y., New York—(Borough of Richmond)—(Official)—Bids were received Oct. 5 for regulating, grading and paving Barrett Blvd., Freylinghuysen Rd. and Havenwood Rd. as follows: Joseph Johnson's Sons, $24,919 (low bidder); J. E. Donovan, $29,078; C. Vanderbilt, $25,069.

N. J., Belleville—Contract for paving Eckle St. in Silver Lake Section awarded to NORTHERN CONSTRUCTION CO., Belleville, at $2.12 per sq.yd. Noted Aug. 26.

N. J., Kearney—Contract for paving Brighton Ave. from Rutland to Afton St. awarded to NORTHERN CONSTRUCTION CO., at $11,216.

N. J., Newark—Bids were received by Board of Chosen Freeholders of Essex County for improving Essex Ave. from Summit to Warren St., as follows: Union Paving Co., $25,235; W. T. S. Crinchfield, $23,850; Standard Bitulithic Co., $25,701. Noted Aug. 19 and Sept. 30.

N. J., Newark—Bids were received by Board of Street and Water Commissioners for paving Chelsea Ave. from South Orange Ave. to city line as follows: W. T. S. Crichfield, $10,809; Newton Paving Co., $10,806; Northern Construction Co., $10,512. Noted Sept. 9 and 30.

N. J., Newark—Bids were received Sept. 30 for paving North Sixth St. from Fourth Ave. to Park Ave. as follows: Glenfield Construction Co., Newark, $8,332; Northern Construction Co., Newark, $8,577; Standard Bitulithic Co., Newark, $8,592. Noted Sept. 23.

Penn., Erie—Contract for widening East Sixth St. awarded to J. & M. DOYLE, at $6,954.

Md., Annapolis—Contract for State-Aid roadway from Curtis Bay to Wagner's Point, Fifth District, awarded to SMITH & RUGGLES, 2680 Dulany St., Baltimore.

Md., Baltimore—All bids received for paving Elliott Driveway rejected by Board of Awards. Work will be readvertised. Noted Sept. 16 and Oct. 17.

Md., Baltimore—Contract for paving Alamede Rd. awarded to AMERICAN PAVING CO., Baltimore, at $16,923. Noted Sept. 9 and Oct. 7.

Md., Baltimore—Contract for road near Stockton awarded to RUSSE PARKER CONSTRUCTION CO., Hudson, at $15,793.

Md., Easton—(Official)—Commissioners of Talbot County rejected all bids for section of State-Aid highway along Harrison St. and have decided to do the work by county forces. Noted Sept. 30.

Md., Snow Hill—Contract for concrete roadway in Worcester County awarded to RUSSO PARKER CONSTRUCTION CO., Hudson, N. Y., at $15,793.

W. Va., Parkersburg—Contract for paving 19th St. from Murdoch Ave. to Avery St. awarded to PARSONS CONSTRUCTION CO., Brownsville, Penn., at $4,890.

S. C., Gaffney—Contract for paving Limestone St. awarded to SOUTHERN PAVING AND CONSTRUCTION CO., Chattanooga, Tenn., at $1.64 per sq.yd. Noted Aug. 26.

Ala., Gastonburg—CENTRAL ALABAMA CONSTRUCTION CO., at $70,000, awarded contract for road from Gastonburg to Clark County line.

Tenn., Columbia—Contract for paving various streets awarded to SOUTHERN ASPHALT & CONSTRUCTION CO., Birmingham, Ala., at about $50,000.

Tenn., Memphis—Bids were received for paving a part of Front St. with wood block as follows: Koehler Bros.-Fowler Construction Co., $7,380; E. J. Wetterstrohm, $7,509; Turney & Thomas, $7,744.

Ky., Madisonville—A. A. SMITH, at $23,139, awarded contract for piking four miles Greenville, Hopkinsville, Princeton and Calhoun Rd.

Ky., Mayfield—Contract for 10¾ miles of road between Mayfield and Graves County line awarded to C. E. CRESAP & BRO., Humboldt, Tenn., at $25,852.

Ky., Newport—Schoolfield & Jones, at $9478, submitted lowest bid for paving Tenth St.

Ky., Vanceburg—Contract for 21½ miles of road over Concord Hill awarded to W. H. KNAPP, at $11,338.

Ohio, Conneaut—Contract for paving State St. awarded to JOHN McCORMICK & SON, Erie, Penn., at $29,844.

Ohio, Coshocton—Contract for paving a portion of East Main St. awarded to JOHN HALL, at $5,327.

Ohio, East Liverpool—(Official)—Contract for Improving Jethro-Hollow Rd. awarded to McLAUGHLIN & ALLISON, at $31,268; Park Way Rd. to PATTERSON & GRAFTON, at $22,917. Noted Sept. 30.

Ohio, Letonia—Contracts for paving awarded as follows: FRANK GEORGE, Pittsburgh, Penn., at $29,968, for 2.95 miles; M. P. CONNELLY & SON, Youngstown, at $34,719, for 16,023 sq.yd.

Ohio, Mt. Gilead—Contract for paving Neal Ave. with brick awarded to GRAVES, BARRETT & LEECH, New London, at $5,637.

Ohio, Mt. Vernon—J. J. Kile, Mt. Vernon, at $7,430, submitted lowest bid for paving Ganzier Ave. with wire-cut brick, and C. L. Wright, Mt. Vernon, at $7,126, for repressed brick.

Ohio, Napoleon—Contract for extension of Napoleon-Wauseon Rd. awarded to A. L. STRAYER, Liberty Center, at $5,972. Noted Sept. 23.

Ind., Angola—(Official)—Contract for two gravel roads awarded to ALLISON FULTON, Bluffton, at $7,600 and $7,250 respectively. Noted Sept. 23.

Ind., Bloomington—Union Asphalt Co., Indianapolis, at $16,326, submitted lowest bid for paving East Sixth St. from Washington St. to Indiana Ave.

Ind., Brazil—(Official)—Contract for gravel road between Jackson and Cass Townships awarded to CAMPBELL & HAWKINS, Brazil. Noted Sept. 16.

Ind., Crawfordsville—(Official)—Contract for road in Ripley Township awarded to WILLIAM McCARTHY, Lebanon, at $6,000. Noted Sept. 23.

Ind., Ft. Wayne—Contract for paving awarded to MOELLERING & GRACE CONSTRUCTION CO.

Ind., Franklin—Contract for gravel road in Pleasant Township awarded to BYERS & BYERS, Trafalger, at $4,750. Noted Sept. 23.

Ind., Indianapolis—Contract for paving Kenwood Ave. between 30th and 38th St. awarded to MARION COUNTY CONSTRUCTION CO., Indianapolis, at $24,829.

Ind., Lebanon—(Official)—Contract for two gravel roads in Perry and Washington Townships awarded to JACKSON BROS., Lebanon, at $6,524, for Anderson F. Smith Rd., and WILLIAM E. BOLTS, at $5,237, for Lon Robinson Rd. Noted Sept. 23.

Ind., Monticello—(Official)—Contract for gravel road in Liberty Township awarded to G. A. KELLENBURGER, Reynolds, at $6,800. Noted Sept. 23.

Ind., Muncie—Contract for macadamized road in Delaware County awarded to CURTIS V. RECTOR, Muncie, at $9,000 Noted Sept. 16.

Ind., New Albany—Contract for reconstructing seven miles of Taoli Pike in Lafayette and Greenville Townships awarded to W. F. WOODRUFF, Louisville, at $41,000.

Ind., Rockport—(Official)—Contract for road in Ohio Township awarded to RUMDMAN CONSTRUCTION CO., Petersburgh, Ind., at $11,499. Noted Sept. 23.

Ind., Rockville—Contract for paving north side of public square awarded to EDWARD PATTON, Veedersburg, at $5,225.

Ind., Winamac—(Official)—Contract for road work in Tippacanoe Township awarded to JOHN BAIR, Winamac, at $8,900. Noted Sept. 23.

Mich., Detroit—Contract for improving Dwight and Dexter Blvd. awarded to DETROIT ASPHALT PAVING CO., at $5,177 and $28,627 respectively.

Ill., Chicago—Contract for paving awarded to AMERICAN ASPHALT CO., at about $145,000.

Ill., Decatur—(Official)—Contract for 17,000 sq.yd. brick pavement and for combined curb and gutter awarded to S. A. TUTTLE, Decatur, at $34,712. Noted Sept. 8.

Ill., La Salle—Contract for improving 11th and Hennepin St. awarded to T. W. KEYS, La Salle, at $13,935.

Ill., Moline—A. E. Ruthledge, Rockford, at $27,513, submitted lowest bid for paving road of Fredericks Hill to Bridge Lane and Milan Rd.

Ill., Rockford—Contract for paving Mulberry St and portions of Oakley Ave. and Andrews St. awarded to F. K. CARRICO, at $19,000.

Ill., St. Charles—Bids were received for improving parts of East Main and West Main St. as follows: Western Improvement Co., Racine, $55,391; Arwin E. Price, Elgin, $56,698; Logan & Giertz, Elgin, $56,958. Noted Sept. 16.

Ill., Urbana—Contract for paving East Main St. awarded to STIPES & PILCHER, at $6,000.

Wis., Green Bay—(Official)—Contract for grading and placing gravel or crushed stone on portions of West Main St. awarded to C. S. McDONALD, Green Bay, at $4435. Noted Sept. 30.

Wis., Milwaukee—Contract for paving, grading, guttering and curbing Center St. from Teutonia to Fond du Lac Ave. awarded to BADGER CONSTRUCTION CO., Milwaukee, at $30,082; contract for paving Clybourn St. from 8th to 13th St. awarded to GEORGE CZERWINSKI, Milwaukee, at $20,200.

Wis., Milwaukee—Contract for 7,000 sq.yd. creosoted block awarded to CHICAGO CREOSOTING CO., Chicago, at $1.27 per sq.yd.

Wis., Racine—Contract for grading Osborne Blvd. awarded to JAMES CAPE & SONS.

Wis., Sheboygan—Contract for paving Ontario Ave. from Fifth to Third St. awarded to JOHN BRAUN, at $4,767.

Iowa, Clinton—Contract for approximately 59,000 sq.ft. of sidewalk awarded to C. M. NEAL. Estimated cost, $7,500.

Iowa, Guthrie Center—Contract for paving 30 blocks awarded to MOORE-SIEG CONSTRUCTION CO., at $69,878. Noted Sept. 2 and Oct. 7.

Minn., Duluth—Contract for paving 58th Ave., West, from Elinor to Eighth St. awarded to A. HEPENBERG, at $4,079.

Minn., Duluth—Contract for paving State Rural Highway No. 82, in Cass and Hubbard Counties, awarded to BRANDENBERG CONSTRUCTION CO., Minneapolis, at $180,000. Noted Sept. 23.

Minn., Red Lake Falls—Contract for Pembina Road Trail, Red Lake County, awarded to M. BARRETT CO., Herman, Minn.

Minn., Redwood Falls—Contract for State Road No. 71 through Kintire Township awarded to J. W. MINTO and WILLIAM SMITH, JR.

Kan., Pittsburg—All bids for paving 12 blocks on Walnut and College Ave. rejected. New bids will be received. Noted Sept. 9.

Kan., Wichita—Contracts for paving awarded as follows: 2d St. from Market St. to Washington Ave. to HARRY L. MILES, Wichita, at $25,983; Belmont Ave. from Douglas to English St., English St. from Fountain to Belmont Ave., and Fountain Ave. from Douglas to English St. to WILLISTON CONSTRUCTION CO., Chicago, Ill., at $15,436.

Neb., Omaha—Contract for grading various streets of city awarded to KEIRLE CONSTRUCTION CO., Florence.

N. D., Minot—Bids received Oct. 4 by Board of City Commisioners for street improvements as follows: Joseph Sampson, $34,846; C. B. McUamara & Co., $35,249; MINOT CONSTRUCTION CO., $33,741 (awarded contract). Noted Sept. 30.

N. D., Wahpeton—Contract for paving Dakota Ave. awarded to GREAT NORTHERN BRIDGE CO., Minneapolis, Minn.

Mont., Bozeman—Contract for paving Tracy and Bozeman Ave. awarded to WARREN CONSTRUCTION CO., at $14,050 and $11,687 respectively.

Mont., Great Falls—Contract for paving around Whitier Park awarded to F. BIRCH & SON, at $24,599.

Mo., Oregon—Contract for grading, paving, curbing and guttering a number of streets awarded to A. JAICKS CO., 510 American Bank Bldg., Kansas City, at about $36,000.

Mo., St. Joseph—DUBOIS & PETER CONSTRUCTION CO., awarded contract for paving Gordon Ave. from Illinois to Michigan Ave.

Tex., Athens—Contract for paving awarded to SMITH BROS. & LA RUE, Crockett, at $18,000.

Okla., Pawnee—Contract for paving Street Improvement District No. 1 awarded to M. A. SWADEK & CO., Oklahoma City, at $51,419. Noted Sept. 30.

Wash., Ellensburg—Contract for grading two miles of Ellensburg and Peshaskin Road awarded to QUIGG CONSTRUCTION CO., Wenatchee, at $5,595.

Wash., Seattle—Contract for improving West Massachusetts St. awarded to CASCADE CONSTRUCTION CO., Central Bldg., Seattle, at $33,984.

Wash., Seattle—Contract for paving Mill St. awarded to E. ARNOLD & CO., Seattle, at $11,260.

Wash., Seattle—Lowest bid received for improving east and west Green Lake Way was that of R. G. Stevenson, 1327 Ewing St., Seattle, at $103,303.

Wash., Seattle—Lowest bid received for improving East Marginal Way was that of Puget Sound Bridge and Dredge Co., Seattle, at $80,957.

Wash., Yakima—Contract for graveling 1⅛ miles on Summitview Rd. awarded to A. H. ZANE & CO., at $6,739.

Wash., Yakima—Contract for Wenan Rd. awarded to THOMAS GINGLE, at $7,825.

Ore., Portland—OSKAR HUBER, Portland, at $10,635, awarded contract for paving Upper Washington St.

Ore., Tillamook—Contract for paving Second Ave. awarded to F. C. FELDSCHAU, Tillamook, at $7,089.

Calif., Los Angeles—CALIFORNIA-ARIZONA CONSTRUCTION CO., at $32,297, awarded contract for improving Rampart Blvd. from First to Sixth St.

Calif., Ontario—Ford & Stout, Bradbury Bldg., Los Angeles, at $57,088, submitted the lowest bid for improving Euclid Ave. Noted Sept. 23.

Calif., San Fernando—Contract for paving Grand Blvd. between San Fernando Mission and southerly end of Hickson Ranch awarded to FAIRCHILD-GILMORE-WILTON CO., Los Angeles.

Calif., San Jose—Contract for four and one-half miles of macadam road awarded to J. M. McDONALD, at $49,497.

Calif., Stockton—Contracts for paving awarded as follows: Van Buren and Monroe St. to A. B. MUNSON & SON, Stockton, at $13,100; Della and Lafayette St. to R. C. TUMELTY, Stockton, at $14,302.

Que., Chateauguay—Contract for macadam roads awarded to JULIEN TOUSSAINT CO., 2743 St. Hubert St., Montreal. Estimated cost, $6,000.

Ont., London—Contract for paving Wharncliffe Rd. and constructing sewer on Grey St. awarded to FIELDER CONSTRUCTION CO., William St., London, at $5,054.

Ont., Toronto—Contract for paving a portion of Scarborough Rd. awarded to ASHPHALTIC CONCRETE CO., Toronto, at $8,430.

Man., Rosser—Contract for grading awarded to A. R. BOIVIN, 303 Notre Dame Investment Bldg., Winnipeg, at $5,200.

INDUSTRIAL WORKS

Proposed Work

Conn., Bridgeport—Bids will soon be received by F. A. Cooper, Arch., for five-story, 65x100-ft. concrete and brick warehouse for Logan Bros. Noted Sept. 16.

N. Y., New York—(Borough of Brooklyn)—F. A. Koch Mfg. Co. will build six-story loft building at Flatbush Ave. Extension and Bridge St.

N. Y., New York—(Borough of Richmond)—(Official)—Bids will be received in November for plant for Louis De Jonge & Co., 446 Richmond Turnpike, Tompkinsville. Valentine & Kissman, 25 Madison Ave., New York, Arch. Estimated cost, $400,000.

N. J., Belleville—L. Sonneborn Sons secured site adjoining present one and will build additional buildings.

Penn., Lebanon—Frackville Mfg. Co., 346 Broadway, New York, N. Y., will build three-story factory at Ninth and Skull St. Estimated cost, $25,000.

Penn., McKeesport—National Tube Co. plans addition to plant.

Penn., Millvale—Pittsburgh Rys. Co. will build car barn.

W. Va., Charleston—Du Pont de Nemours Co. will build magazines in Charleston, Martinsburg, Huntington, Piedmont, Bluefield, Scarboro, Kellogg, Blaine and Rock, W. Va. Estimated cost, $500,000.

N. C., Belmont—Imperial Yarn Mill Co. will organize company with $200,000 capital and will build cotton mill.

Fla., Jacksonville—Citizens' Ice & Cold Storage Co. plans to enlarge its plant. Horace Williams, Mgr.

Fla., Valrico—Fugazzie Commission Co. will build 60x100-ft. packing plant.

Ala., Gadsden—Gulf States Steel Co. plans improvements at estimated cost of $80,000.

Tenn., Memphis—Harris Iron & Supply Co. has plans by G. M. Shaw & Co. for warehouse on South Front St. near Linden Ave. Estimated cost, $20,000.

Tenn., Shelbyville—Valley Cotton Mills Co. will build mill. Estimated cost, $50,000. G. R. Adams, Pres. of Public Light & Power Co., interested.

Ohio, Bellaire—American Stamping & Enameling Co. will make improvements to its plant on Monroe St. Estimated cost, $10,000.

Ohio, Cambridge—Interstate Iron & Steel Co. will build plant in Cambridge.

Ohio, Cincinnati—Bids will soon be received by Ahrens Fox Fire Engine Co. for three-story, 42x120-ft. addition. Bert Baldwin & Co., Perin Bldg., Engr.

Ohio, Cincinnati—Cincinnati Grain Co. will build hay elevator and warehouse at 31 Water St.

Ohio, Cincinnati—City Ice Delivery Co. will soon construct ice plant at Price and Elberon Ave. Bernard T. Wisenall, Arch. Noted Aug. 12.

Ohio, Cleveland—Cleveland Electric Metal Co. has plans for foundry and addition to its plant on West 38th St. Burchart-Roberts-Wales Co., Swetland Bldg., Cleveland, Arch.

Ohio, Cleveland—Johns Machine & Stamping Co. will build factory at Columbus and Leonard St. Benjamin F. Johns, Pres. Estimated cost, $80,000.

Ohio, Cleveland—Parish & Bingham Co. has plans by Ernest McGeorge, Leader-News Bldg., for addition to its plant at Madison Ave. and West 106th St.

Ohio, Cleveland—Standard Welding Co. will build addition to its factory at 1280 East 73rd St. Estimated cost, $180,000.

Ohio, Cleveland—Taber Ice Cream Co. will build ice cream factory addition at 3500 Payne Ave. Estimated cost, $25,000.

Ohio, Cleveland—Ward Baking Co. will build bakery at Perkins and East 40th St. Estimated cost, $250,000.

Ohio, Columbus—Bids being received by N. Bradford, Arch., for two-story shop building for Ohio State University. Estimated cost, $120,000. Noted Sept. 23.

Ohio, Norwood—Concrete Flooring Co. of Kentucky will build 135x164-ft. factory on Baker St. near Sherman Ave.

Ohio, Toledo—Plans being prepared by M. & M. Stophlet, 606 Nasby Bldg., for two-story and basement, 60x120-ft. factory for Arrow Mfg. Co. Estimated cost, $25,000.

Ind., Evansville—Bids will be received about Nov. 1 by Clifford Shipbell & Co., Arch., for five-story, 50x150-ft. factory for Anchor Supply Co. Noted Sept. 2.

Ind., Jasper—Jasper Mfg. Co. having plans prepared by Clifford Shipbell & Co., Evansville, for one-story, 60x500-ft. furniture factory.

Mich., Detroit—Studebaker Automobile Corporation will build addition to its plant at 1216 West Jefferson St. Estimated cost, $30,000.

Mich., Hancock—S. Michelotti Co. will build macaroni factory in West Hancock.

Ill., Chicago—Shampay Bros. will build one-story factory at 4621 Cottage Grove Ave. A. S. Alschuler, Arch. Estimated cost, $17,000.

Ill., Chicago—S. N. Crowen, 30 North La Salle St., preparing plans for seven-story mill construction building at Kingsbury and Ontario St. for Winston & Co. Estimated cost, $100,000.

Ill., Decatur—E-Z Opener Bag Co. plans three-story, 96x340-ft. factory on Pine St. Estimated cost, $30,000.

Ill., Peoria—Barker & Wheeler Co. will build warehouse on South Washington St. near Oak St.

Ill., Quincy—John Musolino and Salvador Bonansinga will build four-story warehouse at 644 Jersey St.

Wis., Milwaukee—Leenhouts & Guthrie, 424 Jefferson St., Milwaukee, prepared plans for three-story, 40x120-ft. building for Phoenix Printing Co.

Iowa, Des Moines—Bids will be received until Oct. 15 by Charles W. De Jarnette, Equitable Bldg., Des Moines, for one- and two-story, 115x200-ft. concrete and brick factory for New Monarch Machine and Stamping Co. Estimated cost, $200,000.

Iowa, Waterloo—Bids being received for four-story and basement, 116x120-ft. brick factory for Waterloo Overland Co. Clinton P. Shockley, Arch. Estimated cost, $100,000. Noted Sept. 16.

Minn., Duluth—Western Rug Co. has plans for addition to its rug factory at 63rd Ave. and Grand Ave. Estimated cost, $18,000.

Minn., Hopkins—American Improved Seat Co. will build plant for manufacture of its specialty. A. C. Webber, Pres.

Kan., Wichita—Schermuly Mfg. Co. will build factory and foundry on Missouri Pacific R.R. line.

Tex., Bonham—Steger Milling Co. will make improvements to its flour mill. Estimated cost, $50,000.

Tex., El Paso—J. S. Curtis and associates will build factory for waterproofing fulminating mining cap protectors. W. H. Wilson, Denver, Colo., Mgr.

Tex., El Paso—Plans being prepared for factory for Miller Mfg. Co. W. H. Wilson, Gen. Mgr.

Tex., Houston—Houston Oil Co. will build lumber mills at East Texas.

Tex., San Antonia—(Official)—Edward Friedrich, 802 East Commerce St., advises that construction of new factory will not be undertaken this year. Noted Sept. 30.

Okla., Blackwell—Uncle Sam Oil Co. contemplates refinery at Blackwell.

Wash., Seattle—Bids will be received until Oct. 20 by Port of Seattle Commission, C. E. Remsberg, Secy., for four-story addition to Commission's warehouse on Whatcom Ave. Estimated cost, $150,000. J. R. West, Ch. Engr.

Wash., Tacoma—George W. Onn, Tacoma, contemplates saw mill on Jones Creek near Pe Ell.

Calif., Eureka—Municipal Water Department will build shop at Sixth and C St. Estimated cost, $10,000.

Calif., Grass Valley—Nevada County Narrow Gage Ry. Co. will rebuild its shops which were recently destroyed by fire. Estimated cost, $40,000.

Que., Valleyfield—National Paper Co., Montreal, will build addition to its plant at Valleyfield. Estimated cost, $100,000.

Ont., Walkerville—Kelsey Wheel Co., Ltd., will make extensions to its plant. Estimated cost, $10,000.

Bids In and Contracts Awarded

N. H., Franklin—Contract awarded to J. W. BISHOP CO., Worcester, Mass., at about $100,000, for three-story, 76x158-ft. mill addition for Sulloway Mills.

Mass., Boston—Contract awarded to WILLIAM F. KEARNS CO., 240 Albany St., for three-story, 70x242-ft. reinforced-concrete building on Blandford St. for Albert Geiger, Jr.

Mass., Brighton—Contract awarded to HARDY & STREETER, 95 Milk St., Boston, at about $60,000 for five-story, 60x100-ft. warehouse. G. N. Meserve, 95 Milk St., Boston, Arch.

Mass., Salem—Contract awarded to EDWARD W. WHEELER, Worcester, at $15,000, for warehouse for C. A. Ketchum.

Mass., Watertown—Contract awarded to C. A. DODGE CO., 15 Exchange St., Boston, at about $10,000, for one-story, 65x97-ft. garage for W. C. Barnard.

Mass., Worcester—Contract awarded to E. J. CROSS CO., for two additional factories for Spencer Wire Co.

R. I., Pawtucket—Crown Mfg. Co. awarded contract to J. W. BISHOP CO., Worcester, Mass., at about $38,000, for storehouse and picker building.

R. I., Providence—Gorham Mfg. Co. awarded contract to H. WALES LINES CO., Meridan, Conn., for three one-story brick additions.

N. Y., Hempstead—Contract awarded to KERWIN ESTERBROOKE CONSTRUCTION CO., INC., Hempstead, at $10,000 for one-story, 70x100-ft. garage at Main St. and Stowe Pl. for Main St. Garage Co.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to E. BROOKS & CO., 3 West 39th St., for 12-story printing building for Estate of Andrew Finck. Crow, Lewis & Wickenhoefer, Arch. Noted Sept. 30.

N. Y., New York—(Borough of Queens)—Contract awarded to FRANK SEERY, 30 East 42 St., Manhattan, for one-story, 50x90-ft. garage on Second Ave., Long Island City for John McLaughlin, 346 East 81 St., Manhattan.

N. Y., Rochester—Contract awarded to WILLIAM F. MARTENS CO., at $30,000, for factory at 267 Mill St. for George W. Brownyard Co., Inc. Noted Oct. 7.

N. J., Camden—Contract awarded to GEORGE BACHMAN, 19 North 30th St., Camden, at about $45,000, for three-story, 80x129-ft. garage and service station for New Jersey Auto and Supply Co., Delaware Ave. and George St. Noted Aug. 26.

N. J., Elizabeth—(Official)—Contract awarded to H. D. BEST & CO., 52 Vanderbilt Ave., New York, N. Y., at $75,000, for buildings for Borne Scryniser Co.

N. J., Jersey City—(Official)—Contract awarded to TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., for factory at Bay and Provost St. for Great Atlantic & Pacific Tea Co.

N. J., Newark—Contract awarded to CHARLES S. COOPER by F. W. Devoe & C. T. Raynolds Co. for addition to its varnish factory. Estimated cost, $25,000.

Penn., Manayunk—Contract awarded to TURNER CONCRETE STEEL CO. for two-story, 62x198-ft. addition to woolen mill of Robert Krook, Walnut Lane and Main St.

Penn., Philadelphia—Contract awarded to HOFFMAN ENGINEERING & CONSTRUCTION CO., at about $100,000, for two-story, 212x540-ft. shop at Norris and Richmond St. for William Cramp Sons' Ship and Engine Building Co. Noted Oct. 7.

Penn., Reading—(Official)—Contract awarded to L. H. FOCHT & SON, Reading, for two-story factory for Carpenter Steel Co. Noted Oct. 7.

Md., Baltimore—Contract awarded to CHARLES L. STOCKHAUSEN CO., for 75x275-ft. plant for Baugh Chemical Co.

Ky., Glencoe—Contract awarded to W. H. HEILMAN for 128x228-ft. steel warehouse for Glencoe Loose Leaf Warehouse Co.

Ohio, Canton—Contract awarded to E. J. LANDOR, at about $20,000 for five-story, 50x66-ft. addition to the plant of Dannemiller Grocery Co.

Ohio, Cleveland—Contract awarded to ANDERS CONSTRUCTION CO., Engineers Bldg., Cleveland, at $20,000, for one-story cold storage plant addition to plant of Blumenstock & Reid Co.

Ohio, Cleveland—Contract awarded to J. T. RICHARDS, 822 Citizens Bldg., for two-story factory at East 78th St. and Wheeling & Lake Erie R.R. for Champion Machine & Forging Co.

Ohio, Cleveland—Contract awarded to PACKARD BUILDING CO., for sales and service station on Carnegie Ave. near East 55th St. for Packard Motor Co. Estimated cost, $125,000.

Ohio, Cleveland—Contract awarded to SAMUEL AUSTIN & SON CONSTRUCTION CO., 14230 Euclid Ave., for two-story, 70x400-ft. addition to plant of Standard Oil Co.

Ohio, Cleveland—Contract awarded to CROWELL-LUND-OFF-LITTLE CO., 1951 East 57th St., at about $70,000, for five-story, 112x112-ft. factory addition to plant of Warner & Swasey Co., 5809 Carnegie Ave.

Ohio, Newport—Contract awarded to ADER CONSTRUCTION CO., Newport, at about $10,000, for warehouse for Becker Bros. & Co.

Mich., Detroit—Contract awarded to BRYANT & DETWILER CO., Detroit, for two factories at East Grand Blvd. and Michigan Central R.R. for Packard Motor Car Co.

Mich., Detroit—Contract awarded to ROGOWSKI BROS. & WEDDA for factory on Confiant Ave. and Grand Trunk R.R. for Vanguard Mfg. Co.

Mo., Kansas City—Contract awarded to R. F. WILSON & CO., Chicago, Ill., at about $300,000 for four-story, 113x267-ft. factory at 13th and Campbell St. for American Can Co., 447 West 14th St., New York, N. Y.

Ark., Helena—Contract awarded to DOYLE & CO., Cotton Plant at about $65,000, by Interstate Grocery Co. for warehouse.

Colo., Pueblo—Contract awarded to ELMER BRECKENRIDGE for warehouse at C and Lamkin St. by A. Adams and will be occupied by Sage Transfer Co.

Ore., Astoria—Contract awarded by Astoria Port Commission to H. E. DOERING, Portland, at $22,658 for grain elevator.

FEDERAL GOVERNMENT WORK

Proposed Work

Riprap—Tompkinsville, N. Y.—Bids will be received at office of Lighthouse Inspector, Tompkinsville, until 2 p.m., Oct. 26, for riprap at Centerville and Saltersville Lights, Newark Bay, N. J.

Bridge and Trestles—Pittsburgh, Penn.—Bids will be received at U. S. Engineer Office, Pittsburgh, until noon, Nov. 5, for service bridge and Poiree trestles at Dam No. 10, Ohio River. (See adv.)

Tank and Tower—Indian Head, Md.—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Oct. 30, for 250,000-gal. steel water tank and tower at naval proving ground, Indian Head.

Sewer—Washington, D. C.—Bids will be received at Office of Commissioners of District of Columbia, Room 509, District Bldg., until 2 p.m., Oct. 19, for sewers in District of Columbia.

Shell House—Norfolk, Va.—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Oct. 30, for one shell house at naval magazine, Norfolk.

Post Office—Huntington, W. Va.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m. Nov. 16, for United States post office at Huntington.

Cranes—Charleston, S. C.—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Nov. 20, for two shipbuilding cranes at navy yard, Charleston.

Post Office—Elyria, Ohio—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for United States post office at Elyria.

Post Office—Boise, Idaho—Bids will be received by James A. Wetmore, Act. Superv., Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 18, for extending and remodeling United States post office at Boise.

Metal Supplies—Panama—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, until 10.30 a.m., Oct. 20, for metal supplies.

Miscellaneous and Metal Supplies—Panama—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, until 10:30 a.m., Oct. 18, for miscellaneous and metal supplies.

Bids In and Contracts Awarded

Cement, Sand and Gravel—New Orleans, La.—Contract for cement, sand and gravel at Southwest Pass, Mississippi River, awarded to LESTER E. ALEXANDER, New Orleans, at $19,-220. Noted Sept. 16.

Post Office—Covington, Tenn.—Bids were received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for post office at Covington as follows: Algernon Blair, Montgomery, Ala., $33,800; William H. Fissell & Co., New York, N. Y., $35,700; George W. Stiles Construction Co., Chicago, Ill., $34,447.

Piling—Louisville, Ky.—Contract for piling for Dam No. 43, Ohio River, awarded to CARNEGIE STEEL CO., Philadelphia, Penn., at $34,111. Noted Sept. 30.

Machinery—Cincinnati, Ohio—Bids were received at U. S. Engineer Office for furnishing and installing operating machinery at Dam No. 29, Ohio River, from: J. & J. B. Milholland Co., 714 Fifth Ave., Pittsburgh, Penn., $9,321, and Miller Supply Co., Huntington, W. Va., $9,314. Noted Sept. 26.

Post Office—Everett, Wash.—Contract for United States post office at Everett awarded to HENRICKSON & CO., Seattle, at $111,519.

Naval Improvements—Pearl Harbor, Hawaii—Contract for improvements at Naval Station, Pearl Harbor, awarded to HAWAIIAN DREDGING CO., Honolulu, at $155,900. Noted Sept. 23.

CANALS DITCHES—IRRIGATION

Proposed Work

Canals—Silver City, Miss.—Bids will be received until Oct. 22 by Atchafalaya Drainage and Levee District for 15 miles of canals and 90,000 cu.yd. of levees.

Drainage—Lafayette, La.—Citizens of Lafayette Parish, Indian Bayou, Subdrainage District, District No. 1, voted $34,000 bonds for drainage system.

Drainage—Monroe, La.—Bonds for $20,000 sold for draining Jack Creek.

Drainage—Henderson, Ky.—(Official)—Bids will be received until 1:30 p.m., Oct. 27, by Board of Drainage Commissioners of Henderson County, for 34,810 ft. drainage ditch. Peter Manion, Pres.

Drainage—Pearl, Ill.—J. E. Schwab, Alton, preparing plans and will superintend drainage and levee improvements.

Ditch—Sycamore, Ill.—Citizens of Kane and De Kalb Counties plan to widen and deepen Maple Park Cortland Virgil Drainage District No. 1. Estimated cost, $20,000. Hay & Lowman, Sycamore, Engr.

Drainage—Kenosha, Wis.—Bids will be received until 3 p.m., Oct. 28, by Supervisors of Town of Bristol, Kenosha County, for drainage system for Bristol Drainage District.

Drainage—Bedford, Iowa—Bids will be received until noon, Oct. 15, by Board of Supervisors of Taylor County for new channel for East Nodaway River in Drainage District No. 3. J. N. Hughes, County Audr.

Drainage—Oskaloosa, Iowa—Plans prepared for Mahaska County drainage district.

Ditches—Bullard, Minn. — (Staples post office) — Citizens contemplate ditching about 11 miles of main ditches and five miles of branches. Gottfrid Anderson, Secy.

Ditch—Caledonia, Minn.—(Official)—Bids will be received by Auditor of Houston County, until Nov. 2, for judicial ditch No. 1. George Ralph, Engr.

Irrigation—Billings, Mont.—Billings Bench Waterusers' Association has taken over the Billings Land & Irrigation Co. and will build canals in upper section.

Drainage—Carrollton, Mo.—Bids will soon be received by Sugar Creek Drainage District Commissioners for 16 miles of open ditch work. E. H. Quisenberry, Clk.

Drainage—Edna, Tex.—Bids will be received about Oct. 28 by A. E. Landin, Chn., Jackson County Drainage District No. 8, for canals and levees. R. J. Bryan, Ganado, Dist. Engr.

Irrigation—Harlingen, Tex.—Bids will be received until Oct. 21, by Director of Cameron County Irrigation District No. 1 for extending canal, about 10,000 cu.yd. of excavation.

Irrigation—Santa Fé, N. M.—George E. Fosberg, Chicago, Ill., interested in a project to revive and complete Arroyo-Honde Irrigation project. Estimated cost, $75,000.

Drainage—Aberdeen, Wash.—Citizens voted in favor of establishing South Bay Drainage District. Estimated cost, $10,000.

Irrigation—Ephrata, Wash.—Grants Orchard Irrigation District organized to form irrigation district estimated to cost $75,000. A. H. Wilburn, Ephrata, Chn.

Irrigation—Medford, Ore.—Rogue River Canal Co. granted franchise to irrigate approximately 1000 acres south of Medford.

Irrigation—Modesto, Calif.—Bids will be received by C. S. Abbott, Secy., Bd. of Directors, Modesto Irrigation District, until Oct. 16, for enlarging main canal and tunnel, Modesto Irrigation District, between Raiden Falls and Upper Dominici, also for reinforced-concrete structures in lower main canal. Noted Sept. 23.

Irrigation—Visalia, Calif.—Election will be held Oct. 16 to vote irrigation of 18,000 acres in Lindsay-Strathmore water district.

Drainage — Westminster, Calif. — Citizens voted $25,000 bonds for drainage ditches. Noted Sept. 30.

Bids In and Contracts Awarded

Barge Canal Work—Albany, N. Y.—(Official)—Contracts for barge canal work awarded as follows: Improvement of Sawyer's Creek, North Tonawanda, to H. S. KERBAUGH, INC., 6 Church St., New York, N. Y., at $9,440; furnishing timber and plank for eastern division of New York State Canal, to H. V. BERRY, Ft. Plain, at $12,685; for middle division to W. J. DOWDLE, Oswego, at $15,440; for western division to G. ELIAS & BRO., INC., Bucalo, at $21,699. Noted Sept. 2 and 16.

Barge Canal Work—Albany, N. Y.—Contract for barge canal work under Terminal Contract No. 47 awarded to I. M. LUDINGTON'S SONS INC., Rochester, at $38,630. Noted Sept. 9 and Oct. 7.

Drainage—Aledo, Ill.—All bids received Sept. 24 by Central State Engineering Co., Hershey Bank Bldg., Muscatine, Iowa, for three contract sections of tile drain in Mercer County rejected. Noted Sept. 9.

Drainage—Adel, Iowa—Contracts for drainage work in Dallas County awarded as follows: Drain No. 32 to PAUL PAULSEN, Carroll, and HOOVER LUMBER CO., Dallas Center, at $8,215 and $16,734, respectively; Drain No. 36 to IOWA PIPE & TILE CO., Des Moines, at $4,689.

Drain—Clarion, Iowa — Board of Supervisors of Wright County rejected all bids for Drain No. 130.

Ditch—Estherville, Iowa—Contract for drainage ditch No. 100 awarded to A. EIKWOLD, Graettinger, at $16,755.

Ditch—Harlan, Iowa—Contract for 12-mile drainage ditch in Mosquito Creek, District No. 8, awarded to LANA CONSTRUCTION CO., at $55,926.

Ditch—Sibley, Iowa—(Official)—Contract awarded to H. B. WHITNEY, Emmetsburg, at about $15,000, for drainage ditch No. 22, Osceola County.

Drainage—Spencer, Iowa—Contract for improving Drainage District No. 22 awarded to CEMENT PRODUCTS CO., Spencer, at $183,254.

Drainage—Storm Lake, Iowa—Contracts awarded to NEWELL CEMENT TILE CO. for tile and to HARRY & JOHN CLINTON for drainage work in Drainage District No. 78, in Buena Vista County. W. W. Benntet, County Audr.

Ditch—Ada, Minn.—(Official)—Contract for repairing, enlarging and cleaning County Ditch No. 3 awarded to UNION DREDGING CO., Carrollton. Noted Sept. 30.

Ditch—Bemidji, Minn.—Contract for clearing and grubbing Ditch No. 31 awarded to G. W. CLIFFORD, Minneapolis, at $7,999; excavation to RIDER & JONES, Minneapolis, at $32,675; contract for Ditch No. 32 awarded to KOHLER CONTRACTING CO., Frazer, at $7,762.

Ditch—Worthington, Minn.—Contract for Ditch No. 12 awarded as follows: 132,348 cu.yd. open work to JAMES McKILLY, Waterloo, at 8.2c. per cu.yd.; tile work to P. L. RIVAED, Pocahontas, Iowa, at $12,700.

Drainage—Tekamah, Neb.—(Official)—Contracts for 500,000 cu.yd. of excavation on old ditches and 300,000 cu.yd. of new excavation awarded to MINNEAPOLIS STEEL & MACHINERY CO., L. MULLIN, E. D. BARR and J W. BOYCE. Estimated cost, $112,000. Noted Sept. 23.

Drainage—Pocahontas, Ark.—Contract for drainage system in Little Aumey Water Drainage District awarded to A. B. WILLS & SONS, Paragould. Estimated cost, $40,000. J. A. Ryan, Corning, Engr.

Irrigation—Fowler, Colo.—OSCAR OLESON awarded contract for dam and other work in Apishapa Cañon. Estimated cost, $300,000.

Drainage—North Yakima, Wash.—(Official)—Contract for drainage system in Drainage Improvement District No. 27 awarded to DUNN & HOGAN, North Yakima, at $19,656. Noted Sept. 30.

MISCELLANEOUS

Proposed Work

Coal Pocket—Roxbury, Mass.—Batchelder Bros., Roxbury, will build coal pocket at 34 Hilton St.

Seawall, Bulkheads and Jetties—Winthrop, Mass.—Bids will be received until 11 a.m., Oct. 20, by Board of Harbor and Land Commissioners, for seawall, bulkheads and jetties along easterly shode of Point Shirley.

Frames—New York, N. Y.—(Borough of Manhattan)—Official)—Bids will be received by Marcus M. Marks, Borough Pres., until 2 p.m., Oct. 14, for furnishing 500 street sign container frames.

Track Supplies—New York, N. Y.—(Borough of Manhattan)—Bids will be received until 12:15 p.m., Oct. 15, by Public Service Commission of First District, 154 Nassau St., for ten portions of special work, frogs and switches for rapid transit railways.

Retaining Wall—Syracuse, N. Y. — Intercepting Sewer Board instructed by City Council to prepare plans for retaining wall along Onondago Creek.

Dredging—Newark, N. J.—Bids will be received until Oct. 21 by City of Newark for dredging portions of Passaic River. Plans on file with E. S. Rankin, City Hall, Newark.

Fire-Alarm System—Cumberland, Md.—Plans being considered to improve fire alarm system. J. S. Schriver, Water and Light Comr.

Piers—Lamberts Point, Va.—(Norfolk post office)—Norfolk & Western Ry. Co., having plans prepared for piers and office building. Southbound pier, 1200x200 ft., northbound pier, 800x200 ft. L. E. Johnson, Roanoke, Pres.

Coaling Dock—Pensacola, Fla. — Construction of coaling dock contemplated by Louisville & Nashville R.R.

Seawall—Gulfport, Miss.—Board of Supervisors of Harrison County contemplate $600,000 bond issue for seawall.

Waterways—Washington, La.—City plans deep water connection between Washington, Morgan City and New Orleans.

Wharf—Chattanooga, Tenn.—City plans to improve wharf and will issue $100,000 bonds. R. Hooke, City Engr.

Dykes—Wellsville, Ohio—Citizens plan bond issue of $50,000 for dykes.

Crib Protection and Dock Repair—Chicago, Ill.—Bids will be received by W. R. Moorhouse, Comr. Dept. of Pub. Wks., until Oct. 18, for protection crib in South Fork, south branch of Ohio River, 35th St., also for repairing existing dock at foot of Lumber St.

Towers—Waukegan, Ill.—Frame unloading towers at coal docks of Reiss Coal Co., recently destroyed by fire, will be rebuilt of steel. John P. Reiss, Gen. Mgr.

Docks—Milwaukee, Wis.—Pennsylvania Coal & Supply Co. contemplates new docks at Muskegon Ave. and Canal St.

Playgrounds—Salina, Kan.—Election will be held to vote on $40,000 bonds for playgrounds.

Wharves and Docks—Belmont, Tex.—Contract will soon be awarded for constructing wharves and docks at Belmont. Estimated cost, $100,000.

Levee—Ennis, Tex.—Citizens voted $121,000 bonds for levees on Trinity River, Ellis County, Levee District No. 2.

Riprap—Galveston, Tex.—Bids will be received by J. M. Murch, County Audr., until 1 a.m., Oct. 18, for approximately 20,000 tons of riprap for seawall.

Park Improvements—Houston, Tex.—George E. Kessler, St. Louis, Mo., prepared plans for George H. Herrmann Park. Estimated cost, $100,000.

Park—Ft. Morgan, Colo.—W. E. Cullen, Boulder, preparing plans for improving city park.

Subway—Tucson, Ariz.—City and Southern Pacific Ry. Co. plan to construct subway under railroad tracks at end of Congress St. Estimated cost, $70,000.

Race Track—Los Angeles, Calif.—George H. Shank, Los Angeles Speedway Association, Union Oil Bldg., plans high-speed automobile racing track at Bell Station. Estimated cost, $1,000,000.

Levee—Sacramento, Calif.—Construction of levee from Knights Landing to Colusa contemplated by Board of Directors of Sacramento River West Side Levee District. Estimated cost, $500,000.

Pier—San Francisco, Calif.—Contract will soon be awarded for pier at foot of Chestnut St. Estimated cost, $250,000.

Bids In and Contracts Awarded

Retaining Wall—Winthrop, Mass.—Contract for retaining wall at Winthrop Yacht Club awarded to FRANK J. McQUEENEY, 9 Atlantic St., Winthrop, Mass.

River Improvements—Hornell, N. Y.—(Official)—Contract for improving Canisteo River awarded to EASTOVER CONSTRUCTION CO., INC., Utica, at $38,543.

Extending Pier—New York, N. Y.—(Borough of Brooklyn)—Contract for extending Pier 22, near Jay St., North River, awarded to RIVERSIDE CONTRACTING CO., 39 Cortlandt St., New York, N. Y., at $22,366. Noted Sept. 23 and Oct. 7.

Pier Shed—New York, N. Y.—(Borough of Manhattan)—Contract for pier shed at West 23d St., North River, under Contract No. 1471, awarded to THOMAS T. WATERS, 271 West 125th St., New York, N. Y., at $36,600. Noted Sept. 16 and 30.

Boardwalk—Stone Harbor, N. J.—Franklin Engineering and Contracting Co., Philadelphia, Penn., submitted lowest bid for boardwalk at Stone Harbor. Bonds for $33,000 sold for this purpose.

Dredging—Trenton, N. J.—Bids were received Sept. 29 by State Department of Commerce and Navigation for dredging first section of Inland Waterway connecting Barnegat Bay with Manasquan River: Richards Dredging Co., Philadelphia, Penn. $0.158 per cu.yd. for excavation; Hill Dredging Co., Atlantic City, $0.174 per cu.yd. and D. X. Shubin, Philadelphia, $0.998. Benjamin F. Cresson, Ch. Engr.

Coal Storage — Philadelphia, Penn. — (Official) — Contract awarded to DAY & ZIMMERMAN, 611 Chestnut St., Philadelphia, at $28,772, for coal storage and appliances for Queen Lane pumping station. Noted Sept. 23.

Pier—Canton, Md. — (Baltimore post office) — Contract awarded to ARTHUR McMULLIN CO., Singer Bldg., at about $1,000,000, by A. C. Shand, Ch. Engr., Pennsylvania R.R. for coal pier. Noted Sept. 9.

Tunnel—Gassaway, W. Va.—(Official)—Coke and Coal Ry. Co. awarded contract for concrete lining of tunnel No. 10 to PIEDMONT CONSTRUCTION CO., Charlottesville, Va. F. D. Cosner, Engr. M. of W.

Coal Pier—Pensacola, Fla.—Contract for coal pier for Gulf, Florida & Alabama Ry. awarded to LINK-BELT CO., Chicago, Ill.

Dike—Baton Rouge, La.—DAMERON & WHITE, Baton Rouge, at $10,209, awarded contract for enlarging dike over University Lake and constructing roadway to dike.

Levee Work—New Orleans, La.—Contract awarded to DAMERON-WHITE CO. by State Board of Engineers for levee work for Red River, Atchafalaya and Bayou Boeuf.

Piers—Evanston, Ill.—Contract for 18 piers awarded to O. L. OLESON, 133 Moraine Rd., Highland Park, at $39,948. Noted Aug. 12.

Excavation—St. Louis, Mo.—Contract for excavating about 600,000 cu.yd. for University Park Realty Co. awarded to FRUIN-COLNON CONTRACTING CO., St. Louis, at 16.6c. per cu.yd.

Bulkhead—Seattle, Wash.—Puget Sound Bridge and Dredging Co., Seattle, at $80,957, submitted lowest bid for filling and bulkheading East Marginal Way. Noted Aug. 19.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Proposed Work

N. H., Manchester—Plans prepared by Hitchins & French, 6 Beacon St., Boston, Mass., for four-story, 50x100-ft. brick and stone store and apartment for I. Shatton, care of architect. Estimated cost, $50,000.

Vt., Montpelier—Densmore & LeClear, 68 Broad St., Boston, Mass., preparing plans for library and supreme court building for state. Estimated cost, $150,000.

Vt., Poultney—Vermont Public Service Commission, Montpelier, ordered Delaware & Hudson Co. to construct passenger and freight station.

Mass., Boston—Bids will be received about Oct. 15 by A. A. Badaracco and I. Freedman, 357 Hanover St., for three-story, 31x288-ft. building at Haymarket Sq. F. A. Norcross, 46 Cornhill St., Arch. Estimated cost, $90,000. Noted Sept. 16.

Mass., Dorchester—Plans being prepared by Funk & Wilcox, 120 Boylston St., Boston, for Sarah Greenwood School, for city of Boston.

Mass., Hathorne—Bids will be received until Nov. 1 by Trustees of Independent Agricultural School for two-story, 55x160-ft. building. John H. Bickford Co., Boston, Arch.

Conn., Bridgeport—Bids will be received until Oct. 18 for normal school. Leonard Asheim, Bridgeport, Arch.

Conn., Hartford—Plans being prepared for four-story brick and stone building for Phoenix Insurance Co. Benjamin Morris, New York, N. Y., Arch.

Conn., Milford—Bids being received for brick and stone town hall. Tracy & Swartwout, New York, N. Y., Arch. Estimated cost, $120,000.

Conn., New Haven—Revised bids being received for church and parish house at Orange St. for German Lutheran Church. Estimated cost, $75,000. C. S. Palmer, Arch.

N. Y., Albany—Fuller Robinson Co., 95 State St., preparing plans for nine-story store and office building at 74 State St. for Kinney & Woodward Co., Waldorf Bldg. Estimated cost, $50,000.

N. Y., Albany—Charles L. Robinson, 577 Western Ave. and Michael J. Hawkins, 48 Orange St., contemplate three-story theater on Orange St. Estimated cost, $75,000.

N. Y., Binghamton—Improved Order of Red Men plans building. Estimated cost, $50,000.

N. Y., Buffalo—S. F. Heckert, Bessemer Bldg., Pittsburgh, Penn., preparing plans for 70x145-ft. church for St. John the Evangelist Church on Seneca St. Estimated cost, $75,000.

N. Y., Buffalo—Polish Falcons, Grunwalk Nest No. 58 and 6 plan gymnasium and club house. Estimated cost, $60,000.

N. Y., Hornell—Plans being prepared by E. J. Thompson, Arch., for three-story, 100x150-ft. building. Estimated cost, $75,000.

N. Y., Middletown—Bids will be received about Jan. 1 for six-story, 78x100-ft. bank and office building at North and Kings St. for Merchants' National Bank. Noted Sept. 16.

N. Y., New York—(Borough of the Bronx)—(Official)—Bids will be received until 10:30 a.m., Oct. 19, by Douglas Mathewson, Borough Pres., for alterations to Bronx Borough hall, at Third Ave. and 177th St.

N. Y., New York—(Borough of Manhattan)—Benjamin W. Mayer, 2 West 33d St., will build seven-story, 53x49-ft., store and office building at 54 Lexington Ave. Herman Lee Meader, 2 West 33d St., Arch.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received about Oct. 22 for lounge room for Hotel Biltmore at 43d St. and Madison Ave. for N. Y. Central R.R. Co. Warren & Wetmore, 16 East 47th St., Arch. Estimated cost, $50,000.

N. Y., New York—(Borough of Manhattan)—Plans prepared by Shape & Bready, Inc., 220 West 42nd St. for seven-story, 99x100-ft. building for New York College of Dentistry. Estimated cost, $250,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Hasco Bldg. Co., 245 West 55th St. will build 16-story, 78x94-ft. office building at Fourth Ave. and 28th St. Estimated cost $500,000. Walter Haefeli, 245 West 55th St., Arch.

N. Y., New York—(Borough of Richmond)—(Official)—Plans being revised by Mason R. Strong, 7 Wall St., New York, for three-story, 75x150-ft. brick orphan asylum at Ft. Wadsworth for Bethlehem Home. Estimated cost, $100,000. Noted Sept. 9.

N. Y., Potsdam—Plans being prepared by Lewis F. Pilcher, Capitol, Albany, for two-story Normal School for New York State Department of Education. Estimated cost, $300,000.

N. Y., Troy—Erection of high school contemplated by Catholic Church, diocese of Albany.

N. J., Ocean City—Bids will soon be received for club house for Ocean City Golf Club. Estimated cost, $50,000. Sauen & Hahn, Philadelphia, Penn., Arch.

Penn., Allenfown—Bids will be received about Nov. 1, for six-story, 62x210-ft. building for Y. M. C. A. Louis E. Jallade, 37 Liberty St., New York, N. Y., Arch. H. W. Elridge, Gen. Secy. Noted Sept. 2.

Penn., Brackenridge—Election will be held Nov. 2 to vote on $60,000 bonds for school.

Penn., Harrisburg—Messiah Lutheran Church will build new edifice at Sixth and Foster St. Estimated cost, $75,000.

Penn., Lebanon—Bids will be received until Oct. 29 by Board of School Directors for high school. A. A. Richter, Reading, Arch. Noted Oct. 7.

Penn., Philadelphia—United Brethern in Christ will build mission at 12th St. and Wyoming Ave. Estimated cost, $75,000.

Penn., Philadelphia—Bids will soon be received for high school for Board of Education at Amber and Cumberland St. J. Horace Cook, Philadelphia, Arch.

Penn., Pittsburgh—Morris Kaufmann will build 20x110-ft. loft and store building at 713 Liberty Ave. H. E. Kennedy Co., Arch. Estimated cost, $60,000.

Penn., Pittsburgh—Atlantic Refining Co. will build 54x154-ft. office building at Butler and 57th St. Estimated cost, $100,000.

Md., Baltimore—Competitive plans will be received until Dec. 1 by Fourth Regiment Armory Commission, for armory at North and Maryland Ave. Estimated cost, $500,000.

Md., Baltimore—Council contemplates school at Lafayette Ave. and Poplar Grove St. Estimated cost, $120,000.

W. Va., Anderson—A. S. Russell will build three-story theater, office and Masonic temple.

W. Va., Bluefield—Plans prepared by Pedigo & Garry, Bluefield, for five-story brick business building at Federal and Scott St. for E. S. Pedigo Co.

W. Va., Clarksburg—United Schools Bldg. Co. recently incorporated with $300,000 capital, will build West Virginia Business College.

Ga., Atlanta—(Official)—Election to have been held Sept. 30 to vote $3,358,000 bonds, part of which to be used for schools and hospital, has been canceled. Noted Aug. 12.

Tenn., Chattanooga—University of Chattanooga will build campus building at cost of $75,000.

Tenn., Nashville—Nashville Property Co. will build five-story office building at Church and Polk St. for use of physicians. Estimated cost, $50,000.

Ky., Louisville—Plans prepared by Joseph & Joseph, Louisville, for citadel for Salvation Army. Estimated cost, $50,000.

Ohio, Athens—(Official)—Bids will be received until 9 a.m., Oct. 30, by Board of Trustees of Ohio University for women's dormitory. Isaac M. Foster, Secy.

Ohio, Canton—(Official)—Bids will be received until noon, Nov. 4, by Board of Education for high school. George F. Hammond, 4220 Prospect Ave., Cleveland, Arch. W. C. Lane, Clk. Noted Sept. 23.

Ohio, Carthagena—Elzner & Anderson, Cincinnati, prepared plans for women's building of Longview Asylum. Estimated cost, $250,000.

Ohio, Cleveland—Ernest Huberty prepared plans for three-story bank and office building for West Side Savings & Loan Co., at West 25th St. and Lorain Ave. Estimated cost, $50,000.

Ohio, Cleveland—W. S. Lougee, 500 Marshall Bldg., Cleveland, prepared plans for three-story apartment and commercial building at 1921 East 70th St., for Florentine Realty Co. Estimated cost, $48,000.

Ohio, Cleveland—Plans approved by City Plan Commission for three-story union passenger station for New York Central and Pennsylvania R.R. Co. Citizens will vote Nov. 2 on bonds. Graham, Burnham & Co., Chicago, Ill., Arch.

Ohio, Monroe—Bids being received by Rusk & Sheets, Arch., Columbus, for two-story and basement, 70x127-ft. school in Preble County. Estimated cost, $50,000. Noted Aug. 12.

Ohio, Niles—Bids will be received about Nov. 15 by C. F. Owsley, Arch., Youngstown, for six-story, 41x90-ft. bank building for Dollar Savings Bank. Estimated cost, $100,000.

Ohio, Northfield—Bids will be received until noon, Oct. 27, by G. L. Williams, Clk. Bd. of Education for school.

Ohio, Wilberforce—Bids will be received until Nov. 4 by Board of Trustees of Wilberforce University for gymnasium. Frank L. Packard, Columbus, Arch., also for recreation building. W. A. Joiner, Supt.

Ind., Evansville—Bids will be received about Oct. 31 for two-story and basement memorial coliseum for county. Clifford Shopbell & Co. Arch. Estimated cost, $125,000.

Ind., Terre Haute—Board of Education retained R. W. Leonard to prepare plans for school on Kafader site. Estimated cost, $130,000. Noted Oct. 7.

Ind., Washington—Bids will be received until Oct. 19 by Mayor and Common Council for completing city hall. J. W. Gaddis, Vincennes, Arch. and Willian Hoddinott, City Clk.

Ill., Chicago—Grace Episcopal Church will be rebuilt. Estimated cost, $500,000. William Otis Waters, Rector.

Ill., Chicago—Jackson Estate, care of H. S. Hecht, 154 West Randolph St., will build four-story brick hotel at 827 Wilson Ave. Estimated cost, $150,000.

Ill., Dixon—Bids will be received until Oct. 18 by Board of Administration, Capitol Bldg., Springfield, for four new buildings for State Colony of Epileptics. James B. Dibelka, 130 North Fifth Ave., Chicago, Arch.

Ill., Rockford—Board of Supervisors of Winnebago County will build addition to courthouse. Estimated cost, $200,000.

Wis., Menominee—Bids being received by State Industrial Board of Education for economics building for Stout Institute. Estimated cost, $200,000. H. E. Miles, Racine, Pres. of Bd.

Wis., Milwaukee—Board of Directors of Wisconsin Telephone Co., 183 Fifth St., Milwaukee, appropriated $175,000 for construction of buildings and repairs for Milwaukee and $145,000 for Wisconsin outside of Milwaukee. H. O. Seymour, Gen. Mgr.

Wis., Platteville—Van Ryan & De Gelleke, Milwaukee, prepared plans for 2½-story science building for State Board of Normal Regents. Estimated cost, $100,000.

Iowa, Monmouth—Bids being received for city hall from plans of Temple & Burrows, Monmouth. Estimated cost, $50,000.

Iowa, Ottumwa—Plans being prepared by Proudfoot, Bird & Rawson, Des Moines, for six-story hotel for Ottumwa Hotel Association. Estimated cost, $300,000. Noted Sept. 23.

Iowa, Sioux City—Chicago & Northwestern Ry. Co. will build freight shed and terminal on Third St. near Jackson St. Estimated cost, $180,000.

Iowa, Spencer—Bids will be received, according to press reports, until Oct. 18 by Lyon County for courthouse.

Kan., Hays—(Official)—Bids will be received about Jan. 1 by State Board of Administration for three-story building at Ft. Hays Normal School. Estimated cost, $100,000. Charles H. Chandler, State Arch. Noted Aug. 19.

Kan., Topeka—Citizens of Shawnee County contemplate settlement building. O. K. Swayze, County Clk. Estimated cost, $50,000.

Mo., Kansas City—H. A. Drake, Reliance Bldg., preparing plans for motion-picture theater at 12th St. and Grand Ave. Frank L. Newman, 4008 Trost Ave., is interested. Estimated cost, $75,000.

Mo., Sarcoxie—Citizens of Jasper County voted $100,000 bonds for county tuberculosis sanitorium.

Tex., Austin—James E. Ferguson, Governor has appointed Atlee B. Ayers, San Antonio, State Architect. He will prepare plans for State School for Blind and for State Land Office, also State Confederate Women's Home.

Bids In and Contracts Awarded

Mass., Cambridge—Contract awarded to STONE & WEBSTER ENGINEERING CO., Milk St., Boston, for two dormitories for Massachusetts Institute of Technology.

Mass., Chelsea—Contract awarded to C. S. CUNNINGHAM & SONS CO., 101 Tremont St., at $80,000, for school. Noted Sept. 23.

Mass., Deerfield—Contract awarded to ALLEN BROS., Amherst, Mass., for library for Deerfield.

Mass., Medford—Contract awarded to MARR BROS. & STEWART CO., 319 Washington St., at about $75,000, for store at Forest and High St., for F. W. Morris, 582 Massachusetts Ave., Cambridge. Noted Aug. 5.

Mass., Wellesley—Contract awarded to J. W. BISHOP CO., Worcester, at about $200,000, for dormitory for Wellesley College. Noted Sept. 16.

R. I., Providence—(Official)—Contract awarded to FAMIGLIETTI BROS CO., Dean St. and Broadway, Providence, at $38,865, for police station at Wayland Ave. and Sessions St. Noted Sept. 30.

Conn., Bridgeport—Contract awarded to W. J. SHAUGHNESSY, Derby, at $46,500 for high school.

N. Y., Hicksville—(Official)—Contract awarded to WINES & HOMAS, Mattituck, for bank building for Bank of Hicksville. Noted Sept. 23.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to A. L. MORDECAI & SON, 30 East 42d St., at $70,000, for six-story, 28x100-ft. showroom and office building at Park Ave. and 57th St., for H. B. Anderson, 15 Broad St.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to FOUNTAIN & CHOATE, 110 East 23d St., at $100,000, for alterations to building at 18th St. and Broadway for Arnold Constable Co., 881 Broadway. Cady & Gregory, Arch.

N. Y., Pearl River—(Official)—Contract awarded to J. B. SCHULTZ, Suffern, N. Y., at $40,000, for laboratory for Lederle Anti-toxin Laboratory. William E. Austin, 46 West 24th St., New York, Arch.

N. J., Elizabeth—John Laurie, Jr., at $82,854, was low bidder for Winfield Scott school and John M. Vose, at $41,442 was low bidder for El Mora school. Noted Sept. 16.

Penn., Dormont—Contract awarded to I. N. DUSHANE & SONS, Carnegie, for Masonic Hall. Noted Aug. 12.

Penn., Philadelphia—Contract awarded to CRAMP & CO., Philadelphia, at about $500,000, for ten-story building at Ninth and Sansom St. Frederick Webber, Philadelphia, Arch.

Penn., Philadelphia—Contract awarded to DOYLE & CO., 1519 Samson St., at $125,000 for three-story and basement, 57x118-ft., school at 416 Queen St. for E. W. Bok.

W. Va., Bluefield—Contract awarded to JOHN F. BARBER & SONS at about $45,000, for school on Rockridge St.

Ga., Chatsworth—Contract awarded to H. J. CARR & CO. for courthouse. Alexander Blair, Macon, Arch.

Ohio, Cincinnati—Contract awarded to FERRO CONCRETE CO., at $452,519, for East High School at Erie and Madison Ave. by Board of Education. Garber & Woodward, Arch. Noted Oct. 7.

Ohio, Cleveland—Contract awarded to MILES CONSTRUCTION CO., Cleveland, at $50,000, for masonic temple for Glenville Masonic Temple Co.

Ohio, Cleveland—Contract awarded to CROWELL-LUND-OFF-LITTLE CO., 1957 East 51st St., Cleveland, at about $600,000, for 13-story commercial and office building on Euclid Ave. for Union National Bank.

Ohio, Cleveland—Contract awarded to UHL-JASTER CO., 1900 Euclid Ave., Cleveland, at about $80,000, for two-story theater and commercial building at Detroit Ave. and Hird St. for Schmitt Realty Co. Noted Aug. 26.

Ohio, Toledo—Contract awarded to H. J. SPIEKER CO., Toledo, at $47,000, for three-story, 25x140-ft. store and loft building for Parks Bldg. Edward Thal, Ohio Bldg., Arch.

Wis., Neenah—Contract awarded to C. R. MEYER & SON, Oshkosh, for hotel and store for Merchants' & Manufacturers' Hotel Co. Estimated cost, $75,000. Noted Sept. 30.

Iowa, Charter Oak—Contract awarded to FRANK LEE, Carroll, for school. Noted Aug. 26.

Minn., Winona — Contract awarded to SEIDLITZ & WERNER, Winona, at $86,820, for high school by Board of Education.

Neb., Lincoln—Contract awarded to SELDEN-BRECK CONSTRUCTION CO., Omaha, at $121,969, for botany and zoology buildings and equipment for University of Nebraska. Noted Sept. 16.

Neb., Seward—Contract awarded to HENRY OHLSON & SON CO., David City, $43,988, for school.

Mo., Kansas City—Contract awarded to ARTHUR PERRY, 1701 Elmwood Ave., at $60,000, for two-story brick church at 12th St. and Bales Ave. for Bales Avenue Baptist Church. Noted Aug. 19.

Mo., St. Louis—All bids for Benton High School gymnasium rejected. Frank & Gordon, Donnelly Court Bldg., revising plans.

Mo., St. Louis—Contract awarded to MURCH BROS. CONSTRUCTION CO., at about $500,000, for theater for Orpheum Theater Circuit at Ninth and St. Charles St. Noted July 29.

CATALOG NOTICES

The Minwax Co., 18 E. 41st St., New York. Bulletin No. 1. Sub-Level Waterproofing. Illustrated, 12 pp., 8½x11 in.

The A. Lietz Co., 632-34 Commercial St., San Francisco, Calif. Manual of Modern Surveying Instruments and Catalog and Price List of Scientific Instruments. Twelfth Edition. Illustrated, 302 pp., 6x9 in.

Trussed Concrete Steel Co., Youngstown, Ohio. Bulletin No. D212. Kahn building products for railroad structures. Illustrated, 8½x11 in.

Walter A. Zelnicker Supply Co., St. Louis, Mo. Bulletin No. 180. Second-hand equipment.

Yawman & Erbe Mfg. Co., Rochester, N. Y. Pamphlet. Vertical file for blue prints. Illustrated, 16 pp., 5x7½ in.

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill. Catalog No. 110. Catalog in Spanish. Air compressors, rock drills, etc. Illustrated, 68 pp., 6x9 in.

Construction News

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

North Carolina—Bonds voted by Chapel Hill and Bingham townships, Orange County, to aid Alamance, Durham & Orange Ry. & Electric Co. to build line from Ossippee to Durham. Junius Harden, Burlington, Pres.

North Carolina—Piedmont & Northern Ry. Co. plans extension of line from Gastonia to Belmont. E. Thomason, Charlotte, Vice-Pres. and Gen. Mgr.

Alabama—Florence & Huntsville Interurban Ry. Co. is having surveys made for line from Florence to Elk River, about 27 miles. T. H. Allen, Florence, Secy.

Mississippi—Gulfport & Mississippi Coast Traction Co. will rebuild its line, recently damaged by hurricane, between Biloxi and Pass Christian, about 30 miles. W. F. Gorenflo, Mgr.

Mississippi—Hattiesburg Traction Co. plans extension of line to Mississippi Woman's College, Hattiesburg. H. F. Wheeler, Gen. Mgr.

Ohio—East Linden Electric Ry. Co. has asked City Council, Columbus, for franchise for construction of two lines.

Indiana—Ft. Wayne, Secatur & Southern R.R. Co. plans extending its Ft. Wayne & Springfield Ry. line.

Indiana—Goshen, Fort Wayne & Northern Interurban Ry. Co. plans line through Albion. Clarence E. Tasher, Goshen, is interested.

Michigan—Bond issue of $3,300,000 has been ordered by Michigan R.R. Commission for construction of line from Detroit to Owosso by Detroit, Pontiac & Owosso Ry. Co. Oliver H. Lau, Detroit, is interested. Noted July 29.

Illinois—Jacksonville Ry. & Light Co. will relay its tracks on South Main St. from Norton Ave. to Michigan Ave., Jacksonville. H. J. Vance, Peoria, Pur. Agt.

Illinois—Illinois Terminal R.R. Co. plans extension of line from Edwardsville to East Carondelet. H. H. Ferguson, Alton, Gen. Mgr.

Minnesota—Great Northern Ry. Co. plans extension of line from Milaca to Hill City along west side of Mille Lacs lake. A. H. Hogeland, St. Paul, Ch. Engr.

Minnesota—Electric Short Line Ry. Co. plans 25 miles of additional track.

Minnesota—Great Northern Ry. Co. contemplates cut-off of line from Hutchinson, Minn., to Redwood Falls, Wabasso, Tracey, Currie, Slayton and Hardwick to Garretson, S. D. A. H. Hogeland, St. Paul, Minn., Ch. Engr.

Kansas—Saline-Northern R.R. Co. contemplates extension of its line from Osborne. E. A. Tennis, Salina, is interested.

South Dakota—South Dakota & Western Ry. Co., recently incorporated with $1,000,000 capital, by W. L. Bruce, W. E. Heaton and J. J. Dorr, will build line from Mitchell to Brule, via Platte.

South Dakota—See item under "Minnesota."

Missouri—Wabash R.R. is having surveys made for line from Orrick to Missouri City. R. H. Howard, St. Louis, Ch. Engr.

Arkansas—Arkansas, Louisiana & Gulf R.R. Co. contemplates railway between Pine Bluff and Monticello. Crossett Lumber Co. is interested. O. F. Cole, Crossett, Ch. Engr.

Arkansas—Gould Southwestern Ry. Co. plans extension of line to Rison or Fordyce, then north to Pine Bluff. W. H. Roberts, Gould, Gen. Mgr.

Texas—Dallas Southwestern Traction Co. is having survey made for line from Glen Rose to Stephenville. E. P. Turner, Gaston Bldg., Dallas, Pres.

Texas—Houston, Richmond & Western Traction Co. will soon begin construction of line between Houston and San Antonio.

Oklahoma—Clinton & Oklahoma Western Ry. Co. contemplates extension of line from Strong City to Guymon, Okla. and Canadian, Tex., about 150 miles. Guy V. McClure, Clinton, Ch. Engr.

Oklahoma—Sapulpa & Oil Field R.R. Co. plans line from Depew to Drumright, via Cushing oil fields. Bridges will be constructed. C. F. Hopkins, Salpulpa, Okla., Gen. Mgr.

Colorado—Arkansas Valley Ry., Light & Power Co., Pueblo, will construct line from Pueblo to state line in Arkansas Valley. W. F. Raber, Pueblo, Vice-Pres. and Gen. Mgr.

Colorado—Denver & Rio Grande R.R. is making surveys for line from Alamosa to Durango. J. C. Gwyn, Denver, Ch. Engr.

Idaho—Spokane & Inland Empire R.R., has been granted franchise by City Council, for single-track steam and electric railway in Cœur d'Alene. A. M. Lupfer, Portland, Ore., Ch. Engr.

Utah—Ogden, Logan & Idaho Ry. plans improvements and extensions to line. Estimated cost, $200,000. P. D. Kline, Ogden, Gen. Mgr.

Washington—C. D. Hillman, Seattle, is back of a movement to build line from Olympia to Boston Harbor, about six miles.

Oregon—Oregon, California & Eastern Ry. Co. recently incorporated, will build 400 miles of standard gage line in central Oregon. Robert C. Sterahorn, Portland, interested.

Oregon—City Council, Medford, has allowed Southern Oregon Traction Co. to abandon its Siskiyou Heights extension and construct line on Hillcrest Rd. touching Highcroft, Laurelhurst and Queen Anne additions. C. G. Bullis, Medford, Gen. Mgr.

Oregon—Portland & West Coast R.R. & Navigation Co. has been offered bonus by citizens of Newport of $100,000 to build first ten miles of line from Newport to Portland.

California—Surveys are being made by Engels Copper Co., Taylorsville, for narrow gage railway from its mine to connect with Western Pacific Ry. near Keddie.

California—Council of Los Angeles granted franchise to Pacific Electric Ry. Co. to construct single-track line on portions of Figueroa St., Denver Ave., Hoover St., Menlo Ave. and Vermont Ave. Noted Sept. 9.

Calif.—San Jose R.R. Co. granted franchise for electric railway in San Jose.

New Brunswick—St. John & Quebec Ry. has been taken over by Provincial Government and will complete line between Gagetown and Centerville. F. P. Gutelius, Moncton, Gen. Mgr.

Manitoba—Brandon Municipal Ry. Co. will soon commence construction of line on College Ave. and 18th St., Brandon.

Bids in and Contracts Awarded

West Virginia—Chesapeake & Ohio Ry. Co. awarded contract to J. C. CARPENTER & MAJOR BROS., for double-tracking between Greenlee and Balcony Falls. B. T. Jellison, Richmond, Va., Pur. Agt.

Michigan—Contract awarded to SMITH-BYERSAPARKS CO., by White Pine Mining Co., Ontonagon for two miles of spur track from its mine to St. Paul R.R.

Minnesota—Northern Pacific Ry. Co. awarded contract to F. A. BAXTER, Superior, Wis., for spur track to Hillcrest mine near Ironton. F. G. Prest, St. Paul, Pur. Agt.

California—Pacific Electric Ry. awarded contract to ROBERT SHERER & CO., Pacific Electric Bldg., Los Angeles, for grading roadbed for line between Hawthorne and Ionia Ave., Los Angeles, on Redondo via Watts line. Estimated cost, $20,000. J. McMillan, Los Angeles, Gen. Mgr.

LIGHT, HEAT AND POWER

Proposed Work

N. Y., Syracuse—Syracuse Lighting Co. will construct three reinforced-concrete substations.

Fla., Titusville—Citizens defeated $35,000 bonds for purchase of Titusville Electric Light Co. L. W. Doolittle, Mayor.

Ala., Fairhope—See item under "Water Works."

Miss., Jackson—R. L. Benson, Chicago, Ill., owner of power plant of Capital Light & Power Co., plans expenditure of between $10,000 and $15,000 for improving same.

La., Lake Charles—J. G. Boyle and J. G. Bessler granted franchise to supply city with gas. Plant will be constructed at estimated cost of $100,000.

Tenn., Cumberland Springs—(Tullahoma post office)—Cumberland Springs Co. contemplates electric-light plant. Noted Oct. 14 under Cumberland Springs, Ga.

Ky., Cynthiana—Lexington Utilities Co., Lexington, has taken over plant of Cynthiana Electric-Light Co. and will improved same. Noted Sept. 9.

Ky., Danville—Danville Light & Power Co. plans to extend its service to Lancaster, Ky., about ten miles.

Ky., Louisville—Louisville Gas & Electric Co. will build substation at Bardstown Rd. and Stevens Ave. Estimated cost, $150,000.

Ky., Mayfield—Election will be held Nov. 2 to vote on purchase of Mayfield Electric Light Plant and Water-Works.

Ohio, Cleveland—Tropical Oil & Paint Co. will build power plant at 1244 West 70th St. Estimated cost, $5,000.

Minn., Brownsdale—H. C. Volkman has applied for franchise to install and operate electric-light plant.

Minn., Deer Wood—Cuyuna Range Power Co. plans to enlarge its plant.

Minn., Raymond—Citizens voted to construct light and power station.

Iowa, Fairbank—Election will be held Nov. 1 to vote to build electric-light plant.

Kan., Attica—Contract will soon be awarded for improving electric-light plant and water system. Estimated cost, $30,000. Noted July 29 and Sept. 23.

Kan., Bucklin—(Official)—Election will be held Oct. 28 to vote $10,000 bonds for improving electric-lighting system. Noted Oct. 7.

Kan., Preston—Citizens will vote to construct municipal electric-light plant.

S. D., Volin—Company being organized to install and operate electric-light and power plant.

N. D., Washburn—Franchise granted Washburn Light & Power Co. for electric-light and power plant.

Mont., Glasgow—Citizens voted $18,000 bonds for improvements to electric-light plant. Noted Aug. 12.

Mo., Poplar Bluff—Bids will be received by H. H. Wilcox, City Clk., until 2 p.m., Nov. 3, for municipal electric-light and power plant. (See adv.)

Tex., Brownwood—Texas Power & Light Co., Dallas, will build transmission line from Brownwood to Comanche.

Tex., Bryan—Fountain Bros. applied to City Council for franchise to construct electric-light and power plant.

Tex., Edgewood—J. W. Freeman, Kilgore, contemplates electric-light plant.

Tex., Greenville—Plans being considered for extending municipal street lighting system.

Okla., Muskogee,—Bonds for $350,000 voted for municipal pipe line to convey natural gas to Muskogee.

Okla., Oilton—Oklahoma Natural Gas Co. contemplates pipe line from wells near Cushing to Guthrie via Stillwater.

Okla., Sapulpa—Citizens contemplate pipe line to gas wells. Estimated cost, $20,000.

Colo., Limon—Denver interests have requested franchise from City Council for electric-light plant.

Idaho, Kendrick—Plans being prepared for electric-lighting system. Estimated cost, $8,000.

Idaho, Twin Falls—James McMillan has been granted franchise for gas plant.

Calif., Escondido—Board of City Trustees plans municipal electric-light and power plant and gas manufacturing plant.

Calif., Red Bluff—Northern California Power Co. plans expenditure of $10,000 for enlarging its gas plant.

Ont., Cobalt—Bids will be received by William Carter, Secy., Box 877, Cobalt, until Oct. 25, for heating system in public school at Giroux Lake.

Ont., Petrolia—Council plans to take over electric-light plant, at $11,280.

Ont., Toronto — Toronto Hydro-Electric Commission plans new sub-station at Gerrard St. and Carlew Ave. Estimated cost, $60,000.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Bronx)—(Official)—Contract for substation for Interboro Rapid Transit Co. awarded to JOHN B. ROBERTS, 1 Madison Ave., New York, N. Y. Estimated cost, $50,000.

Ohio, Cincinnati—Contract for new boilers for Ohio National Guard Armory, Freeman St. awarded to TUDOR BOILER CO., Cincinnati, at $8,980. Noted Sept. 9.

Ohio, Cleveland—Contract for heating system in Division Ave. pumping station awarded to CHAFER CO., Cleveland, at $11,250.

Ohio, Toledo—(Official)—Contract for steam heating and ventilating system for present building of Toledo University and for addition at Illinois and 11th St. awarded to JOHN PISCH CO., Toledo, at $19,790. Noted Oct. 7.

Iowa, Webster City — Contract for electric-light plant awarded to HAWKEYE CONSTRUCTION CO., at $4300.

Neb., Blair—(Official)—Contract for electric-light plant awarded to McGRAW CO., Omaha, at $22,490. Noted Oct. 7.

Ont., Preston—Contract for heating plant at Hurlbut shoe factory awarded to BERNHARDT & SPALDING.

BRIDGES

Proposed Work

Conn., Bridgeport—Grand St. and East Washington Ave. Bridge Commissions have retained J. B. Strauss, Chicago, Ill., to prepare plans and supervise construction of bridges at Grand St. and East Washington Ave. Estimated cost, $220,000 and $130,000 respectively.

Conn., New Hartford—Appropriation of $10,000 made by Town Board for bridge at Satan's Kingdom.

N. Y., Albany—State will build bridge over Rondout Creek between Kingston and Port Ewan to connect State Highway between Albany and New York. Estimated cost, $220,000.

N. Y., Buffalo—Jacob Dold Packing Co. will build car trestle on Howard Ave. Estimated cost, $10,000.

N. Y., Buffalo—Plans being considered by Public Service Commission for Harlem Ave. viaduct. Estimated cost, $400,000.

N. J., Livingston—Bids will be received by Frederick A. Reimer, County Engr., Newark, until 3 p.m., Oct. 25, for bridge on Hobart Gap Rd. over Canoe Brook.

Penn., Mooresburg—Bids being received by Philadelphia & Reading Ry. for concrete bridge on line through Mooresburg.

Md., Towson—Bids will be received by County Commissioners until Oct. 28 for bridge over Dead Run on Franklin Rd.

Va., Lynchburg—(Official)—Bids will soon be received for bridge across James River at Lynchburg. Estimated cost, $250,000. B. H. Davis, 7 Batterly Pl., New York, N. Y., Consult. Engr. Noted Oct. 7.

N. C., Biltmore—City plans bridge across Swannanoa River. Charles E. Waddell, Engr.

N. C., Kinston—Bids will be received by County Commissioners until Nov. 1 for bridge over Neuse River at Caswell St. Estimated cost, $10,000.

Ga., Atlanta—Fulton County and Atlanta contemplate 400-ft. viaduct to connect North Boulevard and Piedmont Park. R. M. Clayton, Ch. Engr.

Ga., Blairsville—Bids will be received by V. I. Butt, Ordinary, Union County, until Oct. 23, for steel bridge across Notla River to be known at Thompson Bridge.

Fla., De Land—See item under "Streets and Roads."

Miss., Columbus—Bids will be received until Nov. 1 by Lowndes County Supervisors for 100-ft. steel or concrete bridge, three wooden bridges and one concrete culvert. C. L. Wood, County Bridge Engr.

Miss., Leakesville—Bids will be received until Nov. 3 by Greene County Supervisors for steel bridge and iron highway bridge across Chickasawhay River. S. R. McKay, Clk.

La., Estherwood—Police Jury plans bridge across Medlanka River. Estimated cost, $4,000.

Tenn., Chattanooga—(Official)—Southern Ry. postponed construction of bridge over tracks at Oak St. indefinitely. Noted Oct. 7.

Tenn., Elizabethtown—Bids will be received until 1 p.m., Oct. 29, by L. D. Gasteiger, Secy., Rd. Comrs. of Carter County, for constructing a number of bridges.

Tenn., Loudon — Loudon County Commissioners granted franchise to F. C. Ferguss, J. H. Jollick and T. H. Baker for toll bridge across Tennessee River.

Tenn., Maynardville—See item under "Streets and Roads."

Ky., Covington—Bids will be received by J. Mason Howk, Comr. of Pub. Property, until 10 a.m., Oct. 28, for bridge piers for bridge to carry duplicate supply main of Licking River at a point approximately 150-ft. south of Louisville & Nashville Ry. bridge. Noted Aug. 26. (See adv.)

Ohio, Bridgeport—Bids will be received about Oct. 25 for repairing two bridges. Estimated cost, $20,000. C. C. Hoffner, City Clk.

Ohio, Cincinnati—Bids will be received by Philip Fosdick, Dir. of Pub. Ser., until noon, Oct. 25, for widening existing bridge on Montgomery Rd.

Ohio, Upper Sandusky—Bids will be received until 11:30 a.m., Oct. 28, by J. Marguerat, Audr., Comrs. of Wyandot County, for substructure of bridge over Sandusky River, Tymochtee Township.

Ind., Anderson—Bids will be received until 10 a.m., Oct. 27, by Commissioners of Madison County, for two additional steel spans for bridge across White River on North Main St. J. B. Benefiel, Audr. Noted Sept. 23.

Ind., Wabash—(Official)—Bids will be received by D. Showalter, Audr., until 1:30 p.m., Nov. 3, for bridge over Wabash River at Wabash. Estimated cost, $40,000. A. W. Grosvenor, Ft. Wayne, Engr.

Mich., Hastings—Bridge will be constructed over Little Thornapple River near county line by Town Boards of Thornapple Township in Barry County and Caledonia Township in Kent County. Estimated cost, $5,000.

Minn., Duluth—City plans to construct two bridges. Estimated cost, $15,000.

Minn., Minneapolis—Bond issue of $85,000 authorized by City Council toward work of concrete arch bridge across Mississippi River at Third Ave., S.

Kan., Hutchinson—Preliminary plans prepared and bids will be received about Jan. 1 for reinforced-concrete bridge over Arkansas River at Hutchinson. Estimated cost, $45,000. W. B. Harris, County Engr. Noted Oct. 14.

Kan., Iola—Plans being prepared by W. S. Gearhart, State Engr., Kansas Agricultural College, Manhattan, for three reinforced-concrete bridges.

Kan., Iola—Bids will be received until noon, Nov. 10, by Commissioners of Allen County, for replacing and repairing McFarlan Bridge.

Kan., Mankato—Bids will be received by County Clerk until noon, Oct. 26, for steel truss bridge with 80-ft. span and 16-ft. roadway.

Kan., Nickerson—Commissioners of Reno County contemplate reinforced-concrete bridge estimated to cost $30,000. P. Peck, Abbeyville, Chn.

Kan., Salina—Commissioners of Salina County plan bridge over Smoky River. W. S. Farier, County Engr.

S. D., Yankton—Election will soon be held to vote $300,000 bonds for railroad bridge across Missouri River.

Mo., Gasconade—Missouri-Pacific Ry. plans expenditure of $60,000 for draw span in bridge over Gasconade River.

Mo., Joplin—(Official)—Bonds for $13,500 sold for North Main St. viaduct. J. J. McAfee, City Engr. Noted Oct. 7.

Mo., Maryville—Election will soon be held in Nodaway County to vote $100,000 bonds for bridges.

Mo., Wellington—See item under "Streets and Roads."

Tex., Harrisburg—Bids will be received by H. L. Washburn, County Audr., until Nov. 1, for bridge over Brays Bayou.

Tex., Palestine—International & Great Northern Ry. Co. and city will build steel viaduct from Spring St. into Reagan Park. O. H. Crittendon, Houston, Ch. Engr. Noted Aug. 5.

Okla., Antlers—Bids will soon be received for five steel bridges in Pushmataha County. Estimated cost, $40,000.

Okla., Chandler—Bids will be received until 10 a.m., Oct. 25, by J. C. Pringley, Clk. of Lincoln County, for four steel bridges across Main Ditch in Deep Fork Drainage District No. 1.

Okla., Guthrie—Plans submitted by J. A. Rankin, Engr., for bridge across Cimarron River near Guthrie. Estimated cost, $18,000.

Ariz., St. Johns—Election will soon be held to vote $75,000 bonds for bridges.

Wash., Seattle—Bids will be received about Nov. 1 for bridge over Lake Washington Canal at 10th Ave. A. Rapp, City Bridge Engr.

Calif., Cloverdale—Town Board plans two bridges, one at First and Main St. and the other at Third St.

Calif., El Centro—Bids will be received until 2 p.m., Nov. 1, by California Highway Commissioners, 515 Forum Bldg., Sacramento, for reinforced-concrete bridge across Myers Creek. C. C. Carleton, Act. Secy.

Calif., Merced—Bids will soon be received by Board of Supervisors of Merced County for reinforced-concrete bridge across Santa Rita Slough, Supervisorial District No. 5. Estimated cost, $6,000.

Calif., San Jose—(Official)—Bids will be received by Board of Supervisors of Santa Clara County, Courthouse, until 11 a.m., Oct. 25, for reinforced concrete bridge on New Ave.

Calif., Sacramento—(Official)—Bids will be received at office of California Highway Commission, 515 Forum Bldg., until 2 p.m., Nov. 1, for reinforced-concrete bridge across Myers Creek, Imperial County.

Bids In and Contracts Awarded

Maine, Brownsville—Contract for concrete bridge across Pleasant River awarded to SANDERS ENGINEERING CO., Portland, at $11,000.

Penn., Lewistown—(Official)—Contract for bridge over Kishacoquilla Creek on Dorset St. tension awarded to R. R. MYERS, Lewistown, at $8,900. Noted Sept. 23.

Penn., Uniontown—(Official)—Contract for bridge over Jacobs Creek at West Overton between Greensburg and Fayette County awarded to HARVEY & WATSON, Mt. Washington, at about $8,000. Noted Sept. 2.

W. Va., Brandywine—Contract awarded to FARRIS BRIDGE CO., Charleston, at $5,600, by Pendleton County Commissioners for concrete bridge.

W. Va., Wheeling—Contract for two concrete bridges awarded to CLATTERTON & BRADY, Sistersville, at $10,000.

S. C., Beaufort—(Official)—Contract for repairs to two piers of Whale Branch Bridge and new bridge between St. Helena and Ladies Islands awarded to CAROLINA CONSTRUCTION CO., Columbia, at $8,952. Noted Sept. 16.

Ohio, Milford—Contract for bridge over East Fork of Little Miami River in Union and Miami Townships awarded to ROCHESTER BRIDGE CO., at $9,289. Noted Sept. 9 and 23.

Ind., Crown Point—(Official)—Contract for pony truss bridge over Hart Ditch, Brown St., Munster, awarded to BARNES & SHEARER, Hobart, at $4,696. Noted Sept. 23.

Ind., Salem—Contract for five concrete bridges awarded to MONTGOMERY-PARKER CO., Hatfield, at $7,000.

Ill., Lake Bluff—Contract for concrete work for bridge on Sheridan Rd. awarded to MODERN ENGINEERING & CONCRETE CO., steel work to KENWOOD BRIDGE CO. Estimated cost, $6,000.

Minn., Kenyon—Contract for two bridges and culverts in Wanamingo Township awarded to KENYON CONCRETE & CONSTRUCTION CO.

Kan., Lawrence—Contract for reinforced-concrete bridge across Kansas River at Lawrence awarded to MISSOURI VALLEY BRIDGE & IRON CO., Leavenworth, at $199,910. Noted Aug. 12 and Oct. 14.

Mont., Billings—Contract for steel bridge over Tongue River awarded to SECURITY BRIDGE CO., Minneapolis.

Ark., Arkadelphia—Contract awarded to HOPE BRIDGE CO., Hope, by Clark County Commissioners for two steel bridges, one across Scrouge Creek in Southfork Township and one on Gurdon and Okolona Rd.

Okla., Lehigh—Contract for three bridges in Coal County awarded to WESTERN BRIDGE CO., Sherman, Tex. Estimated cost, $6,000.

Okla., Pawnee—All bids received for Lankard Bridge, in Section No. 20, Township 22 rejected.

Ariz., Florence—Contract for two concrete bridges across Gila River near Winkleman awarded to TOPEKA BRIDGE & IRON CO., Topeka, Kan., at $46,595. Noted Oct. 7.

Calif., Red Bluff—Contract for three concrete bridges on State Highway awarded to ROSS CONSTRUCTION CO., Sacramento at $17,000. Noted July 22 and Aug. 19.

Calif., San Andreas—Contract for concrete bridge near San Andreas awarded to BLUXOME & CO., San Francisco, at $5,000.

Calif., San Bruno—See item under "Sewers."

Calif., San Luis Obispo—Contract for steel bridge over Paso Robles Creek awarded to GUTLEBEN BROS., New Call Bldg., San Francisco, at $11,733.

WATER WORKS

Proposed Work

Vt., Burlington—Water system will be extended. Estimated cost, $25,000.

Mass., Fall River—Commission on Water Supply reported in favor of system costing $3,000,000.

Mass., Lynn—Bids will soon be received for pumping station at Ipswich River.

Conn., Hartford—(Official)—Bids will be received until 3 p.m., Nov. 1, by Board of Water Commissioners for work under Contracts Nos. 14 and 15 for clearing Neapug reservoir basin. Caleb Mills Saville, Ch. Engr. (See adv.)

N. Y., Hudson—Bonds for $10,000 voted for water mains.

N. Y., New York—(Borough of Manhattan)—Bids will be received by W. Williams, Comr. of Water Supply, Gas and Electricity, until Oct. 22, for furnishing c.-i. pipe, special and valve box castings, cast steel castings and valves.

N. Y., Yorktown—Bids will soon be received by I. G. Harris, Supt. Monhansic State Hospital, for water system and sewage-disposal plant. Estimated cost, $300,000.

N. J., Jersey City—Bids will be received until 11 a.m., Oct. 28, by Board of Commissioners for specials, hydrants, connection plugs, caps, sleeves, etc. Michael I. Fagen, City Clk.

N. J., Waterloo—(Official)—Citizens do not contemplate dam at outlet of Junius Pond. Jacob Brooks, Clk. Noted Oct. 7.

Md., Hagerstown—Washington County Water Co. has increased its capital stock to provide $150,000 for improving water system and $400,000 for building reservoir.

N. C., Durham—City plans water system. G. C. White, Member Bd. of Aldermen.

S. C., Columbia—Citizens voted $500,000 bonds for extending water and sewer systems. Noted Sept. 23.

Ala., Fairhope—Town plans to take over water system and install electric-light plant. Estimated cost, $12,000.

Ala., Florence—Election will be held in November to vote on $200,000 bonds for purchase and improvement of water system.

La., Covington—Election will be held to vote on bonds for water and sewer systems. A. Kramer, Magnolia, Miss., Engr.

La., Oakdale—Bids will be received about Nov. 1 for water system. R. E. Ricketts, City Secy. Estimated cost, $30,000. Noted Oct. 14.

Ky., Mayfield—Election will be held Nov. 2 to vote on purchase of Mayfield Water Works.

Ohio, Cleveland—Election will be held Nov. 2 to vote on $2,000,000 bonds for preventing pollution of Cuyahoga River and Lake Erie.

Ohio, Cleveland Heights—(Warrensville post office)—See item under "Sewers."

Ohio, Dayton—Bids will be received by J. E. Barlow, Dir. of Pub. Ser., until Oct. 28, for one 20,000,000-gal. low service, steam driven pumping unit at Keowee St. pumping station.

Ohio, Tiffin—(Official)—Tiffin Water-Works Co. will build concrete dam by day labor. Noted Oct. 7.

Ind., Brookville—Bonds for $20,525 sold for water works.

Ind., Wakarusa—State Public Service Commission granted permission to Wakarusa Water Co. to issue $20,000 bonds for water system.

Mich., Menominee—Election will be held Nov. 1 to vote on $285,000 bonds for either purchase of property of Menominee Water Co. or for construction of municipal system.

Mich., Saginaw—Election will be held Dec. 2 to vote on $750,000 bonds for water system.

Ill., Aurora—Construction of new reservoir contemplated by Board of Public Works.

Ill., Rankin—Election will be held Oct. 30 to vote on $6,000 bonds for water system.

Ill., Springfield—Improvements to water-works and fire department recommended by National Board of Underwriters. Estimated cost, $200,000.

Ill., Wheaton—(Official)—Board of Local Improvements received estimates for improvements to water system from L. G. Ruddock, City Engr. Estimated cost, $34,620. Noted Sept. 2.

Wis., Kenosha—Bids being received for pumping plant and filtration plant for Board of Public Works. B. C. Brennan, City Hall, Clk. Estimated cost, $100,000.

Wis., Two Rivers—Bids will be received until 7:30 p.m., Oct. 23, by Water and Light Commission for 6-in. water main in Monroe Ave., Jackson St., and 4-in. main in 24th St. Joseph Doleysh, Secy.

Minn., St. Cloud—Water mains will be laid by city by day labor. C. H. West, City Engr. Noted Sept. 16.

Minn., Thief River Falls—Citizens defeated $38,000 bonds for purchase of municipal water system.

Kan., Manhattan—Bonds for $69,500 for water system voted by citizens. Bids being received by F. Walters, City Engr. Noted Sept. 30.

Kan., Morrill—Bonds for $10,000 voted by citizens for water system.

Neb., Bayard—Bids will be received until Nov. 15 by City Clerk for water system. Estimated cost, $12,500. Selzer & Finley, Scotts Bluff Engr Noted Sept. 23.

S. D., Humboldt—Bonds for $10,000 for water system sold.

N. D., Ellendale—Election will be held Oct. 30 to vote on $9,000 bonds for water system. John King, City Audr.

Mont., Broadview—City will build water system. M. Soronson, Chn. of Comrs.

Mont., Glendive—Election will be held in spring to vote on $70,000 bonds for rebuilding water system.

Mo., Odessa—Black & Veatch, 507 Interstate Bldg., Kansas City, making surveys for water system and sewer system.

Tex., El Paso—City plans about ten additional wells near pumping station.

Colo., Durango—City Council will build concrete dam at lower reservoir. A. F. Hood, City Mgr.

Colo., Loveland—Improvement of water system contemplated by City Council.

Colo., Westcliffe—Election will soon be held to vote bonds for water system.

Idaho, Star—McCullah & Swearinger, Engrs., submitted report on water system.

Idaho, Ucon—Citizens voted $5,000 bonds for water system. O. W. Steele, Chn. Water Comm.

Wash., Seattle—Council contemplates expenditure of $75,000 for standpipe in West Seattle.

Ore., Culver—See item under "Canals, Ditches and Irrigation."

Ore., Eastside—Election will be held in December to vote on $50,000 bonds for municipal water system.

Calif., Santa Cruz—Election will soon be held to vote on $100,750 bonds for water system.

Ont., Markham—Bids will soon be received by E. A. James, 57 Adelaide St., Toronto, for water system. Estimated cost, $25,000. Noted Sept. 30.

Man., Winnipeg—(Official)—Bids will be received until noon, Oct. 25, by S. H. Reynolds, Chn. of Coms., Greater Winnipeg Water District, 901 Boyd Bldg., Winnipeg, for portland cement. Estimated number of barrels, 200,000. (See adv.)

Sask., Watrous—Citizens contemplate water system. Estimated cost, $50,000.

B. C., Port Coquitlan—Towns plans to install municipal water system. Estimated cost, $35,000.

N. S., St. Andrews—City will build pumping station. Estimated cost, $35,000.

Bids In and Contracts Awarded

Mass., Boston—(Official)—Bids were received Oct. 11 for laying 15,000 ft. of water mains as follows: John Guarino, 45 Brook Ave., Roxbury, $10,308; Thomas Burke, 7 Shirley St., Roxbury, $10,905 and John T. Shea, Jr., Boston, $11,495.

Mass., Salem—Bay State Dredging Co., 247 Atlantic Ave., Boston, at $13,800 was low bidder for intake and gate house at Wenham Lake.

Penn., Tamaqua—Bids were received Oct. 5 for reservoir in Owl Creek as follows: Di Menna & DePaola, Inc., New York, N. Y., $71,437; M. A. Magan, Pottsville, $93,392; and Lovejoy & Wilson, Philadelphia, $104,368. Noted Aug. 12.

La., Gretna—Contract awarded to J. R. SUTHERLIN & CO., Kansas City, Mo., at $46,830, for water system. Noted Sept. 30.

Ohio, Cleveland—Contract awarded to GEORGE H. WORTHINGTON CO., at about $20,000, for water meters for Water Department.

Ohio, Cleveland—Contract for repairing pumps at Division pumping station awarded to ALLIS-CHALMERS CO., Minneapolis, Minn., at $35,000.

Ohio, Liverpool—Contracts for water system awarded as follows: Distributing and force main to J. I. DICK, Scottdale, Penn., at $94,472; excavating and reinforced-concrete work for river intake, pumping station and filtration plant to T. A. GILLESPIE CO., New York, N. Y., at $100,403. Chester & Fleming, Pittsburgh, Penn., Engr.

Ohio, Wilberforce—Contracts for improving water system awarded as follows: 80,000-gal. steel tank and tower to PITTSBURGH-DES MOINES STEEL CO., Pittsburgh, Penn., at $3,536; two steam pumps to WINEMAN PUMP MFG. CO., Columbus; hot water storage heater and softening plant to SHARTLE MACHINE CO., Columbus; well and connections to S. H. BOND. Estimated cost of work, $8,472. Noted Sept. 16.

Wis., Kenosha—Contract awarded to GRELING BROS., Green Bay, at $78,875, for lake intake and crib on Washington Island.

Iowa, Marcus—(Official)—Contracts awarded to DES MOINES BRIDGE & IRON CO., at $4,000, for 75,000-gal. tank on tower; FAIRBANKS, MORSE & CO., at $3,440, for 60 hp. oil engine, compressor, and centrifugal pump and to WARD & WEIGHTON, at $2,593 for pump house. Noted Sept. 30.

Iowa, Sidney—Contracts awarded by Water Works Board for improvements to water system as follows: ALAMO ENGINEERING CO., Omaha, Neb., $9,621 for water mains; AMERICAN CAST IRON PIPE CO., Kansas City, Mo., $8,122, for c.-i. pipe and to MERKLE-HINES MACHINERY CO., Kansas City, Mo., at $539 for hydrants. Noted Sept. 30.

Minn., Campbell—Contract awarded to WARD & WEIGHTON, Sioux City, Iowa., for water mains. Noted Sept. 23.

Minn., Minneapolis—(Official)—Contract awarded to NEW JERSEY PIPE CORPORATION, 50 Church St., New York, N. Y., for riveted steel pipe. N. E. Alexander, Pur. Agt. Noted Sept. 30.

Kan., Attica—(Official)—Contract awarded to BICKEL CONSTRUCTION CO., Kansas City, Mo., at $29,800, for water and electric-light systems. Noted Oct. 7.

Kan., Pleasanton—Contract awarded to F. D. MARTIN, Rialto Bldg., Kansas City, Mo., at $4,000, for water system.

Kan., Russell—Contract awarded to DES MOINES BRIDGE & IRON WORKS, Des Moines, Iowa, for laying water mains and to U. S. CAST IRON PIPE CO., Kansas City, Mo., at $34.15 per ton for c.-i. pipe. Noted Oct. 14.

S. D., Yankton—Contracts awarded to McLAIN & ELLERMAN, Yankton, at $5,577, for water mains and hydrants and to CHICAGO BRIDGE & IRON CO., at $3,400, for water tower and tank.

Wash., Seattle—Del Guzzo & Co., at $4,800, was low bidder for water mains in 50th Ave., N. E..

Calif., San Francisco—A. J. REEDER, at $31,675, awarded contract for clearing floor at Hetch Hetchy Valley.

Ont., Dundas—(Official)—Contract awarded to DICKSON BUILDING CO., Dundas, at about $7,000, for dam for water system. John L. Fry, Clk. Noted Oct. 7.

Ont., Ottawa—Contract awarded to LAURIN & LEITCH, Montreal, Que., at $194,000, by City Council, for pipe line. R. L. Haycock, Engr.-in-Charge. Noted Oct. 7.

B. C., West Vancouver—Contract awarded to COTTON CO. LTD., Vancouver, at about $90,000, for water system for Sisters Creek.

SEWERS

Proposed Work

Mass., New Bedford—(Official)—City will construct intercepting sewers by day labor. About $65,000 available for this work. Noted Oct. 7.

N. Y., Greenwich—(Official)—Citizens voted to issue $7,500 bonds for sewer pipe on Elman Ave., Main and Bridge St. Noted Sept. 14.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., Room 2032, Municipal Bldg., until 2 p.m., Nov. 4, for tunnel relief sewer in West 46th St. from Hudson River to Seventh Ave.

N. Y., Syracuse—City Council plans new sewers for eastern section, W. T. Wooley, City Engr. Estimated cost, $185,000.

N. Y., Yonkers—Bids will soon be received for sewers in Prescott St., Paulding St., Fillmore St., Hyatt Ave., Lee Ave. and Sherman Ave.

N. Y., Yorktown—See item under "Water-Works."

N. Y., Yorktown Heights—Bids will be received by William B. Osgood, Pres., Bd. of Managers, New York State Training School for Boys, Dept. of Architecture, Room 1224, Woolworth Bldg., New York, N. Y., until 2:30 p.m., Nov. 9, for sewerage and sewage disposal plant. Noted Sept. 30. (See adv.)

N. J., South Orange—Plans prepared by Edmond R. Halsey, Engr., for storm sewers in Maplewood section. Estimated cost, $61,400.

Penn., Ashley—Bids being received by Borough Clerk, for storm sewer in Maxwell and Wyoming St., according to press reports.

Penn., Ingram—(Pittsburgh post office)—Bonds for $14,000 sold for sewer work.

Del., Newport—Election will be held in January, according to press reports, to vote on bonds for sewer system. S. W. Day, Secy.

Md., Rockville—(Official)—Bids will soon be received for sewers and sewage disposal plant for portions of Montgomery County in Little Falls Brook drainage area. E. B. Whitman, Consult. Engr. Noted Sept. 16.

Md., Silver Spring—Harry Stevens, Union Trust Bldg., Washington, D. C., preparing plans for sewer system. Estimated cost, $40,000. Noted Aug. 19.

W. Va., Kenova—Election will be held Nov. 6 to vote $55,000 bonds for sewer system.

S. C., Columbia—Bonds for $300,000 voted by citizens Oct. 5 for extending sewer system. Noted Sept. 16.

Fla., Eustis—Bonds for $60,000 voted by citizens for sewer system. Noted Aug. 16.

Fla., Tampa—(Official)—Bids will be received until 2 p.m., Oct. 26, by Allen Thomas, Clk., Bd. of Comrs. of Pub. Wks., for purchase of $75,000 bonds for sewers and internal improvements.

La., New Orleans—Bids will be received until noon, Dec. 3, by Sewerage and Water Board for labor-material-percentage contract.

Ky., Owensboro—Election will probably be held Nov. 2 to vote on $250,000 bonds for sewer system.

Ohio, Alliance—Bids will be received until Nov. 1 by James I. Rickard, Dir. of Pub. Service, for sewage-disposal plant. Chester & Fleming, Pittsburgh, Penn., Engr. Estimated cost, $40,000.

Ohio, Cleveland Heights—(Warrensville post office)—Bids will be received by H. H. Canfield, Clk., until noon, Nov. 15, for sale of $38,426 bonds for sewers in Cedar Road District No. 3.

Ohio, Cleveland Heights—(Warrensville post office)—Bids will be received by H. H. Canfield, Clk., until noon, Oct. 25, for sewers and water mains in various streets. F. A. Pease Engineering Co., Cleveland, Engr.

Ohio, Springfield—Bids will be received until noon, Nov. 1, by City Auditor, for purchase of $6,271 bonds for sewers. Noted Sept. 16.

Ohio, Youngstown—City plans sewer in Mill Creek Sewer District. Frank Lillie, Engr.

Mich., Hancock—City Council plans new sewer system for West Hancock.

Mich., Menominee—Council plans storm sewers.

Ill., Bloomington—Normal and Bloomington contemplate joint sewage-disposal plant.

Ill., East St. Louis—City Council will make repairs to sewers. Estimated cost, $37,000.

Ill., Jacksonville—Board of Local Improvements will build sewer in Independence Ave. and Hooker St.

Ill., Lemont—Board of Local Improvements plans sewers.

Ill., Rock Island—Bids will be received about Nov. 15 for sewer system and sewage-disposal plant and septic tank. Wallace Trichler, City Engr.

Wis., Fond du Lac—Plans being prepared by City Engineer for sewers in Washington, Morris, Ruggles, West Cotton and East St.

Wis., Manitowoc—Plans being prepared for sewer in Franklin and Sixth St. John Kelley, City Clk.

Wis., Milwaukee—City Council will build sewer in Richards St. Estimated cost, $8,000.

Wis., Stoughton—Bids will be received until Oct. 27 for sewers in various streets.

Iowa, Sioux City—City Council plans extension of storm water sewer in Lafayette St. to Missouri River.

Kan., Belleville—Citizens contemplate sewer system. Estimated cost, $40,000. W. L. Wineland, Mayor.

Kan., Cherryvale—Black & Veatch, Interstate Bldg., Kansas City, Mo., preparing plans for sewer system. Estimated cost, $20,000.

Kan., Hutchinson—Bids will soon be received for sanitary sewer for Hyde Park addition.

Neb., Haverlock—Bids will be received by A. J. Blount, City Engr., until 8 p.m., Nov. 5, for sewers in three districts.

Neb., Loup City—(Official)—Election will be held Nov. 9 to vote $6,500 bonds for sewer system. T. W. D. Wolfe, City Engr. Noted Oct. 7.

Tex., Lancaster—Bonds for $15,000 voted by citizens for sanitary and storm sewers. Noted Sept. 16.

Tex., Sherman—City contemplates sewer system and sewage-disposal plant. Charles Sayville, Dallas, Engr.

Colo., Edgewater — (Official) — Contract for sewer system will be awarded about Oct. 28. Estimated cost, $32,000. Noted Sept. 23.

Colo., Glenwood Springs—City plan sewers in Minturn and Lincoln Ave.

Idaho, Kellogg—City plans sewer work in Pressley addition. Estimated cost, $7,000.

Ore., Amity—City contemplates sewer system.

Calif., Fresno—A. Cronkite, City Engr., authorized to prepare plans for storm and sanitary sewers. Estimated cost, $15,000.

Calif., Los Angeles—Sewers will be constructed in 35th Pl., Van Ness Ave., Cimarron St. and 35th St.

Calif., Richmond—City Council plans sewer work. Estimated cost, $87,400. H. D. Chapman, City Engr.

Calif., Sacramento—City commission plans sewers in Freeport Rd., from Burnside to El Dorado Ave.

Ont., Hamilton—City plans to extend sewer system. Estimated cost, $35,000. A. F. Macallum, Engr.

Ont., Peterborough—City plans to construct sewers on Ribinson, Victoria and Aylmer St. R. H. Pearsons, Engr.

SEWERS

Bids In and Contracts Awarded

Mass., Boston—(Official)—Contract for Section 1, Deer Island Outfall sewer awarded to GEORGE M. BUYNE, 166 Devonshire St., Boston, at $43,370. Frederick D. Smith, City Engr. Noted Sept. 30.

R. I., Providence—(Official)—Bids were received Oct. 11 for sewers in various streets as follows: Bayard St., Antonio Aiello, at $522; River Ave., and Yorkshire St., Charles Crankshaw, at $12,729 and $8,477 respectively; Douglas Ave., Antonio Gonelli, at $1,256. Noted Oct. 7.

N. Y., New York—(Borough of the Bronx)—(Official)—Bids were received Oct. 14 for sewers in Starling Ave., Unionport Rd., McGraw Ave., and Pugsley Ave.: (Low bidders) Briggs & McLaughlin, $5,000; Salvatore Purificato, $5,000; Anita Construction Co., $5,000 and Williamsbridge Construction Co., $5,000.

N. Y., Utica—Contract awarded to A. W. FITCH at $3,358 for storm water sewers.

N. J., Atlantic City—(Official)—Contract for storm water drainage system awarded to JOSEPH FERRY & SONS, INC., Baltimore, Md., at $125,921. Noted Sept. 23.

Penn., Nanticoke—Contract awarded to D. M. ROSSER, for 6-in. brick sewer.

Tenn., North Chattanooga—Contracts awarded to O'SULLIVAN, LONG & HAGERTY, Bessemer, Ala., at $34,000, for 11 miles of 8- to 12-in. sewers and to GUILD & CO., James Bldg., Chattanooga, at $5,665, for 700 ft. of 5- to 9-in. brick sewer. Noted Oct. 7.

Ohio, Cincinnati—(Official)—All bids received for Duck Creek Intercepting sewer rejected. Noted Sept. 16.

Ohio, Martins Ferry — Contract awarded to ARCHER & SHANNAFELDT, Bellaire, for sewer in Elm St.

Ill., Galesburg—Contract awarded to D. E. KEELER CO., Davenport, Iowa, at $3,728, for sewers.

Wis., Appleton—(Official)—Contract for sewers in Richmond St. awarded to J. DELLMONN & CO., Appleton, at 77c. per ft. Noted Oct. 7.

Wis., Green Bay—Contract awarded to B. WAERZEGGERS, Green Bay, at $0.63 per ft. for 12-in. sewers in Oakland Ave. Noted Sept. 30.

Wis., Milwaukee—Contract awarded to ALEX PESTKA, for 12-in. sewer in Menlo Ave. Theodore B. Olson, Clk.

Wis., Racine—Contract for sewers in Carlisle Ave. awarded to PATRICK GAVAHAN, Racine, at $1.40 for 18-in., $1.28 for 15-in. and $1.10 for 12-in.

Iowa, Brooklyn—Contract awarded to PUBLIC SERVICE CONSTRUCTION CO., Omaha, Neb., at $22,194 and $10,274, for sewer system and disposal plant. Noted Aug. 12.

Iowa, Des Moines—Contract awarded to J. L. HAUSMAN, for extension of Ingersoll Run sewer and storm water sewer.

Iowa, Webster City—Contract for Cedar St. sewer awarded to HAWKEYE CONSTRUCTION CO., at $4,300.

Minn., Herman—(Official)—Contract for sewer awarded to BADGER CONSTRUCTION CO., Fargo, N. D., at $4,635. Noted Sept. 23.

Kan., Marysville—Contract awarded to INTER-MOUNTAIN BRIDGE & CONSTRUCTION CO., Tecumseh, Neb., at $8,157, for sewer work.

Neb., Bridgeport — Contract awarded to C. J. BURKE, Kearney, for 8,000 ft. of sewer. Noted Oct. 7.

Neb., Lincoln—Abel & Roberts, First National Bank Bldg., Lincoln, at $35,240, was low bidder for Antelope conduit for city.

S. D., Aberdeen—(Official)—Contract for sewers in Second St. awarded to A. A. DOBSON & CO., Aberdeen. Noted Sept. 30.

Ark., Lake Village—Contract for sewer system awarded to MCCREARY CONSTRUCTION CO., at $18,000.

Idaho, Mountain Home—Contract for sewer construction awarded to IDAHO HARDWARE & PLUMBING CO., Boise, and JOHN W. MORTON, Mountain Home. Estimated cost, $15,360. R. J. Newell, Engr.

Ariz., Mesa—(Official)—Contract for sewer system including 16 miles of sewers awarded to DOYLE BROS., Phœnix, at $51,778. Noted Sept. 30.

Wash., Seattle—(Official)—Contract for overflow sewer in First Ave., N. W., awarded to McDONALD & JONES, 410 Globe Bldg., Seattle, at $15,548. Noted Sept. 30.

Wash., Seattle—Del Guzzo & Co., at $6,200, low bidder for sewers in 50th Ave., N. E.

Ore., Forest Grove—W. C. Elliott, Portland, at $58,448, low bidder for sanitary sewer system. Noted Sept. 9.

Calif., San Bruno—Contract for storm sewers and bridges awarded to CHARLES J. LINDGREN, Monadnock Bldg., San Francisco, at $15,600.

Calif., Stockton—Contracts awarded to TIBBITTS PACIFIC CO., 16 California St., San Francisco, at $14,330 for storm water sewer in east end of city and to D. BISHOP, Stockton, at $16,419, for sanitary sewers in South and Edison St. Noted Oct. 14.

Calif., Visalia—Contract for sewer system awarded to M. MURPHY, Berkeley, at $40,500. Noted Sept. 30.

GARBAGE

Proposed Work

Del., Wilmington—New bids will be received by Board of Health for disposal of garbage for period of years.

Ohio, Akron—(Official)—Bids will be received until noon, Oct. 27, by Board of Control for removal of garbage to Akron garbage disposal plant on Cuyahoga St. C. P. Parker, Dir. of Pub. Serv.

Ind., Ft. Wayne—Board of Works retained Samuel A. Greenley, Milwaukee, Wis., to prepare plans for garbage incinerator. Noted Aug. 5.

Iowa, Mason City—Plans being prepared by E. J. Gones, Macon, Ga., for disposal plant. Estimated cost, $8,000.

Minn., Duluth—Council plans $50,000 bonds for garbage incinerator.

STREETS AND ROADS

Proposed Work

Mass., Woburn—Bids will be received by State Highway Commission, Boston, until Oct. 26 for 5,200 lin.ft. of road.

N. Y., Franklinville—Citizens voted $9,000 for paving Park Sq.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., until 2 p.m., Oct. 28, for regulating and paving and repaving various streets and avenues of the borough.

N. Y., New York—(Borough of Richmond)—(Official)—Bids will be received by Calvin D. Van Name, Borough Pres., Borough Hall, St. George, New Brighton, until noon, Oct. 26, for constructing cement sidewalks on Nelson Ave. from Amboy Rd. to a point about 1962 ft. east of east house line of Southfield Blvd. and Richmond Turnpike from Jewett Ave. to Little Clove Rd.

N. J., Atlantic City—County Board of Freeholders plans to pave Meadow Blvd. from Chelsea to Pleasantville. Estimated cost, $125,000.

N. J., Hackensack—Bids will be received by A. N. Morris and C. N. Cumberland, Comr. of Bd. of Chosen Freeholders of Bergen County, Courthouse, until noon, Oct. 29, for improving Passaic St. from Main St. to Maywood Borough line.

N. J., Newton—Bids will soon be received for paving Newton-Sparta and Ross's Corner-Sussex Rd. Estimated cost, $125,000. Harvey Snook, Engr.

N. J., Redbank—Bids will be received by Board of Chosen Freeholders of Monmouth County, Courthouse, Freehold, until 11 a.m., Oct. 27, for concrete road bed and sidewalks on Throckmorton's Fill.

Penn., Bridgeville—(Official)—Election will be held Nov. 2 to vote $15,000 bonds for paving. Noted Oct. 7.

Md., Denton—Bids will be received by County Commissioners until Nov. 1 for one mile of State Aid Highway upon or along Hillsboro-Denton Rd.

W. Va., Moundsville—Bids will be received until Oct. 23 by O. B. Bonar, City Clk., for paving Seventh St. from Lafayette to Western Ave. and Western Ave. from Seventh St. north.

N. C., Charlotte—Board of Aldermen appropriated $14,000 for paving streets.

N. C., Danbury—Election will be held Nov. 16 in Stokes County to vote $50,000 bonds for roads.

N. C., Durham—City contemplates voting $300,000 bonds for improving streets.

N. C., Greenville—County Commissioners will sell $100,000 road bonds Nov. 1.

Ga., Americus—Commissioners of Sumter County contemplate holding election to vote $100,000 bonds for road improvements.

Fla., Clearwater—Election will be held Nov. 16 in Pinellas County to vote $715,000 bonds for roads. Noted Sept. 9 and Oct. 7.

Fla., De Land—(Official)—Citizens voted to issue $250,000 bonds for roads and bridges. Noted Sept. 9.

Fla., Eustis—Citizens voted $40,000 bonds for roads. Noted Aug. 26.

Fla., Ft. Pierce—Commissioners of St. Lucie County will expend $58,675 for hard surfaced roads.

Fla., Jacksonville—Citizens voted $16,000 bonds for paving.

Fla., Monticello—Citizens of Jefferson County voted $100,000 bonds for Dixie highway.

Fla., Wauchula—City will construct 13 miles of sidewalks.

Ala., Mobile—Wilcox County plans expenditure of $15,000 for roads.

Miss., Canton—Board of Supervisors will issue $135,000 bonds for roads in Beat No. 1.

Miss., Columbus—(Official)—All bids received for 48 miles of highway improvement rejected. New bids will be received until 8 a.m., Nov. 8. G. Hauser, Jr., Engr. Noted Sept. 23.

Miss., Gulfport—Board of Supervisors of Harrison County will issue $200,000 bonds for road.

La., Monroe—Bids will be received until Nov. 5 by D. W. Faulk, City Secy., for improving various streets.

Tenn., Dover—Stewart County Commissioners will pave 140 miles of roads. Estimated cost, $200,000.

Tenn., Elizabethton—Bids will be received until 1 p.m., Oct. 29, by L. D. Gaspeiger, Secy. Rd. Comrs., for 70 miles of graded roads and repairing and completing roads already graded.

Tenn., Maynardville—Bids will be received until Nov. 8 by George N. Taylor, Union County Comr., for macadam roads and bridges.

Tenn., Sweetwater—Bids will be received until Nov. 15 by W. T. Lenoir, Mayor, for street improvements. Noted Sept. 9 and Oct. 7.

Ky., Bellevue—(Newport post office)—City contemplates bond issue for paving various streets.

Ky., Stanton—Powell County plans $25,000 bond issue for road.

Ohio, Canton—Plans will be prepared by W. E. Sarver, City Engr., for widening and repaving Tuscarawas St.

Ohio, Cheviot—(Cincinnati post office)—Bids will be received by Albert J. Deusing, Village Clk., until noon, Nov. 3, for improving North Bend Rd. from Woodbine Ave. to north line of Hirschberg & Kaplans Subdivision.

Ohio, Cleveland Heights—(Warrensville post office)—Bids will be received by H. H. Canfield, Clk., until noon, Oct. 15, for improving Coleridge, Corydon, Cottage Grove, Essex and Winton St. Estimated cost, $84,000.

Ohio, East Cleveland—Commissioners of Cuyahoga County plan to pave Euclid Ave.

Mich., Ann Arbor—City Council will prepare plans for paving Miller Ave. Manly Osgood, City Engr.

Mich., Belding—City plans paving Bridge St. with concrete.

Mich., Calumet—An appropriation of $4000 voted by the Eagle Harbor Township Board for highway work for coming year.

Mich., Dowagiac—Plans being considered for improving highway on Prairie Ronde St.

Mich., Hillsdale—Expenditure of $35,000 planned for paving Manning St.

Mich., Iron Mountain—County contemplates $75,000 annual road budget.

Ill., Hamilton—City Council will macadamize Ninth St. from Broadway to Keokuk St.

Wis., Elkhorn—City contemplates paving Walworth and Wisconsin St. A. C. Oleson, City Clk.

Wis., Green Bay—Bids will be received until 10 a.m., Oct. 25, by City Clerk for crushed stone on North Roosevelt St.

Wis., Superior—City Commissioners authorized $33,000 bond issue for street improvements.

Kan., Columbus—(Official)—Bids will be received until noon, Nov. 1, by Commissioners of Cherokee County, for grading and surfacing with gravel seven miles of county road between Columbus and Crestline.

Neb., Hastings—Bids will be received about Dec. 1 for paving 50 blocks with vertical fiber brick or asphaltic concrete. W. H. Fuller, City Engr.

Mo., Butler—Citizens plan to issue bonds to macadamize Butler-Nevada Rd.

Mo., Hillsboro—Election will be held Nov. 6 in Jefferson County to vote $500,000 bonds for roads and bridges. Noted Oct. 7.

Mo., Lexington—Lafayette County Commissioners will issue $55,000 bonds for roads in Wellington-Napoleon Rd. District.

Mo., Marshall—Citizens contemplate bond issue of between $800,000 and $1,000,000 for road construction. James C. Wonders, Washington, D. C., Highway Engr.

Mo., Sedalia—Bids will be received by F. T. Leaming, City Engr., until Nov. 1 for 9,200 sq.yd. of vertical fiber brick paving.

Mo., Springfield—All bids received for nine miles of road in Ingram Special Road District rejected. New bids will be received. Estimated cost, $20,000.

Mo., Wellington—Citizens voted $55,000 bonds for macadamizing 10 miles of road and for two bridges. Noted Sept. 30.

Tex., Batesville—Election will be held Nov. 2 in Zavalla County, Road Precinct No. 3 to vote $40,000 for roads. Noted Oct. 7.

Tex., Beaumont—Bonds for $85,000 sold for street improvements. Noted Sept. 9.

Tex., Fredericksburg—Citizens of Gillespie County Nov. 7 vote on $300,000 for roads.

Idaho, Orfino—City will expend $11,000 for paving and sidewalks. Robert Swadener, Engr.

Wash., Colville—Bids will be received by A. B. Sansborn, Audr., Comrs. of Stevens County, until Nov. 1, for improving about three miles of Springdale-Hunters Permanent Highway No. 2-A.

Wash., Pomeroy—Bids will be received until 10 a.m., Nov 1, by Commissioners of Garfield County, for improving a portion of Permanent Highway No. 1.

Wash., Stevenson—(Official)—Bids will be received until 1:30 p.m., Oct. 23, by Charles H. Nello, County Audr., for constructing nine miles of Stevenson-Carson Rd. Noted Sept. 23.

Ore., Florence—Citizens voted $5,000 bonds for plank road from Florence to North Fork bridge.

Calif., Alameda—City Council appropriated $50,000 for streets improvements.

Calif., Hayward—City Council plans to macadamize several streets.

Calif., Oroville—Bids will soon be received for paving Montgomery St. from Lincoln St. to Fourth Ave. Estimated cost, $15,843. S. J. Norris, City Engr.

Calif., Richmond—City Council has authorized streets under tracks of Santa Fé R.R. at 16th St. Estimated cost, $7,000. H. D. Chapman, City Engr.

Calif., Sacramento—Plans prepared by Frank C. Miller, City Engr., approved by City Commissioners for paving Cypress Ave. from 37th St. to Upper Stockton Rd.

Calif., San Jose—Bids will be received until 11 a.m., Oct. 25, by Board of Supervisors of Santa Clara County, for improving Lincoln Ave. in Supervisorial District No. 4.

Ont., London—City plans to pave Wellington and Clarence St. with asphalt. H. A. Brazier, Engr.

Ont., Mimico—Movement being agitated to widen Lake Shore Rd. 85 ft. throughout length of municipality.

Man., Winnipeg—City will construct granolithic walks on Woodrow Pl., Manitoba, Sargent and Langside Ave. W. P. Brereton, City Engr.

B. C., Victoria—City Council plans concrete sidewalks on both sides of Prior St. between Hillside and Summit Ave. C. H. Rust, City Engr.

B. C., Victoria—City Council authorized sidewalks on Clawthorpe Ave. and Shakespeare St.

N. S., Halifax—F. W. W. Doane, City Engr., submitted report to Board of Control estimating cost of extending Morris St. at $5,500.

Bids In and Contracts Awarded

Conn., Darien—Contract for constructing Rings End Rd. and Norton Ave. awarded to WILKES-CASEY ENGINEERING & CONTRACTING CO., New Rochelle, N. Y., at $26,130.

N. Y., Albany—(Official)—Bids were received Oct. 15 at office of Superintendent of Public Works for highway north of West Shore R.R. at Port Gibson, Town of Palmyra, Wayne County, as follows: WILLIAM R. KINNEY, 25 South Pearl St., Albany, $3,568 (awarded contract); Fischett Bros., Clyde, $3,955; S. M. Ludingtons' Sons, Inc., Rochester, $3,991.

N. Y., New York—(Borough of Bronx)—(Official)—Lowest bids received for improving (a) Powell Ave. from Tremont Ave. to Zerega Ave., (b) Walker Ave. and former Main St. to easterly terminus of land acquired for West Farms Rd. to Eastern Blvd., (c) Rosedale Ave. from Walker to Tremont Ave., (d) Kingsbridge Terrace from Kingsbridge Rd. to filled grade south of West 299th St. were as follows: (a) Burnside Contracting Co., $12,105; (b) Anabel Construction Co., $76,333; (c) and (d) Municipal Asphalt Co., at $5,124 and $4,323 respectively.

N. Y., New York—(Borough of Manhattan)—(Official)—Lowest bids received for regulating and repaving (a) 51st St. from West Side First Ave. to East Side Third Ave., (b) 52d St. from Fifth to Sixth Ave., (c) 151st St. from Amsterdam Ave. to Broadway, (d) Lexington Ave. from 21st to 23d St., (e) Columbus Ave., (f) 25th St. from Broadway to Sixth Ave., 32d St. from Fifth Ave. to Broadway and from Sixth to Seventh Ave. and Sixth Ave. from 23d to 32d St., were as follows: (b) and (d) Aztec Asphalt Co., Inc., 90 West St., New York, N. Y., at $7,702 and $8,003 respectively; (a), (c), (e) and (f), Barber Asphalt Paving Co., Woolworth Bldg., New York, at $10,727, $6,508, $11,450 and $60,501 respectively.

N. Y., New York—(Borough of Manhattan)—(Official)—W J. Fitzgerald, 547 West 45th St., New York, N. Y., at $5,412. submitted lowest bid for regulating and repaving 18th St. from Broadway to Fourth Ave.

N. Y., Rochester—(Official)—Contract for paving Elmwood Ave. awarded to JULIUS FRIEDRICH CO., INC., Rochester, at $8,680. Noted Oct. 7.

N. J., Freehold—Contract for Tennent Gordon's Corner Rd. awarded to W. H. FLITCROFT, at $6,016. Noted Sept. 30.

N. J., Hoboken—(Official)—Contract for improving portions of First, Third and Harrison St. awarded to LESTER FELLOWS CO., Jersey City, at $4,953. Noted Sept. 30.

N. J., Irvington—(Official)—Contract for paving Lyon Ave. awarded to NORTHERN CONSTRUCTION CO., 665 Broad St., Newark, at $62,070. Noted Sept. 23.

N. J., Jersey City—Nolan & Horning Construction Co., West Hoboken, submitted lowest bid for improving Passaic Ave. and Paterson Plank Rd. Noted July 29 and Sept. 23.

N. J., Madison—Contract for paving Waverly Pl. with asphalt block awarded to GLENFIELD CONSTRUCTION CO., Newark, at $2.14 per sq.yd. for paving and 38c. per sq.yd. for excavation.

N. J., Montclair—(Official)—All bids rejected for paving Upper Mountain Ave. from Bloomfield Ave. to Jerome Pl. Noted Oct. 7.

N. J., New Brunswick—Contract for paving South-Amboy Keyport Rd. awarded to T. H. RIDDLE, New Brunswick, at $45,349. Noted Sept. 9 and 30.

Penn., Mt. Union—Contract for 13,000 sq.yd. vitrified brick pavement awarded to CURWENSVILLE CONSTRUCTION CO., Curwensville.

N. C., Kinston—Contract awarded to WEST CONSTRUCTION CO., Chattanooga, to pave 50½ blocks with Bermudez Lake sheet asphalt on concrete base. Estimated cost, $140,000 to $160,000.

Fla., Arcadia—Contract for road construction awarded to EDWARDS CONSTRUCTION CO., Tampa, at $85,000.

Ala., Camden—Contract awarded to RAWLINGSON CONSTRUCTION CO., Luverne, at $7,635 for five miles of road in eastern section of Wilcox County.

Miss., Jackson—Contract awarded to C. T. TALBOTT to cover and bind two miles of Rankin Pike.

Tenn., Delphi—Contract awarded to CHICKAMAUGA QUARRY & CONSTRUCTION CO., Chattanooga, at $50,000 for Dixie short route through Sequatchie.

Tenn., Memphis—Contract for paving Claybrook St. awarded to GEORGE O. WHITE & CO., at $9,011.

Ky., Bardwell—Carlisle County Commissioners awarded contract to CRESAP BROS., Humboldt, Tenn., at $9,000 for six miles of earth road. Noted Sept. 16.

Ohio, Athens—Mariner, Finsterwald & Gross submitted the only bid for paving Grosvenor St.

Ohio, Canton—Contract awarded to SMITH & KRABILL, by Board of Commissioners of Stark County for paving Gairo-Hartville Rd. in Plain and Lake Townships.

Ohio, Cincinnati—Contract for improving Red Bank Rd. awarded to ARMSTRONG & GIFFORD, at $6,700. Noted Oct. 7.

Ohio, Cleveland—Contract for paving Sykro Rd. and East 32d St. awarded to A. M. PEJSA PAVING CO., at $10,790; East 123d St. to FRESHWATER CONSTRUCTION CO., at $3,924.

Ohio, Cleveland Heights (Warrensville post office)—Contract awarded to CLEVELAND TRINIDAD PAVING CO., Cleveland, for paving Derbyshire and Cedar Rd.

Ohio, Columbus—Monarch Construction Co., 1438 Bryden Rd., at $11,386, low bidder for improving Ryan Ave. from Trapple Pike to Sullivan Ave.

Ohio, Columbus—Contract awarded to KENNEDY-WARNER CO., at $8,409, for improving Cleveland, Wooster Rd. in Parma Township. Noted Sept. 30.

Ohio, New Lexington—Contract awarded to ENGINEERING SERVICE CO., Columbus, at $53,227, by Board of County Commissioners for grading and paving Athens Rd. in Monroe Township.

Ind., Covington—Contract awarded to CHARLES IRVIN, Attica, Ind., at $6,100 for gravel road in Troy Township.

Ind., Franklin—Contract for Adcock Rd. awarded to JOHN W. MURPHY, at $11,000. Noted Sept. 16.

Ind., Gary—Contract awarded to GARY CONSTRUCTION CO., at $4,731 for paving Broadway with asphalt macadam.

Ind., Huntington—(Official)—Contract for sidewalks on Ogan St. awarded to E. BONEBRAKE, Huntington. Noted Sept. 30.

Ind., Indianapolis—Contract for repaving North Capitol Ave. awarded to UNION ASPHALT CONSTRUCTION CO., at $16,005. Noted Sept. 2.

Ind., Noblesville—(Official)—Contract for concrete road in Noblesville Township awarded to A. L. TRIBBLE, Brazil, at $46,866. Noted Sept. 30.

Ind., Shoals—(Official)—Contract for macadam road in Perry Township awarded to GEORGE GREEN, Shoals, at $6,743. Noted Sept. 23.

Ind., Terre Haute—Contract awarded to EDWARD PATTEN, Veedersburg, at $5,225, for paving north side of public square.

Ind., Vincennes—Lowest bids received for paving Second St. from Main to Church St. were Foulkes Construction Co., at $4,471, with brick, Premier Construction Co., at $4,335, with Trinidad Lake asphalt.

Mich., Midland—Contract awarded to S. W. BURTON, for road work.

Ill., St. Charles—Contract awarded to WESTERN IMPROVEMENT CO., Racine, Wis., at $55,891 for paving East and West Main St. and other connecting streets. Noted Sept. 16 and Oct. 14.

Wis., Racine—Birdsall-Griffith Construction Co., $1.95 for brick low bidder for paving 4,491 sq.yd. on Hamilton Ave. Noted Sept. 30.

Iowa, Ft. Dodge—Contract for constructing a number of sidewalks awarded to JOHNSON CEMENT SIDEWALK CO., at $4,000. Noted Oct. 7.

Iowa, Ottumwa—Contract for paving awarded to KEOKUK QUARRY & CONSTRUCTION CO., Keokuk. Estimated cost, $30,000.

Minn., Buffalo—No bids were received for grading Lake Shore Rd. The work will be done by day labor. Noted Sept. 23.

Minn., Duluth—Contract for paving 30th Ave. W., from Superior to Vernon St. awarded to AUGUST A. BODIN & SON, at $9,721.

Mont., Hardin—All bids received Oct. 4 for road between Big Horn River Bridge and Dry Creek rejected. Noted Sept. 30.

Mo., Chillicothe—Contract for paving 31st St. from 9 to Elmdale Rd. awarded to C. A. STEWART, Chillicothe, at $1.56 per sq.yd.

Mo., Kansas City—Contract for 5,574 sq.yd. of 6-in. portland cement concrete paving on South Euclid Ave. awarded to JAMES O'CONNOR & SONS, 8000 East 11th St., at $4,272.

Ark., Lake Village—Contract for paving streets awarded to McCREARY CONSTRUCTION CO. Estimated cost, $16,000.

Colo., Lamar—(Official)—Contract for grading and improving Santa Fé Rd. awarded to FILOON & FORD and HENRY MARSOR, at $4,200. Noted Sept. 30.

Ariz., Phœnix—Contract for paving Madison St. with bitulithic awarded to CALIFORNIA-ARIZONA CO., at $2.10 sq.yd.

Wash., Prosser—Contract for Permanent Highway No. 5 awarded to A. H. ZANE & CO., North Yakima, at $19,230. J. T. Wright, County Engr.

Wash., Seattle—Contract for improving east and west Green Lake Way awarded to R. G. STEVENSON, 1327 Ewing St., Seattle, at $103,303. Noted Oct. 14.

Calif., Arcadia—Bids were received for approximately 16 miles of oiled macadam roadway and 10,000 ft. of concrete curb and gutter as follows: E. A. Baker, $122,998; Rogers Bros. Co., $130,787; Andrew Holloway, $131,628. Noted Sept. 30.

Calif., Bakersfield—Worswick Street Paving Co., Modesto, at $31,460, submitted lowest bid for concrete pavement on Division 1p, Section 5, Weed Catch Loop. Noted Sept. 30.

Calif., East San Diego—M. D. GOODBODY CONSTRUCTION CO., San Diego, at $39,600, awarded contract for grading and improving Hugo Ave.

Calif., Hermosa Beach—Contract for improving a number of streets awarded to CALIFORNIA-ARIZONA CONSTRUCTION CO., at $18,578.

Calif., Oakland—Contract for paving 25th Ave. from East 14th St. south awarded to HUTCHINSON CO.

Calif., Ontario—(Official)—Contract for paving awarded to FORD & STOUT, 336 Bradbury Bldg., Los Angeles, at $57,088. Noted Sept. 23 and Oct. 14.

Calif., Richmond—Contract awarded to GEORGE W. CUSHING, at $4,833 for paving 21st St. and Anita Ave.

Calif., San Bruno—Contract for constructing sidewalks awarded to CHARLES J. LINDGREN, San Francisco, at $29,-959.

Calif., Sanger—Contract for three miles of macadam road awarded to M. HAYNES, Oakland, at $23,801.

Calif., San Francisco—Contract awarded to FLYNN & TREACY, at $17,557 for improving Rhode Island St. from 22nd to 23rd St.

Calif., San Rafael—Contract for graveling Olema Rd. from Lagunitas to Tocaloma awarded to S. P. BROWNLEE, at $4,606.

Ont., Essex—Contract for constructing concrete sidewalks awarded to JOHN WORTLEY.

Ont., Windsor—Contract for concrete pavement and curbs on Cataraqui St. awarded to CALDWELL SAND & GRAVEL CO., at about $4,500.

INDUSTRIAL WORKS

Proposed Work

Mass., Lowell—Tremont & Suffolk Mills will build 43x140-ft. addition. Estimated cost, $35,000.

Conn., Bristol—Plans completed for rolling mill, 188x300-ft. and wing, 60x300-ft. for Bristol Brass Co. Noted Sept. 9.

Conn., Hartford—Gordon Bros. having plans prepared for three-story and basement, 50x140-ft. brick cold-storage building. F. C. Waly, Arch.

Conn., New Haven—National Folding Box & Paper Co. has plans for 105x345-ft. factory addition. Estimated cost, $100,-000.

Conn., Norwich—Shebucket Co. will build two-story brick weave shed, 84x356 ft. Estimated cost, $75,000.

N. Y., Fulton—(Official)—Hunter Arms Co., Inc., advises it does not contemplate additions to its plant. Noted Aug. 19.

N. Y., New York—(Borough of Brooklyn)—Bids being received for four-story, 26x41-ft. brick and steel mill for Chelsea Fiber Mills Co., 1155 Manhattan Ave. William B. Tubby, 81 Fulton St., New York, Arch. Noted Sept. 30.

N. Y., New York—(Borough of Brooklyn)—(Official)—Bids being received for two-story, 98x109-ft. brick shop and garage on Quincy St. for Edison Electric Illuminating Co., 13 Willoughby St. C. L. Knight, Engr. Estimated cost, $40,000.

N. Y., New York—(Borough of Brooklyn)—(Official)—Koch & Wahner, 26 Court St., Brooklyn, preparing plans for two- or four-story, 65x130-ft. brick loft and manufacturing building at Flatbush Ave. extension near Concord St. for F. A. Koch Bldg. Co., Inc. Noted Oct. 14.

N. Y., New York—(Borough of Manhattan)—(Official)—Gronenberg & Lenchtag, 303 Fifth Ave., preparing plans for storage warehouse on 181st St. near Audubon Ave. for Ruth Holding Co. Building will be six-stories, 75x119-ft. Estimated cost, $90,000.

N. Y., Richfield Springs—Simmons Bros. will build one-story, 75x150-ft., garage. Henry Kehoe, Arch.

N. Y., Rochester—Rochester Rotary Washer Co. 55 Franklin St., having plans prepared for five-story factory and office building to be erected in spring.

N. Y., Saratoga Springs—C. G. Anthony, Consult. Engr., preparing plans for State Reservation Commission, Albany, for bottling works. Estimated cost, $162,000.

N. Y., Tonawanda—Bids being received by G. Morton Wolfe, Buffalo, for one-story, 60x273-ft. factory at Fillmore Ave. and New York Central and Erie R.R. for Plastergon Wall Board Co.

N. Y., Waterport—Growers' Cold Storage Co. will build by day labor three-story and basement, 98x126-ft. cold-storage plant. John G. Ellendt, Cutler Bldg., Rochester, Arch.

N. J., Bloomfield—Eastern Tool & Mfg. Co., 74 Richmond St., Newark, will build factory at Bloomfield Ave. and Grove St.

N. J., Kearney—American Splint Corporation, New York, N. Y., will build four-story factory. Estimated cost, $100,000.

Md., Baltimore—John Freund, Baltimore, preparing plans for three-story, 74x100-ft. garage on High St. for City Baking Co.

La., Homer—Hodge Fence & Lumber Co. will rebuild its mill, recently destroyed by fire. Estimated cost, $60,000.

Ohio, Ashtabula—W. C. Owen, Leader-News Bldg., Cleveland, prepared plans for factory for Cleveland Ford Tire Co.

Ohio, Cleveland—Perfection Spring Co. will build warehouse at 2339 East 67th St. George S. Rider & Co., 512 Century Bldg., Arch. Estimated cost, $50,000.

Ohio, Cleveland—Cleveland Punch and Shear Co. will build one-story addition at 3927 St. Clair Ave. Estimated cost, $10,000.

Ohio, Cleveland—O. C. Barber, Barberton, contemplates grain elevator at Cleveland.

Ohio, Cleveland — Ernest McGeorge, Leader-News Bldg., preparing plans for five-story, 50x250-ft. addition to plant of Peerless Motor Car Co., East 93 and Quincy St.

Ohio, Cleveland—U. S. Gypsum Co., Schofield Bldg., will build two-story, 50x80-ft. warehouse at 1714 Merwin Ave.

Ohio, Oakley—(Cincinnati post office)—Cincinnati Milling Machine Co. will build addition to its plant. Estimated cost, $15,000.

Ohio, Youngstown—Trumbull Steel Co. will spend $1,290,000, according to press reports, for enlarging its tinplate and sheet plant.

Ohio, Youngstown—Youngstown Sheet & Tube Co. plans three additional openhearth furnaces. James A. Campbell, Pres. Estimated cost, $500,000.

Ind., Gary—Work will soon begin on construction of addition to plant of American Sheet & Tin Plate Co.

Ind., Kokomo—Elmer Dunlap Co. preparing plans for factory for Mid-West Boxboard Co., Estimated cost, $50,000.

Mich., Howell—Howell General Electric Motors Co., recently incorporated with $30,000 capital, will build factory. H. M. Spencer, Pres.

Mich., Jackson—Brisco Motor Co. having plans prepared for factory. Estimated cost, $100,000.

Mich., Owosso—American Malleable Co. will build addition. Estimated cost, $60,000.

Ill., Chicago—Peterson Express & Van Co. will build six-story warehouse at 1011 East 55th St. T. J. Reynertson, Arch. Estimated cost, $55,000.

Ill., Chicago—Stewart-Warner Speedometer Corporation plans addition at estimated cost of $30,000.

Ill., Chicago—Diamond Glue Co., 3602 Robinson St., will build addition. Estimated cost, $30,000. Marx & Vigeant, Arch.

Ill., Chicago—Jourdans Sausage Mfg. Co. 814 West 20th St., will build two-story brick factory. Estimated cost, $20,000. J. J. Corner, Arch.

Ill., Chicago—Western Shade Cloth Co. will build one-story factory addition at 2000 South Jefferson St. Estimated cost, $75,000. Postle & Fisher, 140 South Dearborn St., Arch.

Kan., Neodesha—Standard Oil Co. of Kansas will build additional stills. Estimated cost, $200,000.

Mo., Kansas City—Berry-Wood Piano Player Co. will build factory at 17th St. and Troost Ave.

Tex., San Antonio—Dixie Oil & Refining Co. will enlarge its plant. Estimated cost, $40,000.

Okla., Jennings—Bids will be received until Nov. 1 by Brennan & Rooney, Arch., Tulsa, for oil refinery for Mid-Continent Refining Co. Noted Sept. 23.

Wash., Seattle—Metz Motor Co., Waltham, Mass., having plans prepared for five-story, 64x112-ft. concrete factory on East Pike St., Seattle. J. P. Scearce, Local Mgr.

Ore., Oregon City—Willamette Valley Flax Co. will build flax mill. John W. Loder, interested. Estimated cost, $300,000.

Ont., Hamilton—W. T. Rawleigh Co., Freeport, Ill., has purchased two-acre site and will build factory.

Ont., Toronto—Chevrolet Motor Car Co. will build addition to its factory at Perth and Kingsley Ave. Estimated cost, $15,000.

Ont., Toronto—R. G. Long & Co., 439 Wellington St., will build factory at 727 King St. Estimated cost, $80,000.

Bids In and Contracts Awarded

N. H., Manchester—Contract awarded to BUNTON & BERNARD, Manchester, at $20,000, for two-story, 78x100-ft. warehouse for Charles Simpson.

Mass, Chicopee—Paige-Storms Co., owned by New England Westinghouse Co., awarded contract to D. G. CANTY, Chicopee, at $25,000, for two additions to its drop-forge plant.

Mass., Fitchburg—Contract awarded to FISHER-CARTER CONSTRUCTION CO., Holyoke, at about $35,000, for three-55x76-ft. factory for Brown Bag Filling Machine Co.

Mass., Forest Hills—(Boston post office)—Contract awarded to JOSEPH IMHOF, 6 Ashley St., Jamaica Plain, at about $16,000, for one-story, 100x100-ft. garage for J. J. Lannin, Tremont Bldg., Boston.

Mass., Holyoke—Contract awarded to CASPER RANGER CONSTRUCTION CO., Holyoke, at about $35,000, for three-story, 100x130-ft. workshop and storage warehouse for F. A. Champlin and D. F. Moriarty.

Mass., Lynn—Contract awarded to C. S. CUNNINGHAM & SONS CO., 101 Tremont St., Boston, at about $10,000, for factory for Hennessey Maxwell & Hennessey Shoe Co.

Mass., Newton—Contract awarded to CHARLES E. CURRIER CO., 110 Summer St., at $50,000, for ice plant for Purity Ice Co.

Mass., Worcester—Contract awarded to E. J. CROSS CO., 82 Foster St., Worcester, by W. & S. Mfg. Co., for two-story, 40x48-ft. brick factory.

Conn., Bridgeport—Contract awarded to T. J. PARDY CONSTRUCTION CO., Bridgeport, at $175,000, by American Graphophone Co. for five-story addition.

Conn., Groton—Contract awarded to H. R. DOUGLAS, INC., New London, for factory for New London Ship and Engine Co.

N. Y., Buffalo—Contract awarded to JOHN W. COWPER CO., Fidelity Bldg., for linseed-oil-crushing mill and storehouse for Archer-Daniels Co. on Buffalo River.

N. Y., Jamestown — Contract awarded to KELLOGG STRUCTURAL STEEL CO., Buffalo, by Jamestown & Chautauqua Traction Co. for car house.

N. Y., New York—(Borough of Brooklyn)—(Official)—Contract awarded to TURNER CONSTRUCTION CO., 11 Broadway New York, for two-story, 40x75-ft. factory at East 83d St. and Ditmars Ave., for W. Becker Aniline & Chemical Co.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to STANDARD CONCRETE STEEL CO., 143 East 31st St., for four-story, 43x100-ft. garage at 146 West 100th St., for Eugene Goll, Patchogue, N. Y.

N. J., Camden—Contract awarded to ARMSTRONG-LATTA CO., by Taylor-White Extracting Co. for three-story addition. Noted Sept. 30.

N. J., Harrison—(Official)—Contract awarded to TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., by Hyatt Roller Bearing Co., for 8-story, 75x200-ft. building at Middlesex and Fifth St.

N. J., Newark—Contract awarded to DAVID HENRY BUILDING CO., at about $15,000, for one-story brick building at 264 Vanderpool St. for Beckton Chemical Co.

N. J., Passaic—(Official)—Contract awarded to JOHN W. FERGUSON CO., New York, N. Y., for five-story, 54x280-ft., building for Forstmann & Huffmann Co., Passaic.

Penn., Philadelphia—Contract awarded to GEORGE STEMBACH, 1609 North Park Ave., at $35,000, for one-story garage on Locust St. near 41st St., for Charles F. Sine.

Penn., Philadelphia—Contract awarded to HENRY E. BATON, Philadelphia, at $50,000, for six-story warehouse for W. J. McCahan Sugar Refining Co.

Penn., Philadelphia—Contract awarded to FRANK G. STEWART, 1619 Sanson St., at $45,000, by Felton Sibley Co., Inc., Fourth and Cherry St. for six-story factory. Noted Sept. 2.

Md., Baltimore—Contract awarded to P. J. CUSHEN, Baltimore, by Maryland Steel Co. for 180x428-ft. machine shop.

Ky., Louisville—Contract awarded to L. W. HANCOCK CO., Louisville, for six-story warehouse for Speed Realty Co. Estimated cost, $60,000. Noted Sept. 30.

Ohio, Cleveland—Contract awarded to UHL-JASTERS CO., 1900 Euclid Ave., Cleveland, for two-story, 54x100-ft. and one-story, 50x60-ft. foundry and one-story warehouse at West 38th St. and Nickel Plate R.R. for Cleveland Electro Metal Co. Noted Oct. 14.

Ohio, Cleveland—Contract awarded to COPPERS CO., Pittsburgh, Penn., at about $150,000 for coke oven plant at Clark Ave. and Wheeling & Lake Erie R.R. for River Furnace Co., Perry Payne Bldg.

Ohio, Newburg—(Cleveland post office)—Contract awarded to H. G. STATMYER & SON CONSTRUCTION CO. by American Steel & Wire Co. for addition to its plant. Estimated cost, $750,000. William P. Palmer, Pres.

Ohio, Toledo—Contract awarded to A. BENTLEY & SONS CO. by Willys Overland Co. for factory on Central Ave. Estimated cost, $300,000.

Mich., Grand Rapids—Contract awarded to F. A. HORNER by Clark Veneer Co. for two-story, 113x165-ft. warehouse on Grandville Ave., S. W. Noted Aug. 12.

Wis., Milwaukee—Contract awarded to PAUL RIESEN'S SONS, by A. C. Clas, Arch., Colby-Abbot Bldg., for machine shop and foundry for Milwaukee Die Casting Co.

Wis., Wausau — Contract awarded to HACKBARTH & KRAUSE, by Marathon Shoe Co., at about $12,000, for shoe factory. Noted Sept. 30.

Minn., Minneapolis—Contract awarded to FARNAM BROS. CO., Minneapolis, by Board of Education for three additions to its shops and warehouse at 245 Ninth Ave. Estimated cost, $17,000.

Kan., Stafford—Southwest Grain Co. awarded contract to AUGUST MATTSON, for seven grain elevators.

Mo., Kansas City—Contract awarded to GRAY CONSTRUCTION CO., O'Rear-Leslie Bldg., by Marshall Oil Co. for one-story, 100x113-ft. warehouse at 14th and Campbell St., North Kansas City.

Mo., Kansas City—Contract awarded to LONSDALE BROS., 520 Bryant Bldg., at $11,000, for remodelling warehouse at 16th and Walnut St. for Every Bird Thayer Dry Goods Co., 11th and Walnut St.

Wash., Olympia—Oregon-Washington R.R. & Navigation Co., Portland, Ore., awarded contract to E. J. ROUNDS CONSTRUCTION CO., Walker Bldg., Seattle, for one-story brick depot and one-story, 30x115-ft. brick freight shed. Estimated cost, $25,000.

Ore., Portland—Contract awarded to JAMES P. FORD, at $30,000 for two-story brick and concrete factory for Oregon Motor Co.

FEDERAL GOVERNMENT WORK

Proposed Work

Paving—New Haven, Conn.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Oct. 28, for sidewalks, curbing, etc., at United States post office and courthouse, New Haven.

Roadwork—Ft. Slocum, N. Y.—Bids will be received at office of Quartermaster, U. S. Army, Recruit Depot, Ft. Slocum, until 9:30 a.m., Oct. 28, for concrete sidewalks, curbs and macadam road at Ft. Slocum.

Engine House—Washington, D. C.—Bids will be received by Secretary of Board of Commissioners, Room 509, District Bldg., until 2 p.m., Nov. 8, for Engine House No. 28. (See adv.)

Oil Storage Tanks—Washington, D. C.—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, until 10:30 a.m., Nov. 16, for steel oil storage tanks. (See adv.)

Radial Gates—Washington, D. C.—Bids will be received by A. P. Davis, Ch. Engr., United States Reclamation Service, Washington, D. C., until 2 p.m., Nov. 1, for ten hoists for radial gates, New Jackson Lake Dam, Snake River Storage Project, Idaho-Wyoming.

Dredging—Jacksonville, Fla.—Bids will be received at U. S. Engineer Office, Jacksonville, until noon, Nov. 8, for dredging and rock removal at Miami Harbor and St. Lucie Inlet. (See adv.)

Officers' Quarters—Key West, Fla.—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Nov. 13, for two officers' quarters, naval station, Key West.

Post Office—Brenham, Tex.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 27, for United States post office at Brenham.

Heating System—Ft. Bliss, Tex.—Bids will be received at office Depot Quartermaster, El Paso, until 11 a.m., Nov. 17, for hot water heating systems in 13 officers' quarters at Ft. Bliss. (See adv.)

Post Office—Navasota, Tex.—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 26, for United States post office at Navasota.

Canal Work—Grand Junction, Colo.—Bids will be received at office of United States Reclamation Service, Grand Junction, until 2 p.m., Nov. 4, for about 340,000 yd. of canal excavation.

Marine Railway—Pearl Harbor, Hawaii—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Nov. 27, for marine railway at naval station, Pearl Harbor.

Miscellaneous Supplies—Panama—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Nov. 5, for furnishing miscellaneous supplies.

Bids In and Contracts Awarded

Building—Boston, Mass.—Bids were received by J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for U. S. appraisers' stores, Boston, (a) foundation sea wall, etc., (b) construction of superstructure, (c) construction complete, as follows: Norcross Bros. Co., Worcester, Mass., (a) $155,000, (b) $490,700, (c) $635,000; George A. Fuller Co., Boston, (a) $149,980, (b) $513,897, (c) $660,000; Z. W. Dall Co., Cleveland, Ohio, (a) $184,000, (b) $474,868, (c) $649,868. Noted Sept. 2.

Elevator Plant—Boston, Mass.—Bids were received Oct. 8 for elevator plant in U. S. appraisers' stores, Boston, from: Otis Elevator Co., Washington, D. C., at $29,439 and A. B. See Electric Elevator Co., Baltimore, Md., at $37,225. Noted Sept. 23.

Post Office—Naugatuck, Conn.—Bids were received Oct. 13 by J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for post office at Naugatuck as follows: E. T Abbott Construction Co., New York, N. Y., $47,900; William H Fissell & Co., New York, N. Y., $50,400; J. S. Rogers, Moorestown, N. J., $50,482.

Riprap—Philadelphia, Penn.—Bids were received Oct. 14 for riprap in Delaware River at Mifflin Bar Dike as follows: Coast & Lakes Contracting Corporation, New York, N. Y., at $1.36 per ton (recommended for acceptance); Peoples Bros. Inc., Philadelphia, at $1.74 per ton; C. R. Simpson, New York, N. Y., at $2.21 per ton. Noted Sept. 23.

Pumping Unit—Washington, D. C.—Bids were received Oct. 11 by Commissioners of District of Columbia for one steam turbine-driven centrifugal pumping unit as follows: De Laval Steam Turbine Co., Trenton, N. J., $12,995, time 115 days, and $15,633, 105 days; Alberger Pump & Condenser Co., New York, N. Y., $17,030; Standard Engineering Co., Washington, D. C., $18,690. Noted Sept. 23.

Sewers—Washington, D. C.—Bids were received Oct. 12 by Commissioners of District of Columbia for Anacostia Intercepting Sewer, (a) ordinary excavation, (b) concrete masonry, (c) vitrified brick masonry, (d) sewer brick masonry, as follows: Whiting-Turner Construction Co., Baltimore, Md., (a) 56c., (b) $8.18, (c) $22, (d) $15; W. F. Brenizer Co., Washington, D. C., (a) $1.25, (b) $7.35, (c) $23, (d) $16; George Hyman, Washington, D. C., (a) $2.50, (b) $6.25, (c) $19, (d) $15.

Dredging—Norfolk, Va.—Contract for dredging and rock excavation on James River awarded to MARYLAND BREDGING & CONTRACTING CO., Baltimore, Md., at $34,590. Noted Sept. 16 and Oct. 7.

Fuel Oil Storage Plants—Norfolk, Va.—Bids were received Oct. 16 for fuel oil storage plants at navy yard, Norfolk, as follows: C. C. Moore & Co., San Francisco, $199,800; Wayne Construction Co., Wayne, Penn., $208,246; Day & Zimmerman, Philadelphia, Penn., $199,696. Noted Aug. 19.

Post Office—Wilkesboro, N. C.—Bids were received by J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for post office at Wilkesboro as follows: King Lumber Co., Charlottesville, Va., $54,700; J. S. Rogers, Moorestown, N. J., $56,945; Richardson Construction Co., Bainbridge, Ga., $52,600. Noted Sept. 16.

Hangars—Pensacola, Fla.—Bids were received at Bureau of Yards and Docks, Navy Dept., Washington, D. C., for three hangers at U. S. Navy Aëronautic Station, Pensacola, as follows: Penn Bridge Co., Washington, D. C., $34,965; Henry Monk, Pensacola, $41,400; Snare & Triest, New York, N. Y., $41,760. Noted Sept. 30.

Machinery—Cincinnati, Ohio—Contract for furnishing and installing operating machinery at Dam No. 29, Ohio River awarded to J. & J. B. MULHOLLAND CO., Pittsburgh, Penn., at $25,788. Noted Aug. 26 and Oct. 14.

Post Office—Logan, Ohio—Bids were received by J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C. for post office at Logan, (a) limestone, (b) sandstone, as follows: Ohio Bridge & Construction Co., Cincinnati, (a) $45,000, (b) $45,000; J. S. Rogers, Moorestown, N. J., (a) $43,150, (b) $44,150; Charles W. Gindele & Co., Chicago, Ill., (a) $44,500, (b) $45,500. Noted Sept. 9.

Remodeling Post Office—Moberly, Mo.—Bids were received Oct. 15 for remodeling post office at Moberly as follows: Algernon Blair, Montgomery, Ala., $32,790; Frank M. Weakley, Portsmouth, Va., $33,443; Dieter & Wenzel Construction Co., Wichita, Kan., $33,406. Noted Sept. 23.

Heating Plants—Ft. Sill, Okla.—Bids were received for steam heating plants at Ft. Sill (a) 19 plants, (b) 13 plants, (c) 6 plants, as follows: Charles T. Taylor, Hampton, Va., (a) $18,821, (b) $13,204, (c) $5,617; Fred B. Hannan, Lawton, (a) $15,675, (b) $11,475, (c) $700; H. H. Lloyd, Lawton, (a) $17,397, (b) $13,095, (c) $6,377.

Fuel Oil Storage Plants—Bremerton, Wash.—Bids were received at Bureau of Yards and Docks, Navy Dept., Washington, D. C., Oct. 16 for fuel oil storage plants at Bremerton as follows: C. C. Moore & Co., San Francisco, Calif., $319,500; Wayne Construction Co., Wayne, Penn., $413,624; John W. Danforth & Co., Buffalo, N. Y., $312,300. Noted Aug. 19.

Barracks—Mare Island, Calif.—Contract for marine barracks at Mare Island Navy Yard awarded to PRINGLE, DUNN & CO., 338 Pine St., San Francisco, at $137,542. Noted Aug. 26 and Sept. 30.

Fuel Oil Storage Plants—Mare Island, Calif.—Bids were received Oct. 16 for fuel oil storage plants at navy yard, Mare Island, as follows: F. P. Walsh, San Francisco, $258,225; C. C. Moore & Co., San Francisco, $295,200; John W. Danforth & Co., Buffalo, N. Y., $308,500. Noted Aug. 19.

Fuel Oil Storage Plants—San Diego, Calif.—Bids were received Oct. 16 for fuel oil storage plants at navy yard and station from: C. C. Moore & Co., San Francisco, $165,780; Wayne Construction Co., Wayne, Penn., $193,740. Noted Aug. 19.

Motor-Driven Capstans—Panama—Bids were received Oct. 11 by General Purchasing Officer, Panama Canal, for 975 motor-driven capstans from American Engineering Co., Philadelphia, Penn., at about $55,000,, and Hyde Windlass Co., Bath, Maine, at $57,695.

Piers—Honolulu, H. T.—Lord-Young Co., at $285,000, submitted lowest bid for concrete piers No. 8, 9 and 10.

CANALS, DITCHES AND IRRIGATION

Proposed Work

N. Y., Albany—Canal Terminal—Bids will be received by W. W. Wotherspoon, Supt. of Pub. Wks., until noon, Nov. 9, for completing canal terminal at Albany. Estimated cost, $42,689.

Ga., Savannah—Drainage—(Official)—Citizens voted $400,000 bonds for drainage. Thomas Halligan, City Clk. Noted Oct. 7.

Fla., Lake Worth—Drainage—(Official)—Plans will be completed about Jan 1 for Lake Worth Drainage District, about 130,000 acres. Orrin Randolph, Ch. Engr. Noted Oct. 7.

Miss, Dublin—Drainage—Drainage District organized by Coahoma County Supervisors, Clarksdale, to reclaim about 10,000 acres. E. L. Fontiane, Ch. Engr.

Ohio, Cleveland—Ditch Improvement—Bids will be received by E. G. Krause, Clk., Bd. of Comrs. of Cuyahoga County until Nov. 6 for ditch improvement in Solon Township.

Ind., Lawrenceville—(Sunman post office)—Ditch—Contract will soon be awarded for improving ditch in England Pond.

Wis., Bristol—Drainage—Bids will be received by Town Supervisor until Oct. 28 for drainage system for Bristol Dranage District. W. E. O'Brien, Kenosha, Engr.

Iowa, Council Bluffs—Drainage—Board of Supervisors of Harrison and Pottawattamie Counties preparing plans for widening and deepening Allen Creek and Fish Lake ditch. Estimated cost, $40,000. Noted Oct. 7.

Iowa, Jefferson—Drainage—Bids will be received until Oct. 25, by B. S. McCulley, Audr. of Green County, for excavation and laying drains in Drainage District No. 108.

Iowa, Muscatine—Dams—Plans being prepared for three dams in Drainage Ditch No. 10.

Iowa, Ottumwa—Ditch—Board of Supervisors contemplate drainage ditch in southern part of county.

Minn., Blue Earth—Ditch—Bids will be received until 1 p.m., Oct. 29, by Jesse L. Herring County Audr., for County Ditch No. 32, Faribault County.

Minn., Grand Rapids—Ditch—Surveys for Ditch No. 6 at Blackberry completed by William Passard.

Minn., St. Paul—Ditch—State Drainage Board plans expenditure of $15,000 for improving Sand Hill River ditch in Polk County.

Neb., Minden—Drainage—Citizens voted to build drainage system in Newark, Lowell and Blane Townships.

N. D., Fargo—Ditch—Bids being received for two ditches through a portion of Kenyon and Noble Township to Red River. Estimated cost, $30,000 each. F. Crabbe, Fargo, Engr. Noted Oct. 7.

Mont., Billings—Ditch—Trustee of Big Ditch Co. authorized to make improvements at estimated cost of $7,000.

Mont., Helena—Irrigation—Beaver Head Water Co., recently incorporated, plans to irrigate land in Beaver Head County. W. T. Piggott, interested.

Mo., Butler—Drainage—(Official)—Bates and Cass County Drainage District being formed and will let contract about Dec. 1 for drainage work.

Tex., Austin—Drainage—Bonds for $158,000 voted by citizens of Noeces County Drainage District No. 2 approved.

Tex., Donna—Irrigation—Donna Irrigation District No. 1, Hildalgo County, plans to construct irrigation system at an estimated cost of $215,000. G. B. Meriwether, Pres.

Tex., Edna—Drainage—Attorney General's Department approved $105,000 bonds for Jackson County Drainage District No. 5.

Tex., Van Horn—Irrigation—Van Horn Valley Land & Ry. Co., Van Horn and Minneapolis, Minn., will construct wells for irrigation.

Colo., Pueblo—Irrigation—Turkey Creek Irrigation Co. plans system of ditches on Teller holdings. J. C. Teller, Pueblo, interested. Estimated cost, $50,000.

Colo., Saguache—Drainage—Citizens contemplate drainage system. W. L. Curtis, Comr.

Idaho, Nyssa—Irrigation—Nyssa Arcadia Drainage District plans to reclaim approximately 8,000 acres near Nyssa. G. McGeen, Caldwell, Ch. Engr.

Ore, Culver—Irrigation—Suttles Lake Irrigation District voted to issue bonds for irrigation and water system to include 12,000 acres. Estimated cost, $532,390.

Calif., Colusa—Reclamation—Reclamation Districts 108, 479 and 787 plan levee improvements. J. W. Browning, E. L. Dow and W. P. Dwyer, Comrs. of West Side District. Estimated cost, $580,000.

Calif., Westminster—Drainage—(Official)—Bids will probably be received in December for drainage system to drain 6000 acres. S. H. Finley, Santa Ana, Engr. Estimated cost, $25,000. Noted Oct. 14.

Bids In and Contracts Awarded

Wis., Grand Rapids—Drainage—Contract awarded to C. W. ROOD CONSTRUCTION CO. for draining Northwest Drainage District.

Iowa, Manson—Drain—Contract for cement tile for 13-mile drain awarded to CEMENT PRODUCTS CO., Sac City, at $21,000.

Iowa, Sibley—Ditch—Contract awarded to SIBLEY CEMENT CO., at $5,290, for ditch work in channel of Ocheyedan River.

Minn., Breckenridge—Ditch—(Official)—Contract for Ditch No. 8-A, Wilkin County, awarded to G. E. BROWN, Litchfield, at $1.25 per cu.yd. Noted Sept. 30.

Minn., Breckenridge—Ditch—(Official)—Contract awarded to C. T. GLASSER, Minneapolis, $0.19 per cu.yd. for ditch work, in Ditch No. 4-A, Wilkin County. Noted Sept. 30.

Minn., Montevideo—Ditch—(Official)—Contract awarded to MARSHALL CEMENT & SIDEWALK CO., Marshall, at $8,918, for County Ditch No. 17. Noted Oct. 7.

Mont., Kalispell—Irrigation—Contract awarded to NELSON RICH for Glen Lake Irrigation project on Tobacco Plans.

Ark., Pocahontas—Ditches—Contract awarded to W. S. COLEMAN, Paragould, at $24,052, for Cook slough ditch in Township No. 18. Noted Sept. 23.

Idaho, Twin Falls—Canal Improvements—Contracts for enlarging highline canal and replacing siphons in upper Rock Creek District awarded to IDAHO CONSTRUCTION CO., BOISE, SMITH & GREEN, and MORRISON KNUDSEN CO. Estimated cost, $88,000. Noted Sept. 16.

Calif., Modesto—Canal Work—Contracts for canal work at Modesto Irrigation District awarded as follows: Main canal lining to J. WILSON, Modesto, at $62,962; Dam No. 6 to TIBBETTS-PACIFIC CO., San Francisco, at $9,080; Dam No. 1 to J. MONK, San Francisco, at $34,039; 11 concrete structures to C. HOLMES. Noted Oct. 14.

MISCELLANEOUS

Proposed Work

Elevated Railway—New York, N. Y.—(Borough of Brooklyn)—Contract form and plans for reconstruction of Brighton Beach Elevated line submitted to Public Service Commission of First District by New York Municipal Railway Corporation approved. Estimated cost from $75,000 to $100,000.

Elevated Railway—New York, N. Y.—(Borough of Brooklyn)—Public Service Commission of First District approved contract form submitted by New York Municipal Railway Corporation for steel for additional tracks for Myrtle Ave. elevated railway from Willoughby Ave. to Palmetto St., also for improvements on Lutheran Cemetery line.

Station Finish—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by Public Service Commission of First District, 154 Nassau St., New York (Borough of Manhattan), until 12:15 p.m., Oct. 26, for station finish for 11 stations on the Broadway-Fourth Ave. Rapid Transit R.R.

Elevated Railway—New York, N. Y.—(Borough of Queens)—Plans and contract form submitted to Public Service Commission of First District for foundations and structures on Section 2, Jamaica elevated extension, consisting of 2.2 mi. two-track elevated railway along Jamaica Ave. from Walnut St. to Cliffside Ave., approved.

Subway Work—New York, N. Y.—(Borough of Queens)—(Official)—Bids for a storm drain, which were to have been opened Oct. 19, have been postponed by Public Service Commission until Nov. 3.

Grade Crossings—Paterson, N. J.—Plans being considered by Erie R.R. for constructing grade crossings in Paterson. R. C. Falconer, New York, N. Y., Supt. Constr.

Flood Protection—Erie, Penn.—City Council contemplates $1,000,000 bond issue for flood protection in Mill Creek. F. Gannett, Harrisburg, Consult. Engr. Noted Sept. 23.

Seawall—Bay St. Louis, Miss.—All bids received for seawall about 8,000 ft. long along beach at Waveland rejected. New bids will be received. Noted Aug. 26.

Elimination of Grade Crossings—Akron, Ohio—Plans being considered by Pennsylvania R.R., Baltimore & Ohio R.R., Erie R.R. and County Commissioners for eliminating Wuchter crossing, east of Akron, Tuscarawas Ave. crossing, Barberton, and Manchester crossing, Kenmore.

Elimination of Grade Crossing—Bratenahl, Ohio—(Cleveland post office)—Bids will be received until noon, Oct. 27, by C. A. Neff, Clk., for sale of $38,918 bonds for eliminating grade crossing on East 105th St.

Retaining Wall—Cincinnati, Ohio—Bids will be received noon, Oct. 25, by Philip Fosdick, Dir. of Pub. Service, for retaining wall on St. Clair Ave.

Steel Tanks—Cincinnati, Ohio—Stegner & Hughes, Cincinnati, prepared plans for four steel tanks for Moore Oil Co., at York and McLean Ave.

Bars and Cable—Cleveland, Ohio—Bids will be received until noon, Oct. 27, by A. R. Callow, Comr. of Purchases and Supplies, Room 511, City Hall, for steel reinforcing bars and lead covered cable for Fire, Light and Water Departments.

Levee—Portsmouth, Ohio—(Official)—Bids will be received about Nov. 2 for levee work at Portsmouth. George S. Wilhelm, City Engr. Noted Sept. 23.

Retaining Wall—Springfield, Ohio—City will build retaining wall on East High St.

Steel Pipe Line—Youngstown, Ohio—East Ohio Gas Co. will build pipe line from Youngstown to Canton, about 52 miles.

Elimination of Grade Crossings—Youngstown, Ohio—Erie R.R. and city plan to eliminate grade crossings.

Elimination of Grade Crossing—Indianapolis, Ind.—Pennsylvania R.R. directed by Board of Public Works to elevate tracks from Ray St. to a point 300 ft. south of Harris Ave.

Levee Improvement—Indianapolis, Ind.—Board of Public Works authorized improvement of White River Levee. B. J. T. Jeup, City Engr.

Ore Docks—Two Harbors, Minn.—Duluth & Iron Range R.R. Co. plans ore docks at Two Harbors. Estimated cost, $1,500,000.

Dikes—Peasanton, Kan.—Citizens contemplate dikes on Marais des Cygnes River to reclaim 1300 acres. J. Gearhart, State Engr.

Machinery and Pier—Beaumont, Tex.—Bids will be received until noon, Nov. 1, by Board of Wharf and Dock Commission, City Hall, for 500-ft. pier, shed and freight-handling machinery at Kirby's Point, Beaumont. H. McL. Harding, Consult. Engr.

Wharf—Beaumont, Tex.—Bonds for $100,000 sold for wharf. Noted Sept. 23.

Pipe Line—Brenham, Tex.—Chappell Hill Oil Co. will build pipe line from Brenham to Wofford, 7½ miles. Estimated cost, $25,000. J. B. Heartfield and F. O. Prescott, interested.

Levee—Ennis, Tex.—Plans approved and bids will soon be received for levees on Trinity River, Ellis County Levee District. Estimated cost, $120,000. O. W. Finley, Waxahachie, Engr. Noted Oct. 14.

Pipe Line—Duncan, Okla.—Corsicana Petroleum Co. has received franchise to lay pipe line through Stephens County to oil wells.

Pipe Line—Martinez, Calif.—Shell Oil Co. plans pipe line from wells to refinery, about six miles. Estimated cost, $45,000.

Retaining Walls—Sanger, Calif.—Bids will be received by D. M. Barnwell, Clk., Bd. of Supervisors of Fresno County, Fresno, until 2 p.m., Nov. 1, for four retaining walls near Sanger.

Bids In and Contracts Awarded

Structural Steel—New York, N. Y.—(Borough of Brooklyn)—Lowest bid submitted for furnishing 60,000 tons structural steel for new lines and terminals and reconstructing existing lines and terminals was that of American Bridge Co. as follows: East New York Division, 18,000 tons at $48 per ton; Fulton St. line, 24,000 tons at $42 per ton; Brighton Beach line, 2,100 tons at $42 per ton; Coney Island terminal, 15,000 tons at $45 per ton.

Track Supplies—New York, N. Y.—(Borough of Manhattan)—(Official—Bids were received Oct. 15 by Public Service Commission of First District for track supplies: William Wharton & Co., Jr., $27,965; Pennsylvania Steel Co., 71 Broadway, New York, $23,950 and Ramapo Iron Works, $24,116 for work under Order No. 5 and for ballast for Rapid Transit Ry.; Upper Hudson Stone Co., 26 Cortland St., New York, at 97 cents for class A, 87 cents for class B, total $77,374. Noted Oct. 14.

Pier—Greenville, N. J.—Contract for pier for Pennsylvania R.R. awarded to HENRY STEER, INC., New York, N. Y.

Coaling Dock—Pensacola, Fla.—Contract for coaling dock for Louisville & Nashville R.R. awarded to ROBINSON-SCHAEFER CO., Chicago, Ill. Noted Oct. 4.

Levees—New Orleans, La.—Contract awarded to DON B. HEAN & SON, at 17.23c. per cu.yd. for levee work on lower coast.

Levees—Shreveport, La.—Contracts for levees awarded as follows: Upper Missionary and Thompson levee, approximately 34,000 cu.yd. and 110,000 cu.yd., to NOEL BROS., at 12.48c. and 13.68c. per cu.yd., respectively; West Egypt and Cedar Bluff levee, approximately 55,000 cu.yd. and 40,000 cu.yd., to F. M. HEARNE, at 10.98c. and 11.50c. per cu.yd., respectively; Loggie Lea and Long Point levee, approximately 100,000 cu.yd. and 30,000 cu.yd., to HALL NATTIN, at 15.20c. and 17.40c. per cu.yd., respectively; Campo Bello levee, approximately 55,000 cu.yd., to DOUGLAS & BURT, at 15.90c. per cu.yd. Noted Sept. 16.

Dikes—Kelso, Mich.—Contract awarded to COLLIER & STEVENSON, Portland, Ore., for dikes in Wahkrakum County Diking District No. 1.

Levee—South Bend, Ark.—Contract for levee at South Bend awarded to BROWN & FARLEY, Little Rock, at 13.95c. per cu.yd. Noted Sept. 30.

Dike—Cathlamet, Wash.—Montague O'Reilly Co., Portland, Ore., at $98,614, low bidder for 17 miles of dike on Columbia River. G. A. Kyle, Portland, Engr. Noted Sept. 9.

Pier—Redondo Beach, Calif.—Contract awarded to McARTHUR BROS., San Francisco and New York, N. Y., at $108,800, for reinforced-concrete municipal pier. Noted Aug. 12.

Jetties—Salinas, Calif.—Contract awarded to L. G. HARE, at $19,880, by Board of Supervisors of Monterey County for jetties on Salinas River.

Pier—San Francisco, Calif.—Clinton Construction Co., at $283,000, was low bidder for Pier 29 for Board of State Harbor Commissioners.

Wharf—Esquimalt, B. C.—Contract for wharf and warehouse at Esquimalt awarded to TAYLOR ENGINEERING CO., Vancouver. Estimated cost, $60,000.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works," "Federal Government Work" and "Miscellaneous."

Proposed Work

Mass., Agawam—Bids will be received Nov. 15 by Hampden County Commissioners for 65x168-ft. brick training school.

Mass., Boston—Back Bay Council K of C has retained Maginnis & Walsh, 100 Boylston St., to prepare plans for three-story, 150x150-ft. clubhouse at Boylston Rd. and Ipswich St., Fenway. Estimated cost, $300,000.

Mass., Holyoke—Bids will soon be received by Board of Public Works for isolation hospital and boiler house. Estimated cost, $40,000.

Mass., Salem—Bids will be received about Oct. 25 for hospital. Haven & Hoyt, 220 Devonshire St., Boston, Arch.

Mass., Taunton—State plans to build armory. Estimated cost, $60,000.

Mass., Westfield—School Board plans to build brick school estimated to cost $60,000. J. M. Dutton, Chn.

Mass., Westfield—Hampden County Commissioners will build county building. Estimated cost, $90,000.

Mass., Woburn—State plans to build armory. Estimated cost, $60,000.

R. I., Providence—(Official)—Bids will be received until 10 a.m., Oct. 28, by Board of Control and Supply for dormitory for State Home and School, 1142 Smith St. William A. Schofield, Chn.

Conn., Bridgeport—Middle Street Realty Co. will build business block on site of Read Carpet Co. building.

Conn., New London—An addition will be built to Griswold Hotel. Estimated cost, $300,000.

Conn., Stratford—Southern New England Telephone Co. will build two-story telephone building.

N. Y., Albany—(Official)—Bids will be received until 3 p.m., Oct. 25, by Trustees of Public Buildings, Executive Chamber, Capitol, for alterations in executive offices of capitol. Noted Sept. 23. (See adv.)

N. Y., Buffalo—(Official)—Bids for church for St. John the Evangelist will not be received until spring. S. F. Heckert, Bessemer Bldg., Pittsburgh, Penn., Arch. Noted Oct. 14.

N. Y., Buffalo—(Official)—We have been advised that Bank of Buffalo is uncertain when it will commence construction of its proposed bank building. E. C. McDougal, Pres. Noted Sept. 30.

N. Y., New York—(Borough of Brooklyn)—(Official)—Bids being received for four-story, 80x100-ft. brick and steel sales station and service station for Ford Motor Co. at Bedford Ave. and Sterling Pl. Estimated cost, $100,000. Francisco & Jacobus, 200 Fifth Ave., New York, Arch. Noted Sept. 23.

N. Y., New York—(Official)—(Borough of Manhattan)—Bids will be received until 4 p.m., Oct. 22 by State Armory Commission, Franklin W. Ward, Secy., Capitol, Albany, for improvements to State Arsenal, Seventh Ave. and 35th St.

N. Y., Potsdam—(Official)—Plans will probably be ready for bids about Nov. 15 for two-story normal school for New York State Department of Education. Lewis F. Pilcher, Capitol, Albany, State Arch. Noted Oct. 14.

N. J., Paulsboro—Board of Education will build school. Clyde S. Adams, Arch.

N. J., Vineland—(Official)—Bids will be received until Oct. 22 by Board of Managers for dining and service building for State Home for Feeble Minded. Estimated cost, $50,000. George S. Drew, Trenton, State Arch. Noted Oct. 7.

Penn., Philadelphia—(Logan)—(Official)—Bids will be received about Nov. 20 by Neff & Thames, Philadelphia, for Methodist Episcopal Church at 13th and Rockland St. Estimated cost, $40,000. Noted Sept. 30 and Oct. 7.

Penn., Philadelphia—Bids will be received about Jan. 1 by Board of Education for three-story brick school at 55th and Chestnut St. Estimated cost, $200,000.

Penn., York—City will build library. Donation of $500,000 made.

Del., Newark—Day & Klauder, Arch., preparing plans for two-story stone and brick building for Delaware College.

Md., Baltimore—(Official)—Bids will be received about Nov. 15 for four-story 130x147-ft. brick building for John Hopkins University. Carrere & Hastings, 52 Vanderbilt Ave., New York, N. Y., Arch. Estimated cost, $50,000.

W. Va., Murraysville—Wilder & Wight, Arch., Kansas City, Mo., preparing plans for granite bank building for Farmer's Trust Co.

Fla., Miami—N. Victor Frohling, Miami, preparing plans for 175-room hotel. Estimated cost, $300,000.

Tenn., Bristol—City plans $60,000 bond issue for new school.

Ky., Covington—Election will be held in Kenton County to vote $150,000 bonds for high school.

Ky., Dawson Springs—H. G. O'Kain, representing a syndicate of Nashville men, has secured site and plans sanitorium. Estimated cost, $250,000.

Ky., Georgetown—Election will be held Nov. 3 to vote on $90,000 bonds for schools. Noted Oct. 14.

Ky., Hopkinsville—Election will be held in November to vote on $100,000 bonds for schools.

Ohio, Berkeley—Bids will be received by M. C. Deppman, Clk., Bd. of Education, until noon, Nov. 13, for school. Schriber, Beelman, Toledo, Arch.

Ohio, Cincinnati—(Official)—Bids will be received about Dec. 1 for Y. M. C. A. building. Elzner & Anderson, Arch. Noted Oct. 7.

Ohio, Cleveland—S. H. Weis, 1030 Schofield Bldg., prepared plans for three-story commercial and apartment building at 1826 Crawford Rd. for W. J. Bennet. Estimated cost, $45,000.

Ohio, Cleveland—Construction work will soon commence on group of buildings for Masonic Temple at 3515 Euclid Ave. Estimated cost, $500,000. Hubbell & Benes, Arch. Noted Aug. 5.

Ohio, Cleveland—Christian, Schwarzenberg & Gaede, 1900 Euclid Bldg., Cleveland, preparing plans for three-story store and service building at 2248 Euclid Ave. for Studio Realty Co. Estimated cost, $60,000.

Ohio, Cleveland—First Church of Christ has purchased site on Euclid Ave. and will build church. Estimated cost, $100,000. Noted Sept. 2.

Ohio, Cleveland—Frank D. Skeel, 213 Vickers Bldg., Cleveland, preparing plans for six-story hotel on East 61st St. for G. W. Crile.

Ohio, Cleveland—Jacob Babin, 319 Williamson Bldg., Cleveland, will build a commercial building at Superior Ave. and East 115th St. Estimated cost, $100,000.

Ohio, Cleveland—(Official)—We have been advised J. A. Wigmore Co. will not build coliseum. Noted Oct. 7.

Ohio, Columbus—Citizens will not be asked to vote on $2,000,000 bond issue for new schools until 1916.

Ohio, Columbus—Bids will be received by C. F. Steeb, Secy., Bd. of Trustees of Ohio State University, until Nov. 15, for hospital and shops for university.

Ohio, Dayton—Dayton Military Academy plans building for vocational school at estimated cost of $150,000. Isaac Warner, 145 Rung St., interested.

Ohio, Lakewood—Election will be held Nov. 2 to vote on $500,000 bonds for school and improvements to schools.

Ohio, Toledo—Toledo Hospital plans to build addition. Estimated cost, $60,000.

Ohio, Wilberforce—(Official)—Bids will be received until noon, Nov. 4, by Board of Trustees, Wilberforce University for recitation building. Frank L. Packard, Columbus, Arch.

Ind., Anderson—Y. M. C. A. plans building. Estimated cost, $250,000.

Ind., Bloomington—Bids will be received until Dec. 1 by Trustees of Indiana University for gymnasium. Estimated cost, $175,000. Noted Aug. 19.

Ind., Brazil—Johnson & Miller, Brazil, retained by city to prepare plans for high school. Estimated cost, $70,000. Noted Aug. 5.

Ind., Evansville—Illinois Central R.R. plans new freight depot. Estimated cost, $50,000. A. S. Baldwin, Chicago, Ill., Ch. Engr.

Ind., Ft. Wayne—Flick Floral Co. will build three-story and basement building at 810 Harrison St. Aaron and Alice M. Shive, interested. Estimated cost, $125,000.

Ind., Indianapolis—Leasehold Realty Co. will build 14-story building at Market and Delaware St. Thomas B. Fulmer, Pres.

Ind., Rockport—County Council will not appropriate $100,000 for new courthouse. Noted Aug. 19.

Mich., Bay City—Henry B. Smith is president of company which will build hospital. Estimated cost, $50,000.

Mich., Detroit—St. Agnes Catholic Parish will build church and school. Estimated cost $60,000. Charles E. Henigan, Pastor.

Mich., Detroit—Statler Hotel, Detroit, will build addition to hotel on Washington Blvd.

Mich., Detroit—Donaldson & Meier, Detroit, prepared plans for club house at Atkinson and Clairmount St. for Ingleside Club. Estimated cost, $44,000.

Mich., Jackson—Election will be held Oct. 23 to vote on $385,000 bonds for high school.

Mich., Owosso—Woodward Bros., and J. C. Osborn will build hotel at estimated cost of $100,000.

Ill. Aurora—Plans prepared for eight-story hotel at Island Ave. and Main St. for Island Improvement Co. Noted Aug. 19.

Ill., Chicago—James A. Bidderman, 38 South Dearborn St., will build six six-story apartments and one 18-apartment building at Sunnyside Ave. and Hazel St. Estimated cost $225,000.

Ill., Chicago—Marshall & Fox, 38 South Dearborn St., preparing plans for theater for Jones, Linick, Schaefer & Co., 110 South State St. Noted Oct. 7.

Ill., Chicago—Plans prepared by James B. Dibelka, State Arch., and Holabird & Roche, for armory for First Cavalry, Illinois National Guard, near Lake Shore Drive and Chicago Ave. Noted Sept. 23.

Ill., Springfield—W. B. Ittner, St. Louis, prepared plans for high school.

Wis., Madison—State Board of Education approved plans prepared by Arthur Peabody for remodeling university gymnasium.

Wis., Milwaukee—University Club will build clubhouse at Oneida St. and Juneau Pl. Estimated cost, $300,000.

Wis., Milwaukee—School Board will build two schools in 1916, one on Green Bay Ave. and other on Franklin St. Estimated cost, $260,000.

Wis., Milwaukee—St. Mary's Church will build school. Estimated cost, $40,000.

Wis., Platteville—(Official)—Bids will be received in January for 2½-story and basement science building for State Board of Normal Regents. Estimated cost, $100,000. Noted Oct. 14.

Wis., Superior—(Official)—Bids will be received about Jan. 1 for three-story and basement training school for State Board of Normal Regents. Estimated cost, $80,000. Noted Oct. 7.

Wis., Superior—Plans being prepared by Emil Ulrich, Arch., 706 Euclid Bldg., Cleveland, Ohio, for Sacred Heart Cathedral for Diocese of Superior. Estimated cost, $150,000.

Wis., Waukesha—Carroll College will build boys dormitory. Estimated cost, $100,000. Wilbur O. Canier, Pres.

Iowa, Carroll—Bonds for $80,000 voted for school.

Iowa, Sioux City—Trinity Luthern Church will build edifice and parsonage at estimated cost of $100,000. A. J. Stenseth, Chn. Finance Com.

Minn., St. Paul—Election will be held in spring to vote on $500,000 bond issue for schools.

Kan., Hiawatha—Bonds for $60,000 sold for school construction.

Kan., Salina—Bids will be received until Oct. 27 by I. C. Housel, Clk., Bd. of Education, for school. Estimated cost, $60,000. William T. Schmitt, 1634 West Tenth St., Oklahoma, Okla., Arch.

Kan., Wellington—(Official)—Bids will be received after Dec. 1 by G. A. Halliday, Secy., Y. M. C. A., for building. Estimated cost, $50,000. Noted Oct. 7.

Kan., Wichita—Election will be held to vote on $100,000 bonds for jail.

Neb., Lincoln—W. E. Sharp, Pres. Lincoln Traction Co., will build office and store at Tenth and O St. Estimated cost, $500,000.

Wyo., Sheridan—George H. Brown is having plans prepared by Baerresen & Wieger, Arch., for hotel on site of Western Hotel. Estimated cost, $125,000.

Mo., Carthage—Bids will be received until Nov. 11 by L. M. Thomas, County Clk., of Jasper County, for purchase of $100,000 bonds for sanitarium. Noted Sept. 30.

Mo., Carthage—First Presbyterian Congregation will build church. Estimated cost, $40,000.

Mo., Kansas City—Plans being prepared for four-story brick hotel at Ninth and Charlotte St. for Hoffman Bros. Investment Co., 524 Ridge Bldg. Estimated cost, $45,000. W. Hilton Smith, 518 Massachusetts Bldg., Arch.

SEWER SYSTEM—OCALA, FLA.

Bids were received Sept. 14 for the construction of a sewer system at Ocala, Fla., from: (A) G. W. Ensign Inc., Harrisburg, Penn.; (B) J. F. Morgan Contracting Co., Attalla, Ala.; (C) J. B. Sheets Co., Pittsburgh, Penn.; (D) O'Sullivan, Long & Haggerty, Bessemer, Ala.; (E) Independent Construction Co., Terre Haute, Ind.; (F) Stamm & Son, St. Petersburg, Fla.; (G) Michler & Flynn, Chattanooga, Tenn.; (H) Guild & Co., Chattanooga, Tenn.; (I) H. W. Tucker, Ocala, Fla.; (J) BRYAN & CO., Jacksonville, Fla., (awarded contract); (K) W. J. Irwin & Son, Greenville, Ohio; (L) Whaley & Edwards, Milan, Mich.; (M) Duval & Ashworth, Miami, Fla. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M
5,580 lin.ft. 6-in. service pipe 6 ft. deep	$0.29	$0.25	$0.28	$0.30	$0.32	$0.30	$0.23	$0.27	$0.183	$0.18	$0.25	$0.51	$0.40
208 lin.ft. 6-in. vertical service pipe in deep trenches	.32	.25	.15	.20	.17	.30	.23	.24	.122	.35	.20	.30	.16
10,270 lin.ft. 8-in. sewer pipe, 0-4 ft. deep	.39	.26	.37	.24	.34	.40	.27	.29	.28	.23	.30	.52	.42
65,115 lin.ft. 8-in. sewer pipe 4-6 ft. deep	.52	.32½	.40	.32	.34	.472	.38	.37	.34	.26	.35	.57	.45
18,135 lin.ft. 8-in. sewer pipe 6-8 ft. deep	.84	.43	.46	.45	.46	.65	.56	.44	.54	.39	.40	.69	.58
5,520 lin.ft. 8-in. sewer pipe 8-10 ft. deep	.85	.55	.61	.60	.75	.85	1.09	.78	.65	.60	.50	1.07	.70
1,955 lin.ft. 8-in. sewer pipe 10-12 ft. deep	1.21	.80	.69	.90	1.00	1.15	1 58	1.37	.88	.85	.70	1.45	.90
100 lin.ft. 8-in. sewer pipe 12-14 ft. deep	1.68	1.50	.70	1.30	1 20	1.35	2.20	2.19	1.07	1.60	1.00	1.82	1.20
105 lin.ft. 8-in. sewer pipe 14-16 ft. deep	2.71	2.25	.93	1.80	1.70	1.75	3 50	2.85	1.20	1.85	1.40	2.98	1.50
115 lin.ft. 8-in. sewer pipe 16-18 ft. deep	3.00	2.75	1.20	2.40	2.00	2.30	5.00	4.19	1.40	2.25	1.60	3.57	2.00
1,985 lin.ft. 10-in. sewer pipe 0-4 ft. deep	.42	.32	.40	.30	.44	.50	.36	.35	.39	.30	.35	.46	.50
2,245 lin.ft. 10-in. sewer pipe 4-6 ft. deep	.51	.40	.43	.40	.44	.60	.45	.44	.46	.33	.45	.56	.58
1,630 lin.ft. 10-in. sewer pipe 6-8 ft. deep	.67	.48	.42	.50	.54	.80	.63	.52	.62	.46	.55	.70	.73
1,345 lin.ft. 10-in. sewer pipe 8-10 ft. deep	.80	.65	.57	.70	.80	1.05	1.15	.89	.75	.67	.85	1.05	.95
570 lin.ft. 10-in. sewer pipe 10-12 ft. deep	1.24	1.25	.65	1 00	1.07	1.30	1.64	1.57	1.12	.92	1.00	1.40	1.25
370 lin.ft. 10-in. sewer pipe 12-14 ft deep	1.71	2.00	.73	1.40	1.27	1.50	2.29	2.37	1.23	1.67	1.20	2.48	1.50
170 lin.ft. 12-in. sewer pipe 0-4 ft. deep	.47	.45	39	.40	.52	.65	.44	.43	.54	.37	.50	.62	.65
1,040 lin.ft. 12-in. sewer pipe 4-6 ft. deep	.57	.50	.42	.55	.52	.76	.53	.53	.60	.40	.60	.70	.75
990 lin.ft. 12-in. sewer pipe 6-8 ft. deep	.72	.60	.48	.65	.64	1.00	.70	.63	.71	.53	.80	.85	0.90
15 lin.ft. 12-in. sewer pipe 8-10 ft. deep	.85	1 25	.63	.85	.90	1.25	1.24	1.04	1.15	.75	1.00	1.00	1.20
1,235 lin.ft. 15-in. sewer pipe 0-4 ft. deep	.54	.61	.53	.55	.67	.85	.58	.58	.67	.57	.70	.78	.75
780 lin.ft. 15-in. sewer pipe 4-6 ft. deep	.64	.70	.57	.70	.67	.95	.77	.69	.75	.67	.80	.82	1.00
1,075 lin.ft. 15-in. sewer pipe 6-8 ft. deep	.79	.90	.64	.80	.87	1.40	1.38	.78	1 10	.80	1.00	.98	1.25
390 lin.ft. 15-in. sewer pipe 8-10 ft. deep	97	1 20	.84	1.00	1 05	1.65	1.85	1.24	1.31	1.10	1.20	1.18	1.65
23 manholes 0-4 ft. deep	26 00	29 50	22.00	20.00	30 00	28.00	23.00	24.00	30.00	25.00	29.00	20.00	29.00
135 manholes 4-6 ft. deep	30 00	33 50	24 00	25.00	35 00	36.50	28.00	28.00	34.00	27.50	34.00	25.00	37 00
41 manholes 6-8 ft. deep	40 00	37 50	29.00	32 00	40 00	45.10	33 00	32.00	42 00	30.00	42.00	35.00	45.00
28 manholes 8-10 ft. deep	47 50	46 00	34.00	40 00	45 00	56.00	40 00	39.00	51.00	35.00	50.00	45.00	55.00
8 manholes 10-12 ft. deep	52 00	55 50	39.00	50 00	50 00	64.00	45 00	45.00	60 00	40.00	58.00	55.00	67.00
1 manhole 12-14 ft. deep	55 00	68 00	46 00	60 00	55 00	70.00	51.00	54.00	74 00	60.00	70.00	65.00	82.00
1 manhole 16-18 ft. deep	62 00	77 50	59 00	80 00	60 00	100.00	62.00	63.00	93 00	80 00	95.00	75.00	100.00
22 drop connections to manholes	20 00	5 00	15 00	3 00	10.00	10 00	4 00	4.00	11 00	10 00	10.00	10.00	8.00
8 lamp holes	12 00	8 00	12.00	7.50	10 00	10.00	10.00	12.00	8 00	10 00	5.00	5.00	5.00
49 automatic flush tanks 0-6 ft. deep	80.00	62 00	75 00	60.00	70 00	60.00	70.00	65.00	59 00	55.00	60.00	70.00	85.00
2 automatic flush tanks 6-8 ft. deep	90.00	70 00	80 00	70.00	75.00	70.00	70.00	72.00	64 00	70.00	70.00	75.00	95 00
34 hand flush tanks 0-6 feet deep	50 00	38 50	40 00	30.00	45.00	45.00	60.00	35.00	48.00	40 00	34.00	60.00	45.00
3 hand flush tanks 6-8 ft. deep	55.00	50.00	45.00	40.00	50.00	57.50	60 00	40.00	56.00	45.00	45.00	70.00	55.00
40 Y-branches 15x6-in	.95	1.20	.95	.50	1.00	.95	.90	.60	1.10	1.00	1.00	1 15	1 45
54 Y-branches 12x6-in	.65	.85	.65	.35	.75	.65	.75	.48	.78	.75	.75	.78	1.00
192 Y-branches 10x6-in	.50	.70	.50	.25	.55	.37	.60	.36	.65	.50	.60	.60	.80
2,481 Y-branches 8x6-in	.35	.40	.25	.20	.40	1.10	.35	.24	.50	.10	.50	.47	.50
1,551 sq.yd. grouted brick taken up and relaid	1.80	1.70	2.00	.75	1.70	.25	1 60	2.00	1 20	.35	2 50	3 00	.40
1,585 sq.yd. sand filler brick taken up and relaid	1.20	.50	1.50	25	.48	.40	.50	.50	.30	.25	1.50	2.50	.20
7,381 sq.yd. macadam pavement taken up and relaid	.85	.30	.70	.10	.60	2,952.40	.60	.50	.40	.20	.50	.70	20
2 sewage settling tank (lump sum)	.....	3,960.06	2,500.00	6,000.00	4,000.00	3,950.00	4,150.00	7,468.20	4,100.00	4,750.00	3,900.00	.....	4,700.00
1 chemical and sludge pump house (lump sum)	.....	1,235 00	800 00	1,000.00	680 00	900.00	1,300.00	2,330.00	850 00	750.00	900.00	.....	900.00
1 sludge bed (lump sum)	.....	500 00	440 00	500.00	383 00	525.00	525.00	659.50	525.00	500.00	500.00	.....	300.00
1 settling basin (lump sum)	.....	710 00	215 00	700.00	563 00	290.00	750 00	986.00	550.00	650.00	500.00	.....	450 00
1 sewage pump and motor installed (lump sum)	.....	500.00	480 00	350.00	462.00	550.00	750.00	440.00	400 00	370.00	550.00	.....	1,300.00
1 chemical feed tank (lump sum)	.....	175.00	85.00	125.00	170.00	110.00	.....	225.00	125.00	150.00	125.00	.....	100.00
260 18-in. sewer pipe 4 ft. deep	.....	.70	1.25	.85	.80	1.22	.80	.94	.85	.75	.90	.85	1.25
30 8-in. sewer pipe 4 ft. deep	.....	.26	.45	.25	.35	.50	.35	.40	.35	.50	.30	.42	.52
50 6-in. soil pipe	.....	.60	.30	.50	.50	.65	.55	.33	.40	.60	.50	.12	.70
5 by pass manholes	.....	45.00	35.00	35.00	40.00	10.00	40.00	33.00	26.00	25.00	25.00	65.00	10.00
1 manhole over 10-in. well	.....	40.00	35.00	30.00	40.00	30.00	30.00	46.00	32.00	25.00	23.00	.....	30.00
1,487 cu.yd. fill	.....	.40	.50	.40	.50	.40	.50	.40	.34	.30	.30	.40	.10
30 cu.yd. class "A" concrete	10.00	12.00	7.50	10.00	10.00	15.00	10.00	12.00	8.50	7.00	9.00	3.50	10.00
3M ft. b.m. lumber in foundations and trenches	20.00	38.00	25.00	30.00	20.00	25.00	35.00	25.00	35.00	25.00	35.00	20.00	20.00
	20.00	38.00	25.00	30.00	20.00	25.00	35.00	25.00	35.00	25.00	35.00	20.00	20.00
150 cu.yd. rock excavation	1.50	4.60	3.00	2.00	6.00	.50	3.00	3.00	2.50	3.00	2.50	3.50	1.25
25 18-in. comp. sewer joints	.....	1.00	.45	.75	.50	.55	.40	.40	.24	.25	.30	.30	.65
200 15-in. comp. sewer joints	.20	.75	.35	.60	.40	.45	.25	.27	.21	.15	.25	.25	.55
100 12-in. comp. sewer joints	.18	.50	.30	.45	.35	.35	.20	.20	.20	.12	.20	.25	.47
200 10-in. comp. sewer joints	.16	.35	.25	.35	.30	.30	.17	.17	.19	.10	.17	.20	.40
1,000 8-in. comp. sewer joints	.15	.25	.22	.25	.25	.25	.14	.13	.14	.08	.15	.20	.3
1 10-in. well approximately 300 ft. deep	.....	5.50	5.15	4.25	5.00	4.25	4.25	5.00	5.00	4.25	5.00	.....	4.00
72 ft. extra for 16-in. c.i. pipe	6.20	3.25	2.25	1.75	2.50	.....	1.70	1.70	2.50	2.00	4.00	.....	.....
928 ft. extra for 10-in. c.i. pipe	4.10	1.70	1.30	1.00	1.30	.....	1.00	.80	1.30	1.00	2.50	.....	.....
384 ft. extra for 8-in. c.i. pipe	2.90	1.40	1.00	.70	.95	.....	.75	.60	1.20	.75	2.00	.....	.....
Extended totals	$104,743	$81,227	$85,668	$74,549	$87,164	$99,023	$32,825	$91,259	$83,894	$66,740	$86,822	$109,293	$93,960

Mo., Kansas City—Bids will soon be received for Mercy Hospital building. Estimated cost, $150,000. Wilder & Wight, Kansas City, Arch. Noted Aug. 19.

Mo., St. Louis—Catholic Cathedral of St. Louis will build parish school. Estimated cost, $100,000.

Mo., St. Louis—F. Warner will build motion picture theater on St. Louis Ave. Estimated cost, $50,000.

Mo., St. Louis—Seventeenth St. Realty Co. will build additional story to Warwick Hotel. G. F. A. Brueggeman, St. Louis, Arch. Estimated cost, $50,000.

Tex., Beaumont—Kansas City Southern R.R. Co. will build passenger station. J. A. Edson, Pres. Estimated cost, $100,000.

Tex., Corpus Christi—Y. M. C. A. plans building. Estimated cost, $65,000. T. A. Anderson, Pres.

Tex, Corsicana—Citizens voted $125,000 bonds for schools.

Tex., Dallas—Bids will be received about Nov. 1 for temple for Emanuel Jewish Church. Hubbell & Green, Dallas, Arch. Estimated cost, $125,000.

Tex., Dallas—Van Slyke & Woodruff, Fort Worth, preparing plans for three-story brick and stone church for Oak Cliff Christian Church. Estimated cost, $40,000. A. E. Efell, Pastor.

Tex., El Paso—Bids will be received until noon, Oct. 20, by Board of Education for high school. Trost & Trost, Mills Bldg., Arch.

Tex., El Paso—Bids will be received until Nov. 9 by County Commissioners for court house and county jail. Trost & Trost, Arch. Estimated cost, $400,000.

Tex., El Paso—Bond issue for $100,000 for poorhouse and poor farm approved.

Tex., Palestine—Bids will soon be received for high school. Sanguinet & Staats, Fort Worth, Arch. Estimated cost, $100,000. Noted Aug. 5.

Tex., San Diego—(Official)—Bids will be received until noon, Oct. 23, by Charles Mull, Bldg. Comn., for two-story brick school. Lane & Dawdy, Arch.

Tex., Wichita Falls—Election will be held to vote on $150,000 bonds for court house.

Okla., Ardmore—W. F. Whittington will rebuild hotel which was recently destroyed by explosion. Estimated cost, $150,000.

Okla, Enid—J. B. Ferguson contemplates three-story brick business building.

Okla., Sand Springs—Charles Page, Tulsa, plans semi-charitable sanitarium and eye hospital. Estimated cost, $150,000.

Okla., Tulsa—Contract will be let in November for high school. Walter E. Gilham, Kansas City, Mo., Arch. Estimated cost, $300,000.

Calif., San Bernardino—(Official)—Election to vote $210,000 bonds for city hall, auditorium and parks postponed indefinitely. Noted July 29.

RAPID TRANSIT SYSTEM—NEW YORK, N. Y.
44th Duct Line

Bids were received, Aug. 4, by the Public Service Commission for the construction of the 44th duct line of the Queensboro Rapid Transit R.R. from, (A) E. C. Moore, (B) Knight & De Micco, Inc., (C) Beaver Engineering & Contracting Co., (D) Hanover Contracting Co., (E) William A. Mitchell, (F) Sorace Contracting Co., (G) Henry E. Fox Construction Co., (H) Goodwin Construction Co., (I) T. H. Reynolds Contracting Co., Inc., (J) Thomas Crimmins Contracting Co., (K) Joseph A. McElroy, (L) Kingsbridge Contracting Co., (M) James O'Leary, (N) G. M. Gest, (O) Frawley-Kaufman Contracting Co. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
3600 cu.yd. earth excavation, above and below mean high water	$2.20	$1.00	$1 25	$1.80	$1.26	$3.00	$2.00	$3.50	$1 60	$2 03	$1 70	$3.00	$4 00	$2.00	$2.50
1000 cu.yd. rock excavation	2.20	2.00	3.00	1.80	4.00	5.00	3.00	3.50	5.00	9 00	5 00	3.00	4 00	5.50	10.00
250 cu.yd. concrete masonry	10.00	8.00	7.00	9.00	6.50	8.00	7.00	7.00	7.00	8.00	25.00	8.00	10.00	8.50	9 00
10 cu.yd. brick masonry	15.00	10.00	12.00	15.00	15.00	8.00	10.00	15.00	13.00	15.00	15.50	18.00	15.00	15.00	15.00
250 lin.ft. vitrified or c.i. drain pipe, in place, 4-in. vitrified	.50	.50	.10	.40	.40	.20	.50	.40	.30	.33	1.00	.40	.10	.50	.50
111,000 duct ft. railroad ducts in place—as required by section 152	.13	.15	.161	.17	.14	.10	.20	.11	.125	.15	11	.18	.20	.135	.15
6 ton riveted steel	60.00	60.00	80.00	50.00	54.00	30.00	40.00	60.00	55.00	50.00	110 00	60.00	50 00	55.00	60.00
6 ton steel beams and shapes	60 00	50.00	80.00	50.00	46.00	25.00	40 00	50 00	52 00	57.50	100.00	60.00	40 00	50.00	50 00
1 ton steel rods and bars	60 00	50 00	60 00	50.00	60.00	30.00	40.00	50.00	58.00	50.00	100 00	60 00	45 00	60.00	60 00
33 ton miscellaneous iron castings	40 00	50 00	45.00	50.00	50.00	33 00	40 00	50 00	60.00	35 00	79 00	30.00	50 00	45.00	50.00
100 sq.yd. street surface restored within curb lines	1.00	1.50	.10	.50	1.25	1.50	1.50	1.00	3 00	1 00	2.25	1.10	1.00	2.00	2.50
1250 sq.yd. street surfacd resotred between curbs (asphalt)	2.00	2.50	2.00	2.50	2.75	3.00	2.00	2.00	2.50	2.41	3.80	2.50	2.50	3.75	2.50
700 sq.yd. street surface restored between curbs (granite block)	.80	2.00	1.60	2.00	2.50	2.00	1.00	2 25	1.60	2.20	1.58	1.25	2.00	3.00	1.50
50 sq.yd. street surface restored between curbs (asphalt block)	1.00	2.50	3.00	3.00	3.50	2.00	2.00	3 50	2 75	2 80	2 50	3.50	2.50	4.00	3.00
500 lin.ft. water pipes, 6 in.	.01	.30	.25	.25	.30	.25	.40	.40	1.25	1.00	65	1 00	.10	1.00	1.00
250 lin.ft. water pipes, 12 in.	.01	.50	.30	.40	1.00	.50	.60	.75	2.35	2 00	1 05	1.50	.15	1.20	2 00
100 lin.ft. water pipes, 30 in.	.01	2.00	.80	.60	1.50	1.00	2 00	2 00	5.50	2 00	4 50	2.50	.20	6.00	3.00
100 lin.ft. water pipes, 48 in.	.01	5.00	.80	1.00	3.00	2.00	2.00	3.00	10.50	3.00	6.50	6.00	.25	10.00	4 00
80 service connections for water pipe	.01	5.00	3.00	2.00	5.00	2.00	1.00	12.00	12.50	8.00	10 00	10.00	1.00	18.00	15.00
150 lin.ft. gas pipe, c.i. 4 in.	.01	.30	.25	.15	.50	.25	.20	.50	.75	.25	60	.60	.10	.65	1.00
150 lin.ft. gas pipe, c.i. 6 in.	.01	.30	.30	.20	.70	.25	.40	.75	.85	.75	.75	.75	.12	1.00	1.00
100 lin.ft. gas pipe, c.i. 8 in.	.01	.40	.35	.25	.90	.30	.40	1 00	.95	.75	1 03	1.00	.15	1.25	1.00
100 lin.ft. gas pipe, c.i. 12 in.	.01	.50	.40	.30	1.10	.50	.60	1.50	1 25	1.00	1.75	1.25	.20	1.75	1.50
100 lin.ft. gas pipe, c.i. 16 in.	.01	1.00	.45	.40	1.25	.75	1.00	1.75	1.75	1.00	2.60	1.50	.25	2.00	1.75
150 lin.ft. gas pipe, c.i. 20 in.	.01	1.50	.50	.50	1.80	1.00	1.20	2.00	2.25	1.00	3 85	1.75	.30	3.00	2.00
200 lin.ft. gas pipe, c.i. 24 in.	.01	2.00	.55	.60	2.00	1.00	1.50	2.50	3 00	1.00	4.50	2.00	.30	4.50	2.50
100 lin.ft. gas pipe, c.i. 30 in.	.01	2.00	.80	.75	3.50	2.00	2.00	3.00	5.00	1.00	5.50	2.50	.35	6.50	3.00
100 lin.ft. gas pipe, w.i. 4 in.	.01	.50	.25	.15	1.00	.50	.20	.50	1.00	.25	.50	.50	.25	.90	1.00
100 lin.ft. gas pipe, w.i. 6 in.	.01	.75	.30	.20	1.00	.50	.40	.75	1 60	.25	.75	.75	.25	1.25	1.00
100 lin.ft. gas pipe, w.i. 8 in.	.01	1.00	.35	.25	1.00	.50	.40	1.00	2.00	.25	.95	1.00	.25	1.75	1.00
50 service connection for gas pipe	.01	5.00	8.00	2.00	3.00	10.00	1.00	10.00	15.00	5.00	6.00	10.00	1.00	12.00	15.00
30 ton c.i. hub and spigot pipe—straight	4(.00	30.00	25.00	22.00	37.00	30.00	25.00	35.00	35.00	50.00	31.00	40.00	20.00	45.00	50. 00
50 lin.ft. new gas pipe, w.i. 4 in.	.01	.60	.40	.20	2.00	.50	.50	1.00	1 00	.75	1.00	.50	90	.60	
50 lin.ft. new gas pipe, w.i. 6 in.	.01	.75	.60	.25	2.00	.50	1.00	1.00	1.75	1.00	1.25	1.25	.50	1.25	.80
50 lin.ft. new gas pipe, w.i. 8 in.	.01	.00	.80	.30	2.00	.50	1.50	1.50	2.70	1.30	1.75	1.50	.50	1.50	
20 ton c.i. hub and spigot pipe, special	50.00	75.00	60.00	65.00	62.00	75.00	60.00	50.00	75.00	70.00	75.00	60.00	40.00	80.00	60 00
100 lb. iron fittings for new w.i. gas pipe	.01	.10	.10	.15	.05	.10	.30	.10	.10	.05	.10	.10	.05	.20	.10
1000 duct ft. electric ducts and conduits	.01	.20	.20	.20	.30	.50	.40	.40	.50	.35	.40	.60	.05	.50	.80
200 lin.ft. electric ducts and conduits, w.i. pipe 2½ in.	.01	.30	.30	.20	.50	.40	.40	.40	.50	.25	.20	.75	.20	.50	.80
1800 lin.ft. electric ducts and conduits, w.i. pipe, 3 in.	.01	.40	.40	.25	.50	.50	.40	.50	.55	.35	.30	.75	.20	.55	.80
1400 lin.ft. electric ducts and conduits, w.i. pipe, 3½ in.	.01	.50	.60	.25	.50	.50	.40	.60	.60	.45	.37	.75	.20	.65	.80
10 service connections for electric conduits	01	5.00	8.00	5.00	10.00	10.00	5 00	15 00	15 00	5 00	6 00	20 00	1 00	25 00	15.00
Extended totals	$34,905	$38,847	$38,918	$40,900	$41,728	$42,784	$45,555	$45,885	$46,460	$49,953	$50,119	$52,802	$53,050	$53,052	$57,395

Colo., Loveland—Election will be held Nov. 1 to vote on $125,000 bonds for high and grammar schools.

N. M., Deming—H. H. Kelly and associates contemplate hotel at estimated cost of $100,000.

Idaho, Gooding—At recent conference at Boise, Methodists planned college at Gooding. Estimated cost, $400,000. J. W. Hancer, Secy., General Bd. of Education of Methodists.

Wash., Peone—(Meade post office)—St. Michael's Jesuit Scholastic Institution will build seminary. A. F. Schinner, Spokane, in charge. Estimated cost, $100,000.

Wash., Seattle—Trustees of N. C. Healy Estate will build eight-story addition to Cobb-Healy Bldg., on Third Ave. near Pike St. Estimated cost, $100,000. Howells & Stokes, Henry Bldg., Arch.

Wash., Tacoma—Health & Gove, National Realty Bldg., Tacoma, prepared plans for reinforced-concrete gymnasium for Stadium High School. Estimated cost, $70,000.

Ore., Eugene—Ellis F. Lawrence, Portland, prepared plans for Womans' Memorial Building on campus of University of Oregon. Estimated cost, $100,000.

Ore, Marshfield—Election will be held in December to vote on $40,000 bonds for city hall.

Ore., Portland—(Official)—Bids will be received about Dec. 1 by School Clerk for Benson Polytechnic School. Estimated cost, $200,000. Noted Sept. 30.

Calif., Berkeley—Plans being prepared for campus buildings for University of California. Estimated cost, $1,000,000.

Calif., Covina—Masonic Homes Association having plans prepared by E. B. Spencer, Union League Bldg., for buildings for Orphans' Home. Estimated cost, $80,000.

Calif., El Centro—S. B. Zimmer, El Centro, preparing plans for high school for Central Union High School district. Estimated cost, $135,000.

Calif., Lodi—Election will be held Oct. 26 to vote on $40,000 bonds for school.

Calif., Los Angeles—F. W. Braun will build two buildings, one at 59th St. and South Vermont Ave. and the other at 58th St. and Clauson Ave. Estimated cost, $75,000. W. J. Saunders and W. W. Mines & Co., Archs.

Calif., Taft—Citizens will vote on $60,000 bond issue for high school.

Que., Montreal—Bonds for $3,000,000 sold for construction of Catholic Churches in Quebec. Charles A. Stoneham & Co. is in charge.

DAM—HARTFORD, CONN.
Contract No. 10

Bids were received Aug. 21 by the Board of Water Commissioners for the construction of the Richards Corner Dam, Contract No. 10, from, (A) C. W. BLAKESLEE & SONS, New Haven (awarded contract), (B) Larkin & Sangster, Seneca Falls, N. Y., (C) Winston & Co., 290 Broadway, New York, N. Y., (D) Coleman Bros., Chelsea, Mass., (E) T. Stuart & Son Co., Newton, Mass., (F) Peter F. Connolly & Co., Boston, Mass., (G) Bruno & Petitti, Boston, Mass., (H) Hugh Nawn Contracting Co., Boston, Mass., (I) H. S. Kerbaugh, Inc., 6 Church St., New York, N. Y., (J) Fred T. Ley & Co., Inc., Springfield, Mass., (K) Pierson Engineering & Construction Co., Hartford, (L) Walsh Construction Co., Davenport, Iowa, (M) J. F. Cagan Co., Woolworth Bldg., New York, N. Y., (N) Bates & Rogers Construction Co., Chicago, Ill., (O) James A. Hart Co., 256 Broadway, New York, N. Y. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
25 acres clearing and grubbing	$125.00	$125.00	$100.00	$150.00	$125.00	$200.00	$175.00	$150.00	$160.00	$65.00	$200.00	$100.00	$150.00	$125.00	$200.00
26,000 cu.yd. earth excavation in cut-off trench below El. 360	.67	.80	1.15	2.00	1.50	2.25	1.25	1.25	.60	.95	1.00	.80	1.50	3.60	4.00
140,000 cu.yd. earth excavation for dam and highway not in item 2	.35	.40	.40	.40	.38	.45	.60	.55	.45	.64	.48	.40	.60	.40	.65
3900 cu.yd. rock excavation for conduit and under core-wall and waste weir	2.15	3.00	3.00	3.00	3.00	3.50	2.50	2.25	1.60	3.75	3.60	5.50	5 00	5.00	3.00
20,000 cu.yd. rock excavation not included in Item 4	1.48	1.60	1.40	1.50	1.50	1.25	1.75	1.65	1.15	2.00	2.00	3.00	2.00	1.25	2.25
3,000 sq.yd. special preparation of rock surfaces	.50	.45	.40	.50	40	.50	.75	.25	25	.30	.33	.50	.25	.30	.50
85,000 cu.yd. refilling and embanking of soil	.62	.55	.54	.45	40	.50	.50	.55	80	.65	.60	.72	.60	.70	1.00
180,000 cu.yd. refilling and embanking of gravvelly material and rock	.27	.40	.47	.37	40	.31	.40	.45	60	.55	.43	.42	.45	.48	.90
37,000 cu.yd. refilling and embanking of cofferdams	.20	.20	.10	.49	.40	.50	.15	.30	33	.12	.35	.40	.30	.15	.85
5,000 cu.yd. surface dressing and grassing	.70	.80	.60	.50	1 00	1.00	.40	.75	.54	1.00	.82	.75	2.00	.60	1.00
15,700 cu.yd. concrete masonry, Class A	3.90	3.90	3.50	3.80	4.40	3.95	4.75	3.50	4 00	3.00	4 75	4 25	4.00	4.90	5.00
2,000 cu.yd. concrete masonry, Class w	3 95	5.50	5.00	5 50	7 50	6.00	5 00	7 00	5 15	4.50	8.00	7.00	7.00	6.15	6.50
2,000 cu.yd. concrete masonry, Class C	4.20	5.50	6.00	5.50	7 50	6.00	5 00	6 00	5.30	3.00	5.50	7.00	7.00	5.25	8.00
100 cu.yd. concrete masonry, Class D	5.60	9.50	9 00	7.00	12.00	7.00	6.00	8.00	16.00	8.00	10.00	8 00	10.00	13.50	12 00
1,800 sq.ft. finishing concrete surfaces by scrubbing and washing with acid	.08	.08	.10	.10	.05	.05	.25	.05	.32	05	.10	.03	.05	.10	.10
25 cu.yd. brick masonry	14.50	20.00	20.00	16.00	20.00	20.00	15.00	20.00	15.00	25.00	20.00	20.00	10.00	12.50	20.00
Grouting machines and equipment (lump sum)	300.00	500.00	350.00	400.00	500.00	450.00	100.00	100.00	250.00	300.00	1,000.00	4,000.00	400.00	1,000.00	500.00
200 making connections from machines to grout pipes	50	2 00	35	1 00	2 00	1 00	1 00	1 00	1 20	2 50	2 00	5 00	1 00	2 50	2 75
300 cu.yd. grout	4 75	4 00	5 00	5.00	5 50	5 00	6 00	3 00	10 00	10 00	7 00	8 00	6 00	5 00	7.00
3,000 lin.ft. drilling holes in rock and masonry	35	50	40	40	55	50	50	50	44	80	75	35	25	60	1 00
25,000 bbl. Portland cement	1.71	1.65	1 60	1 50	1.75	1 70	1.60	1.90	1.60	1 70	1.75	1 90	1 60	1.75	2 00
800 cu.yd. paving and dry rubble masonry	3 25	3.00	2 50	2 50	3 50	2 00	3 00	4 50	3.30	3 50	3.00	4 00	2 50	1.25	3 50
1,000 cu.yd. riprap	1 30	2 00	1 25	2 00	2 00	1 50	1.00	1 50	1.11	2 50	2 00	3.00	1.50	1.00	2.00
5 ton furnishing and laying c.i. pipe and special castings	50.00	55.00	35.00	60.00	60.00	50.00	50.00	60.00	70.00	100.00	70.00	100.00	50.00	45.00	70.00
1,000 lb. small steel pipe	.03	.06	.04	.05	.06	.06	.10	.04	.06½	.05	.10	.06	.05	.05	.10
40,000 lb. metal for reinforcing concrete and water stops	.04	.04	.04	.03	.04	.04	.04	.02½	.05	.03½	.04	.03½	.04	.03½	.05
35,000 lb. miscellaneous cast iron and steel	.04½	.04½	.05	.05	.06	.07	.04	.03½	.06½	.05	.06	.06	.05	.04	.10
500 lb. bronze and copper	.75	.45	.60	.30	.50	.50	.50	.35	.75	.50	1 00	.50	1.00	1.00	.75
15,000 lb. receiving, hauling, storing and placing metal work furnished by Board	03	.02	.02	.01	.02	.02	01	.00¾	.03	.02	.03	02	.02	.02	.02
200 lin.ft. vitrified pipe, 8 in. or less in diameter	55	.40	.50	.50	.50	.50	1 00	.25	35	.30	1.00	.75	.35	.35	.40
100 lin.ft. vitrified pipe, 10 in. to 15 in. in diametr	1 25	.85	1.00	.70	.85	.80	1.00	.50	75	75	1.50	1.50	.60	.75	.75
3,500 sq.yd. gravel surface for highways	.58	.50	75	40	.60	.50	.25	.60	.65	.50	.50	.80	.50	.50	.60
1,000 lin.ft. wooden guard rails	30	25	25	.30	.35	25	.40	.20	.35	.30	.35	.40	.35	.25	.50
Care and maintenance of highways (lump sum)	500.00	500 00	200 00	500 00	500 00	200.00	100.00	1,000.00	1,800 00	1,000.00	500.00	1,000.00	500.00	600.00	1,500.00
200 cu.yd. gravel and broken stone	2 10	1 50	1 00	2 00	2 00	1.50	1.00	2 00	2.50	1.50	2.00	2.00	2.00	2.25	2.50
100 lin.ft. test borings	4 50	8 00	5 00	4 00	5 00	5 00	†2 00	4 00	7 50	7 00	10 00	†2 00	5.00	10.00	5 00
Extended totals	$357,766	$396,999	$399,540	$414,940	$426,290	$433,195	$438,759	$442,805	$449,646	$461,190	$465,285	$485,539	$486,970	$512,267	$723,860

† These prices excluded in computing average bid.

Ont., London—Utilities Board contemplates office building. E. V. Buchanan, City Hall, Gen. Mgr. Estimated cost, $75,000.

Alta., Calgary—Calgary Roman Catholic District No. 1 will build three schools. Estimated cost, $50,000. A. B. MacDonald, Treas.

Bids In and Contracts Awarded

N. H., Dover—Contract awarded to E. H. FROST, Dover, for addition and alterations to Museum for Woodman Institute.

R. I., Westerly—Contract awarded to CHARLES B. MAGUIRE CO., Providence, at $50,000, for three-story and basement brick bank building for Industrial Trust Co.

Mass., West Springfield—Contract for Carnegie Library at Park and Elm St. awarded to E. T. DAVIS & CO.

N. Y., Jamestown—Contract awarded to NATIONAL ENGINEERING CO., 504 Marshall Bldg., Cleveland, at $200,000, for ten-story building for Chamber of Commerce.

N. Y., New York—(Borough of the Bronx)—(Official)—Contract awarded to R. H. CASEY, Inc., 245 West 16 St., at $175,000, for four-story, 100x200-ft. hospital at 196th St. and Grand Concourse for Home of Holy Comforter. J. B. Snook Sons, 261 Broadway, Arch. Noted July 29 and Aug. 12.

N. Y., New York—(Borough of the Bronx)—(Official)—Contract awarded to WILLIAM CRAWFORD, 5 East 42d St., at $250,000, for three-story, 194x196-ft. brick ayslum at Grand Blvd., 193d St. to Kingsbridge Rd. for Society for the Relief of Destitute Blind.

N. Y., New York—(Borough of Brooklyn)—(Official)—Contract awarded to H. C. STOWE CONSTRUCTION CO., for alterations and additions to P. S. 89 at Newkirk Ave. near East 31st St. Noted Aug. 19.

N. Y., New York—(Borough of Brooklyn)—(Official)—Contract for building for St. John's Hospital for Crippled on President St. awarded to WILLIAM KENNEDY CONSTRUCTION CO., 215 Montague St. Estimated cost, $75,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to JOHN T. BRADY CO., 103 Park Ave., at about $130,000 for five-story, 100x125-ft. parochial school at 329 West 13th St., for St. Bernard's Parish. Noted Sept. 16.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to EDWARD CORNING, 52 Vanderbilt Ave., at $40,000, for alterations to building at 716 Fifth Ave. for Metropolitan Trust Co.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to WILLIAM L. CROW CONSTRUCTION CO., 103 Park Ave., New York, at $50,000, for six-story, 22x109-ft., loft and office building at 24 East 42d St. for William Parsons. H. L. Walker, 103 Park Ave., is Arch.

N. Y., Rochester—Contract awarded to A. W. HOPEMAN & SONS' CO., Rochester, for edifice for Parsells Ave. Baptist Church.

N. Y., Syracuse—Onondago Building and Construction Co., at $202,298, was low bidder for Delaware school at Delaware and Geddes St. Noted Sept. 28.

N. J., Bayonne—(Official)—Contract awarded to E. E. PAUL CO., 101 Park Ave., New York, N. Y., at $45,000, for two-story, 50x77-ft., brick building for New York Telephone Co., 15 Dey St., New York. Noted Sept. 30.

N. J., Hoboken—(Official)—Contract awarded to WHITNEY CO., 1 Liberty St., New York, N. Y., for buildings for Stevens Institute. Ludlow & Peabody, 101 Park Ave., New York, N. Y., Arch.

N. J., Jersey City—John T. Brady Co., 103 Park Ave., New York, N. Y., at $754,840, was low bidder for Hudson County jail. Bids opened Oct. 7. Noted Sept. 23.

N. J., Skillman—Contract awarded to EDWARD F. FAY & SON, Philadelphia, Penn., for building for New Jersey State Village for Epileptics, at $150,000.

Md., Baltimore—Contract awarded to CONSOLIDATED ENGINEERING CO., at $160,000, for 2½-story engineering building for Johns Hopkins University.

D. C., Washington—Upton-Smoot Construction Co., Washington Loan and Trust Bldg., Washington, is low bidder at $50,000, for Casualty Hospital.

Va., Lexington—Contract for three-story brick building for Virginia Military Institute awarded to J. L. CROUSE, Greensboro, N. C., at $90,000. Noted Sept. 30.

Va., Roanoke—(Official)—Bids were received Oct. 8 for auditorium, armory and convention hall: C. H. Turner, $41,274; C. F. Fields, $41,840, and A. L. Marshall, $42,846. Noted Sept. 30.

Ky., Louisville—(Official)—Contract awarded to MODERN BUILDING CO., 519 East Broadway, Louisville, at $42,398, for alterations and additions to Central Colored High School. J. Earl Henry, Arch. Noted Sept. 30.

Ohio, Akron—Clemmer & Johnson Co., Hicksville, submitted lowest bid for armory. Estimated cost between $142,000 and $171,000.

Ohio, Cleveland—Contract awarded to C. N. GRIFFIN CO., 3111 Carnegie Ave., Cleveland, at about $215,000, for school on Elmira Ave., by Board of Education. Noted Sept. 9.

Ohio, Cleveland—Contract awarded to GEORGE A. RUTHERFORD CO., 2160 East 18th St., Cleveland, at about $40,000, for two-story bank building at East 79th St. and St. Clair Ave., for Garfield Savings Co. Noted Sept. 30.

Ohio, Washington C. H.—(Official)—Contract awarded to CULLEN & VAUGHN CO., Hamilton, by Baltimore and Ohio Western R.R. Co., for passenger station. Noted Sept. 30.

Mo., St. Joseph—J. W. Lehr, 1712 Frederick Ave., at $50,000, was low bidder for Physician's and Surgeon's office and store at Seventh and Francis St. Noted Oct. 7.

Tex., Galveston—Contract awarded to BROWN & VUILLEMIN at $100,000, for improvements and extensions to John Sealy Hospital.

Tex., Huntsville—Contract awarded to GOSS CONSTRUCTION CO., Waco, at $68,000, by Board of Regents of State Normal School for science building at Sam Houston Normal school.

Tex. Laredo—Contract awarded to LOUIS V. JAMBERS & CO., San Antonio, at $50,000, for bank building for Laredo National Bank.

Calif., San Pedro—Contract awarded to A. S. O'NEIL, at $43,000 for high school.

Wash., Seattle—Contract awarded to HANS PETERSON at $130,113, for Masonic Temple at Harward Ave. and Pine St. Noted Sept. 9.

Calif., Los Angeles—Contract awarded to ALTA PLANING MILL CO., 830 McGarry St., at $87,000, for seven-story and basement apartment hotel at Lake and Sixth St. for James H. Edmonds, 709 Kingsley Drive.

Calif, Maricopa—Contract awarded to FRED GRIBBLE for high school.

Calif., San Francisco—Contract awarded to LINDGREN CO., at $414,000, by Board of Library Trustees for public library.

Wash., Sedro Woolley—(Official)—Contract awarded to WARRACK CONSTRUCTION CO., Seattle, at $134,763, for hospital buildings at Northern Hospital at Norlum, near Sedro Wolley. Noted Sept. 16.

Ont., Windsor—Contract awarded to P. H. SECORD & SONS, LTD., Brantford, for bank building at Ouellette Ave. and Catham St. for Merchants Bank of Canada. Estimated cost, $100,000.

SEWER SYSTEM, SOUTH BOUND BROOK, N. J.

Bids were received Oct. 11 by the Borough Council for constructing a sewer system from (A) ALLEN ENGINEERING CO., Newark (awarded contract); (B) Utility Construction Co., New Brunswick; (C) Louis J. Seiling, Red Bank; (D) D. M. Rosser, Kingston, Penn.; (E) Charles Ippolito, Oranfe; (F) Louis B. Harrison, 220 Broadway, New York, N. Y.; (G) Edward L. Bader, Atlantic City; (H) Hayman & Goodman Co., Jersey City; (I) John W. Heller, South Orange; (J) Averill-Mathews, Newark; (K) Dock Contractor Co., Hoboken. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K
2,000 lin.ft. 8-in. sewer pipe, 0-6 ft. deep	$0 50	$0 49	$0 40	$0 70	$0 49	$0 45	$0 50	$0 50	$0 60	$0 60	$1 80
11,250 lin.ft. 8-in. sewer pipe, 6-8 ft. deep	.70	.58	.42	.85	.63	.65	.57	.50	.90	.75	2.10
1,825 lin.ft. 8-in. sewer pipe, 8-10 ft. deep	.85	.62	.60	1 00	.93	.90	.83	1 40	1 20	1 00	2 40
100 lin.ft. 8-in. sewer pipe, 10-12 ft. deep	.85	.5	1 00	1 20	1 60	1 50	1.30	2 00	1 50	1.30	3 65
100 lin.ft. 8-in. sewer pipe, 12-14 ft. deep	.90	1.35	1 50	1 65	2 50	2 00	2.60	2 40	2 00	1 70	4 30
100 lin.ft. 8-in. sewer pipe, 14 ft. deep and over	1 10	2 60	2 50	2 20	3 00	2.50	2.90	3.50	3.50	2.20	4 00
125 lin.ft. 10-in. sewer pipe, 0-6 ft. deep	.55	.57	.44	.75	.61	.50	.63	.65	.75	.70	2.00
225 lin.ft. 10-in. sewer pipe, 6-8 ft. deep	.75	.65	.60	.90	.69	.70	.82	.65	1.15	.90	2.30
125 lin.ft. 10-in. sewer pipe, 8-10 ft. deep	.85	.75	.80	1.25	1.16	1.00	.88	1.60	1.40	1.15	2 60
125 lin.ft. 10-in. sewer pipe, 10-12 ft. deep	.95	1.00	1 20	1 75	1 60	1.55	1.72	2.20	1.70	1.50	3.95
100 lin.ft. 10-in. sewer pipe, 12-14 ft. deep	1.10	1.48	1.60	2.00	2.60	2.05	2.30	2.60	2.30	2 00	4 60
25 lin.ft. 10-in. sewer pipe, 14 ft. deep and over	1 25	3.40	2 40	2 25	3 00	2.55	4.00	4.00	3.75	2.50	5.20
1,000 lin.ft. 12-in. sewer pipe, 0-6 ft. deep	.65	.68	.50	.80	.73	.75	.69	.80	1.05	.80	2.10
1,100 lin.ft. 12-in. sewer pipe, 6-8 ft. deep	.90	.84	.65	80	81	.90	.87	80	1.40	1 05	2 45
550 lin.ft. 12-in. sewer pipe, 8-10 ft. deep	1 25	1 06	1 00	95	1 16	1 10	1.00	1.80	1.70	1.50	2.90
460 lin.ft. 12-in. sewer pipe, 10-12 ft. deep	1.30	1.30	1.30	1 25	1.58	1.60	2.90	2.40	2.00	1.80	4.30
700 lin.ft. 12-in. sewer pipe, 12-14 ft. deep	1.60	1.58	2.00	1.75	1.90	2.50	3.60	2.70	2.50	2 30	4 90
225 lin.ft. 12-in. sewer pipe, 14-16 ft. deep	2 00	3.50	2 80	2 00	3 00	3 00	3.90	4.00	3.10	2.90	5.50
200 lin.ft. 12-in. sewer pipe, 16 ft. deep and over	2.25	3.85	3.50	2.25	3.25	4.00	4.40	4.50	4 25	3.50	6.10
72 0-8 ft. manholes	37 00	39.00	70.00	2 50	37.00	50.00	50.00	50.00	42.00	40 00	61.00
50 8-ft. manholes	3 00	5.50	7.00	45.00	4.00	5.00	7.00	3.00	5 00	5 00	6 35
2 siphon chambers	50 00	260 00	680 00	450 00	200.00	700 00	550 00	400 00	500 00	470 00	500 00
6 ton c.i. pipe	40 00	49 00	50 00	35 00	55.00	25 00	65 00	40 00	45 00	50 00	50 00
2,000 waterproof joints	20	.25	15	15	15	15	.14	20	20	15	18
Fill, per cu.yd	.75	.85	50	1 00	1.00	1.00	1.00	.75	.50	.30	.60
200 ft. 5-in. deep holes	.35	.38	.25	.20	1.00	.50	.21	.30	.50	.30	.20
10 cu.yd. concrete	8.50	12.00	14 00	8.00	10.00	10.00	20.00	10.00	10.00	7.00	8 00
Sewage disposal plant (lump sum)	7,000.00	7,490.00	8,700.00	6,500.00	9,300 00	6,000.00	9,160 00	9,500 00	10,000 00	9,490.00	8,480 00
Sludge bed (lump sum)	800 00	1,000.00	1,300 00	1,500 00	525 00	4,000 00	690.00	500.00	800.00	906.00	1,220.00
Extended totals	$28,020	$28,068	$29,733	$36,633	$30,847	$32,769	$33,597	$33,447	$34,162	$38,465	$64,292

RESURFACING, NEWARK, N. J.

Bids were received Oct. 7 by the Board of Chosen Freeholders for resurfacing Sussex Ave. from Summit to Warren St. from (A) Newton Paving Co.; (B) U. T. S. Critchfield; (C) Uvalde Asphalt Co.; (D) Ralph Sangiovanni; (E) Continental Public Works Co.; (F) Union Paving Co.; (G) Standard Bitulithic Co. The item bids were as follows:

	A	B	C	D	E	F	G
21,200 sq.yd. asphalt resurfacing	$1.14	$0 99	$1 10	$1 29	$1 09	$1.04	$1.07
250 sq.yd. asphalt on old concrete	1.25	.90	1 00	1 00	1 25	1.25	1.00
150 sq.yd. brick on old concrete	2 25	40	.75	1 50	1.40	1 25	2.00
200 lin.ft. curb 16x5 in.	.70	.70	.80	.72	.75	.75	.70
50 lin.ft. old curb	.30	.35	.30	30	.35	.45	.30
5 basins with single inlet	100 00	60 00	80 00	85 00	85 00	85 00	95 00
6 basins with old connections	90.00	75.00	75 00	65 00	80 00	85.00	80.00
4 basins with double inlet	90 00	80 00	85 00	100.00	90 00	95 00	100.00
7,500 sq.ft. artificial stone walk	13	.18	.20	13	16½	.16	.12½
Extended totals	$27,438	$23,850	$26,547	$30,172	$26,300	$25,235	$25,781

CATALOG NOTICES

Link-Belt Co., 39th St. and Stewart Ave., Chicago, Ill. General Catalog No. 110. Elevating and conveying machinery, power transmission machinery, crushers, etc. Illustrated, 576 pp., 6½x9½ in.

Alberger Pump and Condenser Co., 140 Cedar St., New York. Bulletin No. 20. Hammond water meters. Illustrated, 24 pp., 6x9 in.

The Master Builders Co., Cleveland, Ohio. Booklet. Saniseal. Liquid preparation for preserving and hardening concrete floors. 8 pp., 3½x7 in.

Bolinders Co., 30 Church St., New York. Catalog No. 1700. Crude oil engines for auxiliary trading vessels. Illustrated, 16 pp., 9x12 in. Catalog in English, Swedish, German, French, Russian. Boilers, steam engines, steam turbines, oil engines, sawmill machinery, etc. Illustrated, 9x12 in.

A. S. Cameron Steam Pump Works, 11 Broadway, New York. Bulletin No. 154. Centrifugal pumps. Illustrated, 16 pp., 6x9 in.

Stephens-Adamson Mfg. Co., Aurora, Ill. Catalog No. 22. "S-A" pivoted bucket carrier. Illustrated, 84 pp., 6x9 in.

Alberger Pump & Condenser Co., 140 Cedar St., New York. Bulletin No. 21. Alberger centrifugal boiler feed pumps, Alberger-Curtis steam turbines. Illustrated, 26 pp., 6x9 in.

SKF Ball Bearing Co., 50 Church St., New York. Bulletin No. 45. SKF ball bearings for car lighting generators. Illustrated, 32 pp., 6x9 in.

PAVING, MEMPHIS, TENN.

Bids were received by the city for paving Main St. from Linden to Calhoun Ave. with wood block, from (A) Koehler Bros.-Fowler Construction Co.; (B) E. J. Wetterstrom; (C) M. E. Larkin; (D) Turner & Thomas; (E) Southern Asphalt and Construction Co.; (F) George O. White & Co.; (G) Memphis Asphalt and Paving Co.; (H) Pugh & Thompson Construction Co.; (I) Pouncey Paving and Construction Co. The item bids were as follows:

	A	B	C	D	E	E	G	H	I
9,200 sq.yd. stone block, brick, etc., removed	$0.095	$0.10	$0.08	$0 08	$0.11	$0 20	$0.10	$0.15	$0.10
128.6 lin.ft. c.i. drain boxes removed	.40	.20	60	08	.05	1.00	.80	.60	.50
320 lin.ft. 6x20 in. granite curb removed, shifted and set	.15	.15	.10	.12	.12	.125	.12	.25	.10
320 lin.ft. 6x20 in. granite curb removed	.09	.05	.06	.08	.09	.10	.10	.15	.10
11 solid curb corners removed	.25	1.00	50	1 00	.50	1 00	1.00	.75	1.50
1 solid curb corner adjusted	.75	2.00	1 00	1 00	1.00	1.00	1 00	.75	1.00
9,200 sq.yd. wood block pavement	1.63	1.65	1.72	1 75	1.73	1.36	1 74	1.68	1.78
9,200 sq.yd. wood block pavement maintenance 5 years	.01	.04	.02	.02	.015	.01	03	.01	.02
248 lin.ft. 6x20 in. granite radius corners furnished and set	.75	.65	75	75	.60	1 00	75	.90	.80
240 lin.ft. 4x16 in., 104x20 in. granite headers furnished and set	50	.40	40	50	45	50	45	.48	.50
1,100 cu.yd. concrete foundation bushing	4 20	3.95	4 00	3 89	4.00	6 00	4 20	4.40	4.90
4,320 sq.ft. concrete sidewalk removed	.02	.01	02	.02	.015	10	.02	.02	.02
4,320 sq.ft. concrete sidewalk laid	.125	.13	12	11	.14	10	.12	.125	.12
735 lin.ft. 18 in. drain pipe laid	.40	.70	45	35	.40	50	.60	.55	.80
100 lin.ft. 15 in. drain pipe laid	.40	.60	30	35	.30	.40	45	.55	.75
1 inlet reconstructed	20.00	15.00	20 00	15 00	20.00	70.00	10 00	22.50	10.00
8 No. 7 inlets	20.00	17.00	19 00	20 00	20.00	30 00	20 00	22.50	18 00
2 man holes	22.00	30.00	25.00	22 50	22.50	30.00	20.00	20.00	20.00
Extended totals	$22,204	$22,563	$22,748	$22,765	$23,011	$23,226	$23,604	$23,649	$24,796

TEMPLE, HILLCREST, LORETTE AND ELGIN ST. SEWERS —BOSTON, MASS.

✚Bids were received June 15 by Patrick O'Hearn, Acting Comr. of Pub. Wks., for the construction of sewers in Temple, Hillcrest, Lorette and Elgin St., from: (A) M. Meehan, (B) A. CEFALO (awarded contract), (C) A. Baruffaldi, (D) West Roxbury Trap Rock Co., (E) Merrimac Construction Co., (F) W. Barrett & Co., (G) McCarthy & Welch, (H) Bruno & Petetti, (I) Coleman Bros., (J) Engineer's Estimate. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
493 lin.ft. 18-in. double strength pipe sewer	$3 50	$3.00	$3 80	$6 00	$4 10	$2.75	$6.27	$4.00	$5 00	$4.50
525 lin.ft. 15-in. pipe sewer	.75	.70	1.00	1 00	1 25	1.20	2.52	2.00	2.80	1.20
438 lin.ft. pipe sewers and 431 lin.ft. 2-ft., 3-in. circular concrete surface drain and removal of old sewer	2 33	2.40	3.00	2 50	3.00	3.41	4.77	4.00	2 00	2.85
1020 lin.ft. 8-in. pipe sewer, 379 lin.ft. of 18-in. dcuble strength, 302 lin. ft. of 13-in. pipe and 151 lin.ft. of 12-in. pipe and 292 lin.ft. of 10-in. pipe surface drain	1 00	1.40	1.80	2 00	2.10	2.50	2.62	3.00	3.40	1.65
199 lin.ft. 15-in. pipe surface drain	.70	.70	1.35	90	1 00	1.25	2.27	1.00	2.00	.80
220 lin.ft. 12-in. pipe surface drain	60	.70	1.00	85	90	1.15	2.00	1.00	2 00	.70
840 lin.ft. 10-in. pipe surface drain	50	.50	1.50	.75	90	1.00	2.00	.90	2 00	.65
322 lin.ft. 6-ft. circular concrete conduit	6 00	3.75	15.50	10.00	4.40	5.25	7.77	6.00	9.00	4.50
128 lin.ft. 5 ft. 3-in. circular concrete conduit and 121 lin.ft. 18-in. double strength pipe sewer	8.40	5.25	8.00	13.00	7.00	7.75	10.00	8.00	9.00	6.65
390 lin.ft. 5-ft. circular concrete conduit and 21 lin.ft. 18-in. double strength and 369 lin.ft. pipe sewer	8 40	5.00	6.00	7 50	6.70	7.75	9.50	8.00	9.50	6.30
501 lin.ft. 4 ft. 3-in. circular concrete conduit, 462 lin.ft. and 30 lin. ft. of 12-in. pipe sewer	3.60	2.25	3.50	3.00	3.75	3 15	4.77	5.00	4.00	2.50
229 lin.ft. 3-ft., 9-in. circular concrete conduit, 247 lin.ft. 12-in. pipe sewer	2.60	2.50	3.50	3.00	3.00	3.15	5.00	6.00	4.00	3.40
715 lin.ft. 3-ft., 6-in. circular concrete conduit, 727 lin.ft. 12-in. pipe sewer	5.00	4.50	6.50	4.25	6.75	6.15	10.00	8.00	6.00	6.60
500 cu.yd. earth excavation below grade	....	3.00	01	3.00	1.50	1.50	1.50	1.00	2.00	1.25
100 cu.yd. earth excavation above grade in outside trench	1.00		01	.50	.75	1.25	1.00	.75	1.00	1.00
2300 cu.yd. rock		6.00	.01	5.00	4.00	4.00		3.00	3.00	5.00
600 cu.yd. gravel refill	1.00		.01	2.00	.50	1.75	1.25	1.00	.90	1.40
175 M ft. b.m. spruce lumber for sheeting	16.00		25 00	.01	40.00	25.00	24.00	20.00	20.00	27.00
40 M ft. b.m. 2-in. planed and matched sheeting	35 00	40.00	.01	50.00		30.00		25.00	40.00	40.00
25 M ft. b.m. 3-in. planed Georgia pine	35.00		.01	.01		35.00		25.00	40.00	50.00
16 M ft. b.m. spruce lumber for platforms	35.00		.01	01	10.00	25.00		40.00	40.00	40.00
5400 lin.ft. pipe under drain	.60	.25	.25	10	.15	.25	.15	.75	.20	.15
4000 cu.yd. class A concrete	7.00	6.50	7.00	6.00	6.50	7.00	6.85	7.00	7.00	7.50
300 lin.ft. 10-in. pipe catch basins drain	.50	.50	.50	.50	.60	.75	.75	1.00	1.00	.10
1600 lin.ft. 6-in. pipe for chimneys	.25	.10	10	.05	.10	.10	.15	.05	.10	.15
300 lin.ft. 6-in. pipe house drain in main trench	1.00	.25	.01	1.00	.10	.25	.20	.60	.75	.25
26 lin.ft. 6-in. pipe house drain	2.00	.50	.01	.50	1.50	1.00		.60	.75	.60
250 lin.ft. house drain relaid	1.00	.50	01	1.00	.50	1.00	1.00	.60	1.00	.60
330 slants in new masonry	.05	.10	01	.10	.05	.10	.10	.10	.10	.15
70 lin.ft. 8 and 10-in. pipe sewer connected	1.00	.50	01	.50	.25	1.00	1.00	.75	1.00	.25
22 manholes in sewer	45.00	40.00	50.00	50.00	60 00	35.00	75.00	35.00	.75	45.00
30 manholes on surface drain	45.00	35.00	40.00	50.00	35.00	30 00	40.00	35.00	.60	36.00
6 special manholes on sewer	50.00	70.00	60.00	50.00	65.00	35.00	100.00	35.00	125.00	85.00
4 special manholes on surface drain	50.00	75.00	50.00	50.00	45.00	35.00	100.00	35.00	110.00	75.00
20 catch basins	45.00	45.00	50.00	50.00	45.00	50.00	50.00	40.00	50.00	50.00
1 armhole invert rebuilt	40.00	5 00	.01	5.00	10.00	10.00	5.00	40.00	20.00	5.00
10 cu.yd. other brick masonry	18.00		01	.01		15.00	14.00	15.00	16.00	14.00
1 connection between new and existing conduit	20 00	10.00	10.00	10.00	10.00	10.00	10.00	5.00	15.00	10.00
1 cradle for pipe not exceeding 16-in. diam		10.00	10.00	5.00	10.00	5 00	....	10.00	40.00	10.00
1 cradle for pipe exceeding 16-in. diam		10.00	10.00	5.00	10.00	5.00		10.00	40.00	10.00
'iiiiifl, strength pipe at % discount	75%	78%	75%	75%	72%	70%	73%	75%	63%	70%
$2400 list value double strength pipe at % discount	70%	65%	75%	65%	60%	60%	66%	70%	57%	y5%
100 lin.ft. of 10-in., 30-in. pipe for brook construction and setting grates	3.00	.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.50
Extended totals	$70,358	$70,252	$72,457	$76,429	$79,250	$82,562	$82,807	$83,612	$88,661	$85,153

Construction News

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

Massachusetts—Milford, Attleboro & Woonsocket St. Ry. asked City Council, Franklin, for franchise for relocation of tracks on Central St. H. C. Page, Worcester, Gen. Mgr.

Rhode Island—Rhode Island Co. asked City Council, Pawtucket, for franchise to relocate tracks and lay additional tracks on Broad St. from Exchange St. to Miller St. Howard Elliott, Boston, Mass., Pres. and Gen. Mgr.

New York—International Ry. Co. plans new electric line from Buffalo to Niagara Falls. H. J. Mack, Supt. and J. C. Sheldon, Buffalo, Pur. Agt.

New York—City Council, Utica, granted 50-year franchise to New York State Ry. for extension of line on Elm St. to Neilson St. via James St. B. E. Tilton, Utica, Gen. Mgr. Noted Sept. 16.

Pennsylvania—Press reports state that an electric railway will be constructed from Columbus to Mayville, C. E. Bentley, Jamestown, N. Y., Engr.

Pennsylvania—Project to construct an electric-railway from Milford northeast to Port Jervis, about eight miles, is being revived. Gifford Pinchot, Milford, interested.

Pennsylvania—Mahoning & Shenango Ry. & Light Co. plans to construct an extension of its lines from Beaver Falls to Newcastle, Ohio. G. J. A. Paul, Youngstown, Ry. Mgr.

Pennsylvania—Pottsville & St. Clair Electric Ry., recently incorporated, will construct a railway from Pottsville to St. Clair. W. B. Rockwell, Pres.

Pennsylvania—South Mountain St. Ry. recently incorporated, will apply for charter for electric railway from Kleinfeltersville to Womelsdorf.

West Virginia—Surveys being made for branch line of Western Maryland R.R. from Wyatt to Bingamon Creek to carry coal.

North Carolina—Rutherford Interurban Ry. Co., recently incorporated, plans line from Atlantic coast to Ashville and state line.

North Carolina—Board of Trade, Louisburg, contemplates line from Louisburg to connect with Atlantic Coast Line R.R., about 35 miles. F. A. Turner, Louisburg, interested.

Florida—Atlantic Coast Line R.R. contemplates extension of line from Sebring to Immokalee, via Ft. Thompson, about 80 miles. E. B. Pleasants, Wilmington, N. C., Ch. Engr.

Tennessee—Illinois Central R.R. plans extension and improvement of yards and roundhouse at Jackson. A. S. Baldwin, Chicago, Ill., Ch. Engr. Estimated cost, $150,000.

Tennessee—Central Power Co., Chattanooga, recently incorporated with $50,000 capital, will build line from Chattanooga to Cleveland, Tenn., about 25 miles. G. B. Adams, interested.

Ohio—Cleveland Ry. granted franchise for electric-railway through Parma Township to Bean Rd. G. L. Radcliffe, Cleveland, Gen. Mgr.

Ohio—East Linden Electric Ry. Co. granted franchise by City Council, Columbus, for construction of two new lines. Noted Oct. 21.

Indiana—City Council, Rockport, granted franchise to Evansville Ry. Co. for line on Washington St. to bank of Ohio River. W. A. Carson, Evansville, Gen. Mgr. and Pur. Agt.

Illinois—John E. Melick interested in railroad between Pearl and Kampsville, 11 miles. Surveys being made.

Illinois—Plans being considered for electric railway from Moline to Coal Valley, about six miles. Estimated cost, $60,000.

Minnesota—Duluth & Northern Minnesota Ry. will extend its line to Knife River, Minn. John Millen, Duluth, Pres. and Gen. Mgr.

Montana—Northern Pacific Ry. contemplates spur to mines of Iron Mountain and Iron Mountain Tunnel Co. F. G. Prest, St. Paul, Minn., Pur. Agt.

Missouri—Kansas City, Mexico & Orient Ry. plans to start work soon on proposed new extension, also contemplates improving line south of Wichita. H. B. Holmes, Kansas City, Res. Engr.

Missouri—United Rys. Co. plans to improve street car lines in downtown district of St. Louis. Estimated cost, $125,000. C. O. Jenks, Portland, Ore., Gen. Mgr.

Texas—San Antonio & Austin Interurban has revived plans to construct interurban electric-railway between San Antonio and Austin, about 80 miles. Proposed railway will pass through New Braunfels, Hunter, San Marcos, Kyle, Buda and Manchaca.

Washington—Everett Ry. Light & Water Co., received petition from Riverside Commercial Club for extension of its lines on Riverside Ave. L. Skipwith, New York, N. Y., Pur. Agt.

Oregon—Robert E. Strahorn, Portland, interested in company to build railway from Bend to Klamath Falls, via Silver Lake, from Silver Lake to Lake View and from Ben to connection with Oregon-Washington Ry. & Navigation Co., about 400 miles.

California—City Ry. received franchise from City Council, Los Angeles, for line on South Park Ave. from 13th St. to Slauson Ave.

California—Bids will be received by Board of Public Works until Nov. 10 for railway from Rosasco into Hetch Hetchy reservoir, about 67 miles. M. M. O'Shaughnessy, City Engr. Noted Oct. 7.

Alaska—It is reported that at next session of congress appropriation of $10,000,000 will be asked for continuing construction of Government Alaska R.R.

Bids In and Contracts Awarded

Indiana—Lafayette & Northeastern Traction Co. has awarded the contract for a railway from Lafayette to Kankakee, Ill., to M. A .TALBERT CO.

Minnesota—Contract awarded to CHARLES MAGNUSON by Duluth & Iron Range R.R. Co. for four miles of spur track to Winton.

Oklahoma—Press reports state contract awarded to ARBUCKLE CONSTRUCTION & IMPROVEMENT CO., Arbuckle, Okla., for 176 miles of line for Southern Light, Power & Ry. Co.

LIGHT, HEAT AND POWER

Proposed Work

Mass., Southwick—Southwick Electric Co. plans to construct a power house and install a 100-hp. engine.

R. I., Providence—Narragansett Electric Lighting Co. will build new sub-station on Admiral St.

N. Y., Buffalo—(Official)—Bids will be received until 2:30 p.m., Nov. 5, by State Hospital Commission, Capitol, Albany, for additional boiler capacity, heating work at Buffalo State Hospital. E. S. Elwood, Secy. State Hospital Comn. (See adv.) Noted Sept. 16.

Penn., Philadelphia—Misericordia Hospital plans to build power plant at 53rd St. and Cedar Ave.

Md., Baltimore—Board of Estimate authorized H. K. McCay, Harbor Engr., to prepare plans for hydro-electric plant at Jones' Falls to supply electricity for lighting the city.

N. C., Hickory—City Council rejected all bids for 30-year franchise to operate electric-light and power and fuel and heating plant. New bids will be received. Noted Sept. 9.

Miss., Carriere—Electric-light plant of Lacey Lumber Co., recently destroyed by fire, will be rebuilt.

Wis., Medford—Medford Light & Power Co. plans to extend and improve its plant.

Wis., Mineral Point—Mineral Point Public Service Co. granted permission to issue $50,000 capital stock. Proceeds will be used for improving and extending lighting and heating system.

Wis., Stevens Point—Bids will be received by William Kittle, Secy., Bd. of Normal Regents, Madison, until 10.30 a.m., Oct. 30, for electric wiring of main building and wing of State Normal School.

Iowa, Nashua—Cedar Valley Electric Co. has purchased present power site and plans to rebuild old dam with concrete. Company recently granted 25-year franchise.

Iowa, Waverly—Application made by Cedar Valley Hydraulic Co. for franchise to construct poles for light, power and heating purposes.

Minn., Ely—See item under "Water Supply."

S. D., Emery—Franchise granted to Brady Electric Co. to install and operate electric-light plant.

N. D., Glenburn—M. Thayer granted franchise for electric-light plant.

Mo., Steelville—Steelville Electric-Light & Power Co. applied to Public Service Commission for permission to construct electric-light plant. Estimated cost, $10,000.

Tex., Decatur—See item under "Water Works."

Tex., Gatesville—An expenditure of $10,000 approved by A. Ferguson, Governor, for heating and power plant at State Training School for Boys.

Okla., Paden—Election will be held Nov. 23 to vote to grant franchise to A. G. Rogers and W. E. Davis for electric-light plant.

Colo., Alamosa—Colorado Power Co. plans an expenditure of $20,000 for improving its plant.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Bronx)—(Official)—Lowest bid for installing electric equipment in Evander Childs high school at East 184th St. and Field Pl. submitted by Jandous Electric Equipment Co., 109 West 31st St., at $25,110.

N. J., Newark—Contract for heating system for Milford School awarded to J. F. KELLY, at $20,888.

Del., Milton—Contract for municipal electric-light plant awarded to W. W. CONWELL at $8,600.

N. C., Lumberton—Contract for improving municipal electric-light system awarded to TUCKER & LAXTON, Charlotte. Noted Sept. 30.

Ohio, Youngstown—Contract for new building for Mahoning County Light Co. awarded to HELLER BROS. CO.

Mich., Ishpeming—Contract for power house in North Lake District for Cleveland Cliffs Iron Co. awarded to LOUIS ERICKSON & SON.

Iowa, Luverne—Contract for transmission line from Luverne to Livermore awarded to McCONNELL-LANFORD ELECTRIC CO., Boone, at $7,918. Noted Sept. 23.

Kan., Paola—Contract for heating plant at Ursuline Academy awarded to F. M. SPENCER & SON, at $79,000.

BRIDGES

Proposed Work

R. I., Woonsocket—Bids being received by F. A. Mills, City Engr., for three reinforced-concrete bridges. Estimated cost, $60,000.

N. Y., Hanover—City plans an expenditure of $7,000 for bridge over Silver Creek at Howard St.

N. Y., Scarsdale—Village will build bridge over tracks of New York Central R.R. at Popham Rd. Plans approved by Public Service Commission.

N. J., South Orange—Bids will be received by Walter A. Evans, Chn., Eighth District Bridge Comn., Bd. of Chosen Freeholders of Essex County, Newark, until Nov. 1, for bridge on Pierson Rd. over east branch of Rahway River, South Orange Township.

Penn., Butler—Willis Whited, Bridge Designer, State Highway Dept., Harrisburg, will prepare plans for overhead bridge at foot of Main St. Estimated cost, $50,000.

Penn., Johnstown—(Official)—Bids will be received until 11 a.m., Nov. 6, for Horner St. Bridge. Estimated cost, $50,000. G. A. Flink, Harrisburg, Penn., Engr. Noted Aug. 19.

W. Va., Huntington—Huntington-Chesapeake Bridge Co., recently incorporated, will build bridge across Ohio River from Huntington to Chesapeake, Ohio. J. C. Miller and Thomas W. Harvey, Huntington, interested.

Ga., Roswell—Plans being considered for steel bridge over Chattahoochee River. Estimated cost, $6,000.

Fla., Tampa—Bids will be received by W. P. Culbreath, Clk., County Comrs., until Nov. 26, for bridge over Little Manatee River.

Fla., Tavares—See item under "Streets and Roads."

Miss., Durant—Bids will soon be received by Board of Supervisors of Holmes County, Lexington, for steel bridge over Bowles Creek, near Durant.

Miss., Grenada—Bids will be received by John S. King, Clk., Bd. of Superv., until Nov. 1, for steel bridge across Long Creek District No. 4.

Miss., Natchez—Bridge will be constructed over Homochitto River by Board of Supervisors of Franklin County. Estimated cost, $6,000.

La., New Orleans—Bids will be received until Nov. 16 by A. J. Ricks, Comr., Dept. of Pub. Finances, Accounting Div., for viaduct at West End Lake Shore Park.

Tenn., Selmer—Appropriation of $5,050 made by County Court for eight steel bridges.

Ohio, Cleveland—Bids will be received until 10 a.m., Nov. 3, by E. G. Krause, Clk., Cuyahoga County Commissioners, for bridge work under report No. 3629. W. A. Stinchcomb, County Engr.

Ind., Liberty—(Official)—Bids will be received by G. W. Wray, Audr., Comrs. of Union County, until 2 p. m., Nov. 1, for two concrete bridges.

Minn., Red Wing—Plans being considered by city and county for bridge across Mississippi River at Red Wing and filling in channel and constructing hard road.

Kan., Kansas City—Commissioners appointed by Commercial Club of Kansas City have not decided on character of approaches for bridge over Kaw River. Harrington, Howard & Ash, Orear-Leslie Bldg., Kansas City, Mo., Engr. Noted Sept. 2.

Kan., Kansas City—Bids will soon be received by County Commissioners of Wyandotte County for bridge in Central Ave.

Kan, Lawrence—Bids will be received by Clerk of Douglas County until noon, Nov. 6, for bridge on county line between Douglas and Franklin Counties.

Mo., Joplin—Plans being considered for viaduct over tracks of St. Louis & San Francisco R.R. on Kentucky Ave. J. B. Hodgden, Comr. of Streets.

Tex., Orange—See item under "Streets and Roads."

Tex., Waco—(Official)—Citizens defeated $10,000 bonds for bridges. Noted Sept. 20.

Okla., Oklahoma—Resolution passed by County Commissioners authorizing construction of a number of bridges. Estimated cost, $11,897.

Colo., Denver—Plans approved for reinforced-concrete bridge across Huerfano River north of Walsenburg. Estimated cost, $13,000.

Idaho, Harrison—City has retained A. L. Jaqueth, Great Falls, Mont., to estimate cost of concrete structure across Cœur d'Alene River to replace wooden trestle.

Calif., Cardiff—Plans being completed by J. Butler, County Surveyor for reinforced-concrete bridge on State Highway near Cardiff. Estimated cost, $10,000.

Calif., Richmond—Plans prepared for steel viaduct over Atchison, Topeka & Santa Fe Ry. at 16th St. Estimated cost, $10,000.

China—(Official)—Bids will be received until 9 a.m., Dec. 7 by Robert W. Hunt & Co., Monongahela Bank Bldg., Pittsburgh, Penn., for steel bridgework for Canton-Hankow Ry., Hupei-Hunan Section. Noted Aug. 19. (See adv.)

Bids In and Contracts Awarded

Mass., Nantucket—Bids were received by Massachusetts Highway Commission for pile bridge at Nantucket from Frank C. Taylor, 170 Kempton St., New Bedford, $12,765, and W. H. Ellis & Son Co., East Boston, $17,500.

Mass., Oak Bluffs—All bids received by State Highway Commission, 15 Ashburton Pl., Boston, for bridge and approaches at Oak Bluffs and Edgartown rejected.

N. Y., Lyons Falls—(Official)—Contract awarded to W. S. RAE, Amsterdam, for completing bridge over Blank and Moose Rivers. Estimated cost, $59,385. Noted Oct. 14.

N. J., Paterson—Contract for widening Hope Ave. Bridge awarded to JOHN WHERLÆ, Jr., at $4,098. Noted Oct. 7.

Penn., Philadelphia—Philadelphia & Reading Ry. awarded contracts for bridge work as follows: Contract 1 bridge abutment and removal of core to C. P. BOWER, Philadelphia, at $32,915; Contract 2, superstructure to AMERICAN BRIDGE CO., Philadelphia, $28,415; Contract 3, waterproofing bridge to BARBER ASPHALT PAVING CO., Philadelphia, at $2,389.

Fla., Daytona—(Official)—Contract for steel work for highway drawbridge across St. Johns River between Volusia and Seminole Counties awarded to VIRGINIA BRIDGE & IRON CO., Roanoke, Va., approaches and foundations to BEASLEY CONTRACTING CO., Savannah, Ga. Atlantic Engineering Co., Savannah, Ga., Engr.

Ind., Bedford—See item under "Streets and Roads."

Iowa, Clinton—Contract for six wooden bridges awarded to BUTTERFIELD & MITCHELL.

Iowa, Waukon—Contract for steel superstructures for two bridges awarded to CLINTON BRIDGE CO., at $11,807. Noted Oct. 7.

Minn., Breckenridge—Contract for six steel culverts and 11 steel bridges awarded to T. GLEASON, Minneapolis. Noted Sept. 30.

Mo., St. Louis—Bids were received for Chouteau Ave. viaduct as follows: Frank C. Mueller & Co., $131,939; Hanick Quarry & Construction Co., $137,471; Heman Construction Co., $141,270. Noted Oct. 7.

WATER WORKS

Proposed Work

Maine, Anson—Installation of water system postponed indefinitely. Estimated cost, $120,000. G. H. Viles, Clk., Bd. of Comrs. Noted Aug. 5.

Mass, Lynn—(Official)—Bids will be received until 10:30 a.m., Nov. 9, by Thomas Campbell, 2d, Comr. of Water and Water-Works for Ipswich River pumping station. Noted Oct. 21. (See adv.)

N. Y., Buffalo—Bids will be received until Oct. 30 by Francis G. Ward, Comr. Pub. Wks., for 12-in. high pressure pipe line from Main and Perry St. to the Terrace.

N. Y., Ilion—City postponed awarding of contract for filtration plant and pipe line until 1916. Estimated cost, $80,000. C. C. Hopkins, Rochester, N. Y., Engr. Noted Oct. 14.

N. Y., LeRoy—Bids will be received until Nov. 3 by Board of Water and Light Commissioners for 125,000-gal. tank. James P. Wells, LeRoy, Consult. Engr.

Penn., Charleroi—(Official)—Tri-Cities Water Co. retained Chester & Fleming, Hydraulic Engr., to prepare plans for reinforced-concrete settling basin at filtration plant.

Penn., Johnstown—Johnstown Water Co. plans $75,000 bond issue for additions to its plant. Noted Aug. 19.

Penn., Tamaqua—(Official)—All bids received Oct. 5 for reservoir in Owl Creek rejected. New bids will be received. Noted Aug. 12 and Oct. 21.

Penn., West Leesport—Election will be held Nov. 2 to vote on $11,000 bonds for water system.

Va., Blackstone—Water works and electric light plant will be rebuilt, according to press reports.

Va., Waverly—Election will be held to vote on $55,000 bonds. Part of proceeds will be used for water system.

W. Va., Huntington—Application made to State Public Utilities Commission for reduction in water rates. If request is not granted municipal water system will be constructed.

N. C., Durham—Bonds for $250,000 for water system will be sold Nov. 10. Noted Oct. 21.

Fla., Jacksonville—Bids will be received until Nov. 8 by F. W. Bruce, Ch. Engr. Port Comrs., for 50,000-gal. water tank at Municipal Terminals.

Fla., St. Augustine—S. G. Pollard, 3422 Burch Ave., Cincinnati, Ohio, retained by city to investigate water system.

Fla., St. Cloud—City plans to install water system.

Ala., Florence—Election will be held Nov. 15 to vote on $210,000 bonds for purchase and improvement of water system and installation of filtration plant. Noted Oct. 21.

La., Independence—City plans water works. Xavier A. Kramer, Magnolia, Miss., Engr. Estimated cost, $30,000.

La., Oakdale—(Official)—We have been advised bids will not be received for water system till 1916. Estimated cost, $25,000. R. E. Ricketts, City Secy. Noted Oct. 14.

Ky., Flemingsburg—City Council plans survey for water system.

Ky., Williamsburg—Election will be held Nov. 2 to vote on $25,000 bonds for water system.

Ohio, Barnesville—At November election citizens will vote on additional levy for improving water system, including filtration plant and standpipe.

Ohio, Byesville—Election will be held Nov. 2 to vote on $40,000 bonds for water system. Noted Sept. 30.

Ohio, Columbus—Bids will be received until Nov. 11 by Ohio Board of Administration, Oak and Ninth St., for water softening equipment for Institute for Feeble Minded. A. F. Shepherd, Pres.

Ohio, Lima—Investigation of better water supply being made for city.

Ohio, Middletown—S. G. Pollard, 3422 Burch Ave., Cincinnati, preparing plans for improvements to water system.

Ohio, Warren—(Official)—Local Public Service Corporation retained Chester & Fleming, Hydraulic Engr., Pittsburgh, Penn., to prepare plans for improvements to filtration plant.

Ohio, Zanesville—City Council contemplates relining and enlarging two reservoirs. Estimated cost, $25,000.

Mich., Birmingham—City voted bonds for water main extensions.

Mich., Hancock—Plans prepared by City Engineer for water mains in Lake St. and Hancock Ave. accepted by City Council.

Ill., Elmhurst—(Official)—Bids will be received until 7:30 p.m., Nov. 3, by City Council for tower, pumping station, tank, reservoir and well house. Arthur H. Kochasky, City Clk. (See adv.)

Ill., Wheaton—(Official)—Election will be held Nov. 12 to vote $35,000 bonds for improving and enlarging water system. Noted Oct. 21.

Iowa, Germania—Bids will be received until Oct. 29 by M. H. Stoddard, Town Clk., for laying water mains and constructing water system. Noted Aug. 12.

Minn., Ely—Citizens voted $40,000 bonds for improvements to water system and electric-light plant. Noted Sept. 30.

Minn., Virginia—City plans improvement of water system in spring. Estimated cost, $50,000.

Minn., Worthington—Bonds for $10,000 voted by citizens for extension of water and system.

Kan., Caldwell—State Board of Health ordered installation of water system by July, 1916.

Kan., Caney—City ordered to install water system by July, 1916 by State Board of Health.

Kan., Cedarville—State Board of Health has ordered installation of water system by July, 1916.

Kan., La Harpe—State Board of Health ordered installation of water system by July, 1916.

Kan., Manhattan—City plans an expenditure of $72,600 for improving water system.

Kan., Marion—State Board of Health ordered installation of water system by January, 1917.

Kan., Morrill—(Official)—We have been informed that citizens did not vote $10,000 bonds for water system as stated in our issue of Oct. 21. M. Lichty, City Clk. Noted Oct. 21.

Kan., Paola—City ordered to install water works by July, 1916 by State Board of Health.

Wyo., Thermopolis—(Official)—Citizens voted $40,000 bonds for extending water system. Noted Oct. 14.

Ark., Heber Springs—Bonds for $90,000 for water and sewerage system will be sold. R. D. Alexander, Oklahoma City, Okla., Engr. Noted Sept. 2.

Ark., Tillar—City contemplates new well for additional water supply. Peter Sain, Mayor.

Tex., Decatur—City plans to improve water system and electric-light plant. Estimated cost, $10,000.

Tex., Seadrift—A. Landa, Victoria, presented proposition to Commercial Club for municipal water system. A. D. Powers, Seadrift, interested.

Tex., Timpson—City plans municipal water system.

Colo., Akron—(Official)—Citizens voted $20,000 bonds for water system. Noted Oct. 7.

Idaho, Council—Bids will be received by City Clerk until Nov. 5 for water system. Estimated cost, $20,000. Noted Sept. 30.

Wash., Lakewood—Town Council contemplates municipal water system. Estimated cost, $10,000.

Ore., Baker—Citizens voted $110,000 bonds for improving municipal water system. Noted Sept. 23 and Oct. 7.

Que., Lennoxville—(Official)—Bids will be received some time next year for improving and extending water system. Noted Oct. 14.

Ont., Brockville—Bids will soon be received for filtration plant. G. W. Bryson, Engr.

Bids In and Contracts Awarded

Mass., Boston—(Dorchester and Roxbury)—(Official)—Contract awarded to JOHN GUARENO, 45 Brook Ave., Roxbury, at $10,316, for laying water mains. Noted Oct. 21.

Mass., Salem—(Official) — Contract for intake and gate house at Wenham Lake awarded to BAY STATE DREDGING & CONTRACTING CO., Boston, at $13,800. Noted Oct. 21.

N. Y., Hudson—(Official)—Work of laying new water mains will be done by Commission of Public Works under supervision of M. J. O'Hara, City Engr. Noted Oct. 21.

N. Y., New York—(Official)—Northeastern Construction Co., 225 Fifth Ave., New York, submitted lowest bid for two steel frame buildings for drainage chambers, Shafts 11 and 21, Catskill Aqueduct, under Contract No. 166. Noted Oct. 7.

Penn., Coatesville—Contract for high service system awarded to PARTRIDGE & BURKE, Hohokus, N. J., at $23,834. Noted Sept. 23.

N. C., Lumberton—Contract for filtration plant at municipal water system awarded to TUCKER & LAXTON, Charlotte. Noted Sept. 23.

N. C., Mt. Olive—Contract for two miles of water main awarded to MOREHEAD CITY PLUMBING CO., at about $10,000.

Tenn., Columbia—Contract for filtration plant awarded to INTERNATIONAL FILTRATION CO., Chicago, Ill. Noted Aug. 12.

Ohio, Cincinnati—Contract awarded to U. S. CAST IRON PIPE & FOUNDRY CO., at $34,807, for pipe and castings.

Ind., Miller—(Official)—Contracts for water system awarded as follows: General construction to SHEA & CO., pipe to NATIONAL TUBE CO., tank to CHICAGO BRIDGE & IRON CO. Estimated cost, $14,000. Noted Sept. 30.

Ill., Poplar Grove—Contracts for water system awarded as follows: 5,000 ft. of 4-in. pipe line to ERNEST RIES, Woodstock; pump to FAIRBANKS, MORSE & CO., Chicago, Ill. Noted Oct. 7.

Ill., Quincy—(Official)—Contract for intake pipe line awarded to JOSEPH G. FALCON, 818 Reba Pl., Evanston, by Citizens Water Works Co.

Kan., Kansas City—Contract for improving Quindaro pumping station awarded to COLUMBIAN STEEL TANK CO., 1605 West 12th St., Kansas City, at $4,000.

Kan., Manhattan—City will make improvements to water system by day labor. Noted Act. 28.

Tex., Galveston—Major & Seagraves, at $13,411, submitted lowest bid for reconstructing 36-in. submerged water main Noted Sept. 23 and Oct. 7.

Ore., Amity—J. P. O'Neill, 1175 Burrace St., Portland, low bidder at $11,000 for steel and $9,777 for wood, for water works. Noted Sept. 30.

Calif., Los Angeles—Bids were received by Board of Public Service Commissioners for furnishing 1397 tons of water pipe as follows: American Cast Iron Pipe Co., $31.50 per ton at San Pedro and $32.30 per ton at Los Angeles; Hunter Brockerage Co., $29.15 per ton at San Pedro and $29.95 at Los Angeles; U. S. Cast Iron Pipe & Foundry Co., $30.90 at San Pedro and $31.70 and $33.70 at Los Angeles.

Ont., Lambeth—Contracts for water system awarded as follows: Contract A and B to LONDON FOUNDRY CO., 369 Thames St., London; contract C and D to EWALTER ENGINEERING CO., Middlemarch; waterpipe to GARTSHORE-THOMSON PIPE CO., Stuart St., West Hamilton; elevated steam tank, DES MOINES BRIDGE & IRON CO., Pittsburgh, Penn.; concrete reservoir to E. W. KELLEY, Lambeth.

Ont., Mimico—See item under "Sewers."

SEWERS

Proposed Work

Mass., Fairhaven—Sewer will be built through Rogers estate. Estimated cost, $6,500.

Mass., Haverhill—L. C. Lawton, City Engr., submitted report estimating cost of trunk sewer through North Ave. from head of Marsh Ave. to a point near Snows Brook to Primrose St. at $13,400.

R. I., Woonsocket—Bids will be received until Nov. 3 by Board of Aldermen for surface water drain in Carrington Ave. and Maple St. Frank H. Mills, City Engr.

Conn., Manchester—Appropriation of $12,000 made for storm water sewers. J. Frank Bowen, South Manchester, City Engr.

Conn., Wilson—Plans being considered for improving sewer system. Estimated cost, $12,000.

N. Y., Canadaigua—Plans being prepared by L. P. Adams, Arch., Masonic Temple Bldg., Geneva, for sewage disposal plant between Geneva and Canadaigua for Ontario County Almshouse.

N. Y., Greenwich—(Official)—Bids will be received until 2 p.m., Nov. 1, by Board of Trustees for sewers in Elm Ave., Main and Bridge St. Charles E. Perry, 36 State St., Albany, Engr. Noted Oct. 21. (See adv.)

N. Y., New Rochelle—Board of Estimate authorized $7,500 bond issue for sewer at Upton Park.

N. Y., Niagara Falls—Board of Public Works recommended sewers in New York Ave. from Highland Ave. to Sugar St. Estimated cost, $16,000.

N. Y., Yorktown—Bids will be received until Nov. 9 by State Hospital Commission, Capital, Albany, for sewers and sewage-disposal plant at Mahansic State Hospital, Yorktown. Noted Oct. 21.

N. J., Atlantic Highlands—(Official)—Bids will be received until 8 p.m., Nov. 3, by Mayor and Council for 2½ miles of 8- to 10-in. sewer. W. T. Franklin, Borough Clk. H. O. Todd, Borough Engr. Noted Aug. 12. (See adv.)

N. J., Hoboken—Bids will soon be received for two-trunk sewerage system. Estimated cost, $500,000. James Fuertes, 132 Nassau St., New York, N. Y., Engr.

Penn., Allentown—C. D. Weirbach, City Engr., estimated cost of sewer system with disposal plant on Kline's Island at $1,318,250. Noted Sept. 9.

Penn., Columbia—Election will be held Nov. 2 to vote on $100,000 bonds for sewer system.

Penn., Pittsburgh—Bids will be received until Oct. 29 by City Controller for sewers in portions of various streets.

Penn., Punxsutawney—Application of borough for sewer system approved by State Department of Health.

Penn., Scranton—Samuel G. Dixon, State Comr. of Health, has plans for comprehensive sewer system. Estimated cost, $5,000,000.

Penn., Waynesboro — City Council will build concrete sewer.

Va., Hampton—Citizens contemplate bond election for rebuilding sewer system.

Va., Waverly—Election will be held to vote on $55,000 bonds. Part of proceeds will be used for sewage-disposal plant.

W. Va., Ceredo—Election will be held Nov. 6 to vote on $55,000 bonds for sewer system.

Fla., Jacksonville—Bids will be received by George M. Powell, Chn., until Nov. 4, to furnish and place about 40 piles with c.-i. cradle and removal and delivery to City Property Yard of about 371-ft. c.-i. pipe, also for 484-ft. of 8-in. c.-i. sewer pipe.

Fla., Miami—Bids will be received until Nov. 4 by B. H. Klyce, City Engr., for centrifugal pumps and electric motor for sewage pumping station at Riverside. Noted Sept. 23.

Fla., St. Cloud—City plans to install sewer system. Fred B. Kenney, City Clk.

Ohio, Findlay—(Official)—Sewer on Chamberlain Hill in South Findlay will not be constructed. City Council authorized sewer from Pearl St. to Edgar Ave. W. K. Stringfellow, City Engr. Noted Oct. 14.

Ohio, Martins Ferry—Bids will be received about next spring for sanitary sewer system. Estimated cost, $15,000. Carl P. Lash, City Engr.

Ohio, Toledo—County Commissioners voted $60,000 bonds for five miles of sewer in Home Acres, West Toledo.

Ohio, Vermilion—Bids will be received by Lewis Clattner, Village Clk., until noon, Nov. 16, for sanitary sewer system and sewage disposal plant. Morris Knowles, 2541 Oliver Bldg., Pittsburgh, Penn., Consult. Engr.

Ohio, Wellsville—Plans being prepared by J. M. George, City Engr., for brick storm sewer.

Ind., Elwood—A. D. Moffet, Engr., submitted report estimating cost of sewer system to drain business section at $14,000.

Mich., Benton Harbor—City Council will build sewer in Parsons St.

Mich., Birmingham—Bonds issued for sanitary sewers.

Ill., East Moline—B. Warner, City Engr., will prepare plans for sewer system.

Ill., Grayville—Board of Local Improvements plans sewer system. Estimated cost, $22,016.

Ill., Watseka—Election will soon be held to vote new sewer system and improve old one. Charles E. Blake, Engr.

Wis., Green Bay—Bids will be received until 10 a.m., Nov. 4, by Committee of Sewers and Plumbing of Common Council at office of City Clerk, for sewer construction.

Iowa, Davenport—Press reports state citizens contemplate new sewer system.

Iowa, Marengo—City plans to install sewerage system.

Iowa, Muscatine—(Official)—We have been informed that construction work on sewer in Mad Creek district will not be started for a year. C. H. Young, City Engr. Noted Oct. 7.

Iowa, Oakland—Bids will be received until Nov. 23 by Elvin W. Wentz, City Clk., for 13,500 ft. of sewers. Noted Oct. 7.

Iowa, Rinard—Surveys being made for sewer system and septic tank.

Minn., Worthington—Citizens voted $30,000 bonds for improving and extending sewer system.

Kan., Anthony—Citizens voted in favor of sewer system.

Kan., Iola—Plans being prepared by Theodore Bartlett, City Engr., for extension of sewer system.

S. D., Winner—Election will be held Nov. 1 to vote on $10,000 bonds for sewerage system.

N. D., Wahpeton—Bids will be received by S. H. Murray, City Audr., until 7:30 p.m., Nov. 1, for extending sewers in District Nos. 1 and 3.

Mo., Odessa—Plans being prepared by Black & Veatch, Engr., 507 Interstate Bldg., Kansas City, Mo., for sewer system.

Tex., Corsicana—City voted $20,000 bonds for sewer improvements. Noted Sept. 30.

Tex., Quanah—Proposition being considered by City Council for installation of sewer system.

Tex., San Benito—(Official)—Bids will be received by J. H. Lyons, Mayor, and City Council, until noon, Nov. 24, for sanitary sewage-disposal plant. Noted Oct. 7 and 14.

Tex., Sherman—Plans being prepared by Charles Saville, Engr., Dallas, for sewer system and sewage-disposal plant. Noted Oct. 21.

Tex., Uvalde—Plans being prepared by N. Werenskiold, Consult. Engr., Box 511, Dallas, for sewage disposal plant. Noted Oct. 14.

N. M., Albuquerque—James N. Gladding, City Engr., preparing plans for pump for sewerage pumping station.

Wash., Seattle—(Official)—Board of Public Works has postponed final action for outfall sewer in Seaview Ave. for about six months. Noted Sept. 30.

Ore., Portland—Plans being prepared for reconstructing wood box sewer in Mill and Water St. Estimated cost, $10,000.

Calif., Auburn—Election will be held Nov. 16 to vote on $15,000 bonds for extending sewer system. Noted Sept. 23.

Calif., San Diego—Bids will be received for completing Ocean Beach sewer system.

Calif., Santa Monica—City Engineer submitted report to City Council estimating cost of storm sewer system at $250,000.

Que., Ste. Agathe des Monts—Quimet & Lesage, 76th St. Gabriel St., Montreal, prepared plans for sewage pumping plant. Estimated cost, $125,000.

Ont., London—City Council contemplates storm sewer on Grand Ave.

Ont., Parry Sound—Bids being received by A. Murray, Town Engr., for sewer.

Alta., Edmonton—(Official)—We have been informed that election will not be held to vote on $250,000 bonds for sewage-disposal plant as stated in our issue of Sept. 30.

Bids In and Contracts Awarded

N. Y., Albany—Contract awarded to R. D. WOOD, Philadelphia, Penn., at $80,900, for pumping station at Tivoli St. for sewer system.

N. Y., Newburg—Contract awarded to CHARLES SPINO, Newburg, for sewer in Grand St.

N. Y., New York—(Borough of Brooklyn)—(Official)—Frank Merindino, 556A 17th St., Brooklyn, low bidder at 90% for sewer in Kings Highway from East 16th St. to East 17th St.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to W. J. FITZGERALD, 547 West 45th St., New York, at $10,492, for receiving basins, Nos. 1, 2, 3 and 4. Noted Oct. 14.

N. Y., New York—(Borough of Queens)—(Official)—Contracts awarded for sewers in various streets as follows: (1) in Hunters Point Ave. to J. L. SIGRETTO CO., 20 Curtis Ave., Richmond Hill, at $57,720; (2) Kimball Ave. to GREEN CONTRACTING CO., 292 Fifth Ave., Brooklyn, at $22,847; (3) Herkimer Ave. to JAMES H. JOHNSON, Beekman and Cliff St., New York, at $15,755; (4) Smart Ave., to GREEN CONTRACTING CO., at $5,810; (8) Willard Ave., to J. L. SIGGRETTO CO., at $8,787. Noted Oct. 7.

N. J., Fairview—Bids were received for sewers in Lincoln St. and Wilker St. (low bidders) Bergen Contracting Co., $14,984 and Thomas Cavannaugh, $15,755. Noted Sept. 30.

N. J., Glen Gardner—Contract for additions to sewage-disposal plant at Sanitorium for Tuberculosis Diseases awarded to NEW YORK SEWAGE DISPOSAL CO., New York, N. Y., at $15,727. Noted Sept. 23.

N. J., Newark—Contracts awarded to JOSEPH CRESTONE, Montclair, for storm water sewer in Park Ave. and to JAMES P. BOYLAN, Belleville, for sanitary sewer.

N. J., Seaside Park—(Official)—Contract for sewers and sewage disposal plant awarded to CANTRELL CONSTRUCTION CO., 21st and Sedgely Ave., Philadelphia, Penn., at $21,892. Noted Oct. 7.

N. J., South Boundbrook—Contract for sewer system awarded to ALLEN ENGINEERING CO., Newark, at $28,020. Noted Sept. 30.

Md., Baltimore—Contracts for sewer construction awarded as follows: Contract No. 160, District No. 46, to M. O'HERRON & SONS, 843 North Howard St., Baltimore, at $41,600; contract No. 161, District No. 46, to CONTINENTAL CONTRACTING CO., 1508 Linden Ave., Baltimore, at $32,500; Contract No. 159, District No. 46, to BOYLE & LOHMULLER CO., Calvert Bldg., Baltimore, at $75,000.

W. Va., Parkersburg—Contract awarded to C. KENNEDY & SON, Parkersburg, at $6,000, for sanitary sewers in various streets. Noted Oct. 14.

N. C., Albemarle—Contract for sewer system awarded to ACME PLUMBING CO., Charlotte, at $20,079. Noted Oct. 7.

N. C., Durham—Contract for sanitary sewers, manholes and flush tanks awarded to BLANKENSHIP, McCLELLAND & MENDENHALL, Charlotte; contract for pipe to CHATTANOOGA PIPE CO., Chattanooga, Tenn. Noted Oct. 14.

Miss., Dlo—Contract for sewer system awarded to O. C. EURE, Hattiesburg, at about $12,000.

Tenn., Chattanooga—Contract awarded to JOHN NOLL, SR., Chattanooga, at $10,625, for extending Broad St. sewer.

Ohio, Dayton—Contract for sewers in District No. 6 awarded to WORTH & BLESSING, at $30,830. Noted Oct. 7.

Ohio, Hamilton—Contract for storm sewer awarded to JOHN H. TRUNCK, at $4,266.

Ind., Indianapolis—Contracts for sewers awarded to AMERICAN CONSTRUCTION CO., at $26,499, for sewer in Michigan St. and to GEORGE SCHAUER & SON, at $14,257, for sewer in Germania Ave. Noted Sept. 30.

Mich., Allegan—Contract awarded to H. A. HOXIE, Grand Rapids, by Board of Public Works for north side sewer.

Ill., Marion—Contract awarded to WILLIAMS & TOWNSEND, Marion, at $12,925, for sanitary sewer system.

Ill., Salem—Contract awarded to FRANK MANULLA, Niles, for sanitary sewer system. Noted Sept. 2.

Wis., Ashland—(Official)—All bids received Oct. 14 for sewers rejected. W. C. Morris, City Clk. Noted Oct. 7.

Wis., Manitowac—Contract for concrete sewer awarded to A. H. PITZ, at $5,388. Noted Oct. 21.

Iowa, Davenport—Contract awarded to ADOLPH KAHLES, for sewers in Eastern Ave.

Iowa, Elliott—(Official)—Contract awarded to WILLIAM S. DOLL, Omaha, Neb., at $5,743, for sanitary sewers. Noted Oct. 14.

Iowa, Sioux City—Contract for North Morningside, sewer system awarded to S. T. LEEDER, at about $11,000. Noted Sept. 29.

Minn., Cokato—Contract for sewer system awarded to ISTRUP & OLSON, CITY HALL, Minneapolis, at $5,150. Noted Sept. 23.

Minn., St. Paul—Contract for sanitary sewer system awarded to O'Neil & Preston, St. Paul, at $24,645, cancelled as no money is available in sewer maintenance account of general fund. Noted Oct. 7.

Mont., White Sulphur Springs—Contract awarded to J. KELLEY, Judith Gap, at $4,000, for sewer work.

Ore., Forest Grove—Contract for sanitary sewer system awarded to ELLIOTT CONTRACTING CO., Portland, at $58,448. Noted Oct. 21.

Calif., Compton—James Kennedy, Washington Bldg., Los Angeles, at $42,462, submitted lowest bid for sewer system. Noted Oct. 7.

Calif., Sacramento—Contract awarded to CONTRA COSTA CONSTRUCTION CO., at $53,164, for sewer system through Blauth tract.

Calif., Stockton—Contract for storm sewer in North, East and Madison St. awarded to A. B. MUNSON & SONS, Stockton, at $26,008.

N. S., New Glasgow—Contract for sewer in Trenton Rd. awarded to CHISHOLM & CO., New Glasgow. Noted Sept. 30.

Ont., Mimico—Contracts awarded to HARVEY STEWART & CO., Nova Scotia, at $64,493 water and sewer systems and pumping station and to F. F. FRYE, Toronto, at $15,253 for disposal plant. Noted Aug. 12.

Ont., New Toronto—Contracts awarded to HARVEY STEWART & CO., Nova Scotia, for sewer and water mains, at $59,064 and for pumping station, $5,429, to F. F. FRYE, Toronto, for sewage disposal plant at $15,253 and to ONTARIO SEWER PIPE CO., Toronto, for pipe. Noted July 29.

Ont., Toronto—See item under "Streets and Roads."

Garbage

Proposed Work

N. J., Glen Ridge—City Council received plans for garbage incinerator. Estimated cost, $13,000.

N. J., Nutley—Election will be held Nov. 2 to vote on bonds for garbage incinerator. Noted Sept. 23.

Minn., Duluth—Plans being prepared for garbage incinerator. Estimated cost, $50,000. James A. Farrell, Comr. of Pub. Wks. Noted Oct. 21.

Mo., Kansas City—Council contemplates garbage incinerator. Estimated cost, $400,000.

Bids In and Contracts Awarded

N. J., Newark—Bids received Oct. 21 by Board of Street and Water Commissioners for collecting and disposing of refuse for five years as follows: Newark Paving Co., Newark, $898,200; Henry Van der Roest, Newark, $1,298,250, and J. T. Shanley, Newark, $1,195,000. Noted Oct. 14.

STREETS AND ROADS

Proposed Work

N. Y., Albany—(Official)—Bids will be received until 1 p.m., Nov. 11, by Edwin Dulley, Comr. State Highways, for road work in various counties. (See adv.)

N. Y., Hudson—Bonds for $29,000 for streets voted.

N. Y., New York—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Borough Pres., Room 2, Borough Hall, until 11 a.m., Nov. 4, for repairing sidewalks on various streets.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., Room 2032, Municipal Bldg., until 2 p.m., Nov. 5, for regulating and repaving various streets and avenues of the borough.

N. J., Camden—Board of Chosen Freeholders of Camden County plans to repave Camden-Moorestown Turnpike between 34th and 37th St.

N. J., Hackensack—Bids will be received by Board of Chosen Freeholders of Bergen County until Oct. 29 for paving portions of Essex St.

N. J., New Brunswick—(Official)—Bids will be received until 10 a.m., Nov. 9, by Asher Atkinson, City Engr., for paving seven streets with brick, asphalt block or warrenite.

N. J., Newton—Bids will be received by Board of Chosen Freeholders of Sussex County until Nov. 11 for improving a number of macadam roads. Noted Oct. 21.

Penn., Allentown—(Official)—We have been informed that the city will not receive bids for paving Howard and Tenth St. as stated in our issue of Oct. 14. C. D. Weirbach, City Engr.

Penn., Pittsburgh—Bids will be received by County Controller until 10 a.m., Oct. 29, for improving Beatty, Clinton and Frankfort Rd.

Md., Baltimore—Bids will be received by County Clerk until Nov. 3 for grading 5.21 miles of road between H. D. Gibsons and E. K. Jesses and 2.93 miles between Castle Run and Top Copper Ridge. H. P. Coleman, Richmond, State Highway Comr.

Va., Norfolk—(Official)—Bids will be received until 1 p.m., Nov. 4, by Board of Control for paving work on Granby St. W. H. Taylor, Jr., City Engr. (See adv.)

W. Va., Wellsburg—Election will be held about Jan. 1 in Brooke County to vote on $600,000 bonds for roads.

W. Va., Wheeling—Bids will soon be received for paving 13th Ave. from Fifth to Sixth St., E., Fifth St. from 13th Ave. to North Blvd., alley between Artisan Ave. Fourth, 19th and 20th St., 11th Ave. between Shelton Ave. and 16th St., 9th St. from 11th to 13th Ave.

N. C., Bryson City—Bids will be received until Nov. 1 by T. M. Howerton, Engr., for grading about 6.5 miles along Creek to Almond and nine miles of highway from Swain to Macon county line.

N. C., Franklin—Election will be held Nov. 16 in Macon County, Cowee Township, to vote on $15,000 bonds for improving a number of roads.

N. C., King—Election will be held Nov. 16 in Yadkin Township to vote on bonds for road construction.

N. C., Shelby—Citizens voted $30,000 bonds for road work in Cleveland County. Noted Sept. 23.

Fla., Ft. Myers—Citizens of Lee County voted $350,000 bonds for portion of Tamiami Trail from Ft. Myers to Dade county line.

Fla., Ft. Pierce—Bids will be received until Nov. 2 by Commissioners of St. Lucie County for hardsurfacing Fellsmere-Sebastian Rd. J. E. Fultz, County Clk. Noted Oct. 21.

Fla., Tavares—Bids will be received until Nov. 1 by J. H. Compton, Chn., Comrs. of Lake County, for 2½ miles of roadway in connection with fill and bridge across marsh at Clermont.

Fla., Titusville—Bids will be received until Nov. 9 by Commissioners of Brevard County for about 68 miles of road. Estimated cost, $150,000. S. A. Osteen, Chn.

Miss., Greenwood—Citizens voted $7,500 bonds to pave Carrollton Ave. from Yazoo & Mississippi Valley R.R. to corporate limits.

Miss., Kosciusko—Bids will be received until Nov. 1 by J. H. Oliver, Clk., County Bd. of Supervs. for sale of $50,000 bonds for roads in District No. 1.

La., Monroe—Bids will be received by H. D. Apgar, Mayor, until Nov. 5, for approximately 37,000 sq.yd. gravel with tarvia top and 24,800 ft. of curb and gutter.

Tenn., Chattanooga—Engineering Department of Hamilton County preparing estimates as to cost of constructing approximately two miles of concrete roadway on Chattanooga-Graysville pike and Chattanoogo-Dayton pike.

Tenn., Kingston—Bonds for $32,000 voted for roads and pike in Fifth District between Kingston-Rockwood pike and Hood's Landing.

Ky., Bellevue—(Newport post office)—Election will be held Nov. 2 to vote on $23,000 bonds to improve Taylor Ave. from Fairfield to Grandview Ave. Noted Oct. 21.

Ky., Morganfield—Contract will soon be awarded for constructing Uniontown and Boxville Rds.

Ohio, Cincinnati—Frank Krug, City Engr., submitted report to City Council estimating cost of improving various streets as follows: Marshall Ave. from Spring Grove to Colerain Ave., granite, $9,423; Selim Ave. from Westwood to Lionell Ave., bituminous macadam, $21,461; brick, $28,241, granite, $38,281; Colerain Ave. from Bank to York St., and 6-in. water main asphalt, $11,084, bitulithic, $11,474.

Ohio, Granville—(Official)—Bids will be received by Roe E. Morrow, Village Clk., until noon, Oct. 28, for draining, curbing and paving Broadway St. from east corporation line to west corporation line. (See adv.)

Ohio, Newark—Bids will be received by W. C. Christian, Dir. of Pub. Ser., until noon, Oct. 29, for paving roadway of Park Ave. and resurfacing Hudson Ave.

Ohio, Zanesville—(Official)—Election will be held Nov. 2 to vote on $22,250 bonds for paving. Noted Oct. 14.

Ind., Bloomfield—Bids will be received by Commissioners of Greene County until 2 p.m., Nov. 2, for macadamized road in Fairplay Township. G. E. Kidd, Audr.

Ind., Bloomington—Bids will be received by Commissioners of Monroe County until 2 p.m., Nov. 2, for roads in Van Buren and Washington Townships. W. F. Kinser, Audr.

Ind., Danville—Bids will be received by Commissioners of Hendricks County until 10:30 a.m., Nov. 5, for roads in Center and Middle Townships. L. W. Borders, Audr. Noted Sept. 9.

Ind., Delphi—Bids will be received by Commissioners of Carroll County until 12 a.m., Nov. 2, for constructing roads in Jefferson, Deer Creek, Monroe and Rock Creek Townships. M. G. Haun, Audr. Noted Sept. 9.

Ind., Evansville—Bids will be received by Commissioners of Vanderburgh County until 10 a.m., Nov. 4, for macadam road in Pigeon Township. C. P. Beard, Audr.

Ind., Ft. Wayne—Bids being received for paving Rudisill Ave. from Calhoun St. to Broadway.

Ind., Fowler—Bids will be received until 1 p.m., Nov. 1, by Commissioners of Benton County, for road in Balboa Township. W. Mankey, Audr.

Ind., Goshen—Bids will be received until 2 p.m., Nov. 1, by Commissioners of Elkhart County, for concrete road in Harrison Township. John W. Brown, Audr. Noted Sept. 16 and Oct. 14.

Ind., Greencastle—Bids will be received until 2 p.m., Nov. 1, by Commissioners of Putnam County, for macadam road in Greencastle Township.

Ind., Greensburg—Bids will be received by Commissioners of Decatur County, until 1 p.m., Nov. 1, for road in Washington Township. L. W. Sands, Audr.

Ind., Indianapolis—Board of Public Works plans to pave South Capitol Ave. between Merrill and McCarty St. Estimated cost, $10,694.

Ind., Martinsville—Bids will be received until 12 a.m., Nov. 2, by Commissioners of Morgan County for road in Brown Township. S. Watson, Audr.

Ind., Muncie—Bids will be received by F. M. Williams, Audr., Comrs. of Delaware County, until 10 a.m., Nov. 3, for two roads in Liberty Township.

Ind., New Albany—Bids will be received until 10 a.m., Nov. 11, by Commissioners of Floyd County for constructing 10,200-ft. of road in New Albany Township.

Ind., Noblesville—Bids will be received by Commissioners of Hamilton County until 10 a.m., Nov. 2, for constructing roads in Fall Creek, Wayne, Washington and Noblesville Townships. W. O. Horton, Audr.

Ind., Peru—Bids will be received by Commissioners of Miami County until 12 a.m., Nov. 8, for concrete road in Peru Township. F. K. McElheny, Audr.

Ind., Petersburg—Bids will be received until 2 p.m., Nov. 2, by Commissioners of Pike County, for rock road in Jefferson Township. John D. Gray, Audr.

Ind., Plymouth—Bids will be received until 1:30 p.m., Nov. 2, by Commissioners of Marshall County, for three roads in German Township. G. F. McCoy, Audr.

Ind., Shelbyville—Bids will be received until 10 a.m., Nov. 3, by F. W. Fagel, Audr., Comrs. of Shelby County, for two roads in Washington Township.

Mich., Houghton—County Board of Supervisors will ask for an appropriation of approximately $100,000 for roads in 1916.

Mich., Reeman—Citizens voted $35,000 bonds for gravel road in Sheridan Township.

Ill., Des Plaines—Bids will be received about Nov. 1 by John A. Bell, City Clk., for 4,500 sq.yd. of concrete pavement. Noted Oct. 14.

Ill., Springfield—(Official)—Bids will be received at office of State Highway Commission until 11 a.m., Nov. 3, for approximately 4,140 ft. of State Aid Highway in Sangamon County. Estimated cost, $14,460.

Kan., Marysville—Bids will be received by R. F. Gallup, County Engr., until noon, Nov. 4, for grading ¾ mile of road.

Kan., Pittsburg—Citizens contemplate rock road between Pittsburg and Kansas City.

Kan., Topeka—Contract will be awarded about next spring for paving Kent Rd. Work includes about 23,000 sq.yd. of pavement and curbing. Walter J. Arnold, County Engr.

Mo., Bolivar—Election will be held Nov. 2 in Polk County, Humasville Special Eight Mill Road District, to vote on $30,000 bonds for road improvements.

Mo., Higginsville—Contract will soon be awarded for about eight blocks of vertical fiber brick pavement on concrete base and 1¼ miles curb and gutter.

Mo., Jefferson City—(Official)—Election will be held Nov. 9 to vote on $100,000 bonds for roads. Noted Sept. 2 and Oct. 7.

Mo., Kansas City—Property owners contemplate reducing grade on Main St. Estimated cost between $150,000 and $200,000. Curtis Hill, City Engr.

Mo., Pittsville—Citizens contemplate rock road across Johnson County.

Mo., Springfield—All bids received for nine miles of roads in Ingram Special Road District rejected. New bids will be received. Estimated cost, $20,000.

Tex., Batesville—(Official)—Citizens voted $15,000 bonds for road improvements in Zavalla County. Noted Oct. 7.

Tex., Beaumont—Bids will be received about Nov. 19 for 11 miles of road between Hardin, Liberty and Jefferson Counties.

Tex., Belton—Road bonds for $250,000 for roads in Bell County Road District No. 10 approved by Attorney General, Austin.

Tex., Columbus — Report has been submitted estimating cost of 49 miles of gravel road between Houston and San Antonia at $100,000.

Tex., Corsicana—Citizens voted $80,000 bonds for street improvements. Noted Sept. 23.

Tex., Dallas — Bryan Parkway will be paved between Greenville Rd. and Munger Blvd.

Tex., El Paso—Citizens of El Paso County voted $300,000 bonds for road work. Noted Sept. 23.

Tex., Orange—Election will be held Nov. 20 in Precinct No. 4 to vote on $50,000 bonds for roads and bridges.

Tex., Rusk — Election will be held Nov. 16 in Cherokee County Road District No. 1 to vote on $150,000 bonds for road construction.

Okla., Clinton—City has postponed paving Frisco Ave. indefinitely. Noted Oct. 7.

Okla., Okmulgee—City Commissioners plan an expenditure of about $50,000 for paving South Morton Ave., South Okmulgee and South Alabama St.

Idaho, Lewiston—Citizens of Nez Prece County, Road District Nos. 3 and 26 voted to construct road from Lewiston to Washington State line, about 11 miles.

Wash., Aberdeen—City Council plans an expenditure of about $16,000 for improving Curtis St.

Wash., Coquille—Contract will soon be awarded for Coos Bay-Coquille Rd. Estimated cost, $35,000.

Wash., Seattle—Commissioners of King County will soon award contract for grading and graveling 1½ miles of highway east of Enumclaw to connect with McClellan Pass Highway and for two miles of highway between Newport and Hazelwood.

Wash., Spokane—County Commissioners will soon award contract for 35 miles of roads.

Ore., Portland—Plans being considered for extending William Ave. from connection with railway bridge and Broadway Bridge to Interstate Bridge. Estimated cost, $70,000.

Ore., Salem—State Highway Commission has appropriated $175,000 for improving highways in Wasco, Crook, Columbia and Jackson Counties.

Calif., Arcadia—Bids will be received by George E. Grimes, City Clk., until Nov. 4, for about 16 miles of oiled macadam roadway and 10,000-ft. of concrete curb and gutter. Noted Oct. 23.

Calif., Bakersfield—Bids will be received by County Board of Supervisors until Nov. 1 for paving one mile of Brundage Lane and three miles of Bellview Rd.

Ont., Ottawa—An expenditure of $600,000 planned for macadam highway to St. Lawrence River, the cost to be borne by the city, government and towns and villages through which it will pass.

Ont., York—Bids will soon be received for paving Lauder and Glenholme Ave. Estimated cost, $8,000. F. Barber, 57 Adelaide St., E., Toronto, Engr.

Alta., Beverly—By-law will be voted on Nov. 6 to provide $10,000 for clearing and grading streets.

Bids In and Contracts Awarded

Mass., Boston—Bids were received by State Highway Commission for asphalt macadam road in Grafton and Upton as follows: Perini Construction Co., Ashland, $48,103; Charles E. Horne, Millbury, $50,056; Alco Contracting Co., Boston, $54,471.

Mass., Taunton—(Official)—City will pave a number of streets by day labor. Estimated cost, $14,300. Noted Oct. 14.

N. Y., Herkimer—Lowest bid received for road from Eagle Bay to Big Moose was that of B. F. S. Co., Herkimer, at $48,803.

N. Y., New York—(Official)—(Borough of Bronx)—Contracts for paving awarded as follows: Powell Ave. from Tremont to Zerega Ave. to BURNSIDE CONTRACTING CO., at $12,105; Walker Ave. from intersection of Westchester Ave. and former Main St. to easterly terminus of land acquired for West Farms Rd. to Eastern Blvd., to ANABEL CONSTRUCTION CO., at $76,333; Rosedale Ave. and Kingsbridge Terrace to MUNICIPAL ASPHALT CO., at $5,124 and $4,323 respectively. Noted Oct. 21.

N. Y., New York—(Borough of Brooklyn—(Official)—Lowest bids for improving Bridge St. from Sands to Nassau St. and regulating, grading, curbing and laying sidewalks on Ditmas Ave. from East 87th St. to Ralph Ave., Ralph Ave. from northeasterly side of 85th St. to Old Canarsie Ave. and East 83rd St. from Ditmas Ave. to Old Canarsie Ave. submitted by Charles A. Myers Construction Co., at $6,804 and M. T. Maher, at $9,932.

N. Y., New York—(Borough of Manhattan)—(Official)—Low bids received Oct. 19 for improving various streets and avenues of the city were as follows: 27th St. from Lexington to Madison Ave., 39th St. from Park Ave. to Broadway and from 8th to 11th Ave., 65th and 66th St. from Amsterdam to West End Ave., Aztec Asphalt Co., Inc., 90 West St., New York, at $7,084, $36,686 and $12,663 respectively; 95th St. from Madison to Fifth Ave., Cleveland Trinidad Paving Co., Flushing, N. Y., at $3,563; 35th St. from West Side of Madison Ave. to East Side of Sixth Ave., 37th St. from First to Second Ave., 38th St. from Madison to Sixth Ave., Sicilian Asphalt Paving Co., 41 Park Row, New York, at $9,076, $5,598 and $9,816 respectively; 124th St. from First to Third Ave., Columbus Ave. from 84th to 96th St., Barber Asphalt Paving Co., Woolworth Bldg., New York, at $9,776 and $36,319 respectively; Eighth Ave. from 119th to 125th St. and from Seventh to Eighth Ave., Asphalt Construction Co., 298 Broadway, New York, at $50,767; Perry St. from Greenwich to West St., W. J. Fitzgerald, 547 West 45th St., at $9,509; 179th St. from Northern to New Haven Ave., Barber Asphalt Paving Co., Woolworth Bldg., New York, at $2,579. Noted Oct. 14.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for regulating and repaving East 18th St. from Broadway to Fourth Ave. awarded to W. J. FITZGERALD, 547 West 45th St., New York, at $5,412. Noted Oct. 21.

N. Y., New York—(Borough of Queens)—(Official)—Low bids received Oct. 5 for improving Jerome Ave. from Boyd to Greenwood Ave. and South Ave. from New York Ave. to Rockaway Turnpike were from William T. Maxwell and Peace Bros., for furnishing and delivering 200,000 gal. of road oil from Warner-Quinlan Asphalt Co. Noted Sept. 30.

N. J., Newark—Contract for paving North Sixth St. awarded to GLENFIELD CONSTRUCTION CO., at $8,332. Noted Sept. 23 and Oct. 14.

N. J., Newark—Contract for improving Essex Ave. from Summit to Warren St. awarded to W. T. CHRITCHFIELD, Jersey City, at $23,850. Noted Sept. 30 and Oct. 14.

N. J., Newark—Contract for paving Lyons Ave. awarded to NORTHERN CONSTRUCTION CO., Newark, at $62,970.

Del., Wilmington—Contract for stone road on Kennett Pike awarded to I. J. HOLLINGSWORTH, Elsmere, at $17,493. Noted Oct. 7.

Md., Salisbury—Contract for two miles of State-Aid highway upon or along Salisbury-Anderson's Hill Rd. awarded to JUNIATA CO., 410 Empire Bldg., Philadelphia, Penn., at $13,035. Noted Oct. 7.

W. Va., Adamston—(Official)—Contract for grading, paving and curbing Pike St. awarded to SISLER & MORSE, Marietta, Ohio. Noted Oct. 14.

W. Va., Moundsville—Contract for improving Grant Ave. and Fourth St. awarded to STRINGER & SPRINGER, Wheeling at about $7,000. Noted Oct. 7.

Tenn., Blountville—Contract for grading, draining and macadamizing roads awarded to PATTON BROS., Bluff City.

Ky., Newport—(Official)—Contract for paving Tenth St. awarded to SCHOOLFIELD & JONES, Newport, at $9,478. Noted Oct. 14.

Ky., Williamsburg—Contract for road from Williamsburg to McCreary County line, about 12 miles, awarded to A. CARSON, Knoxville, Tenn.

Ohio, Bexley—Contract for paving Main St. awarded to GEORGE H. HEFFNER & SON, Celina, at $37,375.

Ohio, Cincinnati—(Official)—Contract for improving West Sixth St. awarded to HENKEL & SULLIVAN, Cincinnati, at $80,918. Noted Oct. 7.

Ohio, Cincinnati—(Official)—Contract for improving Wayne Ave. from Stewart Ave. to Martin Rd., Springfield Township, awarded to PAUL MENGER, Cincinnati, at $6,770. Noted Sept. 30.

Ohio, Columbus—Lowest bids received by County Commissioners for improving various roads were as follows: Frantz Rd. in Washington Township, R. W. McCoy, Columbus, at $5,971; McCoy Rd., Perry Township, J. M. Snouffer, Columbus, at $10,311; Miller Rd., Perry Township, Wilson Contracting Co., Newark, at $5,028; Ryan Ave., Franklin Township, Highway Contracting Co., Columbus, at $5,275; Cambridge Rd., Perry Township, Wilson Construction Co., at $8,350. Noted Sept. 23.

Ohio, Toledo—Contract for repaving Ontario St. awarded to H. P. STREICHER CO., at $30,186.

Ind., Bedford—Contract for Bedford-Oolitic Rd. and concrete bridge across Salt Creek awarded to EWING SHIELDS, Seymour, at $61,916.

Ind., La Porte—Contract for Schultz Rd. in Dewey Township awarded to LOUIS MARTINE, at $12,424.

Ind., Vincennes—Contract for two roads awarded to W. E. RUBLE and K. JESSE WILLIAMS, at $4,200 and $2,190 respectively.

Ind., Vincennes—Contract for W. C. Secrest gravel road awarded to W. L. ENSLEY, at $8,114.

Ind., Winamac—Contract for gravel road awarded to JOHN W. BLAIR, Winamac, at $8,265.

Ill., Alton—Contract for paving Summit, Mill and West Fourth St. awarded to M. BURKE, Alton, at $17,493.

Minn., Hibbing—Contract for Malmquist Rd. awarded to G. MALMQUIST.

Minn., Little Falls—Contract for repairing road along line between Little Falls and Belle Prairie awarded to C. A. MATHEWSON.

Minn., Thief River Falls—(Official)—Contract for graveling State Rd. No. 1 awarded to M. BANUT & CO., St. Cloud, at $8,169. Noted Oct. 14.

Kan., Concordia—Contract for 40,000 sq.ft. of sidewalks awarded to FRANCOUER BROS.

Mo., Kansas City—Contract for paving West 14th St. awarded to J. E. WELSH, 1122 East Gillham St., Kansas City, at $5,358; South Woodland Ave. to WILLIAM HARTE, 311 Midland Bldg., Kansas City, at $6,646.

Mo., St. Joseph—Contract for paving 11th St. from Powell to Grand Ave. awarded to YOUNG BROS. CONSTRUCTION CO., at $15,662.

Ark., Conway—Contract for approximately 13,000 sq.yd. of paving in District No. 4 awarded to McCULLOCH & HALTER, Conway, at 89c. per sq.yd.

Tex., Marshall—Contract for paving East Houston Ave. from Lafayette to Albert St. awarded to B. HAHN CONSTRUCTION CO., Dallas.

Tex., Terrell—Contract for 12,000 yd. rock asphalt paving awarded to B. HAHN CONSTRUCTION CO., Paris. H. T. Brewster, Terrell, Engr.

Idaho, Boise—(Official)—Contract for seven miles of Idaho-Pacific State Highway awarded to WHITTET & RELYEA, New Plymouth, at $6,000. Noted Oct. 7.

Wash., Olympia—W. G. Mulligan Co., Spokane, at $21,120, submitted lowest bid for seven miles of highway from Colfax to Rosalia, Whitman County, and General Construction Co., Spokane, at $13,243, low bidder for road on Inland Empire highway in Walla Walla and Columbia Counties between Waitesburg and Dayton.

Calif., Arcadia—(Official)—All bids received Oct. 7 for 16 miles of oiled macadam road and 10,000-ft. concrete curb and gutter rejected. Noted Sept. 30 and Oct. 21.

Calif., Los Angeles—Contract for improving Fourth St. from Boyle Ave. to Fresno St. awarded to FAIRCHILD-GILMORE-WILTON CO., at $50,675.

Calif., Sacramento—Contract for Hood-Franklin highway awarded to CLARK & HENERY, Stockton, at $26,000. Noted Sept. 23.

Calif., Santa Ana—Contract for improving Garden Grove Rd. awarded to O. & C. CONSTRUCTION CO., at $9,400.

Ont., Toronto—Contracts for paving and sewer construction awarded as follows: Paving Main St. to GODSON CONTRACTING CO., at $20,572; Quebec, Bridgman and Wells St to CONSTRUCTING & PAVING CO., at $23,312 and $5,641 respectively; Alberta and Bridgman St. and Goldsmith Drive to R. C. HARRIS, COMR. OF WKS., at $38,392; Pelham St. to BRAYLEY & NICHOLSON, at $6,831; Alton St. and Grace Terrace to WARREN BITUMINOUS PAVING CO., at $30,696; sewers on Chambers and Howick St. to LONGO & GENTILE, at $1,580; Lansdowne Ave. to J. MAGUIRE, at $1,869; Silverthorne and Turnberry St. to R. C. HARRIS, at $4,638.

INDUSTRIAL WORKS

Proposed Work

Mass., Boston—Vacuum Fumigating Co. will build fumigating plant to fumigate foreign cotton.

Mass., Brockton—George E. Keith Shoe Co. will build chemical laboratory near Auburn St. Estimated cost, $45,000.

Mass., Worcester—Packard Motor Car Co. will build garage, repair shop and sales room on Atchison St. Estimated cost, $60,000. Allan Davis, Local Mgr.

R. I., Pawtucket—George A. Cummings will build two-story brick laundry 49x136 ft. on Pawtucket Ave.

Conn., Hartford—Plans prepared for factory for Colt's Patent Fire Arms Mfg. Co. Estimated cost, $400,000.

Conn., Waterbury—Waterbury Farrell Foundry & Machine Co. has plans for two-story, 75x150-ft. mill building.

N. Y., New York—(Borough of Manhattan) — (Official) — Bids being received for one-story, 75x100-ft. brick and steel ice-storage plant at 514 East 71st St. for Ice Mfg. Co., 1480 Broadway. Morteson & Co., 405 Lexington Ave., Arch. Estimated cost, $45,000.

N. Y., New York—(Borough of Queens)—Mirror Film Co. will build motion picture plant at Glendale Casino Park, Woodhaven.

N. Y., Rochester—Plans prepared for two-story 43x100-ft. and five-story, 80x165-ft. additions to plant of Eastman Kodak Co. Noted Oct. 7.

N. Y., Troy—Cluett Peabody Co., Inc., will rebuild its factory. Eight-story, 70x100-ft. building will be constructed first. Entire structure 75x600-ft. Estimated cost, $2,000,000.

N. Y., Yonkers—Reliance Motion Picture Corporation plans studios, power house and shops at 537 Riverdale Ave. Estimated cost, $40,000.

N. J., Bayonne—(Official)—Texas Co. will build service plant by own forces. Noted Oct. 7.

N. J., Bloomfield—Scott & Bowne Co., Orange St., plans addition. Estimated cost, $40,000.

N. J., Newark—Clark Razor Blade Co. will build eight-story factory at 205 New Jersey Railroad Ave. Estimated cost, $50,000.

N. J., Trenton—F. W. Devoe & C. T. Reynolds Co., 213 New Jersey Railroad St. will make additions to its varnish plant. Estimated cost, $25,000.

Penn., Philadelphia—Sauer & Hahn, Arch., preparing plans for four-story, 54x100-ft. brick and concrete factory at 1220 Spring St. for M. Rice & Co., 1220 Race St.

Penn., Philadelphia—H. O. Wilbur & Sons, Inc., will build six-story 130x100-ft. factory and warehouse at 245 North Third St.

Penn., Pittsburgh—Henry Cohen, Charlestown, W. Va., will build five-story warehouse at 1139 Penn Ave. Walter Cohen, Arch. Estimated cost, $50,000.

Penn., Wilkes-Barre—Bids will soon be received by Sturdevant & Poggi, Coal Exchange Bldg., for one- and two-story machine shop, etc., for Lehigh & Wilkes-Barre Coal Co. Estimated cost, $250,000.

Md., Mount Airy—Bids being received by Bachman Shirt Co. for two-story, 200x400-ft. factory.

Va., Norfolk—Bids will soon be received for 90x107x84-ft. brick and steel garage for R. A. Roethke. Herbert W. Simpson, Arch.

Va., Roanoke—Citizens' Crystal Ice Co. will build cold-storage warehouse.

W. Va., Dunbar—American Vacuum Can Co. plans 150x200-ft. brick and steel plant. Estimated cost, $400,000. U. G. Fletcher and F. P. Groscup, interested.

W. Va., Lumberport—Mound City Cut Glass Co. will build 60x240-ft. factory. T. J. Sullivan, Clarksburg, interested.

W. Va., Welch—I. J. Rhodes, and others will build three-story and basement, brick garage.

N. C., Wilson—Atlantic Coast Line R.R. contemplates warehouse, 60x500-ft. E. B. Pleasant Wilmington, N. C., Ch. Engr.

Ga., Douglas—J. S. Scott will build warehouse. Estimated cost, $10,000.

Fla., Tampa—Wilson & Toomer Fertilizer Co., Jacksonville, plans plant at Tampa. Estimated cost, $125,000.

La., New Orleans—Bids will be received until Nov. 9 by city for asphalt plant at municipal repair plant. A. G. Ricks, Comr. Dept. Pub. Finances.

Ky., Ashland—Norton Iron Works will build coke byproduct plant.

Ky., Winchester—John W. Crone, Winchester, prepared plans for warehouse for Winchester Tobacco Warehouse Co. Estimated cost, $20,000.

Ohio, Carthage—(Cincinnati post office)—Pollock Steel Co. will build addition. Estimated cost, $10,000.

Ohio, Cincinnati—Modern Foundry Co. will build addition. Estimated cost, $10,000.

Ohio, Cincinnati—(Official)—Bids will be received about Nov. 1 by B. T. Wisenall, First National Bank Bldg., for ice plant at Price and Elberon Ave. for City Ice Delivery Co. Noted Oct. 14.

Ohio, Cleveland—Art Metals Mfg. Co. will build factory on East 61st St. Robert Cochran, Pres. Estimated cost, $10,000.

Ohio, Cleveland—S. H. Goldfein, Reserve Trust Bldg., prepared plans for three-story brick and steel factory for Miller & Becker Co., 5908 Woodland Ave. Estimated cost, $25,000.

Ohio, Columbus—(Official)—Bids will be received until Nov. 15 by Joseph N. Bradford, Ohio State University, for two-story shop building. Noted Oct. 14.

Ohio, Dayton—Heitman Co. plans 65x300-ft. cigar factory on North Dayton St. Estimated cost, $20,000.

Ohio, Mansfield—Mansfield News will build four-story addition on West Fourth St.

Ohio, Toledo—Toledo Machine & Tool Co. will build 100x400-ft. addition. Estimated cost, $200,000.

Ohio, Urbana—Urbana Packing Co. will make improvements. Estimated cost, $25,000. H. J. Rasmussen, Mgr.

Ohio, Youngstown—Youngstown Car Mfg. Co. contemplates addition to its plant on Wilson Ave. William Wilkoff, Pres.

Ind., Indianapolis—Packard Motor Car Co. will build five-story service station at 2340 Indiana Ave. Estimated cost, $125,000.

Ind., Marion—Plant of Sheron Drain Tile Co., recently destroyed by fire, will be rebuilt. Estimated cost, $30,000.

Mich., Flint—Chevrolet Motor Co., will build factory for manufacture of automobiles.

Mich., Flint—Flint Varnish Works plans factory addition. W. W. Mountain, Pres. and Gen. Mgr.

Mich., Muskegon—Campbell-Wyant & Cannon Co. has plans for foundry at Muskegon Heights. Estimated cost, $100,000.

Mich., Port Huron—Grand Trunk Ry. plans car repair shops. Estimated cost, $200,000.

Ill., Beardstown—Schultz, Baujan & Co. will build six-story, 35x100-ft. mill. Estimated cost, $50,000.

Ill., Chicago—Drying kilns of Chicago Maple & Oak Flooring Co., 2259 South Ashland Ave., recently destroyed by fire will be rebuilt. Estimated cost, $100,000.

Ill., Chicago—Chicago Steel Foundry Co., 3701 South Kedzie Ave. will build one-story, 120x150-ft. foundry. Julius Floto, Arch. Estimated cost, $20,000.

Ill., Peoria—Chic Mfg. Co. will build three-story and basement, 60x180-ft. factory at Adams and Maple St. Estimated cost, $40,000.

Wis., Menasha—International Wire Works Co., recently incorporated with $35,000 capital, will purchase Menasha Baseball Park and build plant.

Wis., Milwaukee—Hartman Machine Co. plans one- and two-story, 60x120-ft. factory at 29th St. and Meinecka Ave. Herbst & Hufschmidt, Arch.

Iowa, Sioux City—Henry F. Weare, Commercial Bldg., will build two-story garage. Estimated cost, $18,000. Paul C. Howe, Arch.

Minn., Duluth—Booth Fisheries Co. plans six-story cold storage warehouse on Lake Ave. S.

Minn., Minneapolis—Price Cereal Co. will build addition to its factory at 13th Ave. and Jackson St. Estimated cost, $60,000.

Minn., St. Paul—Sperry Realty Co. will build garage at Temperance and Jackson St. Estimated cost, $27,000.

Kan., Hutchinson—John Shire, Burrton State Bank Bldg., contemplates salt plant. Estimated cost, $25,000.

Kan., Wichita—Dunn Bros. Mercantile Co., 724 Main St., will build two-story reinforced-concrete warehouse.

Neb., Atkinson—Bids will soon be received for one-story and basement garage for E. McMonies. William V. Kerhan, 17th and Farnam Ave., Arch. Estimated cost, $15,000.

Mo., Jefferson City—Standard Oil Co. plans business building, warehouse and garage.

Mo., St. Louis—Preliminary plans prepared by Arthur G. McKee & Co., Engr., Cleveland, Ohio, for blast furnace for Missouri Iron Co. Estimated cost, $500,000.

Mo., Springfield—Western Cartridge Co. will build plant near Springfield. Estimated cost, $400,000.

Tex., Dallas—Linde Air Products Co., New York, N. Y., will build plant in South Dallas.

Tex., El Paso—O. H. Thorman & Co., prepared plans for three-story, 104x120-ft. warehouse for John Mulligan. Estimated cost, $55,000.

Tex., Marshall—Texas & Pacific Ry. will rebuild its shops recently destroyed by fire with loss of $1,000,000.

Tex., Temple—Clarence Webb and J. V. Clements will build garage at estimated cost of $20,000.

Colo., Loveland—Larimer County Coöperative Milk Condensery Co. will build factory. Estimated cost, $33,000.

Colo., Sugar City—National Sugar Mfg. Co. contemplates alfalfa mill.

Utah, Logan—Ogden, Logan & Idaho Ry. Co. plans car barns, repair shops, freight yards and passenger station. Estimated cost, $200,000.

Ariz., Gilbert—Lamara Alfalfa Milling Co. of Colorado plans alfalfa mill. Estimated cost, $15,000.

Ore., Astoria—Bids will soon be received by Newell, Gossett & Walsh, Spaulding Bldg., Portland, for superstructure for grain elevator for Port of Astoria Commission. Noted Oct. 14.

Ore., Willbridge—(Portland post office)—Shell Oil Co. will build addition.

Calif., Los Angeles—New York Motion Picture Co. will build motion picture plant at Culver City, near Los Angeles. Thomas H. Ince, Mgr. Estimated cost, $20,000.

N. B., Nelson Reserve—Frasers Ltd., Carlton St., Fredericton, N. B., contemplates sawmill at Nelson. Estimated cost, $80,000.

Ont., Hamilton—Mercury Mills, Ltd., 80 Park St., N., will build factory. Estimated cost, $250,000.

Sask., Ryerson — Saskatchewan Coöperative Elevator Co. will build grain elevator. Estimated cost, $10,000.

B. C., Port Moody—Port Moody Steel Works, Ltd., plans steel plant.

Bids In and Contracts Awarded

N. H., Keene—Contract awarded to JOSEPH A. GENN, Fall River, Mass., for 90x200-ft. factory for Wilkins Toy Co. Noted Sept. 30.

Conn., Bridgeport—(Official)—Contract awarded to DOWLING & BOTTOMLAY, Bridgeport, at about $25,000, for two-story, 87x78-ft. bakery for Bridgeport Bread Co.

Conn., New London—Contract awarded to H. R. DOUGLAS, Inc., for two- and three-story, 80x180-ft. factory for New London Ship and Engine Co.

Conn., Norwich—Contract awarded to ARCHIBALD TORANCE, by Shetucket Co. at about $75,000, for two-story brick weave shop. Noted Oct. 21.

N. Y., New York—(Borough of Manhattan)—(Official)—Among those figuring on one-story storage building at 438 West 18th St. for Consolidated Gas Co., 4 Irving Pl., are John T. Brady & Co., 103 Park Ave., McDermott & Hanigan, 103 Park Ave. and Frank Seery, 30 East 42d St. J. S. Maher, 431 West 14th St., Arch. Estimated cost, $20,000.

N. J., Jersey City — (Official) — Contract awarded to TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., by Standard Oil Co. of New Jersey for three-story kiln building.

Penn., Monessen—Contract awarded to McCLINTIC MARSHALL CONSTRUCTION CO., Pittsburgh, at about $225,000, by Pittsburgh Steel Products Co. for addition to specialty department and another addition.

Penn., Philadelphia — Contract awarded to HERMAN VOIGHT, 26th and Thompson St., for two-story, 36x190-ft. garage for Finnesey & Kobler.

Md., Sparrows Point—(Baltimore post office)—Contracts awarded to RAYMOND CONCRETE PILE CO., Munsey Bldg., Baltimore, at $50,000, for concrete piling and foundation and to P. J. CUSHEN, 217 St. Paul St., for superstructure for machine shop for Maryland Steel Co. Estimated cost, $400,000. Noted Aug. 5.

W. Va., Charleston—Contract awarded to GEORGE BROS., Winchester, Va., by International Fruit Products Co., Baltimore, Md., for cider and vinegar plant. W. W. Clous, State Bank of Maryland, Baltimore Md., Pres.

N. C., Albemarle — Efird Mfg. Co. awarded contract to HOLDBROOKS & BRADSHAW, Salisbury, N. C., at about $500,000, for two-story, 107x360-ft. mill addition.

N. C., Winston-Salem—Contract for six-story 156x243-ft. reinforced-concrete building for R. J. Reynolds Tobacco Co., awarded to GENERAL FIREPROOFING CO., Pittsburgh, Penn. Estimated cost, $100,000.

Ala., Andalusia — Contract awarded to R. V. LaBARRE, Birmingham, at about $70,000, for packing plant for Andalusia Packing Co.

La., Henderson—Contract awarded to GARSON BROS., at about $40,000, for rebuilding machine shops of W. K. Henderson Iron Works & Supply Co.

Ohio, Cleveland—Contract awarded to J. T. RICHARDS CO., 822 Citizens Bldg., Cleveland, at $15,000 for factory at 3695 East 78th St. for C. Greve.

Ohio, Cleveland—Contract awarded to JAMES H. WELLS, Marshall Bldg., at about $60,000, for three-story service building at Euclid Ave. and East 20th St. for Hudson Stuyvesant Motor Co. Noted Sept. 30.

Ohio, Cleveland—Contract awarded to UHL JASTER CO., 1900 Euclid Ave., at about $100,000, for six-story warehouse on Rockwell Ave. for W. M. Pattison Supply Co., 215 East St. Clair Ave. Noted Sept. 2.

Ohio, Cleveland—Contract awarded to J. C. CAMPBELL CO., Cleveland, for one-story, 105x382-ft. addition to plant of Perfection Spring Co., Central and East 65th St. Noted Oct. 21.

Ohio, Cleveland—Contract awarded to CROWELL-LUNDORFF-LITTLE CO., 1951 East 57th St., at $180,000, for five-story, 60x500-ft. factory on West 73d St. for Standard Welding Co. Noted Oct. 14.

Ohio, Marion—Contract awarded to MT. VERNON BRIDGE CO., Mt. Vernon, for mill for Interstate Iron & Steel Co. Noted Oct. 7.

Ohio, St. Bernard — (Cincinnati post office) — Contract awarded to McGARVEY & CO., Gerke Bldg., Cincinnati, at about $21,000 for three-story, 100x140-ft. addition to factory of Emery Candle Works.

Ind., Thorntown—Contract awarded to GEORGE DAUBENSPECK, Carmel, at $20,000 for serum plant for Indiana Swine Breeders Association.

Mich., Owosso — Contract awarded to WORDEN-ALLEN CO., 72 West Adams St., Chicago, Ill., at $60,000, for addition to plant of American Malleable Co. Noted Oct. 21.

Ill., Alton—State Board of Administration awarded contracts for buildings at Alton State Hospital as follows: Bakery to A. W. STOOLMAN, Champaign, at $17,820; laundry to J. MOROFF & SON, Bradley, at $30,248; kitchen, store and dining room building to M. A. VOORHEES CONSTRUCTION CO., Alton, at $71,600.

Iowa, Des Moines—Contract for concrete and brick factory for New Monarch Machine Co. awarded to J. E. LUSANT & SON, Seventh and Chestnut St., Des Moines, at $11,000. Noted Oct. 14.

Neb., Omaha—Contract awarded to JOHNSON BROS., CO., Omaha, at about $30,000, for warehouse at 208 South Tenth St. for Swenson Bros.

Mont., Three Forks—Contract awarded to GLOBE CONSTRUCTION CO., Lewistown, for flour mill for Three Forks Milling Co.

Mo., Kansas City—Contract awarded to SWENSON CONSTRUCTION CO., 625 Finance Bldg., Kansas City, at $180,000, for superstructure of eight-story building at 20th and Grand Ave. for Firestone Tire & Rubber Co., Akron, Ohio.

Mo., St. Joseph—Contract awarded to BURREL CONSTRUCTION & ENGINEERING CO., Chicago, Ill., at $23,000, by Chicago, Burlington & Quincy R.R., for grain elevator. T. E. Calvert, Chicago, Ill., Ch. Engr.

Mo., St. Louis—Contract awarded to GAMBLE CONSTRUCTION CO., at $18,000, for warehouses at 3960 Duncan St., for J. Haniels Distilling Co.

Tex., Dallas—Contract awarded to C. C. GATEMAN & SON, Dallas, for two-story garage for L. C. Morris, El Paso. Estimated cost, $32,000.

Ore, Portland—Contract awarded to CAMP & DUPUY by W. C. Glafke & Co., at about $30,000, for two-story concrete commission house. Noted Sept. 9.

Ont., Ottawa—Contract awarded by Ottawa Dairy Co., Cooper St. to K. W. SHANTZ, care of Wegnier Machine Co., Perry and Mississippi St., Buffalo, N. Y., at $15,000 for ice making plant.

FEDERAL GOVERNMENT WORK

Proposed Work

Va., Front Royal—Fire station—Bids will be received by Constructing Quartermaster until 2 p.m., Nov. 15, for fire station at Remount Depot, Front Royal.

Ohio, Cincinnati—Abutments—Bids will be received until Nov. 1 at U. S. Engineer office, Room 415, Custom House, for reconstructing in concrete part of abutments at Dam No. 1, Muskingum River, Ohio.

Mich., Muskegon—Post Office and Custom House—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 29, for U. S. post office and custom house at Muskegon.

Tex., El Paso—Canal Work—Bids will be received at office of U. S. Reclamation Service, Mills Bldg., El Paso, until 2 p.m., Nov. 17, for excavation of Leasburg canal, Picacho branch canal and San Elizario feed canal.

Okla., Lawton—Grading—Bids will be received by Andrious A. Jones, First Asst. Secy., Dept. of Interior, Washington, D. C., until 2 p.m., Nov. 17, for grading Gore Blvd.

Colo., Ft. Logan—Building—Bids will be received until 11 a.m., Nov. 15, at office of Depot Quartermaster, Ft. Logan, for constructing basements under non-commissioned officers' quarters.

Ore., Salem—Building—Bids will be received by Cato Sells, Comr., Indian Affairs, Dept. of Interior, Washington, D. C., until 2 p.m., Nov. 15, for addition to brick assembly hall, Salem Indian School.

Bids In and Contracts Awarded

Mass., Boston—Flooring—Bids were received at Bureau of Yards and Docks, Navy Dept., Washington, D. C., for reinforced-concrete floor in pattern shop, Building 42, U. S. Navy Yard (a) price for floor slabs and fire proofing of trusses, beams and girders; (b) price for floor slabs, omitting fire proofing of trusses, beams and girders, as follows: F. L. McKenzie, 7 Water St., Boston, (a) $8,311, (b) $6,237; C. M. Leach, Boston, (a) $10,573, (b) $6,983; Marston & Leonard Co., Boston, (a) $8,807, (b) $7,030. Noted Sept. 30.

Del., Smyrna—Post Office—Contract for post office at Smyrna awarded to KING LUMBER CO., Charlottesville, at $24,521. Noted Aug. 26 and Oct. 7.

D. C., Washington—Interceptor—Contract for Section No. 5, Anacostia Main Interceptor, awarded to GEORGE HYMAN, Washington, D. C. Noted Oct. 7.

D. C., Washington—Paving—Bids were received Oct. 19 for paving various streets from: Washington Asphalt Block and Tile Co., Cranford Paving Co. and Atlantic Bitulithic Co. Noted Oct. 7.

Va., Fairfax—Road—Rowzie & Slocum, Alexandria, at about $14,000, submitted lowest bid for gravel roadway from a point near Gum Spring to public entrance to Mt. Vernon.

Va., Norfolk—Building—Bids were received Oct. 23 for building at St. Helena Navy Yard, Norfolk, as follows: R. R. Richardson & Co., Norfolk, $35,961; J. L. Robinson Construction Co., Baltimore, $39,000; Baker & Brinkley, Norfolk, $38,103. Noted Sept. 30.

Va., Norton—Post Office—Bids were received Oct. 19 for post office at Norton, (a) limestone, (b) sandstone, as follows: Richardson & Burgess, Washington, D. C., (a) $58,331; J. C. Clouse, Greensboro, N. C., (a) $59,875, (b) $61,500; Westchester Engineering Co., (a) $56,897, (b) $61,500. Noted Sept. 16.

Fla., Tampa—Attendants' Quarters—Contract for attendants' quarters, disinfecting shed, oil house and wharf at Tampa Bay, awarded to E. HART, Norfolk, Va., at $52,110. Noted Aug. 26 and Sept. 23.

Tenn., Covington—Post Office—Contract for post office at Covington awarded to ALGERNON BLAIR, Montgomery, Ala., at $34,765. Noted Oct. 14.

Ill., La Salle—Post Office—Contract for U. S. post office at La Salle awarded to CHARLES W. GINDELE, Chicago, at $67,000.

Wyo., Powell—Canal—Bids were received Oct. 20 for constructing first unit, Frannie Division, Shoshone Project, as follows: Schedule 1 (a), 2 (b), 3 (c), 4 (d), 5 (e): J. E. Hilton, Billings, Mont., (a) $48,315, (b) $33,330; (c) $32,295; Tibbs & Taggart, Colwey, Wyo., (a) $45,090, (b) $29,600, (c) $32,270; R. M. Lynn, Lovell, (b) $27.76; Three Bros. & Jolley, Lovell, (a) $46,499, (b) $31,440, (c) $32,270, (d) $11,179, (e) $58,365 Security Bridge Co., Minneapolis, Minn., (d) $10458, (e) $54,628; Billings Engineering & Contracting Co., Billings, Mont., (d) $10,520. Noted Sept. 23.

T. H., Honolulu—Piers—Contract for torpedo boat piers at naval station, Pearl Harbor, awarded to LORD-YOUNG ENGINEERING CO., Honolulu, at $285,000. Noted Oct. 21.

China, Peking—Storage Plant—Lowest bid submitted for ice making and cold storage plant (complete) at Peking was that of York Mfg. Co., York, Penn., at $7,795. Noted Sept. 30.

CANALS, DITCHES AND IRRIGATION

Proposed Work

N. Y., Plattsburg—Barge Canal Work—Bids will be received until noon, Nov. 9, by W. W. Wotherspoon, Supt. of Pub. Wks., Capitol, Albany, for barge canal terminals.

Fla., Port Tampa City—Canal—Hiram McElroy, Engr., making surveys for ship canal from Old Tampa Bay to Port Tampa Bay. Estimated cost, $12,000. J. G. Yeats, Mayor.

La., Rapides—Drainage—Election will be held in Rapides Parish, first and second wards, to vote on $34,000 bonds for drainage system.

Ind., Williamsport—Drain—Bids will be received by Horace H. Day, Constr. Comr., at office of B. H. Ringer, until 2 p.m., Oct. 30, for drain in Jordan and Steuben Townships.

Ind., Winamac—Ditches—Bids will be received by C. E. Paul, Constr. Comr., until Oct. 30, for W. D. Patterson Ditch No. 3, L. C. Hodgens Ditch and John Panatt Ditch.

Iowa, Spencer—Ditch—Bids will be received by County Auditor until Nov. 28 for Drainage Ditch No. 28.

Minn., Morris—Ditch—Bids will be received by C. R. Wollchan, County Audr., until 2 p.m., Nov. 3, for County Ditch No. 20. Estimated cost, $4,599.

Minn., Roseau—Ditch—Bids will be received by County Auditor until 2 p.m., Nov. 15, for excavating Judicial Ditch No. 62. George A. Ralph, Engr.-in-Charge. Noted Oct. 7.

Mont., Shepherd—Irrigation—Billings Bench Water Users Association will make improvements to its irrigation system. W. W. Clark, Billings, Pres.

Mo., Kansas City—Revetments—Hendrick & Cochrane, Kansas City, preparing plans for Kaw Valley Drainage Board for addition of 4,000 ft. to revetments.

Ark., England—Drainage—Bonds for $45,000 will be issued by Indian Bayou Drainage Commissioners for drainage work.

Tex., Donna—Irrigation—Bids will be received by D. H. Barr, Secy., Donna Irrigation District, until Nov. 1, for irrigation system. Estimated cost, $425,000. C. S. Clark, Engr. Noted Oct. 21.

Idaho, Boise—Irrigation—Surveys being made by Edward Hedden for irrigation system for Black Canyon Irrigation District.

Idaho, Boise—Irrigation—Thayer-Moore Co., Kansas City, Mo., will finance project for constructing Bruneau Irrigation Project in Owyhee County, plans for which have been approved by State Land Board.

Idaho, St. Anthony—Irrigation—North Fork Reservoir Co., recently incorporated with $200,000 capital by M. Hillman, T. F. Rouche and others, will build irrigation system.

Ariz., Yuma—Irrigation—A pumping plant to irrigate 1,400 acres will be built by D. F. Sanguinetti and George Michelson, owners of Painter Property in Yuma Heights.

Calif., Stockton—Irrigation—Citizens voted Oct. 16 to form West Side Irrigation District to irrigate 11,000 acres. Estimated cost, $185,000. Noted Sept. 2.

Bids In and Contracts Awarded

N. C., Shelby—Drainage—Commissioners of Buffalo Drainage District awarded contract for widening creek from Graham's bridge to South Carolina line to THOMPSON-MOSELY CO., Greensboro, at $6,000.

Fla., Tampa—Ditch—Contract awarded to FOSTER & COGGESHALL by County Commissioners for Carr ditch.

Ill., Albany—Drainage—Contract for excavating about 86,960 cu.yd. of earth for 6½ miles of drainage ditch awarded to STEVENS & LANG, Geneseo, at 10c. per cu.yd. Noted Sept. 30.

Iowa, Bedford—(Official)—Drainage—Contract for new channel for East Nodaway River in Drainage District No. 3 awarded to O. P. HERRICK, Des Moines. W. L. Holbrook, Engr. Noted Oct. 14.

Iowa, Panama—Ditch—Contract awarded to LANA CONSTRUCTION CO., at about $55,926, for ditch in Washington Township.

Minn., Breckenridge—(Official)—Ditch—Contract for County Ditch No. 20. Wilkin County, awarded to C. T. GLASSER, Minneapolis. Noted Oct. 7.

Minn., Mankato—(Official)—Ditch—Contract for Ditch No. 39, Blue Earth County, awarded to G. E. GILBERTSON, St. James, at $15,727. R. H. Allison, Engr. Noted Oct. 7.

Ark., Marion—Drainage—Contract awarded to E. M. FORD by Crittenden County Drainage District No. 5 for drainage work in Big Creek, about 18 miles.

MISCELLANEOUS

Proposed Work

Mass., Boston—Tunnel—Bids will be received until Nov. 11 for Dorchester Tunnel, Section G, between West Fourth St. and Old Colony Ave. Plans on file with Boston Transit Commission, 15 Beacon St. Noted Sept. 30.

N. Y., New York—(Borough of Brooklyn)—Pier—Sinking Fund Commission plans pier at foot of Fulton St. Estimated cost, $15,000.

N. Y., New York—(Borough of Brooklyn)—Station Finish—Bids will be received until Nov. 5 by Public Service Commission of First District for station-finish work on New Utrecht Ave. elevated line. Noted Oct. 21.

Miss., Biloxi—Breakwater—City Council contemplates breakwater.

Miss., Waveland—Seawall—Bids will be received until Dec. 1 by Commissioners of District No. 1, Hancock County, at office of Robert L. Genin, Main St., Bay St. Louis, for concrete seawall and filling on beach front at Waveland.

Ohio, St. Clairsville—Retaining Wall—Bids will be received by Emerson Campbell, County Audr., until 1 p.m., Nov. 1, for concrete retaining wall on National Rd. east of St. Clairsville.

Ohio, Wellsville—Dikes—Election to be held in November to vote on $50,000 bonds for dikes. Noted Oct. 14.

Wis., Ashland—Dock—Plans prepared for concrete ore dock for Minneapolis, St. Paul and Sault Ste. Marie Ry. Estimated cost, $3,000,000. C. N. Kalk, Minneapolis, Minn., Ch. Engr.

Iowa, Council Bluffs—Levee—Bids will be received until 10 a.m., Nov. 2 by Pottawatomie County for levee work in Lewis Township.

Mo., New Madrid—Levee Work—(Official)—Bids will be received until 2 p.m., Nov. 15, by St. John Levee and Drainage District of Missouri, Hunter Bank Bldg., New Madrid, for levee work. W. S. Edwards, Secy. (See adv.)

Tex., Temple—Fire-Alarm System—City will build fire-alarm system. Estimated cost, $10,000.

Bids In and Contracts Awarded

Mass., Winthrop—Seawall—Bids opened Oct. 20 by Harbor and Land Commission, Boston, for seawall: W. L. Miller Co., Alford St., Charlestown, $19,030; Dennis F. Crowley, Milton, $19,289, and Bay State Dredging Co., Boston, $19,804. Noted Oct. 14.

N. Y., Buffalo—Train Shed—Contract awarded to EASTERN CONCRETE STEEL CO., D. S Morgan Bldg., for train shed for Lehigh Valley R.R. Co., at Main and Scott St. Estimated cost, $150,000.

N. Y., New York—(Borough of Bronx)—Subway Station—Contract awarded to ALTORIA REALTY AND CONSTRUCTION CO., for subway stations along Jerome Ave. and White Plains Rd.

N. Y., New York—(Borough of Manhattan)—Park Work—Delson Contracting Co., at $11,121, low bidder for improving Isham Park.

N. J., Newark—Dock Improvements—Contract for improving dock awarded to J. & J. McSPIRIT, Jersey City. Noted Oct. 14.

Del., Wilmington—Pier—Contract for pier at Deepwater Point for Du Pont Powder Co. awarded to SNARE & TRIEST, New York, N. Y., and Philadelphia, Penn.

S. C., Charleston—Wharf—Contract awarded to CHARLESTON ENGINEERING AND CONSTRUCTION CO., at $55,000, for wharf and bulkhead at Tradd St.

Miss., Greenville—Levee—Contract awarded to BURT, BOND & McMURRAY, Benoit, at $32,000, for levee work.

Tex., Galveston—(Official)—Riprap—Contract for furnishing 20,000 tons of riprap awarded to HANLEY & FRIDNER, Galveston, at $2.64 per ton. Noted Oct. 14.

Calif., San Diego—Mortuary—Contract awarded to WINTERS & NICHOLSON, at about $50,000, for 100x150-ft. mortuary at Fourth and Ash St., for Johnson, Connell & Saum.

Calif., San Francisco—(Official)—Pier—Contract for pier at foot of Chestnut St. awarded to CLINTON CONSTRUCTION CO., San Francisco, at $283,230. Noted Oct. 14.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Proposed Work

Vt., Northfield—Norwich University plans to construct a new riding hall. Estimated cost, $40,000. Charles Spooner, Pres.

Mass., Boston—Plans prepared by Maginnis & Walsh, Arch., 100 Boylston St., for three-story, 150x150-ft. clubhouse at Boylston Rd. and Ipswich St. for Knights of Columbus Lodge. Estimated cost, $300,000. Noted Oct. 21.

Mass., Brookline—Andrews, Jacques & Rantoul, 50 Congress St., Boston, preparing plans for addition to high school. Noted Aug. 12.

Mass., Cambridge—Edward Radding, 274 Main St. Springfield, will build six-story, 100x150-ft. brick building at Charles River Rd. and Ash. St. Charles R. Greco, 8 Beacon St., Boston, Arch. Estimated cost, $150,000.

Mass., Danvers—Bids will be received until Nov. 5 for two-story and basement, 15x50-ft. brick school for Independent Agricultural School. Estimated cost, $75,000. Noted Sept. 16.

Mass., Fall River—Plans being prepared by J. M. Darling, Fall River, for Masonic Temple. Estimated cost, $120,000.

Mass., Fitchburg—Special City Council Committee on Isolation Hospital plan hospital at estimated cost of $40,000.

Mass., Holyoke—Bids will be received until 2 p.m., Oct. 29, by Board of Public Works for isolation hospital for city. W. J. Howes, Arch. Noted Oct. 21.

Mass., Hyde Park—Myer Dana will build 22 stores at River St., Hyde Park Ave. and Oak St. Estimated cost, $300,000.

Mass., Lawrence—City will build new hospital. Joseph McCarthy, Member Bldg. Com.

Mass., New Bedford—Bids will soon be received for three-story, 85x90-ft. central fire station at North and Pleasant St. Estimated cost, $100,000. James S. McIntyre, Arch.

Mass., Salem—Bids will be received about December for nine room brick school addition for city of Salem. Estimated cost, $75,000. Noted Oct. 7.

Mass., Springfield—Stone and marble church will be built at State and Orleans St. by Christian Scientist Society. Estimated cost, $100,000. S. S. Beman, Chicago, Ill., Arch.

Conn., Mansfield—Connecticut Training School for Feeble-Minded will construct buildings. Estimated cost, $200,000.

Conn., Milford—(Official)—Contract for brick and stone town hall will be awarded about Nov. 15. Estimated cost, $120,000. Noted Oct. 14.

Conn., New Haven—Plans being prepared by Coolidge & Shattuck, Arch., Ames Bldg., Boston, Mass., for music building for Yale University. Estimated cost, $250,000. Noted Sept. 30.

N. Y., Albany—Plans prepared for 14-story addition to Ten Eyck Hotel at State and North Pearl St. Estimated cost, $1,100,000.

N. Y., Buffalo—(Black Rock)—Black Rock Bank will build bank on Niagara St. near Tonawanda St., Black Rock. Estimated cost, $100,000. H. W. Andrews, Pres. Pratt & Lambert, Dir.

N. Y., Freeport—(Official)—Bids being received by C. E. Kern, Arch., 55 East Ave., Freeport, for two-story, 64x96-ft. country club house for Long Island Good Hearted Thespian Society, Inc.

N. Y., New City—Election will be held Nov. 2 in Rockland County to vote to appropriate $50,000 for Tuberculosis Hospital. C. W. Sherwood, Clk., Bd. of Supervs.

N. Y., New York—(Borough of Manhattan)—Plans prepared by Walter Haefeli, Arch., 245 West 55th St., for 16-story office building at Fourth Ave. and 28th St., for Hasco Bldg. Co., 245 West 55th St. Estimated cost, $500,000. Noted Oct. 14.

N. Y., New York—(Borough of Manhattan)—(Official)—Kimball & Roosa, 71 Broadway, preparing plans for alterations to office building at Broadway and Rector St. for O. B. Potters Co., Inc., 71 Broadway.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received in December for 12-story building at 53 West 23rd St. for Naceloc Co., 125 West 56 St. William Birkmire, 1133 Broadway, Arch. Estimated cost, $300,000. Noted Sept. 23.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids are being received for seven-story, 99x100-ft., brick and steel building at 316 East 42d St., for New York College of Dentistry, 205 East 23d St. Shape & Bready, Inc., 220 West 42d St., Arch. Estimated cost, $250,000. Noted Oct. 14.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received about Nov. 1 by John J. Hearn Construction Co., 63 West 46th St., New York, for 12-story apartment at 152 West 86th St. Schwartz & Gross, 345 Fifth Ave., Arch. A. L. L. Construction Corporation, 67 West 46th St., owner. Estimated cost, $400,000. Noted Sept. 9.

N. J., Montclair—Old high school will be remodelled at estimated cost of $50,000.

N. J., Newark—Boys' Industrial School will build school at Dickerson and First St. Estimated cost, $125,000.

N. J., Paterson—Contract will be awarded about January 1 for four-story, 115x175-ft. school in Riverside Section. Estimated cost, $200,000. Fred W. Wentworth, Paterson, Arch. Noted Aug. 5.

N. J., Wildwood—Contract will soon be awarded for two-story school. Estimated cost, $65,000. Noted Sept. 2 and 30.

Penn., Bedford—Preliminary plans being prepared by H. E. Kennedy & Co., Arch., Home Trust Bldg., Pittsburgh, for three-story, 120x176-ft. tourist hotel for Lee Hoffman. Estimated cost, $100,000.

Penn., Freeland—New church will be constructed by congregation of St. John's Sloval Church. Estimated cost, $50,000.

Penn., Greencastle—Election will be held in November to vote on bonds for school on South Washington St.

Penn., Hazelton—(West Hazelton)—Citizens contemplate new school in West Hazelton.

Penn., Lewiston—Election will be held Nov. 2 to vote on $100,000 bonds for high school. J. J. Biemesderfer, Secy.

Penn., Philadelphia—Albert Kelsey, Arch., Perry Bldg., prepared plans for five buildings for Carson College for Orphan Girls, Witherspoon Bldg. Estimated cost, $300,000.

Penn., Philadelphia—A movement is on foot to raise a $500,000 fund to complete buildings at 18th and Bainbridge St. for Children's Hospital of Philadelphia.

Penn., Philadelphia—H. O. Wilbur & Sons has acquired a site at 245-47 New St. on which a reinforced-concrete building will be built. Estimated cost, $100,000.

Penn., Pittsburgh—Bids being received by Walter A. Cohen, Arch., Oliver Bldg., for five-story building at 1139-41 Pennsylvania Ave.

Penn., Scranton—J. J. Howley, Traders' Bank Bldg., prepared plans for alumni building for Sisters of the Immaculate Heart of Mary, Mt. St. Mary's Seminary. Estimated cost, $100,000.

Penn., Shenandoah—Election will be held Nov. 2 to vote on $135,000 bonds for high school.

D. C., Washington—National School of Domestic Art and Sciences will build 11 buildings on Wisconsin Ave. Estimated cost, $500,000. Charles F. Wood, 92 Fendall Bldg., and Mary A. Zurhorst, interested.

Va., Norfolk—Plans being prepared by Browne & Tazewell, Arch., National Bank of Commerce Bldg., for armory. Estimated cost, $165,000. A. Salomnsky, Chn. of Bldg. Com.

W. Va., Huntington—J. Tracy Troeger contemplates motion picture theatre on Fifth Ave. Estimated cost, $65,000.

W. Va., Wellsburg—M. L. Wells, Arch., preparing plans for three-story, 69x98-ft. store and lodge building for Wellsburg Lodge No. 2-A. Estimated cost, $45,000.

N. C., Delma—Charles C. Benton, Wilson, prepared plans for school. Estimated cost, $40,000.

N. C., Durham—Election will be held to vote on $75,000 bonds for two schools on Moorehead school site. George W. Watts, Chn. School Trustees.

N. C., Greensboro—J. W. Long and others contemplate hospital. Estimated cost, $50,000.

N. C., Winston-Salem—Norfolk & Western R.R. Co. plans two-story union passenger station. Estimated cost, $500,000.

S. C., Greenville—City contemplates city hall and auditorium. Estimated cost, $75,000.

Fla., Clearwater—Citizens of Pinellas County will build county court house and jail.

Fla., Ft. Pierce—Mrs. E. C. McAllister will build eight-story steel hotel at 12th St. and Blvd. Estimated cost, $300,000.

Fla., Okeechobee—City will build school. Estimated cost. $40,000. W. L. Foote, Trustee.

Fla., Orlando—Plans prepared for community building for Board of Trade. Estimated cost, $45,000.

Fla., Panama Park—H. J. Klutho preparing plans for eight-room school and additions to West Riverside School. Estimated cost, $110,000.

Fla., South Jacksonville—Plans being prepared for 16-room school and 12-room school. Mark & Sheftall, Arch. Estimated cost, $90,000.

Fla., Springfield — (Jacksonville post office)—Rutledge Holmes preparing plans for eight-room school in New Springfield, cost, $60,000, and two 4-room school at Grand Crossing and Highway.

Fla., Springfield—(Jacksonville post office)—R. A. Benjamin preparing plans for eight-room school in Northeast Springfield and wings to West Springfield school. Estimated cost, $100,000.

Miss., Marion—School Board contemplates $100,000 bonds for agricultural high school.

Miss., Pontotoc—Pontotoc County will build court house. Estimated cost, $75,000.

La., Jennings—Jefferson Davis Parish Police Jury will build court house. Estimated cost, $75,000.

La., Lake Charles—Citizens voted $125,000 bonds for high school.

La., New Orleans—Benevolent Knights of America will make repairs to club and later plan building at estimated cost of $125,000.

Tenn., Bristol—Election to be held to vote on $60,000 bonds for school rescinded. Noted Oct. 21.

Tenn., Memphis—W. T. Bailey, Arch., preparing plans for new church. Estimated cost, $50,000. S. E. Griggs, Lauderdale and Georgia St., Pastor.

Ky., Lexington—Election will be held Nov. 2 to vote $100,000 bonds for two schools. Noted Aug. 19.

Ohio, Antioch—Bids will be received until noon, Oct. 29, by J. W. Lentz, Clk. Perry Township, Bd. of Education, for high school. Albert S. Wilson, Senecaville, Arch.

Ohio, Cincinnati—Congregation of St. Andrews R. C. Church will build one-story, 81x180-ft. church. Estimated cost, $75,000. Samuel Hannaford & Son, 601 Hubert Bldg., Arch.

Ohio, Cincinnati—(Official)—Bids will be received until noon, Nov. 13, by Adjutant General of Ohio, Columbus, for alterations and repairs to armory at Helen and Burnet St.

Ohio, Cleveland—L. W. Thomas, Pythian Temple, prepared plans for remodeling John Anisfield Bldg. at East Ninth and Huron St. for Garfield Realty Co. Estimated cost, $40,000.

Ohio, Cleveland—Bids will be received about Nov. 15 by Cuyahoga County Commissioners, Cleveland, for detention building for boys on Franklin Ave. William S. Lougee, 500 Marshall Bldg., Arch. Estimated cost, $90,000. Noted Aug. 26.

Ohio, Cleveland—Cleveland Columbian Building Co. plans club house. John T. Dietz and Frank Dietz, Dietz Electric Co., interested. Estimated cost, $125,000.

Ohio, Columbus—James H. Butler will build 11-story hotel at Broad St. and Grant Ave. Estimated cost, $500,000.

Ohio, Dayton—Mutual Home & Savings Association will build 10-story reinforced-concrete building at Main and Second St. in spring. Estimated cost, $200,000.

Ohio, Marion—Odd Fellows Temple will build temple on West Center S. Estimated cost, $40,000.

Ohio, Middletown—Knights of Pythias, Lafayette Lodge No. 37, plan three-story, store, office and lodge building. Estimated cost, $50,000.

Ohio, Tiffin—First Presbyterian Church will build church. Estimated cost, $50,000.

Ohio, Toledo—Citizens will vote Nov. 2 on $1,000,000 bonds for school improvements. L. I. Donat, Clk.

Ind., Brazil—(Official)—Bids will be received about Dec. 1 for high school. Estimated cost, $70,000. Noted Oct. 21.

Ind., Terre Haute—Johnson & Miller, Ball Bldg., preparing plans for 16-room school at 25th St. and Fourth Ave.

Mich., Detroit—Plans being considered by County Commissioners for additions to county building. Estimated cost, $600,000.

Mich., Detroit—Plans are being considered for a five or six-story addition to Cass High School. Estimated cost, $359,000.

Mich., Grand Rapids—Williamson & Crow preparing revised plans for buildings for Calvin College. Estimated cost, $125,000.

Mich., Kalamazoo—Bids will be received by Kalamazoo State Hospital until Nov. 1 for Nurses' Home. Estimated cost, $56,000. Wernette, Bradfield, Mead Co., Grand Rapids, Arch. Noted Aug. 19.

Mich., Lansing—Directors of Lansing State Savings Bank will build eight-story building at Washington and Michigan Ave. Estimated cost, $150,000.

Mich., Manistique—Robinson & Campau, 449 Houseman Blk., Grand Rapids, preparing plans for high school. Estimated cost, $100,000.

Ill., Buckley—Lutherans will build church. Estimated cost, $50,000.

Ill., Chicago—Marshall & Fox will build five or six-story office building at Lincoln Parkway and Huron St.

Ill., Chicago—Contract will be awarded about Nov. 1 for two-story, 100x174-ft. building for Ninth Church of Christ Scientist. Carl Barkhausen, 121 Wisconsin St., Milwaukee, Wis., Arch.

Ill., Chicago—Baltimore & Ohio Chicago Terminal R.R. Co. will build two- and three-story freight sheds at 200 West 13th St. M. A. Long, Arch. Estimated cost, $65,000. F. L. Stuart, Baltimore, Md., Ch. Engr.

Ill., Springfield—(Official)—Bids will be received about Dec. 1 for high school. W. B. Ittner, St. Louis, Mo., Arch. Noted Oct. 21.

Iowa, Des Moines—Cathedral will be built in 1916 by Masonic Order. Estimated cost, $300,000. Charles M. Cathcart, Member Bldg. Com.

Iowa, Des Moines—Interurban Ry Co. will build freight depot at Second and Center St. Estimated cost, $50,000.

Iowa, Harlan—Bonds for $120,000 voted by citizens for school. Noted Sept. 2.

Iowa, Washington—Citizens defeated $100,000 bonds for high school.

Minn., Duluth—(Official)—Bids will be received until 7:45 p.m., Nov. 5, by Board of Education for purchase of $100,000 bonds for schools. Charles A. Bronson, Clk. Bd. of Education.

Minn., Minneapolis—Hennepin County Medical Society plans 12-story office building. Estimated cost, $1,000,000.

Minn., North St. Paul—Citizens plan high school. Estimated cost, $40,000.

Minn., St. Paul—(Official)—Bids will be received until Nov. 16 by Board of Control, State Capitol, for Minnesota Historical Society building. Estimated cost, $500,000. Clarence H. Johnston, Arch. Noted Sept. 23.

Kan., Hiawatha—Bids will be received until 7:30 p.m., Nov. 1, by Board of Education for high school. Estimated cost, $60,000. J. H. Felt & Co., Kansas City, Mo., Arch. Noted Oct. 21.

Kan., Topeka—City will build junior high and grade school at Fifth and Lincoln St. Estimated cost, $100,000. L. M. Penwell, Pres. and Chn. Bldg. Com., High School.

Kan., Wichita—Bids are being received by Y. W. C. A. for four-story, 49x140-ft. brick building. Estimated cost, $65,000. A. A. Hyde and H. W. Darling, in charge.

Neb., Alliance—Plans being prepared for three-story and basement hotel for Burlington Hotel Co. Estimated cost, $60,000.

Neb., Hastings—(Official)—Contract for moving picture theatre and office building for William Brach will not be awarded until next spring. Noted Oct. 7.

Mont., Billings—Y. W. C. A. will remodel old Elks club. Estimated cost, $50,000.

Mo., Joplin—Election will probably be held Nov. 10 to vote on $350,000 bonds for schools. J. A. Becker, Pres. School Bd.

Mo., Kansas City—W. Hilton Smith, preparing plans for four-story and basement, 37x76-ft. hotel at East Ninth St. near Charlotte St. for Hoffman Bros. Investment Co. Noted Oct. 14.

Mo., Ozark—Election will be held Mar. 4, 1916 to vote on $50,000 bonds for new court house.

Mo., St. Joseph—Rudolph Meier, Arch., preparing plans for 20-room high school in North Side. Estimated cost, $175,000.

Mo., Springfield—A theater estimated to cost approximately $65,000 will be constructed on the Square. J. L. Carlisle, Kansas City, interested.

Ark., Little Rock—Plans being prepared by W. T. Bailey, Arch., Memphis, Tenn., for Y. M. C. A. building. Estimated cost, $60,000.

Tex., Altavista—Bids will soon be received for 12-room school. Estimated cost, $60,000.

Tex., Houston—City will sell $200,000 bonds for school construction. Benjamin Campbell, Mayor.

Colo., Colorado Springs—Santa Fé R.R. Co. plans station. Estimated cost, $150,000.

Utah, Salt Lake City—Roman Catholic Church plans parochial school. Estimated cost, $150,000.

Ariz., Phœnix—Kibbey & Lescher prepared plans for addition to courthouse.

Wash., Bellingham—Contract will be awarded about Dec. 1 for addition to North Side High School. Estimated cost, $120,000. Noted Aug. 12.

Wash., Seattle—Citizens will vote on $200,000 bonds for West Seattle high school. Edgar Blair, School Arch.

Ore., Portland—W. W. Lucius, Lewis Bldg., Portland, retained by Alisky Estate to prepare plans for rebuilding structure at Third and Morrison St. Estimated cost, $50,000.

Ore., Portland—Bids will be received in November for auditorium for city. Estimated cost, $500,000. Whitehouse & Fouilhoux, Wilcox Bldg., Portland, Arch. Noted Aug. 12.

Calif., Sacramento—Bids will soon be received for hall of justice building for city. Shea & Lofquiest, Arch. Estimater cost, $208,000. Noted July 29.

Calif., Woodland—H. A. Weeks, San Francisco, preparing plans for courthouse for Yolo County. Estimated cost, $200,000.

BARGE CANAL WORK, ALBANY, N. Y.

Contract No. 40

Bids were received Sept. 14 by W. W. Wotherspoon, State Supt. of Pub. Wks., Albany, for Barge Canal Work, Contract No. 40, from (A) J. E. Bishop, Syracuse; (B) Champlain Engineering & Construction Corporation, Saratoga Springs; (C) Eastover Construction Co., Inc., Utica, (D) Holler & Shepard, Rochester. The item bids were as follows:

	A	B	C	D
27,000 cu.yd. excavation	$0.35	$0.38	$0.48	$0.38
6,000 cu.yd. forming embankment	.10	.12	.14	.11
860 cu.yd. gravel surfacing	1.35	1.50	1.80	1.40
3.4 M ft. b.m creosoted lumber	65.00	65.00	75.00	65.00
400 lin.ft. foundation piles	.29	.35	.42	.32
3,750 lin.ft. 12-in. reinforced concrete piles	2.35	2.55	1.50	2.30
50 cu.yd. second class concrete	7.43	8.00	9.60	7.00
190 cu.yd. first class reinforced concrete	11.96	13.50	10.00	12.75
55 cu.yd. second class reinforced concrete	8.94	9.00	9.00	8.00
150 lin.ft. 36-in. reinforced concrete pipe	4.00	5.00	6.00	4.75
18,000 lb. structural steel	.04	.04	.04	.04
14,200 lb. metal reinforcement	.03	.03½	.03½	.03
2,000 lb. iron castings plain	.04	.04	.04	.04
448 lin.ft. wooden fence	.22	.25	.52	.25
65 fender fastenings	1.21	1.20	1.20	1.20
Extended totals	$25,515	$27,140	$26,658	$26,438

PAVING—ST. CHARLES, ILLINOIS

Bids were received for paving East Main St., West Main St. and parts of other connecting streets as follows: (A) Engineer's Estimate; (B) Western Improvement Co., Racine, Wis.; (C) Arwin E. Price, Elgin, Ill.; (D) Logan-Giertz Construction Co., Elgin, Ill.; (E) James Cape & Sons Co., Racine, Wis.; (F) H. H. Enbody, Aurora, Ill.; (G) James A. Sockley Co., Chicago, Ill. The item bids were as follows:

	A	B	C	D	E	F	G
17,670 sq.yd. vitrified brick pavement, 6-in. cement concrete base, 2-in. sand cushion, joints filled with asphalt filler, surface dressed with sand and subgrade complete	$2.03	$1.92	$1.98	$1.95	$1.96	$1 99½	$2.09
8,690 sq.yd. vitrified brick pavement 5-in. cement concrete base, 2-in. sand cushion, joints filled with asphalt filler, surface dressed with sand and sub-grade complete	1.98	1.84	1.90	1.92	1.90	1.97	2.02
10,850 lin.ft. cement concrete curb on layer of bank gravel, subgrade complete	.48	.38	.43	.40	.45	.46	.30
400 lin.ft. 10-in. vitrified sewer laid and constructed complete	.50	.60	.60	.40	.40	.50	.75
16 inlets with c.i. covers placed and completed	15.00	15.00	15.00	12.50	20 00	15.00	15 00
19 combined false curb and gutters with c.i. plate, 8 ft. long	10.00	8.00	9.00	8.00	10 00	10.00	10 00
72 combined false curb and gutter with c.i. plate, 5 ft. long	6.00	6.00	5.00	5.00	6.00	6 00	6 00
36 oak headers in place	14.72	8.00	41c. per ft.	.	10.00	14.72	12 00
Adjustment of existing manhole and C. B., extra concrete per cu.yd.	.....	6.50	4.60	..	8 00	5 00	15 00
Totals	$59,901	$55,391	$86,698	$66,958	$57,410	$58,614	$59,333

Que., Montreal—Marcil Trust Co. will build one-story granite building on Victoria Sq. Estimated cost, $300,000.

Bids In and Contracts Awarded.

Mass., Boston—(Roxbury)—(Official)—Bids received Oct. 19 for addition to High School of Practical Arts: John J. Flynn, 319 Washington St., $69,736, and McNeil Construction Co., 201 Devonshire St., $72,731.

Mass., Haverhill—Contract awarded to KELLY BROS., 30 Pleasant St., Haverhill, for Masonic Temple alterations.

Conn., New London—(Official)—Contract awarded to H. R. DOUGALS CO., Inc., for addition to Griswold Hotel. Noted Oct. 21.

N. Y., Harriman—Contract awarded to HARRIMAN INDUSTRIAL CORPORATION, at $40,000, for school.

N. Y., New York—(Borough of Bronx)—(Official)—Contract awarded to McDERMOTT & HANIGAN, Inc., 103 Park Ave., New York, for 100x100-ft. apartment at 8 Woodycrest Ave. for Woodycrest Bldg. Corporation.

N. Y., Rochester—Contract awarded to A. FRIEDERICH & SONS CO., Rochester, for Y. M. C. A. branch building. Estimated cost, $50,000. Noted Sept. 2.

N. J., Atlantic City—Contract awarded to ALEX CHAMBLEY, 243 South Tenth St., Philadelphia, Penn., for three-story, 90x150-ft. addition to school. Noted Sept. 2.

N. J., Elizabeth—(Official)—Contract awarded by Board of Education to JOHN LAURIE, JR., New York, N. Y., at $84,877, for Madison Ave. school. Noted Oct. 14.

N. J., Jersey City—(Official)—Contract awarded to JOHN T. BRADY CO., 103 Park Ave., New York, N. Y., at $900,000, for Hudson County jail. J. T. Rowland, Jersey City, Arch. Noted Oct. 21.

N. J., Newark—W. G. Sharwell & Co., Newark at $84,989, low bidder for Milford school on 18th Ave.

N. J., Trenton—(Official)—All bids received Oct. 19 by Alfred Gaskill, Dir. of Dept. of Conservation and Development for laboratory rejected. Noted Oct. 7.

Penn., Philadelphia—(Bustleton) — Melody & Heating, Bailey Bldg., at $40,440 low bidder for two-story school addition.

Penn., Scranton—Contract awarded to LUDWIG T. STIPP, People's Bank Bldg., for nine-story, 42x78-ft. hotel addition for Casey Hotel Co. Noted Sept. 30.

W. Va., Charleston—Bids were received for two-story addition to Kanawha County courthouse as follows: G. F. Gates, $49,500; Caldwell & Drake, $53,125; Central Engineering Co., $54,000. Noted Sept. 16.

Ohio, Findlay—Contract awarded to J. G. BULLINGER, Toledo, at $90,000, for infirmary for Hancock County.

Ohio, Marion—Board of Education awarded contract for high school to W. C. HANDSHY & SON, Zanesville, at $84,773. Marriott, Allen & Hall, Columbus, Arch. Noted Sept. 23.

BULKHEAD—PHILADELPHIA, PENN.

Bids were received Aug. 16 by the Department of Wharves, Docks and Ferries for the constructon of a temporary bulkhead in the Schuylkill River from: (A) EDWIN H. VARE, Lincoln Bldg., Philadelphia (awarded contract); (B) Pugh & Hubbard Co., Witherspoon Bldg., Philadelphia; (C) Peoples Bros., 15th and Callowhill St., Philadelphia; (D) J. E. Brenneman, 1523 South Front St., Philadelphia. The item bids were as follows:

	A	B	C	D
800 bearing piles	$10.00	$8.88	$10.50	$12.70
1,600 batter piles	10.60	10.99	16.00	12.90
50 pile shoes	1.50	1.25	1.00	1.70
4,000 6-in. sh. piles	9.00	9.42	10.95	12.45
67 M. ft. yellow-pine lumber	65.00	55.00	45.00	82.50
4,000 galvanized iron caps	.10	.15	.50	.14
800 galvanized iron caps, piles	.22	.37½	.90	.55
Extended totals	$65,966	$67,915	$83,585	$87,212

Ind., Evansville—(Official)—Contract for freight depot for Illinois Central R.R. awarded to GEORGE B. SWIFT & CO., Chicago, at $75,000. A. S. Baldwin, Ch. Engr. Noted Oct. 21.

Wis., De Pere—Contract for substructure of four-story 65x180-ft. building for Premonstratension Fathers awarded to A. F. BEAUREGARD, De Pere. Estimated cost of building, $100,000.

Wis., Watertown—Contract for high school awarded to BAILEY-MARSH CO., Minneapolis, Minn. Estimated cost, $125,000. Noted Sept. 23.

Iowa, Rock Rapids—(Official)—Contract awarded to A. M. OLSON CONSTRUCTION CO., Brookins, S. D., at $107,300, for three-story and basement courthouse. Noted Oct. 7.

Iowa, Sioux City—Contract awarded to COOMER & SMALL, United Bank Bldg., for Elks club house at Eighth and Douglas St. Estimated cost, $75,000. Noted Sept. 9.

Minn., Minneapolis—Contract awarded to J. L. ROBINSON & CO., at $55,000, for two-story brick addition to Schiller school at Grand and 26th Ave.

Minn, Minneapolis—(Official)—Contract for theatre for M. L. Cohen & Co., 239 Nicollett Ave., awarded to FLEISHER-ROSE CONSTRUCTION CO., 515 Plymouth Bldg., Minneapolis, at $41,000. Noted Sept. 23.

S. D., Brookings—(Official)—Contract for four-story dormitory for State College awarded to WOLD CONSTRUCTION CO., Brookings, at $72,000. Noted Oct. 7.

Mont., Baker—Contract awarded to MONEKE BUILDING CO., Fargo, N. D., for court house for Fallon County.

Mont., Havre—Contract awarded to LEASE & RICHARDS, Great Falls, at $63,000, for Masonic Temple at Third Ave. and Third St. Noted Sept. 2.

Mo., Kansas City—Contract awarded to PRATT-THOMPSON CONSTRUCTION CO., 500 Republic Bldg., at about $200,000, for additions to German Hospital at 24th, McCoy and Holmes St.

Mo., Webster Groves—Contract awarded to JOHN GREWE CONSTRUCTION CO., 947 Century Bldg., St. Louis, at about $175,000, for two schools.

Tex., Dallas—Contract awarded to JONES & HARRINGTON, Ft. Smith, Ark., at $59,150, by Board of Education for Winnetka school.

Tex., Dallas—Contract awarded by Board of Education to HOLMBOE CO., Oklahoma, Okla., for high school in Oak Cliff, at $113,000.

Utah, Salt Lake City—Contract for normal and industrial building for University of Utah awarded to AUGUST RUDINE. Estimated cost, $55,000. Noted Sept. 30.

Wash., Tacoma—Contract awarded to CORNELL BROS., Savage-Scofield Bldg., Tacoma, at about $75,000, for hotel for Savage-Scofield Co. and others. Heath & Gove, Tacoma, Arch.

Calif., Ventura—(Official)—Bids received Oct. 18 by W. F. McClure, State Engr., Sacramento, for two cottages and detention building for California State School for Girls: Chirhart & Nystedt, $39,595; The Kling Co., $43,333, and F. O. Engstrum Co., $45,987. Noted Oct. 7.

Ont., Ottawa—Contract awarded to NORCROSS BROS. CO., 103 Park Ave., New York, N. Y., for eight-story office building on Rideau St. for C. Jackson Booth.

The George A. Boyden Pump Co., Baltimore, Md., recently capitalized at $1,800,000, will erect a large plant in the northwest section of Baltimore for the manufacture of pumps. It also plans to establish subsidiary factories in Kansas City and San Francisco. The following are the officers of the company: George A. Boyden, Pres.; J. Calvin Boyden, Vice-Pres.; Janon Fisher, Chn. of the Executive Committee; Harry Carter Irwin, Secy.; and George A. Boyden, Jr., Mechanical Engineer Supt. Edwin H. Brownley and William L. Marbury are acting as counsel. The present offices are located in the Maryland Casualty Bldg., Baltimore.

BARGE CANAL WORK, ALBANY, N. Y.

Contract L

Bids were received Sept. 14 by W. W. Wotherspoon, State Supt. of Pub. Wks., Albany, for Barge Canal Work, Contract L from (A) Cleveland & Sons Co., Brockport; (B) Oswego Construction Co., Inc., Fulton; (C) I. M. Ludingtons Sons, Inc., Rochester; (D) Chesley, Earl & Heimbach, Inc., Buffalo; (E) Vedder Construction Co., Delevan; (F) Grumer & Hallenbeck, Harriman; (G) R. T. Ford Co., Rochester; (H) Frank L. Cohen, Buffalo; (I) Lupfer & Remick, Buffalo; (J) Stanley Construction Co., Buffalo; (K) Larkin & Sangster, Seneca Falls; (L) Scott Bros., Rome; (M) Sherman-Stalter Co., Lyons; (N) Flood & Van Wirt, Hudson Falls. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
21,000 cu.yd. excavation	$0.60	$0.40	$0.50	$0.65	$0.60	$0.62	$0.60	$0.55	$0.60	$0.60	$0 60	$0.42	$0.60	$0.77
500 cu.yd. lining	1.50	1.80	1.50	1.50	2.00	1.40	1.25	1.50	1.50	1.25	1.50	1.35	1.65	1.80
16.5 M. f.b.m. sawed lumber	60.00	78.00	50.00	60.00	60.00	65.00	50.00	50.00	55.00	50.00	60.00	58.00	65.00	60.00
3,500 cu.yd. second-class concrete	6.80	6.00	6.50	6.50	6.80	6.25	7.00	7.00	6.25	8.00	6.60	6.00	7.00	7.00
106 cu.yd. first-class reinforced concrete	12.00	14.40	12.00	12.00	12.00	12.00	10.00	12.00	14.00	11.00	12.00	11.00	12.00	12.00
590 cu.yd. fourth-class rip-rap	2.50	3.00	2.50	2.50	2.00	2.50	2.00	2.50	2.00	2.00	2.00	1.30	2.00	2.00
344,000 lb. structural steel	.04½	.048	.04½	.03	.04	.04	.04	.04	.0458	.03¾	.038	.0378	.042	.038
16,500 lb. metal reinforcement	.03	.036	.03	.03	.03	.03	.02½	.03	.03½	.03	.03	.0315	.03	.03
95 sq.yd. cobblestone gutter	1.25	1.50	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.25	1.20	1.25	.50
265 sq.yd. brick pavement	2.25	2.70	2.25	2.25	2.25	2.25	2.00	2.00	2.25	2.00	2.50	2.35	2.25	2.00
1,240 lin.ft. wooden fence	.25	.30	.25	.25	.25	.25	.30	.25	.25	.25	.25	.27	.25	.25
137 lin.ft. lattice railing	1.75	2.10	1.75	1.75	1.75	1.75	1.75	2.00	1.75	1.50	2.10	1.70	1.75	1.75
Removing existing superstructure at Gorham street (lump)sum	100.00	120.00	100.00	100.00	1.00	100.00	100.00	100.00	120.00	100.00	50.00	100.00	50.00	100.00
12 oil signal lamps	15.00	18.00	15.00	15.00	12.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Maintaining navigation at Gorham St. (lump sum)	50.00	25.00	100.00	100.00	100.00	100.00	100.00	1.00	1.00	100.00	1.00	1.00	1.00	50.00
Maintaining navigation at Kingdom Rd. (lump sum)	50.00	25.00	100.00	100.00	100.00	100.00	100.00	1.00	100.00	100.00	1.00	1.00	1.00	50.00
Timber towpath at Gorham St. lump sum)	200.00	25.00	250.00	150.00	250.00	250.00	250.00	50.00	1.00	250.00	1.00	1.00	1.00	75.00
Timber towpath at Kindom Rd. (lump sum)	250.00	25.00	400.00	200.00	400.00	400.00	400.00	100.00	1.00	400.00	1.00	1.00	1.00	125.00
Cofferdams, pumping, bailing and draining (lump sum)	10,000	12,000	10,000	8,250	8,000	7,500	6,000	12,000	12,000	3,000	8,500	11,432	7,000	7,500
Total	$68,956	$65,943	$65,942	$62,047	$65,357	$63,564	$63,229	$68,292	$68,797	$63,062	$63,572	$59,928	$64,891	$67,786

Meeting of Hydrated Lime Manufacturers

In January, 1915, the National Lime Manufacturers opened at Pittsburgh an office known as the Hydrated Lime Bureau, the purpose of which was to promote the use of hydrated lime in concrete, mainly by acting as a central information office from which all inquiries as to the use of hydrated lime could be promptly and accurately answered. It is thought that the scheme has been very successful and that engineers and contractors are becoming much better informed through the bureau of the advantages of hydrated lime in concrete work. For the coming year it is hoped to extend the operation of the Bureau and to that end a meeting of all the hydrated lime manufacturers in the United States has been called for Dec. 1, 1915, to be held at the office of the Bureau. It is the intention of the Hydrated Lime Manufacturers to make this Bureau of increasing value to the engineering profession, and it is hoped that every manufacturer of this material will attend this meeting and be prepared to support the movement.

The Concrete Form Co., Inc., Syracuse, N. Y., has been awarded the highest award at the Panama-Pacific Exposition for the Whaten Form, a guaranteed collapsable steel culvert form used in road construction.

The J. F. Mundy Hoisting Engine Co., Newark, N. J., has purchased the business of J. F. Mundy and will continue business under the new name. R. L. Strickland is Secy. and Treas.

W. F. Hardy, for the past 11 years connected with the Diamond Rubber Co. and the B. F. Goodrich Co., has been appointed Sales Mgr. of the Boston Belting Co., 84 Linden Park St., Boston, Mass.

The Goulds Mfg. Co., Seneca Falls, N. Y., manufacturer of pumps and hydraulic machinery, will open a branch office at 111 No. 3d St., Philadelphia, Penn., on Oct. 1. The company has purchased the business of H. E. Trotman at this address, who has been the distributor of pumps for this company. E. S. Jenison, formerly with the Canadian Fairbanks-Morse Co., Ltd., Montreal, has been appointed Mgr., and F. G. Kramer, formerly in the employ of H. E. Trotman, will be Assist. Mgr. J. B. Trotman will continue with the Goulds Mfg. Co.

The E. B. Crosby Construction Co., formerly of Muskogee, Okla., has moved to 306 West Ninth St., Kansas City, Mo. This firm has recently completed a $75,000 high school building at Boonville, Mo., for which J. H. Felt & Co., Grand Avenue Temple, Kansas City, Mo., was Arch.

The H. F. Harris Engineering Co. have moved from 168 Osborne St., Bridgeport, Conn., to the corner of Broad and John St., Bridgeport, and are installing additional machinery as fast as it can be obtained.

The Marine Oil Engine Co., of New York, has just been incorporated with a capital of $200,000 for the purpose of carrying on a business of installing oil engines, both in ships and in either municipal or private power plants. Mr. W. R. Haynie, U. S. Manager for Bolingers Co. of Stockholm, Sweden, 50 Church St. is the moving spirit in the concern.

CATALOG NOTICES

General Electric Co., Schenectady, N. Y. Pamphlet. Holophane refractors for street lighting. Illustrated, 30 pp., 6x9 in.

Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn. Circular No. 1536. Alternating current water-wheel generators. Illustrated, 32 pp., 8x10½ in. Special Publication No. 1562. Railway equipments and locomotives in the Far West. Illustrated, 48 pp., 8½x11 in.

The Scranton Pump Co., Scranton, Penn. Bulletin No. 103. Jet condensers and vacuum pumps. Illustrated, 12 pp., 6x9 in.

K-G Kelding & Cutting Co., 556 West 34th St., New York. Catalog. Oxy-acetylene, oxy-blaugas welding and cutting equipment. Illustrated, 24 pp., 4½x7½ in.

American Steel Dredge Co., Ft. Wayne, Ind. Bulletin No. 10. "Single-Line" revolving steam shovels. Illustrated, 8 pp., 8½x11 in.

HIGH SERVICE SYSTEM, COATESVILLE, PENN.

Bids were received Oct. 7 for the construction of a high service system at Coatesville from (A) PARTRIDGE & BURKE, Hohokus, N. J. (awarded contract); (B) H. C. Brooks Co., Martinsburg, W. Va.; (C) Dunleavy Bros., Coatesville; (D) Pugh & Hubbard, Philadelphia, Penn.; (E) Thomas J. Radley Co., Inc., New York, N. Y. The item bids were as follows:

	A	B	C	D	E
12.56 tons 10-in. Class A pipe	$24.75	$26.50	$26.15	$26.50	$28.00
30.56 tons 10-in. Class B pipe	24.75	26.50	26.75	26.50	28.00
62.75 tons 6-in. Class B pipe	24.75	26.50	26.75	27.05	29.00
243.0 tons 8-in. Class O pipe	24.75	26.50	26.75	27.05	28.00
24.15 tons 6-in. Class B pipe	24.75	26.50	26.75	27.05	28.00
13.6 tons 6-in. Class C pipe	24.75	26.50	26.75	27.05	28.00
10.2 tons c.i. specials	60.00	65.00	60.00	58.80	65.00
1,390 lin.ft. 10-in. c.i. pipe laid	.35	.35	.35	.38	.45
11,980 lin.ft. 8-in. c.i. pipe laid	.28	.29	.35	.36	.37
2,170 lin.ft. 6-in. c.i. pipe laid	.23	.27	.35	.34	.35
1 10-in. gate valve	25.75	27.50	30.00	28.50	39.00
8 8-in. gate valves	19.50	21.00	20.00	17.60	25.80
18 6 in. gate valves	14.00	16.00	12.75	12.00	17.10
30 hydrants with gate valve	45.00	50.00	48.00	44.50	50.00
200 cu.yd. excess excavation	.75	1.00	1.25	1.50	.50
3,000 lin.ft. macadam pavement	.10	.10	.05	.20	.17
120 lin.ft. brick pavement	.34	.60	.25	1.75	.45
250,000 gal. water tank	3,700.00	3,750.00	3,600.00	3,685.00	4,600.00
Equipment for pumping station	1,456.00	1,075.00	1,284.00	1,740.00	2,500.00
Venturi meter	650.00	725.00	600.00	706.00	652.00
Superstructure for pumping station	600.00	700.00	960.00	1,720.00	700.00
177 cu.yd. earth excavation	.45	1.00	.60	1.00	.50
7 cu.yd. Class A concrete	8.00	9.00	8.00	15.00	6.50
55 cu.yd. Class B concrete	9.00	8.00	6.00	10.00	6.50
140 lb. of steel reinforcement	.05	.06	.04	.04	.05
Extended totals	$23,834	$24,943	$25,619	$28,127	$28,968

The Detroit Products Co., Detroit, Mich., to celebrate a record-breaking September business, about 30 of its members were the guests of J. G. Rumney, Gen. Mgr., at a banquet given Oct. 19 at the Detroit Athletic Club. The September output of the company including both fenestra solid steel windows and also Detroit self lubricated springs also made by the company was the biggest in the history of the company. And from present indications the remaining months of 1915 are going to be no exception to the rule. The September record was a combination of a series of record-breaking months throughout the year. At the banquet, speeches were made by Walter S. Russel, Pres. of the Russel Wheel and Foundry Co., of Detroit, and by R. S. Drummond, Vice-Pres. of the Detroit Steel Products Co.

American Lumber Used in Portugal—Most of the foreign lumber used in Portugal is imported from Sweden and the United States, especially from the Gulf ports, Pensacola, Apalachicola, Gulfport, New Orleans, and Galveston. Pitch pine, oak, ash, and satinwood are the kinds of American lumber in demand. Pitch pine is used for roof building and flooring, oak and ash for building railway cars and trucks, and satinwood for furniture making. The present price of pitch pine in Lisbon is between 56 and 62c. per cu.ft., as compared with 42c. before the war. The difference is not due to an increase in the price of the lumber itself, but to the exorbitant freight rates and the unusually low exchange. The average sizes of pitch pine imported are 27½ and 30 cu.ft. The usual sizes of Swedish lumber imported are 3x9 and 3x10, employed mainly for beams and for making doors and windows. The price, owing to present circumstances, has increased about 70 per cent. The stock of foreign lumber on hand is very small, but dealers state that they have no desire to increase it, in view of present conditions . The cheap native lumber, which sells for about 25c. per cu.ft., is being used extensively, thus replacing to a considerable extent the imported product. Occasionally small shipments of pitch pine from New Orleans are received, to supply the most urgent demands of the market.

Dodwell & Co., Ltd., 135 Front St., New York, N. Y., announces the removal of its office to 50 Broad St.

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, received the grand prize and gold medal for hydraulic presses at the Panama-Pacific International Exposition. This company has issued a folder on "Maintaining a Precedence in Exposition Awards."

Brick and Tile Produced in the United States in 1914 were valued at $164,986,983, according to Professor Middleton, of the United States Geological Survey. Clay products are made in every state, Ohio leading, Pennsylvania second, and New Jersey third. The strip of land along Hudson River from New York City to Cohoes, including Bergen and Middlesex Counties, in New Jersey, is the greatest brick-making district in this country and probably in the world, and New York City is the leading common-brick market in the United States, about one billion brick being used there annually. In 1914 there were marketed from this region 888,266,000 common brick valued at $4.90 per M. Of these, New Jersey produced 209,146,000 brick valued at $5.10 per M.

Wood-Block Paving in Great Britain is in general use in nearly all of the several hundred boroughs the population of which is greater than 60,000, according to the weekly bulletin of the Canadian Department of Trade and Commerce. In a few prominent cities, such as Glasgow, Dublin, Belfast and Liverpool, wood-block paving is used only in front of hospitals and schools. It is said that the hard pavements in these cities have not been replaced by wood because of the practice of shoeing draft horses with sharp calks, which would tear up the wood blocks. Without exception the wood-block pavement laid in Great Britain at the present time is Swedish or Russian redwood (Pinus sylvestris). The specifications issued by the municipal engineers throughout the country admit this wood and no other, the one exception being the specification for the Borough of Westminister, London, which admits Canadian spruce, red pine or Douglas fir. Swedish and Russian redwood, sawed in 4-in. blocks and given an 8- to 10-lb. treatment of creosote, gives a pavement that will last in London 20 yr. under light traffic and 12 yr. under heavy traffic. The English specifications are not especially rigid. Hearts are admitted, as are also knots, unless the latter are loose or on the upper end of the blocks. There is no rigid adherence to any rule regarding the rate of growth. The Russian redwood is preferred to the Swedish because it is slower growing and therefore harder, but blocks are admitted with six or even four rings to the inch. There is no rigid exclusion of sapwood, some specifications admitting as much as 18% of sap. Timber used by Great Britain for paving in 1913 was approximately 60,000,000 ft.

Contracts to Be Let

Bids received until Nov. 9, 1915.

Sewerage and Sewage Disposal

Yorktown Heights, N. Y.

Sealed proposals for Sewerage and Sewage Disposal Plant at the New York State Training School for Boys, Yorktown Heights, N. Y., will be received by Mr. William B. Osgood Field, President of the Board of Managers, New York State Training School for Boys, Yorktown Heights, N. Y., at the Department of Architecture, Room 1224 Woolworth Building, New York City, until November 9, 1915, at 2:30 p.m., when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by a certified check in the sum of $1,875.00. The contractor to whom the award is made will be required to furnish surety company bond in the sum of 50% of the amount of contract within 30 days after official notice of award of contract and in accordance with the terms of Specification No. 2225. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the New York State Training School for Boys, Yorktown Heights, N. Y., at the New York office of the Department of Architecture, Room 1224 Woolworth Building, and the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon the deposit of a check in the sum of $10.00, made payable to the State of New York, for each set of plans and specifications, which check will be returned when plans and specifications are sent back in good condition to the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Dated, Albany, N. Y., October 5, 1915.

Bids received until Nov. 11, 1915.

Section G. Dorchester Tunnel

City of Boston, Mass.

Sealed bids for building Section G, Dorchester Tunnel, in Dorchester avenue, between West Fourth street and Old Colony avenue, South Boston, will be received by the undersigned until 12 o'clock noon of Thursday, November 11, 1915. The section is about 1,200 feet long. The structure will be mainly of reinforced concrete. The work includes a pump well with an emergency exit, a ventilating chamber with an emergency exit, an open incline for surface cars, a 6′-6″ tidegate chamber on the B street outfall sewer, and sewer changes. Specifications and forms of contract can be obtained at 15 Beacon street, ninth floor. The right to reject any and all bids and to award the contract as is deemed to be for the best interest of the City of Boston is reserved.

By order of the BOSTON TRANSIT COMMISSION,
B. LEIGHTON BEAL, Secretary.

Bids received until Nov. 4, 1915.

Proposals for Repairs to Granby Street

OFFICE BOARD OF CONTROL,
Norfolk, Va., Oct. 22, 1915.

Sealed proposals will be received at this office until one o'clock P. M., Thursday, Nov. 4th, 1915, for reconstructing, repairing and repaving the wood block pavement on Granby Street, from Main Street to Queen Street, according to the terms and conditions of the existing contract between the United States Wood Preserving Company, of New York City, and the City of Norfolk, Va., dated Mar. 3, 1910. The pavement to be restored to a "thoroughly good and satisfactory condition"—without maintenance obligations.

Instructions to bidders, proposals and specifications for the work can be seen at the office of the City Engineer.

A certified check for $2000.00 will be required with each proposal.

The right to reject any or all bids is reserved.

BOARD OF CONTROL.
W. H. TAYLOR, JR., City Engineer.

Bids received until Nov. 15, 1915.

Notice to Hydraulic Dredge Contractors

New Madrid, Mo.

Sealed proposals will be received by the St. John Levee and Drainage District of Missouri until 2 o'clock P.M., November 15, 1915, at the office of the Secretary, in the South Room of the Hunter Bank Building, in New Madrid, Mo.

The work to begin at the east end of New Madrid, extend along the "front" and down stream to high ground; a total distance of about 8,700 ft.; and consists of either 300,000 cu.yds. special hydraulic fill levee; crown 10 ft., slopes 5 to 1 and 10 to 1; or 177,000 cu.yds. special levee combined with 76,500 cu.yds. standard team work levee.

Material for hydraulic fill levee to be obtained from Mississippi River bed or from the immediate bank, part from near each end of the work. Maximum distance to be pumped about 3,200 ft. The material for the team work will be obtained at the site.

The conditions on the ground must be examined to be understood. Plans and specifications can be examined in the office of the Secretary at New Madrid or at that of Miller Engineering Co., Little Rock, Ark.

Bids must be accompanied by a certified check in amount equal to 2% of the price bid. The successful bidder will be required to give satisfactory bond in an amount equal to 40% of the contract price.

Ninety days to begin work; then 12 months to finish.

The right to reject any or all bids is reserved.

W. S. EDWARDS, Secretary.

October 15, 1915.

Bids received until Nov. 3, 1915.

Sewer Extension

Atlantic Highlands, N. J., Oct. 19, 1915.

Bids will be received by the Mayor and Council of the Borough of Atlantic Highlands, N. J., until eight o'clock P.M. on November 3, 1915, for the construction of 2½ miles of 8″ and 10″ sewer pipe with necessary manholes, and concrete pit for sewer lift.

Plans and specifications may be obtained from W. T. Franklin, Borough Clerk, upon deposit of $10.00 as a guarantee for the safe return of same.

A certified check for the sum of $500.00 must accompany all bids, as a guarantee that the bidder will enter into contract and furnish proper bonds, should his bid be accepted. The Borough reserves the right to reject any or all bids.

(Signed) W. T. FRANKLIN, Borough Clerk.
H. O. TODD, Borough Engineer.

Bids received until Nov. 11, 1915.

Highway Work

OFFICE OF THE STATE COMMISSION OF HIGHWAYS.
Albany, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock P. M. on Thursday, the 11th day of November, 1915, for the improvement of the highways in the following counties: Cayuga (approx. 8.00); Chautauqua (approx. 0.79); Genesee (approx. 0.40); Greene (two highways—3.98, 2.39); Jefferson (approx. 6.05); Montgomery (approx. 4.59); Oneida (two highways—4.69, 5.34); Schenectady (approx. 4.22).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose divisions the roads are to be improved. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

I. J. MORRIS, Secretary.
EDWIN DUFFEY, Commissioner.

Construction News

PRICE CHANGES AND THE BUSINESS OUTLOOK

Each week more is heard about the continued improvement in business, not only as applied to goods manufactured for export, but in nearly all lines for local consumption. The net earnings of the railroads show a decided increase over last year at this time, and business is so brisk that they are in no position at present to handle the freight which is piling up. One drawback seems to be the scarcity of transports at freight terminals, which ties up the unloading. According to railroad and shipping interests, deliveries scheduled to start Nov. 1 will be in excess of available cargo room on ships sailing from New York, and consequently railroad shipments will be diverted, to a certain extent, to Canadian ports, where shipping facilities to foreign ports are more easily obtained. A number of the railroads are placing large orders for new freight cars, among which are the New York Central, with an order for 9,000, and the Baltimore & Ohio for 1,000 hopper bottom cars, besides which figures have been asked by other roads for about 6,000 more. The railroads are also placing heavy orders for 1916 delivery of rails, among which are the Pennsylvania for 175,000 tons, the Boston & Maine, 25,000 tons, the Illinois Central, 65,000 tons and the Baltimore & Ohio for 62,500 tons. These orders give us an idea of the vast amount of rail business being handled; when it is understood that Russia alone has bought 350,000 tons and is in the market for more, it can be seen that business already placed in this line alone is around 1,000,000 tons.

The demand for pig iron and various lines of steel is the greatest since 1907, and is in excess of the producing capacity of the furnaces and mills. It is almost impossible to buy any pig iron, scrap, or ingot, for present delivery. Pig iron in the past three months has increased in price approximately 35%, and steel products outside of steel rails about 15%, and business in these lines is more than double that of a year ago. Pittsburgh is booming with this increased activity, the Westinghouse Electric Co. having bought 100 acres, to erect 500 model dwellings for employees at a cost of $1,500,000.

It is interesting to note that from 1900 to 1912, although the population of the United States has increased but a little over 25%, the national wealth has increased 112%, or $803 per person. Exports are reaching new marks each week, being estimated around $100,000,000 the third week in October against $73,700,000 the previous week. Contrast these figures with the weekly average for the past five years of $39,000,000, and some idea of the increase is gained. A large contract recently placed which is of interest is the order for 5,000,000 yd. of cloth, placed with the American Woolen Co., by the Russian Government, and is the greatest single order ever placed with one concern in this line.

Trade balances are piling up faster than ever before, the past four weeks the total being over $200,000,000. A year ago it was about $40,000,000. About 60 per cent. of these exports are for goods fully or partly finished, against a year ago when it was about 25 per cent. Municipal bond issues for September throughout the country, reached a total of over $21,000,000 against $8,712,000 for September a year ago. The increase for nine months of this year against last year is $38,395,668. Bond issues to be voted for the next six months if a good percentage pass, should increase considerably the over total for 1915 as there is a great deal of large work contemplated. Building permits for September from 163 cities furnish us with a contemplated outlay of $72,862,340 or $17,995,319 more than for the same month of last year.

The question of unskilled labor in construction work is very liable to become serious with the opening of work in 1916, as at the present time it is hard to get labor to leave the larger cities even for $2 a day of 8 hr. Emigration to this country has dropped to about ⅛ of what it was a year ago. For instance August, 1915, 21,940 emigrants landed here against 142,655 a year ago. Taking into consideration the great number of laborers returning to their own country, against those arriving and the expected additional construction contemplated for next year, it would seem that the unskilled labor problem is one of prime importance to the contractor.

Conservative banking interests are greatly worried over the present speculation in industrial stocks and consider it would be best for all concerned if the market were given a rest for a time.

The cement market is considerably firmer than it was a month ago with an additional rise in price of 10c. this week, this increase being due to the additional orders being placed and the shortage of labor as the steel interests are taking every available man. The local brick market is in better shape than it was a month ago, prices ranging from $6.75 to $7. Local business in all heavy construction lines seems to be better than before, this being caused by all contractors placing orders in an endeavor to finish as much work as possible before the winter sets in.

CEMENT, LIME AND BRICK

Brick—The brick market is firmer than it has been for some time at around $6.75 per thousand. This price is for Hudson and Raritan brick. Dealers do not expect a further increase in price at present. The reason for prices holding so firm is that the brick manufacturers have all cut down on the regular amount manufactured this year, expecting a continuation in the building slump and consequently are short of stock.

Portland Cement—Exceptional demand for this material has caused prices to increase. Labor scarcity has been a factor causing concern to manufacturers, and shipments are made with some difficulty. In the Eastern district the following quotations are current and show an advance of 10c. over last month:

New York	$1.22
Jersey City	1.16
Boston	1.37

The above prices are exclusive of package and for carload lots f.o.b. cars at places named. To contractors 45c. is added to the above figures, including charge for bags. To dealers 40c. is added to the above figures.

Labor—The market for unskilled labor is more acute at the present time than it has been all summer. This is on account of so many unskilled laborers going back to their own countries, and the regular amount of rush fall business which all contractors want to complete before cold weather sets in. The local employment agencies have a great many calls on hand all the time for laborers, $2 per day for an 8-hr. day, and find it practically impossible to fill them. The call for men in the building line is very slack, men applying for positions all the time, and practically no demand for same. Experienced machine shop men are at a premium, and are almost impossible to get. There is a great demand for machine shop men of all classes in England, advertisements appearing in the New York papers pretty regularly, offering very good inducements, but prices paid in this country are so high at present that, as far as we can understand, they are having very poor success in obtaining any men to fill the positions.

Crushed Stone—Business continues fairly good, and prices over last month have shown some advance. For immediate shipments on fair size contracts for 1½-in. crushed stone the price now ranges from 80 to 90c., and on ¾ in. 90c. to $1. Some dealers may experience difficulty in securing shipments due to the great demand for barges. In this connection it may also be said that prices may advance in accordance with the extra increase on barge charges. The demand for this material for highway improvement continues fair, and dealers appear to be well booked with orders. For extra large contracts, the foregoing prices may be shaded slightly.

Sand and Gravel—Local dealers say that business is better now than it has been for a number of years, although the amount of business being done has not affected prices over a month previous. Sand is quoted at 45c. per cu.yd., some dealers asking only 40c. on large orders. Gravel prices are as follows: Subway, 95c. per cu.yd., and paving 75c. per cu.yd.; 1½ in. gravel 80c. per cu.yd., and ¾ in. gravel at 85c. per cu.yd. These quotations are for full cargo lots of 500 cu.yd., delivered alongside of docks, New York.

IRON AND STEEL

Pig Iron—Not since 1907 has the buying of pig iron been so marked, and in comparison with the situation of a year ago the amount of business has practically doubled. Several times during the month, prices have jumped without occasioning any decrease in the demand, and at present makers are well able to maintain prices, and conditions are such that further increases are forecasted. The present demand is principally attributed to the war, although the domestic consumption is by no means light. At Cleveland during the last week the gathering of the steel representatives occasioned a great deal of interest, and the general discussions of those present gives reason to believe that the present state of the steel trade is almost without parallel. Although the buying in the Pittsburgh district is heavier than a month ago, the price remains the same, bessemer iron being quoted at $16.95 and basic at $15.95. These quotations include the usual freight charge from the valley to the Pittsburgh district. In the Cincinnati district, foundry irons have advanced a dollar per ton. The volume of business has been steady and heavy at this rate. The following quotations are effective:

Cincinnati Southern Foundry No. 2	$15.40 to $15.90
Cincinnati Northern Foundry No. 2	16.51 to 16.76
Cincinnati Northern Foundry No. 2	16.26 to 16.51

Chicago manufacturers are working under heavy pressure, and the volume of business is so great that the maximum of production is almost reached. Prices have been advanced, and are well maintained. The prices following are f.o.b. furnace, and for the switching charge the average is 50c. per ton. Northern Foundry No. 1 is now selling at $15.50 to $16.00; Northern Foundry No. 2 at $15.25 to $15.50. The Birmingham district prices have again advanced a dollar per ton, and shipments at this rate continue very heavy. For delivery f.o.b. furnaces, the price of Southern Foundry No. 2 is $13 to $13.50; No. 1 Southern Foundry sells at $13 to $14. In New York buyers have appeared in the market, and reports show that more deals have been closed than a month ago. In sympathy with the other districts, prices have shown an advance. Northern Foundry No. 2 plain is quoted at $15.75 to $16.25; No. 2X at $16.25 to $16.75. Southern iron is $17 to $17.25 for No. 1, and for No. 2, $16.75 to $17.

Steel Rails—Railroads are still entering the market and buying is even more free than a month ago. The most recent report states that the Pennsylvania R.R. Co. has entered an order of 175,000 tons of steel rails for its lines east and west of Pittsburgh. These rails are to cover the 1916 requirements of this system. Foreign governments are still sending in inquiries, and the mining and lumber interests are appearing in the market especially for orders of light rails. Quotations are without change, and for lots of 1000 tons or over, prices are as follows: Standard sections of bessemer, $28; open-

hearth, $30, both per gross ton f.o.b. Pittsburgh. Girder rails in 30-ft. lengths are $36.40; in 60-ft. lengths, $38.40 per gross ton. Large lots, prices given in cents per lb., are as follows: Standard sections bessemer rails, 1.25c.; open-hearth, 1.34c. Light rails are quoted as follows: 25- to 45-lb. sections, 1.34c.; 16- to 20-lb., 1.39c.; 12- to 14-lb., 1.44c.; 8- to 10-lb., 1.49c. These are for carload or larger lots. An advance of 5c. per 100 lb. is charged for less than carload lots.

Track Supplies—Following the general advance of other steel materials, there has been an increase in the price of spikes, the present quotation being $1.70 per keg. The volume of business is heavier than a month ago, and inquiries on hand show considerable future business. The above quotation is for standard spikes, the smaller spikes selling at $1.80 per keg. Both quotations are f.o.b. Pittsburgh. Track bolts and square nuts are quoted at $2.10 to $2.25 in carload lots Pittsburgh. Standard section angle bars sell at $1.50 to $1.75, base, f.o.b. Pittsburgh. Track bolts at Chicago are selling at $2.10 to $2.25, and tie plates at $30 to $32 per ton.

Plates—Orders for this material have been more numerous and prices have stiffened and are well maintained. Shipbuilding companies are entering the market, and toward the latter half of the month have placed some very generous orders, and several contractors have ordered a fair quantity of plates for the construction of tanks. Although in some instances it is reported that prices have been shaded, the general quotation appears to be firm at $1.45 f.o.b. mills Pittsburgh. This price is equivalent to 1.639c. per lb. Chicago. The charge from stock in Chicago is 2c. per lb. In Philadelphia it is 1.609c., and in New York it is 1.619c., and from store 2.10 to 2.15c.

Structural Material—Building operations have shown an increased activity; especially in this noticeable in industrial circles. As a result, the demand for structural shapes is more apparent, and prices were not only stronger during the earlier part of the month but the latter half an increase of a dollar per ton was necessary. The placing of large orders for railroad cars and the call for special fabricated material from some of the railroads, created a more constant demand for certain structural shapes. The increase has been $2 per ton, and the base price at Pittsburgh is now $1.50 per 100 lb. This includes beams up to 15 in., channels 3 to 15 in. and angles 3 to 6 in.; T's 3 in. and over. Cutting to specified lengths is charged at the following rates: 2 to 3 ft. inclusive, 25c.; 2 ft. to 1 ft., 50c.; under 1 ft., $1.55. No charge is made for cutting to specified lengths over 3 ft. In Philadelphia the base price is 1.659c. Small lots stock sell at least $1 to $2 per ton higher. In New York the base price is 1.619c. Small lots are quoted at a base price of 2.15c. from storehouse. In Chicago delivery from mill is 1.639c., and from stock 2c. The above quotations are per pound.

Pipe—Manufacturers are operating at a greater capacity than a month ago, and the demand has increased. It is rumored that the higher prices in steel products may tend to create a stronger market for this material and cause an increase in the price as well. On very desirable orders discounts on this material may be shaded, but the following for carload lots f.o.b. Pittsburgh hold fairly steady.

	Black	Galvanized
¾- to 2-in. steel, butt welded	79%	63½%
2½- to 6-in. steel, lap welded	78%	62½%
7- to 12-in. steel, lap welded	76%	58½%

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
¾-in.	2.43	4.19	5-in.	32.56	55.50
1-in.	3.57	6.20	6-in.	42.24	72.00
1¼-in.	4.83	8.39	7-in.	57.12	98.77
1½-in.	5.77	10.03	8-in.	60.00	$1.03
2-in.	7.77	12.55	9-in.	82.80	1.43
2½-in.	12.87	21.93	10-in.	98.99	1.70
3-in.	16.83	28.68	11-in.	$1.11	1.92
4-in.	23.98	40.87	12-in.	1.21	2.10

Sheets—Demands for black sheets have been more in evidence during the latter part of the month, and brought higher prices than during the early part. Compared with quotations of a month ago, the advance is 20c. per 100 lb. On galvanized the demand is moderate but fair and the price is lower. Quotations as given below are for large lots f.o.b. Pittsburgh and small lots from store New York:

	Cents per Pound — Large Lots Pittsburgh Black	Large Lots Pittsburgh Galv.	Warehouse Delivery New York Black	Warehouse Delivery New York Galv.
No. 10	1.75	2.50	2.25	.....
No. 12	1.75	2.60	2.30	3.65
No. 14	1.80	2.60	2.35	3.65
Nos. 18 and 20	1.90	2.85	2.55	3.90
Nos. 22 and 24	1.95	3.06	2.60	4.05
No. 26	2.00	3.20	2.65	4.20
No. 27	2.05	3.35	2.70	4.40
No. 28	2.10	3.50	2.75	4.50

Cast Iron Pipe—A keener interest is shown in the market, and more buyers are entering for spring shipments. Prices are firm as follows: In New York, on 6-in. Class B and heavier, $26 per ton tidewater is asked; and on Class A, $27; the latter price also applying to gas pipe. In Birmingham, oerations are on about the same scale as a month ago, and prices as follows, f.o.b. yards: 4-in., $22, 6-in. and upward, $20; on gas pipe $1 per ton is added. In Chicago contracts are more or less scarce, and the tonnages involved in most cases are small. Following are the quotations per net ton in this district: 4-in. pipe, $28; 6-in. and larger, $26; for Class A water pipe and gas pipe $1 extra is added. The advance in this market of $1 a ton has more or less held back some buying.

Steel Sheet Piling—The demand for this material is no greater than a month ago, and the price remains stationary at $1.55 base per 100 lb., f.o.b. Pittsburgh.

Old Material—Mills are only making purchases when offered very attractive prices, and in most cases are rejecting a great deal of material that would not fully fit their requirements. A number of small lots are being purchased, but as yet there has been no decided slump in the market. Dealers in New York are furnishing the following quotations:

	Per Gross Ton
Heavy-melting steel scrap	$12.00 to $12.75
No. 1 railroad wrought	14.00 to 14.50
Stove plate	9.75 to 10.00
No. 1 machinery cast	12.75 to 13.00
Wrought turnings	7.50 to 7.75
Cast borings	7.50 to 7.75
Railroad malleable cast	10.00 to 10.50
No. 2 heavy cast	11.75 to 12.00

A similar condition practically holds true in Chicago, and consumers of materials are buying in moderation and in small quantities. The market, however, is rather strong, considing the general conditions. In this district, at the buyer's works, all freight transfer charges paid, quotations are as follows:

	Per Gross Ton
Heavy melting steel scrap	$11.75 to $12.00
Old steel rails rerolling	13.50 to 14.00
	Per Net Ton
No. 1 railroad wrought	$11.75 to $12.25
No. 2 railroad wrought	11.00 to 11.50
No. 1 cast scrap	10.50 to 11.00
Pipes and flues	8.50 to 9.00
Agricultural malleable	9.25 to 9.75
Railroad malleable	10.25 to 10.75
Cast borings	6.50 to 7.00

Chain—The market continues fair and steady, and the volume of business is about the same as a month ago. Prices remain steady and without change as follows per 100 lb. f.o.b. Pittsburgh.

3/16 in.	$7.50	½ and 9/16 in.	$3.00
¼ in.	4.95	5/8 and 11/16 in.	2.90
5/16 in.	3.95	¾ and 13/16 in.	2.80
3/8 in.	3.40	7/8 and 15/16 in.	2.70
7/16 in.	3.20	1 to 1¼ in.	2.60

EXTRAS TO ABOVE LIST PER 100 POUNDS

	For BB	For BBB
3/16-in. and ¼-in.	$1.50	$2.00
5/16-in. and larger	1.25	1.75

Wire Rope—Sales this month have been more numerous than the preceding month, and prices have shown a decided advance. On galvanized the discount is now 40 and 2½% off list. On bright it is 55 and 2½%. Special brand brights are selling at 50 and 2½% off list. Of these discounts the net price wire rope at the mills is as follows:

Diameter in Inches	Price per Foot — Cast Steel	Crucible Steel	Plow Steel
2½	$0.77	$0.92	$1.10
2¼	0.63	0.75	0.88
2	0.51	0.59	0.70
1¾	0.40	0.48	0.57
1½	0.29	0.35	0.41
1¼	0.20	0.25	0.29
1	0.14	0.16	0.19
¾	0.08	0.09	0.11
⅝	0.07	0.07	0.08

Freight Rates—The freight rate on finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, black sheets (except planished), chain, etc., are as follows in cents per 100 lb.; Boston, 18.9; Buffalo, 11.6; Baltimore, 15.4; Cleveland, 10.5; Cincinnati, 15.8; Chicago, 18.9; Denver, 68.6; New Orleans, 30; New York, 16.9; Philadelphia, 15.9; St. Louis, 23.6; Minnesota and St. Paul, 32.9. Pacific Coast (all rail), 73.9.

Merchant Steel—More interest has been taken in the market for merchant shapes, and transactions during the month have been more numerous and the volume of business more steady. In most instances prices have advanced a dollar per ton. The quotations as given below are the general base prices for small lots in jobber's store:

	Cents Per Pound
Refined iron:	
1 to 1⅞ in., round and square	2.05
1½ to 4 in. x ⅜ to 1 in.	2.05
1½ to 4 in. x ¼ to 5/16 in.	2.25
Norway bars	3.95
Burdens bar iron	3.15
Soft steel:	
¾ to 3 in., round and square	2.05
1 to 6 in. x ⅜ to 1 in.	2.05
1 to 6 in. x ¼ and 5/16	2.10
Rods—⅝ and 11/16 in.	2.15
Bands—1½ to 6x 3/16 in. to No. 8	2.35
Beams and channels—2 to 15 in.	2.10

Angles:	
3 in. x ¼ in. and larger	2.10
3 in. x 5/16 in. and ⅛ in.	2.55
1½ to 2¾ in. x 5/16 in. and thicker	2.30
1½ to 2½ in. x ⅛ in.	2.20
1 to 1¼ in. x 5/16 in.	2.30
1 to 1¼ in. x ⅛ in.	2.35
Tees:	
1½ to 2½x¼ in.	2.25
1½ to 2½x5/16 in.	2.35
3 in. and larger	2.15

Triangle Mesh—The demand continues very good and following the other metal products, increase in this material has resulted. The general revision of price makes the following quotations:

PRICE PER 100 SQ.FT. FOR FOUR-IN. MESH

Style No.	Cross-Sec. Area per Ft. Width	Plain Material—Carload Lots	Plain Material—Less Than Car Lots and Over 10,000 Sq.Ft.	Galvanized—Carload Lots	Galvanized—Less Than Car Lots and Over 10,000 Sq.Ft.
†4	0.102	$1.10	$1.20	$1.31	$1.42
5	0.077	.87	.95	1.04	1.12
6	0.058	.69	.76	.82	.89
†7	0.041	.54	.59	.64	.69
†23	0.170	1.84	2.02	2.20	2.38
24	0.142	1.58	1.74	1.89	2.05
25	0.124	1.40	1.54	1.68	1.82
†26	0.110	1.28	1.40	1.53	1.65
†27	0.085	1.05	1.15	1.25	1.35
28	0.066	.87	.95	1.04	1.12
29	0.049	.71	.78	.85	.92
31	0.261	2.70	2.97	3.23	3.50
32	0.225	2.35	2.58	2.81	3.04
33	0.196	2.09	2.30	2.50	2.71
34	0.140	1.61	1.76	1.92	2.08
35	0.109	1.28	1.40	1.53	1.65
36	0.075	.94	1.04	1.13	1.22
38	0.380	3.85	4.23	4.61	4.98
†39	0.325	3.32	3.64	3.97	4.29
40	0.283	2.91	3.19	3.48	3.76
41	0.208	2.22	2.44	2.65	2.87
42	0.151	1.68	1.85	2.01	2.18
43	0.101	1.20	1.32	1.43	1.55

†This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths of rolls are 150, 300 and 600 ft. Cutting to special length is charged extra.

Bars, Concrete Reinforcing—The mills are receiving more orders than they can take care of, business being even more brisk than it was a month ago. Delivery on orders has been extended to four and five months, and the mills do not appear anxious for any further business for months to come. Prices have advanced 10c. with a further increase expected in a short time. New prices effective October 26 are as follows:

	Cents per Pound—Mill Shipment Pittsburgh	Cents per Pound—F.o.b. Warehouse Pittsburgh	Cents per Pound—Delivered From Warehouse New York
¾ in. base	$1.50	$2.15	$2.15

Full bar card extras.

Expanded Metal Lath—Business is very good with the dealers in this line, and they find it very hard to fill orders on account of the scarcity of material from the mills. This is caused by their being able to sell their entire output to foreign countries if they wished, instead of which they are doing their best to take care of the market in the United States, although they claim that they can get from 25 to 33 per cent. more by exporting it. Prices have advanced since last month, and dealers expect another advance within a few weeks. Prices for painted are as follows, effective Oct. 27.

Gage	Weight	Carload	1,000 to 5,000	Under 1,000
27	233	$11.44	$12.52	$13.52
26	250	12.47	13.55	14.55
25	300	13.57	14.66	15.66
24	340	14.64	15.75	16.75
22	450	17.54	18.75	19.75

For galvanized cut in sheets, add 6c.

METALS

Copper—During the early part of the month there was some activity in the market, and the price of electrolytic rose to 18¼c. per lb., while Lake remained unchanged at 18c. These prices both held very steady, and although the market was not exceptionally strong at these figures, yet business was considered fair. During the last week of the month there was a lull, and prices of both electrolytic and Lake stood at an even level of 18c. At this quotation, the market showed indications of weakness, and buying for both export and domestic use was very light. Manufacturers of war supplies tend to hold the market strong at this writing, the present quotations having advanced to 18⅛c. for electrolytic and 18¼c. for lake.

Tin—Tin opened the beginning of the month with a firm market at 33c. per lb., but at this figure very little interest was shown. Toward the end of the month, a great deal more business appeared, and the activity in the tin market caused an advance of 3c. per lb. It is believed that a great deal of the buying was done on a speculative basis. As we go to press, the quotation remains at 36c. and the market continues brisk and strong.

Lead—Following the advance of tin last week lead was raised to 4.9c. per lb., and buying by both foreign and domestic consumers was very heavy. Trade conditions at this time are exceptionally good, but some dealers are willing to shade this quotation slightly. In comparison with the first three weeks of the month the price remained stationary at 4.5c., but buying was not considered by any means good. However, this price remained firm, although the inactivity was marked.

Spelter—Following the marked activity in the tin and lead market, spelter sales became more numerous and the market stiffened considerably. Domestic consumption is good, although the foreign demand is more or less irregular. The preesent quotation of 14c. is firmly held, and dealers are of the opinion that it will continue at this figure for sometime.

Old Metals—Prices went up and down during the month. Buyers only at instances showed some interest in the market. The following quotations, however, are well maintained, and are for dealers' prices paid in New York:

	Cents per Pound
Copper, heavy cut and crucible	15.00
Copper, heavy and wire	14.75
Copper, light and bottoms	13.00
Brass, heavy	10.00
Brass, light	8.25
Heavy machine composition	12.00
No. 1 yellow rod brass turnings	10.75
No. 1 red brass or composition turnings	10.50
Lead, heavy	3.75
Lead, tea	3.50
Zinc scrap	8.00

MISCELLANEOUS

Asphaltum—Manufacturers are very busy in this line, on account of contractors trying to get all their work done before cold weather sets in, which means that they are ordering enough material to last them for the balance of the season. The price has advanced to $15 a net ton in wooden packages, caused by the difficulty in getting tank steamers to bring Mexican petroleum to this country, and the increased freight rate that they are charging.

Explosives—Prices on caps, explosives, dynamite, etc., can only be obtained from the nearest factory, on account of prices varying so much in the different zones.

Railway Ties—There is very little business at present, conditions not having changed at all since last month. The railroads are commencing to use up their present stock of ties, and a few requests are commencing to come in for prices on deliveries in 1916. The dealers are not particularly discouraged, as they all have reason to know that their line of business is one of the last to be benefited by better conditions, and are confident that it is only a question of time when they will again be very busy. Freight rates are about the same as they have been, and prices are as follows: First class standard ties, 7x9 in. by 8 ft. 6 in., 73c.; 6x8 in. by 8 ft. at 61c. These prices are f.o.b. New York.

Blue Stone—There is the regular Fall picking up in business in this line, so that the contractors can finish all the work possible before the winter sets in, which is keeping them fairly busy at present, and they all seem to be very optimistic about the future. There seems to be very little large work going on, most of the contracts let being very small, but all dealers are planning for a large business next year when they expect a great many of the large contracts to materialize. Prices are as follows: Bronx flagging 17c. per sq.ft.; Manhattan 18c. per sq.ft.; curbing 5x16 in., 40c. per lin.ft.; 5x20 in. 45c. per lin.ft.; sewer bottoms, 5x5 ft. by 3 in. 25c. per sq.ft.; Belgiam bridging 5x24 in., 65c. per lin.ft.

Glass—The following prices are for window, plate and skylight glass. Plate glass 90%, 40%, 10% off of current list. Window glass single strength 1-3 brackets inclusive B quality, 90% and 30% off; A quality 90 and 20% off. Above the third bracket B quality 90 and 10% off; A quality 90% off. Double strength glass all brackets B quality, 90 and 20% off; A quality, 90 and 10% off. In single strength or double strength AA quality, special prices prevail. On skylight glass ¼ in. wire, rough or ribbed, 14c. per sq.ft. Boxing on above, extra for out of town shipment.

Clay Drain Tile—The local dealers in this line are all of the opinion that business is very good and expected to continue so until cold weather sets in. Prices are as follows:

PER 1,000 SQ.FT.

2 in.	3 in.	4 in.	5 in.	6 in.	8 in.
$17.50	$22.50	$32.50	$47.50	$57.50	$97.50

These prices are in carload lots, f.o.b. New York.

Flue Lining—While business might only be considered fair, prices are well maintained, the present discount being 83% off list. At this rate prices are as follows:

FLUE LINING—PRICE PER FOOT

Size in In.	Weight in Lb.	Price per Ft.	Size in In.	Weight in Lb.	Price per Ft.
4½x 8½	14	$0.06	8½x13	28	$0.114
4½x13	20	0.076	8½x18	45	0.153
4½x18	40	0.17	13x13	38	0.144
7 x 7	15	0.068	13x18	57	0.204
8½x 8½	18	0.076	18x18	75	0.34

Sewer Pipe—Dealers report conditions as very favorable considering the period for the year. They are able to maintain the same prices as a month ago, and the outlook for business appears very encouraging. Discounts are firmly held as follows: On 3 to 24 in., 82½ off list is quoted; 27 to 30 in., 72%; 30 to 36 in. At this rate rices are as follows:

PRICE OF SEWER PIPE PER FOOT

Size		Size	
3-in.	$0.045	18-in.	$0.342
4-in.	0.045	20-in.	0.405
5-in.	0.072	22-in.	0.54
6-in.	0.072	24-in.	0.585
8-in.	0.099	27-in.	1.26
10-in.	0.144	30-in.	1.54
12-in.	0.18	33-in.	2.06
15-in.	0.243	36-in.	2.31

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

Connecticut—New York, New Haven & Hartford Railroad plans to double track its Northampton division to complete a stretch of double tracks between New Haven and Westfield. Elmer Gagel, New Haven, Ch. Engr.

New York—International Railway Co., Buffalo, will soon start work on new line on Eleventh St. to College Ave., Niagara Falls. J. C. Sheldon, Buffalo, Pur. Agt. Noted Oct. 22.

Pennsylvania—Baltimore & Ohio Railroad Co. will rebuild its tracks in Johnstown. F. L. Stuart, Baltimore, Ch. Engr.

Delaware—Wilmington & Philadelphia Traction Co., Wilmington, acquired control of Wilmington, New Castle and Delaware City Railway and plans to improve same. T. W. Wilson, Wilmington, Gen. Mgr.

Maryland—L. F. Johnson, Baltimore, interested in electric railway to be built from Hancock, Md., south to Berkley Springs, W. Va., about ten miles.

Maryland—Western Maryland Railway making surveys from point on Baltimore and Ohio Railroad Co. near Hutchinson, W. Va., west to Wyatt, about eight miles, to build line to develop coal fields. H. R. Pratt, Baltimore, Ch. Engr.

North Carolina—Bonds for $50,000 voted to aid proposed line from Topton, N. C., north via Robbinsville and along Cheoah River, about 43 miles. E. Philbrick, Andrews, Ch. Engr. Noted Sept. 23.

Florida—Jacksonville Traction Co., will soon start work on construction of double track through Springfield Park from Pearl to Hogan St., Jacksonville. Hardy Groom, Jacksonville, Local Mgr. and Pur. Agt.

Alabama—Alabama Power Co. received 39-year franchise from City Council to extend line from Sixth and Lapsley St. to Anniston Country Club, Anniston. A. L. Kenyon, Anniston, Mgr. Noted July 29.

Alabama—Montgomery Light and Traction Co. applied to City Council for franchise to extend its line in Montgomery from Day St. terminus west to city limits.

Kentucky—Cumberland Traction Co. has increased its capitol stock from $50,000 to $250,000 and plans to build a railway between Edmonton and Elizabethtown. L. J. Metcalfe, Elizabethtown, Pres.

Kentucky—Louisville, Henderson & St. Louis Railway plans to issue $5,000,000 bonds. Part of proceeds will be used for improvements. F. D. Ferry, Louisville, Pur. Agt.

Kentucky—Southern Railroad will build line through coal and timber districts in Bluefield, W. Va., along border of Kentucky and Virginia, about 65 miles. C. R. Craig, Pur. Agt., Washington, D. C.

Ohio—A company has been formed by N. J. McGuire, R. Faulkner and K. C. Wilson, Indianapolis, Ind., to build traction line between Chillicothe and Hillsboro to be operated by gasoline electric power.

Ohio—Cincinnati, Hamilton & Dayton Railway will double track line from South Dayton to Miamisburg, seven miles. E. H. Bankack, Baltimore, Md., Pur. Agt. Estimated cost, $175,000.

Indiana—Evansville, Chrisney & Eastern Railway plans to build a line from Boonville to Chrisney, about 13 miles, and from Boonville to Lynnville, about 11 miles. J. P. Chrisney, Pres.

Indiana—Ft. Wayne, Decatur & Southern Railroad, recently incorporated, plans to build a line from Decatur to Berne, about 12 miles. Noted Aug. 26. M. Gerke, interested.

Michigan—Surveys being made for electric railway from Muskegon to St. Johns, Mich., about 110 miles.

Illinois—J. E. Melick, 333 South Douglas Ave., Springfield, and associates completed survey for railway between Pearl and Kampsville, 11 miles. Noted Oct. 22.

Iowa—Inter-Urban Railway of Des Moines plans to build an extension of its line from Colfax to Newton, via Metz, about 12 miles. F. M. Harris, Des Moines, Pur. Agt.

Iowa—Muscatine & Iowa City Railway Co. leased lines of Muscatine & Western Railroad Co. and will electrify same between Muscatine and Iowa City. C. D. Van Hecke, Gen. Mgr.

Missouri—Citizens of St. Charles contemplate electric railway. Estimated cost, $50,000.

Arkansas—Press reports state that Iron Mountain Railroad will build branch line from Buffalo to Rush, Ark. W. L. Cole, Keswick, Calif., Gen. Mgr.

Texas—Vernon L. Sullivan, Ft. Stockton, interested in construction of railway from Garvin, Tex., or some point on Kansas City, Mexico & Orient, northwest to connect with Texas & Pacific at Pecos or Barstow, about 80 miles.

Texas—Franchise granted to Dallas Southwestern Traction Co. and Dallas Northwestern Traction Co. for line from Dallas southwest via Cleburne and Glen Rose to Stephenville about 80 miles, and from Dallas to Denton, about 30 miles. E. P. Turner, Gaston Bldg., Dallas, Pres. Noted Oct. 21.

Texas—Gulf, Texas & Western Railway contemplates extending its line from Jacksboro to Ft. Worth, about 35 miles. Benjamin B. Cain, Dallas, Vice-Pres. and Gen. Mgr.

Texas—Charles E. Schaff, receiver of Missouri, Kansas & Texas Railway Co., applied to Federal Court for permission to purchase 15,000 tons of 85 lb. steel rails for relaying 115 miles of track of system in Texas. W. E. Williams, Parsons, Kan., Gen. Mgr.

Oklahoma—Choctaw Railway and Lighting Co. plans extension of line from Hartshorn to Gowen and Wilburton. L. E. Fisher, St. Louis, Mo., Vice-Pres. and Gen. Mgr.

Idaho—G. A. Branson will build two mile spur from Chicago, Milwaukee & Puget Sound Railroad Co. near Santa, to St. Maries Lumber Co.

Washington—Lewistown & Clarkston Transit Co. has applied to Board of County Commissioners of Asotin County for franchise to extend line in Clarkston.

Oregon—Oregon Electric Railway Co. will build spur track to warehouse of Allen & Lewis Co., Eugene, Ore. W. D. Scott, Portland, Gen. Mgr.

Oregon—Pacific Power and Light Co. applied to City Council for 30-year franchise to extend line on Franklin Ave., Astoria. James E. Davidson, Portland, Gen. Mgr.

Quebec—Surveys being made for branch line of Quebec and Lake St. John Railway from Lorettville to Stoneham, about 9½ miles.

Ontario—Canadian Pacific Railway Co. plans industrial spur for Graves, Bigwood, Co., Sudbury, about 52.6 miles. J. M. R. Fairbairn, Montreal, Asst. Ch. Engr.

Saskatchewan—Grand Trunk Pacific Railway Co., has been authorized by Railway Commissioners to build line to Board of Grain Commissioners' elevator, Moose Jaw. H. A. Woods, Winnipeg, Man., Asst. Ch. Engr.

Bids In and Contracts Awarded

North Carolina—Contract awarded by Piedmont and Northern Railway Co. to CHARLOTTE CONSTRUCTION CO., for branch line from Belmont Junction to Belmont, about four miles. Noted Oct. 21.

Texas—Midland & Northwestern Railway awarded contract to J. A. HUNTER, Strawn, Tex., for grading from Midland, Tex., through Andrews County to Seminole, Gaines County, 65 miles. G. W. Thaxter, Ch. Engr., T. J. O'Donnell, Midland, Tex., Pres.

California—Spanish Peak Lumber Co., Quincy, awarded contract to UNITED STATES STEEL PRODUCTS CO., at $35,536, for tramway from Spanish Ranch to Gray's Flat, about 6 miles.

LIGHT, HEAT AND POWER

Proposed Work

Mass., Pittsfield—Pittsfield Coal Gas Co. plans to extend its mains about 13 miles. Estimated cost, $41,000.

Conn., Manchester—Cheney Bros. plan power plant on south side of Hartford Rd.

N. Y., Batavia—Plans being considered for improving electric-light plant. Estimated cost, $22,737.

Penn., Ridgway—Plans being considered by Ridgway Electric Light Co. to issue $15,000 capital stock to extend and improve its plant.

Md., Easton—Newton Electric Co. plans electric transmission system from Easton to Oxford, about 15 miles.

Va., Atkins—Plans being considered by D. P. Musser for electric-light plant.

N. C., Salisbury—Plans being considered by Southern Power Co., Charlotte, for enlarging and improving its plant.

N. C., Wilmington—Tidewater Power Co. plans an expenditure of from $50,000 to $60,000 to extend gas service from Wilmington to Wrightsville Beach and seven other towns, also to build several stations.

Ga., Graymont—City retained W. Hopson Goodloe, Macon, Ga., to prepare plans and supervise construction of electric-light plant to be built by Graymont and Summit. Estimated cost, $10,000. Noted Oct. 7.

Ala., Bessemer—Plant of Bessemer Gas Co. purchased by Birmingham Railway, Light and Power Co., who plan to improve and extend same.

Miss., Utica—Plans being prepared by X. A. Kramer, Magnolia, for electric-light plant.

Tenn., Mason—According to press reports a company is being organized to construct an electric-light plant.

Ky., Louisville—Lyndon Country Club is back of a movement to construct an electric-light plant in Louisville.

Ky., Whitesburg—Wiley W. Gibson & Son, Mater, contemplates electric-light plant.

Ohio, Lima—An expenditure of $23,000 planned by Cincinnati, Hamilton & Dayton Railroad for new power plant.

Ind., Oldenburg—Bids being received for a power house at convent of Sisters of St. Francis, Oldenburg. Estimated cost, $20,000. J. J. Reuckert, 8 Allen Bldg., Cincinnati, Ohio, Arch.

Ill., Chicago—U. S. Ball Bearing Co., 2147 North Kolmar Ave., will build a one-story brick power house. Estimated cost, $15,000.

Ill., Galesburg—See item under "Water Works."

Minn., Raymond—(Official)—City will construct light and power station under supervision of Minnesota Valley Power Co. Estimated cost, $5,000. Noted Oct. 21.

Kan., Oakley—Bids will be received until 7.30 a.m., Nov. 23, by J. A. Switzer, City Clk., for constructing a power plant. G. P. Taylor, Stockton, Engr.

S. D., Ashton—F. W. Boyle, Garden City, interested in Spink County Power Co., recently organized, to furnish light and power to Ashton and other towns.

Mo., Bevier—Bonds for $12,000 voted for purchase of electric-light plant. Noted Oct. 14.

Mo., Maplewood—Western Light and Power Co. granted franchise by City Council to operate electric-light plant.

Mo., Springfield—Election will be held to vote on bonds for electric-light plant.

Ark., Mountain Home—L. J. Goodrich and D. Undergill, Mountain Home, and H. M. Tatum, Sparkman, granted franchise for electric-light plant.

Tex., Austin—Plans prepared for concrete and brick power house for Austin St. Railway Co. Estimated cost, $5,000.

Tex., Beeville—Preliminary plans being prepared by Bartlett & Raney, Consult. Engr., San Antonio, for electric-light plant.

Tex., Sherman—Election will be held to vote on $150,000 bonds for electric-light plant, water system and street improvements.

Idaho, Rockland—G. B. Hodgin and Marsh & Stite have applied to State Public Utilities Commission for permit to construct electric-light system.

Wash., Ellensburg—City Council plans an expenditure of $60,000 for improving municipal power plant.

Calif., Colton—Edison Electric Co. will build an addition to its transformer station.

Bids In and Contracts Awarded

Penn., Manayunk—ELMER L. CUTHBERTSON awarded contract for one-story, 70x98-ft. boiler house for Ripka Mills Co.

Ga., Toccoa—Contracts for electric-light plant awarded to J. G. PHILLIPS, at $9,565, for dam, power house and flue lines and to WALKER ELECTRIC AND PLUMBING CO., at $15,185, for transmission lines and substations. Noted Oct. 7.

La., Lake Charles—Contract for gas plant and distributing system awarded to AMERICAN GAS CONSTRUCTION CO., Chicago, Ill. Estimated cost, $100,000. Noted Oct. 21.

Kan., Attica—(Official)—Contract for improving electric-light plant awarded to BICKEL CO., Kansas City, Mo. Noted Sept. 23 and Oct. 21.

Kan., Atwood—Contract for municipal electric-light plant awarded to F. D. MARTIN CONSTRUCTION CO., 407 Rialto Bldg., Kansas City, Mo., at $11,727. Noted Sept. 30.

BRIDGES

Proposed Work

R. I., Woonsocket—(Official)—Bids will be received by Board of Alderman, Alderman's Chambers, City Hall, until 8:15 p.m., Nov. 23, for building three reinforced-concrete bridges. Noted Oct. 28.

N. Y., Oswego—Bids will soon be received for bridge over Oswego River at Minetto. State has appropriated $50,000 toward cost.

N. J., Plainfield—An expenditure of $9,500 planned for constructing a number of bridges.

Penn., Wilkes-Barre—Bids will be received by Fred H. Gates, City Clk., until noon, Nov. 5, for reinforced-concrete bridge over Solomon's Creek on Barney St.

W. Va., Welch—Proposition submitted to Town Council by Norfolk & Western Railway for bridge across Elkhorn River. J. E. Crawford, Roanoke, Va., Ch. Engr.

Fla., Merritt—City contemplates bond issue for bridge from Cocoa to Merritt.

Ala., Mobile—See item under "Streets and Roads."

Miss., Meridian—Bids will be received by J. O. Wise, Secy. of Good Rds. Comn., until 11 a.m., Nov. 9, for reinforced-concrete bridge.

Tenn., Crossville—Commissioners of Cumberland County will construct reinforced-concrete bridge at Sutton Ford.

Tenn., Nashville—Nashville, Chattanooga & St. Louis Railway and Nashville Railway and Light Co. plan to build viaduct over tracks of Nashville, Chattanooga and St. Louis Railway at Cedar St. Estimated cost, $48,000.

Ohio, Lowellville—Bids will be received until noon, Nov. 15, for purchase of $5,000 bonds for bridge over Mahoning River.

Ohio, Upper Sandusky—(Official)—Bids will be received by Jay Marguerat, County Audr., until noon, Nov. 12, for superstructure of bridge over Sandusky River, Tymochtee Township. Noted Oct. 21.

Ill., Taylorville—(Official)—Bids will be received by C. A. Penington, County Supt., until 10 a.m., Nov. 8, for steel bridge in Bear Creek Township, Christian County.

Wis., Omro—Report submitted by Engineers of State Highway Commission estimating cost of bridge over Fox River at $30,000.

Kan., Salina—(Official)—Bids will be received until noon, Nov. 11, by R. C. Anderson, County Clk., for bridges over Smoky River. Noted Oct. 21.

Kan., Topeka—Commissioners of Shawnee County contemplate an expenditure of $30,000 for new bridges.

Kan., Wathena—City will build concrete arch bridge estimated to cost $6,500.

Neb., Lincoln—Bridge will be constructed at Parshall crossing about five miles south of Butte by Commissioners of Boyd and Holt Counties. Estimated cost, $25,000.

S. D., Yankton—Election will be held Nov. 9 to vote on $300,000 bonds for bridge across Missouri River at Yankton. Noted Oct. 21.

Mo., Lexington—See item under "Streets and Roads."

Tex., Austin—See item under "Streets and Roads."

Tex., Ft. Worth—Plans approved for reinforced-concrete bridge over Deer Creek. Bids will soon be received for same.

Tex., Graham—See item under "Streets and Roads."

Tex., Marshall—Election will soon be held to vote on $50,000 bonds for viaduct over tracks of Texas and Pacific Railway. T. E. Hilliard, City Engr.

Okla., Talihini—See item under "Streets and Roads."

Okla., Vinita—Election will be held Nov. 16 to vote on $50,000 bonds for 17 bridges.

Idaho, Parma—Bids will be received by County Commissioners, Caldwell, until Nov. 22, for steel bridge over Boise River at Parma. Estimated cost, $17,000. Inland Engineering Co., Caldwell, Engr. Noted Oct. 7.

Wash., Metaline Falls—Plans being considered by County Commissioners for steel bridge over Pend O'Reille River between Metaline Falls and Metaline. Estimated cost, $10,000.

Wash., Seattle—Northern Pacific Railroad Co. plans to start work soon on pile trestle connecting present right-of-way with Plummer St. grade. Estimated cost, $25,000.

Ore., Salem—Plans being considered by County Court for steel bridge. Estimated cost, $90,000.

Calif., Bakersfield—Bids will be received by H. A. Jastro, Chn., Bd. of County Supervs., until Nov. 8, for bridges and culverts on Division 10, Section 7, Bakersfield-Mojave Rd.

Calif., Pomona—See item under "Streets and Roads."

Calif., Riverside—Plans being prepared by C. B. Wright, Engr., Rialto, for reinforced-concrete bridge on Fairmont Blvd. for Crescent City Railway Co. Estimated cost, $10,000.

Calif., Sacramento—Plans accepted by City Commission for bridge over Arcade Creek in De Paso Park.

Bids In and Contracts Awarded

Mass., Boston—All bids received Oct. 19 for pile bridge and approaches in Edgartown and Oak Bluffs rejected.

Conn., New Hartford—SPAULDING CO., Suffield, at $8,000, awarded contract for superstructure of bridge at Satan's Kingdom. Noted Oct. 21.

Penn., Sharon—Contract for bridge across Shenango River at State St. awarded to CANTON BRIDGE CO., Canton, Ohio, at about $49,990. Noted Sept. 23.

S. C., Greenville—Contract for bridge across Saluda River on double track between Greenville and Central for Southern Railway awarded to BAILEY CONSTRUCTION CO., Chattanooga, Tenn. Noted Sept. 30.

Fla., Monroe—Contract for bridge across St. Johns River at Monroe awarded to VIRGINIA BRIDGE AND IRON CO., Roanoke, Va., for steel work, and to BEASLEY CONTRACTING CO., Savannah, Ga., for approaches and foundations. Atlantic Engineering Co., Savannah, Ga., Engr. Noted Oct. 14.

Ky., Covington—Bids were received Oct. 28 for bridge piers for bridge to carry duplicate supply main of Licking River at a point approximately 150 ft. south of Louisville and Nashville Railway bridge as follows: C. E. Harris, Covington, Bates & Rogers Construction Co., Chicago, Ill. and D. P. Foley, Cincinnati, Ohio. Noted Oct. 21.

Ohio, Columbus—(Official)—Contract for substructure of Brown Bridge awarded to WILLIAM F. SCHWARTZ, 2634 West Broad St., Columbus, at $4,336.

Ohio, Columbus—(Official)—Contract for constructing approaches to Chenoweth Mill Bridge awarded to PURDUM & SCHWARTZ, 2634 West Broad St., Columbus, at $5,323. Noted Oct. 7.

Ind., Anderson—(Official)—Contract for two additional steel spans for bridge across White River on North Main St. awarded to ELKHART BRIDGE AND IRON CO., Elkhart. Estimated cost, $9,000. Noted Sept. 23 and Oct. 21.

Ind., Indianapolis—DUNN-McCARTHY CONSTRUCTION CO., Chicago, Ill., at $146,378, awarded contract for bridge over Fall Creek at Meridian St.

Mich., Detroit—Contract for temporary Belle Isle Bridge awarded to GEORGE R. COOK, Detroit, at $92,225. Noted Aug. 19 and Sept. 16.

Mich., Spring Lake—Contract for reinforced-concrete bridge over Petty's Bayou in Spring Lake Township awarded to C. M. BLAKESLEE.

Iowa, Humboldt—Contracts for bridge work awarded to HUMBOLDT CEMENT PRODUCTS MFG. CO., Humboldt, for group A, C, D and E, and to KOSS CONSTRUCTION CO., Des Moines, for group B. Estimated cost, $33,000.

Kan., Beloit—County Commissioners rejected all bids for N. H. White bridge across Labon Creek. T. H. McCall, County Clk.

Kan., Concordia—(Official)—Contract for 11 reinforced-concrete bridges awarded to JAMES BOHAMON, Glasco, at $8,899. Noted Oct. 14.

Kan., Mankato—(Official)—Contract awarded to WESTERN BRIDGE CO., Harrisonville, Mo., at $4,549, for steel truss bridge with 80-ft. span and 16-ft. roadway. Noted Oct. 21.

Nebr., Lincoln—(Official)—Contract for bridge over Oak Creek Channel awarded to LINCOLN CONSTRUCTION CO., Lincoln, at $12,850. A. H. Edgrem, Engr. Noted Oct. 14.

Mont., Sheridan—Contract for steel bridge over Tongue River north of Sheridan awarded to SECURITY BRIDGE CO., Billings.

Mo., Independence—Contract for steel bridge in Section 19 awarded to FOX-REDPATH CONSTRUCTION CO., 922 New York Life Bldg., Kansas City, Mo., at $4,219.

Ark., Little Rock—Contract for reinforced-concrete viaduct over tracks of Chicago, Rock Island & Pacific Railway at Second St. awarded to FOX CONSTRUCTION CO., Little Rock. Estimated cost, $35,000. H. R. Shields, Div. Engr.

Tex., Floresville—Contract for bridge across Calaveras Creek on San Antonio-Floresville Rd. awarded to ALAMO CONSTRUCTION CO., San Antonio. Estimated cost, $10,000.

N. M., Roswell—Contract for bridge over the Rio Feliz near Hagerman awarded to MIDLAND BRIDGE CO., Kansas City, Mo., at $11,000. Noted Oct. 7.

Idaho, Boise—Contract for bridge work on state highway through Cassia County awarded to CHARLES MULL, Twin Falls, at $15,300.

Wash., Aberdeen—All bids received for West Toll Bridge over Chehalis River rejected. Noted Aug. 26 and Sept. 23.

Wash., Spokane—BEERS BUILDING CO., Smith Bldg., Seattle, at $18,888 and $15,555, awarded contract for steel bridge over Middle Channel at Howard St. and approach to south end of Monroe St. bridge.

Ore., Portland—Contract for viaduct near Bertha Station awarded to HEINEKE BROS., at $7,611.

Calif., Bakersfield—Contract for bridges on McKittrick Rd. awarded by Board of Supervisors of Kern County to M. T. KEAN, at $12,350.

Calif., Madera—(Official)—Contract for bridge across Fresno River awarded to MANNING BROS., Fresno, at $9,470. Noted Oct. 7. W. C. Utter, City Clk.

WATER WORKS

Proposed Work

Mass., Fall River—(Official)—Special Commission on Watuppa Ponds and Quequechan River water supply recommend improvement of Watuppa Ponds and Quequechan River. Action will probably not be taken till spring. Fay, Spofford & Thorndike, 308 Boylston St., Boston, Engr. Noted Oct. 21.

N. Y., Batavia—Chester & Fleming, Engr., Pittsburgh, Penn., estimates cost of pumping station and filtration plant at $135,000.

N. Y., Hudson Falls—Citizens voted against issuing bonds for $270,000 for water system. Noted Sept. 2.

N. Y., Minoa—City contemplates issuing $28,000 bonds for water system.

N. Y., New York—(Borough of Brooklyn)—(Official)—Bids will be received by William Williams, Comr. of Water Supply, Gas and Electricity, Room 2351, Municipal Bldg., New York, N. Y. (Borough of Manhattan), until 2 p.m., Nov. 12, for furnishing, delivering, unloading, stacking and storing cast-iron pipe.

N. J., Jersey City—(Official)—Bids will be received until 2 p.m., Dec. 2, by City Commissioners for laying about 11 miles of 72-in. steel pipe from Brooksdale to Jersey City and laying twin pipe line under Passaic and Hoboken Rivers. Noted Sept. 30.

N. J., New Brunswick—City contemplates new dam about 200 ft. above present one. Estimated cost, $20,000.

N. J., Vetnor City—(Official)—Bids will be received until 8 p.m., Nov. 22, by Common Council for mechanical equipment for artesian water works. E. Steelman Royal, City Clk. (See adv.)

Penn., Dalmatia—(Official)—Dalmatia Water Co. has had plans approved by State Department of Health for water system.

Penn., Halifax—(Official)—State Department of Health issued permits to Halifax Water Co. for repairs and extensions to spring collecting system.

Penn., Hanover—(Official)—Hanover & McSherrystown Water Co. has plans for additions to reservoir.

Penn., Juniata—State Department of Health approved plans for intake dam for municipality.

Penn., Kittanning—Borough of Kittanning petitioned Public Service Commission for permit to build water system.

Penn., Royersford—(Official)—Home Water Co. has had plans approved by State Department of Health for filtration plant, pumping station and force main.

Del., Wilmington—Water Board petitioned Council for appropriation of $35,000 for extension of underground work.

Va., Norfolk—Contract will soon be awarded for repairs or restoration of three earth dams including protective measures and substitution of concrete spillways for present ones of wood. Estimated cost, $56,000. W. H. Taylor, Jr., City Engr. Noted Oct. 14.

Va., Waverly—(Official)—Citizens defeated $55,000 bonds, part of proceeds of which was to be used for water system. Noted Oct. 28.

W. Va., Clarksburg—(Official)—Bids will be received until noon, Nov. 26, by Water Works and Sewerage Board for installing two gas engines and two pumps at the pumping station. Noted Sept. 23. (See adv.)

Fla., St. Augustine—Plans will be prepared by C. E. Henderson, City Engr., for water system. Noted Oct. 28.

Tenn., Kingsport—City contemplates water system. W. C. Hattan, Engr.

Tenn., Tiptonville—Citizens voted $7,500 bonds for sewer and water systems.

Ohio, St. Clairsville—Bids will be received until Nov. 15 by Emerson Campbell, County Audr., for repairing reservoir at Belmont County Infirmary.

Ohio, Upper Sandusky—Chester & Fleming, Pittsburgh, Penn., retained by water company to prepare plans for installation of low service pump.

Mich., Albion—Election will be held Oct. 9 to vote $10,000 for completing municipal water system.

Mich., Leslie—Plans being prepared by A. H. Smith Co., Engr., Toledo, Ohio, for water system.

Mich., Quincy—Plans being prepared by A. H. Smith Co., Engr., Toledo, Ohio, for water system.

Mich., Sparta—Plans being prepared by Rumsey & Works, Consult. Engr., Grand Rapids, for water tank and tower.

Ill., Galesburg—(Official)—Citizens voted $95,000 bonds for water system and electric-light plant. Noted Oct. 14.

Ill., Mackinaw—Melluish & Broyhill, Mackinaw, prepared plans for remodeling and improving water system. Noted Sept. 30.

Iowa, Holstein—Citizens voted $18,000 bonds for water system. Bids for sale of same will be received until Nov. 16. Albert G. Merkley, City Recdr.

Kan., Lawrence—Citizens will vote again on $175,000 bonds for purchase and improvement of water system. E. H. Dunmire, City Engr.

Kan., Oswego—Election will be held Nov. 12 to vote on bonds for extension and improvement of water system. J. F. Waskey, Clk. Noted Aug. 19.

Neb., Bayard—Bids will be received by City Clerk until Nov. 11 for 13,200 lin.ft. of 4- to 8-in. c.-i. water mains.

Wyo., Thermopolis—Citizens voted $40,000 bonds for water system.

Mont., Glendive—Plans being prepared by Burns & McDonnell, Consult. Engr., Scarritt Bldg., Kansas City, Mo., for improving water system and filtration plant. Estimated cost, $70,000. Noted Oct. 21.

Mont., Three Forks—Bonds will soon be sold for improvement of water-works system.

Ark., Dardanelle—City plans expenditure of $15,000 for improving water system.

Ark., Malvern—Work will be started about Jan. 1 on installation of water system. Estimated cost with proposed sewerage system, $100,000.

Tex., Sherman—See item under "Light, Heat and Power."

Tex., Temple—City Water Commissioners plan expenditure of $6,000 for improving municipal pumping station.

Okla., Tulsa—Election to vote on $600,000 bonds for storage basin at mouth of Shell Creek postponed from Nov. 2 to Nov. 23. Noted Oct. 14.

Idaho, Aberdeen—Public Utilities Commission, Boise, approved installation of municipal water system. Noted Oct. 7.

Idaho, Twin Falls—City will purchase plant of Twin Falls Water Works Co. Estimated cost, $80,000.

Wash., Metaline—Franchise granted to Harry Lincoln, Metaline, to build water system. Estimated cost, $15,000.

Wash., Seattle—D. Huntington, City Arch., authorized to prepare plans for standpipe on Beacon Ave. near Fountain St. Estimated cost, $50,000.

Calif., Santa Cruz—Election will be held Nov. 6 to vote on $100,750 bonds for purchase of F. A. Hihm Co. water system. Noted Oct. 21.

N. B., St. John—Extensions will be made to water mains in Portland Pl. Estimated cost, $4,600. R. W. Wigmore, Comr.

Ont., Tecumseh—Plans being prepared by Tecumseh Water Works Co. for new water system. Estimated cost, $25,000.

Ont., Toronto—Bids will be received by Board of Control until Nov. 9 for valves, steam piping, steel castings and lagging for main pumping station.

Bids In and Contracts Awarded

N. Y., New York—(Official)—Board of Water Supply awarded contract to NORTHEASTERN CONSTRUCTION CO., 225 Fifth Ave., New York, for two steel frame buildings for drainage chambers, Shafts No. 11 and 12, Catskill Aqueduct, under Contract No. 166. Noted Oct. 28.

N. Y., New York—(Official)—Bids were received Oct. 26 by Board of Water Supply, Municipal Bldg., for buildings at Uptake and Downtake chambers of Hill View reservoir as follows: William H. Egan, Lexington Ave. and 125th St., New York, $94,409; Marble Arch Co., $96,500, and Louis Wechsler, $98,650. Noted Oct. 14.

S. C., Spartansburg—Contract awarded by Water Works Commissioners to HAMILTON MFG. CO., Hamilton, Ohio, at $13,000, for engine and pump for main pumping station. Noted Oct. 14.

Ky., Shelbyville—Contract for filtration plant awarded to NEW YORK CONTINENTAL JEWEL FILTRATION CO., New York, N. Y., at $15,000.

Ohio, Cleveland—Contract awarded to ALABAMA PIPE & FOUNDRY CO., at $8,748, for valve boxes for Department of Public Utilities, Division of Water. Noted Sept. 30.

Ohio, East Liverpool—Contracts for water system awarded as follows: Filter equipment for 6,000,000-gal. mechanical filter to PITTSBURGH FILTER MANUFACTURING CO., Pittsburgh, at $44,324; standpipe to MEMPHIS STEEL CONSTRUCTION CO., at $2,887. Chester & Fleming, Pittsburgh, Penn., Engr.

Iowa, Germania—(Official)—Contract for laying water mains and constructing water system awarded to C. W. ROLAND CO., Des Moines, at $8,041. Noted Oct. 28.

Iowa, Kanawha—Contract awarded to DES MOINES BRIDGE AND IRON CO., at $7,293, for 30,000-gal. steel tank on an 80-ft. tower and 7000 ft. of 4- to 6-in. water main. Noted Sept. 30.

Tex., Galveston—(Official)—All bids received for reconstructing 36-in. submerged water main rejected. A. T. Dickey, City Engr. Noted Sept. 23 and Oct. 7.

Calif., Los Angeles—John G. Gardiner, Byrne Bldg., at $21,938, low bidder, for pipe line in Los Angeles County Water Works District No. 1.

Calif., Sacramento—City Commission awarded contract for concrete chamber at water-works to TEICHTER & AMBROSE, at about $16,000.

Ont., Markham—Contract awarded to NATIONAL IRON WORKS, LTD., Cherry St., Toronto, at $5,750 for pipe, hydrants and valves for water system. Noted Oct. 21.

SEWERS

Proposed Work

Mass., Bridgewater—Citizens voted $10,000 toward constructing a sewer system.

Conn., Windsor Locks—Residents of Wilsons Station voted to form sewer district and will build sewer estimated to cost, $12,000.

N. Y., Buffalo—City plans sewers in Exeter Terrace and Camden and North Park Ave.

N. Y., New York—(Borough of Bronx)—(Official) — Bids will be received by Douglas Mathewson, Borough Pres., Municipal Bldg., Crotona Park, 177th St. and Third Ave., until 10:30 a.m., Nov. 11, for sewers in Starling Ave. between Olmsted Ave. and Unionport Rd., Unionport Rd. between Starling and McGraw Ave., between Unionport Rd. and Pugsley Ave. Noted Oct. 21.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., Municipal Bldg., New York, until 2 p.m., Nov. 10, for making repairs to barrel and box sewers at foot of 26th St. and North River, foot of 37th St. and East River, and foot of 110th St. and East River.

N. Y., Rochester—City will issue $100,000 bonds for sewage-disposal plant.

N. J., Garfield—Anton L. Petersen, Engr., preparing plans for sewer system in Arving Pl. Bids will be received by Frank V. Romaglia, Borough Clk.

Va., Newport News—Board of Alderman contemplates $500,000 bond issue for sewers, sewer purification plant, etc.

Va., Waverly—(Official)—Citizens defeated $55,000 bond issue. Part of proceeds was to be used for sewage-disposal plant. Noted Oct. 28.

S. C., Greenwood—Bids will be received until Nov. 10 for 10,000 ft. of 12- to 29-in. storm sewers. A. S. Hartzog, Mayor.

Ga., Savannah—Plans being considered for trunk sewer to dispose of drainage in western section of city. E. R. Conant, Ch. Engr. Citizens recently voted $400,000 bonds for storm sewer system and house drainage.

Fla., Miami—Bids will be received by W. B. Moore, City Clk., until Nov. 8, for sewer construction in Districts Nos. 1, 2 and 3. Bonds for $50,000 sold for this purpose. Noted Aug. 19 and Sept. 16.

Fla., Monticello—City engaged J. B. McCrary Co., Atlanta, Ga., to prepare plans for sewer system.

Tenn., Tiptonville—See item under "Water Works."

Ohio, East Youngstown—Bids will be received until noon, Nov. 12, by Village Clerk for purchase of $45,000 bonds for sewers and roads.

Ohio, Sandusky—Bids will be received by John J. Molter, Dir. of Pub. Ser., until Nov. 18, for intercepting sewer No. 2. Estimated cost, $98,000. Noted Sept. 16.

Ill., Chicago—Bids will be received by John McGillan, Clk., Sanitary District, 700 South Michigan Ave., until Dec. 2, for Calumet Intercepting Sewer, Contract No. 4. Noted Oct. 7.

Ill., Elgin—Sewage-disposal plant estimated to cost $60,000 will be constructed. Morgan H. Brightman, City Engr.

Ill., Fairbury—City Council contemplates sewer system. G. Lemon, Clinton, probable Engr.

Iowa, Oskaloosa—Plans being prepared by Block & Veatch, Kansas City, Mo., for sewer system. Noted Aug. 12.

Minn., St. Paul—(Official)—Bids will be received by August Hobenstein, Pur. Agt., Courthouse and City Hall, until 10:30 a.m., Nov. 8, for sewer on West Sixth St. Noted Sept. 30.

Minn., St. Paul—City Council authorized construction of sewer in Capitol Ave. Estimated cost, $127,360.

Neb., Hastings—Bids will soon be received for sewers in Burlington Ave. between Ninth and 12th St., Second St. between Briggs and Baltimore St., Fourth St. between Briggs and Oswego St.

N. D., Grand Forks—(Official)—Bids will be received by W. H. Alexander, City Audr., until 10 a.m., Nov. 6, for Lateral Sewers No. 18, Sewer District No. 5.

Tex., Waco—Citizens defeated $15,000 bonds for extension of sewer system and $75,000 bonds for sewage-disposal plant. Noted Sept. 30.

Idaho, Bonners Ferry—Local Sewer Improvement District No. 1 created by Council for sewer system and disposal plant. Estimated cost, $29,000. C. T. Laschinger, Clk. Noted Sept. 9.

Idaho, Kellogg—Plans being prepared for sewer system in Pressley addition. Estimated cost, $10,000. Noted Oct. 21.

Wash., Seattle—Plans being considered by Committee of Streets and Sewers for sewer system in Rainer Valley. Estimated cost, $1,000,000. A. H. Dimock, City Engr.

Wash., Seattle—Committee of Streets and Sewers of City Council recommended installation of sewers in Sixth Ave., N. W. Estimated cost, $95,052.

Calif., Pomona—Election will be held in November to vote on $15,000 bonds for storm drains in North Garey, Fulton Rd., San Antonia and Alexander Ave.

Calif., Salinas—City contemplates storm sewer system. Estimated cost, $40,000.

Calif., Willows—New sewer district will be formed including all parts of Willows not included in District No. 1. Estimated cost, $35,000. John P. Ryan, City Engr.

Ont., Ottawa—(Official)—R. S. & W. S. Lea, Consult. Engr., Montreal, submitted report on Rideau River Intercepting sewer. Estimated cost, $400,000.

Ont., Toronto—Bids will soon be received for sewers on Adrian, Campbell, Linder Ave. and Miller St. T. L. Church, Chn., Bd. of Control.

Bids In and Contracts Awarded

Mass., Haverhill—(Official)—City will build trunk sewer through North Ave. from head of Marsh Ave. to point near Snows Brook to Primrose St. by day labor. Estimated cost, $13,400. Noted Oct. 28.

N. Y., Rochester—Contracts for sewer construction awarded as follows: Thomas Creek overflow sewer to WHITMORE, RAUBER & VICINUS, at $15,805, Clinton Ave., N., to FRANK LACHIUSA, at $8,772.

N. J., Bayonne—Contract for sewer in East 22nd St. awarded to CHARLES CAVANAUGH, at $19,999.

N. J., Bound Brook—Contract for sewer in Central Ave. awarded to JOHN McNABB. Estimated cost, $16,000.

N. J., Verona—Contracts for sewers and sewage disposal plant (a) Section 1, (b) Section 2, (c) Section 3, (d) Section 4, (e) Sewage disposal plant, awarded as follows: (a) PETRO SCOLO, Glen Ridge, at $31,232; (b) DONATO FUSCO, Montclair, at $17,801; (c) FRANK CARROZA, Baltimore, Md., at $21,632; (d) CARDELL & ROMANO, Montclair, at $17,796; (e) P. L. BRAUNWORTH, Montclair, at $37,292. Noted Sept. 9 and 30.

W. Va., Parkersburg—Contract for six sewers awarded to C. KENNEDY & SON and three to ARTHUR LYONS. Noted Aug. 12.

Ga., Gainesville—Contract awarded to A. P. STEWART for filter plant for sewer system.

Ohio, Cheviot—(Official)—Contract awarded to the J. RUEBEL CONSTRUCTION CO., Cincinnati, for trunk sewer in ravine east of Glenmore Ave., in North Glenmore Ave. Noted Oct. 7.

Ohio, Cincinnati—Contract for sewers in District No. 6 awarded to WORTH & BLESSING, at $30,829.

Ohio, East Liverpool—(Official)—Contract for sanitary sewers awarded to J. W. RYAN & SON, East Liverpool. Noted Oct. 14.

Ind., Indianapolis—Contract for sewer in Michigan St. between Pleasant Run and De Quincy St. awarded to AMERICAN CONSTRUCTION CO., at $26,499.

Ind., Indianapolis—Contract awarded to GEORGE SCHAUER & SON, at $14,256 for sewer in Germania Ave. and first alley west of Mount St.

Mich., Menominee—(Official)—City will build storm sewers by day labor. Noted Oct. 21.

Ill., Marion—Contract for sewage-disposal plant awarded to HOEFFKEN BROS. CONSTRUCTION AND SUPPLY CO., at $7,267.

Wis., Caledonia—Contract awarded to NATIONAL TILE CO., at $15,500 for 18,275 ft. of vitrified drain tile.

Wis., Manitowoc—Contract awarded to T. H. PITZ, at $6,220 for sewers.

Wis., Plymouth—PETER BORST, Port Washington, at $7,569, awarded contract for 11,800-ft. of 6- to 12-in. sanitary sewers.

Iowa, Ames—Contract awarded to DEARBORN CONSTRUCTION CO., Waterloo, at $70,500 for storm and sanitary sewers.

Iowa, Burlington—Bids received by engineer and Councilman Cockrell for sewer in Mt. Pleasant St. as follows: M. M. Daly, $1.225 per lin.ft.; George Peterson, $1.15 and Charles W. Holmes, $1.37.

Iowa, Charles City—Contract for storm sewer system awarded to C. L. HANSON, at $6,788. Noted Oct. 14.

Iowa, Davenport—Contracts awarded by Board of Public Works to HYDRAULIC CONCRETE AND CONSTRUCTION CO., for sewers in Pleasant and Howell St. and to T. J. O'HARA, for sewer in Boise St.

Iowa, Esterville—All bids received Oct. 4 for sewer in North Sixth St. rejected. Noted Sept. 30.

Iowa, Ida Grove—Contract awarded to F. E. WEST, Sioux City, at $5,451, for Old Town sewer.

Iowa, Pella—Contract awarded to HENRY REES, Quincy, Ill., at $9,217, for 14,500 ft. of sanitary sewer. Noted Oct. 14.

Minn., South St. Paul—O'NEILL & PRESTON, at $25,400, awarded contract for sewer pipes on Third Ave. and Third St., S. Noted Sept. 23.

Neb., Lincoln—(Official)—Contract awarded to ABEL & ROBERTS, First National Bank Bldg., Lincoln, at $35,240, for Antelope Conduit for city. Noted Oct. 21.

Neb., Omaha—Contract awarded to PUBLIC SERVICE CO., Krug Theater Bldg., Omaha, for sewers in 43d and Leavenworth St. Estimated cost, $12,000.

Tex., Beaumont—(Official)—Contract for sanitary sewers awarded to the H. W. CARDWELL CONSTRUCTION CO., at $21,716. Noted Oct. 30.

Calif., Compton—Contract for municipal sewer system in Compton awarded to JAMES KENNEDY, Washington Bldg., Los Angeles, at $42,462. Noted Oct. 28.

Calif., Stockton—Contract awarded to A. B. MUNSON & SON, Stockton, at $26,007, for storm water sewer in Main St. to take place of North St. Canal.

Que., Hull.—Contract for sewer construction awarded to J. DUFRESNE, 16 Champlain St., Hull, at $56,000.

Ont., St. Thomas—Contracts awarded to A. E. PONSFORD, LTD., for septic tank, and to WILLIAM IRWIN, for laying pipe for sewer system. Estimated cost, $8,809.

GARBAGE

Proposed Work

Tex., San Marcos—Contract will soon be awarded for garbage incinerator. Estimated cost, $35,000.

Que., Montreal—Report submitted to Board of Control by city incinerator department for incinerator with daily capacity of 500 tons. Estimated cost, $200,000.

Ont., Toronto—Bids will be received until Nov. 9 by T. L. Church, Chn. Bd. of Control, for garbage incinerator on Don Roadway.

Man., Winnipeg—Citizens defeated proposal to build $10,000 garbage incinerator.

STREETS AND ROADS

Proposed Work

Mass., Boston—Bids will be received by Massachusetts Highway Commission, 15 Ashburton Pl., until noon, Nov. 9, for constructing a section of state highway in towns of Sheffield and Great Barrington.

Conn., Ansonia—Report has been submitted estimating cost of widening Clifton Ave., between Division St. and O'Neill Court, at $6,000.

N. Y., Buffalo—City Council ordered repaving with asphalt Arlington Pl. and Packman, Stewart and Washington St.

N. Y., New York—(Borough of Bronx)—(Official)—Bids will be received by Douglas Mathewson, Borough Pres., Municipal Bldg., Crotona Park, 177th St. and Third Ave., until 10:30 a.m., Nov. 11, for paving with bituminous concrete on cement concrete foundation Tiebout Ave. from East 188th St. to Fordham Rd.

N. J., Boundbrook—(Official)—Bids will be received by Borough Council, American Hose Bldg., East Second St., until 8 p.m., Nov. 19, for paving Main St. Noted July 29.

N. J., Trenton—Ordinance passed for paving Arch St. from Cass to Grand St.

Penn., Greensburg—(Official)—Bids will be received by John S. Sell, County Controller, until noon, Nov. 15, for improving Harrison-City Export Rd. and Hecla-Hurst School House Rd.

Penn., Pittsburgh—(Official)—Bids will be received by Hyatt M. Cribbs, County Controller, until 10 a.m., Nov. 12 for improving Glenn Ave. and Wible Run Extension Rd.

Del., Wilmington—Bids will soon be received for resurfacing with bituminous material the following roads: Odessa to Boyds Corner on Old King Highway, Mt. Pleasant to Middleton via State Rd. and Newark to Glasgow via Coogh's Bridge.

Md., Easton—Bids will be received until Nov. 9 by J. B. Harrington, Clk., for 2.18 miles of shell road from Trappe to Barber under Contract No. 359; one mile of shell road from Bruceville to Windy Hill, under Contract No. 369; 1.06 miles shell or macadam on concrete road from Easton to Easton Point, under Contract No. 401.

W. Va., Huntington—Bids will be received until Nov. 8 by O. H. Wells, Comr. of Streets and Alleys, for paving sections of Sixth, 11th and 13th Ave.

N. C., Asheville—City plans to pave Beaumont St. from Hazard to Miller St. and construct sidewalks on west side of Marjorie St.

N. C., Charlotte—Contract will be awarded about Nov. 11 for 17,500 sq.yd. sidewalks.

N. C., Rockingham—Richmond County will issue $25,000 bonds for road improvements. B. F. Reynolds, County Clk.

N. C., Winston-Salem—Election will probably be held in December to vote on $50,000 bonds for road construction in Yadkin County.

S. C., Greenville—Bids will be received by A. S. Hartzog, Mayor, until Nov. 10, for 60,000 sq.yd. street paving, 10,000 sq.yd. cement gutters and 12,000 lin.ft. of granite curb.

Fla., Bronson—(Official)—Bids will soon be received for road work in Levy County. J. B. McCrary Co., Atlanta, Ga., Engr.

Fla., Gulfport—Citizens voted $9,000 bonds for two miles of modified asphalt streets. Noted Sept. 2.

Fla., Lakeland—Election will soon be held in Polk County to vote on $1,000,000 bonds for road construction.

Fla., Mayo—(Official)—J. B. McCrary Co., Atlanta, Ga., Jacksonville and St. Petersburg, Fla., engaged to prepare plans for roadwork in Lafayette County. Estimated cost, $300,000. Noted Sept. 23.

Fla., Miami—Bids will be received by W. B. Moore, City Clk., until Nov. 8, for grading and paving about 15,000 sq.yd. with asphaltic concrete and binder course on concrete foundation; also grading and paving with sand and asphaltic oil about 10,000 sq.yd. of streets.

Fla., New Smyrna—Citizens of south end of Volusia County voted to form road and bridge district and to issue $250,000 bonds for road across county from beach to St. Johns River, Sanford, hard surface road to De Land and John Anderson Highway from Rose Bay to Brevard county line.

Fla., Pensacola—Election will soon be held to vote on proposition to issue $500,000 bonds for roads.

Fla., Tallahassee—(Official)—Bonds for $200,000 for roads will soon be offered for sale. J. B. McCrary Co., Atlanta, Ga., Engr.

Ala., Dothan—Bids will be received until Nov. 18 by A. C. Crawford, Chn. of Houston County Bd. of Revenue, for constructing 21 miles of road. Estimated cost, $75,000. Noted Sept. 30.

Ala., Mobile—A plan has been submitted to Alabama & Mississippi Gulf Coast Highway Association for highway between Mobile and Baldwin Counties. Work will also include bridge across Spanish River and ferry over Mobile and Tensaw River. Estimated cost, $105,000. Baldwin County plans $55,000 bond issue to pay its portion of project.

Miss., Brookhaven—Commissioners of Lincoln County, District No. 1, plan to construct two miles of gravel roads.

La., Crowley—Plans being considered for constructing 150 miles of gravel roads in Acadia Parish. Estimated cost, $750,000.

La., Donaldsonville—Citizens of Ascension Parish, Road District No. 2, voted $50,000 bonds for road work. Noted Sept. 23.

Tenn., Bristol—Bonds for $8,000 sold for street improvements.

Tenn., Harriman—Appropriation of $32,000 made by Roane County Court for completing pikes in various districts.

Tenn., Murfreesboro—Election will be held about Dec. 15 in Rutherford County to issue $175,000 bonds to purchase and maintain turnpikes. Noted Sept. 30.

Tenn., Pulaski—Election will be held Dec. 20 to vote on $500,000 bonds for roads in Giles County. Noted Oct. 14.

Ky., Catlettsburg—Commissioners of Boyd County contemplate an expenditure of $75,000 for road construction.

Ky., Crittendon—Bonds for improving a number of streets defeated by citizens.

Ky., London—Contract will soon be awarded for 14 miles of Dixie Highway and Boone Way between London and Corbin.

Ky., Louisville—An expenditure of $7,400 voted by Jefferson County Fiscal Court for emergency road work.

Ky., Paducah—Bids will soon be received for improving Hinkleville Rd. from Little Union schoolhouse to Lamont. Estimated cost, $8,836.

Ky., Winchester—Commissioners of Clark County plan to call election to vote on $25,000 bonds for two miles of road under State-Aid law. Noted Aug. 12.

Ohio, Cleveland Heights—(Warrensville post office)—Bids will be received until noon, Nov. 15, by H. H. Canfield, Village Clk., for constructing sidewalks on Somerton Rd. from Wilton to Superior Rd.

Ohio, Cleveland Heights—(Warrensville post office)—Bids will be received until noon, Nov. 15, by H. H. Canfield, Village Clk., for grading, draining and paving Corydon Rd., paving Cottage Grove Drive and grading, draining and paving Essex Rd.

Ohio, East Youngstown—See item under "Sewers."

Ohio, Marietta—Bids will soon be received for paving a number of streets. Estimated cost, $6,500. E. F. Gates, City Engr.

Ind., Columbus—Bids will be received about Nov. 15 for two crushed stone and one gravel road, each 2½ miles long. W. H. Scott, Audr., Bartholomew County.

Ind., Ft. Wayne—Bids will be received until 2 p.m., Dec. 1, for purchase of $15,000 bonds for roads in Wayne Trace County.

Mich., Au Gres—Election will be held Nov. 25 to vote on $30,000 bonds for roads.

Mich., Corunna—According to press reports an election will be held in Shiawassee County in 1916 to vote on $200,000 bonds for road construction.

Mich., Pontiac—Election will be held in April to vote on $1,000,000 bonds for roads.

Mich., St. Ignace—Election will soon be held to vote on $200,000 bonds for constructing county roads.

Mich., St. Joseph—(Official)—Bids will be received by Board of Road Commissioners of Berrien County until Nov. 11 for 48½ miles of water bound macadam roads. Estimated cost, $340,000. W. Cleary, County Highway Engr.

Mich., Standish—Election will be held Nov. 27 to vote on $30,000 bonds for road improvements in Whitney Township.

Ill., Alton—Plans being considered for paving Staunton St. with brick.

Ill., Champaign—An expenditure of $22,000 planned by Board of Supervisors for oiled road.

Ill., Rock Island—Bids will soon be received for paving Eighth Ave. from 24th to 29th St. Estimated cost, $15,000. Noted Oct. 14.

Wis., Birchwood—Bond issue for $5,000 contemplated for street improvements.

Iowa, Lyons—Plans being considered for paving Sixth and Main St.

Minn., Duluth—Grand Ave. from 29th to 54th Ave., West, will be improved. Estimated cost, $130,000. J. A. Farrell, Comr. of Pub. Wks.

Kan., Hiawatha—An expenditure of $200,000 planned by Commissioners of Brown County for concrete road across county.

Kan., Newton—City Council passed ordinance providing for paving, curbing and guttering of Broadway from west side of Kansas Ave. to Logan St.

Kan., Topeka—Commissioners of Shawnee County contemplate an expenditure of $50,000 for repairing and constructing highways.

Kan., Wichita—Contract will be awarded about Nov. 22 for about 1,200 sq.yd. of 3-in. vertical fiber vitrified paving block on 5-in. concrete case, also 500-ft. of curbs.

Mo., Lexington—Bonds for $55,000 voted by Lafayette County, Special Road District, to rock gap in Old Trails Rd. and to repair bridges and culverts.

Tex., Austin—Citizens voted $425,000 bonds for street improvements and bridges. Noted Sept. 16.

Tex., El Paso—City plans to pave portions of Nevada, East Rio Grande, Chihuahua and West Blvd.

Tex., Hondo—Bids will be received until Nov. 8 by H. F. Wurzbach, Comr. of Medina County, Cliff, for about 20 miles of gravel roads.

Tex., Houston—County Commissioners appropriated $200,000 for road work.

Tex., Jacksonville—Election will be held Nov. 16 to vote on $150,000 bonds for improving roads in Road District No. 1.

Tex., Oakville—Bond issue for road construction contemplated by Live Oak County, Precinct No. 2.

Tex., Orange—Citizens of Orange County, Precinct No. 4, voted $7,000 bonds for shell or gravel road on lower Beaumont Rd. Noted Sept. 23.

Tex., Sherman—See item under "Light, Heat and Power."

Tex., Tyler—Election will soon be held to vote on $100,000 bonds for constructing roads.

Tex., Victoria—Bonds for $30,000 sold for street improvements.

Tex., Weimar—Election will probably be held to vote on $100,000 bonds for road improvements.

Okla., Drumright—Plans being considered for paving Broadway.

Okla., Inola—Election will be held Nov. 6 to vote on $30,000 bonds for road construction.

Okla., Talihina—Citizens voted $50,000 bonds for roads and bridges.

Idaho, Wallace—Plans submitted to construct boulevard of Fourth of July Canyon which connects national highway through Wallace and Cœur d'Alenes with Apple Way leading to Spokane. Estimated cost, $45,000.

Wash., Centralia—All bids received for hardsurfacing Veness Rd. in south end of town rejected. New bids will be received.

Wash., Everett—City Commissioners have authorized improvement of 41st St. from Rucker to Crescent St.

Wash., Montesano—County Commissioners have appropriated a sum for the Montesano-Cosmopolis Rd. which is to be built next year.

Wash., Port Orchard—County Commissioners have passed resolution authorizing expenditure of $5,000 for road construction on Bainbridge Island.

Ore., Pendleton—G. Kimbrell, City Engr., instructed to prepare plans for improvement of Riverside Drive from Main to Railey St.

Ore., Pendleton—William Bradley, County Surveyor, submitted report estimating cost of highway between Umatilla and Pendleton, at $51,620.

Calif., Bakersfield—Bids will be received until Nov. 8 by Board of Supervisors for improving Section No. 7, Bakersfield-Mojave Rd.

Calif., Fresno—City Council plans to pave Santa Fe Ave. Estimated cost, $45,000. B. E. Cronkite, City Engr.

Calif., Pomona—Election will be held sometime in November to vote on $50,000 bonds. Part of proceeds will be used for grading and oiling streets and culverts.

Calif., Richmond—Southern Pacific Co. plans to pave Cutting Blvd. Estimated cost, $5,500.

B. C., New Westminster—City Council plans to grade and macadamize Seventh and Belmont St. and Fifth Ave. Estimated cost, $7,850.

Bids In and Contracts Awarded

Mass., Wareham—Contract for 8,750 ft. of highway awarded to THOMAS N. MURPHY, Middleboro, at $9,293. Noted Oct. 14.

N. Y., Albany—(Official)—Bids were received Oct. 26 by State Highway Commission, 55 Lancaster St., for constructing highways by State-Aid as follows:

Road No. 1249, Albany County, 3.41 miles: George J. Curran, Middletown, Conn., $27,855; Huntoon & Ferguson, Hudson Falls, $29,719; A. N. Hoyt, Albany, $30,000.

Road No. 5532, Allegany and Steuben County, 5.25 miles: Kennedy Construction Co., Albany, $50,881; J. G. Hayes Co., Inc., Rome, $51,975; Greenfield Construction Co., Hornell, $52,064.

Road No. 1327, Cayuga County, 6.06 miles: John H. Gordon, Albany, $52,010; Michael H. Ripton, Rochester, $52,110; John G. Hayes & Co., Inc., Rome, $53,054.

Road No. 5594, Clinton County, 3.79 miles: Bluff Point Stone Co., Inc., Plattsburg, $29,160; Boynton & McNally, Keeseville, $30,079; Routley & Summers, Huntingdon, Que., $30,755.

Road No. 1331, Columbia County, 4.27 miles: Russo-Parker Construction Co., Hudson, $39,756; Marks Kearney, Hudson, $39.757; Rumph & Stevens, Lake Placid, $2,290.

Road No. 1332, Columbia County, 7.77 miles: Marks Kearney, Hudson, $62,186; Russo-Parker Construction Co., Hudson, $63,957; Gruner & Hollenbeck, Harriman, $66,659.

Road No. 5595, Cortland County, 3.65 miles: T. H. Gill Co., Binghamton, $39,759; Dana W. Robbins Co., Inc., New York, $40,959; James Rossney, Buffalo, $41,415.

Road No. 1333, Erie County, 9.14 miles: Shanley Construction Co., Buffalo, $141,828; Atlanta Construction Co., Atlanta, $141,094; F. H. Wells, Corfu, $142,263.

Road No. 1334, Erie County, 4.30 miles: Langan Construction Co., Albany, $70,049; Henry P. Burgard Co., Buffalo, $74,886; Larry W. Roberts Co., Utica, $73,991.

Road No. 1335, Erie County, 4.50 miles: Stanley Construction Co., Buffalo, $57,914; Bison City Engineering and Construction Co., Inc., Buffalo, $58,083; F. H. Wells, Corfu, $58,095.

Road No. 1336, Erie County, 5.19 miles: George Neilons, Grand Island, $56,250; John W. Landel, Tonawanda, $59,211; F. J. Mumm Contracting Co., Buffalo, $64,239.

Road No. 5582, Genesee County, 4.53 miles: Chilson & Gibson, Leroy, N. Y., $44,893; Greenfield Consolidated Co., Hornell, $46,094; H. E. Benedict, Williamsport, Penn., $48,063.

Road No. 5593, Livingston County, 7.09 miles: James Anderson, Albany, $63,063; Hendrickson-McCabe Construction Co., Spencerport, $63,554; Ribstine-Holter Co., Rochester, $65,070.

Road No. 1110, Madison County, 3.05 miles: Mohawk Engineering Co., Mohawk, $26,151; Fort Schuyler Construction Co., Oneida, $26.590; Michael O'Brien, Cortland, $27,039.

Road No. 1328, Monroe County, 0.73 mile: Whitmore-Rauber & Vicinius, Rochester, $12,927; Ribstine-Holter Co., Inc., Rochester, $13,113; Julius Friedrich & Co., Inc., Rochester, $13.218.

Road No. 1327, Monroe County, 2.91 miles: Ribstine-Holter Co., Inc., Rochester, $35,548; Langan Construction Corporation, Albany, $37,369; Whitmore-Rauber & Vicinius, Rochester, $38,465.

Road No. 5547, Oneida County, 0.70 mile: Langan Construction Corporation, Albany, $17,187; Harry W. Roberts Co. Utica, $18.795; H. B. Sproul Construction Co., Inc., Peekskill, $19,291.

Road No. 448, Part 2, Orange County, 3.64 miles: Armstrong and Trowbridge, Middletown, $29,868; John Arborio, New Haven, Conn., $30,911; Jackson Bros., Cuddebackville, $31,308.

Road No. 449, Orange County, 5.17 miles: Armstrong & Trowbridge, Middletown, $21,399; A. Buggiens, Wurtsboro, $20,542; John Arborio, New Haven, Conn., $21,925.

Road No. 1329, Orange County, 3.70 miles: Samuel M. Serlesine, New York, $47,269; Heisler & Aldershoff, Albany, $51,574; Belmar Contracting Co., Troy, $52,696.

Road No. 5545, Schenectady County, 5.62 miles: George J. Curran, Middletown, $38,777; John B. Dower, Ballston Spa., $42,983; D. I. Snell & Co., Canajoharie, $48,820.

Road No. 5589, Seneca County, 5.01 miles: Greenfield Construction Co., Hornell, $43,719; Thomas Grady, Rochester, $46,454.

Road No. 5510-A, Sullivan County, 0.43 mile: Henry McNamee, Eddyville, $7,947; Samuel Serliesine, New York, $8,188; John J. Keating, Monticello, $8,337.

Road No. 1079, Tioga County, 4.07 miles: Peter F. Connolly Co., Horseheads, $30,602; Lane Construction Corporation, Meriden, Conn., $32,752; Hendrickson-McCabe Construction Co., Spencerport, $32. 939.

Road No. 1330, Tompkins County, 2.48 miles: Greenfield Construction Co., Hornell, $26,447; Richard Hopkins, Troy, $26,986; Kendor Engineering and Construction Co., Inc., Buffalo, $27,618.

Road No. 603, Ulster County, 10.24 miles: Armstrong and Trowbridge, Middletown, $82,935; Cairnie-St. George Co., New York, $89,684; George H. McAvoy, Creek Locks, $89,742. Noted Oct. 26.

N. Y., Buffalo—Contracts for paving awarded as follows: Mortimer St. to HENRY B. BURGARD CO., 1968 Fillmore Ave., at $25,225, and Virgil Ave. from Hertel Ave. to Tacoma Pl. to GERMAN ROCK ASPHALT AND CEMENT CO., LTD., at $12,-120.

N. Y., Buffalo—Contract for paving Casimir St. awarded to GERMAN ROCK ASPHALT AND CEMENT CO., LTD., at $16,000, and to ERIE CONTRACTING CO., at $32,000, for Rees St.

N. J., Fairview—Contract for paving Walker and Lincoln St. awarded to BERGEN CONTRACTING CO., Cliffside, at $22,500.

N. J., New Brunswick—Thomas F. Dunigan, Woodbridge, at $29,148, submitted lowest bid for improving Amboy Ave. from city line at Spa Springs to Myrtle Ave., and at $5,749 for improving New Brunswick Ave.

Penn., Philadelphia—Union Paving Co., 30th and Locust St., Philadelphia, at $17,163, submitted lowest bid for surfacing with bituminous on 5-in. concrete base.

Md., Baltimore—State Roads Commission awarded contracts for road work as follows: Anderson Mill Rd., Wicomico County, to JUNIATA CO., Empire Bldg., Philadelphia, Penn., at $12,885; Concord Camp Rd., Caroline County, to PHILLIPS & RENSHAW, Preston; Marydel Rd., Caroline County, to S. S. ANDREWS & SON, Cambridge; Glenburnie Rd., Anne Arundel County to F. M. DUVALL, St. Margaret, at $14,676; Big Pool Rd., Washington County, to HOLLINGER & DENIN, Clearspring, at $14,103. Noted Sept. 23.

Va., Petersburg—Contract for granite block paving awarded to K. L. BLACK, Richmond.

Va., Princess Anne—Contract for three miles of Ocean Park Highway awarded to VESTA CONSTRUCTION CO., Terrace Fork, at $4,185.

Fla., Ft. Myers—Contract for Ft. Myers-Marco Rd. awarded to C. W. CARLTON, M. B. DAVIS and W. C. HILL; contract for Mt. Myers-Naples Rd. awarded to W. R. WALLACE CO. Bonds for $177,500 voted for this purpose. Noted Sept. 2.

Fla., Glen Cove Springs—(Official)—Board of County Commissioners of Clay County awarded contract for road work in Special Road and Bridge District No. 1 to J. B. McCRARY CO., Atlanta, Go. Estimated cost, $122,000.

Fla., Pensacola—(Official)—All bids received for paving streets around Pensacola Hospital rejected. Estimated cost, $10,000. Noted Oct. 7.

Fla., Tampa—Contract for 50,000 lin.ft. of concrete curbing awarded to CORNWELL CONSTRUCTION CO., Tampa.

Fla., Wauchula—Contract for approximately 12,000 sq.yd. brick paving awarded to ALABAMA PAVING CO., American Trust Bldg., Birmingham, Ala.

Ala., Gadsden—Contract for rebuilding Steele Station Rd. awarded to I. W. GILBERT, at $4,991.

Ala., Sulligent—Contract for road from Sulligent to Marion County line, about 18 miles, awarded to B. G. EDGAR, Vernon, by Lamar County Commissioners, Vernon.

Miss., Ackerman—Contract for concrete sidewalks awarded to W. L. DAMON, Okolona, at about $25,000.

Miss., Columbus—S. E. FINDLAY CO., Atlanta, Ga., awarded contract for surfacing with tarvia 4½ miles Military Rd.

Tenn., Newport—Contract for grading and macadamizing roads in Cocke County awarded to R. L. PETERS, at $150,900. Noted Oct. 7.

Ky., Central City—Contract for four miles of pike awarded to W. S. MARTIN, Evansville, for labor, and to TRI-STATE STONE CO., Cerulean, for rock. Estimated cost, $25,000.

Ky., Paducah—CRESAP BROS., Humboldt, Tenn., at $9,000, awarded contract for six miles of road.

Ohio, Cincinnati—Contract for improving Van Zandt Rd. and Wayne Ave. awarded to HENRY WESTERMAN, Barnesburg, at $14,107.

Ohio, Coshocton—Contract for 9,900-ft. brick and macadam on Coshocton-West Lafayette Rd. awarded to COSHOCTON CONSTRUCTION CO., at $35,740.

Ohio, Hamilton—Contract for paving North Second St. from Black to Third and Washington St. awarded to ANDREWS ASPHALT PAVING CO. Estimated most, $12,551.

Ohio, Middletown—Contract for grading roadway on Michigan and York Ave. from Garfield Ave. to Walnut St. and Sycamore St. from Armco Ave. to south corporation line awarded to OWEN BANON.

Ind., Ft. Wayne—Contract for paving Rudisill Ave. from Calhoun St. to Broadway awarded to MOELLERING CONSTRUCTION CO., Fort Wayne, at $26,613.

Ind., Franklin—(Official)—Contract for gravel road on Johnson-Marion County line awarded to JOHN W. MURPHY. Noted Sept. 23.

Ind., Indianapolis—Contract for paving 19th St. awarded to A. L. TRIBBLE, Brazil, at $46,878.

Ind., Muncie—Contract for improving Rector Rd. awarded to CURTIS V. RECTOR, at $9,000.

Ind., New Albany—W. F. WOODRUFF, Louisville, Ky., at $13,987, awarded contract for paving 10,590-ft. Grant Line Rd.

Ind., Paoli—Contract for ½ mile of macadam pavement awarded to GEORGE A. CHARLES, West Baden, at $5,863.

Ind., Vincennes—(Official)—Contract for paving Second St. from Main to Church St. with trinidad lake asphalt awarded to PREMIER CONSTRUCTION CO., Indianapolis, at $4,335. Noted Oct. 21.

Mich., Fairfield—Contract for macadam road from state line north to Jasper awarded to GRAY BROS., Bowling Green, at $26,900.

Ill., Alton—Contract for repaving East Second St. awarded to STRUBEL & HELMICK, at $19,457.

Ill., Chicago Heights—Contract for paving 16th and Wentworth St. awarded to CHICAGO HEIGHTS COAL CO., at $70,087.

Wis., Ashland—Contract for grading 16 miles of road awarded to FISH & O'CONNOR, at $8,778.

Minn., Fergus Falls—Contract for grading Laurel St. between Broadway and Buse St. awarded to H. R. BUTLER. Noted Sept. 30.

Minn., Mendota—Contract for paving 11th St. from Joliet to Hennepine St., Hennepine St. from 9th to 11th St. and 19th St. from Hennepine to Tonti St. awarded to T. W. KEYS, La Salle, at $13,935.

Kan., Horton—Contract awarded to KAW PAVING CO., Topeka, for paving, curbing and guttering Lincoln St. from Mina to North St., High St. from North to Garrett St., Rock Island Ave. from North to Garrett St. and Whiteside St. from Main to Rock Island Ave., at $1.51 for paving and 60c. for curbing and guttering.

Neb., Lincoln—Contract for paving Tenth St. awarded to BURKE-COCHRANE CONSTRUCTION CO., at $10,955; portion of Ryon St. to ABEL & ROBERTS, Lincoln, at $7,857.

Mont., Livingston—(Official)—Contract for paving Park St. awarded to WARREN CONSTRUCTION CO., at $8,000. Noted Oct. 14.

Mo., Kansas City—Contract for grading about 70,000 yd. of Ward Parkway from 57th St. to Meyer Blvd. awarded to E. MEEGAN, 4th and Main St., Kansas City, at $0.138 per cu.yd.

Ark., De Witt—Contract for paving awarded to M. J. COLE, JR., Little Rock. Estimated cost, $25,000.

Ark., Little Rock—Contract for constructing sidewalks in District No. 228 awarded to OGLESBY BROS., Monticello, at $5,158.

Tex., Dallas—Contract for paving East Houston Ave. from Lafayette to Albert St. awarded to BERT HAHN CONSTRUCTION CO.

Tex., Graham—Contract for repairing roads and bridges awarded to L. G. HAMILTON. Estimated cost, $20,000.

Tex., Mineral Wells—Contract for paving about 50,000 sq.yd. with asphalt macadam and about 30,000 lin.ft. curbing and guttering awarded to FRANK WHITLEY, Mineral Wells.

Wash., Okanogan—Contract for permanent highway No. 4-A awarded to DOUGLAS & HILL, Tonasket, at $4,300.

Wash., Olympia—Contract for seven miles of highway from Colfax to Rosalia, Whitman County, awarded to W. G. MULLIGAN CO., Spokane, at $21,120, and road on Inland Empire highway in Walla Walla and Columbia Counties between Waitesburg and Dayton to GENERAL CONSTRUCTION CO., Spokane, at $13,243. Noted Oct. 28.

Wash., Seattle — Contract for Issaquah Rd. awarded to GEORGE A. BANDERT, Renton, at $7,199.

Wash., Seattle—Holt & Jeffrey, Railway Exchange Bldg., Seattle, at $11,169, submitted lowest bid for paving 14th Ave.

Wash., Seattle—Independent Asphalt Paving Co., Seattle, at $26,685, submitted lowest bid for paving 47th Ave., N. E. Noted Sept. 16.

Wash., Shelton—Contract for section of permanent highway awarded to F. L. BROWN, Portland, at $7,200.

Wash., Stevenson—Bids were received for improving Second St. from R. D. Shelly, at $4,435, and H. J. Hildeburn, at $5,004.

Ore., Portland—Contract for paving East 23rd, East 24th, and Franklin St. will probably be awarded to GIEBISCH & JOPLIN, Portland, at $13,013.

Calif., Bakersfield—Contracts for paving awarded as follows: McKittrick-Bakersfield Rd. to SHATTUCK & NIMMO WAREHOUSE CO., at $28,802; Weed Patch Loop to WORSWICK STREET PAVING CO., at $31,460. Noted Oct. 21.

Calif., Hollister—Contract for improving Tres Pinos-Paicines Rd. awarded to JOHN McREYNOLDS, San Jose, at $7,941.

Calif., Manhattan Beach — (Manhattan post office) — MODERN CONSTRUCTION CO., Los Angeles, at $8,247, awarded contract for paving Sixth, Seventh and other streets. L. Price, City Clk.

Calif., Sacramento—(Official)—Bids were received Oct. 8 by State Highway Commission for constructing roads in various counties as follows: (a) Conomo County, Div. 4, Route 8, Section A, (b) Placer County, Div. 111, Route 3, Section B, (c) Mariposa County, Div. 6, Route 18, Section A; (a) Spring Construction Co., Berkeley, $22,852; Bates, Borland & Ayer, Oakland, $22,183; P. H. Hoare, Oakland, $24,869; (b) Whitelock & Gorrill, Durham, $50,582; Twohy Bros. Co., San Francisco, $49,114; C. H. and A. W. Gorrill, San Francisco, $47,340; (c) George R. Daley, San Diego, $42,749; G. W. Connors, Eureka, $46,860; Toohey & Johnson, Dunsmuir, $45,285. Noted Oct. 7.

Calif., Vacaville—Bids were received for completing state highway through Vacaville as follows: Bentley & Gates, $10,854; Blumenkranz & Co., $11,465; Wrightson & Jost, $11,152.

INDUSTRIAL WORKS

Proposed Work

Conn., New Haven—Plans being prepared by R. W. Foote, Arch., for two-story, 32x100-ft. garage for G. W. Baldwin & Son.

Conn., Waterbury—Waterbury Farrell Foundry and Machine Co. plans two-story 75x150-ft. brick and steel mill.

N. Y., Albany—Bids will soon be received by Fuller & Robinson, Arch., 95 State St., for nine-story warehouse and show room at 75 State St. for Kinney & Woodward.

N. Y., Buffalo—Gilford Mfg. Co. plans three-story brick addition. Estimated cost, $17,000.

N. Y., Cohoes—John Garside & Co. plans plant. Estimated cost, $10,000.

N. Y., Niagara Falls—E. I. Du Pont de Nemours Powder Co. has asked for permit to build plant.

N. Y., Syracuse—H. H. Franklin Mfg. Co. plans additions to plant. Estimated cost, $500,000.

N. Y., Warren—U. G. Lyons, Pres. of Conewango Refining Co., has secured 40 acres of land in North Warren and will build a refining plant.

Penn., Norristown—Bids will soon be received by Peuckert & Wunder, Arch., 310 Chestnut St., Philadelphia, for bottling house for Adam Scheidt Brewing Co. Estimated cost, $50,000.

Penn., Philadelphia—Bids will soon be received by Sauer & Hahn, Arch., 1112 Chestnut St., for four-story, 54x100-ft. factory for M. Rice & Co. Noted Oct. 28.

Penn., Wilkes-Barre—Henry A. Maier, Arch., Coal Exchange Bldg., prepared plans for five-story, 52x120-ft. brick building for R. S. Williams, 124 East Market St. Building leased by Planters Nut & Chocolate Co., 79 East Northampton St.

Md., Baltimore—Plans prepared for cold-storage plant for Maryland Cold Storage Co.

Md., Baltimore—Leon Rosst, 1902 Eutaw Pl., Vice-Pres. Spanish-American Trading Co. purchased Mt. Vernon Brewery and will improve plant for guncotton factory.

W. Va., Huntington—C. D. Cooley Co., Arch., Century Bldg., Pittsburgh, preparing plans for three-story 100x100-ft. ice cream factory for J. L. Wilson. Estimated cost, $100,000.

W. Va., Wheeling—United States Stamping Co. will build 150x160-ft. addition.

N. C., Wilmington—Hilton Compress and Warehouse Co. will build compress and warehouse. Estimated cost, $50,000.

Ohio, Ashtabula—Plans prepared and bids being received for factory for Cleveland Ford Tire Co. Noted Oct. 21.

Ohio, Canal Dover—Dover By-Product Coke Co. will soon start work on 20-ton coke plant in yards of Penn Iron and Coal Co.

Ohio, Hamilton—Huss Furniture Co. Hamilton, formerly Huss Bros. Mfg. Co., Cincinnati, will build factory.

Ohio, Lima—Lima Brick and Tile Co., Taft Ave., increased capital from $30,000 to $50,000 and will enlarge plant.

Ohio, Massillon—(Columbus Heights) — Central Steel Co. contemplates mill.

Ohio, Reading—Tubular Steel Products Co. contemplates steel plant on Reading Rd.

Ohio, Toledo—Plans being prepared by Devore & McGormley, Arch., 304 Nasby Bldg., for three-story laundry building for Bancroft Realty Co. Estimated cost, $54,000.

Ohio, Toledo—Preliminary plans being prepared by Mills, Rhines, Bellman & Nordhoff for factory on Smead and Lincoln Ave. for Doehler Die Castings Co.

Ohio, Toledo—Electric Auto Lite Co. plans addition. Estimated cost, $100,000.

Ohio, Youngstown—Briar Hill Steel Co. will build two open-hearth steel furnaces. Estimated cost, $500,000.

Ind., Anderson—Pierce Speed Controller Co. plans factory at Ninth St. and Central Ave.

Ind., Kokomo—Apperson Bros. Automobile Co. will build 151x344-ft. factory.

Mich., Buchanan—E. B. Clark, Pres. Celfor Tool Co., and Buchanan Electric Steel Co. contemplates 136x300-ft. addition to plant.

Ill., Chicago—Burt Baker plans one-story brick warehouse on South Green St. F. O. DeMoney, Arch. Estimated cost, $10,000.

Ill., Chicago—Chalmers Motor Co. will build a five-story addition. A. S. Alachuler, Arch., 28 East Jackson Blvd. Estimated cost, $20,000.

Ill., Chicago—Conella Bakery Co. plans two-story bakery at 2006 West Erie St. W. H. Jruyn, Jr., Arch. Estimated cost, $30,000.

Ill., Chicago—Plans being prepared by A. S. Alschuler, 28 East Jackson Blvd., Arch., for two-story, 177x193-ft. factory for the Hump Hairpin Co. Estimated cost, $150,000. Noted Sept. 30.

Ill., Chicago—Selta Star Electric Co. will build one-story brick factory at 2433 Fulton St. R. G. Pierce, 10 South LaSalle St., Arch. Estimated cost, $16,000.

Ill., Chicago—C. Teich plans three-story factory at 1821 Berteau Ave. K. M. Vitthum, Arch. Estimated cost, $40,000.

Ill., Chicago—Union Petroleum Co. plans two-story building on 43d St. Estimated cost, $150,000.

Ill., Peoria—Plans being prepared by Hotchkiss & Harris, Arch., Herald-Transcript Bldg., for 60x180-ft. factory for Chic Apron Co., 215 South Adams St. Noted Oct. 28.

Minn., South St. Paul—Armour & Co. plans packing plant.

Mont., Great Falls—Kurt Grundwal of the Holly Sugar Co., Denver, Colo., will build beet sugar factory.

Mo., St. Louis—G. A. Von Brocht purchased plant of Austin Candy Co. and will improve and install new machinery. Estimated cost, $100,000.

Mo., St. Louis—(South St. Louis)—Monsanto Chemical Works will soon build addition on Lafayette Ave. Estimated cost, $60,000.

Tex., San Antonio—(Official)—Bids will be received until Dec. 1 for enlarging plant of Dixie Oil and Refining Co. Estimated cost, $40,000. Noted Oct. 21.

Okla., Sand Springs—Charles Page is interested in formation of company to build cotton mill. Estimated cost, $500,000.

Colo., Denver—Press reports state that Austin Daly Co. plans addition and will install machinery. Estimated cost, $100,000.

Colo., Denver—Colorado Packing and Provision Co. contemplate building plant. Estimated cost, $350,000.

Ont., Cache Bay—George Gordon & Co. will rebuild sawmill recently destroyed by fire. Estimated cost, $75,000.

Ont., Toronto—George H. Gooderham plans garage on University Ave., Toronto. Estimated cost, $30,000.

B. C., Vancouver—B. T. Bishop will build machine shop on Granville St. Estimated cost, $25,000.

Bide In and Contracts Awarded

Mass., Boston—Contract awarded to FRED T. LEY CO., INC., for four-story 60x200-ft. factory for King Estate.

Mass., Brookline—Colonial Realty Trust Co. has awarded contract to BOYD & BERRY, 11 Crampian Way, for one story, 114x116-ft. garage. Estimated cost, $28,000.

Conn., Bristol—Contract awarded to LEVERING & GARRIGUES CO. for rolling mill for Bristol Brass Co. Noted Oct. 21.

Conn., Waterbury—Waterbury Farrell Foundry & Machine Co. awarded contract to H. WALES LINES CO., Meriden, for two-story, 75x150-ft. mill building. Noted Oct. 28.

N. Y. Binghamton—Ansco Co. awarded contract to JOHN L. LEWIS CO., for four-story brick factory. Estimated cost, $20,000.

N. Y., Buffalo—(Official)—Automatic Transportation Co., Main St., Buffalo, awarded contract for 53x146 ft. warehouse and blacksmith shop to TURNER CONSTRUCTION CO., 11 Broadway, N. Y.

N. Y., Buffalo—(Official)—Contract for four-story, 81x106 ft. warehouse and show room for Robertson Cataract Electric Co. awarded to TURNER CONSTRUCTION CO., 11 Broadway, N. Y.

N. Y., Niagara Falls—(Official)—Carborundum Co. awarded contract to TURNER CONSTRUCTION CO., 11 Broadway, N. Y., for two-story, 80x144 ft. addition to kiln building.

N. J., Camden—New York Shipbuilding Co. awarded contract to DOYLE & CO., 1519 Sanson St., Philadelphia, for one-story, 80x200-ft. warehouse.

N. J., Camden—Contract awarded to GEORGE KOSSLER CONTRACTING CO., Drexel Bldg., Philadelphia, for factory and warehouse for Eavenson & Levering.

Penn., Meadville—Contract for rebuilding Erie freight house awarded to W. K. BYHAM.

Penn., Reading—D. H. Delp & Co. awarded contract to CHARLES H. SCHLEGEL, Reading, for four-story brick and terra-cotta warehouse.

Ohio, Akron—Firestone Tire and Rubber Co. has awarded contract for five-story, 100x125 ft. addition to HUNKIN CONKEY CONSTRUCTION CO., Cleveland.

Ohio, Akron—Goodyear Tire and Rubber Co. awarded contract for two six-story buildings to HUNKIN CONKEY CONSTRUCTION CO., 320 Cuyahoga Bldg., Cleveland. Estimated cost, $600,000.

Ohio, Carthage—(Cincinnati post office)—Polleck Steel Co. awarded contract to M. MARCUS BUILDING CO., for 125x128 ft. addition. Noted Oct. 28.

Ohio, Cleveland—Parish & Bingham Co., West 106th and Madison Ave., awarded contract to W. I. THOMPSON & SON CO., 6110 Euclid Ave., Cleveland, for addition. Noted Oct. 14.

Ohio, Cleveland—Contract awarded to McCLINTIC MARSHALL CONSTRUCTION CO., Pittsburgh, Penn., for factory buildings for Van Dorn & Dutton Co. Estimated cost, $90,000. Noted Oct. 7.

Ohio, Salem—Harris Bros. awarded contract to M. E. FARR for 40x150 ft. plant on West Main St.

Ohio, Salem—Porter Rubber Co. awarded contract for plant to ELLSWORTH KILLE, Salem.

Ind., Evansville—Hercules Co. awarded contract for factory to CALDWELL & MARSHALL, Columbus, Ind.

Ind., Ft. Wayne—Ft. Wayne Electric Works of General Electric Co. awarded contract to A. T. BENTLEY & SON for factory.

Mich., Grand Haven—Amazon Knitting Co. has awarded contract for factory to BUCK & MULLEN, Muskegon.

Mich., Sturgis—Sturgis Steel Go-Cart Co. awarded contract for two-story, 61x85 ft. factory to WILLIAM A. CAVIN.

Ill., Chicago—Gruyton & Cumper Mfg. Co. awarded contract for one-story factory at 4449 Fillmore Ave. to SCHMIDT BROS. CONSTRUCTION CO. Estimated cost, $10,000.

Mo., St. Louis—Ford Motor Car Co. awarded contract to CHAPLINE CONSTRUCTION CO. for five-story assembling plant. Estimated cost, $300,000. Noted Sept. 23.

Utah, Ogden—Ogden, Logan & Idaho Railway Co. awarded contract to C. F. DINSMORE for car barns and repair shops, to UTAH CONSTRUCTION CO. for freight terminal. Estimated cost, $125,000. Noted under Logan, Utah, Oct. 28.

Wash., Camas—Contract awarded to CROWN-WILLAMELLE PAPER CO., Pittock Bldg., Portland, for three-story, 44x67 ft., reinforced-concrete mill by the Van Sant-Houghton Co., San Francisco. Estimated cost, $35,000.

Wash., Seattle—Contract for eight-story building for Times Publishing Co. awarded to A. W. QUIST & CO., Hoge Bldg., Seattle, at $225,985. Noted Aug. 5.

Calif., San Pedro—American Trona Co. awarded contract to LLEWELLYN IRON WORKS for furnishing and erecting the structural steel for a number of buildings. Noted Sept. 30 under Los Angeles, Calif.

Ont., Chatham—Dominion Sugar Co., Wallaceburg, will build refinery at Shatham by day labor. Estimated cost, $1,000,000.

Ont., Port Stanley—Port Stanley Railway Commissioner awarded contract for railway shops and car barns to HAYMAN & SONS, at $27,000.

FEDERAL GOVERNMENT WORK

Proposed Work

Conn., Greenwich—Post Office—Bids will be received by James R. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 10, for U. S. post office at Greenwich.

N. Y., Ft. Totten—Bowling Alleys—Bids will be received at office of Quartermaster until 10 a.m., Dec. 2, for two bowling alleys at Ft. Totten. (See adv.)

N. Y., Ft. H. G. Wright—Building—Bids will be received at office of Constructing Quartermaster until 9 a.m., Nov. 26, for constructing double set officers' quarters.

Penn., Philadelphia—Dredging—Bids will be received at U. S. Engineer Office, Philadelphia, until noon, Nov. 22, for dredging in Delaware River on Bellevue, Cherry Island and Deep Water Point light house ranges. Noted Sept. 9.

Md., Indian Head—Building—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Nov. 6, for magazine building at naval proving ground.

D. C., Washington—Roller Casings, etc.—Bids will be received by F. C. Boggs, Gen. Pur. Officer, Panama Canal, until Nov. 16, for furnishing four boring plates, two roller casings, four roller cages, four roller bearing sleeves, etc.

Va., Norfolk—Dredging—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Nov. 27, for dredging at navy yard, Norfolk.

Ohio, Cleveland—Dredging—Bids will be received at U. S. Engineer Office, Cleveland, until noon, Nov. 26, for dredging in Cleveland Harbor.

Tex., Ft. Bliss—Annex to Hospital—Bids will be received at office of Depot, Quartermaster, El Paso, until 11 a.m., Nov. 27, for rear annex to hospital at Ft. Bliss. (See adv.)

Tex., Ft. Sam Houston—Water Distributing System—Bids will be received at office of Constructing Quartermaster, Ft. Sam Houston, until 11 a.m., Nov. 18, for constructing water distributing system.

N. M., Carlsbad—Pipe Line Extension—No bids were received by U. S. Reclamation Service, Carlsbad, for Dark Canyon pipe line extension of the Carlsbad project, about two miles south of Carlsbad. Noted Oct. 7.

Wash., Meadow Creek—Clearing—Bids will be received at office of U. S. Reclamation, Meadow Creek, until 2 p.m., Dec. 1, for clearing reservoir site at Lake Keechelus.

Panama—Metal Supplies—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10.30 a.m., Nov. 10, for furnishing metal supplies.

Panama—Miscellaneous Supplies—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer of Panama Canal, Washington, D. C., until 10.30 a.m., Nov. 17, for furnishing miscellaneous supplies.

Hawaii, Pearl Harbor—Building—Bids will be received at naval station, Pearl Harbor, and at Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a.m., Nov. 27, for one reinforced-concrete power house, one reinforced-concrete operating building and one wooden double quarters at Pearl Harbor.

Bids In and Contracts Awarded

N. H., Concord—Post Office—Contract for post office at Concord awarded to JAMES MILES & SON CO., Worcester, Mass., at $42,987.

Mass., Boston—Building—Bids were received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., for appraisers' stores, Boston, for construction complete as follows: Norcross Bros. Co., Worcester, $635,000; George Baker Long, Worcester, $617,800; P. J. Carlin Construction Co., 1123 Broadway, New York, N. Y., $611,000. Noted Oct. 21.

Mass., Boston—Flooring—All bids received Oct. 16 for reinforced-concrete floor in pattern shop, Building 42, U. S. Navy Yard, rejected. Work will be done by yard labor. Noted Sept. 30 and Oct. 28.

Conn., Naugatuck—Post Office—Contract for U. S. post office at Naugatuck awarded to W. H. FISSELL & CO., New York, N. Y., at $50,400. Noted Oct. 21.

Penn., Monongahela—Post Office—Bids were received Oct. 27 for U. S. post office at Monongahela as follows: James Devault, Canton, Ohio, $44,200; W. H. Batson, Moundsville, W. Va., $44,700; J. S. Rogers Co., Moorestown, N. J., $46,299. Noted Sept. 23.

Md., Baltimore—Building—Contracts for constructing U. S. Immigration Station, Baltimore, awarded as follows: General construction, WILLIAM DALL CO., Cleveland, Ohio, at $269,688; wharf, NORCROSS BROS. CO., Worcester, Mass., at $6,000; elevators, STANDARD PLUNGER ELEVATOR CO., Worcester, Mass., at $10,950. Noted Sept. 9.

D. C., Washington—Building—Bids were received Oct. 25 for truck house on New Jersey Ave. between D and E St., N. W., as follows: George E. Wyne, $34,950; Skinner & Garrett, $33,929; W. E. Mooney, $34,653.

D. C., Washington—Paving—Contracts for paving awarded to CRANFORD PAVING CO., Washington, for Q St. bridge and to WASHINGTON ASPHALT BLOCK AND TILE CO., Washington, for 12th and 14th St., S. E. Noted Oct. 7 and 28.

Va., Norfolk—Barracks—Contract for brick marine barracks building at navy yard awarded to P. F. GORMLEY CO., Washington, D. C., at $193,926. Noted Aug. 26 and Sept. 30.

Ind., Newcastle—Post Office—Bids were received Oct. 27 for post office at Newcastle, (a) limestone, (b) sandstone, as follows: Charles W. Gindele Co., Chicago, Ill., (a) $53,500; J. S. Rogers Co., Moorestown, N. J., (a) $52,999, (b) $56,000; R. P. Farnsworth & Co., (a) $36,856. Noted Sept. 23.

Ind., Seymour—Post Office—Bids were received Oct. 30 for post office at Seymour (a) limestone, (b) sandstone, as follows: Callahan-Mandl Co., Chicago, Ill., (a) $47,700, (b) $50,000; George W. Stiles Construction Co., Chicago, Ill., (a) $49,600; J. Fred Beggs, Scottsburg, (a) $49,500, (b) $49,600. Noted Sept. 23.

S. D., Newell—Pipe—Contract for constructing 3,285 lin. ft. of 60-in. and 450 lin. ft. of 24-in. continuous wood stave pipe for Belle Fourche Project awarded to PACIFIC TANK AND PIPE CO., San Francisco, Calif., at $12,454. Noted Sept. 2.

Mont., Malta—Reclamation—Contracts for reclamation work at Nelson Reservoir, South Canal, Milk River Irrigation Project, awarded as follows: Building structures to JURGENS, BOOTH & CO., Glasgow, at $34,081; earthwork and structures on Bowboin Canal, first unit, schedule 1 and 2, to JAMES O'CONNOR, Saco, at $18,618; schedule 3 and 4, to JURGENS, BOOTH & CO., Glasgow.

Mo., Kirksville—Post Office—Bids were received Oct. 28 for post office at Kirksville as follows: W. S. King, Lonoke, Ark., $28,850; Charles Wertz Sons., Des Moines, Iowa, $25,213; Mayben & Freuchtel, Gadsden, Ala., $29,730. Noted Sept. 23.

Okla., Ardmore—Post Office—Contract for post office at Ardmore awarded to G. W. STILES CONSTRUCTION CO., Chicago, Ill., at $129,200.

Colo., Montrose—Canal Work—Bids were received Oct. 20 for about 11 miles of Ironstone Canal, Uncompahgre Valley Project, as follows: Mendenhall, Bird & Co., Springvale, Utah, Items 1 and 4, $12,455; 7 to 10, $17,551; 13 to 16, $9,165; 19 to 22, $7,957; 25 to 28, $6,878; C. B. Sherwood, Rocky Ford, Colo., items 17 and 18, $5,775; 23 and 24, $5,742; 29 and 30, $5,164. Noted Sept. 30.

CANALS, DITCHES AND IRRIGATION

Proposed Work

Miss., Clarksdale—Ditches—Bids being received by A. L. Dabney, Engr., Porter Bldg., Memphis, Tenn., for 40,000 yd. ditches in Yazoo Yelta near Clarksdale.

La., Abbeville—Drainage—Citizens of Vermilion parish will vote on $200,000 bonds for drainage in Eighth Ward.

La., Estherwood—Drainage—Citizens voted $38,000 bonds for drainage.

Ill., Cairo—(Official)—Drainage—Dog-Tooth Bend Drainage and Levee District in Alexander County will be organized for drainage and levee purposes. C. A. Patier, Pres. of New York Mercantile Co., Cairo, Chn. of Comn. Oldfield & Brady Co., Cairo, Engr.

Ill., Cairo—Drainage—J. Berthe, Engr., Charleston, filed plans for drainage work in Mississippi County Drainage District No. 31. Estimated cost, $30,000.

Tex., Dallas—Drainage—Commissioners' Court of Dallas County contemplates drainage district in valley of Trinity River near Wilmer.

Wash., North Yakima—Irrigation—Bids will be received, according to press reports, for improvements to irrigation system of Union Gap Irrigation District of Yakima County. C. E. Udell, Secy.

Wash., Spokane—Drainage—Sawyer Bros., Spokane, prepared plans for drainage in Hoodoo Valley in Bonner County, about 14 miles.

Ore., Marshfield—Drainage—E. L. Robinson, Marshfield, retained by residents of Ten Mile District to prepare plans for drainage system. Estimated cost, $15,000.

Ore., Salem—Reclamation—Survey being made for reclamation district in French Prairie.

Calif., Lindsay—Irrigation—Voters of Strathmore-Lindslay Irrigation District voted in favor of forming an irrigation district. Estimated cost, $1,600,000. John Burr, Charles K. Towt and others interested. Noted Aug. 26.

Calif., Marysville—Ditches—Hallwood Irrigation Co. will build drainage ditches.

Bids In and Contracts Awarded

N. Y., Albany—Barge Canal Work—Eastover Construction Co., at $38,534, low bidder for state canal work on Canisteo River near Hornell.

N. Y., Albany—Barge Canal Work—E. Brown Baker, Herkimer, at $7,600, and State Highway Construction Co., Inc., Mohawk, at $6,640 bid on state canal work on Mohawk River and West Canada Creek at Herkimer. Bids opened Oct. 19.

N. Y., Albany—(Official)—Barge Canal Work—Contracts awarded by W. W. Wotherspoon, Supt. of Pub. Wks., for Terminal Contracts No. 20 and 50: WALSH CONSTRUCTION CO., Davenport, Iowa, $419,659 for No. 20 and to RHODY & CLAWSON, Albion, N. Y., at $967 for No. 50. Noted Sept. 30.

N. J., Trenton—Dredging—Contract for dredging first section of Inland Waterway connecting Barnegat Bay with Manasquan River awarded to D. X. SHUBIN, at $0.998 per cu.yd. Noted Oct. 14.

Tenn., Selmer—Drainage—Contract awarded to P. H. THRASHER, Selmer, by Hurricane Creek Drainage District Commissioners for drainage work.

Minn., Blue Earth—Ditches—(Official)—Contracts awarded to CARL C. KNUDSEN, Blue Earth, at $57,200 for fill work, and to MULGREW & SONS CO., Dubuque, Iowa, at $5,498 for open ditch for Judicial Ditch No. 9, and to PAUL PAULSEN, Carroll, Iowa, at $26,956 for Judicial Ditch No. 10. Noted Oct. 7.

Wyo., Rock Springs—Canal—Contract awarded to JOHN BUNNING for overflow canal.

Calif., Modesto—(Official)—Irrigation—Contracts awarded to C. W. RICHARDS, Oakdale, at $33,539 for No. 1; BARRETT & HILP, San Francisco, at $6,209 for No. 2, and PEART BROS., La Grange, at $2,500 for No. 3 for irrigation work in Modesto Irrigation District. Noted Oct. 14.

MISCELLANEOUS

Proposed Work

N. Y., New Hampton—Relayer Rail—Bids will be received by Katharine B. Davis, Comn. of Correction, Municipal Bldg., New York, N. Y., until Nov. 9, for 80 gross tons relayer rail at New Hampton Farms, New Hampton.

N. Y., New York—(Borough of Bronx)—Subway—Form of contract has been submitted to Public Service Commission of First District by Interborough Rapid Transit Co. for Section No. 2, Route Nos. 19 and 22, part of Southern Blvd. and Westchester Ave. branch of Lexington Ave. subway.

N. Y., New York—(Borough of Brooklyn)—(Official)—Station Finish—Bids will be received by Public Service Commission of First District, 154 Nassau St., New York, N. Y. (Borough of Manhattan), until 12:15 p.m., Nov. 5, for constructing station finish for 11 stations on Broadway-Fourth Ave. Rapid Transit R.R.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., Municipal Bldg., New York, until 2 p.m., Nov. 12, for furnishing and delivering 5,000 bags of portland cement.

N. Y., New York—(Borough of Queens)—(Official)—Tracks—Bids will be received by Public Service Commission of First District, 154 Nassau St., New York, N. Y. (Borough of Manhattan), until 12.15 p.m., Nov. 12, for installation of tracks for a portion of Steinway Tunnel Rapid Transit R.R.

Md., Cumberland—(Official)—Fire-Alarm System—We have been informed that plans to improve fire-alarm system have been abandoned for the present. Noted Oct. 14.

Ohio, Newark—Subways—Baltimore and Ohio Railroad Co. approved plans for subways under tracks. Work will start Apr. 1. F. L. Stuart, Baltimore, Md., Ch. Engr.

Ill., Cairo—(Official)—Levee Repair. Bids will be received until noon, Nov. 10, by Rivers and Lakes Commission of Illinois for levee repairs in Cairo. Arthur W. Charles, Chn. (See adv.)

Kan., Arkansas City—Pipe Line—Lesh Pipe Line Co. being organized to build 4-in. pipe line from oil fields. Estimated cost, $25,000.

Kan., Coffeyville—Pipe Line—Citizens will build 16 miles pipe line from oil field. Estimated cost, $25,000.

Neb., Lincoln—Levee—State Irrigation Board contemplates levee system on Nemaha River at Missouri River.

Mo., Kansas City—Wall—Board of Park Commissioners contemplates wall in Slope Park. Estimated cost, $25,000.

Mo., St. Joseph—Speedway—Press reports state two-mile speedway will be constructed at Lake Contrary. John Prince, interested. Estimated cost, $2,000,000.

Mo., St. Louis—Flood Prevention—Board of Public Works contemplates elimination of River des Peres as flood menace. Estimated cost, $6,000,000. Noted Sept. 9.

Tex., Beaumont—(Official)—Machinery and Pier—Bids will be received until noon, Nov. 15, by J. G. Sutton, Secy. Wharf and Dock Commission for quay walls, trans-shipment shed and freight-handling machinery. Noted Oct. 21.

Okla., Bartlesville—Park Improvements—Citizens voted $45,000 bonds for park improvements.

Calif., Hermosa Beach—Bath House—Election will soon be held to vote on $40,000 bonds for bath house.

Calif., McKittrick—Pipe Line—General Petroleum Co. will build 6-in. pipe line from Bear Creek to Lost Hills, about 30 miles.

B. C., Victoria—Baths—Victoria and Island Development Association, Board of Trade Bldg., has had plans prepared for salt water baths on Dougals St. Estimated cost, $75,000.

Bids In and Contracts Awarded

Conn., New Haven—Coal Pocket—F. A. & D. R. Alling has awarded contract for coal pocket on Water St. to GUARANTEE CONSTRUCTION CO., 140 Cedar St. Estimated cost, $13,000.

N. J., Deal Beach—Bulkhead—Frank R. Stoneall, at $13,885, low bidder for concrete bulkhead.

Penn., Philadelphia—(Official)—Superstructures—McClintic-Marshall Co., Philadelphia, at $1,455,000 and $261,400, low bidder for superstructures for elevated railway in sections from Girard Ave. to Unity St., Frankford, and south of Girard Ave. to Callowhill St., respectively. Noted Sept. 30.

Ohio, Cincinnati—(Official)—Steel Tanks—Contract awarded to FERRO CONCRETE CONSTRUCTION CO., Richmond and Harriet St., Cincinnati, for steel tanks for Moore Oil Co. Noted Oct. 21.

Minn., Montevideo—Bulkhead—Contract awarded to MARSHALL CEMENT AND SIDEWALK CO., by County Commissioners for 15,305 ft. of concrete bulkhead.

Mo., Butler—Levees—Contract awarded to A. BENNEMA, Chicago, Ill., for levees along Marais des Cygnes River, about ten miles.

Calif., San Francisco—Esplanade—C. Lamburth, at $49,900, low bidder for beach esplanade. Noted Oct. 7.

Calif., San Francisco—Steamer—Contract awarded to UNION IRON WORKS, at $750,000, by Hind, Rolph & Co. for 410-ft. steamer.

Calif., San Francisco—Vessel—Contract awarded by Matson Navigation Co. to UNION IRON WORKS, at $1,000,000, for freight and passenger vessel.

Calif., San Francisco—Vessel—Contract awarded by Standard Oil Co. to UNION IRON WORKS, at $980,000, for oil tank vessel of 14,000 tons.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous."

Proposed Work

Mass., Boston—Plans prepared by John C. Spofford, MacNaughton & Robinson, Arch., Boston, for riding hall for Norwich University. Estimated cost, $40,000.

Mass., Boston—Union Rescue Mission will build two-story building on Dover St. near Tremont St. Estimated cost, $45,000.

Mass., Ipswich—Plans being prepared by Edward F. Stevens, 9 Park St., Boston, for hospital.

Mass., Southbridge—Revised plans being prepared by Peabody & Stearns, 53 State St., Boston, for two-story, 138x104-ft., high school. Estimated cost, $100,000. Noted Aug. 12 and 26.

Mass., Springfield—Preliminary plans being prepared by Kirkham & Parlett, Arch., for addition to Howard St. school. Noted Sept. 16.

Mass., Worcester—Plans being prepared by Fuller & Delano Co., Arch., 44 Front St., for contagious hospital building.

R. I., Providence—Press reports state that new hotel will be constructed at an estimated cost of $1,300,000. Henry F. Lippitt and Stephen O. Edwards, interested.

Conn., New London—Revised plans being prepared by Ewing & Chappell, Arch., 101 Park Ave., N. Y., for three-story dormitory building for Connecticut College for Women. Bids will soon be received.

N. Y., Binghamton—Congregation of St. John's Parish plan to build new church. Estimated cost, $75,000.

N. Y., Buffalo—Bids will be received until Dec. 1 for purchase of $400,000 bonds for building and equipping public schools.

N. Y., Lockport—Citizens of Niagara County voted bonds for tuberculosis hospital. Estimated cost, $100,000.

N. Y., Niagara Falls—Board of Education plans to build new school.

N. J., Hoboken—Bids will soon be received for two-story, 88x112-ft. gymnasium for Stevens Technical College. Estimated cost, $80,000.

N. J., Hoboken—Board of Education plans an expenditure of approximately $260,000 for addition to high school, $70,000 for addition to School No. 3 and $146,000 for new school on Lincoln School site.

N. J., Jersey City—Plans being prepared for School No. 16 at Washington and Essex St.

Penn., Philadelphia—Bids will soon be received for a one-story building for the Beneficial Savings Fund Society. Estimated cost, $250,000.

Penn., Philadelphia—Bids will soon be received for 15-story office building of brick, stone and concrete at 16th and Market St. C. E. Oelschlager, Philadelphia, Arch.

Md., Baltimore—(Correction)—We have been advised that bids will not be received Nov. 15 for construction of building for Johns Hopkins University. Carrere and Hastings, 52 Vanderbilt Ave., New York, N. Y., Arch. Noted Oct. 21.

Md., Baltimore—Bids will be received about Dec. 1 for two-story, 40x62-ft., and three-story, 50x70-ft., gymnasium for the Y. W. C. A. Estimated cost, $50,000. Noted Sept. 30.

Va., Petersburg—Plans being prepared by Charles M. Robinson & Co., Richmond, for three schools. Estimated cost, $100,000.

Miss., Columbus—Press reports state that high school will be constructed at an estimated cost of $40,000.

La., Lake Charles—Bids will soon be received for high school. Estimated cost, $125,000. Noted Oct. 28.

Ohio, Akron—Arlington Street Baptist Church will build an addition to church and parsonage. Estimated cost, $60,000.

Ohio, Canton—Plans prepared by David Hum, Jr., and submitted to A. Stollbery for station for Baltimore & Ohio R.R. Estimated cost, $200,000.

Ohio, Cincinnati—Samuel Hannaford & Sons, Arch., will prepare plans for addition to Bethesda Hospital in Avondale. Estimated cost, $50,000.

Ohio, Cleveland—Plans being prepared by William C. Jansen, Arch., 403 O'Brien Bldg., for four-story, 60x145-ft. hospital addition for St. Alexis Hospital, Sisters of St. Francis. Estimated cost, $150,000.

Ohio, Cleveland—Bids being received by Charles S. Schneider, Arch., 2248 Euclid Ave., for two-story, 103x103-ft. auditorium for Plymouth Congregational Church. Estimated cost, $50,000. Noted July 29.

Ohio, Cleveland—Bids will soon be received by A. C. Edwards, Arch., 615 Union Bldg., for two-story, 100x116-ft. theater, store and office building for Yale Theater Co. Estimated cost, $40,000.

Ohio, Cleveland—Plans being prepared by Ferguson-Flanigan Co., Arch. and Contr., Vickers Bldg., for eight-story mercantile building at St. Clair Ave. and Ontario St., for Walton Realty Co. Estimated cost, $200,000.

Ohio, Cleveland—Bids will soon be received for detention home on Franklin Ave. Estimated cost, $90,000.

Ohio, Fremont—Memorial Hospital will be constructed at Fremont. About $200,000 available for this purpose.

Ohio, Steubenville—B. P. O. E. No. 231 plans two-story and basement, 65x120-ft. club house. Petersen & Clark, Arch., Nath Bldg. Estimated cost, $40,000.

Ind., Ft. Wayne—Hope Hospital Association will not build six-story hospital until spring. Estimated cost, $100,000.

Ind., Indianapolis—Wigwam Hotel will not build hotel, lodge rooms and auditorium until spring. Estimated cost, $250,000.

Ind., Portland—Preliminary plans being prepared for three-story, 90x160-ft. court house for Jay County. McLaughlin & Hulsken, Arch., 610 Savings Bldg., Lima, Ohio. Estimated cost, $275,000.

Mich., Detroit—Plans prepared by Albert Kahn, Arch., for Merchants and Manufacturers auditorium on Cass Ave.

Ill., Bloomington—Plans being prepared for library building for Illinois Wesley University. Estimated cost, $250,000.

Ill., Chicago—Cadillac Auto Co. will build eight-story and basement 100x160-ft. sales building at Indiana Ave. and 23d St. Estimated cost, $200,000.

Ill., Chicago—Press reports state that hotel to be known as Edgewater Hotel will be constructed at Balmoral Ave. and Sheridan Rd. Estimated cost, $1,000,000.

Ill., Moline—Antlered Tribe of Moline, B. P. O. E. plans to build new club house. Estimated cost, $100,000.

Ill., Springfield—Plans being prepared by Harry J. Reiger, Arch., 42 Ridgely Bank Bldg., for addition to Dubois School. Estimated cost, $75,000.

Iowa, Alta—Plans being prepared by Smith & Keffer, Arch., Des Moines, for new school. Estimated cost, $80,000.

Iowa, Cherokee—Plans will soon be prepared for a new hospital. Estimated cost, $50,000. W. Stiles, Chn. of Comrs.

Iowa, Ft. Dodge—Members of Congregational Church plan new church. Estimated cost, $55,000.

Minn., Duluth—Bids will soon be received for municipal building. F. G. German, Arch.

Minn., Minneapolis—Union City Mission plans to build a 12-story hotel on Second St., N. Estimated cost, $120,000.

Minn., St. Paul—Plans being prepared by C. H. Johnston, Arch., for State Historical Society Building. Estimated cost, $500,000.

Minn., St. Paul—Revised plans prepared for passenger station for Union Depot Co. W. C. Armstrong, Engr.

Minn., St. Paul—Part of uncompleted building at Sixth and St. Peter St. for Mannheimer Bros. will be remodeled into a hotel. Estimated cost, $1,000,000.

Kan., Emporia—Bids will soon be received for Preston B. Memorial Building at State Normal School. Estimated cost, $175,000.

STORM WATER DRAINAGE SYSTEM, ATLANTIC CITY, N. J.

Bids were received Oct. 7 for the extension of the storm-water drainage system from (A) James Ferry & Sons, Inc., Baltimore, Md.; (B) M. B. Markland, Atlantic City; (C) Culp Co., Inc., Paterson; (D) Atlantic Construction and Supply Co., Atlantic City; (E) Empire Construction Co., New York, N. Y.; (F) Dock Contractor Co., Hoboken; (G) Edward L. Bader, Atlantic City; (H) Whiting-Turner Construction Co., Baltimore, Md. The item bids were as follows:

	A	B	C	D	E	F	G	H
17 lin.ft. 4ft, x 2 ft., 6 in. concrete drain	$14.60	$20.00	$11.31	$14.92	$10.70	$11.49	$16.00	$14.76
355 lin.ft. 4 ft. x 2 ft. concrete drain	12.70	13.69	11.31	13.55	10.70	11.01	14.00	13.41
35 lin.ft. 3 ft., 6 in. x 2 ft. concrete drain	10.90	10.00	11.02	12.47	10.10	10.37	13.00	12.65
575 lin.ft. 3 ft. x 2 ft. concrete drain	10.80	12.65	10.94	12.63	10.07	10.02	12.80	12.07
263 lin.ft. 48-in. brick and concrete drain	17.60	16.50	13.92	15.50	14.52	14.00	16.70	17.38
520 lin.ft. 39-in. brick and concrete drain	13.10	14.05	11.83	14.70	11.60	12.50	17.20	15.10
105 lin.ft. 36-in. brick and concrete drain	16.20	9.45	10.53	12.23	10.27	11.57	14.80	14.94
810 lin.ft. 33-in. brick and concrete drain	7.80	8.00	7.18	9.10	7.15	8.88	10.90	10.78
2,148 lin.ft. 30-in. brick and concrete drain	6.90	7.90	7.00	8.70	6.92	8.46	10.40	9.61
2,282 lin.ft. 27-in. brick and concrete drain	5.50	7.00	6.88	7.74	6.48	7.70	9.60	8.74
2,154 lin.ft. 24-in. terra cotta drain	4.80	6.75	7.25	7.80	5.75	7.74	9.00	8.89
1,726 lin.ft. 22-in. terra cotta drain	4.40	6.35	6.55	7.00	5.40	7.00	8.15	8.35
802 lin.ft. 20-in. terra cotta drain	4.10	6.15	6.11	6.45	5.21	6.66	8.15	7.93
544 lin.ft. 18-in. terra cotta drain	3.30	6.70	5.86	5.70	4.93	6.30	7.00	7.40
1,315 lin.ft. 15-in. terra cotta drain	2.70	5.55	5.00	4.90	4.34	6.01	6.40	6.75
267 lin.ft. 12-in. terra cotta drain	2.30	4.50	4.00	3.55	3.67	5.22	5.50	5.60
2,657 lin.ft. 12-in. terra cotta inlet pipe	1.90	1.80	2.55	2.35	3.62	4.69	2.90	4.90
3,756 lin.ft. 10-in. terra cotta inlet pipe	1.80	1.60	2.50	2.10	3.44	4.55	2.65	4.50
394 lin.ft. vertical manholes	6.00	6.00	5.50	6.50	12.50	12.98	4.00	6.50
62 lin.ft. manhole frames and covers	10.00	9.00	9.25	9.00	21.60	11.01	9.50	10.00
209 storm water inlets	25.00	20.00	25.00	30.00	40.00	32.35	26.00	45.00
209 hood traps	4.00	3.50	3.60	3.60	7.00	2.32	4.00	4.00
104 lin.ft. catch basins	45.00	80.00	80.00	68.00	105.00	92.80	75.00	137.00
12,700 lin.ft. underdrain	.30	.20	.36	.21	.25	.53	.30	.36
21,700 lin.ft. piles	.30	.30	.30	.30	.50	.29	.30	.38
2 concrete bulkheads (lump sum)	1,000.00	1,000.00	1,000.00	800.00	1,000.00	850.00	500.00	680.00
Extended totals	$125,921	$147,856	$150,038	$159,598	$159,754	$181,043	$183,837	$205,185

Kan., Winfield—Capitalists of Winfield contemplate hotel at Main St. and Ninth Ave. Estimated cost, $200,000.

Mont., Hardin—T. J. Daniel, A. L. Nitchell and Walter O. Lee are interested in the construction of a two-story, 100x150-ft. hotel. Estimated cost, $50,000.

Mo., Maryville—(Official)—Wilder & Wight, Kansas City, Mo., preparing plans for bank for Farmers Trust Co.

Mo., Springfield—Presbyterian Church plans tabernacle at Cherry St. and Blvd. Estimated cost between $50,000 and $75,000.

Ark., Ft. Smith—St. Edwards Infirmary will build hospital annex at North 15th St. Estimated cost, $100,000.

Tex., El Paso—Plans being prepared for bank and office building for Rio Grando Valley Bank and Trust Co. Estimated cost, $150,000.

Tex., El Paso—F. P. Miller interested in construction of cathedral for Scottish Rite Masons. Estimated cost, $200,000.

Tex., Houston—Bids will be received about Nov. 15 for the Taylor School. Estimated cost, $90,000.

Idaho, Bonners Ferry—G. W. Sperry plans to build a hotel on Main St. Estimated cost, $60,000.

Ariz., Kingman—Plans being prepared by Norman F. Marsh, Arch., Broadway Central Bldg., Los Angeles, Calif., for a two-story high school for Kingman Union High School district. Estimated cost, $50,000.

Wash., Bellingham—Bids will soon be received for constructing the Central High School. Estimated cost, $75,000.

Wash., Seattle—A four-story, 60x120-ft. reinforced-concrete office building will be constructed on the site of the Alaska Theater Bldg. Estimated cost, $75,000.

Wash., Tacoma—Bids will soon be received by Luther Twitchell, Arch., Savage-Scofield Bldg., for a three-story brick and concrete addition to the Bankers Trust Bldg., Pacific Ave. Estimated cost, $50,000. Noted Sept. 9.

Calif., El Centro—S. B. Zimmer, Arch., El Centro, will prepare plans for high school for Central Union high school district. Estimated cost, $135,000.

Calif., Fresno—Plans prepared by Kraft & Son, Arch., San Francisco, for hospital at Fresno and S St. for Burnett Sanitorium Association. Estimated cost, $75,000.

Calif., Los Angeles—Plans being prepared by J. C. Austin, Arch., Baker-Detwiller Bldg., for church for First Methodist Episcopal Church. Estimated cost. $250,000.

Calif., Sacramento—Plans being prepared by R. R. Herold, Arch., for first three units of proposed new county hospital. Estimated cost, $400,000.

Calif., San Bernardino—Plans being prepared by Elmore R. Jeffery and Frank R. Schaeffer, Archs., Wesley Roberts Bldg., Los Angeles, for church for First Congregational Church of San Bernardino. Estimated cost, $50,000.

Calif., San Francisco—Plans prepared by Willis Polk, Arch., for 12-story building at Pine and Montgomery St. for McCreely Estate. Estimated cost, $350,000.

Calif., San Francisco—Plans being prepared by Willis Polk & Co. for building for Western Union Telegraph Co. Estimated cost, $350,000.

Ont., Orillia—Election will be held to vote on $50,000 bonds for City Hall building.

Ont., Toronto—Plans prepared by Clinton & Russell, Arch., for seven-story office building at Church and Court St. for Imperial Oil Co. Noted Oct. 7.

Alaska, Valdez—S. Blum & Co. plans to build a three-story department store building. Estimated cost, $45,000.

Bids In and Contracts Awarded

Mass., Boston—(Roslindale)—All bids rejected for church of Our Saviour. Estimated cost, $50,000.

Mass., Boston—(Roxbury)—All bids received for High School of Practical Arts rejected. Noted Oct. 28.

Mass., Chicopee—Contract for school for St. Stanislaus Polish Church Society awarded to CAGNON & ANGIER, Springfield. Noted Sept. 23.

Mass., Fall River—Darling-Slade Construction Co., Newport, R. I., at $83,000 low bidder for remodeling City Home.

Conn., New Haven—Contract awarded to GEORGE A. FULLER CO., for three-story, 50x144-ft., administration building on Howard Ave., three-story, 54x144-ft., pathological laboratory for General Hospital Society of Connecticut. Noted Sept. 16.

BARGE CANAL WORK, ALBANY, N. Y.

Contract No. 20

Bids were received Oct. 26 by W. W. Wotherspoon, State Supt. of Pub. Wks., for Barge Canal Work, Contract No. 20 from (A) James Stewart & Co., Inc., New York; (B) Walsh Construction Co., Inc., Davenport, Iowa; (C) Sherman Stalter Co., Lyons, N. Y.; (D) T. W. Kinser, St. Louis, Mo.; (E) Larkin & Sangster, Seneca Falls, N. Y.; (F) New York State Dredging Corporation, Rochester; (G) Henry P. Burgard, Buffalo; (H) Eastover Construction Co., Utica; (I) John Young, Syracuse; (J) Great Lakes Dredge and Dock Co., Buffalo; (K) Cleveland Sons Co., Brockport; (L) Central Dredging Co., Cleveland, Ohio; (M) Holler & Shepard, Rochester; (N) State Highway Construction Co., Beacon; (O) T. A. Gillespie, New York; (P) American Pipe and Construction Co., Philadelphia, Penn.; (Q) Grant Smith & Co., Rome; (R) Edwin String; (S) H. S. Kerbaugh, Inc., Buffalo. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
Clearing (lump sum)	$50.00	$50.00	$50.00	$50.00	$50.00	$50.00	$50.00	$50.00	$50.00	$50.00
Removing buildings (lump sum)	8,400.00	1,500.00	3,600.00	10,000.00	12,000.00	8,000.00	10,000.00	10,000.00	10,000.00	10,000.00
1,030,000 cu.yd. excavation	.19	.186	.21	.24	.32	.25	.235	.21	.27	.235
20 M ft. b.m. sheeting and bracing	40.00	45.00	50.00	50.00	50.00	35.00	50.00	30.00	50.00	50.00
10,400 cu.yd. forming embankment	.15	.20	.15	.20	.20	20	.20	.10	.20	.20
85,000 lin.ft. foundation piles	.34	.26	.25	.35	.32	.40	.35	.40	.27	.33
110 fender piles	20.00	15.00	15.00	20.00	20.00	24.00	20 00	20.00	20.00	20.00
790 M ft. b.m. sawed lumber	46.00	36.00	38.00	50.00	40.00	35.00	40.00	35.00	45.00	45.00
33 M ft. b.m. sawed lumber in bridge floor	65.00	55.00	55.00	65.00	65 00	50.00	75.00	65.00	60.00	65.00
8,700 cu.yd. stone filling in cribs	1.70	1.90	1.85	2.00	1.75	1.10	2.00	1.25	1.75	1.50
9,500 cu.yd. second class concrete	7.50	6.00	7.00	7.50	6.75	6.50	7.50	7.50	5.50	7.40
400,000 lb. structural steel	.04	.04	.04	.04	.04	.04	.045	.04	.04	.041
260 lin.ft. lattice railing	2.25	1.75	2.00	2 00	2.00	2.00	1.25	2.20	2.00	5.00
18,000 lb. iron castings, plain	.04	.04	.033	.04	.04	.04	.035	.04	.04	.04
3,300 lin.ft. malleable cast iron nosing	1.25	1.00	1.15	1.25	1.25	1.25	1.20	1.25	1.50	1.25
46,000 lb. metal reinforcement	.03	.026	.036	.035	.035	.035	1.15	.035	.03	.03
550 fender fastenings	1.20	1.00	1.20	1.20	1.20	1.20	3.00	1.20	1.20	1.20
38,000 sq.ft. steel sheet piling	1.05	.90	.75	1.15	1.15	1.10	3.50	1.35	.90	1.00
7,000 cu.yd. wash wall	3.00	2.50	2.20	3.00	3.00	2.00	1.00	1.50	3.00	3.00
2,500 cu.yd. third class rip-rap	3.00	2.50	3.10	3.00	3.00	2.50	1.50	3.00	3.00	3.00
3,300 cu.yd. taking up and relaying rip-rap	1.00	1.00	1.00	1.00	1.00	1.00	1.50	1.20	1.00	1.00
450 sq.yd. paved gutters	1.50	1.20	1.50	1.50	1.50	1.50	.15	1.50	1.50	1.50
4,300 cu.yd. gravel surfacing	1.50	1.30	1.35	1.50	1.35	1.75	.30	1.50	1.50	1.30
7,400 lin.ft. drains	.15	.12	.15	.15	15	.15	...	.15	.15	.15
1,100 lin.ft. wooden fence	.30	.25	.30	.30	.30	.30	...	.30	.25	.30
Maintaining highway traffic (lump sum)	750.00	750.00	1,000.00	1,000.00	1,000 00	900 00	.....	1,000.00	1,000.00	990.00
Cofferdams, pumping, bailing and draining	10,000.00	4,500.00	9,000.00	11,000.00	12,500.00	6,000.00		10,000.00	10,000.00	10,000.00
Extended totals (lump sum)	$481,705	$419,659	$455,935	$542,275	$597,325	$511,115	$532,805	$492,622	$539,800	$519,375

	K	L	M	N	O	P	Q	R	S
Clearing (lump sum)	$50.00	$50.00	$50.00	$50.00	$50.00	$50.00	$50.00	$50.00	$60.00
Removing buildings (lump sum)	10,000.00	10,000.90	5,000.00	10,000.00	9,500.00	10,000.00	10,000.00	1,100.00	12,000.00
1,030,000 cu.yd. excavation	.27	.24	.32	.26	.30	.28	.32	.26	.23
20 M ft. b.m. sheeting and bracing	50.00	40.00	42.00	55.00	51.00	60.00	60.00	60.00	60.00
10,400 cu.yd. forming embankment	.18	.20	.20	.20	.18	.20	.25	.15	.24
85,000 lin.ft. foundation piles	.30	.25	.28	.30	.35	.38	.35	.40	.40
110 fender piles	20.00	15.00	20.00	20.00	16.50	26.00	25.00	14.00	20.00
790 M ft. b.m. sawed lumber	45.00	38.00	45.00	45.00	45.55	40.00	55.00	40.00	35.00
33 M ft. b.m. sawed lumber in bridge floor	65.00	50.00	62.50	65.00	57.60	65.00	70.00	70.00	55.00
8,700 cu.yd. stone filling in cribs	1.10	2.00	2.40	2.00	2.05	1.50	3.00	1.50	1.00
9,500 cu.yd. second class concrete	7.25	6.50	6.90	6.50	7.25	7.90	8.50	8.00	7.50
400,000 lb. structural steel	.04	.04	.04	.04	.04	.04	.05	.04$	.04
260 lin.ft. lattice railing	2.00	2.00	2.50	2.00	2.25	2.00	2.00	2.10	2.40
18,000 lb. iron castings, plain	.04	.04	.04	.04	.04	.04	.04	.045	.03
3,300 lin.ft. malleable cast iron nosing	1.25	1.50	1.10	1.25	1.25	1.50	1.50	1.25	1.10
46,000 lb. metal reinforcement	.03	.03	.031	.03	.03	.03	.04	.04	.03
550 fender fastenings	1.20	1.00	1.20	1.00	1.20	1.20	1.20	1.25	1.10
38,000 sq.ft. steel sheet piling	1.15	1.00	.95	.95	1.10	1.25	1.00	1.00	1.25
7,000 cu.yd. wash wall	2.75	3.00	2.90	2.00	3.00	1.50	3.00	2.50	2.00
2,500 cu.yd. third class rip-rap	2.50	3.00	3.00	3.00	3.50	3.00	3.00	3.00	2.00
3,300 cu.yd. taking up and relaying tip-rap	1.00	1.00	1.00	1.00	1.25	1.00	2.50	1.20	1.00
450 sq.yd. paved gutters	1.50	1.50	1.25	1.50	1.50	1.50	1.50	1.50	1.50
4,300 cu.yd. gravel surfacing	1.50	1.50	1.50	1.25	1.75	1.50	1.50	1.25	1.25
7,400 lin.ft. drains	.15	.18	.15	.15	.15	.15	.25	.15	.16
1,100 lin.ft. wooden fence	.30	.30	.27	.25	.33	.30	.35	.35	.35
Maintaining highway traffic (lump sum)	1,000.00	1,000.00	1,000.00	500.00	600.00	1,000.00	1,000.00	500.00	12,00.00
Cofferdams, pumping, bailing and draining	11,000.00	11,000.00	10,000.00	7,000.00	11,000.00	11,000.00	11,000.00	12,000.00	12,000.00
Extended totals (lump sum)	$588,712	$516,512	$597,398	$530,095	$598,020	$571,900	$653,360	$554,223	$511,989

Conn., Stratford—Stratford Trust Co. awarded contract to S. W. HUBBELL BUILDING CO., Bridgeport, for bank building.

N. Y., Syracuse—Contract awarded to ONONDAGO BUILDING AND CONSTRUCTION CO., at $201,458, for Delaware School at Delaware and Geddes St. Noted Oct. 21.

N. J., Trenton—Contract for a stone and concrete building for State Hospital of New Jersey awarded to GEORGE B. WILLS & CO., New York, N. Y., at $42,887.

Va., Lexington—Contract for Jackson Memorial Hall at Virginia Military Institute awarded to J. L. CROUSE, Greensboro, N. C., at $89,662.

Va., Lynchburg—Contract awarded to J. P. PETTYJOHN & CO., Lynchburg, for three-story, 70x106-ft., school for Virginia Episcopal School. Estimated cost, $57,000.

Va., Roanoke—Contract for auditorium, armory and convention hall awarded to C. H. TURNER, at $41,275, for Roanoke Auditorium Co. Noted Oct. 21.

Ohio, Cincinnati—(Madisonville)—Contract for group of buildings for Children's Home to be constructed at Madisonville awarded to M. MARCUS BUILDING CO. Estimated cost, $100,000. Elzner & Anderson, Arch.

Ohio, Cincinnati—Contract awarded to FERRO CONCRETE CONSTRUCTION CO., at $455,469, for five buildings for the Board of Education.

Ohio, East Cleveland—Contract for additions to Chambers and Rozelle schools awarded to CLEVELAND FIREPROOF CONSTRUCTION CO., 650 Rockefeller Bldg., Cleveland. Estimated cost, $100,000.

Ohio, Oxford—(Official)—Contract awarded to SIMS & BENZING, Hamilton, at $40,093, for pavilion at Miami University.

Ind., Evansville—Contract for Hotel McCurdy awarded to CALDWELL-MARSHALL CO., Columbus, at about $450,000. Noted Sept. 9.

Mich., Wahjamega—(Caro post office)—Farm Colony for Epileptics awarded contract to FRANK L. SHOEMAKER CO., Kalamazoo, for two buildings. Estimated cost, $90,000.

Ill., Peoria—Contract for addition to store building of Block & Kuhl at Adams and Fulton St. awarded to V. JOBST & SONS, at about $150,000.

Ill., Rock Island—Contract for three-story, 82x130-ft., school at Ninth and 12th Ave. awarded to BUILDING CONSTRUCTION CO., Chicago, at $61,970. Noted Oct. 7.

Iowa, Jefferson—Contract for Green County Courthouse awarded to ROWLES CO., Onawa, at $127,327.

Minn., Crosby—Board of Education awarded contract for two-story brick high school to JACOBSON BROS., Duluth. Estimated cost, $100,000. Noted Aug. 5 and 19.

Minn., Minneapolis—Contract for three-story brick and terra-cotta building for N. Geanakoplos awarded to R. J. CHENEY & CO. Estimated cost, $50,000.

Mont., Billings—Contract for addition to Northern Hotel awarded to GAGNON & CO., Billings. Estimated cost, $65,000.

Mo., St. Louis—Contract for a laboratory for the Luyties Pharmacy Co. at 4,200 Laclede Ave. awarded to GAMBLE CONSTRUCTION CO. Estimated cost, $50,000.

Ark., Newport—Contract for building for Arkansas Bank & Trust Co. awarded to BURKE CONSTRUCTION CO., Hattiesburg, Miss., at about $41,000.

Tex., Dallas—Contract for addition to College of Industrial Arts awarded to GILSONITE CONSTRUCTION CO., St. Louis, at $87,000.

Calif., Ventura—Bids were received Oct. 18 for two cottages and detention building for California State School for Girls: King Co., $43,333; F. O. Engstrum, $45,987; L. Bergren & Son, $48,472. Noted Oct. 7 and 28.

Que., Quebec—(Limoilou)—School Commissioner awarded contract to EDWARD BELANGER for school. Estimated cost, $50,000.

CATALOG NOTICES

Independent Pneumatic Tool Co., Thor Bldg., Chicago, Ill. Circular. Thor pneumatic drills, hammers, riveters, etc. Illustrated.

Kingsford Foundry & Machine Works, Oswego, N. Y. Catalog No. 18. Turbine pumps, type L. Illustrated, 22 pp., 6x9 in.

The Berger Mfg. Co., Canton, Ohio. Catalog. Concrete reinforcing and furring plates, expanded metal lath, pressed steel cores. Illustrated, 82 pp., 6x9 in.

ELEVATED RAILWAY WORK, PHILADELPHIA, PENN.

Bids were received by the Department of City Transit, Oct. 19, for constructing the steel superstructure and appurtenant work for the Frankford Elevated Railway from (A) McCLINTIC-MARSHALL CONSTRUCTION CO., Morris Bldg., Philadelphia (awarded contract); (B) E. E. Smith Contracting Co., New York, N. Y.; (C) Conners Bros. Co., Inc., New York. N Y. The item bids were as follows:

	A	B	C
Contract No. 515 (grouping contracts 512 and 513—for the whole work as shown on the plans (lump sum)	.....	$1,109,130	$1,104,000
Contract No. 516 (grouping contracts 512 and 514—for the whole work as shown on the plans (lump sum)	.....	1,095,564	1,089,000
Contract No. 517 (grouping contracts 513 and 514 —for the whole work as shown on the plans (lump sum)	.....	1,235,728	1,229,000
Contract No. 518 (grouping contracts 512, 513 and 514—for the whole work as shown on the plans (lump sum)	$1,455,000	1,720,211	1,684,000
10,000 lb. riveted steel girders	0.0315	0.0425	0.04
10,000 lb. rolled steel beams	0.029	0.0425	0.04
10,000 lb. steel columns	0.04	0.0425	0.04
10,000 lb. steel rods	0.04	0.03	0.035
10,000 lb. iron castings	0.025	0.04	0.05
100 cu.yd. excavation	1.25	2.00	2.00
100 cu.yd. concrete	10.00	8.00	7.50
100 sq.yd. asphalt paving	4.50	2.50	3.00
100 sq.yd. new granite block paving	4.50	4.00	3.50
100 sq.yd. new vitrified block paving	4.50	3.00	3.00
100 sq.yd. new wood block paving	4.50	4.00	3.50
100 sq.yd. granite, wood or vitrified block repaving, concrete base	2.25	4.00	2.25
100 sq.yd. granite, wood or vitrified block repaving, gravel base	2.00	3.00	1.50
100 sq.yd. granolithic sidewalk paving	1.50	2.00	1.50
100 sq.yd. flagstone sidewalk repaving	.75	3.00	1.00
100 sq.yd. brick sidewalk paving	1.00	2.00	3.00
100 lin.ft. 6-in. straight granite curb	1.00	1.50	3.25
100 lin.ft. 8-in. straight granite curb	1.20	2.50	3.50
100 lin.ft. 6-in. or 8-in. curved granite curb	2.25	3.00	4.00
100 lin.ft. granolithic curb	.85	1.00	.80
100 lin.ft. resetting stone curb	.50	.60	.30
1 M ft. b.m. yellow pine lumber	55.00	40.00	55.00
Extended total, contract No. 515		$1,125,380	$1,118,950
Extended total, contract No. 516		1,111,814	1,103,950
Extended total, contract No. 516	$1,476,555	1,744,586	1,706,485

The New York Municipal Railway Corporation has applied to the Public Service Commission for the First District for permission to enter into a contract with the George W. McNulty Co., for the construction of the Coney Island terminal of its elevated railroads. The company, in its application, states that the McNulty Co., in its opinion, is well equipped to do the work, and that the prices which it agrees to perform the work for are reasonable. The McNulty Co. is the same concern which constructed the Sea Beach line for the New York Municipal Railway Corporation. That corporation says the Sea Beach work was very satisfactory, and it believes that by letting the Coney Island terminal contract to the same company it will get as satisfactory work.

The Public Service Commission for the First District and the New York Dock Co. have perfected an agreement which, it is estimated, will save the City of New York at least $500,000 in the cost of construction of the new subways and will result in the immediate expenditure of at least $1,250,000 by the company for the improvement of the Brooklyn waterfront between Fulton St. and Atlantic Ave. The improvement contemplates the replacement of the existing piers, which are about 400 ft. long, by five new piers, which will be from 640 to 750 ft. in length, more than doubling the capacity of the piers and making possible the accommodation of much larger vessels than can be taken care of with the present pier space. Incidentally, three of the new piers will be erected over the existing subway tunnel in Joralemon St., and the two new subway tunnels in Montague and Clark St., so that absolute protection will be afforded for these tubes. The agreement provides for the purchase by the City of easement rights for the new subway at the foot of Clark St., Brooklyn, for $275,000, and that the Dock Co. will agree to pay at least $75,000 for property owned by the city at the foot of Montague St. and at least $25,000 for property owned by the city at the foot of Joralemon St., Brooklyn. In other words the City will acquire the Clark St. easement for $175,000 net, and the Dock Co. will be able to make the improvements above mentioned.

BRIDGE, LYONS FALLS, N. Y.

Bids were received Oct. 19 by W. W. Wotherspoon, State Supt. of Pub. Wks., for constructing a bridge over the Moose and Black Rivers at Lyons Falls from (A) Lupfer & Remick, Buffalo; (B) Walter S. Rae, Pittsburgh, Penn.; (C) Jackson L. Richmond, Grant; (D) Lathrop, Shea & Henwood Co., Buffalo; (E) Chesley, Earl & Heimbach, Inc., Buffalo; (F) John Young, Syracuse; (G) Eastover Construction Co., Inc., Utica; (H) Scott Bros., Rome. The item bids were as follows:

	A	B	C	D	E	F	G	H
5,200 cu.yd. excavation	$0.95	$0.60	$0.40	$0.70	$0.70	$0.75	$0 90	$0.70
300 cu.yd. lining	.65	1.00	1.00	1.25	1.50	1.50	1.50	1.25
4,100 lin.ft. foundation piles	.35	.32½	.40	.30	.30	.60	.45	.35
1,500 cu.yd. second-class concrete	8.00	6.00	7.50	6.50	6.75	6 75	7.50	6.50
736,000 lb. structural steel	.0428	.043	.044	.042	.0425	.05	.0417	.044
500 lb. metal reinforcement	.04	.04	.04	.04	.04	04	.04	04
475 lin.ft. lattice railing	2.00	1.90	2.00	1.75	2.00	2 00	2.25	2.00
40 lin.ft. wrought iron pipe railing	1.25	1.25	1.25	1.25	1.25	1.25	1.50	1.25
1,050 lin.ft. wooden fence	.25	.25	.25	.25	.25	.25	.26	.25
40 cu.yd. third-class rip-rap	1.50	2.00	2.50	3 00	2.50	2.50	2.00	2.50
19.5 M ft. b.m. sawed lumber untreated	40.00	48.00	55.00	50.00	60.00	60 00	65.00	55.00
40.5 M ft. b.m. sawed lumber treated	45.00	69.00	65.00	70.00	80.00	80 00	90.00	75.00
65 sq.yd. cobblestone gutter	1.00	1.00	1.50	1.80	1.50	1.50	1.50	1.50
Cofferdams, pumping, bailing and draining (lump sum)	3,600.00	3,200.00	3,000.00	2,800.00	3,000.00	3,000 00	3,500.00	3,600.00
Maintaining highway traffic (lump sum)	1,200.00	1,200.00	1,000.00	1,000.00	1,000.00	1,000 00	1,000.00	1,200.00
Totals	$58,880.80	$54,911.00	$56,839.00	$54,917.75	$56,615.00	$63,625.00	$59,927.95	$57,974.00

The Marked Decline in Idle Cars—The decline in idle cars on railroads of the United States and Canada during September, as reported by the American Railway Association, was greater than in any previous month for several years. Total number of cars idle Oct. 1 was 78,299, a decrease of 106,710 cars, or 57%, from Sept. 1. There has been a continuous monthly lessening of idle cars since last May, and aggregate decrease of the last four months was 222,254 cars. The September declines were apportioned among the three various classes of freight cars as follows: Box, 62,764; flat, 3,724; and coal, 25,275. Flat and coal cars decreased every month since May and box cars every month in that period except July, when there was a slight increase. As compared with the same period in previous years, the total idle cars Oct. 1 this year was 52,728 less than in 1914 and 67,825 more than 1913. As there was a net shortage of 31,579 cars on Oct. 1, 1912, the figures for this year represent an increase of 109,878. There are less box cars idle now than a year ago, but more than in either 1913 or 1912, when net shortages were reported. Idle flat and coal cars this year are fewer than in 1914, but more than in the two preceding years. At this time three years ago there was a net shortage of all classes of cars. The following table compares the idle cars by classes on Oct. 1, over a period of four years:

Oct. 1	1915	1914	1913	1912
Box cars	36,254	55,131	*1,189	*28,048
Flat cars	6,368	8,733	1,207	*2,997
Coal cars	13,312	37,224	*2,440	*8,406
Total cars	78,299	131,027	10,374	*31,579

*Net shortage.

The manner in which increased freight movement all over the country is lowering the number of idle cars is reflected in the recent statements of the Pennsylvania R.R. system, which show that for nearly two months past there have been no good order cars out of service on any of the Pennsylvania lines.

The United States Steel Corporation issued the following statement of earnings, covering the quarter ending Sept. 30, 1915. The following shows comparison with the same quarter of 1914:

	1915	1914
July earnings	$12,048,218	$7,475,993
August earnings	12,869,099	7,584,926
September earnings	13,793,327	7,215,083
Total earnings after deducting all expenses incident to operations, including those for ordinary repairs and maintenance of plants and interest on bonds of subsidiary companies	$38,710,644	$22,276,002
Less charges and allowances for depreciation, viz.:		
Sinking funds on bonds of subsidiary companies and depreciation and extraordinary replacement funds	7,028,034	6,017,922
Sinking funds on U. S. Steel Corporation bonds	1,636,819	1,576,058
Net income	$30,045,791	$14,682,022
Deduct interest for the quarter on U. S. Steel Corporation bonds outstanding and premium payable on bonds redeemable under sinking funds	5,703,631	5,746,111
Balance	$24,342,160	$8,935,911
Dividends for the quarter on stocks of the U. S. Steel Corporation, viz:		
Preferred	6,304,919	6,304,919
Common	.....	2,541,513
Surplus for the quarter	$18,037,241	$89,479

Municipal Bond Sales Larger—Municipal bond issues throughout the United States during the month of October, including state and county flotations, reached a total of $27,816,300, against $21,215,600 the previous month and $13,141,429 in October, 1914. This brings the total for the ten months of 1915 up to $388,858,100, as compared with $451,023,510 for the corresponding period last year. The feature of the month's transactions was the sale of $3,000,000 bonds of the Imperial Irrigation District of California, which were taken by the Southern Pacific Co. The State of California also sold an issue of $1,800,000 University of California bonds. Another important issue, amounting to $2,668,000, was that disposed of by the city of Pittsburg.

The following table shows the output of permanent municipal bond issues for the month of October and the ten months in previous years:

	Month of October	For the Ten Months
1914	$13,141,429	$415,023,510
1913	39,698,091	327,902,805
1912	27,958,999	345,871,920
1911	26,588,621	341,992,191
1910	27,037,207	258,958,249
1909	16,377,836	288,767,287
1908	14,097,829	257,310,946
1907	9,793,358	209,516,322
1906	14,819,277	167,971,622
1905	7,915,496	148,937,223
1904	10,299,995	208,221,052
1903	12,196,885	123,942,878
1902	5,488,424	123,167,279
1901	9,779,197	109,103,198
1900	16,421,185	113,615,626
1899	9,314,854	104,341,291
1898	4,906,607	88,057,166
1897	6,872,293	113,259,756
1896	4,688,463	60,917,879
1895	6,697,012	98,950,928
1894	8,685,435	99,140,271
1893	11,839,373	52,813,939
1892	11,766,420	75,350,254

Opens Lumber Export Market

Commercial Agent Franklin H. Smith of the Bureau of Foreign and Domestic Commerce has returned to the United States and is ready to confer with lumber dealers and exporters, according to an announcement just made by the Department of Commerce. Mr. Smith has been traveling for the Bureau during the last fourteen months in the Far East, Australia and New Zealand, making an extensive investigation of the markets for American lumber in those regions. He is now in Seattle, Wash., and is expecting to make a trip to the principal centers of the lumber trade on the west coast to confer personally with lumber producers and exporters and give them the benefit of the information he has collected. The Department said:

"Mr. Smith's investigation covered all phases of the lumber markets in the Far East and Australia, including the sources of the present supply, the satisfaction of consumers with their present material, the prices which American producers would have to meet, the extent to which wood using industries have developed, and the methods by which the present trade is carried on. His work led to certain definite conclusions, and it is these points which he will emphasize in his talks with American producers.

"As the lumber industry in the United States is at present much depressed, the prospect of an increased export trade is particularly alluring. The Bureau of Foreign and Domestic Commerce, through the work of Mr. Smith, is endeavoring to supply precisely the information and advice needed to greatly increase this trade.

"Mr. Smith will be in Seattle, Wash., until November 1, and will then go to Portland, Ore., San Francisco, Spokane and Chicago, before reporting at Washington. He will make his headquarters in Seattle, San Francisco and Chicago, at the branch offices of the Bureau of Foreign and Domestic Commerce, and at the other places mentioned he can be reached through the local chambers of commerce."

Lumber Industry—The lumber industry in the state of Washington has been depressed for the last three years and the last year and a half has been particularly unprofitable. At times it has been so low as operating only fifty per cent. of its normal capacity. Within the last three months there has been a slight improvement, due to the demand from the line yards in the eastern sections of the country, and likewise to some offshore business. The former demand has increased the output, but the price paid for the product is barely profitable. It is safe to say that in many cases the product is being disposed of at a loss, for the purpose of conversion by which to meet overhead costs and to pay interest on timber bonds. There is no question but what the lumber industry would materially improve if there were sufficient bottoms to transport it to foreign markets. There is, however, a very marked shortage of vessels. What offshore business we now have is profitable and as soon as carriers can be supplied, a number of the large export mills will resume operation.

Bethlehem-Pennsylvania Deal—A week ago it seemed certain that the controlling interest in the Pennsylvania Steel Co. would pass to the Bethlehem Steel Co., as then stated. There seemed to be no doubt that Mr. Schwab's bid would be accepted by both the Pennsylvania Co. and the Reading Iron Co., whose holdings of the Pennsylvania Steel stocks constitute a very large majority. Indeed, it was stated on the best authority that Schwab's bid was satisfactory to the Pennsylvania people, and that it only remained for the Reading Iron board to approve of the transaction. An unexpected obstacle has arisen, however. As is well known, William H. Donner, president of the Cambria Steel Co., has for some time held an option on the Pennsylvania Steel stock at a fixed price, with the further provision that he should have the first call on the stock in case a higher price should be offered by anyone. It now seems that Mr. Donner has given notice that he will meet the Schwab bid, and the transfer is uncertain pending further negotiations. It is said that H. C. Frick is backing the Donner party.

Railroad Gross Earnings for the third week of October of the 32 leading roads in the United States and Canada show an increase of 17.49% over the corresponding period of last year. The statement is as follows:

	1915	Increase
Denver & Rio Grande	$584,200	$45,600
Detroit & Mackinac	23,499	2,369
Duluth, S. Sh. & Atlantic	66,973	12,699
Alabama Great Southern	116,172	31,748
Ann Arbor	55,951	5,608
Buffalo, Roch. & Pittsburgh	253,231	45,961
Canadian Northern	791,800	292,800
Canadian Pacific	3,068,000	1,028,000
Chesapeake & Ohio	856,961	131,301
Chicago, Great Western	328,005	*12,341
Chicago, Indianapolis & Louisville	155,227	27,737
Cin., New Orleans & Texas Pac.	217,159	40,380
Colorado & Southern	331,292	3,508
Grand Trunk of Canada, Grand Trunk Western, Detroit, Grand Haven & Milwaukee, Canada Atlantic	1,043,088	13,605
Louisville & Nashville	1,142,055	113,185
Mineral Range	20,842	6,636
Minneapolis & St. Louis, Iowa Central	235,924	3,576
Minn., St. Paul & S. S. M.	748,763	76,420
Missouri, Kansas & Texas	642,655	*44,727
Missouri Pacific	1,264,000	2,000
Nevada-California-Oregon	11,288	63
Rio Grande Southern	14,070	*349
St. Louis Southwestern	273,000	44,000
Southern Railway	1,362,937	146,653
Texas & Pacific	408,905	7,957
Toledo, Peoria & Western	25,970	1,328
Toledo, St. Louis & Western	125,108	22,252
Western Maryland	205,009	38,278
Total (82 roads)	$14,372,120	.....
Net increase (17.49%)	.....	$2,146,247

*Decrease.

Construction News

OCTOBER BUILDING OPERATIONS

Building operations are continuing on a fair scale. Although in some sections of the country, the figures for the month show a decline, the other sections partially offset this loss by showing an increase. The whole situation shows improvement over a year ago due principally to the general industrial expansion.

The Eastern States give a decline but at this period of the year this is expected and contractors feel satisfied that conditions are much better than last year.

In the Central States an increase of four million is evidence that business is prospering and in comparison with a year ago shows a gain of over 40%.

Reports from the Southern States show a decline of over a million dollars since last month. It is difficult to account for this but it is believed that industrial operations in this section have decreased considerably, thereby affecting the building trade. A marked improvement, however, can be noticed over the same period of a year ago.

In the Western States the same activity is denoted as during the two months previous. The figures below, however, show a slight gain with a steady amount of operation.

Below is given a table showing the contemplated building operations in the different cities throughout the country:

EASTERN STATES

	Month of October		First Ten Months of Year	
	1915	1914	1915	1914
Albany, N. Y.	$705,365	$239,225	$3,724,825	$5,562,700
Bridgeport, Conn.	655,354	174,437	7,490,001	3,122,473
Buffalo, N. Y.	856,000	604,000	10,109,000	9,864,006
Elizabeth, N. J.	108,049	163,405	983,472	1,215,027
Hartford, Conn.	493,718	360,135	4,577,596	3,360,491
Hoboken, N. J.	16,390	24,950	591,434	765,677
Jersey City, N. J.	438,706	156,850	4 214,323	3,130,966
Newark, N. J.	723,279	709,080	7,180,747	8,792,350
New Bedford, Mass.	151,675	175,350	2,948,779	2,690,377
New Haven, Conn.	280,120	231,315	5,854,942	3,569,117
New York, N. Y.:				
Bronx	2,235,000	1,202,675	22,790,050	19,641,943
Brooklyn	3,670,692	2,453,340	27,116,312	35,552,850
Manhattan	2,420,750	3,551,075	57,152,900	43,151,165
Queens	675,852	967,840	16,805,038	16,183,925
Paterson, N. J.	90,496	55,247	1,311,920	1,428,445
Philadelphia, Penn.	2,980,665	2,467,310	34,432,290	32,688,940
Pittsburgh, Penn.	1,274,960	1,085,348	.....	.....
Reading, Penn.	91,775	28,475	975,075	1,118,825
Rochester, N. Y.	784,969	401,192	7,641,579	7,971,828
Scranton, Penn.	121,740	300,835	1,371,100	1,551,905
Springfield, Mass.	386,792	228,825	4,805,341	4,510,030
Syracuse, N. Y.	392,240	258,665	3,693,997	2,458,205
Utica, N. Y.	283,880	279,925	1,871,535	1,612,495
Totals	$19,838,467	$15,515,499	$227,441,266	$179,943,742

SOUTHERN STATES

	Month of October		First Ten Months of Year	
	1915	1914	1915	1914
Atlanta, Ga.	$252,251	$215,988	$4,045,433	$4,254,524
Birmingham, Ala.	136,747	138,373	1,587,022	2,966,233
Chattanooga, Tenn.	90,440	61,872	474,404	1,018,879
Dallas, Tex.	243,887	204,150	2,841,845	4,989,735
Ft. Worth, Tex.	91,192	150,045	961,424	1,815,578
Houston, Tex.	132,045	175,520	1,416,353	3,295,619
Louisville, Ky.	304,040	327,040	3,350,885	4,061,515
Memphis, Tenn.	165,005	105,580	2,394,613	2,761,289
Norfolk, Va.	120,288	125,210	1,527,805	1,996,356
Richmond, Va.	181,203	122,620	2,684,314	2,940,205
San Antonio, Tex.	110,380	83,150	1,282,305	2,579,610
Tampa, Fla.	158,210	111,110	.....	.....
Washington, D. C.	1,344,999	407,411	10,602,580	8,110,200
Totals	$3,331,287	$2,228,069	$33,168,983	$40,789,743

CENTRAL STATES

	Month of October		First Ten Months of Year	
	1915	1914	1915	1914
Akron, Ohio	$1,215,045	$248,465	$3,746,065	$3,425,995
Canton, Ohio	173,600	94,035	1,706,440	1,513,740
Chicago, Ill.	12,479,250	6,774,200	77,290,680	70,534,910
Cincinnati, Ohio	865,575	402,235	11,862,469	8,239,903
Cleveland, Ohio	3,097,685	2,265,685	27,155,984	23,938,540
Columbus, Ohio	369,085	649,220	4,472,645	5,512,476
Des Moines, Iowa	221,701	145,084	1,666,191	1,795,248
Duluth, Minn.	217,240	236,625	2,336,522	2,609,318
Evansville, Ind.	76,383	99,850	.....	.....
Grand Rapids, Mich.	169,576	152,080	2,208,892	3,324,744
Indianapolis, Ind.	532,777	337,689	6,111,365	7,318,158
Kansas City, Kan.	65,894	66,552	839,852	988,703
Kansas City, Mo.	1,512,015	533,790	9,350,765	9,639,150
Milwaukee, Wis.	747,169	611,577	10,455,671	8,798,928
Minneapolis, Minn.	2,338,555	1,064,570	14,515,516	13,989,510
Oak Park, Ill.	385,240	184,590	2,773,813	1,942,740
Omaha, Nev.	360,225	157,675	4,281,100	4,260,398
Peoria, Ill.	109,700	153,245	.....	.....
St. Louis, Mo.	1,214,618	1,115,874	10,017,100	11,538,589
St. Paul, Minn.	739,308	1,001,300	9,242,233	13,437,945
Toledo, Ohio.	815,552	404,939	6,828,499	5,668,561
Youngstown, Ohio	341,685	203,690	2,259,152	2,738,541
Totals	$28,047,878	$16,902.970	$209,120,954	$201,216,097

WESTERN STATES

	Month of October		First Ten Months of Year	
	1915	1914	1915	1914
Denver, Colo.	$192,450	$157,985	.....	.....
Los Angeles, Calif.	787,389	1,565,000	$9,999,460	$15,845,932
Oakland, Calif.	467,339	423,555	4,240,653	4,059,176
Portland, Ore.	351,030	508,705	4,382,882	6,278,890
Salt Lake City, Utah.	167,155	107,605	1,934,555	2,704,564
*San Diego, Calif.	119,408	115,886	1,022,702	2,801,763
San Francisco, Calif.	1,236,249	1,479,518	11,359,724	26,471,082
Seattle, Wash.	550,765	610,660	4,982,545	11,127,820
Spokane, Wash.	162,023	60,450	1,119,502	909,467
Tacoma, Wash.	70,205	46,563	659,811	1,845,596
Totals	$3,984,605	$4,960,041	$38,679,132	$69,242,527

*Not included in totals.

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

Massachusetts—Worcester Consolidated Street Railway will extend Lake View Line to Lake Ave. thence to Sunderland Rd. to city line. H. C. Page, Worcester, Gen. Mgr.

Rhode Island—Rhode Island Co., plans line in Providence from city sea wall at Fields Point to connect with tracks of New York, New Haven & Hartford R.R. and Southern New England R.R. Edward Gagel, New Haven, Conn., Ch. Engr., New York, New Haven & Hartford, R.R.

Connecticut—Connecticut Co. plans to reconstruct tracks extending through Waterville, and double-track line from Homer St., where tracks enter Boyden St., through Thomaston Ave. C. H. Chapman, Mgr.

New Jersey—Council granted franchise to Salem-Pennsgrove Traction Co. for construction of line between Salem and Pennsgrove. Noted Sept. 30.

Pennsylvania—Philadelphia & West Chester Traction Co. plans extension of Collingdale Division from Parker Ave., Collingdale, to Chester Pike, Sharon Hill.

Delaware—Surveys being made for extension of Philadelphia & Reading Railway from South Wilmington, Del., to plants of Baldt Steel Co. and General Electric Co., near Newcastle. A. T. Dice, Philadelphia, Penn., Vice-Pres. and Gen. Mgr.

West Virginia—Huntington-Chesapeake Bridge Co., recently incorporated, asked County for franchise for street railway from Fourth Ave. and Sixth St. over Ohio River to Chesapeake, Ohio. Estimated cost, $500,000.

Kentucky—Baltimore & Ohio R.R. Co. securing right of way along river front in Ashland for extension from Kenova to Ashland. F. L. Stuart, Baltimore, Md., Ch. Engr.

Ohio—Baltimore & Ohio R R. Co. plans extending line and building station in Canton. Estimated cost, $200,000. F. L. Stuart, Baltimore, Ch. Engr.

Ohio—Cincinnati Traction Co. has secured right-of-way for extension of line to Bond Hill over Paddock Rd. Noted Aug. 26.

Ohio—Mahoning & Shenango Railway & Light Co. will reconstruct Wilson and Federal St. lines in spring. Estimated cost, $175,000. C. O. Bailey, Youngstown, Ohio, Pur. Agt.

Wisconsin—A. C. Lingelbach, Milwaukee, Wis., promoting building of interurban railway from Green Bay to Sheboygan.

Minnesota—Mesaba Electric Railway Co. contemplates improving line between Virginia and Hibbing. H. S. Newton, Gen. Mgr.

Montana—Plans prepared for railway from Ulm to Hound Creek, east of Great Falls, about 60 miles, for Great Falls & Southwestern Railway. E. L. Dana, Parkman, Wyo., Pres. Noted Sept. 16.

Missouri—Commercial Club contemplates building electric railway out of Joplin. A. S. Wilson, J. F. Lanier and Albert Schmidt are interested.

Arkansas—St. Louis, Iron Mountain & Southern Railway (Missouri Pacific System) contemplates branch line from Buffalo City to Rush, Ark. J. F. Murphy, St. Louis, Mo., Gen. Mgr.

Texas—Plans being prepared for railway connecting Van Horn north with New Mexico state line, about 71 miles. Van Horn Valley Land and Railway Co., R. H. Owen, Pres., interested.

Texas—Gulf, Colorado & Santa Fé Railway will soon receive bids for building Gulf and Interstate division from High Island to Port Bolivar, 27 miles.

Texas—Gulf, Texas & Western Railway will extend line from Mineral Wells, Tex. to Seymour, 108 miles, from Salesville east to Ft. Worth, about 50 miles. Benjamin B. Cain, Dallas, Vice-Pres. and Gen. Mgr.

Oklahoma—Company being organized to build railway from Frisco System at Peckham to Santa Fé System at Braman.

Oklahoma—Sallisaw, McAlester & Southwestern R.R. Co., recently incorporated, will build railroad in spring from Spigler through McAlester and to Coalgate. H. B. Smith, McAlester, interested.

Colorado—Surveys made and plans being prepared for electric railway to connect Denver with cities in northern part of state with one branch line to Estes and Rock Mountain National Park.

Colorado—Plans being prepared for taking roadbed and right-of-way of Denver, Laramie & Northwestern R.R. and electrifying road to Greeley. C. M. Smith, Supt., Utah Junction, Colo. (Denver post office). Estimated cost, $500,000.

Utah—Salt Lake & Utah Railway contemplates extension of line to Payson. W. R. Armstrong, Salt Lake City, Gen. Mgr. and Ch. Engr.

Utah—Union Pacific R.R. contemplates line from Park City to Uinta Valley, about 75 miles. R. L. Huntley, Ch. Engr., Omaha, Neb.

Nevada—Richmond Mining Co. plans railroad from Eureka to Elko.

Washington—McCoy Loggie Timber Co., Bellingham, will build four miles of railroad from present terminus to Welcome.

Washington—Pacific Traction Co. contemplates extending line on Steilacoom Blvd., Starling St. and Steilacoom Ave. to Union and Lafayette, about two miles. George W. Rounds, Gen. Mgr.

Washington—Puget Sound & Cascade Ry. Co. will extend line west from Clear Lake to Mount Vernon, 7 miles. B. R. Lewis, Pres.

Washington—Seattle Port Commission contemplates belt-line railroad-terminal system to serve Main Elliott Bay waterfront, Smith Cove, Interbay, Salmon Bay and Lake Union Districts. Proposition will be submitted to citizens at election on Dec. 4. Estimated cost, $400,000.

Oregon—Linnton Council granted franchise to O. M. Clark and associates for railway from Portland to Linnton.

Oregon—Southern Pacific Co. has entered into contract with Booth-Kelly Lumber Co. to build spur to timber land near Wendling Ranch. W. Hood, San Francisco, Calif., Ch. Engr.

California—(Official)—Bids will be received until Nov. 26 by Board of Public Works for railway from Rosasco into Hetch Hetchy reservoir, about 67 miles. M. M. O'Shaughnessy, San Francisco, City Engr. Noted Oct. 7 and 21.

California—Western Pacific Railway having preliminary surveys made for branch line from Quincy to Engels copper mine in Lights Cañon. C. M. Levey, San Francisco, Gen. Mgr.

Bids In and Contracts Awarded

North Carolina—Linville River Railway awarded contract to H. C. McCRARY, Knoxville, Tenn., for extending line from Montezuma via Linville, Linville Gap and Foscoe, N. C. to Shulls Mills, N. C., 14 miles. W. O. Dyer, Ch. Engr.

California—Pacific Electric Ry. awarded contract to ROBERT SHERER & CO., Los Angeles, for grading roadbed between Hawthorne and Iona Ave. on Redono via Watts Line. Estimated cost, $20,000.

LIGHT, HEAT AND POWER

Proposed Work

Mass., North Adams—Bids will be received until noon, Nov. 17, by School Committee, for heating and ventilating system in Drury high school. F. J. Oleara, Secy., School Bd.

Mass., Quincy—Fore River Shipbuilding Corporation plans to build power house. Estimated cost, $600,000.

N. Y., Albany—Municipal Gas Co. granted permit for construction of Riverside power station. Estimated cost of superstructure, $100,000.

N. Y., Oswego—Public Service Commission received application from Niagara, Lockport & Ontario Power Co., Buffalo, for permit to build transmission lines in Oswego.

N. Y., Patterson—Ralph Griffing has applied to Public Service Commission for permit to build electric-light plant and for approval of franchise granted by town.

N. J., Toms River—Ocean County Electric Co., recently incorporated with $525,000 capitol stock, plans to build a dam across Toms River between Toms River and Allenhurst to generate power for industrial purposes. J. P. Murray, Philadelphia, interested.

Penn., Mauch Chunk—Carbon Transit Co. will enlarge and concentrate power plants, install 250-hp. boiler and 300 kw., 600 volt d.c. generating unit.

Penn., Williamsport—Plans prepared for improving Northern Central Gas Co. Work includes two miles of 12-in. main and approximately 2,100-ft. of service lines in Rose St.

Va., Blackstone—Franchise granted C. E. Wilson, Crewe, for electric-light plant.

Fla., Clearwater—J. N. and J. M. McClung granted franchise by Commissioners of Pinellas County for electric-light and power system in Clearwater.

Fla., Homestead—Bonds for $40,000 voted for electric-light plant.

La., White Castle—Bids will be received until Nov. 17 by H. S. Batts, Mayor, for electric-light plant. E. A. Kramer, Magnolia, Miss., Engr.

Tenn., Camden—John D. Rice and W. Powry plan to construct electric-light plant.

Ohio, Canton—Bids will be received until Nov. 22 by Board of Education for electrical work in new Daniel Worley School.

Ohio, Eaton—Capitol stock of Eaton Lighting Co. has been increased from $50,000 to $80,000. Company plans to extend its transmission line and service to Camden, Ohio .

Ohio, Lorain—Citizens defeated $350,000 bonds for municipal electric-light plant. Noted Oct. 7.

Ohio, Mansfiefild — Plans being considered by Mansfield Electric Co. to extend its transmission line to Bellflower, about seven miles.

Ind., Grandview—Rockport Water Works Co., Rockport, plans to extend its transmission line to Grandview to furnish electrical service, about 15 miles.

Ind., Nashville—Citizens voted $7,000 bonds for electric-light plant.

Ind., Shoals—Shoals Utilities Co. plans to issue $27,500 capital stock, proceeds of which will be used for improving electric-light plant and water system.

Ill., Hamilton—Press reports state that right-of-way is being secured for transmission line from Hamilton to Carthage, about 12 miles.

Wis., Appleton—Bids will be received about Nov. 15 by Woodmansee & Davidson, Consult. Engr., First National Bank Bldg., Chicago, Ill., for addition to steam power plant of Wisconsin Traction, Light, Heat and Power Co. Noted Aug. 19.

Wis., Chippewa Falls—Wisconsin-Minnesota Light and Power Co. will rebuild dam of C. L. & B. Co. Estimated cost, $500,000.

Wis., Milwaukee—Plans being considered by Milwaukee Electric Railway and Light Co. to extend its transmission line to Merton and Lake Five.

Wis., Shawano—Election will soon be held to vote to issue $60,000 bonds for dam and hydro-electric power plant of Wolf River.

Iowa, Cedar Rapids—Iowa Power and Light Co. plans to build electric transmission line from Cedar Rapids to Shellsburg, about 15 miles.

Iowa, Corwith—City plans to install municipal electric-lighting system. Estimated cost, $5,000.

Iowa, Ft. Madison—Plans being considered by Ft. Madison Electric Co. for constructing a substation.

Iowa, Keokuk—Application has been made to State Public Utilities Commission by Mississippi River Power Co. for permit to build 12 mile spur from main transmission line to Carthage.

Iowa, Orient—City Council plans to install electric-light system. Estimated cost, $7,000.

Iowa, Waverly—See item under "Water Works."

Kan., Little River—Bids will be received until Nov. 15 for municipal electric-light plant and distributing system. Estimated cost, $16,000. W. B. Rollins & Co., 439 Midland Bldg., Kansas City, Mo., Engr.

Neb., Lncoln—Election will be held Nov. 19 to vote on bonds for installation of electric-lighting system.

N. D. Medina—City contemplates electric-light system.

Tex., San Angelo—See item under "Water Works."

Tex., San Anglo—See item under "Water Works."

Okla., Stillwater—Election will be held Nov. 16 to vote on $24,000 bonds for extending electric-light system.

Idaho, Dubois—See item under "Water Works."

Idaho, Oneida—Work will soon be started on addition to hydro-electric power plant of Utah Power and Light Co., Salt Lake City, on Bear River. Estimated cost, $250,000.

Utah, Garden City—Plans being considered by Swan Creek Electric Co. for enlarging its plant at Swan Creek and to extend its transmission lines to Paris, Bloomington, St. Charles and Fish Haven.

Calif., Loyalton—City plans to install municipal electric-light plant. Estimated cost, $5,000.

Que., Waterville—Sherbrooke Railway and Power Co. contemplates building substation.

Ont., Petrolia—Plans being prepared for transformer station. Estimated cost, $5,000.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Manhattan)—(Official)—Interboro Rapid Transit Co. awarded contract for substation No. 7 at 99th St. and Third Ave. to F. W. BURNHAM, 30 East 42d St.

N. J., Trenton—STRANG ELECTRIC CO., 214 South Seventh St., Philadelphia, Penn., at $4,024, awarded contract for electrical work for new admission building at State Hospital.

Ill., Dixon—Board of Administration awarded contract to W. M. ALIEN & SONS, Peoria, at $48,000 for power house for State Colony for Epileptics. Noted Sept. 30.

Ill., Peoria—Contract for electric work at new county jail awarded to ANTHONY KEEFER at $11,500; heating system to J. M. SHEA & CO., at $4,350.

Kan., Hiawatha—Contract for heating and plumbing system in new high school awarded to O'CONNOR CO., Muskogee, Okla., at $11,197.

Mo., Gallatin—See item under "Water Works."

Mo., Poplar Bluff—(Official)—Contract for municipal electric-light and power plant awarded to UNITED ENGINEERING CO., Chicago, Ill. Estimated cost, $46,400. Noted Oct. 21.

Que., Sherbrooke—Contract for municipal gas plant awarded to WESTERN GAS CONSTRUCTION CO., Cleveland, Ohio, at $30,980. Noted Aug. 12.

BRIDGES

Proposed Work

Mass., Boston—Bids will be received until noon, Nov. 22, by Metropolitan Park Commission, 1 Ashburton Pl., for reinforced-concrete bridge over Charles River at North Beacon St.

N. Y., Kingston—Commission of Highways, Albany, preparing plans for bridge at Kingston.

Penn., Watsontown—Northumberland County Court has directed Northumberland County Commissioners to build bridge across Susquehanna River between Watsontown and White Deer. Estimated cost, $150,000.

Ga., Savannah—Carolina, Atlantic & Western Railway plans to build bridge across Back River.

Tenn., Harriman—Plans prepared by S. A. Breazeale, Rd. Comr., for concrete bridge across Emory River. Estimated cost, $50,000.

Tenn., Knoxville—City Commissioners contemplate construction of a viaduct from Depot to Vine St. Estimated cost, $500,000.

Ky., Covington—(Official)—Bids will be received by J. Mason Howk, Comr. of Public Prop., until 10 a.m., Dec. 9, for bridge to carry duplicate water supply main over the Licking River. Noted Oct. 21 and Nov. 4. (See adv.)

Ohio, Cincinnati—Bids will be received by Board of County Commissioners until noon, Nov. 19, for concrete box culvert on Old State Rd., Anderson Township.

Ohio, Cleveland—Bids will be received by E. G. Krause, Clk., Comrs. of Cuyahoga County, until 10 a.m., Nov. 17, for bridge work. W. A. Stinchcomb, County Engr.

Ohio, Monroe—Election will be held in December to vote on $60,000 bonds for bridge over Raisin River.

Ill., Highwood—Chicago & Milwaukee Electric Railroad Co. contemplates bridges estimated to cost $40,000.

Ill., Quincy—(Official)—Bids will be received by County Superintendent of Highways until 2 p.m., Nov. 27, for steel bridge in Richfield Township, Adams County.

Wis., Prairie du Sac—Citizens voted $12,000 bonds for bridge over Wisconsin River.

Kan., Abilene—(Official)—Bids will be received until noon, Nov. 18, by County Commissioners for bridge repairs. Estimated cost, $7,000. Noted Oct. 7.

Kan., Ottawa—Citizens contemplate construction of bridge across Marais Des Cygnes River. J. Z. Clark, Comr.

Mo., Joplin—(Official)—Bids will be received by O. E. Lichliter, City Clk., until 10 a.m., Nov. 17, for North Main St. viaduct. Estimated cost, $35,000. Noted Oct. 7 and 21.

Ark., DeQueen—County Court has made an appropriation for bridge over Little River at Greenwood Shoals and Sycamore Creek near Lockesburg and to repair bridges.

Ark., Wilmot—Appropriation of $8,000 made by Commissioners of Ashley County, Hamburg, for steel bridge across Bayou Bartholomew near Wilmot.

Tex., Marlin—County Court has been asked by W. N. Moore, County Comr., Reagan, to replace bridge which was recently destroyed with 110-ft. steel span.

Tex., Marshall—Election will be held Nov. 23 to vote on $50,000 bonds for viaduct over tracks of Texas & Pacific Railway. Noted Nov. 4.

Colo., Denver—Commissioner of Improvements has asked for an appropriation of $45,000 for concrete bridge over Cherry Creek at West Colfax Ave.

Colo., Denver—Commissioner of Improvements has asked for appropriation of $30,000 for concrete bridge over Cherry Creek on Logan St.

Idaho, Caldwell—Bids will be received until Nov. 22 for bridge across Boise River. Estimated cost, $17,500. Fred H. McConnell, County Engr.

Calif., Sacramento—Bids will be received by California State Highway Commission, Forum Bldg., until Nov. 29, for plate-girder bascule bridge near easterly side of Yolo By-Pass. W. R. Ellis, Secy. of Comn.

Bids In and Contracts Awarded

N. Y., Gloversville—Bids were received for reinforced-concrete bridge over east channel of Hudson River from K. Guthrie, Schenectady, at $23,500 and J. F. Leary Construction Co., Rochester, at $25,960.

Penn., Bethlehem—S. W. Chiles, South Bethlehem, at $4,252, submitted lowest bid for paving Broad St. bridge.

Penn., Kennett Square—P. J. Riley, Westchester, at $5,650, submitted lowest bid for stone arch bridge over Red Clay Creek.

Penn., Mercer—Bids were received for bridge to replace State St. structure from T. F. Hungiville, at $54,000, for single span bridge and from Canton Bridge Co., at $49,990, for two span bridge.

Va., Hampton—E. C. McCOMB, Roanoke, at $4,850, submitted lowest bid for three concrete bridges. Noted Oct. 14.

N. C., Kinston—Contract for bridge over Neuse River at Caswell St. awarded to VIRGINIA BRIDGE AND IRON CO., Roanoke, Va., at $9,485. Noted Oct. 21.

Ind., Lafayette—Contract for steel bridge over Wildcat Creek, east of Dayton, awarded to WEST & JAMISON, at about $11,000.

Ill., Rockford—(Official)—Contract for superstructure of bridge in Rockton Township awarded to WORDEN-ALLEN CO., Milwaukee, Wis., substructure to NORTHERN STEEL AND CONCRETE CO., Freeport, Ill. A. R. Carter, County Supt. of Highways. Noted Oct. 7.

Wis., Cleveland—Contract for steel bridge across Eau Pleine River awarded to WASSAU IRON WORKS, Wassau, at $12,989.

Minn., St. Paul—Contract for bridge at Surrey St. awarded to ILLINOIS STEEL CO., at $7,645.

N. D., Montpelier—Contract for bridge awarded to J. JARDEEN, Jamestown, at $8,000.

Tex., Harrisburg—Horton & Horton, at $19,960, submitted lowest bid for bridge in Harris County.

Okla., Beaver—Contract for bridge over Cimarron River for Beaver, Mead & Englewood Railway Co., awarded to J. T. HARVEY, Wichita, Kan.

Okla., Enid—Contract for constructing and repairing bridges in Garfield County awarded to MONARCH ENGINEERING CO., Falls City, Neb., at $12,911. Noted Sept. 16.

Colo., La Junta—Contract for bridge across Purgatory River awarded to PUEBLO BRIDGE CO., at $6,440.

Idaho, Boise—Bids were received Oct. 22 for steel bridge across Lake River at McKeeth's Ferry as follows: Missouri Valley Bridge and Iron Co., Denver, Colo., $19,860; Coas Bridge Co., Portland, Ore., $20,000; Midland Bridge Co., $20,750.

Wash., Walla Walla—Contract for steel bridge awarded to C. L. GRAVES at $4,090.

Ore., Heppner—GRANT-SMITH & CO., Henry Bldg., Seattle, at about $10,000, awarded contract for steel superstructure of bridge for Oregon-Washington Railway and Navigation Co.

Calif., Los Angeles—MESMER & RICE, 231 Marsh-Strong Bldg., Los Angeles, awarded contract for bridge over Castaic Creek, at $30,761, and for bridge over south fork of Santa Clara River at $25,974.

Calif., Sacramento—(Official)—Bids were received Oct. 1 by State Highway Commission for bridge in Imperial County as follows: Holland Construction Co., San Diego, $15,600; Forest City Paving & Construction Co., Live Oak, $17,885; Robert Shearer & Co., Los Angeles, $28,748.

Calif., San Diego—P. H. C. SPARKS, at $7,380, awarded contract for concrete bridge over San Elijo Lago on State Highway at Ardiff.

Calif., Santa Barbara—Contract for steel bridge across Dos Pueblos Creek awarded to SECURITY CONSTRUCTION CO., 3710 South Alameda St., Los Angeles, at $9,720; reinforced-concrete girder bridge across Eagle Canon Creek to BOARDMAN CONSTRUCTION CO., 1107 Story Bldg., Los Angeles, at $10,961.

WATER WORKS

Proposed Work

N. Y., Glens Falls—Citizens defeated proposition to install gravity water system. Estimated cost, $270,000. C. E. Perry, Albany, Consult. Engr.

N. Y., Ramapo—Ramapo Mountains Water Power and Service Co., recently incorporated with capital of $150,000, will build water distributing plant.

N. J., Glen Rock (Ridgewood Post Office)—Board of Public Utility Commissioners granted permission to Glen Rock Water Works to make extensions to water system and install hydrants.

N. J., Ventor—Bids will be received until Nov. 22 by city for supply of pumps, air compressors, etc.

Penn., Coatesville—City will proceed with construction of Rock Run Water Works. Bonds for $185,000 voted for same two years ago.

Penn., Fleetwood—City plans to install water system. Estimated cost, $10,000.

Va., Mineral—City plans to install water system. Estimated cost, $5,000. W. P. Burch, Clk. of Water and Light Com. of Business Men's Assoc.

N. C., Greensboro—See item under "Sewers."

La., Monroe—City plans to issue $500,000 bonds. Part of proceeds will be used to improve water system.

Tenn., Benton—Citizens defeated $10,000 bond issue for water works. Noted Sept. 30.

Miss., Pass Christian—See item under "Streets and Roads."

Ohio, Athens—City plans to construct water system. Estimated cost, $40,000.

Ohio, Byesville—(Official)—Citizens defeated $40,000 bonds for water system. Noted Sept. 30 and Oct. 21.

Ohio, Janesville—Plans being prepared for enlarging and relining two city reservoirs. Estimated cost, $25,000.

Ohio, Sandusky—Bonds for $8,300 will be sold for improving water system.

Ohio, Shaker Heights—(Cleveland post office)—Bids will be received by C. A. Palmer, Village Clk., First National Bank Bldg., Cleveland, until noon, Nov. 30, for 10-in. water main in South Woodland Rd.

Ind., Shoals—See item under "Light, Heat and Power."

Mich., Albion—Election will be held Dec. 14 to vote on $10,000 bonds for completing municipal water system. Noted Nov. 4.

Mich., Menomoninee—(Official)—Citizens voted $285,000 bonds for either purchase of property of Menomoninee Water Co. or construction of municipal water system. Noted Oct. 21.

Mich., Tecumseh—Board of Trade interested in formation of company to be known as Tecumseh and District Waterworks Corporation, who plan to install water system. Estimated cost, $25,000.

Ill., West Frankfort—Bids will be received by O. Dorris, City Clk., until Nov. 22, for municipal water system.

Wis., Madison—M. E. Layne, of Layne & Bowler Co., Houston, Tex., retained to survey water system and submit a plan for development of the artesian water supply.

Wis., Madison—University of Wisconsin has had preliminary plans prepared for improving pumping station. Estimated cost, $20,000.

Wis., Melrose—Bids will be received by Z. P. Gilbert, Village Clk., until Dec. 1, for water system.

Wis., Sheboygan—City Commissioners contemplate installing 300 hp. high pressure boiler and 12,000,000 gal. high duty pumping station.

Iowa, Holstein—See item under "Sewers."

Iowa, Moville—Citizens voted $6,000 bonds for water system.

Iowa, Waverly—Bonds for $50,000 voted to purchase electric-light plant and construct sewage-disposal plant and water system.

Minn., St. Cloud—Bids will soon be received for 13,000 ft. of 6-in. iron water pipe.

S. D., Scotland—Town Council contemplates new water system. Estimated cost, $4,000.

N. D., Ellendale—(Official)—Citizens defeated $9,000 bonds for water system. Noted Oct. 21.

Mont., Broadview—Bids will soon be received for water system. Estimated cost, $30,000.

Mont., Glendive—Construction of 2,000,000-gal. filtration plant under consideration. A. Colin, City Clk.

Mont., Roundup—Contract will soon be awarded for extension of water mains along various streets in District No. 13. Estimated cost, $10,000.

Ark., Piggott—City has issued $40,000 for proposed water system. A. C. Moore, Joplin, Mo., Consult. Engr.

Tex., Alice—City plans to extend water mains about 30 blocks and install about 30 fire plugs.

Tex., Beeville—Bartlett & Ranney, Consult. Engr., San Antonio, retained to prepare plans for water system and electric-light plant. Estimated cost between $20,000 and $30,000. Noted Sept. 23.

Tex., San Angelo—Plans being considered by San Angelo Water, Light and Power Co. for improving water system and electric-light plant. Estimated cost, $50,000.

Tex., Winters—Bonds for $6,000 voted for extending water system.

Okla., Cleveland—Election will soon be held to vote on $125,000 bonds for water system. A. C. Moore, Joplin, Mo., Consult. Engr.

Okla., Clinton—Plans being prepared by Benham Engineering Co., Colcord Bldg., Oklahoma City, for water works. Noted Oct. 14.

Colo., Boulder—City plans expenditure of $6,000 for improving water system.

Colo., Loveland—City Council estimates cost of improving water system at $60,000. Noted Oct. 21

Colo., Platteville—Plans prepared by L. L. Stimson, Greeling, for water system. Estimated cost, $20,000. Noted Oct. 14.

Idaho, Dubois—D. T. Murphy, Pocatello, plans to install water system and electric-light plant.

Idaho, Fairview—Election will be held Nov. 22 to vote on $10,000 bonds for municipal water system.

Utah, Roosevelt—Contract will soon be awarded for water system. Estimated cost, $10,500.

Wash., Nooksack—L. A. Sorber, Nooksack, has applied for water rights to construct two water systems to supply the towns of Nooksack and Everson. Estimated cost, $10,000 each.

Wash., Ridgefield—Citizens voted to issue $11,000 bonds for water system. Noted Sept. 30.

Calif., Corcoran—Election will soon be held to vote on $30,000 bonds for water system.

Calif., Imperial—See item under "Sewers."

Calif., Oakdale—South San Joaquin Irrigation District plans to build reservoir. Estimated cost, $300,000.

Calif., San Francisco—City will install water main and water tank in University Mound District. Estimated cost, $4,000.

Calif., San Francisco—Bids will be received by Supervisors' Finance Committee until Dec. 6 for purchase of $43,287,000 bonds for Hetch Hetchy project.

Calif., Stockton—Plans prepared for improving pumping station of Pacific Gas and Electric Co., at Sonora and East St. Estimated cost, $25,000.

N. B., St. Andrews—Town Council plans to extend water system. Estimated cost between $20,000 and $30,000.

Bids In and Contracts Awarded

Conn., Hartford—Bids received Nov. 1 by Board of Water Commissioners for clearing and grubbing Nepaug Reservoir, (a) northern section, (b) southern section, as follows: L. I. Fletcher, Akron, Ohio, (a) $25,670, (b) $22,745; F. T. Ley Co., Springfield, Mass., (a) $26,720, (b) $21,895; Roberts Construction Co., Fitchburg, Mass., (a) $24,990; Davis & Brock, Brookline, Mass., (b) $23,450. Noted Oct. 21.

N. J., Bayonne—Board of Commissioners has awarded contract to CHARLES T. KAVANAUGH, INC., for water system in 22d St. Estimated cost, $10,999.

N. J., Peapack—Contract for water system awarded to H. C. BROOKS CO., Martinsburg, W. Va., at $45,000. Noted Sept. 9 and Oct. 14.

Iowa, Humbolt—Contract awarded to DES MOINES BRIDGE AND IRON CO., Des Moines, for water system. Noted Aug. 26

Iowa, Kenawha—MIDWEST ELECTRIC CO., Omaha, Neb., at $4,755, awarded contract for distribution plant.

Iowa, Perry—Contract awarded to MERKLE-HINES MACHINE CO., for pump for water-works. Estimated cost, $5,100.

Minn., St. Paul—Contract for laying pipes on Third Ave. and Third St. S., awarded to O'NEIL & PRESTON, St. Paul, at $25,400.

Kan., Newton—Contracts for improvements to water system awarded as follows: MURRAY IRON WORKS, Burlington, Iowa, at $8,175 for generating engines; H. R. WORTHINGTON, 925 Scarritt Bldg., Kansas City, Mo., at $9,636, for 3,000,000-gal. Corliss pump in engine and at $5,790, for two deep well pumps.

S. D., Dallas—Contract for water system awarded to C. H. GREEN & CO., at $10,000. Noted Oct. 14.

Mo., Gallatin—Contracts for water works and electric light improvements awarded to WESTINGHOUSE CO., for 75 k.v.a. generator, exciter and switchboard with equipment and station wiring; AMERICAN WELL WORKS, for two centrifugal pumps with 20 hp. motors; AMERICAN CAST IRON PIPE CO., for 150 tons 4 in. c.-i. pipe and 10,000 lb. special castings; MERKLE-HINES MACHINERY CO., for fire hydrants, hub-end connections, gate valves and valve boxes; GEORGE TOMLINSON, for power house, pump and engine foundations, concrete storage reservoir and repair to well; F. D. MARTIN CONSTRUCTION CO., for all pipe valves, fittings for pumps at power house and well.

Mo., Kansas City—Contract for intake for pumping station awarded to MISSOURI VALLEY BRIDGE AND IRON CO., Leavenworth, Kan., at $30,350.

Ark., Heber Springs—Contract for water system awarded to INLAND CONSTRUCTION CO., Chandler, Okla., at $50,800. Noted Oct. 28.

Wash., Hillyard—All bids received for water tanks rejected as too high. Sawyer Bros., Spokane, Consult. Engr. Noted Aug. 12 and 19.

Ore., Amity—(Official)—Contract for water system awarded to J. P. O'NEILL, Portland, at $9,777. Noted Sept. 30 and Oct. 28.

SEWERS

Proposed Work

Mass., Boston—(Roxbury)—(Official)—Bids will be received by E. F. Murphy, Comr. of Pub. Wks., City Hall Annex, until noon, Nov. 12, for pipe sewers and drains in Randall St., Roxbury.

Mass., Boston—(West Roxbury)—(Official)—Bids will be received by E. F. Murphy, Comr. of Pub. Wks., 511 City Hall Annex, until noon, Nov. 12, for sewerage works in Pleasant, Dent, Ivory and Perham St., West Roxbury.

Mass., Boston—(West Roxbury)—(Official)—Bids will be received by E. F. Murphy, Comr. of Pub. Wks., City Hall Annex, until noon, Nov. 18, for sewerage works in Woodman, Custer, Ballard, Bardwell, Hathaway, Center and Aldworth St. and Dunster Road, West Roxbury.

Mass., Boston—(Official)—Bids will be received by E. F. Murphy, Comr. of Pub. Wks., City Hall Annex, until noon, Nov. 15, for sewer work in Canal St.

Mass., Boston—Appropriation of $26,000 for sewers on North Beacon St. approved by Mayor.

Mass., Boston—Bids will be received by Metropolitan Water and Sewerage Board, 1 Ashburton Pl., until 1:30 p.m., Nov. 12, for Metropolitan Sewerage Works.

Mass., Brighton—City plans to install sewers in North Beacon St. between Cambridge and Market St. Estimated cost, $26,000.

N. Y., Oneonta—City contemplates sewage-disposal plant. Estimated cost, $45,000. F. M. Gurney, City Engr.

N. Y., Patchogue—City plans an expenditure of $116,000 for sewer work. C. Potts, 30 Church St., New York, Consult. Engr.

N. J., Atlantic Highlands—Council instructed by State Board of Health to install sewage-disposal plant. Citizens voted to appropriate $25,000 bonds for extension of sewers within borough limits.

N. J., Camden—Bids will be received by Highway Department until 8 p.m., Nov. 15, for sewers in Pulaski, Ninth, 29th and 30th St., Sherman and Arthur Ave. and Park Blvd.

N. J., East Orange—City considering plans for joining Passaic Valley sewerage system, including Orange and Montclair. Estimated cost from $550,000 to $900,000. Hering & Gregory, 170 Broadway, New York, N. Y., Engr.

N. J., Ocean Grove—(Official)—Bids will be received at office of Neptune Township Committee, 75 South Main St., until 8 p.m., Nov. 22, for about 10,800 lin. ft. of citrified pipe sewers. (See adv.)

N. J., Perth Amboy—City Council contemplates new sewer systems in Cornell St. and Compton Ave. Wilbur La Roe, City Clk.

N. J., Trenton—Ordinances have been passed authorizing construction of sewers Nos. 642, 643 and 637 in Emmett, Park and Home Ave.

Penn., Allentown—C. D. Wierbach, City Engr., estimated cost of sewer system and sewage-disposal plant on Koehler Farm at $1,318,250.

Penn., Columbia—(Official)—Citizens defeated $100,000 bonds for sewer system. Noted Oct. 28.

Penn., Greensburg—City contemplates sewage-disposal plant. J. J. Neel, City Engr.

Penn., Harrisburg—(Official)—Bids will be received by Samuel B. Rambo, Supt. of Pub. Grounds and Bldg., until 2 p.m., Nov. 23, for sewer outlet from Pennsylvania State Capitol and Library Buildings to connect with brick sewer at Third and State St.

Penn., Parnassus—Chester & Fleming, Engr., Pittsburgh, retained to prepare plans for sewage system and sewage disposal plant.

Md., Baltimore—Sewerage Commission asked City Controller for appropriation of $200,000 for sewer work in 1916.

N. C., Greensboro—Election will be held Dec. 14 to vote on $75,000 bonds for improving and extending sewers and water system.

Ga., Atlanta—City contemplates sewer system in Buckhead District. Estimated cost, $50,000.

Fla., Eustis—Isham Randolph Co., Chicago, Ill., preparing plans for sewerage system, including Imhoff tank. Estimated cost, $20,000.

Fla., St. Augustine—C. E. Henderson, City Engr., preparing plans for sewer system.

Tenn., Camden—City plans to construct sewer system during 1916.

Ky., Lexington—(Official)—Citizens voted $350,000 bonds for sewer system. James J. O'Brien, City Clk. Noted Sept. 16.

Ky., Lexington—Ordinance passed by City Commission authorizing construction of sanitary sewers and paving several streets in Forest Hill. J. O'Brien, City Clk.

Ohio, Canal Dover—City contemplates sewage-disposal plant about one mile south of Canal Dover. Estimated cost, $60,000. G. E. Arnold, Broadway, New Philadelphia, Engr.

Ohio, Columbus—Bids will be received until Dec. 1 by George A. Borden, Dir. of Pub. Serv., for motor-driven centrifugal pump at East Side sewage pumping station.

Ohio, Columbus—(Official)—Bids will be received by G. A. Borden, Dir. of Pub. Serv., until noon, Nov. 23, for Frames Ave. relief sewer.

Ohio, Dayton—City plans sewer district in Dry Hollow Centers. Estimated cost, $200,000. Harrison P. Eddy, Consult. Engr.

Ohio, Elyria—Plans being considered by City Council for three large storm sewers. Estimated cost, $150,000.

Ohio, Lakewood—Bids will be received by E. M. Cook, Dir. of Finance, until noon, Nov. 15, for sale of $9,270 bonds for sewer in Louis Drive.

Ohio, New Comerstown—City contemplates sewage-disposal plant. Estimated cost, $60,000. E. Beaty, City Engr.

Ohio, Springfield—(Official)—Bids will be received by C. E. Ashburner, City Mgr., until noon, Nov. 15, for constructing a number of sewers in various streets.

Ohio, Toledo—Bonds for $60,070 sold for five miles of sewers in Home Acres, West Toledo. Noted Oct. 28.

Ohio, Urichsville—Plans will soon be prepared for sewage-disposal plant to be used jointly by Urichsville and Dennison. Estimated cost, $75,000. George E. Arnold, Broadway, New Philadelphia, Engr.

Ohio, Xenia—(Official)—Bonds for $60,000 sold for sewage-disposal plant. Noted Oct. 14.

Ind., Indianapolis—Board of Works plans to construct sewers in Meridian, Madison and State St. Estimated cost, $16,000.

Ind., Logansport—Bids will be received some time next spring for sewers in eastern section of city. Estimated cost, $350,000. Noted Aug. 19 and 26.

Mich., Hancock—(Official)—We have been informed that city will do nothing at present time in regard to new sewer system as stated in our issue of Oct. 21.

Ill., McHenry—City plans to install sewer system. Estimated cost, $8,090.

Wis., Racine—Board of Public Works estimates cost of sewers in district bounded by Herrick Ave., 12th St., Washington Ave. and Washington Park at $14,020.

Wis., Superior—City plans an expenditure of $35,000 for sewer work.

Iowa, Holstein—Citizens voted $18,000 bonds for sewer and water systems. A. G. Merkley, City Recdr.

Iowa, Waverly—See item under "Water Works."

Minn., Duluth—City contemplates sewer in 56th Alley from Main to Nicollett St.

Minn., St. Paul—(Official)—Bids will be received by August Hohenstein, Pur. Agt., Courthouse and City Hall, until 10:30 a.m., Nov. 15, for sewer on Page St. between Andrew St. and Brown Ave.

Minn., St. Paul—(Official)—Bids will be received by August Hohenstein, Pur. Agt., Courthouse and City Hall, until 10:30 a.m., Nov. 15, for sewer on Carroll Ave.

Kan., Larned—Preliminary plans being prepared by Black & Veatch, Engr., Kansas City, Mo., for storm sewers. Estimated cost, $80,000.

Kan., Liberal—Plans being prepared by E. T. Archer & Co., Engr., Kansas City, Mo., for sewer system and sewage disposal plant. Estimated cost, $35,000.

Kan., Neodesha—Plans being prepared by Black & Veatch, Engr., Kansas City, Mo., for sewage-disposal plant. Estimated cost, $50,000.

Kan., Osborn—Preliminary plans being prepared by Black & Veatch, Engr., Kansas City, Mo., for storm sewer.

N. D., Mandan—Report submitted estimated cost of installing drainage system in portion of city at $16,131. Black & Griffin, Engr.

Ark., Nashville—See item under "Water Works."

Tex., Austin—See item under "Streets and Roads."

Tex., Ennis—Plans being prepared by N. Werenskoild, Consult. Engr., Dallas, for sewage-disposal plant.

Tex., Houston—Citizens voted $1,000,000 bonds for sanitary sewers and sewage-disposal plants.

Tex., Lancaster—Plans are being prepared for sanitary sewer system. Estimated cost, $15,000. H. E. Rawlins, City Secy. Noted Oct. 21.

Tex., Temple—City Commissioners authorized extension of sanitary sewer mains in northwestern section of city 6,000 ft.

Okla., Muskogee—Bids will be received about Dec. 1 for sanitary sewer system. Estimated cost, $23,000. E. F. Peterson, City Engr. Noted Oct. 14.

Wash., Seattle—Report submitted to City Council estimating cost of sewers in West and North 50th St. at $68,619.

Ore., Portland—All bids for reconstructing wood box sewer in Mill and Water St. rejected. New bids will be received. Noted Oct. 28.

Ore., Portland—City Council rejected all bids for sewer in Hall St. New bids will be received.

Calif., Imperial—Election will soon be held to vote on $100,000 bonds. Part of proceeds will be used for improving sewer and water systems.

Calif., Los Angeles—City plans to construct sewers in Meridian, Ardmore, Van Ness and 57th St.

Calif., Los Angeles—Plans being prepared for north outfall sewer system. Estimated cost, $2,000,000.

Calif., Oak Park—Joseph E. Tempest, Engineering Dept., will prepare plans for six miles of sewers.

Calif., Santa Monica—(Official)—Election will be held Dec. 7 to vote on $250,000 bonds for storm sewer system. Noted Oct. 28.

Calif., Stockton—City Engineer estimates cost of sewers in Homestead, Kidd's, Mark's, Lane's and Sunset Addition and Vischer Tract at $32,844.

N. B., St. John—Extension of water and sewage mains on Portland Pl. recommended by R. W. Wigmore, Comr.

Ont., Ottawa—Bids will be received some time in January for supply of catch basin covers. Estimated cost, $10,000. F. C. Askwith, Engr.

Man., Beverly—City plans to improve sewage system and sewage disposal plant. Estimated cost, $15,000.

Bids In and Contracts Awarded

Mass., Bridgewater—John E. Palmer, Old South Bldg., Boston, at about $6,000 submitted lowest bid for sewer system. Noted Nov. 4.

R. I., Woonsocket—(Official)—Brien & Bonvier, Woonsocket, at $4,715, submitted lowest bid for surface water drain in Carrington Ave. and Maple St. Noted Oct. 28.

N. Y., Greenwich—(Official)—John D. Dower, Ballston Spa, at $4,237, submitted lowest bid for sewers in Elm Ave., Main and Bridge St. Noted Oct. 28.

N. Y., Hudson—Contract for sewer system at Fair Ground Blvd. awarded to GREEN-STAR ENGINEERING CO., Philadelphia, Penn.

N. Y., New York—(Borough of Manhattan)—(Official)—Lowest bids received Nov. 5 for tunnel relief sewer in West 46th St. were as follows: Frazer & Burchenal, 80 Maiden Lane, $259,013; Battery Engineering and Construction Co., 17 Battery Pl., $292,438; James O'Leary, $283,872. Noted Oct. 21.

N. J., Atlantic Highlands—(Official)—Contract for 2½ miles of 8- to 19-in. sewer awarded to R. W. SMITH CORPORATION, 30 Church St., New York, N. Y., at $15,401. Noted Oct. 28.

N. J., Hightstown—Contract for six car loads of 8-in. sewer pipe awarded to SHANGLE & HUNT; contract for installing same awarded to MARTIN NOLAN, A. P. DEVLIN and DAVID EXCEL.

Md., Baltimore—Thomas Mullen, 3002 Greenmount Ave., Baltimore, submitted lowest bid for lateral sewers under Contract No. 163. Calvin W. Hendrick, 904 American Bldg., Ch. Engr. Sewage Comn.

Ohio, Cincinnati—Contract for sewer in Culvert St. awarded to THURBER & BROWNING CO., Cincinnati, at $6,861.

Ohio, Kent—WILLIAM HUNT & SONS Co., Akron, at $11,555, awarded contract for trunk sewer.

Ohio, Mansfield—Carl Weiss, Peru, Ind., at $6,667, submitted low bid for trunk line sewer in District No. 1.

Ohio. Mansfield—Bids were received Oct. 22 for improving sanitary sewage disposal plant as follows: Ohio Valley Construction Co., $74,055; David Lowensohn, $79,218; L. Wideson, $81,080.

Ind., Muncie—Contract for sewer in Main St. from Lincoln St. to within 15-ft. of Macedonia Ave. and sewer in Seymour St. from Vine St. to within 20-ft. of Hackley St. awarded to WILLIAM M. BIRCH CO.

Ill., Chicago—Bids received Oct. 2 for Calumet-Sag channel for Sanitary District from James O. Heyworth, at $720,171 for Contract No. 13, A. Guthrie & Co., at $828,823 for Contract No. 14. Noted Oct. 7.

Wis., Appleton—Contract for Atlantic St. trunk sewer awarded to C. R. MEYER & SON CO., Oshkosh, at $20,252.

Wis., Appleton—Contract for segmental block sewer awarded to WEGENBURG & BLAKE, Appleton, at $29,915.

Wis., Fond du Lac—Contract for sewers in Washington, Morris, Ruggles, West Cotton and East St. awarded to A. KRUEGER, Fond du Lac. Noted Oct. 21.

Iowa, Algona—(Official)—Contract for sewers in various streets awarded to MOORE-SIEG CONSTRUCTION CO., Waterloo, at $17,416. Noted Sept. 30 and Oct. 14.

Iowa, Elliott—Contract for sanitary sewers awarded to WILLIAM S. DOLL, Omaha, Neb., at $5,744. Noted Oct. 14.

Iowa, Jefferson—Contract for laying tile and sewer pipe, catch basins, etc., awarded to DE LONG CONSTRUCTION CO., Terrill, at $55,206.

Iowa, Ogden—Contract for sewer system awarded to A. DOBSON CO., Lincoln, Neb., at $37,909.

Iowa, Ogden—ZITTEREL & SULLIVAN, Webster City, at $10,000, awarded contract for sewage disposal plant.

Kan., Atchison—Contract for sewer at State Soldiers' Orphans' Home awarded to INTER-MOUNTAIN BRIDGE CO., Tecumseh, Neb., at $5,986.

N. D., Grand Forks—(Official)—Contract for lateral sewer No. 16 and 17, District 5, awarded to GRAND FORKS CONCRETE CO., Grand Forks.

Mo. St., Joseph—Contract for sewers in District No. 27 awarded to E. F. MIGNERY.

Ark., Heber Springs—Contract for sewer system awarded to INLAND CONSTRUCTION CO., Chandler, Okla., at $33,000. Noted Sept. 2.

Tex., Beaumont—Contract awarded to H. W. CARDWELL CONSTRUCTION CO., Texarkana, at $21,717 for sanitary sewers.

Tex., Beeville—Contract for sewer system awarded to EUGENE CAMPBELL, Ft. Worth, 25,670 lin.ft. of pipe to SAN ANTONIO TEXAS CO. Estimated cost, $15,000.

Tex., Dallas—City Commissioners rejected all bids for sanitary sewer main between Zang's Blvd. and Winnetka Ave. in Oak Cliff.

Idaho, Idaho Falls—(Official)—Oren & Lindstrum, Butte, Mont., at $17,600, low bidder for 16,000-ft. of 8- 12- and 15-in. vitrified sanitary pipe sewers.

Utah, Ogden—Contract for sewer in District No. 128 awarded to J. P. O'NEIL CONSTRUCTION CO., at $5,740.

Wash., Seattle—D. Parisi Co., 1506 16th Ave., Seattle, at $9,531, submitted lowest bid for sewers in North and West 49th St.

Ore., Enterprise—Contract for lateral sewers awarded to JAMES KENNEDY, Portland, at $18,652. Noted Aug. 12.

Calif., Daly City—Contract for sewer work awarded to W. J. TOBIN, at about $5,000.

Calif., Sausalito—(Official)—Contract for sewer work in District F awarded to HEAFEY & TOBIN, 735 Filbert St., Oakland, at $11,026. Leonard R. Hohl, Town Engr. Noted Aug. 12.

Que., St. Agathe-des-Monts—(Official)—L. Beauchamp, at $12,500, submitted lowest bid for sewer system and sewage-disposal plant.

Man., The Narrows—See item under "Water Works."

GARBAGE

Proposed Work

Kan., Wichita—R. A. Branson contemplates building two-story, 25x60-ft. dessicating plant. Estimated cost, $10,000.

Neb., Lincoln—City contemplates $10,000 bond issue for garbage disposal plant.

Bids In and Contracts Awarded

Penn., Philadelphia—Morris L. Cooke, Dir. of Pub. Wks., received following bids for collection and disposal of garbage for 1916, District No. 1—A. J. A. Mullen, $39,700; District No. 1-B, James Irwin, $121,800; District No. 2, Edwin H. Vare, $255,000; District No. 3, Edwin H. Vare, $310,000; District No. 4-A, Howard D. Ruch, $125,000; District No. 4-B, Thomas L. Flannagan, $9,600; District No. 5, J. D. Dorney, $157,800; District No. 6, Estate of D. McMahon ,$157,900. Collection of rubbish and ashes as follows: District No. 1-A, James A. Mullen, $44,900; District No. 1-B, James Irwin, $55,800; District Nos. 2 and 3, Edwin H. Vare, $80,000 and $90,000, respectively; District No. 4-A, Frank Curran, $65,000; District No. 4-B, Thomas L. Flannagan, $77,800; District No. 5, Frank Curran, $63,780; District No. 6, Estate of D. McMahon, $97,850.

Ga., Augusta—Contract for garbage incinerator awarded to T. O. BROWN & SON. Estimated cost, $10,000.

Ohio, Akron—(Official)—Contract for removal of garbage to Akron garbage disposal plant awarded to CHARLES H. WATTERS, at $3.12 per ton. Noted Oct. 21.

Mich., Ishpeming—(Official)—Contract for garbage incinerator awarded to McGUIRE HUNTER INCINERATOR CO., at $8,885. Noted Oct. 14.

Wash., Seattle—Seattle Cedar Lumber Mfg., Ballard, awarded contract to SEATTLE BOILER WORKS for incinerator.

STREETS AND ROADS

Proposed Work

Mass., Boston—(Dorchester)—(Official)—Bids will be received by E. F. Murphy, Comr. of Pub. Wks., until noon, Nov. 16, for asphalt or bitulithic pavement in Fernboro St. from Lawrence Ave. to Intervale St., Dorchester.

Mass., Boston—(Dorchester)—(Official)—Bids will be received by E. F. Murphy, Comr. of Pub. Wks., until noon, Nov. 16, for asphalt or bitulithic pavement in Mendon Park from Upland Ave. to Bourneside St. and in Harwood St. from Willowwood to Lucerne St., Dorchester.

Mass., Boston—(West Roxbury)—(Official)—Bids will be received by E. F. Murphy, Comr. of Pub. Wks., until noon, Nov. 16, for asphalt or bitulithic pavement in Kittredge St. from Cornell to Beech St., West Roxbury.

Mass., Brighton—City plans to improve North Beacon St. between Cambridge and Market St. Estimated cost, $63,000.

R. I., Narragansett Pier—Town appropriated $5,000 for macadamizing South Pier Rd.

Conn., Manchester—Plans being considered for improving Main St. Estimated cost, $15,000.

N. Y., Buffalo—City plans to pave Evelyn Ave. and Galveston Pl. and repave East North St.

N. Y., New York—(Borough of Bronx)—(Official)—Bids will be received by Douglas Mathewson, Borough Pres., Municipal Bldg., Crotona Park, 177th St. and Third Ave., until 10:30 a.m., Nov. 16, for furnishing and delivering 2,500 cu.yd. of grits and repairing asphalt-block pavement and setting curb on various streets of the borough.

N. Y., New York—(Borough of Queens)—(Official)—Bids will be received by Maurice E. Connolly, Borough Pres., Borough Hall, Fifth St. and Jackson Ave., Long Island City, until 11 a.m., Nov. 18, for furnishing and delivering to Bureau of Highways 3,000 cu.yd. of broken stone and screenings of trap rock and improving a number of streets and avenues of the borough.

N. J., Bloomfield—Bids will be received by R. F. Davis, Town Clk., until 8 p.m., Nov. 15, for 12,000 lin.ft. of 5-in. by 16-in. bluestone curb and 6,000 lin.ft. combination curb and gutter.

Penn., Pittsburgh—City will pave Susquehanna St. and Neuman Way.

Del., Wilmington—Bids will be received by James Wilson, State Highway Comr., for Newcastle County, Church Bldg., until noon, Nov. 16, for improving Philadelphia Turnpike.

Md., Baltimore—Report submitted to Board of Estimate to improve Gwynn's Falls Parkway from Gwynn's Falls Park to Druid Hill Park estimating cost of same at $500,000. John H. Robinette, Pres., Bd. of Comrs.

Va., Jonesville—Bonds for $15,000 for road construction voted by citizens of Lee County, Rose Hill District.

Va., Richmond—Northwide Blvd. from Chamberlayne Ave. through Roland Park, Battery Court, North Richmond and Barton Heights, will be constructed by city.

W. Va., Charleston—Bids will be received for paving about 15 streets of the city with bituminous concrete. J. M. Clark, City Engr.

W. Va., Charleston—Bids will be received by L. C. Massey, Clk. of Kanawha County, until 11 a.m., Nov. 17, for 1½ miles of brick, macadam or concrete pavement in London and Pokla District.

S. C., Anderson—City will pave East Market and East Earl St. from McDuffie to Main St.

Ga., Atlanta—City plans to pave Grant Ave. from Georgia to Glenwood Ave. with wood block.

Fla., Eustis—Plans being prepared by Isham Randolph Co., Engr., Chicago, Ill., for clay base road with penetration and sand asphalt top. Estimated cost, $80,000.

Fla., Ft. Lauderdale—Election to vote on $165,000 bonds for roads contemplated by Broward County Commissioners.

Fla., Kissimmee—Election to vote on $250,000 bonds for road construction contemplated by Commissioners of Osceola County.

Fla., Pinellas Park—City plans to improve 33d St. from Sixth to 12th Ave., Park Blvd, from 39th to 22d St. and 22d St. Blvd. to north town limit by grading, curbing and paving. C. M. de Champ, Engr.

Fla., Wauchula—(Official)—Bids will be received by City Clerk until Dec. 6 for approximately 13 miles of sidewalks. Estimated cost from $20,000 to $30,000. Noted Oct. 21.

Fla., West Palm Beach—Sidewalks on Clematis, Rosemary, Olive, Banyan and Datura St. will be paved by city.

Miss., Pass Christian—Election will soon be held to vote on $100,000 bonds for paving, water works and city hall. X. A. Kramer, Magnolia, Engr.

La., Bunkie—Gravel road from Bunkie to Morrow, about 20 miles, contemplated. Bunkie Business League interested.

La., Franklin—Main St. will be improved at an estimated cost of $17,000.

Tenn., Livingston—Citizens defeated $160,000 bonds for road work. Noted Aug. 19 and Sept. 23.

Tenn., Lonsdale—(Knoxville post office)—Citizens voted $20,000 bonds for paving. Noted Oct. 7.

Ky., Lexington—See item under "Sewers."

Ohio, Cincinnati—Report submitted estimating cost of improving Warner St. from McMicken to Fairview Ave. at $6,000.

Ohio, Cincinnati—Bids will be received by Board of Commissioners of Hamilton County until noon, Nov. 19, for improving Summit Ave. from canal to Reading pike in Springfield and Sycamore Townships.

Ohio, Pomeroy—Bids will soon be received for paving Mechanic St. with brick, about ¼ of mile.

Ohio, Youngstown—Sidewalks will be constructed on Lennox Ave., Sheridan Rd. and Kent St.

Ohio, Zanesville—(Official)—Citizens defeated $22,250 bonds for paving. Noted Oct. 14 and 28.

Ind., Brazil—Bids will be received by W. O. Graeser, Audr., Comrs. of Clay County, until 10:30 a.m., Dec. 7. for two roads in Harrison Township.

Ind., Kentland—Bids will be received by S. R. Sizelove, Audr., Comrs. of Newton County, until 2 p.m., Dec. 6, for macadam road in McClellan Township.

Ind., New Albany—Bids will be received until 10 a.m., Nov. 24, by Commissioners of Floyd County, for road in New Albany Township.

Ind., Rensselaer—Bids will be received by J. P. Hammond, Audr., Comrs. of Jasper County, until 2 p.m., Dec. 7, for stone road in Walker Township.

Ind., Tipton—Bids will be received by Commissioners of Tipton County until Dec. 6 for constructing gravel roads in Madison and Cicero Townships.

Mich., Baldwin—City will hold election in April to vote on $10,000 bonds for road construction.

Mich., Flint—Bonds for $100,000 for road construction voted by Supervisors of Genessee County.

Mich., Marshall—Bonds for $124,000 appropriated by County Commissioners for road construction.

Mich., Mason—Appropriation of $115,000 for road construction made by County Supervisors.

Ill., Quincy—Bids will soon be received for paving 14th St. from Broadway to State St. F. L. Hancock, City Hall, Engr.

Kan., Larned—Plans being prepared by Black & Veatch, Engr., Kansas City, Mo., for 25 blocks of vitrified fiber brick pavement on concrete base. L. E. Burgess, City Clk. Noted Sept. 23.

Kan., Ottawa—An ordinance passed to pave a portion of First St. with brick on concrete base.

Neb., Grand Island—Citizens plan to pave several portions of Paving District No. 17.

Neb., Lincoln—Bids will be received by H. E. Wells, Clk., Lancaster County, until Nov. 15, for construction of paving District No. 9. Noted Oct. 7.

Mo., Higginsville—(Official)—We have been informed that city will not pave any streets this year as stated in our issue of Oct. 28.

Mo., Sedalia—Bids will be received by F. T. Leaming, City Engr., until Dec. 6, for 9,200 sq.yd. of vertical fiber brick paving. Noted Oct. 21.

Ark., Marshall—Construction of 14 miles of road in mining district contemplated by Searcy County Improvement District.

Tex., Austin—Bids will be received by P. W. Powell, Comr. of Sts., until Nov. 19, for paving a number of streets and constructing storm sewers. Estimated cost, $330,640.

Tex., Batesville—Bonds for $15,000 will be sold for road improvements in Zavalla County. Noted Oct. 21 and 28.

Tex., El Paso—City plans to pave Prospect St. from Upson Ave. to West Blvd. Estimated cost, $15,430.

Okla., Bristow—Election will be held Nov. 16 to vote on $25,000 bonds for good roads.

Okla., Catoosa—Election will soon be held to vote on $18,000 bonds for road construction.

Okla., Chelsea—Election will soon be held to vote on $50,000 bonds for road construction.

Okla., Claremore—Election will be held in Oowala Township to vote on $30,000 bonds for constructing roads.

Okla., Collinsville—Election will soon be held to vote on $30,000 bonds for constructing roads.

Okla., Foyil—Citizens plan to hold election to vote on $25,000 bonds for road construction.

Okla., Idabel—Election will be held Nov. 13 to vote on $24,000 bonds for roads in Sulphur Township.

Okla., Muskogee—Bids will be received about Dec. 1 for road improvements in Muskogee County. Estimated cost, $10,000. J. P. Clonts, County Engr.

Okla., Oologah—Citizens will hold election to vote on $20,000 bonds for road construction.

Okla., Sapulpa—Election will soon be held in Creek County, Newby Township, to vote on $20,000 bonds for roads.

Okla., Talala—Election will soon be held to vote on $20,000 bonds for constructing roads.

Okla., Tulsa—City will pave 15th St. from Hudson to Robinson Ave., 14th St. from Broadway to Stiles Ave., Harvey Ave. from 14th to 15th St. and alley east of University Station.

Okla., Verdigris—Citizens will vote on $50,000 bonds for road construction.

Colo., Denver—Contract will soon be awarded for paving alley 41 in Park Hill. Estimated cost, $12,068.

Colo., Denver—Contract will be awarded some time next year for 300,000 sq.yd. of smelter slag surfacing. Estimated cost, $125,000.

Colo., Denver—State Highway Commission and Department of Parks contemplate one mile of paved road on West Colfax Ave. from city limits in direction of mountain Park system.

Colo., Denver—Commissioner of Improvements is considering estimates for 20,000 yd. of asphaltic concrete pavement on a 5-in. concrete base for West Colfax Ave. from Zuni St. west across Platte River to Irving St.

Colo., Estes Park—Residents have asked Congress for an appropriation of $125,000 for development of roads and trails in Rocky Mountain National Park.

Idaho, Cottonwood—(Official)—Citizens defeated bonds for paving main business streets of city. E. L. Parker, Chn., Bd. of Trustees. Noted Sept. 9 and 30.

Ariz., Globe—Election will be held Nov. 15 in Gila County to vote on $100,000 bonds for roads.

Ariz., Nogales—(Official)—Citizens voted $150,000 bonds for highways in Santa Cruz County. Noted Oct. 7.

Ariz., Tucson—Citizens voted $400,000 bonds for roads. Noted Sept. 30.

Calif., Fresno—City Trustees plan to pave Ventura Ave.

Calif., Los Angeles—City plans to pave Ord St. from North Broadway to Castelar St.

Calif., San Francisco—Board of Works plans to pave 20th Ave. and Noe St. Estimated cost, $21,445.

Calif., San Gabriel—Bids will be received by I. H. Stouffer, City Clk., until Nov. 16, for improving a portion of Las Tunas Drive.

Ont., Kingston—Bids will soon be received by City Council for paving University Ave. W. W. Sands, Clk.

Ont., Pembroke—Town Council contemplates construction of macadam roadway. Estimated cost, $4,000.

Ont., Sudbury—Town Council plans an expenditure of $4,000 for sidewalks. W. J. Ross, Clk.

Bids In and Contracts Awarded

Mass., Boston—Bids were received Oct. 29 for paving Jones Ave. as follows: James Doherty, 133 Calumet St., Roxbury, asphalt, $8,631, bitulithic, $8,659; C. J. Jacobs Co., 107 Terrace St., Roxbury, asphalt, $8,822, bitulithic, $8,650; Central Construction Co., 6 Beacon St., Boston, asphalt, $8,914.

Conn., North Haven—Contract for 20,800 yd. of bituminous concrete pavement awarded to UNION PAVING CO. and LANE CO.

N. Y., Albany—(Official)—Contracts awarded for constructing highways by State Aid as follows: Road No. 1279, Albany County, 3.41 miles: Award held; Road No. 5,532, Allegany County, 5.25 miles: KENNEDY CONSTRUCTION CO., Albany, $50,881; Road No. 1327, Cayuga County, 6.06 miles: JOHN H. GORDON, Albany, $52,011; Road No. 5594, Clinton County, 3.79 miles: BLUFF POINT STONE CO. INC., Plattsburg, $29,160; Road No. 1331, Columbia County, 4.27 miles: RUSSO-PARKER CONSTRUCTION CO., Hudson, $39,756; Road No. 1332, Columbia County, 7.77 miles: MARKS KEARNEY, Hudson, $62,186; Road No. 5595, Cortland County, 3.65 miles: T. H. GILL CO., Binghamton, $39,759; Road No. 133, Erie County, 0.14 mile: Award held; Road No. 1334, Erie County, 4.30 miles: LANGAN CONSTRUCTION CO., Albany, $70,049; Road No. 3135, Erie County, 4.50 miles: Award held; Road No. 1336, Erie County, 5.19 miles: Award held; Road No. 5582, Genesee County, 4.53 miles: CHILSON & GIBSON, Leroy, $44,893; Road No. 5593, Livingston County, 7.69 miles: JAMES ANDERSON, Albany, $63,063; Road No. 1110, Madison County, 3.05 miles; MOHAWK ENGINEERING CO., Mohawk, $26,151; Road No. 1328, Monroe County, 0.73 mile: WHITMORE-RAUBER & VICINIUS, Rochester, $12,927; Road No. 1327, Monroe County, 2.91 miles: RIBSTINE-HOLTER CO. INC., Rochester, $35,548; Road No. 5547, Oneida County, 0.70 mile: LANGAN CONSTRUCTION CO., Albany, $17,187; Road No. 5247-A, Onondaga County, 0.18 mile: M. J. GLEASON & CO., Syracuse, $2175; Road No. 448, Orange County, 3.64 miles: ARMSTRONG & TROWBRIDGE, Middletown, $29,368; Road No. 449, Orange County, 3.17 miles: ARMSTRONG & TROWBRIDGE, Middletown, $21,399; Road No. 1329, Orange County, 3.70 miles: Award held; Road No. 5591, Orange County, 0.38 mile: SCHUNEMUNK CONSTRUCTION CO., Highland Mills, $3072; Road No. 5545, Schenectady County, 5.62 miles: Award held; Road No. 5589, Seneca County, 5.01 miles: GREENFIELD CONSTRUCTION CO., Hornell, $43,719; Road No. 5510-A, Sullivan County, 0.43 mile: HENRY McNAMEE, Eddyville, $7,947; Road No. 1079, Tioga County, 4.07 miles: PETER F. CONNOLLY CO., Horseheads, $30,603; Road No. 1330, Tompkins County, 2.48 miles: GREENFILE CONSTRUCTION CO., Hornell, $26,447; Road No. 603, Ulster County, 10.24 miles: ARMSTRONG & TROWBRIDGE, Middletown, $82,935. Noted Oct. 14 and Nov. 4.

N. Y., Buffalo—Contract for paving Skillen St. awarded to HENRY P. BURGARD CO., at $10,875.

N. Y., Middletown—Contract for paving Mill St. awarded to ABNER M. HARPER CO., Newburgh, at $4,100.

N. Y., New York—(Borough of Brooklyn)—(Official)—Contracts for regulating and repaving Bridge St. from Sands to Nassau St., awarded to CHARLES A. MYERS CONTRACTING CO., at $6,804; regulating, grading, curbing and laying sidewalks on Ditmas Ave. to M. F. MAHER, at $9,932. Noted Oct. 21.

N. Y., New York—(Borough of Manhattan)—(Official)—Contracts for paving awarded as follows: Arden St. to ASPHALT CONSTRUCTION CO., Madison Ave. and 137th St., New York, at $5,934; 161st St. to AZTEC ASPHALT CO., 90 West St., New York, at $6,264; Front St., to W. J. FITZGERALD, 547 West 45th St., at $34,838. Noted Oct. 21.

N. Y., New York—(Borough of Manhattan)—(Official)—Lowest bids received Nov. 5 for regulating and repaving (a) West side of Broadway from curb to rail from north side of 108th St. to north side of 110th St., (b) Sixth Ave. from Eighth Ave. to 19th St., Greenwich Ave. from Sixth Ave. to north of Perry St., West 10th St. from Greenwich to Sixth Ave., (c) 25th St. from Sixth to Seventh Ave., (d) 72d St. from Central Park West to Columbus Ave., (e) 78th St. from First to Third Ave., of 95th and 96th St. from Broadway to Amsterdam Ave. were as follows: (a) Asphalt Construction Co., Madison Ave. and 137th St., $5,189; (b) Aztec Asphalt Co., 90 West St., $52,151; (c) Sicilian Asphalt Paving Co., 41 Park Row, $5,277; (d) Aztec Asphalt Co., $10,655; (e) Sicilian Asphalt Paving Co., $11,060; (f) Barber Asphalt Paving Co., Woolworth Bldg., $6,439. Noted Oct. 28.

N. J., New Brunswick—Contract for improving Amboy Rd. from city line at Spa Springs to Myrtle Ave. awarded to THOMAS F. DUNIGAN, Woodbridge, at $29,148. Noted Nov. 4.

N. J., New Brunswick—Contract for 10,000 sq.yd. of appianite pavement on Raritan Ave. awarded to FRANKLIN CONSTRUCTION CO., New York, N. Y.

N. J., Plainfield—(Official)—Bids were received Nov. 1 by Common Council for improving Sherman and Fillmore Ave. and East Fourth St. from Burke & Bonham, at $4,037 and Mobus Bros., at $4,142.

Penn., Greensburg—Contract for Scottdale-Tyrone Mills Rd. awarded to SAMUEL HOLMES, Scottdale, at $19,958. Noted Oct. 7.

Penn., Greensburg—Bids were received Oct. 28 for Jeanette-Grapeville Rd. as follows: L. Edwards, Greensburg, $21,123; McCrady Bros., Braddock, $21,601; Ridge Bros., Pittsburgh, $22,071. Noted Oct. 7.

Penn., Philadelphia—UNION PAVING CO., 112 North Broad St., awarded contract for paving Jasper St. at $16,978.

Penn., Pittsburgh—(Official)—Contracts for paving awarded as follows: Clinton and Frankfort Rd. to D. W. CHALLIS & SONS, at $34,667; Beatty Rd. to R. H. CUNNINGHAM & SONS, INC., at $48,736. Noted Oct. 28.

Md., Baltimore—Contract for paving State, Trenton and Mace St. and Breindenbaugh and Stable Alley awarded to GEORGE LONG CONTRACTING CO., at $6,438.

Md., Baltimore—Contract for paving portions of Balderson, Water, Grant and Mercer St. awarded to BALTIMORE ASPHALT BLOCK AND TILE CO., at $5,231. Noted Oct. 14.

Md., Baltimore—Contract for grading main and upper portions of Ellicott Driveway awarded to F. B. BEASMAN CO., 7 Clay St., Baltimore, at $21,015. Noted Oct. 7 and 14.

N. C., Gastonia—Contract for 50,000 sq.yd. asphalt paving awarded to NOLL CONSTRUCTION CO., Chattanooga, Tenn.

Fla., Ft. Pierce — Contract for hardsurfacing Fellsmere-Sebastian Rd. awarded to H. R. SLOANE, Sebastian Rd., at about $6,000. Noted Oct. 28.

Ohio, Findlay—(Official)—C. B. Hall & Son, Findlay, at $5,495, submitted lowest bid for paving East Sandusky St. with brick.

Ohio, Independence—(Official)—Contract will be awarded about Nov. 27 for sidewalks on Brecksville Rd. Bonds for $9,500 sold for this purpose. Noted Oct. 14.

Ind., Evansville—(Official)—Contract for macadam road in Pigeon Township awarded to TRAYLOR & KREMPP, Jasper, at $7,848. Noted Oct. 28.

Ind., Fowler—(Official) — Contract for road in Balboa Township awarded to A. E. GRAY, Goodland, at $8,967. Noted Oct. 28.

Ind., Greencastle—(Official)—Contract for macadam road in Greencastle Township awarded to EARL HURST, Cloverdale, at $13,000. Noted Oct. 28.

Ind., Logansport—(Official)—Contract for paving awarded to ANDREWS ASPHALT PAVING CO., Hamilton, Ohio, at $100,228. Noted Sept. 16 and 30.

Ind., Plymouth—(Official)—Contract for three roads in German Township awarded to FRANK BALLINGE, Donaldson, at $10,660. Noted Oct. 28.

Ind., Shelbyville—(Official)—Contract for two roads in Washington Township awarded to HARVEY OLDMAN, Edenburg, at $5,570, and MOBERLY & CO., Shelbyville, at $3,148. Noted Oct. 28.

Ind., South Bend—Contract for paving Leeper Ave. from Howard to Angella Ave. awarded to HARRY N. BARNES, at $12,437.

Ill., Joliet—Contract for paving Jefferson St. between Eastern Ave. and Herkimer St. with bituminous macadam awarded to R. F. CONWAY CO., 133 West Washington St., Chicago.

Wis., Tomah—Contract for vitrified brick paving awarded to GEORGE R. KEACHIE CO., Madison, at about $15,000. Noted Oct. 14.

Kan., Columbus—(Official)—Contract for grading and surfacing with gravel seven miles of county road between Columbus and Crestline awarded to W. HUNTSINGER, Columbus, at about $6,000. Noted Oct. 21.

Kan., Independence — Contract for paving awarded to GREEN & CULLEN, at $33,422.

Mo., Kansas City—Contract for grading a portion of Meyer Blvd. awarded to McMILLAN CONSTRUCTION CO., Chicago, Ill., at $86,000. Noted Sept. 6 and Oct. 14.

Mo., St. Louis—Contract for improving Marcus Ave. awarded to SHRAINKA CONSTRUCTION CO., at $7,684.

Tex., Beaumont — Contract for paving various streets awarded to UVALDE ROCK ASPHALT CO., Beaumont, Tex. Estimated cost, $275,000.

Tex., Bryan—Contract for road construction in District No. 1 awarded to ALNEY AND McCORMICK, Houston. Estimated cost, $20,000.

Tex., Dallas—Contract for paving awarded to LEVY & LEVY, Muskogee, Okla., at about $50,000.

Tex., Houston—Contract for paving Creston Ave. awarded to EUREKA PAVING CO., Houston, at $6,000.

Colo., Denver—Contract for paving alley 36 awarded to A. F. HEWITT, at $12,859.

Colo., Denver—Contract for paving alley 37 in Country Club District awarded to G. W. STARK, at $13,802.

Utah, Salt Lake City—P. J. MORAN, 152 North Second St., at $15,860, awarded contract for paving.

Wash., Bremerton—Contract for concrete walks and permanent gutters on Burwell Ave. awarded to L. L. KENT, at $6,356.

Wash., Colville—(Official)—Contract for improving three miles of Springdale-Hunters Permanent Highway No. 2-A awarded to SPOKANE ASPHALT MACADAM AND PAVING CO., Spokane, at $10,000. Noted Oct. 21.

Wash., Everett—Contract for improving Harrison Ave. awarded to ERVIG & HAUGH, Everett, at $7,951.

Wash., Pomeroy—(Official)—Contract for improving portion of Permanent Highway No. 1 awarded to TRIBOU & BLACKMAN, Walla Walla, at $9,249. Noted Oct. 21.

Wash., Stevenson—(Official)—Contract for nine miles of Stevenson-Carson Rd. awarded to J. M. AMBROSE, 22-23 Bates Dock Bldg., Portland, Ore., at $48,000. Noted Sept. 23 and Oct. 21.

Calif., Riverside—Bids were received for 11 miles of roadway on Route No. 18 as follows: B. R. Davison Construction Co., Monrovia, concrete, $45,096; macadam, $52,825; Johnson-Shea Co., Riverside, concrete, $42,489; macadam, $56,889.

Calif., Riverside—Contract for 10 miles of Moreno Rd. awarded to CONNER CONSTRUCTION CO., at $61,825.

Calif., San José—(Official)—Contract for improving Lincoln Ave. in Supervisorial District No. 4 awarded to RAISCH IMPROVEMENT CO., Crocker Bldg., San Francisco, at $14,340. Noted Oct. 21.

Calif., Santa Barbara—(Official)—Contract for paving Booths Point Rd. awarded to F. R. RITCHIE & CO., San Francisco, at $15,475. Noted Oct. 7.

INDUSTRIAL WORKS

Proposed Work

Conn., Hartford—Swift & Co. contemplates building three-story addition to refrigerating plant. Estimated cost, $100,000.

Conn., Waterbury—Waterbury Tool Co. will build one-story, 220x212-ft. machine shop in Browns Meadow.

N. Y., Albany—Plans being prepared for one-story, 125x200-ft. addition to factory of Modern Machine and Tool Co.

N. Y., New York—(Borough of Brooklyn)—Plans prepared for three-story, 200x320-ft. factory at 43d St. and First Ave., for E. W. Bliss Co. Estimated cost, $175,000.

N. Y., New York—(Borough of Brooklyn)—Plans prepared for two-story, 110x200-ft. brick machine shop on 23rd St. for Empire Repair and Electric Welding Co., 42 Whitehall St., New York.

N. Y., New York—(Borough of Brooklyn)—(Official)—Linde Air Products Co., 30 East 42d St., plans one-story, 72x100-ft. brick factory at Driggs Ave. Estimated cost. $16,500.

N. Y., New York—(Borough of Manhattan)—(Official)—Plans being prepared by Francisco Jacobus, Arch., 200 Fifth Ave., for eight-story 98x100-ft. factory at 25th St. and Tenth Ave., for Marginal Realty Co. Estimated cost, $150,000.

N. Y., New York—(Borough of Manhattan)—(Official)—J. B. Snooks' Sons, Arch., 261 Broadway, preparing plans for 10-story, cold storage plant at 10th Ave., Marginal, 16th and 17th St., for Merchants Refrigerating Co., 7 Harrison St. Estimated cost, $1,000,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Plans being prepared by J. S. Maher, Arch., 431 West 14th St., for alteration to factory of Miller Estate. Estimated cost, $25,000.

N. Y., Poughkeepsie—Plans being prepared for four-story, 75x350-ft. factory for Victor Typewriter Co. John J. Petit, 103 Park Ave., N. Y., Arch.

N. Y., Troy—(Official)—Westinghouse, Church, Kerr & Co., Arch., N. Y., preparing plans for eight-story, 70x100-ft. factory for Cluett Peabody Co., Inc, Estimated cost, $2,000,000. Noted Oct. 28.

N. Y., Utica—Heron Mfg. Co. contemplates two-story addition to plant. Estimated cost, $100,000.

N. J., Newark—Plans being prepared for five-story factory on High St. for Splitdorf Electrical Co., 98 Warren St.

Penn., McKeesport—American Sheet Steel Co. will enlarge W. Dewees wood plant. Estimated cost between $125,000 and $150,000.

Penn., McKeesport—McKeesport Tinplate Co. will build addition to plant.

Penn., New Kensington—Plans being prepared by W. G. Wilkins Co., Westinghouse Bldg., Pittsburgh, for brick and steel factory for National Lead and Oil Co. Estimated cost, $100,000.

Penn., Philadelphia—(Official)—Bids will be received about Dec. 1 for four-story, 54x100-ft. factory for M. Rice & Co. Noted Nov. 4.

Penn., Philadelphia—Plans prepared by William Steele & Sons Co., 16th St. and Archer St., for five-story, 16x243-ft. reinforced-concrete building at Westmoreland and Masther St. for Philadelphia Tapestry Mills. Estimated cost, $120,000.

Penn., Pittsburgh—Plans being prepared by V. Wyss-Thalman, Arch., 5113 Jenkins Arcade, for two-story, 84x136-ft. warehouse for Liquid Fuel Combustion Co. Noted Sept. 30.

Md., Baltimore—Baltimore Car and Foundry Co., Curtis Bay, Md., will build 273x1,200-ft. addition. Estimated cost, $500,000.

W. Va., Huntington—Huntington Tobacco Warehouse Co. will build 160x160-ft. wood and concrete warehouse.

W. Va., Moundsville—U. S. Stamping Co., Wheeling, contemplates building addition to plant at Moundsville.

W. Va., Wheeling—LaBelle Iron Works will build coke plant. Estimated cost, $2,000,000.

Ga., Gainesville—H. Clark, Bowersville, contemplates knitting mill. Estimated cost, $25,000.

Ala., Birmingham—Harris Transfer and Warehouse Co. contemplates building five-story reinforced-concrete warehouse. Estimated cost, $50,000.

Ky., Ashland—Norton Iron Works estimates cost of proposed bi-product plant between $200,000 and $500,000. Noted Oct. 28.

Ky., Owensboro—Hull Pump and Tank Co. contemplates building plant.

Ohio, Canton—The Universal Mfg. Co. will build a plant. Frederick G. Grant is interested.

Ohio, Cincinnati—(Hyde Park)—Hyde Park Lumber Co. will build brick warehouse. Estimated cost $10,000.

Ohio, Cincinnati—Joseph G. Steinkamp & Bros., Arch., preparing plans for garage at Fifth St. and Sycamore St. for Frank Fox. Estimated cost, $40,000.

Ohio, Cleveland—Plans prepared by Multon & TaTylor, Hippodrome Bldg., for eight story, 211x330-ft. and 71x222-ft. warehouse for Home Financing Co. Estimated cost, $500,000.

Ohio, Cleveland—American Steel and Wire Co. will build addition.

Ohio, Dayton—Plans being prepared for addition to plant of Maxwell Motor Car Co.

Ohio, Dayton—Plans being prepared by Thies & Thies, Davis Bldg., for three story brick and steel addition to plant of Ohio Metal Products Co., 39 Edgar St.

Ohio, East Liverpool—National Drawn Steel Co. contemplates building addition to plant.

Ind., Brazil—Plans prepared for addition to plant of Wood Turret Machine Co.

Ind., La Fayette—A. J. Fogarty, Michigan City, interested in building of twine factory. Estimated cost, $35,000.

Ill., Chicago—J. Ogden Armour purchased site in Broad St. and will build garage.

Ill., Chicago—Cadillac Automobile Co., 2301 South Michigan Ave., purchased site at Indiana Ave. and 23d St. and will build eight-story building. Estimated cost, $200,000.

Ill., Chicago—Plans prepared by Postle & Fisher, Arch., 140 South Dearborn St., for one-story, 209x480-ft. factory at 2000 South Jefferson St., for Western Shade Cloth Co. Estimated cost, $75,000. Noted Oct. 21.

Ill., Springfield—Western Cartridge Co., East Alton, Ill., will build plant at Springfield.

Wis., Madison—Co-Operative Packing Co. will build packing plant. Estimated cost, $200,000.

Wis., Manitowoc—Plans being prepared by Earl F. Miller, Arch., Dempsey Bldg., for 55x300-ft., five-story, brick and steel factory for Aluminum Goods Manufacturing Co.

Wis., Milwaukee—Schlitz Candy Co. will build factory. Leonard Schlitz interested.

Wis., New Richmond—Intercounty Packing Co. contemplates building plant. Estimated cost, $100,000. T. J. Davis, Pres.

Minn., Minneapolis—Maples Steel and Machine Co. will build one-story, 140x365-ft. factory. Estimated cost, $60,000.

Minn., Minneapolis—Western States Coke Co. plans factory at Marshall St. and Northern Pacific right-of-way.

Minn., Minneapolis—Janney, Semple Hill & Co., First Ave. S. and Second Ave., will build addition to warehouse on First St. and Third Ave. Estimated cost, $200,000.

Minn., Minneapolis—Kronick Cleaning Co., 1213 Hennepin Ave., will build two-story reinforced-concrete store and dry cleaning building. Estimated cost, $45,000.

Minn., Minneapolis—Minnesota Motor Car Co. contemplates building two-story reinforced-concrete building and one-story, 10x142-ft. garage. Estimated cost, $50,000.

Minn., Minneapolis—Minneapolis Steel and Machinery Co., 29th and Minnehaha St., will build one-story, 140x356-ft. factory at 2906 Minnehaha St. Estimated cost, $60,000.

Minn., St. Paul—Contract will soon be awarded for ten-story, 48x150-ft. concrete terminal elevator for Equity Co-Operative Exchange. Plans prepared by Foltz Engineering Co., 1410 Pioneer Bldg., Arch. Estimated cost, $125,000. Noted Sept. 30.

Minn., St. Peter—St. Peter Woolen Mills will build factory. Estimated cost, $10,000. J. C. Brinkler interested.

Kan., Argentine—Plans being prepared for addition to car repair shed for Atchison, Topeka & Santa Fé Railway. Estimated cost, $45,000.

Kan., Wichita—Rumley Products Co. plans two-story, 100x120-ft. warehouse. Estimated cost, $30,000.

Mont., Butte—Roberts Cereal Mill Co. will build flour and feed mill at Butte. A. G. Roberts interested.

Mont., Helena—T. C. Power Co. will build 42x48x55-ft. seed cleaning plant and grain elevator.

Mo., Kansas City—Plans being prepared for bakery for Nafziger Baking Co. Estimated cost, $40,000.

Mo., St. Louis—J. Johansen will build three-story machine shop and garage.

Utah, Salt Lake City—Plans prepared by F. C. Barnes for garage at Main St. Estimated cost, $10,000.

Wash., Leavenworth—Rothert Process Steel Co. purchased site at Leavenworth and will build plant.

Ore., The Dalles—Dri Fresh Co. plans two-story, 75x150-ft. addition.

Alaska, Seward—F. T. Frank, Cordova, will build cement plant. Estimated cost, $100,000.

Bids In and Contracts Awarded

Mass., Malden—Parks-Osgood Co. awarded contract to WILLIAM M. BAILEY, 88 Broad St., Boston, for one-story garage. Estimated cost, $20,000.

Mass., Palmer—Armour & Co. awarded contract to FLYNT BUILDING AND CONSTRUCTION CO., Palmer, for three-story brick and reinforced-concrete plant. Estimated cost, $35,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for mason work for one-story, 75x100-ft. brick and steel ice storage plant for Ice Mfg. Co., 1480 Broadway, awarded to GEORGE H. McENTEE. Noted Oct. 28.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to ROSEN CONSTRUCTION CO., 3099 Stagg St., for three-story, 49x100-ft. garage at 440 E. 11th Ave., for N. Y. Herald.

N. Y., Rhinebeck—(Official)—Contract awarded to ROBERT S. POLLOCK, 110 East 28th St., for dairy buildings for Vincent Astor, 23 West 26th St. Estimated cost, $100,000. Noted Sept. 23.

N. Y., Rochester—(Official)—Eastman Kodak Co. awarded contract for two-story, 45x140-ft. and five-story, 80x165-ft. additions to plant to ALEXANDER, SHUMWAY & UTZ, Rochester. Noted Oct. 28.

N. J., Jersey City—Contract awarded to JOHN M. FERGUSON, Paterson, at $80,000, for three-story reinforced-concrete factory at Baldwin Ave. and High St. for Durham Duplex Razor Co.

N. J., Phillipsburg—Cannister Co. awarded contract for factory to BUTZ CLADER & CO., Allentown, N. J. Estimated cost, $50,000.

Penn., Philadelphia—Contract for 100x200-ft. reinforced-concrete grain elevator addition at Schuylkill Ave. for Pennsylvania R.R. awarded to JAMES STEWART & CO., Chicago, Ill. Estimated cost, $200,000.

Penn., Philadelphia—Louis Walther Mfg. Co. awarded contract for three-story, reinforced-concrete factory at Torresdale Ave. and N St. to M. WARD EASBY, Crozer Bldg., at $56,000. Noted Oct. 7.

Penn., Pittsburgh—Pittsburgh & Lake Erie R.R. Co. awarded contract to JAMES L. STUART for six-story warehouse at Smithfield St. Estimated cost, $1,000,000.

Del., Wilmington—William Freihofer Baking Co. awarded contract for bakery to PHILIP HAIBACH CONSTRUCTION CO. Estimated cost, $100,000. Noted Sept. 30.

D. C., Washington—Washington Steel and Ordnance Co. awarded contract to BLAW STEEL CONSTRUCTION CO., Pittsburgh, Penn., for 126x165-ft. addition to forge shop.

Ohio, Oakley—(Cincinnati post office)—Cincinnati Ball Crank Co. awarded contract to ADAM KOENIG, for excavation and masonry work, L. SCHREIBER & SONS CO., for iron work, for one-story, 100x276-ft. factory.

Ohio, Youngstown—Brier Hill Steel Co. awarded contract to LACKAWANNA BRIDGE CO., Buffalo, N. Y., for two open-hearth steel furnaces. Noted Nov. 4.

Ind., Evansville—(Official)—Contract for five-story, 50x150-ft. factory for Anchor Supply Co. awarded to KOCH & GRIESBACHER. Noted Oct. 14.

Ind., Jasper—Jasper Mfg. Co. awarded contract for factory to SCHMIDT & RENNER, Jasper, at $14,774. Noted Oct. 14.

Ill., Dixon—State Colony for Epileptics awarded contract for cold storage, laundry and bakery building to A. B. KRAUEL, Danville, at $73,000.

Minn., Red Wing—Busch & Boxrud awarded contract to W. J. LONGCOR, Red Wing, for garage. Estimated cost, $25,000.

Ark., Foreman—(Official)—Consumers Portland Cement Co., 1405 Lumber Exchange Bldg., La Lalle and Madison St., Chicago, Ill., awarded contract to FULLER ENGINEERING CO., Allentown, Penn., for building plant.

Wash., Seattle—Bids were received Oct. 20 by Port of Seattle Commission for four-story addition to warehouse on Whatcom Ave. from Harry Brandt Construction Co., at $60,500, Hans Pederson, $68,684, W. T. Butler, $67,500. Noted Oct. 14.

FEDERAL GOVERNMENT WORK

Proposed Work

Md., Indian Head—Extension to Pulping and Poaching House—Bids will be received by H. R. Stanford, Ch. of Bureaus of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Nov. 27, for extension to pulping and poaching house, Naval Proving Ground, Indian Head.

D. C., Washington—Heating Plant—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., until 10 a.m., Nov. 17, for central heating, lighting and power plant at Washington, D. C.

Fla., Pensacola—Paving—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Dec. 4, for concrete pavement at navy aëronautic station, Pensacola.

Tenn., Humboldt—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 20, for U. S. post office at Humboldt.

Ky., Louisville—Lock Bridges—Bids will be received at U. S. Engineer Office until Dec. 6 for swing bridge over locks of Louisville and Portland Canal.

Ohio, Middletown—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 18, for U. S. post office at Middletown.

Mich., Sault. Ste. Marie—Timber—Bids will be received at U. S. Engineer Office, 337 Federal Bldg., Detroit, until noon, Dec. 15, for furnishing and delivering about 110,000-ft. B. M. of white oak timber. (See adv.)

Mo., Jefferson City—Elevator—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 29, for new hoist way and electric freight elevator, etc., in U. S. courthouse and post office, Jefferson City.

Colo., Denver—Machinery—Bids will be received by U. S. Reclamation Service, Denver, until Nov. 16, for furnishing excavating machinery for Yuma Project, Arizona.

Calif., San Francisco—Dry-dock—Secretary of Navy, Washington, D. C., approved plans of Union Iron Works for dry dock at Hunters Point.

Hawaii, Pearl Harbor—Buildings—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Dec. 4, for three buildings at naval station, Pearl Harbor.

P. I., Cavite—Buildings—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Jan. 4, for five buildings at naval station, Cavite.

Bids In and Contracts Awarded

Md., Indian Head—Tank and Tower—Bids were received Oct. 30 for 250,000-gal. steel water tank and tower at Naval Proving Ground, Indian Head, as follows: Pittsburgh-Des Moines Steel Co., Curry Bldg., Pittsburgh, Penn., $10,184; York Bridge and Construction Co., Curry Bldg., York, Penn., $10,980; Memphis Steel Construction Co., Greensburg, Penn., $11,228. Noted Oct. 14.

Penn., Harrisburg—Post Office—H. L. Brown & Co., Mt. Vernon, N. Y., at $113,405, submitted lowest bid for additions and alterations to U. S. post office. Noted Aug. 26 and Oct. 7.

Ohio, Logan—Post Office—Contract for U. S. post office at Logan awarded to A. W. LANE, 19 South La Salle St., Chicago, Ill., at $42,820. Noted Sept. 9 and Oct. 21.

Wis., Merrill—Post Office—Bids were received Nov. 1 for post office at Merrill, (a) limestone, (b) sandstone, as follows: James Devault, Canton, Ohio, (a) $59,700, (b) $60,900;

John Lauritzen, Fergus Falls, Minn., (a) $53,900; Callahan-Mandl Co., 814 Reaper Blk., Chicago, Ill., (a) $58,700; (b) $60,000. Noted Sept. 30.

Mont., St. Ignatius—Excavation—Contract for Mission lateral H and sub-laterals, Flathead irrigation project, awarded to WILSON BROS., Polson, at $16,423. Noted Sept. 30.

Okla., Tulsa—Mechanical Equipment—Contract awarded to FARWELL HEATING AND ENGINEERING CO., Joplin, Mo., at $25,667, for mechanical equipment for U. S. post office and court house. Noted Sept. 2.

Okla., Tulsa—Post Office—Contract for U. S. post office and court house awarded to M. YEAGER & SON, Danville, Ill., at $184,856. Noted Oct. 7.

CANALS, DITCHES AND IRRIGATION

Proposed Work

Mass., South Hyannis—Dredging—State appropriated $10,000 for dredging Lewis Bay between Egg Island and Dumbars Point.

Md. Hagerstown—Canal Improvements—Canal Towage Co. will improve Chesapeake & Ohio Canal, including concrete lock at Dam No. 6.

Fla., Arcadia—Ditch—Bids will be received until Nov. 15 by County Commissioners for drains, canals and ditches for Arcadia Drainage District in DeSoto County. Noted Oct. 7.

Fla., Bradentown—(Official)—Drainage—Bids will be received until Nov. 15 for purchase of $130,000 bonds for drainage. C. A. Tilton, Clk. of Bd. of County Comn. (See adv.)

Mich., Saginaw—Drainage—Saginaw County Supervisor contemplates draining land located by Spaulding, James, Swan Creek, Albee St., Charles and Plymouth Townships.

Ill., Chicago—Drainage—Drainage Board will issue $2,000,000 for widening river south of Van Buren St. and for diverting sewage in Calumet District.

Ill., Chicago—Canal—City plans 8-ft. canal to connect Chicago with Mississippi River and cheap water transportation with Gulf of Mexico and Pacific Coast.

Wis., Chilton—Drainage—Citizens contemplate establishing drainage district to drain land in Zimmerman Swamp and Saukville.

Minn., Bemidji—Ditches—A. Stanton, Judge County Court, plans Ditches Nos. 34 and 36, in Hamre and Steenerson Townships and in unorganized townships. Estimated cost, $283,882.

Minn., Duluth—Ditch—Contract will soon be awarded for Ditch No. 5 by County Commissioners. Estimated cost, $150,000.

Kan., Topeka—Drainage—Survey being made by V. R. Parkhurst of Indian and Soldier Creek territories of North Topeka Drainage District.

Tex., Aldine—Drainage—Bonds for $140,000 sold for drainage work in Drainage District No. 7.

Tex., Austin—Reclamation—A. A. Stiles, State Reclamation Engr., made surveys for organization of levee district for reclamation of 100,000 acres from mouth of Little Brazos to point near Marlin. Noted Aug. 26.

Tex., Bay City—Drainage—E. N. Gustafson, Engr., submitted report to Matagorda County Commissioners for drainage system in District No. 6. Estimated cost, $47,988. Noted Sept. 2.

Tex., Houston—Drainage—Bonds for $140,000 for drainage system have been sold. Noted Sept. 9.

N. M., Carlsbad—Irrigation—Bids will soon be received by L. E. Foster, Project Mgr., for Down Canyon Pipe line.

Utah, Minersville—Irrigation—Delta Land and Water Co. and Minersville Irrigation Co. contemplate lateral system of water distribution over 12,000 acres in Beaver County.

Wash., Brewster—Irrigation—Contract will soon be awarded for Brewster Irrigation District project. Estimated cost, $1,069,000. Noted Sept. 30.

Ore., Burns—Irrigation—Harbey Basin Development Co. has secured water rights to irrigate 50,000 acres of land.

Ore., Grandview—Irrigation—Election will be held Nov. 22 to vote on $600,000 bonds for Suttle Lake Irrigation District. C. I. Henline, Secy. Bd. of Directors.

Ore., Grants Pass—Irrigation—Rogue River Public Service Corporation granted permit by State Engineer to appropriate water for irrigation of 12,460 acres.

Ore., Hood River—Irrigation—Bids will be received until Nov. 16 by Board of Directors of East Fork Irrigation District Nos. 5 and 6, Hood Bldg., for diversion gates, dam and intake works and for enlarging canals. Noted Sept. 23.

Ore., Medford—Canal Improvements—Rogue River Canal Co. contemplates enlarging canal, building ten mile extension to Hopkins Canal and other improvements. Estimated cost, $250,000.

Ore., Salem—Reclamation—Surveys will be completed about Dec. 15 for reclamation of 75 miles on French Prairie. Noted Nov. 4.

Ore., Salem—Irrigation—Harney Basin Development Co. will irrigate about 50,000 acres.

Ore., Warrenton—Dredging—Surveys will be made for dredging mouth of Skipanon River at Warrenton. Estimated cost, $40,000.

Calif., Blythe—Irrigation—Plans prepared for irrigation of 60,000 acres for California Farm and Irrigation Co.

Calif., Lindsay—Irrigation—Preliminary surveys made for Lindsay Strathmore Irrigation District. Estimated cost, $1,600,000. John Burr, Charles K. Towt and others interested. Noted Nov. 4.

Calif., Los Angeles—Irrigation—Board of Supervisors contemplating issuing $2,606,000 bonds for organization of Irrigation District No. 3.

Calif., Pollasky—(Friant post office)—Irrigation Dam—Madera Canal and Irrigation Co. contemplates building irrigation dam across San Joaquin River near mouth of Hildreth Creek.

Calif., Stockton—Irrigation—Board of Supervisors will issue $300,000 bonds for West Side Irrigation District to irrigate 11,000 acres, pumping plant and ditch system. Noted Oct. 28.

Bids In and Contracts Awarded

Fla., Miami—Canals—South Florida Farm Co. awarded contract for 100 miles of canals and laterals on Lake Okeechobee in Lee and De Soto Counties to W. F. POLK.

Miss., Silver City—Canals—Contract for 15 miles of canals for Atchafalaya Drainage and Levee District awarded to W. P. BULLOCK CO., Kansas City, Mo., at $0.0777 per cu.yd.; 90,000 cu.yd. of levees to C. B. BOX, Midnight, Miss., at $0.23 per cu.yd. Noted Oct. 14.

Ky., Henderson—(Official)—Drainage—Contract for 34,810 ft. drainage ditch awarded to A. BENNEMAN, Chicago, Ill., at $11,600. Noted Oct. 14.

Ohio, Toledo—Ditch—County Commissioners awarded contract for Harris Ditch to C. J. BOSTON, Monclova, Ohio.

Iowa Council Bluffs—Drainage—Contract for improving Allen Creek ditch and Fish Lake of Harrison-Pottawatomie Drainage District No. 1 awarded to R. S. MORROW, Omaha. Estimated cost from $38,000 to $50,000. Noted Oct. 21.

Iowa, Jefferson—Drainage—Contracts for drainage work in Drainage District No. 102, Greene County awarded as follows: SAC CITY CEMENT PRODUCTS CO., at $26,336, ARTHUR McHOSE, at $28,870, BART JONES AND C. A. MOORE, at $20,974.

Iowa, Jefferson—(Official)—Drainage—Contract for tile for drain No. 108, Franklin Township, awarded to JEFFERSON CEMENT PRODUCTS CO., at $11,017; labor to THOMAS LARSEN, Callender, at $9,703. Noted Oct. 21.

Minn., Blue Earth—(Official)—Ditch—Contract for County Ditch No. 32, Fairbault County, awarded to OTTO MILLER, at $14,435. Noted Oct. 21.

Ark., Corning—Ditch—Contract for 1,560,000 cu.yd. of ditch and 116,500 cu.yd. of levee work for Big Gun Drainage District, Clay and Green Counties, awarded to NORTHERN CONSTRUCTION CO., Elkhart, Ind., at $116,330.

Ark., Pocahontas—Drainage—Contract for drainage work in Big Running Water and Tupeld Drainage Districts awarded to SCHWEINGRUBER & POWERS, Datto, Ark.

Tex., Victoria—Drainage—Contract for improving Drainage District No. 3 awarded to U. B. McCURDY. Estimated cost, $190,500. Noted Sept. 30.

Colo., Sterling—Dam—North Sterling Irrigation District awarded contract for refacing dam 100 ft. high to CLARK & HESSELMAN, Pueblo. Estimated cost, $100,000.

N. M., Tularosa—Irrigation—Contract for installing pumping plant on Tularosa Creek for irrigation of 500 acres awarded to J. E. MALONEY.

MISCELLANEOUS

Proposed Work

N. Y., Buffalo—Wharf Improvements—Commissioner of Public Works will soon award contract for concrete wall paralleling the Bird Island Pier, 50x80 ft. out in river. Wall will be 3,000 ft. long.

N. J., Trenton—Fire-Alarm Station—Board of Commissioners will build central station for new police fire-alarm system.

Penn., Philadelphia—Piers—Cramp Shipbuilding Co. granted permission to build two piers into Delaware River at Girard Ave. Estimated cost, $45,900.

Penn., Philadelphia—(Official)—Pier—Bids will be received until noon, Dec. 6, by John Meigs, Dir. of Dept. of Wharfs, Docks and Ferries, 555 Bourse Bldg., Philadelphia, for superstructure of McKean St. Pier, Nos. 78 and 80 south, and adjacent bulkhead shed in Delaware River between McKean St. and Snyder Ave. Estimated cost, $500,000. Noted Aug. 26. (See adv.)

Md., Baltimore—Tunnel—Preliminary plans prepared for tunnel under Patatsco River for Pennsylvania R.R. Estimated cost, $12,000,000.

W. Va., Huntington—Subway—Plans prepared for subway in Tenth St. for Chesapeake & Ohio R.R. Co. Estimated cost, $50,000.

Miss., Bay St. Louis—Seawall—Bids will be received until Dec. 1 by Charles G. Moreau, seawall. Noted Oct. 21.

Ky., Louisville—Park Improvements—Park Commissioners considering improvements to parks.

Ohio, Portsmouth—Flood Protection—Bids will be received until noon, Nov. 17, by William Gergens, Dir. of Pub. Ser., for second section of flood protection wall. Noted Oct. 7.

Ohio, Springfield—Retaining Wall—Bids will be received until noon, Nov. 29, by Walter J. Barrett, City Audr., for purchase of $13,500 bonds for building and improving retaining walls in Mill Run. Noted Oct. 21.

Ohio, Wellsville—(Official)—Dikes—Citizens voted $50,000 for dykes. Noted Oct. 28.

Ind., Ft. Wayne—Elimination of Grade Crossing—Plans prepared for track elevation for Pennsylvania R.R. and Wabash R.R. Alexander C. Shand, Philadelphia, Penn., Ch. Engr., Pennsylvania R.R.

Ill., Belleville—Tunnel—City contemplates building tunnel to care for flood waters of Richland Creek which will bisect city from north to south. John Taylor, interested.

Ill., East St. Louis—Coal Terminal—Wiggins Ferry Co. contemplates building coal terminal at foot of Trendley Ave.

Wis., Beloit—Mausoleum—City will build mausoleum within year. Estimated cost between $45,000 and $75,000.

Neb., Omaha—Crane—Bids will be received until Nov. 16 by T. J. O'Connor, City Clk., for railroad crane of five tons capacity.

Mo., St. Joseph—Speedway—Plans prepared for two-mile speedway at Lake Contrary. John Prince interested. Estimated cost, $2,000,000. Noted Nov. 4.

Tex., Galveston—Dry Dock—J. J. Kane and associates plan dry dock and marine way.

Tex., Galveston—Wireless Station—Marconi Wireless Telegraph Co. will build wireless station with sufficient power to send and receive message from Europe.

Tex., Houston—Wharves and Slips—City contemplates expenditure of $1,000,000 for wharves and slips next year.

Tex., Orange—Dredging—Bids will soon be received for dredging slips for wharfs and docks. E. U. Henry, City Engr.

Wash., Seattle—Sprinkling System—Chicago, Milwaukee & Puget Sound Ry. Co. will install automatic sprinkling system for protecting Milwaukee docks on East Waterway. Estimated cost, $15,000.

Wash., Tacoma—Dike—County Commissioners of Pierce County, Thomas N. Morris, Audr., plans dikes along Lincoln Ave. on tideflats of Hylebos Creek. Estimated cost, $200,000.

Ore., Bandon—Jetty—Plans being prepared by Port Engineer for south jetty for Port of Bandon. Estimated cost, $20,000.

Calif., Huntington Beach—Subway Work—Bids will be received until Nov. 15 by City Clerk for reinforced-concrete pipe culverts, reinforced concrete and timber subway and approaches under Southern Pacific tracks.

Calif., Los Angeles—Elimination of Grade Crossings—Pacific Electric Ry. Co. will elevate tracks from station at Sixth and Main St. to San Pedro St. Estimated cost, $300,000.

Calif., Ocean Beach—Seawall—Citizens contemplate issuing $50,000 bonds for seawall.

Que., Montreal—Elimination of Grade Crossing—Plans prepared for eliminating grade crossing at St. Denis St. over tracks of Canadian Pacific Ry., which will involve building of bridge 500-ft. long with ornamental balustrades and electric-light standards. Estimated cost, $70,000.

Ont., London—Subway—H. A. Brazier, City Engr., estimates cost of Egerton St. subway to be $94,000.

Bids In and Contracts Awarded

Mass., Boston—Convenience Station—Contract for convenience station awarded to M. S. KELLIHER, Oak St., Atlantic. Estimated cost, $13,009.

N. Y., New York—(Borough of Brooklyn)—(Official)—Station Finish—Bids were received Nov. 5 for station finish for 11 stations on Broadway-Fourth Ave. Rapid Transit R.R. from A. L. GUIDONE, 131 East 23d St., N. Y., at $513,656 (awarded contract); Louis Wechsler, $535,000; Marble Arch Co., $546,000. Noted Nov. 4.

N. Y., New York—(Borough of Brooklyn)—Terminal—New York Municipal Ry. awarded contract for Coney Island Terminal to GEORGE W. McNULTY CO., New York.

N. Y., New York—(Borough of Queens)—(Official)—Storm Drain—Bids were received Nov. 3 for storm drain for Queensborough Rapid Transit R.R. from Murphy Bros., Madison Ave. and 42d St., N. Y., at $7421; Lawrence Contracting Co., 2409 Walton Ave., N. Y., at $9,326; L. J. Moran, at $9,817.

N. J., Deal Beach—Bulkhead—Contract for bulkhead awarded to FRANK R. STONEWALL, Melvin, N. J., at $13,885. Noted Nov. 4.

N. J., Jersey City—Trap Rock—Hudson County Park Commissioner awarded contract to CHARLES T. KAVANAUGH, Bayonne, at $1.54 per cu.yd. for 3,300 cu.yd. 2½-in., 2,100 cu.yd. 1½-in. and 300 cu.yd. of ¾-in. broken trap rock; JAMES BRADY'S SONS CO., at $1.16 per bbl. for 500 bbl. of cement.

Penn., Philadelphia — Superstructures—McCLINTIC-MARSHALL CO., Philadelphia, awarded contract for steel superstructures on three sections of Frankford Elevated Line extending from Girard Ave. north to Unity St. at $1,455,000. Noted Nov. 4.

Penn., Pittsburgh—Retaining Wall—Contract awarded to WILLIAM J. PAYNE, JR., CO., at $20,460, for various retaining walls along Scotia Hollow Rd. in Jefferson Township.

Penn., St. Clair—Elimination of Grade Crossing—Contract awarded to P. J. CAMPION, Mahanoy City, for subway under Reading Ry. at northern section of Second St. on line of Schuylkill Ry. Co. to eliminate grade crossing.

Va., City Point—Pier—E. I. Du Pont de Nemours Powder Co. awarded contract to W. D. MURRAY & CO., at $50,000, for pier on James River.

Va., Lamberts Point—(Norfolk post office)—Piers—Press reports state that John P. Pettyjohn & Co., Lynchburg, will be awarded contract for two piers for Norfolk & Western R.R. Estimated cost, $1,800,000. Noted Oct. 14.

La., New Orleans—Levee—State Board of Engineers awarded contract to A. G. THOMAS, at $5 per hour for levee from Happy Jack to Butlar.

Ill., Alton—Tunnel—Board of Administration, Alton State Hospital, awarded contract to STRUBEL & HELMICK, Alton, at $53,850, for tunnel system.

Ill., Shawneetown—Levee—River and Lakes Commission awarded contract for repair work to Shawneetown Levee to J. A. CAMPBELL, Oakland, Ind., at $0.67 per cu.yd.

Wis., Lake Geneva—Storage Tank—John C. Flemming awarded contract to J. D. READER for 10,000-gal. storage tank and steel support.

Wis., Superior—Dock Improvements—M. A. Hanna & Co. awarded contracts for improvements to docks to BARNETT RECORD CO., concrete work; MEAD MORRISON CO., Chicago, Ill., steel work. Estimated cost, $90,000.

Wis., Superior—Freight Steamer—Interlake Steamship Co., Cleveland, Ohio, awarded contract to AMERICAN SHIP BUILDING CO., at $440,000, for 60x600-ft. freight steamer.

Iowa, Muscatine—Terminal—Levee Commission awarded contract to B. LAYTON, Chicago, Ill., at $13,676, for terminal.

Tex., Temple—(Official)—Fire-Alarm System—Contract for fire-alarm system awarded to GAMEWELL FIRE ALARM CO, Estimated cost, $10,000. Noted Oct. 28.

Tex., Victoria—Freight Pier—Contract for reinforced concrete pier 1,000 ft. long and 100 ft. wide for Raisin, Fordtran & Smiley Ry. awarded to FRED URBAN BUILDING CO. Estimated cost, $1,000,000.

Wash., Cathlamet—Dike—Contract for 17 miles of dike on Columbia River awarded to MONTAGUE & O'REILLY, Portland, Ore., at $99,000. Noted Oct. 21.

Wash., Seattle—Bulkhead—Contract for filling and bulkheading East Marginal Way awarded to PUGET SOUND BRIDGE AND DREDGING CO., Seattle, at $80,957. Noted Oct. 14.

Ore., Portland—Elimination of Grade Crossing—Contract for underground crossing on Sandy Rd. awarded to CROWLITZ BRIDGE CO.

Calif., San Francisco—(Official)—Esplanade—Contract for Section A of esplanade and sea wall awarded to C. E. LAMBURTH, San Francisco, at $48,500. Noted Nov. 4.

Porto Rico, San Juan—Bulkhead Shed—Bids received Oct. 1 by Harbor Board for (a) 841-ft. shed, (b) 529-ft. shed, (c) 1 crane, (d) 2 cranes as follows: J. Benitez, (a) $72,975, (b) $17,582, (d) $30,498: P. J. Carlin Construction Co., (a) $78,800, (b) $53,000, (c) $17,000, (d) $29,000; John Monks & Son, (a) $83,138, (b) $56,975, (c) $19,000, (d) $34,000. Noted Sept. 2.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Proposed Work

Mass., Boston—(Roxbury)—(Official) — Bids will be received by Schoolhouse Commissioners of City of Boston until noon, Nov. 12, for addition to High School of Practical Arts. Noted Oct. 28 and Nov. 4.

Mass., Boston—Plans being prepared for theater, bowling alleys, garage and stone building for Myer Dana, 209 Washington St. Silverman Engineering Co., 43 Tremont St., Arch. Estimated cost, $400,000.

Mass., Boston—Plans being prepared by Joseph D. McGinnis, Arch., 16 Arlington St., for 3-story school. J. P. Lomasney, Ch. of Schoolhouse Com. Estimated cost, $200,000.

Mass., Boston—Shawmut Avenue Real Estate Trust will build six-story mercantile building at Shawmut Ave. and Castle St. Estimated cost, $200,000. G. N. Meserve, Arch.

Mass., Boston—Plans being prepared by C. Howard Walker, 71 Kilby Bldg., Boston, for office building for Eugene F. Sullivan.

Mass., Boston—Josiah H. Bentors, Chn. Bd. of Trustees, plans addition to Public Library at Copley Sq. Estimated cost, $300,000.

Mass., North Adams—Bids will be received until Nov. 17 by E. C. and G. C. Gardner, Arch., Springfield, Mass., for three-story, 100x270-ft. brick high school. Estimated cost, $125,000. Noted Sept. 16.

Mass., Waltham—Bids will be received until Nov. 15 for one-story, 62x184-ft. brick and terra cotta church for St. Charles R. C. Church. Estimated cost, $80,000. Noted Oct. 7.

R. I., Providence—Bids will be received until Nov. 22 by Board of Contract and Supply for grammar school building. Carpenter & Sheldon, Arch. Estimated cost, $150,000. Noted Oct. 7.

Conn., Wethersfield—Plans being prepared for administration building for Connecticut Institute for the Blind. A. Raymond, Arch.

N. Y., Buffalo—Bids will be received until 11 a.m., Nov. 16, by E. J. Meyer, Chn. of Hospital Com., 1312 Main St., for hospital at Kensington Ave. and Grider St. Estimated cost, $600,000. Green & Wicks, 110 Franklin St., Arch.

N. Y., Far Rockaway—Board of Education contemplates building addition to Public School No. 39. Estimated cost, $50,000.

N. Y., New York—(Borough of Bronx)—(Official)—Preliminary plans being prepared by Louis Allen Abramson, Arch., 220-Fifth Ave., for four-story, 200x200-ft. hospital for Home of Daughters of Jacob, 302 East Broadway. Estimated cost, $400,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Preliminary plans being prepared by Mott B. Schmidt, Arch., 15 East 40th St., for 12-story, 25x100-ft. reinforced-concrete loft building for 23 West 57th St. Corps. Estimated cost, $150,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Plans prepared for 12-story, 25x100-ft. store and office building at 58th St. near Fifth Ave. for 25 West 57th St. Co., 128 Broadway M. B. Schmidt, Arch., 15 East 40th St. Estimated cost, $125,000.

N. Y., New York—(Borough of Manhattan)—(Official)—R. H. Almivoty, Arch., 220 Fifth Ave., preparing plans for alteration to loft and store building for Pinchot Estate, 60 Broadway. Estimated cost, $125,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Plans being prepared for addition to department store at Lexington Ave. and 60th St. for Bloomingdale Bros., 59th St. and Third Ave. Buchman & Fox, Arch., Madison Ave. and 42nd St. Estimated cost, $400,000.

N. Y., Rochester—Plans being prepared by Gordon & Madden, Arch., Sibley Bldg., for school No. 37. J. S. Mullan, Secy. Bd. of Education. Estimated cost, $90,000.

N. Y., Saranac Lake—Plans submitted by Mann & MacNeille, Arch., 70 East 45th St., N. Y., to C. M. Palmer, Chn. Local Development Com. of Bd. of Trade for hotel and club house. Estimated cost, $500,000.

N. J., Elizabeth—Bids will soon be received for El Mora School by the Board of Education. Estimated cost, $60,000.

N. J., Jersey City—Board of Commissioners will build school for crippled children.

N. J., Montclair—(Official)—Bids will be received until 8 p.m., Nov. 23, by Frank J. Taylor, Secy. Bd. of Education, for alterations to Spaulding School. Estimated cost, $50,000. Noted Oct. 28. (See adv.)

N. J., Morris Plains—Commission of Mental Defectives preparing preliminary plans for addition to State Hospital.

N. J., Newark—Citizens voted $1,500,000 bond issue for municipal memorial building.

N. J., New Providence—Bids will be received until Nov. 15 by Board of Education for Lincoln School.

N. J., Spring Lake—Plans prepared by Watson & Huckel, Arch., 1211 Walnut St., Philadelphia, Penn., for five-story brick addition to Hotel Monmouth. Estimated cost, $45,000.

N. J., Westfield—Holy Trinity Church contemplates building church and school on Westfield Ave. Estimated cost, $70,000.

Penn., Brackenridge—(Official)—Citizens voted $60,000 bonds for school. Noted Oct. 14.

Penn., Butler—Plans being prepared for three-story, 80x160-ft. lodge building for L. O. O. M. No. 67. M. Nirdlinger, Arch., Diamond Bank Bldg. Estimated cost, $75,000.

Penn., Carlisle—F. H. Hall, Secy. Pub. Charities Comn., contemplates building inebriate asylum. J. M. McColum, Berger Bldg., Pittsburgh, Arch. Estimated cost, $300,000.

Penn., Edgewood—Plans being prepared by Thomas Hannah, Arch., for church for First Presbyterian Church. Estimated cost, $75,000.

Penn., Harrisburg—Kesher Israel and Chisul Emuna Jewish Congregations have united and will build synagogue. Estimated cost, $80,000.

Penn., Hershey—First United Brethren Church will build church on Chocolate Ave. Estimated cost, $60,000. M. S. Hershey, interested.

Penn., Lewisburg—Union County contemplates one and two-story jail. A. H. Frick, Arch. Estimated cost, $75,000.

Penn., Lewistown—(Official)—Citizens voted $100,000 bonds for high schools. Noted Oct. 28.

Penn., Philadelphia—(Official)—Bids will not be received this year for one-story building for Beneficial Savings Fund Society. Estimated cost, $250,000.

Penn., Philadelphia—St. Carthage Church will build two-story stone church at 62nd St. and Cedar Ave. Henon & Boyle, Arch.

Penn., Philadelphia—Plans being prepared by W. H. Thomas, Arch., Philadelphia, for church at 51st and Spruce St. for Protestant Episcopal Chapel of Mediator. Estimated cost, $100,000.

Penn., Pittsburgh—Plans prepared by Thomas Hannah, Arch., for church for Edgewood Presbyterian Congregation. Estimated cost, $80,000.

Penn., Pittsburgh—Plans being prepared for five-story, 82x114-ft. building for First U. P. Church. Estimated cost, $300,000.

Penn., Scottdale—Plans being prepared for two-story church for United Brethren Church. Estimated cost, $40,000.

Penn., Wilkinsburg—Board of Education retained Ingham & Boyd, Arch., Vanderbilt Bldg., Pittsburgh, to prepare plans for school. Estimated cost, $300,000.

Penn., York—York County contemplates building one and two-story almshouse. B. F. Willis, 10 West Market St. Estimated cost, $400,000.

Del., Newark—Bids will soon be received for two-story agriculture building for Delaware State College. Day & Klauber, Arch., Philadelphia, Penn. Noted Oct. 21.

D. C., Washington—Plans being prepared by Marsh & Peter, Arch., 520 13th St., N. W., for preparatory school for Georgetown University. Estimated cost, $400,000.

D. C., Washington—Y. M. C. A. plans six-story building. C. L. Harding, Woodward Bldg., Arch. Estimated cost, $400,000.

D. C., Washington—Plans prepared by R. W. Geare, Arch., Woodward Bldg., for motion picture theater. Estimated cost, $100,000.

W. Va., Wheeling—Plans prepared by F. F. Faris, E. B. Frankheim and M. F. Giese, Archs., for clubhouse for Knights of Columbus. Estimated cost, $100,000.

W. Va., Wheeling—Royal Southern Amusement Co. plans to build theater and dance hall. Estimated cost, $50,000. G. H. Dieringer, 106 North Huron St., Arch.

Ga., Athens—Bids will be received until noon, Dec. 1, by W. T. Forbes, Secy. Bldg. Comn., for Y. M. C. A. building.

Fla., Jacksonville—Contracts for ten schools will be awarded in January by Board of Public Instruction of Duval County. Bonds for $1,000,000 sold. William B. Ittner, St. Louis, Mo., Arch.

Miss., Pass Christian—See item under "Streets and Roads."

La., New Orleans—Bids will be received until 5 p.m., Nov. 17, by Rathbone DeBuys and Charles R. Armstrong, Arch., 1018 Hibernia Bank Bldg., New Orleans, for Corinne Casanas Memorial Clinic Hospital at Birod St.

Tenn., Knoxville—Board of Commerce contemplates building to be known as Tennessee Vocational Reformatory for Girls. Estimated cost, $50,000.

Tenn., Memphis—Plans being prepared for six-story building at Union Ave. and Third St. for Frank G. Jones. Estimated cost, $75,000.

Tenn., Murfreesboro—Plans prepared by R. H. Hunt, Arch., Chattanooga, for new Baptist Church. Estimated cost, $40,000.

Tenn., Nashville—Board of Education having plans prepared by W. B. Ittner, for addition to high school building. Estimated cost, $100,000.

Tenn., Nashville—Commercial Club will remodel Vanderbilt Law Bldg., and build swimming pool. Marr & Holman, Nashville, Arch. Estimated cost, $75,000.

Ky., Ashland—Congregation of Ashland Methodist Episcopal Church plans to build church and Sunday school. Estimated cost, $75,000. V. T. Ritter, 1119 First National Bank Bldg., Huntington, W. Va., Arch.

Ky., Georgetown—(Official)—Citizens defeated $90,000 bonds for new school. Noted Oct. 14 and 21.

Ky., Lexington—(Official)—Citizens voted $100,000 bonds for two schools. Noted Aug. 28.

Ohio, Avondale—Plans being prepared by Samuel Hannaford & Son, Arch., for building for Bethesda Hospital. Estimated cost, $50,000.

Ohio, Bratenahl—(Cleveland post office)—Plans prepared by A. Garfield, Arch., 815 Garfield Bldg., Cleveland, for city hall building at East 105th St. C. A. Neff, City Clk.

Ohio, Canton—Bids will be received by School Board until Nov. 22 for Daniel-Worley School.

Ohio, Chillicothe—A tuberculosis hospital will be constructed by Ross, Fayette, Highland, Sciota and Fairfield Counties. Estimated cost, $40,000. Robert Alexander, Secy.

Ohio, Chillicothe—Bids will soon be received for two-story memorial building and armory for Fourth Regiment. Estimated cost, $65,000.

Ohio, Cleveland—Citizens voted $2,000,000 bonds for schools and improvements to schools. Noted Oct. 17.

Ohio, Cleveland—Cleveland Council, Knights of Columbus, contemplate new clubhouse. Estimated cost, $50,000.

Ohio, Cleveland—Plans prepared by William S. Lougee, Arch., 500 Marshall Bldg., for two-story club house at 2097 East 21st St. for Bricklayers' Union. Estimated cost, $40,000.

Ohio, Cleveland—Bids will soon be received by Hubbell & Benes, 201 Avenue Bldg., Arch., for club house and auditorium for Al Koran Temple of the Mystic Shrine. Estimated cost, $300,000.

Ohio, Cleveland—Mall Building Co. will not build theater until spring. Estimated cost, $65,000.

Ohio, Cleveland—Plans are being prepared by Franz C. Warner, Arch., 767 Hippodrome Bldg., for four-story, 110x120-ft. college for Western Reserve University Dental School. Estimated cost, $125,000.

Ohio, Cleveland—Bids will soon be received for four-story, 60x145-ft. addition for St. Alexis Hospital, Sisters of St. Francis. William C. Jamsen, Arch., 403 O'Brien Bldg. Estimated cost, $150,000. Noted Nov. 4.

Ohio, Columbus—Howard & Merriam contemplate building school in Goshen Township. Estimated cost, $40,000.

Ohio, Columbus—Plans prepared for school building for Preble County.

Ohio, Columbus—Plans prepared by Stribling & Lum, Arch., for Columbus General Hospital at Indianola Ave. and Glen Echo Ravine.

Ohio, Columbus—Bids will be received until noon, Nov. 15, by Ohio State University, Carl E. Steeb, Secy., for Homeopathic Hospital.

Ohio, Dayton—Peter Kuntz will build tuberculosis hospital above Stillwater River off Covington pike. Estimated cost, $500,000.

Ohio, Elyria—Plans being considered by Willys-Overland Co. for hospital for employees. Estimated cost, $60,000.

Ohio, Fremont—Grace Lutheran Church plans one-story church and parish house. Estimated cost, $75,000.

Ohio, Lakewood—Citizens voted $500,000 bonds for schools

Ohio, Martins Ferry—Preliminary plans being prepared by C. W. Bates, National Bank of West Virginia Bldg., for store, bank and office building for German Savings Bank. Estimated cost, $80,00. E. E. McCombs, Pres.

Ohio, Norwood—South Norwood Welfare Association interested in plan to issue $45,000 bonds for new school in Norwood View.

Ohio, Old Fort—Board of Education retained H. C. Millott, Arch., 411 Columbus Ave., to prepare plans for two-story, 98x108-ft. school. Estimated cost, $40,000.

Ohio, Painesville—Preliminary plans prepared for gymnasium for Lake Erie College. Bids will not be received until spring. Estimated cost, $70,000.

Ohio, Somerville—(Official)—Bids will be received until noon, Nov. 20, by F. W. Peter, Clk., Bd. of Education of Somerville Village School District, for fire-proof school building.

Ohio, Steubenville—Bids will soon be received for three-story, 48x70-ft. lodge and store building for Lodge No. 1, Knights of Pythias. Estimated cost, $40,000. J. C. Ault, Market St., Chn. of Trustees.

Ohio, Toledo—A 16-story, reinforced-concrete hotel will be constructed on site of present Boody House. Estimated cost, $3,000,000.

Ohio, Uhrichsville—Board of Education plans to hold election to vote on bond issue for $40,000 for new school on Trenton Ave. and repairing Main St. school.

Ohio, Warren—Plans being prepared by Crow, Lewis & Wickenhoefer, Arch., 200 Fifth Ave., New York, N. Y., for two-story church for First Presbyterian Church. Estimated cost, $55,000.

Ohio, Wooster—Board of Education of Wayne Township plans to issue $40,000 bonds for high and grade school.

Ohio, Youngstown—Y. W. C. A. plans to build a five-story, 58x144-ft. dormitory. Estimated cost, $40,000. E. F. Moore, 225 W. Raven St., Gen. Secy.

Ind., Brookston—Edward Ferguson, Trustee, has retained Elmer E. Dunlap, 909 State Life Bldg., Indianapolis, Arch.., to prepare plans for high and grade school. Estimated cost, $40,000.

Ind., Springfield—Board of Education contemplates building high school at Eighth and North B St. Estimated cost, $150,000.

Ind., Terre Haute—(Official)—Bids will be received about Dec. 1 for 16-room school at 25th and Fourth Ave. Estimated cost, $70,000. John & Miller, Ball Bldg., Arch. Noted Oct. 28.

Mich., East Lansing—Bids will be received until noon, Nov. 17, by A. M. Brown, Secy. State Bd. of Agriculture, for gymnasium at Michigan Agriculture College. E. A. Brown, Lansing, Mich., Arch.

Mich., Grand Rapids—Bids will soon be received by Lee De Camp, Arch., 26 Empress Bldg., for three-story, 13,132-ft. theater. Estimated cost, $225,000. Noted Aug. 12.

Mich., Lansing—Bids will be received about Nov. 15 for eight-story 45x100-ft. bank and office building for Lansing State and Savings Bank. S. D. Butterworth, Arch., 432 Tussing Bldg. Noted Oct. 28.

Ill., Chicago—Chicago Theological Seminary contemplates building theological school. Estimated cost, $200,000.

Chicago, Ill.—Chicago Telephone Co., 212 West Washington St., will build three-story brick exchange at 1509 North Western Ave. Estimated cost, $90,000.

Ill., Danville—Bids will soon be received for four-story, 75x150-ft. building for Masonic Lodge. Estimated cost, $150,000. J. Sutton, Secy.

Ill., Decatur—State Federation of Labor contemplates building temple. Estimated cost, $75,000.

Ill., Freeport—Elks of Moline will build lodge building. Estimated cost, $100,000.

Ill., Mendota—Citizens voted $60,000 bonds for high-school building.

Ill., Springfield—Charles H. Seward will build three-story building at Third and Adams St. Estimated cost, $50,000.

Wis., Kenosha—Kenosha County Supervisors plan to build hospital for insane. Estimated cost, $100,000.

Wis., Madison—Chicago, Milwaukee & St. Paul Railway will build new union station. Estimated cost, $16,000,000.

Wis., Milwaukee—Plans being prepared for 12-story 120x120-ft. club house for Ticonic Investment Co., 927 Wells Bldg. Estimated cost, $500,000.

Wis., Milwaukee—Bids will be received in December for two-story, 109x174-ft. and one-story, 35x76-ft. school and power house for Board of Education. Van Ryn & De Gelleke, Caswell Bldg., Arch.

Wis., Milwaukee—Henry G. Lotte, Arch., 304 West Water St., preparing plans for one-story moving-picture theater for O. L. Meister. Estimated cost, $50,000.

Wis., Milwaukee—Plans prepared by Schmidt, Garden & Martin, Arch., 104 South Michigan Ave., Chicago, Ill., for four-story Columbia Hospital at Hartford and Maryland Ave. Estimated cost, $300,000.

Wis., Waukegan—Carroll College will build gymnasium in connection with proposed boys dormitory. Estimated cost, $100,000.

Minn., Minneapolis—Milwaukee Railway Co. contemplates passenger station in southern part of city. Estimated cost, $100,000.

Minn., St. Paul—Work will soon be started on building of 12-story addition to St. Paul Hotel. Estimated cost, $250,000.

Kan., Coffeyville—Preliminary plans being prepared by C. A. Henderson, Arch., Kellogg Bldg., for school buildings for Board of Education. G. Halsey, Clk., Bd. of Education. Estimated cost, $56,000. Noted Sept. 30.

Kan., Salina—Work will be started in spring on academy for Sisters of St. Joseph. Estimated cost, $200,000.

Kan., Wichita—New bids will be received until Nov. 22 for Y. M. C. A. building. Estimated cost, $65,000. H. S. Conrow, Beacon Bldg., Arch. Noted Oct. 28.

Kan., Winfield—Plans prepared for six-story hotel on Main St. and Ninth Ave. for Capitalists of Winfield. Estimated cost, $200,000. Noted Nov. 4.

Mo., St. Louis—Bids will be received until noon, Nov. 19, by Board of Public Works, 315 City Hall, for first unit of new children's building for City of St. Louis.

Tex., Austin—Plans being prepared for hotel for H. A. Wroe and associates. Estimated cost, $500,000.

Tex., Wichita Falls—(Official)—Election will be held Nov. 20 to vote on $150,000 bonds for courthouse. Noted Oct. 14.

Okla., Holdenville—Election will be held Nov. 17 to vote on $100,000 bonds for courthouse and jail.

Okla., Vinita—Citizens contemplate holding election to vote on $50,000 bonds for courthouse. E. J. McBride, County Clk.

Colo., Denver—Board of Education will build three schools. Estimated cost, $140,000.

Colo., Loveland—Citizens voted $90,000 bonds for high and grammer school. Noted Oct. 21.

Wash., Bellingham—Trezise Estate will build three-story, 55x125-ft. building at 1214 Commercial St. Estimated cost, $60,000.

Ore., Pendleton—W. H. McCormack, Pendleton, retained C. E. Troutman, Arch., to prepare plans for anamusement resort consisting of hotel, matatorium and 20 cottages. Estimated cost between $50,000 and $75,000.

Calif., Lodi—(Official)—Election will soon be held to vote on bonds for school. Otto Weihe, Secy. School Bd. Noted Oct. 21.

Calif., San Francisco—Ellis Street Investment Co. is financing a project for building theater at Ellis and Mason St. Estimated cost, $300,000.

Bids In and Contracts Awarded

Maine, Bucksport—Contract for theater for H. O. Hussey awarded to OTTO NELSON CO., Bangor.

Mass., Holyoke—(Official)—All bids received for isolation hospital for city rejected as being too high. Estimated cost, $40,000. Noted Oct. 21 and 28.

Mass., Milford—Contract for brick construction of school awarded to DILLON BROS., Milford, at $69,873. Noted Sept. 30.

Mass., Worcester—Notre Dame Church awarded contract to E. BELISLE for three-story, 69x72-ft. parochial school. Estimated cost, $50,000.

R. I., Providence—Contract for dormitory for State Home and School awarded to CRUISE & SMILEY CO., Pawtucket. Noted Oct. 21.

Conn., Milford—(Official)—Contract for municipal building awarded to NORMAN KER, 1123 Broadway, N. Y., at $120,000. Noted Oct. 14 and 28.

Conn., New Haven—New Haven Hospital awarded general contract for eight buildings to TRACY BROS., Waterbury, Conn. Estimated cost, $400,000.

N. Y., Albany—Contract for six-story office building at 124 State St. for Municipal Gas Co. awarded to WELLS BROTHERS CO. Estimated cost, $250,000. Noted Sept. 16.

N. Y., New York—(Borough of Brooklyn)—(Official)—Bids were received Nov. 1 by Park Commission for two-story lecture hall and greenhouse extension for Brooklyn Botanic Garden from Frymier & Hanna Co., 25 West 45th St., at $140,223; Thomas McKeown, 103 Park Ave., at $147,235; P. F. Kenney Co., 33 Old Broadway, at $155,000. Noted Sept. 30.

N. Y., New York—(Borough of Manhattan)—St. Bernard's R. C. Church, 328 West 14th St., awarded contract for five-story, 66x125-ft. school to JOHN BRADY & CO., 103 Park Ave. Estimated cost, $130,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for lounge room for Hotel Biltmore, 43d St. and Madison Ave., for New York Central R.R. Co. awarded to JOHN PIERCE, 383 Madison Ave. Estimated cost, $50,000. Noted Oct. 14.

N. Y., White Plains—(Official)—Contract for penitentiary and workhouse at East View, for Westchester County, awarded to JOHN T. BRADY & CO., 52 Vanderbilt Ave., at $500,000. Noted Sept. 9.

N. J., Hoboken—(Official)—Hoboken Land and Improvement Co. awarded contract to TURNER CONSTRUCTION CO., 11 Broadway, N. Y., for Section D of 12-story, 81x263-ft. building at 15th St.

N. J., Newark—Board of Education awarded contract for Milford School at 18th Ave. to E. M. WALDRON & CO., INC., at $101,090 for mason and carpenter work, CHARLES GOELLER CONSTRUCTION CO., at $13,645 for steel and iron. Noted Oct. 28.

Penn., Allentown—Board of Education awarded general contract to OCHS CONSTRUCTION CO., 450 Wire St., at $79,125, for two-story school.

Penn., Lebanon—Bids have been received for two-story high-school building from F. W. Finn, Altoona, at $149,330, and Pitzell & Kuhn, Lancaster, at $207,169. A. A. Richter, Reading, Penn., Arch.

Penn., Philadelphia—(Bustleton)—(Official)—Contract for two-story school addition awarded to MELODY & KEATING, Bailey Bldg., at $40,444. Noted Oct. 28.

Ga., Macon—(Official)—Contract for three-story, 84x245-ft. main station, 54x12-ft. baggage building, 54x132-ft. express building for Central of Georgia R.R. Co. awarded to J. HENRY MILLER, Baltimore, Md. Estimated cost, $1,000,000. Noted Sept. 30.

Tenn., Nashville—Contract for seven-story office building for Nashville Property Co. awarded to AMERICAN CONSTRUCTION CO.

Ohio, Athens—Contract awarded to CULLEN & VAUGHN, Hamilton, Ohio, at $97,796, for women's dormitory for Ohio University. Noted Oct. 14.

Ind., Terra Haute—(Official)—A. W. Stoolman, Champaign, Ill., submitted lowest bid for building for Masonic Temple Association. Estimated cost, $90,000. Noted Oct. 7.

Ill., Alton—Alton State Hospital awarded contract for dinning hall to FRANK VOORHEES, at $70,000.

Wis., Madison—State Board of Control of Charitable and Penal Institutions awarded contract for substructure of first unit of Southern Home for Feeble-Minded, Racine County, to C. A. DIEMAN CO., Wauwatosa.

Iowa, Rock Rapids—Contract for three-story courthouse awarded to A. M. WOLD CONSTRUCTION CO., Brookings, S. D., at $107,300. Noted Oct. 7 and 28.

Kan., Hiawatha—Contract awarded to CENTRAL CONCRETE CONSTRUCTION CO., Kansas City, Mo., at $53,650, for erecting high school. Noted Oct. 28.

Tex., El Paso—Contract for high school awarded to AMERICAN CONSTRUCTION CO., Houston, at $272,900. Noted Oct. 14.

Wash., Seattle—(Official)—Board of Regents, University of Washington, awarded contract for university building to TINNE & GJARDE, 725 Northern Bank and Trust Bldg., Seattle, at $99,936. Noted Oct 7.

Calif., San Francisco—Standard Oil Co. awarded contract for addition at Bush and Sansome St. to P. J. WALKER CO., at $100,000.

SEWERS, BOSTON, MASS.

Bids were received Aug. 24 by the Board of Public Works for constructing sewers and drains in Albany St. from (A) William Barrett & Co.; (B) West Roxbury Trap Rock Co.; (C) James J. Conway; (D) Antony Cefalo; (E) Peter W. Hill; (F) Atlas Contracting Co.; (G) Coleman Bros.; (H) James J. Coughlin Co.; (I) George J. Regan; (J) George M. Bryne; (K) Anthony Baruffaldi; (L) M. De Sisto; (M) Bruno & Petitti; (N) McCarthy & Walsh; (O) Michael Russo & Co.; (P) A. G. Tomasello; (Q) J. H. Ferguson & Co.; (R) Hugh Nawn Contracting Co.

	A	B	C	D	E	F	G	H	I
243 lin.ft. 24-in. pipe sewer	$2.57	$2.95	$1.00	$4.00	$2.65	$13.00	$2.00	$2.00	$1.50
887 lin.ft. 18-in. pipe sewer	2.51	2.95	1.00	3.80	2.65	13.00	2.00	2.00	1.50
10 lin.ft. 15-in. pipe sewer	2.70	2.00	1.50	3.50	3.00	5.00	1.50	1.25	2.00
70 lin.ft. 12-in. pipe sewer	2.70	2.00	1.50	3.50	2.15	5.00	1.50	1.25	2.00
10 lin.ft. 10-in. pipe connection with intercepting sewer	10.00	2.00	3.00	3.50	1.75	5.00	1.50	1.50	2.50
1,700 lin.ft. 2 ft., 6 in. x 4 ft., 4 in. concrete sewer	3.67	3.75	2.00	4.50	4.10	3.50	3.25	3.25	5.00
650 lin.ft. 2 ft., 0 in. x 4 ft., 0 in. concrete sewer	3.00	3.25	2.00	4.00	3.20	13.50	3.00	3.25	4.00
100 cu.yd. excavation below grade	3.00	3.00	2.00	5.00	1.50	3.00	1.50	2.00	3.00
30 cu.yd. excavation above grade	3.00	.50	2.00	3.00	1.50	2.00	1.00	2.00	3.00
20 cu.yd. rock excavation	5.00	6.00	10.00	6.00	6.00	.....	2.00	5.00	5.00
200 cu.yd. clean gravel refill	.....	1.00	.....	4.00	1.50	.....	1.50	1.00	3.00
Spruce piles under 20 ft. in length	.25	.25	.25	.25	.25	.25	.25	.25	.25
Spruce piles 20 ft. to 30 ft. in length, both inclusive	.25	.25	.25	.25	.25	.25	.25	.25	.25
Spruce piles exceeding 30 ft. and including 40 ft	.28	.28	.28	.28	.28	.28	.28	.28	.28
Spruce piles exceeding 40 ft. in length	.35	.35	.35	.35	.35	.35	.35	.35	.35
250 M ft. b.m. spruce lumber for sheeting and shoring	.....	.....	24.00	.....	.....	.....	20.00	25.00	.....
5 M ft. b.m. 2-in. spruce for sheeting and shoring	40.00	30 00	60.00	35.00	40.00	36.00	30.00	30.00	60.00
5 M ft. b m. 3 to 6-in. planed grooved and Georgia pine	.....	.....	.....	.....	40 00	.....	34.00	40.00	.....
37 M ft. b.m. spruce lumber for pile gaps, platforms	30.00	30.00	30.00	.....	40 00	40.00	35.00	25.00	50.00
3,540 lin.ft. pipe underdrain	.20	.05	.....	.25	.25	.30	.20	.30	.....
1,850 cu.yd., Class A, concrete	6.80	8.00	7.00	7.00	7.00	.....	7.00	7.50	8.00
Class A, concrete mixed hydrated lime	.50	.50	.50	.50	.50	.50	.50	.50	.50
Class B concrete	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Class C concrete	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
460 lin.ft. 10-in. pipe catch basin drain	.75	1.00	1.00	1.00	1.00	.60	1.00	1.25	2.00
Pipe for chimneys	.15	.15	.15	.15	.15	.15	.15	.15	.15
100 lin.ft. laying pipe house drain	.....	1.00	1.00	.....	1.00	1.00	1.00	1.00	1.00
350 lin.ft. relay, reconn., existing house drain, in or outside main trench	1.00	1.00	.10	4.00	1.00	.....	.70	1.00	3.00
240 lin.ft. relaying, reconnect., existing catch basin drain	1.00	1.00	.10	3.00	1.00	.....	.70	1.00	3.00
50 lin.ft. relaying, reconn., existing drain other than house and catch basin drain	.....	.50	.10	.....	1.00	.....	1.00	1.25	.....
50 lin.ft. relaying, reconn., existin drain outside main trench other than house and catch basin drain	.....	.50	2.00	.....	1.00	.....	1.00	1.25	.....
Placing Y's in existing pipe sewers or surface drain	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Placing slants or connections in existing masonry sewers drain	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
360 slants or connections in new masonry sewers or sewers drain	.10	.10	.10	.10	.50	.....	.20	.25	.10
Laying and connecting 3 to 10-in. metal pipe in or outside main trench	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
115 tons steel rods or bars for masonry rein	49.00	35.00	40.00	42.00	35.00	.....	45.00	40.00	60.00
14 manholes on new concretes	30.00	40.00	40.00	40.00	60.00	50.00	45.00	45.00	45.00
7 manholes on new or old sewers	35.00	40.00	40.00	45.00	40.00	50.00	60.00	45.00	50.00
1 manhole on existing masonry sewer	40.00	40.00	50.00	50.00	75.00	60.00	60.00	45.00	50.00
1 sump manhole	50.00	75.00	100.00	50.00	75.00	120.00	70.00	50.00	50.00
8 catch basins built	50.00	60.00	40.00	60.00	60.00	.....	40.00	40.00	60.00
40 existing catch basins rebuilt	5.00	10.00	20.00	10.00	30.00	.....	13.00	30.00	30.00
Other brick masonry	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Catch basin traps taken out and reset and catch basin drain	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Guttermouths for catch basins or drop inlets cut in existing edgestone	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1 connection between new and existing conduits	5.00	10.00	50.00	10.00	25.00	5,000	50.00	30.00	50.00
170 sq.yd. granite block paving	.50	1.00	1.00	.....	.75	.....	.40	.50	1.00
60 ton crushed stone	1.50	1.50	1.50	3.00	2.00	.....	2.00	1.75	2.50
Placing cradles for pipe crossings for pipes	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
6,400 list value single strength sewer pipe	74%	73%	70%	75%	60%	73%	67%	70%	70%
$100 list value double strength sewer pipe	64%	65%	50%	100%	50%	50%	61%	65%	60%
1 tide gate chamber	25.00	200.00	150.00	50.00	100.00	230.00	200.00	50.00	75 00
170 sq.yd. existing pavement with concrete base rem	.50	.30	1.00	.50	.75	.30	.60	.35	.30
2,030 lin.ft. old sewers removed	.....	.....	.50	.....	1.00	.....	1.00	.10	.....
Supporting and protecting buildings and structures	.....	.....	.....	.....	100.00	100.00	25.00	100.00	.....
4 old catch basins removed, contents masonry, stone work inc	5.00	10.00	25.00	60.00	15.00	.....	10.00	15.00	.....
Extended totals	$36,414	$37,183	$37,985	$41,893	$42,277	$43,782	$43,789	$44,322	$45,962

	J	K	L	M	N	O	P	Q	R
243 lin.ft. 24-in. pipe sewer	$2.75	$3.00	$1.75	$2.00	$2.65	$3.00	$1.75	$1.60	$5.50
887 lin.ft. 18-in. pipe sewer	2.65	3.00	1.75	2.00	2.50	3.00	1.60	1.40	5.20
10 lin.ft. 15-in. pipe sewer	2.00	3.00	1.00	1.50	2.50	2.00	1.00	2.00	4.90
70 lin.ft. 12-in. pipe sewer	1.50	3.00	1.25	1.50	2.00	1.75	1.50	1.50	4.60
10 lin.ft. 10-in. pipe connection with intercepting sewer	2.50	5.00	3.00	3.00	2.50	1.00	1.00	4.00	7.00
1,700 lin.ft. 2 ft., 6 in. x 4 ft., 4 in. concrete sewer	3.50	7.10	3.75	4.00	5.00	3.00	3.50	4.75	9.30
650 lin.ft. 2 ft., 0 in. x 4 ft., 0 in. concrete sewer	2.75	7.85	3.75	4.00	4.00	3.00	2.75	3.50	6.00
100 cu.yd. excavation below grade	2.00	2.00	1.50	1.50	2.00	2.00	.50	3.00	3.00
30 cu.yd. excavation above grade	1.00	2.00	1.00	1.00	2.00	1.75	1.00	3.00	3.00
20 cu.yd. rock excavation	5.00	5.00	5.00	3.00	.....	5.00	3.00	5.00	5.00
200 cu.yd. clean gravel refill	1.25	.....	1.50	2.00	1.75	1.75	1.50	2.00	1.00
Spruce piles under 20 ft. in length	.25	.25	.25	.25	.25	.25	.25	.25	.25
Spruce piles 20 ft. to 30 ft. in length, both inclusive	.25	.25	.25	.25	.25	.25	.25	.25	1.25
Spruce piles exceeding 30 ft. and including 40 ft	.28	.28	.28	.28	.28	.28	.28	.28	.28
Spruce piles exceeding 40 ft. in length	.35	.35	.35	.35	.35	.35	.35	.35	35
250 M ft. b.m. spruce lumber for sheeting and shoring	25.00	21.00	25.00	20.00	26.00	20.00	20.00	22.00	25.00
5 M ft. b.m. 2-in. spruce for sheeting and shoring	30.00	26.00	40.00	25.00	.....	23.00	30.00	30.00	30.00
5 M ft. b.m. 3 to 6-in. planed groved and Georgia pine	40.00	.01	50.00	30.00	.....	23.00	50.00	45.00	40.00
37 M ft. b.m. spruce lumber for pile gaps, platforms	35.00	.01	40.00	35.00	40.00	40.00	30.00	40.00	35.00
3,540 lin.ft. pipe underdrain	.15	.10	.50	.25	.20	.30	.15	.20	.15
1,850 cu.yd., Class A, concrete	7 50	6.00	7.50	8.00	8.00	7.50	8.50	8.00	8.00
Class A, concrete mixed hydrated lime	.50	.50	.50	.50	.50	.50	.50	.50	.50
Class B concrete	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Class C concrete	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
460 lin.ft. 10-in. pipe catch basin drain	.75	.01	.75	1.00	1.50	1.00	.90	.60	2.50
Pipe for chimneys	.15	.15	.15	.15	.15	1.00	.15	.15	.15
100 lin.ft. laying pipe house drain	1.00	.01	.25	1.00	.....	1.00	1.00	.75	2.00
350 lin.ft. relay, reconn., existing house drain, in or outside main trench	1.50	1.00	40	.50	1.00	.....	.60	.60	1.50
240 lin.ft. relaying, reconnect., existing catch basin drain	.75	1.00	.50	.50	1.25	1.00	1.00	.60	2.00
50 lin.ft. relaying, reconn., existing drain other than house and catch basin drain	1.00	.01	.50	.50	.....	1.00	.50	1.00	.50
50 lin.ft. relaying, reconn., existin drain outside main trench other than house and catch basin drain	1.50	.01	.25	.50	.....	1.00	1.00	1.00	2.00
Placing Y's in existing pipe sewers or surface drain	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Placing slants or connections in existing masonry sewers drain	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
360 slants or connections in new masonry sewers or sewers drain	.10	.10	.50	.10	.10	5.00	.10	.10	.10
Laying and connecting 3 to 10-in. metal pipe in or outside main trench	1 50	1 50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
115 tons steel rods or bars for masonry rein	50 00	40.00	45.00	60.00	40.00	55.00	80.00	60.00	50.00
14 manholes on new concretes	35 00	40.00	50 00	35.00	60.00	58.00	60.00	45.00	55.00
7 manholes on new or old sewers	40 00	40 00	50 00	50.00	50.00	55.00	75.00	60.00	65.00
1 manhole on existing masonry sewer	40 00	40 00	50 00	50 00	50.00	58.00	60 00	60.00	75.00
1 sump manhole	45.00	40.00	65.00	75.00	70.00	70.00	125.00	100.00	88.00
8 catch basins built	55.00	60.00	57.00	50.00	55.00	60.00	50.00	70.00	50.00
40 existing catch basins rebuilt	20.00	2.00	25.00	10.00	20.00	60.00	35.00	30.00	35.00
Other brick masonry	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Catch basin traps taken out and reset and catch basin drain	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Guttermouths for catch basins or drop inlets cut in existing edgestone	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1 connection between new and existing conduits	25.00	10.00	50.00	5.00	25.00	10.00	5.00	50.00	25.00
170 sq.yd. granite block paving	1.00	1.00	.45	.50	1.00	1.75	2.00	1.50	.50
60 ton crushed stone	2 00	1.00	1.50	1.75	2.00	1.50	2.25	1.60	1.50
Placing cradles for pipe crossings for pipes	10 00	10 00	10 00	10.00	10.00	10.00	10.00	10.00	10.00
6,400 list value single strength sewer pipe	65%	75%	70%	70%	72%	70%	66%	70%	70%
$100 list value double strength sewer pipe	55%	60%	50%	60%	60%	65%	66%	60%	60%
1 tide gate chamber	50.00	100.00	300.00	50.00	150.00	100.00	250.00	150.00	87.00
170 sq.yd. existing pavement with concrete base rem	.35	.25	.50	.50	.25	.50	1.00	.40	.60
2,030 lin.ft. old sewers removed	.25	.10	.25	.25	.....	.15	05	.40	.50
Supporting and protecting buildings and structures	50.00	5 00	10.00	10.00	.....	.....	10.00	.....	500.00
4 old catch basins removed, contents masonry, stone work inc	12.00	5.00	5.00	10.00	10.00	60.00	10.00	25.00	25.00
Extended totals	$46,258	$47,010	$47,075	$47,158	$49,154	$49,604	$49,799	$50,100	$65,433

Construction News

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

Maine—Mattawamkeag & Northern Railway having surveys made for line from Mattawamkeag to Millinocket and East Millinocket, about 23 miles. Charles W. Mullen and I. B. Wood, Bangor, interested.

Rhode Island—Rhode Island Co. will ask City Council for appropriation of $300,000 for railway from city docks to point of connection with New York, New Haven & Hartford R.R. Edward Gagel, New Haven, Conn., Ch. Engr., New York, New Haven & Hartford R. R. Noted Nov. 11.

New York—Emporium Lumber Co. plans to extend line from Childwood on Adirondack Division of New York Central Railway to Cranberry Lake and thence to Carthage & Adirondack R.R. at Newton Falls.

Georgia—Georgia Railway and Power Co. contemplates extending line from Atlanta to Alpharetta via Roswell and Crabapple. W. H. Smaw, Atlanta, Ga., Pur. Agt.

Alabama—Jackson-Tinney Lumber Co. will soon award contract for logging road extending southwest from Wagley, about six miles. W. J. Tinney, Talladega, Ala., Pres.

Mississippi—Magnolia, Fernwood & Summit Electric Railway having surveys made for new line. Xavier A. Kramer, Magnolia, Engr.

Kentucky—Chesapeake and Ohio Railway plans to build extension up right fork of Beaver Creek, 15 miles. B. T. Jellison, Richmond, Va., Pur. Agt.

Ohio—Cleveland Railway Co. will extend line on Madison Ave. from West 117th St. to Rocky River. George L. Radcliffe, Cleveland, Gen. Mgr.

Ohio—Dover, Millersburg and Western Railway received 20-year franchice to build and operate electric railway in Millersburg; also granted franchise to build electric railway to connect Millersburg with Sugar Creek and Canal Dover. Noted Sept. 23.

Ohio—Ohio Northern Electric Railway will award contract about Jan. 1 for Bucyrus Tiffin electric line . George W. Stewart, Pres.

Ohio—Wheeling & Lake Erie R.R. obtained right-of-way for two-mile spur to circle east boundaries of Canton. W. L. Rohback, Cleveland, Ch. Engr.

Indiana—Goshen, Ft. Wayne & Northern Interurban Railway Co. will build electric railway, Branch A, from Warsaw through Winona Lake, North Webster, Wolf Lake, Albion and Kendallville to Ashley-Hudson; Branch B, from junction at Ligonier through Topeka to Lagrange; Branch C, from Columbia City through Collins, Churubusco, Huntertown and Leo to Grabill. Noted Oct. 21.

Illinois—Joliet and Eastern Traction Co. plans to extend line from Chicago Heights, Ill., to Hammond, Ind.

Illinois—Waukegan & Woodstock Traction Co., recently incorporated, will build interurban line between Waukegan and Woodstock.

Kansas—C. V. Wardell promoting construction of railroad from Greensburg south to connecting line, direct to gulf.

Kansas—Citizens of Kinsley voted to issue $252,000 bonds to aid Athony & Northern Railway to extend line from Trousdale to Kinsley. O. P. Byers, Hutchinson, Kan., Pres. Noted Sept. 30.

Kansas—Hutchinson Interurban Railway Co. will build line on Carpenter St. James E. Humbert, Hutchinson, Kan., Gen. Mgr. and Pur. Agt.

Kansas—Kansas City, Mexico & Orient R.R. applied to State Public Utilities Commission for permission to issue $51,238,000 bonds. Part of proceeds to be used for building line from Wichita to Kansas City. Edward Dickinson, Kansas City, Kan., Pres.

Kansas—Citizens voted $20,000 bonds to aid Oklahoma & Interstate Railway Co. in building lines to connect Columbus with Galena and Commerce, Okla.

Missouri—Kansas City and Tiffany Springs Railway Co., recently incorporated, will build railway from Kansas City, Mo., to Tiffany Springs, Platte County, about 15 miles.

Missouri—H. W. Knight promoting construction of railroad from Keokuk to Jefferson, will connect with Chicago & Alton R.R. at main line.

Texas—E. P. Turner and associates, Dallas, Tex., plan to build railway from Denton to Krum, about 15 miles.

Texas—Texas and Pacific Railway will build steam railway from point on main line to Seminole. Noted Sept. 30.

Oklahoma—Election will be held Nov. 23 to vote on $15,000 bonds for railway from Columbus and Baxter Springs to Galena for Oklahoma and Interstate Railway. John R. Rose, Oklahoma City, Pres. Noted Sept. 30.

Oklahoma—T. C. Alley and W. T. Crossland, Oklahoma, contemplate building interurban electric line between Coalton, Henryetta and Kusa.

Oklahoma—Citizens of Bartlesville and Pawhuska plan to build railroad, about 43 miles, to connect cities. Estimated cost, $774,000.

Idaho—Lewiston-Clarkston Transit Co. received franchise from Council to build electric railway in Asotin County from city limits of Clarkston on Sixth St. to Highland and 13th St., 1½ miles.

Washington—Cascade Lumber Co., North Yakima, plans to build railroad, 12 miles, with eight miles of branches and spur tracks.

Washington—Tacoma Railway and Power Co., Tacoma, received 50-year franchise to extend line from Ft. Steilacoom Insane Asylum to town of Steilacoom, about two miles. G. W. Rounds, Tacoma, Gen. Supt. Noted Sept. 30.

Oregon—Great Southern R.R. Co. contemplates extending line to connect at The Dalles with steamers on Columbia River. J. G. Heimrick, The Dalles, Ore., Gen. Mgr.

Oregon—Oregon-Washington R.R. & Navigation Co. will renew tracks on various parts of main line between Portland and Huntington. Estimated cost, $800,000. J. B. O'Brien, Portland, Ore., Vice Pres. and Gen. Mgr.

Oregon—Pacific Power and Light Co. received 30-year franchise to extend line on Franklin Ave., Astoria. James E. Davidson, Portland, Gen. Mgr. Noted Nov. 4.

California—Contract will soon be awarded by Board of Public Works for Church St. extension of municipal railway system. M. M. O'Shaughnessy, City Engr.

California—Southern Pacific Railway has taken over Butte County R.R. and will extend line to Westwood to connect with Fernley & Lassen R.R. Co. W. Hood, San Francisco, Calif., Ch. Engr.

Quebec—Canadian Pacific Railway, Montreal, will build spur for Aetna Chemical Co. of Canada, Ltd. Grant Hall, Winnepeg, Man., Vice Pres. and Gen. Mgr.

Ontario—Canadian Pacific Railway will build sidings for Canadian Explosives, Ltd. Grant Hall, Winnepeg, Man., Vice Pres. and Gen. Mgr.

Ontario—Michigan Central R.R., Detroit, Mich., granted permission to build industrial siding for Norton Co., Short Line, Chippewa. G. H. Webb, Ch. Engr., Michigan Central R.R., Detroit, Mich.

Ontario—National Trans-continental Railway (Canada Government Railways) will build three-mile line in Neelands, Ont. C. B. Brown, Moncton, N. B., Ch. Engr., and F. P. Gutelius, Moncton, N. B., Gen. Mgr.

Alberta—Canadian Northern Railway, Toronto, will build spur for Premier Coal Co., Ltd. William Mackenzie, Toronto, Ont., Pres.

LIGHT, HEAT AND POWER

Proposed Work

Vt. Middlebury—A company will be organized to be known as the Central Power Co. of Vermont with capital stock of $1,000,000 to develop water power on the East Middlebury River. C. H. Thompson, Montpelier, interested.

Mass., Holyoke—Bond issue of $100,000 for improving municipal electric-light plant authorized by Board of Aldermen.

N. Y., Beacon—(Official)—Bids will be received by John B. Riley, Supt. of State Prisons, Capitol, Albany, until noon, Nov. 23, for heating work at Matteawan State Hospital, Beacon. (See adv.)

N. Y., Elmira—Morrow Mfg. Co., plans to build a new heating plant for its factories. Estimated cost, $100,000.

N. Y., Monticello—Murray Electric Light and Power Co. will extend its transmission lines from Monticello to Hurleyville. Company also plans transmission line to Centerville on south and Woodbourne on north.

N. J., Lambertville—The Lambertville Public Service Co., recently organized, has acquired the plant and system of the Lambertville Light, Heat and Power Co. and plans extensive improvements in the power system and station.

N. J., Stratford—Clementon Electric Light Improvement Co. of Laurel Springs is negotiating with town authorities for installation of electric-lighting system.

Md., Easton—(Official)—Bids will be received until Dec. 30 by Newton Electric Co. for electric transmission system from Easton to Oxford, about 15 miles. Noted Nov. 4.

Va., Hopewell—Stuart, James & Cook, Engrs., 50 Church St., New York, N. Y., plan to install distributing system in Hopewell.

Fla., West Palm Beach—A site has been acquired by Frank D. Mosier, Trenton, N. J., and associates, on which they plan to build a gas plant.

Miss., Marks—City has granted James Fitzel 20-year franchise to construct and maintain electric-light plant.

Ohio, Cincinnati—See item under "Water Works."

Ohio, Lima—Bonds for $60,000 defeated by citizens for municipal electric-light plant and lighting system.

Ohio, Marietta—(Official)—Citizens defeated $45,000 bonds for municipal electric light plant. Noted Oct. 7.

Ohio, Newark—City plans to improve municipal electric-light plant. Estimated cost, $30,000.

Ill., Belleville—Plans being considered by City Council for municipal electric-light plant.

Wis., Madison—Wisconsin River Power Co. plans to build transmission lines in Sauk, Dane and Columbia Counties.

Wis., Shawano—(Official)—Citizens voted $60,000 bonds for dam and hydro-electric power plant on Wolf River. Noted Nov. 11.

Kan., Perry—Bonds for $5,000 voted for installing new equipment in municipal electric-light plant.

Neb., Heartwell—See item under "Water works."

Mont., Ryegate—Plans being considered for electric-lighting system.

Mo., New Madrid—Bids will be received by W. H. Copeland, City Clk., until Nov. 29, for additions to electric-light plant.

Mo., Trenton—Trenton Gas and Electric Co. plans an expenditure of $100,000 for improvements to its plant.

Ark., Newport—Plans being considered by Arkansas Light and Power Co. for electric transmission line from Newport to Pocahontas.

Tex., Dallas—Plans being prepared for power plant for Union Terminal Co. Estimated cost, $40,000.

Tex., Port Arthur—Port Arthur Gas and Power Co., recently incorporated with $250,000 capital stock, plans to build a gas plant and electric power station.

Okla., Westville—Election will soon be held to vote on $10,000 bonds for improving electric-light plant.

Colo., Golden—Jefferson County Power and Light Co. plans to build transmission line to Morrison, about eight miles, and install distributing system.

Idaho, Hailey—Installation of a hot water heating system contemplated by E. J. Gordon and associates. Estimated cost, $50,000.

Idaho, Victor—City plans to install electric-light plant. Bonds for $4,000 authorized for this purpose.

Ore., Pilot Rock—L. K. Harlan has applied to City Council for franchise to install electric-light plant in Pilot Rock.

Que., Montreal—Laurentide Power Co., Ltd., recently incorporated with $10,500,000 capital stock, plans to construct and operate light, heat and power plants. W. F. Chipman, interested.

Ont., London—City Council plans to improve lighting system on Richmond St. Estimated cost, $10,000.

Ont., Niagara Falls—Plans being prepared for government power house to be constructed between Queenston Heights and Niagara Falls. It is planned to develop 300,000 hp. by using surplus waters of Welland Canal.

Ont., Welland—City plans to improve municipal electric-light plant and purchase power from Ontario Hydro-Electric Power Commission. Estimated cost, $14,000.

Bids In and Contracts Awarded

Mass., Southbridge—Contract for two-story, 56x67-ft. powerhouse for Hamilton Woolen Co. awarded to E. D. WARD, Worcester.

N. J., Paterson—Contract for electric-light and power plant in high school building awarded to BENNETT & BROWN, Paterson. Noted Nov. 23.

Penn., Pittsburgh—Contract for heating and ventilating system for City-County Bldg. awarded to BAKER, SMITH & CO., at $137,500.

Penn., Weatherly—Contract for transmission line from Laurytown to Weatherly for Middle Coal Field Poor District awarded to RODNEY D. ALLEN, Philadelphia, at $8,650.

Md., Baltimore—Contract for power plant and heating system for group of buildings at Johns Hopkins University awarded to ENTERPRISE STEAM AND HOT WATER HEATING CO., 407 North Howard St., Baltimore.

N. C., Stantonsburg—FAIRBANKS, MORSE & CO., Atlanta, Ga., awarded contract for municipal electric-light plant.

Ill., Springfield—Western Cartridge Co. awarded contract for power plant to URBAUER-ATWOOD HEATING CO., St. Louis, Mo. Estimated cost, $100,000.

Wis., Chippewa Fal's—Wisconsin-Minnesota Light and Power Co., Eau Claire, awarded contract for power dam and concrete dam and powerhouse on Chipnewa River to KELSEY-BREWER CONSTRUCTION CO., Michigan Trust Bldg., Grand Rapids. Estimated cost, $1,000,000. Noted Nov. 11.

Neb., Du Bois—Contract for transmission line between Pawnee City and Du Bois awarded to KORSEMEYER CO., Lincoln.

Tex., El Paso—Contract for heating system in new high school awarded to ELLIOTT ENGINEERING CO., El Paso, at about $52,000.

Okla., Haworth—Contract for electric-light plant in Haworth awarded to FRANK McMILLAN, at $5,000.

Calif., San Jose—Contract for steel light tower awarded to GOLDEN GATE IRON WORKS, San Francisco, at $6,087.

Man., Reston—Contract for electric generating plant and distribution system awarded to ACCUMULATOR LIGHTING CO., Winnipeg.

BRIDGES

Proposed Work

N. Y., Honeoye Falls—Village plans to raise $6,000 for concrete bridge over Honeoye Creek.

N. J., Atlantic City—(Official)—Bids will be received by Boards of Chosen Freeholders of Atlantic and Burlington Counties, G. A. R. Hall, New York Ave., Atlantic City, N. J., until noon, Dec. 18, for bridge over Mullica River at Chestnut Neck near New Gretna. (See adv.)

N. J., Elizabeth—Plans prepared for two bridges over roads in Vaux Hall section of Union Township for Rahway Valley Co. J. S. Caldwell, Kenilworth, Gen. Mgr.

N. J., Plainsboro—Pennsylvania Railroad will build new bridge on its Trenton Division at Plainsboro.

Penn., Harrisburg—Loan of $300,000 voted by citizens for bridge construction.

Va., Bristol—Southern Railway plans to build steel bridge at English St. crossing. Estimated cost, $7,000.

Va., Hanover—(Official)—Bids will be received at Clerk's Office Court House, until noon, Nov. 24, for reinforced-concrete bridge over Little River, Hanover County. G. P. Coleman, Richmond, State Highway Comr.

Va., Norfolk—Construction of bridge at Falkland St. in connection with improvement of Newton Creek contemplated by city. About $10,000 available for this work.

Va., Stuart—Bids will be received until Nov. 23 by Commissioners of Patrick County for superstructure of steel bridge over Dan River about six miles from Meadsfield. G. P. Coleman, Richmond, State Highway Comr. Noted Aug. 12.

Ala., Selma—Bids will be received until Dec. 13 by Commissioners of Dallas County for nine steel bridges.

Miss., Leakesville—Bids will be received by Greene County Supervisors until Dec. 6 for steel and iron highway bridge across Chickasawhay River. E. McKay, Clk. Noted Oct. 21.

Tenn., Harriman—(Official)—Bids will be received by S. A. Breazeale, Rd. Comr., until Nov. 20, for concrete bridge across Emory River. Estimated cost, $50,000. Noted Nov. 11.

Tenn., Paris—Plans being considered by Nashville, Chattanooga & St. Louis Railway for reinforced-concrete viaducts at South Market and Dunlap St.

Ohio, Monroe—Election will be held Dec. 6 to vote on $60,000 bonds for bridge over Raisin River. Noted Nov. 11.

Mich., Grand Rapids—City Council contemplates concrete culvert over Coldbrook Creek from west line of Lafayette Ave. west to east end of present culvert.

Ill., Chicago—(Official)—Bids will be received by John McGillen, Pres. of Sanitary District of Chicago, Room 700, 910 South Michigan Ave., until noon, Dec. 2, for superstructures of Calumet-Sag Bridges. (See adv.)

Wis., Westpoint (Lodi post office)—Bridge will be constructed over Wisconsin River at an estimated cost of $48,000, half of which will be borne by state and half by county.

Iowa, Des Moines—City Council plans to build bridge across Des Moines River at North St.

Mo., Chillicothe—(Official)—Bids will be received by J. Broaddus, Bridge Comr., Courthouse until noon, Dec. 5, for five reinforced-concrete bridges.

Mo., Hillsboro—See item under "Streets and Roads."

Ark., Clarksville—Quorum Court of Johnson County authorized construction of four steel bridges.

Ark., Fulton—See item under "Streets and Roads."

Ark., Montrose—An appropriation of $8,000 made by Commissioners of Ashley County Court for steel bridge.

Ark., Piggott—County will build several steel bridges. W. O. Irby, County Judge.

Ark., Sheridan—County will build 130-ft. steel bridge across Saline River.

Ark., Stoneland—Bonds for $8,000 voted by citizens for improving bridges and streets.

Tex., Huntsville—Commissioners of Walker County, Huntsville, and Trinity County, Groveton, will build bridge across Trinity River between Walker and Trinity County. Estimated cost, $50,000.

Okla., Potenu—Bonds for $50,000 voted by citizens of Le Flore County for bridges and roads.

Colo., Walsenburg—Bridge will be constructed across Huerfano River, north of Walsenburg. Estimated cost, $12,500.

Wash., North Yakima—Bridge will be constructed on North Sixth Ave. over ditch of Pacific Power and Light Co. by City and County Commissioners. Estimated cost, $16,000.

Ore., McMinnville—Plans being prepared for concrete viaduct through San Cozine Creek. Estimated cost, $15,000.

Ore., Portland—Bids will be received by A. L. Barbur, County Auditor, until Nov. 29, for reinforced-concrete viaduct for extension of Union Ave. Estimated cost of viaduct, $53,000, fill, $13,000.

Ore., Salem—State Highway Department, Salem, prepared plans for bridge across Willamette River at Salem. Estimated cost, $230,000.

Calif., Bridgeport—Bids will be received by Board of Supervisors of Mono County until noon, Jan. 3, for steel bridge across East Walker River, six miles north of Bridgeport.

Bids In and Contracts Awarded

N. Y., Binghamton—All bids received Oct. 4 for replacing bridge over Big Snake Creek near Corbettsville rejected. Noted Oct. 20.

N. Y., Conklin—Contract for bridge over Little Snake Creek awarded to BINGHAMTON BRIDGE CO., Press Bldg., Binghamton, at $4,000.

N. Y., Ft. Edward—Keith Guthrie, Schenectady, at $23,500 submitted lowest bid for bridge over Hudson River at Ft. Edward. Noted Sept. 30 and Oct. 14.

Penn., Johnstown—(Official)—Contract for Horner St. bridge awarded to JOHN L. ELDER, Ebensburg, at $38,358. Noted Aug. 19 and Oct. 28.

Penn., Mooresburg—Contract for concrete bridge for Philadelphia & Reading Railway awarded to C. H. REINARD, Bloomsburg. Noted Oct. 21.

Penn., Norristown—James Smith, Perkiomenville, awarded contract for stone arch bridge over Goshenhoppen Creek, Frederick Township.

N. C., Biltmore—C. W. REQUOTH CO., Charlotte, at about $13,600, awarded contract for bridge across Swannanoa River Noted Oct. 21.

Fla., Arcadia—Contract for ten concrete bridges awarded to LUTEN BRIDGE CO., at about $20,000. Noted Sept. 30.

Miss., Columbus—Contract for 100-ft. steel bridge and one concrete culvert awarded to H. C. TERRY, Columbus. Noted Oct. 21.

Tenn., Elizabethtown—(Official)—Contract for bridges in Carter County awarded to LUTEN BRIDGE CO., Indianapolis, Ind., at about $47,000. Noted Oct. 21.

Ohio, Cincinnati—RUNCK BROS, First National Bank Bldg., Cincinnati, at $115,94, awarded contract for widening existing bridge on Montgomery Rd. Noted Oct. 21.

Wis., Beloit—Contract will soon be awarded for bridge in South Beloit and Rockton Township. Estimated cost, $10,750.

Wis., Wascott—Contract for concrete bridge over St. Croix River awarded to C. J. ST. ONGE, at $4,185.

Kan., Salina—Contract for bridge over Smoky River awarded to WILMARTH & ZERBE, Salina, at $4,642. Noted Oct. 21 and Nov. 4.

Mont., Miles City—Contract for steel bridge across Fallon Creek awarded to SECURITY BRIDGE CO., Billings, at $9,480.

Mont., Terry—SECURITY BRIDGE CO., at $5,000, awarded contract for bridge across Cedar Creek.

Mo., Kansas City—Contract for reinforced-concrete viaduct at 77th St. and the fence awarded to H. H. HANNENKRATT, at about $65,000. Noted Sept. 2.

Okla., Cherokee—KANSAS CITY BRIDGE CO., Kansas City, Mo., at $22,243, awarded contract for 13 bridges.

Idaho, Boise—Contract for bridge across Snake River at Granite awarded to MISSOURI VALLEY BRIDGE & IRON CO., Denver, Colo., at $19,850. Noted Oct. 14 and Nov. 11.

Calif., Sacramento—Bids were received Nov. 1 for reinforced-concrete bridge across Ayers Creek, Imperial County, as follows: Holland Construction Co., San Diego, $15,600; Forest City Paving and Construction Co., Live Oak, $17,885; Robert Shearer & Co., Los Angeles, $28,748. Noted Oct. 21.

Calif., Willows—Contract for reinforced concrete bridge at Newville awarded to COTTON BROS., Oklahoma, Okla., at $6,000.

Ont., Darling—Contract for bridge on Toronto-Sudbury line of Canadian Pacific at Darling awarded to FOUNDATION CO., Montreal, Que. Estimated cost, $50,000.

WATER WORKS

Proposed Work

Mass., Lowell—Report has been submitted estimating cost of extending water system to Collinsville at about $50,000.

Mass., West Mansfield—W. C. Byrne Co. estimates the cost of water system connecting with Skinners Crossing at $26,000.

N. Y., Batavia—Citizens voted $175,000 bonds. Part of proceeds will be used for filtration and pumping plants.

N. Y., Minoa—(Official)—Citizens defeated $28,000 bonds for water system. Noted Nov. 11.

N. Y., Port Washington—Plans prepared by Harold G. Stevens, Engr., 150 Nassau St., New York, N. Y., for water system for Port Washington Water District.

N. J., South Amboy—Council is considering installation of municipal water works.

Penn., Dalmatia—(Official)—Dalmatia Water Co. will build water system. Estimated cost, $10,000. Noted Nov. 4.

Penn., Morrisville—Common Council planning installation of filtration plant at city water works.

Del., Media—City plans to improve water system. Estimated cost, $70,000.

S. C., Charleston—Bids will be received by L. M. Pinckney, 56 Broad St., until Nov. 28, for terra cotta pipe drains and appurtenances in portions of Romney, King, Poplar and other streets.

Fla., Travares—City contemplates holding election to vote on bonds for water works.

Miss., Wesson—Bids will be received by P. S. Burt, City Clk., until Dec. 7, for water system and electric light plant. Estimated cost, $18,000. Noted Sept. 9.

La., Shreveport—See item under "Sewers."

Tenn., Camden—City plans to build water system.

Tenn., Henderson—Bids will be received by Mayor and Board of Aldermen until Dec. 3 for water system. Frank L. Wilcox, Syndicate Trust Bldg., St. Louis, Mo., Engr.

Ohio, Albion—Election will be held Dec. 14 to vote on $10,000 bonds for water system.

Ohio, Barnesville—(Official)—Citizens voted for improving water system, including filtration plant and standpipe. Estimated cost, $25,000. M. Knowles, Pittsburgh, Penn., Engr. Noted Oct. 22.

Ohio, Cincinnati—Citizens defeated $400,000 bonds for high pressure fire service. Noted Sept. 30 and Oct. 14.

Ohio, Columbus—Bids will be received by George A. Borden, Dir. of Pub. Ser., until Dec. 1, for supplying pumps and installing necessary fittings at pumping station.

Ohio, Newark—Bonds for $30,000 voted for improving water system.

Ohio, Wadsworth—Citizens voted to purchase light and water plant for $85,000. H. E. Hiers, City Clk.

Ind., Bloomington—Plans prepared for extension of municipal water works plant.

Ind., Michigan City—Bond issue of $75,000 authorized for water works improvements.

Ind., Morocco—Public Service Commission will issue bonds for water works.

Ind., Van Buren—Bonds for $8,000 will be sold. Proceeds will be used to install water system.

Mich., Escanaba—Election will be held Nov. 22 to vote on amendment, permitting the issue of bonds for water works.

Ill., Rankin—(Official)—Citizens voted $6,000 bonds for water system. Noted Oct. 21.

Ill., Waukegon—Report submitted by John Chester of Chester & Fleming, Consult. Engr., Pittsburgh, Penn., estimating cost of filtration plant from $80,000 to $100,000.

Wis., Oshkosh—Council retained H. A. Allen, Consult. Engr., Chicago, Ill., to prepare plans for filtration plant for municipal water system.

Iowa, Iowa City—Construction of reservoir with capacity of 700,000-gal. recommended by J. J. Dunlap, Professor of Iowa University.

Iowa, Marshalltown—Election to vote on $12,000 bonds for extending water mains under consideration.

Minn., Swanville—Citizens voted $9,000 bonds for water system.

Kan., Oswego—(Official)—Citizens voted bonds for extension and improvement of water system. Estimated cost between $28,000 and $30,000. Noted Nov. 4. J. C. Moore, Joplin, Mo., Engr.-in-Charge.

Neb., Heartwell—Franchise granted to Heartwell Water, Light and Power Co. for electric light plant and water system. C. Gilson, Minden, Secy.

Wyo., Powell—City will erect water works system at cost of $20,000. Contract will be let in fall. Green Engineering Co., Spokane, Wash., Engr.

Mont., Townsend—Election will be held to vote on $30,000 bonds for municipal water system.

Mo., Cape Girardeau—City will issue $75,000 bonds for municipal water works.

Mo., Lees Summit—Election will be held Nov. 23 to vote on $28,000 bonds for water system.

Tex., Ft. Stockton—Election will be held Dec. 1 to vote on $28,000 bonds for water system.

Tex., San Angelo—See item under "Light, Heat and Power."

Tex., Tyler—Plans being prepared by H. E. Elrod, Consult. Engr., Dallas, for water system. Estimated cost, $250,000.

Okla., Haworth—City voted $17,000 bonds for water works plant.

Idaho, Hailey—According to press reports E. J. Gordon, Hailey, contemplates building of pipe line from Hailey Hot Springs to Hailey. Estimated cost, $40,000.

Idaho, Samuels—Election will soon be held to vote on $20,000 bonds for water system.

Wash., Auburn—Ordinance passed for installation of water mains in District No. 12.

Wash., Seattle—Bids will soon be received for water mains in downtown streets. Estimated cost, $27,000.

Wash., Seattle—Resolution passed providing the installation of water mains in Dexter Ave., from Wheeler to Aloha St. Estimated cost, $14,000.

Ore., Fossil—Bids will soon be received for replacing wooden water main between The Springs and reservoir with steel mains.

Ore., Lakeside—Water system will be installed by Milo Pierson and John D. Goss. Estimated cost, $10,000.

Ore., Seaside—Election will be held in December to vote on $50,000 bonds for water system.

Ont., London—City will construct 10-in. water main on Carling St. and also plans to lay piping to additional wells and springs and to install pumps to extend water collecting system.

Alaska, Anchorage—Alaska Engineering Commission will build a water system.

Bids In and Contracts Awarded

N. Y., Buffalo—Contract for 12-in. high pressure pipe line awarded to DARK & CO., 654 Main St., Buffalo, at $12,300.

N. Y., New York—(Official)—Board of Water Supply awarded contract for two buildings at Hill View reservoir under Contract No. 128 to WILLIAM H. EAGAN, Lexington Ave. and 25th St., New York.

N. Y., Waterbury—Contract for water system awarded to WILLIAM G. FRITZ CO., at $25,554.

N. Y., White Plains—William H. Green at $4,034, submitted lowest bid for extension of water mains to Byram Lake.

Tenn., Columbia—Contract for filtration plant of 1,000,000-gal. capacity per 24 hours awarded to INTERNATIONAL FILTRATION CO., Chicago, Ill.

Tenn., Maryville—Contract for the construction of water works system awarded to F. D. LISCOMB.

Ohio, Dayton—Contract for 2,000,000-gal centrifugal pump awarded to DE LAVAL CO., at $31,000.

Mich., Sparta—(Official)—Contract awarded to PITTSBURGH-DES MOINES STEEL CO. for construction of 65,000 gal. tank on 36-ft. tower. Noted Nov. 4.

Ill., Virginia—Contract for drilling wells at water works awarded to C. P. BRYANT & CO., Chicago. Estimated cost, $15,000.

N. D., Grand Forks—Contract for water main No. 77 on Viets Ave. from Lewis Blvd. to Conkling Ave. awarded to CARROLL BROS.

Mo., Poplar Bluff—Contracts for water system awarded to UNITED ENGINEERING CO., 327 South La Salle St., Chicago, Ill., at $46,400, for brick power house, machinery foundations, water tubular boiler, feed pump and heater, condenser, two 300-hp. Skinner una flow engines, General Electric generators, pole lines and station wiring, and to WASCO SUPPLY CO., St. Louis, at $9,480, for pole line supplies and materials.

Mo., St. Louis—Bids were received Nov. 12 by Board of Public Service for steam pump, valves and fittings and altering pumping rooms as follows: Modern Heating Co., St. Louis, $10,777; Urbauer Atwood Heating Co., St. Louis, $9,998; Edwin P. Ambler, St. Louis, $11,263.

Idaho, Council—(Official)—E. L. Phelps, Weiser,, at $11,100, submitted lowest bid for water system. Noted Oct. 22.

Calif., San Francisco—Official)—Contract for 3,975 bbl. of cement for Hetch Hetchy diversion dam to direct Tuolumne River into 20-ft. diversion tunnel past main dam awarded to STANDARD CEMENT CORPORATION, $2.37 per bbl.

Ont., Markham—Contract for pipes, hydrants and valves for water system awarded to NATIONAL IRON WORKS, LTD., Cherry St., Toronto, at $5,750.

Ont., Toronto—Contract for the supply and installation of valves and other mechanism at the main pumping station awarded to DRUMMOND McCALL & CO., 373 Front St., E, at $9,530. Noted Nov. 4.

SEWERS

Proposed Work

Mass., Winchendon—Report submitted by R. Fletcher, Professor of Dartmouth College, Hanover, estimating cost of sewer system at $10,000.

Conn., Waterville—Bonds for $300,000 will be sold for trunk sewer from Waterville to terminus of Waterbury sewers.

N. Y., Suffern—Citizens voted to build sewer system.

N. J., Asbury Park—Bids will be received at office of Neptune Township Committee, 75 South Main St., Ocean Grove, until 8 p.m., Nov. 22, for about 10,800 lin.ft. of 6- to 10-in. vitrified pipe sewers and 2,400 lin. ft. of 4-in. vitrified pipe sewer connections.

N. J., Asbury Park—Plans approved for sewer extension in Myrtle and Bangs Ave., section of Neptune Township.

N. J., Caldwell—Citizens voted to extend sewer system.

N. J., Jersey City—Bids will be received by City Commissioners until 2 p.m., Dec. 2, for pipe sewer in Wade St. to connect with sewer in Ocean Ave.

N. J., Manasquan—State Board of Health ordered city to improve sewage-disposal plant. William F. Lefferson, Mayor.

N. J., Newark—Bids will be received by Board of Street and Water Commissioners until Nov. 24 for Valisburg sewers, southwesterly section, and Front St., Arlington Ave. and Greenwood Lake Railroad sewers.

Penn., Sharon—Bonds for $185,000 for sewage-disposal plant defeated by citizens. Noted Oct. 14.

Md., Baltimore—Bids will be received by Board of Awards, City Hall, until Nov. 24, for Section No. 1, Waverly trunk sewer and lateral sewers in District No. 34-D, Contract No. 158 and 169.

W. Va., Kenova—(Official)—Citizens voted $55,000 bonds for sewer system. Noted Oct. 21.

Fla., Ft. Pierce—Ordinance providing for $25,000 bond issue for extending sewer system passed by City Council.

La., Shreveport—Bonds for $1,200,000 voted for sewer and water systems.

Tenn., Chattanooga—North Side Business Men's League will build new sewer. J. S. Bell, Pres.

Tenn., Kingport—City plans to build sanitary sewer system.

Tenn., Memphis—City contemplatess new sewer on water front to divert drainage from front of levee.

Ky., Lexington—Citizens voted $35,000 bonds for sewers.

Ky., Owensboro—Citizens voted $250,000 bonds for sewer system. Noted Oct. 21.

Ky., Paducah—(Official)—Citizens defeated bonds for outfall sewer, District No. 3, Contract No. 1. Noted Aug. 12 and 26.

Ohio, Cuyahoga Falls—Bonds for $60,000 voted for sewage-disposal plant. Noted Oct. 7.

Ohio, Dayton—Citizens voted $1,000,000 bonds. Part of proceeds will be used for sewer construction.

Ohio, East Liverpool—Plans for Sewer District No. 3, east end, approved by City Council.

Ohio, Marion—Bids will be received by J. H. Cheney, Dir. of Pub. Ser., until Nov. 24, for sanitary and storm sewers in Gill Ave., Herman and Senate St.

Ohio, Tiffin—City ordered by Board of Health to build new sewage-disposal plant. Estimated cost, $500,000.

Ohio, Toledo—Bids will be received by Board of County Commissioners until Nov. 26 for main sanitary sewer No. 13.

Ill., Calumet—City plans to install sewer system between 87th, Halstead, 95th and Lake Michigan St. Estimated cost, $665,000.

Ill., Decatur—Plans presented to City Commissioners by J. S. Waterfield Sanitation Co. of Illinois, for sewage treatment plant. Estimated cost, $180,000.

Ill., Dixon—Bids will be received by F. D. Whipp, Fiscal Superv., Springfield, until 3 p.m., Nov. 29, for concrete tunnels and storm water and sanitary sewers at State Epileptic Colony near Dixon.

Minn., Duluth—City Council authorized construction of sanitary sewers in Vineland and Meadow St. and Boundary Ave., 16th Alley west from Raleigh to Sherburne St. and Belmont Alley from Chester Park to Parkland Ave.

S. D., Winner—Bonds for $10,000 voted for sewer system. Noted Oct. 28.

Mont., Townsend—Election will soon be held to vote on $30,000 bonds for sewerage system. L. Poole, City Engr.

Mo., Joplin—City plans to improve sewer system.

Mo., Kirksville—Bids will soon be received for sewer in District No. 3. Estimated cost, $7,300. C. V. Downing, City Engr.

Tex., El Paso—Plans being considered for storm sewer.

Wash., Seattle—Contract will soon be awarded for sewers in Alonzo Ave., N. W., from West 70th to West 67th St. and West 67th St. from Alonzo Ave., N. W., to 14th Ave., N. W. A. H. Dimock, City Engr.

Ont., London—City Council plans to lay about 5,000 ft. of 8- to 12-in. sanitary sewers.

Bids In and Contracts Awarded

N. Y., New Rochelle—Contract for sewer at Hudson Park awarded to A. SOLIMENE, New Rochelle, at $7,417. Noted Sept. 23.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids were received Nov. 10 for making repairs to barrel and box sewers at (a) 26th St. and North River, 37th St. and East River, and 110th St. and East River, (b) 158th St. and North River, Third St. and East River, Stanton and Rivington St., East River as follows: Lawrence Construction Co., (a) $6,902, (b) $5,641; E. A. Riverside Construction Co., (a) $5,818, (b) $5,077; P. J. Kearns, (a) $7,189, (b) $5,886. Noted Nov. 4.

N. J., Perth Amboy—(Official)—Contract for sewer systems in Cornell St. and Compton Ave. awarded to ROHR & POULSEN. Noted Nov. 11.

D. C., Washington—Contract for Section No. 2, Hillbrook Service sewer awarded to WARREN F. BRENIZER, 611 Fourth St., N. E., Washington, at $6,000.

Va., South Boston—City will improve sewer system by day labor. Estimated cost, $7,000.

Ohio, Cleveland—Contract for sewer in East 123rd St. awarded to FRESHWATER CONSTRUCTION CO., at $4,000; sewers in Western Ave. to CONGER HELPER REALTY CO., at $4,350.

Ohio, Wilmington—Contract for sewer work awarded to BOYD & COOK, Dayton, at $6,498.

Ill., Ottawa—Contract for sewer work awarded to A. C. SHREITER, Manitowoc, Wis., at $10,000.

Ill., Upper Alton—Contract for storm and sanitary sewers at Alton State Hospital awarded to MYERS CONSTRUCTION CO., St. Louis, Mo., at $21,370; tunnel work to STRUBEL & HELMICK, Alton, at $53,860. Noted Oct. 14.

Wis., Oshkosh—(Official)—J. Rasmussen & Sons Co. submitted the lowest bid for sewer in Seventh St. from Michigan St. west to Summit. George F. Newmann, Asst. Engr.

Wis., Racine—Contract for Albert and Tenth St. sewer awarded to H. C. HANSON, and Blake Ave. sewer to PETER G. PETERSON.

Iowa, Mason City—(Official)—Inter Mountain Bridge and Construction Co. submitted lowest bid for sewage-disposal plant of Imhoff type. Estimated cost, $70,000. Noted Aug. 12.

Neb., Hastings—(Official)—Contract for sewer construction in Districts No. 71, 72 and 73 awarded to E. R. BING, Hastings, at $7,202. Noted Nov. 4.

Neb., Haverlock—(Official)—Contract for sewers in three districts awarded to J. S. HAMILTON. Noted Oct. 21.

S. D., Dell Rapids—Contract for 17 blocks of sewers awarded to FANEBUST BROS., Sioux Falls.

Mo., Webster Groves—Contract for storm water sewer between Rock Hill and Big Bend Rd., Sylvester and Lakewood Ave. awarded to JOHN F. McMAHON, at $28,000.

Colo., Arvada—Contract for sewer system awarded to GIBBONS CONSTRUCTION CO., Denver. Estimated cost, $30,000.

Colo., Hugo—Contract for sewer system awarded to GORDAN & TAYLOR CONSTRUCTION CO., Denver, at $10,100.

Wash., Harrington—Bids were received for sewer system as follows: Fire Security Bridge Co., Lewiston, Idaho, $5,136; J. W. Hill & Co., 1709 Main St., Spokane, $5,245; H. De Camp, Spokane, $5,922. Noted July 29.

Ore., Portland—Contract for reconstructing wood box sewer in Mill and Water St. awarded to J. P. O'NEILL, on a revised bid at $14,596. Noted Nov. 11.

Calif., El Centro—JAMES KENNEDY, 901 Washington Bldg., Los Angeles, at $206,199, awarded contract for El Centro-Imperial sanitary sewer system.

Calif., Richmond—City Council awarded contract to RICHMOND DREDGING CO., at $92,844, for sewer system. Noted Oct. 21.

Ont., Hamilton—Contract for construction of sewer system awarded to J. J. ARMSTRONG, 116 Burris St. Noted Oct. 21.

Ont., St. Thomas—Contract for sewage-disposal plant awarded to A. E. PONSFORD, LTD., at $8,809. Noted July 29.

Ont., Toronto—Contract for the construction of sewers on Clendennan, Marie, Vine and Symnot St. awarded to AGNEW CO., 606 Avenue Rd., at $8,593.

GARBAGE

Proposed Work

Okla., Bartlesville—Bids will soon be received for garbage incinerator. Estimated cost, $6,500. John Johnstone, Comr. of Finance. Noted Oct. 14.

Bids In and Contracts Awarded

N. J., Newark—Contract awarded to NEWARK PAVING CO., Newark, at $898,200, for collecting and disposing of refuse for five years. Noted Oct. 28.

Ohio, Alliance—City awarded contract to SANITARY SERVICE CO. for handling garbage.

Tex., San Marcos—Contract awarded to JONES BROS., Macon, Ga., for garbage incinerator. Estimated cost, $35,000. Noted Nov. 4.

Ont., Toronto—City awarded contract to GEORGE WEBB, Toronto, for garbage incinerator. Estimated cost, $84,500. Noted Nov. 4.

STREETS AND ROADS

Proposed Work

Vt., Brattleboro—Construction of road from Brattleboro to Bennington under consideration. Estimated cost, $125,000.

Mass., Boston—(Dorchester)—(Official)—Bids will be received by E. F. Murphy, Comr. of Pub. Wks., City Hall Annex, until noon, Nov. 19, for asphalt or bitulithic pavement in Eric Ave., Dorchester.

Mass., Boston—(West Roxbury)—(Official)—Bids will be received by E. F. Murphy, Comr. of Pub. Wks., Room 511, City Hall Annex, until noon, Nov. 19, for asphalt or bitulithic pavement in Vista St., West Roxbury.

Mass., Boston—(West Roxbury)—(Official)—Bids will be received by E. F. Murphy, Comr. of Pub. Wks., Room 51, City Hall Annex, until noon, Nov. 19, for asphalt or bitulithic pavement in Augustus Ave., West Roxbury.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., Room 2032, Municipal Bldg., New York, until 2 p.m., Nov. 23, for improving a number of streets and avenues of the borough.

N. Y., New York—(Borough of Queens)—(Official)—Bids will be received by Maurice F. Connolly, Borough Pres., Borough Hall, Fifth St. and Jackson Ave., Long Island City, until 11a.m., Nov. 22, for improving a number of streets and avenues of the borough.

N. Y., New York—(Borough of Richmond)—(Official)—Bids will be received by Calvin D. Van Name, Borough Pres., Borough Hall, St. George, New Brighton, until noon, Nov. 23, for constructing cement sidewalks on Colfax Ave., east side, between Railroad Ave. and Egbert St., fourth ward; Central Ave., east side, between Frastina Pl. and railroad track, third ward, and Van Name Ave. between Richmond Terrace and railroad track, third ward.

N. J., Haddonfield—Board of Commissioners contemplates paving Hawthorne and Berdwood Ave.

N. J., Newark—Bids will be received by Board of Freeholders until 3:30 p.m., Nov. 22, for improving South Orange Ave. from 20th St. to South Orange Village line.

Penn., Pittsburgh—(Official)—Bids will be received by Hyatt M. Cribbs, County Controller, until 10 a.m., Dec. 1, for improving Cliff Mines and Beaver Grade Connecting Rd., Section No. 1.

Md., Baltimore—Bids will be received until Nov. 23 by O. E. Weller, Chn. of Maryland State Rds. Comn., 601 Garrett Bldg., for seven miles of macadam paving on Annapolis Blvd. between Severn River and College Creek bridges.

Md., Cumberland—Georges St. from Baltimore to Dilly St. will be paved with wood blocks.

W. Va., Martinsburg—Bids will be received by E. D. Bromley, Street Comrs., until Nov. 30, for improving Spring St.

W. Va., Princeton—Bids will be received until Dec. 6 by G. H. Hill, Ch. Engr. of Rd. Constr., for 6½ miles of waterbound macadam road in Mercer County.

W. Va., Welch—Election will be held Dec. 18 in McDowell County, Sandy River District, to vote on $293,000 bonds for road construction.

N. C., Gastonia—Citizens voted $150,000 bonds. Part of proceeds will be used for new roads and part for improving old ones. Noted Aug. 19 and Sept. 2.

S. C., Summerville—City plans to hold election to vote on $20,000 bonds for street improvements.

Fla., Auburndale—Bonds for $30,000 voted for roads to connect with county hard roads which will be constructed if $1,000,000 Polk County bond issue is authorized.

Fla., New Augustine—Plans being prepared by J. B. McCrary Co., Engr., Atlanta, Ga., for paving King St. Estimated cost, $10,000.

Fla., Sebring—Election will be held Dec. 14 to vote on $50,000 bonds for street improvements.

Fla., West Palm Beach—Bids will be received by F. E. Encell, Chn., Comrs. of Palm Beach County, until Nov. 23, for hard surfacing Military Trail from Okeechobee Rd. west of Palm Beach to Palm Beach Canal.

Ala., Bay Minette—Election will be held Jan. 18 in Baldwin County to vote on $200,000 bonds for improving a number of roads and $55,000 bonds for its portion of highway between Mobile and Baldwin Counties. Noted under Mobile Nov. 4.

Miss., Edwards—Bids will be received by Highway Commission until Dec. 6 for 6½ miles of gravel road. Noted Aug. 19.

La., Mansfield—Election to vote on $280,000 bonds for roads contemplated by De Soto Parish, Wards 2, 4, 5, 6 and 7.

Ky., Bellevue—(Newport post office)—Citizens voted $23,000 bonds for improvement of Taylor Ave. Noted Oct. 21 and 28.

Tenn., Jonesboro—Election will be held Dec. 18 in Washington County to vote on $425,000 bonds for road construction.

Ohio, Cleveland—Citizens defeated $300,000 bonds for improving Carnegie Ave. from East 89th St. to Blvd. Noted Oct. 28.

Ohio, Linden Heights—Bonds for $10,000 voted by citizens for street improvements.

Ohio, Toledo—Bids will be received by County Commissioners until Nov. 30 for grading, draining and macadamizing with water bound macadam Otter Creek Rd., Oregon Township.

Ind., Columbia City—No bids were received Nov. 5 for road on Whitley-Noble county line. Noted Sept. 30.

Ind., Muncie—Bids will be received by F. M. Williams, Audr., Comrs. of Delaware County, until 10 a.m., Dec. 8, for gravel roads in Perry and Mt. Pleasant Townships.

Mich., Jackson—Supervisors of Hinds County plan $50,000 bond issue for improving roads in western part of county.

Mich., Saginaw—Construction of trunk line road between Saginaw and Owosso authorized by Board of Supervisors. Estimated cost, $40,000.

Ill., Peoria—Chamber of Commerce, Peoria, and citizens of Averyville contemplate paving "The Narrows," Galena Rd. Estimated cost, $22,000.

Ill., Streator—Ordinance passed authorizing paving of Bridge and Penn St. Estimated cost, $14,140.

Wis., Green Bay—Bids will be received until 10 a.m., Nov. 23, by F. Biemert, Chn., Com. on Streets, for crushed stone on West Mason St.

Wis., Kenosha—Commissioners of Kenosha County plan an expenditure of $66,405 for permanent highway in 1916. R. H. Jones, County Clk.

Iowa, Ida Grove—Bids will be received until Nov. 30 for paving a number of streets. K. C. Gaynor, Sioux City, Engr. Noted Aug. 15 and Sept. 2.

Minn., Excelsior—Bids will be received by F. S. Skemp, Village Clk., until 7:30 p.m., Dec. 7, for paving a number of streets with concrete, vitrified brick or creosoted blocks.

Kan., Pittsburg—(Official)—Bids will be received by L. Boyd, City Clk., until 8 p.m., Nov. 24, for recurbing and repaving Broadway from Second to Quincy Ave. and curbing and paving Elm St. from 12th to 20th St. and Lindburg Ave. from Broadway to Pine St. Noted Oct. 14.

Neb., Omaha—Bids will be received by T. J. O'Connor, City Clk., until 10 a.m., Nov. 23, for paving 41st, 35th, Cumming St. and various other streets.

Mo., Hillsboro—Bonds for $500,000 for roads and bridges defeated. Noted Oct. 7 and 21.

Mo., Jefferson City—Citizens defeated $100,000 bonds for roads. Noted Oct. 28.

Mo., Liberty—Election will be held Nov. 19 in Clay County, Excelsior Springs Special Road District, to vote on $100,000 bonds for roads. Noted Sept. 16.

Ark., De Witt—Surveys made for macadam road from De Witt to Reydell. Estimated cost, $120,000. L. S. Haller, County Judge.

Ark., Fayetteville—Surveys made for macadam road across Washington County, north and south, via Fayetteville, about 40 miles. Estimated cost, $200,000.

Ark., Fulton—Commissioners of Miller County Highway and Bridge District, Texarkana, will build 16 miles of road and bridge across Red River between Fulton and Index. About $60,000 available for this purpose.

Ark., Harrison—Surveys made for macadam road south to Newton County line to connect with proposed road north from Jasper in Newton County, about nine miles. Estimated cost, $38,000.

Ark., Little Rock—Commissioners of Pulaski County contemplate 22 miles of macadamized and graveled highways.

Ark., Osceola—Mississippi County has completed formation of three separate road districts and fourth is under consideration. New districts plan to build about 200 miles of improved highways.

Ark., Pine Bluff—Jefferson County has formed Road Improvement District No. 12 and will build about 22 miles of hard road in northern part of county. C. M. Philpot, County Judge.

Ark., Pine Bluff—Bonds for $13,000 sold for road from Pine Bluff to Free Bridge.

Ark., Winslow—Plans prepared for macadam road from Winslow to Ft. Smith.

Tex., Crockett—Election will soon be held to vote on $50,000 bonds for improving roads in Houston County.

Tex., Denison—No bids were received Oct. 19 for approximately 13,000 sq.yd. of paving. Noted Oct. 14.

Tex., Eastland—See item under "Bridges."

Tex., Sulphur Springs—Commissioners of Hopkins County plan to hold election to vote on $400,000 bonds for macadam roads.

Tex., Waco—Commissioners of McLennan County, Precinct No. 6, plan to hold election to vote on $200,000 bonds for road construction.

Okla., Poteau—See item under "Bridges."

Colo., Denver—Surveys completed for proposed road from Colfax Highway near rifle range to summit of Green Mountain, about five miles.

Wash., Walla Walla—Bids will be received by County Commissioners until Nov. 27 for two miles of highway near Whitman's Station.

Ore., Pendleton—(Official)—Bids will be received by City Recorder until 5 p.m., Nov. 24, for improvement of Riverside Drive from Main to Railey St. Noted Nov. 4.

Calif., Oakdale—Plans being prepared for paving F St. Estimated cost, $50,000.

Alta., Beverly—(Official)—Citizens voted $10,000 bonds for clearing and grading streets. Noted Oct. 28.

Bids In and Contracts Awarded

Mass., Boston—(Cheshire)—Bids were received Nov. 9 for 1,750 lin.ft. of road in Cheshire as follows: Middlesex Construction Co., Boston. $4,065; Roberts Construction Co., Pittsfield, $4,113; C. B. Lindholm, Pittsfield, $4,542.

Mass., Boston—(Sheffield and Great Barrington)—Bids were received Nov. 9 for section of state highway in Sheffield and Great Barrington from: J. D. Michael & Bros., Torrington, Conn., at $28,382, and Powers Bros., Brockton, at $33,615. Noted Nov. 4.

Mass., Woburn—(Official)—Contract for 5,200 lin.ft. of road awarded to DAVIS & PALLATTO, Lowell, at $11,968. Noted Oct. 21.

N. Y., Albany—(Official)—Bids were received Nov. 11 by State Highway Commission, 55 Lancaster St., for constructing highways by State-Aid as follows:

Road No. 1317, Auburn-Weedsport, Cayuga County, 8.00 miles—Brayer Bros., Auburn, $123,708; Sullivan Construction Co., Syracuse, $123,808; John Young, Syracuse, $124,724.

Road No. 5596—Mayville Village-Erie St., Chautauqua County, 0.79 mile—Edward T. Beck & Co., Warren, Penn., $25,800; Elmer F. Love & Son, Corry, Penn., $26,529; Ontario Roads Co., Inc., Manchester, $26,922.

Road No. 1339, Leroy-Brockport, Part II, Genesee County, 0.40 miles—Atlanta Construction Co., Atlanta, $13,010; Rhodey & Clawson, Albion, $14,119; Parker & Carney, Batavia, $14,631.

Road No. 1253, Chaumont-Depauville, Jefferson County, 6.05 miles—Henry P. Burgard, Buffalo, $45,249; Richard Hopkins, Troy, $47,453; Gruner & Hollenbeck, Harriman, $48,247.

Road No. 512, Akin-Johnstown, Part I, Montgomery County, 4.59 miles—Routley & Summers, Huntingdon, Quebec, $29,528; S. B. Van Wagenen, Inc., Rondout, $31,010; John Arborio, New Haven, Conn., $31,715.

Road No. 5558, Oneida-Verona, Oneida County, 4.69 miles—J. G. Hayes Co., Inc., Rome, $36,624; James Rossney, Buffalo, $38,134; Charles O. McComb, Syracuse, $38,322.

Road No. 5597, Utica-Poland, Part III, Oneida County, 5.34 miles—Routley & Summers, Huntingdon, Que., $51,591; Hovey E. Benedict, Williamsport, Penn., $51,706; James Rossney, Buffalo, $54,129.

Road No. 1338, Scotia-Saratoga County Line, Part I, Schnectady County, 4.22 miles—DeGraff & Hogeboom, Kingston, $33,775; S. B. Van Wagenen, Inc., Rondout, $35,081; John Arborio, New Haven, Conn., $36,207. Noted Oct. 28.

N. Y., New York—(Borough of Brooklyn)—(Official)—Contract for regulating, curbing, and laying sidewalks on Bay 34th St. awarded to B. TURECAMO CONTRACTING CO., INC., at $12,717, regulating, curbing and laying sidewalks on 23rd Ave. to J. J. GUINAN CONTRACTING CO., 2314 Gravesend Ave., New York, at $8,975. Noted Sept. 30 and Oct. 14.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for regulating and repaving various streets awarded as follows: West side of Broadway from curb to rail from north side of 108th St. to north side of 110th St. to ASPHALT CONSTRUCTION CO., Madison Ave. and 137th St., New York, at $5,189; 25th St. from Sixth to Seventh Ave. to SICILIAN ASPHALT PAVING CO., 41 Park Row, New York, at $5,277; 72d St. from Central Park West to Columbus Ave. to AZTEC ASPHALT CO., 90 West St., New York, at $10,655; 78th St. from First to Third Ave., 95th and 96th St. from Broadway to Amsterdam Ave. to SICILIAN ASPHALT PAVING CO., 41 Park Row, New York, at $11,060; Sixth Ave. from Eighth to 10th St., Greenwich Ave. from Sixth Ave. to north of Perry St., West 10th St. from Greenwich to Sixth Ave. to AZTEC ASPHALT CO., 90 West St., New York, at $52,151. Noted Oct. 28 and Nov. 11.

N. Y., Rensselær—JAMES J. RIDNEY, Rensselær, at $48,000 awarded contract for paving Riverside Ave.

N. Y., Schenectady—Contract for paving various streets awarded to UNION PAVING CO., at $23,687, and SCHENECTADY PAVING CO., at $2,427.

N. J., Hackensack—E. C. HUMPHREY, 173 Main St., Hackensack, at $24,226, awarded contract for improving Essex and Passaic St. Noted Oct. 28.

N. J., Newton—Contract for improving Newton-Sparta Rd. awarded to RICHARDSON & GASTON, INC., 143 Liberty St., New York, N. Y., at $57,163. Noted Oct. 21 and 28.

N. J., Redbank—Contract for concrete roadway at Throckmortons Fill awarded to WILLIAM A. COVENTRY, Ocean Grove. Noted Oct. 21.

N. J., Trenton—Contract for road from Hightstown to Princeton Junction awarded to MAINWARING & CUMMINGS, Philadelphia, Penn. Estimated cost, $55,000. Noted Oct. 14.

N. J., Trenton—Contract for Section No. 1 of River Rd. from Washington Crossing to Hunterdon County line awarded to UTILITY CONSTRUCTION CO., New Brunswick, at $38,264, for concrete; Section No. 2 to NEWTON PAVING CO., Trenton, at $73,245, for bituminous concrete.

Penn., Harrisburg—M. BENNETT & SONS, Indiana, at $16,640, awarded contract for brick block pavement in Marion Center Borough, Indiana County, and at $14,916, for water bound macadam road in Hickory Township, Lawrence County. Noted Oct. 14.

Penn., Philadelphia—Contract for improving Independence Sq. awarded to F. S. MARKLAND, 1500 Sansom St., Philadelphia, at $10,970.

Penn., Philadelphia—(Official)—Contract for surfacing with bituminous on 5-in. concrete base awarded to UNION PAVING CO., 30th and Locust St., Philadelphia, at $17,162. Noted Nov. 4.

Penn., Pittsburgh—(Official)—Contract for improving Glenn Ave,. awarded to GORDON CONTRACTING CO., Pittsburgh, at $8,335; Wible Run Extension Rd. to JOHN FOLEY, Columbus, Ohio, at $35,398. Noted Nov. 4.

Penn., Pittsburgh—(Official)—All bids received Sept. 23 for improving Painters Run Rd. rejected. Noted Sept. 9.

Penn., Pittsburgh—(Official)—Contract for repaving Webster Ave. awarded to BOOTH M. FLINN, LTD., at $11,036.

Va., Norfolk—Contract for paving work on Granby St. awarded to LOUIS LAWSON, Norfolk. Estimated cost, $6,000. Noted Oct. 28.

W. Va., Huntington—(Official)—Contract for paving sections of Sixth, 11th and 13th Ave. awarded to J. ULLOM, Huntington, at $20,052. Noted Oct. 4.

La., Amite—Contract for 52,000 sq.yd. of paving awarded to WORMACK & KENT, Kentwood, at $9,620.

La., Monroe—(Official)—Contract for improving various streets of the city awarded to MERRILL ROAD IMPROVEMENT CO., Chattanooga, Tenn., at $40,000. Noted Oct. 21.

Tenn., Elizabethton—Contract for 70 miles of graded roads and repairing and completing roads already graded awarded to OLIVER HILL CONSTRUCTION CO., at $180,000. Noted Oct. 21.

Tenn., Kingston—Contract for two miles of Harriman and Oliver Springs pike awarded to HARRIMAN CEMENT AND STONE CO., Harriman.

Tenn., Kingston—Contract for pike from Harriman to Rockwood awarded to FRANK GAMBILL CO. Noted Oct. 28.

Tenn., Park City—(Knoxville post office)—Contract for paving Magnolia Ave. awarded to MURRAY CONSTRUCTION CO. Estimated cost, $105,000. Noted Oct. 7.

Ohio, Cheviot—(Cincinnati post office)—Contract for paving with brick on Olivette Ave. and sewer in North Bend Rd. awarded to KIRCHNER CONSTRUCTION CO., Cincinnati.

Ohio, Elyria—Contract for slag water-bound macadam road awarded to PUBLIC CONTRACTING CO., Masonic Temple, Elyria, at $8,419.

Ohio, Granville—(Official)—Contract for draining, curbing and paving Broadway St. from east to west corporation line awarded to OHIO ENGINEERING CO., Lorain, at $50,580. Noted Oct. 28.

Ind., Bloomington—Contract for paving East Sixth St. awarded to UNION ASPHALT CO., Indianapolis, at $16,326. Noted Oct. 14.

Ind., La Fayette—Contract for gravel road in Wayne Township, Tippecanoe County, awarded to S. S. PALMA, La Fayette, at $8,190.

Ind., Muncie—Contract for two roads in Liberty Township awarded to SNYDER & BARNETT, Frankfort. Noted Oct. 28.

Ind., Newport—Contract for gravel roads in Helt and Clinton Townships awarded to JAMES HEBER, Hillsdale, at $4,100, and CLAUDE INGRAM, Hillsdale, at $2,940. Noted Oct. 14.

Ind., Portland—Contract for brick pavement on macadam base in street from Ship St. across river bridge to Lake Erie Railroad awarded to FITZMAURICE & BEARD, at $1.42 per sq.yd.

Ind., South Bend—Contract for three gravel roads awarded to H. W. REED & SONS, Mishawaka, at $51,350. Noted Oct. 14.

Ind., Williamsport—Contract for gravel roads in Jordan and Pike Township awarded to CHARLES L. IRVIN, Attica, at $4,550. Noted Oct. 14.

Mich., Detroit—Contract for paving Sheridan Ave. from Gratiot to Frederick St. and Wabash Ave. from McGraw to West Grand Blvd. awarded to DETROIT ASPHALT PAVING CO., Detroit, at $4,424 and $13,068 respectively; Lynn St. from Oakland to Cameron Ave., to CLEVELAND TRINIDAD PAVING CO., at $4,140.

Mich., Sault Ste. Marie—Contract for 7½ miles of gravel roads awarded to A. T. BOUND, Brimley, at $47,000. Noted Oct. 14.

Ill., Springfield—Contract for extending Peoria hard road from Springfield awarded to CAMERON JOYCE, Keokuk, Iowa, at $13,673, by State Highway Commission, Springfield.

Minn., Park Rapids—(Official)—C. T. Glasser, Minneapolis, at $7,352, submitted lowest bid for job No. 2, State Highway No. 1, between Akely and east county line.

Minn., Wayzata—Lowest bid received for grading main road through Wayzata submitted by McCullough & Cheney at $10,756.

Kan., Bonner Springs—Contract for paving, grading and curbing awarded to A. JAICKS CO., American Bank Bldg., at $6,312.

Mont., Livingston—Contract for paving Park St. awarded to WARREN CONSTRUCTION CO., at $8,000.

Tex., El Paso—Contract for paving San José St. and Portland Ave., Manhattan Heights, awarded to SOUTHWESTERN PAVING CO. Estimated cost, $10,000.

Tex., Terrell—Contract for 55 miles of gravel and macadam highway awarded to J. S. TOBY & CO., Ft. Worth, at $114,000. Noted Oct. 7.

Wash., Dayton—Contract for two miles of highway on Highway No. 1 awarded to TRIBOU & BLACKMAN, Walla Walla, at $4,250.

Calif., Arcadia—(Official)—Contract for about 16 miles of piled macadam roadway and 10,000 lin. ft. of concrete curb and gutter awarded to ROGERS BROS. CO., Los Angeles. Estimated cost, $118,000. Noted Oct. 28.

Calif., Hillsborough—Contract for improving a number of streets awarded to RAISCH IMPROVEMENT CO., San Francisco, at $10,000. Noted Aug. 14.

Calif., Los Angeles—(Official)—Contract for paving Western Ave. from Temple St. to Fountain Ave. awarded to GEORGE R. CURTIS, at $49,266. Noted Sept. 30.

Calif., Morgan Hill—Contract for improving Monterey Rd. awarded to CASLEY & HAMILTON, San Jose, at $6,249.

Calif., San José—Contract for paving a new street between Rucker and Leavesly awarded to JOHN BOYLE, at $4,287.

Calif., Santa Cruz—Contract for paving a number of streets awarded to HOWARD CONSTRUCTION CO., Oakland, at $40,994. Noted Sept. 16.

INDUSTRIAL WORKS

Proposed Work

Mass., Ware—Otis Co. contemplates building three-story building to replace Mill No. 2.

Mass., Worcester—Worcester Woolen Co. will build four-story, 63x106-ft. concrete mill.

R. I., Woonsocket—Joseph G. Ray, Franklin, Mass., will build three-story, 80x380-ft. brick mill on Pont St.

Conn., Hartford—Bids will soon be received for three-story addition to refrigerating plant of Swift & Co. Estimated cost, $100,000. Noted Nov. 11.

N. Y., Buffalo—Buffalo Distilled Water Ice. Co. will build warehouse at 2 Central Ave. Estimated cost, $10,000.

N. Y., Elmira—Plans being prepared for plant for Morrow Manufacturing Co. Estimated cost, $100,000.

N. Y., Ft. Plain—Plans being prepared for two-story, 50x185-ft. plant for A. A. Warath & Son.

N. Y., New York—(Borough of Brooklyn)—(Official)—Plans prepared by Francisco & Jacobus, Arch., 200 Fifth Ave., for four-story, 80x100-ft. brick and steel sales and service station at Bedford Ave. and Sterling Pl., for Ford Motor Co., Detroit, Mich. Estimated cost, $100,000.

N. Y., Poughkeepsie—Plans prepared by J. J. Petit, Arch., 103 Park Ave., N. Y., for four-story, 75x350-ft. factory for Victor Typewriter Co. Estimated cost, $250,000. Noted Nov. 11.

N. J., Elizabeth—Plans prepared for one-story, 40x236-ft. factory for Metal Plating Co., 200 Fifth Ave., New York, N. Y. Noted Sept. 23.

N. J., Gibbstown—Du Pont Powder Co. contemplates building plant No. 2.

N. J., Irvington—Lionel Manufacturing Co., 365 Ogden St., Newark, contemplates building two-story, 228x235-ft. plant on South 21st St. Estimated cost, $60,000.

N. J., Newark—W. S. Rockwell Co. will build two-story factory on Balls Lane. Estimated cost, $20,000.

Penn., Cedar Hollow—Plans being prepared by Day & Zimmerman, Engr., 611 Chestnut St., Philadelphia, for lime kiln for Charles Warner Co., Wilmington, Del. Estimated cost, $80,000.

Penn., Philadelphia—Revised plans prepared by Charles E. Oelschlager, Arch., for three-story, 98x135-ft. warehouse for James Gallagher, Inc.

Penn., Phillipsburg—Mercantile Realty Co. will build window glass factory. Estimated cost, $10,000.

Penn., West End—A. B. Davidson, West Seventh Ave., contemplates building two-story grain elevator and warehouse at East St. and West Sixth St.

D. C., Washington—Plans being prepared for four-story bakery for Holmes & Son. C. D. Cooley & Co., Century Bldg., Pittsburgh, Penn., Arch. Estimated cost, $50,000.

D. C., Washington—Plans being prepared by George T. Santmyer, 917 New York Ave., for two-story, reinforced-concrete warehouse at 12th and C St. for W. R. Nash. Estimated cost, $10,000.

Va., Danville—Riverside and Dam River Cotton Mills will build two-story, 115x170-ft. building. Estimated cost, $40,000. Shattuck & Hussy, 19 South La Salle St., Chicago,, Ill., Arch.

Va., Lamberts Point—(Norfolk post office)—Bids will soon be received by Norfolk & Western Ry. Co. for two-story warehouses. Estimated cost, $1,800,000. L. E. Johnson, Roanoke, Ch. Engr. Noted Oct. 7.

W. Va., Charleston—Biago Fruit and Produce Co. having plans prepared for cold storage, ice plant and office building. Estimated cost, $48,000. Paul M. Egan, 814 Quarrier St., Arch.

W. Va., Huntington—Stroehamnns Vienna Bakery has plans for one and two-story, 90x100-ft. bakery and office building. Estimated cost, $40,000. C. D. Cooley Co., Arch., Century Bldg., Pittsburgh, Penn. Noted Oct. 7.

W. Va., Wheeling—Plans being prepared by Charles W. Bates, Arch., 702 National Bank of West Virginia Bldg., for two-story, 175x200-ft. packing plant for Kalbitzer Packing Co.

N. C., Durham—Durham Steel Products Co., recently organized, will build a large plant for the manufacture of war munitions.

N. C., Durham—Imperial Tobacco Co. plans to build plant. Estimated cost, $500,000.

N. C., Greensboro—C. W. Edwards will build one-story, 67x200-ft. garage to be occupied by Gate City Motor Co. Estimated cost, $1,000.

N. C., Hendersonville—J. E. Sirrine, Greenville, S. C., preparing plans for 50x80-ft. mill and 22x76-ft. dyehouse for Hendersonville Hosiery Knitting Mill.

N. C., Raleigh—News and Observer Publishing Co. will rebuild plant destroyed by fire.

N. C., Statesville—Statesville Cotton Mill plans to build addition and install new machinery. Estimated cost, $70,000.

S. C., Columbia—Du Pre Motor Co. will build one-story, 47x100-ft. garage. Estimated cost, $10,000.

Ga., Athens—Georgia R.R. will build warehouse to be occupied by Callaway Grocery Co. Estimated cost, $35,000.

Ga., Augusta—Riverside Compress Co. will rebuild compress which was recently destroyed by fire.

Ga., Columbus—Plans prepared for addition to plant of Bibb Manufacturing Co., 23rd and River St. Estimated cost, $200,000.

Ga., Moultrie—T. H. Rothe and James B. Carlton will build a commercial hog cholera serum plant. Estimated cost, between $15,000 and $25,000.

Fla., Miami—Pin-Ap-Ola Co., 801 Longacre Bldg., New York, N. Y., will built a plant. Estimated cost, $35,000.

Ala., Shreveport—Developers Oil and Refiners Co. will build oil refinery at Shreveport.

Ala., Sylacauga—Avondale Mills, Birmingham, will enlarge cotton mill at Sylacauga. Estimated cost, $100,000.

La., New Orleans—Mohawk Motor Co., Wilmington, Del., plans to build factory. J. Bart Davis, interested.

Tenn., Nashville—J. B. Palmer will build two-story, 50x175-ft. brick garage. Estimated cost, $12,000.

Ky., Louisville—Kentucky Distillery and Warehouse Co. will improve building and build warehouse at Hamilton and Gregory St. and build addition to building at Thorn and Hamilton St. Estimated cost, $22,500.

Ohio, Canal Dover—Immel Feed and Milling Co. will rebuild plant which was recently destroyed by fire. Estimated cost, $40,000.

Ohio, Lima—Crucible Steel Co. will build an addition to plant. Estimated cost, $30,000.

Ohio, Sebring—E. H. Sebring Pottery Co. plans to build one and two-story addition. Estimated cost, $10,000.

Ohio, Toledo—Scheiwe Storage Co. will build warehouse at 141 Woodruff Ave. Estimated cost, $65,000.

Ohio, Toronto—Wayne Pottery Co. acquired plant of American China Co. and will improve same. Estimated cost, $20,000.

Ind., East Chicago—American Steel Foundries contemplates building 200x330-ft. addition to plant.

Ind., Indianapolis—J. B. Howard will build garage at Meridian and Tenth Ave. Estimated cost, $13,000.

Ind., Muncie—Gill Clay Pot Co. will rebuild plant which was recently destroyed by fire with loss of $100,000.

Mich., Fenton—Aetna Portland Cement Co., 412 Union Trust Bldg., Detroit, will enlarge plant. R. E. Paine, 50 Church St., Boston, Mass. ,and others interested.

Mich., Flint—A. L. A. Tire Co. will build one and two-story, 100x275-ft. plant on East Kearsley St.

Mich., Flint—Buick Motor Car Co. will build two-story, 300x350-ft. foundry.

Mich., Muskegon—Plans being prepared for 100x380-ft. plant for American Enameled Magnet Wire Co.

Ill., Chicago—Armour & Co. will build two-story garage at 3041 Piting St. Estimated cost, $28,000.

Ill., Chicago—Merchants Wholesale Grocery Co. will build two-story warehouse. Estimated cost, $25,000. C. Thisslew, Arch.

Ill., Chicago (South Chicago)—Illinois Steel Co. will build duplexing plant. Estimated cost, $2,000,000.

Ill., Chicago—General Fire Extinguisher Co., 1511 West 38th St., will build addition to plant. Estimated cost, $30,000. S. S. Joy, 1118 West 35th St., Arch.

Ill., Galesburg—Coulter Disc Co. will build plant to replace one recently destroyed by fire with loss of $100,000.

Wis., Superior—Great Northern Railway will build grain elevators in spring. A. H. Hogeland, St. Paul, Minn., Ch. Engr.

Iowa, Keokuk—Keokuk Electric Metals Co. will build plant. Estimated cost, $100,000.

Minn., Brainerd—Plans prepared for 80x410-ft., reinforced-concrete paper and pulp mill for Northwestern Paper Co. Estimated cost, $300,000. T. T. Whittier, Ch. Engr.

Kan., Wichita—Standard Oil Co. approved plans for warehouse, wash house, boiler room, tank house, office building and garage. Estimated cost, $75,000. Noted Sept. 9.

Neb., Gering—Gering Sugar Co., auxiliary of Great Western Sugar Co., will build plant. Estimated cost, $125,000.

Mo., St. Louis—International Shoe Co. will build two-story, 110x110-ft. addition. Estimated cost, $35,000.

Mo., Springfield—Springfield Ice and Refrigerating Co. will build a warehouse. Estimated cost, $125,000. B. E. Meyer, is Mgr.

Tex., Galveston—J. J. Kane and associates plan to build plant for construction and repair of ships. Estimated cost, $1,000,000.

Tex., Garland—F. W. White, A. R. Davis and Z. S. Armstrong organized a company to build a grain elevator. Estimated cost, $15,000.

Tex., Gatesville—Gatesville Cotton Yard and Warehouse Co. will build warehouse. Estimated cost, $12,000. J. T. Post interested.

Tex., Houston—Plans being prepared by Finger & Bailey, Houston, for four-story, 130x140-ft. reinforced-concrete warehouse for Magnolia Paper Co.

Tex., Mexia—Mexia Glass Works will build four-story plant. Estimated cost, $75,000.

Okla., Tulsa—Contract will soon be awarded for two-story, 50x120-ft. warehouse for W. L. Britton. Estimated cost, $12,000.

Wash., Port Angeles—Standard Oil Co., Railway Ave. and Whatcom St., Seattle, will install three oil tanks, build office building and warehouse. Estimated cost, $75,000. John McLean, Mgr.

Wash., Seattle—U. K. Loose, Lowman Bldg., interested in construction of plate plant. Estimated cost, $2,000,000.

Que., Sherbrooke—Canadian Ingersoll Rand Co. will build machine shop. Estimated cost, $50,000.

Que., Valleyfield—Castings Co. will establish forge, foundry and shell factory. L. A. Boyer, Town Clk

Bids In and Contracts Awarded

Mass., Leominster—Contract awarded to WILEY & FOSS, Fitchburg, for two-story, 40x241-ft. addition to plant of Viscoloid Co.

Mass., Worcester—(Greeendale)—Norton Co. awarded contract to E. J. CROSS CO., 82 Foster St., for four-story, 40x56-ft. addition.

Conn., Torrington—Contract awarded to TORRINGTON BUILDING CO., 179 Water St., for one-story, 220x240-ft. plant for Coe Brass Branch of American Brass Co.

Conn., Waterbury—Contract for machine shop and office building for Waterbury Tool Co. awarded to TRACY BROS. CO., Waterbury. Estimated cost, $70,000. Noted Nov. 11.

N. Y., Buffalo—Contractors Plant Manufacturing Co. awarded general contract for one-story, 60x140-ft. addition to JOHN W. COWDER CO. Estimated cost, $15,000.

N. Y., New York—(Borough of Brooklyn)—(Official)—Edison Electric Illuminating Co., 13 Willoughby St., awarded contract to J. C. LYONS SONS CO., 30 East 42d St., for two-story, 98x100-ft. brick shop and garage on Quincy St. Estimated cost, $40,000. Noted Oct. 21.

Penn., Harrisburg—Contract awarded to MASHEK ENGINEERING CO., 90 West St., New York, N. Y., for plant for Gamble Fuel Briquette Co., Harrisburg.

Penn., Norristown—Adam Scheidt Brewing Co. awarded contract to PHILIP HAIBACH CONSTRUCTION CO., Philadelphia, for three-story, reinforced-concrete bottling plant. Estimated cost, $70,000. Noted Nov. 4.

Penn., Philadelphia—Girard Point Storage Co. awarded contract for 100x200-ft. addition to grain elevator to JAMES STEWART & CO. Estimated cost, $200,000.

Penn., Sharon—Contract for grain elevator for J. B. Roux awarded to FARRELL BUILDING CO. Estimated cost, $25,000.

Penn., Yardley—Klauder Weldon Dyeing Machine Co. awarded contract to CHARLES T. EASTBURN, Yardley, for stone and steel foundry.

Md., Baltimore—Curtis Bay Distilling Co. awarded contract to CHICAGO BRIDGE AND IRON CO., 1300 West 105th St., Chicago, Ill., for 67 steel tanks. Estimated cost, $250,000.

Md., Baltimore—City Baking Co. awarded contract to CHARLES L. STOCKHAUSEN, 1 National Marine Bank Bldg., Baltimore, for three-story, 74x100-ft. bakery and garage. Estimated cost, $20,000. Noted Oct. 21.

Md., Baltimore—International Motor Co. awarded contract to CONSOLIDATED ENGINEERING CO., 243 Calvert Bldg., for one-story, 60x150-ft. garage.

N. C., Charlotte—Buckeye Cotton Oil Co. awarded contract to BLYTHE & ISENHOUR, Charlotte, for two additional buildings. Estimated cost, $20,000.

Go., Columbus—Chero-Cola Bottling Co. awarded contract to L. E. WOOTEN, Columbus, for two-story plant. Estimated cost, $150,000.

Fla., Tampa—Consumers Ice and Cold Storage Co. awarded contract to McGUKEN & HEYER, Tampa, for five-story, 30x 90-ft. packing plant. Estimated cost, $250,000.

Ala., Selma—Contract for additions to plant of Buckeye Cotton Oil Co. awarded to THOMAS PURVIS, Selma. Estimated cost, $40,000.

Ohio, Cincinnati—City Ice Delivery Co. awarded contract to REAUGH CONSTRUCTION CO., 2835 East 51st St., Cleveland, for ice plant at Price and Elberon Ave. Estimated cost, $17,000. Noted Oct. 28.

Ohio, Cleveland—Davis Laundry Co. awarded contract to PAUL BROS. CONSTRUCTION CO., 615 Citizens Bldg., Cleveland, for two-story, 50x100-ft. addition. Estimated cost, $10,000.

Ohio, Xenia—Contract for elevator, warehouse and feed mill for C. O. Miller, of Trebiens, awarded to BURRELL ENGINEERING AND CONSTRUCTION CO., Chicago.

Mich., Detroit—Studebaker Automobile Corporation awarded contract for 50x350-ft. building adjacent to plant No. 3, at Brush and Piquette St., to WISCONSIN BRIDGE AND IRON CO., 505 Moffat Block. Estimated cost, $30,000. Noted Oct. 14.

Mich., Muskegon Heights—Campbell-Wyant and Cannon Co. awarded contract to INDIANA BRIDGE CO. for two-story foundry. Estimated cost, $100,000. Noted Oct. 28.

Ill., Chicago—Martha Washington Candies Co. awarded contract to MUELLER CONSTRUCTION CO. for three-story factory. Estimated cost, $22,000.

Wis., Milwaukee—A. J. Lindermann-Hoverson Co., Midland and Cleveland Ave., awarded general contract to DANIEL B. DANIELSON, 874 Layton Blvd., for enameling shop. Estimated cost, $20,000.

Neb., Omaha—Contract for dye works at 24th and Erskine St. for Frank J. Carey, 24th and Lake St., awarded to JOHN BROS. CO., 3152 Chicago St., at $16,000.

Mo., St. Louis—(South St. Louis)—Monsanto Chemical Works awarded contract to GILSONITE CONSTRUCTION CO., Wainwright Bldg., St. Louis, for warehouse. Estimated cost, $70,000. Noted Nov. 4.

Mo., St. Louis—Terminal R.R. Association awarded contract to FRUIN-COLNON CONSTRUCTION CO., St. Louis, for two-story, 50x100-ft. service building at Compton and Scott St. Estimated cost, $15,000.

Wash., Seattle—All bids received Oct. 20 for four-story addition to warehouse on Whatcom Ave. for Port of Seattle Commission have been rejected. Noted Nov. 11.

Calif., Los Angeles—Murphy Oil Co. awarded contract to E. M. WHEATLAND, 108 North Greenleaf Ave., Whittier, Calif., at $56,434 for one-story packing plant.

N. B., St. John—Contract awarded to RHODES, CURRY CO. for 80x350-ft. warehouse, running parallel to No. 15.

Ont., Welland—Electric Steel and Metals Co., Welland, awarded contract to STANDARD STEEL CONSTRUCTION CO. for machine shop. Estimated cost, $20,000.

FEDERAL GOVERNMENT WORK

Proposed Work

Mass., Attleboro—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 21, for United States post office at Attleboro.

N. Y., New York—Dredging—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Dec. 11, for dredging at Navy Yard, New York.

N. Y., New York—Dredging—Bids will be received at U. S. Engineer Office until noon, Dec. 14, for dredging Newark Bay and Passaic River, N. J. (See adv.)

N. Y., New York—(Borough of Manhattan)—Post Office—Plans being prepared by W. H. Volkening and J. Holler, Jr., Archs., 88 Wall St., for post office at Fourth Ave. and 13th St. for Estate of Charles A. Chesebrough to be leased by U. S. Government. Estimated cost, $50,000.

Wis., Antigo—Post Office—Bids will be received about Jan. 1 for U. S. post office at Antigo. Estimated cost, $70,000.

Wis., Beaver Dam—Post Office—Bids will be received about Jan. 1 for U. S. post office at Beaver Dam. Estimated cost, $75,000.

Neb., Aurora—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 22, for United States post office at Aurora.

Guam—Steel Towers—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Jan. 8, for two 400-ft. steel towers at radio station, island of Guam.

Panama—Miscellaneous and Metal Supplies—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Dec. 1, for miscellaneous and metal supplies.

Panama—Miscellaneous Supplies—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Dec. 1, for miscellaneous supplies.

P. R., San Juan—Pipe Line—Bids will be received by Depot Quartermaster until 10 a.m., Dec. 1, for pipe line from Fort El Morro to points of distribution post of San Juan.

Bids In and Contracts Awarded

Mass., Boston—Building—Contract for U. S. appraisers' stores, Boston, awarded to P. J. CARLIN CONSTRUCTION CO., 1123 Broadway, New York, at $610,000. Noted Oct. 21 and Nov. 4.

Penn., East Pittsburg—Post Office—Bids were received Nov. 6 for U. S. post office at East Pittsburgh, (a) limestone, (b) sandstone, as follows: Torbett Construction Co., Hampton, Va., (a) $49,021, (b) $49,945; Fissell & Co., Marbridge Bldg., New York, N. Y., (a) $50,000, (b) $50,,500; George Hogg Co., Pittsburgh, Penn., (a) $51,000, (b) $51,350. Noted Sept. 30.

Penn., Harrisburg—Post Office—Contract for U. S. post office at Harrisburg awarded to H. L. BROWN CO., Mt. Vernon, N. Y., at $113,405. Noted Aug. 26, Oct. 7 and Nov. 11.

Penn., Monongahela—Post Office—Contract for U. S. post office at Monongahela awarded to JAMES DEVAULT, Canton, Ohio, at $44,500. Noted Sept. 23 and Nov. 4.

Penn., Pittsburgh—(Official)—Bridge and Trestles—Bids were received Nov. 5 for service bridge and Poiree trestles at Dam No. 10, Ohio River, as follows: Independent Bridge Co., Pittsburgh, $8,732; Penn Bridge Co., Beaver Falls, $9,198; York Bridge and Construction Co., York, $10,013. Noted Ovt. 14.

Md., Baltimore—Mechanical Equipment—Contract for mechanical equipment for U. S. immigration station awarded to W. G. CORNELL, Washington, D. C., at $82,759. Noted Aug. 12.

Va., Norfolk—Shell House—Baker & Brinkley, 220 Dixon Bldg., Norfolk, at $15,574, submitted lowest bid for shell house at Naval Magazine, Norfolk. Noted Oct. 14.

Va., Norfolk—Building—Contract for building at St. Helena Navy Yard awarded to R. R. RICHARDSON & CO., Norfolk, at $36,978. Noted Sept. 30 and Oct. 28.

Va., Norton—Post Office—Contract for U. S. post office at Norton awarded to WESTCHESTER ENGINEERING CO., White Plains, N. Y., at $56,897. Noted Sept. 16 and Oct. 28.

N. C., Wilkesboro—Post Office—Contract for United States post office at Wilkesboro awarded to RICHARDSON ENGINEERING & CONSTRUCTION CO., Bainbridge, Ga., at $52,600. Noted Sept. 16 and Oct. 21.

Fla., Pensacola—Hangars—Contract for three hangars at U. S. Navy Aeronautic Station, Pensacola, awarded to C. H. TURNER CO., Pensacola, at $37,842. Noted Sept. 30 and Oct. 21.

Ohio, Sidney—Post Office—Bids were received Nov. 8 for post office at Sidney, (a) limestone, (b) sandstone, as follows: Ohio Building and Construction Co., Cincinnati, (a) $50,800, (b) $51,650; E. T. Abbott Construction Co., St. James Bldg., New York, N. Y., (a) $51,900, (b) $53,250; James Devault, Canton, (a) $51,500, (b) $52,470. Noted Oct. 7.

Ohio, Van Wert—Post Office—Bids were received Nov. 10 for U. S. post office at Van Wert, (a) limestone, (b) sandstone, as follows: Original Cabinet Co., Evansville, Ill., (a) $56,429, (b) $56,769; Colonial Construction and Supply Co., Charlottesville, Va., (a) $56,333, (b) $56,973; C. W. Gindele Co., Chicago, Ill., (a) $56,000, (b) $56,250. Noted Oct. 7.

Ind., New Castle—Post Office—Contract for U. S. post office at New Castle awarded to J. S. ROGERS CO., Moorestown, N. J., at $52,999. Noted Sept. 23 and Nov. 4.

Ind., Seymour—Post Office—Contract for U. S. post office at Seymour awarded to CALLAHAN-MANDL CO., Chicago, Ill., at $47,700. Noted Sept. 23 and Nov. 4.

Wis., Merrill—Post Office—Contract for U. S. post office at Merrill awarded to JOHN LAURITZEN, Fergus Falls, Minn., at $53,900. Noted Sept. 30 and Nov. 11.

Wyo., Powell—Canal—Contracts for constructing first unit, Frannie Division, Shoshone Project, awarded as follows:

Schedules 1 and 3 to THREET BROS. & JOLLEY, Lowell, at $78,760; schedule 2 to R. M. LYNN, Lovell, at $27,076. Noted Sept. 23 and Oct. 28.

Mo., Kirksville—Post Office—Contract for extending and remodeling U. S. post office at Kirksville awarded to CHARLES WEITZ SONS, Des Moines, Iowa, at $25,213. Noted Sept. 23 and Nov. 4.

Tex., New Braunfels—Post Office—Bids were received Nov. 5 for U. S. post office at New Braunfels as follows: George W. Stiles Construction Co., Chicago, Ill., $41,750; Algernon Blair, Montgomery, Ala., $42,315; Weston & Kroeger, San Antonio, $40,949. Noted Sept. 30.

Okla., Ft. Sill—Heating Plants—Contract for steam heating plants at Ft. Sill awarded to F. B. HANNAN, Lawton, at $11,475. Noted Oct. 21.

Colo., Montrose—Canal Work—Contracts for about 11 miles of Ironstone Canal, Uncompahgre Valley Project, awarded as follows: Schedules 1 and 2 to MENDENHALL, BIRD & CO., Springfield, Utah, at $30,006; schedules 3, 4 and 5 to C. B. SHERWOOD, Rockford, Colo., at $16,681. Noted Sept. 30 and Nov. 4.

CANALS, DITCHES AND IRRIGATION

Proposed Work

Mass., Boston—(Official)—Dredging—Bids will be received until Nov. 24 by Directors of Port of Boston, 40 Central St., for dredging and filling East Boston, about 1,500,000 cu.d. (See adv.)

R. I., Providence—Drainage—Frederick V. Waterman estimates cost of drainage swamp land adjacent to Broadway from Ten Mile River on north to Watchemoket Cove on south at $121,148.

Tenn., Lexington—Canal—Henderson County Commissioners will construct Cane Creek Drainage Canal from Lexington and Scotts Rd. to Beech River, 5½ miles. Estimated cost, $11,825.

Ind., Winamac—Ditch—Bids will be received until Nov. 20 by C. E. Paul, Constr. Com., for Lutcher Thompson Ditch, Marion Land Co. Ditch Nos. 2 and 4.

Wis., Grandview—Reclamation—Company being formed for drainage project to reclaim 20,000 acres of land. D. M. Macy, Washburn, interested.

Minn., Windom—Ditches—Bids will be received until 1:30 p.m., Nov. 19, by S. A. Brown, County Audr., for Judicial Ditch Nos. 20, 21 and 22. Estimated cost, $23,000, $15,500 and $6,900 respectively.

Kan., Junction City—Ditch—County Commissioners plan to construct two-mile ditch to drain land along Republican River between Junction City and Aliga.

Mo., Belleville—City Council and Civic Organizations Committee will organize drainage district to improve Richland Creek in Belleville.

Ark., Marion—Drainage—Willis E. Ayres, Memphis, Tenn., preparing plans for draining 20,000 acres for Drainage District No. 8.

Tex., Ennis—Drainage—Bids will be received about Dec. 15 by Ellis County Levee Improvement District No. 2 for reclaiming 12,000 acres on Trinity River. Estimated cost, $121,000. Noted Sept. 30.

Tex., Ft. Stockton—Irrigation—El Sinore Catile Co. plans to build four pumping plants and canal system in Pecos County to irrigate 6,000 acres of land.

Tex., Orange—Dredging—Bids will be received until Nov. 30 by E. U. Henry, City Engr., for dredging slip 3,000 ft. long.

Idaho, Boise—State Land Board approved plans of Thayer & Moore, Engr., Kansas City, Mo., to irrigate 30,000 acres in vicinity of Little River near Boise.

Idaho, Montour—Tunnel—Bids will be received until Nov. 29 by H. Taylor, Secy., Emmett Irrigation District, for concrete tunnel.

Wash., North Yakima—Irrigation—C. E. Udell, Secy. Com., plans to improve canal and irrigation system by installing ¾ mi. of flume, relocate and improve portions of canal. Estimated cost, $35,000. H. A. Marble, Engr.

Ore., Astoria—Dredging—A. Walsh, Engr. Port of Astoria, estimates cost of dredging channel in Skipnon River at $40,000 for 6-ft. channel and $60,000 for 15-ft. channel.

Calif., Doyle—Irrigation—Southern Leffen Irrigation District retained William L. Wales, Engr., Woodland, to prepare plans for irrigation district in Honey Lake Valley.

Calif., Los Angeles—Irrigation—Los Angeles County Water District No. 3 approved half of $2,606,000 bond issue for irrigation of 77,000 acres in San Fernando Valley recently annexed to Los Angeles. Noted Nov. 11.

Calif., San Joaquin—Reservoir—Bids will soon be received by Directors of South San Joaquin Irrigation District for purchase of $450,000 bonds for Woodward Reservoir.

Calif., Thermalito—Irrigation—Thermalito Irrigation District organized to irrigate 6,000 acres with water from West Branch of Feather River. F. A. Egan, R. S. Powers and Scott Lawton interested.

Bids In and Contracts Awarded

N. Y., Albany—(Official)—Barge Canal Terminal—Contract awarded to PATRICK W. MULDERRY, Albany, at $33,704, for barge-canal terminal, Contract No. 2-P. Noted Oct. 28 under Plattsburg, N. Y.

N. Y., New York—(Borough of Manhattan)—(Official)—Dredging—Bids were received by Department of Docks and Ferries for dredging in Borough of Manhattan under Contract No. 1482 as follows: Morris & Cummings Dredging Co., at $0.12½ per cu.yd.; Henry Du Bois Sons Co., at $0.1295 per cu.yd.; Coastwise Dredging Co., at $0.128 per cu.yd.

Fla., Tampa—Canal—Florida Beach Development Co. awarded contract to HILLSBOROUGH DREDGING CO., Tampa, for 2,300-ft. boat canal through Haven Beach property on Sand Key to extend from Government Channel in Boca Ceiga Bay.

La., Abbeville—Drainage—Youngs Coulee Drainage District of Vermilion Parish awarded contract to WARREN CONSTRUCTION CO., Lake Charles, for 250,000 cu.yd. drainage canal. Estimated cost, $25,000.

Minn., Blue Earth—Ditches—Contracts for ditches awarded as follows: Ditch No. 35, NELS STOUGARD & EDWARD NELSON, Wells, at $8,740; Ditch No. 36, ELMORE CEMENT AND TILE CO., Elmore, at $18,370; Ditch No. 38, ABSOLM GUDAH, Bricelyn, at $9,700.

Minn., Roseau—(Official)—Ditch—Contract awarded to E. G. BRANDENBURG CONSTRUCTION CO., Minneapolis, for excavating Judicial Ditch No. 62. Noted Oct. 7.

Ark., Marion—Drainage—Contract for Drainage District No. 6 awarded to CANAL CONSTRUCTION CO., Memphis, Tenn., at $130,000.

Tex., Edna—Drainage—All bids received Oct. 28 by A. E. Landin, Chn. Jackson County Drainage District No. 8 rejected as being too high. Noted Oct. 14.

Calif., Modesto—Canal Work—Bids were received for constructing concrete facing and curtain wall for Dam No. 1 as follows: Peart Bros., Oakland, $72,800; Contra Costa Construction Co., San Francisco, $75,000; Tibbitts-Pacific Co., San Francisco, $77,770. Noted Sept. 23.

Calif., Oakdale—Syphon—Board of Directors of Oakdale Irrigation District awarded contract to LARSEN BROS., Turlock, Calif., at $17,000, for concrete syphon under tracks of Santa Fé Ry.

MISCELLANEOUS

Proposed Work

Mass., Boston—Bulkhead—Bids will be received until Nov. 24 by Commissioners of the Port for bulkhead.

N. Y., Buffalo—(Official)—Hardware—Bids will be received by Col. Franklin W. Ward, Secy., State Bd. of Armory Comrs., Telephone Bldg., Albany, until 4 p.m., Nov. 24, for furnishing and finishing hardware for Armory and Stable for Troop I, First Cavalry, N. G. N. Y. (See adv.)

N. Y., New York—(Borough of Bronx)—Track Installation—Bids will be received until noon, Nov. 23, by Public Service Commission of First District, 154 Nassau St., for track installation on White Plains Rd. and extension of existing subway.

N. Y., New York—(Borough of Manhattan)—Subway—Bids will be received until Nov. 30 by Public Service Commission of First District, 154 Nassau St., for Section No. 2, Route Nos. 19 and 22.

N. Y., New York—(Borough of Manhattan)—Subway—Bids will be received until Dec. 7 for part of Eastern District Subway No. 3, Route No. 8 under East River from Manhattan at 14th St. to North Seventh St., Brooklyn.

N. Y., Olean—Flood Protection—Plans submitted to W. W. Wotherspoon, State Supt. of Pub. Wks., for deepening and straightening Olean Creek from junction with Alleghany River to point 2½ miles up stream and building dikes and retaining walls on bank of creek. Estimated cost, $150,000.

N. Y., Syracuse—Retaining Wall—Intercepting Sewer Board submitted report to Common Council estimating cost of building retaining wall along bank of creek in 14th Ward, at $75,000. Noted Oct. 14.

Penn., Philadelphia—(Official)—Elevated Railway Work—Bids will be received by A. M. Taylor, Dir., Dept. of City Transit, 754 Bourse Bldg., until noon, Dec. 7, for concrete column foundations and piers for about 4,000 lin.ft. of two-track elevated railway in Frankford Ave. from Unity to Dyre St. under Contract No. 502. (See adv.)

Penn., Philadelphia—(Official)—Elevated Railway Work—Bids will be received by A. M. Taylor, Dir., Dept. of City Transit, 754 Bourse Bldg., until noon, Dec. 14, for steel superstructure and appurtenant work for two-track elevated railway in Franford Ave. from Unity to Dyre St., under Contract No. 519. (See adv.)

Fla., Miami—Channel—Plans being prepared for ship channel. Estimated cost, $36,000.

La., Port Allen—Levee—Atchafalaya Basin Levee District will build Cocoa Levee, two section ½ mile apart.

Ky., Louisville—Park Improvements—Commissioners provided in budget $423,800 for additions and improvements to park system. Noted Nov. 11.

Ohio, Cincinnati—Elimination of Grade Crossing—Hamilton County Commissioners and Cincinnati, Hamilton & Dayton Railway contemplate eliminating grade crossing at Springfield Pike. Estimated cost, $70,000.

Ohio, Cincinnati—Park Improvements—Citizens voted $1,250,000 bonds for park and playground improvements. Noted Sept. 16.

Ohio, Cleveland—Comfort Stations—Citizens voted $100,000 bonds for comfort stations. Noted Sept. 30.

Ohio, Cleveland—Elimination of Grade Crossing—Citizens voted $1,600,000 bonds for elimination of grade crossings. Noted Oct. 7.

Ohio, Toledo—Park Improvements—Citizens voted $750,000 bonds for park and boulevard improvements.

Ohio, Wellsville—(Official)—Dikes—We have been advised that bonds for $50,000 for dikes were not voted at November election. The proposition will be taken up later. Noted Oct. 28 and Nov. 11.

Mich., Rock River—(Au Train post office)—Parks—Citizens voted $40,000 for parks.

Ill., West Chicago—Park Improvements—West Chicago Park Commissioners sold $1,000,000 bonds for park improvements.

Minn., Two Harbors—Ore Docks—Bids will soon be received for building concrete ore dock and remodeling Dock No. 6 for Duluth & Iron Range R.R. Co. Estimated cost, $1,635,000. Noted Oct. 21.

Mo., Kansas City—Improving Station Park—City Council will issue $100,000 bonds for improving station park.

Mo., Kansas City—Levee—City plans to build about six miles of levee from Grand Ave. to mouth of Blue River. Estimated cost, $1,500,000.

Ark., Arkansas City—Pipe Line—Company being organized to build oil pipe line from Arkansas City Oil and Gas fields to refinery. Estimated cost, $25,000.

Tex., Aransas Pass—Wharf—Fisheries Co. will build wharf at St. Josephs Island Plant.

Tex., Houston—Park Improvements — City sold $243,750 bonds for park improvements. Noted Oct. 21.

Tex., Orange—Dredging—Bids will be received until Nov. 30 by City Commissioners for dredging slips for wharfs and docks, 750,000 cu.yd. E. U. Henry, City Engr. Noted Nov. 11.

Tex., Port Arthur—Seawall—Revised plans being prepared by J. F. Coleman, Consult. Engr., New Orleans, for seawall. Noted Sept. 30.

Utah, Salt Lake City—Bath House—Citizens contemplate construction of bath house at Warm Springs. Estimated cost, $250,000. H. M. Wells, Comr.

Ariz., Tucson—Subway—Bids will be received until Nov. 27 by C. K. Clarke, City Mgr., for subway under railroad tracks at end of Congress St. Estimated cost, $70,000. L. R. Walker, Tucson, Designing Engr. Noted Oct. 14.

Ore., Portland—Automatic Sprinklers — Bids will be received until 4 p.m., Dec. 2, by R. H. Thomas, School Clk., for installing automatic sprinkler equipment in various schools.

Calif., Los Angeles—Subway—Pacific Electric Railway will rearrange tracks at Hill St. Station preliminary to building subway under Olive St., west of station, about six miles. Estimated cost rearranging tracks, $40,000, subway, $12,000,000.

Que., Montreal—Park Improvement—Council of Maisonneuve will advance Park Commission $25,000 for preliminary work in improving park.

MISCELLANEOUS

Bids In and Contracts Awarded

Mass., Boston—Tunnel—Bids were received Nov. 11 for section of tunnel under Dorchester Ave. from West Fourth St. to Old Colony Ave. from: T. A. Gillespie & Co., New York, N. Y., at $396,833, and Coleman Bros., Chelsea, at $382,364. Noted Sept. 30 and Oct. 28.

Mass., Winthrop—Seawall—All bids received Oct. 20 by Harbor and Land Commission for seawall rejected. Noted Oct. 28.

N. Y., New York—(Borough of Brooklyn)—Steel—New York Municipal Railway Corporation awarded contract for 60,000 tons structural steel for new lines and terminals and reconstructing existing lines and terminals to AMERICAN BRIDGE CO. Estimated cost, $2,274,700. Noted Oct. 21.

N. Y., New York—(Borough of Manhattan)—(Official)—Park Improvement—Contract for improving Isham Park awarded to DELSON CONTRACTING CO., at $11,121. Noted Oct. 28.

N. Y., New York—(Borough of Queens)—(Official)—Tracks—Bids were received Nov. 12 for installation of tracks for a portion of Steinway Tunnel Rapid Transit Railroad as follows: Thomas Crimmins Contracting Co., $204,898; George F. Bennett, $206,001; Degnon Contracting Co., $233,619. Noted Nov. 4.

N. Y., New York—(Borough of Queens)—Elevated Railway—New York Municipal Railway Corporation awarded contract to CONNORS BROS. CO., INC., at $726,158 for Second Ave. Section of new elevated railroad including steel work between Walnut St. and Cliffside Ave. Noted Oct. 21.

N. Y., New York—(Borough of Queens)—Tracks — New York Municipal Railway Corporation awarded contract to CHARLES A. MYERS CONSTRUCTION CO., INC., at $17,123 for grading, removing and shifting tracks, laying new tracks for construction work and improving Freshpond Yards.

Miss., Pascagoula—Seawall—Jackson County Commissioners awarded contract to HANCOCK, HARBIN & HANCOCK, Mobile, Ala., for 5,000-ft. seawall.

La., Natchitoches—Dams—Natchitoches Parish Police Jury awarded contract to N. TANSEY, Shreveport, at $19,775 for two dams across Canal River.

Ohio, Cleveland—Subway—Cleveland, Akron and Canton Terminal R.R. awarded contract to FOUNDATION CO., Woolworth Bldg., New York, N. Y., at about $15,000,000 for subway, freight docks and terminal.

Ohio, Toledo—Steamer—Contract for 600-ft. steamer for Great Lakes Steamship Co. awarded to TOLEDO SHIPBUILDING CO., Toledo, at $450,000.

Ill., Benton—Levee—Contract awarded to J. W. CAMPBELL, Oaktown, Ind., at $0.60 per cu.yd., for levee repair along Ohio River in Gallatin County.

Ill., Cairo—(Official)—Levee Repairs—Contract for levee repairs in Cairo awarded to D. F. McCARTHY COAL CO., Cairo, at $23,209. Noted Nov. 4.

Minn., Duluth—Dock—M. A. Hanna Coal Co. awarded contract to BARNETT & RECORD CO., Duluth, for dock. Estimated cost, $90,000.

Mo., New Madrid—Levee Work—Contract for levee work for St. John Levee and Drainage District of Missouri awarded to CHARLESTON CONSTRUCTION CO. Estimated cost, $50,000. Noted Oct. 28.

Ark., Texarkana—Levees—Contract for repairing breaks and cave-ins on levees around Red River awarded to E. P. CONSTANT, Alexandria, La., by Miller County Levee District No. 2 and Bowie County Levee and Drainage District No. 1. Estimated cost, $80,000.

Calif., Oakland—Filling—City Council awarded contract to CHARLES E. COTTON, Oakland, for filling in land east of Southern Pacific tracks in West Oakland, about 50,000 cu.yd. Estimated cost, $14,000.

B. C., Vancouver—Seawall—Contract for seawall which is part of Canadian Northern Railway Co. false creek terminal scheme awarded to A. G. GREELMAN & CO., Vancouver. Noted Sept. 16.

Porto Rico, San Juan—Bulkhead Shed—Contract for one-story steel frame bulkhead shed, 841-ft. long awarded to JESUS BENITEZ, San Juan, at $72,975. Noted Nov. 11.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Proposed Work

Vt., Montpelier—Bids will be received about Nov. 25 by Desmore & Le Clear, Arch., 88 Broad St., Boston, Mass., for two-story, 90x150-ft. court house and library for state. Estimated cost, $125,000. Noted Oct. 14.

Mass., Adams—Bids will soon be received for Drury High School. Estimated cost, $190,000. E. C. and G. C. Gardner, 33 Lyman St., Springfield, Arch.

Mass., Boston—Plans being prepared by Samuel D. Kelley, 209 Washington St., for 11-story office building at Tremont St. and Court Sq. for Kimball Building Trust.

Mass., Boston—Plans being prepared by Silverman Engineering Co., 43 Tremont St., for theater, bowling alleys and garage for Myer Dana. Estimated cost, $400,000.

Mass., Boston—Preliminary plans being prepared by Philip S. Avery, Arch., 120 Tremont St., for three-story home for Union Rescue Mission.

Mass., Lowell—Plans being prepared for church for St. Louis Parish of West Centralville. Walter F. Fountaine, Woonsocket, R. I., Arch.

R. I., Barrington—Plans being prepared by Martin & Hall, Arch., Union Trust Bldg., Providence, for school.

R. I., Providence—Bids will be received until Nov. 22 by William C. Pelkey, Clk., for school building at Cole and Luzon Ave. Estimated cost, $150,000. Stone, Carpenter & Sheldon, 802 Industrial Trust Bldg., Arch. Noted Aug. 26.

R. I., Providence—Plans being prepared for grammer school for City of Providence. William R. Walker & Son., Providence, Arch.

N. Y., Binghamton—Board of Managers of Binghamton State Hospital will ask next legislature for appropriation of $200,000 for new buildings and improvements to present institution.

N. Y., Dunkirk—Supervisors of Chautauqua County will build new tuberculosis hospital. Estimated cost, $150,000.

N. Y., Dunkirk—Bids will soon be received for building for Salvation Army, 122 West 14th St., New York, N. Y. Estimated cost, $100,000.

N. Y., Medina—Plans being prepared by W. S. Brickell-Swain Co., Arch., 46 Chapin Bldg., Buffalo, N. Y., for high school for Board of Education. Estimated cost, $80,000.

N. Y., New York—(Borough of Bronx)—(Official)—Plans being prepared for alterations to public school at Lorillard Pl. and 189th St. Estimated cost, $140,000.

N. Y., New York—(Borough of Bronx)—(Official)—Plans being prepared by G. F. Pelham, Arch., 30 East 42d St., New York, for theater on Webster Ave. between 195th and 196th St. for Bedford Park Amusement Co. Estimated cost, $175,000.

N. Y., Rochester—Board of Education will build school at Post and Congress Ave.

N. J., Jersey City—Hudson County Hebrew Orphans' Home will build an orphanage. Estimated cost, $50,000.

N. J., Jersey City—City Commission will soon receive bids for addition to City Hospital. Estimated cost, $350,000. John T. Rowland, Jersey City, Arch.

N. J., Newark—Contract for completing 12-story hotel for Philip N. Jackson Estate awarded to GEORGE A. FULLER CO., 111 Broadway, New York, N. Y.

N. J., Summit—Common Council purchased site on Maple St. for high school building.

Penn., Easton—Preliminary plans being prepared by William M. Michler, Arch., Drake Bldg., for three-story hospital. Estimated cost, $125,000. Dr. Tonkin, Chn. Hospital Comn.

Penn., New Kensington—Plans prepared by Thomas Hannah, Arch., for church for Edgewood Presbyterian Congregation. Estimated cost, $80,000.

Penn., Williamsport—Plans being prepared by Mowbray & Uffinger, Arch., 56 Liberty St., New York, N. Y., for one-story bank building for West Branch National Bank. Estimated cost, $150,000.

Del., Farnhurst—Bids will soon be received by State of Delaware, Dover, for three-story addition to hospital at Farnhurst. Estimated cost, $60,000. L. W. Crawford, Odd Fellows Temple, Wilmington, Arch.

Del., Wilmington—Plans being prepared for 12-story addition to office building of Dupont Powder Co.

Md., Baltimore—Bids will be received about Dec. 1 by Highlandtown Branch of Y. W. C. A. for three-story building on Clinton St. near Eastern Ave. Estimated cost, $40,000.

Md., Baltimore—Revised plans being prepared by Joseph Evans Sperry, 409 Calvert Bldg., for six-story, 69x141-ft. Y. M. C. A. building at Park Ave. and Franklin St. Estimated cost, $200,000.

D. C., Washington—Bids will soon be received for preparatory school for Georgetown University. Estimated cost, $400,000. Marsh & Peter, 520 13th St. N. W., Arch. Noted Nov. 11.

D. C., Washington—Plans being prepared by A. M. Schneider, Arch., 1430 K St., N. W., for seven-story, 121x148-ft. hotel for Harry Wardman. Estimated cost, $500,000.

W. Va., Huntington—Pocahontas-Winifrede Coal Co., First National Bank Bldg., will build office building at 814 Sixth Ave. in spring.

W. Va., Wheeling—Board of Education of Richland District will hold election to vote on $85,000 bonds for central school in Center Warwood.

N. C., Durham—Plans being prepared by Milburn, Heister & Co., Union Savings Bank Bldg., Washington, D. C., for four-story, 70x150-ft. courthouse and jail for County Commissioners. Estimated cost, $250,000.

N. C., Durham—Election will be held Dec. 14 to vote on $75,000 bonds for two schools on Moorehead school site. George W. Watts, Chn. School Trustees. Noted Oct. 28.

Ga., Albany—Plans being prepared by A. Ten Eyck Brown, 607 Forsythe Bldg., for seven-story, 43x90-ft. bank and office building at Broad St. and Courthouse Ave. for First National Bank. Estimated cost, $100,000.

Ga., Atlanta—Fulton County Board of Education will build grade school on Peachtree Battle Ave. Virlyn B. Moore, Chn. of Com.

Ga., Lagrange—H. P. Park in charge of Park Hotel, contemplates organizing a company to build hotel and improve present Park Hotel. Estimated cost, $40,000.

Ga., Macon—Trustees of Masonic Home will enlarge building. Estimated cost, $40,000. W. L. Collier, Supt.

Fla., De Land—Volusia County Commissioners plan to build high school. Estimated cost, $40,000.

Fla., Live Oak—Bids will be received until Dec. 14 by Suwannee County Board of Education for school. Mark & Shaftall, 210 Clark Bldg., Jacksonville, Arch.

Fla., Miami—Plans being prepared by Frohlin & De Garmo, Arch., for eight-story, 40x100-ft. hotel for E. C. McAllister. Estimated cost, $300,000.

Fla., Okeechobee—Election will be held Dec. 1 by Special Tax District No. 6 to vote on $40,000 for school. W. L. Foote, Trustee. Noted Oct. 28.

Miss., Columbus—Election will soon be held to vote on $50,000 bonds for high school. Noted Nov. 4.

Miss., Meridian—Board of County Supervisors contemplate agricultural high school. Estimated cost, $100,000.

La., New Orleans—Knights of Maccabees plan to construct a building.

La., New Orleans—Bids will be received until Nov. 23 by Department of Public Finances for isolation hospital.

Tenn., Nashville—Ward Belmont College for Women will build new building.

Tenn., Nashville—Committee appointed by Governor to select site on which to build Tennessee Tuberculosis Hospital. About $100,000 available for this purpose.

Ky., Danville—Election will soon be held to vote on $50,000 bonds for purchase of ground and building of school.

Ky., Hopkinsville—Citizens voted $100,000 bonds for schools. Noted Oct. 21.

Ohio, Akron—Bids will soon be received by Henry Murphy, Arch., 523 Second National Bldg., St. Louis, Mo., for four-story 60x115-ft. club house. Estimated cost, $75,000.

Ohio, Akron—Plans prepared for seven-story, 70x70-ft. bank and office building for Peoples Saving and Trust Co. Fichter & Brooker, 527 Second National Bank Bldg., Arch. Estimated cost, $150,000.

Ohio, Athens—Bids will soon be received by Christian Church for one-story, 40x65-ft. church and Sunday school. Estimated cost, $60,000. E. E. Pruitt, Hartman Bldg., Columbus, Arch.

Ohio, Cincinnati—Plans being prepared by E. H. Dornette, Arch., Pickering Bldg., Cincinnati, for four-story, 35x80-ft. hospital for German Deaconess Hospital Association. Estimated cost, $40,000.

Ohio, Circleville—Plans being prepared by R. Z. Dawson, Arch., Columbus, for grade and high school building for Washington Township, Pickaway County.

Ohio, Cleveland—Citizens voted bonds for three-story union passenger station for New York Central and Pennsylvania R.R. Co. Graham, Burnham & Co., Chicago, Ill., Arch. Noted Oct. 14.

Ohio, Cleveland—Plans being prepared by W. H. Nicklos, Arch., 1900 Euclid Ave., Cleveland, for two-story addition to McGregor Memorial Home for Aged at Terrace and Lee Rd.

Ohio, Cleveland—Plans prepared by F. C. Warner, Arch., 767 Hippodrome Bldg., for six-story, 48x240-ft. hotel for Euclid 66th St. Co. Estimated cost, $200,000.

Ohio, Cleveland—Livingston Taylor will build four-story hotel on East 18th St. Estimated cost, $100,000.

Ohio, Cleveland—Cleveland Presbyterian Union contemplates building new churches. Estimated cost, $100,000.

Ohio, Cleveland—Western Reserve University plans to build gymnasium. Estimated cost, $150,000. C. W. Hopkinson, 900 Rose Bldg., Arch.

Ohio, Columbus—Plans being prepared recreation building for City of Columbus. Estimated cost, $40,000.

Ohio, Edgefield—Bids will be received until Dec. 3 by Board of Education for school building. Herman J. Wagner, 532 Renkert Bldg., Canton, Ohio, Arch.

Ohio, Galion—Plans being prepared by W. T. Mills Co., Arch., 49 North High St., Columbus, for one- and two-story church for First M. E. Church. Estimated cost, $60,000.

Ohio, Gallipolis—Plans being prepared for three-story, 68x80x40-ft. hospital by F. L. Packard, Arch., 1212 New Hayden Bldg., Columbus, for Charles E. Holzer.

Ohio, Lakewood—Plans being prepared for three-story high school for Board of Education. Charles W. Hopkinson, Arch., 900 Rose Bldg., Cleveland. Estimated cost, $200,000.

Ohio, Mansfield—Emergency Hospital Association will build hospital and nurses' home. Estimated cost, $80,000.

Ohio, Massillon—Plans being prepared for cottage for Massillon State Hospital. Estimated cost, $70,000.

Ohio, Portsmouth—Preliminary plans being prepared for the new Fourth St. Methodist Church. Estimated cost, $40,000. Louis Clauson, Member of Bldg. Com.

Ohio, Reading—Plans being prepared by Garber & Woodward, Arch., Union Central Bldg., Cincinnati, for new school. Estimated cost, $60,000.

Ohio, Toledo—Citizens voted $1,000,000 bonds for school improvements. Noted Oct. 28.

Ohio, Uhrichsville—W. H. Nicklas, Arch., 1900 Euclid Bldg., Cleveland, Ohio, will prepare plans for one-story, 66x75-ft. church for First Presbyterian Church. Estimated cost, $40,000.

Ohio, West Manchester—Bids will be received until noon, Dec. 4, by Board of Education for grade and high school.

Ind., Auburn—Board of Education contemplates building high school. Estimated cost, $50,000. M. Boland, Pres. Bd. of Education.

Ind., Columbus—Bartholomew County Trustees will build new hospital. Estimated cost, $100,000.

Ind., Fowler—Bids will be received early in spring for two-story grade and high school for J. Sheedy, Trustee. J. F. Alexander & Son, 105 North Fourth St., La Fayette, Ind., Arch. Estimated cost, $50,000.

Ind., Hammond—Plans being prepared by Albert A. Schwartz, Arch., 601 Straus Bldg., Chicago, Ill., for one-story, 80x100-ft. building for H. E. Moriarity and H. J. Kavanaugh. Estimated cost, $75,000.

Ind., Indianapolis—Preliminary plans being prepared by Rubush & Hunter, Arch., 428 American Central Life Bldg., for two-story moving picture theater for Samuel L. Cohn, San Francisco, Calif., and Morris Cohn, Denver, Colo. Estimated cost, $150,000.

Ind., Peru—City will build two-story city hall. Estimated cost, $75,000.

Ind., Richmond—Board of Education plans to build new high school. Estimated cost, $150,000. Sarah A. Hill, Secy.

Ind., South Bend—County Club will build two-story club house in spring. Estimated cost, $50,000.

Ind., Terre Haute—Indiana State Normal School will build science building. Estimated cost, $100,000.

Ind., Warsaw—Preliminary plans being prepared by S. A. Craig, Arch., Huntington, Ind., for two-story grade school. Estimated cost, $50,000. Wilbur Maish, Pres. Bd. of Education.

Mich., Grand Rapids—Bids will soon be received for buildings for Calvin College. Williamson & Crow, Arch. Estimated cost, $125,000. Noted Oct. 28.

Mich., Jackson—Citizens voted to issue $385,000 bonds for high school. Noted Oct. 21.

Mich., Lansing—Plans being prepared by J. N. Churchill, Arch., 514 Oakland Bldg., for two-story, 72x112-ft. school for Board of Education.

Mich., Saginaw—Eagles' Temple plans to build three-story lodge building. Estimated cost, $60,000. L. M. Lempke, 210 Franklin St., interested.

Mich., St. Johns—Bids being received by J. N. Churchill, Arch., 514 Oakland Bldg., Lansing, for two-story, 50x100-ft. theater and lodge building for Odd Fellows Temple.

Ill., Bloomington—F. Wolkau, Sr., 920 Broadway, contemplates building theater.

Ill., Champaign—F. K. Robeson plans to build five-story office building.

Ill., Chicago—Plans being prepared for three-story assembly hall addition to Beaubien School for Board of Education. A. F. Hussander, Arch.

Ill., Winnetka—Plans being prepared by Carl W. Westerland, Arch., 111 West Washington St., Chicago, for two-story, 60x125-ft. theater and store building for Gustav Lindahl. Estimated cost, $45,000.

Wis., De Pere—Bids will be received about Dec. 1 for superstructure of three-story, 64x180-ft. building for St. Orbert's College. Estimated cost, $100,000. William Reynolds, 109 11th St., Green Bay, Wis., Arch. Noted Sept. 16.

Wis., Madison—Cosmoramic Amusement Co. will build theater. Estimated cost, $125,00. J. W. Bidwell interested.

Iowa, Alta—Election will soon be held to vote on bonds for building high school. Smith & Keffer, Arch., Des Moines. Noted Nov. 4.

Iowa, Ames—Bids will soon be received for three-story, 44x115-ft. hospital for city. Estimated cost, $60,000. A. B. Maxwell, City Clk.

Iowa, Des Moines—Board of Education will build seven-story grade school. Estimated cost, $100,000.

Iowa, Dubuque—Holy Ghost Church approved plans prepared by Guido Beck, Arch., for 60x160-ft. church. Estimated cost, $50,000.

Iowa, Estherville—F. H. Graaf plans to build theater. Estimated cost, $50,000.

Iowa, Ft. Dodge—Hope Martin and A. M. Krackman plan to build six-story office and store building. Estimated cost, $40,000.

Iowa, Iowa Falls—Capitalists of Iowa Falls plan hotel on site of Old Central House. Estimated cost, $40,000.

Iowa, Knoxville—Board of Education will build high school. Estimated cost, $75,000.

Iowa, Mason City—Western Electric Telephone Co. contemplates erecting business building. Estimated cost, $150,000.

Iowa, Mason City—School Board plans to build high school. Estimated cost, $200,000.

Iowa, Rowley—Bids will be received until 2 p.m., Nov. 22, by P. C. Thedens, Pres. of Consolidated Independent School District, for school.

Iowa, Waterloo—Bids will be received about Dec. 1 for general contract for three-story, 48x136-ft. parochial school for Sacred Heart Church congregation. Estimated cost, $50,000. Noted Oct. 7.

Minn., Appleton—Plans being prepared by Edwins & Edwins, Arch., 911 North West Bldg., Minneapolis, for two-story, 70x150-ft. high school. Estimated cost, $60,000. O. B. Carlson, Secy. Bd. of Education.

Minn., Bagley—Independent School District No. 2 voted $51,000 bonds for high school building.

Minn., Minneapolis—Plans being prepared by Hewitt & Brown, Arch., for six-story bank and office building for Metropolitan National Bank.

Minn., Minneapolis—Plans being considered by Board of Directors of Y. M. C. A. for system of buildings consisting of central building and five branches. Estimated cost, $1,000,000 E. L. Carpenter, Pres.

Minn., Minneapolis—W. D. Riley, Pastor of First Baptist Church, interested in a plan to build a missionary school at 11th St. and Harmon Pl., to be known as Northwestern Bible and Missionary School. Estimated cost, $750,000.

Minn., Minneapolis—Plans being prepared for four-story, 45x120-ft. theater and office building by James A. Burner, Arch., 845 McKnight Bldg. Estimated cost, $40,000.

Minn., Ortonville—Bids will soon be received for two-story school for Board of Education. Estimated cost, $55,000. Robert Hunter, Clk. Bd. of Education.

Minn., Rosemount—School Board will build school. Estimated cost, $40,000.

Minn., St. Paul—Plans being prepared by A. H. Stem, Arch., 601 Endicott Bldg., for 10-story club and office building for St. Paul Athletic Club. Estimated cost, $500,000.

Minn., St. Paul—Commercial Street Bank will build two-story bank building.

Minn., Stillwater—Plans are being prepared by C. H. Johnson, Arch., 715 Capital Bank Bldg., for three-story women's prison for the state of Minnesota.

Minn., Warren—Plans being prepared by Kirby T. Snyder, Arch., 643 Plymouth Bldg., Minneapolis, for two-story high school for Board of Education. Estimated cost, $45,000.

Kan., Emporia—Bids will be received until Nov. 30 by E. T. Hackney, Pres. Bd. of Administration, for four-story, 68x268-ft. administration building for state. Estimated cost, $175,000.

Kan., Topeka—R. Marks, 213 Third St., contemplates the construction of a 10-story office building. Estimated cost, $100,000.

Kan., Winfield—Board of Education plans to build manual training building. Estimated cost, $40,000.

Neb., Chadron—Bids will soon be received for bank and office building for C. F. Coffee and B. F. Putman. James C. Stitt, 13 Norfolk National Bank Bldg., Arch.

Neb., Fremont—A company is being organized to construct a hotel at an estimated cost of $75,000. A. J. Eddy, interested.

Neb., North Platte—Election will be held Dec. 7 to vote on $60,000 bonds for school.

Neb., Omaha—Board of Education will build school in Waveland Park.

N. D., Crosby—Election will be held Dec. 14 to vote on $75,000 bonds for courthouse. W. E. Vadnais, County Audr.

Mont., Judith Gap—H. L. Bills contemplates building hotel. Estimated cost, $250,000.

Mo., Carthage—(Official)—Bonds for $101,390 sold for sanitarium for tuberculosis patients. Noted Oct. 21.

Mo., Columbia—Seventh Day Adventists plan to build college and church. Estimated cost, $50,00. F. L. Limerick, Clinton, Mo., interested.

Mo., Joplin—Board of Education postponed election to vote on $350,000 bonds for schools from Nov. 10 to Nov. 23. J. A. Becker, Pres. School Bd. Noted Oct. 28.

Mo., Kansas City—Plans prepared by Greenebaum & Hardy, Kansas City, for six-story store and hotel building for Acme Realty and Investment Co. Estimated cost, $125,000.

Mo., Kansas City—Bids being received by Smith, Rea & Lovitt, Arch., 602 Finance Bldg., for three-story, 40x108-ft. hotel for J. H. Harris, 901 East Armour Blvd.

Mo., Kansas City—Preliminary plans being prepared for Pythian Temple for Knights of Pythias. Madorie & Birdsall, Arch. Estimated cost, $75,000.

Mo., St. Louis—Metropolitan Opera House Co. of St. Louis contemplates opera house. Estimated cost between $500,000 and $600,000. W. H. McElfatrick & Co., 701 Seventh Ave., New York, N. Y., Arch.

Tex., Austin—Bids will be received until Nov. 24 by W. H. Cullen, Pres. School Bd., for three-story high schohol.

Tex., Ft. Worth—Trustees of Texas Woman's College plan to build dormitory. Estimated cost, $100,000. A. H. Boaz, Pres.

Tex., Sweetwater—Nolan County Commissioners contemplate holding election to vote on $150,000 bonds for courthouse.

Tex., Waco—J. M. Dawson, Pastor First Baptist Church, appointed chairman of committee which plans to build sanitarium. Estimated cost, $100,000.

Tex., Wichita Falls—Plans being prepared by Field & Clarkson, Arch., Wichita Falls, for three-story, 50x150-ft. temple for Masonic Lodge. Estimated cost, $50,000.

Okla., Alva—Board of Education contemplates holding election to vote on $100,000 for high school.

Okla., Muskogee—Oklahoma Baptist Hospital plans to build addition. Estimated cost, $40,000.

Okla., Tulsa—Bids will soon be received for five-story, 50x140-ft. hotel at 509 South Main St., for H. R. Tetchum. Estimated cost, $50,000.

Okla., Tulsa—J. C. Culbertson contemplates building four-story, 100-ft. deep, office building.

Colo., Colorado Springs—Vollmer Bros. will build a business building at Pikes Peak and Nevada Ave. Estimated cost, $50,000.

Colo., Denver—Board of Education plans additions to Garden Pl. School, Emerson School and Myrtle Hill building. Estimated cost, $50,000, $50,000 and $40,000 respectively.

Colo., La Junta—Local business men forming company to build store building. Estimated cost, $40,000.

Colo., Pueblo—Citizens voted to issue $300,000 bonds for new city hall. J. M. Jackson, City Clk. Noted Sept. 23.

Idaho, Caldwell—Grand Lodge of Odd Fellows plans to build lodge building. Estimated cost, $60,000.

Idaho, Gooding—(Official)—Bids will soon be received by G. W. Padgham, Secy., for Methodist College. Estimated cost, $400,000. Noted Oct. 14.

Utah, Salt Lake City—Plans prepared for station for Salt Lake & Ogden Railway and Salt Lake & Utah Railway. Estimated cost, $250,000.

Wash., Seattle—Plans prepared for 12-story building at Third and Cherry St. for James Moses. Estimated cost, $400,000. A. Warren Gould, Arch.

Ore., Astoria—Election will be held Nov. 29 to vote on $100,000 bonds for building new schools and improving old ones.

Ore., Baker—Election will soon be held to vote on $125,000 bonds for high school.

Ore., Portland—County Commissioners considering construction of armory. Estimated cost, $100,000.

Ore., Portland—Tentative plans prepared by Houghtaling & Dougan, Arch., Portland, for three-story temple at 20th and Washington St. for New Labor Temple Association. Estimated cost, $105,000.

Calif., Los Angeles—Plans being prepared by Harold Cross, Arch., 123 South Dillon St., for hospital for Kings Hospital Association. Henry D. Keys, Investment Bldg., interested.

Calif., Sacramento—University of California sold $1,800,000 bonds for four new buildings. Ralph P. Merritt, University Controller.

Ont., Hull—Plans being prepared for church for Sacred Heart Church. Estimated cost, $75,000.

Bids In and Contracts Awarded

Mass., Boston—Contract awarded to J. J. PRINDEVILLE CO. for 11-story building for Fidelity Trust Co. Estimated cost, $350,000.

Mass., Boston—(Roxbury)—Bids were received for addition to High School of Practical Arts, Greenville and Winthrop St., Roxbury, as follows: J. J. Flynn, 319 Washington St., Boston, $56,672; M. B. Niely, 114 Chestnut St., Brookline, $57,200; John Bowen, Roxbury, $59,000. Noted Oct. 28 and Nov. 4.

Mass., Chicopee—Contract for brick school for St. Stanislaus Polish Church awarded to GAGUIER & ANGIERS, Springfield. Estimated cost, $80,000.

Mass., Fall River—Darling Slade Construction Co., at $93,000 submitted lowest bid for remodeling Bay St. Jail. Noted Oct. 7.

Mass., Fall River—Fall River Union Hospital awarded contract for two-story nurses' home to C. F. GUNNIL, 402 South Main St. Estimated cost, $40,000.

Mass., Springfield—Contract for eight-story commercial building at State and Willow St. for Winthrop Building Associates awarded to EDWARD RADDING.

Conn., New Haven—Contract for addition to Cloister Club House on Hillhouse Ave. for Stone Trust Association awarded to SPERRY & TREAT CO. Estimated cost, $63,000.

Conn., Orange—Contract for addition to Washington School awarded to SULLIVAN & McKEOWN, 902 Chapel St., New Haven.

N. Y., New York—(Borough of Brooklyn)—(Official)—The contract for two-story lecture hall and greenhouse extension for Brooklyn Botanical Garden awarded to FRYMIER & HANNA CO., 25 West 45th St., at $140,223. Noted Nov. 11.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for store and office building at 54 Lexington Ave. for B. W. Mayer, 2 West 33d St., awarded to BROWN BROS., INC., 11 East 30th St., New York. Estimated cost, $65,000. Noted Oct. 14.

N. Y., Syracuse—Contract for Delaware School awarded to ONONDAGO BUILDING AND CONSTRUCTION CO., at $202,483.

N. Y., Troy—Contract awarded to C. W. BOWLAND, for freight house for Boston & Maine R.R.

N. J., Wildwood—(Official)—Contract for two-story school awarded to RICHMAND CONSTRUCTION CO., Moorestown, at $64,978. Noted Oct. 28.

Penn., Lebanon—Bids were received Oct. 29 by Board of School Directors for high school from W. H. Fissel & Co., N. Y., at $246,300; Melton Construction Co., at $209,995; Dawson Construction Co., $212,000. Noted Oct. 14.

Penn., Philadelphia—City Club awarded contract to A. RAYMOND RAFF for five-story brick and stone club house at South Broad St.

Penn., Philadelphia—Contract for office building at 16th and Walnut St. awarded to STACY REEVES & SONS, 2011 Market St., Philadelphia. Estimated cost, $400,000. Noted Nov. 4.

Penn., Pittsburgh—E. A. Wehr, Pittsburgh, submitted lowest bid for three-story office building on Butler St. for Atlantic Refining Co. Estimated cost, $100,000. Noted Oct. 14.

Penn., Sayre—Contract awarded to CORNING BUILDING CO. for brick addition to Packer Hospital. Estimated cost, $50,000.

Md., Baltimore—Public Service Building Co. awarded contract to GEORGE A. FULLER CO., Fuller Bldg., New York, N. Y., for steel frame for 20-story office building at Lexington and Liberty St.

Va., Petersburg—Petersburg Investment Co. awarded general contract for hotel to FULTON BRICK WORKS, Richmond, Va.

Va., Richmond—Contract awarded to J. T. NUCKOLS, at $55,000, for police station building at Smith and Marshall St.

Ohio, Akron—General contract awarded to CLEMMER & JOHNSON, Hicksville, for two-story auditorium and armory for State of Ohio. Estimated cost, $150,000.

Ohio, Cincinnati—Contract awarded to M. MARCUS BUILDING CO., for five buildings for Childrens Home. Estimated cost, $100,000.

Ohio, Cincinnati—Board of Control awarded contract for playhouse at Third St. Reservoir Park to WILLIAM MILLER & SON. Estimated cost, $40,000.

Ohio, Cleveland—Contract for church at Cedar Ave. and East 55th St. for St. Andrew's Episcopal Church awarded to EDWARD A. WEHR, Pittsburgh, Penn.

Ohio, Cleveland—Studio Realty Co. awarded contract to FATH CONSTRUCTION CO., Illuminating Bldg., Cleveland, for three-story store and service building. Estimated cost, $60,000. Noted Oct. 21.

Ohio, Cleveland—See item under "Miscellaneous."

Ohio, Dayton—(Official)—Contract for building for B. P. O. E. Lodge No. 56 awarded to STRUCTURAL CONCRETE CO., Dayton, at $90,000. Noted Sept. 23.

Ohio, East Cleveland—Board of Education awarded contract for two-story, 75x100-ft. school to CLEVELAND FIREPROOF CONSTRUCTION CO., 650 Rockefeller Bldg. Estimated cost, $60,000.

Ohio, Sidney—Ol. › Building and Construction Co., Cincinnati, submitted lowest bid for public library. Estimated cost, $50,000.

Ind., Dayton—W. H. Warren awarded general contract for two-story high and grade school to J. WESLEY REED, Hammond. Estimated cost, $40,000.

Ind., Terre Haute—Masonic Temple Association awarded contract to A. W. STOOLMAN, Champaign, Ill., for three-story building. Estimated cost, $100,000. Noted Nov. 11.

Mich., Muskegon—Occidental Hotel Co. awarded contract to BLAIS & JENSON, Muskegon, for four-story, 42x85-ft. hotel. Estimated cost, $40,000. Noted Aug. 12.

Ill., Cicero—Cicero Stickney High School District awarded general contract to SCHMIDT BROS. CONSTRUCTION CO., 105 North Clark St., Chicago, for addition to Sterling Morton School.

Ill., Decatur—Contract for structural steel and iron for five-story, 120x152-ft. theater and hotel awarded to DECATUR BRIDGE AND IRON CO.

Ill., Jacksonville—Contract will soon be awarded for two-story addition to hospital for Norbury Sanitarium. Estimated cost, $40,000.

Ill., Monmouth—Contract awarded to ENGLISH BROS. Champaign, for fireproof city hall. Estimated cost, $50,000.

Wis., Lake Geneva—Lake Geneva County Club awarded contract for one-story club house to REINET & MALEH, Lake Geneva. Estimated cost, $45,000.

Wis., Milwaukee—Contract awarded to JOHN H. PARKER CO., 315 Fourth Ave., New York, N. Y., for five-story, 120x200-ft. hotel for Charles Sommers and associates.

Iowa, Spencer—Contract for courthouse in Green County awarded to ROWLES CONSTRUCTION CO., at $168,000. Noted Oct. 14.

Minn., St. Cloud—General contract awarded to JOHNSON CONSTRUCTION CO., Minneapolis, at $112,112 for high school.

Kan., Kansas City—G. H. Nettleton Home awarded general contract to G. G. BROWN & SON, 1300 Rialto Bldg., for two-story, 142x154-ft. home for aged women. Estimated cost, $100,000.

Kan., Salina—Contract awarded to J. O. BROWN, at $61,539 for school. Noted Oct. 21.

Tex., Beaumont—Contract for constructing building for South Park School awarded to R. J. McBRIDE. Estimated cost, $50,000.

Tex., Denton—Contract for two additions to College of Industrial Arts awarded to GILSONITE CONSTRUCTION CO., St. Louis, Mo., at $78,000.

Tex., Houston—Contract for 10-story, 50x158-ft. office building at Main and Rusk St. for Gulf Refining Co. awarded to AMERICAN CONSTRUCTION CO., Houston. Estimated cost, $600,000.

Okla., Norman—University of Oklahoma awarded general contract to HOLMBEE CONSTRUCTION CO., 311 Majestic Bldg., for four-story, 60x120-ft. science hall. Noted Oct. 7.

Calif., San Francisco—California Street Realty Co. awarded contract for three-story office building at California and Davis St. to JAMES H. HJUL, at $175,000.

The Fargo Mfg. Co., Inc., has opened new offices at 52 Vanderbilt Ave., New York City. The factory and general office will be at Poughkeepsie, N. Y., as heretofore.

The Cleveland Galvanizing Works Co., Cleveland, Ohio, recently acquired 19 parcels of land adjacent to its present location which will permit the company to greatly enlarge its present plant and output, as soon as some leases expire.

DORCHESTER TUNNEL, BOSTON, MASS.

Section G

Bids were received Nov. 11 by the Boston Transit Commission for constructing Section G of the Dorchester Tunnel from (A) T. A. Gillespie Co., 50 Church St., New York, N. Y.; (B) Bruno & Petitti, Boston; (C) Low B. Cleveland, Watertown, N. Y.; (D) Coleman Bros., Chelsea, Mass.; (E) James J. Coughlin Co., Boston; (F) Hugh Nawn Construction Co., Roxbury; (G) P. McGovern & Co., Boston. The item bids were as follows:

	A	B	C	D	E	F	G
224 lin.ft. excavation between station 72 + 00 and station 74 + 24	$207.40	$260 00	$300.00	$200.00	$309.00	$229.00	$363.75
456 lin.ft. excavation between station 74 + 24 and station 78 + 80	153.55	120.00	250.00	155.00	235.00	177.75	271.60
320 lin.ft. excavation between station 78 + 80 and station 82 + 00	141.30	130.00	250 00	130.00	211.00	206.46	252.20
280 lin.ft. excavation between station 82 + 00 and station 84 + 80	145.90	167 00	200.00	139.00	220.00	165.20	252.20
620 lin.ft. of intercepting sewer	30.00	40.00	50.00	30.00	33.00	21.40	40.40
All concrete for 224 lin.ft. of tunnel between station 72 + 00 and station 74 + 24	169.40	195.00	160.00	168.00	175 00	177.14	202.00
All concrete for 456 lin.ft. of tunnel between station 74 + 24 and station 78 + 80	88.95	85.00	110.00	87.00	96 00	98.89	95.50
All concrete for 320 lin.ft. of tunnel between station 78 + 80 and station 82 + 00	77.75	81.00	100.00	81.00	85 00	80 07	95.50
All concrete for 280 lin.ft. of tunnel between station 82 + 00 and station 84 + 80	94 40	115.00	90.00	90.00	102 00	102.00	112.50
10 cu.yd. cinder concrete	5.00	8 00	8.00	5 00	10.00	8 00	7 00
150 cu.yd. brick masonry made with Portland cement mortar	15.00	16.00	18.00	16.00	18.00	18 00	20.00
750 lin.ft. 6 to 12-in. vitrified pipe, for permanent invert drain	.90	.75	1.00	.40	.50	.50	.50
1,750 lin.ft. 6 to 15-in. vitrified pipe, for house connections, etc	.90	.75	1.00	.50	1.00	.75	.75
1,250 lin.ft. 18 to 30-in. vitrified pipe, for sewers	2.00	1.25	2.00	.90	1.00	1.00	2.00
900 tons reinforcing rods, etc., weighing less than 6 lb. per lin.ft. per ton of 2,000 lb	8.50	10 00	10.00	8.00	7.00	7.00	9.00
15 tons steel and iron weighing 6 lb. or more per lin.ft. per ton of 2,000 lb	18.00	20.00	15.00	16.00	15.00	15 00	20 00
4,000 sq.yd. Portland cement mortar, ½-in. or more in thickness	.30	.50	.25	.30	.60	.40	.60
50 cu.yd. grout made of neat Portland cement	14.00	20.00	20.00	15.00	16.00	20 00	17.00
100 cu.yd. grout made of one volume of Portland cement to one and one-half of fine sand	12.00	17.00	15.00	10.00	12.00	12 00	15.00
100 cu.yd. grout made of one volume of Portland cement to four of fine sand	10 00	13.00	12.00	7.00	5 00	6 00	12.00
50,000 sq.yd. prepared textile and asphalt	.40	.40	.25	.35	.40	.45	.60
Maintaining and protecting the buildings and structures on the line of the work, and all other work and risks (lump sum)	5,000 00	10,000.00	3,000.00	5,000.00	10,000.00	2,500.00	12,500.00
4,000 lin.ft. spruce piles	.45	.30	.40	.25	.30	.25	.25
Extended totals	$396,833	$419,097	$530,205	$382,364	$513,492	$439,521	$597,661

SEWER SYSTEM, MAYWOOD, N. J.

Bids were received July 26 for the construction of a sewer system at Maywood, according to plans prepared by Alexander Potter, 50 Church St., New York, N. Y. For Contract A, Subdivision (a) lateral sewers, and Subdivision (b) trunk sewers, bids were received from (A) MARTIN, MILLER & PIZZIMENTI, Caldwell, N. J. (awarded contract); (B) Fusco Construction Co.; (C) D'Napolio & Toriello Contracting Co.; (D) Frank Puglia; (E) Utility Construction Co.; (F) Allen Engineering and Contracting Co.; (G) Dock Contractor Co.; (H) Murphy Bros.; (I) Cestone Construction Co.; (J) Marrison & Hall; (K) Humphrey Engineering Co. For Contract B, sewage disposal plant, bids were received from (A) James R. Donnelly; (B) F. R. Long-W. G. Broadhurst Co.; (C) A. Vignola & Co.; (D) Heyman & Goodman Co.; (E) E. C. Humphrey; (F)Suburban Engineering Co.; (G) MARTIN, MILLER & PIZZIMENTI, Caldwell, N. J. (awarded contract); (H) P. T. Braunworth; (I) I. H. Card; (J) Fusco Construction Co.; (K) Di Napoli & Toriello Construction Co.; (L) Young & Hyde, Inc. The item bids were as follows:

Contract A—Subdivision (a)

	A	B	C	D	E	F	G	H	I	J	K
2,500 cu.yd. loose rock	$1.00	$1.50	$0 50	$1.25	$0 65	$0.50	$1 10	$0.75	$1.00	$0.75	$1.00
3,500 cu.yd. solid rock	1.00	1.75	1 40	2 00	1.50	1 50	2 00	2 50	1.75	2.50	2.50
2,500 cu.yd. wet earth excavation	.50	.25	40	.40	.80	2.00	1.25	.60	75	1.25	1.00
34,154 lin.ft. 8-in. vitrified pipe:											
2,732 lin.ft.0-6 ft. deep	.35	.37	.39	.40	.39	.44	.45	.61	.51	.45	42
25,937 lin.ft. 6-8 ft. deep	.48	.40	.46	.45	.50	.56	.49	.77	.62	.60	.66
3,863 lin.ft. 8-10 ft. deep	.65	.50	58	.65	.68	.65	.59	.92	.67	.80	1.04
1,472 lin.ft. 10-12 ft. deep	1.05	.62	.75	.90	.89	.78	.70	1.09	.93	1.25	1.65
150 lin.ft. 12-14 ft. deep	1.57	.75	1.10	1.30	1.65	.90	1.16	1.38	1.00	2.50	1.90
1,715 lin.ft. 10-in. vitrified pipe:											
665 lin.ft. 0-6 ft. deep	.45	.47	48	.46	.46	.55	.49	.57	.63	50	.48
360 lin.ft. 6-8 ft. deep	57	.52	54	.55	.58	.64	.58	.75	.75	.65	.72
320 lin.ft. 8-10 ft. deep	80	.60	.66	.85	.78	.88	.79	.98	.90	.84	1.04
370 lin.ft. 10-12 ft. deep	1.15	.67	.85	1.10	1.00	1.10	.90	1.20	1.00	1 30	1.71
108 manholes	37.00	50.00	45 00	30.00	37.40	40.00	53.75	42.00	47.00	50.00	55.00
8 feet of drop manholes	3.00	8.00	5 00	2.00	15.00	4 00	5 00	5.00	10.00	4.00	10.00
21 flush tanks	70 00	100.00	100 00	75.00	65.00	75.00	95 00	74.75	97.00	70.00	75.00
500 branches on 8-in. pipe	40	1.00	60	.42	.55	50	.50	.57	.50	.50	1.25
15 branches on 10-in. pipe	60	1.25	75	.75	.90	65	75	.80	1.00	.50	1.35
6,000 lin.ft. gravel foundation	10	25	10	.15	.08	.10	.07	17	.12	.20	.15
10 cu.yd. concrete masonry	7.50	8.50	10 00	7.00	13.00	6.00	8 00	5.75	10.00	9.00	8.50
20 M ft. b.m. sheeting and timber	30.00	30.00	30 00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
14,300 lin.ft. macadam replaced	.15	12	08	.10	.10	06	28	.17	.12	.17	.50
Crossing of N. Y., S. & W. R.R., 27 lin.ft. of 8-in. steel pipe	3.00	5.00	2 50	12.00	4 50	3.00	11 50	2.30	2.50	10 00	10.00
Extended totals	$35,334	$37,901	$34,518	$37,479	$36,802	$40,691	$44,933	$51,148	$44,080	$49,914	$57,536

Subdivision (b)

	A	B	C	D	E	F	G	H	I	J	K
1,000 cu.yd. loose rock	$0.75	$1.00	$0 50	$1.25	$0.55	$0.50	$1 10	$1 00	$0.50	$0.75	$1.00
900 cu.yd. solid rock	1.00	1.50	1.40	2.00	1.45	1.50	2.00	2 50	1.00	2.50	2.50
3,500 cu.yd. wet earth excavation	.50	.50	.40	.40	1.15	2.00	1.25	1.00	.90	1.25	1.50
953 lin.ft. 12-in. vitrified pipe:											
10 lin.ft. 0-6 ft. deep	.50	.50	.67	.75	.64	.62	.68	.80	.65	.50	.52
70 lin.ft. 6-8 ft. deep	.65	.57	76	.80	.84	.73	.68	1.10	.80	.70	.81
220 lin.ft. 8-10 ft. deep	.80	.65	.92	.90	1.06	1.00	.89	1.25	.90	.85	1.00
653 lin.ft. 10-12 ft. deep	1.05	.70	1.19	1.10	.130	1.29	1.05	1.40	1.05	1.00	1.78
1,331 lin.ft. 15-in. vitrified pipe:											
105 lin.ft. 6-8 ft. deep	.85	.65	.87	1.00	1.04	.88	90	1.10	.80	.65	1.00
360 lin.ft. 8-10 ft. deep	1.00	.70	.98	1.25	1.27	1.14	1.17	1.15	1.00	.90	1.41
600 lin.ft. 10-12 ft. deep	1.25	.82	1.18	1.75	1.55	1.48	1.30	1.27	1.35	1.40	1.92
266 lin.ft. 12-14 ft. deep	1.60	1.00	1.47	2.25	1.80	2.00	1.46	1.45	1.60	2.50	2.30
8,967 lin.ft. 18-in. vitrified pipe:											
6,953 lin.ft. 0-6 ft. deep	.85	.82	1.05	1.00	1.21	.91	.88	1.05	1.40	1.25	1.00
1,154 lin.ft. 6-8 ft. deep	1.00	.92	1.22	1.25	1.35	1.20	1.15	1.25	1.50	1.50	1.34
320 lin.ft. 8-10 ft. deep	1.50	1.00	1.37	1.70	1.62	1.50	1.26	1.60	1.70	1.65	1.65
210 lin.ft. 10-12 ft. deep	1.85	1.10	1.58	2.00	1.77	1.70	1.52	1.84	1.85	1.75	2.20
330 lin.ft. 12-14 ft. deep	2.05	1.25	1.86	2.25	2.17	1.93	1.65	2.18	2.00	3.00	2.40
6,615 lin.ft. 20-in. vitrified pipe:											
5,670 lin.ft. 0-6 ft. deep	1.05	.92	1.25	1.15	1.72	1.10	.95	1.15	1.50	1.45	1.25
730 lin.ft. 6-8 ft. deep	1.25	1.00	1.50	1.60	1.93	1.26	1.20	1 38	1.65	1.60	1.46
65 lin.ft. 8-10 ft. deep	1.65	1.10	1.71	2.00	2.25	1.53	1.42	1.84	1.80	1.80	1.77
150 lin.ft. 10-12 ft. deep	2.05	1.25	1.96	2.50	2.50	1.96	1.65	2.07	2.00	2.00	2.29
87 manholes	35.00	50.00	45.00	40.00	42.50	40.00	53.75	40.00	57.00	50.00	60.00
3 branches on 12-in. pipe	.60	1.50	1.00	2.00	.75	.75	.90	3.00	1.00	1.00	3.00
5 branches on 15-in. pipe	.90	2.00	1.50	2.00	.98	1.25	1.55	3.00	1.50	1.25	4.00
5 branches on 18-in. pipe	1.35	3.00	2.25	2.25	1.50	1.85	2.28	3.00	2.00	1.40	5.00
5 branches on 20-in. pipe	1.65	3.50	3.00	2.50	1.75	2.35	2.81	3.00	2.00	1.50	6.25
1,600 lin.ft. gravel foundation	.10	.30	.10	.15	.08	.10	.07	.20	.15	.20	.15
2,282 lin.ft. 12-in. c.i. pipe:											
1,210 lin.ft. 0-6 ft. deep	1.50	1.75	1.73	1.75	1.45	1.80	1.90	1.55	2.20	1.50	1.63
462 lin.ft. 6-8 ft. deep	1.65	1.80	1.90	2.00	1.58	2.00	2.15	1.78	2.25	2.00	1.93
440 lin.ft. 8-10 ft. deep	1.90	1.90	2.05	2.25	1.83	2.25	2.37	2.00	2.50	2.50	2.28
170 lin.ft. 10-12 ft. deep	2.25	2.00	2.34	2.90	2.18	2.40	2.67	2.30	2.55	3.00	2.95
1,555 lin.ft. 14-in. c.i. pipe:											
1,013 lin.ft. 0-6 ft. deep	1.85	1.85	2.10	2.00	1.61	2.00	1.82	1.90	2.75	1.75	1.90
500 lin.ft. 6-8 ft. deep	2.05	2.00	2.30	2.50	1.74	2.25	2.12	2.12	3.00	2.00	2.20
42 lin.ft. 8-10 ft. deep	2.40	2.15	2.55	3.00	2.04	2.75	2.38	2.53	3.25	3.00	2.50
2,200 lin.ft. 18-in. c.i. pipe, 0-6 ft. deep	2.30	3.00	2.95	2.00	2.15	2.25	2.70	2.87	3.07	2.50	2.50
240 lin.ft. 20-in. c.i. pipe, 0-6 ft. deep	2.75	4.00	3.50	3.25	2.65	2.50	3.00	3.45	20.00	3.00	2.80
40 cu.yd. concrete masonry	7.00	10.00	10.00	7.00	14.00	6.00	8.00	5.75	9.00	9.00	8.00
40,000 ft. b.m. sheeting and timber	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
4,000 lin.ft. macadam replaced	.15	.15	.08	.10	.10	.06	.28	.30	.10	.17	.50
Railroad crossings:											
117 lin.ft. 18-in. steel pipe	4.00	5.00	5.00	15 00	6.50	4.00	13.25	8.00	15 00	15.00	20.00
90 lin.ft. 12-in. steel pipe	4.00	3.00	3.50	14.00	5.50	3.00	9 15	6.30	10.00	10.00	20.00
27 lin.ft. 18-in. steel pipe	4.00	5.00	5.00	15 00	6.50	3.75	13 25	6 90	8.77	10.00	15.00
Coles Brook siphon (lump sum)	400.00	1,500.00	800 00	300.00	300.00	575 00	500.00	920.00	.....	5,600.00	545.00
Extended totals	$40,985	$43,972	$47,275	$48,395	$51,615	$48,709	$50,358	$51,315	$60,557	$56,117	$59,037

Contract B

	A	B	C	D	E	F	G	H	I	J	K	L
850 cu.yd. earth excavation	$2 00	$1 67	$2.75	$1 40	$2 50	$1 50	$2 50	$5 00	$4.75	$2 00	$2 00	$4.95
100 cu.yd. Class A concrete	15 00	14 36	10.00	21 00	15 00	14 50	16 00	13 50	13.50	7.50	20 00	12 65
29 cu.yd. Class B concrete	8 00	13 40	10.00	21 00	14 00	11 50	12.00	12 50	8 00	7.00	15 00	12.10
780 sq.ft. hy-rib partition, including reinforcement	19	36	.35	30	.50	30	1.00	28	.48	.50	1.00	.46
230 bbl. of cement	1 63	1 65	2.00	2 00	1.65	2 20	1.50	1.70	1.95	2.00	2.00	2.30
9,800 lb. steel reinforcement	03	04	.03	05	.04	.05	10	.04	.035	.05	.10	.05
660 sq.ft. No. 23 triangular mesh	045	.10	.04	.10	.15	05	.25	.22	.04	.10	.30	.06
Superstructure	500 00	702 00	1,105.00	600 00	750.00	1,000.00	750 00	700 00	857.40	1,700.00	2,700 00	1,700.00
Equipment	898 00	985 00	895.00	1,030 00	1,015.00	1,450 00	1,500 00	800 00	933.00	500.00	800 00	1,840 00
Sludge bed	275 00	380 00	375.00	260 00	400.00	275 00	500 00	250 00	195.00	1,000.00	1,800 00	810 00
250 lin.ft. 16-in. c.i. pipe	2 50	2 52	2.55	3 00	2.60	2.95	2 00	2 40	2.47	4.00	2 25	4 00
Extended totals	$9,077	$9,579	$10,243	$10,789	$10,706	$10,734	$11,593	$11,861	$11,885	$12,259	$14,665	$16,591

Construction News

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

Connecticut—Plans prepared for Hartford, Meriden & New Britain Ry. for line from Meriden to Hartford via Kensington, New Britain and Newington, 20 miles. Louis Fiske, Branford, Pres.

New York—Champlain & Sanford R.R. Co. secured right-of-way for line from Sanford Lake, N. Y., to Ft. Ticonderoga, about 60 miles.

New York—Otsego & Herkimer R.R., Cooperstown, N. Y., contemplates improving its line. Estimated cost, $250,000. S. W. Mower, Cooperstown, Second Vice-Pres. and Gen. Mgr.

New Jersey—New Jersey & Pennsylvania Traction Co. contemplates double-tracking line on West Hanover St. from Greens Pl. to Calhoun St. Gaylord Thompson, Trenton, N. J., Vice-Pres. and Gen. Mgr.

Pennsylvania—New York Central & Hudson River R.R. plans to build branch from Keating to Avis. G. W. Kittredge, Grand Central Terminal, New York, N. Y., Ch. Engr.

Pennsylvania—Rights-of-way obtained for third rail electric railway system throughout central Pennsylvania. Road will connect Scranton, Kingston, Mocanaqua, Shickshinny, Berwick, Bloomsburg, Danville, Northumberland, Sunbury, Harrisburg, Sunbury Shamokin, Mt. Carmel, Tamaqua and Hazleton. J. F. Richards, Sunbury, interested.

Pennsylvania—Hershey Transit Co., Hershey, will extend line to Hamburg. J. B. Lightheiser, Hershey, Gen. Mgr., H. N. Herr, Ch. Engr.

Virginia—Contract will soon be awarded for line from West Point to Urbana, 17 miles, for Richmond, Rappahannock & Northern Railway Co., Richmond, Va. C. L. Ruffin, 514 American National Bank Bldg., Richmond, Ch. Engr. Noted Sept. 30.

West Virginia—Virginian Ry. contemplates extending line from Bluefield, W. Va., to Shelby Junction, Ky., to connect with Chesapeake & Ohio R.R., 63 miles.

Georgia—Southern Ry. will build approaches for its line to new union passenger station in Macon. Estimated cost, $100,000. B. Herman, Washington, D. C., Ch. Engr.

Florida—Right-of-way secured for municipal railroad from new dock to connect with main line of Florida East Coast Ry. Charles D. Boise, New York, N. Y., Pur. Agt. Noted Aug. 19.

Florida—Gulf Coast Ry., recently incorporated, will build line from Venice southeast to Placida, 22 miles.

Alabama—Louisville-Nashville R.R. contemplates building three-mile spur from Altoona to Walnut Grove. W. H. Courtenay, Louisville, Ky., Ch. Engr.

Alabama—Pensacola, Mobile & New Orleans R.R. will extend line from Daphne to Mobile Bay and Pinto Island, 17 miles. H. McLaughlin, Pensacola, Fla., Pres.

Ohio—Baltimore & Ohio R.R. contemplates extending Findlay, Ft. Wayne & Western Ry. from Findlay to Tiffin. F. L. Stuart, Baltimore, Md., Ch. Engr.

Michigan—Boyne City, Gaylord & Alpena R.R. contemplates extending line from point east of Atlanta, Mich., towards Alpena, nine miles. M. D. Gates, Boyne, Mich., Ch. Engr.

Illinois—It is reported that construction will be started in spring for proposed electric railway to connect Marion, Johnson City and Herrin with Benton and Harrisburg. W. H. Schott, 1813 Harris Trust Bldg., Chicago, Ill., interested.

Kansas—Chicago, Rock Island & Pacific Ry. contemplates double-tracking line in spring from Topeka to McFarland, 38 miles. A. E. Swat, Topeka, Kan., Gen. Mgr., Second District.

Kansas—Greensburg, Coldwater & Northwestern R.R. Co., recently incorporated, contemplates building 210-mile railway from Coldwater across state of Kansas to Almena on Nebraska line. P. Z. Wardall, Greensburg, Kan., interested.

Oklahoma—Project under way for building interurban railway from Bartlesville to connect Nowata and Pawhuska. George C. Priestly, Bartlesville, interested.

Colorado—Colorado, Wyoming & Eastern Ry. had surveys made for line from existing line at North Gate, Colo., southwest to Hayden, 90 miles. J. M. Herbert, Laramie, Wyo., Pres.

Utah—Salt Lake & Utah R.R. plans to extend electric line from Provo to Olmstead via Pleasant View. W. R. Armstrong, Salt Lake City, Gen. Mgr. and Ch. Engr.

Washington—Surveys made and right-of-way secured for railroad 12 miles, with eight miles of branches and spur tracks for Cascade Lumber Co., North Yakima.

Washington—Chicago, Milwaukee & St. Paul Ry. Co. has had surveys for extension to line from Metaline to Northport, 30 miles.

Oregon—Central R.R. of Oregon plans to build line from Union, Ore., to Walla Walla, Wash., 77 miles, and branch line from Union to Medical Springs, 22 miles. G. E. Dunklee, Union, Ore., Gen. Mgr.

Oregon—Surveys completed for eight-mile extension of railroad into Siletz Basin for Falls City Lumber Co., Falls City, Ore.

Oregon—J. L. Soule asked Council for franchise to build and operate electric railway in Baker. Commercial Club, Baker, interested.

California—Pacific Gas and Electric Co. contemplates extending East Lawn line through Elmhurst to State Fair Grounds. John H. Hunt, San Francisco, Pur. Agt.

California—Patterson & Western Ry. Co. secured right-of-way for railway from Patterson to Mt. Hamilton, about 25 miles. H. G. Ginica, Pres. Noted Oct. 14.

Nova Scotia—Surveys made for extension of line of Cape Breton Ry. Co. from St. Peters northeast to Sydney, 60 miles. G. E. Johnson, St. Peters, N. S., Secy. and Gen. Mgr.

New Brunswick—Kent Northern Ry. plans to build line from Kent Junction southwest to Chipman, about 50 miles. Surveys being made. W. B. Cronk, Richibucto, N. B., Vice-Pres.

Ontario—Council of Toronto authorized Toronto Civic Railway to build Bloor St. Line from Dundas St. to Quebec Ave. Estimated cost, $125,000.

Alaska—Peabody-Alaska Copper Co. plans to build tramway near Valdez, about 15 miles. Estimated cost, $10,000 per mile. C. L. Peabody, Pres.

Bids In and Contracts Awarded

Tennessee—Nashville & Eastern Railway, Nashville, awarded contract for line from Lebanon to Smithville, 35 miles, to MYERS CONSTRUCTION CO., Chicago, Ill. C. T. Edwards, Nashville, interested. Noted Sept. 2.

Kentucky—Contract for building north end of Cumberland & Manchester R.R. running from Barbourville to Manchester, Ky., awarded to E. G. and W. T. GARRARD.

Missouri—Mexico & Santa Fé R.R., Mexico, awarded contract to MEXICO INVESTMENT AND CONSTRUCTION CO. for electric railway from connection with Chicago & Alton R.R. at Mexico to point in Monroe County, 16 miles northeast.

LIGHT, HEAT AND POWER

Proposed Work

Maine, Biddeford—Pepperell Manufacturing Co. will build a new power plant to furnish power and light in its cotton mills.

Maine, Skowhegan—Central Marine Power Co. plans to extend its lines to Malbon Mills and Athens.

Maine, Turner—Turner Light and Power Co. has been granted permission to extend its transmission lines to Buckfield and furnish electric service.

N. Y., Delevan—Plans being considered for installation of municipal-electric light plant.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by E. S. W. Elwood, Secy. of State Hospital Commission, Capitol, Albany, until 2:30 p.m., Dec. 2, for heating work, power plant, heating system and equipment at Manhattan State Hospital, Wards Island, New York. (See adv.).

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by John A. Kingsbury, Comr., Dept. of Pub. Charities, 10th Floor, Municipal Bldg., until 10:30 a.m., Dec. 2, for furnishing labor and materials required for constructing and installing new steam supply and return lines between power house and main building of city hospital district, Blackwell's Island.

N. Y., New York—(Borough of Richmond)—(Official)—Bids will be received by Calvin D. Van Name, Borough Pres., Borough Hall, St. George, New Brighton, until noon, Nov. 30, for furnishing, delivering and installing complete with all appurtenances two steam drums for Babcock & Wilcox boiler at West New Brighton destructor.

N. Y., Oswego—Niagara, Lockport & Ontario Power Co., Buffalo, has been granted permission by Public Service Commission to build transmission line across West River Rd. in Oswego, to furnish energy to Syracuse, Lake Shore & Northern line of Empire United Railways.

N. J., Keyport—Plans being prepared for new substation at Stone Church to replace portable one now in use for Jersey Central Traction Co. New station will supply energy to Highlands and adjacent towns.

N. J., Woodbridge—Port Reading R.R. granted franchise for new power line along Turtle Brook Rd.

Penn., New Brighton—Borough Council considering plans for installation of municipal electric-light plant. Estimated cost, $57,175.

W. Va., Fenwick—City Council considering installation of electric-light plant.

W. Va., Pennsboro—Pennsboro Ice and Water Co., recently incorporated, plans to install electric-light plant. Estimated cost, $25,000.

Ga., Metter—Election will be held in December to vote on $7,500 bonds for electric-light plant.

Ga., Waycross—Plans being considered by O. L. Dittmar and B. G. Appleby, of Michigan for gas plant and distributing system. Estimated cost, $150,000.

Fla., Ft. Pierce—Ordinance passed by City Council authorizing $25,000 bond issue for improving municipal electric-light system.

Fla., Lakeland—See item under "Water Works."

Miss., McComb—McComb & Magnolia Railway and Light Co. contemplates building power plant. H. W. Bell, Laurel-Engr.

Ky., Providence—Citizens voted $20,000 bonds for municipal electric-light plant.

Ohio, Perrysville—Bids will be received by L. W. Truman, Clk., until noon, Dec. 27, for purchase of $6,000 bonds. Proceeds will be used for improving electric-light plant.

Ill., Chicago—Morris & Co., will build a three-story boiler house on Ashland Ave. Estimated cost, $31,000.

Ill., Peoria—Central Illinois Light Co. has been granted franchise by Public Utilities Commission to erect transmission line between Maquon and Yates City, Knox County.

Wis., Lowell—Lowell Light and Power Co. has had plans prepared for installation of electric-light plant. Estimated cost, $10,000.

Wis., Merrimack—A. M. Farnsworth has been granted franchise to install electric-light plant.

Minn., Plummer—Plans being considered for installation of municipal electric-light plant.

Minn., Tracy—Franchise has been granted to E. W. Erick to install electric-light plant in Tracy.

Kan., Arkansas City—Election will be held Dec. 14 to vote on $200,000 bonds for gas distribution plant and pipe line to field south west of city.

S. D., Ashton—Spink County Power Co. will install electric-light plant. H. Triplett, Redfield, Engr.-in-charge.

S. D., Winner—Floyd D. Hunt, Chicago, Ill., plans to install electric-light plant in Winner.

Mo., Branson—Citizens contemplate granting a franchise for an electric-light plant to C. C. Bradshaw, Frontenac, Kan.

Mo., Crane—Press reports state that company is being organized to build electric-light plant in Crane.

Tex., Atlanta—Atlanta Electric and Ice Co., will build electric-light and power plant in Atlanta.

Tex., Victoria—Application has been made to City Council by P. J. Sult, Pres. of Columbus Gas Construction Co., Milwaukee, Wis., for franchise to build gas plant.

Okla., Bartlesville—A. J. Discher, at head of company recently organized with capital of $1,500,000, plans to build gas pipe line into Newkirk gas fields.

Okla., Westville—Citizens voted $10,000 bonds for improving electric-light plant. Noted Nov. 18.

Idaho, Arco—Richard W. Ferris applied to Public Utilities Commission for permission to build and operate electric light and power plant in Arco, Blaine County. Estimated cost, $5,000.

Wash., Poulsbo—Franchise granted Poulsbo Light and Power Co. for construction of electric-light plant and to build and maintain transmission lines in Kitsap County.

Wash., Valleyford—Valleyford Water Co. plans to install electric-light system in Valleyford. A. E. Jones, Pres.

Calif., Burbank—Citizens voted $30,000 bonds for electric-light plant and distributing system. Noted Sept. 30.

Calif., Redding—Plans being considered for municipal electric-light plant.

Calif., Riverside—Pacific Power Co. plans for power development on Levining Creek in Mono County. Work will consist of two miles of tunnnel through granite rock, 4,000-ft. of steel pressure line and a 10,000-kw. installation consisting of hydraulic and electric equipment. C. O. Poole, Riverside, Ch. Engr.-in-charge.

Ont., Granton—Town Council will install hydro-electric lighting system. Estimated cost, $5,000. Noted Sept. 16.

Man., Winnipeg—M. Jance and Boomer & Hughes negotiating with city to build gas pipe line to supply city.

Bids In and Contracts Awarded

Ohio, Columbus—(Official)—Contract for heating and plumbing for two-story shop building for Ohio State University awarded to HUFFMAN ANKLIN CO., Columbus, at $17,731.

Ill., Chicago—Bids were received Nov. 13 for (a) heating work, (b) electric work in Chicago Municipal Tuberculosis Hospital as follows: (a) William A. Pope, $17,249, Henley-Casey Mechanical Equipment Co., $17,690, Mehring & Hanson Co., $18,145; (b) Lake City Electric Construction Co., $4,458, United Electrical Construction Co., $7,785, F. E. Newberry Electric Co., $7,940.

Wis., Milwaukee—See item under "Industrial Works."

Wis., Stevens Point—(Official)—Contract for electric wiring of main building and wing the State Normal School awarded to NATWICK ELECTRIC CO., Grand Rapids, at $4,097. Noted Oct. 28.

Kan., Little River—(Official)—Contract for electric-light plant and distributing system awarded to F. D. MARTIN CONSTRUCTION CO., Kansas City, Mo., at $15,163. Noted Nov. 11.

Calif., Riverside—Pacific Power Co. has awarded contract to DUNCANSON & HAROLDSON, San Francisco, for two multiple arch concrete dams in Mono County.

Ont., Exeter—Contract for hydro-electric system awarded to B. BAWDEN, Exeter. Estimated cost, $5,000. Noted July 29.

Ont., Hamilton—Board of Control awarded contracts for equipment for Mt. Hamilton Hospital to ADAM CLARK, $25,000, plumbing and heating; CULLEY & BREAY, $9,010, electrical equipment.

BRIDGES

Proposed Work

Conn., New London—Plans being prepared by engineers of New York, New Haven & Hartford R.R. for bridge over Thames River at New London. Estimated cost, $2,500,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by F. J. H. Kracke, Comr. of Bridges, Municipal Bldg., until 2 p.m., Dec. 9, for constructing Unionport bridge over Westchester Creek.

N. C., Bryson City—See item under "Streets and Roads."

Ga., Savannah—Commissioners of Chatham County will build four steel drawbridges in connection with road from Savannah to Tybee Island.

Fla., Clearwater—Government has granted E. W. Parker, Curry Bldg., and associates, permission to build two-mile bridge from Clearwater to Clearwater Key.

Miss., Holly Springs—Bids will be received by C. H. Wright, Clk. Bd. of County Supervs., until Dec. 6, for four bridges on Red Bank Creek.

Tenn., Carthage—Election will be held Dec. 30 in Smith County to vote on $300,000 bonds for bridges and roads.

Tenn., Clinton—Commissioners of Anderson County will rebuild steel bridge across Clinch River on Clinton-Knoxville Pike.

Ohio, Lorain—(Official)—Bids will be received by F. L. Ellenberger, Clk. of Bd. of County Comrs., until 1 p.m., Dec. 8, for constructing cribbing at Erie Ave. bridge, Black River Township.

Mich., Monroe—Election will soon be held to vote on $60,000 bonds for bridges.

Mich., Ypsilanti—City contemplates viaduct over tracks of Michigan Central Railroad at Miles St.

Ill., Marion—(Official)—Bids will be received at office of County Superintendent of Highways, Marion, until 1:30 p.m., Nov. 30, for bridge in West Marion Township, Williamson County.

Wis., Milwaukee—Plans will be prepared for bridge over Milwaukee River at North Ave. Estimated cost, $240,000.

Neb., Lincoln—Bids will soon be received for steel or concrete bridge across South Platte River. Estimated cost, $30,000.

S. D., Yankton—Citizens voted $300,000 bonds for bridge across Missouri River at Yankton. Noted Oct. 21 and Nov. 4.

Ark., Texarkana—Commissioners of Miller County Bridge and Highway Improvement District No. 1 contemplate bridge across Red River and 60 miles of roads.

Tex., Midland—Plans being considered by Midland & Northwestern Ry. for 400-pile trestle in connection with 65 miles of railway from Midland to Seminole.

Ariz., Avondale—A reinforced-concrete bridge will be built across the Agua Fria River at Avondale. Estimated cost. $20,000.

Que., Windsor Mills—Town Council contemplates construction of steel bridge. Estimated cost, $6,000. D. McCarthy, Mayor.

B. C., Vancouver—Plans being considered by City Council and Vancouver Sewage Commission for constructing Stanley Park Causeway and trunk sewer across coal harbor. Estimated cost, $40,000. F. L. Fellowes, City Engr.

Bids In and Contracts Awarded

Conn., Hartford—(Official)—Bids were received Nov. 15 for reinforced-concrete bridges and widening of causeway in Haddam Township as follows: Donahue Bros., Middletown, $6,217; F. D. Miller, Norwich, $6,707; A. Brazos & Sons, Middletown, $7,053.

Conn., Hartford—(Official)—Bids were received Nov. 15 for concrete bridge on Hartford-Saybrook Turnpike, Chester Township, as follows: J. G. Holbrook, Westbrook, $6,165; A. Brazos & Sons, Middletown, $6,439; Charles A. Sibley, New Haven, $10,073.

N. J., Perth Amboy—Contract for reinforced-concrete slab bridge on Brace Ave., Perth Amboy, awarded to ABRAHAM JELIN, New Brunswick. Noted Sept. 23.

N. J., Plainsboro—Contract for bridge on Trenton Division of Pennsylvania R.R. at Plainsboro awarded to STILLMAN-DELEHANTY-FERRIS CO., Jersey City. Noted Nov. 18.

La., New Orleans—(Official)—Midland Bridge Co., Kansas City, Mo., at $7,350, submitted lowest bid for viaduct at West End Lake Shore Park. Noted Oct. 28.

Tenn., Jefferson City—Contract for steel bridge across Holston River awarded to VIRGINIA BRIDGE AND IRON CO., Roanoke, Va.

Mo., Joplin (Official)—Contract for North Main St. viaduct awarded to HORTON CONSTRUCTION CO., Kansas City, at $18,890. Noted Nov. 11.

Tex., Longview—BLODGETT CONSTRUCTION CO., Kansas City, Mo., at $20,000, awarded contract for steel bridge across Sabine River.

Okla., Oklahoma—Contract for eight concrete bridges awarded to A. E. ALWARD, at $6,101.

Wash., Spokane—POOLE & BEAN, Portland, Ore., at $16,000, awarded contract for steel work on five viaducts.

Calif., Merced—Contract for reinforced-concrete bridge across Santa Rita Slough awarded to ANGLE & BIBBER, Dos Palos, at $4,725. Noted Oct. 21.

Calif., Riverside—HUGH G. PURCELL, at $11,357, awarded contract for bridge and trestle over Santa Ana River.

Calif., Visalia—Contract for three bridges over Cross Creek awarded to PARLIER CONSTRUCTION CO., Tulare, at $8,255.

N. B., Moncton—DOMINION BRIDGE CO., Montreal, Que., at about $125,000, awarded contract for superstructure of bridge over Petitcodiac River at Moncton.

N. S., Cape Breton—JONES, GIROUARD & CO., LTD., Plaza Bldg., Rideau St., Ottawa, Ont., awarded contract by Dominion Department of Railways and Canals for eight bridges on main line of Inter-Colonial Railway, Sydney Sub-division.

WATER WORKS

Proposed Work

N. J., Atlantic City—City will increase and improve water supply.

S. C., Bamberg—See item under "Sewers."

Ga., Metter—City will vote in December on $12,500 bonds for water works.

Fla., Ft. Lauderdale—City will issue $35,000 bonds for water works extensions.

Fla., Lakeland—(Official)—Bids will be received by J. R. B. Boulware, Secy., Bd. of Bond Trustees, until 10 a.m., Dec. 17, for additions to fire, water and electric systems. (See adv.)

Ala., Camden—Election will be held Dec. 6 to vote on $15,000 bonds for water system.

Ala., Citronelle—Bids will be received by City Clerk until Nov. 30 for water system. Bonds for $15,000 voted for this purpose. Noted Oct. 14.

Ala., Florence—Citizens voted bonds for $210,000 for purchase and improvement of property of Florence Water Co. and installation of filtration plant. Noted Oct. 21 and 28.

Ky., Williamsburg—Citizens defeated $25,000 bonds for water system. Noted Oct. 28.

Ohio, Bedford—See item under "Sewers."

Ohio, Glendale—(Official)—At recent election bonds for $8,500 for water system were defeated. Noted Sept. 23.

Mich., Flint—Preliminary plans prepared for addition of a water softening plant at city's water works plant. Estimated cost, $25,000.

Ill., Champaign—Two miles of 14-in. fire main will be laid in business district of Champaign and one mile of 10-in. fire main in downtown district of Urbana by Champaign & Urbana Water Co.

Ill., Kenosha—City contemplates installing filtration plant. Bids will soon be received for same.

Ill., Wheaton—Bids will be received until Dec. 2 by Water Supply Comr. for 200,000-gal. tank. L. J. Ruddock, Engr.

Ill., Wheaton—Citizens voted $35,000 bonds for improving and enlarging water system. Noted Oct. 21 and 28.

Iowa—Ft. Dodge—City voted $100,000 bonds for municipal dam.

N. D., Fargo—City plans an expenditure of about $500,000 for improving water and sewerage systems and for paving.

Mo., St. Louis—Board of Public Service is formulating plans to construct 36-in. c.i. pump main, from Bissell's Point pumping station to Compton Hill reservoir. Estimated cost, $300,000.

Ark., Pocahontas—Plans being prepared for water system and pumping station.

Tex., Goldthwaite—Citizens voted $31,000 bonds for water works.

Tex., Houston—City will expend $12,000 for additions and improvements to water works.

Colo., Castle Rock—City contemplates water system H. G. Johnson, Clk.

Okla., Commerce—Citizens will hold election to vote of $40,000 bonds for construction of sewer system.

Okla., Henryetta—Citizens will vote on Nov. 30, for $100,000 bonds for water works system.

Colo., Firestone—Citizens will hold election soon to vote bond proposition for construction of water works system.

Idaho, Boise—Plans of Wickahoney Land and Water Co., to irrigate 30,000 acres of land, have been approved and work will start at once.

Idaho, Minidoka—City will make application to Public Utilities Commission, Boise, for certificate of convenience for installation of municipal water system.

Idaho, St. Anthony—City Council is considering installation of new water system.

Wash., Seattle—Plans will soon be prepared for building a water system in vicinity of Issaquah.

Wash., Seattle—See item under "Miscellaneous."

Wash., Seattle—Bids will soon be received for a 24-in. water main through siphon tunnel at Third Ave. About $15,000 has been appropriated for this purpose.

Wash., Tyler—Harry E. Elrod, Engr., preparing plans for water works system. Estimated cost, $250,000.

Ore., Falls City—Bids will soon be received for water system.

Ore., Milwaukee—Bid will soon be received by City Council for installation of water distributing plant. J. W. Morris, Cy., Engr.

Ont., Brantford—City Council decided to repair dam. Estimated cost, $4,660.

Ont., Port Dover—City will install water works and gravity system combined with high pressure pumps. James, Loudon and Hertzberg, Consult. Engr.

Bids In and Contracts Awarded

Mass., Boston—(Official)—Contract for building Faneuil Valley Brook conduit, Brighton District, awarded to PETER W. HILL, 97 Proctor St., Boxbury, at $6,271.

Mass., New Bedford—DONALDSON IRON CO., Emaus, Penn., at $27,751, awarded contract for c.-i. pipe and special castings.

N. Y., LeRoy—(Official)—All bids received for 125,000-gal. tank rejected.

N. Y., New York—R. D. WOOD & CO., 400 Chestnut St., Philadelphia, Penn., was lowest bidder for furnishing c.-i. pipe, specials and valve box castings, cast steel castings and valves. Noted Oct. 21.

Ky., Henderson—Contract for filtration plant awarded to FILTER MANUFACTURING CO., Pittsburgh, Penn. Estimated cost, $50,000.

Wis., Manitowoc—Contract awarded to PLATTE IRON WORKS, Dayton, Ohio, for installing 3,000,000-gal. pumping engine in municipal water works plant. Estimated cost, $8,845.

Iowa, Marshalltown—Contract to construct dam awarded to H. J. BENSON, Union, Iowa.

Minn., St. Cloud—Contract for 13,000-ft. of 6-in. c.-i. water pipe awarded to AMERICAN CAST IRON PIPE CO. Noted Nov. 11.

Tex., Galveston—UNITED STATES CAST IRON AND FOUNDRY CO., Chicago, Ill., at $26,440, awarded contract for 3,600-ft. of 30-in. pipe, for undergoing water main across Galveston Bay.

SEWERS

Proposed Work

N. Y., Buffalo—Bonds for $46,000 for trunk sewer have been voted.

Md., Baltimore—Bids will be received until Dec. 1 by Charles England, Chn., Sewage Comn., for lateral sewers in District No. 34-C, Sanitary Contract No. 170 and in District No. 39-A, Sanitary Contract No. 171.

N. C., Charlotte—Plans contemplated for east trunk sewer line. Estimated cost $60,000.

S. C., Bamberg—City contemplates voting on bonds to build sewer system and water works.

Fla., Ft. Lauderdale—City will issue $35,000 bonds for sewer extensions. George W. Hall, City Clk.

Fla., Ft. Myers—Citizens voted $25,000 bonds for improving sewer system.

Fla., Key West—Bids will be received until Jan. 4 by Harold Pinder, Clk. Bd. of Pub. Wks., for sewers from Greene and Duval St. to Front and Caroline St.

Tenn., Park—(Knoxville post office)—Bids will soon be received for constructing sewer laterals.

Ohio, Bedford—Bids will be received by H. T. Hubbell, Clk., until noon, Dec. 22, for sale of $4,164 bonds. Proceeds will be used for sewers and water main.

Ohio, Canal Dover—(Official)—Bids for sewage disposal plant will not be received this year. Noted Nov. 11.

Ohio, Lakewood—City plans new sewer and change in present sewer. Estimated cost, $175,000.

Ohio, Mansfield—Bids will be received until Dec. 1 for sewage-disposal plant. W. J. Hazeltine, City Engr.

Ohio, Youngstown—Plans prepared for concreting basin of Crab Creek from East Madison Ave. to Oak St. Work includes concrete trough 40-ft. wide and 12-ft. deep with two hewers. Estimated cost, $300,000.

Wis., Madison—City Council will be requested to include East Johnson St. from the Yahara River to North St. in storm sewer improvements next year. Estimated cost, $80,000.

Iowa, Emmetsburg—Bids will be received Dec. 6 for sewers in following streets: Seventh from Superior to Call St., thence on Call St. to Sixth St. T. F. Rutledge, City Clk.

Iowa, Lisbon—Contract will soon be awarded for sewer system and sewage disposal plant. Estimated cost, $30,000. Noted Oct. 7.

Iowa, Strawberry Point—Bids will be received about Dec. 21 by J. Schofield, Town Clk., for sewer system and sewage-disposal plant. Estimated cost, $23,000. M. Tschirgi & Sons, Cedar Rapids, Engr.

Minn., Duluth—Sanitary sewer will be built in 61st Alley west from Polk St. to Northern Pacific right of way, in Northern Pacific right of way, to outlet sewer between Main and Nicollet St. W. H. Borgen, City Clk.

Minn., Glencoe—City Council will lay sewer system on Greeley St. from Water to Washington St., thence west on Washington to Sibley St., thence south on Sibley St. to Penn St. Peter Hatz, Clk.

Minn., Lake Crystal—Citizens considering installation of sewers.

Minn., St. Cloud—Commercial Club contemplates storm sewers. Estimated cost, $8,800.

Minn., St. Paul—City plans to build sewers on Chatsworth St. from Otto to Race St., and on Race St. from Chatsworth to Alaska St. Estimated cost, $8,122.

Kan., Cherryvale—Bids will be received until Dec. 16 by M. Hartel, City Clk., for sewers in District No. 2. Noted Oct. 21.

Kan., Erie—Ordinance passed for sewer extensions and connections on Main and Santa Fe St. south to city limits. B. W. Garvin, Mayor.

Neb., Loup City—(Official)—Bond issue of $6,500 for sewer system defeated at election held Nov. 11. Noted Oct. 21.

Neb., Omaha—The Kenwood Fairfax, Fontelle Park and Lincoln Heights Improvement Clubs plan to establish a sanitory sewer district from 43rd and Ohio St. to 36th and Sprague St.

N. D., Fargo—See item under "Water-Works."

Mont., Glendive—City will vote on $70,000 bonds for sewer improvements.

Mont., Manhattan—City plans to install sewer system at an estimated cost of $200,000.

Okla., Shawnee—F. D. Brown, City Engr., preparing plans for about 20 blocks of 6- and 8-in. vitrified sewer pipe.

Okla., Tulsa—Bids will be received by City Auditor until Nov. 29, for sanitary sewer system in Sewer District Nos. 102 and 103. T. C. Hughes, City Engr.

Wash., Seattle—See item under "Miscellaneous."

Ont., Bertie—Township Council will rebuild sewage system in connection with Ft. Erie race track.

B. C., Vancouver—See item under "Bridges."

Bids In and Contracts Awarded

Mass, Boston—Bids were received Nov. 12 for reconstructing Malden River siphon between Everett and Medford as follows: Bay State Dredging Co., 241 Atlantic Ave., $29,110; G. M. Byrne, 166 Devonshire St., $26,000; C. H. Haskins, West Medford, $31,240.

Mass., Boston—Bids were received Nov. 15 for sewer in Canal St. as follows: W. Barrett & Co., Roxbury, $9973; A. Baruffaldi, Somerville, $10,947; J. J. Coughlin & Co., Boston, $14,372. Noted Nov. 11.

Mass., Boston—(West Roxbury)—(Official)—Contract for sewerage works in Woodman, Custer, Ballard, Bardwell, Hathaway, Center and Aldworth St. and Dunster Rd., West Roxbury, awarded to MATRINO DE MATTEO, 146 Dudley Ave., Roslindale. Estimated cost, $15,399. Noted Nov. 11.

N. Y., Albany—Sewage Disposal and Water Co. was low bidder at $71,115 for sewage disposal plant at Mohansic State Hospital.

N. Y., Lackawanna—Contract for South Park sewer awarded to CALDWELL, JOYCE, STARK CO., at $4,300.

N. J., Camden—(Official)—Contract for sewers in Pulaski, Ninth, 29th and 30th St., Sherman and Arthur Ave. and Park Blvd., awarded to KELLY & McFEELY CO., 432 Market St., Camden, N. J. Noted Nov. 11.

Fla., St. Cloud—Contract for sanitary sewer system awarded to WILBUR A. GINN, Sanford, Fla.

Ohio, Cleveland—Contract for excavating and installing drainage system and appurtenances for southerly sewage treatment works awarded to FRED R. JONES CO., Chicago, Ill. Estimated cost, $8,000.

Ohio, Fairport—City Council awarded contract for sewer and water connections in High, Seventh and East St. to CHARLES HUKARI, Ashtabula, Ohio. Estimated cost, $4,000.

Ind., East Chicago—SHEA & CO., 253 Highland St., East Chicago, at $13,595, awarded contract for main sewer in Washington St. Noted Oct. 14.

Ill., Rock Island—Contract for sewer system and sewage disposal plant and septic tank awarded to GEORGE W. WRIGHT. Noted Oct. 21.

Iowa, Burlington—George Peterson submitted lowest bid for building new sewer in Mt. Pleasant St. Noted Nov. 4.

Tex., Kaufman—Contract for sewer system awarded to E. L. DALTON, Dallas, at $19,977. Noted Oct. 14.

Colo., Edgewater—Contract for sewer system awarded to GIBBONS CONSTRUCTION CO., Denver, Colo. Estimated cost, $29,500. Noted Oct. 21.

Wash., Seattle—Contract for sewers in North and West 48th St. awarded to D. PARISI CO., 1506 Atlantic St. Seattle, at $9,551. Noted Sept. 16.

Calif., San Diego—(Official)—Contract for completing Ocean Beach sewer system awarded to DORAN & ARMSTRONG, San Diego, Calif. Noted Oct. 28.

Calif., Stockton—Contract for laying sanitary sewers in Homestead District awarded to WILLIAM E. EDWARDS, Oakland, Calif.

GARGBAGE

Proposed Work

Penn., York—Bids will be received until Dec. 3 for collection and disposal of garbage for a period of five years.

Wis., Green Bay—Common Council considering the installation of municipal garbage-incinerator plant. Estimated cost, $8,500. A. Brauns, City Engr.

Tex., Kingsville—City plans to build an incinerator plant. Estimated cost, $20,000.

STREETS AND ROADS

Proposed Work

Conn., Hartford—Public Utilities Commission and New York, New Haven & Hartford R.R. Co. have agreed to plans which provide for building of steel bridge with concrete abutments and a clearance of 14-ft. over Capitol Ave. extension. Estimated cost, $100,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., Room 2032, Municipal Bldg., until 2 p.m., Dec. 3, for constructing concrete sidewalks on west side of Broadway from 73d to 74th St.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., Room 2032, Municipal Bldg., until 2 p.m., Nov. 30, for furnishing and delivering seven trailers and for regulating and repaving 113th St. from west side of Broadway to a point 240 ft. west of west house line.

N. Y., New York—(Borough of Richmond)—(Officials)—Bids will be received by Calvin D. Van Name, Borough Pres., Borough Hall, St. George, New Brighton, until noon, Nov. 30, for regulating and grading Beechwood Ave. from Crescent Ave. to Fifth St.

N. Y., Tuckahoe—Bids will be received by John Matthews, Town Supt. of Highways of Eastchester at office of Town Clerk, Depot Sq., Tuckahoe, until 8 p.m., Dec. 6, for improving California Rd. between Mill Rd. and Highland Ave. and between Highland Ave. and Union Corners.

N. J., Brunswick—Plans will be prepared for section of George's Rd. to Mercer County line.

Penn., Media—Delaware County Commissioners appropriated $10,000 as the County's share of macadamizing Baltimore Pipe from Wawa to Chadd's Ford. Estimated cost of entire road, $100,000.

Penn., Uniontown—(Official)—Bids will be received by Board of Supervisors of Jefferson Township, Fayette County, until noon, Nov. 27, for improving public road beginning at Coal Center Ferry, Newell Village, Jefferson Township, Fayette County, and extending to Redstone Parsonage.

Penn., Wyomissing—City Council contemplates an expenditure of $30,000 for street improvements.

W. Va., Kingwood—Election will be held Dec. 7 in Preston County to vote on $500,000 bonds, half of which will be used for roads in Portland District and half in Kingwood District.

N. C., Danbury—(Official)—Citizens defeated $50,000 bonds for roads. Noted Oct. 21.

N. C., Elizabethtown—Bonds for $25,000 for road construction voted by Bladen County, Bladenboro Township.

N. C., Greensboro—Election will be held Dec. 14 to vote on $50,000 bonds for street improvements.

N. C., Halifax—City will issue $60,000 bonds, proceeds to be used for road construction.

N. C., King—(Official)—Citizens defeated bonds for road construction. Noted Oct. 28.

N. C., Lenoir—Election will be held Jan. 4 in Caldwell County to vote on $90,000 bonds, $50,000 of which will be used for road construction in Lenoir Township and $40,000 for road construction in Lower Creek Township.

Fla., De Land—Citizens defeated $110,000 bonds for roads and bridges in Volusia County Road District. New election will be held. Noted Sept. 30.

Ala., Birmingham—(Official)—Bids will be received by Board of Commissioners until 3 p.m., Nov. 30, for concrete sidewalks on First Ave. from 32d St. to 41st St. Estimated cost, $5,500. J. Kendrick, City Engr.

Ala., Camden—Election will be held Dec. 6 to vote on $4,250 bonds for street improvements.

Ala., Grove Hill—Commissioners of Clarke County plan to build road between Jackson and West End and Jackson Highway.

Ala., Tuscaloosa—Bonds for $4,000 will be issued by City Commissioners for improving 20th St.

Miss., Biloxi—Board of Supervisors of Harrison County contemplates an expenditure of about $200,000 for 22 miles of road from Biloxi to Pass Christian.

Miss., Cleveland—Bond issue of $150,000 for gravel road construction approved by Road District No. 1, Bolivar County.

Tenn., Carthage—See item under "Bridges."

Tenn., Decatur—Meigs County Commissioners rejected all bids for purchase of $100,000 bonds to be used for road construction. Noted Sept. 16.

Tenn., Huntsville—Commissioners of Scott County will issue $300,000 bonds for road improvements. W. H. Potter, County Judge.

Ky., Georgetown—Election will be held in Scott County Jan. 15 to vote on $100,000 bonds for roads. Noted Oct. 7.

Ky., Liberty—Election will be held Dec. 11 to vote on $100,000 bonds for road construction.

Ohio, Columbus—Bids will be received by Clinton Cowen, State Highway Comr., until 2 p.m., Dec. 3, for improving Section E of Cincinnati-Chillicothe Rd. in Hamilton County.

Ohio, Columbus—Bids will be receved by Clntiion Cowen, State Highway Comr., until 2 p.m., Dec. 3, for improving Section F of Cincinnati-West Union Rd. in Hamilton County.

Ohio, Columbus—Bids will be received by Clinton Cowen, State Highway Comr., until 2 p.m., Dec. 3, for improving Section G, Cincinnati-West Union Rd. in Hamilton County.

Ohio, Columbus—Bids will be received by Clinton Cowen, State Highway Comr., until 2 p.m., Dec. 3, for improving Section H of Cincinnati-Louisville Rd. in Hamilton County.

Ohio, Springfield—(Official)—Bids will be received by W. J. Barrett, City Audr., until noon, Dec. 13, for purchase of $7,000 bonds for improving East Hight St.

Ohio, Toledo—Bids will be received until Nov. 30 by County Commissioners for ¾ mile of water-bound macadam road.

Ohio, Youngstown—(Official)—Bids will be received by H. C. Fox, Clk., Dir. of Pub. Ser., until noon, Nov. 30, for paving Lincoln Park Drive between Shehy and Rigby St.

Ind., Anderson—Bids will be received until 10 a.m., Dec. 10, by Commissioners of Madison County, for 12 gravel roads and nine concrete roads.

Mich., Charlotte—Following streets will be paved by order of City Council: Cochran St. to Grand Trunk passenger station with brick; Washington Ave. from Lawrence Ave. to Seminary St. with cement pavement; McClure St. to Michigan Central and Grand Trunk with brick.

Wis., Kenosha—Kenosha County contemplates an expenditure of $65,805 for highway improvements in 1916.

Wis., Rhinelander—County Commissioners plan to issue $200,000 bonds. Proceeds will be used for improving roads in Oneida County.

Wis., Washburn—City plans to pave Main St.

Iowa, Atlantic—Atlantic Commercial Club is promoting the construction of a road from Atlantic to city limits. Estimated cost, $12,000. J. B. Jones and J. D. Goff, Members of Com.

Iowa, Missouri Valley—Citizens plan to pave portion of Third, Fourth, Fifth, Sixth, Seventh, Eighth, Ninth and Ontario St., also several alleys.

Minn., St. Paul—City Council plans an expenditure of $13,333 for paving Grove St. with creosote blocks.

N. D., Fargo—See item under "Water Works."

Mo., Fayette—A road from Fayette to Glasgow along Old Trails Route, about 12 miles, will be constructed by Howard County.

Mo., Lebanon—Commissioners of Laclede County plan to hold election to vote on $250,000 bonds, $200,000 of which will be used for road construction.

Ark., Lake Village—County contemplates 40 miles of macadam or concrete road.

Ark., Texarkana—See item under "Bridges."

Tex., Crystal City—Bonds for $40,000 voted by citizens for road improvements.

Tex., Gilmar—Election will be held Dec. 11 to vote on $75,000 bonds for roads in Upshur County, Justice Precinct No. 7.

Tex., Jacksonville—(Official)—Citizens defeated $150,000 bonds for improving roads in Road District No. 1. Noted Nov. 4.

Okla., Collinsville—Citizens voted $30,000 bonds for road construction. Noted Nov. 11.

Okla., Verdigris—(Official)—Citizens voted $50,000 bonds for road construction. Noted Nov. 11.

Colo., Colorado Springs—County Commissioners appropriated $125,000 for road and bridge work in 1916.

Idaho, Idaho Falls—City Council plans to pave several streets. Estimated cost, $15,000.

Idaho, Jerome—Citizens of Appleton Highway District voted $25,000 bonds for highway construction.

Wash., Seattle—See item under "Miscellaneous."

Ore., Portland—City Council plans to pave East Stark St. from East Water to East First St.

Calif., El Centro—Bids will be received by State Highway Commission, 515 Forum Bldg., San Francisco, until Dec. 6, for 12 miles of concrete highway between Dixieland and El Centro.

Calif., Los Angeles—City Council plans to pave 64th Ave. from city limits to Meridian St.

Calif., Mill Valley—Board of Trustees contemplate an expenditure of $10,000 annually for improving streets for a period of five years.

Bids In and Contracts Awarded

Mass., Boston—(Dorchester)—Bids were received Nov. 16 for asphalt or bitulithic pavement in (A) Mendon Park from Upland Ave. to Bourneside St.; (B) Harwood St. from Williwood to Lucerne St. as follows: (A) D. M. Biggs & Co., Dorchester, asphalt, $5,483, Central Construction Co., Boston, asphalt, $5,528; J. Doherty, Roxbury, asphalt, $5,566, bitulithic, $5,577; (B) J. Doherty, Roxbury, asphalt, $6,221, bitulithic, $6,242; D. M. Biggs & Co., Dorchester, asphalt, $6,302; M. De Matteo, Roslindale, asphalt, $6,334, bitulithic, $6,355. Noted Nov. 11.

Mass., Boston—(Dorchester)—Bids were received Nov. 16 for asphalt or bitulithic pavement in Fernboro St. from Lawrence Ave. to Intervale St. as follows: J. Doherty, Roxbury, asphalt, $4,301, bitulithic, $4,315; M. De Matteo, Roslindale, asphalt, $4,418, bitulithic, $4,433; John Kelly Co., Roxbury, asphalt, $4,334, bitulithic $4,519. Noted Nov. 11.

Mass., Boston—(Grafton, Upton)—Contracts for asphalt and macadam road in Grafton and Upton awarded to PERINI CONSTRUCTION CO., Ashland, at $48,104. Noted Oct. 28.

Mass., Boston—(West Roxbury)—Bids were received Nov. 16 for asphalt or bitulithic pavement in Kittredge St. from Corbell to Beach St. as follows: C. J. Jacobs & Co., Roxbury, asphalt, $4,747, bitulithic, $4,715; M. De Matteo, asphalt, $4,753, bitulithic, $4,868; J. Doherty, Roxbury, asphalt, $4,899, bitulithic, $4,868. Noted Nov. 11.

N. Y., Albany—(Official)—Contracts awarded for constructing roads by State Aid as follows: Road No. 1317, Auburn-Weedsport Cayuga County, 8 miles: BRAYER BROS., Auburn, $123,709; Road No. 5,596, Mayville Village, Erie St., Chautauqua County, 0.79 mile: EDWARD T. BECK & CO., Wareen, Penn., $25,8000; Road No. 1,110, Leroy-Brockport Rd., Part 2, Genesee, County, 0.40 miles: ATLANTA CONSTRUCTION CO., Atlanta, $13,010; Road No. 1,253, Chaumont-Depauville, Jefferson County, 6.05 miles: HENRY BURGARD, Buffalo, $45,249; Road No. 512, Akin-Johnstown, Part 1, Montgomery County, 4.59 miles: ROUTLEY & SUMMERS, Huntington, Quebec, $29,528; Road No. 5,558, Oneida-Verona, Oneida County, 4.69 miles: J. G. HAYES CO., INC., Rome, $36,625; Road No. 5,597, Utica-Poland, Part 3, Oneida County, 5.34 miles: ROUTLEY & SUMMERS, Huntington, Quebec, $51,592; Road No. 1,338, Scotia-Saratoga County Line Part 1, Schenectady County, 4.22 miles. Award held. Noted Oct. 28 and Nov. 18.

N. Y., Buffalo—Contracts for paving various streets awarded as follows: Abbott Rd. and Frontenac and Lyndhurst Ave. to GERMAN ROCK ASPHALT AND CEMENT CO., D. S. Morgan Bldg., Buffalo, at $15,710, $10,990 and $6,315 respectively; Spaulding St. to CONSTANTINE CONSTRUCTION CO., at $6,269; Hubbell Ave., to ERIE CONTRACTING CO., at $6,385; Sprenger St., to SPIRE & PRIOR, at $22,490.

N. Y., New York—(Borough of Queens)—(Official)—Bids were received Nov. 18 for furnishing and delivering to Bureau of Highways 3,000 cu.yd. of broken stone and screenings of trap rock from New York Trap Rock Co., at $2.18 per cu.yd., and Haverstraw Crushed Stone Co., at $2.25 per cu.yd. Noted Nov. 11.

N. J., Stone Harbor—FRANKLIN ENGINEERING CO., Philadelphia, Penn., at $30,086, awarded contract for boardwalk at Stone Harbor.

Penn., Connellsville—J. I. DICK, Scottsdale, at about $15,1000, awarded contract for paving Washington Ave. and East Apple St.

Penn., Greensburg—(Official)—Contracts for road construction awarded as follows: Harrison City Export Rd. to JOHN HERRMANN, Latrobe, at $106,146, and Hecla-Hurst School House Rd. to F. T. BYERS, Mt. Pleasant, at $23,841. Noted Nov. 4.

Del., Wilmington—(Official)—Contract for improving Philadelphia Turnpike awarded to ALFRED H. McDOWELL, Marshallton, Del. Noted Nov. 11.

N. C., Bryson City—Commissioners of Swain County awarded contract for roads and bridges to WRIGHT JOHNSTONE CONTRACTING CO., Bryson City. About $110,000 available for this purpose. A. S. Patterson, Chn. of Comrs.

N. C., Newbern—Commissioners of Craven County awarded contract for 15 miles of road on principal highways leading out of Newbern to McGUIRE CONSTRUCTION CO., Norfolk, Va., and the BARRETT MFG. CO., Philadelphia, Penn., for surfacing with Tarvia B stone chip filler 4½ miles of road.

Fla., Homestead—Contract for Ingraham Highway from Homestead to Cape Sable awarded to J. B. McCRARY CO., Atlanta, Ga., at $93,000.

Fla., Miami—R. B. Fickle, at $9,535, awarded contract for preparing streets for oil pavement and FREEDLING CONSTRUCTION CO., at $7,877, for applying oil.

Fla., Titusville—Contract for 68 miles of road awarded to J. B. McCRARY CO., Atlanta, Ga., at $143,022. Noted Oct. 28.

Ky., Burlington—Contract for six miles of roads awarded to T. J. JUMP, Williamstown.

Ohio, Cincinnati—County Commissioners awarded contract to WESLEY TAULMAN, Hazelwood, at $10,212, for improving Symmestown Rd. from Conrey Rd. west to Lebanon Pike.

Ohio, Euclid—All bids received Nov. 8 by H. S. Dunlop, Village Clk., Town Hall, for improving Chardon Rd. rejected. Noted Oct. 14.

Ohio, Shawnee—Contract for completing paved road between New Straitville and Shawnee awarded to P. J. CONNELL, Cambridge City, Ind., at $38,000.

Ind., Indianapolis—(Official)—Lowest bids received by Board of Public Works for paving South Capitol Ave. from Merrill to McCarthy St. were from County Construction Co., Indianapolis, at $6,550, for asphalt, and A. D. Bowen, Indianapolis, at $6,800, for brick. Noted Oct. 28.

Ind., Indianapolis—Contract for improving 36th St. awarded to JOHN ARNOLD, at $4,100.

Ind., New Albany—(Official)—Contract for road in New Albany Township awarded to GAMES & JONES, Louisville, Ky., at $9,264.

Mich., Pontiac—Bids were received for completing concrete road between Kimble's Corners and Birmingham on Detroit Rd. from J. H. Baker & Sons, Port Huron, at $62,588, and R. D. Baker & Co., Detroit, at $62,090.

Mich., St. Joseph—County Commissioners awarded contracts for road work as follows: Pipestone Rd., Section 1, Niles Township, 15,092 lin.ft.; R. C. ATKINSON, Niles, Mich., $18,280 stone; Pipestone Rd., Sections H and G, Berrien Township, 61,030 lin.ft., CHARLES THOMAS, St. Joseph, $73,560; Three Oaks-Sawyer, Section C, Chikaming Township, 13,514 lin.ft., C. W. BOYES, Grand Rapids, $16,999; Galien-Stevensville, Section F, Galien Township, 15,126 lin.ft., D. L. VARING, Three Oaks, $18,175 for stone; Lake Shore Rd., Section D, Lake and Weesaw Townships, 26,007 lin.ft., FRANK C. TEACH, Crown Point, Ind., $33,500; Lake Shore Rd., Section F, New Buffalo Township, 12,770 lin.ft., B. W. BOYES, Grand Rapids, $17,495; Watervliet South Haven Rd., Section 1, Watervliet Township, 10,441 lin.ft., Paw River, Section G and Territorial Rd., Section F, 37,845 lin.ft., W. W. McCRACKEN, St. Joseph, $53,260; Niles Rd., Sections F, E and D, 50,391 lin.ft., FRED CUNNINGHAM, Martinsville, Ind., $82,725. Noted Oct. 7 and Nov. 4.

Minn., Wayzata—Contract for grading road through Wayzata awarded to McCULLOUGH & CHENEY, at $10,758. Noted Nov. 18.

Kan., Hutchinson—Contract for paving Poplar St. between Ave. A and Sherman St. with brick awarded to STAMEY & MACKEY, at $1.73 per sq.yd.

Kan., Wichita—Contract for eight miles of sand clay road awarded to L. J. GILLETTE, at $5,660. Noted Sept. 9.

Neb., Lincoln—ABEL & ROBERTS, at $12,303, awarded contract for paving several streets in District No. 312.

Mo., Kansas City—Contract for paving one mile of road awarded to NATIONAL PAVING CO., Kansas City, at $14,715.

Mo., Monett—Contract for oiled macadam paving on Fricco Ave. awarded to M. E. GILLOZ, 708 Euclid Ave., Monett, at $6.000.

Mo., Springfield—Contract for paving Boonville St. between Division and Pine St. and for two ft. on either side of rails of Springfield Traction Co. awarded to PLUMMER-ADAMS CO., at about $13,500.

Tex., Floresville—Contract for constructing roads in Precinct No. 4 awarded to BEXAR CONSTRUCTION CO., at $30,000.

Tex., Jourdantown—Contract for road construction in Atascosa County awarded to A. N. DAWSON, San Antonio, at about $100,000.

Tex., Longview—OWENS CONSTRUCTION CO., Vicksburg, Miss., awarded contract by Commissioners of Gregg County for 35 miles of road.

Tex., Stephenville—Contract for improving a number of roads awarded to A. N. DAWSON, San Antonio. Bonds for $120,000 voted for this purpose.

Okla., Muskogee—Contract for constructing gravel roads awarded to WILLIAM HEWETT. About $4,000 available for this purpose.

Ariz., Yuma—Contract for paving approximately 17 miles of highway with warrenite awarded to O. & C. CONSTRUCTION CO., Fullerton, at about $150,000.

Wash., Seattle—ROWAN & ANDERSON, Transportation Bldg., at $11,676, awarded contract for walks on Ferdinand St.

Calif., Lindsay—Contract for paving Hermosa St. awarded to WORSWICK PAVING CO., Fresno. Noted Sept. 23.

Calif., Los Angeles—Contract for improving Western Ave. from Temple St. to Fountain Ave. awarded to GEORGE R. CURTIS, at $49,366.

Que., Montreal—SICILY ASPHALTIC PAVING CO., LTD., 60 St. Viateur St., E., Montreal, awarded contract for paving St. Andre, Panet and St. Lawrence St.

Ont., Brockville—City will lay tarvia pavement on a number of streets by day labor. Estimated cost, $14,000. G. H. Bryson, Engr. Noted Sept. 30.

Ont., Toronto—Contract for asphalt paving on Condor and Empress St. awarded to R. C. HARRIS, Works Comr., at $4,143.

Ont., Toronto—GRANT CONTRACTING CO., at $15,795, awarded contract for brick block pavement on Coxwell Ave., and to COMMISSIONER OF PUBLIC WORKS, at $22,048, for sheet asphalt on portions of Bleecker St., Elmwood and Spring Grove Ave., also a portion of Coxwell Ave.

INDUSTRIAL WORKS

Proposed Work

Mass., Lowell—Wamesit Power Co. will build four-story, 75x85-ft. factory on Crosby St. Estimated cost, $27,000.

Mass., Springfield—Springfield Street Railway has had plans prepared for carhouse and shops on Hooker St. Estimated cost, $175,000.

Conn., Killingly—Plans being prepared for two-story, 152x172-ft. building for Killingly Manufacturing Co.

Conn., New Haven—Plans being prepared by Frank Elwood Brown, Arch., for three-story, 50x135-ft. plant for New Haven Dairy Co.

N. Y., Farmingdale—(Official)—Bids will be received until 2 p.m., Dec. 3, by William Wirth Mills, Secy., Bd. of Trustees, at New York office of Dept. of Agriculture, Room 1224, Woolworth Bldg., for construction work, etc., of garage at New York State School of Agriculture. (See adv.)

N. Y., New York—(Borough of Manhattan)—(Official)—Plans being prepared by Mulliken & Moelier, 103 Park Ave., Arch., for six-story 91.5x100-ft. garage and service station at 67th St. near West End Ave. for Hudson Motor Garage of N. Y., Inc., 1842 Broadway.

N. J., Camden—Plans being prepared by Ballinger & Perrott, Arch., Philadelphia, Penn., for six-story, 91x274-ft. and four-story, 76x233-ft. additions to plant of Victor Talking Machine Co., Front and Market St., Camden.

N. J., Jersey City—Henry Byrne plans to build factory on Mercer St. between Fremont and Factory St. Estimated cost, $13,000.

N. J., Jersey City—Great Atlantic & Pacific Tea Co. contemplates building factory on Warren St. Estimated cost, $110,000.

N. J., Newark—American Gas Accumulation Co., Philadelphia, Penn., will build four buildings at South Newark. Estimated cost, $300,000.

N. J., Perth Amboy—Nelson & Landsberg will build plant. Estimated cost, $20,000.

Penn., Harrisburg—Plans being prepared by C. Harry Kain, Arch., Harrisburg, for five-story cigar factory on State St. for T. J. Dunn & Co., New York, N. Y. Estimated cost, $40,000.

Penn., Kane—Aluminum Co. of America, Pittsburgh, Penn., has taken over French aluminum plant at Kane and will improve same.

Penn., Philadelphia—Supplee Alderney Dairies Co. will build three-story, 100x100-ft. ice cream factory at 3333 Ludlow St. Charles H. Casper, Arch.

Va., Radford—John H. Heald & Co., Lynchburg, Va., purchased site at Radford and will build extract plant. Estimated cost, $150,000.

Va., Richmond—Plans prepared by David L. Davis Co., Chicago, Ill., for five-story cold storage plant for Richmond Cold Storage Co. Estimated cost, $150,000.

W. Va., Weirton—Phillips Sheet and Tinplate Co. will build addition to strip steel plant at Weirton. Estimated cost, $1,000,000. B. M. Weir, Vice-Pres.

N. C., Charlotte—Plans prepared for 125x520-ft. factory for Climax Spinning Co., Belmont. Estimated cost, $125,000.

Ala., Mobile—Benjamin J. Glazier Realty and Engineering Co., Chicago, Ill., contemplates building a ship building and repair plant on Blakeley Island. Estimated cost, $5,000,000.

Tenn., Chattanooga—Ford Motor Co. will build reinforced-concrete garage. Estimated cost, $20,000.

Tenn., Kinsport—New York capitalists through John C. Herden, Engr., have selected site in Kingsport and will build dye plant.

Ky., Augusta—Bids are being received for 172x280-ft. warehouse for Burley Tobacco Society.

Ohio, Carthage—(Cincinnati post office)—Hess Springs and Axle Co. will build 200x200-ft. addition to plant on 66th St. Estimated cost, $60,000.

Ohio, Cleveland—Plans prepared by G. B. Bohn, Arch., 1628 Williamson Bldg., for three-story, 75x120-ft. addition to plant of Federal Knitting Mills Co. at Detroit and West 28th St. Estimated cost, $40,000.

Ohio, Cleveland—Plans prepared by W. C. Ferguson Co., 1900 Euclid Ave., Cleveland, for two-story, 50x200-ft. factory at East 131st St. for Great Lakes Refining Co.

Ohio, Cleveland—J. McGrath will build factory at 7802 Finney Ave. Estimated cost, $15,000.

Ohio, Cleveland—Overland Automobile Co. will build garage and service building at East 66th St. and Euclid Ave. Estimated cost, $75,000.

Ohio, Cleveland—Sheets Bros. Elevator Co., 6529 Broadway, will build 50x200-ft. grain warehouse at East 131st St. and Erie R.R.

Ohio, Cleveland—Preliminary plans being prepared by Mills, Rhines, Bellman & Nordhoff, Arch., Ohio Bldg., Toledo, for three-story service station and garage for Willys-Overland Co. Estimated cost, $50,000.

Ohio, Dover—Dover By-Products Coke Co. will build coke plant in yards of Penn Iron and Coal Co.

Ohio, Lima—East Iron and Machine Co. purchased site at Lima and will build factory.

Ohio, New Philadelphia—Contract will be awarded about Dec. 1 for plant for New Philadelphia Paving Block Co. Estimated cost, $130,000. American Clay Machinery Co., Bucyrus, Ohio, Arch.

Ohio, Youngstown—Carnegie Steel Co. will build three additional open-hearth furnaces at Ohio Works. Estimated cost, $800,000.

Ind., Gary—According to press reports, the Indiana Steel Co. will build additions to local plant. Estimated cost, $7,500,000.

Mich., Bay City—Kelton Aurand Manufacturing Co. plans to build 56x240-ft. plant at Bay City.

Ill., Chicago—American Printing Ink Co. will build two-story addition to plant at 401 North Claremont St. Estimated cost, $15,000. S. S. Joy, Arch.

Ill., Chicago—Excelsior Steel Furnace Co. will build plants in Goose Island Section. Estimated cost, $200,000.

Ill., Chicago—General Chemical Co. will build one-story factory at 123rd St. and Carondelet Ave. Estimated cost, $15,000. W. G. Uffende, Arch.

Ill., Chicago—Robert Glendinning will build one-story warehouse at 2204 West 49th St. Estimated cost, $20,000. J. L. Carey, Arch.

Ill., Chicago—Gustav Kurger will build one-story garage at 6321 Broadway. Estimated cost, $17,500. G. T. Dippell, Arch.

Ill., Chicago—Morris & Co. will build two-story distillation plant at 4319 South Ashland Ave. Estimated cost, $32,000. F. A. Fielder, Arch.

Ill., Chicago—Rinzie Co. will build garage at 554 Diversey Blvd. Estimated cost, $35,000. J. Alschlager & Son, Arch.

Ill., Chicago—C. L. Searle, 215 West Ohio St., will build six-story chemical factory. Estimated cost, $80,000. C. Hengela, Arch.

Ill., Chicago—Sure Pure Ice Cream Co., 1800 Cornella Ave., will build one-story addition to factory. Estimated cost, $15,000. J. J. Kocher, Arch.

Ill., Lemont—Aluminum Products Co. will build 54x70-ft. steel factory. Estimated cost, $15,000.

Wis., Manitowoc—(Official)—Bids will be received about Dec. 15 for the general contract for five-story, 55x300-ft. factory for Aluminum Goods Manufacturing Co. Noted Nov. 11.

Wis., Milwaukee—Advance Engineering Co. will build one-story, 150x165-ft. machine shop on 13th St. Estimated cost, $25,000. Herbst & Hufschmidt, Arch.

Wis., Milwaukee—Milwaukee Auto Engine and Supply Co. will build two-story, 125x132-ft. factory on 29th St. Herbst & Hufschmidt, Milwaukee, Arch.

Iowa, Sioux City—Plans being prepared for five-story brick warehouse for William Tackaberry Co., 205 Pearl St. Estimated cost, $150,000. Beuttler & Arnold, Security Bank Bldg., Arch.

Ark., Argenta—McLean Hardwood Lumber Co., Memphis, Tenn., will build reinforced-concrete plant. Estimated cost, $80,000.

Ark., Little Rock—It is reported that the Arkadelphia Milling Co. will build a flour mill. Estimated cost, $250,000.

Tex., Corpus Christi—Corpus Christi Cold Storage Co. contemplates building a plant. Estimated cost, $50,000.

Tex., Dallas—Texas Portland Cement Co. will improve its plant at Dallas.

Tex., Onalaska—According to press reports the West Lumber Co. will rebuild saw mill recently destroyed by fire. Estimated cost, between $150,000 and $200,000.

Tex., Wichita Falls—Press reports state that Panhandle Refining Co. will build 2,000-bbl. refining plant and 4-in. pipe line to Burkburnett oil fields. Estimated cost, $200,000.

Colo., Denver—Denver Union Stock Yards Co. will build new buildings, improve existing buildings and build roofed arena. Estimated cost, $50,000.

Colo., Denver—Plans being prepared by H. A. Merrick, Chicago, Ill., for five-story, 120x120-ft. packing plant for Colorado Packing and Provision Co. Estimated cost, $200,000. Noted Nov. 4.

Colo., Penrose—It is reported that Beaver, Penrose & Northern Railway Co. will build shops and roundhouse. C. G. Whitlock, Engr.-in-charge.

Colo., Pueblo—Bids will be received about Dec. 1 for packing plant for Nuckolls Packing Co. Estimated cost, $250,000. Harvey Nuckolls, Pres. Noted Sept. 30.

Idaho, Nampa—Oregon Short Line R.R. plans to build roundhouse. Estimated cost, $25,000. Carl Stradley, Salt Lake City, Utah, Ch. Engr.

Wash., Seattle—American Nitrogen Products Co. contemplates building plant. Estimated cost, $50,000.

Wash., Tacoma—Oregon-Washington Railroad and Navigation Co. and Glacier Fish Co. will build plant. Estimated cost, $15,000.

Ore., Baker—Oregon Lumber Co. will install four dry kilns. Estimated cost, $15,000.

Calif., Los Angeles—Plans prepared by Albert C. Martin, Arch., Los Angeles, for seven-story, 100x115-ft. addition to furniture factory of Peck & Hills, Alpine and San Fernando St.

Ont., Toronto—Farmers Dairy Co. will build three-story reinforced-concrete building at Walmer Rd. and Bridgman St. Estimated cost, $50,000.

B. C., Alert Bay—British Columbia Packers' Association, Granville St., Vancouver, will build cannery at Alert Bay. Estimated cost, $20,000.

Bids In and Contracts Awarded

Vt., Quechee—Quechee Mills awarded contract to J. H. MENDELL CO., Manchester, N. H., for three-story, 75x98-ft. brick mill. Estimated cost, $25,000.

Mass., Framingham—Contract for preliminary work in connection with construction of factory for London Syndicate awarded to McNALLY BUILDING CO., Gardner.

Mass., Springfield—Willys-Overland Co. awarded contract to FRED T. LEY & CO. for four-story, 75x230-ft. reinforced-concrete garage.

R. I., Pawtucket—George A. Cummings awarded contract to DAVID W. LATMORE for two-story, 49x136-ft. brick laundry on Pawtucket Ave. Estimated cost, $25,000. Noted Oct. 28.

Conn., Meriden—New England Westinghouse Co. awarded contract to H. WALES LINES CO. for two one-story, 80x200-ft. and 80x100-ft. brick and steel factories.

Conn., New Haven—(Fair Haven)—National Folding Box Paper Co. awarded general contract for one-, two- and three-story, 222x350-ft. factory addition to C. W. MURDOCK. Noted Oct. 21.

N. Y., Buffalo—J. P. Devine Co. awarded general contract to JOHN W. COWPER CO., Fidelity Bldg., for two-story, 60x200-ft. addition to factory at Clinton St. and Erie R.R.

N. Y., Elmira—Morrow Manufacturing Co. awarded general contract to COMPTON REAL ESTATE CO. for one-story, 120x740-ft. tannery. Estimated cost, $100,000. Noted Nov. 18.

N. Y., Jamestown—Watson Manufacturing Co. awarded general contract for 60x120-ft. addition to JAMESTOWN CONSTRUCTION CO. Estimated cost, $20,000.

N. Y., Lincoln Park—General Railway Signal Co. awarded general contract to JOHN W. COWPER CO., Buffalo, for one-story, 120x140-ft. addition to plant. Estimated cost, $80,000.

N. Y., New York—(Borough of Brooklyn)—(Official)—American Tobacco Co., 111 Fifth Ave., awarded contract for five-story, 200x300-ft. brick factory at Sanford St. and Nostrand Ave., to WELLS BROS., 366 Fifth Ave. Estimated cost, $750,000. Noted Nov. 4.

N. Y., New York—(Borough of Manhattan)—(Official)—Consolidated Gas Co., 4 Irving Pl., awarded contract to STANDARD CONCRETE STEEL CO., 413 East 31st St., for alterations to storage building at 438 West 18th St. Estimated cost, $20,000. Noted Oct. 28.

N. Y., New York—(Borough of Queens)—(Official)—American Druggists' Syndicate awarded contract to CRAMP & CO., 25 East 26th St., New York, for four-story, 175x175-ft. warehouse and factory at Borden and Van Alst Ave. Estimated cost, $125,000. Noted Sept. 30.

N. Y., Syracuse—Brown, Lipe & Chapin Co. awarded contract to W. J. BURNS CO. for six-story, 75x150-ft. addition at Marcellus, Seneca and West Fayette St. Estimated cost, $100,000.

N. Y., Utica—Utica Motor Car Co. awarded contract to R. RICHARDS & SONS for garage. Estimated cost, $20,000.

N. J., New Brunswick—(Official)—Howe Rubber Co. awarded contract to TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., for three-story, 76x250-ft. reinforced-concrete factory at Fulton and Codwise Ave.

N. J., Perth Amboy—(Official)—United Lead Co. awarded contract for 62x62-ft. carpenter shop to TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y.

Penn., Birdsboro—Birdsboro Steel Foundry and Machine Co. awarded contract for 60x240-ft. building to serve as roll foundry to L. H. FOCHT, Reading, Penn.

Penn., Philadelphia—Julius Gebaur awarded contract for one-story, 100x155-ft. woolen mill on Frankford St. to KIRBY BUILDING CO. Estimated cost, $18,000.

Penn., Philadelphia—Philadelphia Tapestry Mills awarded contract for five-story, 16x234-ft. reinforced-concrete building at Westmoreland and Masther St. to WILLIAM STEELE & SONS CO., Philadelphia, at $120,000. Noted Nov. 11.

Penn., Pottstown—(Official)—Bids have been received for three-story, brick and steel plant for National Rubber Co., Pottstown, Penn. Estimated cost, $100,000. M. N. Schoemaker, 512 Union Bldg., Newark, N. J., Arch.

La., New Orleans—(Official)—Warren Bros. Co., 59 Temple St., Boston, Mass., at $33,800 submitted lowest bid for asphalt plant at municipal repair plant. Noted Oct. 28.

Tenn., Nashville—Contract for reinforced-concrete garage at 1214 Broadway for C. M. Ferriss, Trustee, awarded to FOSTER & CREIGHTON CO. Estimated cost, $16,000.

Tenn., Nashville—Contract awarded to FOSTER & CREIGHTON CO. for reinforced-concrete garage for J. B. Palmer. Estimated cost, $75,000. Noted Nov. 18.

Ohio, Ashtabula—Cleveland Ford Tire Co. awarded contract for two-story, 73x150-ft. plant to E. J. INMAN. Estimated cost, $22,500.

Ohio, Cleveland—Contract for addition to plant of Brown Carriage and Auto Co., East 32nd and Superior St., awarded to SAMUEL AUSTIN & SONS CONSTRUCTION CO., 14230 Euclid Ave., Cleveland. Estimated cost, $10,000.

Ohio, Cleveland—Contract for factory at 2237 Chester Ave. for H. F. Neighbors, to be occupied by Willard Storage Battery Co., awarded to WILLIAM DUNBAR CO., 8209 Cedar Ave., Cleveland. Estimated cost, $15,000.

Ohio, Cleveland—Contract for factory at East 49th and Superior Ave. for Steel Socket Shaft End Co. awarded to GEORGE A. RUTHERFORD CO., 2160 East 18th St., Cleveland.

Ohio, Cleveland—E. T. Tinnerman Realty Co. awarded contract to SLATMYER & SONS CONSTRUCTION CO., 203 Lakeside Ave., Cleveland, for factory at 2868 Detroit Ave. Estimated cost, $25,000.

Ohio, Columbus—(Official)—Contract for two-story shop building for Ohio State University awarded to DAWSON CONSTRUCTION CO., Pittsburgh, at $85,000. Noted Oct. 28.

Ohio, Warren—Trumbull Steel Co. awarded contract for enlarging tinplate and sheet plant to RITER-CONLEY MANUFACTURING CO. Noted Oct. 21.

Ind., Gary—American Sheet and Tin Plate Co. awarded contract for grading and excavating for third unit of plant to A. F. HARTIGAN & CO., East Chicago, Ind. Noted Oct. 21.

Mich., Muskegon—Brunswick-Balke Collender Co. awarded contract to BUCK & MULLEN for three-story, 90x120-ft. addition to plant.

Ill., Chicago—J. J. Badenoch Co. awarded contract to SUMMER SOLLITT CO. for six-story warehouse at 1604 South Robey St. Estimated cost, $30,000.

Ill., Chicago—Contract awarded to UNION CONSTRUCTION CO. for six-story factory at 357 West Erie St. for J. A. Chapman and J. F. Stone. Estimated cost, $40,000.

Ill., Chicago—Contract awarded to J. W. SNYDER CO. for two-story machine shop at 3213 Shields Ave. for McDonald Machine Co. Estimated cost, $40,000.

Wis., Manitowoc—(Official)—Aluminum Goods Manufacturing Co. awarded contract for steel work on five-story factory to WORDEN-ALLEN CO., Milwaukee. Noted Nov. 11.

Wis., Milwaukee—Phoenix Printing Co., Chicago and Jackson St., awarded contract for excavation, mason and concrete work to PAUL RIESENS' SONS CO., electrical work to REUSS & BEYER ELECTRICAL CO. Noted Oct. 14.

Iowa, Cedar Rapids—General contract for one-story brick and stone garage for C. J. Novack, 1035 South Second St., awarded to LOOMIS BROS., Kimball Bldg. Estimated cost, $18,000.

Mo., Hannibal—Waters Pierce Oil Co. awarded general contract to L. M. HAGER for warehouse, tanks and office building, brick work and concrete foundation to G. W. WILLIAMS.

Mo., North Kansas City—General contract awarded to R. F. WILSON & CO., Chicago, Ill., for can factory at 14th and Campbell St. Estimated cost, $200,000.

Mo., St. Louis—Contract for two-story factory at 4200 Laclede St. for Luyties Pharmacy Co. awarded to GAMBLE CONSTRUCTION CO. Estimated cost, $29,000.

Colo., Trinidad—Swift & Co. awarded contract to J. E. TULLEY, 215 West Adams St., Pueblo, Colo., for storage house. Noted Sept. 16.

Calif., San Pedro—Merchants Realty and Investment Co., Van Nuys Bldg., at $117,138 submitted lowest bid for seven-story reinforced-concrete warehouse for Harbor Commissioners.

FEDERAL GOVERNMENT WORK

Proposed Work

Maine, Portland—Buoys—Bids will be received by Light House Inspector, Portland, until 2 p.m., Nov. 29, for furnishing 275 spruce spar buoys.

Conn., Seymour—Post Office — Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 28, for U. S. post office at Seymour.

Penn., Ridgway—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 30, for U. S. post office at Ridgway.

D. C., Washington—Building—Bids will be received at office of Commissioners of District of Columbia, Room 509, District Bldg., until 2 p.m., Nov. 30, for constructing an addition and altering Powell School Building No. 157.

D. C., Washington—Sewer Work—Bids will be received at office of Commissioners of District of Columbia, Room 509, District Bldg., until 2 p.m., Nov. 29, for sewer work in District of Columbia.

Va., Norfolk—Coal—Bids will be received at U. S. Engineer Office, Custom House, until noon, Dec. 20, for furnishing about 3,000 tons of bituminous coal. (See adv.)

Fla., St. Petersburg—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 30, for U. S. post office at St. Petersburg.

Tex., Galveston—Court House—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 30, for remodeling of U. S. courthouse at Galveston. (See adv.)

Calif., Ft Mason—Building—Bids will be received at Office of Constructing Quartermaster, Ft. Mason, until Nov. 24, for addition to nurses' dormitory, Letterman General Hospital.

Hawaii, Pearl Harbor—Marine Railway—Date for receiving bids for marine railway at naval station extended to Dec. 18. Noted Oct. 21.

Bids In and Contracts Awarded

N. Y., Salamanca—Post Office—Bids were received Nov. 12 for U. S. post office at Salamanca (a) limestone, (b) sandstone, as follows: Durolithic Co., Buffalo, (a) $54,180, (b) $54,600; Westchester Engineering Co., White Plains, (a) $56,756, (b) $58,800; King Lumber Co., Charlottesville, Va., (a) $58,000, (b) $59,000. Noted Oct. 7.

Md., Indian Head—Building—Contract for magazine building at naval proving ground, Indian Head, awarded to J. L. ROBINSON CONSTRUCTION CO., at $7,015. Noted Nov. 4.

D. C., Washington—Engine House—Contract for constructing Engine House No. 28 awarded to JAMES L. MARSHALL, Washington, D. C., at $22,300. Noted Oct. 21.

D. C., Washington—Power Plant —Bids were received Nov. 17 for central heating and power Section A, construction of buildings; B, turbo-alternators, turbo exciters, etc.; C, condensing equipment; D, boilers; E, mechanical stokers; F, pumps; G, piping; H. feed water heaters; I, cables and transformers for power house; J, electric crane; K, coal and ash handling machinery; L, lead covered cables; M, substation, switching gear and wiring; N, substation converters and transformers; O, construction of pipe tunnels; P, pipe connections at substations; Q, changes and alterations, as follows: Section A to Q, George T. Kelley, Yonkers, N. Y., $1,788,000; W. G. Cornell Co., Washington, $1,698,500; P. J. Carlin Construction Co., New York, N. Y., $2,160,000, alterations, $2,090,000; section B. I. M. N., Hanley-Casey Co., $289,000; Westinghouse Electric and Mfg. Co., $282,911; William Dall, $289,000. Noted Sept. 2.

D. C., Washington—Pumping Unit—Contract for one steam turbine driven centrifugal pumping unit awarded to DE LAVAL STEAM TURBINE CO., Trenton, N. J., at $15,633. Noted Sept. 23 and Oct. 21.

D. C., Washington—Sewers—Contract for 18th St. and Connecticut Ave. sewers awarded to WARREN F. BRENIZER CO., Washington; Benning Rd. sewer main to GEORGE HYMAN, Washington. Noted Oct. 21.

W. Va., Huntington—Post Office—Bids were received Sept. 16 for U. S. post office at Huntington as follows: King Lumber Co., Charlottesville, Va., $121,800; Norcross Bros. Co., Worcester, Mass., $123,790; Boyle-Robertson Construction Co., Washington, D. C., $124,975. Noted Oct. 14.

S. C., Charleston—Cranes—Bids were received Nov. 20 for furnishing two jib cranes for shipbuilding ways at Charleston as follows: Heyle & Paterson, Inc., Pittsburgh, Penn., $24,200; McMyler Interstate Co., Bedford, Ohio, $23,490; Terry & Tench, New York, N. Y., $25,230. Noted Oct. 14.

Ohio, Elyria—Post Office—Bids were received Nov. 19 for U. S. post office at Elyria, (a) limestone, (b) sandstone, as follows: John G. Unkefer & Co., Minerva, (a) $75,231, (b) $78,481; Charles W. Gindele & Co., Chicago, Ill., (a) $78,400. (b) $82,400; William H. Fissell & Co., New York, N. Y., (a) $79,800, (b) $81,900. Noted Oct. 14.

Idaho, Boise—Post Office— Bids were received Nov. 18 for addition to U. S. post office at Boise as follows: Welch Bros. & Hannaman, Gridley, Calif., $41,874; R. E. Campbell, Salt Lake City, Utah, $44,687; Frank M. Weakley, Portsmouth, Va., $45,333. Noted Oct. 14.

CANALS, DITCHES AND IRRIGATION

Proposed Work

N. Y., New York—(Borough of Manhattan)—Drainage—State Board of Health estimates cost of draining all swamp land in New York City, 38,500 acres, to exterminate mosquitoes, at $385,000.

Ill., Chicago—Waterway—The waterway project which is planned to connect Chicago with Mississippi River will be under the supervision of the state and not the city as was mentioned in the issue of Nov. 11.

Iowa, Mason City—Ditch—Bids will be received until Dec. 6 by County Auditor for County Ditch No. 29.

Minn., Redwood Falls—Ditch—Contracts for County Ditch No. 27 will be awarded Dec. 1, by County Auditor.

Kan., Topeka—(Official)—Drainage—We have been advised that the surveys which are being made of North Topeka Drainage District are for record in case of flood. No contract contemplated now. Noted Nov. 11.

Neb., Bayard—Irrigation—Bids will be received until 1:30 p.m., Dec. 7, by Catherine Roberts, Secy. Short Line Irrigation District, for purchase of $15,582 bonds for irrigation.

Neb., Tekamah—(Official)—Drainage—Bids will be received until noon, Dec. 18, for three concrete culverts for Burt-Washington drainage district near Tekamah, Towl Engineering Co., 1122 City National Bank Bldg., Omaha, Engr.

Ark., Marion—(Official)—Ditches—Bids will be received until Dec. 10 by Board of Commissioners of Drainage District No. 7, Crittenden County, for 44 miles of ditches requiring about 1,800,000 cu.yd. excavation. Morgan Engineering Co., Memphis, Tenn., Engr.

Tex., Anahuac—Irrigation Improvements—Election will soon be held by Trinity River Irrigation District to vote on $30,000 bonds for repairing bulkhead across Turtle Bay.

Tex., Corpus Christi—Reclamation—Nueces County Commissioners sold $157,000 bonds for reclamation of 80,000 acres. Bids will soon be received.

Tex., Laredo—Irrigation—Max Deutz will install irrigation pumping plant.

Tex., Leon Springs—Irrigation —Leon Springs Irrigation Co. plans to build reservoir and install pumping plant to irrigate 3,017 acres in Leon Springs Valley.

Tex., Marfa—Irrigation — White Elephant Irrigation Co. plans to build water storage reservoir of 5,333,660 cu.ft. and install pumping plant for irrigating 200 acres of land

Okla., Bartlesville—Ditch—Citizens of Washington County contemplate building drainage ditch along Caney River. Estimated cost, $200,000. A. M. Wheeler, Chn. of Comr.

Colo., Grand Junction—Irrigation—Press Reports state that Redlands Irrigation Co. will extend irrigation system. Estimated cost, $200,000. L. Bartlett, Denver, Mgr.

N. M., Ft. Sumner—Irrigation — M. Fishback and Smith Bros. will build dam for local irrigation project. Estimated cost, $80,000.

Wash., North Yakima—Canal—Selah Maxee Canal Co. will improve 3,000 ft. of its canal. Estimated cost, $10,000.

Wash., Tacoma—Dredging—Oregon-Washington R.R. and Navigation Co. and Glacier Fish Co. will dredge channel in middle waterway. Estimated cost, $125,000.

Ore., Salem—Irrigation—B. Lewis, State Engr., approved application of Wesley B. Sherman, Grants Pass, for irrigation project on Graves Creek to irrigate 20,000 acres. Estimated cost, $1,000,000.

Ore., Salem—Reclamation—Surveys completed by Guy Hart, Drainage Engr. of U. S. Dept. of Agriculture, for reclamation of 75 miles on French Prairie Drainage District from Lake Labish on south to Woodburn and West Woodburn on north. Noted Nov. 4 and 11.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Brooklyn) — (Official) — Dredging—Bids have been received from H. G. Packard Co., 133 Greenwick St., at $0.89 per cu.yd., and Wilfred E. Potter, $0.94½ per cu.yd. for dredging Gowanus Canal from its Head to Hamilton Ave., 6000 cu.yd.

N. Y., New York—(Borough of Manhattan)—(Official)—Dredging — Contract awarded to MORRIS & CUMMINGS DREDGING CO., at $0.12½ per cu.yd., for dredging in Borough of Manhattan under Contract No. 1482. Noted Nov. 18.

Mich., St. Johns—Drainage—Louis S. Green, County Drainage Com., awarded contract to WOOLMAN CONSTRUCTION CO., Sandusky, for Cox Drain in Essex Township.

Ill., Chicago—Drainage—Drainage Board awarded contract to A. GUTHRIE & CO., St. Paul, Minn., at $1,600,000 for two miles of Chicago Drainage Canal. Noted Nov. 11.

Iowa, Clarinda—Ditch — Contract for ditch in Nodaway Drainage District, Taylor County, awarded to O. P. HERRICK. Estimated cost, $15,500.

Iowa, Mason City—Drainage—Contract for drainage project awarded to WALTER H. ANDERSON.

Iowa, Sioux City—Ditch—Contract for Upper Wolf Creek Ditch, 154,000 yd. excavation, awarded to MURPHY & HUPP, Hornick, Iowa, at $0.08½ per cu.yd.

Minn., Marshall—Ditches—County Commissioners awarded contracts for County Ditches No. 17, 18 and 19 to TRACY CEMENT CO., Tracy, $7,100 A. HENRIKSEN, Askov, $16,400, MARSHALL TILE AND SIDEWALK CO., Marshall, $10,254, respectively.

Ark., Knobel — (Official)—Ditch—Northern Construction Co., Elkhart, Ind., submitted lowest bid for 52.75 miles of ditches and 3.25 miles of levees.

Idaho, St. Maries—Drainage—Contract for four-mile dyke from Hell's Gulch to Chatcolet, Idaho, and for reclaiming and draining 1,000 acres awarded to CARSCALLEN BROS., Cœur d'Alena, Idaho. Estimated cost, $17,000.

MISCELLANEOUS

Proposed Work

Maine, Lewiston—Fire Alarm System—City Board of Fire Commissioners contemplates installing automatic fire alarm system.

Mass., Brookhaven—Race Track—Citizens contemplate building racetrack and grandstand. J. S. Kimberlin, Jackson, Miss., interested.

N. Y., New York—(Borough of Manhattan)—(Official)—Frogs and Switches—Bids will be received until 12:15 p.m., Dec. 7, by Public Service Commission of First District for supply of special work, Order No. 6, for use in construction of rapid transit railroads, frogs and switches for Lexington Ave. line.

N. Y., New York—(Borough of Manhattan)—(Official)—Station—Public Service Commission of First District ordered Interborough Rapid Transit Co. to build and maintain new local station on Sixth and Ninth Ave. Elevated lines in neighborhood of 150th St.

N. J., Atlantic City—Speedway—City Commissioners approved projected Absecom-Atlantic City Speedway, four miles long. Estimated cost, $250,000. State will pay $80,000 of cost.

Penn., Philadelphia—Pier Superstructure—Plans and specifications for the proposed McKean St. pier superstructures, bids for which are to be received until noon, Dec. 6, are on file at our New York office. (See adv. in issues of Nov. 11 and 18.)

Fla., Lakeland—Addition to Fire System—See item under "Water-Works."

Tenn., Memphis—Dock—Standard Oil Co. contemplates building dock at West Memphis.

Ohio, Akron—Elimination of Grade Crossing—Plans prepared for elimination of grade crossing at Forst St. City portion of cost, $25,000; railroad's, $75,000.

Ohio, Cleveland—Pier—Bids will be received until noon, Dec. 2, by Commissioner of Purchase and Supplies, City Hall, for repair to pier protections.

Ohio, Cleveland—Subway—City of Cleveland and Cuyahoga County Commissioners plan to build subway from New High Level Bridge to Public Square. Estimated cost. $3,000,000. Noted Aug. 19.

Ohio, Cleveland—Grading Subway—Bids will be received until noon, Dec. 2, by Commissioner of Purchase and Supplies, City Hall, for grading subway at Hamilton Ave. and Pennsylvania R. R.

Ohio, Cleveland—Ore Docks—Erie R.R. Co. will improve ore docks on Cuyahoga River. Estimated cost, $200,000. Robert S. Parsons, Gen. Mgr.

Ohio, Tiffin—Retaining Wall—City Council approved $40,000 bond issue for retaining wall and widening Sandusky River.

Ill., Quincy—River Terminals—City Council and Chamber of Commerce plan to build river terminals. Estimated cost, $100,000.

Mo., Kansas City—Elimination of Grade Crossing—Kansas City Terminal Co. making plans to eliminate grade crossings at Holmer St., Chestnut Ave., Van Brunt Blvd., 15th St., Adams St. and Indiana Ave. Estimated cost, $600,000. H. H. Adams, Pres.

Mo., Kansas City—Speedway—Citizens contemplate building motor speedway. Estimated cost, $500,000. Darius A. Brown, 515 Commerce Bldg., interested.

Mo., St. Louis—Dock—Board of Public Service contemplates building municipal dock at foot of North Market St. Estimated cost, $285,000. Noted Sept. 22.

Mo., St. Louis—Levee—Upper Mississippi Levee and Drainage Association petitioned Congress to appropriate $4,000,000 for completing levee system from Cairo, Ill., to Rock Island, Ill.

Tex., Marshall—Elimination of Grade Crossing—Election will be held Dec. 4 to vote on $50,000 bonds for elimination of grade crossing over tracks of Texas & Pacific Railway. T. E. Hilliard, City Engr.

Utah, Salt Lake City—Bath House—Plans prepared by Niels P. Larsen, Arch., for bath house at Warm Springs. Estimated cost, $250,000. Noted Nov. 18.

Wash., Seattle—Amphitheater—University of Washington contemplates building concrete amphitheater on campus. Estimated cost, $50,000. H. Suzzalo, Pres.

Wash., Seattle—Seawall—Bids will be received until 10 a..m., Dec. 10, by L. B. Young, Chn., Bd. of Pub. Ser., for concrete seawall, reconstructing sewers and water mains, and paving. Estimated cost, $100,000.

Wash., Seattle—Steamer—Port of Seattle Commission concontemplates building ferry steamer for service on Elliott Bay. Estimated cost, $30,000. J. R. West, Ch. Engr.

Wash., Seattle—Tunnel—County Commissioners of King County will build tunnel entrance to new courthouse and city hall. Estimated cost, $15,000.

Ore., Portland—Sprinkler Systems—Bids will be received until 4 p.m., Dec. 2, by R. H. Thomas, School Clk., for installing antomatic sprinkler systems and fireproofing various school buildings.

Calif., San Francisco—Dry Dock—Union Iron Works will remodel foundry, install floating dry dock and extend slip. Estimated cost, $1,000,000. John A. McGregor, Pres.

Calif., Whittier—Mausoleum—Whittier Heights Cemetery Association will build mausoleum. Estimated cost, $50,000. J. J. Frauenfelder, Story Bldg., Los Angeles, Arch.

Ont., Ft. William—Coal Docks—Ft. William Coal Docks Co. will build addition to plant on Mission River. Estimated cost, $200,000.

B. C., Barnet—Oil Tanks and Docks—Shell Oil Co. will build five steel oil tanks and dock. Estimated cost, $50,000 and $7,000, respectively.

Bids In and Contracts Awarded

N. H., North Walpole—(Bellows Falls, Vt., post office)—Coal Pocket—Boston & Maine R.R. awarded contract for coal pocket to H. P. CUMMINGS CONSTRUCTION CO., Ware, Mass.

Mass., Boston—(Official)—Tunnel—Contract for section of tunnel under Dorchester Ave. from West Fourth St. to Old Colony Ave. awarded to COLEMAN BROS., Boston, at $382,364. Noted Nov. 18.

Mass., Winthrop—Seawall—Contract for seawall awarded to W. L. MILLER CO., 171 Alford St., Charleston, at $19,030. Noted Oct. 28 and Nov. 18.

N. Y., New York—(Borough of Bronx)—(Official)—Elevated Lines—Bids were received Nov. 15 for (a) Section 6-d, West Farms Subway; (b) Section 9-B, Webster Ave. line; (c) Section 10-C, Eighth Ave. and 162nd St. connection; (d) totals, as follows: Hyde, McFarlin & Burke, (a) $123,667; (b) $1,014,125, (c) $565,439, (d) $1,703,231; Fred L. Cranford, Inc. (a) $131,312, (b) $950,487, (c) $512,215, (d) $1,594,015; Terry & Tench, Inc., and T. A. Gillespie Co., (a) $129,135, (b) $914,997, (c) $511,931, (d) $1,556,063; Snare & Triest Co., (a) $136,770, (b) $926755, (c) $543,291, (d) $1,606,816; William Bradley, (a) $124,202, (b) $906,035, (c) $498,947, (d) $1,529,184.

N. Y., New York—(Borough of Queens—(Official)—Tracks—Public Service Commission awarded contract for installation of tracks for portion of Steinway Tunnel Rapid Transit R.R. to THOMAS CRIMMONS CONTRACTING CO., at $204,898. Noted Nov. 4 and 18.

N. J., Jersey City—Police Flashlight Signal System—City Commission awarded contract to GAMEWELL FIRE ALARM CO. for police flashlight signal system. Estimated cost, $10,000.

Penn., Philadelphia—Coal Pockets—C. P. Bowers, Reading, at $65,899, and McNichol Paving and Contracting Co., Philadelphia, at $74,360, submitted lowest bids for coal pockets on Emerald St. for Philadelphia & Reading Railway Co. Samuel T. Wagner, Ch. Engr.

Penn., Pittsburgh—(Official)—Underground Comfort Station)—Lowest bid received for underground comfort station at Penn. Ave. and Butler St. was that of H. L. Kreusler, 3301 Penn. Ave., Pittsburgh, at $10,130.

Fla., Jacksonville—Docks—Merchants & Miners Transportation Co. awarded contract to HILLYER & SPEARING CO., Jacksonville, for dock improvements. Estimated cost, $75,000.

Ohio, Columbus—Monument—Contract for soldiers monument awarded to P. E. BONNEL & CO., Cleveland, at $17,500.

Ohio, Portsmouth—Flood Protection Wall—Glandorf & Browning, Cincinnati, at $67,779, submitted lowest bid for second section of flood protection wall. Noted Nov. 11.

Ill., Freeport—Excavation for Lakes—Contract for excavation for three lakes at Taylor's Park awarded to GUND-GRAHAM CO., at $10,220.

Wis., Baraboo—Mausoleum—A. Ringling awarded contract for Ringling family mausoleum in Baraboo Cemetery to S. A. COLLINS CO., Reedsburg, Wis. Estimated cost, $25,000.

Calif., San Francisco—(Official)—Esplanade—Contract for Section A of esplanade and seawall recently awarded to C. E. Lamburth has been rescinded and reawarded to J. D. HANNAH, Monadnock Bldg., San Francisco, at $59,975. Noted Nov. 11.

Calif., San Francisco—Pier Repair—State Board of Harbor Commissioners awarded contract to HEALY-TIBBITTS CONSTRUCTION CO., at $63,616, for repairing Pier No. 9.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works," "Federal Government Work" and "Miscellaneous"

Maine, Augusta—Bids will be received until Dec. 1 by T. G. O'Connell, Arch., 18 Boylston St., Boston, Mass., for church for St. Augustines Congregation. Estimated cost, $80,000.

N. H., Manchester—Bids will be received until Dec. 1 by City Clerk for isolation hospital at Derryfield Park. Estimated cost, $75,000. W. E. Provost, 581 Main St., Arch.

Mass., Boston—Plans being prepared by A. H. Bowditch, 44 Bromfield St., for automobile sales building at 655 Beacon St. for Albert Geiger, Jr., 87 Milk St.

Mass., Boston—Plans prepared by Kendall, Taylor & Co., Arch., 93 Federal St., for five-story school and dormitory for Gordon Bible Institute, 7 Montgomery St. Estimated cost, $60,000.

Mass., Boston—Plans being prepared by S. S. Eisenberg, Arch., 5 Everett Ave., Chelsea, for six-story business block for A. Bevilacquac, 91 Prince St. Estimated cost, $100,000.

Mass., Fall River—All bids received for remodeling City Home rejected. New bids will be received. Estimated cost, $90,000. Noted Nov. 4.

Mass., Norwood—Citizens of Norfolk County voted $75,000 bonds for agricultural school.

Conn., Hartford—Plans prepared for parish house for Christ Episcopal Church as memorial to James J. Goodwin. Estimated cost, $50,000. James Goodwin, Pastor.

Conn., Milford—Election will be held to vote on $150,000 bonds for town hall.

N. Y., Corning—New freight house contemplated by Delaware, Lackawanna & Western R.R. Co. Estimated cost, $55,000.

N. Y., New York—(Borough of Manhattan)—Contract for temple for Mount Neboh Congregational at 159th St., near Broadway will be awarded about Dec. 1. Noted Sept. 30.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will soon be received for five-story, 40x100-ft. brick and steel studio building at 163 West 57th St., for L. H. Chalif, 7 West 42d St. Estimated cost, $125,000.

N. Y., Rochester—Board of Trustees approved plans for proposed Chamber of Commerce Bldg. at Mortimer and St. Paul St.

N. J., Hackensack—Citizens of Teaneck voted to issue $40,000 bonds for school.

N. J., Jersey City—Contract will soon be awarded for addition to City Hospital. Estimated cost, $350,000. Noted Nov. 18.

N. J., Jersey City—City Commission is considering plans for constructing following schools: Addition to Lincoln High School and School No. 11 new high school in Hudson City District and new school in Greenville section.

N. J., Newark—Board of Freeholders contemplates $300,000 bond issue for additional buildings at Soho Isolation Hospital.

N. J., Newark—Board of Freeholders contemplates eight-story county office building at High St. and Springfield Ave. Estimated cost, $800,000.

N. J., Newark—Council authorized bond issue of $45,000 for building laboratory and morgue at City Hospital.

N. J., Roselle Park—(Elizabeth post office)—(Official)—Contract will soon be awarded for three-story high school. Estimated cost, $60,000.

Penn., Hazleton—(West Hazleton)—Bonds for $140,000 for new schools voted by citizens. Noted Oct. 28.

Penn., Lawrenceville—(Official)—Board of Education plans to build a two-story school. John N. Hotchkiss, Secy.

Penn., Lehighton—School Board contemplates new high school. Estimated cost, $100,000.

Penn., Marcus Hook—City contemplates building school. Estimated cost, $89,000.

Penn., Philadelphia—County Commissioners will expend about $50,000 for enlarging and improving Magdalen Home at 21st and Race St., and $40,000 on old Vaux School at 12th and Wood St.

Penn., Philadelphia—Revised plans prepared for Municipal Art Museum at Green St. entrance to Fairmount Park. Estimated cost, $4,500,000. E. K. Price, Chn. of Museum Com.

Penn., Philadelphia—Plans prepared for four-story, 250x400-ft. loft building at 23rd and Market St. for Kahn & Greenberg.

Penn., Slatington—School Board will award contract in spring for two-story, 95x135-ft. school building. Estimated cost, $60,000.

Penn., South Mountain—Plans being prepared by A. A. Ritcher, Arch., Sixth and Court St., Reading, Penn., for two-story reinforced-concrete building for Asylum for Chronic Insane.

Del., Wilmington—Grand Lodge of Delaware, Independent Order of Odd Fellows, contemplate building home for aged.

Md., Baltimore—Board of Estimates contemplates, issuing $1,500,000 bonds for additional schools.

D. C., Washington—William Corcoran Eustis plans to build a hotel at 15th St. and Pennsylvania Ave. at an estimated cost of several million dollars.

Va., Norfolk—Plans prepared for four-story building for Brambleton Lodge No. 56, Knights of Pythias. Estimated cost, $75,000.

Va., Richmond—State Capitol Building Commission plans new Capitol Building. Estimated cost between $200,000 and $250,000.

W. Va., Charleston—F. L. Whitney and W. S. Mason are negotiating for an estate on which to build a modern theater and concert hall.

W. Va., Wheeling—(Official)—Bids will be received some time next spring for theater and assembly hall for Royal Southern Amusement Co. Estimated cost, $50,000. Noted Nov. 11.

N. C., Asheville—Citizens voted $250,000 bonds for constrcting schools. Noted Aug. 26.

N. C., Dobson—Commissioners of Surry County contemplate new courthouse. Estimated cost, $60,000.

N. C., Gastonia—Plans being considered by First National Bank for new building. Estimated cost, $100,000. L. L. Jenkins, Asheville, Pres.

S. C., Greenville—Bids will be received by A. G. Furman, Chn. of Court House Comrs., until Jan. 4, for courthouse. P. T. Mayre, Candler Bldg., Atlanta, Ga. Arch., and H. O. Jones, Skelton Bldg., Greenville, Superv. Arch.

Fla., Titusville—Bids will be received until noon, Dec. 7, by Edward E. Macy, Supt. Pub. Instruction, for school.

Ala., Birmingham—Miller & Martin, Arch., Title Guarantee Bldg., prepared plans for five-story, 100x140-ft. building at Second Ave. and 19th St. for Louis Saks Clothing Co., 1900 First Ave.

Tenn., Knoxville—(Official)—We have been advised that the Board of Commerce does not contemplate building to be known as Tennessee Vocational Reformatory for Girls as stated in our issue of Nov. 11. Noted Nov. 11.

Tenn., Nashville—Plans being prepared by Ludlow & Peabody, Arch., 101 Park Ave., New York, N. Y., to remodel building at Fourth Ave. and Union St. for bank and office buiilding for Fourth and First National Bank. Estimated cost, $125,000.

Ky., Covington—Citizens voted $150,000 bonds for high school. Noted Oct. 14.

Ohio, Akron—Citizens of Richfield Township voted to issue $40,000 bonds for central school.

Ohio, Alliance—Citizens voted $100,000 bonds for improving a number of schools.

Ohio, Ashtabula—Citizens voted $40,000 bonds for schools.

Ohio, Canton—Bids will be received next spring for a two-story addition to Woodland School. Estimated cost, $60,000. W. C. Lane, Clk., Bd. of Education.

Ohio, Cincinnati—Bids will soon be received by E. H. Dornette, Arch., for four-story, 35x80-ft. hospital for German Deaconess Hospital Association. Estimated cost, $40,000. Noted Nov. 18.

Ohio, Cincinnati—A six-story building 40x90-ft. will be erected on Fourth St. west of Elm St. Estimated cost, $40,000.

Ohio, Cleveland—Plans will be prepared by Maurer & Mills, Arch., 1335 Scofield Bldg., for new building for Glenville M. E. Church. Estimated cost, $40,000.

Ohio, Columbus—Bids will be received about Dec. 1 for recreation building at Schiller Park for city. Estimated cost, $40,000. Ray Sims, c/o Ohio State University, Arch. Noted Nov. 18.

Ohio, Dayton—Citizens of Oakwood Township have authorized $50,000 bond issue for school improvements.

Ohio, Eaton—Citizens voted $250,000 bonds for three-story court house. Thies & Thies, Arch., Dayton. Noted Sept. 16.

Ohio, Fremont—(Official)—Bids will be received some time next year for church, Sunday school building and parish house for Grace Lutheran Church. Estimated cost, $100,000. W. E. Tressell, Pastor.

Ohio, Galion—Bonds for $40,000 voted for Children's Home in Crawford County.

Ohio, McCutchenville—Bonds for $40,000 voted by citizens for new school.

Ohio, Marion—J. E. Albert, Cleveland, is interested in the organization of a company for the purpose of building a hospital. Estimated cost, $60,000.

Ohio, Springfield—Plans being prepared by R. F. Gable, Arch., Springfield, for church on Fair St. for Phillips Chapel.

Ohio, Steubenville—J. H. Andrews, New Cumberland, W. Va., is interested in a project to raise $100,000 to finish and equip the Ohio Valley Hospital.

Ohio, Tiltonsville—Bonds for $45,000 voted by citizens for new school.

Ohio, Uhrichsville—Citizens voted $45,000 bonds for new school on Trenton Ave. Noted Nov. 11.

Ohio, Wadsworth—Plans prepared for church for Lutheran congregation. Estimated cost, $60,000.

Ohio, Wapakoneta—Plans being prepared by Roy F. Gable, Arch., Springfield, for church for Presbyterian congregation.

Ohio, West Richfield—Citizens of Richfield Township voted $40,000 bonds for central school on site between East and West Richfield.

Ohio, Youngstown—Citizens of Howland Township voted $40,000 bonds for schools.

Ind., Evansville—Red Men contemplate constructing eight or nine-story building. Estimated cost, $75,000.

Ind., Hammond—Contract will soon be awarded for two-story, 85x183-ft. building for Harry Kavanaugh. A. A. Schwartz, 6 North Clark St., Chicago, Ill., Arch. Noted Nov. 18.

Ind., Indianapolis—Strand Theater Co., 332 South Michigan Ave., Chicago, Ill., leased Lyceum Theater at Indianapolis and will remodel and reconstruct same. Estimated cost, $50,000.

Mich., Detroit—Contract will soon be awarded for building theater, store and office building on Grayiot Ave. for Boulevard Theater Co. C. Howard Crane, 2323 Dime Bank Bldg., Arch.

Mich., Grand Rapids—Contract will soon be awarded for three-story, 125x150-ft. church for Wealthy Street Baptist congregation. Estimated cost, $75,000.

Ill., Chicago—Y. W. C. A. plans to build a new building at Ashland Ave. and Monroe St. Estimated cost, $65,000.

Ill., Freeport—State Bank of Freeport plans to build six-story bank and office building.

Ill., Homer—Township School Trustees contemplate high school. Estimated cost, $40,000.

Ill., Joliet—Plans prepared by H. E. Hewitt, Peoria, for Eastern Ave. school. Estimated cost, $40,000.

Ill., Peoria—Peoria Labor Temple Association, recently incorporated, plans to build a temple for labor organizations of city. Estimated cost, $50,000.

Ill., Sidney—Construction of high school contemplated by Township Board of Education. Estimated cost, $40,000.

Wis., Madison—Students of University of Wisconsin contemplate using endowment of about $350,000 of J. Stephens Tripp of Prairie du Sac for clubhouse.

Iowa, Des Moines—Scottish Rite Masons will build 132x180-ft. cathedral at 14th and West Hight St. Estimated cost, $300,000. William Koch, Pres. Bldg. Com., 2809 Cottage Ave.

Iowa, Des Moines—Valley National Bank contemplates building 15-story office building at Fourth and Walnut St.

Iowa, Washington—Construction of new building contemplated by Washington Telephone Co. Estimated cost, $50,000

Iowa, Waterloo—Election will be held Dec. 12 to vote on $250,000 bonds for high school building for Board of Education of District of East Waterloo.

Minn., Albert Lea—Plans being prepared for six-story hotel for Commercial Club.

Minn., Duluth—Plans being prepared by Kelly & Williams, Arch., Duluth, for three-story, 160x200-ft. high school building. Estimated cost, $105,000.

Minn., Hibbing—John A. Healy, owner of Hibbing Hotel, recently destroyed by fire, will organize a company for purpose of building hotel. Estimated cost, $100,000.

Minn., Hibbing—City will build court house. Estimated cost, $100,000.

Minn., Northfield—Trustees of Carlton College plan to build mens dormitory. Estimated cost, $110,000.

Minn., Northfield—Plans being prepared for chemistry building at Northfield. Estimated cost, $80,000.

Minn., St. Paul—Plans being prepared by F. H. Ellerbe, Endicott Bldg., St. Paul, for three hospitals.

Kan., Noedesha—Plans being prepared for two-story, 426x526-ft. office building for Standard Oil Co. C. A. Henderson, Coffeyville, Arch.

Kan., Topeka—R. Marks, Des Moines, Iowa, plans to build department store building at Eighth and Kansas Ave.

Neb., David City—Bonds for $60,000 voted for high school.

S. D., Mitchell—Plans being prepared for building for Mitchell Trust Co. Estimated cost, $65,000. M. F. Patton, interested.

S. D., Webster—Plans being prepared by Holmes & Flinn, Arch., 8 South Dearborn St., Chicago, Ill., for high school. Estimated cost, $60,000.

Mont., Butte—A three-story business building will be constructed by B. K. Wheeler, U. S. District Attorney. Estimated cost, $50,000.

Mo., St. Louis—An addition of five stories will be built to the Shubert Theatre at 12th and Locust St. Estimated cost, $250,000.

Mo., Springfield—Y. W. C. A. will build three-story, brick building. Estimated cost, $75,000. Harry Cooper, 297 East Water St., Chn. Bldg. Com.

Tex., Austin—Plans for new hospital at Agricultural and Mechanical College have been submitted to State Inspector of Masonry. Estimated cost, $50,000.

Tex., Brownsville—Election will be held Dec. 11 to vote on $100,000 bonds for purchasing site and building high and ward schools for Brownsville Industrial School District.

Tex., El Paso—Plans being prepared by Trost & Trost, Arch., Mills Bldg., for new temple at Montana and Oregon St. to be known as Temple Mt. Sinai. Estimated cost, $50,000.

Tex., El Paso—Plans being prepared by Trost & Trost, Mills Bldg., for addition to Everybody's Dry Goods Store, Inc. Estimated cost, $100,000.

Tex., Port Arthur—Plans prepared by W. R. Burk, Arch., New Orleans, La., for five-story, brick and concrete store and office building for A. G. Wutky.

Okla., Oklahoma—Bids will be received by M. Cornelius, Clk., Bd. of Oklahoma County Commissioners, until 10 a.m., Dec. 6, for school.

Okla., Tulsa—Kinney, Kingsbury & Tingley, 415 First National Bank Bldg., contemplates building eight-story, 50x100-ft. reinforced-concrete building. Estimated cost, $125,000.

Colo., Denver—Press reports state that Loyal Order of Moose will build sanitarium near Denver. Estimated cost, $2,000,000.

Colo., Denver—School Board has acquired a site at 29th and Dexter St. on which it plans to build the proposed Park Hill school.

Colo., Swink—City purchased site and will build city hall. Estimated cost, $40,000.

Ariz., Solomonville—Bids will be received until 2 p.m., Dec. 6, by Supervisors of Graham County for two-story court house and jail. Estimated cost, $44,000. B. Blake ,Clk.

Wash., Seattle—Bids will be received by Board of Seattle Commissioners until Dec. 8 for superstructure of Spokane Ave. freight shed. Estimated cost, $60,000.

Calif., Palo Alto—Joseph Larkin plans to build a hotel at an estimated cost of $80,000.

Calif., Redding—Plans prepared for school at Pine and Larkin St. Estimated cost, $82,000.

Calif., Santa Barbara—Plans being prepared for two-story, 125x125-ft. Carnegie Library building. Estimated cost, $50,000. Francis W. Wilson, Arch., Santa Barbara.

Ont., Ingersoll—Election will soon be held to vote on $70,000 bonds for school. W. R. Smith, Clk.

Ont., Sarnia—Plans being prepared for school for Middle Ward. Estimated cost, $50,000.

Ont., Toronto—Sons of Canada contemplate building club house. Estimated cost, $50,000.

Bids In and Contracts Awarded

Mass., Agawam—All bids received Nov. 15 for brick training school rejected as too high. Estimated cost, $100,000. Noted Oct. 21.

Mass., Boston—(Roxbury)—Contract for addition to High School of Practical Arts, Greenville and Winthrop St. awarded to J. J. FLYNN, 319 Washington St., Boston, at $56,756. Noted Nov. 18.

Mass., Danvers—Lowest bids received Nov. 5 for brick building for Independent Agricultural School were as follows: L. A. McAllon, North Andover, $64,400; John A. Driscoll, North Andover, $69,450. Noted Oct. 28.

Mass., North Adams—All bids received Nov. 17 by E. C. and G. C. Gardner, Arch., Springfield, Mass., for three-story, 100x270-ft. brick high school rejected as being too high. Estimated cost, $125,000. Noted Nov. 11.

Mass., Springfield—Contract for church at State and Orleans St. for Christ Scientist Church awarded to FRED T. LEY & CO. Estimated cost, $100,000.

R. I., Providence—Contract for church for St. Charles Barromeo Church awarded to P. J. TRETTIER, East Providence. Estimated cost, $60,000.

N. J., Elizabeth—Contract for El Mora School awarded to P. B. POLHEMUS, Roselle, N. J. Estimated cost, $60,000. Noted Nov. 11.

N. J., Jersey City—Contract for new home for Sisters of Charity of Providence to be known as St. Ann's Home for Aged awarded to D. W. McGEE CONSTRUCTION CO., INC., at $94,065.

Penn., Philadelphia—Contract for 15-story office building at 16th and Walnut St. awarded to STACEY, REEVES & SONS. Estimated cost, $400,000.

Penn., Philadelphia—Contract for two-story, 62x120-ft. parochial school and chapel at 62d and Cedar St. for St. Carthage Church awarded to JOHN McSHAIN, 1610 North St., Philadelphia. Estimated cost, $40,000.

Penn., Pittsburgh—Ceneral contract for five-story, 84x114-ft. building for First U. P. Church awarded to ROSE & FISHER. Noted Nov. 11.

D. C., Washington—Contract for office building at 901 Massachusetts Ave. for American Federation of Labor awarded to R. P. WHITBY CO. Estimated cost, $90,000.

S. C., Columbia—General contract for high school awarded to GEORGE W. WARING, Columbia, at $97,979.

Ky., Louisville—ALFRED STRUCK CO., Louisville, at about $45,000, awarded contract for new building for Western Union Telegraph Co.

Ohio, Akron—INDIANA ENGINEERING AND CONSTRUCTION CO., Ft. Wayne, awarded contract for business block. Estimated cost, $80,000.

Ohio, Canton—ROBERT H. EVANS & CO., Columbus, at $408,443, awarded contract for high school. Noted Oct. 14.

Ohio, Columbus—(Official)—Dawson Construction Co., May Bldg., Pittsburgh, Penn., at $40,000, submitted lowest bid for homeopathic hospital at Ohio State University. Noted Nov. 11.

Ohio, Dayton—Contract for two-story addition to Steele High School awarded to STRUCTURAL CONCRETE CO., Dayton, at $62,000. Noted Sept. 30.

Ind., Evansville—Bids were received Oct. 31 for coliseum for county as follows: H. W. Klausman, Indianapolis, $123,660; W. M. Sutherland, St. Louis, $123,889; A. W. Stallman, Champaign, Ill., Mo., $124,779. Noted Oct. 14.

Ind., Marion—(Official)—All bids received Nov. 11 for high school rejected. Estimated cost, $150,000. Noted Sept. 16.

Ill., Chicago—Bids received by Board of Education for three-story assembly hall addition to Beaubien School from Franzen Construction Co., $8,978; Gage Structural Steel Co., $11,529; Bolters Sons, $10,239, structural steel; B. J. Regnall Co., $7,984; Hauson Bros., $7,288; H. Schrick, $8,060, carpentry; H. Schrick, $19,537; F. A. Siebold, $18,480; S. N. Neilson, $18,858, masonry; Frust & Fanning, $7,449; A. G. Ward, $7,800; James A. Hagen, $7,980, stone. Noted Nov. 18.

Ill., Chicago—Bids were received Nov. 13 for general contract for Chicago Municipal Tuberculosis Hospital as follows: Thomas G. Gage Co., $65,000; William Adams Co., $68,975; H. Eilenberger & Co., $78,459.

Ill., Danville—Contract for four-story, 75x150-ft. building for Masonic Lodge awarded to YEAGER & SON, Danville. Estimated cost, $150,000.

Wis., Sheboygan—Contract for city hall awarded to IMMEL CONSTRUCTION CO., Fond du Lac. Estimated cost, $99,000.

Iowa, Waterloo—LANITZEN CONSTRUCTION CO., Lafayette Bldg., awarded contract for three-story 48x136-ft. parochial school for Sacred Heart Church congregation. Estimated cost $46,000. Noted Nov. 18.

Minn., Gary—Contract awarded to ALEXANDER ROBERTS, 1606 Minnesota Ave., Duluth, for brick hotel for George A. Pine. Estimated cost, $44,000.

Mo., Jefferson City—Contract for office building awarded to LOGAN CONSTRUCTION CO., Carthage. Estimated cost, $70,000.

Mo., St. Louis—Bids were received Nov. 19 by Board of Public Works for first unit of children's building for City of St. Louis from John Hill Construction Co., St. Louis, $65,747; Murch Bros. Construction Co., St. Louis, $67,200; Gillick Bros., St. Louis, $67,498. Noted Nov. 11.

Tex., El Paso—Contract for courthouse awarded to J. E. MORGAN, El Paso, at $364,971. Noted Oct. 14.

Wash., Spokane—Contract for proposed office building at Riverside Ave. and Stevens St. awarded to HURLEY-MASON CO., Spokane. Estimated cost, $125,000.

Calif., Los Angeles—Contract for eight-story, reinforced-concrete office building at Los Angeles and Sixth St. awarded to WEYMOUTH CROWELL, 2026 West Ninth St., Los Angeles.

The American Society of Civil Engineers will draft a federal law to eliminate existing disputes and open the way for a $50,000,000 project on the Columbia River in Oregon for the manufacture of nitrates to be used in the manufacture of explosives.

CATSKILL AQUEDUCT, NEW YORK, N. Y.

Contract 166

Bids were received by the Board of Water Supply, Oct. 19, for Contract 166, constructing two galvanized-steel covered superstructures for drainage chambers at shafts 11 and 21 of the tunnel of the Catskill Aqueduct from (A) NORTHEASTERN CONSTRUCTION CO., 225 Fifth Ave., New York (awarded contract); (B) Louis Wechsler, 1133 Broadway, New York; (C) Levering & Garrigues Co., 552 West 23d St., New York; (D) A. L. Guldone & Son, Inc., 161 East 23d St., New York; (E) Simon Russek, Inc., 261 Broadway, New York; (F) William H. Egan, 147 East 25th St., New York; (G) H. C. Stowe Construction Co., 221 Greenpoint Ave., Brooklyn; (H) James MacArthur Co., 22 Ormond Pl., Brooklyn; (I) Snare & Triest Co., 233 Broadway, New York; (J) Post & McCord, 101 Park Ave., New York; (K) Vulcan Rail and Construction Co., 35 Meserole Ave., Brooklyn; (L) Marble Arch Co., 216th St. and Broadway, New York. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L
460,000 lb. structural steel	$0.03325	$0.035	$0.0377	$0.03951	$0.039	$0.0375	$0.0365	$0.043	$0.04	$0.04	$0.0455	$0.04
24,000 lb. galvanized sheet steel and miscellaneous iron and steel	.114	.155	.102	.09	.11	.1675	.154	.08	.14	.17	.1325	.15
20 M. ft. b.m. timber and lumber	63.60	46.00	54.00	75.00	63.00	58.00	55.00	55.00	70.00	46.00	97.00	60.00
4,000 sq.ft. roofing	.03	.05	.036	035	.03	.04	.055	.08	.07	.24	.0425	.04
Doors and windows in building at shaft 11 (lump sum)	788.50	1,150.00	805.00	784.00	1,130.00	1,539.00	1,200.00	1,800.00	1,500.00	1,956.00	960.00	2,500.00
Doors and windows in building at shaft 21 (lump sum)	660.16	950.00	720.00	869.00	1,020.00	1,339.00	1,000.00	1,767.00	1,400.00	2,016.00	810.00	2,200.00
17-ton electrically-operated crane in building at shaft 11 (lumps um)	4,200.00	3,075.00	3,830.00	3,458.00	3,170.00	3,100.00	4,700.00	2,900.00	3,600.00	3,073.00	4,800.00	4,500.00
18-ton hand-crane in building at shaft 21 (lump sum)	2,184.00	1,650.00	1,940.00	1,662.00	1,460.00	1,500.00	1,700.00	1,450.00	2,850.00	1,597.00	1,900.00	2,500.00
20 cu.yd. concrete masonry	15.60	20.00	15.70	9.50	25.00	28.00	18.00	15.00	25.00	22.90	17.00	20.00
Extended totals	$27,567	$28,165	$28,623	$28,937	$29,240	$30,628	$30,766	$31,337	$33,290	$33,460	$35,030	$35,460

Brown & Clarkson, Washington, D. C., has moved its office from the Star Bldg. to the Oxford Bldg., 14th and New York Ave. Both members of this firm were for a number of years with the U. S. Geological Survey; the firm is specializing in topographic mapping and precise surveys of all kinds. It did the topographic mapping of the Cincinnati Topographic Survey, covering an area of 100 sq. miles, for the Department of Sewerage Investigation, City of Cincinnati, Ohio.

Burns & McDonnell, Consulting Engineer, has moved its offices from the Scarritt Bldg. to Suite 400, Interstate Bldg., Kansas City, Mo.

E. M. Hagar, former president of the Universal Portland Cement Co., declined W. E. Corey's invitation to join the Midvale Steel and Ordnance Co.'s official staff, because he prefers to devote his whole attention to his new $20,000,000 cement merger, called Hagar Portland Cement Co., although his plans have been temporarily delayed on advice of financial backers awaiting more favorable conditions for new merger enterprises.

Industrial Works, Bay City, Mich., has established an office in the Widener Bldg., Philadelphia, Penn. Information can be obtained from its Philadelphia office regarding wrecking and freight-handling cranes, pile drivers, locomotives, etc.

Capital to the Amount of $50,000,000 may be attracted to Alabama for the purpose of building a plant to generate nitrogen, providing the permission of the government is secured for the construction of two more dams on the Coosa River.

CATALOG NOTICES

The Hydraulic Pressed Steel Co., Cleveland, Ohio. Catalog. "Hydraulic" pressed steel forms for concrete construction. Illustrated, 96 pp., 5x8 in.

B. F. Sturtevant Co., Hyde Park, Boston, Mass. Bulletin No. 221. Electric fans. Illustrated, 24 pp., 6½x9 in.

A. M. Byers Co., Pittsburgh, Penn. Bulletin No. 26. Wrought iron pipe. Illustrated, 24 pp., 8½x11 in.

Asbestos Protected Metal Co., Pittsburgh, Penn. Bulletin No. 56. "Waugh" grazing construction. Illustrated, 20 pp., 8x10½ in.

Ingersoll-Rand Co., 11 Broadway, New York. Catalog No. 76. "Water Lifted By Compressed Air." Illustrated, 80 pp., 6x9 in. Form No. 9201. Calyx core drills. Illustrated, 128 pp., 6x9 in.

General Electric Co., Schenectady, N. Y. Bulletin No. 44,005. Line material and rail bonds for mine and industrial haulage. Illustrated, 76 pp., 8x10½ in.

Chicago Pneumatic Tool Co., Fisher Bldg., Chicago, Ill. Booklet No. 213. Simplate flat disc valves. Illustrated, 10 pp., 3½x6 in. Bulletin No. 216. "Hummer" self rotating hammer drills. Illustrated, 28 pp., 6x9 in.

American Bitumastic Enamels Co., 17 Battery Pl., New York. Pamphlet. "Recent Achievements in the Prevention of Corrosion." Illustrated, 48 pp., 8x10½ in.

Ball Engine Co., Erie, Penn. Bulletin S-12. Erie revolving shovels. Illustrated, 12 p., 8½x11 in.

CATSKILL AQUEDUCT, NEW YORK, N. Y.

Contract 128

Bids were received by the Board of Water Supply, Oct. 26, for Contract 128, constructing two superstructures for Hill View Intake and Downtake Chambers, in City of Yonkers from (A) William H. Egan, 147 East 125th St., New York; (B) The Marble Arch Co., 216th St. and Broadway, New York; (C) Louis Wechsler, 1133 Broadway, New York; (E) Conners Bros. Co., 64 West 88th St., New York; (F) Frederic W. Burnham, 30 East 42d St., New York; (G) Emerson Building Co., 103 Park Ave., New York; (H) P. F. Kenny Co., 33 Old Broadway, New York. The item bids were as follows:

	A	B	C	D	E	F	G	H
1,000 bbl. gray Portland cement	$1.70	$2.50	$1.70	$1.60	$2.00	$1.75	$1.57	$2.25
250 bbl. white Portland cement	3.20	4.00	3.00	3.00	4.00	4.00	2.90	3.80
Hill View Uptake Chamber superstructure, exclusive of items 1 and 2 (lump sum)	35,353.00	39,000.00	38,100.00	37,254.00	39,300.00	46,750.00	49,000.00	48,000.00
Hill View Downtake Chamber superstructure, exclusive of items 1 and 2 (lump sum)	56,556.00	54,000.00	58,100.00	60,184.00	63,700.00	69,300.00	71,000.00	74,816.00
Extended totals	$94,409	$96,500	$98,650	$99,788	$106,000	$118,800	$122,295	$126,016

STATE HIGHWAYS—CALIFORNIA

Bids were received by the State Highway Commission, Sacramento, Calif., for constructing highways in Sonoma, Placer and Mariposa Counties, from (A) L. F. Gerdetz Co., San Francisco; (B) F. Rolandi, San Francisco; (C) J. A. Marshall, Berkeley; (D) P. H. Hoare, Oakland; (E) A. J. Fairbanks, Willits; (F) Palmer & McBryde, San Francisco; (G) Bauer & Beard, Two Rivers; (H) Bates, Borland & Ayer, Oakland; (I) G. W. Conners, Eureka; (J) Moffett & Mead, San Francisco; (K) Spring Construction Co., Berkeley; (L) W. B. Hunt & Sons, Alameda; (M) O'Brien Bros., Martinez; (N) M. Blumenkranz, Stockton; (O) Forest Paving and Construction Co., Live Oak; (P) Taylor & Berdiner, Willows; (Q) Whitlock & Gorrill, Durham; (R) Twohy Bros. Co., San Francisco; (S) C. H. & A. W. Gorrill, San Francisco; (T) Manuel Jacinto, Sacramento; (U) George R. Daley, San Diego; (V) Toohey & Johnson, Dunsmuir; (W) J. F. Fitzpatrick, Red Bluff; (X) W. J. Schmidt, Berkeley; (Y) George S. Benson & Sons, Los Angeles; (Z) Occidental Construction Co., Los Angeles; (Z-1) Engineer's estimate. The item bids were as follows:

Sonoma County	A	B	C	D	E	F	G	H	I	J	K	L	M	(Z-1)
43,500 cu.yd. excavation unclassified	$0.55	$0.59	$0.42	$0.43	$0.50	$0.48	$0.485	$0.38	$0.52	$0.42	$0.365	$0.54	$0.48	$0.50
14 M b.m. Oregon pine lumber in place	40.00	40.00	35.00	34.00	30.00	30.00	28.00	32.00	50.00	40.00	42.50	18.00	40.00	30.00
19 M b.m. Redwood lumber in place	45.00	50.00	40.00	39.00	32.00	35.00	32.50	40.00	50.00	45.00	48.20	18.00	40.00	32.50
266 lin.ft. 12-in. corrugated metal pipe	.75	.50	.60	.30	.50	.50	.55	.50	.50	.50	.53	.60	.60	.50
120 lin.ft. 15-in. corrugated metal pipe	1.00	.60	.80	.30	.60	.60	.60	.50	.55	.60	.65	.70	.60	.60
194 lin.ft. 18-in. corrugated metal pipe	1.20	.70	.90	.40	.80	.70	.70	.60	.60	.70	.75	.80	1.00	.70
442 lin.ft. 24-in. corrugated metal pipe	1.25	.80	1.00	.65	1.00	.80	.80	.75	.65	.90	1.10	1.10	1.25	.80
264 lin.ft. 30-in. corrugated metal pipe	1.50	1.00	1.00	.75	1.25	1.00	.80	.75	.75	1.00	1.30	1.30	1.50	1.10
1,200 lin.ft. 4-in. tile drain	.40	.30	.50	.25	.25	.15	.35	.10	.35	.20	.30	.65	.15	.25
185 cu.yd. concrete, Class B, culverts and monuments	15.00	20.00	16.00	12.50	8.00	13.00	14.50	10.00	10.00	14.00	10.00	15.00	11.00	10.00
2,400 lin.ft. moving and resetting property fences	.15	.10	.05	.05	.04	.05	.025	.04	.05	.04	.10	.07	.06	.06
4,200 lin.ft. board and wire new property fences	.15	.10	.05	.03	.04	.04	.035	.04	.04	.05	.05	.05	.06	.036
32,400 lin.ft. woven wire new property fences	.15	.09	.05	.04	.05	.04	.04	.04	.045	.06	.045	.05	.06	.045
76 monuments	1.00	1.00	1.00	1.50	1.00	1.10	1.25	1.00	1.00	1.00	2.00	.50	1.00	.50
Extended totals	$36,022	$35,845	$26,242	$21,869	$27,650	$27,176	$27,727	$22,183	$29,163	$25,408	$22,852	$30,903	$28,205	$31,870

Mariposa County	B	I	U	V	W	X	Y	Z	(Z-1)
53,000 cu.yd. excavation	$0.62	$0.58	$0.38	$0.40	$0.60	$0.55	$0.74	$0.75	$0.45
1,700 cu.yd. excavation, solid rock	1.10	1.00	1.50	.90	1.20	1.90	.74	1.50	1.00
1,024 lin.ft. 12-in. corrugated metal pipe	.50	.50	.80	.60	.60	.60	.90	.50	1.00
156 lin.ft. 18-in. corrugated metal pipe	.60	.50	.90	.70	.75	.85	.90	.70	1.00
406 lin.ft. 24-in. corrugated metal pipe	.80	.60	1.00	.80	.90	1.00	1.00	.95	1.30
310 lin.ft. 30-in. corrugated metal pipe	1.10	.70	1.25	1.00	1.10	1.25	1.00	1.20	1.75
810 cu.yd. concrete, Class B, culverts and monuments	15.00	15.00	20.00	24.00	17.00	15.00	17.50	17.00	15.00
2,324 lin.ft. guard rail	.35	.40	.75	.60	.40	.50	.80	.50	.40
290 monuments	1.00	1.00	1.25	1.25	2.00	1.00	3.00	1.00	.50
Extended totals	$49,254	$46,860	$45,285	$45,285	$50,557	$47,522	$59,160	$58,900	$47,178

Placer County	A	F	H	N	O	P	Q	R	S	T	(Z-1)
45,000 cu.yd. excavation unclassified	$0.60	$0.60	$0.65	$0.50	$0.60	$0.55	$0.45	$0.42	$0.39	$0.475	$0.45
480 lin.ft. 12-in. corrugated metal pipe	.75	.50	.50	.50	.40	.70	.50	.30	.55	.50	.30
330 lin.ft. 18-in. corrugated metal pipe	1.00	.60	.50	.60	.50	.80	.60	.50	.60	.50	.40
120 lin.ft. 24-in. corrugated metal pipe	1.25	.70	.75	.75	.60	1.00	.70	.60	.70	.50	.50
235 cu.yd. concrete, Class B, culverts and monuments	12.00	12.50	10.00	10.00	10.00	9.50	10.00	9.00	9.00	10.00	9.00
8,760 cu.yd. concrete, Class B, pavement	2.80	3.25	3.50	3.15	2.95	2.70	3.00	2.98	2.98	3.50	2.85
3,120 lin.ft. guard rail	.35	.30	.35	.40	.35	.50	.35	.50	.30	.50	.35
88 monuments	1.00	1.00	1.00	1.00	1.10	1.00	1.00	.60	1.00	2.00	.50
Extended totals	$56,368	$59,953	$63,935	$54,308	$56,809	$53,002	$50,582	$49,113	$47,339	$56,586	$56,123

SEWER—CLINTON, IOWA

Bids were received Sept. 14 for constructing sewers in District No. 2 and 3 from (A) D. E. Keeler, Davenport; (B) A. C. Comstock, Cedar Rapids; (C) Independent Construction Co., Davenport; (D) Illinois Improvement and Ballast Co., Chicago, Ill.; (E) O'Neal & Preston, St. Paul, Minn.; (F) James Kennedy, Fargo, N. D.; (G) Dearborn Construction Co., Waterloo; (H) THOMAS CAREY & SONS, Clinton (awarded contract). The item bids were as follows:

DISTRICT NO. 3—Division A

	A	B	C	D	E	F	G	H
Bulkhead, segment block	$800.00	$1,000.00	$500.00	$610.00	$780.00	$700.00	$500.00	$550.00
Bulkhead, reinforced concrete	800.00	.....	.....	610.00	.....	.....	.....	550.00
1,710 lin.ft. 54-in. segment-block sewer	8.70	9.00	8.25	8.50	8.76	8.40	9.26	8.15
1,710 lin.ft. reinforced-concrete sewer	9.50	.....	.....	9.00	.....	.....	.....	9.00
920 lin. ft. 45-in. segment-block sewer	8.00	9.00	7.30	7.50	7.40	7.60	9.48	7.15
920 lin.ft. 45-in. reinforced-concrete sewer	9.65	.....	.....	8.25	.....	.....	.....	8.20
1,240 lin.ft. 39-in. segment-block sewer	8.00	9.00	7.15	7.50	7.40	7.50	7.50	7.15
1,240 lin.ft. 39-in. reinforced-concrete sewer	9.65	.....	.....	8.25	.....	.....	.....	8.20
1,063 lin.ft. 36-in. segment-block sewer	6.50	8.00	6.25	6.50	7.00	6.40	6.44	6.15
1,063 lin.ft. 36-in. reinforced-concrete sewer	7.89	.....	.....	7.60	.....	.....	.....	7.50
700 lin.ft. 33-in. segment-block sewer	5.00	7.00	5.20	5.50	5.75	5.00	5.49	5.15
700 lin.ft. 36-in. reinforced-concrete sewer	7.40	.....	.....	7.25	.....	.....	.....	7.25
323 lin.ft. 30-in. segment-block sewer	4.75	6.00	4.50	4.50	4.00	4.70	2.88	4.15
323 lin.ft. 30-in. reinforced-concrete sewer	7.20	.....	.....	6.75	.....	.....	.....	6.40
235 cu.yd. rock (track) excavation (segment block)	5.00	10.00	5.00	6.00	6.00	7.00	5.00	5.00
235 cu.yd. rock (track) excavation (reinforced concrete)	5.00	.....	.....	6.00	.....	.....	.....	5.00
4,361 cu.yd. rock excavation (segment block)	4.00	4.00	3.50	4.00	4.00	3.75	4.00	3.50
4,361 cu.yd. rock excavation (reinforced concrete)	4.00	.....	.....	4.00	.....	.....	.....	3.50
15 manholes No. 1 (segment block)	80.00	80.00	75.00	60.00	70.00	80.00	35.00	50.00
15 manholes No. 2 (reinforced concrete)	80.00	.....	.....	60.00	.....	.....	.....	50.00
3 manholes No. 2 (segment block)	100.00	100.00	100.00	90.00	95.00	80.00	85.00	75.00
3 manholes No. 2 (reinforced concrete)	100.00	.....	.....	90.00	.....	.....	.....	75.00
28 catch basins (segment block)	35.00	35.00	35.00	40.00	42.00	32.00	35.00	35.00
28 catch basins (reinforced concrete)	35.00	.....	.....	40.00	.....	.....	.....	35.00
420 lin.ft. catch-basin connections (segment block)	.50	.40	.55	.60	.60	.53	.50	.50
420 lin.ft. catch-basin connections (reinforced concrete)	.50	.....	.....	.60	.....	.....	.....	.50

Division B

320 lin.ft. 24-in. vitrified sewer pipe	2.30	3.00	2.50	2.75	2.70	2.65	2.50	2.50
320 lin.ft. 24-in. concrete sewer pipe	....	....	....	3.50	....	....	....	3.00
370 lin.ft. 22-in. vitrified sewer pipe	2.00	3.00	2.00	2.00	2.10	1.90	2.15	1.75
370 lin. ft. concrete sewer pipe	....	....	....	3.00	....	....	....	2.40
570 lin.ft. 20-in. vitrified sewer pipe	2.50	3.00	2.10	2.00	2.25	2.00	2.00	2.00
570 lin.ft. 20-in. concrete sewer pipe	....	....	....	3.00	....	....	....	2.40
1,435 lin.ft. 18-in. vitrified sewer pipe	1.40	2.50	1.45	1.50	1.65	1.30	1.60	1.30
1,435 lin.ft. 18-n. concrete sewer pipe	....	....	....	2.00	....	....	....	1.65
3,364 lin.ft. 15-in. vitrified sewer pipe	1.35	1.50	1.30	1.40	1.33	1.25	1.35	1.25
3,364 lin.ft. 15-in. concrete sewer pipe	....	....	....	1.50	....	....	....	1.45
3,848 lin.ft. 12-in. vitrified sewer pipe	.90	1.00	.92	.90	.95	.85	.90	.90
3,848 lin.ft. 12-in. concrete sewer pipe	....	....	....	1.25	....	....	....	1.20
5,279 lin.ft. 10-in. vitrified sewer pipe	.83	.90	.75	.80	.85	.78	.75	.67
5,279 lin.ft. 10-in. concrete sewer pipe	....	....	....	1.00	....	....	....	.90
1,670 lin.ft. 8-in. vitrified sewer pipe	.55	.70	.58	.60	.67	.59	.60	.60
1,670 lin.ft. 8-in. concrete sewer pipe	....	....	....	.75	....	....	....	.75
2,091 cu.yd. rock excavation (vitrified)	4.00	4.00	3.50	4.00	4.00	3.75	4.00	3.50
2,091 cu.yd. rock excavation (concrete)	....	....	....	4.00	....	....	....	3.50
46 manholes No. 1 (vitrified)	40.00	40.00	38.00	40.00	42.00	37.00	35.00	35.00
46 manholes No. 1 (concrete)	....	....	....	40.00	....	....	....	35.00
104 catch basins (vitrified)	35.00	35.00	35.00	40.00	42.00	32.50	35.00	35.00
104 catch basins (concrete)	....	....	....	40.00	....	....	....	35.00
1,560 lin.ft. catch-basin connections (vitrified)	.50	.40	.55	.60	.60	.53	.50	.50
1,560 lin.ft. catch-basin connections (concrete)	....	....	....	.60	....	....	....	.50
Extended totals for segment-block sewer	$66,209.00	$73,614.00	$63,797.00	$64,954.00	$66,118.00	$63,734.00	$66,564.00	$60,016.00
Extended totals for reinforced-concrete sewer	75,233.00	.....	.....	70,499.00	.....	.....	.....	67,370.00
Extended totals for vitrified sewer	32,838.00	36,509.00	31,253.00	33,610.00	34,627.00	31,134.00	32,391.00	30,008.00
Extended totals for concrete sewer	....	.....	.....	38,397.00	.....	.....	.....	34,431.00

DISTRICT NO. 2

	A	B	C	D	E	F	G	H
Bulkhead (vitrified)	$350.00	$500.00	$360.00	$410.00	$275.00	$375.00	$500.00	$300.00
Bulkhead (concrete)	....	.....	.....	410.00	.....	.....	.....	300.00
675 lin.ft. 33-in. vitrified sewer pipe	6.00	8.00	6.30	6.50	6.25	6.25	5.00	6.00
675 lin.ft. 33-in. concrete sewer pipe	....	.....	.....	8.00	.....	.....	.....	8.00
300 lin.ft. 33-in. D.S. track (vitrified)	8.00	10.00	7.50	6.50	8.50	7.25	6.00	6.00
300 lin.ft. 33-in. D.S track (concrete)	....	.....	.....	9.00	.....	.....	.....	8.00
592 lin.ft. 30-in. vitrified sewer pipe	4.70	6.00	4.20	4.50	4.40	4.60	4.80	4.10
592 lin.ft. 30-in. concrete sewer pipe	....	.....	.....	9.50	.....	.....	.....	6.25
674 lin.ft. 28-in. vitrified sewer pipe	3.80	6.00	3.75	4.00	4.20	3.90	4.60	3.60
674 lin.ft. 28-in. concrete sewer pipe	....	.....	.....	5.50	.....	.....	.....	5.00
345 lin.ft. 27-in. vitrified sewer pipe	3.30	5.00	3.20	3.50	4.00	3.40	4.40	3.10
345 lin.ft. 27-in. concrete sewer pipe	....	.....	.....	5.50	.....	.....	.....	5.00
195 lin.ft. 22-in. vitrified sewer pipe	3.45	4.50	3.20	3.50	3.75	3.25	2.19	3.10
195 lin.ft. 22-in. concrete sewer pipe	....	.....	.....	3.80	.....	.....	.....	3.80
480 lin.ft. 20-in. vitrified sewer pipe	2.60	3.50	2.25	2.50	2.75	2.15	2.00	2.10
480 lin.ft. 20-in. concrete sewer pipe	....	.....	.....	2.75	.....	.....	.....	2.60
1,030 lin.ft. 15-in. vitrified sewer pipe	1.65	2.00	1.40	1.50	1.55	1.40	1.35	1.35
1,030 lin.ft. 15-in. concrete sewer pipe	....	.....	.....	1.75	.....	.....	.....	1.65
1,295 lin.ft. 12-in.vitrified sewer pipe	1.05	1.05	.90	.85	1.10	1.05	.90	.85
1,295 lin.ft. 12-in. concrete sewer pipe	....	.....	.....	1.35	.....	.....	.....	1.35
6,740 lin.ft. 10-in. vitrified sewer pipe	.90	.90	.85	.90	.85	.86	.80	.80
6,740 lin.ft. 10-in. concrete sewer pipe	....	.....	.....	1.10	.....	.....	.....	1.05
150 lin.ft. 8-in. vitrified sewer pipe	.55	.55	.55	.60	.50	.50	.60	.50
150 lin.ft. 8-in. concrete sewer pipe	....	.....	.....	.60	.....	.....	.....	.70
40 manholes (vitrified)	40.00	40.00	38.00	40.00	42.00	37.00	35.00	35.00
40 manholes (concrete)	....	.....	.....	40.00	.....	.....	.....	35.00
68 catch basins (vitrified)	35.00	35.00	35.00	40.00	42.00	32.00	35.00	35.00
68 catch basins (concrete)	....	.....	.....	40.00	.....	.....	.....	35.00
1,020 catch-basin connections (vitrified)	.50	.40	.55	.60	.60	.53	.50	.50
1,020 catch-basin connections (concrete)	....	.....	.....	.60	.....	.....	.....	.50
81 cu.yd. rock (track) excavation (vitrified)	5.00	10.00	5.00	4.50	4.50	7.00	5.00	5.00
81 cu.yd. rock (track) excavation (concrete)	....	.....	.....	4.50	.....	.....	.....	5.00
2,948 cu.yd. rock excavation (vitrified)	4.00	4.00	3.50	4.00	4.00	3.75	4.00	3.40
2,498 cu.yd. rock excavation (concrete)	....	.....	.....	4.00	.....	.....	.....	3.40
Extended totals for vitrified sewer	$39,321.00	$45,536.00	$36,712.00	$39,287.00	$40,070.00	$37,774.00	$37,247.00	$34,831.00
Extended totals for concrete sewer	....	.....	.....	43,144.00	.....	.....	.....	42,671.00

CONTRACT PRICE

ELEVATED RAILWAY WORK, PHILADELPHIA, PENN.

Bids were received by the Department of City Transit, Oct. 19, for constructing the steel superstructure of elevated railway work in Front St. from Callowhill St. to South of Girard Ave., Contract No. 511, from (A) McClintic-Marshall Co., Philadelphia; (B) Pennsylvania Steel Co., Steelton; (C) Conners Bros. Co., New York, N. Y.; (D) E. E. Smith Contracting Co., New York, N. Y. The item bids were as follows:

	A	B	C	D
Whole work as shown on plans, proposed line (lump sum)	$249,000.00	$265,940.00	$283,000.00	$282,665.00
Whole work as shown on plans, alternate line (lump sum)	261,400.00	279,500.00	304,000.00	304,465.00
10,000 lb. riveted steel girders	.0315	.033	.04	.0425
10,000 lb. rolled steel beams	.029	.028	.04	.0425
10,000 lb. steel columns	.04	.042	.04	.0425
10,000 lb. steel rods	.04	.0405	.035	.03
10,000 lb. iron castings	.025	.03	.05	.04
100 cu.yd. excavation	1.25	1.10	2.00	2.00
100 cu.yd. concrete	10.00	11.80	7.50	8.00
100 sq.yd. asphalt paving	4.50	3.00	3.00	2.50
100 sq.yd. new granite block paving	4.50	4.50	3.50	4.00
100 sq.yd. new vitrified block paving	4.50	3.75	3.00	3.00
100 sq.yd. new wood block paving	4.50	4.00	3.50	4.00
100 sq.yd. granite, wood or vitrified block repaving, concrete base	2.25	2.50	2.25	4.00
100 sq.yd. granite, wood or vitrified block repaving, gravel base	2.00	1.50	1.50	3.00
100 sq.yd. granolithic sidewalk paving	1.50	2.00	1.50	2.00
100 sq.yd. flagstone sidewalk repaving	.75	.50	1.00	3.00
100 sq.yd. brick sidewalk paving	1.00	1.10	3.00	2.00
100 lin.ft. 6-in. straight granite curb	1.00	1.25	3.25	1.50
100 lin.ft. 8-in. straight granite curb	1.20	1.50	3.50	2.50
100 lin.ft. 6-in. or 8-in. curved granite curb	2.25	2.00	4.00	3.00
100 lin.ft. granolithic curb	.55	.60	.80	1.00
100 lin.ft. resetting stone curb	.50	.50	.30	.60
1,000 ft. b.m. yellow pine lumber	55.00	60.00	65.00	40.00
10,000 dollars force account (per cent. added)	12½%	20%	10%	15%
Extended totals of bid, proposed line	$256,185	$273,895	$290,475	$290,790
Extended totals of bid, alternate line	268,585	287,455	311,475	312,590

Sand and Gravel Production in the United States for the year 1914 has just been reported in a bulletin by G. F. Loughlin, of the United States Geological Survey. The following table shows the total production of sand and gravel, including glass sand, from 1904 to 1914:

Year	Quantity Short Tons	Value	Year	Quantity Short Tons	Value
1904	10,679,728	$5,748,099	1910	69,410,436	$21,037,630
1905	23,204,967	11,223,645	1911	66,846,959	21,158,583
1906	32,932,002	12,698,208	1912	68,354,561	23,113,208
1907	41,851,918	14,492,069	1913	79,555,849	24,217,508
1908	37,216,044	13,270,032	1914	79,281,735	23,846,999
1909	59,565,551	18,336,990			

More complete returns account principally for the large apparent increase during recent years as compared with 1904. Sand for building purposes constituted, as in previous years, more than one-half of the total sand production. The production in 1914 was 24,003,962 short tons, valued at $7,688,774. This was a decrease of 1,393,421 tons, or 5.4% in quantity and of $319,275, or 3.9%, in value from the production of 1913. The average price per ton, which increased from 31c. in 1911 to 33½c. in 1912 and decreased to 31½c. in 1913, increased to 32c. in 1914. Paving-sand production increased slightly in both quantity and value from 3,335,508 tons, valued at $1,020,389, in 1913 to 3,580,171 tons, valued at $1,121,999, in 1914. The production of gravel in 1914 exceeded that of building sand by more than 15,000,000 tons, an excess which was 2,000,000 tons more than that in 1913. The total production of gravel in 1914 was $39,212,858 tons, valued at $9,398,897, an increase in quantity of 689,360 tons and in value of $556,086 over the production of 1913. These figures show an average cost ton of nearly 25c., as compared with slightly less than 23c. in 1913 and about 26c. in 1912. The entire report of the production of sand and gravel is necessarily incomplete, because it is impracticable to attempt to get reports or to estimate the quantity of sand produced by the thousands of individuals who each year dig a small quantity for their own use.

On Nov. 12 and 13 the sales engineers of the Blaw Steel Construction Co. held their annual convention in Pittsburgh, Penn. The men met Friday morning at the works at Hoboken, Penn., and made an inspection of the plant. A number of new devices were shown and the men were entertained at luncheon in the dining room of the Blaw plant. In the evening a banquet was held at the Concordia Club, where 63 men assembled. A feature was a play in which various members of the Blaw Organization were imitated. This was along the lines of the annual meeting of the Gridiron Club in Washington. Following this, the Convention reconvened for serious work on Saturday. Some very interesting tests were made of the workings of the various Blaw products. The Blaw Steel Construction Co. is a designer and builder of steel forms for every type of concrete construction.

The Department of Commerce in a recent report issued the following, giving details showing the value of merchandise imported from and exported to each of the principal countries during August and the eight months ended with August, 1915, compared with corresponding periods of the preceding year.

Imports from:	——Month of August—— 1914	1915	8 Months Ended with August 1914	1915
Grand Divisions—				
Europe	$50,620,866	$38,142,368	$565,147,023	$351,389,547
North America	39,217,253	46,104,723	309,480,732	354,397,501
South America	15,095,782	22,280,972	157,448,040	199,449,175
Asia	20,629,273	31,438,884	190,907,276	184,017,968
Oceania	3,514,573	2,440,359	32,327,846	38,662,981
Africa	690,143	1,396,896	15,050,346	22,941,588
Total	$129,767,890	$141,804,202	$1,270,361,263	$1,150,858,760
Principal Countries—				
Austria-Hungary	$880,506	$113,061	$12,802,157	$4,540,168
Belgium	2,329,145	76,368	28,184,693	1,771,434
France	6,902,603	7,538,826	77,309,772	46,994,257
Germany	9,400,043	725,244	119,887,898	36,819,943
Italy	3,445,825	2,694,413	36,987,465	34,496,134
Netherlands	3,446,031	1,831,813	24,418,125	17,271,961
Norway	1,071,991	659,771	6,714,829	4,617,563
Russia in Europe	740,766	440,124	12,096,202	912,373
Sweden	614,322	1,158,911	7,240,898	7,504,829
United Kingdom	17,872,280	18,535,932	194,708,846	161,737,848
Canada	15,550,650	15,853,723	105,590,085	101,360,082
Mexico	6,154,189	8,638,928	61,511,188	58,846,452
Cuba	14,524,219	17,411,854	111,633,962	156,175,825
Argentina	4,173,415	6,214,692	40,751,672	61,253,369
Brazil	5,094,398	5,998,404	62,633,412	66,557,308
China	2,482,149	4,515,138	25,465,870	32,320,521
India, British	4,403,791	7,358,316	52,794,013	42,735,263
Japan	10,068,124	10,063,178	68,737,653	62,752,966
Australia	751,888	978,611	14,270,660	21,996,923
Exports to:				
Grand Divisions—				
Europe	$48,875,232	$172,495,744	$783,921,580	$1,634,693,475
North America	47,670,215	52,072,286	333,212,508	335,937,399
South America	5,312,457	13,450,247	65,403,666	86,595,898
Asia	3,789,548	10,268,041	61,810,908	90,242,210
Oceania	3,306,885	9,269,451	49,936,201	62,005,215
Africa	1,413,157	3,469,181	17,064,793	22,333,868
Total	$110,367,494	$261,024,950	$1,311,349,656	$2,231,808,065
Principal Countries—				
Austria-Hungary	.....	$6,698	$12,798,495	$43,334
Belgium	$432,527	1,490,829	32,696,395	14,057,335
France	7,420,800	28,884,743	76,607,804	333,408,123
Germany	68,737	38,743	156,038,929	11,688,510
Italy	1,169,326	15,511,875	39,296,253	150,151,448
Netherlands	2,524,488	6,744,829	69,672,403	108,702,267
Norway	1,077,259	1,618,414	5,700,859	27,840,068
Russia in Europe	76,681	9,723,520	16,974,084	58,650,085
Sweden	312,723	4,258,322	7,985,212	61,703,589
United Kingdom	32,951,250	93,583,342	331,539,577	574,090,545
Canada	33,494,209	34,766,904	219,988,697	209,192,906
Mexico	2,520,130	3,598,577	22,037,281	25,189,017
Cuba	6,160,892	8,110,947	42,965,089	54,445,981
Argentina	971,129	4,573,089	19,648,581	31,149,868
Brazil	1,604,207	4,055,434	15,973,222	21,077,463
China	603,969	1,838,762	15,945,153	13,642,517
India, British	450,353	1,091,951	6,403,459	9,679,438
Japan	1,694,620	3,088,981	23,825,545	28,677,607
Australia	1,825,453	5,285,223	28,258,622	34,190,998

The Buffalo & Susquehanna Ry. is at last to be scrapped. Failing in a long attempt to find a buyer who would operate this road, the company was finally forced to abandon it and the Buffalo Housewrecking Co. at a bid of $220,000 took over the track and equipment.

The roadway to be abandoned runs from about the center of the village of Wellsville to Blasdell and was the western division of the Buffalo & Susquehanna R.R., which was built to Blasdell from Wellsville about 12 years ago. When financial troubles began, the Buffalo & Susquehanna Ry., the Buffalo-Westville road, was divorced from the Buffalo & Susquehanna R.R.

The coal business of the Buffalo & Susquehanna Ry. was diverted to the Pennsylvania R.R. and brought west by that route because it could be so carried more cheaply. The loss of the coal traffic created a situation whereby the receivers could not make the Buffalo & Susquehanna Ry. meet the cost of operation. The bondholders presented the matter in court about a year ago and obtained an order permitting them to abandon the road.

Citizens of Wellsville and other communities along the line interested themselves in trying to find someone to take and run the railway and were instrumental in having the order for the abandonment of the road extended from month to month, but in the end failed.

The bondholders still retain the right-of-way and a valuable water-front property near the Rogers-Brown steel plant.

Highway Improvements in Minnesota for 1916 will cost over $3,000,000 according to a recent statement of George W. Cooley, Secy. of the Highway Commission. Already the state has distributed $750,000 to the counties to aid in the cost of road building and maintenance, on both state and county roads. By the end of the year this will reach $1,500,000, and at least an equal sum is being expended by counties and villages.

In a recent letter to the state efficiency and economy commission answering its request for suggestions, Mr. Cooley urged a state automobile tax to provide a special fund for road maintenance.

He also recommended continuing the one-mile state tax, and making the state's share of state aid work 50 per cent. He strongly indorsed the present system, and letters from assistants in the department, along the same line, have been filed with the commission.

Construction News

PRICES AND BUSINESS CONDITIONS.

Although for a number of months past business in all lines affected by the war has been rushed, it is safe to say at this time that the foreign demand no longer overshadows domestic requirements. Even those lines of business that are last to feel the effects of good times are now busy, and in a great many cases with more orders than they can handle.

Prices for steel, iron and other metals are still advancing, with the high mark still to come. Some of the mills are sold so far ahead they are refusing any new foreign business in an effort to take care of the domestic trade. Outputs of record proportions are not sufficient to fill orders, and under the circumstances making deliveries is more important than getting new business. Tin plate for 1916 has advanced 40c. a box. Plates command a premium in most cases for prompt shipment. Dealers in black and galvanized sheets are sold so far ahead that one concern has been notified by their mill to accept no more orders before Aug., 1916, delivery. Coke is a little easier for prompt shipment than it has been, although lack of labor seems to be a serious handicap to any better conditions at present.

Scarcity of transports and lack of vessels for exporting are still tying up the supply of cars on the railroads, one of the western roads unloading all its cars either in St. Louis or Kansas City, in order to relieve the shortage west of that point. The railroads have placed orders with the car shops for over, 80,000 cars, and it is estimated that there are inquiries for about 60,000 more, the placing of which will be dependent on the builders getting the amount of steel necessary to build them. Orders for over 300,000 tons of rail were placed by the roads in November, and there are inquiries outstanding for at least 150,000 tons more. The railroads are showing a marked increase, both in their gross and net earnings. In the second week in November there was an increase of 25.7 per cent. in the gross earnings of the railroads which sent in their statements, and net earnings show an increase of between 20 and 25 per cent. This is not confined to any particular part of the country, but is general in all sections.

The lumber industry, which has been one of the last to be affected by good times, is now very busy, particularly in the case of yellow pine, which has advanced over $2 per thousand in the past six weeks. The railroads and car companies are buying liberally, and there is a good export demand. Dealers are expecting a large volume of business when the building season opens in the spring. The paint industry, which follows with the lumber business, is correspondingly busy, and the manufacturers are not accepting any future orders at prevailing prices, and are prophecying a considerable advance for 1916.

A marked improvement in the condition of the labor market during October and November, in spite of the greatly increased demand, is noticed. While unemployment has shown further decreases, the demand for labor has spread to practically all basic industries instead of being confined to munition plants and the metal working trade. It would seem that with the advance in prices of all building materials concerns would be somewhat cautious about doing any new building at the increased cost, but this does not seem to hold true. As the prices steadily increase we note a marked increase in building permits and sales of bonds for public work all over the country.

Official figures from Canada explain that the yield of Canadian wheat for this year was underestimated by more than 100,000,000, bushels, making a total of about 300,000,000 bushels from Canada alone. The British Government has attempted to forestall any cornering of the market in raising of prices by seizing the wheat in some of the Eastern elevators for which they are to pay the owners a fair price. It is understood that both in the United States and Canada that the 1916 grain crop will not be as heavy as this year. The immense yield of the present season and the consequent reduction of prices will have a tendency to discourage extraordinarily large seedings. The lateness and immensity of the small grain crop have made it almost impossible for farmers to get in the usual amount of their fall plowing, and consequently they are not in position, even if they would, to plant the crops next year that they have had this year. This is in marked contrast to conditions prevailing a year ago when the price of wheat was high, and the lateness of the season permitted the farmer to prepare an extra large acreage for planting.

The Crop Reporting Board of the Department of Agriculture in a statement issued in connection with, but not made a part of the official report, shows a table comparing the production of this year with three previous years, showing that 1915 is ahead on production of everything with the exception of corn, which was larger in 1912. The five leading cereals give collectively a yield of some 358,000,000 bushels greater than any previous annual yield, and based on November 1 prices against 1914, are of value about $155,000,000 more than last year.

Business failures as reported by Bradstreet for the weeks of November 18 and 25 are less than they were in 1914. For the week of Nov. 25 reporting 295, and Nov. 18, 389. About 86% of the total number, were less than $5,000, and 9% under $20,000 which leaves 5% of the failures over $20,000.

Money is very plentiful. In the past few days loans amounting to something like $206,000,000 having been announced in Wall Street. Part of these are domestic, and the balance the foreign powers. Russia has practically concluded negotiations for a $60,000,000 loan and the London banks have completed their loan of $50,000,000, the balance of the $206,000,000 having been loaned to different railroads throughout the country, most of it for much needed improvements.

CEMENT, STONE AND GRAVEL

Sand and Gravel—Local dealers say that business is still very good, and is considerably better than it has been for a number of years, although the volume of business has not seemed to have affected prices over the last two or three months. Sand is quoted at 45c. per cy.yd., some dealers asking 40c. on large orders. Gravel prices are as follows: Subway, 95c. per cu.yd., and paving, 75c. per cu.yd.; 1½-in. gravel, 80c. per cu.yd., and ¾-in. gravel at 85c. per cu.yd These quotations are for full cargo lots of 500 cu.yd., delivered alongside of docks, New York.

Portland Cement—Business particularly in the Eastern cement manufacturing zones has showed an increase of fully 50% over November, 1914, although during that period of last year business was not normal. Prices are still holding very stiff, and some of the mills are so far sold up that they are not soliciting orders for 1916 business. Prices are as follows:

New York	$1.27	Milwaukee	$1.48
Jersey City	1.21	Minneapolis	1.58
Boston	1.42	St. Paul	1.58
Chicago	1.31	Duluth	1.56
Pittsburgh	1.41	Peoria	1.39
Cleveland	1.45	Cedar Rapids	1.50
Detroit	1.40	Davenport	1.40
Indianapolis	1.44	Denver	2.28
Toledo	1.44	San Francisco	2.30

The above prices are exclusive of package and for carload lots f.o.b. cars at places named. To contractors 45c. is added to the above figures, including charge for buying. To dealers 40c. is added to the above figures.

Bluestone—During the early part of the month there seemed to be a great deal of price cutting among the different dealers which to some extent was brought about by close competition. Greater efforts were made by some of the important dealers to get new customers, and as a result this necessitated some price cutting in order for some of the interests to retain their present customers. The outlook at present is more optimistic than a month ago, and business has shown considerable improvement. At present prices are more firm than in the past few months, and are as follows:

Bronx flagging 17c. per sq.ft.; Manhattan, 18c. per sq.ft.; curbing, 5x16 in., 40c. per lin.ft.; 5x20 in., 45c. per lin.ft.; sewer bottoms, 5x5 ft. by 3 in., 25c. per sq.ft.; Belgian bridging, 5x24 in., 65c. per lin.ft.

Crushed Stone—Business still continues good; prices holding about the same as a month ago. For 1½-in., price ranges from 80 to 90c. and on ¾-in. from 90c. to $1. There is an indication of an advance in price if the continued scarcity of barges is not relieved. Most of the deliveries now being made are contracts signed up several months ago, and dealers are experiencing great difficulty in the delivering. Ordinarily, barges could be had for about $6 and now they are very hard to get for $10, on account of so many of the railroads storing freight on them, waiting for steamers to arrive. Dealers in the Boston report practically the same prices, together with the same difficulties in delivering.

IRON AND STEEL

Pig Iron—With production at probably the greatest capacity on record, and new business pouring in at an exceptionally heavy rate, prices have made conspicuous advances several times during the past month. The mills have been strained to such an extent that at present efforts are now being made to construct additions to the shops as well as build new furnaces. Buyers are so eager to place orders that they are offering premiums on the more important contracts. In anticipation of continued activity the United States Steel Corporation has already chartered a number of vessels for the delivery of ore for 1916. Orders now arriving at the mill call for, in some cases, delivery for the second half of the year of 1916. Prices in the Pittsburgh District have advanced $1 per ton. Basic is now selling at $16.25 and Bessemer at $17.95. It is reported that a few sales have been made at higher figures but such sales are unconfirmed. In Chicago, the activity is even more marked than a month ago, and prices have shown decided advances over that period. The following prices are f.o.b. furnace, and for the switching charge the average is 50c. per ton: Northern Foundry No. 1 sells at $18 and No. 2 at $17.50. These prices, of course, are well maintained. In the Birmingham District prices have advanced and the demand for foundry iron is exceptionally good. Southern Foundry No. 2 sells at $13.50 to $14, and No. 1 from $14 to $14.50. These prices are for delivery f.o.b. furnace.

In New York purchases have been more numerous than a month ago and prices have shown a decided advance. Northern Foundry No. 2 plain is now quoted at $17.25 to $17.50. No.

2X at $17.75 to $18. Southern Iron is $18.25 to $18.50 for No. 1 and $17.75 to $18.25 for No. 2 Foundry and No. 2 soft. Cincinnati prices are as follows: No. 2 Southern $16.40 to $16.90, Cincinnati Southern Foundry No. 2 is selling at $16.40 to $16.90. Cincinnati Northern Foundry No. 2 at $17.76 to $18.26.

Track Supplies—Along with the general demand for steel rails and other railroad supplies, the call for spikes has been excessive. Prices have advanced considerably in the past month. One of the most recent orders placed was that by the Erie R.R. calling for 22,000 kegs. Railroad spikes f.o.b. Pittsburgh sell at $2 per 100 lb. for delivery in the first quarter, and small railroad spikes are $2.10 to $2.25. Track bolts now sell at $2.50 per 100 lb. and tie plates at $34 to $35 per ton. Standard section angle bars are selling at $1.50 to $1.75.

Steel Rails—Although most of the larger interests have already placed their orders for 1916 rails, still a number of small orders are being received calling for 300 to 1,000 tons. The demand for light rails is still very good, and the lumbering interests, as well as the coal operators, have placed considerable business with the mills. Standard section bessemer rails are quoted at $1.25; openhearth rails, $1.34; light rails, 8 to 10 lb., $1.60; light rails, 8 lb., $1.49; light rails, 12 to 14 lb., $1.55; light rails, 12 lb., $1.44; light rails, 16 to 20 lb., $1.50; light rails, 25 to 45 lb., 1.45. These prices are per 100 lb. f.o.b. Pittsburgh in carload or larger lots. For less than carload lots 5c. per 100 lb. extra is charged.

Structural Material—Although in the building line the demand for structural material has not been so apparent as during the month previous, the call for structural material has in no sense diminished. Car builders have entered the market and have placed very generous orders. Several advances have been made during the month, but had no effect in curtailing the demand. Mills are about sold up and have been postponing deliveries in a great many cases. Prices, as a result of course, are very steady, and beams and channels up to 15 in. are quoted at $1.70 f.o.b. mills. For prompt deliveries 2c. and over has been paid. The above quotation includes beams up to 15 in., channels 3 to 15 in., and angles 3 to 6 in.; tees 3 in. and over. Cutting to specified lengths is charged at the following rates: 2 to 3 ft. inclusive, 25c.; 2 ft. to 1 ft., 50c.; under 1 ft., $1.50. No charge is made for cutting to specified lengths over 3 ft. This price in Chicago is equivalent to $1.89 to $1.99; in Philadelphia, $1.859 to $1.909; in New York, $1.869 to $1.919; in San Francisco, $2.05.

Pipe—Since last month's issue, the price on black pipe has increased 1% and present indications favor a further advance. At present the following prices are firmly held.

On carload lots f.o.b. Pittsburgh the following discounts hold:

	Black	Galvanized
¾ to 2-in. steel, butt welded	78%	63½%
2½ to 6-in. steel lap welded	77%	62½%
7 to 12-in. steel lap welded	75%	58½%

At this rate prices are as follows:

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
¾-in.	2.53	4.19	5-in.	34.04	55.50
1-in.	3.74	6.30	6-in.	44.16	72.00
1¼-in.	5.06	8.39	7-in.	59.50	98.77
1½-in.	6.05	10.02	8-in.	62.50	$1.03
2-in.	8.15	12.55	9-in.	86.25	1.43
2½-in.	13.45	21.92	10-in.	$1.03	1.70
3-in.	17.59	28.68	11-in.	1.16	1.92
4-in.	25.07	40.87	12-in.	1.27	2.10

Sheets—The phenomenal demand for black galvanized sheets caused several advances in price during the month and the mills are so well booked with orders that deliveries in most cases are not promised before April. One of the more important factors in this line refuses to quote for delivery prior to August. Quotations given below are for large lots f.o.b. Pittsburgh and small lots New York:

	Cents per Pound — Large Lots Pittsburgh		Warehouse Delivery New York	
	Black	Galv.	Black	Galv.
No. 10	2.05	3.25	2.55	....
No. 12	2.05	3.35	2.55	4.15
No. 14	2.10	3.35	2.60	4.15
Nos. 18 and 20	2.20	3.60	2.80	4.40
Nos. 22 and 24	2.25	3.80	2.85	4.55
No. 26	2.30	3.95	2.90	4.70
No. 27	2.35	4.10	2.80	4.85
No. 28	2.40	4.25	3.00	5.00

Cast-Iron Pipe—Quite a number of fair-sized contracts for water pipes have turned up during the month, and several large gas companies have entered the market for considerable supply. Due somewhat to the war business in this country, a number of companies have been forced to make extensions to existing lines. Increased cost of raw materials along with the improvement in business has caused an advance in the price per ton over last month, and in New York we quote carload lots of 6-in. Class B and heavier at $27 per net ton Tidewater; Class A and gas pipe at $28 per ton. Birmingham f.o.b. makers' yard per net ton as follows: 4-in., $23.50; 6-in. and upward, $21.50; gas pipe, $1 per ton extra. In this section it might be noted that the advance has been $1.50 the last month. In the Chicago district the following prices hold per net ton: Water pipe, 4-in., $29; 6-in. and larger, $27; Class A water pipe and gas pipe with an extra charge of $1.

Chain—Due to the advance in the cost of raw materials, the price has advanced 50c. per 100 lb. Business is very good and the following quotations hold firm and steady:

5/16 in.	$8.00	½ and 9/16 in.	$3.50
¼ in.	5.45	5/8 and 11/16 in.	3.40
7/32 in.	4.45	¾ and 13/16 in.	3.30
3/8 in.	3.90	⅞ and 15/16 in.	3.20
7/16 in.	3.70	1 to 1¼ in.	3.10

The above prices are per 100 lb. f.o.b. Pittsburgh.

EXTRAS TO ABOVE LIST PER 100 POUNDS

	For BB	For BBB
5/16-in. and ¼-in.	$1.50	$2.00
7/16-in. and larger	1.25	1.75

Triangle Mesh—The call for this material continues and the consequent advance in the price of other metal products caused the general revision in the quotations for this material. As we go to press the following quotations hold steady.

PRICE PER 100 SQ.FT. FOR FOUR-IN. MESH

Style No.	Cross-Sec. Area per Ft. Width	Plain Material — Carload Lots	Plain Material — Less Than Car Lots and Over 10,000 Sq.Ft.	Galvanized — Carload Lots	Galvanized — Less Than Car Lots and Over 10,000 Sq.Ft.
*4	0.102	$1.14	$1.25	$1.35	$1.46
5	0.077	.90	.99	1.07	1.16
6	0.058	.72	.78	.85	.92
*7	0.041	.56	.61	.66	.71
*23	0.170	1.91	2.09	2.27	2.45
24	0.142	1.64	1.80	1.95	2.11
25	0.124	1.46	1.60	1.73	1.87
*26	0.110	1.33	1.45	1.58	1.70
*27	0.085	1.09	1.19	1.29	1.39
28	0.66	.90	.99	1.07	1.16
29	0.049	.74	.81	.88	.95
31	0.261	2.81	3.07	3.34	3.60
32	0.225	2.44	2.67	2.90	3.13
33	0.196	2.17	2.38	2.58	2.79
34	0.140	1.67	1.83	1.98	2.14
35	0.109	1.33	1.45	1.58	1.70
36	0.075	.98	1.07	1.17	1.26
38	0.380	4.00	4.38	4.76	5.13
*39	0.325	3.45	3.77	4.10	4.42
40	0.283	3.02	3.31	3.59	3.88
41	0.208	2.31	2.52	2.74	2.96
42	0.151	1.75	1.91	2.08	2.24
43	0.101	1.25	1.36	1.48	1.60

*This material is made in regular widths of 18, 22, 26, 30, 32, 42, 46, 50, 54 and 58 in. Standard lengths of rolls are 150, 300 and 600 ft. Cutting to special length is charged extra.

Bars—Concrete Reinforcing—Mills are so busy turning out bars that they are not promising delivery on any new business for at least six or eight months. Over last month the price has advanced 20c., and it is safe to predict from the extraordinary amount of business on hand that a further advance is more than likely to take place. In this respect it is clearly shown that increases in the price does not at all curtail the demand. As we go to press, the following prices are effective:

	Cents per Pound — Mill Shipment Pittsburgh	F.o.b. Warehouse Pittsburgh	Delivered From Warehouse New York
¾ in. base	$1.70	$2.35	$2.35

Wire Rope—The same steady volume of business continues, and prices over the preceding month remain unchanged. On galvanized the discounts are 40 and 2½% off list. On bright they are 55 and 2½%. Special brand brights are selling at 50 and 2½% off list. At these discounts, the net price of wire rope at the mills is as follows:

Diameter in Inches	Price per Foot — Cast Steel	Crucible Steel	Plow Steel
2½	$0.77	$0.92	$1.10
2¼	0.63	0.75	0.88
2	0.51	0.59	0.70
1¾	0.40	0.48	0.57
1½	0.29	0.35	0.41
1¼	0.20	0.25	0.29
1	0.14	0.16	0.19
¾	0.08	0.09	0.11
⅝	0.07	0.07	0.08

Expanded Metal Lath—Business continues very good, the dealers complain that they have more orders than they can fill, on account of the lack of stock. Prices remain the same as last month, but expected increase is due around the first of the year.

Prices for painted are as follows:

Gage	Weight	Carload	1,000 to 5,000	Under 1,000
27	233	$11.44	$12.52	$13.52
26	250	12.47	13.55	14.55
25	300	13.57	14.66	15.66
24	340	14.64	15.75	16.75
22	450	17.54	18.75	19.75

For galvanized cut in sheets, add 6c.

Freight Rates—The freight rate on finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, black sheets (except planished), chain, etc., are as follows in cents per 100 lb.: Boston, 18.9; Buffalo, 11.6; Baltimore, 15.4; Cleveland, 10.5; Cincinnati, 15.8; Chicago, 18.9; Denver, 68.6; New Orleans, 30; New York, 16.9; Philadelphia, 15.9; St. Louis, 23.6; Minnesota and St. Paul, 32.9. Pacific Coast (all rail), 73.9.

Steel Sheet Piling—The price remains unchanged at $1.50 to $1.55 per 100 lb. for base sizes f.o.b. Pittsburgh.

Plates—Demand for plates has been exceptionally good and railroads have placed many orders for cars and locomotives, also shipbuilders have received contracts for vessels which has stimulated business to a great extent. However, a very recent report states that the Pennsylvania R.R. has recently withdrawn its inquiry for 11,000 cars because of the high prices quoted by the builders, who are having difficulty in getting deliveries on car wheels. Plate mills are well filled with orders for the first quarter, and deliveries are now being promised more or less at the convenience of the mills. Plates are nominally quoted at $1.75 per 100 lb., but for early delivery, $1.90 to $2. In Chicago, $1.89 to $1.99 is demanded; in New York, $1.87 to $1.97.

Old Material—The market for old material is exceptionally strong; prices have jumped since the last month and are well maintained. Very heavy sales are being reported and orders are pending calling for large quantities. In New York the improved conditions are very perceptible, and the following prices are being paid to dealers and producers per gross ton in this section:

Heavy melting steel scrap	$12.75 to 13.75
No. 1 railroad wrought	15.00 to 15.25
Stove plate	9.75 to 10.00
No. 1 machinery cast	12.75 to 13.00
Wrought turnings	7.75 to 8.00
Cast borings	7.75 to 8.00
Railroad malleable cast	10.00 to 10.50
No. 2 heavy cast	11.75 to 12.00

In Chicago the offering includes a number of large tonnages, cast scraps and rails, also a considerable amount of car wheels. The consumers show heavy demand for scrap materials and prices have advanced and are well maintained. For delivery at the buyer's works, Chicago and vicinity, including freight transfer charges, the following quotations hold:

Heavy melting steel scrap	$15.00 to 15.50
Old steel rails rerolling	15.25 to 15.50
No. 1 railroad wrought	14.00 to 14.50
No. 2 railroad wrought	13.00 to 13.50
No. 1 cast scrap	13.00 to 13.50
Pipes and flues	10.75 to 11.25
Agricultural malleable	10.50 to 11.00
Railroad malleable	13.00 to 13.25
Cast borings	6.75 to 7.00

Merchant Steel—Warehouse business has been so very good the last month that stocks are pretty well depleted, dealers having some difficulty in placing orders at the mills. As a result, prices have advanced every week in the past month, and the present quotations given below are very firm, and indications forcast further increase. Quotations as given below are the general base prices for small lots in jobber's store:

Refined iron:	Cents Per Pound
1 to 1⅞ in., round and square	2.35
1½ to 4 in. x ⅜ to 1 in.	2.35
1½ to 4 in. x ¼ to 5/16 in.	2.55
Burden's bar iron	3.05
Norway bars	4.50
Soft steel:	
¾ to 3 in., round and square	2.35
1 to 6 in. x ⅜ to 1 in.	2.35
1 to 6 in. x ¼ and 5/16 in.	2.40
Rods—⅝ and 11/16	2.45
Bands—1½ to 6 x to No. 8	2.65
Beams and channels—3 to 15 in.	2.40
Angles:	
3 in. x ¼ in. and larger	2.40
3 in. x 3/16 in. and ⅛ in.	2.85
1½ to 2½ in. x ⅛ in.	2.60
1½ to 2¾ in. 3/16 in. and thicker	2.50
1 to 1¼ in. x 3/16 in.	2.60
1 to 1¼ x ⅛ in.	2.65
Tees:	
1½ to 2½ x ¼ in.	2.55
1½ to 2½ x 3/16 in.	2.65
3 in. and larger	2.45

METALS

Copper—A very large business has been done in electrolytic copper in the past month, with a steady increase in price noted. The price of electrolytic the first of November was 18⅛c. against the price of 20c. at the present time. Lake copper was selling at that time for 18¼c. and i snow selling for 20c. Business has been very good up until last week, when the 20c. price went into effect, since which time there has been a little lull. It is interesting to note that a year ago at this time copper was selling at $11.75.

Tin—Tin opened up the first week of November at 36c., with a drop the following week of 2¼c. After that continued buying forced the prices up. Until about the 25th of the month tin was selling at 42c. Since that time numerous reports have beared the market to some extent, and the price is now 40c. per lb.

Lead—The market on lead has been quieter than other metals, with less advance. There has been an advance over last month from 4.9c. to 5¼c., due to large export buying. Domestic trade is moderate, and dealers think that if the continued price holds there is enough incentive for smelters to stock well ahead.

Spelter—There has been a large demand during the past month for spelter, prices showing more of an increase than any of the other metals listed. A month ago this was selling for 14c. and 20c. is now being asked for futures with prompt shipment at 19c., with a very brisk market. At the price at which this is held, it is unprofitable for anybody to buy unless absolutely necessary, and this should curtail the demand enough so that a drop in price ought to be noticed shortly.

OLD METALS—The market is strong. The following are the dealers' purchasing prices in New York:

Copper	Cents per Lb.
Heavy and crucible	16.50
Heavy and wire	16.00
Light and bottoms	14.00
Lead	
Heavy	4.50
Tea	4.25

Brass	Cents per Lb.
Heavy	11.50
Light	9.50
No. 1 yellow rod turnings	12.00
No. 1 red turnings	11.00
Zinc	12.00

MISCELLANEOUS

Asphaltum—The demand still continues very heavy and will continue so until the paving season is finally closed. If the season in the north had not practically closed at the present time, prices would have been advanced on account of the scarcity of Mexican petroleum compared to the phenomenal demand. Business has been better than ever before in this line, and dealers figure that next year will be the largest year in the history of the business. Prices remain $15 per net ton in wooden packages in New York and about $19 in Chicago.

Labor—The market for unskilled labor is in about the same position as it was a month ago, being almost impossible to get men to go away from the cities without extra inducements being offered. Unemployment has dwindled to insignificant proportions, and numerous cities report a paucity of help, which is likely to become more marked as the season advances. A development that is all the more remarkable because at this season outdoor work usually slackens. The price for laborers is $2 a day for an 8-hr. day around New York.

Railway Ties—It is clearly evident that conditions have now reached a turning point. Inquiries now in the market for ties have been received from a great many of the principal roads in the country, and in most cases call for a very good supply for 1916 requirements. The Italian Government very recently appeared in the market for several million feet of yellow pine lumber, and as a result this caused some concern to tie manufacturers. In some cases it is believed that some of the railroads entered the market because of this. The freight situation shows no improvement, and partly as a result prices have advanced. Should business develop at the same rate as it did during the latter part of this month, a revision in the price is more than likely to take place. At present, however, the following prices hold:

First-class standard ties 7x9 in. by 8 ft. 6 in., 77c.; 6x8 in. by 8 ft. 67c. These prices are f.o.b. New York.

Sewer Pipes—Dealers report prices somewhat better in this line than a month ago, and a slight increase in price is noted with a prospect of a future advance. Discounts are as follows:

3 to 24"-80% off list; 27 to 30"-70% off list; on 30 to 36"-65% off list. At this rate prices are as follows:

PRICE OF SEWER PIPE PER FOOT

Size	Price	Size	Price
3-in.	$0.05	18-in.	$0.38
4-in.	.05	20-in	.45
5-in.	.08	22-in	.60
6-in.	.08	24-in.	.65
8-in.	.11	27-in	1.35
10-in.	.16	30-in.	1.65
12-in.	.20	33-in.	2.187
15-in.	.27	36-in	2.45

Flue Lining—Business is increasing and dealers are expecting another increase in price over the one noted in this issue. The present discount being 81% off of list. At this rate prices are as follows:

FLUE LINING—PRICE PER FOOT

Size in In.	Weight in Lb.	Price per Ft.	Size in In.	Weight in Lb.	Price per Ft.
4½ x 8½	14	$0.066	8½x13	28	$0.123
4½x13	20	.085	8½x18	45	.17
4½x18	40	.19	13 x13	38	.16
7 x 7	15	.076	13 x18	57	.228
8½x 8½	18	.085	18 x18	75	.38

Glass—Market conditions have improved greatly in the past month, and at the present time large manufacturers claim that business is almost normal. The tendency seems to be to higher prices, and it is expected within a very short time there will be an increase. Prices as follows: Window: Single strength, 1-3 brackets inclusive, B quality, 90% and 30%; single strength, 1-3 brackets inclusive, A quality, 90% and 20%; single strength, above 3d bracket, B quality, 90% and 10%; single strength above 3d bracket, A quality, 90%; double strength, all brackets, B quality, 90% and 20%; double strength, all brackets, A quality, 90% and 10%; single and double strength, AA quality, special prices. Plate, 90% and 40%. Skylight, ¼-in. wire rough or ribbed, 14c. per sq.ft. Boxing on above extra for out-of-town shipment.

Clay Drain Tile—Local dealers in this line are very much pleased at the amount of business they are doing and look to a big increase over present business in the early spring. Prices are as follows:

PER 1,000 SQ.FT.

2 in.	3 in.	4 in.	5 in.	6 in.	8 in.
$17.50	$22.50	$32.50	$47.50	$57.50	$97.50

These prices are in carload lots, f.o.b. New York.

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

Maine—Bar Harbor & Union River Power Co. plans to build electric line from Bluehill Falls to Brookline and Sedgwick, 14 miles. C. M. Tolman, Bangor, Maine, Ch. Engr.

Maine—Mattawamkeag & Northern Ry. received charter to build line from Mattawamkeag northwest via East Millipocket to Millinocket, 23 miles. Charles W. Mullen and I. B. Wood, Bangor, interested. Noted Nov. 18.

Massachusetts—Bay State Street Railway Co. received franchise from Council to double track line on new river boulevard from Lowell St. to Lawrence Line. R. S. Goff, Boston, Mass., Vice-Pres. and Gen. Mgr.

Massachusetts—Holyoke Street Railway Co. contemplates extending line in South Hadely Falls on West Main St. to Canal St., Canal to Taylor St., Taylor to West Main St. Louis D. Pellissier, Holyoke, Gen. Mgr. and Pur. Agt.

Connecticut—New York, New Haven & Hartford R.R. will expend $17,000,000 for improving its line as follows: Additional electrification to get full benefit of that already done, $1,500,000; trackage, yards and sidings, $3,000,000; improved signals, $1,000,000; rolling stock, $9,000,000.

Pennsylvania—Baltimore & Ohio R.R. Co. contemplates constructing third track from Green Junction to Indian Creek, seven miles. F. L. Stuart, Baltimore, Md., Ch. Engr.

Pennsylvania—Highland Grove Traction Co. contemplates extending line from McKeesport to East Pittsburgh. John M. Lyle, McKeesport, Gen. Mgr. and Pur. Agt.

Maryland—Press reports state that Western Maryland R.R. contemplates double-tracking branch line from Cumberland to Hagerstown in spring. H. R. Pratt, Baltimore, Ch. Engr.

Virginia—Surveys completed and right-of-way secured by Norfolk, Washington & New York R.R. for line from Newport News, Va., to Washington, D. C., 159 miles, with branch line down Northern Neck, 50 miles. Channing W. Ward, Richmond, Va., Pres.

West Virginia—Baltimore & Ohio R.R. Co. will double-track its line from Fairmont to Wheeling, 77 miles. Estimated cost between $3,500,000 and $4,000,000. F. L. Stuart, Baltimore, Md., Ch. Engr.

West Virginia—Pond Fork Railway will award contract about Jan. 10 for 15-mile railway from Madison. According to press reports Cole & Crane will build several miles of logging road as an extension of Pond Fork Railway. F. I. Cabell, Richmond, Va., Ch. Engr. Noted Sept. 23.

North Carolina—Surveys being made for extension of line of Watauga & Yadkin River R.R. from Darby, N. C., to Rogers Mills, eight miles. H. C. Landon, North Wilkesboro, Gen. Mgr. Noted Sept. 16.

Florida—Pensacola, Mobile & New Orleans R.R. sold bonds to complete its line from Pensacola to Mobile, Ala., about 17 miles. Henry McLaughlin, Pensacola, Fla., Pres.

Tennessee—New Orleans, Mobile & Chicago R.R. contemplates extending line from Middleton to Jackson, Tenn. B. V. Wright, Laurel, Miss., Ch. Engr.

Tennessee—Tennessee Power Co., Chattanooga, plans to electrify six miles of its railroad from Parksville which connects with Louisville & Nashville R.R., near Shelton. F. W. Hoover, Chattanooga, Tenn., Gen. Mgr.

Indiana—Plans being considered for building electric railway from Washington and Linto via Bicknell, Frelandville, Pleasantville and Dugger. A. L. Brocksmith, Bicknell, interested.

Illinois—Blue Island Commercial Club, Riverdale Improvement Association, Dolton Civic Club, West Hammond City Club and the Hammond Chamber of Commerce, Chicago, interested in construction of railway from Calumet Park to State Line St., West Hammond.

Illinois—J. W. Kendrick in a report to Directors of Chicago, Rock Island & Pacific Railway recommended expenditure of $27,000,00 during next three years for rehabilitation of line. C. A. Morse, Chicago, Ill., Ch. Engr.

Illinois—Illinois Central R.R. will build double track line from Grayville to Metropolis, about 100 miles. A. S. Balwin, Chicago, Ill., Ch. Engr.

Iowa—Citizens of Sioux City plan to build interurban railway from Sioux City, Iowa, to Mitchell, S. D. Estimated cost, $1,500,000.

Iowa—Ft. Madison Street Railway Co. will rehabilitate its lines. Estimated cost, $50,000. D. A. Morrison, Ft. Madison, Pres., Gen. Mgr. and Pur. Agt.

Minnesota—Preliminary surveys being made for spur track from Steelton to Morgan Park for Spirit Lake Transfer Ry. Co., New Duluth, Minn.

Kansas—It is reported that Arkansas Valley Interurban Ry. Co. is considering plans to extend line from Wichita to Eldorado. Charles D. Bell, Wichita, Kan., Secy., Supt., Pur. Agt. and Ch. Engr.

Kansas—Wichita R.R. and Light Co., Wichita, plans to build line on East 13th St. D. I. Hayworth, Wichita, Ch. Engr.

South Dakota—Duluth, Huron & Southern Ry. plans to build line from Huron, S. D., to Duluth, Minn. G. W. Morrow, Sisseton, S. D., Vice-Pres.

South Dakota—South Dakota Packing and Shipping Co. will build spur track from Great Northern R.R. into yards of plant at Watertown.

North Dakota—Minneapolis, St. Paul & Sault Ste. Marie Ry. plans to build line from Max to Minot. C. N. Kalk, Minneapolis, Minn., Ch. Engr.

Montana—Great Northern Ry. Co. contemplates building a line from Scobey to Glentana, 50 miles, during 1916. A. H. Hogeland, St. Paul, Minn., Ch. Engr.

Missouri—Benjamin F. Bush, receiver for Iron Mountain R.R. and Missouri Pacific Ry., authorized to expend for new steel rails $175,000 for Iron Mountain R.R. and $530,000 for Missouri Pacific Ry. and $273,000 to improve road and equipment of both systems. E. A. Hadley, St. Louis, Ch. Engr., Missouri Pacific Ry.

Arkansas—Pine Bluff & Northern Ry. plans to build extension to line from Cullor, Ark., to Pine Bluff, 35 miles. E. C. Buchanan, Little Rock, Ark., Ch. Engr.

Texas—A. T. Perkins, 401 Locust St., St. Louis, Mo., Pres. Marshall & East Texas Railway interested in construction of railroad from Paris to New Orleans.

Texas—Street railways of Dallas contemplate building loop around block surrounded by Jefferson, Jackson, Houston and Young St. to provide service to union terminal stations. Edward T. Moore, Dallas, Mgr. of Dallas Consolidated Electric Street Railway Co., Rapid Transit Railway Co. and Metropolitan Electric Street Railway Co.

Texas—Proposition being considered for building gas-electric interurban railway from Buena Vista to connect with Orient R.R. and run northwest up Pecos Valley, 35 miles. Pecos Valley R.R. Association interested. V. L. Sullivan, Chn.

Texas—Press reports state that Southern Traction Co. plans to extend line from Waco south to Austin, about 100 miles, thence to San Antonio, 82 miles. R. B. Stuchter, Dallas, Tex., Gen. Mgr. and Luther Dean, Dallas, Ch. Engr.

Colorado—It is reported that the business men of Tulsa, Okla., plan to build railway from Colorado Springs east to Ordway and Garden City, Kan., and from Garden City, Kan., to Tulsa, Okla.

Idaho—Sandpoint & Interurban Railway Co., Ltd., will improve its line and build spur track to Great Northern Railway Depot. A. Filson, Sandpoint, Idaho, Pres., Gen. Mgr. and Pur. Agt.

Washington—Bellingham & Northern R.R. plans to extend line from Goshen, Wash., to Welcome, 11 miles. E. O. Reeder, Seattle, Wash., Ch. Engr.

Washington—Merrill & Ring Lumber Co., Everett, contemplates building logging railway from mouth of Pysht River in Clallam County. Estimated cost, $250,000.

Oregon—Southern Pacific Co. plans to electrify line from Whiteson to Corvallis, 43 miles. W. Hood, San Francisco, Calif., Ch. Engr.

New Brunswick—Department of Railways and Canals, Ottawa, will complete portion of St. John & Quebec Ry. (Canadian Government Railways), from Georgetown to Centerville. C. B. Brown, Moncton, N. B., Ch. Engr.

Quebec—Quebec Central Ry. contemplates extending line from English Lake, Que., to point in township of Dionne, L'Islet County, about 25 miles. J. H. Walsh, Aherbrooke, Que., Gen. Mgr.

Ontario—Plans being considered for hydro-radial railway from Petrolia to Chatham.

Ontario—Grand Trunk Ry. authorized to build sidings and spurs across number of highways in village to premises of Port Credit Land Co., Ltd. H. R. Safford, Montreal, Que., Ch. Engr.

Ontario—Plans being prepared for extension of line of London & Lake Erie Railway and Transportation Co. from Lambeth to Delaware. W. N. Warburton, London, Gen. Mgr. and Pur. Agt.

Alberta—Grand Trunk Ry. authorized to build railway spur for Great West Coal Co., Ltd., in northeast quarter of Section 6 and southeast quarter of Section 7-53-23, North Alberta. H. R. Safford, Montreal, Que., Ch. Engr.

Bids In and Contracts Awarded

Ohio—Contract for double-tracking line of Cincinnati, Hamilton & Dayton Ry. from Dayton to Cincinnati awarded to FERGUSON & EDMONSON, Pittsburgh, Penn. F. L. Stuart, Baltimore, Md., Consult. Engr.

Utah—Salt Lake & Utah R.R. awarded contract to WASATCH CONSTRUCTION CO. for grading of extension from Spanish Fork to Payson. Noted Nov. 11.

LIGHT, HEAT AND POWER

Proposed Work

Mass., Framingham—Edison Electric-Lighting Co., Boston, has applied for permission to place its wires underground in the business section. Estimated cost, $40,000.

Conn., Hartford—Connecticut Power Co., New London, has applied for a permit to enlarge its power house on Commerce St. Estimated cost, $197,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., North River, until 10 a.m., Dec. 6, for furnishing and delivering boiler tubes.

N. Y., Tonawanda—General Electric Co., Buffalo, will build power plant at Tonawanda. Estimated cost, $2,000,000. C. R. Huntley, Pres.

Penn., Brackenridge—Municipal electric-lighting system will be installed in Brackenridge. S. B. Martin, Pittsburgh, Consult. Engr.

Md., Frederick—City Council considering plans for enlarging municipal electric-light plant. Estimated cost, $103,000. C. L. Reeder, Baltimore, Consult. Engr.

W. Va., Thurmond—Mt. Hope Electric Power and Water Co., Mt. Hope, has applied for permission to install and operate electric-light, water and sewer systems in Thurmond.

N. C., Statesville—An electric transformer station will be built at Statesville by Southern Power Co. of Charlotte.

Miss., Boonville—See item under "Water Works."

Miss., Clarksdale—Bids will be received by City Commissioners until Dec. 14 for furnishing equipment for improving power plant.

La., Church Point—Citizens plan to hold election to vote on bonds for electric-light plant and water system.

Ky., Mater—Electric-light system will be installed in Mater by Wiley W. Gibson.

Ohio, Cleveland—City Council authorized an expenditure of $75,000 for extending cable of municipal electric-light plant.

Ohio, Massillon—Massillon Electric and Gas Co. plans to improve its plant on Erie St. Estimated cost, $100,000.

Ohio, Salem—Municipal Service Co., Philadelphia, Penn., plans to take over the plant of the Salem Electric-Light and Power Co. and the Columbiana County Electric-Light and Power Co., Salem. Company contemplates an expenditure of $100,000 for improvements. H. T. Hartman, Philadelphia, Pres.

Ohio, West Salem—F. L. Berry has purchased electric-light franchise and system at $4,400.

Ind., Terre Haute—See item under "Buildings."

Ill., Galesburg—See item under "Water Works."

Wis., North Milwaukee—A. O. Smith Co., 27th St. and Keefe Ave., will soon award contract for boiler house. Estimated cost, $35,000.

Iowa, Clarinda—Clarinda Electric Light Co. will build power plant. Estimated cost, $80,000.

Iowa, Ft. Dodge—Citizens voted to issue $100,000 bonds for power dam in Des Moines River in connection with hydro-electric power plant for Ft. Dodge. Noted Oct. 14.

Iowa, Imogene—Plans for electric-light system in Imogene being considered.

Iowa, Low Moor—City plans to install electric-lighting system. Bonds for $4,500 authorized for this purpose.

Minn., Montrose—Plans being considered for electric-light system.

Minn., Rochester—(Official)—Bids will be received by Public Utility Board until 10 a.m., Dec. 6, for furnishing equipment for new power plant. Charles L. Pillsbury Co., Minneapolis, Minn., Engr.

Kan., Coffeyville—Election will soon be held to vote on $20,000 bonds for improving municipal electric-light plant.

Neb., Dixon—Election will soon be held to vote to issue bonds for electric-lighting system.

S. D., Chancellor—Press reports state that municipal electric-light plant will be installed in Chancellor.

S. D., Mitchell—Mitchell Street & Suburban Ry. investigating water power at Great Bend, 78 miles north of Mitchell, with view of installing power plant to supply electricity to proposed railway and surrounding towns.

Wyo., Cheyenne—An expenditure of $50,000 planned by Western Power Co., owner of Cheyenne Light, Fuel and Power Co., for improvements.

Mo., Springfield—Election will be held Jan. 11 to vote on $400,000 bonds for electric-light plant.

Okla., Heavener—Bonds for $20,000 voted by citizens for electric-light plant.

Okla., Shamrock—Plans being considered by Sapulpa & Oil Fields R.R. Co. to install electric-power plant to furnish electricity for operating machinery in oil fields and for railroad use.

Colo., Frederick—Citizens contemplate municipal electric-light plant.

N. M., Santa Fe—Plans of Rio Grande Light, Heat and Power Co. for raising dam in White Rock Canyon to furnish current to Albuquerque, Santa Fe, Las Vegas and other points approved by James A. French, State Engr. Estimated cost, $650,000.

Idaho, Arco—Public Utilities Commission granted franchise to Richard W. Ferris to build and operate electric-light and power plant and water system in Arco. Noted Nov. 25.

Ariz., Miami—Election will be held Dec. 14 to vote on $12,500 bonds for municipal gas plant.

Ariz., Miami—Election will be held Dec. 14 to vote on $40,000 bonds for municipal electric-light plant.

Wash., Woodland—North Coast Power Co. plans to build power line from Woodland to Vancouver.

Ore., Albany—Franchise has been granted William Hoeflich to install and operate electric-light plant in Albany.

Calif., Newport—Board of Trustees considering installation of gas distributing system. Estimated cost, $30,000.

Ont., Forest—Town Council contemplates installing hydro-electric lighting and power system. R. Karr, Clk.

Bids In and Contracts Awarded

R. I., Providence—(Official)—Contract for heating system in new school at Cole and Luzon Ave. awarded to WILLIAM E. DOHERTY, Providence, at $14,025.

N. Y., Buffalo—Fitzpatrick & Hoepfner at $67,500, submitted lowest bid for heating and power work, and Bison Electric Co., at $22,900, for electrical work at Buffalo State Hospital. Noted Sept. 16 and Oct. 28.

N. Y., Utica—Contract for installing ventilating system in Utica Free Academy awarded to MONARCH VENTILATOR CO., New York, N. Y., at $41,000.

S. C., Hartsville—Contract for installing heating plant in Coker College awarded to W. B. GUIMARIN & CO., Columbia, at $17,500.

Ala., Tuscaloosa—Contract for completing gas mains for Tuscaloosa Belt Railway and Utilities Co. awarded to MUNICIPAL ENGINEERING AND CONSTRUCTION CO., Atlanta, Ga. Estimated cost, $12,000.

La., New Orleans—Bids were received by Dock Board for underground conduits, wiring, etc., at municipal dock as follows: Marks Electric Construction Co., $21,690, Barnes Electric Construction Co., $21,700, W. A. Dilzell, $26,900. Ford, Bacon & Davis, Engr.

Wis., Bloomington—GLOBE ELECTRIC CO., Milwaukee, awarded contract for electric-light plant in Bloomington.

BRIDGES

Proposed Work

Mass., Salem—Plans being considered by County Commissioners for rebuilding Essex bridge across Danvers River between Salem and Beverly.

N. Y., Lancaster—(Official)—Bids will be received by F. H. Maute, Town Clk., until 3 p.m., Dec. 15, for two bridges in Transit Rd. between Lancaster and Cheektowga.

N. Y., Silver Creek—Two concrete bridges will be built in Silver Creek. Estimated cost, $14,500.

N. J., Highlands—Plans being prepared for bridge across Shrewsbury River at Highlands. Estimated cost, $35,000.

N. J., Newark—State Board of Commerce and Navigation is negotiating with Central R.R. of New Jersey for construction of new bridge over Newark Bay between Elizabeth and Bayonne.

N. J., New Gretna—Bridge will be constructed across Mullica River by Atlantic and Burlington Counties. Estimated cost, $80,000.

Penn., Bowmanstown—Lehigh Valley R.R. will build bridge across Lehigh River at Bowmanstown.

Penn., Erie—(Official)—Bids will be received by State Highway Department, Harrisburg, until 10 a.m., Dec. 15, for bridge near Kearsarge, Erie County.

Penn., Harrisburg—(Official)—Bids will be received by State Highway Department until 10 a.m., Dec. 7, for bridge across Four Mile Creek, Harborcreek Township, Erie County.

Penn., Philadelphia—City will build three reinforced-concrete bridges. G. S. Webster, Engr., Dept. of Public Wks.

Penn., Phoenixville—Bids will be received by County Commissioners, Norristown, until Dec. 11, for reinforced-concrete bridge over Schuylkill River. B. H. Davis, Consult. Engr., Whitehall Bldg., New York, N. Y.

Penn., Sunbury—(Official)—Bids will be received by Samuel B. Rambo, Supt. of Pub. Grounds and Bldgs., Harrisburg, until 2 p.m., Dec. 14, for 175-ft. steel truss bridge at Sunbury. G. A. Flink, Harrisburg, Engr.

Ga., Roswell—Commissioners of Cobb County, Marietta, will build steel bridge across Chattahoochee River at Roswell. Estimated cost, $6,000. Noted Oct. 28.

Fla., Ft. Lauderdale—See item under "Streets and Roads."

Ala., Birmingham—Plans being prepared for bridge over Cahaba River on Birmingham and Leeds Highway.

Ala., New Decatur—W. B. Edmundson is interested in a project to build a toll bridge at an estimated cost of $200,000.

Miss., Fayette—Bids will be received by J. C. Shelton, Clk., County Bd. of Superv., until Dec. 6, for steel bridge across Davenport Bayou.

Miss., Grenada—Bids will be received until Dec. 6 by County Supervisors for steel bridge near Leflore.

Miss., Woodville—Bids will be received until Dec. 6 by County Supervisors for three bridges over Buffalo Bayou.

Ohio, Akron—Plans being prepared for bridge across railroad tracks at Forge St. Estimated cost, $100,000, $75,000 of which will be paid by railroad company and $25,000 by city.

Ohio, Cleveland—Bids will be received by E. B. Krause, Clk. Bd. of Comrs. of Cuyahoga County, until 10 a.m., Dec. 8, for bridge work as per Report No. 3654.

Ohio, Dayton—Bonds for $115,000 voted by citizens for Mad River and Keewee St. bridge.

Ohio, St. Clairsville—(Official)—Bids will be received by B. W. Hopkins, Audr. of Belmont County, until 1 p.m., Dec. 13, for three bridges and one culvert on line of Jenewine Rd. in Wayne and Washington Townships, Belmont County.

Ohio, Warren—Bids will be received by Board of Commissioners of Trumbull County until Dec. 6 for superstructure of South Main St. bridge.

Ind., Evansville—Plans being prepared by Herman Laub, Engr., Pittsburgh, Penn., for bridge across Ohio River about six miles above Evansville. Estimated cost, $550,000.

Ind., Wabash—Bids will be received until Dec. 7 by Board of County Commissioners for Huntington St. bridge.

Mich., Ada—Bids will be received until Dec. 8 by Kent County Road Commissioners for steel bridge across the Grand River at Ada. Estimated cost, $30,000.

Mich., Lansing—Bids will be received by Frank F. Rogers, State Highway Comr., until noon, Dec. 9, for bridge No. 37 and 50.

Ill., Bellflower—(Official)—Bids will be received by R. O. Edwards, County Supt. of Highways, Court House, Bloomington, until 2 p.m., Dec. 18, for steel bridge in Lexington Township.

Ill., Watseka—(Official)—Bids will be received by B. Jordan, County Supt. of Highways, until 11 a.m., Dec. 15, for reinforced-concrete or steel bridge in Douglas Township, Iroquois County.

Ill., Watseka—(Official)—Bids will be received until 11 a.m., Dec. 15, at office of County Superintendent of Highways, for reconstruction of bridge No. 137 between Belmont and Milford Townships, Iroquois County.

Wis., Chippewa Falls—Press reports state that bridge will be built across Chippewa River above Paint Creek dam. Estimated cost, $55,000.

Wis., Prairie du Sac—Plans being prepared by M. W. Torkelson, Bridge Engr., State Highway Comn., Madison, for bridge across Wisconsin River at Prairie du Sac. Estimated cost, $75,000. Noted Nov. 11

Iowa, Epworth—Construction of viaduct being considered by Illinois Central R.R. A. S. Baldwin, Chicago, Ill., Ch. Engr.

Iowa, Iowa City—Iowa City Commercial Club is promoting the construction of a viaduct across the tracks of Rock Island Southern Ry. at College Ave. Estimated cost, $35,000.

Minn., Anoka—See item under "Streets and Roads."

Kan., Ft. Scott—City plans to build concrete bridge across Mormaton River on North National Ave. Estimated cost, $10,000.

Kan., Topeka—City plans to construct reinforced-concrete bridge over Shunganunga Creek on Sixth Ave. Estimated cost, $12,600.

Mont., Hamilton—Bids will be received by F. E. Robbins, Clk., Bd. of County Comrs., until Dec. 6, for destroying and removing old bridge across Bitter Root River east of Florence and building two new bridges across East Fork of Bitter Root River.

Mo., Warsaw—Bids will be received until 1:30 p.m., Dec. 14, by B. R. Burton, Clk. of Benton County, for bridge over Pomme de Terre River, Township 39.

Tex., Clarksville—See item under "Streets and Roads."

Okla., Purcell—An election will soon be held to vote on $100,000 bonds for bridge work in McClain County.

Okla., Vinita—(Official)—Citizens defeated $50,000 bonds for 17 bridges. Noted Nov. 4.

Wash., Pasco—Plans being prepared by C. E. Fowler, Consult. Engr., Central Bldg., for steel bridge across Snake River between Pasco and Burbank. Estimated cost, $50,000.

Bids In and Contracts Awarded

Maine, Kingsfield—SAUNDERS ENGINEERING CO., Portland, at $15,000, awarded contract for reinforced-concrete bridge over Carrabassett River.

Mass., Boston—Bids were received Nov. 22 for concrete bridge over Charles River at North Beacon St. as follows: A. G. Tomasello, 69 Gibson St., Dorchester, $117,352; Fred T. Leyl Co., Springfield, $119,560; Coleman Bros., Chelsea, $124,011. Noted Nov. 11.

R. I., Woonsocket—(Official)—Bids were received Nov. 23 for Hamlet Ave. and Fairmount St. bridge as follows: Hamlet Ave. bridge, E. W. Foley Contracting Co., New York, N. Y., $71,886; Brien & Bouvier, Boston, Mass., $73,152; Bruno & Petitte, Boston, Mass., $90,090; Fairmount St. bridge, Spaulding Construction Co., Suffield, Conn., $21,812; E. W. Foley Contracting Co. ,New York, N. Y., $23,795; E. B. Roberts Construction Co., Pittsfield, Mass., $24,742. Noted Nov. 4.

Conn., Hartford—Contract for reinforced concrete bridges and widening of causeway in Haddam Township awarded to DONAHUE BROS., Middletown, $6,217. Noted Nov. 25.

Conn., Hartford—Contract for concrete bridge on Hartford-Saybrook Turnpike, Chester Township, awarded to JOHN G. HOLBROOK, Westbrook, at $6,165. Noted Nov. 25.

N. J., New Brunswick—Contract for reinforced-concrete bridge over Tennents Brook on South Amboy-Bordentown Turnpike awarded to ERRICKSON & MORRELL, Moyton.

Penn., Allentown—Central of New Jersey awarded contract to PENNSYLVANIA STEEL CO., Steelton, Penn., for fabricating and erecting steel superstructure of new bridges over Lehigh River at Allentown. Estimated cost, $52,500.

Penn., Kennet Square—Contract for stone arch bridge over Red Clay Creek awarded to P. J. McCORMIC & SON, West Chester, at $5,598. Noted Nov. 11.

Penn., Philadelphia—Contract for reinforced-concrete bridge across Ludlow St. awarded to F. W. VAN LOON CO., Philadelphia, at $20,000.

Kan., Pittsburgh—Contract for bridge at West Prairie Ave. awarded to A. JAICKS CO.

Mo., Joplin—(Official)—Contract for viaduct over tracks of St. Louis & San Francisco R.R. on Kentucky Ave. awarded to HORTON CONCRETE CONSTRUCTION CO., 520 Reliance Bldg., Kansas City, at $18,890. Noted Oct. 28.

Okla., Bigheart—Contract for reconstructing bridge awarded to ROCHESTER BRIDGE CO., at $5,995.

Wash., Aberdeen—A. R. EICHLER, Seattle, at $4,355, awarded contract for approaches and false work for repairing bridge across Chehalis River. Noted Sept. 23 and Nov. 4.

Calif., Bakersfield—Robert Sherer Co., Pacific Electric Bldg., Los Angeles, at $13,465, submitted lowest bid for bridges and culverts on Division, 10, Section 7, Bakersfield-Mojave Rd. Noted Nov. 4.

Calif., Los Angeles—Edgar T. Wheeler, at $7,190, submitted lowest bid for bridge across San José Creek on Lemon Ave.

Calif., Sacramento—(Official)—Contract for reinforced-concrete bridge across Myers Creek, Imperial County, awarded to HOLLAND CONSTRUCTION CO., San Diego, at $15,600. Noted Oct. 21 and Nov. 18.

WATER WORKS

Proposed Work

N. Y., Buffalo—An appropriation of $57,599 made by Board of Alderman for improving water system.

N. Y., Red Creek—Surveys being made by H. C. Kittredge, Hydraulic Engr., Rochester, for water system. Estimated cost, $25,000.

Penn., Pittsburgh—Election will soon be held to vote on $7,000,000 bonds, $1,200,000 of which will be used for enlarging and improving water system. R. Swan, Dir. of Pub. Wks.

Md., Somerset—Plans being considered by Somerset Heights Water & Power Co. for improving and enlarging water system.

Va., Newport News—Newport News Light and Water Co. plans new 23-in. supply line from Reservoir toward Oyster Bay.

W. Va., Thurmond—See item under "Light, Heat and Power."

S. C., Charleston—Election will be held Dec. 14 to vote on $1,500,000 bonds for purchase of plant of Charleston Light and Water Co. and $100,000 bonds for improving and enlarging same.

Ala., Cullman—Water mains will be extended about two miles.

Miss., Boonville—Bids will be received by County Supervisors until Dec. 6 for constructing water and light plant.

Miss., Clarksdale—Bids will be received until Dec. 14 by M. W. Purnell, City Clk., for improving water system.

La., Church Point—See item under "Light Heat and Power."

Ky., Winchester—City plans to enlarge water system.

Ohio, Canal Winchester—Bids will be received by G. M. Herbst, Clk., until noon, Dec. 30, for purchase of $12,000 bonds for constructing water system.

Ohio, Wilberforce—Bids will be received by Board of Trustees until Dec. 14, for furnishing materials and improving water supply system.

Mich., Mt. Morris—Press reports state that city contemplates installation of water system. H. W. Graham, interested.

Mich., Quincy—(Official)—We have been informed that plans for water system are not being prepared as stated in our issue of Nov. 4.

Ill., Galesburg—Bonds for $80,000 sold for water system and electric-light plant. Noted Oct. 14 and Nov. 4.

Wis., Milwaukee—City Council has accepted report of committee for extending Linwood Ave. intake water tunnel 2,500 ft. Estimated cost, $500,000. F. G. Simmons, Comr. of Pub. Wks. Noted Aug. 19.

Iowa, Marshalltown—Plans being prepared for addition to municipal pumping station.

Kan., Emporia—Plans being prepared by Black & Veatch, Engr., Kansas City, Mo., for filtration plant, distributing system and other improvements to water system. Estimated cost, $125,000.

Kan., Lawrence—Election will be held March 7 to vote on $175,000 bonds for purchase and improvement of water system. Noted Nov. 4.

Mo., Cape Girardeau—Plans for building intake tower being considered by Missouri Public Utilities Co. of St. Louis. Estimated cost, $25,000.

Mo., Lees Summit—Contract for water system will be awarded about Dec. 15. Estimated cost, $45,000. Henrci, Kent & Lowry Engineering Co., Kansas City, Engr. Noted Sept. 30.

Ark., Beebe—Bids will be received about Jan. 1 for water system. Estimated cost, $15,000. Noted Oct. 7.

Ark., Gravette—Plans being considered by City Council for improving municipal water system and electric light.

Tex., Denton—Bids will soon be received for 4,000-ft. of water pipe and one mile of sewer pipe.

Tex., Houston—David Fitzgerald, City Water Comr., will drill artesian wells, install pumps and build pumping house for North side auxiliary water plant and connect water pipe from new plant to city mains through Glen Park and North Main St. Estimated cost, $35,000.

Tex., Mart—City will issue $18,000 bonds for water-works extensions. J. L. Vaughn, Mayor.

Tex., Trinity—H. S. Wilder, Consult. Engr., Houston, will prepare plans and submit report estimating cost of complete water system.

Okla., Clinton—Election will be held to vote on bonds for $6,000 for extension of water works system.

Okla., Tulsa—Election to vote on $600,000 bonds for storage basin at mouth of Shell Creek postponed from Nov. 23 to Jan. 2. Noted Nov. 4.

Idaho, Arco—See item under "Light, Heat and Power."

Idaho, New Plymouth—City Council has received petition from R. S. White, Pres. of New Plymouth Water Co. for permission to build and operate water system in New Plymouth.

Utah, Aurora—Installation of municipal water system under consideration.

Utah, Centerville—Election will soon be held to vote bonds for municipal water system.

Ariz., Flagstaff—Coconino Water Development and Stock Co., recently incorporated with $100,000 capital stock, plans to develop a supply of water on the slope on San Francisco Peak, near Flagstaff, and to distribute it by means of a pumping plant and pipe line to all stations on Atchison, Topeka & Santa Fe R.R. between Ashfork and Angel, also to tourist resorts on rim of Grand Canyon. C. H. Spencer, interested.

Ariz., Miami—Election will be held Dec. 14 to vote on $80,000 bonds for water system.

Calif., Azusa—City has retained F. E. Trask, Engr., Union Oil Bldg., Los Angeles, to prepare plans for municipal water system.

Calif., Richmond—(Official)—J. H. Dockweiler, Engr., retained by Richmond Water Commission to submit a report on a most suitable water system for city.

Calif., Whittier—Plans will be prepared by F. C. Roberts, Engr., Marsh-Strong Bldg., Los Angeles, for water and distributing system. Estimated cost, $100,000.

Que., Montreal—City plans to enlarge and improve water system. M. Cote, City Comptroller.

Que., St. Hyacinthe—Bids will be received until Jan. 11 by Hector Cadieux, City Engr., for mechanical gravity filter plant.

Ont., Cornwall—Plans being considered by Town Council for extending water mains and installing pump. Estimated cost, $25,000. J. E. Harkness, Clk.

Ont., Dryden—Town Council contemplates water system. B. S. McKenzie, 1002 Union Trust Bldg., Winnipeg, Man., Consult. Engr.

Ont., Galt—City plant to install two motors in electrical pumping plant at water-works. Estimated cost, $5,000.

Bids In and Contracts Awarded

Mass., Lynn—Contract "A" for Ipswich River pumping station awarded to BAY STATE DREDGING AND CONTRACTING CO., Boston, at $11,263; Contract "C" for De Laval pump to POWER EQUIPMENT CO., Boston, at $11,995. Noted Oct. 21 and 28.

N. Y., Syracuse—Contract for intake pipe at Onondaga Lake for Solvay Process Co. awarded to GREAT LAKES DREDGE AND DOCK CO., Buffalo, at $200,000.

N. J., South Orange—Contract for laying water mains in Audley St. and Montague Pl. awarded to DOMINICK MERCANDANTE.

La., White Castle—Contract for installing water system awarded to AMERICAN CAST IRON PIPE CO., Birmingham, Ala. Noted Sept. 2.

Ohio, Cincinnati—Contract for concrete water tanks in Kennedy Heights awarded to FERRO CONCRETE CONSTRUCTION CO., at $168,747. Noted Oct. 14.

Ohio, Cleveland—Contract for boiler foundations for filtration plant awarded to F. W. MARK CO., Leader News Bldg. Estimated cost, $4,500.

Ohio, Cleveland—Contract for two 60-in. water mains at Division Ave. Pumping Station awarded to HOAG & ZULLO CO.

Ill., West Frankfort—(Official)—Contract for municipal water system awarded to CHARLES S. LAIM, St. Louis, Mo., at $83,000. Noted Nov. 11.

Iowa, Boyden—Contracts for water system awarded as follows: ADNA DOBSON, Lincoln, Neb., at $5,563, for pipe line; DES MOINES BRIDGE AND IRON CO., Des Moines, at $2,650, for tower and tank; WARD & WEIGHTON, Sioux City, at $1,528, for pump house and drill well; FAIRBANKS, MORSE CO., Chicago, Ill., at $610, for pump and engine.

Minn., Duluth—Contract for 5,000-ft. 1¼-in. and 1,000-ft. 1¼-in. galvanized iron pipe awarded to DULUTH PLUMBING SUPPLIES CO.

Tex., Beaumont—Contract awarded to SPENCE & HOWE CONSTRUCTION CO. for water mains across Neches River. Estimated cost, $10,800.

Tex., Ft. Worth—Contract awarded to HEDGES CONSTRUCTION CO., Springfield, Mo., for completing West Fork Reservoir and constructing sewage-disposal plant. Estimated cost, $172,000. Noted Oct. 14.

Ont., Berlin—City Council awarded contracts for water system as follows: CANADIAN-ALLIS-CHAMBERS CO., LTD., King St., W. Toronto, at $4,492, for pumping machinery; GARTSHORE-THOMPSON PIPE AND FOUNDRY CO., Stuart St., W., Hamilton, at $7,074, for piping; KERR ENGINE CO., Walker Rd., Walkerville, for valves.

SEWERS

Proposed Work

Mass., Lynn—City plans an expenditure of $50,000 for improving sewer system.

N. Y., Batavia—Citizens voted $17,000 bonds for repairs to sewer pumping plant.

N. Y., New York—(Borough of Manhattan)—Bids will be received Dec. 8 for repairs to barrel sewers under pier at foot of 36th St. and North River.

N. Y., New York—(Borough of Queens)—(Official)—Bids being received for sewers and catch basins in Willard and Hatch Ave., Woodhaven, about 1,600 ft. Louis Englehardt, Willard Ave., in charge.

N. Y., Wappinger Falls—City will vote for bond issue of $15,000 for completion of sewer system.

N. J., Hackensack—(Official)—Bids will be received by M. Demarest, Pres. of Hackensack Improvement Comn., Municipal Bldg., 346 State St., until 8 p.m., Dec. 6, for sewers in Passaic and State St.

N. J., Ridgefield Park—Bids will be received by H. F. Ayers, Chn. of Bd. of Village Comrs., until Dec. 7, for sewer system in West View Section.

Md., Baltimore—Bids will be received until Dec. 8 by Board of Awards, City Hall, for lateral sewers in District No. 38-A, Sanitary Contract No. 172.

W. Va., Kenova—Bids will be received about Dec. 23 for sewer system. Estimated cost, $55,000. Oliver & Maupin, Huntington, W. Va., Engr. Noted Nov. 18.

W. Va., Thurmond—See item under "Light, Heat and Power."

Fla., Ft. Myers—Citizens did not vote $25,000 bonds for improving sewer system as was noted in the issue of Nov. 25.

La., Donaldson—A. W. Jackman has applied to City Council for franchise to install sewerage system in Donaldson.

Ky., Lexington—Plans will be prepared for sewage disposal plant and sewer in North Main St. Estimated cost, $350,000. J. White Guyn, City Engr.

Ky., Owensboro—Contract for sewer system will be awarded about Jan. 15. Citizens recently voted $250,000 bonds for this purpose. Noted Oct. 21 and Nov. 18.

Ohio, Brewster—City will install sewer system. Estimated cost, $10,000.

Ohio, Cuyahoga Falls—Bids will be received by W. F. Williston, City Clk., until Dec. 14, for sewer construction. Estimated cost, $20,000. R. W. Pratt, 708 Hippodrome Bldg., Cleveland, Consult. Engr.

Ohio, Troy—Bids will be received by C. F. Rannells, Audr., until noon, Dec. 11, for purchase of $21,500 bonds for sewer construction .

Ind., Ft. Branch—Construction of sanitary sewer system and purification plant under consideration. Estimated cost, $15,000.

Ind., Greencastle—Plans being considered for sewage purification plant and sewer from Greencastle to Big Walnut Creek.

Ind., Vincennes—Plans being prepared for storm sewers in eastern and southeastern part of city. Estimated cost, $150,000. H. T. Watts, City Engr.

Mich., Flint—No bids were received for sanitary sewers in Wilcox St. from Flint River to Glenwood Ave. and in Decker St. from Cleveland Ave. to Poplar St. Work will be done under supervision of City Engineer.

Mich., Grand Rapids—Grandville Avenue Improvement Association interested in a project to secure sewer system for south and sauthwestern section of city. Estimated cost, $250,000.

Mich., Harbor Beach—Bids will be received by W. A. Trescott, City Clk., until 8 p.m., Dec. 8, for sanitary sewer system and disposal plant. R. W. Roberts, Saginaw, Engr.

Ill., East St. Louis—City plans an expenditure of $50,000 for repairing sewers. Work will be done under supervision of City Engineer.

Wis., Randolph—Citizens plan installation of sewerage system. Estimated cost, $15,000.

Iowa, Clinton—City contemplates sewers in Districts Nos. 7 and 8. J. G. Thorne, City Engr.

Iowa, Dubuque—City Council will construct 8-in. tile pipe sanitary sewer in St. Ambrose St. from present manhole at intersection of Willow and St. Ambrose St.

Iowa, Farragut—Surveys being made for sewer and drainage system. Estimated cost, $4,000.

Iowa, Ft. Madison—Contract will soon be awarded for two miles of sanitary sewers. R. J. Lewis, City Engr.

Iowa, Mason City—City plans to install sewage-disposal plant. Estimated cost, $100,000.

Iowa, Oskaloosa—Bids will soon be received by Black & Veatch, Engr., Kansas City, Mo., for sewer system. Noted Aug. 12 and Nov. 4.

Iowa, Sioux City—Bids will be received by P. J. Wells, City Clk., until Dec. 4, for sewer in Leech Ave. from South Fowler to South Westcott St.

Minn., Belle Plaine—Bids will be received until Dec. 13 for construction of sanitary sewers in Market St. from Minnesota River to Forest St., in Forest St. from Market St. to Meridan St., in Meridan St. from Forest St. to Prairie St.

Minn., Minneapolis—City plans to install two sewers.

Minn., South St. Paul—(Official)—Bids will be received by the City Clerk until Dec. 6 for sewer on Third St. and Third Ave. Estimated cost, $26,000. Contract recently awarded for this work has been ruled invalid. John Fearing, City Engr. Noted Nov. 4.

Minn., Virginia—Plans approved by City Council for construction of sanitary sewer through certain portions of Ridgewood addition.

Kan., Neodesha—Bids will soon be received by Black & Veatch, Engr., Kansas City, Mo., for sewage-disposal plant. Estimated cost, $50,000. Noted Nov. 11.

Neb., Pawnee City—Sewer system will be installed in city. Estimated cost, $35,000.

Neb., Wausa—Bids will be received about Jan. 1 for sewer system and sewage disposal plant. Estimated cost, $12,000. Noted Sept. 23.

S. D., Alexandria—Election will soon be held to vote on bonds to install sewer system.

S. D., Edgemont—Bids will be received by W. S. Wyatt, City Audr., until 8 p.m., Dec. 6, for constructing sewers in District No. 3.

N. D., Mandan—Bids will be received about Jan. 1 for installing drainage system and paving various streets. Estimated cost, $216,000. Black & Griffin, Consult. Engr. Noted Nov. 11.

Ark., Harrison—Sewer system will be constructed. Estimated cost, $65,000.

Tex., Belton—Citizens voted $40,000 bonds for sewer system.

Tex., Dallas—City will build storm sewer estimated to cost $5,000.

Tex., Houston—Ordinances passed by City Council authorizing an appropriation of $51,000 for storm sewers to drain Main St. between tracks of Galveston, Harrisburg & San Antonio Railway and Bellaire Blvd. and an appropriation of $21,000 for storm sewers on Hathaway St. from Baldwin to Crocker St.

Tex., Seguin—City plans installation of sewerage system.

Tex., Uvalde—Plans for proposed sewage-disposal plant submitted to E. R. Benson, City Engr., by N. Werenskiold, Dallas, Consult. Engr.

Tex., Winnsboro—J. D. Carter submitted plans for installation of municipal sewer system.

Okla., Commerce—Plans being considered by city for sewer system. Benham Engineering Co., Oklahoma, Engr.

Okla., Enid—City will build sewer system in three new sewer districts and make extensions in two districts. W. C. Rogers, City Clk.

Ariz., Miami—Election will be held Dec. 14 to vote on $60,000 bonds for sewerage system and sewage-disposal plant.

Wash., Seattle—Bids will soon be received by Board of Public Works for sewer system in Mead St. and 51st Ave. S.

Wash., Seattle—City Engineer has submitted report to Board of Public Works estimating cost of sewers in Fairmount Ave. at $60,893.

Ore., Mt. Angel—City Council has authorized construction of sewer system.

Calif., Auburn—(Official)—Citizens voted $15,000 bonds for extending sewer system. Noted Oct. 22.

Calif., Imperial—(Official)—We have been informed that election to vote on $100,000 bonds for improving sewer and water systems will not be held as stated in our issue of Nov. 11.

Calif., Pasadena—A tract of land comprising about 600 acres east of Coyote Pass, south of Alhambra, has been purchased by cities of Pasadena, South Pasadena and Alhambra to be used as a sewer farm.

Calif., Pomona—Special election will be held Jan 11 to vote on bonds for $15,000 for storm sewers. Noted Nov. 4.

Calif., San Francisco—Bids will soon be received by Board of Public Works for sewer system in South Bay View District. Estimated cost, $55,000.

Que., Montreal—Board of Control contemplates an expenditure of $1,022,320 for sewer work.

Que., Montreal—City plans to install collecting sewer in north of Island. Estimated cost, $500,000.

Ont., Toronto—R. C. Harris, Comr., has recommended the following work to the Board of Control: Sanitary sewers, $13,000; storm sewers, $43,500; asphalt paving, $126,800; asphaltic concrete paving, $4,400; brick block paving, $12,560.

Ont., Toronto—Bids will be received until Dec. 7 by Board of Control for sewer construction.

Man., Assiniboia—Bids will be received until noon, Dec. 6, by Frank Ness, Clk., Kirkfield Park, for constructing lateral sewers on a number of streets.

B. C., Vancouver—Plans for trunk sewer along south side of False Creek from Brewery Creek to China Creek trunk at Seventh Ave. and Keith Drive, will be submitted to Board of Works for approval. F. L. Fellowes, City Engr.

Bids In and Contracts Awarded

Mass., Boston—Contract for sewer pipe awarded to WALDO BROS., INC., Boston.

Mass., Boston—Contract for pipe sewers and drains awarded to M. DE SISTO, 198 La Grange St., West Roxbury, at $4,811.

N. Y., Fairport—Contract for East Church St. intercepting sewer awarded to BISHOP CONSTRUCTION CO., at $4,583.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids were received for improving sewer in Cedar St. between Broadway and Nassau St. as follows: U. S. Drainage and Irrigation Co., $8,523; Lawrence Contracting Co., $9,283; Patrick Riley, $11,237.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for making repairs to barrel and box sewers at 26th St. and North River, 37th St. and East River, 110th St. and East River, 158th St. and North River, Third St. and East River, and Stanton and Rivington St., East River awarded to RIVERSIDE CONTRACTING CO. Noted Nov. 4 and 18.

N. Y., Yorktown Heights—Sewage Disposal and Water Co., Schenectady, at $71,115, submitted lowest bid for sewage disposal plant at Mahonsic State Hospital, and Frederick N. Lewis, New York, at $31,970, for plant at Yorktown Heights Training School for Boys. Noted Oct. 21.

N. J., Atlantic Highlands—Contract for extending sewer system awarded to R. W. SMITH CORPORATION, New York, N. Y. Estimated cost, $15,000.

N. J., Newark—Bids were received by Passaic Valley Sewerage Commission, Nov. 14, for Vailsburg sewers, southwesterly section ,as follows: James A. Christie, Newark, $9,711; Michael Stefanelli, $9,658; Peter D'Amato, Newark, $10,482. Noted Nov. 18.

N. J., Ocean Grove—(Official)—Contract for 10,800-ft. of vitrified pipe sewers awarded to LOGAN CONSTRUCTION CO., 13 Park Row, New York, N. Y., at $8,951. Noted Nov. 11.

Md., Baltimore—(Official)—Lowest bids received for (a) Locust Point Interceptor sewer, Sanitary Contract No. 168, Section 3, (b) Maiden Choice Run trunk sewer, Sanitary Contract No. 167, were as follows: (a) M. O'Harron & Son, $30,517; Smith & Ruggles, $30,824; Whiting-Turner Construction Co., $31,462; (b) Frank Carozza, $13,933; Boyle-Lohmuller Construction Co., $14,870; Whiting-Turner Construction Co., $15,198. C. W. Hendrick, Ch. Engr.

Md., Baltimore—Contract for sewers under Sanitary Contract No. 65 awarded to F. B. BEASMAN & CO., 7 Clay St., Baltimore.

Ohio, Lakewood—(Official)—Contract for sewer in Louis Drive awarded to JOSEPH WINTERBOTTOM, 3274 West 25th St., Cleveland, at $22,000. Noted Nov. 11.

Ohio, Sandusky—(Official)—Contract for intercepting sewer No. 2 awarded to J. B. SHEETS, Pittsburgh, Penn. Noted Nov. 4.

Ind., Indianapolis—Contract for sewer awarded to INDEPENDENT CONSTRUCTION CO., Terre Haute, at $9,500.

Mich., Marquette—Contract for improvement of sewer on Harrison St. awarded ROGER TANSEY.

Mich., Sault Ste. Marie—Contract for sewer work in Mission St. awarded to EDWARD O'DONNELL, at $5,155.

Iowa, Oakland—(Official)—Contract for 13,500-ft. of sewers to M. A. CAMERY, Harlan, at about $10,000. Noted Oct. 7 and 28.

Minn., Virginia—Contract for lateral sewer in Illinois St., Sixth to Ninth St., awarded to L. W. KELLEY.

N. D., Grand Forks—Contract for lateral sewer No. 18, District No. 5, awarded to CARROLL BROS., Grand Forks. Noted Nov. 4.

N. D., Wahpeton—Contract for extending sewers in Districts 1 and 3, awarded to AIKEN CONSTRUCTION CO., Fargo, N. D. Noted Oct. 22.

Tex., Houston—Lowest bids received for sewerage work were as follows: Storm sewer on Hawthorne St., F. D. Horton & Son., at $16,883; Smith St. sewer, H. C. Hunter, at $4,272; storm sewer on Bagby and Laure St., Hardman & Nelson, at $13,809.

Idaho, Kellogg—Contract for sewer in Pressley Addition awarded to NELS ERICKSON, Anacortes, Wash. Noted Nov. 4.

Wash., Seattle—Washington Paving Co., at $78,694, submitted lowest bid for sewers in Sixth Ave., N. W. Noted Aug. 12.

Calif., Los Angeles—S. Zarubica, at $7,577, submitted lowest bid for sewer in Pico St. from Grenshaw Blvd. to Sixth Ave.

Ont., Hamilton—BRENNAN & HOLLINGWORTH, Hamilton, awarded contract for sewer in Kenilworth Ave.

GARBAGE

Proposed Work

Penn., Altoona—City contemplates building garbage crematory. George W. Kuebler, Comr. of Pub. Safety. Estimated cost, $25,000.

Ohio, Canton—Council contemplates garbage disposal plant and system of free city collection.

Wis., Madison—Preliminary plans being prepared by F. C. Parker, City Engr., for garbage disposal system for city, including two incinerating furnaces. Estimated cost, $25,000. Noted Oct. 14.

Wis., West Allis—Bids will soon be received by the city for municipal garbage incinerator. Estimated cost, $5,000. E. G. Orbert, Engr.

Bids In and Contracts Awarded

Mich., Detroit—Contract for disposal of city's garbage awarded to DETROIT REDUCTION CO.

Ill., Decatur—Alfs Garbage Co. awarded contract to BOILER EFFICIENCY ENGINEERING CO., 608 South Dearborn St., Chicago, Ill., for garbage incinerator. Estimated cost, $10,000.

STREETS AND ROADS

Proposed Work

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., Room 2032, Municipal Bldg., until 2 p.m., Dec. 6, for regulating and repaving 151st St. from west side of Seventh Ave. to east side of McCombs Pl.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., North River, until 10 a.m., Dec. 6, for repairing pavement on marginal street and piers, North, East and Harlem River.

N. Y., Rockville Center—Press reports state that a boulevard will be constructed from Rockville Center to Long Beach. Estimated cost, $500,000.

Penn., Yardley—Bonds for $10,000 voted by citizens for street improvements.

Va., Richmond—Construction of Northside Blvd. under consideration by City Council. Estimated cost, $500,000.

N. C., Bladenboro—Bonds for $25,000 voted by citizens of Bladenboro Township for road construction.

N. C., Franklin—Bonds for $15,000 for improving a number of roads defeated by citizens of Macon County, Cowee Township. Noted Oct. 28.

N. C., Snow Hill—Bids will be received until Dec. 6 by Commissioners of Greene County for constructing sand clay roads. Estimated cost, $32,500.

Fla., Ft. Lauderdale—Election will be held Dec. 11 to vote on $165,000 bonds for roads and bridges for Broward County. Noted Nov. 11.

Fla., St. Petersburg—City plans to extend and pave Eighth Ave. with brick.

Ala., Bay Minette—Bids will be received until Dec. 14 by Commissioners of Baldwin County for road from Point Clear to Fairhope.

Ala., Birmingham—City plans to pave South 26th St. from Sixth to Eighth Ave. with asphaltic concrete. Estimated cost, $6,400.

Miss., Port Gibson—Plans being considered by Board of Supervisors of Claiborne County to issue $100,000 bonds for about 50 miles of gravel roads.

Tenn., Knoxville—Knox County Roads Commission plans to build a boulevard through Cherokee Purchase.

Tenn., Memphis—Plans being prepared by B. A. Adams, Park Engr., for first stretch of proposed parkway to encircle city.

Ohio, Eaton—City plans to pave Barron and Maple St.

Ohio, Greenville—See item under "Canal Ditches and Irrigation."

Ohio, Hillsboro—Bids will be received until noon, Dec. 13, by Commissioners of Highland County, for purchase of $7,500 bonds for road construction.

Ohio, Sandusky—City plans to pave East Ninth St. from Remington Ave. to corporation line. Estimated cost, $13,370.

Ohio, Troy—Bids will be received until noon, Dec. 11, by C. F. Rannells, Audr., for purchase of $36,700 bonds for street improvements.

Ohio, Washington C. H.—Bids will be received by John McFadden, City Audr., until Dec. 20, for purchase of $5,800 bonds for improving East Court St.

Ind., La Porte—(Official)—Bids will be received in January for about 38,000 sq.yd. of paving. L. D. Goddard, 410 First National Bank Bldg., City Engr.

Ind., Michigan City—Bids will be received until Dec. 14 by Board of Public Works for paving with brick Center St. and Lake Ave.

Mich., Sault Ste. Marie—Bids will be received by H. A. Osborn, County Rd. Comr., until 3 p.m., Jan. 13, for 24½ miles of highway.

Ill., Averyville—Election will be held Dec. 14 to vote on $4,000 bonds for paving Narrows Rd. with brick.

Ill., Elgin—City Council plans to repave Grove St. with brick. Estimated cost, $16,150.

Ill., La Salle—Press reports state that La Salle Commercial Association contemplates bond issue for $1,500,000 for highway improvements.

Ill., Morrison—Press reports state that election to vote $125,000 bonds for road construction in Whiteside County contemplated.

Wis., La Crosse—La Crosse County has appropriated $80,000 for road construction during 1916.

Wis., Madison—City Council appropriated $25,000 to street improvement fund for coming year, making total $150,000.

Minn., Anoka—County plans an expenditure of $31,500 in 1916 for roads and bridges.

Minn., Brainerd—City plans an expenditure of $70,000 in 1916 for road improvements.

N. D., Mandan—See item under "Sewers."

Neb., Lincoln—Two new paving districts formed providing for paving of Tenth St. from E to F St., F St. from Seventh to Tenth St. and Sewell St. from Seventh to 24th St.

Mo., Bolivar—Citizens of Polk County, Bolivar Special Road District, voted $25,000 bonds for road improvements. Noted Oct. 28.

Mo., Poplar Bluff—Commissioners of Butler County contemplate election to vote on $275,000 bonds for road improvements.

Tex., Clarksville—(Official)—Bids will be received by George Morrison, Judge, Red River County, until noon, Dec. 9, for system of highways including bridges, culverts, etc., for Road District No. 1, Red River County.

Tex., Beaumont—Contract for highways between Hardin, Liberty and Jefferson Counties will not be awarded to Hanson Sons, Inc., until the bonds are O. K'd. by the court. Noted Oct. 28.

Tex., Risk—Bonds for $150,000 for road construction defeated by citizens of Cherokee County Road District No. 1. Noted Oct. 28.

Tex., Sweetwater—Election will be held in Nolan County Dec. 18 to vote on $100,000 bonds for road construction.

Tex., Texarkana—Commissioners of Bowie County voted to appropriate $20,000 for improving roads in Precinct No. 1.

Okla., Catoosa—Bonds for $18,000 voted by citizens for road construction. Noted Nov. 11.

Okla., Chelsea—Citizens voted $50,000 bonds for road construction. Noted Nov. 11.

Okla., Claremore—Citizens of Oowala Township voted $30,000 bonds for road construction. Noted Nov. 11.

Okla., Foyil—Citizens voted $25,000 bonds for constructing roads. Noted Nov. 11.

Okla., Inola—Citizens voted $30,000 bonds for road construction. Noted Nov. 4.

Okla., Oolgah—Citizens voted $20,000 bonds for road construction.

Okla., Talala—Bonds for $20,000 voted by citizens for road construction. Noted Nov. 11.

Okla., Wister—Bonds for $45,000 voted by citizens for road work.

Colo., Pueblo—Plans for paving area on north side between Second and Tenth St. being considered. Estimated cost, $20,000.

Idaho, Wallace—City Council plans an expenditure of about $18,000 for paving District No. 4.

Ariz., Globe—Bonds for $350,000 voted by citizens of Gila County for road construction. Noted Nov. 11.

Wash., Olympia—Bids will be received until Dec. 20 by State Highway Commission for constructing 35 miles of Inland Empire Highway.

Calif., Alameda—City plans to pave Central Ave. from Fernside Blvd. to Fourth St. About $100,000 available for this purpose.

Calif., Pasadena—Bids will be received by H. Dyer, City Clk., until Dec. 13, for paving Hillside Terrace.

Calif., Pomona—Election will be held Jan. 11 to vote on $20,000 bonds for improving a number of streets.

Calif., San Francisco—Board of Public Works plans an expenditure of about $25,000 for paving portions of Alison and Bay View St.

Ont., Toronto—See item under "Sewers."

Bids In and Contracts Awarded

Conn., Hartford—Framingham Contracting Co., South Framingham, Mass., at $8,490, submitted lowest bid for native stone macadam road in Weston Township, and Frank Arrigoni & Bro., Middletown, at $6,763, submitted lowest bid for trap rock macadam on Middlefield Rd., Middletown Township.

N. Y., New York—(Borough of Manhattan)—(Official)—Lowest bids received for improving (a) 145th St. from west side of Lenox Ave. to east side of Seventh Ave., (b) Columbus Ave. from 96th St. to Cathedral Parkway, (c) 96th St. from Second Ave. to a point east of easterly house line of Lexington Ave., were as follows: (a) (b) Asphalt Construction Co., Madison Ave. and 137th St., New York, at $8,786; (c) W. J. Fitzgerald, 547 West 45th St., New York, at $7,186. Noted Nov. 23.

N. Y., New York—(Borough of Queens)—(Official)—Bids were received Nov. 22 for improving a number of streets and avenues of the borough as follows: Charles A. Myers Contracting Co., $5,331; Peace Bros., 20 Main St., Flushing, $6,672; Frank Chiullia, Belle Harbor, $6,859. Noted Nov. 18.

N. J., Bloomfield—(Official)—Bids were received Nov. 15 for 123,000 lin. ft. of 5-in. by 16-in. bluestone curb and 6,000 lin. ft. combination curb and gutter as follows: Filippone Scanniello, $8,512; C. S. Carracino, $8,957; Robert Doriety, $9,091. Noted Nov. 11.

N. J., Newark—Contract for improving South Orange Ave. from 20th St. to South Orange Village line awarded to GLENFIELD CONSTRUCTION CO., at $87,845. Noted Nov. 18.

N. J., Perth Amboy—Contract for improving Convery Pl. awarded to GRAHAM & McKEON.

Md., Easton—Lowest bids received Nov. 9 for constructing highways by State-Aid were as follows: Contract No. 401, 1.06 miles of shell or macadam or concrete road from Easton to Easton Point, Holt Construction Co., Denton, at $10,603; Contract No. 361, three miles from Easton toward Mathews, Juniata Paving Co., Empire Bldg., Philadelphia, Penn., at $20,199 for macadam, $24,424 for concrete and $16,150 for shell. Noted Nov. 4.

W. Va., Charleston—Contract for 1½ miles of warrenite road in London and Polka District awarded to ATLANTIC BITULITHIC CO., at $36,855. Noted Nov. 11.

N. C., Charlotte—Bids were received Nov. 11 for 17,500 sq.yd. of paving as follows: A. H. Guion & Co., Gastonia, $20,505; J. W. Haas, Charlotte, $21,943; Blankenship & McClelland, Charlotte, $21,050. Noted Nov. 4.

S. C., Greenville—(Official)—Bids were received Nov. 10 for 60,000 sq.yd. of street paving, 10,000 sq.yd. of concrete gutters, and 12,000 lin.ft. of granite curb, (a) sheet asphalt, (b) asphalt concrete, (c) brick, (d) concrete, (e) bitulithic, (f) rocomac, as follows: Noll Construction Co., Chattanooga, Tenn., (a) $111,248; Gulf Paving Co., Chattanooga, Tenn., (a) $105,753, (b) $96,153; Southern Paving and Construction Co., Chattanooga, Tenn., (a) $105,585, (b) $97,785, (c) $140,385; West Construction Co., Chattanooga, Tenn., (b) $97,450; William P. McDonald Construction Co., Mt. Vernon, N. Y., (c) $150,490; F. J. McGuire, Norfolk, Va., (c) $150,560, (d) $112,160, (f) $112,160; Case & Cothran, Atlanta, Ga., (d) $109,128; J. F. Morgan & Co., Attalla, Ala., (d) $110,575, (f) $112,975; Atlantic Bitulithic Co., Boston, Mass., (e) $159,002; R. M. Hudson, Atlanta, Ga., (f) $111,694. Noted Nov. 4.

Fla., Miami—Contract for constructing sidewalks on Ave. D from 20th to 25th St. and Eighth St. and Boulevard awarded to F. L. DE VANE.

Fla., Sarasota—Contract for paving, curbing and guttering awarded to SOUTHERN ASPHALT AND CONSTRUCTION CO., Birmingham.

Fla., Tampa—Contract for paving Hyde Park Pl. awarded to GEORGIA ENGINEERING CO.

Ala., Dothan—Contract for 21 miles of road awarded to BOYD & BRADSHAW and JORDAN & PHILLIPS. Estimated cost, $100,000. Noted Nov. 4.

Tenn., Chattanooga—Contract for paving Chestnut St. from 9th to 10th St. awarded to SOUTHERN PAVING AND CONSTRUCTION CO., at $5,277.

Ky., Lebanon—Marion County Commissioners awarded contract to T. M. ESTES and FORREST WARD, at $13,420, for improving Bradfordsville Pike from Lebanon to Bradfordsville, nine miles.

Ky., Morganfield—Union County Commissioners awarded contract for improving Uniontown and Boxville Rds. to COLLINS & PAVY, Mt. Vernon, Ill., at $28,508. Noted Oct. 28.

Ohio, Akron—Contract for paving George Rd. awarded to J. C. DEVINE, Alliance.

Ohio, Cincinnati—(Official)—Contract for improving Summit Ave. in Springfield and Sycamore Township awarded to WILLIAM P. FLYNN, 1252 Chase St., Cincinnati, at $4,744. Noted Nov. 11.

Ind., Indianapolis—Contract for Pleasant Run Parkway awarded to C. C. KING & SON, at $22,986.

Ind., Vincennes—Contracts for gravel roads awarded as follows: Volmer Rd., Johnson Township, to H. F. JONES, Vincennes, at $4,907; Brooks Rd., Vincennes Township, to JOHN E. MILLIGAN, Vincennes, at $3,500.

Mich., Pontiac—Contract for completing concrete road between Kimble's Corners and Birmingham on Detroit Rd. awarded to R. D. BAKER & CO., Detroit, at $62,090. Noted Nov. 25.

Ill., Springfield—Contract for paving Converse Ave. from 11th St. to Michigan Ave. awarded to HENRY MELCH & SON.

Ill., Berwyn—(Official)—R. F. Conway Co., Chicago, at $68,459, submitted lowest bid for paving a number of streets.

Kan., Iola—Contract for paving on South Chestnut St., North Chestnut St. and alley in rear of Physicians & Surgeons Hospital awarded to HANREDDY & ROSS, at $7,000.

Neb., Lincoln—Burke-Cochrane Construction Co. submitted lowest bid for paving of District No. 9. Noted Oct. 7 and Nov. 11.

Mo., Springfield—Contract for 9¾ miles of road in Ingram Special Road District awarded to OTTO CHAPMAN, Strafford, at $22,000. Noted Oct. 21.

Mo., Springfield—Contract for paving awarded to PLUMMER-ADAMS CO., at about $13,500.

Ark., Ravenden Springs—Contract for pike road between city and Ravenden Station awarded to H. C. NIXON, Argenta, at $18,000.

Tex., Eagle Lake—Contractor for graveling streets awarded to F. E. BOOTHE; about $12,000 available for this work.

Tex., Ft. Worth—Contract for paving Sunset, Jarvis and Daggett Ave. awarded to GENERAL CONSTRUCTION CO., Ft. Worth; Fifth Ave. and Jessamine St. to TEXAS BITULITHIC CO., Dallas.

Tex., Georgetown—Contract for 55 miles of gravel and macadam road awarded to J. S. TOBY & CO., Ft. Worth, at $114,000.

Tex., Houston—Contract awarded to HORTON & HORTON, Houston, for paving with Uvalde rock asphalt intersection of Stratford and Connor St. with Lovett Blvd. Estimated cost, $4,500.

Tex., Kountze—Hardin County Commissioners awarded contract to COBB & GREGORY for shell road from Pine Island Bayou to Kountze. Estimated cost, $75,000.

Tex., Livingston—Contract for street improvements awarded to J. G. BROWNE CO., Houston, at $27,600.

Okla., Oklahoma—Contract for paving awarded to WESTERN PAVING CO., Oklahoma, at $29,496.

Okla., Okmulgee—Contract for improving number of streets awarded to PARKS & MORAN, Okmulgee, at $69,853. Noted Oct. 28.

Colo., Del Porte—(Official)—All bids received Nov. 10 for eight miles of State Primary Rd. No. 60 rejected as being too high.

Calif., Sacramenta—(Official)—Contract for road work in Sonomo County, Division 4, Route 8, Section A, awarded to BATES, BORLAND & AYER, Oakland Bank of Savings Bldg., Oakland, at $22,183. Noted Oct. 7 and Nov. 4.

Calif., San Francisco—Contracts for paving awarded to FEDERAL CONSTRUCTION CO., at $17,110, for Corbett Ave. between Danvers St. and Caselli Ave., and to C. B. EATON, at $16,408, for Congo St. between Flood Mangels Ave.

Calif., San Gabriel—(Official)—Contract for improving a portion of Las Tunas Drive awarded to M. R. CO., INC., Fernando Bldg., Los Angeles, at $17,930. Noted Nov. 11.

Calif., Santa Monica—Contract for improving Central Ave. from Eighth St. to city limits awarded to NATIONAL PAVING CO., Kansas City, at $50,810.

Calif., South San Francisco—Contract for paving and constructing sidewalks awarded to F. R. RITCHIE & CO., Chronicle Bldg., San Francisco, at $8,074 and $7,883, respectively.

INDUSTRIAL WORKS

Proposed Work

Conn., Hartford—United States Tire Co. contemplates building additions to plant at Allyn and High St. Charles B. Wittlesey, Gen. Mgr.

Conn., New Haven—Revised plans will be prepared by R. W. Foote, 185 Church St., New Haven, Arch., for three-story, 65x75-ft. garage and salesroom for Cowles Tolman. Estimated cost, $30,000. Noted Aug. 12.

Conn., Thompsonville—Biglow-Hartford Carpet Co., 58 Main St., will build two additions to plant in spring.

N. Y., Buffalo—George Miller Spring Tire Co., recently incorporated, will establish factory. W. L. Williams, interested.

N. Y., Buffalo—Schoellkopf Analine Chemical Works, Inc., plans to build addition to plant at 351 Abbott Rd. Estimated cost, $13,513.

N. Y., New York—(Borough of Brooklyn)—(Official)—Plans being prepared by W. T. McCarthy, Arch., 16 Court St., for two-story, 100x100-ft. brick factory on Harrison St. for A. L. Fogel, 534 Myrtle Ave. Estimated cost, $12,000.

N. Y., New York—(Borough of Brooklyn)—Soss Manufacturing Co., 435 Atlantic Ave., will build four-story factory at Grand Ave. and Bergen St. Estimated cost, $60,000.

N. J., Bloomfield—International Arms and Fuse Co. will build addition to its plant. Estimated cost, $80,000.

N. J., Harrison—Plans prepared for three-story brick and steel plant on Fourth St. for Crucible Steel Co., 420 Canal St., New York, N. Y.

N. J., Pompton Lakes—Contract will soon be awarded for building addition to cap works of Du Pont Powder Co. Estimated cost, $100,000. H. K. Babbitt, Supt. of Cap Works.

Penn., Danville—Charles M. Schwab secured control of Danville Structural Tubing Co. and will build steel mill. Estimated cost, $600,000.

Penn., Donora—United States Steel Corporation will improve Donora plants. Estimated cost, $350,000.

Penn., Harrisburg—Plans being prepared by C. H. Kain, Arcade Bldg., for five-story brick and concrete factory at State and Cameron St. for Dauphin Cigar Co. Estimated cost, $40,000.

Penn., Philadelphia—Contract will soon be awarded for four-story, 89x98-ft. brick and reinforced-concrete shop at 18th and Buttonwood St. for Baldwin Locomotive Works, Broad and Spring Garden St.

Penn., Philadelphia—Plans prepared for three-story, 100x100-ft. ice-cream factory at 3333 Ludlow St., for Supplee Alderney Dairies Co. Estimated cost, $35,000. Charles H. Casper, Arch. Noted Nov. 25.

Penn., Pittsburgh—Pittsburgh Gage and Supply Co. will build addition to plant at 13th and Liberty St. Estimated cost, $15,000. W. G. Wilkins Co., Arch.

Penn., Port Carbon—Coxe Traveling Grate Co. plans to enlarge its plant. Estimated cost, $100,000.

Penn., Pottstown—Plans prepared for improvements to plant of McClintic-Marshall Structural Co., which includes factory, office building, 390x618-ft. main shop and installing cranes and hoists. Estimated cost, $1,000,000.

Penn., South Bethlehem—Bethlehem Steel Co. will rebuild plant recently destroyed by fire.

Md., Baltimore—Plans being prepared for two-story garage at 25-33 West Mt. Royal Ave. for W. H. Marcus, 525 Equitable Bldg.

Md., Baltimore—Plans being prepared by C. N. Fiz, Arch., Baltimore, for four-story garage and repair shop at 27 South Charles St. for Mid-City Garage and Motor Supply Co. Estimated cost, $90,000.

N. C., Greensboro—It is reported that American Agricultural Chemical Co., 2 Rector St., New York, N. Y., contemplates building fertilizer factory at Greensboro. Estimated cost, $100,000.

N. C., New Bern—Shops of Norfolk Southern R.R., recently destroyed by fire, will be rebuilt. F. L. Nicholson, Norfolk, Ch. Engr.

Ga., Columbus—It is reported that Hardaway Cargill Co. will build plant at Sixth Ave. and Tenth St. Estimated cost, $100,000.

Ga., Waycross—Ware County Light and Power Co. granted permit by City Council for abattoir and cold-storage plant. Estimated cost, $100,000.

Fla., Tampa—Hillyer & Spearing will remodel building on East Bay St. for warehouse. Estimated cost, $50,000.

Ala., Birmingham—A plant for the manufacture of automobile tires will be constructed in Birmingham. Estimated cost, $500,000. C. E. Frost, Athens, interested.

Ala., Birmingham—Plans prepared for 60x150-ft. bakery for Birmingham Bread Co.

La., Shreveport—Allen Mfg. Co. will build a plant at Shreveport. Estimated cost, $20,000.

Tenn., Chattanooga—Marion Extract Co., Marion, Va., purchased site at Chattanooga and will build plant to manufacture tannic acid from chestnut oak. Estimated cost, $150,000.

Tenn., Columbia—Columbia Ice and Cold Storage Co. will build two-story addition to plant.

Ky., Ashland—Kentucky Solvay Co. contemplates building plant to manufacture dyes from coal by-products. Estimated cost, $150,000.

Ky., Ashland—Plans being prepared for two-story, 50x120-ft. garage for W. B. Whitt & Son, McGlone. J. B. Gieseke, Ceredo, W. Va., Arch.

Ohio, Canton—Canton Clay Products Co., recently incorporated with $75,000 capital stock, plans to build a brick plant about one mile east of Robertville station on Wheeling & Lake Erie R.R.

Ohio, Canton—Globe Motor Car Co. will build four-story, 60x200-ft. salesroom and garage. Estimated cost, $80,000. J. H. Wile, 410 Wick Bldg., Youngstown, Arch.

Ohio, Carthage—(Cincinnati post office)—Contract will soon be awarded for 200x200-ft. addition to plant of Hess Springs and Axle Co. Estimated cost, $40,000. Noted Nov. 25.

Ohio, Celina—Plans being prepared by A. C. DeCurtins, Arch., 503 Opera House Bldg., Lima, for three-story, 60x125-ft. factory for Mersman Bros. & Brandt.

Ohio, Cincinnati—Peters Cartridge Co. will build plant at Kings Mills and Fosters Crossing. Estimated cost, $200,000. Leden & Schilling, Detroit, Mich., Arch.

Ohio, Cleveland—Plans prepared for automobile salesroom for Adams Oakland Co. Estimated cost, $100,000. W. S. Ferguson Co., 1900 Euclid Ave., Arch.

Ohio, Cleveland—East Ohio Gas Co. will build three-story warehouse on Rockwell St. Estimated cost, $12,000. Frank Horneck, Rose Bldg., Arch.

Ohio, Cleveland—Plans being prepared for 12-story addition to plant of William Edwards Co., West Ninth St. W. S. Lougee, Marshall Bldg., Engr.

Ohio, Cleveland—Plans being prepared by Poe Engineering Co., Rockefeller Bldg., for two factory buildings, 75x225 ft. and 75x100 ft., for Horsburgh Forging Co., 5102 Hamilton Ave.

Ohio, Cleveland—Hydraulic Pressed Steel Co. plans to build three additions to plant at 3152 East 61st St. Estimated cost, $50,000.

Ohio, Cleveland—Winton Motor Carriage Co. will build 80x300-ft. addition to plant on Berea Rd.

Ohio, Columbus—Central Ohio Paper Co. will build three-story, 63x120-ft. plant. Estimated cost, $35,000.

Ohio, Dayton—Plans prepared by Peters, Hermann & Brown, Reibold Bldg., for four-story reinforced-concrete plant on Fifth St. for Dayton Pure Milk and Butter Co., 219 East Fifth St.

Ohio, Euclid—White Automobile Co., Cleveland, purchased site at Euclid and will build plant. Plant will be built in sections as business demands. Estimated cost of first section, $200,000. Rolin H. White, interested.

Ohio, Fostoria—Fostoria Light Car Co. will enlarge its plant at Fostoria.

Ohio, Kent—Mason Tire and Rubber Co., Cleveland, secured site at Kent and will build factory. Estimated cost, $60,000.

Ohio, Salem—Andalusia Dairy Co., 105 Ferry St., contemplates building addition to plant. Estimated cost, $40,000.

Ind., Indianapolis—Preliminary plans being prepared by C. B. Comstock, 110 West 14th St., New York, N. Y., for four-story, 98x246-ft. baking plant for Bryce Baking Co.

Mich., Grand Rapids—Plans being prepared by John Ahlschlager & Son, Arch., Chicago, Ill., for two-story plant for Grand Rapids Baking Co. Estimated cost, $60,000.

Mich., Marquette—Nufer Cedar Co. plans to build plant at Marquette. William L. Nufer, interested.

Mich., Muskegon—Continental Motor Manufacturing Co. will build 80x100-ft. plant at Market and Jefferson St.

Mich., St. Johns—Ford Motor Co. will build two-story, 80x100-ft. garage at West Higham and Brush St.

Ill., Champaign—Plans being prepared for plant for Champaign News. Estimated cost, $50,000.

Ill., Chicago—Chicago & Northwestern R.R. will erect grain elevator for Armour Grain Co. at South Chicago. Estimated cost, $2,000,000.

Ill., Chicago—Chicago Nut Co. will build two-story, 100x150-ft. factory at 2513 West 29th St. Estimated cost, $38,000. R. E. Pingrez, Arch.

Ill., Chicago—Fisher Furniture Co. will build three-story factory at 400 North May St. Estimated cost, $25,000. F. E. Danielson, Arch.

Ill., Chicago—Swift & Co. will build six-story soap factory at 42nd and Justine St. Estimated cost, $30,000. B. H. Jilson, 9542 South Seeley Ave., Arch.

Ill., Kewanee—Farmers Elevator Co. will build grain elevator with capacity of 40,000 bu.

Wis., Madison—Plans being prepared by Gardner & Lindberg, Arch., 1130 South Dearborn St., Chicago, Ill., for packing plant for Farmers Co-Operative Packing Co. Estimated cost, $200,000. Noted Nov. 11.

Iowa, Des Moines—Plans being prepared by Proudfoot, Bird & Rawson, Arch., Hubble Bldg., for seven-story, 66x68-ft. building at Fourth St. and Ft. Dodge, Des Moines & Southern R.R. for Charles Hewitt & Son. Estimated cost, $100,000.

Minn., Minneapolis—Chevrolet Motor Co. will build assembling plant.

Minn., Moose Lake—John Keogh Co., Chicago, Ill., will build plant for manufacture of excelsior and wood wool. Estimated cost, $25,000.

Wyo., Sheridan—National Life Preserver Co., recently incorporated with $175,000 capital stock, plans to establish a factory at Sheridan. O. A. Youngren, interested.

Mo., Trenton—Ice plant will be constructed by Trenton Gas and Electric Co. Estimated cost, $36,000.

Ark., Stamps—Bodcaw Lumber Co. will rebuild warehouse recently damaged by fire with a loss of $200,000.

Ark., Trumann—Ozark Cooperage and Lumber Co. will build plant. Estimated cost, $125,000.

Tex., Dallas—Plans being prepared for automobile assembling plant for Chevrolet Motor Co. Estimated cost, $250,000.

Tex., Dallas—Press reports state that Union Terminal Co. will construct additional buildings including boiler house, turntable, signal house, etc. Estimated cost, $100,000. C. H. Dana, Ch. Engr.

Tex., Port Aransas—Fisheries Co., recently incorporated with $450,000 capital stock, will build a plant on St. Joseph's Island. J. W. Munn, Pres.

Okla., Enid—Plans being prepared for two-story, 25x160-ft. reinforced-concrete factory for Mitchell Bakery Co. Estimated cost, $12,000. R. W. Shaw, Arch.

Okla., Miami—Trustees Mining Co. will build 200-ton mill at Miami.

Colo., Buena Vista—National Manufacturing Co. contemplates building smelting and cyanide plant. Estimated cost, $85,000.

Colo., Kline—Farmers Equity Association contemplates building flour mill. Estimated cost, $50,000.

Ariz., Miami—Election will be held Dec. 16 to vote on $18,000 bonds for municipal ice plant.

Wash., Odessa—Plans being prepared by Whitehouse & Price, Arch., Spokane, for two-story reinforced-concrete garage for Odessa Hardware and Improvement Co. Estimated cost, $20,000.

Wash., Spokane—Plans prepared for five-story, 60x100-ft. warehouse on Stevens St., for McClintock Trunkey Co. Bids will be received after the first of year. Estimated cost, $50,000. Noted Aug. 5.

Wash., Tacoma—Company organized by A. A. Dunewald, J. G. Anderson and J. A. Wright for the purpose of building a plant for the manufacture of milk bottles from wood plup. Estimated cost, $75,000.

Ore., Portland—Plans being prepared by N. M. Loney, Engr., for branch plant for American Can Co. Estimated cost, $600,000.

Ore., Portland—Rasmussen & Co. will build ten-story warehouse. Estimated cost, $50,000.

Calif., Los Angeles—Plans being prepared by Morgan, Walls & Morgan, Arch., Van Nuys Bldg., for four-story warehouse on Banning St. for Los Angeles Soap Co.

Calif., San Francisco—Plans prepared for two-story reinforced-concrete garage and repair shop for J. K. Bigelow. Estimated cost, $35,000. August G. Headman, Arch.

N. B., Washademoak—Daley & Carvell, St. John, purchased site at Washademoak and will build factory.

Ont., Kincardine—William Mitchell & Co. contemplates building knitting mill.

Ont., Petrolia—Marine City Sugar Co. contemplates establishing plant at Petrolia. Estimated cost, $800,000.

Ont., Port Dover—Port Dover contemplates building factory. Estimated cost, $10,000. W. Carson, Mgr.

Ont., Toronto—Plans approved for three-story reinforced-concrete building at Walmer Rd. and Bridgman St., for Farmers Dairy Co. Estimated cost, $50,000. Noted Nov. 25.

Bids In and Contracts Awarded

Conn., New Britain—Hart & Cooley Manufacturing Co. awarded contract for two-story addition to plant on Booth St. to B. H. HIBBARD CO. Estimated cost, $20,000.

Conn., Waterbury—(Official)—Contract for two-story reinforced-concrete oil-storage building for Scovill Manufacturing Co. awarded to TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y.

N. Y., New York—(Borough of Brooklyn)—(Official)—Contract for four-story, 80x100-ft. milk plant at Dean St. and Third Ave., for R. F. Stevens Co., Third Ave. and Dean St. reawarded to JAMES McARTHUR, 22 Ormund Pl. Estimated cost, $140,000. Noted Apr. 22 and 29.

N. J., Bayonne—(Official)—Vacum Oil Co. awarded contract to TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., for three-story reinforced-concrete filter building.

Penn., Philadelphia—American Ice Co. awarded contract for enlarging its ice-manufacturing plant at Belfield Ave. and Reading R.R. to TURNER CONCRETE AND STEEL CO., 1713 Sansom St. Estimated cost, $50,000. Noted Sept. 23.

Penn., Philadelphia—Contract awarded to SMITH-HARDICON CO., 1606 Cherry St., for building two-story, 74x150-ft. factory at American and Filbert St., for J. D. Litt. Estimated cost, $30,000.

Penn., Pittsburgh—Pennsylvania R.R. awarded contract to W. F. TRIMBLE & SONS CO. for three-story, 40x449-ft. top addition and one-story, 27x583-ft. side addition to freight warehouse.

Md., Baltimore—Baltimore Buggy Top Co. awarded contract for one-story, 76.4x124x49-ft. addition to plant to McLAUGHLIN BROS., INC., 915 Bolton St.

Md., Sparrows Point—Maryland Steel Co. awarded contract for 75x625-ft. foundry to WEST CONSTRUCTION CO., Knickerbocker Bldg., Baltimore. Estimated cost, $350,000.

Ohio, Cleveland—American Multigraph Co., Kelly Ave. and East 40th St. awarded general contract to MASTERS & MULLEN CONSTRUCTION CO., Electric Bldg., for one-story addition. Estimated cost, $25,000.

Ohio, Cleveland—Contract awarded to REAUGH CONSTRUCTION CO., 2835 East 51st St., for two-story garage for East Ohio Gas Co. Estimated cost, $50,000.

Ohio, Cleveland—Oster Manufacturing Co., East 61st St., awarded contract for factory to BOLTON PRATT CO., Columbia Bldg. Estimated cost, $50,000. Noted Sept. 23.

Ohio, Cleveland—Jacob Spang Baking Co., Barber Ave. and West 30th St., awarded general contract for reinforced-concrete building to H. E. KLEFMAN & CO., 4319 Woodbridge Ave. Estimated cost, $12,000.

Ohio, Cleveland—The Superior East 105th Realty Co. awarded contract to METTLER-GLOYD CO., Hippodrome Bldg., for one, two and three-story garage and store building at Superior Ave. and East 105th St. Estimated cost, $49,000.

Ohio, Dayton—Ohio Metal Product Co., 39 Edgar St., awarded contract to JOHN ROUSER CO., Dayton, for three-story brick and steel addition to plant. Noted Nov. 11.

Ohio, East Akron—American Hard Rubber Co. awarded contract to KIDDER & McCOURT for five-story, 150x400-ft. plant.

Ohio, Toledo—Contract awarded to WALLS, BOCH & KUHLMAN for addition to plant of Toledo Machine and Tool Co., 1736 Dorr St. Estimated cost, $55,000. Noted Oct. 28.

Ind., Gary—American Sheet and Tin Plate Co. awarded concrete foundation contract for tin mills to ILLINOIS IMPROVEMENT AND BALLAST CO., 208 South La Salle St., Chicago, Ill. Estimated cost, $156,000. Noted Nov. 25.

Mich., Grand Rapids—Blue Valley Creamery Co. awarded contract to SCHREIMER & SCHUUR for two-story, 60x113-ft. brick and concrete plant. Estimated cost, $11,000.

Mich., Holland—Holland Furnace Co. awarded contract for 90x120-ft. addition to foundry to FRANK DYKE.

Mich., Saginaw—Kelton Aurand Co. awarded contract to LOUIS MUELLER, JR., for 60x190-ft. factory.

Ill., Chicago—Diamond Glue Co. awarded contract to R. STANDING for two-story factory at 1726 Heald Ave. Estimated cost, $10,000. Noted Oct. 21.

Ill., Chicago—Contract awarded to ANDERSON STRANDBERG CO., for two-story warehouse at 1230 Carondolet Ave. for General Chemical Co. Estimated cost, $10,000. Noted Nov. 25.

Ill., Chicago—International Harvester Co. awarded contract to W. McRAE for one-story warehouse at 2600 Marshall Blvd. Estimated cost, $17,500.

Ill., Chicago—Link Belt Co., 367 West 39th St., awarded contract to E. W. SPROUL CO. for two-story foundry. Estimated cost, $30,000.

Ill., East St. Louis—Plymouth Cordage Co., Plymouth, Mass., awarded contract to FOX CONSTRUCTION CO., Boston, Mass., for four-story, 102x140-ft. plant at 22d and Market St. Estimated cost, $100,000.

Wis., Milwaukee—Advance Engineering Co. awarded contract for one-story, 120x220-ft. factory and machine shop at North Ave. and 30th St. to C. M. WINNEMANN, concrete and cement, and to MILWAUKEE STRUCTURAL STEEL CO., steel. Noted Nov. 25.

Wis., Milwaukee—Contract awarded to FOSTER CONSTRUCTION CO., Milwaukee, for garage and commercial building for Federal Realty Co. Estimated cost, $30,000.

Iowa, Waterloo—(Official)—Contract for four-story, 116x120-ft. brick garage for Waterloo Overland Co. awarded to H. A. MAINE CO., Waterloo, at $86,000. Noted Oct. 14.

Neb., Omaha—General contract awarded to ROBERT BUTKE, Paxton Bldg., Omaha, for three-story, 40x120-ft. dye works for Dresher Bros. Estimated cost, $20,000.

Tex., Houston—Contract for two-story, 70x125-ft. garage awarded to W. B. ZINKY.

Tex., Orange—Orange Rice Mill Co. awarded contract to T. HOWELL, Orange, for 100x200-ft. warehouse.

Colo., Denver—Armour & Co. awarded contract for packing plant at Denver Union Stock Yards to STOCKER & FRASER Estimated cost, $200,000.

Colo., Denver—Colorado Packing and Provision Co. awarded contract to STOCKER & FRASER, Chamber of Commerce Bldg., Denver, for six-story packing plant. Noted Nov. 25.

Calif., Los Angeles—Harbor Commission awarded contract for six-story warehouse on Municipal Pier No. 1 to MERCHANTS REALTY AND INVESTMENT Co., Los Angeles, at $117,000.

Que., Sherbrooke—Canadian Ingersoll-Rand Co. awarded contract to ANGLINS LIMITED, Montreal, for machine shop. Estimated cost, $50,000. Noted Nov. 18.

Ont., Cobourg—Contract for garage on South King St., for Soarling & Reeson awarded to JEX, MARTIN & CO., Division St. Estimated cost, $11,000.

FEDERAL GOVERNMENT WORK

Proposed Work

Penn., Titusville—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Terasury Dept., Washington, D. C., until 3 p.m., Jan. 10, for U. S. post office at Titusville.

Md. Ft. McHenry—(Baltimore post office)—Memorial—Competitive plans will be received until Apr. 1 by Col. W. W. Hart, War Dept., U. S. Government, 1729 New York Ave. N. W., Washington, D. C., for building Francis Scott Key Memorial at Ft. McHenry. Estimated cost, $75,000.

D. C., Washington—Elevators—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., until 3 p.m., Dec. 23, for installing electric passenger elevator in each of following buildings: U. S. post office and courthouse at Pendleton, Ore., Brattleboro, Vt., and Ardmore, Okla.

Mont., Missoula—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 29, for U. S. post office at Missoula.

Wash., Vancouver—Press reports state that U. S. post office will be built at Vancouver. Estimated cost, $75,000.

Panama—Miscellaneous Supplies—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Dec. 8, for furnishing miscellaneous supplies.

Panama—Miscellaneous Supplies—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Dec. 15, for furnishing miscellaneous supplies.

Panama—Miscellaneous and Metal Supplies—Bids will be received by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Dec. 13, for furnishing miscellaneous and metal supplies.

Bids In and Contracts Awarded

Mass., Boston—Elevator Plant—Contract for elevator plant in U. S. appraiser's stores awarded to OTIS ELEVATOR CO., Washington, D. C. Noted Sept. 23 and Oct. 21.

N. Y., Salamanca—Post Office—Contract for U. S. post office at Salamanca awarded to DUROLITHIC CO., Buffalo, at $55,550. Noted Oct. 7 and Nov. 25.

N. Y., Tompkinsville—Buoys—Contract for six type G Pintsch gas buoys awarded to SAFETY CAR HEATING AND LIGHTING CO., 2 Rector St., New York, at $10,800.

Penn., East Pittsburgh—Post Office—Contract for U. S. post office at East Pittsburgh awarded to TORBETT CONSTRUCTION CO., Hampton, Va., at $49,021. Noted Sept. 30 and Nov. 18.

Penn., Philadelphia—Dredging—American Dredging Co., Philadelphia, at $0.089 per cu.yd. submitted lowest bid for dredging Section "F" in Delaware River on Bellevue, Cherry Island and Deep Water Point lighthouse ranges and Home Dredging Co., Mobile, Ala., at $0.08875, for Sections "H" and "J." Noted Nov. 4.

Penn., Reading—Post Office—Contract for U. S. post office at Reading awarded to JOHN LOWRY, 8 West 40th St., New York, N. Y., at $90,880.

Md., Indian Head—Extension to Pulping and Poaching House—Bids were received Nov. 27 for extension to pulping and poaching house, Indian Head, from John H. Nolan Construction Co., Washington, D. C., at $6,977, and P. L. Robinson Construction Co., Baltimore, Md., at $8,497. Noted Nov. 11.

D. C., Washington—Building—Contract for truck house on New Jersey Ave. awarded to SKINKER & GARRETT, Washington, at $33,929. Noted Nov. 4.

D. C., Washington—Sewer Work—Bids were received Nov. 29 at Office of Commissioners of District of Columbia for sewer work as follows: Section 2, Kenilworth service sewer, (a) 12,200 cu.yd. ordinary excavation, (b) 150 cu.yd. sewer brick masonry, (c) 1,000-lin.ft. 18-in. diameter pipe sewer, (d) 900 lin.ft. 15-in. pipe sewer, (e) 7,200 lin.ft. 12-in. pipe sewer, (f) 2,400 lin.ft. 10-in. pipe sewer: Harper & Voigt, (a) 50c., (b) $14, (c) 78c., (d) 69c., (e) 60c., (f) 51c.; C. H. Tompkins. (a) 67c., (b) $13.75, (c) 66c., (d) 62c., (e) 60c., (f) 41c.; Warren F. Brenizer Co., (a) 85c., (b) $12, (c) 80c., (d) 70c., (e) 60c., (f) 50c.; storm and service mains, Petworth trunk sewer, (a) 1,900 cu.yd. ordinary excavation, (b) 100 cu.yd. concrete masonry, (c) 16 cu.yd. vitrified brick masonry, (d) 15 cu.yd. sewer brick masonry, ((e) 480 lin.ft. 24-in. pipe sewer: C. H. Tompkins, (a) 70c., (b) $7, (c) $21, (d) $14, (e) 90c.; Warren F. Brenizer Co., (a) 80c., (b) $7, (c) $21, (d) $14, (e) $1.10; George Hyman, (a) $1.25, (b) $7, (c) $20, (d) $15, (e) $1. Noted Nov. 25.

Va., Norfolk—Dredging—Bids were received Nov. 27 for dredging at navy yard, Norfolk, as follows: Bay State Dredging and Contracting Co., Boston, Mass., 13.7c. per cu.yd.; Coastwise Dredging Co., Norfolk, Va., 14c. per cu.yd.; Morris & Cummings, New York, N. Y., 14.89c. per cu.yd. Noted Nov. 4.

Ohio, Cleveland—Dredging—Bids were received Nov. 26 for dredging in Cleveland Harbor from Great Lakes Dredge and Dock Co., Williamson Bldg., Cleveland, $60,000; Duluth-Superior Dredging Co., Duluth, Minn., $80,000; Duluth-Marine Construction Co., Duluth, Minn., $88,000. Noted Nov. 4.

Ohio, Van Wert—Post Office—Contract for U. S. post office at Van Wert awarded to CHARLES W. GINDELE CO., Chicago, Ill., at $56,250. Noted Oct. 7 and Nov. 18.

Mich., Muskegon—Post Office and Custom House—Bids were received Nov. 29 for U. S. post office and custom house at Muskegon as follows: Maybel & Freuchtel, Gadsten, Ala., $63,666; R. P. Farnsworth & Co., New Albany, Ind., $69,500; George W. Stiles Construction Co., Chicago, Ill., $71,818. Noted Oct. 28.

Tex., Brenham—Post Office—Bids were received Nov. 27 for U. S. post office at Brenham as follows: W. G. Carter, Chicago, Ill., $44,834; George W. Stiles Construction Co., Chicago, Ill., $45,200; Algernon Blair, Montgomery, Ala., $46,285. Noted Oct. 21.

Tex., Navasota—Post Office—Bids were received Nov. 26 for U. S. post office at Navasota, (a) limestone, (b) sandstone, as follows: (a) Algernon Blair, Montgomery, Ala., $41,836; W. D. Lovell, Minneapolis, Minn., $42,000; George W. Stiles Construction Co., Chicago, Ill., $42,200; (b) Volney E. Taylor, Marlin, $53,000. Noted Oct. 21.

Tex., New Braunfels—Post Office—Contract for U. S. post office at New Braunfels awarded to WESTON & KROEGER, San Antonio, at $40,949. Noted Sept. 30 and Nov. 18.

CANALS—DITCHES—IRRIGATION

Proposed Work

N. Y., La Salle—Turning Basin—Bids will soon be received for turning basin, 50 ft. wide, at Wheatfield town line in Cayuga Creek.

N. Y., New York—(Borough of Brooklyn)—(Official)—Dredging—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., North River, Manhattan, until 10 a.m., Dec. 6, for dredging in slip at foot of 28th St.

Fla., New Smyrna—Drainage—Lake Ashby Drainage District plans to drain about 42,000 acres. Estimated cost, $250,000. Isham Randolph & Co., Chicago, Ill., Engr. B. H. Wilson, Secy. of Drainage Dist.

Fla., Orlando—Drainage—J. Edson Andrews, Secy. and Treas. of Orlando Securities Co., Orlando, is interested in formation of drainage district to build about 60 miles of ditches and canals. Estimated cost between $130,000 and $175,000.

Ohio, Greenville—Ditch—Bonds for $38,400 for ditches and road work have been sold.

Ind., Hartford City—Ditch—Bids will be received until 2 p.m., Dec. 21, by Drainage Commissioner, I. O. O. F. Bldg., for construction of O. H. Hiatt Ditch in Washington, Jackson and Licking Townships, Blackford County.

Mich, Caro—Drainage—Sanilac, Lapeer and Tuscola Counties will build 40-mile drain. Estimated cost, $250,000.

Mich., Macon — Drainage — Commissioners of Lenawee, Washtenaw and Monroe Counties contemplate building middle branch of Macon Drain. Estimated cost between $40,000 and $50,000.

Mich., Mason—Drainage—Alaiedon and Vevay Townships will drain Alaiedon swamp, 12 miles.

Iowa, Des Moines—Ditch—Bids will be received until Dec. 6 by County Board of Supervisors for Drainage Ditch No. 16, Webster Township, and a bulkhead. Estimated cost, $10,922.

Iowa, Des Moines—Ditch—Bids will be received until Dec. 6 by County Board of Supervisors for Drainage Ditch No. 17 in Lincoln and Crocker Townships and a bulkhead. Estimated cost, $26,100.

Iowa, Keosauqua—Drainage—Van Buren County contemplates straightening Fox River, includes approximately 500,950 yd. excavation. Estimated cost, $55,650.

Iowa, Ottumwa—Ditch—H. O. Wray will make surveys of Soap Creek Drainage Ditch. Noted Oct. 21.

Iowa, Wall Lake—(Official)—Drainage—Surveys made and plans prepared for straightening and deepening Boyer River and draining Goose Pond Swamp. Estimated cost, $81,000. Seth Dean, Glenwood, Iowa, Engr.

Minn., Anoka—Drainage—County contemplates draining Coon Creek, eight miles. Estimated cost, $45,000. W. L. Ridge Co., Suveyor.

Minn., Bemidji—Ditches—Bids will be received until Dec. 15 by J. L. George, County Audr., Beltrami County, and L. H. Slocum, Audr., Koochiching County, for constructing Judicial Ditch No. 36, about 127 miles long. Estimated cost, $212,195. Noted Nov. 11.

Minn., St. Cloud—Ditch—Contract will soon be awarded for Ditches Nos. 26 and 35. S. S. Chute, County Surveyor.

Minn., Windom—Ditch—Contract will be awarded about Dec. 13 for Judicial Ditch No. 24. Estimated cost, $22,803. P. G. Newfeld, Clk., District Court.

Mo., Bloomfield—Ditch—Bids will be received until 2 p.m., Dec. 6, for ditch for Drainage District No. 28. R. F. Jones, County Clk.

Tex., Anahuac—Irrigation Improvements—Trinity River Irrigation District voted $30,000 bonds for repairing bulkhead across Smith Bay. Noted Nov. 25.

Tex., Barstow—Irrigation Improvements—Bids will be received until Dec. 20 for building dams, reservoirs, headgates, sluice-gates and all other improvements for Ward County Irrigation District No. 1. G. W. Dyer, Pres.

Tex., Dallas—Reclamation—Kaufman County No. 1, Ellis County No. 1, Ellis County No. 2, Ellis County No. 3 and Dallas County No. 1 contemplate reclaiming about 50,000 acres of land. Estimated cost, $420,000. O. W. Fonley, District Engr.

Tex., Robstown—Drainage—Bids will be received until Dec. 6 by Neuces County Drainage District No. 2 for ditches.

Colo., Craig—Irrigation—Preliminary plans prepared for irrigation system for Elk River Irrigation Co. Estimated cost, $2,000,000. William P. Finley, Consult. Engr.

N. M., Raton—Irrigation—Trustees of Antelope Irrigation District contemplate enlarging storage capacity of district and extending ditches. Estimated cost, $325,000.

Idaho, Caldwell—Dam—Directors of Glen Lake Irrigation District contemplate building concrete dam on Boise River about five miles below Arrowrock Dam. W. W. Peters, Secy.

Idaho, Caldwell—Irrigation—Election will be held Dec. 14 in Caldwell Irrigation District to vote on $27,000 bonds for repairing and enlarging system.

Idaho, Nyssa—(Official)—Irrigation—Bids will be received about Jan. 10 for reclaiming approximately 8,000 acres near Nyssa for Nyssa-Arcadia Drainage District. G. McGee, Caldwell, Ch. Engr. Noted Oct. 21.

Utah, Ephraim—Irrigation—George A. Snow, Salt Lake City, Walter I. Moddy, Chicago, Ill., and C. A. Tusch, California, contemplate constructing irrigation project. Estimated cost, $500,000.

Ariz., Holbrook—Irrigation—Contract will soon be awarded for rebuilding Woodruff Dam and repairing irrigation works. Q. R. Gardner, County Superv.

Ariz., Tempe—Ditches—Bids will be received until Dec. 14 by J. W. Miller, Chn., Bd. of Directors, District No. 1, Maricopa County, for constructing 8.4 miles main open drain ditch.

Wash., Kennewick—Irrigation—Commercial Club interested in development of Benton County land through extension of Sunnyside Irrigation Canal to Hover, 12 miles, to irrigate about 40,000 acres.

Ore., Salem—Dam—State Engineering Department approved application of Dobbins Ditch Co., Joseph, to build dam on outlet of Wallowa Lake.

Ore., Silver Lake—Irrigation—Silver Lake Water Users' Association will form irrigation district to irrigate 46,000 acres of land. United States Reclamation Service estimates cost at $28.10 per acre.

Calif., San Joaquin—Reservoir—Bids will be received until Dec. 6 for Woodward Reservoir. Estimated cost, $174,000. A. Geiffen, Monteca, Engr. C. A. Proudfit, Monteca, Secy., South San Joaquin Irrigation District. Noted Nov. 18.

Bids In and Contracts Awarded

Mass, Boston—Dredging—One bid received Nov. 24 by Directors of Port of Boston, 40 Central St., for dredging and filling East Boston Flats, Contract No. 46, about 1,500,000 cu.yd., from H. P. Converse & Co., 88 Broad St., Boston, at $371,250. Noted Nov. 18.

N. Y., New York—(Borough of Manhattan)—(Official)—Dredging—P. Sanford Ross, Inc., 135 Bay St., Clifton, S. I., at $0.30 per cu.yd., submitted only bid Nov. 23 for dredging in North River from 103rd to 109th St., approximately 33,000 cu.yd.

N. Y., New York—(Borough of Manhattan)—(Official)—Dredging—Bids were received Nov. 23 by Department of Docks and Ferries for dredging at foot of East 90th St., East River, 17,000 cu.yd., from Morris & Cummings Dredging Co., 17 State St., New York, $0.33 per cu.yd.; P. Sanford Ross, Inc., $0.70 per cu.yd.; R. C. Packard & Co., $0.80 per cu.yd.

Penn., Port Richmond—(Philadelphia post office)—Dredging—Contract awarded to BOWERS SOUTHERN DREDGING CO., Galveston, Tex., for deepening ship channel in Delaware River. Estimated cost, $75,000.

Fla., Tallahassee—Locks and Dams—Contract for three locks and dams in Everglades Drainage District awarded to SAVANNAH ENGINEERING AND CONSTRUCTION CO., Savannah, Ga., at $120,000. Noted Aug. 12.

Iowa, Jefferson—Drainage—Contract for furnishing tile for drainage work in Districts Nos. 10 and 33 awarded to MACOMB SEWER PIPE CO., Macomb, Ill., at $10,622.

Minn., Alexandria—Ditch—Contract for Ditch No. 17 awarded to CARL CHRISTENSON, Litchfield, at $17,589.

Minn., Blue Earth—Ditches—County Commissioners awarded contracts for construction of ditches to HAWKEYE CONSTRUCTION CO., Webster City, Iowa, $7,943, Ditch No. 29; O. C. OLESON, Blue Earth, $7,195, Ditch No. 40. Jesse L. Harring, County Audr.

Minn., New Ulm—Ditches—Contract for tile and open ditches awarded to CHRISTOPHER NIELSEN, Sunborn, at $12,345.

Minn., Windom—Ditch—Contract for Judicial Ditch No. 20 awarded to REDDING & SMAGE, Windom, at $23,700. Noted Nov. 18.

Minn., Windom—Ditch—County Commissioners awarded contract for Ditch No. 21 to HANS TRUFESEN, Live Creek, at $13,989. Noted Nov. 18.

Ark., Blytheville—Drainage—Contract for Drainage Ditch No. 16 awarded to CLYDE WALDE, National Bank Bldg., La Grande, Ind., at $6.39 per cu.yd. Estimated cost, $425,000.

Ark., Knobel—Ditch—Contract for 52.75 miles of ditches and 4.25 miles of levees awarded to NORTHERN CONSTRUCTION CO., Elkhart, Ind., at $116,300. Noted Nov. 25.

Colo., Trinidad—Ditch—Contract for ditch awarded to J. A. LAUGHLIN. Estimated cost, $15,000.

Idaho, Boise—Irrigation—Contract awarded to WICKAHONEY LAND AND WATER CO. for irrigation of 30,000 acres for Bruneau Irrigation Project in Owyhee County. Estimated cost, $50 per acre. Noted Oct. 28.

Ore., Baker—Ditch—Contract awarded to MACY BROS., Sparta, for constructing ditch to connect Hogen Ditch with Eagle Creek, three miles.

Ore., Hood River—(Official)—Irrigation—Board of Directors of East Fork Irrigation District Nos. 5 and 6 awarded contract to CENTRAL TIMBER AND CONTRACTING CO., Carlton, for diversion gates, dam and intake works and for enlarging canals. Noted Nov. 11.

Calif., Modesto—Irrigation—George J. Ulrich at $19,340 submitted lowest bid for nine concrete drops for Modesto Irrigation District.

T. H., Honolulu—Irrigation—Lord-Young Engineering Co., Honolulu, at $109,600 submitted lowest bid for Waiolama fill for Waiolama Reclamation and Sanitation Project at Hilo.

MISCELLANEOUS

Proposed Work

Conn., Windsor—Elimination of Grade Crossing — Plans submitted to Highway Commissioner, Hartford, for elimination of grade crossing in Windsor. Estimated cost, $90,000.

N. Y., Albany—Fire Alarm Station—Bids will be received until Dec. 6 by Board of Contract and Supply for building fire alarm station at Delaware and Myrtle Ave.

N. Y., Ithaca—Elimination of Grade Crossings — Surveys completed for street junctions and railroad gradings preparatory to elimination of grade crossing on Delaware, Lackawanna & Western R.R. in South Aurora St., South Hill, Ithaca. Estimated cost, $40,000.

N. Y., New York—(Borough of Brooklyn)—(Official)—Tank—Bids will be received by L. H. Pounds, Borough Pres., Room 2, Borough Hall, until 11 a.m., Dec. 9, for furnishing labor and materials for construction of steel tank and fittings, having a capacity of 52,800 gals., to be used for storage of liquid asphalt, at municipal asphalt plant, 7th St. basin, Gowanus Canal.

N. Y., Olean—Flood Protection—Plans approved by W. W. Wotherspoon, State Supt. of Pub. Wks., for deepening and straightening Olean Creek from junction with Alleghany River to point 2½ miles up stream and building dikes and retaining walls on bank of creek. Estimated cost, $150,000. E. W. Fitzgerald, Olean, Pres. of Flood Abatement Comn. Noted Nov. 18.

N. Y., Rochester—Bathhouse and Bandstand—Plans prepared for bathhouse and bandstand at Durand-Eastman Park. Estimated cost, $12,000.

N. J., Ventnor—(Atlantic City post office)—Jetties—City Council authorized bond issue of $10,000 for jetties from Cambridge to Portland Ave.

Penn., Erie—Flood Protection—City Council adopted plan recommended by Farley Gannett, Telegraph Bldg., Harrisburg, for flood protection in Milk Creek. Plan adopted calls for reinforced-concrete conduit about 12,500 ft. long, 22 ft. wide, 18 ft. high with inside diameter capacity of 12,000 cu.ft. per second. Estimated cost, $900,000. Noted Oct. 21.

Va., Richmond—Creek Improvements—Charles E. Bolling, City Engr., estimated cost of straightening sewers and cover in Shockee Creek from river to Seventh and Hospital St. at $1,035,000.

Fla., Miami—Harbor Channel and Piers—Bids will be received until Dec. 20 for harbor channel and piers, Miami. Isham Randolph & Co., Chicago, Ill., Engr. Noted July 8 and Sept. 16.

Miss., Meridian—Subway—City officials and representatives of interested railroads estimate cost of 26th St. subway at $100,000.

La., Lake Charles—Retaining Wall—City will build retaining wall from Gill to Foster St., and construct boulevard and city park. Estimated cost, $100,000.

Tenn., Chattanooga—Wharf—City sold $100,000 bonds to improve wharf. R. Hooke, City Engr. Noted Oct. 14.

Tenn., Memphis—River Improvements — Mississippi River Commissioners plan to direct flow of Wolf and Loosahatchie Rivers to keep harbor clear of sand bars.

Ohio, Akron—Subway—Firestone Tire and Rubber Co. secured permission to build subway under South Main St. from factory to new club house and restaurant.

Ohio, Columbus—Elimination of Grade Crossing — Plans prepared by engineers of Pennsylvania R.R. and four other railroad companies for elimination of grade crossing in North Side of Columbus. Estimated cost, $600,000. City will pay $200,000 of cost.

Ohio, Sandusky—Coal Dock—Cleveland, Cincinnati, Chicago & St. Louis Railway contemplates building coal docks and car dumping machine. George P. Smith, Cincinnati, Consult. Engr.

Ohio, Upper Sandusky—Creek Improvement—County Commissioners contemplate widening and straightening Tymochett Creek. Estimated cost, $125,000.

Ill., Chicago—Engine House—City will build two-story brick engine house at 5318 Western Ave. Estimated cost, $19,000. C. Kallah, Arch.

Iowa, Jefferson—Subway—Chicago & Northwestern Railway will build subway under tracks. Estimated cost, $25,000. W. H. Finley, Chicago, Ill., Ch. Engr.

Minn., St. Paul—Steel Stairway—Bids will be received until 10:30 a.m., Dec. 6, by August Hohenstein, Pur. Agt., for steel stairway on Hall Ave. between South Wabasha St. and Prospect Terrace.

Wyo., Cheyenne—Pipe Line—According to press reports Governor Kendrick appointed committee to confer with committee of Nebraskans on proposition to build oil pipe line from Wyoming into and across state of Nebraska. Cost limited to $5,000 mile.

Tex., Beaumont—Machinery and Pier—All bids received Nov. 15 by J. G. Sutton, Secy. Wharf and Dock Commission, for quay walls, trans-shipment shed and freight machinery rejected. New bids will be received. Noted Nov. 4.

Tex., Ft. Worth—Levee—Election will soon be held to vote on $75,000 bonds for levees. A. A. Stiles, State Reclamation Agt.

Tex., Galveston—Bulkhead—A. T. Dickey, City Engr., estimates cost of raising protective grade back of seawall, 21 ft. from Sixth to 19th St. with bulkhead at $109,280, without bulkhead at $91,280.

Ore., Astoria—Mausoleum—Portland Mausoleum Co., Portland, contemplates building Mausoleum at Astoria. Estimated cost, $40,000.

Ore., Riverview — Mausoleum — Plans being prepared by Lawrence & Holford, Arch., for mausoleum for Portland Mausoleum Co., Portland. Estimated cost, $65,000.

Calif., Oakland—Mausoleum—Pacific Mausoleum Co. plans to build a mausoleum in Contra Costa County. Estimated cost, $300,000.

Que., St. Lambert—Race Track—Bids will soon be received by T. C. Kirby, 128 Bleury St., Montreal, for grading, ballasting, fencing, building double deck grand stand, single stage bleacher and club house required in construction of automobile race track for Canadian Speedway Co., Ltd.

Bids In and Contracts Awarded

Mass., Boston—Bulkhead—Bids were received Nov. 24 by Directors of Port of Boston for bulkhead and 170,000 cu.yd. dredging and placing filling beneath and around bulkhead, Contract No. 47, from Bay State Dredging Co., 247 Atlantic Ave., Boston, $82,830; Coleman Bros., Pearl St., Chelsea, $95,500; H. P. Converse & Co., 88 Broad St., Boston, $123,218. Noted Nov. 18.

Mass., Boston—(Roxbury)—Engine House—Lowest bids received by city Nov. 22 for alteration to Engine House No. 14 on Center St., Roxbury, were as follows: D. R. McKillop, 127 West Brookline St., $12,792; McDonald & Son, 98 Granite St., $12,943; McNeil Construction Co., 201 Devonshire, St., $13,187.

Mass., Boston—(Roxbury)—Ladder House—Bids received Nov. 22 by city for alteration to Ladder House No. 14 on Dudley St., Roxbury, from D. R. McKillon, 127 West Brookline St., $13,333; McDonald & Son, 98 Granite St., South Boston, $13,735; M. D. Mealy Co., Brookline, $13,945.

R. I., Providence—Arena—Contract awarded to JOHN F. MACLAREN, Providence, for two-story, 100x120-ft. arena for Marieville Association. Estimated cost, $25,000.

N. Y., New York—(Borough of Bronx)—(Official)—Track Installation—Bids were received Nov. 23 by Public Service Commission of First District, 154 Nassau St., for track installation on White Plains Rd. and extension of existing subway from Coast & Lake Contracting Corporation, 41 Broad St., New York, $53,930; Southeastern Construction and Engineering Corporation, $101,205; T. H. Reynolds Contracting Co., $102,126. Noted Nov. 18.

N. Y., New York—(Borough of Brooklyn)—Dry Dock—Contract for floating dry dock at foot of 58th St. awarded to MORSE DRY DOCK AND REPAIR CO.

Md., Baltimore—(Official)—Coal Pier—Baltimore & Ohio R.R. awarded contracts for coal pier at Curtis Bay, Baltimore, to H. S. KERBAUGH, INC., Baltimore, dredging, bulkhead and superstructure; ROBINS CONVEYING AND BELT CO., New York, N. Y., conveying machinery; SMITH-McCORMICK, Easton, Penn., grading. Estimated cost, $1,500,000. F. L. Stuart, Ch. Engr. Noted Sept. 30.

La., New Orleans—Revetment—Contracts awarded to W. J. COMERFORD, New Orleans, for wooden revetment and restoring wave wash from Kentucky to Angelina St., P. C. POWERS & SONS, McComb, Miss., for reinforced-concrete revetment and toe-wall from Bartholomew to Lesseps St.

La., New Orleans—Wharf—Doullut & Williams, New Orleans, at $154,000, submitted lowest bid for piling, timber, etc., for wharf of grain elevator, wharf to be 1,350 ft. long and 12 ft. wide.

Ky., Hawesville — Creek Improvements — Contract for widening and straightening Panther Creek in Hancock and Ohio Counties awarded to W. E. EWAN, at $10,000.

Ohio, Portsmouth—Flood Protection Wall—Contract for second section of flood protection wall awarded to GLANDORF & BROWNING, Cincinnati, at $67,779. Noted Nov. 25.

Ind., Gary—Ore Dock—Contract for ore dock for U. S. Steel Co. awarded to ILLINOIS IMPROVEMENT AND BALLAST CO.

Neb., Omaha — (Official) — Crane — Contract for railroad crane of five tons capacity awarded to LINK BELT CO., Chicago, Ill. Noted Nov. 11.

Tex., Beaumont—Wharf—City Council awarded contract to JOHN O. KELLY, San Antonio, at $65,000, for 500-ft. wharf to be known as Unit No. 2. Noted Oct. 21.

Tex., Galveston—Bathhouse—Contract for bathhouse for Murdoch Bathhouse Co. awarded to J. W. ZEMPTER, Galveston. Estimated cost, $18,000.

N. M., Gallup—River Improvements—Santa Fé R. R. awarded contract to SHARP & GALLUP, Topeka, Kan., for initial work at Gallup to change course of Puerco River. Site when filled in will be used for shops, roundhouses and tracks. Estimated cost, $67,000.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works," "Federal Government Work" and "Miscellaneous."

Proposed Work

Maine, Camden—Preliminary plans being prepared by W. E. Schwartz, Arch., Camden, for hotel. Estimated cost, $40,000.

N. H., Dixville—Preliminary plans being prepared for hotel for Dixville Notch Corporation. Estimated cost, $200,000. C. R. Whitchner, The Beacon, Manchester, Arch.

Mass., Boston—(Dorchester)—Bids will be received by Schoolhouse Committee, City Hall Annex, until Dec. 11, for Sarah Greenwood Elementary School, Dorchester. Estimated cost, $140,000. Funk & Wilcox, 120 Boylston St., Boston, Arch.

Mass., Bourne—Plans being prepared for railroad station for New York, New Haven & Hartford R.R. E. Gagel, New Haven, Ch. Engr.

Mass., Everett—Plans being prepared by Charles R. Greco, 8 Beacon St., Boston, for one-story church for St. Joseph's Church Society. Estimated cost, $50,000.

Mass., Lynn—Press reports state that school will be constructed on Conomo Ave. Estimated cost, $100,000.

Mass., Newton—Tentative plans prepared by Haven & Hoyt, Arch., for club house for Commonwealth Country Club. Estimated cost, $50,000.

Mass., Springfield—All bids received for Hampden County training school rejected as being too high. Plans will be revised and new bids asked.

Mass., Stoneham—Plans being prepared by Penn Varney, 27 Exchange St., Lynn, for fire and police station. Estimated cost, $40,000.

Mass., Worcester—J. W. Critchley, 663 Southbridge St. has purchased a site at Main and Walnut St. on which he will build a 10-story office building.

R. I., Pawtucket—George W. and Ella Shaw will build a three-story business block at Hillside and Pawtucket Ave.

Conn., Bridgeport—Plans being prepared by F. A. Cooper, Arch., for an addition to the Garfield School. Estimated cost, $45,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Plans prepared by Gronenberg & Leuchtag, Arch., 303 Fifth Ave., for one-story, 151.3x130.5-ft. brick store and theater building at Fordham Rd. and Grand Concourse for Fordham Road Corporation. Estimated cost, $75,000.

N. Y., Pelham—Board of Education contemplates building additions to three schools. Estimated cost, $50,000. Louis W. Francis, Pres., Bd. of Education.

N. Y., Potsdam—Contract will soon be awarded for two-story normal school for New York State Department of Education. Estimated cost, $300,000. Noted Oct. 14 and 21.

N. Y., Rochester—George Simpson, Regent Theater, East Ave., interested in organization of company for purpose of building theater and store building. Estimated cost, $1,000,000. Leon Lempert & Son, 149 Culter Bldg., Arch.

N. J., Bayonne—Plans being prepared for addition to high school, and School No. 3 and for building new School No. 5. Estimated cost, $482,000. Fagan & Briscoe, 95 River St., Hoboken, Arch.

N. J., Freehold—Council plans to build new city hall and fire house.

N. J., Hoboken—Board of Education plans to build three new school buildings to replace Schools Nos. 2, 3 and 4. James Laverty, Pres. Bd. of Education.

N. J., Princeton—Plans being prepared by Coolidge & Carlson, 89 State St., Boston, Mass., Arch., for medical research buildings for Rockefeller Institution. Estimated cost, $300,000.

Penn., Allentown—Y. M. C. A. will construct six-story addition. Estimated cost, $100,000. Louis E. Jallade, New York, N. Y., and Ruhe & Lange, Allentown, Archs.

Penn., Eddystone—Plans being prepared by Henon & Boyle, Arch., Philadelphia, for seven-story hotel for Remington Arms Co. Estimated cost, $175,000.

Penn., Philadelphia—Plans being prepared by Robeson Lea Perot, Arch., 34 South 17th St., Philadelphia, for 12-story reinforced-concrete office building. Estimated cost, $250,000.

Penn., Philadelphia—Mount Carmel Methodist Episcopal Congregation will build church at Broad St. and Northeast Blvd. Estimated cost, $75,000.

Penn., Pittsburgh—A 16-story mercantile and office building will be constructed at Seventh Ave. and Smithfield St. by G. T. Oliver, U. S. Senator.

Penn., Uniontown—Election will soon be held to vote on $250,000 bonds for schools.

Del., Wilmington—Plans being prepared by Edward Canby May, Arch., du Pont Bldg., for two bank buildings.

Md., Baltimore—Plans being prepared by Alfred C. Leach, Arch., for public school at Patterson Park. Estimated cost, $100,000.

Md., Baltimore—Baltimore Evangelistic Association will build a tabernacle at Greenmount Ave., Barclay, 28th and 29th St. D. Baker, 520 Equitable Bldg., interested.

D. C., Washington—Plans prepared for two-story, 150x173-ft. theater and office building for George T. Smallwood and I. Cassidy, 3520 16th St., N. W. Estimated cost, $100,000. R. W. Geare, Southern Bldg., Arch.

D. C., Washington—Preliminary plans prepared for theater for Rialto Building Co. Estimated cost, $150,000. Thomas W. Lamb, 644 Eighth Ave., New York, N. Y., Arch.

Va., Norfolk—A four-story building will be constructed on Kin St. for St. Paul's Female Academy.

Va., Roanoke—L. E. Johnson, Pres. of Norfolk & Western R.R., and associates will enlarge Hotel Roanoke. Estimated cost, $200,000.

S. C., Greenwood—Main Street Methodist Church will erect building. Estimated cost between $40,000 and $50,000. A. C. Stockman, C. C. Featherstone and George Hart, interested.

Fla., Clearwater—Election will probably be held in December by citizens of Pinellas County to vote on $150,000 bonds for courthouse and jail. Noted Oct. 28.

Fla., Jacksonville—National Motion Picture Co. contemplates building motion-picture theater. Estimated cost, $300,000.

Ala., Birmingham—Plans prepared by William Leslie Welton, Arch., Jefferson County Bank Bldg., for two additions to Birmingham Infirmary in West End. Estimated cost, $100,000.

Ala., Montgomery—Women's College plans to build dormitory in spring. Estimated cost, $50,000. W. M. Swartz interested.

Miss., Pontotoc—Bids will be received about Dec. 6 for court house for Pontotoc County. Estimated cost, $75,000. Noted Oct. 28.

Miss., Yazoo City—Bonds for $45,000 will be issued for high school.

La., Alexandria—Three-story building will be constructed by Knights of Columbus, Alexandria Council No. 1134.

La., Shreveport—Construction of building estimated to cost $50,000 contemplated by Shreveport Fair Association.

Tenn., Bristol—Citizens voted $60,000 bonds for high school. Noted Oct. 28.

Tenn., Cookeville—State Board of Education, Nashville, plans to construct two buildings at State Normal and Polytechnic School. Estimated cost, $145,000.

Tenn., Nashville—Bids will soon be received by Board of Education for Elliott Street School and negro high school. Estimated cost, $70,000 and $55,000 respectively. Noted Oct. 7.

Tenn., Nashville—Bids will be received until Dec. 4 by Asmus & Norton, Arch., for dormitories and administration buildings for State Polytechnic School. Estimated cost, $125,000.

Ky., Danville—Bids will be received about Jan. 1 by W. S. Van Dalsem, Arch., Masonic Bldg., for five-story, 78x100-ft. hotel for Danville Hotel Co. Estimated cost, $60,000.

Ky., Lexington—Plans prepared for two-story, 30x40-ft. Sunday school for Porter Memorial Church. Estimated cost, $40,000. Frank L. Smith, 29 Lexington Bank and Trust Bldg., Arch. Bids for same will be received in spring.

Ky., Lexington—Board of Education plans to build two-story school. Estimated cost, $50,000. C. T. Melcher, Pres. Bd. of Education.

Ohio, Akron—Bids will soon be received by the Board of Education for two-story Jennings School. Estimated cost, $100,000. T. R. Ridley, Arch., Cottage Pl., Akron.

Ohio, Akron—Summit County contemplates building county infirmary. Estimated cost, $250,000. C. L. Bower, Clk. Bd. of County Comr.

Ohio, Akron—Bids will be received by J. F. Barnheart, Clk. of Bd. of Education, until noon, Dec. 13, for Bowen School. Harpster & Bliss, Nantucket Bldg., Arch.

Ohio, Alliance—Chamber of Commerce is interested in a project to build a new union station.

Ohio, Cincinnati—A theological seminary will be constructed on Norwood Heights by Archdiocese of Cincinnati. Estimated cost, $300,000.

Ohio, Cincinnati—Bids will be received by C. W. Handman, Bus. Mgr., Bd. of Education, until noon, Dec. 20, for Industrial Arts Building, tunnel K and power house, stadium, gymnasium and tunnel J, of Eastside High School.

Ohio, Cincinnati—Plans will be prepared by Garber & Woodward, Arch., for new public school. Estimated cost, $60,000.

Ohio, Cleveland—Plans being prepared by E. E. Hart, Ch. Engr., for two-story, 100x800-ft. railroad terminal and steel trestle, 600-ft. long on Clay Court and East Ninth St., for New York, Chicago & St. Louis R.R. Estimated cost, $400,000.

Ohio, Cleveland—Cleveland Public Library Board will build library building. Estimated cost, $2,000,000.

Ohio, Cleveland—Frank D. Skeel, Arch., 213 Vickers Bldg., Cleveland, will soon award contract for six-story hotel on East 61st St. for G. W. Crile. Noted Oct. 21.

Ohio, Columbus—Plans being prepared by Richards, McCarty & Bulford, Arch., for church at Auburn and Madison Ave., for Franklin Park M. E. Church. Estimated cost, $45,000.

Ohio, Defiance—Lodge No. 147, B. P. O. E. contemplates building two-story lodge building. Estimated cost, $60,000.

Ohio, East Cleveland—City contemplates two new fire stations. Estimated cost, $50,000.

Ohio, Findlay—Buckeye National Bank will remodel and improve its bank building. Estimated cost, $40,000.

Ohio, Lakewood—New York, Chicago & St. Louis R.R. contemplates building two-story passenger station. Estimated cost, $50,000. William H. Canniff and E. E. Hart, 412 Hickox Bldg., Ch. Engrs.

Ohio, Lebanon—Bids will be received by Bausmith & Drainie, Arch., Gerke Bldg., Cincinnati, until Dec. 20, for public memorial building.

Ohio, New Philadelphia—Bids will be received until noon, Dec. 14, for two-story, 60x85-ft. school for Goshen Township. Estimated cost, $45,000. J. W. Syron, 118 Court St., New Philadelphia, Clk. of Bd. of Education.

Ohio, Olmsted Falls—Plans being prepared by W. H. Nickolas, Arch., 1900 Euclid Ave., Cleveland, for high and grade school. Estimated cost, $50,000.

Ohio, Orient—Bids will be received until noon, Dec. 13, by John W. Lane, Clk., Bd. of Education, Rural School District, Scioto Township, for purchase of $45,000 bonds for school.

Ohio, Toledo—Plans being prepared by Thomas F. Huber, Arch., Toledo, for 10-story hotel on Summit St. for George P. Waldorf. Estimated cost, $125,000.

Ohio, Toledo—Central Ohio Paper Co., Columbus, plans to build three-story commercial building on Ontario St., Toledo. Estimated cost, $40,000.

Ohio, Wilmington—Plans prepared for three-story, 110x140-ft. courthouse and jail for Clinton County. Estimated cost, $300,000. H. Castl, County Audr.

Ind., Huntington—Plans being prepared by Elmer E. Dunlap, Arch., 909 State Life Bldg., Indianapolis, for two-story, 141x183-ft. high school for Board of Education. Bids will be received about Jan. 1.

Ind., Indianapolis—Pennsylvania R.R. plans to build freight station on Pennsylvania St. Estimated cost, $300,000.

Ind., Portland—Bids will soon be received for three-story, 90x160-ft. court house for Jay County. Estimated cost, $275,000. Noted Nov. 4.

Ind., Terre Haute—Plans will be prepared by H. W. Foltz, Arch., Indiana Pythian Bldg., Indianapolis, for proposed McLean School. Estimated cost, $115,000.

Mich., Flint—Citizens voted $100,000 bonds for schools.

Mich., Grand Rapids—Plans being prepared by Pierre Lindhout, Arch., 718 Ashton Bldg., for two-story, 88x110x141-ft. bank and store building and garage.

Mich., Kalamazoo—Contract will soon be awarded for Nurses' Home for Kalamazoo State Hospital. Estimated cost, $56,000. Wernette, Bradfield & Mead, 441 Houseman Bldg., Grand Rapids, Mich., Arch. Noted Oct. 28.

Ill., Champaign—Plans being prepared for two-story theater for a stock company represented by Thomas Wilson, 53 North Market St., Champaign. C. W. & George L. Rapp, Arch., 69 West Washington St., Chicago, Ill. Estimated cost, $100,000.

Ill., Chicago—Bids will be received by Ottenheimer, Stern & Reichert, Arch., 220 State St., until Dec. 10, for 12-story clubhouse for Chicago Lodge No. 4, B. P. O. E. Estimated cost, $350,000.

Ill., Chicago—A new hospital will be constructed at Highland Park. Estimated cost, $100,000.

Ill., Mattoon—Trustees of Memorial Hospital plan to construct new hospital.

Ill., Ottawa—Plans prepared by J. F. Richardson, Arch., for Illinois Valley general hospital. Estimated cost, $75,000. J. W. Pettit, interested.

Ill., Urbana—Plans being considered by Methodists of Illinois for several buildings at University of Illinois. Estimated cost, $500,000.

Wis., Eau Claire—Common Council considering construction of municipal auditorium. Estimated cost, $85,000.

Wis., Milwaukee—Preliminary plans being prepared by Van Ryn & DeGelleke, Arch., Caswell Block, for three-story, 85x120-ft. school of trades for girls for Milwaukee Board of School Directors. Estimated cost, $160,000.

Wis., Plymouth—Press reports state that Lutheran hospital will be constructed in Plymouth. Estimated cost, $40,000.

Wis., Superior—Allied Protestant Churches plan to build hospital. Estimated cost, $100,000.

Iowa, Carroll—Contract for three-story, 88x149-ft. school will be awarded some time in January by Board of Trustees of Independent School District. Bonds for $80,000 voted for this purpose. Noted Oct. 21.

Iowa, Centerville—Bids will be received until Dec. 15 for three-story hospital for Sisters of Mercy. Estimated cost, $45,000. F. E. Cox, Arch., 45 Baldwin Bldg., Council Bluffs.

Iowa, Davenport—Bids will be received by George D. Stanhuhar, Arch., 608 Best Bldg., Rock Island, Ill., until Dec. 15, for senior hall, dormitories and chapel for St. Ambrose College. Estimated cost, $75,000.

Minn., Minneapolis—Thorpe Bros. contemplates building at Eighth and Hennepin Ave. Estimated cost, $500,000.

Minn., Minneapolis—Plans being prepared by Kees & Colburn, Arch., for 12-story commercial and theater building at Hennepin and Seventh St. for Hennepin Holding Co. Estimated cost, $1,000,000. Hazen J. Burton, Pres.

Minn., Rochester—Plans being prepared by F. H. Ellerbe, Arch., 692 Endicott Bldg., St. Paul, for three hospital buildings.

Minn., St. Paul—New building contemplated by Home of the Friendless, 469 Collins St. Estimated cost, $75,000.

Minn., St. Paul—People's Bank of St. Paul plans to construct business building. Estimated cost, $150,000.

Minn., Virginia—Plans being prepared by Carl E. Nystrom, Arch., 502 Palladio Bldg., Duluth, for two-story high school. Estimated cost, $150,000. A. B. Holly, Clk. Bd. of Education.

Kan., Iola—Allen County State Bank will build a two-story building. Estimated cost, $50,000. T. H. Bowlus, Pres.

Kan., Pittsburgh—Plans being prepared by Crowell & Van Meter, Arch., Wichita, for three-story, 70x150-ft. hospital. Bids will be received about Jan. 1. Estimated cost, $100,000.

Kan., Wichita—Press reports state that Bell Telephone Co. will build a five-story office building at First and Market St.

Neb., David City—Citizens voted $60,000 bonds for high school. Noted Nov. 25.

Neb., Lincoln—Bids will be received until 4 p.m., Dec. 15, by J. S. Dales, Secy. Bd. of Regents of Nebraska University, for chemistry and hospital buildings.

Neb., Lincoln—Plans prepared for 10-story 85x142-ft. terminal building at 10th and O St. for Lincoln Traction Co.

Neb., Lincoln—Orpheum Building Co. plans to build new theater. Estimated cost, $75,000.

Neb., Omaha—Plans being prepared for hospital for University of Nebraska, College of Medicine. Estimated cost, $150,000. John Latenser & Sons, 626 Bee Bldg., Arch.

S. D., Webster—Election will be held in December to vote of $60,000 bonds for two-story high school for Board of Education. Holmes & Flinn, Arch., 8 Dearborn St., Chicago, Ill. Noted Nov. 25.

Mo., Jefferson City—Citizens of Cole County defeated $50,000 bonds for jail and tuberculosis hospital. Noted Aug. 12.

Mo., Joplin—Joplin School District voted to issue $350,000 bonds for high school. J. A. Becker, Pres. School Bd. Noted Nov. 18.

Mo., Kansas City—Plans being prepared by Madorie & Birdsall, Arch., 832 Reserve Bank Bldg., for four-story, 62x128-ft. dormitory for city. Estimated cost, $125,000.

Mo., Kansas City—Plans being prepared by F. H. Michaelis, Arch., 113 McGee St., for a 12-story office building at 912-14 Walnut St. for Richard W. Smith, 3120 Charlotte St. Estimated cost, $150,000.

Mo., Neosha—Bonds for $48,000 voted for high school.

Mo., Nevada—Citizens defeated $40,000 bonds for city hall.

Mo., St. Joseph—Bartlett Bros. Land and Loan Co. will build five-story building at Eighth and Felix St.

Mo., St. Louis—Missouri National Guard, Troop B, plans to build armory. Estimated cost, $350,000.

Mo., St. Louis—Y. M. C. A. plans to erect colored branch building. Estimated cost, $125,000.

Ark., Searcy—Company is being organized for the purpose of building hotel. Estimated cost, $40,000. C. E. Myrick, interested.

Tex., El Paso—Plans being prepared for seven-story store and office building at Mills and Stanton St. for William M. Banner and M. D. Roberts. Estimated cost, $200,000.

Tex., Gainesville—Bids will be received about Dec. 20 by Patrick Henry, Chn. of Bd. of Control, for four dormitories for Texas State Girls' Training School.

Okla., Tulsa—(Official)—We have been advised that George Winkler, Tulsa, and not Walter E. Gilham, Kansas City, Mo., is architect for high school, as stated in our issue of Oct. 21. Walter E. Gilham is Engr.

Colo., Colorado Springs—Atchison, Topeka & Santa Fé R.R. contemplates building depot and hotel. Estimated cost, $500,000.

Colo., Loveland—Plans being prepared by Roeschlaub & Fuller, Arch., 310 Foster Bldg., Denver, for high school. Estimated cost, $85,000. Noted Oct. 21 and Nov. 11.

Colo., Pueblo—Bids will be received until 10 a.m., Dec. 15, by Colorado State Board of Corrections for three buildings at Colorado Insane Asylum.

N. M., Santa Fé—Plans prepared for office building for Santa Fé Water and Light Co. Estimated cost, $100,000.

Idaho, Nampa—Election will soon be held to vote on $50,000 bonds for high school.

Wash., Seattle—Bids will soon be received by Thompson & Thompson, Arch., Mutual Life Bldg., Seattle, for four-story, 60x120-ft. hotel, store and lodge building for use of Chinese Masons. Estimated cost, $60,000.

Wash., Seattle—Plans being prepared by B. M. Pretica, Arch., for a 180x180-ft. reinforced-concrete natatorium building. Estimated cost, $250,000. C. D. Stimson, interested.

Wash., Tacoma—Knights of Columbus will build club house on C St. Estimated cost, $50,000.

Ore., Baker—Bonds for $125,000 voted for high school. Noted Nov. 18.

Ore., Portland—First Christian Congregation plans to build new church. Estimated cost, $50,000.

Calif., Los Angeles—Bids will be received until 9 a.m., Dec. 9, for group of buildings at Hooper and Compton Ave. and 38th St. to be known as Jefferson High School. Estimated cost, $200,000. Norman F. Marsh, Broadway Central Bldg., Arch. Noted Sept. 16.

Calif., Los Angeles—Loma Linda College of Medical Evangelists will build hospital, clinic and students' home. Estimated cost, $75,000.

Calif., Yosemite—Desmond Commissary Co. plans to build a hotel in Yosemite Valley. Estimated cost, $150,000.

Que., Hull—Plans being prepared for church for Sacred Heart Congregation. Estimated cost, $75,000.

Que., Maisonneuve—School Commission will build school to replace one destroyed by fire. Estimated cost, $400,000.

Que., Westmount—Kenneth G. Rea, Arch., will prepare plans for municipal building. Estimated cost, $150,000.

Ont., London—Plans being prepared for constructing an addition and altering building of Canadian Theaters Co. Estimated cost $100,000.

Ont., Orillia—Citizens defeated $50,000 bonds for city hall. Noted Nov. 4.

Ont., Toronto—Toronto Hydro-Electric Commission, 226 Young St., contemplates office building. Estimated cost, $450,000.

B. C., Vancouver—Plans prepared by F. Townley, Arch., St. Paul, for depot for Great Northern Railway. Estimated cost between $250,000 and $400,000.

B. C., Victoria—Election will soon be held to vote on $75,000 bonds for natatorium.

Bids In and Contracts Awarded

Mass., Danvers—All bids received for school on Maple St. rejected by Trustees of Essex County Agricultural School.

R. I., Providence—(Official)—General contract for school at Cole and Luzon Ave. awarded to W. WILLIAMS, Providence, at $118,000. Noted Nov. 11.

N. Y., Buffalo—Buffalo General Hospital awarded contracts for three-story, 55x80-ft. service building on High St. to BUFFALO STRUCTURAL STEEL CO., structural steel; CHARLES H. EVERITT, masonry. Estimated cost, $50,000.

N. Y., Buffalo—George Baker Long, Worcester, Mass., at $372,500, submitted lowest bid for general contract for four buildings for hospital for city at Grider St. and Kensington Ave. Noted Nov. 11.

N. Y., Mineola—Nassau County Trust Co. awarded general contract to HARTEL & DAVIES, 353 East 78th St., New York, for one-story bank building. Estimated cost, $75,000.

N. Y., Mt. Vernon—New York Central R.R. awarded contract for passenger station to R. H. HOWES CONSTRUCTION CO.

N. J., East Rutherford—Contract for school awarded to MAGEE CONSTRUCTION CO., Newark, N. J.

N. J., Roselle Park—(Elizabeth post office)—(Official)—Contract for three-story high school awarded to CHARLES FLOCKEN, Elizabeth, at $60,000. Noted Nov. 25.

Penn., Clearfield—School District of Clearfield awarded general contract to W. A. LUKINS, Clearfield, for two-story, 63x140-ft. high school. Estimated cost, $80,000.

Penn., Philadelphia—General contract awarded to JOHN McSHAIN, 1610 North St., for two-story, 64x121-ft. school and chapel for Parish of St. Carthage. Estimated cost, $40,000.

Penn., Pittsburgh—General contract awarded to ROSE & FISHER for five-story, 82x114-ft. community building for First U. P. Church. Estimated cost, $300,000.

Va., Norfolk—Contract for building for Park Place Methodist Church awarded to J. A. TURPIN, Norfolk.

N. C., Charlotte—Central Realty Co. awarded contract to TRAVERS-WOOD CO. for building on West Trade St. to be occupied by Buick Motor Co. and Overland Carolinas Co. Estimated cost, $50,000.

Ohio, Cincinnati—Contract for bank and office building for Provident Savings Bank and Trust Co. awarded to H. HARIG & CO., Cincinnati. Estimated cost, $100,000. Noted Sept. 23.

Ohio, Cleveland—General contract awarded to JAMES H. WELLS CO., Marshall Bldg., Cleveland, for two-story addition to McGregor Memorial Home for Aged at Terrace Ave. and Lee Rd. Estimated cost, $50,000. Noted Nov. 18.

Ohio, Columbus—Contract for homeopathic hospital at Ohio State University awarded to DAWSON CONSTRUCTION CO., May Bldg., Pittsburgh, Penn., at $40,000. Noted Nov. 11 and 25.

Ohio, Kilbourne—Contract for school awarded to L. R. DELAUDER, Marion, at $42,000.

Ind., Indianapolis—Contract for coliseum for city awarded to H. W. KLAUSMAN CO., at $123,660.

Mich., Holland—BYERS & CO., Kalamazoo, at $50,000, awarded contract for building for First State Bank.

Ill., Chicago—Contract for freight station for Pennsylvania R.R. awarded to GEO. A. FULLER CO. Estimated cost, $1,300,000.

Ill., Orcola—Board of Education awarded general contract to H. B. KRAUEL, Dale Bldg., Danville, Ill., for two-story high school. Estimated cost, $80,000.

Ill., Peoria—Contract for building for Merchants & Illinois National Bank at 217-19 South Adams St. awarded to V. JOBST & SONS. Estimated cost, $75,000.

Iowa, Sioux City—Contract for church at 19th and Nebraska St. for First Methodist Episcopal Church awarded to DUBEL & ANDERSON, 514 Jackson St., Sioux City. Estimated cost, $65,000.

Iowa, Sioux City—Contract for freight shed and terminal at Third and Jackson St. for Chicago & Northwestern Railway awarded to GIMBLE CONSTRUCTION CO., Chicago, Ill. Estimated cost, $185,000. Noted Oct. 14.

Minn., Duluth—General contract awarded to H. B. RICKETTS, Danville, Ill., for two-story, 120x200-ft. high school building. Estimated cost, $100,000. Noted Nov. 25.

Minn., St. Paul—Lowest bid received for Minnesota Historical Society building submitted by O. Swenson, St. Paul, at $463,155. Noted Sept. 23 and Oct. 28.

Neb., Omaha—Ford Hospital Co., 604 City National Bank Bldg., awarded general contract for three-story, 60x110 ft. hospital to BUSK & WIND, 543 Ramge Bldg. Estimated cost, $150,000.

Neb., Omaha—Coad Real Estate and Investment Co., 402 First National Bank Bldg., awarded general contract to ALEXANDER BECK, for three-story, 60x80-ft. hotel. Estimated cost, $40,000.

Mo., Kansas City—Contract for an addition to the German Hospital at 23rd, Holmes and McCoy St. awarded to PRATT-THOMPSON CONSTRUCTION CO., 500 Republic Bldg., Kansas City. Estimated cost, $250,000.

Mo., St. Louis—Riverview Club awarded contract to GILSONITE CONSTRUCTION CO. for three-story club house at 10,952 Riverview Dr.

Tex., Carlsbad—Texas Tuberculosis Sanitarium awarded contract for building to B. T. & C. N. DAVIS, Ft. Worth, Tex., at $58,312.

Tex., El Paso—Pitts & Denning, at $62,000 submitted lowest bid for building addition to Alta Vista School.

Tex., Palestine—Contract for high school awarded to A. W. FLINT, Ft. Worth, at $65,000. Noted Oct. 21.

Tex., San Antonio—Contract for building City and County Hospital awarded to H. N. JONES CONSTRUCTION CO., at $200,000.

Okla., Wilburton—Contract for court house awarded to A. EASLEY and H. R. HARDER, Wilburton.

Wash., Seattle—Board of Regents of University of Washington awarded general contract for home economics building to FINNE & GJARDE, 725 Northern St., at $143,254.

Calif., Berkeley—University of California awarded contract for stone work on Benjamin Ide Wheeler Hall to RAYMOND GRANITE CO., San Francisco, at $225,000. Noted Oct. 14.

Calif., Visalia—Southern Pacific Co. awarded contract for passenger depot to E. E. ETHERTON, Monadnock Bldg., San Francisco, at $43,000.

Ont., Toronto—(Official)—Contract for seven-story office building at Church and Court St. for Imperial Oil Co., Toronto, awarded to THOMPSON & STARRETT, 49 Wall St., New York, N. Y. Estimated cost, $150,000. Noted Nov. 4.

CALUMET SAG CHANNEL, CHICAGO, ILL.

Bids were received by the Sanitary District of Chicago, Oct. 12, for construction of Sections 13 and 14 of the Calumet Sag Channel from (A) Porter Bros. Co., Portland, Ore.; (B) A. Guthrie & Co., Inc., St. Paul, Minn.; (C) Winston Bros. Co., Minneapolis, Minn.; (D) Byrne Bros. Dredging and Engineering Co., Chicago; (E) Dunn-McCarthy Co., Chicago; (F) Marquette Construction Co., Chicago; (G) Schnable & Quinn, Chicago; (H) Bates & Rogers Construction Co., Chicago; (I) Flick Construction Co., Chicago; (J) Walsh Construction Co., Davenport, Iowa; (K) T. J. Forscher Contracting Co., Lemont, Ill.; (L) J. J. O'Heron & Co., Chicago; (M) Robert Grace Contracting Co., Pittsburgh, Penn.; (N) James O. Heyworth, Chicago. The item bids were as follows:

Section 13	A	B	D	E	F	H	I	J	K	O
500,000 cu.yd. glacial drift	$0.45	$0.33	$0.44	$0.36	$0.40	$0 45	$0.37	$0.3325	$0.37	$0.284
55,000 cu.yd. glacial drift at B. & O.-G. T. W. crossing	.60	.59	.79	.54	.85	.90	.52	.35	.50	.284
30,000 cu.yd. glacial drift at Rock Island crossing	.60	.59	.69	.52	.85	.90	.50	.35	.60	.284
60,000 cu.yd. solid rock	.95	.90	1.35	.85	1 15	.75	.98	.84	.90	.80
4,000 cu.yd. solid rock at B. & O.-G. T. W. crossing	1.75	1.75	1.60	2 00	1.50	1 25	2.00	1.75	1.25	.80
2,000 cu.yd. solid rock at Rock Island crossing	1.75	1.75	1.60	2.00	1 50	2.00	2.50	1.75	1.25	.80
50,000 sq.ft. channeling	.30	.30	.33	.30	.38	.45	.33	.35	.35	.40
500 sq.yd. rip-rap slopes	1.00	1.50	1 25	.50	1 00	2 00	1 25	1.38	2 50	2.50
2,500 cu.yd. number one concrete	7.50	6.50	12.75	6.50	9 00	8 30	7.75	7.40	7 50	7.50
1,500 cu.yd. number one concrete at B. & O.-G. T. crossing	8.00	7.10	12 75	6.50	9.00	7.45	9.25	7 40	8 50	7.50
200 cu.yd. number one concrete at Rock Island crossing	8.00	7.10	12 75	6.50	9 00	8 05	9 25	7.40	8 50	7.50
70,000 cu.yd. number two concrete	5.60	5.10	5 59	5.00	5 95	6 20	4 85	4.60	5.25	4.75
8,000 cu.yd. number two concrete at B. & O.-G. T. W. crossing	6.00	5.60	5.59	5.75	7.00	5 85	7 50	5 50	7 50	4.75
3,000 cu.yd. number two concrete at Rock Island crossing	6.00	5.60	5.59	5.75	7.00	6.45	7.50	5 75	7 50	5.15
80 cu.yd. coping concrete	11.50	8.00	15 00	7.00	14.00	11 00	11.00	8 00	10 00	12.00
40 cu.yd. granite concrete	12.00	9.00	16.00	10.00	18.00	13.00	12.00	9.00	15 00	18.00
5,000 cu.ft. concrete foundation columns	.60	.55	.50	.60	1.00	1.15	.75	.60	.50	.70
10,000 cu.ft. concrete cylinders at Rock Island crossing	.60	.55	.60	.60	1.00	1.10	1.00	.90	.60	.80
725 lin.ft. concrete railing	1.75	1.60	2 50	1.00	2.50	3.75	3.75	3.00	3.00	2.50
250,000 lb. reinforcing metal	.03	.035	.0350	.0325	.04	.0375	.0325	.0275	.04	.035
8,000 sq.yd. macadam pavement	1.75	1.10	1.25	1.50	1.25	2.25	1.25	1.00	1.50	1.25
3,000 sq.yd. cinder sidewalk	2.50	1.00	1.00	.75	.90	1.00	1.00	.20	.50	.60
Erection of Ann street bridge (lump sum)	3,400.00	3,100.00	3,720 00	1,500 00	3,100.00	3,500.00	3,410.00	3,390.00	3,500 00	3,410.00
Erection of Western avenue bridge (lump sum)	6,000.00	5,000.00	5,976.00	2,000 00	5,000.00	5,000.00	5,478.00	5,050 00	5,500 00	5,478.00
Erection of Chicago street bridge (lump sum)	3,700.00	3,100.00	3,720 00	1,500.00	3,100.00	3,500 00	3,410.00	3,640 00	3,750.00	3,410.00
Erection of Division street bridge (lump sum)	4,000.00	3,300.00	4,014.00	1,500.00	3,400.00	3,800 00	3,680.00	4,000 00	4,250 00	3,680.00
Stony Creek timber flume	8,500.00	10,000.00	5,000.00	10,000.00	7,000.00	10,500.00	9,500.00	10,800.00	12,000.00	10,260 00
Extended totals	$970,418	$798,490	$955,822	$794,310	$964,902	$991,033	$839,981	$747,640	$859,375	$720,170

Section 14	A	B	C	D	F	G	H
550,000 cu.yd. glacial drift	$0.42	$0.2825	$0.31	$0.37	$0.35	$0.415	$0.42
85,000 cu.yd. solid rock	.95	.80	.75	1.40	1.15	1.09	.76
60,000 sq.ft. channeling	.30	.25	.37	.33	.38	.432	.45
2,000 sq.yd. rip-rap slopes	1.00	1.50	2.00	1.25	1.00	1 50	2.00
7,000 cu.yd. number one concrete	7.50	6.40	6.25	12.75	9.00	6 56	8.65
80,000 cu.yd. number two concrete	5.60	5.00	4.85	5.59	5.95	5.83	5.68
120 cu.yd. coping concrete	11.50	8.00	12.00	15.00	14.00	6.70	13.50
3,000 cu.ft. concrete foundation columns	.60	.55	.90	.50	.95	.80	1.15
125 lin.ft. concrete railing	1.75	1.50	3.25	2.50	2.50	4 00	3.75
500,000 lb. reinforcing metal	.03	.03	.03	.035	.04	.045	.035
2,500 lin.ft. roadway construction	8.00	2.50	3.00	2.50	2.50	4 50	2.80
Ashland avenue bridge (fabrication and erection) (lump sum)	7,000 00	7,500 00	7,500.00	8,455.80	8,000.00	9.500 00	10,100.00
Controlling works road bridge (fabrication and erection) lump sum)	3,000.00	2,400 00	2,500.00	2,649.00	2,500.00	3,000.00	3,100.00
Controlling works foot bridge (fabrication and erection) lump sum)	1,500.00	1,400.00	1,500.00	1,584.00	1,500.00	1,600.00	1,900.00
Sector gates and collateral work (fabrication and erection) lump sum)	75,000.00	75,000.00	80,000.00	85,320.00	76,000.00	82,465 00	118,000.00
Miscellaneous work collateral to the controlling works (lump sum)	2,000.00	2,500.00	2,500.00	2,421.60	2,500.00	3,450.00	3,000.00
Miscellaneous work for transformer house and sewage discharge chamber (lump sum)	4,200.00	5,000.00	3,700.00	4,585.20	3,800.00	5,980.00	6,100.00
Electrical equipment (lump sum)	17,000.00	15,000.00	15,600.00	17,520.00	18,000.00	16,790.00	20,000.00
Ten-foot concrete sewer	30.00	25 00	30.00	40.00	30.00	37.85	36.40
Sewer junction (lump sum)	3,000.00	1,800.00	3,750.00	5,500.00	700.00	6,900.00	2,800.00
Additional structural steel, per lb	.05	.06	.0475	.052	.06	.043	.08
Additional machinery, steel and iron, per lb	.10	.14	.10	.108	.14	.09	.18
Additional steel castings, per lb	.09	.12	.09	.098	.12	.082	.16
Additional iron castings, per lb	.08	.07	.07	.077	.07	.063	.09
Additional bronze and babbitt, per lb	.75	.60	.55	.60	.60	.50	.75
Extended totals	$992,948	$828,822	$845,896	$1,049,448	$1,007,742	$1,041,391	$1,048,236

Section 14	I	J	K	L	M	N
550,000 cu.yd. glacial drift	$0.31	$0.35	$0.33	$0.30	$0.24	$0.247
85,000 cu.yd. solid rock	.78	.84	.85	.90	.64	.80
60,000 sq.ft. channeling	.33	.35	.35	.425	.24	.40
2,000 sq.yd. rip-rap slopes	1.25	1.28	2.50	1.10	1.25	2.50
7,000 cu.yd. number one concrete	7.90	7.00	7.50	8.00	9.00	7.50
80,000 cu.yd. number two concrete	5.00	4.60	5.00	5.55	5 95	5.00
120 cu.yd. coping concrete	11.00	7.20	10.00	10.00	15.00	12.00
3,000 cu.ft. concrete foundation columns	.75	.60	.50	.60	.50	.70
125 lin.ft. concrete railing	3.75	3.00	3.00	1.30	2.50	2.50
500,000 lb. reinforcing metal	.0325	.0275	.04	.03	.03	.035
2,500 lin.ft. roadway construction	2 70	2 00	2.00	2 00	2.25	2.00
Ashland avenue bridge (fabrication and erection) (lump sum)	8,154.00	8,850 00	10,000.00	8,000.00	6,375 00	8,400.00
Controlling works road bridge (fabrication and erection) lump sum)	2,588 00	2,575 00	3,000.00	2,500.00	1,900.00	2,800.00
Controlling works foot bridge (fabrication and erection) lump sum)	1,400 00	1,870 00	2,000.00	1,400 00	1,263.00	1,600 00
Sector gates and collateral work (fabrication and erection) lump sum)	78,040 00	96,440.00	75,000.00	87,000.00	77,770 00	80,000 00
Miscellaneous work collateral to the controlling works (lump sum)	2,247.00	2,780.00	3,500.00	3,500.00	2,143.00	2,742.00
Miscellaneous work for transformer house and sewage discharge chamber (lump sum)	4,957.00	6,210 00	7,000.00	6,000.00	3,453.00	4,400 00
Electrical equipment (lump sum)	17,000 00	15,000 00	15,000.00	15,500.00	16,060.00	16,000 00
Ten-foot concrete sewer	28 50	35 00	25.00	18.00	19.50	14,000.00
Sewer junction (lump sum)	29,95.00	3,000.00	3,500.00	1,500.00	1,000.00	3,000.00
Additional structural steel, per lb	.05	.06	.05	.06	.043	.06
Additional machinery, steel and iron, per lb	.12	.15	.09	.15	.09	.14
Additional steel castings, per lb	.12	.12	.10	.12	.082	.12
Additional iron castings, per lb	.08	.08	.07	.06	.063	.10
Additional bronze and babbitt, per lb	.70	.60	.55	.60	.50	60
Extended totals	$868,007	$874,174	$887,325	$923,522	$882,741	$844,644

CATALOG NOTICES

Tippett & Wood, Phillipsburg, N. J. Catalog. Water towers, stand pipes, etc. Illustrated, 62 pp., 5½x8½ in.

M. Smolensky Mfg. Co., Cleveland, Ohio. Catalog. Suction and check valves. Illustrated, 16 pp., 6x9 in.

The James Leffel & Co., Springfield, Ohio. Catalog No. 65. Steam engines and boilers. Illustrated, 32 pp., 8½x11 in.

Harrison Safety Boiler Works, Philadelphia, Penn. Pamphlet. "Finding and Stopping Waste in Modern Boiler Rooms by Use of Cochrane Meters." Illustrated, 68 pp., 6x9 in.

Union Iron Works, Hoboken, N. J. Catalog No. 34. Pile driving machinery. Illustrated, 126 pp., 7x10 in.

The Richardson-Phenix Co., Milwaukee, Wis. Bulletin No. 50. Phenix force feed lubricators. Illustrated, 12 pp., 8½x11 in. Bulletin No. 60. Richardson Model M sight feed oil pump. Illustrated, 20 pp., 8½x11 in.

Warren-Knight Co., 136 N. 12th St., Philadelphia, Penn. Booklet. "Facts Concerning Sterling Transits and Levels." Illustrated, 24 pp., 4x7 in.

The Foxboro Co., Foxboro, Mass. Bulletin No. 98. Recording gauges for all purposes. Illustrated, 40 pp., 8x10½ in.

The Gardner Governor Co., Quincy, Ill. Pamphlet. "Helpful Hints on Air Compressor Installations." Illustrated, 8 pp., 4x9 in.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1097. Power transformers. Illustrated, 24 pp., 8x10½ in. Bulletin No. 1636. Hydraulic turbines and accessories. Illustrated, 56 pp., 8x10½ in.

Contracts to Be Let

Bids received until Dec. 14, 1915.

Drainage Works

Tempe, Ariz.

The Board of Directors of Drainage District No. 1, of Maricopa County, Arizona, will receive sealed bids for the construction of the portion of the proposed drainage works, hereinafter particularly described, until 2 o'clock p.m., Tuesday, December 14, 1915, at the office of the Board, at Tempe, Arizona.

The portion of the work for which bids will be received consists:

First: Of a main open drain ditch, approximately 8.4 miles in length; the upper or Northerly portion thereof approximately 40,350 feet in length, having a depth of from 6 feet to 12.5 feet, and the lower or Southerly portion thereof approximately 4,000 feet in length, having a depth of from 6 feet to 1 foot.

Said ditch begins at a point about 100 feet South and 55 feet East of the Northwest corner of Section 35 in T. 1 N. R. 4 E. in Maricopa County, Arizona, and extends South to a point near the East quarter of Section 22 T. 1 S. R. 4 E.; thence in a Southwesterly direction to Culvert B 16 on the line of the Arizona Eastern Railroad.

Second: Eleven structures consisting principally of reenforced concrete to be installed at various points where the line of the proposed ditch intersects highways, canals and ditches.

The portions of the work above referred to are particularly described in the drawings and specifications therefor adopted by said Board, which are hereby referred to for a more particular description of the work.

Each bid must be submitted on form furnished by the Board for that purpose and accompanied by a certified check, payable to Alfred H. Oeltjen, Secretary of the Board, for 5% of the gross amount of the bid.

Drawings and specifications for the above work are on file and can be seen at the office of the Board and at the office of the Engineer, L. G. Knipe, 16 South Second Avenue, Phoenix, Arizona, and bidders may obtain sets of these upon application and payment of $10.00.

The bids will be opened at the office of the Board at 2:00 o'clock p.m., Tuesday, December 14, 1915, and the contract will be let to the lowest responsible bidder, but the Board expressly reserves the right to reject any or all bids, or any part of any bid.

Dated at Tempe, Arizona, November 12, 1915.

J. W. MILLER,
ALFRED H. OELTJEN,
I. M. SAYLOR,
Board of Directors, Drainage District No. 1.

Bids received until Dec. 11, 1915.

Aluminum Sulphate

OFFICE OF SUPERINTENDENT CITY WATER WORKS,
Room 112, City Hall.

Richmond, Va.

Sealed proposals will be received at this office until 12 M. December 11, 1915, for furnishing this department with aluminum sulphate, high basicity for water clarification, containing seventeen per cent. aluminum oxide, delivered f. o. b. Korah Station, Chesapeake and Ohio Railway, in barrels, at such time and in such quantities as the superintendent may require. Bidders are requested to bid on one, two and three years' contract. Estimated quantity eight hundred (800) tons per year.

Further information can be obtained at this office. The Administrative Board reserves the right to reject any or all proposals or any part of any or all proposals, also to increase or decrease the specified quantities twenty per cent.

A certified check for two hundred dollars, payable to the City Treasurer, must accompany each bid.

Proposals must be submitted in sealed envelopes, containing the name and address of the bidder, directed to the Administrative Board, and in the lower left-hand corner must be written "Proposals for Aluminum Sulphate."

Bond will be required on contract.

E. E. DAVIS, Superintendent.

Bids received until Dec. 21, 1915.

Mont Clare Bridge Over Schuylkill River

BETWEEN PHOENIXVILLE AND MONTCLARE, PENN.

Sealed proposals will be received by the Commissioners of Montgomery and Chester Counties, at the County Commissioners' Office, Norristown, Pennsylvania, until 10 A.M., December 21, 1915, for the construction of a reinforced-concrete arch bridge of five spans over the Schuylkill River, connecting Phoenixville and Mont Clare, Pennsylvania.

The plans and specifications including form of proposal and bond may be seen at the County Commissioners' Office, Norristown, Pennsylvania, and at the County Commissioners' Office at West Chester, Pennsylvania, and at the offices of "Engineering News" and "Engineering Record," in New York City.

Copies of the plans and specifications may be obtained from the Consulting Engineer, B. H. Davis, Whitehall Building, No. 17 Battery Place, New York City, upon deposit of Twenty-five ($25.00) Dollars, which sum will be refunded upon the return of all papers in good condition.

Each proposal must be accompanied by a certified check drawn to the order of the Commissioners of Montgomery and Chester Counties for the lump sum of Five Thousand ($5,000.00) Dollars, and by a guaranty signed by an acceptable surety company, in separate enclosures, that the bidder will, if awarded the contract, enter, within ten days, into a contract, and furnish satisfactory surety company bond for the construction of the bridge.

The certified checks of the unsuccessful bidders will be returned as soon as the contract is awarded. A satisfactory surety company bond for seventy-five (75%) per cent. of the contract price will be required of the successful bidder.

All regular proposals accompanied by certified checks and guaranties in separate enclosures, received at 10 A.M. will be publicly opened and the bids tabulated at 11 A.M., December 21, 1915, in the County Commissioners' Office, Norristown, Pennsylvania. The right is reserved to reject any and all bids or parts thereof not deemed to the advantage of the Counties.

JOHN N. JACOBS,
Controller of Montgomery County.
ISAAC Y. ASH,
Controller of Chester County.

Bids received until Dec. 8, 1915.

Mullica River Bridge

Atlantic City, N. J.

Sealed proposals will be received for building a bridge, 742 feet long, composed of creosoted pile trestle approaches, steel trusses and bascule draw span with wood block floor and concrete substructure, over the Mullica River at Chestnut Neck, near New Gretna, N. J., according to plans and specifications on file with the Engineers for Atlantic and Burlington Counties. The bids will be received by the Boards of Chosen Freeholders of the Counties of Atlantic and Burlington at the G. A. R. Hall, New York Ave., Atlantic City, N. J., at 12 o'clock noon on Wednesday, December 8th, 1915, and opened immediately thereafter.

Plans and specifications may be obtained from A. H. Nelson, Guarantee Trust Building, Atlantic City, N. J., or from James Logan, Mount Holly, N. J., by depositing $5.00. This sum will be refunded if plans and specifications are returned in good condition by 12 o'clock noon, December 9th, 1915, otherwise not.

The right is reserved to reject any or all bids.

A. H. NELSON,
Atlantic County Engineer.
JAMES LOGAN,
Chairman Atlantic County Bridge Committee.
Burlington County Engineer.
JOHN K. JOHNSON,
ALFRED I. DAVIS,
Director, Burlington County.

Construction News

NOVEMBER BUILDING RETURNS

Although normally at this time of the year building operations are usually light, this month's figures compiled from 65 cities all over the country, show that building permits filed practically double what they did a year ago last November. Our figures show that about $52,000,000 worth of permits were granted during last month against about $26,000,000 one year ago. During the first part of this year building permits were way below what they were a year ago. Our records for September show that we had about $57,000,000 permits less granted for the first eight months of the year than we did in 1914. November's figures show that we have caught up all this difference, and are now about $5,000,000 ahead of last year. The doubling of value of the permits granted is general all over the country, with the exception of the Western States which showed an increase of only about $350,000. Below is given a table of contemplated building operations from representative cities throughout the country.

EASTERN STATES

	Month of November		First Eleven Months of Year	
	1915	1914	1915	1914
Albany, N. Y.	$588,305	$301,578	$4,313,130	$5,864,278
Bridgeport, Conn.	490,973	364,859	7,980,974	3,487,332
Buffalo, N. Y.	788,000	498,000	10,897,000	10,362,006
Elizabeth, N. J.	166,609	98,388	1,050,081	1,313,415
Harrisburg, Penn.	84,275	34,000	.....	.....
Hartford, Conn.	707,709	399,385	5,285,305	3,759,876
Hoboken, N. J.	90,580	1,650	682,014	767,327
Jersey, N. J.	610,758	176,804	4,825,081	3,307,770
Newark, N. J.	641,385	373,427	7,822,132	9,165,777
New Bedford, Mass.	135,119	144,700	3,113,898	2,835,077
New Haven, Conn.	966,080	315,755	6,821,022	3,884,872
New York, N. Y.				
Bronx	3,107,900	314,750	25,897,950	20,045,343
Brooklyn	4,282,576	1,423,840	31,398,888	36,976,690
Manhattan	3,894,400	1,505,800	61,047,100	44,656,965
Queens	1,658,415	1,316,220	18,463,453	17,500,145
Passaic, N. J.	99,975	22,410	1,024,857	850,939
Paterson, N. J.	149,585	46,961	1,461,505	1,475,406
Philadelphia, Penn.	2,408,665	1,240,530	36,840,955	33,929,470
Pittsburgh, Penn.	663,312	777,368	10,341,414	14,721,582
Portland, Maine	115,200	77,050	1,519,329	1,136,295
Reading, Penn.	21,025	20,350	996,100	1,138,175
Rochester, N. Y.	817,254	397,830	8,458,833	8,369,658
Scranton, Penn.	322,164	88,852	1,693,264	1,640,757
Springfield, Mass.	650,050	179,502	5,455,391	4,707,532
Syracuse, N. Y.	608,324	235,365	4,302,321	2,693,570
Utica, N. Y.	151,035	95,300	2,022,570	1,707,795
Totals	$24,249,673	$10,362,474	$263,714,577	$236,298,052

SOUTHERN STATES

	Month of November		First Eleven Months of Year	
	1915	1914	1915	1914
Atlanta, Ga.	$284,647	$228,104	$4,330,180	$4,482,628
Birmingham, Ala.	121,904	76,710	1,708,926	3,042,943
Chattanooga, Tenn.	52,532	28,258	526,935	1,047,137
Ft. Worsh, T.s.	124,243	104,840	1,085,667	1,920,418
Houston, Tex.	179,461	76,912	1,595,814	3,372,531
Louisville, Ky.	246,030	139,900	3,596,915	4,201,415
Memphis, Tenn.	191,485	133,275	2,586,098	2,894,564
Norfolk, Va.	138,926	64,255	1,666,731	2,060,611
Richmond, Va.	275,251	130,638	2,959,565	3,070,843
Tampa, Fla.	100,335	54,361	.....	.....
Washington, D. C.	594,925	419,544	11,197,505	8,529,744
Totals	$2,309,739	$1,667,372	$31,254,336	$34,622,834

CENTRAL STATES

	Month of November		First Eleven Months of Year	
	1915	1914	1915	1914
Akron, Ohio	$535,105	$171,585	$4,281,170	$3,597,580
Canton, Ohio	138,250	43,675	1,844,690	1,557,415
Chicago, Ill.	10,861,600	6,513,150	88,152,280	77,048,060
Cincinnati, Ohio	790,965	336,210	12,198,679	8,576,113
Cleveland, Ohio	2,434,715	2,153,645	29,590,699	26,092,185
Columbus, Ohio	347,350	377,385	4,819,995	5,889,861
Davenport, Iowa	33,143	57,075	.....	.....
Duluth, Minn.	204,371	189,510	2,540,893	2,798,828
Evansville, Ind.	277,383	57,086	1,316,025	1,270,390
Grand Rapids, Mich.	335,325	171,425	2,544,217	3,496,169
Indianapolis, Ind.	438,823	265,190	6,550,188	7,573,348
Kansas City, Kan.	86,802	50,435	926,654	1,039,138
Kansas City, Mo.	724,115	341,220	10,074,880	9,980,370
Milwaukee, Wis.	1,132,925	591,583	11,588,596	9,390,511
Minneapolis, Minn.	1,539,225	703,615	16,054,831	14,693,125
Oak Park, Ill.	359,420	216,140	3,033,233	2,158,880
Omaha, Neb.	656,075	133,583	4,937,175	4,393,981
Peoria, Ill.	197,575	600,200	.....	.....
St. Louis, Mo.	782,943	650,029	10,800,043	12,188,618
St. Paul, Minn.	619,701	710,697	9,861,934	14,148,642
Toledo, Ohio	535,750	276,676	7,364,249	5,945,237
Youngstown, Ohio	203,790	79,275	2,463,242	2,817,816
Totals	$23,135,351	$12,689,398	$204,312,673	$214,676,267

WESTERN STATES

	Month of November		First Eleven Months of Year	
	1915	1914	1915	1914
Denver, Colo.	$312,085	$134,410	.....	.....
Los Angeles, Calif.	1,000,239	785,310	10,999,699	16,631,242
Oakland, Calif.	315,767	281,769	4,556,420	4,340,945
Salt Lake City, Utah.	156,705	107,232	2,091,260	2,811,796
Spokane, Wash.	46,475	55,880	1,165,977	965,347
Tacoma, Wash.	140,305	270,655	800,116	2,116,251
Totals	$1,971,576	$1,635,256	$19,613,472	$26,865,581

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

New York—International Railway, Buffalo, applied to City Council for franchise to build a double-track extension on Washington St., between Ohio and Perry St., and on Ohio St., between Washington and Main St.

Pennsylvania—Harrisburg Traction Co. granted right-of-way by Council of East Berlin for a trackless trolley line between East Berlin and Dover. D. B. Noist, Harrisburg, Ch. Engr.

Pennsylvania—Slate Belt Electric Street Railway Co., Penn Argyl, contemplates 15 miles of new line from Wind Gap to Stroudsburg, Penn., during 1916. W. J. Mutton, Penn Argyl, Ch. Engr.

West Virginia—Manns Creek & Meadow River Co., recently incorporated with $100,000 capital stock, plans to build a railway from Chesapeake & Ohio Railway on east side of New River to Russellville, W. Va., about 10 or 15 miles. H. B. Smith, Charleston, interested.

North Carolina—Big Sandy & Cumberland R.R. contemp plates line from Matney, N. C., to Grundy, Va., 10 miles. G. W. Litz, Gen. Mgr., Columbus, Ohio.

North Carolina—Roanoke River Ry. plans line from Townsville, N. C., to some point on Southern Ry., about 11 miles. G. W. Marrow, Pres. and Gen. Mgr., Townsville, N. C.

Georgia—Flemington, Hinesville & Western R.R. Co. plans to construct a railway from Hinesville to Glennville, Ga., about 22 miles. J. B. Way, Hinesville, Pres. and Gen. Mgr.

Georgia—Ocilla Southern R.R. having surveys made for extension line from Perry to Macon, about 30 miles. D. C. Smith, Ocella, Ga., Gen. Mgr.

Florida—Birmingham, Columbus & St. Andrews Ry. Co. plans extensions from Chipley to Graceville, Fla., 12 miles, and from Southport to Bunkers Cove, Fla., 23 miles. J. M. Owsley, Chipley, Fla., Audr. and R. D. Reeder, Chipley, Supery.

Louisiana—Gulf, Sabine & Red River R.R. contemplates 35-mile extension of its line in Louisiana. This line is owned by the Lutcher & Moore Lumber Co., Orange, Tex.

Louisiana—New Iberia & Northern R.R. contemplates line from Oakland to New Orleans, La., 93 miles, from Port Barre, La., to Sabine River, 107 miles, with branches to salt mines at Weeks and Avery Islands. R. J. Lockwood, New Iberia, La., Vice-Pres. and Gen. Mgr.

Louisiana—Vicksburg, Alexandria & Southern Ry. contemplates extension from Thomas to Harrisonburg, La., about 50 miles. A. D. Alderson, Alexandria, La., Gen. Mgr.

Tennessee—Nashville Railway and Light Co. plans to build a branch line from the 19th St. line between Lillian and Rothschild St. into Shelby Park, Nashville. J. P. W. Brown, Nashville, Ch. Engr.

Kentucky—Kentucky Midland R.R. Co. plans to build an extension from Summers to Dawson Springs, via Earlington, Ky., about 22 miles. M. M. Wheeler, Central City, Gen. Mgr. and Asst. Treas.

Illinois—A movement is being agitated to have the Illinois Traction System construct a railway from Edwardsville east to Marine and Highland.

Illinois—Belleville & Mascoutah Traction Co. plans to construct about 10 miles of single-track line between Belleville and Mascoutah, Ill., during 1916. David O. Thomas, Belleville, Engr.

Iowa—Tri-City Railway and Light Co., Davenport, contemplates building an extension into the territory southeast of Moline. B. J. Denman, Davenport, Vice-Pres.

Kansas—Ft. Scott & Pittsburg Ry. plans to build a line from Ft. Scott to Pittsburg, about 36 miles. Proposed line will connect Ft. Scott, Garland, Arcadia, Mulberry, Frontenac and Pittsburg. H. A. Cooper, Redfield Bldg., Act. Secy.

Kansas—Lawrence, Topeka & Western R.R. Co., recently incorporated with $100,000 capital stock, will build electric railway from Lawrence to Topeka, Kan. W. R. Stubbs, interested.

South Dakota—John Rosholt, Minneapolis, Minn., is interested in project to build railway from Bruton, S. D., to Ortonville, Minn.

Missouri—Kansas City, Ozark & Southern Ry. contemplates extension of about 30 miles. John W. Byng, Ava, Mo., Audr. and Gen. Mgr.

Texas—Altus, Lubbock, Roswell & El Paso R.R. Co. contemplates line from Lubbock to Memphis, Tex., about 100 miles. E. C. Noble, Houston, Tex., Pres. and Gen. Mgr.

Texas—Asherton & Gulf Ry. plans to extend line from Asherton to Eagle Pass, Tex., 52 miles. L. V. Richardson, Asherton, Tex., Pres. and Gen. Mgr.

Texas—Beaumont Traction Co. plans to extend its Sabine St. line on Doucette St. to Grove St., Beaumont. E. J. Emerson, Beaumont, Gen. Supt.

Texas—Jefferson & Northwestern Ry. Co. abandoned plan to build line to Naples, Tex., and will construct extension to Kildare on Texas & Pacific Ry., about nine miles. H. B. Montgomery, Jefferson, Ch. Engr.

Texas—Marlin-Temple Interurban Promotion Co., recently organized, plans to promote the construction of an interurban railway from Marlin to Temple. S. D. Hanna, Temple, Ch. Engr. Noted Sept. 30.

Texas—Marshall & East Texas Ry. plans to build extension from Winnsboro to Paris, 60.5 miles, and from Elysian Fields to the Sabine River, 98 miles. V. Snyder, Marshall, Vice-Pres. and Gen. Mgr. Noted Aug. 19 and Dec. 2.

Texas—Trinity Valley & Northern Ry. plans to build extension from Lumm to Lamb, Tex., about nine miles. A. J. Wise, Houston, Ch. Engr.

Oklahoma—Clinton & Oklahoma Western Ry. plans extension from Clinton to Colony, about 30 miles. W. S. Haid, Gen. Mgr., Clinton, Okla.

Oklahoma—Henryetta, Oklahoma & Western Ry. Co. will build from Henryetta to Krusa, Dewar and other towns. R. D. Long, Muskogee, Okla., interested. Noted Oct. 14 and Nov. 18.

Oklahoma—It is reported that Indian Territory Illuminating Oil Co., Bartlesville, Okla., will have surveys made for interurban railway from Bartlesville to Pawhuska, Okla., about 20 miles.

Oklahoma—Oklahoma Ry. Co. contemplates extending line from Edmond to Guthrie, Okla., 15½ miles. George W. Knox, Oklahoma, Okla., Second Vice-Pres. and Gen. Mgr.

Oklahoma—Plans being considered by Oklahoma Union Traction Co., Tulsa, for 15 miles of interurban line between Tulsa and Sapulpa during 1916. G. B. Small, Tulsa, Ch. Engr.

Utah—Utah Light and Railway Co. , Salt Lake City, applied for permission to extend its Capitol Hill line. G. H. Robinson, Deseret Bldg., Pur. Agt.

Oregon—Oregon-Washington R.R. & Navigation Co. and Oregon Short Line R.R. will change main line from Blalock to Coyote, Ore., by straightening curves and lowering grades, 36 miles. Estimated cost, $500,000. J. R. Holman, Portland, Ch. Engr. of Oregon-Washington R.R. & Navigation Co.

California—Plans of City Engineer for Church St. municipal railway between 18th and 22d St. of Municipal Railways of San Francisco approved by Board of Public Works. Proposed line will run through Mission Park from 18th to 20th St. over right-of-way acquired by city between 20th and 22d St. T. A. Cashin, San Francisco, Supt. and Claim Agt.

California—San Diego Electric Railway Co. plans to extend its line on University Ave. to Euclid Ave. William Clayton, Vice-Pres. and Gen Mgr.

Ontario—Plans being considered for hydro-electric railway from river front, Sombra, to all points from Wallaceburg to Sarnia. W. A. Scott, Bickford, Clk.

Bids In and Contracts Awarded

Virginia—Richmond, Rappahonnock & Northern Ry. awarded contract to CENTRAL CONSTRUCTION CO., Harrisburg, Penn., for line from West Point to Urbanna, Va., 17 miles. C. L. Ruffin, 514 American National Bank Bldg., Richmond, Ch. Engr. Noted Nov. 25.

South Carolina—Atlantic Coast Line R.R., Walterboro, awarded contract for extension of Hollywood Spur, 4½ miles, to W. Z. WILLIAMS CO., Macon, Ga. J. E. Willoughby, Wilmington, N. C., Ch. Engr.

Florida—Florida East Coast Railway Co. has awarded contract for grading extension of Okeechobee Division from Maytown, Fla., to a connection with main line at New Smyrna, 17.25 miles, to J. M. COOK, Jacksonville. Bridge work and track laying will be done by company forces. Estimated cost, $200,000. E. B. Carter, Ch. Engr.

Kentucky—Cumberland & Manchester R.R. awarded contract for southern end of its line from Barbourville to Manchester, Ky., to READ CONSTRUCTION CO., Philadelphia, Penn. Noted Nov. 25.

Arkansas—Ozark Valley Railway has awarded contract for line from Rothville to Mountain Home, about 10 miles, to BLODGETT CONSTRUCTION CO., Kansas City, Mo. K. V. Loba, Mountain Home, Pres. Noted Sept. 16 and 30.

Texas—Gulf, Colorado & Santa Fé Ry. awarded contract to L. J. SMITH CONSTRUCTION CO., Kansas City, Mo., for grading 23½ miles of Gulf & Interstate Ry. from High Island to Port Bolivar. F. Merritt, Ch. Engr., Galveston, Tex. Noted Nov. 11.

California—(Official)—Bids received Nov. 26 by Board of Public Works for railway from Roasasco into Hetchy Hetchy reservoir, about 67 miles, were as follows: F. ROLANDI 550 Montgomery St., San Francisco, $1,543,080 (awarded contract); McArthur Bros. & Co., and Mason & Hanger Co., 1015 Chronicle Bldg., San Francisco, $1,955,062; Utah Construction Co., Phelan Bldg., San Francisco, $1,800,925. M. M. O'Shaughnessy, San Francisco, City Engr. Noted Oct. 21 and Nov. 11.

LIGHT, HEAT AND POWER

Maine, Biddeford—City Council contemplates municipal electric-light plant.

Mass., Foxboro—Foxboro Gas Co. will lay about eight miles of pipe line to furnish gas to Foxboro. E. F. Draper, Boston, Dir.

Mass., Westfield—At recent town meeting sum of $14,000 was appropriated for new boiler and other improvements to electric-light plant. Noted Aug. 5 and 12.

N. Y., Albany—(Official)—Bids will be received by the Trustees of Public Buildings, Executive Chamber, Capitol, until 3 p.m., Dec. 22, for electric fixtures and equipment for Senate Chamber, Capitol. Lewis F. Pilcher, Albany, State Arch. (See adv.)

N. Y., Batavia—Genesee Light and Power Co., of Batavia will issue $10,000 bonds, $5,605 of which will be used for electric distribution system in Elba Village. Noted Nov. 4.

N. Y., Buffalo—Atlas Works of Standard Oil Co. will build boiler house at Elk St. and Buffalo Creek Terminal R.R. Estimated cost, $15,000.

N. Y., New York—(Borough of Bronx)—(Official)—Bids will be received by J. B. Snyder, Supt. of School Bldgs., Park Ave. and 59th St., until 4 p.m., Dec. 19, for alterations and repairs to heating and ventilating apparatus in Public School No. 2, Third Ave. near 169th St.

N. Y., New York—(Borough of Brooklyn)—(Official)—Bids will be received by C. J. B. Snyder, Supt. of School Bldgs., Park Ave. and 59th St., New York, N. Y. (Borough of Manhattan), until 4 p.m., Dec. 13, for installing heating and ventilating apparatus and temperature regulation in additions to and alterations in Public School No. 89, Newkirk Ave. between East 31st and East 32d St.

N. Y., New York—(Borough of Queens)—(Official)—Bids will be received by Maurice E. Connolly, Borough Pres., Borough Hall, Fifth St. and Jackson Ave., Long Island City, until 11 a.m., Dec. 10, for furnishing labor and material for electric-lighting system in Jamaica Town Hall.

N. J., South Orange—Civic Association is negotiating with Board of Trustees for the establishment of municipal electric-light plant.

Penn., Philadelphia—See item under "Industrial Works."

Md., Port Covington—(Baltimore post office)—Plans prepared for boiler house, screening shed and other improvements at Port Covington for Western Maryland R.R.

N. C., Granite Falls—Comstock Electric Co., High Point, retained by city to prepare plans and install electric-light system in Granite Falls.

Ga., Davisboro—Plans prepared by W. Hopson Goodloe, American National Bank Bldg., Macon, for an electric-light plant.

Ala., Georgiana—Bids will be received until Apr. 1 by J. R. Bennett, Secy., McGowin-Bennett Milling Co., for electric plant in feed mill to develop 100-hp. Estimated cost, $10,000.

Ohio, Elyria—Lorain County Electric Co. plans to extend its high tension transmission system. J. B. Johnson, Gen. Mgr.

Ill., Aurora—See item under "Water-Works."

Ill., Poplar Grove—Plans being considered by Illinois Northern Utilities Co., Dixon, for transmission line from Capron to Poplar Grove.

Wis., Monticello—Citizens voted $12,000 bonds for municipal electric-light plant.

Iowa, Des Moines—Des Moines Electric Co. has applied to City Council for permission to build a 44,000-volt high-tension transmission line from power plant to east city limits.

Kan., Oakland—Citizens contemplate installation of electric-light system.

Neb., Imperial—James Hoke is interested in a project to construct an electric power plant on Frenchman River.

Neb., Valley—Plans being considered by Platte Valley Power Co. for extending transmission lines to Arlington and other towns.

S. D., Bruce—Franchise granted to Weibers & Schulz by Board of Trustees for electric-light system.

N. D., Bisbee—Press reports state that City Council has granted 20-year franchise to an electric company to build and operate electric-light system in Bisbee.

N. D., Napoleon—J. F. Jacobs, Bismarck, interested in project to construct electric-light plant in Napoleon.

Wyo., Wheatland—City plans to improve municipal electric-light plant. Estimated cost between $6,000 and $10,000.

Mo., Crocker—Franchise granted to Crystal Ice and Bottling Co., Crystal, to install electric-light plant.

Ark., Batesville—Arkansas Light and Power Co. plans to secure contract from Government to utilize power from Lock and Dam No. 1 at Batesville.

Tex., Houston—National Oil and Gas Co. will build a 22-mile pipe line.

Tex., Roswell—Roswell Gas and Electric Co. will install large steam turbine and make other improvements to its plant. Estimated cost, $20,000.

Tex., Victoria—City Council granted franchise to Columbus Gas Construction Co., Milwaukee, Wis., to build gas plant. P. J. Sult, Pres. Noted Nov. 25.

Tex., Windom—Texas Power and Light Co. will install street-lighting system in Windom.

Okla., Goltry—Election will be held Dec. 21 to vote on $11,500 bonds for municipal electric-light plant. Noted Oct. 14.

Okla., Heavener—City will use part of proceeds of bonds for $20,000 recently voted by citizens for municipal electric-light plant to purchase plant of Heavener Light and Power Co., for $9,325, and expend about $6,000 for improvements. Noted Dec. 2.

Colo., Liberty—Plans being considered for municipal electric-light plant.

Idaho, Hailey—Richard W. Ferris granted franchise to install and operate an electric-light plant and water system in Hailey.

Idaho, Pocatello—City plans to extend street-lighting system. Estimated cost, $35,000. J. H. Giles, City Engr.

Utah, Monticello—Stockholders of Blue Mountain Irrigation Co. plan to install electric-light plant and water system in Monticello.

Ariz., Prescott—Power house will be constructed on Fossel Creek by Arizona Power Co. and new transmission lines built. Estimated cost, $300,000. M. W. Watson, Prescott, Mgr.

Ore., Sublimity—Franchise granted C. E. Taylor of Slayton Electric Light Co., Slayton, to install and operate electric-light and power system for a period of 25 years.

Calif., Los Angeles—Plans being prepared by F. L. Roehrig, Arch., American Bank Bldg., for sub-station for Aqueduct Power Board. Estimated cost, $50,000.

Que., Sherbrooke—City Council considering plans for improvement of electric-light plant and system. C. E. Gatien, City Clk.

Ont., Huntsville—Town Council has decided to remodel electric-light plant and construct new substation. T. M. Cullon, Town Clk.

Man., The Pas—See item under Sewers.

Bids In and Contracts Awarded

Conn., New London—Contract awarded to H. R. DOUGLAS, INC., 376 Bank St., New London, for one-story, 45x71-ft. power house for Shore Line Electric Co. Estimated cost, $15,000. Noted Aug. 29.

N. Y., Binghamton—Ansco Co., manufacturer of photographic supplies, awarded contract to J. G. WHITE ENGINEERING CORPORATION, 43 Exchange Pl., New York, for extensions and improvements to its power plant.

N. Y., New York—(Borough of Queens)—Board of Education received bids Dec. 6 for installing heating and ventilating system in Public School No. 93, Forest Ave. between Woodbine and Madison St., from Wells & Newton Co., Ave. B and 17th St. (Borough of Manhattan), $66,983; Daniel J. Rice, $67,500; E. Rutzler Co., $69,181.

N. Y., Tonawanda—General Electric Co., Buffalo, awarded contract for power plant at Tonawanda to STONE & WEBSTER ENGINEERING CORPORATION, Boston, Mass. Noted Dec. 2.

N. J., Jersey City—Contract for heating system in new county jail awarded to W. H. & F. W. CRANE, New York, N. Y., at $93,000; electrical work to PLAT & POWERS, New York, N. Y., at approximately $9,000.

Penn., Lebanon—School Board awarded contract to B. F. CARPENTER CO., at $24,440 for installing heating and ventilating system in new high school.

Penn., Pittsburgh—Contract for two turbo generators of total capacity of 75,000 hp. to be installed at power station on Brunots Island awarded to WESTINGHOUSE ELECTRIC AND MFG. CO. by Duquesne Light Co. Estimated cost, $2,500,000.

Penn., Wilkes-Barre—Contract awarded to JOHN CURTIS CO. for one-story, 40x80-ft. boiler house for City Hospital. Estimated cost, $30,000.

Md., Baltimore—Contract for heating and ventilating plant for Guilford School awarded to WALTER E. HILL & CO., at $7,590.

Ala., Florence—Lauderdale Power Co. has awarded contract for power house and dam on Cyprus Creek to ALLENTOWN CONSTRUCTION CO.

Mich., Detroit—Contract awarded to FULLER CO., Penobscot Bldg., Detroit, for 10-story, 120x150-ft. power plant for Murphy Power Co.

Iron Mountain, Mich.—Contract for addition to power house of Peninsular Power Co. awarded to G. A. GUSTAFSON. Noted Supt. 23.

Wis., Appleton—Contract for furnishing 1,000 tons of structural steel for new power house of Wisconsin Traction, Light, Heat & Power Co. awarded to LACKAWANNA BRIDGE CO., Buffalo, N. Y. Noted Aug. 19 and Nov. 11.

Tex., El Paso—Contract for wiring new courthouse, auditorium and jail awarded to NATIONAL TELAGRAPHONE SUPPLY CO., El Paso, at $16,000.

Wash., Spokane—Contract awarded to P. J. DOWLING & CO., Spokane, at $7,000 for heating and plumbing in monastery for Poor Clare Sisters.

BRIDGES

Proposed Work

Mass., Lawrence—A $300,000 bond issue authorized by City Council for work on Central Bridge.

Conn., Ansonia—Plans being considered by city of Ansonia and Derby for rebuilding Division St. bridge with concrete structure. Estimated cost, $16,000.

N. Y., Fairfield—According to press reports bridge will be built across Maultanno Brook next year. C. N. Richardson, Fairfield, interested.

N. Y., Little Falls—Canal Board approved plans for highway bridge over Mohawk River at Little Falls. Estimated cost, $59,339. Frank M. Williams, State Engr. and Survr.

N. J., Newark—Board of Chosen Freeholders plans to appropriate $20,000 for repairing county bridges. S. Reimer, County Engr.

N. J., New Brunswick—Bids will be received by Board of Chosen Freeholders until Dec 13 for reinforced-concrete slab bridge over Tennents Brook on South Amboy-Bordentown Turnpike. Noted Dec. 2.

Penn., Camptown—Bids will be received by David A. Keefe, Consult. Engr., Athena, until 2 p.m., Dec. 14, for state bridge across Wyalusing Creek at Camptown.

Penn., Lewistown—(Official)—Bids will be received by Commissioners of Mifflin County, Courthouse, until 11 a.m., Dec. 18, for bridge over Jacks Creek at Sigler's Fording, Derry Township.

Penn., Philadelphia—Bids will be received until Dec. 14 by George S. Webster, City Engr., City Hall, for Diamond St. bridge over connecting railway. Estimated cost, $75,000.

Penn., Phoenixville—(Official)—Bids will be received by Commissioners of Montgomery and Chester Counties, Norristown, until 10 a.m., Dec. 21, for reinforced-concrete bridge across Schuylkill River between Phoenixville and Mont Clare. (See adv.)

Va., Pembroke—Press reports state that $8,400 has been appropriated by Commissioners of Giles County for bridge over New River. Norfolk & Western Ry. will also appropriate $10,000 toward cost.

Ga., Roswell—Bids will be received by Commissioners of Cobb and Fulton Counties, Fulton Comn. Rooms, Atlanta, until Dec. 21, for bridge across Chattacoochee River at Roswell. Estimated cost, $6,000. Noted Oct. 28 and Dec. 2.

Fla., Clearwater—(Official)—Pinellas County will build two-mile bridge from Clearwater to Clearwater Key under supervision of E. W. Parker, Curry Bldg. Estimated cost, $115,000. Noted Nov. 25.

Fla., Cocoa—Election will soon be held to vote on $65,000 bonds for bridge across Indian River to Merritts Island.

Ala., Birmingham—Plans being considered by Board of Revenue of Jefferson County for bridge over Valley Creek between Rock Creek and Oak Grove.

Ohio, Akron—See item under "Miscellaneous."

Ohio, Miamisburg—Contract will soon be awarded for new bridge over Miami River at Sycamore St.

Ohio, St. Clairsville—(Official)—Bids will be received by M. W. Hopkins, Audr. of Belmont County, until 1 p.m., Dec. 20, for repairing Union St. bridge.

Ohio, Youngstown—An expenditure of $8,500 authorized by City Council for painting and repairing Spring Common and Center St. viaduct.

Mich., Detroit—Plans will be prepared for temporary and permanent Belle Isle Bridge. R. H. McCormick, City Engr. Noted Sept. 16 and No. 4.

Ill., Bloomington—Bids will be received at Court House until 2 p.m., Dec. 18, for Becker Bridge in Lexington Township. Estimated cost, $13,690.

Wis., Milwaukee—Plans being considered for bridge across Upper Milwaukee River at State St. J. C. Pinner, Jr., Supt. of Bridges and Pub. Bldgs.

Iowa, Des Moines—Plans being prepared by E. L. Masqueray, Engr., 595 Endicott Bldg., St. Paul, Minn., for concrete bridge. Estimated cost, $40,000.

Neb., David City—Bids will be received until 2 p.m., Dec. 16, by Board of Commissioners of Butler County, for bridge work during 1916.

Mont., Missoula—Bids will be received until Dec. 18 by Commissioners of Missoula County for steel bridge across Hell Gate River at Turah.

Mo., Kansas City—Harrington, Howard & Ash Engineering Co. commissioned by Board of Public Works to prepare plans for 23d St. traffic way viaduct. Estimated cost, $40,000. Curtis Hill, City. Engr.

Okla., Miami—Contract will soon be awarded for bridge across Upper Horse Creek. Bonds for $85,000 recently voted for bridge work.

Okla., Purcell—Election will be held Dec. 21 to vote on $100,000 bonds for bridge work in McClain County. Noted Dec. 2.

Ariz., Globe—Bids will be received until noon, Dec. 16, by Mayor and City Council, for reinforced-concrete bridge across Pinal Creek. R. A. Smith, City Engr.

Ariz., Miami—Election will be held Dec. 14 to vote on $17,500 bonds for bridges.

Wash., La Center—W. A. Schwarz, County Engr., preparing plans for bridge over Lewis River at La Center. Estimated cost, $10,000.

Ore., Portland—Holgate St. viaduct will be constructed by Southern Pacific Co. Estimated cost, $55,000.

Bids In and Contracts Awarded

Mass., Boston—(Official)—Contract for concrete bridge over Charles River at North Beacon St. awarded to A. C. TOMASELLO, 69 Gibson St., Dorchester, at $117,352. Noted Nov. 11 and Dec. 2.

R. I., Woonsocket—Contract for two bridges on Hamlet Ave. awarded to E. W. FOLEY CONTRACTING CO., New York, N. Y., at $71,886, and one bridge on Fairmont St. to SPAULDING CONSTRUCTION CO., Suffield, Conn., at $21,812. Noted Aug. 26 and Oct. 28.

N. Y., New York—(Hollis)—(Borough of Queens)—Contract for steel for bridge across Farmers Ave., Hollis, for Long Island R.R. awarded to AMERICAN BRIDGE CO., 30 Church St., New York, N. Y. Estimated cost of substructure, $16,800; superstructure, $65,800. J. R. Savage, Ch. Engr.

Penn., Reading—Contract for two reinforced-concrete bridges for Philadelphia & Reading Ry. awarded to JOHN DONAGHUE, Mahonoy City.

La., New Orleans—Contract for viaduct at West End Lake Shore Park awarded to MIDLAND BRIDGE CO., Kansas City, Mo., at $7350. Noted Oct. 28 and Nov. 25.

Ohio, Steubenville—All bids received Oct. 15 by Commissioners of Jefferson County for reinforced-concrete bridge on State Rd. in Springfield Township rejected. Noted Sept. 13.

Kan., Iola—Contract for three bridges awarded to CANTON BRIDGE CO., Canton, Ohio, at $9,240, $10,150 and $10,040, respectively. Noted Oct. 21.

Tex., Canadian—Contract for bridge across Canadian River awarded to CANTON BRIDGE CO., Kansas City, Mo., at $71,000. Noted Aug. 12 and Sept. 16.

Okla., Bartlesville—Contract for bridge work in Washington County awarded to ROCHESTER BRIDGE CO., as follows: Two bridges across Big Caney at $10,125 and $13,825, respectively; one bridge across Curl Creek at $5,150; nine small bridges at $22,125. J. G. Mitchell, County Clk.

Okla., Chickasha—Contract for bridge across South Canadian River awarded to CANADIAN VALLEY BRIDGE CO., at $60,000. P. E. Colby, City Engr. Noted Oct. 14.

Idaho, Caldwell—Contract for bridge across Boise River at Caldwell awarded to MISSOURI VALLEY BRIDGE AND IRON CO., Leavenworth, Kan., at $18,580. F. H. McConnell, County Engr. Noted Nov. 11.

Wash., Seattle—P. Manson, 2407 Boylston Ave., N., Seattle, at $5,787, submitted lowest bid for 23d Ave. bridge.

Calif., Sacramento—(Official)—Low bids received Nov. 24 by State Highway Commission for plate girder bascule bridge near easterly side of Yolo By-Pass were as follows: Ross Construction Co., Sacramento, $26,949; C. E. Lamburth, San Francisco, $25,800; Security Construction Co., Los Angeles, $24,671. Noted Nov. 11.

WATER-WORKS

Proposed Work

Maine, Wilton—City granted authority by Maine Public Utilities' Commission to issue $8,000 bonds for installing new intake, screen chamber and new pipe.

R. I., Cranston (Providence post office)—Bids will be received until Dec. 22 for making wash and core borings. Walter B. Chafee, City Clk.

N. Y., Rochester—City will lay about 16½ miles of 37-in. c.-i. water mains next year. F. D. Elwood, City Engr. Noted Sept. 30.

N. J., Atlantic City—Surveys being made and plans being prepared for 20-in. high-pressure water main with 12-in. laterals under board walk. L. Van Gilden, Ch. Engr. and Supt. of Bureau of Water.

N. J., Jersey City—Bids were not received Dec. 2 by City Commission as stated previously, for the construction of pipe line from Hackensack River to Brookdale. Revised plans will be prepared and new bids called. Estimated cost, $1,000,000. Noted Nov. 4.

Penn., Waynesboro—Waynesboro Water Co. employed Chester & Fleming, Pittsburgh, Engr., to make investigation and report regarding extension and development of water supply. Noted Oct. 7.

Ga., Lumpkin—City plans to remove water works from present location to site of electric-light plant to consolidate same. Work will include construction of reservoir and drilling a deep well. W. M. Crook, Macon, Ga., Engr.

Ga., Savannah—Report submitted to Water Committee of City Council by E. R. Conant, Ch. Engr., estimating cost of improving water system at about $200,000. Noted Sept. 30.

Ala., Gadsden—Press reports state that Gulf States Steel Co., Birmingham, will build water waste reservoir and also install high-pressure fire pump. Estimated cost, $15,000.

La., Donaldsonville—A proposition has been submitted to the Water and Light Commission by the National Water Purification Co., Dallas, Tex., to install filtration plant at an estimated cost of $4,500.

Ky., Flemingsburg—Preliminary plans being prepared by C. H. Babbitt, Engr., Columbus, Ohio, for municipal water system. Estimated cost, $10,000. Noted Oct. 28.

Ohio, Chardon—Chardon Water Works Co. plans to extend water mains five miles. C. H. Felton, 731 Williamson Bldg., Cleveland, Engr.

Ohio, Geneva—A private company contemplates constructing water works at Geneva in spring. Estimated cost, $8,000. M. C. Goddard, Engr.

Ohio, Hamilton—Bids will be received by S. D. Nelson, Supt. of Water Wks., until Dec. 14, for three 10-in. wells and intake for water works system. Joseph B. Meyers, Dir. of Pub. Ser. Noted July 29.

Ohio, Idlewood (Warrensville post office)—Bids will be received by John Howard, Village Clk., until noon, Dec. 13, for 6-in. water main in Friedel Rd.

Ohio, South Charleston—Bids will be received by W. L. Wentz, Village Clk., until Dec. 14, for water system.

Ind., Lakeville—Citizens defeated bonds for water works system.

Ind., Mishawaka—Board of Public Works will extend water system. Estimated cost, $16,000.

Mich., Albion—Bids will be received by City Clerk until Dec. 15 for pumping station and boiler house for water system.

Mich., Hamtramck—City will extend water mains in Charest Ave. and McDougall St. from Caniff to Carpenter Ave. and in McDougall St. from Stuart to Carpenter Ave. J. C. Schulthesis, Village Clk.

Ill., Aurora—Plans being considered by city for improving pumping station and power plant. Estimated cost, $75,000.

Ill., Chicago—(Oak Park)—Board of Local Improvements plans an expenditure of $34,066 next year for water mains and water service pipe.

Ill., Decatur—Contract will be awarded about Jan. 15 for 10,000 ft. 6-in. water mains in Homestead Pl. P. T. Hicks, City Engr.

Wis., Kenosha—Bids will be received by Board of Water Commissioners until Dec. 20 for water plant on Washington Island, including pumping station, filtration plant and equipment. Estimated cost, $250,000.

Wis., Madison—Board of Regents of University of Wisconsin plans to expend $30,000 for an electrically operated pumping station.

Minn., Rochester—Citizens will vote on bonds for water system.

Kan., Emporia—Citizens will hold election Dec. 28, to vote on $150,000 bonds, for water-works system. Black & Veatch, Kansas City, Mo., Engr. Noted Dec. 2.

Kan., Hiawatha—See item under "Streets and Roads."

Mont., Great Falls—Election will be held in January to vote to issue bonds for filtration plant at water works.

Mo., Cardwell—Citizens voted at recent election $5,000 bonds for water-works system.

Mo., Lees Summit—Bids will be received by city until Dec. 15, for pipe, valves, tower and tank, pump, concrete reservoir and brick pump house. Kent & Lowery, 715 Reserve Bank Bldg., Kansas City, Engr.

Mo., Steelville—Citizens planning to install water works system.

Mo., Summit—Bids will be received about Dec. 15 for municipal water system. Estimated cost, $46,000. Henrici, Kent & Lowry, Consult. Engr., 715 Reserve Bank Bldg., Kansas City.

Tex., Cleburne—City plans to construct water system. Estimated cost, $25,000.

Tex., Ft. Worth—Holman & Laird submitted report, estimating cost of perfecting city water system at $300,000, including completion of conduit from Lake Worth doing away with artesian well system, abolishing North Side water-works, providing proper filtration and improving dual water system.

Tex., Galveston—Election will soon be held to vote on $200,000 bonds to repair, restore or submerge water mains across Galveston Bay.

Tex., Oak Cliff—(Dallas post office)—City Commission authorized purchase of 8,000 ft. of 16-in. water pipe and 6,000 ft. of 12-in. water pipe.

Tex., Palestine—Citizens plan purchase of present water-works system, or construction of new municipal plant. J. W. Sammons, Engr.

Tex., Pampa—Pampa Water, Light and Power Co. have been organized to build water and light plant. A. E. Davis, interested.

Okla., Clinton—Citizens voted $6,000 bonds for extension of water-works system. Noted Dec. 2.

Okla., Dewey—City plans to install water system.

Okla., Henryetta—(Official)—Citizens recently voted $100,000 bonds for water-works system. B. Williams, City Clk. Noted Nov. 25.

Okla., Tulsa—Election to vote on $600,000 bonds for storage basin at mouth of Shell Creek, postponed from Jan. 2 until spring. Noted Dec. 2.

Colo., Lafayette—Citizens will construct municipal water-works system. Estimated cost, $50,000.

Colo., Orchard—Bonds for $50,000 authorized by City Council for water system.

Idaho, Hailey—See item under "Light, Heat and Power."

Utah, Blanding—City plans municipal water system. Estimated cost, $25,000.

Utah, Monticello—See item under "Light, Heat and Power."

Ariz., Phoenix—J. B. Girand, City Engr., recommends to City Council expenditure of $1,000,000, for improving water-supply system.

Wash., Bremerton—City will purchase present water system and improve same at a cost of $70,000. Citizens recently voted $260,000 bonds for this purpose. E. J. McCall, City Clk.

Wash., Everett—Bids will not be received for improving water system until July. Estimated cost, $1,700,000. Burns & McDonald, Engr. Noted Sept. 2.

Wash., Seattle—Board of Public Works approved plans for laying water mains in Maynard Ave. and Michigan St., and 43rd Ave., N. W. Bids will soon be called for. A. H. Dimmock, City Engr.

Wash., Seattle—Contract will be awarded in about two months for water mains in Dexter Ave. Estimated cost, $32,000. A. H. Dimock, City Engr. Noted Sept. 30 and Oct. 7.

Que., Princeville—City will construct water system pumping station, and will purchase 4 and 6 in. c.-i. pipe, valves, pumps, hydrants, etc.

Ont., Penetanguishene—Citizens defeated proposition for extension of water mains.

Ont., Port Dover—Plans being prepared for water-works plant and system. James Louden & Hertzberg, 79 Adelaide St., Toronto. Noted Nov. 25.

Ont., Tweed—City will construct water-works plant. Estimated cost, $25,000. Kerry & Chase, Ltd., Confederation Life Bldg., Toronto, Engr.

Man., The Pas—See item under Sewers.

B. C., Port Moody—City will start work on construction of water-works system in February. P. Moe, Mayor.

Bids In and Contracts Awarded

Mass., Boston—Contract for water pipes awarded A. DADDARIO, 49 Edgewater Drive, Mattapan, Mass.

Mass., Lynn—Contract "B" for superstructure of Ipswich River pumping station awarded to H. T. CUMMINGS CONSTRUCTION CO., Ware. Noted Oct. 21 and 28.

Penn., Philadelphia—Contract for one-story steel and frame pump house awarded A. L. CARHART, Hale Bldg., Philadelphia. Estimated cost, $30,000.

Ohio, Cleveland—Low bidders for water mains in South Woodland Road, were: Lanese Co., Columbia Bldg., at $19,946; Phillips & Bixel, 235 Superior Ave. N. W., at $23,720; George Bros., 1148 Bolivar Rd., at $22,253. F. A. Pease Engineering Co., Marshall Bldg., Engr. Noted Nov. 11.

Ohio, East Liverpool—Contract for superstructure for pumping station and filter plant awarded to PITT CONSTRUCTION CO., Pittsburgh, Penn., at $52,900. Noted Sept. 23.

Ind., New Albany—New Albany Water Works Co. awarded contract for roof over reservoir to S. DAY & SON. Estimated cost, $4,138.

Ill., Chicago—Contract for steam-generating equipment at Mayfair Pumping Station awarded to WILLIAM A. POPE, 28 North Jefferson St., Chicago, by Department of Public Works. Estimated cost, $127,640.

Ill., Rock Island—Contract for installation of water mains on 21st Ave. between 24th and 25th St., awarded to P. F. TRENKENSCHUH.

Ill., Wheaton—Low bids received for 2,000,000 gal. tank, were submitted by Memphis Steel Construction Co., Pittsburgh, Penn., at $9,543 with hemispherical bottom, and $18,851 with elliptical bottom. L. V. Ruddock, Engr. Noted Nov. 18.

Iowa, Marshalltown—Lowest bid received for pump for water system submitted by Allis-Chalmers Mfg. Co., Chicago, Ill., at $14,485.

Neb., Neligh—Contract for extension of water-works system awarded to U. S. SUPPLY CO., Omaha.

Tex., Houston—City Council received bids Dec. 1, for deep-well pumps to be installed in new pumping station in North Main St. from J. G. Brown Co., at $19,948; Layne & Bowler Co., at $21,874; Southern Engine and Pump Co., at $28,000.

Idaho, Council—Contract for water system awarded to E. L. PHELPS, Weiser. Estimated cost, $11,200. Noted Nov. 18.

Utah, Salt Lake City—Contract for 18-in. c.-i. pipe line from Butler Ave., Federal Heights, to hydraulic laboratory of State University awarded to JAMES KENNEDY CONSTRUCTION CO.

Wash., Hillyard—Contract for steel tower and 2,000,000-gal. tank, awarded to CHICAGO BRIDGE AND IRON CO. Estimated cost, $8,288. Contract for pump, for pumping plant awarded to FAIRBANKS, MORSE & CO., Spokane. Estimated cost, $2,060. Noted Nov. 11.

Man., Winnipeg—Contract for laying water main in Wellington Crescent, awarded to DOMINION CONSTRUCTION CO., 290 Selkirk Ave., Winnipeg.

SEWERS

Proposed Work

Mass., Boston—(Dorchester)—Bids will be received by Commissioner of Public Works until noon, Dec. 15, for Davenport Brook Conduit, from Magdala to Washington St. Edward F. Murphy, Comr. Pub. Wks.

N. Y. New Rochelle—City contemplates enlargement of sewer system. Estimated cost, $400,000. John Hadert, City Engr.

N. J., Caldwell—Plans being prepared by J. S. Provost, Engr., for extending sewer system. Estimated cost, $18,000. Noted Nov. 18.

N. J., Trenton—Board of Commissioners approved ordinances providing the construction of sewers in Gardener, Cook, Greenwood and Hobart Ave.

Penn., Philadelphia—Plans prepared for two main sewers in Decker and Seventh St. and nine branch sewers in various other streets. Estimated cost, $80,000. George S. Webster, City Engr.

Md., Crisfield—Bids will be received next spring for about eight miles of sewers and a sewage-disposal plant. Greiner & Whitman, 1319 Fidelity Bldg., Baltimore, Engr. Noted Oct. 14.

Md., Hagerstown—City plans to construct sewer system. J. B. Ferguson, City Engr.

Md., Rockville—Plans being prepared by E. B. Whitman, Consult. Engr., 1319 Fidelity Bldg., Baltimore, for sewer system for Bethesda District, Montgomery County. B. E. Clark, Clk., Bd. of County Comrs.

Va., Roanoke—Bids will be received by P. H. Tucker, Village Clk., until noon, Dec. 21, for sewers. F. L. Gibboney, City Engr.

Ga., Lumpkin—City plans to install sewer system. W. G. Pugh, Mayor.

Ohio, Alliance—City contemplates building one mile of sanitary sewer. W. W. Shideler, Engr.

Ohio, Chillicothe—City Council passed ordinance for 12-, 36- and 40-in. storm-water sewer laterals in Western Ave. Estimated cost, $4,400. H. M. Reid, City Engr.

Ohio, Cincinnati—(Official)—Bids will be received by Philip Fosdick, Dir. of Pub. Ser., until noon, Dec. 13, for Duck Creek Interceptor Sewer, Contract No. 3.

Ohio, Cincinnati—Bids will be received by Philip Fosdick, Dir. Pub. Ser., until noon, Dec. 13, for improving sewers in Whitely St. from Colerain Ave. 180 ft. west, and right-of-way from Whitely St. 140 ft. south.

Ohio, Cincinnati—Bids will be received by Philip Fosdick, Dir. Pub. Ser., until noon, Dec. 15, for improving sewers in Resor Ave., from Middleton to Clifton Ave., and Clifton Ave. from Resor Ave. north to trunk sewer.

Ohio, East Palestine—Bids will be received by O. L. Butts, Village Clk., until noon, Dec. 20, for sanitary sewer and sewage-disposal plant. Estimated cost, $60,000.

Ohio, Geneva—Bids will soon be received for sewage-disposal plant. Estimated cost, $27,000. M. C. Goddard, 42 Walnut St., Geneva, Engr. and W. E. Morgan, City Clk.

Ohio, Leetonia—Citizens plan sewage-disposal plant. Estimated cost, $40,000. James P. Sculley, City Clk.

Ohio, Painesville—City contemplates building two miles of 8-, 10,- 12-, 16- and 20-in. sanitary sewers. M. A. Tuttle, Dir. of Pub. Ser. F. N. Downer, City Engr.

Ind., Vincennes—Contract will be awarded about Jan. 1 for storm sewers in eastern and southeastern part of city. Estimated cost, $150,000. H. T. Watts, City Engr. Noted Dec. 2.

Mich., Grand Rapids—W. S. Moore, City Engr., has submitted a plan to Oakdale Improvement Association for sewer in Oakdale Ave., S. E., down Kalamazoo Ave. to Silver Creek Valley. Estimated cost, $30,000.

Mich., Hillsdale—City has been ordered to improve sewerage system by State Board of Health.

Ill., Chicago—(Oak Park)—City plans an expenditure of $23,923 for pipe sewers in Oak Park next year.

Ill., Salem—City plans to build sewage-disposal plant and sewer system. Estimated cost, $50,000. H. L. Caldwell, 710 Ayres Bank Bldg., Jacksonville, Ill., Engr.

Wis., Fond du Lac—City contemplates storm sewers in Dixie, Everett, Juneau, Rees, Baumister St., and Fond du Lac Ave. John McCullough, City Engr.

Wis., New Lisbon—Preliminary plans being prepared for sewer system. W. G. Kirchoffer, 24 North Carroll St., Madison, Engr.

Iowa, Charter Oak—Plans being prepared by Bruce, Standeven & Boynton, Consult. Engr., Bee Bldg., Omaha, Neb., for sewer system. C. Robertson, City Clk.

Iowa, Ft. Mason—City will construct about one mile of 10- to 15-in. sewers. Bids will soon be asked. R. J. Lewis, City Engr.

Iowa, Hampton—Bids will be received by C. A. Van Pelt, City Clk., until 7:30 p.m., Dec. 15, for sanitary sewer system.

Iowa, Marshalltown—City will construct storm sewers. W. H. Steiner, City Engr.

Iowa, Mason City—Bids will be received by City Clerk until Jan. 6 for sewage-disposal plant of Imhoff type. Estimated cost, $70,000. F. P. Williamson, City Engr. Noted Aug. 12.

Iowa, Ottumwa—Citizens plan sewers in Center Ave. and East Court St.

Minn., St. Paul—Bids will be received by A. Hohenstein, Pur. Agt., until 10:30 a.m., Dec. 13, for sewer in Fairview, Denslow, Annapolis and Dale St.

Minn., St. Paul—Plans approved for sewer in Eaton St. between Chicago and Indiana Ave. Oscar Clausson, City Engr.

Kan., Erie—(Official)—Bids will not be received for sewer extensions and connections in Main and Santa Fe St. south to city limits. B. W. Garvin, Mayor. Noted Nov. 25.

Neb., Grand Island—Bids will be received in about four months for constructing storm sewers. Estimated cost, $100,000. H. E. Clifford, City Clk. Noted Sept. 2 and 9.

Neb., Pawnee City—Citizens defeated $35,000 bonds for sewer system. Noted Dec. 2.

Neb., Pierce—Election will be held Dec. 14 to vote on $20,000 bonds for sewer system.

S. D., Herrick—City will install sewer system.

Wyo., Cheyenne—Bids will be received by J. J. Showalter, City Clk., Dec. 13, for extending sewers in 19th St. from Bent to O'Neil St.

Mo., Aurora—Election will be held in January to vote on bonds for sewer system.

Mo., Stanberry—Citizens voted $4,000 bonds for sewerage system.

Tex., Canadian—Citizens will vote on $20,000 bonds for municipal sewer system. Oswell Hudson, Mayor.

Tex., Childress—City plans installation of sewer system.

Tex., Ft. Sam Houston—Bids will be received until Dec. 14 for sewage system and sewage-disposal plant.

Tex., Houston—Bids will be received for construction of storm sewers on Burnette St. from Hardy St. to White Van Bayon Outfall, and other improvements to the Carolina St. storm sewer, storm sewer on Paschall St., from North Main St. to Cockran St., and for storm sewer on White Oak and Florence St. E. E. Sands, City Engr.

Tex., San Marcos—San Marcos Sewer Co. plans sewage-disposal plant. Estimated cost, $5,000.

Okla., Haileyville—Citizens will vote on $50,000 bonds for sanitary sewer system.

Ore., La Grande—Contract will soon be awarded for sewer system. Estimated cost, $16,000. L. D. Howland, City Engr.

Ore., Portland—Plans being considered by city for sewer in East Davis and East 72d St., Mt. Tabor. Estimated cost, $8,758.

Calif., Pasadena—Election will soon be held to vote on $485,246 bonds for sewer system and sewage-disposal plant to be used by the cities of Pasadena, South Pasadena and Alhambra. Noted Dec. 2.

Ont., Bosanquet—(Thedford post-office)—City Council plans construction of Hampton drain and other improvements. G. Sutherland, Thedford, City Clk.

Ont., Brantford—City will construct sanitary sewers in Drummond and Read St., and Jubillee Ave. T. H. Jones, City Engr.

Ont., Goderich—City will construct sewer in Lighthouse St. Work will not be done this fall. C. L. Knox, City Clk.

Ont., Leamington—Council authorized construction of sewers in Russell and Mill St., and Victoria Ave.

Ont., London—City will make extensions to storm-sewer system, and will construct sewers in Regent, William, Dundas and Elizabeth St. Estimated cost, $50,000. S. Baker, Clk.

Ont., Romney—Plans being considered for several drains. J. W. Kennedy, Wheatley, Ont., Clk.

Ont., Toronto—City will construct sewers in Queen, Leslie St. and Pape Ave. Estimated cost, $56,500.

Ont., Woodstock—City Council plans construction of storm sewers. Estimated cost, $25,000.

Man., The Pas—Bids will be received Jan. 17, for the purchase of $130,000 bonds, $80,000 for sewer construction and water-works; $50,000 for construction and equipment of an electric-light system. H. H. Elliott, Town Clk.

Bids In and Contracts Awarded

N. Y., New York—(Borough of the Bronx)—Contract for sewers in Starling Ave. between Olmstead Ave. and Unionport Rd., Unionport Rd. between Starling and McGraw Ave., McGraw Ave. between Unionport Rd. and Pugsley Ave., awarded to ANITA CONSTRUCTION CO., 2975 Marion Ave., N. Y. Noted Nov. 4.

N. Y., New York—(Borough of Manhattan)—Contract for tunnel relief sewer in West 46th St. awarded to BRAZER & BURCHENAL, 80 Maiden Lane, New York, at $250,013. Noted Oct. 21 and Nov. 11.

Penn., Mt. Carmel—Contract for sewage pumping station awarded to THOMAS J. RADLEY, 143 Liberty St., New York, N. Y. Estimated cost, $13,226.

Tenn., Cleveland—Contract for sewer system, for which $75,000 was appropriated, awarded to A. C. BROOKS & CO., Birmingham, Ala.

Tenn., Park—(Knoxville P. O.)—(Official)—Contract for constructing sewer laterals awarded to J. A. ASHLER, Knoxville. Noted Nov. 25.

Ohio, Cleveland Heights—(Warrensville post office)—Contract for sewers in Cedar Road District No. 3 awarded to ROSS-COOK ENGINEERING CO., 193 Crosby St., Akron, at $32,039. Noted Oct. 21.

Ohio, Columbus—Contract for Frames Ave. relief sewer awarded to BOYD & COOK, Dayton, Ohio. Estimated cost, $43,780. Noted Nov. 11.

Ohio, Sandusky—J. B. Sheets Co., Pittsburgh, Penn., at $69,554 submitted lowest bid for intercepting sewer from Mills to Meigs St. J. J. Molter, Dir. of Pub. Serv.

Ohio, Toledo—(Official)—Contract for main sewer No. 13 awarded to BREYMANN & O'NEIL, Nashby Bldg., Toledo, Ohio. Noted Nov. 18.

Ill., Aurora—F. E. KAMINSKI, Watertown, Wis., at $11,910, awarded contract for sewer system in northeastern section of city. M. Tarble, Engr. Noted Sept. 9.

Ill., Melrose Park—Contract for sewers awarded to T. H. IGLEHART, 718 Rookery Bldg., Chicago. Estimated cost, $27,000.

Iowa, Dubuque—(Official)—Contract for constructing 8-in. tile sanitary sewer in St. Ambrose St. from manhole at intersection of Willow and St. Ambrose St., awarded to J. A. R. DANIELS, 112 Alpine St., Dubuque. J. J. Shea, City Clk. Noted Dec. 2.

Kan., Manhattan—Contract for sewers in three districts awarded to W. W. COOK, Junction City, Kan. Estimated cost, $14,287. Noted Oct. 14.

Neb., Omaha—Contract for sewer in Larimore Ave. awarded to E. P. DONAHUE, 503 Ware Bldg. John A. Bruce, City Engr.

Tex., Houston—Contract for sewerage work awarded as follows: Storm sewer on Hawthorne St. to F. D. HORTON & SON, at $18,000; Smith St. sewer to HORTON & HORTON, at $4,800; storm sewer on Bagby and Laure St. to HARDMAN & NELSON, at $15,200. Noted Dec. 2.

Tex., San Benito—(Official)—Contract for sanitary sewage disposal plant awarded to S. S. DODDS, San Benito, Tex. Estimated cost, $4,272. Noted Oct. 28.

Idaho, Bonners Ferry—HURD, DECAMP & WOODS, Spokane, Wash., at $24,778, awarded contract for sewer system. Noted Sept. 9 and Nov. 4.

Wash., Seattle—Contract for sewers in Sixth Ave. N. W., awarded to WASHINGTON PAVING CO., Seattle. Estimated cost, $78,694. Noted Nov. 4.

Calif., Los Angeles—Contract for sewer in Pico St. from Granshaw Blvd. to Sixth Ave. awarded to S. ZARUBICA, at $7,577. Noted Dec. 2.

Calif., Los Angeles—P. S. Tomich, at $11,500, submitted lowest bid for sewer in Griffith Ave.

Calif., Stockton—Contract for sewer work awarded to W. S. GAUSE, Piedmont, at $6,196.

Calif., Stockton—Contract for sanitary sewer in southwestern section of city awarded to CHAMBERS & HEAFEY, at $24,050.

GARBAGE

Proposed Work

Maine, Bar Harbor—Bids will be received by Board of Health, Odd Fellows Hall, until Dec. 15, for disposal of garbage for periods of three and five years.

N. J., Glen Ridge—Election will be held Dec. 23 to vote on $15,000 bonds for garbage disposal plant in Carteret St. Noted Oct. 28.

Ont., Welland—Plans being considered by J. G. Stephenson for garbage disposal plant. Estimated cost, $20,000.

Bids In and Contracts Awarded

Mass., Boston—Contracts for removing snow and ice awarded by E. F. Murphy, Comr. of Pub. Wks., as follows: JOSEPH M. KILEY, Roxbury, at 44c. per cu. yd. for District No. 1; J. P. McCABE CO., at 33c. for District No. 2; C. J. JACOBS CO., 107 Terrace St., Boston, COLEMAN BROS., Chelsea, at 37c. and 40c. respectively for District No. 4 and 5; JOSEPH SPRISSLER, at 37c., for District No. 6; JAMES DRISCOLL & SON CO., at 35c., for District No. 7.

N. J., Atlantic City—Contract for collection and disposal of garbage for a period of five years awarded to FARMERS PRODUCT AND SUPPLY CO., Atlantic City. Noted Oct. 7.

Penn., York—(Official)—Contract for collection and disposal of garbage for a period of 10 years awarded to C. C. FISCHER, York, at $19,000. Noted Nov. 25.

La., Hammond—Contract awarded to SUTHERLIN CONSTRUCTION CO., Kansas City, Mo., for garbage incinerator.

STREETS AND ROADS

Proposed Work

N. Y., Kingston—City plans to pave Hosbrouck Ave. in 1916. G. Wallace Codwise, City Engr.

N. Y., New York—(Borough of Richmond)—(Official)—Bids will be received until noon, Dec. 14, by Calvin D. Van Name, Borough Pres., Borough Hall, St. George, New Brighton, for constructing concrete sidewalks.

N. Y., Wampsville—Towns in Madison County plan to raise a fund of $70,447 for highway construction in 1916.

N. J., Irvington—Town Commission plans to pave Howard St. and Ellis Ave.

N. J., Newton—Bids will be received about Jan. 1 by Board of Chosen Freeholders of Sussex County for improving Rosse's Corner-Sussex Rd. Estimated cost, $85,000. H. Snook, County Engr. Noted Oct. 21.

Md., Cumberland—City plans to pave Cumberland St. from Franklin to Tilghman St. with concrete and from Allegany to Franklin St. with brick. J. P. Gaffney, City Engr.

Md., Salisbury—Bids will be received until Dec. 14 by Commissioners of Wicomico County for 1.35 miles of State-Aid highway upon or along Brawington's Branch Zion Rd. H. M. Clark, Road Engr.

Va., South Boston—City plans an expenditure of $25,000 for 15,000 sq.yd. of pavement. Anderson & Christie, Charlotte, N. C., Consult. Engr.

W. Va., New Cumberland—Election will be held during 1916 to vote on $50,000 bonds for paving Poe Road District with brick. E. Grafton, County Engr.

N. C., Marion—A $5,000 bond issue for constructing roads contemplated by Commissioners of McDowell County.

Fla., Tallahassee—Election will be held Dec. 28 to vote on $4,000 bonds for paving College Ave. from Adams to Copeland St. A. H. Williams, City Clk.

La., De Ridder—Citizens of Calcasieu County plan to issue $700,000 bonds for road construction.

Tenn., Dover—Election will soon be held to vote on $200,000 bonds for road construction. Noted Oct. 21.

Tenn., Knoxville—City Commission will improve State St.

Tenn., Knoxville—Bids will be received until noon, Dec. 15, by Good Roads Commission of Knox County for rebuilding Kingston Rd. from corporate limits of city to Eastern Insane Asylum.

Ohio, Cincinnati—(Officiial)—Bids will be received by A. Reinhardt, Clk., Comrs. of Hamilton County, until noon, Dec. 17, for widening Boudinot Ave. near Warsaw and Bridgetown Pike, Green Township.

Ohio, Cincinnati—City will expend portion of $1,250,000 bonds recently voted for extending Bloody Run Parkway to Eden Park. Philip Fosdick, City Engr.

Ohio, Columbianna—City plans to pave West Park, about ½ mile, and Union Park, about ⅝ mile. C. E. Beard, Engr.

Ohio, East Liverpool—City plans to pave Harvey and Elizabeth St. with concrete. J. C. Kelley, City Engr.

Ohio, Marysville—Commissioners of Union County plans to expend $10,200 for road improvements.

Ohio, Painesville—City plans an expenditure of $45,000 in 1916 for paving. F. N. Downer, City Engr.

Ohio, Salem—Plans being prepared for about 7,000 sq.yd. of brick paving. B. M. French, City Engr.

Ohio, Washington—Bids will be received until Dec. 11 by Director of Public Service for improving a number of city streets.

Ind., Angola—(Official)—Bids will be received by R. Hirst, City Clk., until 1:30 p.m., Dec. 15, for improving North Wayne St. (See adv.)

Ind., Winamac—Bids will be received by W. E. Munchenberg, Audr., Comrs. of Pulaski County, until noon, Jan. 4, for gravel road.

Mich., Kalamazoo—Bids will be received until 10 a.m., Dec. 14, by Road Commissioners of Kalamazoo County, for resurfacing a number of roads.

Wis., Birchwood—(Official)—Citizens defeated $5,000 bonds for street improvements. Noted Nov. 4.

Wis., Kenosha—Bids will soon be received for approximately 8,000 sq.yd. of vitrified brick paving on Pomeroy St. from Fremont to Newhall St. B. C. Brennan, Supt. of Pub. Wks.

Wis., Racine—City plans to pave Mound Ave. with brick in 1916. P. H. Connolly, City Engr.

Iowa, Mason City—Contract for paving estimated to cost $500,000 will be awarded about Jan. 15. E. P. Wilson, City Engr.

Iowa, Storm Lake—Contract for 60,000 sq.yd. of paving will be awarded about Feb. 1. J. E. Ruland, City Clk.

Minn., Pine City—Bids will be received by W. H. Hamilton, County Audr., until Dec. 10, for constructing Elwell Rd. Estimated cost, $50,000.

Minn., St. Paul—Bids will be received by A. Hohenstein, Pur. Agent, until 10:30 a.m., Dec. 13, for improving Edgecomb Rd. from West Seventh St. to Lexington Ave. O. Claussen, City Engr.

Minn., St. Paul—Bids will be received by A. Hohenstein, Pur. Agent, until 10:30 a.m., Dec. 13, for improving Oxford St. from Rondo to Thomas St., Edmond St. from Lexington Ave. to Dunlap St. and Oxford St. from Iglehart Ave. to Rondo St. O. Claussen, City Engr.

Kan., Hiawatha—City Commissioners plan an expenditure of $100,000 in 1916 for paving and improving water system.

Mont., Billings—Citizens plan to hold election in January to vote on $175,000 bonds for improving highways in Yellowstone County.

Mo., Kansas City—Board of Public Works plans to pave Broadway from 14th St. to Southwest Blvd.

Mo., Stotts City—Citizens of Stotts City Road District voted $13,500 bonds for rock surfacing about nine miles of roads.

Ark., Little Rock—City Council plans to pave Center St. from Markham to Seventh St. H. Levinson, City Engr.

Ark., Stuttgart—An expenditure of $30,000 contemplated by city for paving. F. W. Towl, Engr.

Tex., Lockhart—Commissioners of Caldwell County plan to hold election to vote on $50,000 bonds for highway construction.

Tex., Luling—Election will soon be held to vote on $50,000 bonds for hard surfacing roads.

Tex., Marlin—A bond issue for $200,000 for constructing roads contemplated by Commissioners of Falls County.

Okla., Bristow—Citizens defeated $25,000 bonds for roads. Noted Nov. 11.

Okla., Norman—Election will be held Dec. 15 in Norman Township to vote on $25,000 bonds for road construction and $5,000 bonds in Case Township.

Idaho, Lewiston—Commissioners of Nez Perce County plan to construct John Kennedy Rd. on Upper Tom Muriel Creek. Estimated cost, $20,000. C. J. Vassar, County Surveyor.

Idaho, Preston—County Commissioners contemplate $150,000 bond issue for road construction.

Wash., Ellenburg—Report submitted to Commissioners of Kittitas County by County Engineer, estimating cost of highway between Ellenburg and Wenatchee at about $200,000.

Wash., Prosser—Bids will be received by State Highway Board, Olympia, until Dec. 20, for improving 11½ miles of highway between Kiona and Richland, Benton County. T. J. Wright, Prosser, County Engr.

Wash., Seattle—Bids will be received until 10 a.m., Dec. 21, by B. Phelps, Clk., Comrs. of King County, for Permanent Highway No. 13.

Ore., Albany—City Council plans an expenditure of $9,149 for hard-surfacing Washington St.

Ore., Portland—Advisory Budget Committee of Multnomah County has recommended that $431,000 be appropriated for road construction for 1916.

Ore., Warrenton—Citizens of Warrenton Road District plan an expenditure of $25,000 for road improvements.

Calif., Modesto—Supervisors of Stanislaus County contemplate $1,500,000 bond issue for constructing roads.

Calif., Sacramento—(Official)—Bids will be received until 2 p.m., Dec. 27, by the State Highway Commission, 515 Forum Bldg., for roads in various counties.

Calif., Sawtelle—Bids will be received until 5 p.m., Dec. 20, by City Clerk, for improving Wabash Ave. between Iowa Ave. and Santa Monica Blvd.

Ont., Chatham—City Council plans to pave Lansdowne Ave. during 1916 with reinforced-concrete. F. P. Adams, Engr.

Bids In and Contracts Awarded

Mass., Boston—(Sheffield and Great Barrington)—(Official)—Contract for section of state highway in Sheffield and Great Barrington awarded to JOHN DE MICHAEL & BROS., Torrington, Conn., at $28,382. Noted Nov. 4 and 18.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids were received Dec. 6 for regulating and repaving 151st St. from west side of Seventh Ave. to east side of McCombs Pl. as follows: Uvalde Asphalt Paving Co., $4,329; Asphalt Construction Co., $4,801; Barber Asphalt Paving Co., $5.308. Noted Dec. 9.

N. Y., New York—(Borough of Queens)—Contract for improving Rockaway Blvd. awarded to H. J. MULLEN CONTRACTING CO., Flushing, at $56,000. Noted Sept. 23 and Oct. 7.

N. J., Jersey City—Contract for improving Old Bergen Rd. from Blvd. to Merritt Ave. awarded to W. T. S. CRITCHFIELD CO., Hoboken.

N. J., Mt. Holly—MANWARING & CUMMINGS, 1326 Chestnut St., Philadelphia, Penn., at $5,710, awarded contract for paving Vinceton and Buddton Rd., and at $4,579, for Vincetown and Eayerstown Rd.

Penn., Philadelphia—Contracts were awarded for paving as follows: 80th St. to HARRY MAGEE, at $4,982; Hartford Ave., to JAMES A. MULLIN, at $27,762; 54th St. to BARBER ASPHALT PAVING CO., Woolworth Bldg., New York, at $9,984; East wick St. to J. JOSEPH McHUGH, at $5,914; Second St. to the BARBER ASPHALT PAVING CO., Woolworth Bldg., New York, at $5,358; Harvey St. to D. J. LYNCH, at $8,616.

Penn., Pittsburgh—(Official)—Contract for improving Cliff Mines and Beaver Grade Connecting Rd., Sec. No. 1, awarded to SAMUEL GAMBLE CO., Carnegie, at $7,493. Noted Nov. 18.

Md., Baltimore—D. M. Andrews Co., Equitable Bldg., at $6,520, submitted lowest bid for paving on Annapolis Blvd. between Severn River and College Creek bridges. Noted Nov. 18.

Md., Leonardtown—Contract for 1.18 miles of State-Aid highway on Washington and Fenwick St. awarded to AUSTIN & IRELAND, Baltimore.

N. C., Winston-Salem—An expenditure of $17,000 planned by Forsyth County Highway Commission for concrete pavement on Main St. Work will be done by convict labor. D. W. Harmon, Highway Engr.

S. C., Greenville—Contract for 60,000 sq.yd. of street paving, 10,000 sq.yd. of concrete gutters and 12,000 lin.ft. of granite curb awarded to CASE & COTHRAN, 1507 Candler Bldg., Atlanta, Ga. About $175,000 available for this work. Noted Nov. 4 and Dec. 2.

Ga., Atlanta—Commissioners of Fulton County plan to build 10 miles of road by convict labor. W. T. Wilson, County Highway Engr.

Fla., Clearwater—Contract for improving Ft. Harrison Ave. from Eldridge St. to corporate limits awarded to PINELLAS CONSTRUCTION CO., Augusta, Ga., at $22,806.

Fla., Fellsmere—Contract for 5½ miles of concrete sidewalks awarded to E. HAWK. Citizens recently voted $50,000 bonds for paving and sidewalks. C. W. Tolmage, Ch. Engr. Noted Oct. 14.

Fla., Ft. Pierce—Contract for surfacing 4½ miles of Dixie Highway along Indian River awarded to GOOD ROADS CONSTRUCTION CO., Memphis, Tenn.

Tenn., Chattanooga—Contract for asphalting McCallie Ave. awarded to NELL CONSTRUCTION CO.

Tenn., Dunlap—Contract for 28 miles of macadam road in Sequatchie County awarded to CHICKAMAUGA QUARRY AND CONSTRUCTION CO.

Ohio, Shaker Heights—(Cleveland post office)—Bids were received for grading and flagging South Woodland Rd., Shaker Heights Village, from Walsh Construction Co., Citizens Bldg., at $25,322, and J. W. Chapman, 1653 Ridgefield Rd., at $25,176.

Ohio, Toledo—BREYMANN & O'NEILL, Nasby Bldg., awarded contract for grading, draining and macadamizing with water bound macadam Otter Creek Rd., Oregon Township. Noted Nov. 18.

Ind., New Albany—Contract for road in New Albany Township awarded to W. F. WOODRUFF, Louisville, Ky., at $12,462. Noted Nov. 11.

Ill., Berwyn—Contract for 21,349 lin.ft. of sidewalks awarded to FREDERICK ASP, Maywood, at $12,169.

Ill., Ottawa—Contract for hard surfacing four miles of drives through Illinois State Park awarded to W. J. BRENNAN, La Salle, at $14,990.

Kan., Lawrence—Contract for 15,000 sq.yd. of brick paving awarded to A. R. YOUNG. E. H. Dunmier, City Engr.

Kan., Pittsburg—Contract for repaving Broadway awarded to WILLIAMS CONSTRUCTION CO., Joplin, Mo., at $35,176. L. E. Curfman, City Engr. Noted Oct. 14 and Nov. 18.

Mo., Kansas City—Contract for grading Mever Blvd. from Paseo to Wornall Rd. awarded to W. C. MULLINS, 24th and Wyandotte St., at $25,000.

Mo., Springfield—Contract for paving Bonvile St. from Division to Pine St. and two feet on each side of tracks of Springfield Traction Co. awarded to PLUMMER-ADAMS CO., at $13,500.

Tex., Austin—Contract for paving about 50,000 yd. of streets awarded to TEXAS BITULITHIC CO., at about $100,000. M. C. Wellborn, City Engr.

Tex., Dallas—Contract for paving Bryan Parkway awarded to VIBROLITHIC CO., at $7,550. J. M. Preston, City Engr. Noted Oct. 28.

Wash., Walla Walla—(Official)—Contract for two miles of highway near Whitman's Station awarded to L. LANNING, Boyer Ave. and Blue St., Walla Walla, at $4,900. G. C. Cookerly, City Engr. Noted Nov. 18.

Ore., Pendleton—(Official)—Contract for improving Riverside Drive from Main to Railey St. awarded to WARREN CONSTRUCTION CO., Portland, at $4,780. Noted Nov. 4 and 18.

Calif., Antioch—Bids were received by City Trustees for paving a number of streets as follows: Raisch Improvement Co., San Francisco, $15,489; McGillivray Construction Co., Sacremento, $15,891; City Improvement Co., San Francisco, $21,850.

Calif., Glendale—Contract for improving portions of Grand Blvd., Doran and First St. awarded to GEORGE H. OSWALD, Los Angeles, at $25,988.

Calif., Huntington Beach—Contract for paving Main and other streets awarded to GEORGE H. OSWALD, Los Angeles, at about $81,481.

Calif., Los Angeles—Contract for improving Westmoreland Ave. awarded to WATTSON & SPICER, at $11,596.

Calif., Pasadena—Contract for improving Prospect Blvd. awarded to ANDREW HOLLOWAY, at $5,038.

Calif., Sacremento—Contract for road work in Mariposa County, Div. 6, Route 18, Sec. A, awarded to GEORGE R. DALEY, San Diego, at $42,748; and for Div. 111, Route 3, Sec. B, Placer County, to A. W. GORRILL, San Francisco, at $47,339. Noted Oct. 7 and Nov. 4.

Calif., San Francisco—Contract for paving section of East St. awarded to K. ERHART, at $11,294.

INDUSTRIAL WORKS

Proposed Work

Conn., New Haven—Plans prepared by Frank Elwood Brown, Arch., for three-story, 50x135-ft. plant for New Haven Dairy Co., 159 Hazel St. Noted Nov. 25.

N. Y., New York—(Borough of Brooklyn)—Plans being prepared for six-story factory for Bush Terminal Co. foot 43d St., Brooklyn. Estimated cost, $10,000.

N. Y., New York—(Borough of Brooklyn)—Bids will soon be received for two-story, 50x75-ft. garage for Albert H. Marquis, 4311 Brandon Ave. Estimated cost, $10,000.

N. Y., New York—(Borough of Queens)—Plans being preprepared for two-story, 50x100-ft. and one-story, 50x75-ft. factory for H. W. Beyer & Co., 507 West 50th St., New York. National Fireproofing Co., 949 Broadway, New York, Arch.

New York, N. Y.—(Borough of Queens)—(Official)—Contract will soon be awarded for six-story, 117x217-ft. reinforced-concrete factory for Gustav Sandblom, Inc., 30 East 42 St., New York, N. Y. (Borough of Manhattan), at Skillman, Moore and Foster Ave. Estimated cost, $100,000.

N. Y., Woodbury—Plans being prepared for two-story, 100x100-ft. garage for Otto H. Kahn, 52 William St., New York, N. Y.

N. J., Belleville—Press reports state that Pathe Freres Phonograph Co. plans a four-story addition to its plant on Cortland St.

Penn., Bellefonte—Plans prepared for two-story bakery for J. Ceaders. Estimated cost, $20,000. C. D. Cooley Co., Century Bldg., Pittsburgh, Arch.

Penn., Chester—Plans being prepared by Wadleigh & Osbourn, Real Estate Trust Bldg., for superstructure of plant on Delaware River for Stewart Distilling Co., Philadelphia. Estimated cost, $500,000. Noted Sept. 30.

Penn., Philadelphia—Plans being prepared for a three- or four-story mill and power house at Reed, Dickinson, 25th and 26th St. for S. B. & B. W. Fleisher, Eighth and Chestnut St. William Steele & Sons Co., 1600 Arch St., Engr.

Penn., Reading—Plans being prepared by F. A. Muhlenberg, Arch., for 100x220-ft. factory on South Eighth St. for Pennsylvania Optical Co.

Penn., Scranton—Ford Motor Co. contemplates building three-story, 60x100-ft. service building. Estimated cost, $12,000.

Md., Baltimore—C. W. Christian, 401 East 25th St., plans to establish factory.

Md., Baltimore—Plans prepared for one-story, 150x150-ft. garage at Maryland Ave. and 27th St. for T. W. Cooke.

Va., Martinsville—American Furniture Co. will build an addition to plant. Estimated cost, $25,000.

Va., Petersburg—Contract will be awarded about Dec. 10 for two-story, 40x120-ft. laundry for White Cross Laundry Corporation. Estimated cost, $18,000.

Va., Port Norfolk—(Portsmouth post office)—Bids will be received about Jan. 5 for 100x240-ft. addition to plant at Port Norfolk, of South Hill Manufacturing Co., South Hill.

Va., Winchester—C. L. Robinson Ice and Cold-Storage Corporation will build 150x150-ft. plant. C. L. Robinson, Pres.

N. C., Asheville—Asheville Milling Co. will rebuild plant recently destroyed by fire.

Ga., Atlanta—It is reported that Chevrolet Motor Co., Flint, Mich., contemplates building assembling plant at Atlanta.

Ga., Augusta—Gorgan & O'Dowd contemplates building 190x250-ft. warehouse on Ninth St.

Ga., Savannah—Georgia Land and Cattle Co. will establish a stockyard, abattoir, etc.

Fla., Jacksonville—Plans prepared for two-story, 56x125-ft. ice cream plant for Purity Ice Cream Corporation. Estimated cost, $40,000. C. D. Cooley Co., Century Bldg., Pittsburgh, Penn., Arch.

Ala., Anniston—Polar Ice and Coal Co., will build one-story, 40x50-ft. addition to plant. Estimated cost, $10,000.

Ala., Georgiana—McGowin-Bennett Milling Co. will establish an ice plant. Estimated cost, $10,000.

Ala., Mobile—Joseph F. Durham secured grain elevator of Mobile & Ohio R.R. and will organize a company for the purpose of improving the elevator. Estimated cost, $40,000.

La., New Orleans—(Official)—Bids will be received by Ernest M. Loeb, Pres., Bd. of Comrs. of Port of New Orlens, Suite 200, New Orleans Court Bldg., until 8 p.m., Dec. 20, for reinforced-concrete elevator on east bank of Mississippi River. (See adv.)

Tenn., Chattanooga—Plans prepared for garage and sales building for Hamilton Motor Car Co.

Ky., Carlisle—Carlisle Electric and Power Co. will construct and equip an ice plant.

Ky., Cynthiana—Burley Tobacco Co., Lexington, will build sales warehouse at Cynthiana.

Ky., Louisville—Plans prepared for two-story brick packing plant for C. F. Vissman & Co. Estimated cost, $10,000.

Ohio, Akron—Mason Tire & Rubber Co., Kent, plans a factory in Akron. Estimated cost of building and equipment, $60,000.

Ohio, Cincinnati—Bids will soon be received for six-story, 65x102-ft. garage and salesroom for Graydon Estate. Estimated cost, $100,000. Elzner & Anderson, 135 Ingalls Bldg., Cincinnati, Arch.

Ohio, Cleveland—Plans being prepared for two four-story, 160x350-ft. and 143x512-ft. factories for Properties Co. O. M. Stafford, Pres.

Ohio, Cleveland—City plans automobile repair shop. Estimated cost, $15,000. Robert Hoffman, City Engr.

Ohio, Cleveland—Weideman Co. will build warehouse and garage at 924 Mandrake Ave. Estimated costs, $70,000 and $12,000, respectively. W. S. Lougee, Marshall Bldg., Arch.

Ohio, Columbus—Plans being prepared by H. C. Holbrook, Arch., for one-story, 40x130-ft. addition with two wings 30x40-ft. and 15x60-ft. to plant of Union Oil Cloth Co., Spruce St.

Ohio, East Liverpool—Columbia Steel Co., recently incorporated by East Liverpool and Pittsburgh capitalists, purchased site near Ohio-Pennsylvania line and Ohio River on which the company plans to build plant. Estimated cost, $600,000.

Ohio, Hamilton—A plant for extracting light oils from tar and ammonia will be constructed by the Hamilton Otto Coke Co. Estimated cost, $80,000.

Ohio, Lima—Plans prepared for roundhouse for Lake Erie & Western R.R. Estimated cost, $50,000. J. K. Connor, Indianapolis, Ind., Ch. Engr.

Ohio, Painesville—Preliminary plans being prepared for two-story ice plant for E. W. Moore. F. N. Downer, Painesville, Arch.

Ohio, Robertsville—Canton Clay Products Co., recently incorporated with $75,000 capital stock, will build brick plant about ½ mile east of Robertsville. C. A. Bourgouis, interested.

Ohio, Sebring—Sebring Rubber Co. contemplates building two-story, 60x190-ft., factory. Estimated cost, $20,000.

Ohio, Springfield—Robbins & Myers Co. will build four-story, 300x300-ft. addition to plant. Estimated cost, $150,000. C. F. McGilvray, Pres.

Ind., Indianapolis—Preliminary plans being prepared by J. Edwin Kopf, Arch., for three-story garage for Cadillac Automoble Co. C. F. Eckler, 500 Capital Ave., Indianapolis, Mgr.

Ind., Muncie—Plans prepared for two new factory buildings for T. W. Warner Manufacturing Co. Estimated cost, $100,000.

Ind., Shelbyville—A. Hirschburg, Shelbyville, will build two-story, 32x150-ft. garage.

Mich., Detroit—J. H. Schmidt will build 50x150-ft. garage on Third St., to be occupied by the La Bell Motor Co. Estimated cost, $20,000.

Mich., Grand Haven—Plans being prepared for one- and two-story, 70x140-ft. factory for Challenge Refrigerating Co.

Mich., Lansing—Plans being prepared for three-story warehouse for National Grocery Co., 123 North East St. E. A. Bowd, 127 West Allegan Ave., Lansing, Arch.

Ill., Chicago—Joseph Dvorak will build one-story garage at 3854-62 Ogden Ave. Estimated cost, $13,500.

Ill., Freeport—Plans prepared for enlarging roundhouse and building addition to tool house of Illinois Central R.R. Estimated cost, $30,000. A. S. Baldwin, Chicago, Ch. Engr.

Ill., Joliet—Bates Machine Co. plans expenditure of $100,000 for enlarging and improving its plant at Henderson Ave. and Jackson St.

Wis., Milwaukee—Bids will soon be received by R. E. Oberst, Arch., for three-story molasses feed plant for Milwaukee Grain & Feed Co., 512 Commerce St. Estimated cost, $25,000.

Wis., Sauk City—Farmers Packing Co. contemplates building packing plant. Estimated cost, $100,000. M. P. Schneider, 401 West Doty St., Madison, Wis., Arch.

Iowa, Des Moines—Plans being prepared by F. W. Clarks, 683 Brandels Bldg., Omaha, Neb., for three-story, 45x160-ft. warehouse for Farmers Coöperative Produce Co.

Minn., Mankato—Mankato Bread Co. contemplates building three-story, 38x120-ft. factory.

Minn., Minneapolis—Pence Auto Co. will build eight-story, 132x308-ft. warehouse. Chapman & Magney, Essex Bldg., Minneapolis, Arch.

Minn., St. Paul—Plans being prepared for three-story, 100x150-ft. plant for Brown, Blodgett & Sperry Co. Estimated cost, $50,000. C. H. Johnston, 715 Capital Bank Bldg., St. Paul, Arch.

Mo., Kansas City—It is reported that Chevrolet Motor Co., Flint, Mich., contemplates building assembling plant at Kansas City. Estimated cost, $750,000.

Mo., Kansas City—Willys-Overland Co., Toledo, Ohio, has purchased a site at Kansas City and will build six-story plant.

Mo., St. Louis—Lowell Bleachery, Lowell, Mass., will build branch factory at St. Louis. Estimated cost, $200,000.

Ark., Jonesboro—Plans prepared for two-story, 23x110-ft. cold storage plant for Jonesboro Ice Co.

Tex., Dallas—Reported that Studebaker Corporation, Detroit, Mich., will build branch distributing plant at Dallas.

Tex., Dallas—T. B. Burnett & Co. will build mattress factory at Dallas. Estimated cost, $300,000

Tex., El Paso—Proposition submitted to El Paso Chamber of Commerce by J. T. Ward, Denver, Colo., for establishing factory at El Paso for manufacture of automobile tires.

Tex., Houston—National Oil and Gas Co. will build oil refinery. Estimated cost, $200,000.

Tex., Houston—Plans prepared by Finger & Bailey, Arch., Houston, for four-story, 130x140-ft. reinforced-concrete warehouse for Magnolia Paper Co. Estimated cost, $100,000. Noted Nov. 18.

Tex., Orange—Plans prepared for rebuilding plant of Lutcher & Moore Lumber Co. which was destroyed by fire with a loss of $150,000. Noted Aug. 19.

Okla., McAlester—A. C. Murray, Clarksville, Tenn., organized a company with capital of $50,000, and will build an ice plant.

Okla., Sand Springs—Sand Springs Home will build two-story, 50x110-ft. factory. E. A. Page, Secy.

Okla., Tulsa—Nichols Transfer and Storage Co. will erect three-story, 40x140-ft. reinforced-concrete building.

Wash., Tacoma—E. I. Du Pont de Nemours Powder Co. plans to build four new buildings south of Tacoma. Estimated cost, $40,000. I. J. Cox, Supt.

Ore., Portland—Plans being prepared for two-story, 80x175-ft. planing mill for Frank Schmidt & Co. Estimated cost, $10,000.

Ont., Sandwich—United States Steel Corporation, 71 Broadway, New York, N. Y., will establish plant at Sandwich.

Bids In and Contracts Awarded

Mass., Beverly Farms—Contract for garage for J. A. L. Blake awarded to HOLT-FAIRCHILD CO., 1001 Old South Bldg., Boston. Estimated cost, $10.000.

Mass, Readville—Stafford Co., Hyde Park, awarded contract for foundry to J. J. PRINDIVILLE CO., South Framingham. Estimated cost, $40,000.

Conn., Goshen—Contract awarded to W. A. SMITH & SON, 188 Cannon St., Bridgeport, for two-story garage for W. B. Lashen, 647 Clinton Ave., Bridgeport. Estimated cost, $15,000.

N. Y., Buffalo—Contract awarded to JOHN A. ZOLL, 398 Bird Ave., Buffalo, for four-story, 55x71-ft. warehouse and elevator for Eldad Milling Co. Estimated cost, $30,000.

N. Y., New York—(Borough of Manhattan)—Contract for three-story, 100x225-ft. printing building for Consolidated Gas Co., 4 Irving Pl., awarded to ROBERT J. ALGIE, 141 West 41st St. Estimated cost, $65,000.

N. J., Jersey City—Contract for three-story, 70x200-ft. factory building for Davis-Bournonville Co. awarded to JOHN N. GILL & CO., 1215 Filbert St. Estimated cost, $70,000.

N. J., Newark—Interstate Creamery Co. awarded contract to M. MILLER, 11 Highland Ave., Newark, for two-story, 85x110-ft. plant. Estimated cost, $16,000.

N. J., Passaic—Contract awarded to J. J. O'LERAY, 500 Bloomfield Ave., Passaic, for flour mill for New Jersey Flour Co. Estimated cost, $11,000.

Penn., Allentown—Solomon Lipschutz awarded contract for three-story, 52x60-ft. cigar factory to W. A. STEIN & CO., North Fulton St., Allentown. Estimated cost, $12,000.

Penn., Bryn Mawr—Contract awarded to GRAY BROS., Rosemont, for garage for E. L. Blabon. Estimated cost, $75,000.

Penn., Coatesville—UNITED ENGINEERING AND FOUNDRY CO., Youngstown, Ohio, awarded contract for plate rolling mill for Lukens Iron and Steel Co.

Penn., Monessen—Contract for two open-hearth furnaces for Pittsburgh Steel Co., Pittsburgh, awarded to LOCKMAN BROS., Pittsburgh. Estimated cost, $500,000.

Penn., Philadelphia—Contract for four-story, 89x98-ft. brick and reinforced-concrete shop at 18th and Buttonwood St. for Baldwin Locomotive Works awarded to IRWIN & LEIGHTON, 126 North 12th St., Philadelphia. Noted Dec. 2.

Penn., Philadelphia—Contract for garage at Kinsey and Paul St. for E. S. Gilmour, 4712 Penn St., awarded to JOHN McSHAIN, 1610 North St., Philadelphia.

Penn., Philadelphia—Contract for two warehouses at 19th and Glenwood Ave. for Hale & Kilburn Co. awarded to H. E. BATON, 12th and Sansom St., Philadelphia. Estimated cost, $23,000.

Del., Wilmington—Contract for garage for Tourist Garage Co. awarded to WILLIAM SCHOOLMASTER, Wilmington. Estimated cost, $10,000.

Md., Baltimore—Hess Steel Co. awarded contract for factory to DIETRICH BROS., Baltimore. Estimated cost, $30,000.

Ga., Athens—Georgia R.R. awarded contract to HINTON & STEWART, Athens, for warehouse at Foundry and Board St. Estimated cost, $16,000. Noted Nov. 18.

Ga., Columbus—Bibb Manufacturing Co. awarded contract to T. C. THOMPSON CO., Greenville, S. C., for addition to plant at 23d and River St. Estimated cost, $200,000. Noted Nov. 18.

Ga., Macon—Buckeye Cotton Oil Co. awarded contracts for 70x200-ft. seedhouse and warehouse to H. B. HOHENDIETZEL CO., Macon, for concrete foundation and side walls, to VIRGINIA BRIDGE AND IRON CO., Roanoke, Va., for steel roof.

Fla., Jacksonville—Contract awarded to O. P. WOODCOCK, Jacksonville, for warehouse for Estate of M. H. Basnett. Estimated cost, $22,000.

Ky., Glasgow—Glasgow Motor Car Co. awarded contract to EDWARD FORD, Glasgow, for two-story, 70x127-ft. garage. Estimated cost, $14,000.

Ky., Harrodsburg—Contract awarded to WALLKER PARSONS, Harrodsburg, for 83x96-ft. garage for Ft. Harrod Garage Co. Estimated cost, $10,000.

Ky., Lexington—Contract awarded to McCORMICK LUMBER CO., Lexington, for two-story, 50x400-ft. warehouse for Farmers Home Tobacco Warehouse Co. Estimated cost, $15,000.

Ky., Louisville—Contract awarded to L. V. ABBOTT, Louisville, for 80x432-ft. plant for Hoosier Veneer and Panel Co. Estimated cost, $40,000.

Ohio, Carthage—(Cincinnati post office)—Contract for addition to plant of Hess Spring and Axle Co. awarded to J. R. STEVENS CO., Odd Fellows Temple, Cincinnati. Estimated cost, $30,000. Noted Dec. 2.

Ohio, Cleveland—Contract for one-story, 77x135-ft. storage building for Multigraph Co. awarded to MASTERS & MULLEN CO., 601 Electric Bldg., Cleveland. Estimated cost, $10,000.

Ohio, Cleveland—Contract for three-story, 33x97-ft. factory and office building for National Carbon Co., 11,900 Madison Ave. awarded to HUNKIN-CONKEY CONSTRUCTION CO. Estimated cost, $16,000.

Ohio, Cleveland—Contract for storage plant for City Ice Delivery Co. awarded to W. I. THOMPSON CO., Cleveland. Estimated cost, $20,000.

Ohio, Cleveland—(Official)—Contract for addition to plant of Federal Knitting Mills Co. at Detroit and West 28th St. awarded to H. G. SLATMYER, 103 Lakeside Ave., Cleveland. Estimated cost, $40,000. Noted Nov. 25.

Ohio, Hamilton—Contract for two-story, 42x110-ft. building for Eickenberry Bros. awarded to BURRELL ENGINEERING AND CONSTRUCTION CO., Chicago, Ill., at $12,000.

Ohio, Kings Mills—Contract awarded to WELLS & GRAY, Toronto, Ont., for four-story, 65x416-ft. factory for Peters Cartridge Co. Estimated cost, $250,000. F. C. Tuttle, 1701 First National Bank Bldg., Cincinnati, Secy.

Ohio, Middletown—Contract for addition to plant of P. A. Sorg Paper Co. awarded to CALDWELL & ISEMINGER. Estimated cost, $10,000.

Ohio, Toledo—Electric Auto Lite Co. has taken out a permit for three-story reinforced-concrete factory building at 1209 Champlain St. Estimated cost, $73,000. Noted Nov. 4.

Ohio, Warren—Ohio Corrugating Co. will build one-story, 80x200-ft. factory by day labor.

Ohio, Youngstown—Contract for benzol factory for Youngstown Sheet and Tube Co. awarded to SEMET-SOLVAY CO., Syracuse, N. Y. Estimated cost, $450,000.

Ind., Richmond—Contract awarded to A. M. FRY, Piqua, Ohio, for three-story, 88x124-ft. warehouse for Miller Bros. Hardware Co.

Ill., Chicago—Fisher Furniture Co. awarded contract for three-story factory at 400 North May St. to CHICAGO IRON AND STEEL WORKS, 733 Fulton St., Chicago, for structure and miscellaneous iron. Noted Dec. 2.

Ill., Chicago—Chicago & Northwestern Ry. has awarded contract for grain elevator to be leased by Armour Grain Co. to WITHERSPOON-ENGLER CONSTRUCTION CO., Chicago. Estimated cost, $2,000,000. Noted Dec. 2.

Ill., Chicago—Contract for freight storage building for Pennsylvania R.R. awarded to GEORGE A. FULLER CO., Chicago. Estimated cost, $2,500,000. Noted Aug. 19.

Wis., Milwaukee—Contract for addition to plant of Cudahy Packing Co. awarded to W. F. TUBESING. Estimated cost, $50,000.

Minn., Duluth—Contract for addition to elevator plant of Capitol Elevator Co. awarded to BARNETT-RECORD CO. Estimated cost, $700,000.

Wash., Seattle—MacRae Bros., Empire Bldg., Seattle, at $16,394 submitted lowest bid for garage at 11th and Pine St. for Charles Frisell, to be occupied by Metz Auto Co.

Calif., San Pedro—Contract for concrete warehouse for Harbor Commissioners awarded to MERCHANTS REALTY AND INVESTMENT CO., Van Nuys Bldg., Los Angeles, at $117,139. Noted Nov. 25.

FEDERAL GOVERNMENT WORK

Proposed Work

R. I., Portsmouth—Oil Tank—U. S. Navy Department contemplates fuel-oil tank with capacity of 2,000,000-gal. About $40,000 available for this purpose.

N. Y., Ft. Totten—Wharf—Bids will be received until 10 a.m., Dec. 15, by A. J. Cooper, C. A. C., for repairs to short wharf. Noted Oct. 7.

N. J., Sea Girt—Bulkheads and Jetties—Bids will soon be received for new bulkheads and jetties at state rifle range, Sea Girt. Estimated cost, $10,000. John D. Kilpatrick, Maj. of Quartermaster Corps.

D. C., Washington—Dredging—Bids will be received at U. S. Engineer office, Room 305, Southern Bldg., Washington, until noon, Dec. 18, for dredging in Anacostia River.

W. Va., Wheeling—Power House—Bids will be received at U. S. Engineer Office, Wheeling District, Wheeling, until 11 a.m., Jan. 6, for fireproof power house at Dam No. 14, Ohio River. (See adv.)

Fla., Key West—Repairing Breakwater—Bids will be received at U. S. Engineer office, Jacksonville, until noon, Dec. 31, for repairing breakwater at Ft. Taylor, Key West.

Tenn., Memphis—River Improvements—Plans being prepared by U. S. Engineers for canal to direct flow of Wolf River into Isle of Mad chute to wash out Memphis Harbor and maintain channel. About $55,000 available for this work at present time but approximately $150,000 will be necessary to complete project. Col. McD. Townsend, Chn. of Mississippi River Comn. Major E. M. Markham, Engr.-in-Charge.

Mich., Sault Ste. Marie—Timber—Bids will be received at U. S. Engineer Office, 337 Federal Bldg., Detroit, until noon, Dec. 15, for 110,000 ft. b.m. of white oak timber. (See adv.)

Tex., Galveston—River Improvements—Plans being prepared by C. S. Riche, U. S. Engr., for system of locks and dams for Guadalupe River near Victoria. Estimated cost, $800,000.

Idaho, Boise—Post Office—All bids received Nov. 18 for addition to U. S. post office at Boise rejected. New bids will be received. Noted Oct. 14 and Nov. 25.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Manhattan)—(Official)—Post Office—Contract for post office at 4th Ave. and 13th St. for Estate of Charles A. Chesebrough to be leased by U. S. Government awarded to JOHN H. DEEVES & BROS., 103 Park Ave., New York. Estimated cost, $50,000. Noted Nov. 18.

D. C., Washington—Building—Bids were received by Commissioners of District of Columbia, Nov. 30, for addition and alterations to Powell School as follows: Burgess & Parsons, Washington, $60,000; A. L. Guidone & Sons, $60,450; Melton Construction Co., $61,295. Noted Nov. 25.

Va., Norfolk—Dredging—Contract for dredging at navy yard Norfolk, awarded to BAY STATE DREDGING AND CONTRACTING CO., Atlantic Ave., Boston, Mass. Estimated cost, $100,000. Noted Nov. 4 and Dec. 2.

Fla., Pensacola—Paving—Bids were received Dec. 4 for concrete pavement at navy aeronautic station, Pensacola, as follows: C. H. Turner Co., Pensacola, $6,959; William A. Burnett, Houston, $9,916; Henry Monk, Pensacola, $11,334. Noted Nov. 11.

Ohio, Elyria—Post Office—Contract for U. S. post office at Elyria awarded to JOHN G. UNKEFER & CO., Minerva, at $78,481. Noted Oct. 14 and Nov. 25.

Ohio, Sidney—Post Office—Contract for U. S. post office at Sidney awarded to OHIO BUILDING AND CONSTRUCTION CO., Cincinnati, at $51,650. Noted Oct. 7 and Nov. 18.

Colo., Grand Junction—Canal Work—Contracts for canal work at Grand Junction awarded as follows: Schedules 1 to 8, REYNOLDS-ELY CONSTRUCTION CO., Springville, Utah, at $28,534; schedule 9, HENRY WILSON, CARL HICKS and H. H. WILSON, Fruita, at $3,323; schedule 10, C. S. KIRKENDALL and JOHN E. NELSON, Fruita, at $2,801; schedule 11, SAM KLOZKO, Loma, at $1,649; schedule 12, J. M. GROESBECK, Springville, Utah, at $2,937; schedule 13, J. O'BRYAN, Fruita, at $2,364; schedule 14, J. W. COLLIER, Grand Junction, at $1,323; schedule 15, WADE COLLIER, Grand Junction, at $1,420; schedule 16, CHARLES E. LUTZ, Loma, at $1,578. Noted Oct. 21.

Hawaii, Pearl Harbor—Buildings—Bids were received Dec. 4 by H. R. Stanford, Ch. of Bureau of Yards and Docks, for three buildings at naval station, Pearl Harbor, (a) power house, (b) operating building, (c) double quarters for chief operators, (d) work complete as follows: Spalding Construction Co., San Francisco, Calif., (a) $12,023, (b) $10,127, (c) $9,535, (d) $31,685; Construction and Engineering Co., San Francisco, Calif., (a) $11,471, (b) $9,722, (c) $8,129, (d) $29,322. Noted Nov. 11.

CANALS, DITCHES, IRRIGATION

Proposed Work

N. Y., Albany—(Official)—Barge Canal Work—Bids will be received early next year for barge canal work under Terminal Contract No. 51. Estimated cost, $8,379. W. W. Wotherspoon, State Supt. of Pub. Wks.

N. Y., Albany—(Official)—Canal—Bids will be received by W. W. Wotherspoon, State Supt. of Pub. Wks., until noon, Jan. 4, for completing construction of canal from Northumberland to Stillwater, Contract No. 73A. Estimated cost, $432,045.

N. Y., Albany—(Official)—Canal—Bids will be received early next year for completing canal from station 5130 near Sterling Creek to Herkimer-Oneida County line, Contract No. 29-A. Estimated cost, $162,005. W. W. Wotherspoon, State Supt. of Pub. Wks.

N. Y., Albany—(Official)—Canal—Bids will be received early next year for completing canal from about station 2449 about 400-ft. east of Genesee River to about station 2566-58 about 42-ft. from east end of Contract No. 6, work to be done under Contract No. 21-A. Estimated cost, $415,700. W. W. Wotherspoon, State Supt. of Pub. Wks.

N. Y., New York—(Borough of Manhattan)—(Official)—Dredging—All bids received for derdging in North River from 103d St. to 109th St. rejected. New bids will be received until 3 p.m., Dec. 16 by Park Board, Dept. of Parks, Municipal Bldg., New York. Cabot Ward, Pres. Noted Dec. 2.

N. J., Trenton—Canal—Surveys will be made for proposed ship canal between Delaware River and Raritan Bay by State Department of Commerce and Navigation. Next legislature will be asked to appropriate $500,000 to purchase proposed canal.

Fla., Largo—Drainage—Contract will soon be awarded for drainage system for Lake Largo-Cross Bayou Drainage District. Estimated cost, $220,000.

Ohio, Cincinnati—(Official)—Ditch—Bids will be received by Fred E. Wesselmann, Pres., Bd. of Comrs. of Hamilton County, until noon, Dec. 17, for building ditch on Harrison and New Haven Rd., Crosby Township.

Wis., Racine—Drainage—Plans being prepared for 14 miles of open ditch and 15 miles of 18- to 24-in. drain tile for Root River Drainage District Commission. Estimated cost, $80,000.

Iowa, Emmetsburg—Drainage—Palo Alto County plans to construct drainage ditch. Estimated cost, $129,000. G. R. Campbell, interested.

Iowa, Tipton—(Official)—Ditch—Bids will be received by Jesse O. Bowlin, Supt. of Constr., until 2 p.m., Dec. 18, for constructing James A. Dunham ditch in Jefferson Township.

Iowa, Wall Lake—Drainage—Contract will be awarded about Apr. 1 by Board of Supervisors of Sac County for straightening and deepening Boyer River and draining Goose Pond Swamp. Estimated cost, $81,000. Seth Dean, County National Bank Bldg., Glenwood, Engr. Noted Dec. 2.

Kan., Dayton—Drainage—Property owners plan to organize Drainage District No. 1, Saline County. Proposed district will include portions of 10 sections in Dayton Township lying between Solomon River and Union Pacific main line.

Kan., Manhattan—Drainage—C. F. Pfentze interested in organization of drainage district to include three miles of open ditch work. Estimated cost, $10,000.

Kan., Ozawkie—Drainage—Contract will be awarded about Feb. 1 by Delaware River Drainage District for about 31,000 cu.yd. of work on six cutoffs on Peck Creek, about four miles from Newman on Union Pacific R. R. H. A. Plough, Secy., H. B. Walker, Manhattan, Engr.

Kan., Salina—Drainage—Plans being prepared for drainage work in District No. 1. Estimated cost, $12,000. P. A. Tobin, 109 North Santa Fé St., Engr.

Kan., Solomonn—Drainage—Contract will soon be awarded for approximately 80,000 cu.yd. of open ditch work for Drainage District No. 1, Salina County, about three miles from Solomon. H. B. Walker, Manhattan, Engr.

Kan., Strong City—Drainage—Drainage District recently organized in Chase County will build about two miles of open ditches requiring about 70,000 cu.yd. of excavation. Estimated cost, $10,000. H. B. Walker, Manhattan, Engr. Noted Sept. 23.

Wyo., Casper—Irrigation—Surveys made for irrigating and reclaiming about 8,000 acres on Bessemer Flats, about 14 miles southwest of Casper. Estimated cost, $100,000. A. C. Reeves, New York, N. Y., interested.

Mo., Louisiana—Drainage—Bids will be received about Jan. 1 for 13 miles of levees for River Land Drain District. J. Cherry, Jacksonville, Mo., Chn.

Mo., Poplar Bluff—(Official)—Ditches—Bids will be received by John H. Greason, Engr., Drainage District No. 11, Butler County, Court House, until Jan. 10 between 1 and 3 p.m., for constructing four drainage ditches and cleaning out one slough; also for constructing one wooden bridge across Main Ditch. (See adv.)

Tex., Brownsville—Irrigation—La Feria Mutual Canal Co. will extend canal irrigation system, to include 25 miles of main canals and 75 miles of laterals. Estimated cost, $150,000.

Tex., Lagrange—Drainage—Colorado County Drainage District No. 1 will issue $17,000 bonds for drainage system.

Ore., Gateway—Irrigation—Bidwell Cram, Gateway, granted permission by State Engineer to appropriate water from Trout Creek to irrigate about 507 acres near Gateway. Estimated cost, $14,000.

Ore., Grants Pass—Irrigation—Plans being prepared by W. B. Sherman for irrigation system and power plant for Rogue River Public Service Corporation. Estimated cost, $200,000. Noted Nov. 11.

Calif., Richvale—Drainage—Richvale Drainage District to drain about 20,000 acres will be organized by property owners.

Calif., Thermalito—Irrigation—Thermalito Irrigation District, recently organized, contemplates $250,000 bond issue to irrigate 6,000 acres. W. E. Duncan, Jr., Attorney. Noted Nov. 18.

Bids In and Contracts Awarded

Mass., Boston—Dredging—All bids received Nov. 24 by Directors of Port of Boston for dredging and filling East Boston, about 1,500,000 cu.yd., rejected. Noted Nov. 18 and Dec. 2.

N. Y., New York — (Borough of Brooklyn) — (Official) — Dredging—Contract for dredging Gowanus Canal from its head to Hamilton Ave., 6,000 cu.yd., awarded to R. G. PACKARD CO., 133 Greenwich St., New York, at 89c. per cu.yd. Noted Nov. 25.

N. Y., New York—(Borough of Manhattan)—(Official)—Dredging—Contract for dredging at foot of 90th St. and East River, awarded to MORRIS & CUMMINGS DREDGING CO., 17 State St., New York, at 0.33c. per cu.yd. Noted Dec. 2.

S. C., Anderson—Dredging—Drainage Commission of Rocky Creek Drainage District No. 1, Anderson County, awarded contract to L. O. WHITE, Statesville, N. C., for dredging Rocky River, about ten miles. Estimated cost, $19,500. Noted Aug. 12.

Ill., Forest City—Ditch—Commissioners of Tazewell and Mason County District awarded contract for cleaning Day, Reed and Bratt ditches to the CHESTER MASON CO., Mason City.

Wis., Caledonia—Canal—Contract for Caledonia Drainage Canal awarded to NATIONAL DRAIN TILE CO., Streator, Ill., at $15,000.

Iowa, Spencer—Ditch—(Official)—Contract for Drainage Ditch No. 28 awarded to CEMENT PRODUCTS CO., Spencer, at $59,780. Noted Oct. 28.

Minn., Bemidji—Ditches — Contract for construction of Judicial Ditch No. 34 awarded to LESTER E. GESELL and FRED A. BLAKE, Thief River Falls. Noted Nov. 11 and Dec. 2.

Minn., Redwood Falls—(Official)—Ditch — Contract for County Ditch No. 27 awarded to B. P. JENNINGS, Wanda, at $11,998. Noted Nov. 25.

Tex., Athens—(Official)—Flood Gates—Contract for flood gates impounding 1,000 acres of water for the Koon Klub awarded to AUSTIN BROS., Dallas. Henry E. Elrod, Southwestern Life Bldg., Dallas, Engr.

Tex., Orange—(Official)—Dredging—John Jacobson, Texas City, at 6.2c. per cu.yd. submitted lowest bid for dredging slips for wharfs and docks, 750,000 cu.yd. E. U. Henry, City Engr. Noted Nov. 18.

Calif., Modesto—Irrigation—Contract for concrete facing and curtain wall for Dam No. 1 awarded to PEART BROS., Oakland, at $72,800. Noted Nov. 18.

MISCELLANEOUS

Proposed Work

N. Y., Niagara Falls—Elimination of Grade Crossing—Grade Crossing Commission plans to eliminate grade crossing in Lockport, Whirlpool and Portage St. John L. Harper, Comn. Engr. Estimated cost, $485,000.

N. Y., Syracuse—Flood Protection—Report has been submitted to Flood Commission by John C. Hoyt of Water Resource Branch of U. S. Geological Survey, Washington, D. C., estimating cost of making surveys to prevent recurrence of Onondage Creek floods between $20,000 and $50,000.

Penn., Philadelphia—Subways and Elevated Railways—Election will be held Feb. 8 to vote on $45,000,000 bonds for subways and elevated railways and $8,000,000 for port development

Penn., Pittsburgh—Playground—City plans to expend $10,000 for playground around two point bridges. R. Swan, Dir. of Pub. Wks.

W. Va., Wheeling—Swimming Pool—Plans prepared by F. F. Faris for swimming pool for West Virginia State Fair Association. Estimated cost, $25,000.

Ala., Mobile—Docks—Tentative plans will be prepared by Ford, Bacon & Davis, Engr., 921 Canal St., New Orleans, for docks.

La., New Orleans—(Official)—Wharf and Causeway—Bids will be received by Ernest M. Loeb, Pres. Bd. of Comrs. of Port of New Orleans, Suite 200, New Orleans Court Bldg., until 8 p.m., Jan. 5, for constructing Dumaine St. creosoted wharf and reinforced-concrete causeway with creosoted wood block roadway (See adv.)

La., New Orleans—(Official)—Piling and Lumber—Bids will be received by Ernest M. Loeb, Pres., Bd. of Comrs. of Port of New Orleans, Suite 200, New Orleans Court Bldg., until 8 p.m., Jan. 5, for furnishing piling, lumber, etc., to be used in construction of Dumaine St. wharf. (See adv)

Tenn., Knoxville—Underpasses—City Commission and Southern Ry. will construct five underpasses. J. B. McCalla, City Engr.

Tenn., Memphis—Subway—City Commission, Nashville, Chattanooga & St. Louis Ry. and Memphis Street Ry will jointly build subway at Lamar Ave. Estimated cost, $108,000.

Ohio, Akron—Subways and Bridge—B. F. Goodrich Co., manufacturer of rubber goods, granted permission by City Council for three subways and overhead bridge in Falor and Main St.

Ohio, Bellaire—Dock—Pennsylvania R.R. plans to build coal dock at Bellaire. Estimated cost, $65,000. A. C Shand, Philadelphia, Penn., Ch. Engr.

Ohio, East Liverpool—Tunnel—City Council plans to build tunnel under Thompson Hill to accommodate Grandview car line. Estimated cost, $40,000.

Wis., Milwaukee—Bath House—Plans being prepared by C. E. Malig, Arch., Dept. of Pub. Wks., for bath house in McKinley Park Beach. Estimated cost, $50,000.

Mo., Springfield—Fish Hatchery—State will build fish hatchery near Springfield. Estimated cost, $15,000.

Tex., Houston—Pipe Line—National Oil & Gas Co. contemplates construction of 22 mile pipe line.

Que., Magog—Dam—Dominion Textile Co., Main St., plans to build dam.

Bids In and Contracts Awarded

N. Y., Bronxville—Elimination of Grade Crossing—Contract for eliminating grade crossing over Harlem division tracks of New York Central R.R. at Pondfield Rd. awarded to TRANSIT CONSTRUCTION CO., Mt. Vernon.

N. Y., New York—(Borough of Manhattan)—Alterations to Pier—Contract for alterations to Pier No. 64, North River, for Anchor Line S. S. Co. awarded to HENRY STEERS, INC., 17 Battery Pl. Estimated cost, $20,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Cement—Contract for 5,000 bags of portland cement awarded to MURTHA & SCHMOHL CO., 109th St., New York. Noted Nov. 4.

N. Y., New York—(Borough of Manhattan)—(Official)—(Subway)—Low bids received Nov. 30 by Public Service Commission of First District for Section No. 2, Route Nos. 19 and 22, part of Southern Blvd. and Westchester branch of Lexington Ave. subway were as follows: Lawrence C. Manuell, $2,063,877; Rodgers & Haggerty, $2,089,247; Cremshaw Engineering and Construction Co., $2,113,957. Noted Nov. 4 and 18.

N. Y., New York—(Borough of Manhattan)—Frogs and Switches—Bids were received Dec. 7 by Public Service Commission for special work, Order No. 6, for use in construction of Rapid Transit Railroads, frogs and switches for Lexington Ave. line, from Ramapo Iron Works, 30 Church St., New York, $48,195; William Warton, Jr., & Co., $48,815; Pennsylvania Steel Co., $54,043. Noted Nov. 25.

N. Y., New York—(Borough of Manhattan)—Subway—Bids were received Dec. 7 for part of Eastern District Subway, Section No. 3, Route No 8, under East River, from Manhattan at 14th St. to North Seventh St., Brooklyn, from Booth & Flinn, Ltd., 17 Battery Pl., New York, $6,631,000; Holbrook, Cabot & Rollins Corporation, $6,907,000; Degnon Contracting Co., $7,231,000; McMullen & Hoff, $9,467,000. The above are unofficial totals. Noted Nov. 18.

Penn., Philadelphia—Pier—Contract for dredging in connection with Pier No. 78, foot of McKean St. awarded to AMERICAN DREDGING CO., at $75,000; substructure of pier to SNARE & TRIEST CO., Woolworth, Bldg., New York, N. Y., at $575,000. Low bids received Dec. 6 for superstructure were as follows; Snare & Triest Co., $488,600; Irwin & Leighton, $494,800; Pennsylvania Steel Co., $495,300. Noted Aug. 26, Nov. 11 and 25.

La., New Orleans—Wharf—Contract awarded to DOULLUTT & WILLIAMS, New Orleans, at $188,000 for piling, timber, etc., for wharf of grain elevator, wharf is 1,350 ft. long and 12 ft. wide. Noted Dec. 2.

Minn., Two Harbors—Ore Docks—(Official)—Contract for superstructure of concrete ore dock for Duluth & Iron Range R.R. Co. awarded to AMERICAN BRIDGE CO., New York, N. Y., substructure to BARNET & RECORD CO., Minneapolis, Minn. New dock will replace Dock No. 2. Estimated cost, $1,635,000. Noted Oct. 21 and Nov. 18.

Mo., Kansas City—Memorial—Contract for memorial in Mt. Washington Cemetery for the W. R. Nelson Estate awarded to GEORGE A. FULLER CONSTRUCTION CO., 418 Dwight Bldg., Kansas City. Estimated cost, $125,000.

Tex., Arthur City—Revetment—Contract for revetment work on Red River above Arthur City for Risco R.R. awarded to J. W. McMURRAY CONTRACTING CO., Kansas City, Mo.

Calif., Huntington Beach—(Official)—Subway Work—Contract for reinforced-concrete pipe culverts, reinforced-concrete and timber subway and approaches under Southern Pacific tracks awarded to G. H. OSWALD, Los Angeles, at about $81,481. Noted Nov. 11.

Ont., Ft. William—(Official)—Coal Docks—Contract for addition to plant of Ft. William Coal Dock Co., Ltd., on Mission River awarded to ROBERTS & SCHAEFER CO., Chicago, Ill. Estimated cost, $300,000. C. B. Nineaber, Gen. Mgr. Noted Nov. 25.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Mass., Boston—(Fenway)—Plans being prepared for five-story, 40x150-ft. school and dormitory for Gordon Bible Institute, 7 Montgomery St., Boston. Estimated cost, $60,000. Kendall Taylor & Co., 93 Federal St., Boston, Arch.

Mass., North Adams—Board of Education has notified City Council that proposed new high school will cost $252,650 instead of $190,000 and has asked for an additional appropriation. Noted Nov. 11 and 25.

Mass., Quincy—City Council appropriated $220,000 for two school buildings. E. R. Stone, Mayor.

Mass., Salem—Plans prepared for addition to Bowditch School.

Mass., Springfield—Revised plans being prepared by F. M. Knowlton, Arch., 21 Merwin St., for six-story hotel for M. Rainville, 7 Myrtle St. Estimated cost, $100,000.

Mass., Stoneham—(Official)—Contract for fire and police station will be awarded in about two weeks. Estimated cost, $40,000. P. Varney, Arch. Noted Dec. 2.

R. I., Smithfield—Bids will be received until Jan. 17 for school. William R. Walker & Son, 17 Custom House St., Providence, Arch.

Conn., Bridgeport—Contract will soon be awarded for addition to Garfield School. Estimated cost, $45,000. H. S. Challenger, Chn. of Bldg. Com. Noted Dec. 2.

N. Y., Buffalo—Brown & Hoffman, Arch., 778 Genesee St., preparing plans for two-story addition to Columbus Turnverein to be used as a clubhouse. Estimated cost, $65,000. C. North, 1261 Genesee St., Secy.

N. Y., Fredonia—Citizens voted to issue $150,000 bonds for tuberculosis hospital.

N. Y., Jamestown—William J. Maddox is interested in the construction of an eight-story 100x160-ft. exposition building on the site of the old Fenton Homestead.

N. Y., New York—(Borough of Bronx)—(Official)—Contract will be awarded about Jan. 1 for two-story, 100x200-ft. theater at Webster Ave. and 195th St. for Max J. Kramer Co., 35 Nassau St. Estimated cost, $175,000. G. F. Pelham, 30 East 42nd St., Arch. Noted Nov. 18.

N. Y., New York—(Borough of Brooklyn)—Justices of Supreme Court plan to enlarge and remodel courthouse at Court and Jerolemon St. Estimated cost, $600,000. Frank H. Quinby, 99 Nassau St., New York, N. Y., Borough of Manhattan, Arch.

N. Y., New York—(Borough of Brooklyn)—Plans being considered by Department of Public Charities, New York, for addition to Kings County Hospital at New York Ave. and Clarkson St. Estimated cost, $75,000.

N. Y., New York—(Borough of Manhattan)—Plans will be prepared by Henry B. Herts, Arch., 345 Fifth Ave., for proposed Isaac L. Rice Memorial Hospital. Estimated cost, $1,000,000. Beth Israel Hospital, 70 Jefferson St., interested.

N. Y., New York—(Borough of Richmond)—John K. Burke and James Plunkett plan to build two-story brick theater at Bay and Wave St. Estimated cost, $70,000. H. R. Brewster, 116 Nassau St., New York, N. Y. (Borough of Manhattan), Arch.

N. Y., Peekskill—Westchester County Building Commission rejected all bids received for building county penitentiary. New bids will be received.

N. Y., Purchase—D. Barber, Arch., 101 Park Ave., New York, will prepare plans for meeting hall for A. W. Reed, Nassau and Cedar St., New York. Estimated cost, $700,000.

N. Y., Rochester—(Official)—Bids will be received until Dec. 15 for Chamber of Commerce Building at Mortimer and St. Paul St. Claude Braydon, Cutler Bldg., and Foster & Gade, Sibley Bldg., Rochester, Arch. Noted Nov. 25.

N. Y., Syracuse—Board of Education plans to build two-story, 160x270-ft. building to be known as Madison School. Estimated cost, $300,000. A. E. Larkin, Pres.

N. J., Atlantic City—Press reports state that new hotel will be built on site of Windsor Hotel. Jules E. Mastbaum, Philadelphia, Penn., interested.

N. J., Edgewater—Bonds for $40,000 sold for firehouse.

N. J., Paterson—Board of Education plans to enlarge and remodel School No. 7. Estimated cost, $60,000. J. F. Dunphy, City Hall, Clk.

N. J., Paterson—Plans being prepared for parochial school for Our Lady of Lourdes Church. Estimated cost, $50,000. B. P. Ketchell, 207 Market St., Newark, N. J.

N. J., Summit—Plans being considered by Public Service Corporation, 759 Broad St., Newark, for office building at Springfield Ave. and Beechwood St. Estimated cost, $75,000.

N. J., Trenton—School Commission plans to rebuild school which was recently destroyed by fire. Thomas D. Sensor, Pres.

Penn., Dickson City—Plans being prepared by Hancock & Koch, Arch., Coal Exchange Bldg., Scranton, for two-story school. Estimated cost, $50,000.

Penn., Harrisburg—Samuel Fishman, Market St., Harrisburg, plans to build a 60-room addition to the Lenox Hotel.

Penn., Johnstown—Press reports state that three-story municipal building will be constructed at Main and Market St. N. Miller, Supt. of Finance Dept.

Penn., Lehighton—Contract will soon be awarded for new high school. Estimated cost, $100,000. J. N. Hotchkiss, Secy. of Bd. of Education.

Penn., Monongahela—Board of Education will build two-story school. Estimated cost, $50,000. Charles J. Rieger, Germania Bank Bldg., Pittsburgh, Arch.

Penn., New Kensington—Plans will be prepared by Janssen & Abbott, Arch., Century Bldg., Pittsburgh, for two-story clubhouse for Aluminum Co. of America. Estimated cost, $100,000. Noted Dec. 2.

Penn., Philadelphia—Bids will be received about Jan. 1 by A. C. Shand, Ch. Engr., for four-story 60x68-ft. freight house for Pennsylvania R.R.. Estimated cost, $250,000.

Penn., Philadelphia—Board of Education will build addition to Harriet Beecher Stowe School at 70th St. and Woodland Ave. Estimated cost, $60,000. J. Horace Cook, Arch.

Penn., Philadelphia—Board of Education will build four-story school at B and Westmoreland St. Estimated cost, $350,000. J. Horace Cook, Arch.

Penn., Philadelphia—Election will be held Feb. 8 to vote on $6,000,000 bonds for municipal art gallery, general hospital and convention hall.

Penn., Philadelphia—Bids will be received by William Dix, Secy., Com. on Property of Bd. of Education, for 31-room school at B and Allegheny Ave. and nine-room addition to school at 70th and Woodland Ave.

Md., Baltimore—Plans being prepared by Lewis Levi, Munsey Bldg., Baltimore, for four-story office building on German St. for Immediate Benefit Life Insurance Co. Estimated cost, $70,000.

D. C., Washington—Preliminary plans prepared by Frank G. Pierson, Arch., Washington Loan and Trust Bldg., for one- and three-story convention hall for a company which is now being formed. W. E. Dentinger, Evans Bldg., promoter. Estimated cost, $400,000.

D. C., Washington—W. E. Dentinger plans to organize a company to construct a convention hall. Estimated cost, $400,000. G. Pierson, Washington Loan and Trust Co., Arch.

Va., Norfolk—Bellamy & Hough plans to build hotel at Ocean Park.

W. Va., Bluefield—An expenditure of $40,000 contemplated by Bluefield Lodge, B. P. O. E., for improving building.

W. Va., Spencer—Bids will be received until Dec. 22 by H. C. Ferguson, Secy. of Bd. of Education, for three-story high school. V. T. Ritter, Huntington, W. Va., Arch.

W. Va. Wheeling—Bonds for $85,000 voted for central school in Center Warwood by citizens of Richland District. J. E. Evans, Secy. of Bd. of Education. Noted Nov. 18.

N. C., Durham—Bids will be received until Jan. 11 by Commiissioners of Durham County, for four-story courthouse and jail. Estimated cost between $180,000 and $250,000. Milburn, Heister & Co., Union Savings Bank Bldg., Washington, D. C., Arch. Noted July 29.

N. C., Gastonia—Bonds for $100,000 will be sold Dec. 14 for schools.

Fla., Seabreeze—Plans being prepared by Mark & Sheftall, Clark Bldg., Jacksonville, for three-story concrete school for Board of Public Instruction. Estimated cost between $40,000 and $50,000.

Ala., Birmingham—Plans prepared for school for Blessed Sacrament Church. Estimated cost, $50,000.

Ala., Mobile—Church will be constructed at Broad and Charleston St. by Greek Orthodox Society. L. G. Hiakapulos, interested.

Tenn., Bristol—(Official)—We have been informed that although bonds for $60,000 have been voted for high school bids for same will not be received for some months. Noted Oct. 28 and Dec. 2.

Tenn., Cleveland—Bids will be received until Dec. 14 by S. Y. Adcock, Supt. of High School Bd. of Bradley County, for high school. C. T. Jones, Hamilton National Bank Bldg., Chattanooga, Arch.

Tenn., Columbia—Congregation of First Presbyterian Church will rebuild structure recently destroyed by fire. Estimated cost, $50,000.

Tenn., Cookeville—State Board of Education, Nashville, will soon award contract for two buildings at State Normal and Polytechnic School. Estimated cost, $145,000. Noted Dec. 2.

Tenn., Cumberland Gap—Lincoln Memorial University is campaigning to raise $800,000 for three dormitories and equipment. George A. Hubbel, Pres.

Tenn., Lebanon—J. W. Hamilton is interested in a plan to organize a company to build a hotel, dancing pavilion and swimming pool on Hamilton property at Hampton Springs.

Tenn., Nashville—Bids will be received until Dec. 10 by V. Tolmie, Chn. of Bldg. Com., for Elliott School and negro high school. Estimated cost, $70,000, and $55,000 respectively. Noted Oct. 7 and Dec. 2.

Tenn., Nashville—(Official)—Bids will soon be received for remodeling building at Fourth Ave. and Union St. for bank and office building for Fourth and First National Bank. Estimated cost, $100,000. Noted Nov. 25.

Ky., Lexington—Eastern Kentucky State Hospital contemplates addition to hospital. Estimated cost, $90,000.

Ky., Louisville—Fraternal Order of Eagles will construct building at 812 South Second St. M. G. Mature, Chn. of Bldg. Com.

Ohio, Alliance—E. J. and R. I. Parthe, 240 East Main St., plan to build a two-story theater and store building. Estimated cost, $45,000. W. W. Matchett, 537 East Main St., Arch.

Ohio, Andover—Press reports state that a sanitarium will be built in Andover by Cincinnati, Youngstown and Andover capitalists. Estimated cost, $150,000.

Ohio, Athens—Trustees of Athens County Children's Home contemplate new home.

Ohio, Atwater—Plans being prepared by L. Thomas, Arch., 305 Pythian Temple, Cleveland, for school for Board of Education.

Ohio, Barberton—City contemplates election to vote on $67,500 bonds for city hall.

Ohio, Batavia—Bids will be received until Dec. 16 by Robertson & Fahnestock, Arch., Cincinnati, for public school.

Ohio, Cedar Point—Plans prepared by W. W. Hodges Co., Arch., 1216 Scofield Bldg., Cleveland, for three-story hotel for Cedar Point Amusement Co. G. A. Boecklin, Sandusky, Gen. Mgr.

Ohio, Cincinnati—(Official)—Date for receiving bids for Y. M. C. A. building postponed until about Feb. 1. Noted Oct. 7 and 21.

Ohio, Cincinnati—Browning-King Co. will build a four-stroy building on site of old St. Nicholas Hotel at Fourth and Race St. Estimated cost, $150,000.

Ohio, Cleveland—Contract will be awarded about Feb. 15 for two-story, 70x120-ft. church for Parkhill Baptist Church, 10600 Hathaway Ave. Estimated cost, $40,000. Fulton & Butler, Uniontown, Penn., Arch.

Ohio, Cleveland—Plans prepared for additions to Cleveland Chamber of Commerce Building in Public Sq. Estimated cost, $400,000.

Ohio, Columbus—Plans being prepared by D. Riebel & Sons, Arch., New First National Bank Bldg., for 11-story hotel for Broadway Co. Estimated cost, $400,000.

Ohio, Ironton—William Bay plans office and store building at Third and Center St. Estimated cost, $50,000.

Ohio, Lakewood—(Official)—We have been informed that New York, Chicago & St. Louis R.R. does not contemplate passenger station estimated to cost, $50,000, as stated in our issue of Dec. 2 M. H. Canniff, Pres.

Ohio, Niles—Bids will be received about Feb. 15 for six-story building for Dollar Savings Bank. Estimated cost, $200,000. C. F. Ownsley, Mahoning Bank Bldg., Youngstown, Arch. W. F. Stevens, Secy and Treas. Noted Oct. 14.

Ohio, Norwood—Bids will be received until Dec. 13 by Harold Ryland, Clk. of Bd. of Education, for purchase of $45,000 bonds for new school in Norwood View. Noted Nov. 11.

Ohio, Olmsted Falls—Plans being prepared by W. H. Nicklas, Arch., 1900 Euclid Ave., Cleveland, for school. Bids will be received about Jan. 1. Estimated cost, $60,000.

Ohio, Ravenna—Bids will be received about Jan. 1 for church and sunday school for congregation of First M. E. Church. Estimated cost, $50,000. W. T. Saltzman, 426 King St., Chn. of Bldg. Com.

Ohio, Ravenna—H. W. Riddle, East Main St., plans to build a three-story, 46x100-ft. theater. Estimated cost, $60,000. J. W. Greene, 246 Grant St., Arch.

Ohio, Willoughby—Plans will be prepared by Franz C. Warner, Arch., Hippodrome Bldg., Cleveland, and E. D. Litchfield, New York, N. Y., for new buildings for Andrews Institute. Estimated cost between $800,000 and $1,000,000.

Ind., Huntington—Bids will be received about Jan 1 for two-story, 141x183-ft. high school for Board of Education. Elmer E. Dunlap, 909 State Life Bldg., Indianapolis, Arch. Noted Dec. 2.

Ind., Indianapolis—Bids will soon be received by D. A. Bohlen & Son, Arch., 1002 Majestic Bldg., for four-story bank and office building for Meyer & Kiser. S. Meyer, 137 East Washington St., Pres.

Ind., Peru—Plans will be prepared by Schriber-Beelman Co., Second National Bank Bldg., Toledo, Ohio, for two-story city hall. Estimated cost, $125,000. Noted Nov. 18.

Ind., Terre Haute—Board of Education will build two-story McLain Grade School. Estimated cost, $115,000. Herbert Foltz, 1456 Lemcke Annex, Indianapolis, Arch.

Mich., Detroit—Plans prepared by Smith, Hinchman & Grylls, Arch., for three-story building at 765-75 East Congress St. for Michigan State Telephone Co. Estimated cost, $60,000.

Mich., Grand Rapids—Y. W. C. A. plans to construct new building. Estimated cost, $100,000.

Ill., Chicago—Plans being prepared by Schmidt, Gardner & Martin, Arch., 104 South Michigan Ave., for three-story, 90x140-ft. building for Eleanor Club. Estimated cost, $125,000.

Ill., Tuscola—Board of Education plans to build high school. Estimated cost from $125,000 to $150,000.

Ill., Urbana—Press reports state that Cleveland, Cincinnati, Chicago and St. Louis Ry. will build passenger station at Urbana. Estimated cost, $45,000. C. A. Paquete, Cincinnati, Ohio, Ch. Engr.

Wis., Green Bay—Plans being prepared by Helmle & Helmle, Arch., 805 Fergus Bldg., Springfield, Ill., for addition to St. Vincent's Hospital. Estimated cost, $50,000.

Wis., Milwaukee—(Official)—Bids will be asked in about 60 days for three-story, 85x120-ft. School of Trades for Milwaukee Board of School Directors. Estimated cost, $160,000. Van Ryn & De Gelleke, Caswell Block, Arch. Noted Dec. 2.

Wis., Milwaukee—Preliminary plans being prepared for remodeling Empire Building at Grand Ave and West Water St. for Pabst Brewing Co. Estimated cost, $75,000. Henry Danisohefsky, Mgr.

Wis., Milwaukee—Plans being prepared by C. E. Malig, Arch., Dept. of Pub. Wks., for administration building for Isolation Hospital. Estimated cost, $40,000. F. G. Simmons, Comr. of Pub. Wks.

Wis., Taycheedah—Bids will be received next spring by State Board of Control for reformatory for women. Estimated cost, $200,000. M. J. Tappins, Secy., State Bd. of Control. Noted Sept. 23.

Iowa, Des Moines—Bids will be received about Jan. 1 for three-story brick building at Fourth and Grand Ave. for Willard Dixon, 1390 Pleasant St.

Iowa, Eldora—Citizens of Independent School District voted $93,000 bonds for school.

Iowa, Harlan—Bids will be received until 2:30 p.m., Jan. 5, by B. B. McPheeters, Secy. of Bd. of Education, for high and grade school buildings. J. D. Chubb, Arch., 109 North Dearborn St., Chicago, Ill.

Iowa, Sioux City—Commissioners of Woodbury County plan to build three-story, 150x150-ft. courthouse. Estimated cost, $50,000. Henry Metz, Chn. of Bd. of Superv.

Minn., Duluth—Northern Pacific Ry. plans to build new depot.

Minn., Duluth—Holstead & Sullivan, Arch., Palladio Bldg., preparing plans for two buildings at Superior St. and 21st Ave., W., for Stack Bros. Estimated cost, $70,000.

Minn., Duluth—Contract will be awarded in about six weeks for Morgan Park School. Estimated cost, $110,000. Kelly & Williams, Duluth, Arch.

Minn., Eveleth—Tentative plans prepared by W. T. Bray, Arch., Duluth, for high school. Estimated cost, $200,000.

Minn., St. Paul—Bids will be received until 10:30 a.m., Dec. 13, by A. Hohenstein, Pur. Agt., for building Carnegie Library, No. 1.

Kan., Ottawa—G. Washburn & Son, Arch., preparing plans for three-story addition to hotel for John Nelson.

Kan., Salina—Plans will be prepared by E. O. Brostrom, Arch., 300 Brent Bldg., Kansas City, Mo., for church for St. John's Lutheran congregation. Estimated cost, $40,000.

Kan., Topeka—Plans will be prepared for junior high and grade school. Estimated cost, $70,000.

Kan., Topeka—(Official)—R. Marks, Des Moines, Iowa, informs us that proposed department store building at Eighth and Kansas Ave. will not be constructed for about one year. Noted Nov. 25.

Neb., Omaha—Plans being prepared for two-story office building for Armour & Co., South Omaha. Bids will be received about Jan. 1. Estimated cost, $70,000.

Neb., Omaha—Bids will be received by J. S. Dales, Secy., Bd. of Regents of University of Nebraska, Sta. A, Lincoln, for hospital on grounds of College of Medicine, University of Nebraska. Estimated cost, $150,000. John Latenser & Sons, 626 Bee Bldg., Arch. Noted Dec. 2.

S. D., Mitchell—G. P. Botson will start campaign to raise funds for building State Methodist Hospital. Estimated cost, for first unit, $75,000.

Mo., Plattsburg—Bids will be received by E. McWilliams, Secy. of Bd. of Education, until 2 p.m., Dec. 15, for school. Owen & Payson, Arch., 731 Scarritt Bldg., Kansas City, Mo.

Mo., St. Louis—Plans prepared by Barnett, Haynes & Barnett, Arch., for two-story, 80x140-ft. parish school for Catholic Cathedral of St. Louis. Estimated cost, $100,000. Noted Oct. 21.

Mo., Springfield—Plans being prepared by O. L. Buttner, Arch., Holland Bldg., for building on South Jefferson St. for Y. W. C. A. Estimated cost, $75,000. H. Cooper, 297 East Water St., Chn. of Bldg. Com. Noted Nov. 25.

Ark., Little Rock—Morgan Smith, Dean of Medical Dept. of University of Arkansas, is interested in a plan to build a State General Hospital.

Ark., Little Rock—Plans being considered by Church of Nazarath, 14th and John St., for new building.

Tex., Abilene—Dormitory will be constructed at Simmons College. Estimated cost, $40,000.

Tex., Austin—Plans being prepared by Atlee B. Ayres, Bedell Bldg., San Antonio, for land office building and remodeling State Capitol for the state. Estimated cost, $300,000.

Tex., Beaumont—Bids will be received until Dec. 27 by Jefferson Hotel Co., c/o Cooke & Co., Theater Bldg., Houston, for nine-story hotel at Jefferson, Laurel and Alamo St. Estimated cost, $200,000.

Tex., College Station—Bids will be received until Dec. 22 by R. Adelspeyer, Arch., for hospital at State Agriculture and Mechanical College. Estimated cost, $50,000. Noted July 29 and Aug. 19.

Tex., Greenville—Wesley College will build administration building. Estimated cost, $50,000.

Tex., Harrisburg—Bonds for $50,000 voted by Harris County School District No. 20 for schools.

Tex., Houston—Bids will be received until 2 p.m., Dec. 13, by City Secretary for building administration building for Montrose School.

Tex., Houston—Bonds for $50,000 voted for schools in School District No. 20.

Tex., Kerrville—Mountain Park Sanitarium, recently organized with $124,000 capital stock, plans to build tuberculosis sanitarium near Kerrville. C. S. Fowler, San Antonio, interested.

Tex., Paris—Plans prepared for hotel on South Second St. Estimated cost, $45,000.

Tex., Pharr—Bond issue for $40,000 of Hidalgo County Common School District No. 4 for high school approved by Attorney General.

Tex., Wichita Falls—Plans being prepared by Field & Clarkson, Arch., for three-story building for A. F. & A. M. Estimated cost, $50,000.

Tex., Wichita Falls—Citizens voted $225,000 bonds for court house. Noted Nov. 11.

Okla., Durant—Citizens contemplate election to vote on $100,000 bonds for courthouse and jail for Bryant County.

Okla., Holdenville—Citizens voted $100,000 bonds for courthouse and jail. Noted Nov. 11.

Okla., Miami—Plans being prepared for county courthouse. Citizens recently voted $75,000 bonds for this purpose.

Okla., Okmulgee—Election will be held about Dec. 28 to vote on $150,000 bonds for county courthouse and jail.

Okla., Tulsa—Theater will be constructed by William Smith owner of Empress Theater. Estimated cost, $100,000.

Okla., Tulsa—Bids will be received until Dec. 20 by Board of Education for high school. Estimated cost, $300,000. H. O. McClure, Pres. Noted Dec. 2.

Utah, Salt Lake City—Salt Lake Terminal Co. will build station at South Temple and West Temple St. Estimated cost, $200,000.

Wash., Seattle—Plans will be prepared by Bebb & Gould, Arch., Denny Bldg., for school to be built on University Campus. Estimated cost, $150,000.

Ore., Portland—Woodmen of the World, Multnomah Camp No. 77 will erect building. Estimated cost, $65,000.

Ore., Portland—City will award contract for auditorium on Market Blk early next year. Estimated cost, $600,000. Philip H. Dater, City Engr. Noted Aug. 12 and Oct. 28.

Ore., Portland—Bids will soon be received for three-story, 83x100-ft. building at 20th and Washington St. for Labor Temple Association. Estimated cost, $105,000. Houghtaling & Dougan, 508 Henry Bldg., Arch. Noted Nov. 18.

Calif., Bakersfield—Election will be held Dec. 14 to vote on $75,000 bonds for two schools.

Calif., El Centro—Central Union High School District will award contract for high school in January. Estimated cost, $135,000. S. B. Zimmer, El Centro, Arch. Noted Oct 14.

Calif., Fresno—Bids will be received by H. E. Verble, Clk., Bd. of Trustees of Kingsburg Joint Union High School District, until 2 p.m., Dec 11, for high school.

Calif., Fresno—Bids will soon be received for edifice for Christian Science congregation. Estimated cost, $40,000. R. B. Hotchkin, Arch. Noted Aug. 12.

Calif., Riverside—Preliminary plans being prepared by Lester H. Hibbard, Arch., for citrus experiment station for University of California. Plans include director's residence, garage and shops. About $125,000 available for this purpose.

Calif., Sacramento—Revised plans being prepared by Shea & Lofquist, Arch., for William Land School on 17th., 18th., E., and F St. Estimated cost, $160,000. E. J. Carraghar, Pres. Bd. of Education.

Calif., San Leandro—Bonds for $125,000 voted for two new district schools.

Calif., Waco—Election will be held Dec. 11 to vote on $45.000 bonds for high school.

Bids In and Contracts Awarded

Mass., Boston—Contract awarded to G. A. FULLER CO. for pavilion on Charles St. for Massachusetts General Hospital. Noted Oct. 7.

Mass., Danvers—Trustees of Essex County Agricultural School awarded contract for school on Maple St. to LOUIS McALOON, North Andover, at $65,320. Noted Dec. 2.

N. Y., Buffalo—Contract for laboratory and experimental building for Pierce-Arrow Motor Car Co. at Elmwood Ave. and New York Central R.R. belt line awarded to ABERTHAW CONSTRUCTION CO., Boston, Mass. Estimated cost, $15,000.

N. Y., New York—(Borough of Bronx)—(Official)—Contract awarded to BUILDING VIOLATIONS CORPORATION, Woolworth Bldg., (Borough of Manhattan), for church at East 187th St. and Tiebout Ave., for East 187th St. United Presbyterian Congregation. Estimated cost, $40,000. Noted Sept. 30.

N. Y., New York—(Borough of Richmond)—(Official)—Contract for three-story, 75x150-ft. brick orphan asylum for Bethlehem Home awarded to C. SCHNEIDER & SON, 1251 DeKalb Ave., Brooklyn. Estimated cost, $100,000. Noted Oct. 14.

N. J., Atlantic City—(Official)—Contract for 12-story addition to St. Charles Hotel at St. Charles Pl. and Boardwalk for Newlin Haines Co., South New Jersey Ave. awarded to CRAMP & CO. Denckla Bldg., Philadelphia, Penn.

N. J., Princeton—Contract for club house for Quadrangle Club awarded to MATTHEWS CONSTRUCTION CO., Princeton. Estimated cost, $40,000.

Penn., Lebanon—Board of School Directors awarded contract for high school to BEARD CONSTRUCTION CO., Reading, at $151,333. Noted Oct. 7 and 14.

Penn., Scranton—Contract for building for First National Bank awarded to S. SYKES & SON, 218 Larch St., Scranton. Estimated cost, $190,000.

Penn., Wilkes-Barre—Contract for two-story school awarded to HERMAN MAILANDER, 169 Barney Ave., Wilkes-Barre. Estimated cost, $50,000.

S. C., Spartanburg—Contract for hotel at Morgan Sq. and King St. for Spartanburg Hotel Corporation awarded to LONGEST & TESSIER CO., Greensboro, N. C. Estimated cost, $150,000.

La., New Orleans—(Official)—Bids received Nov. 23 by Department of Public Finances for Isolation Hospital from J. A. Petty, $32,956; Lionel F. Favrot, $34,429; M. Chessi Co., $34,-700. Noted Nov. 11.

Ohio, Canton—Contract awarded to INDIANA ENGINEERING AND CONSTRUCTION CO., Ft. Wayne, Ind., at $47,725 for Daniely-Worley School. Noted Nov. 11.

Ohio, Cleveland—General contract awarded to BOLTON PRATT CO. for club house for Bricklayers' Union. Estimated cost, $65,000. Noted Nov. 11.

Ohio, Cleveland—General contract awarded to SAMUEL AUSTIN & SON CO., 14230 Euclid Ave., for building for J. H. Donahey and Elbert H. Baker, Plain Dealer Bldg., to be occupied by Hudson Stuyvesant Motor Car Co.

Ohio, Cleveland—General contract awarded to ROBINSON CONTRACTING CO., Wade Bldg., for four-story, 110x120-ft. college for Western Reserve University Dental School. Estimated cost, $75,000. Noted Nov. 11.

Ohio, Cleveland—Great Western Oil Co. awarded contracts for office building to PAUL BROS., Citizens Bldg., masonry work; YOUNGER & FARMER, carpentry work. Estimated cost, $49,000.

Ind., Bloomington—Contract for gymnasium for Indiana University awarded to A. E. KEMMER, Lafayette, at $157,200. Noted Aug. 19 and Oct. 21.

Ind., Ft. Wayne—INDIANA ENGINEERING AND CONSTRUCTION CO., Ft Wayne, awarded contract for three-story, 58x220-ft. building on Harrison St. for Ft. Wayne Land and Improvement Co.

Ill., Chicago—Pennsylvania R.R. awarded contract to FULLER CONSTRUCTION CO., New York, N. Y., for four-story, 400x800-ft. freight station. Estimated cost, $1,300,000. Noted Oct. 7.

Ill., Chicago—Bids received Dec. 1 by Board of Education for building Bell School from E. Reininga, carpentry at $27,-772; A. E. Anderson, masonry at $51,490; South Halsted Street Iron Works, steel at $36,461.

Wis., Milwaukee—Alfred C. Clas, Arch., awarded contract for eight-story, 120x200-ft. hotel for Harvey Bros. to DAHLMAN CONSTRUCTION CO., 914 Majestic Bldg., Milwaukee. Estimated cost, $750,000.

Minn., Minneapolis—Contract for state historical building awarded to GEORGE J. GRANT CONSTRUCTION CO., St. Paul, at $397,000.

Minn., Northfield—(Official)—Contract for chemistry building at Northfield awarded to H. N. LEIGHTON CO., Minneapolis. Estimated cost, $50,000. Noted Nov. 25.

Kan., Wichita—Contract awarded to SWENSON CONSTRUCTION CO., 625 Finance Bldg., Kansas City, Mo., for administration building for Y. M. C. A. Estimated cost, $50,-000. Noted Nov. 11.

Neb., Chadron—(Official)—General contract awarded to JOHN OHLSEN & SON, Loup City, Neb., for bank and office building for C. F. Coffee and B. F. Putman. Noted Nov. 18.

Tex., Austin—(Official)—Contract for three-story high-school awarded to VAN HORN SHAW CONSTRUCTION CO., Ft. Worth, Tex., at $100,790. Noted Nov. 18.

Tex., Houston—Reinhart & Donovan, Oklahoma, at $56,000, submitted lowest bid for Taylor School. Noted Nov. 4.

Idaho, Boise—Walsh Bros. & Hannan, Girdley, Calif., at $41,874, submitted lowest bid for addition to public building.

Colo., Greeley—Lowest bid received on general contract for courthouse was that of Seerie & Varnum, at $95,400.

Ore., Echo—Contract for city hall awarded to C. H. KRANTZ, Portland, at $40,065.

Calif., Los Angeles—Contract awarded to F. O. ENGSTRUM CO., Fifth and Seator St., Los Angeles, for bank building on Spring St. for Security National Bank.

Benjamin B. Lawrence, Class of 1878 Columbia School of Mines, New York, N. Y., has purchased the Pelton-Doble waterwheel and Pelton-Francis turbine exhibits of the Pelton Water Wheel Co., San Francisco, at the exposition, and has presented the same to the above school.

John Pierce & Co., 901 West St., New York, N. Y., granite contractors, has filed a petition in bankruptcy.

The Aberthaw Construction Co. announces the removal of its offices to more commodious quarters in the newly erected Niles building, at 27 School St., Boston, Mass. Here this company will be still better equipped for handling the construction of industrial plants, dams, and similar structures.

The Burdett Oxygen Co. will complete the erection of its Ft. Worth, Tex., plant, at 23rd and Jones St., on Dec. 15, 1915. The plant is designed to supply the Texas trade with Electrolytic Oxygen 99½% pure. The Texas plant is the ninth plant erected by the Burdett Co. in the various industrial centers of the country.

E. W. Van C. Lucas, Consulting Engineer, has moved his office from the Municipal Bldg. to 111 Broadway, New York, N. Y.

Subway—The Public Service Commission on Dec. 7 awarded the contract for the installation of tracks on the White Plains extension of the Lenox Ave. branch of the existing subway to the COAST AND LAKE CONTRACTING CORPORATION, at $53,930.50. On the ground that a mistake had been made in its estimate, the corporation requested the permission of the Public Service Commission to withdraw its bid, but the latter refused. It allowed that the bidder was responsible for the error and that the usual method would be followed by awarding the contract to the lowest bidder. It is evident that the city will benefit by the award when it is noted that the next lowest bid, that of the South Eastern Construction and Engineering Corporation, was $101,205.86.

The Russian Society for Electrical Enterprises, Ltd., of Petrograd, which is concessionary of electric lighting stations in Pawlowsk, Uman, Kamenetz-Podolsk, and of tramways in Elizabethgrad and Uman has opened a branch where it is willing to entertain propositions from manufacturers in the United States on electrical machines and apparatus, insulating materials, steam and naphtha engines and water turbines, and desire to enter into relations with first-class factories in this country for Russia.

The Buffalo Foundry and Machine Co., Buffalo, N. Y., has opened an office at 1432 Whitehall Bldg., 17 Battery Pl., New York, N. Y., to take care of business in this section of the country.

Exports for the Week—Following is a statement of exports (exclusive of specie) from the port of New York, as reported by the Custom House, for the week ended December 4, with comparisons with the previous year:

	1915	1914
Exports for the week	$63,713,174	$20,061,744
Previously reported	1,601,327,622	786,351,600
Total since Jan. 1	$1,665,040,796	$806,413,344

To—	Value	To—	Value
Argentine Republic	$1,603,579	Mexico	200,455
Brazil	1,250,320	Norway	1,359,419
Bolivia	52,049	Netherlands	2,246,235
Belgium	937,132	Netherlands Poss.	135,839
British Possessions	2,994,681	Portugal	406,368
China	75	Peru	199,178
Cuba	1,987,118	Panama	509,040
Central America	164,807	Philippines	536,265
Chili	100,857	Paraguay	1,295
Colombia	249,498	Russia	5,620,036
Denmark	703,692	Russian Possessions	642,290
Danish Possessions	19,157	Scotland	436,611
England	19,721,403	Sweden	358,652
Ecuador	77,578	Spain	292,410
Egypt	242,188	Spanish Possessions	1,014
France	16,391,477	Siam	11,918
French Possessions	94,482	Santo Domingo	203,370
Germany	224,227	Switzerland	68,772
Greece	405,849	Turkey	748
Hayti	2,944	Uruguay	284,630
Ireland	553,233	Venezuela	228,774
Italy	2,105,734		
Kongo	745	Total	$63,713,174

RAILWAY, SAN FRANCISCO, CALIF.

Hetch Hetchy Project

Bids were received by the Board of Public Works, Nov. 26, for constructing a railway from Roasasco to the Hetch Hetchy Reservoir, about 67 miles, from (A) Porter Bros. Co., San Francisco; (B) F. ROLANDI, San Francisco (awarded contract); (C) MacArthur Bros. Co., and Mason & Hanger, San Francisco; (D) Tibbitts-Pacific Co., San Francisco; (E) Utah Construction Co., San Francisco; (F) Twohy Bros. Co., San Francisco. The item bids were as follows:

	A	B	C	D	E	F
161,673 cu.yd. grading, proposition No. 1, granite	$1.17	$1.05	$1.23	.....	$1.30	$1.36
376,540 cu.yd. grading, proposition No. 1, solid rock	1.07	.94	.80	.....	1.20	1.36
97,801 cu.yd., proposition No. 1, soft rock	.69	.70	.45	.....	.70	.75
372,735 cu.yd., proposition No. 1, earth	.38	.37	.30	.....	.33	.36
1,008,749 cu.yd. grading, proposition No. 2, alternate to proposition No. 1, all materials	.7943	.67	.62	.83	.93	1.04
811 lin.ft. Culverts, 12-in. corrugated iron	1.25	.98	1.20	1.50	1.505	1.30
811 lin.ft. culverts, 12-in. corrugated steel	1.25	.90	1.15	1.45	1.445	1.23
4,454 lin.ft. culverts, 24-in. corrugated iron	2.25	1.90	1.80	2.55	2.78	2.30
4,454 lin.ft. culverts, 24-in. corrugated steel	2.25	1.75	1.70	2.40	2.66	2.20
527 lin.ft. culverts, 30-in. corrugated iron	3.00	2.70	2.80	3.50	3.765	3.20
527 lin.ft. culverts, 30-in. corrugated steel	3.00	2.50	2.65	3.30	3.585	3.10
944 lin.ft. culverts, 36-in. corrugated iron	3.75	3.30	3.25	4.20	4.615	3.80
944 lin.ft. culverts, 36-in. corrugated steel	3.75	3.15	3.10	3.90	4.395	3.70
30 miles fencing, common	425.00	600.00	475.00	812.00	500.00	420.00
10 miles fencing, hog-tight	425.00	670.00	570.00	750.00	625.00	500.00
1 mile ballast, section 1, broken stone	2,700.00	2,122.80	2,535.00	3,360.00	3,000.00	2,000.00
1 mile ballast, section 1, gravel	2,250.00	1,592.10	1,335.00	1,690.00	2,250.00	2,400.00
7.4 miles ballast, section 1, selected	1,350.00	707.60	1,235.00	1,045.00	1,720.00	1,900.00
1 mile ballast, section 2, broken stone	2,700.00	1,592.10	2,535.00	3,040.00	3,000.00	2,000.00
1 mile ballast, section 2, gravel	2,250.00	1,405.20	1,310.00	1,525.00	2,250.00	2,300.00
13.7 miles ballast, section 2, selected	1,350.00	1,061.40	1,135.00	895.00	1,720.00	1,900.00
1 mile ballast, sectional, broken stone	2,700.00	1,592.10	2,535.00	2,540.00	3,000.00	2,000.00
1 mile ballast, section 3, gravel	2,250.00	1,326.75	1,285.00	1,400.00	2,250.00	2,000.00
15.2 miles ballast, section 3, selected	1,350.00	1,061.40	1,085.00	895.00	1,720.00	2,000.00
1 mile ballast, section 4, broken stone	2,700.00	1,592.10	2,535.00	2,760.00	3,000.00	2,000.00
1 mile ballast, section 4, gravel	2,250.00	1,405.20	1,285.00	1,580.00	2,250.00	2,300.00
11.7 miles ballast, section 4, selected	1,350.00	1,061.40	1,085.00	875.00	1,720.00	2,000.00
1 mile ballast, section 5, broken stone	2,700.00	2,034.35	2,535.00	2,540.00	3,000.00	2,000.00
1 mile ballast, section 5, gravel	2,250.00	1,503.65	1,285.00	1,350.00	2,250.00	2,000.00
11 miles ballast, section 5, selected	1,350.00	884.50	1,085.00	975.00	1,720.00	2,000.00
69 miles track construction	9,750.00	3,450.00	9,485.00	11,480.00	8,726.88	9,100.00
30 sets switches, frogs and switch stands	175.00	140.00	190.00	200.00	224.24	225.00
20,000 lin.ft. guard rails	1.00	.62	.50	.11	.50	.60
2,400 lb. iron point castings for guard rails	.07	.065	.09	.08	.0375	.06
25,000 rail braces	.30	.33	.32	.44	.27	.21
10,000 anti-creepers	.25	.21	.27	.27	.22	.21
10 derails	30.00	15.00	14.00	32.00	10.00	20.00
100 cattle guards	25.00	15.00	14.00	25.00	29.90	20.00
8 redwood water tanks	550.00	400.00	365.00	670.00	377.05	420.00
60,000 pounds steel oil tanks (2)	.08	.04	.08	.086	072	.06
1 set equipment for oil tank, with gasoline engine	850.00	995.00	550.00	1,200.00	785.68	1,800.00
1 set equipment for oil tank, with steam pump	1,700.00	1,282.00	560.00	2,200.00	1,432.42	2,300.00
040070 lb. Tuolumne River bridge (2 alternatives), proposition No. 1: mSteel truss bridge, solid riveted	.052	.055	.06	.069	.05962	.0625
470,000 lb. Tuolumne River bridge (2 alternatives), proposition No. 2: Steel truss bridge, pin connected	.052	.053	.055	.067	.05786	.0575
130,00 lb. (2 alternatives) steel plate girder approaches	.052	.052	.055	.06	.05005	.055
450 M ft. b.m. trestles, lumber, erected	40.00	40.00	43.00	63.00	40.00	70.00
25,000 lb. iron in trestles	.06	.05	.05	.063	.04	.06
2,500 cu.yd. masonry, concrete	14.00	12.00	8.50	14.50	12.00	11.00
1,000 sq.yd. rubble in cement mortar	3.50	3.00	3.50	4.00	5.00	8.00
2,000 sq.yd. rubble, dry, hand laid	2.50	2.00	2.50	2.00	2.00	6.00
1,000 sq.yd. rip-rap	1.50	1.75	65	1.00	1.00	6.00
50 miles telephone line, complete	700.00	575.00	415.00	540.00	500.00	340.00
9 miles on poles already set	250.00	380.00	245.00	112.00	114.33	100.00
10 sets station instruments, installed	25.00	16.00	25.00	50.00	16.17	20.00
Extended totals	$1,932,668	$1,800,925	$1,955,062	$1,555,376	$1,543,080	$1,810,807

Construction News

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

New York—Movement is being agitated to construct electric railway from Oneonta to Davenport, through South Worcester and Charlotteville to Summit.

Virginia—Chesapeake & Ohio Railway contemplates an expenditure of $160,000 for new terminal trackage at Newport News. F. I. Cabell, Richmond, Cr. Engr.

West Virginia—Spur will be constructed from Cross Creek Tunnel north to Wellsburg to Follansbee, about three miles, by Wabash R.R. A. O. Cunningham, St. Louis, Mo., Ch. Engr.

West Virginia—Surveys being made by Kanawha, Glen Jean & Eastern R.R. for extension from Tamroy south to Beckley, 8.05 miles. V. Veazey, Mt. Hope, Ch. Engr.

North Carolina—Southern Power Co. plans to build electric railway from Greensboro to Reidsville and Spray, 30 miles. W. S. Lee, Charlotte, Vice-Pres. and Ch. Engr.

Georgia—Savannah & Southern Railway contemplates extension from Willie southwest to Glennville, about 16 miles. W. G. Tuten, Letford, Ga., Gen. Mgr.

Florida—Jacob Brown and J. H. Taylor interested in construction of railway from Ocala to Silver Springs, Fla., about five miles.

Alabama—Press reports state that Alabama, Tennessee & Northern Railway has been purchased by Illinois Central R.R. which plans to extend line to Tuscaloosa, 30 miles. A. S. Baldwin, Chicago, Ill., Ch. Engr., Illinois Central R.R.

Alabama—Surveys made by Gulf, Florida & Alabama Railway for extension from Kimbrough north to Jasper, Ala., 158 miles. G. A. Berry, Pensacola, Ch. Engr.

Louisiana—Louisiana & Arkansas Railway plans to build an extension from Wildsville Junction to Vidalia, La., about 22.59 miles. William Buchanan, Texarkana, Ark., Pres.

Tennessee—Carolina, Greenville & Northern Railway has sold bonds for proposed railway between Bristol and Knoxville, via Kingsport, Newport and Sevierville, about 140 miles. F. A. H. Kelley, Greenville, Tenn., Ch. Engr. Noted Oct. 14.

Tennessee—Surveys being made by Nashville, Chattanooga & St. Louis Railway for spur to Sylvan Mills, about two miles. H. McDonald, Nashville, Ch. Engr. Noted Sept. 23.

Ohio—Cleveland, Alliance & Mahoning Valley R.R., Cleveland, contemplates a double-track line from Warren to Youngstown, via Niles.

Indiana—Gary, Hobart & Eastern Traction Co., Hobart, contemplates construction of 12 miles of track between Hobart and Valparaiso next year. B. J. Schramm, Hobart, Gen. Supt. and Pur. Agt.

Michigan—United Railway Co., Detroit, plans to extend South Dearborn line from River Rouge to Ecorse. F. W. Brooks, Detroit, Gen. Mgr.

Wisconsin—Green Bay & Eastern R.R. incorporated to build an interurban railway from Green Bay to Sheboygan, via Manitowac, about 70 miles. Charles Frazier, Manitowac, interested. Noted Nov. 11.

Iowa—Citizens of Des Moines voted to grant 25-year franchise to Des Moines City Railway Co. Under terms of franchise company will be obliged to expend $1,500,000 for improvements during next three years, including eight mile extension. L. L. Sloss, Des Moines, Pres.

Iowa—Ft. Dodge, Des Moines & Southern R.R., Boone, plans to build railway from Swanwood Junction to Des Moines, about six miles, next year.

Minnesota—Surveys being made for railway from Port Arthur to Duluth, Minn., to be known as Great Northern, Minnesota & Duluth R.R.

Minnesota—St. Paul Southern Electric Railway, St. Paul, plans to build a railway from Hastings to Rochester, 64 miles, during 1916. H. A. Genung, 1615 Pioneer Bldg., St. Paul, Ch. Engr.

South Dakota—South Dakota & Western Railway Co. secured right-of-way for railway from Mitchell to Brule, via Platte. W. L. Bruce, interested. Noted Oct. 21.

Missouri—Kansas City, Lawrence & Tokepa R.R. Co., Kansas City, plans to build about 52 miles of track between Zarah and Topeka next year. F. P. Dickson, Kansas City, Pres, and Pur. Agt.

Arkansas—Cache Valley R.R. plans to build line from Thebes, Ill., to Little Rock, Ark., 246 miles. G. W. L. Brown, Sedgwick, Ark., Asst. Pres., Secy. and Gen. Mgr.

Arkansas—Surveys made by Ft. Smith, Subiaco & Eastern R.R. for line from Scranton to Dardanelle, Ark., 23 miles. Henry Stroup, Paris, Pres. and Gen. Mgr.

Texas—Chicago, Weatherford & Gulf Railway Co., recently incorporated with $250,000 capital stock, plans to construct a railway from Gainesville via Weatherford to Waco, Tex., about 150 miles. L. Decker, Middletown, N. Y., Vice-Pres. and Gen. Mgr.

Texas—Preliminary surveys made by Houston & San Antonio Interurban Electric Railway Co. for proposed railway via Seguin, Zeul, Gonzales Schulenberg and Eagle Lake, about 200 miles. E. Kennedy, Houston, Pres.

Texas—Surveys being made by Lutcher & Moore Lumber Co. for extension of its Gulf, Sabine & Red River R.R., about 35 miles.

Oklahoma—Surveys made for railway from Clinton to Chickasha for Clinton, Oklahoma & Western Railway, also for extension to Oklahoma and from Clinton to Tuttle, via Union City. G. V. McClure, Oklahoma, Ch. Engr. Noted Aug. 26.

Oklahoma—Ft. Smith, Poteau & Western Railway plans to build extension south from Poteau, 10 miles. J. E. Finney, Gen. Mgr.

Oklahoma—Santa Fé System contemplates spur from Sumpter to oil field, northeast of Blackwell, Kay County. C. F. W. Felt, Chicago, Ill., Ch. Engr., Atchison, Topeka & Santa Fé System.

Colorado—Denver & Rio Grande R.R. plans to broad gage 235 miles of its line in Colorado and New Mexico. J. G. Gwyn, Denver, Ch. Engr.

Idaho—Lewiston, Nezperce & Eastern R.R., Lewiston, plans to issue bonds to construct railway to Waha, Idaho. J. P. Vollmer, Lewiston, Vice-Pres.

Idaho—Business men of Pocatello plan to organize Pocatello Transportation and Interurban Co. to construct a railway about seven miles long.

Arizona—Phœnix Railway Co., of Arizona plans to double track its line on West Washington St. to the Capitol. Samuel H. Mitchell, Gen. Mgr.

Oregon—Southern Oregon Traction Co., Medford, plans to extend its line to Ruch and Blue Ledge copper mine, about 30 miles. C. E. Bullis, Medford, Gen. Mgr.

California—City Council granted franchise to Oakland, Antioch & Eastern Railway to build double-track line on M. St. extending westerly to Sacramento River, easterly along M St. to Third St., along Third St. to I St. H. A. Mitchell, San Francisco, Secy. and Gen. Mgr.

California—Western Pacific Railway plans an expenditure of $20,000,000 for new line when same is taken from the hands of receiver. T. J. Wyche, Ch. Engr.

Ontario—Pere Marquette R.R., Detroit, plans to double-track its line between Blenheim and Wilkie, Ont. A. L. Grandy, Detroit, Ch. Engr.

Ontario—Toronto, Hamilton & Buffalo Railway Co., Hamilton, plans to build a railway between Dunville and Port Mailland. H. L. Latham, Hamilton, Ont., Ch. Engr.

Alberta, Edmonton—See item under "Light, Heat and Power."

Bids In and Contracts Awarded

Oklahoma—Henryetta, Oklahoma & Western Railway Co. awarded contract for grading line from Henryetta to Kusa, Dewar and other towns to ALLY BROS. W. T. Croslen, Oklahoma, Pres. Noted Nov. 18 and Dec. 9.

LIGHT, HEAT AND POWER

Proposed Work

N. Y., Lindehurst—See item under "Water-Works."

N. Y., New York—(Borough of Manhattan—(Official)—Bids will be received by John A. Kingsbury, Comr., Dept. of Pub. Charities, Municipal Bldg., until 10:30 a.m., Dec. 20, for new steam supply and return lines between power house and main building of City Hospital District, Blackwell's Island.

N. Y., Sanborn—Plans being considered for electric-light plant.

N. Y., Scriba—Public Service Commission, Oswego, granted franchise to Peoples Gas and Electric Co., Oswego, to install and operate electric distribution system in Scriba.

N. Y., Syracuse—Syracuse Lighting Co. granted franchise by Public Service Commission, Syracuse, for transmission line between Syracuse and Geddes.

N. J., Trenton—New Jersey State Hospital will build addition to its powerhouse.

Penn., Ellwood City—Mahoning & Shenango Valley Electric Co. plans to build transmission line from New Castle to station of Pennsylvania Power Co. in Ellwood City.

Penn., Meadville—City plans to enlarge and improve electric-light plant. Estimated cost, $10,000.

Penn., Norristown—(Official)—Bids will be received by Trustees of State Hospital for Insane of Southeastern District of Pennsylvania until Dec. 30 for center crank automatic engine, alternating current dynamo, switchboard and ventilating fans. W. W. Hibbert, 415 Hale Bldg., Philadelphia, Consult. Engr. (See adv.)

Penn., West Reading—Reading Transit Co. plans to improve its power plant at West Reading. Estimated cost, $300.000.

Md., Baltimore—Press reports state that Columbia Gas and Electric Co., New York, N. Y., will build natural gas pipe line from West Virginia fields to Baltimore. Estimated cost, $10,000,000. A. B. Leach, 149 Broadway, New York, N. Y., Pres.

W. Va., Wellsburg—Company will be organized by American Gas and Electric Co., 30 Church St., New York, N. Y., to build electric-light plant on Ohio River and Pennsylvania R.R. near Wellsburg. Estimated cost, $2,500,000. Sargeant & Lundy, Chicago, Ill., Consult. Engr.

La., Crowley—See item under water works.

Ky., Georgetown—See item under "Water Works."

Ky., Mt. Olive—A. Chandler interested in construction of electric-light plant in Mt. Olivet.

Ohio, Belpre—Proposition to grant franchise to install and operate electric-light plant and water system in Belpre under consideration by Village Council.

Ohio, Norwood—Ault & Wiborg Co., Cincinnati, plan to build boiler and power house addition to its plant in Norwood.

Ohio, Steubenville—American Gas and Fuel Co. plans to build power plant at Beach Bottom near Steubenville. Estimated cost, $2,500,000.

Ind., Miller—City has applied to Public Service Commission for permission to issue $12,500 bonds for electric-light plant.

Ill., Oakwood—City contemplates municipal electric-light plant.

Wis., Waupaca—City and O. G. Nelson Lumber Co. will build power dam across Waupaca River.

Iowa, Fairbanks—Citizens voted $6,000 bonds for electric-lighting system. Noted Oct. 21.

Iowa, Thornton—Thornton Light and Power Co., recently incorporated, will build electric-light and power plant. H. O. Cace, Pres.

Minn., Brown Valley—Ottertail Power Co., Fergus Falls, has purchased local electric-light plant for $13,500. Company will build transmission line to Brown Valley and also extend lines to Beardsley, Peever and Siseton.

Minn., Plummer—(Official)—Bonds for municipal electric-light plant will be sold Dec. 27. Noted Nov. 25.

Kan., Altoona—Plans being considered for electric-light plant in Altoona. Frank Adams of Overleese & Askins, Bartlesville, Okla., interested.

Kan., Coffeyville—(Official)—Election will be held Dec. 28 to vote on $20,000 bonds for municipal electric-light plant. H. H. Deichler, City Clk. Noted Dec. 2.

Kan., Dodge City—Midland Water, Light and Ice Co. plans to extend transmission lines to Bucklin and Ford, about 30 miles.

Kan., Riley—R. B. Fegan, Junction City, applied to City Council for franchise to install and operate electric-light plant in Riley.

Neb., Dawson—Installation of electric-light plant in Dawson under consideration.

Neb., Ruskin—Citizens voted $6,000 bonds for electric-lighting system.

S. D., Revill—Plans being prepared for electric-light plant in Revill.

N. D., Plaza—Construction of electric-light plant in Plaza under consideration.

Mo., Pleasant Hill—Pleasant Hill Light and Power Co. plans to build transmission line from Pleasant Hill to Strasburg.

Ark., Hartford—City plans to install electric-light plant.

Tex., Gainesville—Texas Power and Light Co. plans to install new equipment in its plant next year.

Tex., McKinney—Citizens voted to sell municipal electric-light plant to Texas Light and Power Co. who will improve same. Estimated cost, $100,000.

Tex., Portland—Citizens plan to incorporate town and issue bonds for electric-light plant.

Okla., Ardmore—City contemplates $150,000. bond issue for gas pipe line. J. H. Corlock, City Engr.

Okla., Oklahoma—Plans being considered by Oklahoma Gas and Electric Co. for extending service mains to territory surrounding city.

Ariz., Globe—Arizona Commercial Co. plans to build power plant. Estimated cost, $50,000.

Wash., Prescott—Pacific Power and Light Co., Walla Walla, applied to County Commissioners for permit to build transmission line from Prescott to Waitesburg.

Wash., Prosser—City contemplates election to vote on bonds for municipal electric-light and power plant.

Calif., Loyalton—Election will be held Dec. 27 to vote on $5,000 bonds for municipal electric-light plant. Noted Nov. 11.

Calif., San Pedro—Permit granted F. O. Engstrum Co., Fifth and Seaton St., Los Angeles, for power house for American Trona Co., Pacific Electric Bldg.

Que., Hull—City plans expenditure of $20,000 for extending electric-lighting system. H. Boulay, Clk.

Ont., Kamoka—Town will build hydro-electric power and distribution system. Estimated cost, $10,000. E. R. Barclay, Clk.

Ont., Watford—Plans being prepared for hydro-electric power and distribution plant. Estimated cost, $14,000. W. S. Fuller, Watford, interested.

Alta., Edmonton—Press reports state that G. W. Farrell & Co., St. Francis Xavier St., Edmonton, plans to build power plant and electric railway. Estimated cost, $6,000,000.

Bids In and Contracts Awarded

N. Y., Cape Vincent—LEONARD J. GATES, Cape Vincent, awarded contract for transformer station for Northern Utilities Co., Inc., Watertown.

N. J., Elizabeth—(Official)—Contract for two-story, 100x 241-ft. gas accumulator building for American Gas Co. awarded to UNITED FIREPROOFING CO., 8 West 40th St., New York, N. Y. Estimated cost, $60,000.

Ind., Terre Haute—Indiana Gas and Coke Co. awarded contract for gas coke plant to GAS MANUFACTURING CO., Cleveland. Estimated cost, $750,000.

Minn., St. Paul—(Official)—Contract for installing heating and lighting systems in Minnesota Historical Society Building awarded to GEORGE M. McGEARY & SON, St. Paul, at $40,324; and ELECTRIC CONTRACTING CO., St. Paul, at $11,000. See item under "Buildings."

Calif., Keeler—Contract for seven mile transmission line from Keeler to Cerro Gordo mines for Southern Sierras Power Co., Riverside, awarded to M. A. STAMPHER CO., 1821 South Hoover St., Los Angeles.

BRIDGES

Proposed Work

N. Y., Perry—Town Board contemplates rebuilding of Borden Ave. bridge. Estimated cost, $6,000.

N. J., Newark—Report of Bridge Committee recommending an appropriation for preliminary survey of new bridge over Newark Bay between Elizabeth and Bayonne adopted by Board of Freeholders of Union County. Noted Dec. 2.

Penn., Johnstown—City, County and Johnstown Traction Co. contemplate concrete bridge. Estimated cost, $75,000. J. W. Cramer, City Clk.

Penn., New Castle—Plans will be prepared by T. A. Gilkey, Engr., for new bridge to replace South Mill St. bridge.

Penn., Pittsburgh—City contemplates concrete or steel bridge across Greenfield Ave. Estimated cost of former, $100,000; latter, $65,000. George S. Webster, City Engr.

N. C., Bryson City—Bids will be received until Dec. 20 by Swain County Highway Commission for four 40-ft. span and one 300-ft. concrete bridges. T. M. Howerton, Bryson City, Engr.

Tenn., Bristol—Southern Ry. plans to build bridge across railway tracks at English St. Estimated cost, $7,000. B. Herman, Washington, D. C., Ch. Engr.

Ohio, Bridgeport—Bids will soon be received for repairing bridges at an estimated cost of $7,000.

Ind., Jeffersonville—Pennsylvania R.R. will build double-track bridge across Ohio River between Jeffersonville and Louisville, Ky. Estimated cost, $2,500,000.

Kan., Lawrence—Date for receiving bids for bridge on county line between Douglas and Franklin Counties extended from Nov. 6 to Jan. 3. Noted Oct. 28.

Neb., York—Bids will be received until noon, Jan. 11, by the Commissioners of York County for steel and concrete bridges for 1916. A. H. Beck, County Clk.

Mo., Valley Park—W. A. Koons is interested in proposition to bond city for $150,000 for constructing bridge and culverts in St. Louis County.

Tex., Marshall—Citizens voted $50,000 bonds for viaduct over tracks of Texas & Pacific Railway. Noted Nov. 4 and 11.

Okla., Purcell—Election to vote on $100,000 for bridge work in McClain County has been postponed indefinitely. Noted Dec. 2 and 9.

Calif., Sacramento—Bids will be received by State Highway Commission, 515 Forum Bldg., Los Angeles, until 2 p.m., Dec. 27, for bridge across Petaluma Creek at Green Point.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Manhattan)—(Official)—Lowest bids received Dec. 9 for constructing Unionport bridge over Westchester Creek were as follows: Rodgers & Hagerty, Inc., $195,511; William J. Rodgers, $199,399; H. D. Robinson, $208,103. Noted Nov. 25.

Penn., Harrisburg—(Official)—Contract for bridge across Four Mile Creek, Harborcreek Township, Erie County, awarded to LININGER & BENNETT, Conneaut Lake, Ohio, at $3,994. Robert J. Cunningham, State Highway Comr. Noted Dec. 2.

Penn., Philadelphia—Bids were received Dec. 8 by Department of Public Works for (a) Annsbury St. and North Pennsylvania R.R. bridge, (b) Orthodox St. bridge, as follows: (a) Donato Delise, Philadelphia, $41,410; Peoples Bros., Philadelphia, $43,999; T. F. Reilly, Philadelphia, $46,000; (b) Richard Walsh & Sons, Inc., Philadelphia, $23,750; Donato Delise, Philadelphia, $24,600; J. D. Domey, Philadelphia, $24,990. George S. Webster, City Engr. Noted Dec. 2.

Va., Hanover—(Official)—All bids received Nov. 24 for reinforced-concrete bridge over Little River, Hanover County, rejected. Noted Nov. 18.

Miss., Leakesville—(Official)—Contract for bridge across Chickasawhay River awarded to VINCENNES BRIDGE CO., Vincennes, Ind., at $8,289. Noted Oct. 21 and Nov. 18.

Tenn., Jackson—Contract for three highway bridges awarded to NASHVILLE BRIDGE CO., Nashville, at $8,850.

Ohio, Warren—(Official)—Contract for superstructure of South Main St. bridge awarded to OREGONIA BRIDGE CO., Lebanon, at $8,200. Noted Dec. 2.

Ind., Wabash—(Official)—Contract for Huntington St. bridge awarded to JANSE BROS., BOOMER, HUGHES & CRAIN CONSTRUCTION CO., Detroit, Mich., at $42,498. A. W. Grovenor, Ft. Wayne, Engr. Noted Dec. 2.

Mich., Detroit—(Official)—Contract for wrecking burned Belle Isle Bridge awarded to CANDLER DOCK AND DREDGE CO., 305 Moffat Bldg., Detroit, at $4,250, plus approximately 800 tons of salvaged wrought iron. R. H. Hidey, Engr.

Ill., Chicago—(Official)—Lowest bids received Dec. 2 by Sanitary District of Chicago for superstructures of Calumet Sag bridges were as follows: Milwaukee Bridge Co., Milwaukee, Wis., North Rd. bridge, $5,970; Paper Rd. bridge, $11,033; 48th Ave. bridge, $4,073; Homan Ave. bridge, $10,556; Kedzie Ave. bridge, $3,158; Francisco Ave. bridge, $3,158; Chicago Bridge and Iron Co., Chicago, Ill., Archer Rd. bridge, $3,900; Western Ave., bridge, $6,900; Division St. bridge, $3,300; Ann St. bridge, $3,450; Chicago St. bridge, $3,450. Noted Nov. 18.

Kan., Wathena—Contract for reinforced-concrete bridge across Peters Creek awarded to J. H. WAGENKNECHT, Wathena, at $5,477. Noted Nov. 4.

Ark., Osceola—Contract for eight bridges awarded to MIDLAND BRIDGE CO., Kansas City, Mo., at $7,869; draw bridge across Little River to VINCENNES BRIDGE CO., Vincennes Ind., at $5,850.

Okla., Miami—Contract for five bridges for Ottawa County awarded to CONCRETE STEEL AND CONSTRUCTION CO., Joplin, Mo., at $4,240.

Idaho, Parma—(Official)—Contract for steel bridge across Boise River at Parma awarded to MISSOURI VALLEY BRIDGE AND IRON CO., Leavenworth, Kan., at $18,580. Noted Oct. 7 and Nov. 4.

Calif., Sacramento—(Official)—Contract for plate girder bascule bridge near easterly side of Yolo By-Pass awarded to SECURITY CONSTRUCTION CO., 38th and Alameda St., Los Angeles, at $24,671. Noted Nov. 11 and Dec. 9.

Que., Hammond—Contract for bridge awarded to A. BEAUCHESNE, Arthabaska. Estimated cost, $4,000.

WATER-WORKS

Proposed Work

Mass., Bernardston—Citizens voted to petition the Legislature to allow town to establish water system. Estimated cost, $30,000.

Mass., Fitchburg—City will soon make loan of $250,000, $130,000 of which will be used for improving water-works.

Conn., Bridgeport—Bridgeport Hydraulic Co. will develop its water shed in Saugautuck Valley.

Conn., Collinsville—Plans being considered by Collinsville Water Co. for filtration plant.

N. Y., Batavia—Contract for filtration plant and pumping station will be awarded next spring. Estimated cost, $135,000. Chester & Fleming, Pittsburgh, Penn., Engr. Noted Nov. 4.

N. Y., Buffalo—See item under "Miscellaneous."

N. Y., Lindenhurst—Plans prepared for water system and electric-light plant. Estimated cost, $125,000.

N. Y., New York—(Official)—Bids will be received by William Williams, Commissioner of Water Supply, Gas and Electricity, Municipal Bldg., until 2 p.m., Dec. 24, for furnishing apparatus and appurtenances for applying liquid chlorine to Croton water-supply at Dunwoodie, Yonkers, N. Y.

N. Y., New York—(Official)—Bids will be received by William Williams, Commissioner of Water Supply, Gas and Electricity, until 2 p.m., Dec. 24, for furnishing and erecting a frame building for use as boiler house at the Clove pumping station.

N. Y., New York—(Borough of Manhattan)—See item under "Miscellaneous."

N. J., Butler—Butler Water Co. will extend water system to Lake Keiko next spring. Estimated cost, $12,000. Noted Aug. 26.

N. J., Far Hills—L. V. Ludlow and associates plan the organization of local water company, to install and operate system for Far Hills and Bedminister.

N. J., Keyport—People's Water Co., Keansburg, has applied to Township Committee for bonds for the installation of water system.

Penn., Leighton—City will have plans prepared for water system. A. J. Snyderm, Borough Secy. Noted Nov. 30.

Md., Baltimore—City contemplates installation of water meters in all buildings, except two-story buildings with frontage of 12-ft. Estimated cost, $1,500,000. H. K. McKay, City Engr.

W. Va., Charleston—City Council contemplates municipal water system.

S. C., Johnston—Citizens will hold election to vote on $40,000 bonds for water-works and sewers.

Ga., Columbus—City contemplates reservoir at Pumpkinton Ferry. W. C. Campbell, City Engr.

Ga., Tifton—See item under "Sewers."

Fla., Homestead—Citizens voted $40,000 bonds for construction of water works plant.

Fla., Lake Worth—City will issue $20,000 bonds for water works system.

Ala., Camden—(Official)—Citizens voted $15,000 bonds for water system. B. H. Matthews, City Clk. Noted Nov. 24.

La., Crowley—Citizens will issue $35,000 bonds for water works and electric light.

La., De Ridder—Plans being prepared for water works system by Xavier A. Kramer, Magnolia, Miss. Bids will be called for in about 60 days.

Ky., Bowling Green—Contract will soon be awarded for sedimentation basin at water plant.

Ky., Georgetown—City has purchased a site for water-works and electric-light plant.

Ohio, Belpre—See item under "Light, Heat and Power."

Ohio, Cleveland—City plans to issue $500,000 bonds for improving water system. Charles F. Schultz, Comr. of Water-Works.

Ohio, East View—(Warrensville post office)—Bids will be received until noon, Jan. 17, for sale of $15,095 bonds, for water mains and sewers in East View Ave.

Ind., Orleans—Citizens will construct a water-works system. Estimated cost, $50,000.

Mich., Escanaba—Citizens voted on amendment permitting the issue of bonds for water system. City plans to purchase plant of North Michigan Water Co. for which appraisal is now being made. W. J. Hodson, City Engr. Noted Nov. 18.

Mich., Grand Rapids—Citizens voted $23,000 bonds for installation of water works system. L. E. Stevens, City Engr.

Mich., Saginaw—(Official)—Citizens defeated $750,000 bonds for water system. Noted Oct. 21.

Mich., Watervleit—Bonds for $23,000 voted by citizens for pumping station and water system.

Ill., Galesburg—Bids will be received by William L. Boutelle, City Clk., until Dec. 20, for tubular deep well, about 2,500 ft. deep. F. L. M. Connolly, City Engr.

Minn., McKinley—Citizens voted at special election to enlarge and extend water-works system. Estimated cost, $8,500.

Minn., Tracy—Elevated tank of about 75,000-gal. capacity will be constructed by city.

Kan., Chanute—Citizens contemplate improvement of municipal water works system. Estimated cost, $29,000.

Kan., Humbolt—Citizens contemplate improvement of municipal water works system. Estimated cost, $10,000.

Kan., Hutchinson—Citizens contemplate two-mile extension to water-works system during 1916. Edward Metz, City Clk.

Mo., Kansas City—(Official)—Bids will be received Jan. 12, for steam turbine, reduction gear, centrifugal pumping unit for water-works. Burton Lowther, Ch. Engr. (See adv.)

Ark., Hartford—City contemplates construction of water works.

Tex., Dallas—City will lay new water pipes along Oakcliff St. Estimated cost, $21,500. J. M. Preston, City Engr.

Tex., Elgin—Bonds for $10,000 sold for sinking artesian well. Noted July 29 and Aug. 12.

Tex., Grants Pass—City plans to hold election to vote on $80,000 bonds for municipal water system.

Tex., Texarkana—Citizens voted to improve water-works system.

Tex., Tyler—City will hold election Jan. 23 to vote on $250,000 bonds for municipal water system. H. E. Elrod, Dallas, Consult. Engr. Noted Nov. 18.

Okla., Oklahoma—Plans being prepared for water system. Election will probably be held next March to vote on bonds for same.

Wash., Seattle—City Council contemplates water mains in the following streets: 24th Ave. N. W.; Orcas St. from 42d to 41st Ave. S.; 51st Ave. S.; 14th Ave. N.W., from West 75th to West 85th; Seventh Ave. N.W.; West 55th St. from Sixth to Eighth Ave. N.W.; West 56th St.

Calif., San Francisco—(Official)—The sale of $43,287,000 bonds for Hetch Hetchy project has been canceled. M. M. O'Shaughnessy, City Engr. Noted Nov. 11.

N. S., Glace Bay—Plans for new pumping unit at water-works being prepared by A. McKinnon, City Engr. Estimated cost, $10,000.

Ont., Blenheim—Pere Marquette R.R., Detroit, Mich., is having plans prepared for water system at Blenheim. J. J. Corcoran, Supt.

Ont., New Toronto—City Council considerating installation meters in connection with new water system. Hugh Thomas, Supt.

Ont., Sarnia—City Council considering extensions to water-mains. Estimated cost, $12,000. J. D. Stewart, City Clk.

Ont., Stratford—City plans to lay new water main on Wellington and Britannia St. A. B. Manson, City Engr.

Man., Winnipeg—(Official)—Bids will be received until noon, Dec. 29, by Commissioners of Greater Winnipeg Water District, for the supply of one steam operated dragline excavator. S. H. Reynolds, Chn. (See adv.)

Man., Winnipeg—City will lay water main on Talbot Ave. from Kent St. to east city limits. Estimated cost, $7,000. W. P. Brereton, City Engr.

Man., Winnipeg—City will lay water mains on Academy Rd. and Centennial St. Estimated cost, $13,000. W. P. Brereton, City Engr.

B. C., Port Coquitlam—City plans to install water system next spring. Estimated cost, $100,000. J. R. McKenzie, Mayor.

B. C., Victoria—Plans being considered by Water-Works Department for water main in Douglas St. from end of Sooke Lake pressure main to Herald St. Estimated cost, $4,500. C. H. Rust, City Engr.

Bids In and Contracts Awarded

N. Y., Le Roy—According to press reports, Board of Water and Light Commissioners awarded contract for additional storage tank in connection with new water-works system to PITTSBURGH-DES MOINES STEEL CO., Pittsburgh, Penn. Estimated cost, $5,200. Noted Nov. 25.

Ala., Citronelle — (Official) — Contract for water system awarded to J. W. GURLEY, Mobile. Noted Nov. 25.

Ohio, Ashtabula—Contract for laying water mains across Ashtabula River awarded by Ashtabula Water Supply Co., to GILLEN & CO., Ashtabula. Chester & Fleming, Pittsburgh, Penn., Engr.

Ohio, Upper Sandusky—Contract for installation of low service pump awarded to HARRIS PUMP & SUPPLY CO., Pittsburgh, Penn. Chester & Fleming, Pittsburgh, Penn., Engr. Noted Nov. 4.

Ill., Wheaton—(Official)—Contract for 2,000,000-gal. tank awarded to MEMPHIS STEEL CONSTRUCTION CO., Greensburg, Penn. Estimated cost, $8,843. Noted Dec. 9.

Iowa, Marshalltown—(Official)—Contract for pump for water system awarded to ALLIS-CHALMERS CO., Chicago, Ill. Estimated cost, $14,485. Noted Dec. 9.

Neb., Lincoln—AMERICAN CAST IRON PIPE CO., Birmingham, Ala., at $8,000, awarded contract for 5,200 ft. of 12-in. c.-i. pipe.

Utah, Salt Lake City—Bids were received Nov. 24 for constructing storage dam in Parley's Cañon, as follows: P. J. Morgan, 152 West Second St., at $117,052 and $216,587, alternately, on Ambursen type, and at $226,212, on arched type, completed dam; Parrott Bros., at $75,290, on multiple-arch type, first unit, and at $138,839 on completed dam, and $88,670, arched concrete type, first unit. Noted Sept. 16 and Oct. 14.

Ont., Brockville—City Council will lay water mains in Cedar, James, Charles and Pearl St., by day labor. G. H. Bryson, City Engr.

Ont., Hespeler—Contract for water works pumping station awarded to GRILL BROS.

B. C., Port Moody—Contract for water system awarded to ROBERTSON-GOODSON CO., Vancouver, at $37,050. Noted Dec. 9.

SEWERS

Proposed Work

R. I., Providence—Bids will be received Dec. 20, for furnishing sewer pipe, branches, etc., for Department of Public Works. W. C. Polkey, City Clk.

N. Y., New York—(Borough of Manhattan)—Bids will be received by Marcus M. Marks, Borough Pres., until Dec. 20, for improving sewer in East 70th St.

N. Y. New York,—(Borough of Manhattan)—See item under "Miscellaneous."

N. Y., Oneonta—Plans being prepared for sewage disposal plant. Estimated cost, $45,000. F. M. Gurney, City Engr. Noted Nov. 11.

N. Y., Wappingers Falls—Bonds for $15,000 voted for sewer system. H. L. Sterling, Wappingers Falls, Engr.

S. C., Johnston—City plans to vote on $40,000 bonds for sewers and water-works.

Ga., Tifton—Citizens plan election to vote on $100,000 bonds for sewer system and water-works.

Fla., Gainesville—Citizens voted $21,000 bonds to extend sewer system.

Fla., Gainesville—See item under "Streets and Roads."

Ohio, Cheviot—(Cincinnati post office)—Bids will be received until noon, Dec. 22, for sewer in Beech St. from Harrison to Mozart Ave. Albert J. Reusing, City Clk.

Ohio, Cleveland—Bids will be received by A. R. Callow, Commissioner of Purchases and Supplies, City Hall, until noon, Dec. 23, for construction of nine sewers in various streets. Robert Hoffman, 405 City Hall, Engr.

Ohio, Dayton—Contract will soon be awarded for 61,000 ft. of sewer pipe. Estimated cost, $10,000.

Ohio, East View—(Warrensville post office)—See item under "Water-Works."

Ohio, Mansfield—Bids will be received until Dec. 23, for improvement of sewer in Reed and Tremont St., also construction of 8-in. sanitary sewer. W. R. Kuhn, Secy. Bd. of Control.

Ohio, New Comerstown—(Official)—Bids for sewage-disposal plant will not be received until the spring. Estimated cost, $60,000. E. Beaty, City Engr. Noted Nov. 11.

Ohio, Painesville—Bids will be received by F. A. Tuttle, Dir. of Pub. Ser., until Dec. 22, for constructing sewers. Estimated cost, $38,750. F. N. Downer, City Engr. Noted Dec. 9.

Ohio, Toledo—Plans being prepared by L. A. Boulay, City Engr., for a sewage pumping station between Glendale Ave. and limits of Maumee. Estimated cost, $40,000.

Ohio, Toledo—County Commissioners plan to build sewer from Sylvania Ave. to Ten Mile Creek, about 1½ mi. L. A. Boulay, County Engr.

Ohio, Xenia—Contract will be awarded some time this winter for sewage-disposal plant. Estimated cost, $60,000. Noted Oct. 14 and Nov. 11.

Ohio, Youngstown—City contemplates over 40 miles of sewers. F. M. Lillie, City Engr.

Ind., Anderson—Citizens will hold election to vote on sewer system in Third St. from Madison Ave. to Sycamore St.

Ind., Indianapolis—Board of Public Works approved expenditure of $114,560 for new sewer in Warman Ave.

Mich., Bad Axe—Citizens voted $38,500 bonds for sanitary sewer system.

Mich., Flint—E. C. Shoecraft, City Engr., has recommended an appropriation of $137,000 for storm and sanitary sewers during 1916 which has been approved by City Council.

Mich., Grand Rapids—Plans prepared by J. R. Rumsey, Consult. Engr., for sewage-disposal plant at Kent County Home.

Mich., Grand Rapids—Citizens plan to construct a sewage-disposal plant. Estimated cost, $1,500,000.

Mich., Jackson—Citizens plan to construct sewage disposal plant.

Ill., Peoria—Plans being prepared by L. D. Jeffries, City Engr., for sewer system in Second Ward. Bids will be received in spring.

Ill., West Chicago—Citizens voted to construct sewer system. Estimated cost, $130,000. Noted Oct. 7.

Wis., Beloit—City plans to build storm sewers next year. G. E. Heebink, City Engr.

Wis., La Crosse—City plans to award contract next March for extetnding sewer system. George Bradish, City Engr. Noted Sept. 30.

Wis., New Lisbon—City will not install sewer system until next spring. W. G. Kirchoffer, 24 North Carroll St., Madison, Engr. Noted Dec. 9.

Wis., Superior—City plans to construct sewers at an estimated cost of $40,000 to $100,000.

Wis., West Allis—City will build sewage-disposal plant.

Iowa, Mason City—Contract for sewage disposal plant will be let about Jan. 6. Estimated cost, $100,000. Noted Dec. 2.

Ia., Northwood—City Council plans sewerage system in Northwood.

Ia., Rock Island—City Council plans sewer. Estimated cost, $4,500.

Minn., Benson—City retained S. B. Gardner, Engr., Benson, to make preliminary survey for sanitary sewer and sewage-treatment plant. About $16,000 available for this purpose.

Minn., Duluth—City will construct sewer in Billings Park District, and alley between Washington and New York Ave. from 21st to Belnap St.

Minn., Minneapolis—According to press reports City Council plans expenditure of $100,000 for deep tunnel sewers. Carl Illstrup, City Sewer Engr.

Minn., St. Paul—Bids will be received by A. Hohenstein, City Pur. Agt., until 10:30 a.m., Dec. 20, for sewer in Eaton St Claussen, City Engr. Noted Dec. 9.

Neb., Lincoln—Contract will soon be awarded for storm sewer in J St. Estimated cost, $6,500. T. H. Berg, City Clk.

Neb., Omaha—City plans to award contracts for sewer work early next year. Estimated cost, $100,000. E. E. Bruce, City Engr.

S. D., Alexandria—(Official)—Citizens recently voted against installation of sewer system. Noted Dec. 2.

Mo., Brookfield—Plans prepared for sewer system in District No. 34. Bids will soon be received.

Mo., Jefferson—Plans being prepared for construction of storm sewers in Walnut and McCarty St.

Ark., Rogers—Bids will be received until Dec. 20, by Charles S. Applegate, Secy. Bd. of Sewer Improvements, for sewer system in District No. 3.

Tex., Belton—The Attorney General refused approval of $40,000 bonds for sewer system. City Council has ordered another election to be held Jan. 4. Noted Dec. 2.

Tex., Graham—Citizens will hold election to vote on bonds for sewer system.

Tex., Houston—City will build storm sewers in Leeland Ave. and Andrew St., from Main to Crosby St., in Day and Eagle Ave. from West Alabama Ave. to San Jacinto St. and Hathaway Ave. E. E. Sands, City Engr.

Ont., Alvinston—Town Council is considering improvements to sewers. W. J. Weed, City Clk.

Ont., Brockville—Town Council will install electric sewage pump at the Fair Grounds Military Camp. George Bryson, City Engr.

Ont., Gulph—City Council plans to construct sewers in Mitchell, Galt and Fergus St. F. McArthur, City Engr.

Ont., London—City Council plans sewers in Dundas and Adelaide St. H. A. Brazier, City Engr.

Ont., Toronto—Bids will be received until noon, Dec. 21, by Board of Control, for constructing sewers on various streets. C. H. Rust, City Engr.

Bids In and Contracts Awarded

Mass., Boston—(West Roxbury)—Contract for sewer work in Saville St., West Roxbury, awarded to WILLIAM L. DOLAN, 44 Tower St., West Roxbury, at $6,375.

N. Y., New York—(Borough of Bronx)—Official—Lowest bidder for sewer and connections was Briggs & McLaughlin Contracting Co., at $4,230.

N. J., Linden—Township Committee awarded contract for installation of sewer in Wood Ave. to MATHEW WADE, Elizabeth.

N. J., Ridgefield Park—Fred E. Gross, Yonkers, submitted lowest bid for sewer system in West View Section, at $27,794. Noted Dec. 2.

Penn., Philadelphia—Contract for sewer work at foot of Snyder Ave. awarded to D. A. CONAN, 1345 Arch St., Philadelphia, at about $22,000.

Penn., Philadelphia—Robert F. Higgins, 4642 Lancaster Ave., Philadelphia, submitted lowest bid, at $70,000 for Rock Run sewer.

Md., Baltimore—Board of Awards received bids Nov. 24 for Section No. 1, Waverly trunk sewer and lateral sewers in District No. 34-D, Contract No. 168 and 169, as follows: (a) Frank Carozza, $40,126; W. H. & C. F. Thompson, $10,000 F. B. Beasman & Co., $10,322; (b) Thomas Hampton Co., $9,888; Frank Carozza, $10,240; F. B. Beasman & Co., $10,402.

S. C., Charleston—Contract for pipe drains in portions of Poplar, Romney and various other streets awarded to CHARLESTON ENGINEERING AND CONTRACTING CO., Charleston, at $16,780.

Tenn., Cleveland—Contract for reinforced-concrete sewage disposal plant awarded to CONCRETE-STEEL CONSTRUCTION CO., Cleveland. W. C. Kirkpatrick, Birmingham, Ala., Engr.

Ind., Indianapolis—Contract for Ohio and Harding St. sewer, awarded to COLUMBIA CONSTRUCTION CO., Indianapolis. B. J. D. Jeup, City Engr.

Mich., Harbor Beach—(Official)—Contract for sanitary sewer system and disposal plant awarded to McHALEY & EDWARDS, Milan, Mich. Estimated cost, $16,209. Noted Dec. 2.

Ill., Chicago—All bids received Dec. 2 for Calumet Intercepting sewer, Contract No. 4 rejected by Board of Trustees of Sanitary District. Noted Nov. 4.

Ill., Dixon—HATCH & MONTAGUE, Niles, at $51,555, awarded contract for concrete tunnels at State Epileptic Colony near Dixon, and LOGAN & GIERTZ, at $27,700, for sanitary sewers. Noted Nov. 18.

Minn., South St. Paul—(Official)—Contract for sewer in Third St. and Third Ave. awarded to TANNER BROS., St. Paul. Estimated cost, $24,490. Noted Nov. 4.

Idaho, Bonners Ferry—(Official)—Contract for sewer system and sewage-disposal plant awarded to CLIFTON APPLEGATE CO., Spokane, Wash. Estimated cost, $23,493.

Calif., Lodi—Bids have been rejected for furnishing city with 1,300 ft. of 18-in. sewer pipe.

Ont., Berlin—Contract for pumps for new sewage-disposal plant awarded to CANADIAN ALLIS-CHALMERS, LTD. Estimated cost, $4,402.

Ont., London—Contract for sewers on Egerton and William St. awarded to BLIGHT & FIELDER.

Garbage

Proposed Work

N. Y., Perry—City contemplates garbage disposal plant.

Va., Norfolk—W. R. Russell, Supt. of St. Cleaning Dept., has recommended installation of new garbage incinerator in Norfolk.

Ind., Ft. Wayne—(Official)—Bids will be received at office of Board of Public Works until 3 p.m., Jan. 3, for construction of garbage incinerator. H. W. Becker, Clk. Noted Aug. 5 and Oct. 21. (See adv.)

Ont., Crowland—J. G. Stephenson, Welland, contemplates garbage-disposal plant. Estimated cost, $20,000.

STREETS AND ROADS

Proposed Work

Conn., Hartford—Bids will be received by State Highway Commission until 2 p.m., Dec. 21, for constructing road in Branford, Thompson, Cornwall and Portland Townships and city of Norwalk.

N. Y., New York—(Borough of Bronx)—(Official)—Bids will be received until 10:30 a.m., Dec. 23, by Douglas Mathewson, Borough Pres., for improving Odell St. from Unionport Rd. to Starling Ave.; Newbold Ave. from Catsle Hill to Zerega Ave.; Waterbury Ave. from Westchester Ave. to Zerega Ave.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received until noon, Dec. 20, by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., for repairing asphalt pavements on marginal streets and piers, North, East and Harlem Rivers; also on Dec. 21 for wood-block pavement in the team gangways and wagon-way spaces of the municipal ferryboats "Manhattan," "Bronx," "Queens," "Brooklyn," "Richmond," "Bayridge," "Gowanus," "Nassau" and "Mayor Gaynor."

N. Y., Schoharie—Board of Supervisors of Schoharie plans to construct 17 miles of roads in Schoharie County.

N. J., Haddonfield—Bonds for $55,000 sold. Proceeds will be used for improving streets.

N. J., Newark—Board of Freeholders plans to improve Roseville Ave. with wood block pavement.

N. J., New Brunswick—Bids will be received by Board of Freeholders of Middlesex County until Dec. 20 for repairing eight miles of Cranbury Turnpike.

N. J., Newton—Board of Freeholders of Sussex County will apply to State Road Commission for appropriation of $10,000 for road improvements. E. A. Stevens, Comr.

N. J., Ocean Grove—(Official)—Bids will be received by Frank P. Butcher, Township Clk., 75 South Main St., until 7:30 p.m., Dec. 27, for paving South Main St. (See adv).

N. J., Wildwood—Board of Freeholders of Cape May County, Cape May C. H., will resurface boulevard from Wildwood to mainland. Estimated cost, $80,000.

Penn., Eldred—(Official)—Bids will be received by G. W. Russell, Pres., Eldred Borough Council, until 8 p.m., Dec. 22, for improving Main St.

Md., Baltimore—Bids will be received until Dec. 22 by R. Keith Compton, Chn. Paving Comn., for paving Pratt St. from Linwood Ave. to east city limits. M. K. McCay, City Engr.

Md., Baltimore—City plans to widen St. Paul St. from Lexington to Hamilton St.

Va., Abingdon—Bonds for $18,000 sold by Board of Supervisors of Washington County for road construction on Kinderhook District.

Va., Pulaski—City Council plans to improve Randolph Ave. from Fifth to 14th St.

W. Va., Martinsburg—Bids will be received next spring for approximately 7,000 sq.yd. asphalt or brick pavement. E. D. Bromley, St. Comr.

W. Va., Terra Alta—Citizens of Preston County voted $265,000 bonds for road work.

N. C., Wilson—Bonds for $130,000 sold for street improvements. Noted Sept. 23.

Ga., Mason—City Council plans to pave Coleman Ave. with concrete.

Fla., Gainesville—Citizens voted $21,000 bonds for paving portion of University Ave. and extending sewer system.

Fla., Kissimmee—Bids will soon be received for paving Main St. with brick. Estimated cost, $12,000.

Fla., Tampa—Bids will be received by D. B. McKay, Chn., Comrs. of Pub. Wks., until Dec. 20, for 112,650 sq.yd. asphalt block pavement and 3,500 sq.yd. concrete pavement.

Ala., Dothan—Bids will be received by A. C. Crawford, Chn. of Bd. of Revenue, until Dec. 30, for road from Dothan toward Midland City, seven miles.

Ala., Eutaw—Commissioners of Greene County plan an expenditure of between $10,000 and $15,000 for highway from Eutaw to Finch's Ferry.

Ala., Monroeville—Bids will be received by County Board of Revenue until Dec. 27 for grading, draining and surfacing with gravel section of Old Federal Rd. P. W. Turner, County Engr.

Ala., Opelika—Bids will be received by County Commissioners until Dec. 27 for sand clay road. Estimated cost, $11,000. W. S. Keller, Montgomery, State Highway Engr.

Ala., Rockford—Bids will be received by County Commissioners until Jan. 11 for grading and topsoiling Rockford and Kellyton Rd., about 4½ miles.

La., New Orleans—(Official)—Bids will be received at office of Highway Department of Board of State Engineers, Room 104, New Orleans Court Bldg., until noon, Jan. 3, for section of Gretna-Belle Chasse Highway, Plaquemines Parish. W. E. Atkinson, State Highway Engr.

Tenn., Athens—Commissioners of McMinn County contemplate $100,000 bond issue for road construction.

Ky., Harlan—Election will be held Feb. 12 to vote on $250,000 bonds for road construction.

Ohio, Defiance—Bonds for $25,000 will be sold by County Commissioners for road improvements.

Ohio, East Cleveland—City will sell $25,000 bonds Jan. 4 for improving Terrace Rd. E. L. Hickey, City Audr.

Ohio, East View—(Warrensville post office)—Bids will be received by Charles E. Burger, Clk., East 143d St., until noon, Jan. 17, for improving East View Ave. Estimated cost, $29,800.

Ohio, Kenton—City will pave West Franklin St. Estimated cost, $19,500.

Ohio, Lisbon—(Official)—Bids will be received until 1 p.m., Dec. 27, by Village Trustees for improving East Liverpool Lisbon Rd. H. C. Armstrong, Lisbon, County Highway Supt.

Ohio, Painesville—Bids will be received by city until Dec. 22 for 5,942 sq.yd. brick paving on Richmond St. F. N. Downer, City Engr.

Ohio, Painesville—Plans prepared by F. N. Downer, City Engr., for 6,360 sq.yd. brick pavement on Jackson St.

Ind., Anderson—Bids will be received until Jan. 8 by the Commissioners of Madison and Delaware Counties for improving highway on line between counties. Joel B. Benefiel, Audr. Madison County.

Ind., Crawfordsville—Bids will be received by B. B. Engle, Audr., Comrs. of Montgomery County, until 10 a.m., Jan. 4, for road in Ripley Township.

Ind., Franklin—Bids will be received by H. L. Knox, Audr., Comrs. of Johnson County, until 2:30 p.m., Dec. 31, for two gravel roads.

Ind., Greenfield—Bids will be received by L. Woods, Audr., Comrs. of Hancock County, until 10 a.m., Jan. 3, for gravel road in Jackson Township.

Ind., Marion—Bids will be received by E. H. Kimball, Audr., Comrs. of Grant County, until 2 p.m., Jan. 4, for road in Center Township.

Ind., New Castle—Bids will be received by P. A. Walford, Audr., Comrs. of Henry County, until 10 a.m., Dec. 31, for road in Harrison Township.

Ind., Noblesville—Bids will be received by W. O. Horton, Audr., Comrs. of Hamilton County, until 10 a.m., Jan. 4, for road in Noblesville Township.

Mich., Grand Rapids—Board of Public Works will pave Union Ave., with bituminous concrete, from Pleasant to Franklin St. L. E. Stevens, City Engr.

Mich., Iron River—An election will be held Dec. 27 to vote on $40,000 in bonds to improve a number of streets.

Mich., Watervliet—At recent election citizens voted to extend Butternut St.

Joliet, Ill.—Board of Local Improvements plans to pave Cass St. with brick; estimated cost, $32,987.

Ill., Rockford—(Official)—Bids will be received by W. W. Bennett, Pres., Bd. of Local Improvements, until 1:30 p.m., Dec. 22, for paving with brick portions of Kishwaukee St. (See adv.)

Ill., Rock Island—City plans to pave Eighth Ave. and 24th and 29th St. with asphalt. Estimated cost, $15,052.

Ill., Sterling—City plans to pave Third St. and Sixth Ave. Estimated cost, $80,000. A. G. Hubbard, Engr.

Wis., Baraboo—City will construct about 9,000 sq.yd. of pavement and 5,000 lin.ft. of gutter. Estimated cost, $10,000. A. E. French, City Engr.

Wis., Caledonia—Election will soon be held to vote on $8,000 bonds for road improvements.

Wis., Oshkosh—City will improve number of streets and avenues during 1916.

Minn., Rochester—City plans to pave North Broadway. J. C. Utton, City Engr.

Neb., Omaha—Bids will be received by City Commission until Dec. 28 for paving in District No. 1438, 1545, 1548 and other districts, about five miles. E. E. Bruse, City Engr.

S. D., Sioux Falls—Plans being considered by Commissioners of Minnehaha County for improving 125 miles of highway within next few years. Estimated cost, $500,000.

Mo., Cleveland—Kansas City-Joplin Short Route Rock Road Association organized to build rock road between Cleveland and Joplin.

Mo., Marshall—Election will be held Feb. 19 to vote on $1,310,000 bonds for 92 miles of rock roads.

Mo., Nevada—Election will soon be held to vote on rock surfacing about 250 mi. of roads.

Mo., Sweet Springs—Citizens plan to establish district to rock surface eight miles of road. Estimated cost, $50,000.

Orange, Tex.—Citizens defeated $50,000 bond issue for roads and bridges. Noted Oct. 28.

Idaho, Wallace—(Official)—Bids will be received by W. W. Smith, Chn. of Finance Com., until Jan. 15, for paving and improving streets of District No. 4. Robert Merriam, City Engr. Noted Dec. 2.

Utah, Logan—City plans to pave about 30,000 sq.yd. with concrete. Roy Ballen, City Engr.

Ariz., Flagstaff—Election will soon be held to vote on $200,000 in bonds for hard surfacing roads in Coconino County.

Ariz., Tucson—Plans being prepared by W. C. Goetz, County Engr., for mountain resort road, about 19 miles, and commercial roads. Estimated cost, $100,000 and $300,000 respectively.

Wash., Olympia—Contract for paving will will be awarded early next year. Estimated cost, $11,000. J. B. Weddell, City Engr.

Wash., Seattle — Report submitted to Board of Public Works by A. H. Dimock, City Engr., estimating cost of paving Burke Ave. at $50,000.

Ore., The Dalles—Commissioners of Wasco County plan $340,00 bond issue for constructing roads.

Calif., Los Angeles—Bids will be received by Board of Supervisors of Los Angeles County until 2 p.m., Dec. 27, for concrete pavement on southerly five miles of Mint Cañon Rd., Section A, Rd. Dist. No. 5. Estimated cost, $68,000.

Calif., Ontario—Bids will be received until Jan. 10 by the City Council for the improvement of East State St. and Euclid Ave.

Calif., Santa Monica—City Council plans to pave Beach Rd. from Colorado St. northward to Santa Monica Cañon outlet. Estimated cost, $50,000.

Ont., Leamington—Town Council considering paving Mill and Russell St. with concrete. R. M. Selkirk, Clk.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for improving 96th St. from Second Ave. to point east of easterly house line of Lexington Ave. awarded to W. J. FITZGERALD, 547 West 45th St., New York, at $7,186. Noted Nov. 18 and Dec. 2.

N. J., Perth Amboy—Contract for improving High, First and Commerce St. and Hall, Watson, Brighton and Catalpa Ave. awarded to OLIVER W. RAMSAY, Perth Amboy, at $110,000.

Penn., Greensburg—Frank T. Byers, Mt. Pleasant, at $23,841, submitted lowest bid for brick road in Mt. Pleasant Township.

Penn., Philadelphia — Contract for granolithic walks in Clarence Clark Park awarded to D. A. CONAN, 1345 Arch St., Philadelphia, at about $5,000.

W. Va., Princeton—(Official)—Contract for 6¼ miles of water bound macadam road in Mercer County awarded to SULLIVAN, TILSON & CARTER, Bluefield, at $28,936. Noted Nov. 18.

N. C., Charlotte—(Official)—Contract for 17,500 sq.yd. of paving awarded to A. H. GUION, Gastonia, at $20,505. Noted Nov. 4 and Dec. 2.

La., Franklin—Contract for road between Franklin and Iberia awarded to PERRY BONNER.

Ky., Albany—(Official)—John G. Huff & Co., at $8,640, submitted lowest bid for three miles of macadam road.

Ohio, Columbus—Lowest bids received Dec. 3 by State Highway Commission for road work were as follows: Cincinnati-West Union Rd., Hamilton County, 1.11 miles, H. W. Curry & Co., Eaton, $14,350; Cincinnati-Chillicothe Rd., Hamilton County, 0.94 mile, Warren Bros. Co., Boston, Mass., $13,100; Lancaster-Logan Rd., 1.35 miles, R. G. Culbertson, Richmond, Ind., $20,756; Mansfield-Millersburg Rd., 1.59 miles, Philip Dieffenbacker, Massillon, $26,800; Pomeroy-Jackson Rd., 0.29 mile, John Lindsay, Middleport, $6,000; Findlay-Tiffin Rd., 2.59 miles, G. W. Eicher, Fostoria, $16,839; Urbana-Marysville Rd., John J. Porter, Marysville, $4,631; West Unity-Montpelier Rd., 2.09 miles, Kelley Construction Co., Bryan, $19,196; Cincinnati-Louisville Rd., 1.74 miles, H. W. Curry & Co., Eaton, $11,828; Cincinnati-West Union Rd., 0.90 miles, H. W. Curry & Co., Eaton, $5,200. Noted Nov. 25.

Ind., Brazil—(Official)—Contract for two roads in Harrison Township awarded to JOHN WEATHEUVAX, Clay City, at $4,964. Noted Nov. 11.

Ind., Brookville—Contract for macadam road in Franklin County awarded to F. W. WILSON, Brookville.

Ind., Delphi—Contract for road work in Carroll County awarded to WILLIAM MANLEY, Frankfort, at $18,973. Noted Sept. 23 and Oct. 28.

Ind., Franklin — Contract for road in Johnson County awarded to BROWN & PITCHER, Trafalger, at $6,127.

Ind., Kentland—(Official)—Contract for macadam road in McClellan Township awarded to F. A. CAMBLIN, Morocco, at $5,960. Noted Nov. 11.

Ind., Kokomo—Contract for road in Howard County awarded to JAMES H. WATSON & CO., Kokomo, at $10,933.

Ind., Mt. Vernon—Contract for road work in Posey County awarded to MT. VERNON CONSTRUCTION CO., Mt. Mernon, at $5,968; and L. J. UTLEY, Bethel, at $3,549.

Ind., Muncie—Commissioners of Delaware County awarded contracts for road work as follows: FRANK HINES, at $10,390, for Edward C. Schwar Rd., Mt. Pleasant Township; LORING S. GATES, at $4,990, for John B. Jackson Rd., Perry Township; FRANK HINES, at $2,290, for Thomas Hiatt Rd., Mt. Pleasant Township; BORTER ROSS, at $3,995, for Lewis E. Oxley Rd., Perry Township. Noted Nov. 18.

Ind., Salem—FRED SIMPSON, Salem, at $8,690, awarded contract for road work in Washington County.

Iowa, Idagrove—Contract for paving awarded to NATIONAL ROOFING CO., Omaha, Neb., at about $97,000. Noted Nov. 18.

Minn., St. Paul—All bids received for improving Arcade St. have been rejected.

Mo., Kansas City—SMITH BROS. awarded contract by J. C. Nichols Realty Co. for grading 58th St., 58th St. Terrace, 59th St. Terrace, Huntington Rd. and Bellevue Ave.

Mo., Sedalia—(Official)—Contract for 9,200 sq.yd. of vertical fiber brick paving awarded to W. MENEFEE, Sedalia, at $1.64 per sq.yd. Noted Oct. 21 and Nov. 11.

Ark., Pocahontas—H. C. NIXON, Argenta, awarded contract for pike road from Revenden Springs to Ravenden Station.

Okla., Muskogee—(Official)—H. B. Wilson, at $8,000, submitted lowest bid for road improvements in Muskogee County. J. B. Clonts, County Engr. Noted Nov. 11.

Wash., Bellingham—KNUTE SAUSET, Bellingham, at $17,625, awarded contract for paving South Elk and 11th St.

Wash., North Yakima—(Official)—S. A. Shockley, Outlook, at $4,570, submitted lowest bid for Permanent Highway No. 16, and Cascade Construction Co., Seattle, at $4,935, for Permanent Highway No. 17. O. E. Brashears, County Engr.

Calif., San Jose—J. W. McDONALD, JR., Monadnock Blk., San Francisco, at $13,930, awarded contract for paving San Carlos St.

Calif., San Mateo—Contract for paving awarded to FEDERAL CONSTRUCTION CO., Sharon Bldg., San Francisco, at $8,432.

INDUSTRIAL WORKS

Proposed Work

Mass., Lynn—Plans being prepared for four-story, 50x100-ft. factory at 17 Stewart St., for Campbell Electric Co.

Mass., Maplewood—(Boston post office)—H. H. Kelly Co. will build two-story, 40x120-ft. factory. Estimated cost, $20,000.

Mass., Worcester—Bids will soon be received for superstructure of one-story, 60x62-ft. garage and salesroom for J. Francis Southgate, 5 Crown St. Estimated cost, $15,000. O. C. S. Ziroli, 306 Main St., Arch.

Conn., New Haven—According to press reports plans are being prepared for extensive additions to plant of Maxim Munitions Co.

Conn., New Milford—Lonsdale Linen Co., Lonsdale, R. I., purchased site at New Milford for large bleachery.

Conn., Stamford—American Cupro Nickel Co. will build rolling mill on Fairfield Ave. Emmens & Abbott, Arch.

N. Y., Buffalo—Farmamel Manufacturing Co., Inc., purchased site at Chandler St. and New York Central R.R. for grain elevator and feed mill.

N. Y., Buffalo—Contract will soon be awarded for garage for Charles M. Peabody, 588 Main St. Estimated cost, $20,000.

N. Y., Buffalo—Pierce Arrow Motor Car Co. will build two-story addition to plant at 1661 Elmwood Ave. Estimated cost, $12,000.

N. Y., New York—(Borough of Bronx)—Plans prepared by Wesley S. Bessell, Arch., 3 West 29th St. (Borough of Manhattan), for garage at Webster Ave. and 170th St., for Manderkin Building Co. Estimated cost, $10,000.

N. Y., New York—(Borough of Bronx)—Official)—Plans prepared by Homer A. Reid, Arch., 347 Fifth Ave. (Borough of Manhattan), for two-story, 85-95-ft. ice and cold-storage plant on 170th St. near Third Ave. for Tremont Fireproof and Refrigerating Co. Estimated cost, $60,000.

N. Y., New York—(Borough of Bronx)—Official)—Plans being prepared by Richard A. Wright, Arch., 233 Broadway (Borough of Manhattan), for one-story, 76x127-ft. factory for Sigmund Ullman Co., Park Ave. and 146th St. Estimated cost, $15,000.

N. Y., New York—(Borough of Brooklyn)—(Official)—Plans prepared by Shampan & Shampan, Arch., 772 Broadway (Borough of Manhattan), for one-story, 85x90-ft. building at Bedford Ave. and Prospect Pl., for Triangle Holding Co., 44 Court St., to be used for auto showrooms. Estimated cost, $35,000.

N. Y., New York—(Borough of Manhattan)—Plans being prepared by J. A. Fitzpatrick, Arch., 71 Broadway, for factory at Montgomery and Water St., for Butwell Building Corporation, 120 Broadway. Estimated cost, $125,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Plans being prepared for garage on 127th St. near Broadway by J. M. Felson, Arch., 1133 Broadway, for Klein Operating Co. Estimated cost, $20,000.

N. Y., Poughkeepsie—C. F. Hoag Co. plans to build factory and fire tower at Poughkeepsie.

N. Y., Poughkeepsie—Fred Smith plans to build two-story, 38x142-ft. garage. Estimated cost, $40,000. W. J. Beardsley, 49 Market St., Arch.

N. Y., Utica—Linde Air Products Co. purchased site on Walnut St., between Schuyler and Stark St., for plant.

N. J., Elizabeth—Plans prepared by F. G. Ring, Arch., 280 North Broad St., for machine shop for S. L. Moore & Sons Corporation. Estimated cost, $200,000. Other additions will be made later which will aggregate $1,500,000.

N. J., Rockaway—Plans being prepared for one-story, 173x300-ft. shop for International High Speed Steel Co., 99 Nassau St., New York, N. Y.

Penn., Chambersburg—Chambersburg Ice and Cold Storage Co. has increased its capital stock from $20,000 to $50,000 and will use proceeds for enlarging its plant on Grant St.

Penn., Oakmont — Plans being prepared for three-story, 150x300-ft. factory for Autocar Co., 23rd and Market St., Philadelphia. Stearns & Castor, Stephen Girard Bldg., Philadelphia, Arch.

Va., Pulaski—Press reports state that New York capitalists plan to build an iron plant. Estimated cost, $500,000. K. Thomas, Engr., New York, N. Y., interested.

W. Va., Chester—Chester Rubber Tire and Tube Co. plans to build one-story addition to its plant. Estimated cost, $20,000. Philip Freshwater, Gen. Mgr.

N. C., Shulls Mills—Sawmill and dry kilns will be constructed by Boone Fork Lumber Co., Elizabethton, Tenn. Estimated cost, $100,000. M. Miller, Supt.

S. C., Clover—Company will be organized by M. L. Smith, Secy.-Treas. of Clover Cotton Manufacturing Co., with $200,000 capital stock, to build cotton yarn mill.

Ala., Dothan—Home Guano Co. contemplates expenditure of $75,000 for enlarging and improving its plant. M. L. Hannahan, Gen. Mgr.

La., Slidell—Salmen Brick and Lumber Co. plans to build a sawmill with a daily capacity of 150,000 ft. E. H. Michel, Whitney-Central Bank Bldg., New Orleans, Sales Mgr.

Tenn., Nashville—Golden Grain Co., recently incorporated, contemplates construction of cereal mill. W. M. Carr and H. G. O'Kain interested.

Ohio, Cleveland—Cleveland, Akron & Canton Terminal Railway Co. will build ten-story warehouse. Estimated cost, $1,000,000. O. C. Barber, Pres.

Ohio, Cleveland—Cleveland Machine and Manufacturing Co. contemplates one-story pattern storage building. Estimated cost, $20,000.

Ohio, Columbus—Farmers' Fertilizer Co. contemplates plant for manufacture of sulphuric acid. Estimated cost, $200,000.

Ohio, Dayton—W. A. Apple & Co., 343 Cincinnati Rd., plans to rebuild its factory recently destroyed by fire. Estimated cost, $15,000.

Ohio, East Palestine—W. S. George Pottery Co. plans to build one and two-story, 150x400-ft. factory and office building. W. S. George, Pres.

Ohio, Girard—Carnegie Steel Co., Youngstown, plans to build plant near Girard. Estimated cost, $10,000,000. Thomas McDonald, Dist. Supt.

Ohio, Kent—Plans being prepared by W. C. Owen & Co., Arch., Leader News Bldg., Cleveland, for two-story factory for Mason Tire and Rubber Co. Estimated cost, $60,000. O. M. Mason, Pres. Noted Dec. 2.

Ohio, Lima—Solar Refining Co. contemplates an expenditure of $700,000 for enlarging and improving its plant.

Ohio, Mansfield—Mansfield Sheet and Tin Plate Co. will build a 140x240-ft. finishing mill to cost approximately $65,000.

Ohio, Shadyside—Belmont Casket Co. contemplates expenditure of $40,000 for addition to its plant.

Ohio, Springfield—Preliminary plans prepared for one-story, 50x200-ft. garage for city. Estimated cost, $20,000. R. C. Gotwald, 54 Gotwald Bldg., Arch.

Ohio, Springfield—Plans being prepared by W. E. Russ, Merchants National Bank Bldg., Indianapolis, Ind., for four-story, 300x300-ft. addition to plant of Robbins & Myers Co. Estimated cost, $150,000. C. F. McGilvray, Pres. Noted Dec. 9.

Ohio, Steubenville—Bids will be received about Jan. 1 by Steubenville Ice Co. for two-story ice plant. Estimated cost, $20,000. G. E. Wisener, Pres.

Ohio, Steubenville—Bids will be received next spring for four-story warehouse for Steubenville Stone Co., 513 Market St. Estimated cost, $30,000. Peterson & Clark, National Bldg., Arch.

Ohio, West Carrollton—Bids will soon be received by Dexter & McCleur, Arch., 405 Canby Bldg., Dayton, for two-story, 75x102-ft. factory for West Carrollton Parchment Co. Estimated cost, $10,000.

Ind., Indian Harbor—Inland Steel Co. plans an expenditure of $5,000,000 for improvements at its plant.

Mich., Grand Rapids—Michigan Railway contemplates one-story, 125x180-ft. warehouse on Mt. Vernon Ave. Estimated cost, $10,000. G. B. Ross, Jackson, Mich., Pur. Agt.

Ill., Chicago—Peoples Laundry Co. will build one-story addition to plant to cost $10,000. F. W. Fischer, 9154 Commercial Ave., Arch.

Wis., Madison—(Official)—Bids will be received some time in January for meat-packing plant for Farmers Coöperative Packing Co. Gardner & Lindberg, 1130 South Dearborn St., Chicago, Ill., Arch. Estimated cost, $200,000. Noted Dec. 2.

Wis., Milwaukee—Morawetz & Co., 217 East Water St. plan to build two-story, 80x120-ft. addition to its plant.

Wis., Mineral Point—P. O. Vivian will build a machine shop and garage to cost $10,000.

Wis., Oshkosh—Plans being prepared by Fluor Bros., Construction Co., Arch., 511 State St., for two-story, 40x80-ft. factory for Carver Ice Cream Co., 714 South Main St.

Wis., Oshkosh—Morgan Lumber Co. plans to build three-story, 80x194-ft. factory next spring. Estimated cost, $25,000. Fluor Bros. Construction Co., 511 State St., Arch.

Iowa, Des Moines—Plans prepared by F. W. and E. B. Clarke, Archs., Omaha, Neb., for three-story, 45x160-ft. warehouse for Farmers Coöperative Produce Co. Noted Dec. 9.

Kan., LeHunt—(Sycamore post office)—Sunflower Cement Co. contemplates an expenditure of $100,000 for improving and enlarging its plant.

Mont., Great Falls—Great Western Sugar Co. plans three or four sugar factories in States of Montana and Nebraska. First factory will be built at Great Falls.

Mo., Kansas City—Plans prepared by S. B. Tarbot & Co., Arch., for two-story, 100x120-ft. laundry for Graham Domestic Laundry Co. Estimated cost, $30,000.

Mo., Kansas City—Plans being prepared by C. M. Williams, Arch., Rialto Bldg., Kansas City, for five-story reinforced-concrete storage and warehouse for J. R. Hulse Storage and Transfer Co.

Mo., St. Louis—Warehouse of Belcher Sugar Refining Co., Main and Ashley St., purchased by Booth Fisheries Co., Chicago, who plan to build addition. Estimated cost, $50,000.

Mo., St. Louis—The Larmore Ice Cream Co. will build factory on Easton Ave. Estimated cost, $15,000. J. C. Donovan, Arch.

Mo., St. Louis—Plans being prepared by Barnett, Haynes & Barnett, Arch., Century Bldg., for eight-story publishing house for Pulitzer Publishing Co., 212 North Broadway. Estimated cost, $200,000. Noted Aug. 19.

Mo., St. Louis—Contract will be awarded in March by J. L. Wees, Arch., 410 Commercial Bldg., for seven-story, 100x250-ft. warehouse and river terminal for St. Louis River Front and Dock Association. Estimated cost, $250,000.

Tex., Dallas—Burgoyne Bros., Hugo, Okla., purchased site at Dallas for lumber mill to cost $80,000.

Tex., Dallas—Expenditure of $50,000 is planned for enlarging and improving Dallas Cotton Mills.

Tex., Galveston—See item under "Miscellaneous."

Tex., Lockhart—Lockhart Oil Mill Co. will rebuild cotton-seed oil mill recently destroyed by fire. Estimated cost, $50,000.

Okla., Tulsa—Crosbie & Mitchell plan to construct five-story, 100x140-ft. storage warehouse. Estimated cost, $75,000. C. Winkler, Tulsa, Arch.

Wash., Seattle—Plans being prepared for four-story, Class "A" warehouse at Juneau and Atlantic St. for Oregon-Washington R.R. and Navigation Co. Estimated cost, $50,000.

Calif., Los Angeles—Union Wax and Parchment Co., Hamburg, N. J., purchased site at 50th and Alameda St., Los Angeles, for one-story, 261x396-ft. factory.

Calif., Martinez—W. S. O'Brien plans to construct cement and asphalt plant. Estimated cost, $20,000.

Calif., San Dimas—Plans prepared for pre-cooling plant for San Dimas Orange Growers' Association. Estimated cost, $50,000. C. M. Gay & Son, 335 Towne Ave., Engr.

Calif., San Francisco—Workman Packing Co. has plans for reinforced-concrete packing plant on Seventh St. near Harrison St. Estimated cost, $25,000. C. H. Workman, 180 Erie St., San Francisco, Pres.

Ont., Leamington—S. G. Morse plans to build warehouse. Estimated cost, $25,000.

Ont., Toronto—Automobile Supply Co. will build four-story showroom and garage at 249 Simcoe St. Estimated cost, $50,000.

B. C., Vancouver—American Can Co. contemplates four-story, 125x130-ft. addition to plant at 535 Railway Ave. M. Bigger, Mgr.

Bids In and Contracts Awarded

Mass., Holyoke—Contract for addition to wire mill of D. W. Princeton & Co. awarded to P. J. KENNEDY CO., Holyoke, at $12,000.

Mass., Holyoke—Smith Tablet Co. awarded contract for brick addition to its plant to LYNCH BROS. BRICK CO., 206 High St., Holyoke. Estimated cost, $18,000.

Mass., Indian Orchard—Contract for addition to plant of Fiberoid Co. on Worcester St. awarded to D. W. MELLEN, 293 Bridge St., Springfield.

Conn., Hartford—Contract for rebuilding factory of S. Donchian Rug Co., 205 Pearl St., recently destroyed by fire, awarded to ROBERT PORTENS, 13 Forest St., Hartford. Estimated cost, $10,000.

Conn., Norwich—Contract for addition to plant of Joseph Hall Woolen Mills awarded to DOYLE & MURPHY, Willimantic.

Conn., Stamford—Richards & Co. awarded contract for one-story, 93x186-ft. storage building on Ludlow St. to J. W. FERGUSON CO. Estimated cost, $10,000.

Conn., West Hartford—Contract for a foundry for J. M. Craig, 79 Arch St., awarded to J. H. GROZIER CO., 721 Main St., West Hartford. Estimated cost, $10,000.

N. Y., Buffalo—BRASS BROS. CO., Niagara Falls, awarded contract for group of farm buildings to include dairy, grain elevator, etc., for J. C. Dold, 745 William St., Buffalo. Estimated cost, $40,000.

N. Y., Dansville—Contract for four-story addition to plant of Blum Shoe Co. awarded to A. J. WERDEIN, at $15,000.

N. Y., Gates—Contract for addition to factory of H. Symington Co. awarded to A. FRIEDERICH & SONS CO., Mill St., Rochester. Estimated cost, $25,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract awarded to CHAMPLIN CONTRACTING CO., 103 Park Ave., for six-story, 100x100-ft. garage and service station on 67th St. near West End Ave., for Hudson Motor Garage of New York, 1842 Broadway. Noted Nov. 25.

N. Y., New York—(Borough of Queens)—(Official)—Contract awarded to FOUNTAIN & CHOATE, 110 East 23rd St. (Borough of Manhattan), for six-story, 117x217-ft. factory at Skillman and Foster Ave., Long Island City, for Gustav Sandblom, 30 East 42nd St. (Borough of Manhattan). Estimated cost, $110,000. Noted Dec. 9.

N. J., Athenia—Athenia Steel Works awarded contract for steel plant to J. J. O'LEARY CO., 500 Bloomfield Ave., Passaic. Estimated cost, $40,000.

N. J., Elizabeth—Contract for two additions to plant of F. H. Kalbfleisch, Baltic and Third St., awarded to SCHULER CEMENT CONSTRUCTION CO., Waverly, N. J.

N. J., Newark—G. T. Casebolt, 1005 Broad St. awarded contract for garage, automobile sales room and machine shop to BECKER CONSTRUCTION CO., 361 Grove St., Newark.

N. J., Paterson—Contract for ice houses and automatic conveyer for Thomas H. Alyea awarded to GUNN-VAN DALE CO., 31 Clinton St., Newark, at $40,000.

N. J., Shadyside—(Edgewater post office)—(Official)—JOHN W. FERGUSON CO., New York, N. Y., awarded contract for manufacturing building for General Chemical Co.

N. J., Trenton—Stokes Rubber Co. awarded contract for two-story, 100x110-ft. manufacturing building to SCOTT & DAY. Estimated cost, $12,500.

Penn., Harrisburg—Blough Manufacturing Co., Riley and Fulton St. awarded contract for four-story factory to J. POMRAINING, 1918 North Second St., Harrisburg, at $10,000.

Penn., Lancaster—Contract for warehouse for David Miller awarded to I. M. WINTER, 45 South Queen St., Lancaster. Estimated cost, $10,000.

Penn., Manayunk—A. T. Baker Co., Main and Carson St. awarded contract for factory to BARCLAY, WHITE & CO., Perry Bldg., Manayunk, at $10,000.

Penn., Marcus Hook—Contract for two buildings for Benzol Products Co. awarded to F. W. VAN LOON, Denckla Bldg., Philadelphia. Estimated cost, $45,000.

Penn., Philadelphia—A. L. CARHART, at $16,000, awarded contract for addition to plant of Barrett Manufacturing Co., Margaretta and Bermuda St.

Penn., Philadelphia—CHARLES COOPER, Philadelphia, at about $35,000, awarded contract for three-story, 100x100-ft. ice cream factory at 3333 Ludlow St. for Supplee Alderney Dairies Co. Noted Nov. 25 and Dec. 2.

Penn., Philadelphia—Contract awarded by Philadelphia Steel and Forge Co. to BELMONT IRON WORKS for factory buildings at Milnor and Bleigh St. Estimated cost, $10,000.

Penn., Pittsburgh—Contract for three-story addition and alterations to ice plant of Consolidated Ice Co., 13th and Pike St. awarded to NICOLA BLDG. CO., Farmers Bank Bldg. Estimated cost, $25,000.

Penn., Pittsburgh—Contract for addition to plant of Pittsburgh Gage and Supply Co., 13th and Liberty St. awarded to L. H. KREUSLER, 33d and Penn Ave., Pittsburgh. Estimated cost, $15,000. Noted Dec. 2.

Del., Wilmington—Contract for factory buildings for Harlan & Hollingsworth Co. awarded to A. HAVENS & CO., Philadelphia, Penn. Estimated cost, $80,000.

Md., Baltimore—GEORGE REPP, 316 Stinson St., Baltimore, awarded contract for addition to warehouse of Mergenthaler & Co., 116 Hollingsworth St. Estimated cost, $10,000.

Va., Newport News—Contract for building for construction of hydroplanes and hydro-aëroplanes for Atlantic Coast Experimental Association awarded to HARWOOD & MOSS, Newport News. Estimated cost, $10,000.

W. Va., Warwood—Contracts for building for manufacture of sprinklers for Merchant & Evans Co., Philadelphia, Penn., awarded as follows: C. H. SEABRIGHT & CO., Wheeling, foundation; J. E. MOSS IRON WORKS, Wheeling, structural steel; JOHN H. MURPHY CO., Warwood, carpenter work.

Ga., Atlanta—Contract awarded for one-story warehouse at Milton Ave. and Belt Line R.R. to R. D. COLE, by Atlanta & West Point R.R. Estimated cost, $10,000.

Ga., Atlanta—Contract for building for Goodyear Tire and Rubber Co., Akron, Ohio, awarded to MACKLE CONSTRUCTION CO., Atlanta. Estimated cost, $18,000.

Ala., Birmingham—Contract for warehouse for Harris Transfer and Warehouse Co. awarded to EVANS BROS. CONSTRUCTION CO., Birmingham. Estimated cost, $50,000. Noted Nov. 11.

Tenn., Chattanooga—(Official)—Marion Extract Co., Marion, Va., will construct by day labor a plant to manufacture tannic acid from chestnut oak at Chattanooga. Estimated cost, $150,000. Noted Dec. 2.

Ky., Louisville—Kentucky Distillers and Warehouse Co. will remodel three buildings for warehouses by day labor. Estimated cost, $20,000. J. P. Hanley, Hamilton and Mellwood St., Secy. Noted Nov. 18.

Ky., Louisville—Contract for packing plant for C. F. Vissman & Co. awarded to G. H. ROMMEL CO., 639 Campbell St., Louisville. Estimated cost, $15,000. Noted Dec. 9.

Ohio, Canton—(Official)—Globe Motor Car Co. awarded contract for steel work on four-story, 60x200-ft. salesroom and garage to CANTON BRIDGE CO., Canton. Estimated cost, $80,000. Noted Dec. 2.

Ohio, Cleveland—Contract awarded to WILLIAM MOORE CO., 1278 West Fourth St., Cleveland, for factory at 3038 Cedar Rd. for F. L. Henderson. Estimated cost, $25,000.

Ohio, Cleveland—Contract for two-story addition to plant of Cleveland Steel Barrel Co., 9612 Meech Ave., awarded to S. W. EMERSON CONSTRUCTION CO., Engineers Bldg., Cleveland. Estimated cost, $17,000.

Ohio, Cleveland—Contract for grain warehouse at East 131st St. and Erie R.R. for Sheets Bros. Elevator Co. awarded to GEORGE D. BARRIBAL, Miles Ave., Cleveland. Estimated cost, $45,000. Noted Nov. 25.

Ohio, Cleveland—Contract for four-story factory building for D. O. Summers Cleaning Co. awarded to FRED LINDHORST & SONS. Estimated cost, $50,000.

Ohio, Cleveland—Winton Motor Carriage Co. awarded contract for one-story, 80x300-ft. addition to plant on Berea Rd. to BOLTON-PRATT CONSTRUCTION CO., Columbia Bldg., Cleveland. Noted Dec. 2.

Ohio, Dayton—Contract for garage at Third and Kenton St. for W. F. Stark awarded to STRUCTURAL CONCRETE CO., 751 Reibold Bldg., Dayton. Estimated cost, $30,000.

Ohio, Euclid—White Automobile Co., Cleveland, awarded contract for factory to W. I. THOMPSON & SON, 6110 Euclid Ave., Cleveland. Noted Dec. 2.

Ohio, Toledo—Contract for press house and agitator house for Paragon Refining Co., Front St., awarded to J. COMTE, 666 Oswald St., Toledo. Estimated cost, $25,000.

Ind., Ft. Wayne—M. IRMSCHER, 2103 Forest Park Blvd., Ft. Wayne, awarded contract for garage and commercial building for Aaron Shive, 2832 Thompson Ave. Estimated cost, $30,000.

Ind., Indianapolis—Contract for grain warehouse for F. E. Janes Realty Co., 522 Board of Trade Bldg., awarded to HALL-CURRY CONSTRUCTION CO., 807 Bd. of Trade Bldg., Indianapolis. Estimated cost, $40,000.

Mich., Marquette—Contract for plant for Nufer Cedar Co. awarded to FOSTER CONSTRUCTION CO., Milwaukee, Wis. Noted Dec. 2.

Ill., Chicago—Contract for two-story, 100x150-ft. factory for Chicago Nut Co., 619 West Jackson Blvd. awarded to CHANEY ARCHIBALD CO., 189 West Madison St., Chicago. Estimated cost, $40,000. Noted Dec. 2.

Ill., Chicago—E. W. SPROUL CO., 1120 West 35th St., Chicago, awarded general contract for warehouse for General Fire Extinguisher Co. Estimated cost, $60,000. Noted Nov. 18.

Ill., Chicago—Ogden Auto Sales and Garage Co. awarded contract for garage to CALIFORNIA CUT STONE CO., 2136 South Sawyer Ave., Chicago, at $13,500. J. Dvorak, 1909 South Lawndale Ave., Pres.

Wis., Ladysmith—Contract for four-story, 60x132-ft. factory building for A. W. Schram Manufacturing Co. awarded to E. POLLEY, Oshkosh.

Iowa, Burlington—Chicago, Burlington & Quincy R.R. Co. awarded contract for grain drier to H. A. BECK, 1707 Mt. Pleasant St., Burlington, at $10,000. T. E. Calvert, Chicago, Ill., Ch. Engr.

Minn., Minneapolis—R. A. Jacobson, 699 Madison St., will build a three-story, 62x142-ft. warehouse by day labor.

Minn., St. Paul—Contract for factory for Milton Dairy Co., West Ninth St., awarded to W. J. HOY CO., St. Paul. Estimated cost, $25,000.

Kan., Wichita—Contract for warehouse for Rumley Products Co. awarded to VEITER & WENZEL, Wichita, at $40,000. Noted Nov. 11.

Neb., Lehigh—F. L. Vlach and J. J. Tesar awarded contract for garage to T. EASTERGARD, North Bend, Neb., at $10,400.

Mo., Hannibal—Hannibal Wire Fabric Co. will build factory by day labor. Estimated cost, $35,000. Albert Andris, Supt. of Constr. Noted Sept. 23.

Mo., Kansas City—Contract for garage for A. H. Jennings & Son, 1809 North Seventh St. awarded to J. E. ANDERSON & SON, 713 Minnesota Ave., Kansas City. Estimated cost, $20,000.

Mo., Kansas City—W. R. Nelson Estate, 17th and Grand Ave. awarded contract for garage to W. F. JACKSON, Kansas City, at $19,000.

Mo., St. Louis—Contract for two-story, 61x122-ft. factory for A. W. Swebder, 823 South 10th St., awarded to W. J. HOHAN, La Salle Bldg., St. Louis.

FEDERAL GOVERNMENT WORK

Proposed Work

N. Y., Hornell—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 19, for U. S. post office at Hornell.

N. Y., Waterloo—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 21, for U. S. post office at Waterloo.

N. J., Hackensack—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 17, for U. S. post office at Hackensack.

W. Va., Wheeling—Lock Gates—Bids will be received at U. S. Engineer Office, Wheeling District, Wheeling, until 11 a.m., Jan. 14, for steel lock gates for Dam No. 14, Ohio River. (See Adv.)

Fla., Pensacola—Building—Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Jan. 8, for remodeling building No. 52 at Navy Aeronautic Station, Pensacola.

Ky., Ashland—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 24, for U. S. post office at Ashland.

Minn., Anoka—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 18, for U. S. post office at Anoka.

Mo., St. Louis—Coal—Bids will be received at U. S. Engineer Office, Custom House, St. Louis, until 11 a.m., Dec. 29, for furnishing 30,000 tons of coal.

Colo., Denver—Reclamation—Western Division of U. S. Reclamation Service will ask Congress for an appropriation of $9,200,000 to complete 28 western projects now being constructed. Budget of S. B. Williamson, Ch. of Western Division, for above appropriation approved by F. T. Lane, Secy. of Interior.

Panama—Metal Supplies—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Dec. 29, for furnishing metal supplies.

Panama—Miscellaneous Supplies—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until 10:30 a.m., Dec. 22, for furnishing miscellaneous supplies.

Bids In and Contracts Awarded

Conn., Greenwich—Post Office—Bids were received Dec. 10 for U. S. post office at Greenwich, (a) limestone, (b) sandstone, as follows: Frymier & Hanna, New York, N. Y., (a) $66,769, (b) $68,269; E. T. Abbott Construction Co., New York, N. Y., (a) $66,750, (b) $69,800; Joseph Christiano, Greenwich, (a) $67,992, (b) $69,992. Noted Nov. 4.

N. Y., New York—(Borough of Brooklyn)—Dredging—Bids were received Dec. 11 for dredging at Navy Yard, New York, as follows: P. Sanford Ross, Inc., Jersey City, N. J., at 26c. per cu.yd.; Coastwise Dredging Co., Norfolk, Va., at 25⅞c. per cu.yd.; Morris & Cummings, New York, at 29½c. per cu.yd. Noted Nov. 18.

Md., Indian Head—Extension to Pulping and Poaching House—Contract for extension to pulping and poaching house awarded to JOHN H. NOLAN CONSTRUCTION CO., Washington, D. C., at $7,074. Noted Nov. 11 and Dec. 2.

D. C., Washington—Sewer Work—CHARLES H. TOMPKINS CO., Washington, at $2,008, awarded contract for Petworth sewer; HARPER & VOIGT CO., Washington, at $15,145, awarded contract for Kenilworth sewer. Noted Nov. 25 and Dec. 2.

Fla., Key West—Officers' Quarters—HENRY MONK, Pensacola, at $14,350, awarded contract for two officers' quarters at naval station, Key West. Noted Oct. 21.

Tex., Brenham—Post Office—Contract for U. S. post office at Brenham awarded to W. G. CARTER CO., Chicago, Ill., at $44,830. Noted Oct. 21 and Dec. 2.

Tex., Ft. Bliss—Heating System—Contract for heating system in 13 officers' quarters at Ft. Bliss awarded to W. S. KING, Lonoke, Ark., at $9,090. Noted Oct. 21.

Tex., Navasota—Post Office—Contract for U. S. post office at Navasota awarded to ALGERNON BLAIR, Montgomery, Ala., at $41,836. Noted Oct. 21 and Dec. 2.

Colo., Ft. Logan—Pump House—Contract for pump house and pump awarded by U. S. Quartermaster to H. T. WATERMAN, 17th and Wynkoop St., Denver, at $4,450.

Wash., Meadow Creek—Clearing—Lowest bids received Dec. 1 for clearing reservoir site at Lake Keechelus were as follows: M. P. Zindorf, Seattle, $178,000; Harrington-Peters Co., Seattle, $129,000; Maxham & Maxham, Tacoma, $168,000. Noted Nov. 4.

CANALS, DITCHES AND IRRIGATION

Proposed Work

N. Y., New York—(Borough of Brooklyn)—(Official)—Dredging—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., North River, Manhattan, until noon, Dec. 23, for dredging in slip at foot of 28th St. Noted Dec. 2.

N. Y., New York—(Borough of Manhattan)—(Official)—Dredging—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., North River, until noon, Dec. 20, for dredging in boroughs of Manhattan, Brooklyn, Queens, Bronx and Richmond.

La., Jennings—Irrigation—William Bradford, Alexandria, interested in project to irrigate rice fields by constructing canal from Red River through Jefferson Davis Parish. Estimated cost, $2,000,000.

Tenn., Dyersburg—Drainage—County Court of Dyersburg inevsigating project to drain district between Gibson County line and Obian River. Estimated cost, $200,000.

Ky., Louisville—Drainage—Fiscal Court considering drainage project involving 16,000 acres of swamp land in southern part of county.

Ky., Morganfield—Ditch—Bids will be received by Drainage Commissioners of Union County, until 1 p.m., Dec. 30, for constructing Dennis O'Nan Public Ditch. Norman R. Orcutt, Morganfield, Ch. Engr. Noted Aug. 5.

Ky., Morganfield—Drainage—Surveys being made for H. O. Roberts Drainage Ditch. Estimated cost, $43,000. Norman R. Orcutt, Morganfield, Ch. Engr.

Ind., Hartford City—(Official)—Ditch—Bids will be received by Frank P. Wallace, Drainage Comr., until 2 p.m., Dec. 28, for constructing Delilan Hineker Ditch, Monroe and Washington Townships.

Ind., Huntington—Bids will be received by Andrew Kilty, Constr. Comr., until Jan. 9, for improving ditch in Salamonie Township.

Mich., Davison—Drain—Bids will be received by I. H. Reid, County Drain Comr., until 9 a.m., Dec. 17, for constructing White Drain, Davison Township.

Mich., Macon—Drainage—Contract for middle branch of Macon Drain will be awarded about Apr. 1. Estimated cost, between $40,000 and $50,000. D. S. Sullivan, County Drain Comr. Noted Dec. 2.

Mich., Monroe—Drainage—Contract for Swamp Raisin Drain will be awarded about Apr. 1. D. S. Sullivan, County Drain Comr.

Ill., Belleville—Drainage—Press reports state that drainage district will be organized for improving Richmond Creek. Estimated cost, $150,000. G. A. Kloess, Chn. of Bd. of Trustees.

Wis., Racine—Dredging—City plans to dredge river during 1916. P. H. Connolly, City Engr.

Iowa, Spirit Lake—Drainage—Bids will be received by Board of Supervisors of Dickinson County until 1 p.m., Dec. 22, for tile drain in Drainage District No. 34, Dickinson County. John S. Blow, County Audr.

Minn., Anoka—Drainage—County will award contract for draining Coon Creek, eight miles, about May. Estimated cost, $45,000. W. L. Ridge, Drainage Engr. Noted Dec. 2.

Minn., Benson—Ditches—County plans to build five ditches.

Minn., Mankato—Ditch—Bids will be received by County Commissioners until Dec. 18 for constructing County Ditch No. 41.

Minn., Montevideo—Ditch—County Commissioners will soon award contract for Drainage Ditch No. 16. Estimated cost, $100,000. J. J. Stennes, County Audr.

Minn., Montevideo—Ditches—Contracts will be awarded some time in January for Ditches Nos. 21, 22 and 23. Estimated cost, $10,000, $175,000 and $20,000, respectively.

Minn., Pine City—Ditch—Bids will be received by W. H. Hamlin, County Audr., until Dec. 23, for constructing Ditch No. 4. Estimated cost, $9,870.

N. D., Fargo—Ditches—Contract for two ditches through portion of Kenyon and Noble Townships to Red River will be awarded early next year. Estimated cost, $30,000 each. F. Crabbe, Fargo, Engr. Noted Oct. 7 and 21.

Mont., Billings—Irrigation—U. S. Reclamation Service approved plans of Big Horn Cañon Irrigation and Power Co. for 400-ft. dam. Estimated cost, $175,000.

Mo., Birmingham—Drainage—Contract will be let some time in January or February by Board of Supervisors of Birmingham Drainage District for 10.8 mi. of levee work for developing about 5,400 acres of land. Estimated cost, $335,400. J. H. Powell, 312 Reliance Bldg., Kansas City, Mo., Secy. Brooks & Jacoby, 512 Shukert Bldg., Kansas City, Mo., Engr.

Tex., Harlingen—Irrigation—Bids will be received by Board of Directors of Cameron County Irrigation District No. 1 until Dec. 30 for extending canal, about 411,900 cu.yd. of excavation. Noted Oct. 14.

Tex., Houston—Dredging—See item under "Miscellaneous."

Idaho, Montour—Tunnel—Mannry Boise Co., Boise, at $44,250, submitted only bid for concrete tunnel for Emmett Irrigation District. New bids will be received. Noted Nov. 18.

Idaho, Twin Falls—Irrigation—Twin Falls Land and Water Co. plans to reclaim about 699 acres in Bruneau tract in Owyhee and Twin Falls Counties. Estimated cost, $30,000,000.

Wash., Sequim—Irrigation—Bids will soon be received by Highland Irrigation District Commissioners for seven miles of ditches. Estimated cost, $25,000.

Ore., Astoria—Reclamation—City Council considering creation of reclamation district in west end of city. Estimated cost, $142,795.

Ore., Klamath Falls—Irrigation—Plans being prepared for Yainax Irrigation project to include approximately 2,135 acres. Estimated cost, $75,000. H. W. Hincks, Indian Reclamation Service, Astoria, Engr.

Calif., Redding—Irrigation—Plans being considered by Anderson Cottonwood Irrigation District for bond issue for $400,000 for irrigation.

Calif., San Joaquin—(Official)—Reservoir—All bids received Dec. 6 for Woodward reservoir for South San Joaquin Irrigation District rejected. New bids will be received until 10 a.m., Jan. 3. C. A. Proudfit, Monteca, Secy. Noted Nov. 18 and Dec. 2.

Bids In and Contracts Awarded

Ky., Calhoun—Ditch—Contract for excavating ditch in McLean County awarded to J. N. FORGY DREDGE CO., Owensboro, at $25,000.

Ohio, Kenton—Drainage—Contract for Upper Scotia Drainage and Conservation District, Hardin County, to include about 25,000 acres, awarded to ELI PUGH and JAMES POLING, at $1,310,000. Noted Sept. 10.

Ind., Plymouth—Ditch—Contracts for ditch awarded as follows: YODER & SCHWARTZ, Nappanee, at $8,275, for dredge portion of Jesse McKesson lateral ditch; WALTER HYGEMA, Nappanee, at $3,499, for tile and open shovel portion of main ditch; JESSE McKESSON, Teegarden, at $625, for McKesson lateral.

Mich., Ithaca—Drain—Contract for excavating, clearing right-of-way, etc., for County Drain No. 110 and branches, awarded to A. S. GIBSON, Ithaca, at $2.34 per cu.yd.

Wis., Bristol—Drainage—T. C. Froemming, 1288 Humboldt Ave., Milwaukee, at $14,282, submitted lowest bid for drainage ditch in Bristol Drainage District. W. E. O'Brien, Kenosha, Engr. Noted Oct. 21.

Wis., Necedah—(Official—Ditches—P. Brandt & Son, Finley, at 8c. per cu.yd., submitted lowest bid for constructing new ditches and deepening and widening old ones, about 820,000 cu.yd. excavation, for Little Yellow Drainage District. A. C. Willard, Secy.

Iowa, Des Moines—(Official)—Ditch and Bulkhead—Contract for Drainage Ditch No. 16, Webster Township, and bulkhead, awarded to EMPIRE CONSTRUCTION CO., Des Moines, at $12,680. Noted Dec. 2.

Iowa, Des Moines—(Official)—Ditch and Bulkhead—Contract for Drainage Ditch No. 17, Lincoln and Crocker Townships, and bulkhead, awarded to J. C. ANDERSON, Marshalltown, at $30,954. Noted Dec. 2.

Iowa, Mason City—(Official)—Contract for County Ditch No. 29 awarded to HAWKEYE CEMENT TILE CO., Mason City. Noted Nov. 25.

Minn., Anoka—Ditch—Contract for repairing County Ditch No. 32 awarded to K. C. RICHARDSON, at $12,741.

Minn., Grand Rapids—Ditch—Contract for Judical Ditch No. 3, west of Deer River, awarded to P. SEASTRAND, Cambridge. Estimated cost, $104,000.

Mo., Carrollton—Drainage—Contract to construct 12,000 yd. of embankment awarded to J. O. MOORE, Noborne. Carl Weighert, Drainage Comr.

Utah, Corinne—Drainage—Contract for drainage project near Corinne, Boxelder County, awarded to J. P. O'NEILL CONSTRUTION CO. Estimated cost, $175,000.

Calif., Modesto—Irrigation—Contract for nine concrete drops for Modesto Irrigation District awarded to G. J. ULRICH, Modesto, at $19,340. Noted Dec. 2.

Calif., Richmond — Canal Improvements. — RICHMOND DREDGING CO., Richmond, at $95,845, awarded contract for improving Canal Subdivision.

MISCELLANEOUS

Proposed Work

N. Y., Buffalo—Docks—Donner Steel Co., Inc., recently organized with $5,000,000, capital stock, has taken over plant of New York State Steel Co. and will improve same. Improvements include ore docks along Buffalo River, installation of ore handling equipment and by-product coking plant.

N. Y., New York—(Borough of Brooklyn)—(Official)—Bulkhead—Bids will be received by L. H. Pounds, Borough Pres., Room 2, Borough Hall, until 11 a.m., Dec. 20, for furnishing labor and material to build pile and timber bulkhead at municipal bath building, Coney Island.

N. Y., New York—(Borough of Manhattan)—(Official)—Market—Bids will be received by Marcus M. Marks, Borough Pres., Room 2032, Municipal Bldg., until 2 p.m., Dec. 20, for constructing market under Queensboro bridge, 59th and 60th St., First and Ave A; also for installing drainage and water systems in said market.

N. Y., New York—(Borough of Manhattan)—(Official)—Market—Bids will be received by Marcus M. Marks, Borough Pres., Room 2032, Municipal Bldg., until 2 p.m., Dec. 23, for constructing public market under Third Ave. bridge; 130th St. and Third Ave.

N. Y., New York—(Borough of Manhattan)—Stadium—Bids will soon be received for stadium for New York Federal League Club. Estimated cost, $500,000. C. B. Comstock, 110 West 40th St., Arch.

N. Y., Syracuse—Retaining Wall—Board of Alderman defeated proposition to issue $75,000 bonds for retaining wall along bank of Onondaga Creek. Noted Oct. 14 and Nov. 18.

Penn., Philadelphia—Electric Hoists—Bids will be received by John Meigs, Dir. of Dept. of Wharves, Docks and Ferries, until Dec. 20, for electric hoists for Southwark piers, Delaware River, between Catharine and Christian St.

Va., Norfolk—Docks, etc.—Norfolk Storage Co., Inc., recently incorporated, has purchased a site of 19 acres at Burtons Point and will dredge river, and build docks and sheds. C. S. Powell, New York, N. Y., Pres.

Fla., Miami—Harbor Improvement—Bids will be received by W. B. Moore, City Clk., until noon, Dec. 22, for excavating a slip, a turning basin and channel across Biscayne Bay, also building a concrete dock. Separate proposals for dock.

Ala., Mobile—Elevated Railway—Magnolia Compress and Warehouse Co. has had plans prepared for system of elevated railways between warehouses and water front.

La., New Orleans—(Official)—Grain Elevator Equipment—Bids will be received by E. M. Loeb, Pres., Bd. of Comrs. of Port of New Orleans, Suite 200, New Orleans Court Bldg., until 8 p.m., Dec. 29, for furnishing equipment for public grain elevator in New Orleans. (See adv.)

Ohio, Columbus—(Official)—Elimination of Grade Crossings—We have been informed by R. Trimble, Ch. Engr. of M. of W., Pennsylvania Lines West of Pittsburgh, that it will be some time before bids will be received for elimination of grade crossings in north side of Columbus. Noted Dec. 2.

Ohio, Painesville—Monument—Ohio Mausoleum Co., Galion, will build monument at Painesville. Estimated cost, $50,000. T. Robert Moore, Painesville, interested.

Ind., Miller—Coney Island—Press reports state that New York capitalists plan to establish a Coney Island at Miller Beach. Estimated cost, $500,000.

Mich., Detroit—Subway—Plans prepared for subway for Woodward Ave. cars from Grand Circus Park to river front. Estimated cost, $1,500,000.

Ill., Chicago—Machinery—Bids will be received by J. D. Robertson, Comr. of Health, until Dec. 18, for elevating and conveying machinery for new Mill Building at municipal reduction plant, 39th and Iron St.

Minn., St. Paul—Channel—Project being considered to construct 6-ft. channel from St. Paul to mouth of Missouri River. Mississippi River Improvement Association, interested.

Mo., St. Louis—River Terminals—Plans prepared by J. L. Wees, 419 Commercial Bldg., for seven-story, 100x250-ft. river terminal and warehouse for St. Louis River Front and Dock Association. Estimated cost, $250,000.

Tex., Galveston—Dry Dock—Dry dock, marine railway and ship building and repair plant will be constructed by Galveston Dry Dock and Construction Co. C. N. Growell, Mgr. Noted Nov. 11.

Tex., Houston—Wharf and Warehouse—City Council has appropriated $300,000 for work on Houston Turning Basin. Works includes dredging for wharf, building wharf and warehouse, etc.

Ariz., Tucson—Subway—Bids will be received by C. K. Clarke, City Mgr., until Dec. 17, for subway under railway tracks at end of Congress St. Estimated cost, $70,000. Noted Oct. 14 and Nov. 18.

Wash., Seattle—Tunnel—Plans prepared by A. H. Dimock, City Engr., for reinforced-concrete tunnel at entrance to new courthouse and city hall. Estimated cost, $30,000. Noted Nov. 25.

Ore., Portland—Tunnel—Press reports state Oregon-Washington R.R. and Navigation Co. will reline tunnel with concrete from Mock's Bottom to Columbia Slough. Estimated cost, $100,000. J. K. Holman, Portland, Ch. Engr.

Calif., Santa Monica—Bath House — Santa Monica Bath House Corporation will build three-story, 95x100-ft. bath house. Estimated cost, $25,000.

MISCELLANEOUS

Bids In and Contracts Awarded

Mass., Boston—Bulkhead—BAY STATE DREDGING AND CONTRACTING CO., Boston, at $82,830, awarded contract for bulkhead and 170,00 cu.yd. dredging and placing filling beneath and around bulkhead, Contract No. 47. Noted Nov. 18 and Dec. 2.

N. Y., New York—(Borough of Bronx)—Track Installation—Contract for track installation on White Plains Rd. and extension of existing subway awarded to COAST AND LAKE CONTRACTING CORPORATION, 41 Broad St., New York, at $53,930. Noted Dec. 2.

N. Y., New York—(Borough of Brooklyn)—(Official)—P. P. Farley, 103 Park Ave., New York, at $5,335, submitted lowest bid for steel tank and fittings to be used for storage of liquid asphalt at municipal asphalt plant, 7th St. basin, Gowanus Canal. Noted Dec. 2.

N. Y., New York—(Borough of Manhattan)—Pier Shed—Baltimore & Ohio R.R. Co. awarded contract for Pier Shed No. 21, East River, to MILLIKEN BROS., 111 Broadway, New York.

N. J., Ventnor—(Atlantic City post office)—Jetties—Contract for jetties from Cambridge to Portland Ave. awarded to EUGENE BOEHM, at $4.22 per ft. Noted Dec. 2.

Penn., Philadelphia—Bath House—Contract for bath house for Public Baths Association of Philadelphia awarded to FRANKE E. WALLACE, 1220 Chancellor St., Philadelphia. Estimated cost, $20,000.

Penn., Philadelphia—(Official)—Elevated Railway Work—Contract for concrete column foundations and piers for about 4,000 lin.ft. of two-track elevated railway in Frankford Ave. from Unity to Dyre St. awarded to EDWIN H. VARE, 604 Lincoln Bldg., Philadelphia, at $17,700. Noted Nox. 18.

Penn., Philadelphia—Park Improvements — City awarded contract for park improvements to C. A. CONAN, 1345 Arch St., Philadelphia. M. L. Cooke, Dir., Dept. of Pub. Wks.

Md., Baltimore—Coal Pier—Baltimore & Ohio R.R. Co. awarded contract for foundation and piling for coal pier at Curtis Bay, Baltimore, to PHOENIX CONSTRUCTION CO., 41 Park Row, New York, N. Y. Estimated cost, $1,500,000. Noted Sept. 30 and Dec. 2.

Miss., Waveland—(Official)—Seawall—Contract for concrete seawall and filling on beach at Waveland awarded to MASSIE & CO., 218 Saratoga St., New Orleans, La., at $10.74 per lin.ft. Noted Oct. 28.

Ohio, Cleveland—Pier—AMERICAN CONSTRUCTION CO., Cleveland, awarded contract for repairs to pier protections. Noted Nov. 25.

Ill., Chicago—Engine House—Contract for two-story brick engine house awarded to WARNER CONSTRUCTION CO., at about $19,000. Noted Dec. 2.

Calif., Martinez—Pipe Line—Shell Oil Co., Martinez, awarded contract for grading work for pipe line to PRICE CONSTRUCTION CO. and O'BRIEN BROS., about 130,000 cu.yd. excavation. Estimated cost, $40,000. Noted Oct. 21.

Calif., Sacramento—Levee—F. E. Frey, at $10,312, submitted lowest bid for levee work near Sutterville.

Calif., Sacramento—Levee Work—Contract for levee work awarded to A. TEICHERT & SON, Ochsner Bldg., at $11,250.

BUILDINGS

Other items relative to Building Construction will be found under the following heads: "Industrial Works," "Federal Government Work" and "Miscellaneous."

Proposed Work

Vt., White River Junction—Plans approved by Boston & Maine R.R. and Boston & Central Vermont R.R. for station at White River Junction. Estimated cost, $55,000.

Mass., Boston—Plans being prepared by S. S. Levy, 35 Court St., Arch., for five-story hotel and loft building. Estimated cost, $50,000.

Mass., Dedham—Dedham Masonic Lodge has postponed building of temple until next spring. Estimated cost, $40,000. Noted Sept. 23.

Mass., Salem—Bids will be received until Dec. 23 by city for addition to Bowditch School. Estimated cost, $75,000. John M. Gray, 16 Arlington St., Boston, Arch. Noted Dec. 9.

N. Y., Baldwin—Citizens voted to build school. Estimated cost, $40,000. William Steele, interested.

N. Y., Bronxville—Plans being prepared by Bates & How, Arch., 542 Fifth Ave., New York, for motion picture, store and apartment building for Residence Co. of Lawrence Park. Estimated cost, $50,000.

N. Y., Gloversville—City National Bank will build bank. Estimated cost, $80,000. Mowbray & Uffinger, 56 Liberty St., New York, Arch.

N. Y., New York—(Borcugh of Brooklyn)—(Official)—Bids will be received by John A. Kingsbury, Comr., Dept. of Pub. Charities, Municipal Bldg. (Borough of Manhattan), until 10:30 a.m., Dec. 23, for alterations to and additional buildings at Greenpoint Hospital.

N. Y., New York—(Borough of Manhattan)—(Official)—Union Square Realty Corporation, 15 Broad St., plans to build 13-story, 50x100-ft. store and showroom building at 26 Union Sq. Estimated cost, $225,000. W. G. Pigueson, 59 Pearl St., Arch.

N. Y., New York—(Borough of Manhattan)—(Official)—Plans prepared for two-story, 65x128-ft. building at 175th St. and Wadsworth Ave. for New York Telephone Co., 15 Dey St. Estimated cost, $93,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will soon be received for seven-story, 100x150-ft. assembly building for Y. W. C. A. at Lenox Ave. and 124th St. Estimated cost, $250,000. Louis E. Jallade, 37 Liberty St., Arch.

N. Y., Syracuse—University of Syracuse plans to build College of Agriculture. Estimated cost, $250,000.

N. J., Paterson—Bids will be received until 4 p.m., Dec. 20, by J. E. Dunphy, Secy. of Bd. of Education, City Hall, for constructing Public School No. 10.

Penn., Allentown—Bids recently received for six-story addition to Y. M. C. A. Bldg. rejected. New bids will be received. Ruhe & Lange, Allentown, Arch. Estimated cost, $100,000. Noted Dec. 2.

Penn., Butler—Movement has been started in Mercer County to construct hospital for insane. Estimated cost, $300,000. S. C. Moore, Comr.

Penn., Chester—Plans being prepared by E. A. Wilson, Arch., 1208 Chestnut St., Philadelphia, for three-story hotel.

Penn., Eddystone—Bids will soon be received by Henon & Boyle, Arch., 10 South 18th St., Philadelphia, for seven-story, 50x120-ft. hotel for Remington Arms Co. Estimated cost, $175,000. Noted Dec. 2.

Penn., Lancaster—Plans being prepared by C. E. Urban, Arch., Woolworth Bldg., for three-story high school for Board of Education. Estimated cost, $150,000.

Penn., York—Plans being prepared by Gemmill & Billmeyer, Arch., for four-story club house for Loyal Order of Moose. Estimated cost, $60,000.

Md., Baltimore—(Official)—Bids will be received about Jan. 1 for four-story office building on German St. for Immediate Benefit Life Insurance Co. Estimated cost, $70,000 Louis Levi, 1408 Munsey Bldg., Arch. Noted Dec. 9.

D. C., Washington—Plans being prepared for new art building for Smithsonian Institute. Estimated cost, $1,000,000.

D. C., Washington—Contract will be awarded about Feb. 1 by Thomas W. Lamb, Arch., for Rialto Building Co. Estimated cost, $150,000. Noted Dec. 2.

D. C., Washington—Plans prepared for one-story motion picture theater for Crandall Theater Co. Estimated cost, $50,000. A. P. Clark, Jr., 816 14th St., N. W., Washington, Arch.

Va., Norfolk—Bids will soon be received for six-story, 26x104-ft. office building on City Hall Ave. J. W. Lee, Norfolk, Arch.

W. Va., Wheeling—Citizens of Richland District voted $85,000 bonds for schools. R. A. Alexander, Pres. of Bd. of Education.

Ga., Macon—Plans being prepared for hotel on Cherry St. for J. S. Shingler, Ashburn. Estimated cost, $120,000.

Ga., Savannah—Plans being prepared for auditorium for city. H. Wallin, Arch.

Ga., Tifton—City plans to hold election to vote on $100,000 bonds for city hall.

Fla., Ft. Pierce—Citizens of Special Tax District No. 6 voted $40,000 bonds for school.

Fla., Miami—Bids will be received about Dec. 30 for eight-story, 40x100-ft. hotel for McAllister Hotel Co. Frohlin & De Garmo, Miami, Arch. Noted Nov. 18.

Ala., Birmingham—Plans prepared by William T. Warren, Arch., for three-story Science Hall for Birmingham College.

Ala., Mobile—Commissioners of Mobile County School have recommended election to Board of Revenue and Road Commissioners on Jan. 18 to vote on $150,000 bonds for county schools.

Ala., Union Springs—New freight and passenger station will be constructed by Birmingham & Southern R.R.

La., Jennings—Plans will be prepared by W. L. Stevens, Arch., Baton Rouge, for courthouse for Jefferson Davis Parish Police Jury. Estimated cost, $75,000. Noted Oct. 28.

Ky., Somerset—Press reports state that hotel will be constructed at Dry Ridge by syndicate composed of Georgetown, Dry Ridge and Lexington capitalists. Estimated cost, $100,000.

Ky., Winchester—R. P. Taylor is interested in plan to organize Clark County Unity Club to raise money to build a club house. Estimated cost, $50,000.

Ohio, Cleveland—Plans prepared for three-story, 50x185-ft. dormitory for Livingston Taylor. Estimated cost, $100,000. C. S. Schneider, 2248 Euclid Ave., Cleveland, Arch.

Ohio, Cleveland—Plans will be prepared by Franz C. Warner, Hippodrome Bldg., Cleveland, and E. D. Litchfield, New York, N. Y., Archs., for new building for girls at Andrews Institute. Estimated cost, $1,000,000.

Ohio, Cleveland—Plans prepared by S. H. Wesi, Arch., 1030 Schofield Bldg., for three-story commercial building at St. Clair and Yale Ave. for Herman Stern, Cleveland. Estimated cost, $60,000.

Ohio, Cleveland—Plans being prepared by W. R. McCormack, Arch., Bd. of Education, Cleveland, for additions to Memorial, East Clark and Tremont Schools. Estimated cost, $100,000.

Ohio, Cleveland—Plans will be prepared by C. S. Schneider, Arch., 2248 Euclid Ave., for addition to Y. W. C. A., East 18th St. and Prospect Ave. Estimated cost, $60,000.

Ohio, Cleveland—Plans prepared by Hubbell & Benes, Arch., 4600 Euclid Ave., for exchange building on Euclid Ave. for Superior Realty Co., Erie Bldg. Estimated cost, $800,000. A. B. Smythe, interested.

Ohio, Cleveland—Plans being prepared by Ferguson-Flanigan Co., Arch., Vickers Bldg., for eight-story commercial building at St. Clair Ave. and Third St., for Walton Realty Co.

Ohio, Columbus—Bids will be received about Jan. 1 for 11-story hotel for Broadway County. Estimated cost, $400,000. J. H. Butler, Hotel Columbus, Mgr.

Ohio, Dayton—Plans being prepared by Frank Hill Smith, Arch., 1035 Reibold Bldg., Dayton, for ten-story, 50x178-ft. bank and office building for Dayton Savings and Trust Co. Estimated cost, $100,000.

Ohio, East Liverpool—East Liverpool Lodge No. 122, Loyal Order of Moose, plans to build lodge building.

Ohio, Ironton—Masons plan to build new temple. Estimated cost, $75,000.

Ohio, Oberlin—Press reports state that Oberlin College plans to build new theological seminary. About $100,000 available for this purpose.

Ohio, Olmsted Falls—Board of Education will award contract for high and grade school in about five weeks. Estimated cost, $50,000. F. R. Gallagher, Clk. Noted Dec. 9.

Ohio, Ravenna—Congregation of First Christian Church plans to build one-story, 76x104-ft. church and Sunday school. Estimated cost, $40,000. Richard Hollowell, Chn. of Bldg., Com.

Ohio, Wilmington—Charles Murphy plans to build opera house. Estimated cost, $100,000.

Ind., Brookston—Bids will be received early next year for high and grade school. Estimated cost, $40,000. Noted Nov. 11.

Ind., Delphi—Plans being prepared by Elmer E. Dunlap, 909 State Life Bldg., Indianapolis, for three-story courthouse for Carroll County. Estimated cost, $200,000. M. G. Haun, Audr.

Ind., Goshen—Plans being considered for nine-story hotel on site of Sherman Hotel at 233 North Michigan St.

Ind., Indianapolis—(Official)—Contract will soon be awarded for freight station for Pennsylvania R.R. Estimated cost, $150,000. Noted Dec. 2.

Ind., Portland—(Official)—Contract for three-story, 90x160-ft. courthouse for Jay County will be awarded in about two or three months. Estimated cost, $275,000. Frank Gillespie, County Clk. Noted Nov. 4 and Dec. 2.

Ind., Terre Haute—(Official)—Bids will be received some time in February for three-story McLain grade school. Estimated cost, $115,000. Herbert W. Foltz, 1456-60 Lemcke Annex, Indianapolis, Arch. Noted Dec. 9.

Mich., Detroit—Plans being prepared by Joseph P. Jogerst, Arch., 1401 Kresge Bldg., Detroit, for seven-story, 40x90-ft. hotel for S. Satovosky. Estimated cost, $100,000.

Mich., Detroit—Plans being prepared for six-story, 30x93-ft. hotel for Mack McKenzie. Smith & Kohner, 302 Free Press Bldg., Detroit, Arch.

Mich., Detroit—Plans prepared by O. C. Gottesleben, Arch., for 14-story hotel on Griswold St. for Tavern Hotel Co. M. J. Leod, Pres.

Mich., Detroit—Plans prepared by Albert Kahn, Arch., Detroit, for new library for University of Michigan. Estimated cost, $350,000.

Mich., Detroit—Citizens of Highland Park will vote on $275,000 bonds for new school.

Mich., Jackson—Contract will be awarded in about two months by Board of Education for three-story, 140x275-ft. high school. Estimated cost, $385,000. Noted Oct. 21 and Nov. 18.

Mich., Menominee—Rogers M. Andrews interested in construction of club house. Estimated cost, $40,000.

Mich., Monroe—Bids will soon be received by Harry J. Rill, Arch., 54 Buhl Blk., Detroit, for five-story, 150x200-ft. college for Sisters of Immaculate Heart of Mary.

Mich., Port Huron—Board of Education considering bond issue for $100,000 for new junior high school.

Ill., Chicago—Union League Club plans to build three-story addition to club house on Jackson Blvd. Estimated cost, $190,000. Holabird & Roche, Arch.

Ill., Ottawa—(Official)—Bids will be received next spring for Illinois Valley General Hospital. Estimated cost, $75,000. J. F. Richardson, Jr., Arch. Noted Dec. 3.

Ill., Quincy—Congregation of Baptist Church plans to build new edifice next spring. Estimated cost, $60,000.

Ill., Springfield—Plans for addition to Dubois School submitted to Board of Education by Harry J. Reiger, Arch., 42 Ridgley Bank Bldg., for approval. Estimated cost, $75,000. Noted Nov. 4.

Ill., Tuscola—Bids will be received about Mar. 15 for two-story high school. Estimated cost between $125,000 and $150,000. C. C. Kazey, Secy. of Township High School Bd. Noted Dec. 9.

Wis., Mensha—Board of Education engaged Van Ryn and De Gelleke, Arch., Caswell Blk. to prepare plans for two-story addition to high school.

Wis., Milwaukee—Plans prepared by Holabird & Roche, Arch., Chicago, Ill., for two-story, 200x522-ft. arcade building on Grand Ave. A. J. Harvey, Cleveland, Ohio, interested.

Wis., Racine—Knights of Columbus plan to build club house. J. E. Henen, Arch., 74 Main St., Mem. of Bldg. Com.

Wis., Racine—Plans being prepared by A. A. Guilbert, Arch., Robinson Bldg., for auditorium and armory for city.

Iowa, Alton—Bids will be received by Board of Education until Dec. 21 for school. Buettler & Arnold, Arch.

Iowa, Atlantic—Y. M. C. A. plans to build two-story, 100x130-ft. building. Estimated cost, $100,000. W. H. Fuller, Chn. of Bldg. Con.

Iowa, Cedar Rapids—Campaign will be started next spring to build new Y. M. C. A. Estimated cost, $150,000.

Minn., Henderson—Bids will be received until Jan. 4 by Board of Commissioners of Sibley County for court house, jail and sheriff's residence. Estimated cost, $100,000.

Minn., Mound—Preliminary plans being prepared by F. E. Halden, Arch., 601 Kasota Bldg., Minneapolis, for two-story consolidated school. Estimated cost, $60,000. D. Wilkins, Secretary of Bd. of Education.

Kan., Emporia—College of Emporia plans to rebuild administration building recently destroyed by fire. Estimated cost, $100,000. W. A. White, Chn. of Bldg. Com.

Kan., Norton—Election will soon be held to vote on proposition to issue $40,000 bonds for school. F. M. Duvall, Clk., Bd. of Education.

Kan., Salina—Bids will be received about Feb. 1 for church for St. John's Lutheran Congregation. Estimated cost, $40,000. E. O. Brostrom, 300 Brent Bldg., Kansas City, Mo., Arch, Noted Dec. 9.

Neb., North Platte—Union Pacific Ry. Co. plans to rebuild station recently destroyed by fire. Estimated cost, $80,000.

Mo., St. Louis—(Official)—Bids will be received by Barnett, Haynes & Barnett, Arch., Century Bldg., until Jan. 15, for parish school for Catholic Cathedral of St. Louis. Estimated cost, $100,000. Noted Oct. 21 and Dec. 9.

Mo., St. Louis—Plans being prepared by J. M. Hirshstein, Arch., for three-story club house for Young Men's Hebrew Association.

Tex., Austin—Contract will soon be awarded for hotel for H. A. Wroe and associates. Estimated cost, $500,000. Noted Nov. 11.

Tex., Austin—Bids will be received by Kate Daffan, Supt., until noon, Dec. 23, for two-story hospital building at State Confederate Women's Home. Noted Oct. 14.

Tex., Corpus Christi—M. Donigan, owner of State Hotel, plans to improve same. Estimated cost, $80,000.

Tex., El Paso—Building will be constructed at Mills and Stanton St. by M. D. Roberts and William Banner. Estimated cost between $200,000 and $250,000.

Tex., Ft. Worth—George Clarke, Pres. of School Bd., has recommended bond issue for $225,000 for three schools.

Tex., Lubbock—Plans being prepared by Rose & Peterson, Arch., Kansas City, Kan., for three-story, 80x96-ft. courthouse for Lubbock County. Estimated cost, $100,000. Noted Oct. 7.

Tex., Port Arthur—Plans being prepared by William B. Ittner, Arch., Ninth and Locust St., St. Louis, Mo., for three-story school for Board of Education.

Tex., Savoy—Election will be held Dec. 18 by Board of Trustees of Savoy Independent School District to vote special tax for schools.

Tex., Seguin—Rock Hotel Co. will build hotel to cost $50,000. James A. Harley, interested.

Tex., Victoria—New building to replace one recently destroyed by fire will be constructed by Lady of Lourdes German Church. Estimated cost, $50,000.

(Continued on page 382)

PROGRESS ON DUAL SYSTEM CONTRACTS

INTERBOROUGH LINES

City Contracts

Sec.	Contractor	Limits	Contract Delivered	Time Expires	Amount of Bid	Per Cent. of Value of Work Completed		Item Bids Published in Engineering News
		Routes Nos. 43 and 26—Diagonal Station Connection						
1	Rapid Transit Subway Construction Co.	Connection between existing subway and Lexington Avenue and Steinway Lines	12- 3-14	4- 3-17	$3,097,312.50	38		Oct. 22, 1914
7	Rapid Transit Subway Construction Co.	Lexington Ave., 43d to 53d St.	8- 7-17	3 -7-17	1,915,164.50	36		June 25, 1914
8	Bradley Contracting Co.	Lexington Ave., 53d to 67th St.	7-21-11	10-21-15	3,369,484.20	95		Nov. 3, 1910
9	Patrick McGovern & Co.	Lexington Ave., 67th to 79th St.	2-13-12	9-21-15	1,961,997.00	100		Dec. 14, 1911
10	Bradley Contracting Co.	Lexington Ave., 79th to 93d St.	7-21-11	9-21-15	3,253,072.80	100		Nov. 3, 1910
11	Bradley Contracting Co.	Lexington Ave., 93d to 106th St.	7-21-11	9-21-15	3,132,195.05	100		Nov. 3, 1910
12	Oscar Daniels Company	Lexington Ave., 106th to 118th St.	9-13-11	9-13-15	2,825,740.74	99		Nov. 3, 1910
13	Assigned to McMullen, Snare & Triest.	Lexington Ave., 118th to 129th St.	11-17-11	11-17-15	4,071,416.50	85 2		Nov. 3, 1911
14	Arthur McMullen & Hoff Co.	Lexington Ave. & 129th St., Manhattan, to 137th St., The Bronx	7-23-12	11-13-15	3,889,775.05	100		June 16, 1912
15	Assigned to Rodgers & Hagerty, Inc.	Mott & Gerard Aves., 135th to 157th St.	11-17-11	11-17-15	3,820,129.75	97.7		Nov. 3, 1910
		Route No. 16—Jerome Avenue Extension						
1	Oscar Daniels Company	Jerome Ave., 157th to 182d St.	12-31-13	10- 3-15	1,077,978.00	97.8		Dec. 11, 1913
2	Cooper & Evans Company	Jerome Ave., 182d St. to Woodlawn Rd.	4- 3-14	10- 3-15	1,076,831.00	95.2		Feb. 19, 1914
		Route No. 18—White Plains Road Extension						
1	Oscar Daniels Company	Bronz Park East to White Plains Road and Burke Street	3 -24-14	2- 1-16	914,400.25	79 6		Feb. 19, 1914
2	Alfred P. Roth	White Plains Road, Burke Street to 241st Street	1-13-14	11-24-15	958,484.00	100		Dec. 4, 1913
		Routes Nos. 16 and 18—Station Finish, Jerome Avenue and White Plains Road Lines						
..	Altoria Realty & Const. Co.	Jerome Avenue and White Plains Road Lines	10-13-15	4-13-16	860,636.50			
		Routes Nos. 19 and 22—Southern Boulevard and Westchester Avenue Extension						
1	Richard Carvel Co., Inc.	138th St. & Southern Boulevard, Alexander Ave. to 147th St.	10-22-12	2-22-16	2,253,281.75	78.3	H	Sept. 26, 1912
1-A	Rodgers & Hagerty, Inc.	Southern Boulevard and Whitlock Ave., 1475h St. to Bancroft St.	12-31-13	6-30-16	2,253,159.25	77		Dec. 11, 1913
		Routes Nos. 4 and 38—Seventh Avenue-Lexington Avenue Subway						
1-A	Rapid Transit Subway Construction Co.	South Ferry to Battery Place and Greenwich Street	9- 4-14	4- 4-17	474,244.00	59		June 18, 1914
1	Rapid Transit Subway Construction Co.	Greenwich St., Battery Pl. to Vesey St.	6-19-14	3-19-17	2,121,077.25	42		Apr. 30, 1914
2	Degnon Contracting Co.	West Broadway, Vesey to Beach St.	3-13-14	3-13-17	3,059,522.00	51		Dec. 11, 1913
3	Degnon Contracting Co.	Varick St. & 7th Ave. Ext., Beach to Commerce Street	12-31-13	12-31-16	2,185,063.50	75		Nov. 20, 1913
4	U. S. Realty & Imp. Co.	Seventh Ave., Commerce to 16th St.	4-17-14	4-17-17	1,837,726.50	45		Mar. 12, 1914
5	U. S. Realty & Imp. Co.	Seventh Ave., 16th to 30th Street	12-31-13	12-31-16	2,401,306.75	68		Nov. 20, 1913
6	Rapid Transit Subway Construction Co.	Seventh Ave., 30th to 43d Street	2-24-14	2-24-17	2,292,943.50	60		Jan. 8, 1914
6-A	Holbrook, Cabot & Rollins Corporation	Seventh Ave., 43d to 45th Street	8- 6-14	5- 6-17	421,566.00	91		May 28, 1914
		Route No. 48—Park Place, William and Clark Street Subway						
1	Frederick L. Cranford, Inc.	Park Place and Beekman St., West Broadway to William St.	12- 7-14	4- 7-17	1,571,363.50	26		Oct. 22, 1914
2	Smith, Hauser & MacIsaac, Inc.	William St., Beekman St. to Old Slip	12- 7-14	4- 7-17	2,254,670.00	46		
3	Assigned to Flinn-O'Rourke Co., Inc.	Old Slip, Manhattan, to Clark Street, Brooklyn	8- 6-14	2- 6-18	6,469,916.25	19.3		June 4, 1914
		Route No. 12—Eastern Parkway, Brooklyn, Subway						
1	Cranford Company	Flatbush Ave. & St. Felix St., Fulton St. to Prospect Place	7-17-14	1-16-17	2,195,296.25	30		June 25, 1914
1-A	Cranford Company	Flatbush Ave., Prospect Place to Plaza	5- 4-14	11- 4-16	2,225,519.25	54		Apr. 9, 1914
2	Inter-Continental Const. Co.	Eastern Parkway, Prospect Park Plaza to Nostrand Ave.	6-15-15	4-15-17	2,744,263.00	6		May 6, 1915
3	Rodgers & Hagerty, Inc.	Eastern Parkway, Nostrand Ave. to Buffalo Ave.	9-25-15	5-25-17	2,170,652,50	...		Aug. 5, 1915
		Route No. 29—Nostrand Avenue, Brooklyn, Subway						
1	Newman & Carey Co.	Nostrand Ave., Eastern Parkway to Church Ave.	8-20-15	5-20-17	2,073,303.20	...		July 1, 1915
2	Dock Contractor Co.	Nostrand Ave., Church to Flatbush Ave.	10- 8-15	7- 8-17	1,692,370.70	...		Aug. 19, 1915
		Routes Nos. 36 and 37—Woodside, Astoria and Corona Elevated Line						
1	Snare & Triest	Queensboro Bridge Plaza, Jackson Ave. & Diagonal Street	10- 7-13	4- 3-16	884,859.00	71		Aug. 28, 1913
2	Cooper & Evans Company	Second Ave., Beebe Ave. to Ditmas Ave.	3-11-13	9-11-14	860,743.50	100		Feb. 13, 1913
3	E. E. Smith Contr. Co.	Queens Boulevard & Roosevelt Ave., Van Dam St. to Alburtis Ave.	3-11-13	1- 7-13	2,063,588.00	98		Feb. 13, 1913
		Routes Nos. 36 and 37—Queensboro Subway						
3	Murphy Bros.	Storm drain, Queens Boulevard, Hill St. to Gosman Ave.	.....	.....	7,421.25	..		
		Routes Nos. 36 and 37 and 50—Station Finish, Queensboro Subway Extension and Astoria and Corona Lines						
1 & 3 and Route 50	Snare & Triest Co.	Queensboro Subway Extension and Corona Line	10- 4-15	4- 4-16	609,885.00	...		Oct. 7, 1915
2	Charles Meads & Co.	Astoria Line	10- 5-15	4- 5-16	268,102.50	...		Oct. 7, 1915
		Routes Nos. 36 and 37 and 50—Track Installation, Queensboro Subway Extension and Astoria and Corona Lines						
..	Thomas Crimmins Contracting Co.	Installation of Tracks	.....	.....	204,798.10	...		
		Route No. 26—Queensboro Subway						
..	Rapid Transit Subway Construction Co.	Madison Ave. & 42d St., Manhattan, to Davis St., Queens	4-14-14	6-15-15	383,910.75	100		Feb. 26, 1914
		Route No. 50—Queensboro Subway Extension						
..	Degnon Contracting Co.	Davis St. & Ely Ave., Van Alst Ave. to Queensboro Bridge Plaza	13-31-13	1- 7-16	557,856.50	93		
		Route No. 50—Station Finish, Queensboro Subway Extension						
..	Station Construction Co.	Station finish for Hunter's Pt. Ave. station	.....	.....	2,999.99	...		
		44th Street Duct Line						
..	E. C. Moore	Duct line in 44th St. for Queensboro Subway	.....	.....	34,005.90	...		Oct. 21, 1915

Company Contracts

		Third-Tracking Elevated Railroads in Manhattan and The Bronx						
	Terry & Tench Co., Inc., Snare & Triest Co., and T. A. Gillespie Co.	Addition Tracks on Second, Third and Ninth Avenue Elevated Lines	2-13-14	8-13-15	(Cost plus)	...		1557

NEW YORK MUNICIPAL LINES

City Contracts

1	F. L. Cranford, Inc.	Trinity Place & Church Street, Morris to Fulton Street	9-27-12	1-27-16	$1,222,269,20	93		Sept. 19, 1912
1-A	F. L. Cranford, Inc.	Church & Vesey Streets & Broadway, Fulton Street to Park Place	9-27-12	1-27-16	982,740.70	95		Sept. 19, 1912
2	Degnon Contracting Co.	Broadway, Park Place to Walker St.	2- 6-12	6- 6-15	2,355,828.50	99.3		Feb. 1, 1912
2-A	O'Rourke Eng. Const. Co.	Broadway, Walker to Howard Street	7-17-12	11-17-15	912,351.60	95		Apr. 11, 1912
3	Underpinning & Foundation Company	Broadway, Howard to Bleecker Street	1-19-12	9-19-15	2,295,086.50	99.7		Jan. 18, 1912
4	Dock Contractor Company	Broadway, Bleecker St. to Union Sq.	8-19-13	8-19-16	2,578,078.00	91		July 10, 1913
		Routes Nos. 4 and 36—Broadway-Fourth Avenue Subway						
2	U. S. Realty & Imp. Co.	Broadway, 26th to 38th Street	7-23-14	3-23-17	2,657,004.50	43		May 7, 1914
3	Holbrook, Cabot & Rollins Corp.	Broadway and Seventh Ave., 38th to 51st St.	9- 8-15	5- 8-17	3,740,913.50	2		Aug. 5, 1915
4	Litchfield Construction Co.	Seventh Avenue, 51st to 59th St.	5-26-15	2-26-17	1,937,509.00	3		Aug. 6, 1914

Progress on Dual System Contracts—Continued

NEW YORK MUNICIPAL LINES

City Contracts

			Contract	Time	Amount	Per Cent. of Value of Work Com-	Item Bids Published in
		Route No. 33—Broadway-Fourth Avenue Subway					
1	Assigned to Flinn-O'Rourke Co., Inc.	Whitehall St., Battery Pl. to South St.	6-17-14	2-17-17	2,059,182.00	24	Apr. 23, 1914
2	Assigned to Flinn-O'Rourke Co., Inc.	Whitehall St., Manhattan, to Montague Street, Brooklyn	7-16-14	1-16-18	5,974,809.50	21.4	June 4, 1914
3	Flinn-O'Rourke Co., Inc.	Montague Street, Clinton Street to Flatbush Avenue Extension	10- 9-14	10- 9-17	3,395,152.00	11	Sept. 3, 1914
		Route No. 20—Canal Street Subway					
2	Underpinning and Foundation Co.	Canal St., Broadway to Bowery	7-16-14	3-16-17	1,822,994.25	44	May 21, 1914
		Routes Nos. 9 and 11—Fourth Avenue, Brooklyn, Subway					
Six sections	Wm. Bradley; Smith, Scott & Co.; Tidewater Building Co. & Thos. B. Bryson and E. E. Smith Con. Co.	Manhattan Bridge to 43d Street	11- 9-09	.....	*16,014,388.26	100	
		Platform Edge Reconstruction, Fourth Avenue Subway					
..	Irving Iron Works Co.	Reconstruction of edges, Manhattan Bridge 59 26th Street	5-10-15	5-28-15	5,180.00	..	
		Route No. 9—Fourth Avenue, Brooklyn, Subway					
9 C-1	Samuel Beskin	Reconstruction of DeKalb Ave. Station	2- 5-15	9- 5-15	133,947.46	61.5	Dec. 10, 1914
		Removal of Temporary Sewer, Fourth Avenue Subway					
..	Norton & Gorman Con. Co.	Removal of temporary sewer from Section 11-EA-1	3-31-15	5-31-15	15,233.75	100	
		Track Installation, Fourth Avenue Subway					
..	Thomas Crimmins Contracting Co.	Laying of tracks from Manhattan Bridge to 86th Street. Materials furnished by the City	7-21-14	1-21-15	210,880.00	84 9	
		Route No. 11 B—Fourth Avenue, Brooklyn. Subway Extension					
1	Degnon Contracting Co.	Fourth Avenue, 43d to 61st Street	10- 4-12	11- 1-15	1,930,258.50	94 5	Sept. 26, 1912
2	Degnon Contracting Co.	Fourth Avenue, 61st to 86th Street	10- 4-12	11- 4-15	1,904,171.25	89	Sept. 26, 1912
		Station Finish, Fourth Avenue Subway					
..	Station Construction Co., Inc.	Six stations, 43d to 86th Street	8- 6-15	8- 1-15	251,133.72	99	
		Fourth Avenue Subway—Completion of Construction and Station Finish					
..	D. C. Serber	Hanson Place to Butler Street	6- 8-15	9- 8-15	40,676.25	69 7	
		Route No. 39—New Utrecht Avenue, Brooklyn, Elevated Line					
1	New York Municipal Railway Corporation	Fourth Avenue, 33d to 38th St.; Culver Cut, Fourth Ave. to Tenth Ave.	2- 3-14	8- 3-15	.....	99	
2	Post & McCord, Inc.	New Utrecht Ave., 86th St. & Stillwell Ave., 39th St. to Coney Island	12-31-13	11- 1-15	1,672,190.00	98 3	Dec. 4, 1913
		Route No. 39—Station Construction, New Utrecht Avenue Elevated Line (Sub-Contract under N. Y. M. Ry. Corp.)					
1	Snare & Triest Co.	9th Ave. station	7-15-15	.....	23,940.00	81	
1	Frank L. Davis	Station finish for 9th Ave. station	10- 8-15	1- 8-16	16,130.00	20	
		Route No. 39—Track Installation on New Utrecht Avenue Elevated Line					
2	Ward & Tully, Inc.	New Utrecht Ave., 38th St. to Coney Island	9-10-15	2-10-16	71,355.00	1.6	July 29, 1915
		Route No. 39—New Utrecht Avenue Station Finish					
2	A. L. Guidone & Son, Inc.	From 39th St. and Tenth Ave. to Coney Island	.....	.....	513,656.54	...	
		Route No. 49—Gravesend Avenue Elevated Line					
1	Post & McCord, Inc.	Gravesend Ave., 37th St. to Bay Parkway	9- 8-15	12- 8-16	877,959.00	...	Aug. 19, 1915
2	Oscar Daniels Co.	Gravesend Ave. and Shell Road, 22d Avenue to Avenue X	7-10-15	1-10-17	863,775.00	2.6	June 3, 1915
		Route No. 9-O—Centre Street Loop Subway					
..	Bradley Con. Co.; Cranford Co.; Degnon Con. Co.	Centre Street, Brooklyn Bridge to Williamsburg Bridge	1907	.....	**$12,884,896.49	100	
		Route No. 9-O—Centre Street Loop Reconstruction					
..	New York Municipal Railway Corporation	Centre Street, Brooklyn Bridge to Williamsburg Bridge	4-25-13	.....	325,000.00	100	
..	New York Municipal Railway Corporation	Centre Street, Brooklyn Bridge to Williamsburg Bridge	2- 3-14	11- 3-14	600,000.00 (Approximate)	99.5	
		Company Contracts					
		Sea Beach Line Reconstruction					
..	G. W. McNulty, Inc.	62d & 65th Streets, between Fourth Avenue and 86th Street	10- N-15	7- 6-15	1,877,525.00	100	
..	G. W. McNulty, Inc.	Extra work on Sea Beach Reconstruction	8-19-14	7-19-15	299,539.00	100	
..	Wilson & English Const. Co.	Construction of retaining walls and bridges	7-21-14	1-21-15	281,882.50	100	
..	Post & McCord, Inc.	Construction of stations	3- 9-15	9- 9-15	331,163.03	91	
		Lutheran Cemetery Line					
1	Cooper & Evans Company	Private right of way, Wyckoff Ave. to Fresh Pond Road	8-28-13	5- 8-15	245,870.00	100	
2	F. W. Burnham	Private right of way, Fresh Pond Road to about 1,050 feet east of Fresh Pond Road	2-27-14	7-27-14	143,225.40	100	
		Lutheran Cemetery Line—Station Construction					
..	F. W. Burnham	Construction of stations	7-22-14	4 mos.*	134,354.00	100	
		Liberty Avenue Elevated Line					
..	Phoenix Bridge Company	Liberty Avenue, from Borough line to Lefferts Avenue, Queens Borough	2- 9-14	2- 9-15	707,661.00	100	
..	P. J. Carlin Const. Co.	Construction of six stations on this line	1- 6-15	6 mos.*	232,000.00	91	
		Myrtle Avenue Addition Tracks					
..	Phoenix Bridge Co.	Steel for additional tracks, Willoughby to Wyckoff Ave.	.....	.....	.....	...	
		Myrtle Avenue-Broadway Connection					
..	Terry & Tench Co., Inc.	Myrtle Avenue, Broadway to Willoughby Avenue and private right of way between Broadway and Myrtle Avenue	7-18-13	1-18-14	110,411.50	100	
		Fulton Street Additional Tracks					
..	Miliken Bros.	Steel for additional tracks,, Nostrand Avenue to Sackman Street	3-20-14	1- 5-15	466,800.00	100	
..	Terry & Tench Co.	Erectors of above	6-16-14	6-16-15	462,871.50	100	
..	John Thatcher & Son	Construction of stations	3-22-15	3 mos.*	258,664.00	66	
		Broadway Elevated Line Additional Tracks					
..	McClintic-Marshall Co.	Steel for additional tracks, Havemeyer Street to Myrtle Avenue	8-14-14	4-14-15	193,000.00	100	
..	Terry & Tench Co., Inc.	Havemeyer Street to Myrtle Avenue Street to Myrtle Avenue	10-15-14	10-15-15	321,305.70	90	
..	Lewis F. Shoemaker & Co.	Steel for additional tracks, Myrtle Avenue to Aberdeen Street	3-16-15	9-16-15	279,000.00	48	
..	The Jobson-Gifford Co.	Myrtle Ave. to Aberdeen St.	9-10-15	9-10-16	400,441.70	1	
.	John Thatcher & Son	Construction of stations	9- 7-15	3 mos.*	320,325.00	...	
		Jamaica Avenue Elevated Extension					
1	Post & McCord, Inc.	Crescent Street to Myrtle Avenue	3-18-15	1-18-16	734,340.00	12	
2	Connors Bros. Co.	Myrtle Ave. to Cliffside Ave.	.....	.....	726,168.40	...	
		Fresh Pond Road Yard—Installation of Tracks					
..	Charles A. Myers Contracting Co.	Grading, tracklaying, etc.	.....	.....	17,123.48	...	
		Steel for Third-Tracking and Other Improvements					
..	American Bridge Co.	Steel for Fulton St., Coney Island terminal, East New York yard and Brighton Beach line	.....	.....	2,274,700.00	...	

* Includes $200,000 for real estate.

John Adams, formerly engr. in charge of the local power house of the Eastern Wisconsin Ry. and Light Co., and L. A. Corwin, who until recently was chief engineer for the Harris Typewriter Co., have become associated in the steam and electrical engineering business. Their office is located in the McDermott Blk., Fond du Lac, Wis.

BUILDINGS—Continued from p. 379

Tex., Wichita Falls—Contract will soon be awarded for three-story, 50x150-ft. building for A. F. & A. M. Estimated cost, $50,000. Noted Dec. 9.

Okla., Ardmore—Plans prepared for freight and passenger depot for Gulf, Colorado & Santa Fé R.R. Estimated cost, $50,000. F. Merritt, Galveston, Ch. Engr.

Okla., Muskogee—A. F. & A. M. plan to build temple in Muskogee. Estimated cost, $75,000.

Colo., Denver—Plans being prepared by M. B. Biscoe, Arch., Exchange Bldg., for four-story children's hospital. Estimated cost, $150,000.

Idaho, Payette—Plans prepared by J. R. Walker, Arch., for three-story hotel. Estimated cost, $50,000.

Wash., Tacoma—Congregation of First M. E. Church plans to build one-story, 120x120-ft. edifice next spring. Estimated cost $90,000. Fulton & Butler, 51 West Main St., Uniontown, Penn., Arch.

Calif., Los Angeles—Plans prepared by Walter Webber, Arch., Ferguson Bldg., for one-, two- and three-story fireproof tourist hotel at Lake Tahoe for Anita M. Baldwin.

Ont., Windsor—Bids will soon be received by James Pennington, Arch., La Belle Bldg., for three-story addition to school for Board of Education. Estimated cost, $100,000. A. Courtney, Secy., Bd. of Education.

Bids In and Contracts Awarded

N. H., Manchester—(Official)—Contract for isolation hospital at Derryfield Park awarded to GEORGE BAKER LONG, Worcester, Mass., at $60,150. Noted Nov. 25.

Mass., Boston—Contract for six-story, 50x70-ft. mercantile building on Elm St. for Daniel P. Collins, 7 Water St., awarded to NATHAN HURWITZ, 26 Wolcott St., Dorchester. Estimated cost, $40,000.

Mass., Boston—(Somerville)—Contract for three-story school for St. Ann's Roman Catholic Church awarded to McGAHEY & O'CONNOR, Main St., Cambridge. Estimated cost, $50,000.

Mass., Boston—(Dorchester)—Bids were received Dec. 10 for new school, in Oliver Wendell Holmes District, Dorchester, as follows: P. H. Rose Construction Co., Boston, $159,735; John Bowen, 874 Morton St., Milton, $159,844; D. R. McKillop, 137 West Brookline St., Boston, $169,300. Noted Oct. 14.

Mass., Fall River—(Official)—General contract for remodeling City Home awarded to JOHN CROWE, INC., at $89,875. A. J. Dolan, Supt. Noted Nov. 4 and 25.

Conn., Hartford—(Official)—Contract for four-story office building for Phœnix Insurance Co. awarded to CAULDWELL-WINGATE CO., 381 Fourth Ave., New York, N. Y. Noted Oct. 14.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for court, jail and detention home for women at 135-41 West 39th St. for City of New York awarded to EMERSON BUILDING CO., 103 Park Ave., New York. Estimated cost, $365,000. Noted Mar. 25 and Aug. 26.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for temple at 150th St. near Broadway for Mt. Neboh Congregation awarded to J. A. ZIMMERMAN & SON, INC., 18 East 41st St., New York. Estimated cost, $80,000. Noted Sept. 30 and Nov. 25.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for alterations to office building at Broadway and Rector St. for O. B. Potters Co., Inc., 71 Broadway, awarded to MARC EIDLITZ & SON, 30 East 42d St., New York. Noted Oct. 28.

N. J., Paulsboro—Contract for two-story school awarded to E. P. HENRY, Woodbury. Noted Oct. 21.

N. J., Spring Lake—Contract for five-story, 42x76-ft. addition to New Monmouth Hotel awarded to H. H. MOORE, Spring Lake. Estimated cost, $45,000. Noted Nov. 11.

Penn., Nanticoke—Contract for building for First M. E. Church awarded to NANTICOKE CONSTRUCTION CO., Nanticoke. Estimated cost, $40,000.

Penn., Philadelphia—Contract for six-story, 259x400-ft. loft building at 2nd and Market St. for Kahn & Greenberg awarded to TURNER CONCRETE STEEL CO., Philadelphia. Estimated cost, $500,000. Noted Nov. 25.

Penn., Pittsburgh—Diamond Country Market awarded contract for restaurant, arcade and market to N. V. WATSON, 215 Fourth Ave., Pittsburgh. Estimated cost, $110,000.

Va., Danville—H. A. OSBORNE & SONS, Danville, at about $40,000, awarded contract for Y. M. C. A. building for Riverside and Dan River Cotton Mills.

Ga., Savannah—F. McRAE, Savannah, awarded contract for remodeling courthouse at Bull and President St. for municipal court. Estimated cost, $50,000.

Tenn., Chattanooga—Contract for campus building for University of Chattanooga awarded to T. S. MOUDY & CO., Chattanooga, at $53,100. Noted Oct. 14.

Tenn., Nashville—(Official)—All bids received Dec. 4 for dormitories and administration building for State Polytechnic School rejected. Plans will be revised and new bids received. Estimated cost, $125,000. Noted Dec. 2.

Ohio, Cleveland—Contract for hotel on East 61st St. for G. W. Crile awarded to C. N. GRIFFIN CO., 3111 Carnegie Ave., Cleveland, at about $100,000. Noted Oct. 21 and Dec. 2.

Ohio, Cleveland—Contract for restaurant and store building for Peter Schmitt, Lake Shore Blvd., awarded to L. A. WEISMAN, 868 East 95th St., Cleveland. Estimated cost, $45,000.

Ind., Indianapolis—Contract for gymnasium for University of Indiana awarded to A. E. KEMMER, La Fayette, at $167,200.

Ind., Indianapolis—Contract for library at Meridian and St. Clair St. for city awarded to GEORGE H. FULLER & CO., Chicago, Ill.

Ind., Owensville—Contract for township school awarded to WALTER VAN HOY, Loogootee, Ind., at $54,800. Noted Oct. 7.

Mich., East Lansing—Contract for gymnasium at Michigan College of Agriculture awarded by State Board of Agriculture to HOERST CONSTRUCTION CO., Grand Rapids, at $149,000. Noted Nov. 11.

Mich., Kalamazoo—(Official)—Contract for Nurses' Home for Kalamazoo State Hospital awarded to J. J. WOLFFE. Estimated cost, $56,000. Noted Dec. 2.

Minn., Minneapolis—Contract for theater at 1021 East Franklin Ave. for C. E. Marr awarded to CHARLES E. HOAGSTROM. Estimated cost, $40,000.

Minn., St. Paul—(Official)—GEORGE J. GRANT CONSTRUCTION CO., St. Paul, at $397,324, awarded contract for Minnesota Historical Society Building. Noted Oct. 28 and Dec. 2.

Neb., Florence—Contract for administration building for House of Hope awarded to THOMAS HERD, Florence. Estimated cost, $50,000.

Mo., Kansas City—Contract for theater, store and office building for Altman Realty Co., Altman Bldg., awarded to MARTIN CARROLL CONSTRUCTION CO., 1118 McGee St., Kansas City. Estimated cost, $100,000.

Mo., St. Joseph—(Official)—Contract for five-story building at Eighth and Felix St. for Bartlett Bros. Land and Loan Co. awarded to HOGGSON BROS., Chicago, Ill. Noted Dec. 2.

Tex., Greenville—SHEPPARD BROS. awarded contract for administration building for Wesley College. Estimated cost, $50,000. Noted Dec. 9.

Tex., Houston—Contract for Taylor School awarded to REINHART & DONOVAN, Oklahoma, Okla., at $56,000. Noted Nov. 4 and 9.

Calif., Suisun—Contract for school awarded to H. L. PETERSON, San Francisco, at about $40,000.

B. C., Vancouver—Contract for depot for Great Northern Ry. Co. awarded to COAST CONTRACT CO., Vancouver. Estimated cost, $750,000. Noted Dec. 2.

Contractors' Efficiency Course—A number of New York City contractors are getting together, under the direction of the Emerson Institute, of which Harrington Emerson, the efficiency engineer, is dean, to study efficiency and scientific management methods as applied to contracting and engineering work. This is probably the first concerted attempt ever made by a number of contractors to get together and study the possibilities of the so-called "efficiency movement." A course of 16 sessions has been laid out, to be held in the rooms of the Packard School, 35th St. and Lexington Ave., beginning Jan. 10, 1916. The sessions will be divided into two parts, lecture and laboratory. The lectures will summarize what has been done by such men as Mr. Emerson, Frederick W. Taylor, Frank B. Gilbreth, along the lines of organization, motion study and standardization of conditions and operations in engineering construction. The laboratory work will give the students actual practice in the methods of analyzing operations, hunting down waste motion and eliminating it, making motion studies, etc. The solution of two or more problems of this nature will be required in connection with each laboratory period. Among the reference books to be used are Gilbreth's Motion Study, Field System, Bricklaying System, Primer of Scientific Management, Taylor's Principles of Scientific Management, Taylor and Thompson's Concrete Costs, Gillette's Cost Data, Hauer's Economics of Contracting, Davies' Engineering Office Systems and Methods, Emerson's Efficiency. Only contractors and their men will be admitted to the course. The instructor will be George F. Barber, president of the Efficiency Club of New York, who has been associated with Mr. Emerson for several years as a teacher of efficiency.

Blaine S. Smith, Gen. Sales Mgr., Universal Portland Cement Co., Chicago, Ill., was elected General Secretary of the Chicago Association of Commerce at the annual meeting, Dec. 8. He has served the association actively for several years as chairman of the Illinois Committee and until now as chairman of the Ways and Means Committee Council. Mr. Smith has an enviable record of achievement, both in his association work and as head of the sales organization of the Universal Portland Cement Co., to which position he was appointed early this year.

Edwin G. Booz, former statistician of the Produce Corporation, of Chicago, Ill., has recently organized the Business Research Service and has been made its Director. This service is the first of its kind in the Central West and is designed to meet the new demand on the part of manufacturers, sales and advertising managers and advertising agencies for a skilled research service in the field of business. Particular attention will be paid to the subject of investigating market conditions in different fields and industries, and also to making studies and investigations for trade and commercial organizations of various kinds. Mr. Booz has served as director of the Research Department of the largest woman's magazine in its field, also for a large Chicago newspaper and several corporations in the East. The offices of the Business Research Service are located in the Otis Bldg., Chicago.

CATALOG NOTICES

The Terry Steam Turbine Co., Hartford, Conn. Bulletin No. 20. "The Terry Turbine." Illustrated, 8 pp., 8½x11 in.

American Clay Machinery Co., Bucyrus, Ohio. Catalog. Steam shovels. Illustrated, 40 pp., 8x11 in. Catalog. Haigh continuous kiln. Illustrated, 32 pp., 8½x10½ in.

Carnegie Steel Co., Pittsburgh, Penn. Pamphlet. "Steel Sheet Piling—Tables and Data on the Properties and Uses of Sections." Illustrated, 96 pp., 5x7½ in.

Pelton Water Wheel Co., San Francisco, Calif. Circulars printed in English, Spanish and Portuguese. Pelton water wheels adapted for different purposes. Illustrated, 4 pp., 7½x10½ in.

Construction News

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

New Hampshire—Boston & Maine R.R., Boston Mass., plans to electrify its Portsmouth & Dover branch, Portsmouth. F. B. Freeman, Boston, Mass., Ch. Engr.

New York—City Council, Buffalo, denied franchise to International Ry. to build double-track extension on Washington St. between Ohio and Perry St. and granted franchise for extension on Ohio St. from Washington to Main St. J. C. Sheldon, Buffalo, Pur. Agt. Noted Dec. 9.

Pennsylvania—R. B. Williams, Scranton, Penn., interested in construction of railway from Schenectady, N. Y., to Bloomsburg, Penn.

Virginia—Norfolk & Western Railway plans to construct second track from Walton to Ripplemead, 8.05 miles, next year. J. E. Crawford, Roanoke, Ch. Engr.

West Virginia—Surveys being made by Baltimore & Ohio R.R. for line along Big Sandy River near Beaver Creek, Ky. Company has also secured right-of-way for line on left fork of Beaver Creek into Beaver Falls. F. L. Stuart, Baltimore, Md., Ch. Engr.

West Virginia—Appalachian Power Co., Bluefield, contemplated 1 mile extension to line. Herbert Markle, Bluefield, Gen. Mgr.

North Carolina—Atarka Valley R.R. Co., Bryson City, recently incorporated, plans to build a railway from Bryson City to Falls of Atarka Creek, 12 miles. Arthur Brooks, Buckhannon, W. Va., and Leslie Brooks, Bryson City, interested.

North Carolina—Durham Traction Co. contemplates 2.6 mi. extension in Durham. R. L. Lindsay, Durham, Pur. Agt., Audr. and Gen. Mgr.

Georgia—Savannah & Atlanta Railway Co., recently incorporated with $500,000 capital stock, will build a line from St. Clair to a connection with Georgia R.R., about 35 miles, thence to Washington, Ga., 25 miles. Line will be extension of Savannah & Northwestern Ry. John H. Hunter, Henry D. Stevens and Edwin M. Frank, Savannah, Ga., interested. L. B. Ackerman, Savannah, Ch. Engr., Savannah Northwestern Ry.

Mississippi—S. M. Anderson, Greenwood, and associates plan to build a railway from Greenwood via Ittabena to Schlater, about 46 miles, and to Black Hawk.

Mississippi—According to press reports Gammill Lumber Co., Pelahatchee, plans to build standard gage railway in Pearl River Valley.

Tennessee—Nashville, Chattanooga & St. Louis Railway will enlarge yards at Hollow Rock Junction. H. McDonald, Nashville, Ch. Engr.

Tennessee—Tennessee Valley Iron and Railroad Co., Clifton, plans to extend its line from Collinwood to Savannah, Tenn., providing county will vote bonds to pay part of cost.

Ohio—Baltimore & Ohio Railroad Co. plans an expenditure of $1,240,000 for double-tracking its line between Midland City and Cincinnati, and for second track and track elevation through Defiance. F. L. Stuart, Baltimore, Md., Ch. Engr.

Ohio—Mt. Vernon Railway Co. contemplates 2-mile extension to line in Mt. Vernon. Charles Weirick, Columbus, Supt.

Ohio—Northern Ohio Traction and Light Co. plans 0.7-mile extension of line in Akron and 9.4 miles of double-track line from Akron to Cleveland for cutoffs. Charles Currie, Akron, Vice-Pres. and Gen. Mgr.

Ohio—Wheeling & Lake Erie R.R. will soon award contract for three-mile spur to circle east boundaries of Canton. Estimated cost between $200,000 and $250,000. W. L. Rohback, Cleveland, Ch. Engr. Noted Nov. 18.

Indiana—Chicago, Lake Shore & South Bend Railway Co., Michigan City, contemplates four-mile loop in south and southwest sections of Gary. R. Antibus, Michigan City, Ch. Engr.

Michigan—Robert Oakman, Detroit, received franchise for electric railway between Hamilton Blvd. and Grand River Ave., old city limits and Highland Park.

Minnesota—Minnesota-Northwestern Electric Ry., Thief River Falls, plans to build 20 mi. of new line. H. W. Protzeller, Thief River Falls, Secy. and Gen. Mgr.

Kansas—Manhattan City & Interurban Ry. contemplates 1-mile extension to line in Manhattan City. T. B. Waller, Manhattan City, Ch. Engr.

Montana—Commercial Club of Ft. Benton appointed committee to make investigations on construction of railway, about 1 mile. L. D. Sharpe, C. O. Vowell and C. W. Hudson, interested.

Illinois—Illinois Traction System contemplates railway between Jefferson City and Columbia, Ill. H. J. Vance, Peoria, Pur. Agt.

Arkansas—Yellville, Rush & Mineral Belt Railway Co., Yellville, recently incorporated with $140,000 capital stock, plans to build railway from Yellville southeast along Mill Creek to Cowan Barrens, Clabber Creek and Buffalo River to mouth of Panther Creek. J. C. Shepherd, Rush, Pres.

Texas—Corpus Christi Railway and Light Co. contemplates 1-mile extension to line in Corpus Christi.

Texas—Houston, Richmond & Western Traction Co. plans branch line from Seguin to New Braunfels. E. Kennedy, Pres.

Texas—Northern Texas Traction Co. received franchise from Board of Commissioners, Dallas, for extension of line on Jefferson St. from Pak Cliff Viaduct to Commerce St. C. F. Hollerder, Dallas, Pur. Agt. Noted Sept. 30.

Texas—Plans being considered by Pecos Valley Railroad Association for gasoline-electric interurban railway from connection with Kansas City, Mexico & Orient Ry. of Texas, northwest via Buena Vista, 35 miles up Pecos Valley.

Oklahoma—Surveys will be made for interurban railway from Bartlesville to Pawhuska. Illuminating Oil Co., Bartlesville, interested.

Idaho—Pocatello Traction and Interurban Co., recently incorporated with $100,000 capital stock, will construct a railway about seven miles long. Richard Douglas, Pres. Noted Dec. 16.

Utah—Ogden, Logan & Idaho Railway Co. plans to build new line from Ogden to Harrisville and from Hot Springs to Brigham City, 22 mi.

Washington—A. Van Eppes, Leavenworth, interested in railway from Leavenworth to Icicle, 25 miles.

California—Surveys made by Engels Copper Co., Taylorsville, for narrow gage railway from its mine to connect with Western Pacific Railway near Keddie, seven miles. Noted Oct. 21.

California—Fresno Interurban R.R. Co. plans to build railway from Fresno to Clovis and from Fresno to Centerville during 1916, about 18½ mi.

California—Press reports state that Santa Fé System contemplates line from Needles, Calif., to Oatman, Ariz. F. W. Felt, Chicago, Ill., Ch. Engr., Atchison, Topeka & Santa Fé System.

New Brunswick—Moncton Tramways, Electricity and Gas Co., Moncton, plans to build about 1½ miles of track next year. E. B. Keeser, Farmers Bldg., Pittsburgh, Penn., Vice-Pres. and Gen. Mgr.

New Brunswick—Bids will be received until noon, Dec. 30, by I. R. Todd, Pres., St John & Quebec Railway Co., Fredericton, N. B., to complete portion of railway (Canadian Government Rys.), between Georgetown and Centerville. C. B. Brown, Moncton, N. B., Ch. Engr. Noted Dec. 2.

Ontario—Press reports state that government received application from firm of lawyers of Ft. William for charter for railway to be known as Manitoba & Ontario Ry., to be built between Ft. William and Lake of the Woods, Man.

British Columbia—Surveys being made by Canadian Northern Railway System for line from Kamloops southeast via Vernon and Kelowna to Lumby, 141 miles, also on Island of Vancouver from Alberni to Nootka Sound, 15.6 miles. F. W. Vancouver, B. C., Gen. Supt.

Bids In and Contracts Awarded

California—Board of Public Works, San Francisco, awarded contract for extension of Church St. line from 18th to 22d St. to CONTRA COSTA CONSTRUCTION CO., at $120,500. M. M. O'Shaughnessy, City Engr. Noted Nov. 18.

LIGHT, HEAT AND POWER

Proposed Work

Vt., Brandon—Hortonia Power Co. will issue $500,000 bonds. Proceeds will be used for developing Silver Lake water-power project.

Vt., Hardwick—City plans to extend lighting service to East Hardwick, Greensboro, Greensboro Bend and Craftsbury. Estimated cost, $11,626.

Mass., Newburyport—Newburyport Gas and Electric Co. will build plant on Water St. at Merrimac River. Estimated cost, $200,000.

Conn., Winsted—Plans being prepared for hydro-electric power plant for Winsted Gas and Electric Co. Estimated cost, $100,000.

N. Y., Batavia—Chester & Fleming, Engr., Union Bank Bldg., Pittsburgh, Penn., retained by city to prepare plans for electric-light plant and water and sewer systems. Citizens recently voted $175,000 bonds for this purpose.

N. Y., Cobleskill—Courter Electric Co. will build high-tension transmission line from Ft. Plain to Cobleskill through towns of Milton, Canajoharie and Sharon.

N. Y., New York—(Borough of Richmond)—Richmond Light and Railroad Co., New Brighton, applied to Public Service Commission for permission to enlarge and improve its plant.

Penn., Ellwood City—Mahoning & Shenango Railway and Light Co., Youngstown, Ohio, has purchased plant of Pennsylvania Power Co., Ellwood City, and will improve same, work to include construction of dam. Estimated cost, $150,000. Noted Dec. 16.

Penn., Monroeton—Press reports state movement is on foot to organize company to build electric-light plant in Monroeton.

Penn., Philadelphia—Philadelphia Electric Co. considering proposition to build large electric-power plant in northeastern section of city.

Fla., Ft. Pierce—See item under "Water-Works."

Fla., Jacksonville—Eagle Film Manufacturing and Producing Co. will build electric-light plant. A. S. Roe, Pres.

Fla., Okeechobee—See item under "Sewers."

Miss., Columbus—Election will soon be held to vote on $10,000 bonds for municipal electric-light plant.

Miss., Oxford—City will issue $6,500 bonds for improving electric-light plant. J. H. Lawshee, Clk.

Miss., Pass Christian—City contemplates $7,000 bond issue for improving electric-light system. X. A. Kramer, Magnolia, Engr.

Miss., Wesson—See item under "Water-Works."

La., Washington—Plans being considered for municipal electric-light plant.

Tenn., Chattanooga—Tennessee River Power Co., Chattanooga, approved plans for development of water-power of Caney Fork River, near Rock Island. Work will include dam and powerhouse having output of 40,000 hp.

Tenn., Maryville—Aluminum Co. of America plans to build power dam at Maryville in connection with new plant.

Ohio, Massillon—City engaged H. O. Swoboda, Consult. Engr., Pittsburgh, Penn., to prepare plans for electric-lighting system.

Ill., Macomb—Plans being considered for installing municipal electric-light plant in Macomb.

Ill., Olney—City Council considering installation of electric-lighting system.

Ill., Poplar Grove—(Official)—Illinois Northern Utilities Co., Dixon, will build transmission line from Capron to Poplar Grove. Noted Dec. 9.

Wis., Lowell—(Official)—Bids will be received until Jan. 1 by W. F. Pease, Engr., for electric-light plant and power station. Estimated cost, $10,000. Noted Nov. 25.

Wis., Merrill—Merrill Railway and Lighting Co. plans to build high tension transmission line from Merrill to Wausau. Plans include development of Trappe Rapids water power of Wausau Street Railway Co.

Wis., Prentice—D. Y. Parkinson, Ashland, and J. E. Feely, Fifield, will install and operate electric-light plant in Prentice.

Wis., Wauwatosa—County Board of Control revived project to build central heating and lighting plant in Wauwatosa. Estimated cost, $355,000. O. Broecker, Secy.

Iowa, Cumberland—City contemplates municipal electric-light plant.

Minn., Carver—Minnesota General Electric Co., Minneapolis, will install electric-lighting system in Carver.

Minn., Rochester—Press reports state that Commercial Club plans to purchase holdings of Zumbro Power Co. at Zumbro Falls for city and to develop same to generate electricity for Rochester and other cities. Estimated cost of project about $979,000.

Kan., Arkansas City—Citizens voted $14,000 bonds for gas distribution plant and pipe line to field southwest of city. Noted Nov. 25.

Kan., Dwight—R. B. Fegan Co., Junction City, will install electric-light and power system in Dwight.

Kan., Eskridge—Citizens contemplate municipal electric-light plant.

Kan., Sharon Springs—City will issue $10,000 bonds for electric-lighting system.

Mont., Scobey—Plans being considered by Scobey Electric Light Co. for improving and enlarging its plant.

Mo., Flat River—City contemplates installing electric-light plant and water-works.

Mo., Memphis—City contemplates municipal electric-light plant. E. McDaniel, Clk.

Mo., St. Louis—Laclede Gas Light Co. applied to city for franchise to place high-tension electric wires in underground conduits for two miles and to extend electrical service in western and northern sections of city.

Mo., Shamrock—Power house will be constructed by Sapulpa & Oil Fields R.R. S. W. Barnes, Kansas City, Supt.

Tex., Sherman—Texas Traction Co. will rebuild substation recently destroyed by fire.

Okla., Welch—See item under "Water-Works."

Colo., De Beque—Rifle-De Beque Oil and Gas Co. will build heating plant. Estimated cost, $7,000.

Colo., Golden—N. W. Osborne, John Reynolds and John Wallace appointed as committee to make investigations and submit report for installing electric-light plant in Golden.

N. M., Roswell—Roswell Gas and Electric Co. plans to improve its plant. Estimated cost, $20,000.

Idaho Falls, Idaho—J. A. Jones and E. G. Kindred contemplate installation of gas plant at Idaho Falls.

Wash., Seattle—City contemplates election in March to vote on $3,000,000 bonds for additional power plant, if present plans are agreed upon.

Calif., San Francisco—State Railroad Commissioners received application from Pacific Gas and Electric Co. for permission to issue $2,500,000 capital stock for enlarging and improving its plant.

Ont., Harriston—Bylaw passed by Council authorizing raising of $4,000 for hydro-electric power plant. Noted Aug. 5.

Bids In and Contracts Awarded

Mass., Worcester—E. J. CROSS CO. awarded contract for addition to plant of Worcester Electric Light Co. Estimated cost, $10,000.

Penn., Coatesville—Contract for one-story, 43x170-ft. boiler house for Worth Bros. Co. awarded to IRWIN & LEIGHTON, 126 North 12th St., Philadelphia.

Ga., Davisboro—(Official)—Contract for electric-light plant awarded to FAIRBANKS, MORSE & CO., at $5,000. Noted Dec. 9.

Wis., Milwaukee—Contract for steel work on boiler house for A. C. Smith awarded to MILWAUKEE BRIDGE CO., Milwaukee. Estimated cost of house, $40,000.

Mo., New Madrid—Contract for addition to electric-light plant awarded to FAIRBANKS-MORSE CO., St. Louis, at $15,065. Noted Nov. 18.

BRIDGES

Proposed Work

N. J., Jersey City—Central R.R. of New Jersey applied to City Commission for permission to build viaduct over Phillips St.

Penn., Beaver—(Official)—Bids will be received until noon, Dec. 28, by County Controller, for bridge over Sewickley Creek. J. G. Chalfont, Pittsburgh, County Engr.

Penn., Harrisburg—City will build bridge across tracks of Pennsylvania R.R. at Walnut St. Estimated cost, $300,000.

W. Va., Huntington—Huntington-Chesapeake Bridge Co. granted franchise by City Commission to build bridge across Ohio River from Huntington to Chesapeake, Ohio. J. C. Miller, interested. Noted Oct. 28.

N. C., Pineola—County Highway Commission, Newland, will soon award steel contract for bridge across Linville River. G. Love, Engr.

Fla., Bradentown—Election will be held Jan. 18 in Manatee County, Special Road and Bridge District, Precinct No. 10, to vote on $75,000 bonds for bridges, culverts and roads. M. G. Rushton, Chn. of County Comrs.

Miss., Mendenhall—Contract will be awarded by Supervisors of Simpson County about Jan. 3 for steel bridge across Sanders Creek, near Braxton, and one across Limestone Creek, near Harrisville.

Ohio, Dayton—City has had plans prepared for bridge at Fifth St.

Ohio, Willoughby—According to press reports plans being considered for bridge across Chagrin River. Estimated cost, $100,000. J. P. Curtiss, interested.

Ind., Washington—Bids will be received by County Auditor until 2 p.m., Dec. 30, for steel bridge.

Ill., Rockford—(Official)—Bids will be received by H. J. Gallagher, Chn. of Street and Alley Com., until 1:30 p.m., Jan. 26, for reinforced-concrete bridge over Rock River at Morgan St. Estimated cost, $83,000. (See adv.)

Wis., Green Bay—Bids will soon be received for bridge across Duck Creek. Estimated cost, $12,000.

Wis., Milwaukee—Milwaukee County Circuit Court has decided that Chicago, Milwaukee & St. Paul Ry. must rebuild Grand Ave. viaduct. Estimated cost, $60,000.

Iowa, Iowa City—H. Hughes, City Engr., has recommended concrete bridge across Iowa River and one across Ralston Creek to City Council. Estimated cost, $75,000 and $15,000 respectively.

Iowa, Knoxville—Bids will be received by J. D. Schlotterbach, County Audr., until 1:15 p.m., Jan. 18, for constructing bridges and culverts.

Minn., Amboy—Concrete arch bridge will be constructed over Blue Earth River by county. C. L. Kennedy, Mankato, County Audr.

Minn., Colerain—Duluth, Missabe & Northern Ry. plans to build several steel bridges. H. L. Dresser, Duluth, Ch. Engr.

Minn., Mankato—Bridge will be built across Minnesota River at Main St. D. D. Price, Lincoln, Neb., Engr.

Minn., Wadena—Bids will be received by County Auditor until Jan. 4 for State Bridge No. 1739 across Wing River.

Kan., Hutchinson—Plans will soon be prepared by G. L. McLane, City Engr., for two reinforced-concrete bridges over Cow Creek at Plum St. and Avenue F. Estimated cost, $6,000 each.

Neb., Omaha—Bids will be received until noon, Dec. 31, by Commissioners of Douglas County, for constructing and repairing bridges during 1916.

Ark., Texarkana—Plans prepared by Harrington, Howard & Ash, Consult. Engr., Kansas City, Mo., for bridge across Red River. Noted Nov. 25.

Tex., Ft. Worth—Commissioners of Tarrant County plan to rebuild Park St. bridge, recently destroyed by flood. Estimated cost, $7,500.

Colo., Denver—All bids recently received for bridge across Huerfano River north of Walsenburg rejected. New bids will be received. Estimated cost, $13,000. Noted Oct. 28.

Colo., Sterling—Bids will be received by County Clerk until 1 p.m., Dec. 28, for four bridges across South Platte River.

Idaho, Sandpoint—Bids will be received by Clerk of County Commissioners until Jan. 15 for superstructure and piers of bridge over Pend d'Oreille River at Priest River. Estimated cost, $22,000. C. J. Chaffins, County Engr.

Wash., Wenatchee—Surveys made by A. Warren, County Engr., for steel bridges across Wenatchee River at end of Wenatchee Ave.

Ore., McMinnville—Press reports state that $26,430 will be expended for bridge work in 1916.

Ore., Portland—Bids will be received by A. L. Barbur, County Audr., about Dec. 29, for reinforced-concrete viaduct for extension of Union Ave. Estimated cost of viaduct, $53,000; fill, $13,000. Noted Sept. 30 and Nov. 18.

Calif., Los Angeles—Press reports state that bridge will be constructed across tracks of Pacific Electric Ry. at Western Ave. Estimated cost, $13,000.

Calif., San Francisco—State Board of Harbor Commissioners will soon award contract for 225-ft. viaduct on Market St.

Calif., Santa Barbara—A. V. Saph, Engr., University of California, Berkeley, preparing plans for bridge across Santa Ynez River. Estimated cost between $100,000 and $125,000.

Ont., Wardsville—Council of Middlesex County plans to build bridge at Wardsville. C. Talbot, County Bldg., London, County Engr.

Bids In and Contracts Awarded

N. J., Atlantic City—Contract for bridge over Mullica River at Chestnut Neck near New Gretna awarded to GEORGE S. BENNETT, Mt. Vernon, N. Y. Noted Nov. 18.

Penn., Erie—(Official)—State Highway Department, Harrisburg, awarded contract for bridge near Kearsarge, Erie County, to B. W. BLYSTONE, Cambridge Springs, at $5,119. Noted Dec. 2.

Penn., Philadelphia—(Official)—Bids were received Dec. 14 for Diamond St. bridge over connecting railway as follows: Cantrell Construction Co., Philadelphia, $60,715; Keystone State Construction Co., $62,500; Bran & Stuart, $64,000. Noted Dec. 9.

Miss., Meridian—Contract for culvert on 17th Ave. between Fourth and Fifth St. awarded to JOHN E. WRIGHT at $11,000.

Ill., Ludlow—Contract for bridge on line of Kankakee & Urbana Traction Co., north of Ludlow, awarded to CENTRAL STATE BRIDGE CO., Indianapolis, Ind.

Ill., Watseka—(Official)—Contract for bridge in Douglas Township, Iroquois County, awarded to JOHN J. O'HERON CO., 326 West Madison St., Chicago, at $9,600. Noted Dec. 2.

Neb., David City—(Official)—Contract for bridge work during 1916 awarded to NEBRASKA CONSTRUCTION CO., Lincoln. Noted Dec. 9.

Mo., Warsaw—(Official)—All bids received Dec. 14 for bridge over Pomme de Terre River rejected. B. R. Burton, County Clk. Noted Dec. 2.

Tex., Dallas—(Official)—Commissioners of Dallas County awarded contract for bridge over Bachman Creek to KELIN BROS. CO., Dallas, at $4,500.

Tex., Llano—Contract for three low-water bridges awarded to MIDLAND BRIDGE CO., Kansas City, Mo. Citizens recently voted $24,000 bonds for bridge work.

N. M., Las Cruce—Contract for four bridges in Dona Ana County awarded to EL PASO BRIDGE AND IRON CO., El Paso, at $24,000.

Wash., Seattle—P. MASON, 2407 Boylston Ave., N., Seattle, at $5,787, awarded contract for 23d Ave. bridge. Noted Dec. 9.

Wash., Stevenson—COAST BRIDGE CO., Portland Ore., at $13,940, awarded contract for bridge near Section 37, Township 3.

Calif., Merced—Contract for bridge across San Luis Creek west of Los Banos awarded to WEST SIDE CONSTRUCTION CO., Los Banos, at $6,427.

WATER-WORKS

Proposed Work

Maine, North Anson—Citizens voted $40,000 bonds for 14-in. pipe line from Hancock Pond to end of Madison and Anson bridge.

Mass., Salem—City will construct additional water supply system. Estimated cost, $120,000. J. Clifford Entwisle, City Clk.

N. Y., Albion—State Conservation Commission approved plans for water supply system at Eagle Harbor. J. F. Witmer, Buffalo, Consult. Engr. Noted Sept. 16.

N. Y., Batavia—See item under "Light, Heat and Power."

N. Y., Cobleskill—Citizens voted to extend water mains in North Grand St. Estimated cost, $4,000.

N. Y., Rochester—City will sell $1,270,000 bonds, of which $200,000 will be used for improvements to water-works and $250,000 for sewage-disposal plant.

N. J., Branchville—Common Council plans municipal water system.

N. J., Far Hills—F. S. Tainter, Engr., 55 Wall St., New York, N. Y., retained to submit plans for municipal water works system. Estimated cost, $20,000. L. V. Ludlow, in charge. Noted Dec. 16.

N. J., Irvington—Town Commission considering installation of municipal water and electric-light plant. I. J. Casey, City Engr.

Penn., Fleetwood—(Official)—Bids will not be received until the spring for a water system. Estimated cost, $10,000. Noted Nov. 11.

Penn., Greenville—Citizens will improve water-works system.

Penn., Lancaster—City Council plans to install electrically driven centrifugal pumps in water-works plant. James W. Armstrong, Baltimore, Md., Consult. Engr.

Penn., Ringtown—Citizens voted $12,100 bonds for municipal water system. Noted Oct. 7.

Penn., Windsor—State Department of Health authorized city to construct reservoir and install water-works system.

Md., Baltimore—James H. Preston, Mayor, reported in favor of installing water meters in all buildings except two-story buildings with frontage of 12 ft. Estimated cost, $1,500,000. H. K. McKay, City Engr. Noted Dec. 16.

W. Va., Benwood—City will build well-water system, about May 1. Estimated cost, $45,000. Carl Strouts, Mayor.

W. Va., Warwood—City plans to build well-water system next spring. Estimated cost, $258,265. T. M. Haskins, Dir. of Pub. Ser., Wheeling. C. B. Coowe and C. C. Smith, Engrs.

N. C., Beaufort—City contemplates water and sewer systems.

N. C., Fayetteville—City will improve water system.

N. C., Hendersonville—Gilbert C. White, Consult. Engr., Charlotte, retained by city to investigate proposed improvement of water-works.

N. C., Lillington—City contemplates water and sewer systems.

N. C., Salisbury—See item under "Sewers."

Ga., Tifton—City plans to improve water system. Estimated cost, $21,000.

Fla., Ft. Pierce—W. R. Jackson, City Clk., will sell $25,000 bonds, Jan. 5, for improving water-works, sewers, streets and light systems.

Fla., Okeechobee—See item under "Sewers."

Miss., Wesson—Bids will be received until Jan. 4 by Paul Burt, City Clk., for water system and electric-light plant. M. L. Culley, Jackson, Miss., Engr. Noted Nov. 18.

La., Covington—Citizens will hold election Jan. 1 to vote on $71,000 bonds for municipal water-works and sewer system.

Tenn., Coster—(Knoxville post office)—Southern Ry. will build a 48,000-gal. water tank at Coster. B. Herman, Washington, D. C., Ch. Engr.

Tenn., Sharon—City voted $15,000 bonds for water-works plant.

Ohio, Athens—Contract for water system will be let early in spring. Estimated cost, $40,000. Noted Nov. 11.

Ohio, Hamilton—(Official)—Bids will not be received for three 10-in. wells and intake for water-works system. Joseph B. Myers, Dir. of Pub. Ser. Noted Dec. 9.

Ind., Orleans—Orleans Water Co., J. B. Marvin, Engr., preparing plans for water works system. Estimated cost, $50,000. C. J. Post, City Clk. Noted Dec. 16.

Mich., Hamtramck—(Official)—Detroit Water Board will lay water mains in Mitchell, McDougall and Chester Ave. by day labor. Noted Dec. 9.

Ill., Danville—Bids will be received by Board of Water Commissioners until Jan. 10 for reinforced-concrete rapid sand filter having capacity of 300,000 gal. Chester & Fleming, Pittsburgh, Penn., Engr.

Ill., Waukegan—See item under "Sewers."

Wis., Milwaukee—City Council directed F. G. Simmons, Commissioner of Public Works, to advertise for bids, for extending Linwood Ave., intake water tunnel 2,500-ft. Estimated cost, $555,000. Noted Dec. 2.

Wis., Sheboygan—Citizens will construct water works system. C. U. Boley, City Engr.

Minn., Crosby—Crosby Water and Light Co. will soon award contract for six miles of 6-, 8- and 10-in. water mains.

Minn., Duluth—Citizens contemplate construction of water system. C. S. Palmer, City Clk.

Minn., Swanville—Contract will be let early next spring for water system, for which citizens recently voted $9,000 bonds. Noted Nov. 18.

Kan., Coffeyville—Citizens will hold election Dec. 28 to vote on $20,000 bonds, to purchase water works equipment. Charles E. Stromquist, Supt. Water and Light Dept.

Kan., Tonganoxie—Citizens contemplate municipal water-works system.

S. D., Morristown—Town Board plans to install water works system next spring.

Mont., Broadview—County Commissioners rejected all bids for water system. New bids will be received. Estimated cost, $30,000. F. E. Williams, City Clk. Noted Nov. 11.

Mo., Flat River—See item under "Light, Heat and Power."

Ark., Dardenelle—H. D. Evans, Supt. of Water System, has recommended following improvements: 7,000 ft. of 6-in. and 1,720 ft. of 3- and 4-in. pipe, one 65-ft. well, reservoir with 170,000 gal. capacity, brick pumping station, oil engine and three stage pumps. Noted Nov. 4.

Tex., Ennis—Citizens will build filtration plant.

Tex., Tyler—Citizens will vote Jan. 4 on $250,000 bonds for municipal water-works plant and distributing system.

Okla., Commerce—Citizens will hold election Dec. 30, to vote on $40,000 bonds for water works system. Benham Engineering Co., Oklahoma City, will have charge of work. Charles R. Martin, City Clk. Noted Nov. 25.

Okla., Walter—Bonds for $7,500 voted by citizens for water system.

Okla., Welch—Citizens will install water-works and electric-light plant. Estimated cost, $32,000.

Okla., Wilson—At recent election citizens defeated bonds for water-works system.

N. M., Springer—J. S. Bowman is interested in installation of water system in Springer.

Ore., Baker—(Official)—Bids will be received until Jan. 3, for improving municipal water system. Estimated $110,000. L. R. Stockman, City Engr. Noted Oct. 22.

Calif., Banning—All bids recently received for water system in District No. 1 rejected. New bids will be received.

Calif., Oakland—J. S. Bragg, San Francisco, presented plan to State Water Commissioner, Sacramento, for water supply system for cities of Oakland, Berkeley, Alameda and Stockton. Estimated cost, $1,000,000.

Calif., Sacramento—City will install pump for city water-works. Estimated cost, $17,000.

Que., Aylmer—Board of Public Works considering installation of electric pumping plant. E. Mulherbe, City Clk.

B. C., North Vancouver—City will install water system east of the Seymour River. J. E. Farmer, City Clk.

Australia—Tasmania, Hobart—(Official)—Bids will be received by Mayor and Board of Aldermen until 4 p.m., Jan. 24, for about 42,000 lin.ft. of water pipe. (See adv.)

Bids In and Contracts Awarded

Conn., New Britain—Contract for borings for course of the new pipe line awarded to C. L. GRANT CO., Hartford. William H. Hall, City Engr.

N. J., Jersey City—Contract for installation of pipe line for water supply at county institutions, awarded by Board of Freeholders to CULLIGAN & MACHANSKA, Bayonne, N. J.

Ala., Cullman—Contract for extending water mains about 2 mi. will be awarded in April. Estimated cost, $12,000. A. G. Coe, City Clk. Noted Dec. 2.

Ohio, Columbus—Contract for water-softening equipment for Institution for Feeble-Minded awarded to WILLIAM GRAVER TANK WORKS, East Chicago, Ind. Noted Dec. 28.

S. D., Aberdeen—City Commissioners awarded contract for a booster pump, electric motor and Venturi meter to R. A. WHITACRE CO.

Tex., Ft. Sam Houston—Contract for water distributing system, awarded to NOLAND-CLIFFORD CO., Newport News, Va. Estimated cost, $4,970.

Utah, Salt Lake City—(Official)—Contract for constructing storage dam in Parleys Cañon awarded to PARROTT BROS., Salt Lake City. Estimated cost, $108,582. Noted Dec. 16.

SEWERS

Proposed Work

Mass., Boston—Bids will be received by Edward F. Murphy, Comr. of Pub. Wks., until noon, Dec. 24, for pipe sewers and drains in Chester St. between Rockaway and Oakland St. and between Rexford and Chester St.

Mass., Boston—Bids will be received by Edward F. Murphy, Dir. of Pub. Wks., until noon, Dec. 24, for pipe sewers and drains in Allerton and Kenberma Rd., from Park to Washington St.

Mass., Winchendon—Citizens voted $15,000 bonds for sewer system. Noted Nov. 18.

Conn., Greenwich—Bids will be received Dec. 30 for sewage-disposal plant and trunk sewers. Estimated cost, $100,000. Clyde Potts, 30 Church St., New York, N. Y., Engr.

N. Y., Batavia—See item under "Light, Heat and Power."

N. Y., Rochester—See item under "Water-Works."

Penn., Pittsburgh—County Commissioners authorized $125,000 bonds for sewage-disposal plant, and tuberculosis hospital at County Home, Woodville.

Md., Hagerstown—(Official)—City plans to hold election next spring to vote on bonds for constructing sanitary sewers. J. B. Ferguson, City Engr. Noted Dec. 9.

W. Va., Glendale—Citizens plan sewer system. R. Hollingshead, City Engr.

N. C., Beaufort—See item under "Water-Works."

N. C., Lillington—See item under "Water-Works."

N. C., Salisbury—Board of Alderman sold $200,000 bonds for sewers, water-works and improving streets. Noted Aug. 19.

Fla., Ft. Pierce—See item under "Water-Works."

Fla., Okeechobee—City contemplates election to vote on $50,000 bonds for sewer and water systems and electric-light plant.

La., Covington—See item under "Water-Works."

La., Shreveport—Bids will be received by city until Jan. 5 for $750,000 bonds for sewer extensions. This is part of the $1,200,000 bond issue recently voted for municipal water-works plant.

Ky., Lexington—Preliminary plans prepared by Solomon-Norcross Co., for sewage-disposal plant at North Main St. Estimated cost. $350,000. J. White Guyn, City Engr. Noted Dec. 2.

Ohio, Cincinnati—Bids will be received by Philip Fosdick, Dir. of Pub. Ser., until noon, Dec. 27, for improving sewer in Race St. from Elder St. north to existing trunk sewer.

Ohio, Cleveland—Bids will be received until noon, Dec. 30, for sewers in several streets. Robert Hoffman, City Engr.

Ohio, Columbus—Bids will be received by Paul G. Kemper, Clk., Dir. of Pub. Ser., until Dec. 28 for sewers in Richardson Ave. and Essex St. and various alleys.

Ohio, Dayton—Director of Public Service preparing plans for storm sewers.

Ohio, Delaware—City Council considering new sewage-disposal plant.

Ohio, Painesville—Bids will be received by F. L. Kelley, City Clk., until noon, Dec. 27, for the sale of $32,000 bonds for sewers in various streets.

Ohio, Springfield—Bids will be received by Charles E. Ashburner, City Mgr., until noon, Dec. 27, for storm sewer in Lowry St. M. J. Bahin, City Engr.

Ohio, Toledo—L. A. Boulay, County Sanitary Engr., prepared plans for sewage-pumping station. Estimated cost, $40,000.

Wis., Elkhart Lake—Preliminary plans being prepared for sewers. Donahue & Sinz, 720 New York Ave., Sheboygan, Wis., Engr.

Wis., Green Bay—Citizens contemplate concrete and tile sewers in spring. Estimated cost, $40,000. A. Brauns, City Engr.

Wis., Jefferson—Plans being prepared for extension of sewer system. Citizens will vote on bond issue in January. J. B. Brewer, Mayor.

Ill., Batavia—Movement started by Improvement Association of East Batavia for constructing sewer system.

Ill., McHenry—Report submitted by P. E. Green, Engr., estimating cost of sanitary sewer system at $27,000.

Ill., Waukegan—Citizens plan installation of sewer and water mains in Sand St. Estimated cost, $20,367.

Iowa, Des Moines—(Highland Park)—Preliminary plans for eight miles of sewers being prepared. F. Carrs, City Hall, City Engr.

Iowa, Des Moines—Bids will be received early in January for Closes Creek sewer system. Estimated cost, $197,658. F. Carrs, Engr. Noted Sept. 30.

Iowa, Farragut—Surveys made for the construction of a sewer and drainage system. Estimated cost, $4,000. F. L. Shenandoah, City Engr. Noted Dec. 2.

Iowa, Hampton—(Official)—Owing to error in procedure of work for sanitary sewer system, bids must be readvertised, and contract will be let some time in January. P. A. Van Felt, City Clk. Noted Dec. 9.

Iowa, Woodbine—City contemplates sewer system. Bruce & Standwear, Omaha, Neb., Engr.

Minn., Faribault—City will construct sanitary sewers. Bids will be received in January. Estimated cost, $4,000. Frank McKellip, City Engr.

Minn., Mankato—City contemplates storm sewer in North Fifth, Rock and other streets. Estimated cost, $6,000. H. F. Blomquist, City Engr.

Minn., St. Paul—Oscar Claussen, City Engr., preparing plans for storm sewer system for St. Anthony Hill section. Estimated cost between $500,000 and $1,000,000.

Minn., St. Paul—Common Council approved plans for sewer in Yankee St. between Cliff and Dousman St.

Kan., Manhattan—Plans being prepared for storm sewer on Manhattan Ave. Fred Walters, City Engr.

Kan., Minneapolis—Press reports state citizens contemplate establishment of new sewer district and sewer system. Estimated cost, $5,000. A. D. Todd, City Clk.

Kan., Ottawa—City plans to improve sewer system. E. M. Cusick, City Clk.

Neb., Pierce—(Official)—Citizens recently voted $20,000 bonds for sewer system. L. P. Tonner, City Clk. Noted Dec. 9.

Mont., Columbus—City will let contract in March for sewer system. Estimated cost, $10,000. N. Cardozo, City Engr. Noted Sept. 30.

Mo., Alton—Plans being prepared for sewer in Shields St.

Tex., Gatesville—Citizens voted $22,500 bonds for construction of sewer system. T. R. Mears, Mayor. Noted Sept. 30.

Tex., San Marcos—Plans prepared by Clyde Potts, 30 Church St., New York, N. Y., for sewage-disposal plant. Noted Dec. 9.

Ore., Baker—City Commissioners will soon award contract for 17,000 ft. of 12-in., 12,700 ft. of 14-in. and 4,800 ft. of 15-in. vitrified and concrete sewer pipe. L. R. Stockman, City Engr.

Calif., Alhambra—(Official)—Citizens will vote on bonds for sewer system.

Calif., Santa Monica—(Official)—Citizens recently defeated $250,000 bond issue for storm sewer system. Noted Oct. 28 and Nov. 11.

Ont., Brockville—City plans expenditure of $12,823 for sewers. George K. Dewey, City Clk.

Bids In and Contracts Awarded

Mass., Boston—(Official)—Contract for Davenport Brook Conduit, from Magdala to Washington St., awarded to WILLIAM J. BARRY, 431 Ashland St., West Roxbury, Mass. Estimated cost, $29,871. Edward F. Murphy, Comr. Pub. Wks. Noted Dec. 9.

Mass., Needham—(Official)—Bay State Dredging and Contracting Co., 247 Atlantic Ave., Boston, at $59,055, submitted lowest bid for sewer work, Section No. 104.

N. Y., Yonkers—JAMES J. CORBALIS, 811 Clover St., Yonkers, at $9,760, awarded contract for sewer in Saw Mill River Rd.

N. J., Camden—Contract for sewer in Pensauken Township awarded to W. PENN CORSON, at about $10,000.

N. J., Ridgefield Park—(Official)—Contract for sewer system in West View Section awarded to DI NAPOLI & TARIELLO CONSTRUCTION CO., 11 Broadway, Hackensack, $27,765. Noted Dec. 2 and 16.

Penn., Philadelphia—(Official)—Department of Public Works awarded contract for Packer St. sewer to CANTRELL CONSTRUCTION CO., Philadelphia, at $75,000; Rock Run sewer in Seventh St. to ROBERT HIGGINS, Philadelphia, at $76,000. George S. Webster, Ch. Engr. and Surv. Noted Dec. 9.

Md., Baltimore—Contract for Section No. 1, Waverley trunk sewers, Contract 168, awarded to CARROZZA BROS., 606 Munsey Bldg., Baltimore. Estimated cost, $10,126. Noted Dec. 16.

Ind., Indianapolis—Board of Public Works received low bids for sewer in Henry St. from Federal Contracting Co., Merchants Bank Bldg., Indianapolis, at $4,800; Columbia Construction Co., 2102 Columbia Ave., Indianapolis, at $5,150. B. J. T. Jeup, City Engr.

Ind., New Castle—Contract for sewer in Plum St. awarded to JAMES GARVEY. Estimated cost, $4,827.

Mo., Kansas City—Board of Public Works awarded contract for sewers in two districts, in Division No. 7, to W. C. MULLINS, 1230 Montgall Ave., at $4,085; and in one district in Division No. 3 to ANDERSON & DUNN, 3219 Jefferson Ave., at $7,203. Curtis Hill, City Engr.

Wash., Seattle—(Official)—Contract for sewer system in Mead St. and 51st Ave., S., awarded to WASHINGTON PAVING CO., Smith Bldg., Seattle, at $78,694. Noted Dec. 2.

Calif., Los Angeles—Contract for sewer in Griffin Ave. awarded to P. S. TOMICH, at $11,500. Noted Dec. 9.

Que., Montreal—(Official)—Citizens voted $1,151,453, for sewer work. Work will be done by day labor. L. N. Senecal Secy., Bd. of Comrs. Noted Dec. 2.

GARBAGE

Proposed Work

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., until noon, Dec. 29, for receiving and removing ashes in borough, Contract No. 1502.

N. J., Glen Ridge—Borough Council will issue $15,000 bonds for garbage incinerating plant. Action calling for election to be held Dec. 23 rescinded. Noted Dec. 9.

Penn., Swissvale—Bids will be received until 7 p.m., Jan. 10, by W. H. Garrett, Secy., for collection and disposition of garbage in Borough of Edgewood.

STREETS AND ROADS

Proposed Work

N. Y., New York—(Borough of Bronx)—(Official)—Bids will be received until 10:30 a.m., Dec. 27, by Douglas Mathewson, Borough Pres., for improving Odell St. from Unionport Rd. to Starling Ave., Waterbury Ave. from Westchester to Zerega Ave., Newbold Ave. from Castle Hill to Zerega Ave. Noted Dec. 16.

N. Y., New York—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Borough Pres., until 11 a.m., Dec. 30, for repairing sidewalks on east side of Adams St. between Tillary and Johnson St. and 25 other locations in Heights district, south side of Amity St. between Columbia and Hicks St. and 22 other locations in Heights and Bay Ridge district; west side of Bradford St. between Sutter and Blake Ave. and 21 other locations in New Lots district; regulating and repaving with permanent asphalt pavement on 6-in. concrete base Surf Ave. from West Eighth to West 20th St.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., until noon, Dec. 30, for wood-block pavement in team gangway and wagonway spaces of municipal ferryboats "Bayridge," "Gowanus" and "Nassau," Contract No. 1504. Noted Dec. 16.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., until noon, Dec. 30, for wood-block pavement in team gangway and wagonway spaces of muniicpal ferryboats "Manhattan," "Brooklyn," "Queens," "Bronx" and "Richmond,' Contract No. 1505. Noted Dec. 16.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., until noon, Dec. 30, for wood-block pavement in team gangway and wagonway spaces of municipal ferryboat 'Mayor Gaynor," Contract No. 1506. Noted Dec. 16.

N. Y., Oswego—Plans being prepared by E. A. Howard, County Supt., for improving 150 miles of highway. Estimated cost, $3,000 per mile.

N. Y., Rome—Bids will be received by W. W. Wotherspoon, State Supt. of Pub. Wks., Albany, until Jan. 11, for improving State Canal by building two connecting highways.

N. J., Atlantic City—(Official)—Bids will be received by Board of Chosen Freeholders of Atlantic County, Mays Landing Court House, until Jan. 1, for paving Meadow Blvd. between Atlantic City and Pleasantville. A. H. Nelson, Atlantic City, Consult. Engr. Noted Oct. 21.

N. J., Jersey City—Bids will be received until 11 a.m., Dec. 30, for improving Neptune Ave. from Hudson Blvd. to west of Romar Ave. with brick.

Va., Petersburg—Sum of $25,000 voted by Council as part of fund to be raised for highway between Petersburg and Hopewell.

W. Va., Kingwood—Election will be held Jan. 25 in Preston County, Kingwood District, to vote on $250,000 bonds for road improvements. Noted Nov. 25.

N. C., Concord—City plans to pave Church St. with asphalt from East Buffalo to Mt. Marys St.

N. C., Greensboro—Bonds for $50,000 voted by citizens for street improvements. Noted Nov. 25.

N. C., High Point—Election will be held to vote on $50,000 bonds for improving streets.

N. C., Salisbury—See item under "Sewers."

S. C., Florence—Bids will be received by J. Newton Johnson, Comr. of Streets, until Jan. 11, for paving and constructing sidewalks, C. H. Carlisle, City Engr.

S. C., Greenville—City contemplates paving portions of Westfield, Church and Pettigrue St. and Green Ave., also sidewalks on McCall and Academy St.

Fla., Bradentown—See item under "Bridges."

Fla., Ft. Pierce—See item under "Water-Works."

Ala., Camden—Citizens voted $4,250 bonds for street improvements. E. B. Kay, Tuscaloosa, Engr.

Ala., Dadeville—Bids will be received until Jan. 12 by Commissioners of Tallapoosa County for road from Dadeville to Chambers County line, 14 miles, from Alexander to Dadeville, 14 miles, and from Camp Hill to East Tallassee Highway, 10 miles.

Ala., Huntsville—Bids will be received by M. S. Bingham, Rd. Superv., until Jan. 4, for 2¼ mi. of waterbound macadam road.

Miss., Columbus—Bonds for $85,000 sold by Board of Supervisors of Lowndes County for road improvements.

Ky., Owensboro—Commissioners of Daviess County contemplate expenditure of $50,000 for road construction next year.

Ohio, Hillsboro—(Official)—Bonds for $7,550 sold for road construction. John F. Ridgway, County Audr. Noted Dec. 2.

Ind., Bedford—Bids will be received by E. W. Edwards, Audr., Comrs. of Lawrence County, until 1 p.m., Jan. 4, for roads in Bond Pleasant Run, Shawswick and Guthrie Townships.

Ind., Bloomfield—Bids will be received by G. E. Kidd, Audr., Comrs. of Greene County, until 2 p.m., Dec. 30, for macadamized road in Fairfield Township.

Ind., Bloomington—Bids will be received until 2 p.m., Jan. 4, by W. F. Kinser, Audr., Comrs. of Monroe County, for road in Bloomington Township.

Ind., Boonville—Bids will be received by G. H. Bass, Audr., Comrs. of Warrick County, until 10 a.m., Jan. 4, for two rock roads in Ohio Township.

Ind., Fowler—Bids will be received by W. Mankey, Audr., Comrs. of Benton County, until 1 p.m., Jan. 3, for roads in Grant, Center and Bolivar Townships.

Ind., Goshen—Bids will be received until 10 a.m., Jan. 3, by J. W. Brown, Audr., Comrs. of Elkhart County, for roads in Concord and Harrison Townships.

Ind., Lebanon—Bids will be received by D. M. Clark, Audr., Comrs. of Boone County, until 2 p.m., Jan. 4, for four roads.

Ind., Monticello—Bids will be received by A. G. Fisher, Audr., Comrs. of White County, until 10 a.m., Jan. 4, for road in Monon Township.

Ind., Newport—Bids will be received until 10 a.m., Jan. 3, by R. Slater, Audr., Comrs. of Vermilion County, for road in Clinton Township.

Ind., Paoli—Bids will be received by E. A. Palmer, Audr., Comrs. of Orange County, until 2 p.m., Dec. 31, for road in Northeast Township.

Ind., Shelbyville—Bids will be received by F. W. Fagel, Audr., Comrs. of Shelby County, until 10 a.m., Jan. 5, for road in Liberty Township.

Ind., Spencer—Bids will be received by George W. Stwalley, Audr., Comrs. of Owen County, until 2 p.m., Jan. 4, for gravel roads in Marion and Jackson Townships.

Ind., Vevay—Bids will be received by J. W. Smith, Audr., Comrs. of Switzerland County, until 1 p.m., Jan. 3, for road in York Township.

Ind., Vincennes—Bids will be received until 2 p.m., Jan. 4, by J. I. Muentzer, Audr., Comrs. of Knox County, for gravel roads in Palmyra and Buseron Townships.

Ind., Williamsport—Bids will be received until 2 p.m., Jan. 3, by D. H. Moffit, Audr., Comrs. of Warren County, for four roads.

Ind., Winamac—Bids will be received until noon, Jan. 4, by W. E. Munchenberg, Audr., Comrs. of Pulaski County, for gravel road.

Ill., Edwardsville—Board of Trade, Alton, interested in proposition to induce Madison County to create $1,000,000 bond issue for roads in county in connection with State-Aid Fund.

Ill., Evanston—(Official)—Bids will be received by H. P. Pearsons, Pres., Bd. of Local Improvements, City Hall, until 8 p.m., Jan. 17, for paving, with brick on concrete, portions of Simpson and Bridge St., Leon Pl., Asbury Ave., Grant St., Noyes St., Leonard Pl., Washington Pl., Wesley, Jackson and Ashland Ave. and Payne St. (See adv.)

Ill., Evanston—(Official)—Bids will be received by H. P. Pearsons, Pres. of Bd. of Local Improvements, City Hall, until 8 p.m., Jan. 17, for paving with brick on concrete portions of Bridge and Payne St., County Rd., Noyes St., Dodge Ave., Grant St., Brown, Grey and Hartray Ave. and Pioneer Rd. (See adv.)

Wis., Milwaukee—City appropriated $300,000 for Lake Shore Drive to be built in 1916.

Iowa, Ames—Bids will soon be received for approximately 110 blocks of paving. J. B. Wickham, City Engr.

Iowa, Ft. Madison—City contemplates 18,000 sq.yd. concrete paving, 18,300 sq.yd. brick paving, and 13,000 lin.ft. concrete curb and gutter. R. J. Lewis, City Engr.

Iowa, Greenfield—(Official)—Bids will be received by H. G. Spooner, Town Clk., until 7 p.m., Jan. 20, for about 25,000 yd. paving, 16,000 ft. curbing and small amount of storm-sewer work.

Minn., Windom—County contemplates expenditure of $30,000 next year for road improvements. D. R. Savage, County Rd. Engr.

Kan., Olathe—Bids will be received until noon, Dec. 27, by G. Z. Erns, Clk., for grading and macadamizing hill on either side of Cedar Creek.

Neb., Omaha—Election will be held in Douglas County Apr. 18 to vote on $2,000,000 bonds for road improvements.

Mo., Chillicothe—Bids will soon be received for paving Calhoun St. from Dickenson to Sunset Ave. J. O. Broaddus, City Engr.

Mo., Seymour—Bids will be received until Jan. 5 by Seymour Special Road District for improving roads. Estimated cost, $30,000.

Mo., Waverly—Citizens of Waverly Special Road District voted $49,000 bonds for rock road.

Ark., Harrisburg—Plans being prepared by Morgan Engineering Co., Memphis, Tenn., for seven-mile macadam road for Poinsett County.

Tex., Athens—Commissioners of Henderson County contemplate election to vote on $100,000 bonds for road construction.

Tex., Bastrop—Bastrop County Road District No. 2 will issue $50,000 bonds for road construction.

Tex., Big Sandy—Citizens voted $75,000 bonds for roads.

Tex., Fredericksburg—Citizens of Gillespie County defeated $300,000 bonds for roads. Noted Oct. 21.

Tex., Gilmer—Bonds for $75,000 voted by citizens for roads in Upshur County, Justice Precinct No. 7. Noted Nov. 25.

Tex., Gonzales—Election will be held Feb. 5 to vote on $75,000 bonds for roads in Gonzales County, Road District No. 2.

Okla., Mounds—Election will be held Dec. 28 to vote on $100,000 bonds for road construction.

Idaho, Boise—S. M. Booth, State Highway Engr., preparing plans for 135 mi. of State-Aid highways.

Idaho, Wallace—Commissioners of Kootenai County have agreed to contribute $15,000 toward proposed boulevard through Fourth of July Cañon to connect national highway through Wallace and Cœur d'Alene with Apple Way leading to Spokane. Estimated cost, $45,000. Noted Nov. 4.

Wash., Chehalis—Preliminary surveys made by Lewis County for hard surfacing pavement to be built next year.

Wash., Everett—Election will be held Dec. 28 to vote on bonds for road work in Snohomish County.

Wash., Pomeroy—City Council plans to pave two principal streeets of city.

Ore., Gresham—Commissioners of Multomah County contemplate appropriation of $50,000 for hard surface highway from Gresham to Fairview.

Ore., Hood River—Appropriation of $60,000 made by County Court for road work in 1916.

Ore., Marshfield—Citizens of McKinley Road District plan to raise $19,600 for road work.

Ore., The Dalles—Bids will be received by County Court until Jan. 6 for constructing two roads.

Que., Montreal—Bids will be received until noon, Dec. 27, by Board of Commissioners, City Hall, for furnishing and delivering 70,000 lin.ft. straight curbstone, 3,500 lin.ft. circular curbstone, 15,000 lin.ft. straight granite curb and 750 lin.ft. circular granite curb.

Ont., Ottawa—City Council authorized widening of Rosemont Ave. Estimated cost, $18,111.

Ont., Ottawa—City Council authorized expenditure of $77,660 for paving portion of Rideau St. with wood block and asphalt and wood-block pavement. F. C. Askwith, Engr.

Bids In and Contracts Awarded

Mass., Gloucester—Contract for road construction awarded by State Highway Commission, Boston, to T. A. MOYNIHAN, South Hamilton, at $30,423.

Mass., New Braintree—State Highway Commission, Boston, awarded contract for road construction to COLUMBUS CONSTRUCTION CO., 16 Foster St., Boston, at $7,790.

N. Y., Buffalo—GERMAN ROCK ASPHALT AND CEMENT CO., D. S. Morgan Bldg., Buffalo, at $13,140, awarded contract for paving Peckham St. Noted Nov. 4.

N. Y., New York—(Borough of Manhattan)—(Official)—Contract for regulating and repaving 151st St. from west side of Seventh Ave. to east side of McCombs Pl. awarded to UVALDE ASPHALT PAVING CO., New York, at $4,329. Noted Dec. 2 and 9.

N. Y., Yonkers—HANNIFAN CO., at $8,498, awarded contract for improving Ellsworth Ave. and at $6,297, for Amberson Ave.

N. J., Bayonne—Contract for improving Avenue A awarded to ILLINOIS SURETY CO., 170 Broadway, New York, N. Y., at $6,668.

N. J., Hackensack—FRANKLIN VAN RODEN, East Rutherford, at $18,560, awarded contract for improving Meadow Rd. and Rutherford Ave.

W. Va., Charleston—W. D. WEAVER, Charleston, at $33,237, awarded contract for 1¾ miles of road, from Porter's Hollow to Kanawha City, by Commissioners of Kanawha County.

N. C., Westfield—C. C. JORDAN awarded contract for road construction in Westfield Township. About $30,000 available for road work.

Fla., Arcadia—Contract for 36 miles of road awarded to J. W. FARR, Wauchula, at $42,806, by Commissioners of De Soto County.

Ala., Bay Minette—L. C. ROLLINSON, Montgomery, at $5,774, awarded contract for first section of road from Point Clear to Fairhope; Abraham Bros. & Giddens, Montgomery, at $15,077, submitted lowest bid for second section. Noted Dec. 2.

Miss., Edwards—Contract for 6½ miles of gravel road awarded to HINDS COUNTY HIGHWAY CONSTRUCTION CO., Clinton, and T. JACKSON, Clinton. Noted Aug. 19 and Nov. 18.

Miss., Kosciusko—Contract for 39 miles of sand clay and two miles of gravel roads awarded to F. V. HARVEY & CO., Memphis, Tenn., at $38,008. Noted Oct. 28.

Tenn., Maryville—Contract for three miles of road in Blount County awarded to OLIVE & HILL, Knoxville.

Ky., Murray—C. D. McQUARRY, Adams, Tenn., at $7,460, awarded contract for first two miles of highway from Pine Bluff on Tennessee River toward Murray.

Ohio, Washington—(Official)—Contract for improving a number of streets awarded to GEORGE H. HEFFNER & SON, Celina, at $1.80 per sq.yd. Noted Dec. 9.

Ind., Brazil—PFIZENMAYER CONSTRUCTION CO., Terre Haute, at $1.17 and $1.35 per sq.yd. respectively, awarded contract for paving Blaine and Alabama St. with brick.

Mo., East St. Louis—(Official)—Meyer & Thomas, at $21,227, submitted lowest bid for paving Broadway from Third St. to St. Clair Rd. Noted Oct. 7.

Minn., Pine City—(Official)—Contract for Elwell Rd. awarded to C. J. PEARSON & CO., Sandstone, Minn., at $48,042. Noted Dec. 9.

Kan., Newton—Contract for paving about two miles on North and South Main St. awarded to A. JAICKS CONSTRUCTION CO., American Bank Bldg., Kansas City, Mo.

Mo., Kansas City—Contract for paving 17th and Belleview St. awarded to A. JAICKS CONSTRUCTION CO., American Bank Bldg., Kansas City, at $5,450 and $4,633, respectively.

Mo., Warrensburg—Contract for paving a number of streets with brick awarded to J. W. MENEFEE, Sedalia, Mo., at $1.56 per yd.

Tex., Houston—Horton & Horton, at $7,905, submitted lowest bid for paving a number of streets of city.

Tex., San Antonio—TEXAS BITULITHIC CO. awarded contract for paving River Ave. with bitulithic.

Colo., Del Porte—Contracts for eight miles of State Primary Rd. No. 60 awarded to J. E. SHEEHAN, Larkspur, at $9,685, for Section 1, and LOGAN & WEST, Pagosa Springs, at $8,460, for Section 2. Noted Dec. 2.

N. M., Roswell—Cleveland-Trinidad Co., Cleveland, Ohio, at $1.50 per sq.yd., submitted lowest bid for paving Fifth St. from Garden to Pennsylvania Ave.

Wash., Bellingham—Independent Asphalt Paving Co., at $5,062, submitted lowest bid for improving Kentucky St.

Wash., Bellingham—K. Sauset, at $6,321, submitted lowest bid for improving West Holly St. with brick with asphalt covering; J. M. Riddle, at $5,790, with brick without asphalt covering.

Wash., North Yakima—CASCADE CONSTRUCTION CO., Seattle, at $4,935, submitted lowest bid for Permanent Highway No. 17. Noted Dec. 16.

Wash., Seattle—Contract for paving Hamlin St. awarded to P. J. McHUGH, Seattle, at $15,926.

Wash., Seattle—L. COLLUCCIO, 1642 Lane St., Seattle, at $6,352, awarded contract for grading 28th Ave., N. E.

Wash., Seattle—CITY CONTRACTING CO., 1319 21st Ave., S., Seattle, at $27,115, awarded contract for paving Western Ave.

Ore., Portland—Contract for paving Union Ave. from Bryant St. to Columbia Blvd. awarded to OREGON INDEPENDENT CO., at $29,950.

Ore., Portland—Contract for paving East 28th St. and Francis Ave. District in Kenilworth awarded to OREGON HASSAM PAVING CO., at $41,366.

Calif., El Centro—(Official)Bids were received Dec. 6 by State Highway Commission, Sacramento, for 12 miles of concrete highway between Dixieland and El Centro as follows: Fred Hoffman, Long Beach, $72,089; Doran, Armstrong & Daley, San Diego, $83,099; Mesmer & Rice, Los Angeles, $87,512. Noted Nov. 25.

Calif., Ontario—Contract for paving A St. and Bon View Ave. awarded to J. L. FRAZER, Long Beach, at $21,634.

Calif., Richmond—Contract for improving a number of streets awarded to MUNICIPAL IMPROVEMENT CO., 803 Macdonald Ave., Richmond, at $7,006.

Calif., Salinas—Contract for Castroville-Monterey Rd. awarded to GRANITE ROCK CO. at $38,542.

Calif., San Francisco—Contract for improving 24th Ave. awarded to OWEN McHUGH at $9,979.

INDUSTRIAL WORKS

Proposed Work

Maine, Waterville—J. E. McCormick & Son leased property at Waterville and will build two-story, 40x150-ft. warehouse. Estimated cost, $12,000.

Mass., Boston—(Allston)—Plans being prepared for automobile warehouse on Commonwealth Ave. for George Grow. Estimated cost, $150,000.

Mass., Malden—H. H. Kelley Co., 230 Purchase St., Boston, will build two-story, 40x120-ft. factory. McNaughton & Robinson, 101 Tremont St., Boston, Arch.

Mass., Worcester—Plans prepared by E. T. Chapin, Arch., for three-story, 60x100-ft. addition to plant of New England Corset Co.

R. I., Providence—Terminal Warehouse Co. will build one-story, 100x300-ft. addition to warehouse on Allens Ave.

Conn., Putnam—Manhasset Manufacturing Co. will build two-story, 120x180-ft. addition to plant on Canal St.

N. Y., Bath—Borden Condensed Milk Co. will establish plant at Bath. Estimated cost from $20,000 to $25,000.

N. J., Elizabethport—(Elizabeth post office)—Bids will soon be received for two-story machine shop for S. L. Moore Son Corporation. Estimated cost, $160,000. Ring, Cleaves, Graham Co., 280 North Broad St., Elizabeth, Arch.

N. J., Trenton—Plans prepared for three-story, 200x350-ft. addition to plant of Ajax-Grieb Rubber Co. Samuel M. Green Co., Arch. Noted Sept. 30.

Penn., Coatesville—Midvale Steel and Ordnance Co. will construct additions to its plant. Estimated cost, $6,000,000.

Penn., New Galilee—Beaver Clay Co., Beaver, will build plant. Estimated cost, $100,000. Mitchel Baker, Beaver, Engr.

Penn., Philadelphia—Belmont Iron Works plans 92x108-ft. hammer shop at Milnor and Bleight St. Estimated cost, $10,000.

Penn., Philadelphia—Bids will soon be received for three- or four-story mill and power house at Reed, Dickinson, 25th and 26th St. for S. B. & B. W. Fleisher, Eighth and Chestnut St. William Steel & Sons Co., 1600 Arch St., Philadelphia, Arch. Noted Dec. 9.

Penn., Westfield—Preliminary plans being prepared by Pierce & Bickford, Arch., 118 Lake St., Elmira, N. Y., for two-story, 50x200-ft. welt house for Everly Tannery. Estimated cost, $30,000.

D. C., Washington—Plans being prepared for two-story, 55x145-ft. garage for Thomas W. Smith. Estimated cost, $30,000.

Va., Lynchburg—Lynchburg Diamond Ice Co. will build warehouse. G. A. Barnett, Mgr.

Va., Norfolk—S. D. Scott & Co. will rebuild grain elevator recently destroyed by fire.

Va., Norfolk—Plans being prepared by B. F. Mitchell, Norfolk, for three-story, 128x166-ft. warehouse on Dunmore St. for Southgate Terminal Corporation.

W. Va., Wheeling—Wheeling Steel and Iron Co. contemplates combination sheet and bar mill. Estimated cost, $200,000. I. M. Scott, Pres., Main and South St., Wheeling.

S. C., Woodruff—Woodruff Cotton Mills will build four-story, 80x124-ft. addition to plant.

Fla., Jacksonville—Eagle Film Manufacturing and Producing Co. will build plant at Jacksonville. M. F. Kellt, Supt. local plant.

Fla., Miami—Coöperative Ice and Cold Storage Co. will build cold-storage plant.

Fla., Mulberry—Mulberry Explosives and Supply Co. will build 50x120-ft. plant. Amos H. Norris, Mgr.

Tenn., Bristol—G. L. Archeuline will build abattoir. Estimated cost, $60,000.

Tenn., Bristol—Bristol Grocery Co. will erect building at Bristol. Estimated cost, $50,000.

Tenn., Chattanooga—Cameron & Barr Co. contemplates bakery. Estimated cost, $55,000.

Ohio, Celina—(Official)—Bids will be received until Jan. 3 for addition to plant of Mersman Bros. & Brandt. Estimated cost, $15,000. Noted Dec. 2.

Ohio, Cleveland — Abbott Realty Co., 5606 Euclid Ave., Cleveland, will build factory and office building at East 61st St. and Euclid Ave. Estimated cost, $100,000.

Ohio, Cleveland—Preliminary plans being prepared for two-story factory for Cleveland Galvanizing Works. W. J. Carter, 1423 Illuminating Bldg., Cleveland, Arch.

Ohio, Cleveland—Sheriff Street Market and Cold Storage Co. plans to build cold-storage plant. Estimated cost, $500,000.

Ohio, Collinwood—Plans being prepared for one-story, 75x225-ft. and 75x100-ft. forging plant for Horsburgh Forging Co.

Ohio, Martins Ferry—It is reported that American Seamless Tube Co., Inc., will build plant. Estimated cost, $2,000,000.

Ohio, Martins Ferry—La Belle Box Co. contemplates building two-story box factory. Estimated cost, $25,000. Martin L. Maxwell, Mgr.

Ohio, Toledo—Toledo Furnace Co. plans blast furnace and steel plant. Estimated cost, $5,000,000.

Ind., Rushville—National Serum Co. purchased site at Rushville and will build plant. Estimated cost, $100,000.

Mich., Kalamazoo—Riverview Coated Paper Co. will build plant. Estimated cost, $400,000.

Ill., Chicago—Plans being prepared for four-story factory for American Ever Ready Works. S. Scott Joy, 1118 West 35th St., Chicago, Arch.

Ill., Chicago—Plans being prepared by S. Scott Joy, Arch., 1118 West 35th St., Chicago, for four-story factory for Central Bag Manufacturing Co., 1545 West 35th St.

Ill., North Chicago—Pfanstiehl Electric Laboratory contemplates building two-story, 35x130-ft. factory. Carl Pfanstiehl, Pres.

Ill., Watertown—Bids will be received until 3 p.m., Dec. 27, by Frank D. Whipp, Fiscal Superv. Ed. of Administration, for addition to laundry of Watertown State Hospital.

Wis., De Pere—Bids will be received in spring for two-story, 60x106-ft. factory for Western Steel and Iron Works.

Wis., Madison—Preliminary plans being prepared for plant for French Battery and Carbon Co. J. B. Ramsey, Pres.

Wis., Manitowoc—Plans being prepared for three-story, 60x80-ft. warehouse for J. F. Kapple & Co., South 15th St. Juul & Sixta, 107 North Eighth St., Manitowoc, Arch.

Wis., Milwaukee—Plans being prepared by F. W. Andree, Arch., 77 Cawker Bldg., Milwaukee, for four-story, 75x150-ft. manufacturing building for Wallace Realty Co.

Wis., New Richmond—Bids will be received about Dec. 27 by Gardner & Linberg, Arch., 140 South Dearborn St., Chicago, Ill., for three-story, 80x120-ft. reinforced-concrete packing plant for Inter-County Coöperative Packing Co. Estimated cost, $100,000. Noted Nov. 11.

Wis., Oshkosh—(Official)—Bids will soon be received for two-story, 40x80-ft. factory for Carver Ice Cream Co., 714 South Main St. Fluor Bros. Construction Co., 511 State St., Arch. Estimated cost, $15,000. Noted Dec. 16.

Wis., Sheboygan—Gutsch Brewing Co. will rebuild brewery recently destroyed by fire. Estimated cost, $20,000.

Iowa, Creston—It is reported that Charles B. Elliot, local agent for Ford Motor Co. plans two-story brick garage at West Mills and Maple St. Estimated cost, $15,000.

Iowa, Des Moines—Marks Hat Co. will build two-story, 44x150-ft. addition to factory at 213 Third St. Estimated cost, $20,000.

Minn., Hopkins—Plans prepared for one-story, 100x290-ft. plant for American Improved Seat Co. Haugen & Newstrom, Iron Exchange Bldg., Minneapolis, Arch. Noted Oct. 14.

Minn., Mankota—Plans prepared for two-story, 66x130-ft. factory for Hugo Shirt Co. Estimated cost, $18,000.

Minn., St. Paul—American Can Co., 747 North Prior Ave., will build addition to plant in Midway District. Estimated cost, $100,000.

Minn., St. Paul—(Official)—Bids will be received about Jan. 10 by C. H. Johnson, Arch., 715 Capital Bank Bldg., St. Paul, for three-story, 100x150-ft. plant for Brown, Blodgett & Sperry Co. Noted Dec. 9.

Minn., St. Paul—Chevrolet Motor Car Co., Flint, Mich., will build assembling plant at St. Paul. Estimated cost, $300,000.

Minn., St. Paul—Lead Coating Manufacturing Co., subsidiary of Brown Sheet Iron and Steel Co., will build plant at Berry and Pearl St. Estimated cost, $100,000.

Minn., St. Paul—F. G. Leslie Paper Co. will erect building at 248 East Fourth St. Estimated cost, $250,000.

Kan., Augusta—It is reported that Wichita Ice and Cold Storage Co. will build ice plant and cold-storage house. Estimated cost, $12,000.

Kan., Osborne—Plans being prepared for ice plant for H. B. Vinning, 503 Finance Bldg., Kansas City.

Kan., Overland Park—Swanson St. Joseph Plow Manufacturing Co. will build factory. Estimated cost, $15,000. H. S. Swanson, Pres.

Wyo., Lowell—Big Horn Basin Sugar Co., branch of Great Western Sugar Co., Denver, Colo., will build factory at Lowell.

Mont., Livingston—Charles Garnier, Sr., contemplates building cigar factory.

Mo., St. Louis—Plans being prepared by T. P. Barnett Co., Central National Bank Bldg., St. Louis, Arch., for ten-story factory for Blanton Co.

Mo., St. Louis—Brilliant Sign Co. purchased site at St. Louis, and will build four-story plant.

Tex., Abilene—See item under "Buildings."

Tex., Beaumont—Plans being prepared for two-story building at Park and Washington St., for Phelan-Josey Grocery Co. Estimated cost, $40,000.

Tex., Dallas—(Official)—Bids will be received until Jan. 10 for mattress factory for T. B. Burnett & Co. Estimated cost, $65,000. Noted Dec. 9.

Tex., Dallas—Pierce-Fordyce Oil Association will build warehouse. Estimated cost, $38,000.

Tex., El Paso—Perry-Kirkpatrick Co. will erect warehouse. Estimated cost, $18,000.

Tex., Ft. Worth—John B. Laneri will build two-story, 60x100-ft. warehouse on East Elizabeth St. Estimated cost, $14,000.

Tex., Laredo—North Laredo Packing Co. plans to build cold-storage and pre-cooling plant.

Tex., Tyler—Tyler Ice Co. plans two-story, 38x112-ft. brick and concrete factory.

Tex., Waxahachie—Waxahachie Cotton Mill will build two-story, 57x150-ft. addition to factory.

Okla., Altus—It is reported that Interstate Compress Co. will rebuild its plant recently destroyed by fire. Estimated cost, $100,000.

Okla., Tulsa—Right Way Laundry will build laundry. Estimated cost, $10,000.

Colo., Buena Vista—(Official)—Bids will be received until Jan. 30 for smelting and cyanide plant for National Manufacturing and Constructing Co. Estimated cost, $150,000. Noted Dec. 2.

Colo., Pueblo—Weaver Investment Co. will build garage on Ninth St. Estimated cost, $25,000. R. J. Weaver, Pres.

Idaho, Filer—Volger Seed Co., Salt Lake City, Utah, purchased site at Filer and will build warehouse and grain elevator.

Utah, Brigham—Utah-Idaho Sugar Co. will build factory. Estimated cost, $1,000,000.

Wash., Spokane—Plans prepared for five-story, 100x150-ft. warehouse for E. H. Stanton Co. Estimated cost, $100,000.

Wash., Spokane—Reported that Western Soap Co. plans to enlarge factory. Estimated cost, $20,000.

Ore., Albany—Plans prepared for mill for Thomas Pulp and Paper Co. Estimated cost, $750,000. Noted Oct. 7.

Ore., Oregon City—Hawley Pulp and Paper Co. plans addition to mill. Estimated cost, $500,000. W. P. Hawley, Sr., Pres.

Calif., San Francisco—Ford Motor Co. will build five-story reinforced-concrete addition to assembling plant at 21st and Harrison St. J. B. Lund, Mgr.

Ont., Hamilton—Canadian Cartridge Co., Ltd., will enlarge its plant and install new equipment. Estimated cost, $500,000. F. W. Bathlie, Pres.

Ont., Hamilton—Steel Co. of Canada will build additions to plant.

Ont., Toronto—W. H. Harris will build warehouse on Richmond St. Estimated cost, $18,000.

B. C., Port Moody—Plans being prepared for steel plant for Port Moody Steel Works, Ltd. Noted Nov. 28.

Bids In and Contracts Awarded

Mass., Everett—Broad Gauge Iron Works, 77 Portland St., Boston, awarded contract for factory at Everett to CLARK & LEE, 201 Devonshire St., Boston. Estimated cost, $12,000.

Mass., Worcester—Contract awarded to E. J. CROSS CO., 82 Foster St., Worcester, for four-story, 63x106-ft. concrete mill for Worcester Woolen Co. Noted Nov. 18.

R. I., Woonsocket—Contract for four-story, 120x278-ft. addition to Nyanaza Mills, two-story, 100x130-ft. picker room and four-story, 68x100-ft. store room awarded to TORRINGTON BUILDING CO., Torrington, Conn.

Conn., Stamford—(Official)—Contract for rolling mill on Fairfield Ave. for American Cupro Nickel Co. awarded to S. A. GREGORY, Stamford. Estimated cost, $20,000. Noted Dec. 16.

N. Y., Buffalo—Contract awarded to SCHAFF CO., Mutual Life Bldg., Buffalo, for garage for Charles M. Peabody, 588 Main St. Estimated cost, $20,000. Noted Dec. 16.

N. Y., Rochester—Best Yet Laundry Co. awarded contract for two-story, 55x138-ft. laundry to J. L. STEWART, 126 North Water St., Rochester.

N. Y., Rochester—Contract for one-story, 168x264-ft. factory for North East Electric Co. awarded to A. LINK, 654 South Ave., Rochester. Estimated cost, $20,000.

N. Y., Rochester—Rochester Motor Co. awarded contract for one-story, 62x150-ft. plant to DUNNING & SCOTT, 53 Ardmore St., Rochester. Estimated cost, $10,000.

N. Y., Syracuse—Contract awarded to D. W. NICHOLSON, 514 Turtle St., Syracuse, for 70x140-ft. plant for Crucible Steel Co. of America. Estimated cost, $15,000.

N. Y., Syracuse—Syracuse Malleable Iron Works awarded contracts for one-story, 110x150-ft. foundry to WILLIAMS BRIDGE CO., for structural steel and iron and to DAWSON BROS., for masonry.

N. J., Newark—Contract for bottling plant on Waverly Ave. for Seiler Bros., Inc., awarded to WILLIAM G. SHARWELL & CO., at $29,950.

Penn., Berwyn—Contract for ice-storage building for Bryn Mawr Ice Manufacturing Co., Bryn Mawr, Philadelphia, awarded to HERMAN VOIGHT, Philadelphia.

Penn., Philadelphia—Contract for one-story, 60x550-ft. machine shop for Midvale Steel Co. awarded to BARCLAY WHITE CO., Perry Bldg., Philadelphia.

Penn., Philadelphia—General contract for four-story, 54x192-ft. factory for Schaum & Uhlinger, Inc., awarded to WILLIAM STEELE & SONS CO., 1600 Arch St., Philadelphia. Estimated cost, $15,000.

Penn., Philadelphia—Contract awarded to A. RAYMOND RAFF, 1635 Thompson St., Philadelphia, for two-story, 50x100-ft. foundry for Schneider-Bowman Co.

Penn., Philadelphia—Contract for seven-story factory at 10th and Filbert St. for Samuel Sternberger awarded to FREUND-SIEDENBACH CO., Bulletin Bldg. Estimated cost, $25,000.

Penn., Pottstown—Contract for two-story, 134x170-ft. plant for National Rubber Co., Pottstown, awarded to JAMES H. WELLS, Heed Bldg., Philadelphia. Estimated cost, $100,000. Noted Nov. 25.

Penn., South Bethlehem — Bethlehem Steel Co. awarded contract for concrete work for addition to machine shop No. 2 to WILLIAM STEELE & SONS CO., Arch St., Philadelphia, at about $100,000. Noted Sept. 23.

Del., Wilmington—Contract awarded to JOHN E. HEALY & SON for two-story, 50x100-ft. garage for L. McKee. Estimated cost, $20,000.

D. C., Washington—Contract for two-story, 33x130-ft. garage for John H. Schwarzmann awarded to M. A. WELLER, 814 14th St., Washington. Estimated cost, $15,000.

D. C., Washington—Contract for two-story, 30x60-ft. garage for R. E. Trimble and F. M. Clark awarded to JAMES C. MARSH. Estimated cost, $10,000.

D. C., Washington—Contract for one-story garage for J. H. Wurdemann awarded to RICHARDSON & BURGESS, Washington. Estimated cost, $15,000.

W. Va., Wheeling—Wheeling Mold and Foundry Co. awarded contract for two-story, 57x140-ft. addition to foundry to R. R. KITCHEN CO. Estimated cost, $10,000. Noted Sept. 23.

Ga., Atlanta—Contract awarded to SOUTHERN FERRO CONCRETE CO., Atlanta, for ice-storage house and shipping platform at Inman Yards for Atlantic Ice and Coal Corporation. Estimated cost, $25,000.

Ga., Augusta—General contract awarded to O. T. BROWN, Augusta, for two- and three-story, 76x146-ft. bakery for H. H. Claussen Baking Co. Estimated cost, $40,000.

Ky., Lexington—Chesapeake & Ohio Railway awarded contract to COMBS LUMBER CO., Lexington, for roundhouse, storehouse, office and club house in Netherland Yards. Estimated cost, $30,000.

Ohio, Columbus—Columbus Bank Note Co., 66 East Gay St., awarded contract for two-story reinforced-concrete factory at 46 East Spring St. to C. R. CURRAN CONSTRUCTION CO. Estimated cost, $16,000.

Ohio, Norwood—Contract awarded to FERRO CONCRETE CONSTRUCTION CO., Richmond and Harriet St., Cincinnati, for factory for Ault & Wiborg. Estimated cost, $75,000.

Ohio, Shadyside—Addition to plant of Belmont Casket Co. will be built by day labor. Estimated cost, $20,000. Noted Dec. 16.

Mich., Detroit—Detroit Battery Co. awarded masonry contract for three-story, 70x90-ft. factory to P. C. SCHULTZ.

Mich., Detroit—Regan & Jones Pie Co. awarded contract for one-story factory on Russell St. to OVERLAND CONSTRUCTION CO. Estimated cost, $14,000.

Ill., Chicago—Contract for five-story factory for J. N. Eisendrath Co. awarded to M. RAUEN, 111 West Washington St., Chicago.

Ill., Chicago—Contract for one-story garage at 5016 Cottage Grove Ave. for Louis Neroman awarded to HENRY ERICSON. Estimated cost, $18,000.

Ill., Chicago—Contract for five-story warehouse at 2114 Carroll Ave., for Vauglin & Bushnell awarded to R. SOLLITT & SONS. Estimated cost, $30,000.

Ill., Chicago—Contract awarded to A. T. KRAMER for one-story factory at 1515 Dayton St., for E. H. Wach. Estimated cost, $35,000.

Ill., Clearing—Wilson & Bennett Manufacturing Co. awarded contract for two-story, 100x200-ft. plant to PETER OLSON CO. Estimated cost, $55,000.

Ill., North Chicago—Contract for two tanneries for Wilder-Manning Co. awarded to JOHN H. SUTTER, 30 North La Salle St., North Chicago.

Wis., Racine—West Side Laundry Co. awarded contracts for laundry to BONDGARD & CHRISTENSEN, mason and concrete, and ROBERTS CO., cut stone. Estimated cost, $15,000.

Iowa, Des Moines—(Official)—Contract for three-story, 45x160-ft. warehouse for Farmers' Coöperative Products Co. awarded to BENSON & MARXER, Des Moines. Estimated cost, $40,000. Noted Dec. 16.

Minn., Rochester—Contract awarded to G. SCHWARTZ & CO., Rochester, for two-story, 74x95-ft. garage for Case Auto Co. Estimated cost, $20,000.

Mo., Kansas City—Nafziger Baking Co. will build two-story, 50x100-ft. bakery by day labor. Estimated cost, $40,000. Noted Nov. 11.

Mo., St. Louis—Contract for one-story, 78x131-ft. bottling shop for Griesedieck Bros. Brewing Co. awarded to J. H. REMMERS, 2040 Russell St., St. Louis.

Tex., Galveston—Contract for rebuilding packing plant of Armour & Co., recently destroyed by fire, awarded to M. L. MOODY & CO., Chattanooga, Tenn. Estimated cost, $60,000. Noted Sept. 23.

Okla., El Reno—El Reno Mill and Elevator Co. awarded contract for additions to plant to LEHRACK CONTRACTING AND ENGINEERING CO., Kansas City, Mo. Estimated cost, $40,000.

Wash., Seattle—Bids were received Dec. 1 for four-story addition to warehouse on Whatcom Ave. for Port of Seattle Commission from Kiehl & Whipple, Central Bldg., Seattle, $32,867; Kieburtz & Smith, $35,600; Beers Building Co., $36,200. Noted Nov. 18.

Calif., Colton—Contract awarded to LEONARDT & PACK, H. W. Hellman Bldg., Los Angeles, for cold-storage plant and loading platform at Colton for Pacific Fruit Express Co. Estimated cost, $25,000.

Calif., San Francisco—Contract for three-story tobacco factory at Fourth and Brannan St. for John Bollman Co. awarded to LANGE & BERGSTROM, Sharon Bldg., San Francisco, at $135,000.

FEDERAL GOVERNMENT WORK

Proposed Work

R. I., Newport—Shelving, Racks, etc. — Bids will be received by H. R. Stanford, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Jan. 8, for metal shelving, portable steel racks, steel boxes, etc., at naval torpedo station, Newport, R. I.

W. Va., Wheeling—Power Houses—Bids will be received at U. S. Engineer Office, Wheeling District, Wheeling, until 11 a.m., Jan. 22, for fireproof power houses at Dams Nos. 16 and 17, Ohio River. (See adv.)

N. C., Shelby—Post Office— Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 26, for U. S. post office at Shelby.

Iowa, Washington—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 28, for U. S. post office at Washington.

Colo., Montrose—Canal Work—Bids will be received at office of U. S. Reclamation Service, Montrose, until 4 p.m., Jan. 18, for about 9½ mi. of Peach Valley Lateral, Uncompahgre Valley Project, vicinity of Austin. (See adv.)

Wash., Ellensburg—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 27, for U. S. post office at Ellensburg.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Brooklyn)—Dredging—Contract for dredging at navy yard awarded to COASTWISE DREDGING CO., Norfolk, Va., at 25⅞c. per cu.yd. Noted Nov. 18 and Dec. 16.

S. C. Charleston—Cranes—Contracts for shipbuildig equipment at Charleston awarded as follows: Cranes to McMYLER INTERSTATE CO., Bedford, Ohio, $23,490; ways to SIMONS-MAYRANT CO., Charleston, $19,073. Noted Oct. 14 and Nov. 25.

Fla., Pensacola—Paving—Contract for concrete pavement at navy aëronautic station, Pensacola, awarded to C. H. TURNER CO., Pensacola, at $9,489. Noted Nov. 11 and Dec. 9.

Ky., Louisville—Lock Bridges—Milwaukee Bridge Co., 1400 34th St., Milwaukee, Wis., at $23,717, submitted lowest bid for swing bridge over locks of Louisville and Portland Canal. Noted Nov. 11.

Mo., Moberly—Remodeling Post Office—Contract for remodeling post office at Moberly awarded to ORIGINAL CABINET CO., Evanston, Ill., at $31,450. Noted Sept. 23 and Oct. 21.

Tex., El Paso—Canal Work—U. S. Reclamation Service awarded contracts for canal work as follows: TOOHEY & JOHNSON, Phœnix, Ariz., at $23,000, for approximately 162,000 cu.yd. of earthwork for Leasburg Canal and Piacache Branch Canal; H. E. WILLIAMS, El Paso, at $3,149, for earthwork on San Elizaro feed canal near Ysleta; JOHN MULLIGAN, El Paso, at $2,838, for earthwork on San Elizaro feed canal. Noted Oct. 28.

Hawaii, Pearl Harbor—Buildings—J. L. YOUNG, Honolulu, H. T., at $26,100, awarded contract for power house, operating building and double quarters for chief operators at Naval Station, Pearl Harbor. Noted Nov. 4 and 11 and Dec. 9.

Hawaii, Pearl Harbor—Marine Railway—Bids were received Dec. 18 for marine railway at naval station, Pearl Harbor, (a) structural steel ship cradle complete with rollers and roller frames delivered at bidder's plant, (b) same delivered at Pearl Harbor, (c) materials for construction of engine house delivered at bidder's plant, (d) same delivered at Pearl Harbor, (e) electrically driven hoist, wire rope, bilge block chains, etc., delivered at bidder's plant, (f) same delivered at Pearl Harbor, (g) piling and concrete work, including steel reinforcement and steel roller paths, etc., (h) erection of steel ship cradle, (i) erection of house for hoist, (j) erection of electrically driven hoist, as follows: Spalding Construction Co., San Francisco, Calif., (a) $24,337, (b) $30,446, (c) $3,334, (d) $4,485, (e) $38,110, (f) $48,102, (g) $45,173, (h) $6,363, (i) $1,400, (j) $1,750; Lenher Engineering Co., 100 Broadway, New York, N. Y., (e) $26,970; United States Steel Products Co., 30 Church St., New York, N. Y., (a) $21,906, (b) $26,578, (c) $3.000, (d) $3,680. Noted Oct. 21 and Nov. 25.

CANALS, DITCHES—IRRIGATION

Proposed Work

Mass., Boston—Dredging—Bids will be received until noon, Dec. 27, by Directors of Port of Boston for dredging 35,000 cu.yd. in Neponset River. Noted Oct. 7.

N. Y., New York—(Borough of Manhattan)—(Official)—Dredging—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., until noon, Dec. 29, for dredging slip on east side of Pier No. 21, East River, Contract No. 1487.

Fla., New Symrna—Drainage—Preliminary surveys being made by Isham Randolph & Co., Consult. Engr., Jacksonville, for draining about 43,000 acres for Lake Ashby Drainage District. Estimated cost, $300,000. Noted Dec. 2.

Iowa, Clarinda—Ditch—Bids will be received about Feb. 1 by C. W. Duke, Audr. of Page County, for ditch five miles long. A. S. Can Sandt, Engr.

Iowa, Emmetsburg—Drainage—Contracts will be awarded in March for drainage ditch for Des Moines River Valley. Estimated cost, $105,000. G. R. Campbell, Emmetsburg, Engr. Noted Dec. 9.

Minn., Walker—Ditch—Contract will be awarded about Feb. 2 for D. L. Frazier Ditch. Estimated cost, $29,000. A. W. Moulster, Pine River, Engr.-in.-charge.

Minn., Willmar—Ditch—Lake Lillian Judicial Ditch will be 60 miles long. Estimated cost, $143,934. John Norgaard, Granite Falls, Engr.

Kan., Topeka—Ditch—Bids will soon be received by East Side Drainage District for drainage ditch in Shungnunga Creek. G. E. Burnam, 1202 East Sixth St., Topeka, interested.

Ark., Marion—Canals—Plans being prepared by Willis A. Ayres, Memphis, Tenn., for canals and ditches in connection with Arkansas Drainage Districts. Estimated cost, $250,000.

Tex., Alpine—Irrigation—Jackson & Harmond will build pumping plant and irrigation system.

Tex., Ballinger—Irrigation—Anton Mika will install pumping plant on Colorado River and construct irrigation system to irrigate 150 acres.

Tex., Mercedes—Irrigation—John T. Beamer Co., Chicago, Ill., purchased holdings of American Rio Grande Land and Irrigation Co. and will construct pumping plant and extend irrigation-canal system. Estimated cost, $3,000,000.

Tex., San Antonio—(Official)—Irrigation—Plans prepared for reservoir and to install pumping plant to irrigate 3,017 acres in Leon Springs Valley, Bexar County, for Leon Springs Irrigation Co. Noted Nov. 25 under Leon Springs, Tex.

N. M., Columbus—Irrigation—M. L. Barringer will install irrigation pumping plant.

N. M., Dexter—Irrigation—H. W. Goodner plans to install irrigation pumping plant at Dexter.

Idaho, Caldwell—(Official)—Irrigation— Citizens defeated $27,000 bond issue in Caldwell Irrigation District for repairing and enlarging system. Noted Dec. 2.

Ariz., Walnut Grove—Dam—Plans prepared for reinforced-concrete dam across Hassayampa River to irrigate 17,600 acres for E. Whitman, Philadelphia, Penn.

Calif., Colusa—Irrigation—Blevins Mallon Ditch Co. applied to State Water Commission for permit to appropriate waters of Sacramento River to irrigate about 2,000 acres in Colusa County.

Calif, Colusa—Irrigation—Cheney Slough Irrigation District plans irrigation in Colusa County. B. H. Mitchell interested.

Calif., Paradise—Irrigation—Citizens petitioned Board of Supervisors for organization of irrigation district to build two storage reservoirs. Estimated cost, $150,000.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Manhattan)—(Official)—Dredging—P. Sanford Ross, Inc., 277 Washington St., Jersey City, N. J., at $0.30 per cu.yd., submitted only bid for dredging North River from 103 to 109th St., 33,000 cu.yd. Noted Dec. 9.

Ind., Ridgeville—(Official)—Ditch—Contract awarded to T. A. ERWIN, Greenville, Ohio, at $22,348, for ditch.

Iowa, Denison—Ditch—Contract awarded to LANA CONSTRUCTION CO., Council Bluffs, for laterals Nos. 1 and 2 of Boyer Ditch No. 1, and 13,000 cu.yd. excavation near Arion.

Minn., Bemidji — (Official) — Ditch — Contract for Judicial Ditch No. 36 awarded to JOHNSON & BAUNN, Superior, Wis., at $194,238. Noted Dec. 2.

Tex., Corpus Christi—Drainage—All bids received Dec. 6 for ditches for Drainage District No. 2, Nueces County, rejected as being too high. Noted Dec. 2 under Robstown, Tex.

Tex., Victoria—Drainage—Contract for improving Drainage District No. 3 awarded to J. B. ARPIN & DRAINAGE CO., Houston, at $126,188. Noted Sept. 30.

MISCELLANEOUS

Proposed Work

N. Y., Medina—Improving Dock Wall—Bids will soon be received by W. W. Wotherspoon, State Supt. of Pub. Wks., for improving dock wall and grading and resurfacing site near Church St.

N. Y., New York—(Official)—Steel Float—Contract will soon be awarded for steel float 110 ft. long by 50 ft. wide by 10 ft. deep, of ¼-, ⅜- and ½-in. plate, with channel iron framed interior. All to be knocked down ready for export shipment. Time of delivery, four-five months. Delivery east of Mississippi. (See adv.)

N. Y., New York—Steel Tubing—Sociedad General De Represenantaciones, Madrid, Spain, has a quantity of flush-joint steel tubing in the following sizes: 273x260x256; 283x226x222; 104x193x191; 173x165x163; 149x138x136; 102x93x91. It can place orders immediately for from 3,000 to 10,000 of seamless flush-joint tubes in standard random lengths. Henry S. Moos, M. E., 30 Church St., New York, Gen. Mgr.

N. Y., New York—(Borough of Manhattan)—(Official)—Improvements to Radiographic Department—Bids will be received by Board of Trustees of Bellevue and Allied Hospitals, 415 East 26th St., until noon, Dec. 27, for constructing, erecting and completing changes in Radiographic Department of Pavilion K, Bellevue Hospital.

N. Y., New York—(Borough of Manhattan)—(Official)—Pier—Bids will be received by R. A. C. Smith, Comr. of Docks, Pier "A," Battery Pl., until noon, Dec. 28, for widening pier at foot of West 57th St., North River, constructing shed foundations and laying concrete surface on piers at West 56th and West 57th St., North River, and bulkhead adjacent.

N. J., East Orange—Underground Cable—Bids will be received until 8 p.m., Jan. 4, by C. E. Mitchell, Pres. Fire Com., for five miles of underground cable.

N. J., Linden—Fire House—Town Council appropriated $20,000 for fire house at Wood and Morris Ave.

Penn., Philadelphia—Improving Pier No. 46—Bids will soon be received for improving Pier No. 46, south wharves for Pennsylvania R.R. Co. William H Cookman, Arch.

W. Va., Huntington—Mausoleum—Plans will be prepared by J. K. Hall, Arch., for one-story mausoleum for West Virginia American Mausoleum Co., 631 National Exchange Bank Bldg., Wheeling. Estimated cost, $60,000.

Fla., Daytona—Pavilion—C. G. Burgoyne will build 150x150-ft. pavilion with about 40-ft. extending over river.

Tenn., Cowan—Coaling Station—Nashville, Chatttanooga & St. Louis Ry. will build automatic coaling station. Louis H. McDonald, Ch. Engr.

Tenn., Knoxville—(Official)—Underpasses—Knox County Road Commission will construct five underpasses. E. J. Gorham, County Highway Engr. Noted Dec. 9.

Ohio, Cincinnati—Speedway—Plans will be prepared by Harry Hake, Arch., Telephone Bldg., Cincinnati, for speedway.

Ohio, Defiance—See item under "Railways."

Ohio, Portsmouth—(Official)—Flood-Protection Wall—All bids received Dec. 8 for flood-protection wall rejected. New bids will be received. Noted Dec. 2.

Ind., Bicknell—Coaling Station—Pennsylvania R.R. contemplates building coaling station. Estimated cost, $150,000.

Minn., Minneapolis — Coal Distributing Plant — Berwind Coal Co., Minneapolis, will build coal-distributing and storage plant on 29th St.

Minn., St. Paul—Steel Stairway—Bids will be received until 10:30 a.m., Dec. 27, by A. Hohenstein, Pur. Agt., for steel stairway on Hall Ave. between South Wabasha St. and Prospect Terrace. Noted Dec. 2.

Tex., Victoria—Fire Station—Plans prepared for two-story fire station. Estimated cost, $15,000.

Calif., Sacramento—Levee Repair—State Reclamation Board completed surveys for repairs and revetment of levee on east side of Sacramento River.

France, Avignon—Metal Products—A union of 15 French firms, in wholesale iron, steel, ironware and hardware business, buying together more than 25,000,000 francs yearly, is in market for all American metal products. Berton-Sicard, Avignon, interested.

Bids In and Contracts Awarded

Mass., Malden—Comfort Station—Contract for one-story comfort station awarded to APTED & McDUFFIE, 265 Pleasant St., Malden. Estimated cost, $15,000.

Conn., Riverside—Swimming Pool—Contract for swimming pool for A. Langeloth awarded to C. W. LUYSTER, JR., 35 Nassau St., New York, N. Y. Estimated cost, $12,000.

N. Y., New York—(Borough of Brooklyn)—Elevated Railway—New York Municipal Railway Corporation awarded contract for steel for additional tracks for Myrtle Ave. elevated railway from Willoughby Ave. to Palmetto St.; also for improvements on Luthern Cemetery line to BAYLY HIPKINS. Noted Oct. 21.

N. Y., New York—(Borough of Brooklyn)—Station—Lowest bids submitted for railroad station from Church Ave. to Malbone St., Brighton Beach Line, for New York Municipal Railway Corporation, 85 Clinton St., were as follows: Flick-Manuell Co., 11 Pine St., $1,039,000; Inter-Continental Construction Co., 215 Rogers Ave., $1,064,832; P. J. Carlin Construction Co., 1123 Broadway, $1,123,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Frogs and Switches—Contract for special work, Order No. 6, for use in construction of Rapid Transit Railroads, frogs and switches for Lexington Ave. line, awarded to RAMAPO IRON WORKS, 35 Church St., at $146,195. Noted Dec. 9.

New York, N. Y.—(Borough of Manhattan)—Subway—Contract for Section No. 2, Route Nos. 19 and 22, part of Southern Blvd. and Westchester branch of Lexington Ave. subway, awarded to FLICK, MANUELL CO., 11 Pine St., at $2,063,877. Noted Dec. 9.

Ill., Chicago—Bathhouse—Contract for two municipal bathhouses awarded to BAKKIN CONSTRUCTION CO. Estimated cost, $26,000.

Ill., Dixon—Service Tunnels—Contract for service tunnels for State Epileptic Colony awarded to HATCH & MONTAGUE, Niles, Mich., at $51,555.

Tex., Galveston—Filling—City awarded contract for seawall improvement filling to STANDARD AMERICAN DREDGING CO. A. T. Dickey, City Engr.

Wash., Seattle—Transit Shed—Seattle Port Commission awarded contract for transit shed No. 2, at East Waterway Terminal Project to MANHATTAN CONSTRUCTION CO., Seattle, at $34,760.

Ore., Portland—Tunnel—Contract for relining tunnel from Mocks Bottom under Columbia Park to Columbia Slough for Oregon-Washington R.R. and Navigation Co. awarded to GUTHRIE-McDOUGALL & CO., Portland. Estimated cost, $400,000. Noted Dec. 16.

Calif., Monrovia — Mausoleum — Contract for 40x80-ft. mausoleum for Monrovia Mausoleum Co., awarded to DAVIDSON CONSTRUCTION CO., Los Angeles. Calif. Estimated cost, $40,000.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous"

Maine, Islesboro—Plans being prepared by F. L. Savage, Bar Harbor, for hotel to replace Islesboro Inn. Estimated cost, $150,000.

Mass., Boston—(Roxbury)—Plans prepared by A. J. Carpenter, Jr., Arch., for one-story. 42x100-ft. synagogue for Shari Congregation. Estimated cost, $40,000.

Mass., Lynn—(Official)—Bids will be received about Feb. 1 by George A. Cornet, Comr. of Pub. Wks., for school on Conomo Ave. Estimated cost, $100,000. Noted Dec. 2.

R. I., Howard—Bids will be received until Jan. 6 by Board of Control and Supply for two-story, 40x160-ft. ward building for State Hospital for the Insane. Martin & Hall, 806 Union Trust Bldg., Howard, Arch.

R. I., Providence—R. I. Hospital Trust Co. plans to build an addition to bank.

R. I., Providence—Bids will be received by Board of Education until Jan. 15 for school. Estimated cost, $200,000. William R. Walker & Son, Providence, Arch. Noted Nov. 18.

Conn., East Hartford—Bids will be received by Wilson Potter, Arch., Union Sq., New York, N. Y., for high school. Estimated cost, $75,000. Noted Sept. 16.

N. Y., Buffalo—Lafayette Hotel Co. plans to build addition to hotel at Clinton and Washington St. Estimated cost, $48,000.

N. Y., Gloversville—(Official)—Bids will be received by City National Bank until Dec. 28 for one-story bank building. Estimated cost, $80,000. Noted Dec. 16.

N. Y., New York—(Borough of Brooklyn)—Trustees of Polytechnic Institute contemplate new buildings on Dyker Meadows site. Estimated cost, $600,000.

N. Y., Port Washington—Election will be held Jan. 7 to vote on $100,000 bonds for addition to high school. J. Hutchinson, Clk., Bd. of Education.

N. Y., Rifton—Plans prepared for three-story addition to hotel for H. Holding Realty Co. Girard L. Betz, 51 John St., Kingston, Arch.

N. Y., Rochester—Clinton-Mortimer Corporation will build motion-picture theater.

N. Y., Watertown—Plans will be prepared by C. M. Curtiss, Arch., Vinney Bldg., Syracuse, for remodeling Franklin Arcade Building into theater. Estimated cost, $50,000.

N. J., Atlantic City—Preliminary plans being prepared by Hoffman Co., Arch., Finance Bldg., Philadelphia, Penn., for ten-story hotel. Estimated cost, $600,000.

N. J., Atlantic City—Plans being prepared by Sewart G. Dobbins, Arch., 1318 Atlantic Ave., Atlantic City, for three-story, 350x670-ft. convention hall for Convention Hall Co. Estimated cost, $500,000.

N. J., Camden—Trustees of Public Library plans library in Cooper Sq. Estimated cost, $130,000.

N. J., Collingswood—C. S. Adams, Arch., 1509 Arch St., Philadelphia, Penn., preparing plans for three-story hospital and sanitorium. Estimated cost, $125,000.

N. J., Newark—Preliminary plans prepared for building on West St. for Foresters of America. Estimated cost, $80,000. Philip J. Schotland, Chn., Bldg. Com.

Penn., Carbondale—Owen McGlynn, Arch., Carbondale, will prepare plans for new high school. Estimated cost, $150,000. Noted Sept. 9 and 16.

Penn., Delaware Water Gap—Plans being prepared for rebuilding hotel for J. Purdy Cope, Atlantic City, N. J. Estimated cost, $50,000. S. Hudson Vaughn, Guarantee Trust Bldg., Atlantic City, N. J., Arch.

Penn., Eddystone—Plans will be prepared by G. H. Nattress & Son, Arch., 1129 Walnut St., Philadelphia, for three-story building for St. Lukes Protestant Episcopal Church.

Penn., Lancaster—Lancaster Theological Seminary will build dormitory. Estimated cost, $60,000.

Penn., Philadelphia—Bids will soon be received for four-story, 43x200-ft. store building for Blauners, Inc., 833 Market St. Estimated cost, $100,000. Hoffman Co., Finance Bldg., Philadelphia, Arch.

Penn., Pittsburgh—See item under "Sewers."

Penn., West Chester—Bids will soon be received for church for Methodist Episcopal Congregation. Wesley L. Blitho, 608 Chestnut St., Philadelphia, Arch.

Penn., Williamsport—Bids will be received about Jan. 10 by West Branch National Bank for one-story building. Estimated cost, $150,000. Mowbray & Uffinger, 56 Liberty St., New York, N. Y., Arch. Noted Nov. 18.

Md., Blue Mountain—J. Castelbery, 322 West Baltimore St., Baltimore, and C. S. Gardner, Blue Ridge Summit, Penn., interested in erection of hotel at Blue Mountain. Estimated cost, $300,000.

D. C., Washington—Plans being prepared by Snowden & Ashford, Municipal Arch., Municipal Bldg., for hospital at 14th and Upshur St. Estimated cost, $500,000.

D. C., Washington—Bids will soon be received by Reginald W. Geare, Arch., 327 Woodward Bldg., for three-story, 137x157-ft. theater for George T. Smallwood and I. Cassidy, 3520 16th St. Estimated cost, $80,000. Noted Dec. 2.

Va., Newport News—Plans being operated by B. F. Mitchell, Norfolk, for three-story, 54x126-ft. reinforced-concrete office building for Chesapeake & Ohio Railway. Estimated cost, $65,000.

W. Va. Charleston—Rev. P. J. Donohue, Bishop of Catholic Diocese of West Virginia, interested in construction of hospital. Estimated cost, $60,000.

W. Va., Fairmont—George T. Watson and associates will build hotel. Estimated cost, $300,000.

W. Va., Welch—McDowell Lodge No. 112, A. F. & A. M., will build four-story store, office and lodge building. Pedigo & Garry, Bluefield, Arch.

N. C., Biltmore—Biltmore School District plans to build high school.

S. C., Columbia—Union Station Co. will improve passenger station. Estimated cost from $50,000 to $100,000. J. W. Wassum, Columbia, Secy.

Ga., Atlanta—Negro Y. M. C. A. will erect building. Estimated cost, $50,000.

Fla., Clearwater—Election will be held Feb. 3 to vote on $130,000 bonds for courthouse and jail for Pinellas County. Noted Dec. 2.

Fla., Miami—Y. M. C. A. will erect 90x140-ft. building. Estimated cost, $100,000. William S. Frost, Secy.

Miss., Columbus—Election will be held Feb. 1 to vote on $50,000 bonds for high school. Noted Nov. 18.

Ky., Louisville—Plans being prepared for building for Kentucky Athletic Club. Estimated cost, $100,000.

Ohio, Alliance—Plans being prepared by W. T. Miller Co., Arch., Columbus, for school.

Ohio, Bryan—Board of Education contemplates new school. Estimated cost, $40,000.

Ohio, Bucyrus—Charles J. Scriggs is organizing a company to build Masonic Temple. Estimated cost, $40,000.

Ohio, Bucyrus—Election will be held Jan. 14 to vote on $40,000 bonds for school for Tiro Consolidated School District. W. W. Davis, Secy. Bd. of Education.

Ohio, Cincinnati—Bids will soon be received for Catholic University on Dana Ave. Estimated cost, $75,000.

Ohio, Cleveland—(Official)—Bids will be received about Mar. 15 for additions to Memorial, East Clark and Tremont Schools. Estimated cost, $150,000. W. R. McCormack, Arch. Noted Dec. 16.

Ohio, Cleveland—Board of Education contemplates building two grade schools. Estimated cost, $200,000. S. E. Hyre, Clk. Bd. of Education.

Ohio, Cleveland—Plans being prepared for three and five-story, 87x114-ft. Masonic Temple for Newburgh Masonic Temple Co. Estimated cost, $65,000. W. J. Carter, 1423 Illuminating Bldg., Cleveland, Arch.

Ohio, Cleveland—Plans being prepared by Ferguson-Flanigan Co., Arch., Vickers Bldg., Cleveland, for eight-story building at St. Clair Ave. and East Third St. for Walton Realty Co.

Ohio, Columbus—Plans being prepared by Werner & Atkins, Cincinnati, for jail for Clinton County. Estimated cost, $350,000.

Ohio, Columbus—Plans being prepared by Richards, McCarty & Bulford, Arch., Hartman Bldg., Columbus, for four-story building at 31 North Fourth St., for H. C. Godman Shoe Co.

Ohio, Dennison—According to press reports plans are being considered for enlarging University of Dennison. C. W. Chamberlain, interested.

Ohio, Kent—Kent State Normal School will build dormitory at Kent. Estimated cost, $120,000.

Ohio, Tiffin—Plans prepared for dormitory for National Orphans Home.

Ohio, Tiro—Election will be held Jan. 24 to vote on $40,000 bonds for consolidated school.

Ohio, Toledo—Bids will be received by Clerk of Board of Education until noon, Jan. 10, for alterations and additions to Ironville School at Millard and Tiffin Ave.

Ohio, Toledo—Keith Co. will build theater in Toledo.

Ohio, Toledo—Edward D. Libbey and E. H. Close contemplate erecting building at Admane and Huron St. Estimated cost, $1,000,000.

Ohio, Waterville—Board of Education plans to build new high school.

Ohio, Wellsville—First Presbyterian Congregation will build church. Estimated cost, $68,000.

Ohio, Youngstown—Board of Education plans to build Pine Hollow grade school. Estimated cost, $73,000.

Ind., Clinton—County plans to build new hospital. Estimated cost, $50,000. S. N. Sellers, Chn. of Bldg. Com.

Ind., Ft. Wayne—Members of Christs Lutheran Church will build edifice next spring. Estimated cost, $50,000.

Ind., Peru—(Official)—Bids will be received in the spring for two-story city hall. Estimated cost, $125,000. Noted Nov. 18.

Ind., Vincennes—Tentative plans prepared by J. W. Gaedis, Arch., for school. Estimated cost, $138,000. J. W. McCoy, Secy. of School Bd.

Mich., Detroit—Congregation of North Woodward Ave. Methodist Church plans to build new edifice. Estimated cost, $200,000. Fred L. Cook, Pres. of Bd. of Trustees.

Mich., Grand Rapids—Press reports state that seven-story hotel will be built at Sheldon Ave. and Oakes St. A. Brown, 501 Paris Ave., S. E., interested.

Mich., Grand Rapids—Plans being prepared by J. &. G. Daverman, Arch., for hospital at Bristol Ave. and Fourth St. for Christian Psycopathic Hospital.

Ill., Freeport—Plans prepared for eight-story hotel for Freeport Hotel Co. Estimated cost, $500,000.

Ill., Woodriver—Board of Education plans to build school. Estimated cost, $50,000.

Wis., Appleton—Plans prepared for girl's dormitory at Lawrence College. Estimated cost, $70,000.

Wis., Eau Claire—Citizens voted $85,000 bonds for municipal auditorium. Noted Dec. 2.

Wis., Madison—E. C. Bracken, 753 East Johnson St., plans to build theater and office building. Estimated cost, $90,000.

Wis., Racine—Manufacturers' National Bank of Racine plans to build bank and office building during 1916. Estimated cost, $150,000.

Iowa, Cedar Rapids—Citizens contemplate coliseum. Estimated cost, $125,000.

Iowa, Des Moines—Board of Education contemplates high school on Park Ave. J. W. Studebaker, Supt.

Idaho, Idaho Falls—Commissioners of Bonneville County contemplate court house. Estimated cost, $60,000.

Iowa, Muscatine—First Baptist Congregation will build church at Muscatine. Estimated cost, $75,000.

Iowa, Sioux City—(Official)—Bids will be received until Feb. 7 by H. Metz, Chn. Bd. of Superv., for three-story, 150x150-ft. courthouse. Estimated cost, $500,000. Noted Dec. 9.

Neb., North Platte—Plans being prepared by Bert M. Reynolds, Arch., for high school. Estimated cost, $50,000.

N. D., Bowbells—Citizens defeated $75,000 bonds for Burke County courthouse.

Mont., Havre—Great Northern Railway Co. will build three-story freight and office building on Main St.

Tex., Abilene—Texas & Pacific R.R. plans to build passenger and freight depot, including warehouse, at Abilene. Estimated cost, $50,000.

Tex., Corpus Christi—City contemplates holding election to vote on $100,000 bonds for auditorium.

Tex., Dallas—Dallas Terminal Association contemplates interurban terminal depot. Estimated cost, $1,500,000. C. F. Wallace, Dallas, interested.

Tex., El Paso—Gustav Zork plans to build six-story store and office building at Texas and Kansas St. Estimated cost, $80,000.

Tex., Galveston—Plans being prepared for addition to Y. M. C. A. Estimated cost, $50,000.

Tex., Port Arthur—Election will be held Jan. 8 to vote on $450,000 bonds for schools for Port Arthur Independent School District. Noted Dec. 16.

Tex., Waco—Missouri, Kansas & Texas Railway will build three-story freight depot and improve passenger station. Estimated cost from $180,000 to $200,000.

Tex., Waco—B. L. Scott contemplates erecting three-story building at Eighth and Washington St.

Tex., Wichita Falls—(Official)—Bids will be received until Jan. 5 by Field & Clarkson, Arch., for three-story, 50x150-ft. building for A. F. & A. M. Estimated cost, $50,000. Noted Dec. 9 and 16.

Okla., Bartlesville—Board of Education plans to build junior high school. Estimated cost, $75,000.

Okla., Bartlesville—Revised plans being prepared by Shattuck & Hussey, Arch., 19 South La Salle St., Chicago, Ill., for Y. M. C. A. building.

Okla., Tulsa—McMan Oil Co. will build ten-story office building at Fourth and Boston St. Estimated cost, $300,000.

Okla., Tulsa—F. M. McFarlin purchased site at Tulsa and will build 100x140-ft. building at Fourth St. and Boston Ave. Estimated cost, $200,000.

Okla., Tulsa—Press reports state plans being prepared for 10-story addition to Hotel Tulsa. W. N. Robinson, Mgr.

Colorado, Durango—Election will be held Jan. 12 to vote on $175,000 bonds for high school.

Colo., Trinidad—Bids will be received until Jan. 4 by Commissioners of Las Animas County for jail. Estimated cost, $80,000.

N. M., Silver City—Plans being prepared for hotel by Silver City Chamber of Commerce. Estimated cost, $100,000. Carl Hinton, Secy.

Idaho, Pocatello—H. F. Dunn, Payette, is interested in a project to build a three-story hotel. Estimated cost, $50,000.

Wash., Seattle—(Official)—Bids will be received about Feb. 10 by Board of Regents of University of Washington for recitation building. Estimated cost, $150,000. Noted Dec. 9.

Wash., Seattle—Edgar Blair, Arch., 1426 Jackson St., preparing plans for improving schools during 1916. Bonds for $750,000 recently voted for this purpose.

Ore., Springfield—District No. 19 contemplates building high school. A. P. McKinsey, Clk.

Calif., Red Bluff—Plans being prepared by W. H. Weeks, Arch., 75 Post St., San Francisco, Calif., for high school annex. Estimated cost, $90,000.

Ont., Ottawa—City contemplates police station. Estimated cost, $100,000.

Bids In and Contracts Awarded

N. H., Hampton Beach—Contract for two-story, 50x132-ft. theater awarded to HARRY A. KIRK. J. A. Hallaron, Arch., 164 Federal Bldg., Boston.

Mass., Boston—P. H. Rose Construction Co., 730 Wash St., Boston, at $159,735, submitted lowest bid for Sarah Greenwood School. Noted Dec. 2.

Mass., North Adams—Contract for high school awarded to H. C. WOOD & CO., North Adams, at $144,860. Noted Dec. 16.

Mass., Waltham—Contract for one-story, 62x184-ft. church for St. Charles Congregation awarded to MICHAEL LALLY, 20 Calvary St., Waltham. Estimated cost, $80,000. Noted Nov. 11.

Mass., Watertown—Contract awarded to J. J. FLYNN, 319 Washington St., Boston, for three-story, 44x60-ft. addition to convent of St. Patrick's Church. Estimated cost, $60,000.

Conn., Waterbury—Contract awarded to THOMAS G. SMITH, Waterbury, for two-story school. Estimated cost, $44,918.

Penn., Philadelphia—Melody & Keating, Bailey Bldg., at $291,689, submitted lowest bid for four-story school at B St. and Westmoreland Ave. for Board of Education. Noted Dec. 9.

Penn., Philadelphia—W. Beaumont, Stephen Girard Bldg., Philadelphia, at $58,147, submitted lowest bid for three-story addition to Harriet Beecher Stowe School at 70th St. and Woodland Ave. Noted Dec. 2.

Va., Roanoke—Contract for addition to Hotel Roanoke awarded to JOHN R. PETTYJOHN & CO., Roanoke. Estimated cost, $100,000. Noted Dec. 2.

Ga., Athens—Southern Ferro-Concrete Co., Atlanta, at $100,000, submitted lowest bid for Y. M. C. A. building. W. T. Forbes, Secy. Bldg. Com. Noted Nov. 11.

Ga., Savannah—W. H. FISSELL & CO., New York, N. Y., awarded contract by National Bank of Commerce to remodel building. Estimated cost, $40,000.

Fla., Live Oak—(Official)—Contract for school for Suwannee County Board of Education awarded to FLORIDA ENGINEERING AND CONSTRUCTION CO., 403 Main St., Jacksonville, at about $45,000. Noted Nov. 18.

Ala., Birmingham—Contract for five-story store building for Louis Sax Clothing Co. awarded to SMALLMAN-BRICE CO., Birmingham. Estimated cost between $100,000 and $150,000. Noted Nov. 25.

Miss., Pontotoc—Contract awarded to DOBSON & OLIVE, Montgomery, Ala., at $56,884, for courthouse for Pontotoc County. Noted Dec. 2.

Tenn., Cookeville—All bids received for two buildings for Tennessee Polytechnic Institute rejected. Revised plans will be prepared by Asmus & Norton, Arch., Nashville. Estimated cost, $145,000. Noted Dec. 9.

Ohio, Akron—Contract for school awarded to NATIONAL CONCRETE FIREPROOFING CO., 1315 Citizens Bldg., Cleveland, at $84,000.

Mich., St. Joseph—F. H. Beauman Co., Chicago, Ill., at $75,977, submitted lowest bid for high school. Noted Sept. 2.

Iowa, Centerville—Contract for three-story hospital for Sisters of Mercy awarded to J. C. MARDIS CO., Des Moines. Estimated cost, $75,000. Noted Dec. 2.

Kan., Emporia—(Official)—Contract for four-story administration building for state awarded to HEMAN CONTRACTING CO., St. Louis, Mo., at $191,881. Charles H. Chandler, State Arch. Noted Nov. 18.

Neb., Lincoln—Contract for hospital and chemistry building for University of Nebraska awarded to E. P. GOULD & SON, Omaha, at $105,745. Noted Dec. 2.

Mo., St. Louis—Jewish Shelter Home for Boys and Girls awarded contract for building to JAMES BLACK MASONRY AND CONSTRUCTION CO., St. Louis.

Tex., El Paso—Contract for four-story hospital at Montana and Piedras St. for Rolston Hospital awarded to JOLLY & MORRIS, El Paso. Estimated cost, $40,000.

Calif., Los Angeles—Pacific Mutual Co. awarded contract for office building at Sixth and Olive St. to C. J. KUBACH CO., Merchants Bank Bldg., Los Angeles.

Calif., San Francisco—Contract for steel work on two wings of San Francisco Hospital awarded to DYER BROS., 17th and Kansas St., San Francisco, at $101,425.

A Partnership has just been formed under the name of Demorest & Hieber, in the Dollar Savings and Trust Bldg., Pittsburgh, Penn., as structural steel engineers. Originally Mr. Demorest and Mr. Heiber were associated but decided that it would be better for their interests to form a partnership.

The Chicago Bridge and Iron Works has moved its general sales office from Washington Heights to the Old Colony Bldg., 37 West Van Buren St., Chicago., Ill., and has combined with it the city sales office formerly at 332 South Michigan Ave.

The Government of the Philippine Islands completed arrangements yesterday for the purchase of the stock of the Manila R.R. the securities of which are now held for the most part by a syndicate headed by James Speyer, of New York. Governor-General Harrison will submit the plan to the Legislature after the holidays.

New Way to Produce Iron—An entirely new method of producing pure iron, which it is believed will save the electrical industries of the country more than $15,000,000 a year, has been discovered by Dr. Trygve Yensen, an assistant in the engineering experiment station of the University of Illinois, it was announced at the university today.

The method used by Dr. Yensen consists of melting electrolytically refined iron in a vacuum, reducing the impurities thus far below any point which had been reached by previous investigators. The magnetic property of this vacuum-fused iron has proved to be as remarkable as its purity. Its maximum permeability, i.e., measure of ease with which it can be magnetized, was found to be about 20,000, which is two or three times higher than for the best magnetic iron or iron allow previously produced.

A practical result of this investigation is that, if it should turn out to be commercially profitable, the amount of material needed for electrical machinery such as transformers, could be cut in two and the losses which occur continuously as long as the machine is in operation would be greatly minimized. The annual saving to the electrical industries of the country by application of this discovery will amount to between $15,000,000 and $20,000,000, if it should turn out that the iron can be produced at the same expense as the iron at present used.

Contracts to Be Let

Bids received until Jan. 4, 1916.

Barge Canal Work

STATE OF NEW YORK,
OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.
Albany, December 6th, 1915.

Sealed proposals will be received by the undersigned at his office in the Capitol, at Albany, N. Y., until twelve o'clock noon of Tuesday, January 4th, 1916, at which place and hour they will be publicly opened and read, for improving the New York State canals pursuant to the provisions of Chapter 147, Laws of 1903, and of the amendments thereto, as follows:

CONTRACT NO. 73-A (Revised).
Champlain Canal—Section 1.

For completing the construction of the canal from Northumberland to Stillwater.

Length about 15.0 miles. Sheets 1 to 16 inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the City of Albany or New York, issued by a national or State bank in good credit within the State and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds, coinsurance only will be accepted.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the State will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.

Bids received until Jan. 17, 1916.

Steam Pumping Unit

St. Paul, Minn., Dec. 18, 1915.

Notice is hereby given that sealed proposals, bearing the number 667 of the bid and endorsed with the name of the bidder and the date of presentation will be received at the office of the Purchasing Agent at the Court House and City Hall until 10:30 a.m., Jan. 17, 1916, for the designing, construction, delivery and erection complete of a steam pumping unit, of a capacity to pump continuously fifteen (15) million U. S. gallons of water per twenty-four (24) hours, against a total combined head of one hundred and seventy-one (171) feet, with steam pressure of one hundred and fifty (150) pounds per square inch at throttle; together with all auxiliary equipment, tools and appurtenances necessary; all in accordance with the plans and specifications on file in the office of the Purchasing Agent.

Bids are invited on two types of pumping units, namely: (a) The centrifugal type of pump driven by a steam turbine through reduction gears, and (b) the triplex plunger type of pump driven by a vertical triple expansion type of steam engine. The type and make of pumping unit that will be purchased will be that showing the lowest operating cost per year to be determined on a basis given in the specifications plus fixed charges on the total investment.

A bond in the sum of 20 per cent. of the amount bid, with two sureties, residents of the City of Saint Paul, or a Surety Company bond in the same amount, or a certified check for 10% of the amount bid, must accompany each proposal as surety for the making and execution of a contract.

The City reserves the right to reject any or all bids, or any part thereof.

Bids are to be submitted in duplicate upon the regular proposal blank, furnished by the Purchasing Agent on request, and are subject to the conditions stated thereon. All bids will be opened in public, at the time above stated, by the Purchasing Agent, in the presence of the Purchasing Committee.

AUGUST HOHENSTEIN,
Purchasing Agent.

Bids received until Jan. 12, 1916.

Turbo-Centrifugal Pump

Kansas City, Mo.

SEALED PROPOSALS will be received by the Purchasing Agent of Kansas City, Missouri, at the office of the Purchasing Agent, Second Floor City Hall, until two o'clock p.m. of January 12, 1916, for the designing, construction, delivery and erection of a steam turbine, reduction gear, centrifugal pumping unit of a capacity to pump continuously twenty (20) million U. S. gallons of water per twenty-four (24) hours, against a total combined head of three hundred and sixty (360) feet and a steam pressure of one hundred and sixty-five (165) pounds per square inch at throttle; together with all machinery, tools and appurtenances necessary; all in accordance with the plans and general specifications on file in the office of the Chief Engineer of the Water Department.

Each bidder shall deposit with the City Comptroller a certified check in the amount of Seven Hundred and Fifty Dollars ($750.00), payable to the City Comptroller of Kansas City, Missouri, and accompany his bid with the Comptroller's receipt therefor.

The certified check referred to in the Advertisement shall be submitted by each bidder as a guaranty that the bidder will, within ten (10) days after receiving the award of a contract, file with the City a satisfactory bond to the amount of Twenty-five Thousand Dollars ($25,000.00) and will execute the contract.

The Board of Fire and Water Commissioners does not bind itself to accept the lowest or any bid offered, and reserves the right to reject any and all bids and to waive any irregularity or informality in the bids.

(Signed) J. P. LANGAN, Purchasing Agent.
BURTON LOWTHER, Chief Engineer.

Construction News

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

Maine—Rockland, South Thomaston & St. George Ry. will build 1-mile extension to line in St. George. Alfred S. Black, Rockland, Pres. and Gen. Mgr.

Massachusetts—Council granted franchise to Springfield Street Railway Co. to lay tracks on Church St. and Broadway, Chicopee Falls. J. F. McCabe, Springfield, Pur. Agt.

Pennsylvania—Northampton Traction Co., Easton, merged with Bangor & Portland Traction Co., plans to build railway from Windgap to Delaware Water Gap. W. O. Hay, Easton, Vice-Pres., Gen. Mgr. and Pur. Agt.

Pennsylvania—Scranton & Binghamton Traction Co., Scranton, contemplates building about 20 miles of railway from Heart Lake to Hallstead via New Milford during 1916. T. C. Dougherty, Scranton, Ch. Engr.

Pennsylvania—Surveys being made by West Penn Traction Co., Pittsburgh, for extension of lines in Butler District. W. E. Moore, Pittsburgh, Vice-Pres. and Gen. Mgr.

Maryland—Curtis Bay R.R. Co. plans to build railway about three or four miles long from Curtis Bay to Hawkins Point, near Baltimore, to connect two plants of Davison Chemical Co. C. W. Miller, interested.

West Virginia—Charleston-Dunbar Traction Co., Charleston, plans to build railway, about 20 miles long. E. W. Alexander, Charleston, Secy., Gen. Mgr. and Pur. Agt.

West Virginia—Reported that Grafton Light and Power Co., Grafton, will build 1 mile of new railway. J. Clyde Lewis, Grafton, Supt. and Pur. Agt.

West Virginia—Morgantown & Wheeling Ry., Morgantown, plans to build interurban railway from Price to Blacksville, 7.45 miles. R. D. Hennen, Morgantown, Ch. Engr.

North Carolina—Goldsboro Street Railway Co., Goldsboro, contemplates building 1 mile of new railway. E. L. Gentir, Goldsboro, Secy. and Gen. Mgr.

Georgia—Surveys being made for extension of Ocilla, Pinebloom & Valdosta Ry. from Willacoochee to Sirmans, Ga., about 20 miles. G. W. Davis, Willacoochee, Gen. Mgr.

Florida—Panama Line, Pensacolo & Missouri Valley Railroad Co., recently chartered, plans to build line from point near Pensacola, Fla., to Kansas City, Mo., and Omaha, Neb., with branches to coalfields in Alabama and Arkansas. Walter D. Seaver, Pascagoula, Fla., interested.

Alabama—Reported that Gulf States Steel Co., Gadsden, will build railway about 3 miles long.

Mississippi—Meridian Light and Railway Co., Meridian, contemplates building 1¾ miles of new railway. A. B. Paterson, Meridian, Gen. Mgr. and Pur. Agt.

Tennessee—Memphis Street Railway Co., Memphis, contemplates extending line in Florida St. to Nonconnah. J. H. Haylow, Memphis, Ch. Engr.

Illinois—Surveys made for extension of line of Palatine, Lake Zurich & Wauconda R.R. from Wauconda to Fox Lake, 10.5 miles. C. H. Patten, Palatine, Gen. Mgr.

Illinois—Springfield Consolidated Railway Co. contemplates extending line east to Bergen Park, Springfield. A. D. Mackee, Springfield, Gen. Mgr. and Pur. Agt.

Minnesota—Duluth Street Railway Co., Duluth, contemplates building 4 miles of new railway. J. Carson, Duluth, Ch. Engr.

Kansas—Kansas Southern Traction Co. contemplates building interurban railway from Parsons to Oswego and Columbus. Philip Strack, Parsons, interested.

Missouri—Surveys being made and right-of-way being secured for railway from Kansas City, Mo., to Tiffany Springs, Platte County, about 15 miles, for Kansas City and Tiffany Springs Railway Co. W. M. Spratt, Kansas City, Ch. Engr. Noted Nov. 18.

Arkansas—Surveys being made for narrow-gage railroad from Cotter to Rush, about 14 miles, and will traverse Buffalo River and Rush Creek mining districts.

Texas—Dallas Standard Traction Co. asked Council for franchise to build line through Mt. Auburn to Parkview Pl., Dallas. O. A. Zeal, Dallas, Ch. Engr.

Oklahoma—Surveys will soon be made by Guthrie-Edmond Electric Ry. Co., Oklahoma, recently incorporated with $500,000 capital stock, for proposed extension of Oklahoma Electric Ry. from Edmond to Guthrie, Okla. Burke Shartel and Charles Hoopes, Oklahoma, interested.

Oklahoma—Kansas-Oklahoma Electric Co. plans to build railway from Caney to Dewey. S. M. Porter, Caney, interested.

Oklahoma—Okmulgee Northern Ry. Co., recently incorporated, will construct railway from Okmulgee to Coalton, Okla., 12 miles. Lee Clark and Frank L. Hale, interested.

Quebec—Plans being prepared for 5-mile extension from Three Rivers to Cap Magdeleine for Three Rivers Traction Co. Thomas McDougall, Pres.

Ontario—Sarnia Street Ry. Co., Ltd., contemplates building ½-mile line in Sarnia. W. Williams, Sarnia, Ch. Engr.

Ont., St. Thomas—See item under "Industrial Works."

Bids In and Contracts Awarded

Georgia—Contract awarded to THOMAS WORTHINGTON, Birmingham, Ala., for construction of extension of Savannah & Northwestern Ry. from St. Clair to Warrenton, Ga., about 30 miles. L. B. Ackerman, Savannah, Ch. Engr. Noted Oct. 7.

Tennessee—Oneida & Western R.R., Oneida, awarded contract for 2½-mile extension of line to COOK CONSTRUCTION CO. G. H. Jackson, Oneida, Ch. Engr.

Tennessee—Contract awarded to RHODES, McDOWELL & BAKER for 11-mile extension of Tennessee Ry. C. W. Butts, Oneida, Ch. Engr.

Ohio—Wheeling & Lake Erie R.R. awarded contract for grading 3-mile spur to circle east boundaries of Canton to CASEY CONTRACTING CO., Pittsburgh, Penn. W. L. Rohback, Cleveland, Ch. Engr. Noted Nov. 18 and Dec. 23.

LIGHT, HEAT AND POWER

Proposed Work

Vt., Waterbury—C. E. Huntingale, New York, N. Y., has purchased from L. J. Roberts mill and dam on Little River, about four miles from Waterbury, to develop same to generate electricity. Property is capable of developing about 750 hp.

N. Y., Belmont—Allegany County Electric Light and Power Co. plans to construct concrete dam in Genesee River and install electric power plant in Belmont. J. K. Harker and George W. Francis, New York, N. Y., interested.

N. Y., Buffalo—International Railway Co. contemplates an expenditure of $150,000 for enlarging its substations. J. C. Sheldon, Buffalo, Pur. Agt.

N. Y., Buffalo—Plans being prepared by F. J. Neis, Arch., and G. J. Neis, Engr., Delaware, Lackawanna & Western R.R., Hoboken, for power house at passenger terminals of Delaware, Lackawanna & Western R.R. at Buffalo. Noted Sept. 23.

N. Y., Lebanon Springs—Plans being considered for electric-lighting system in Lebanon Springs.

N. Y., New York—(Borough of Queens)—(Official)—Bids will be received by C. B. J. Snyder, Supt. of Schools, Dept. of Education, Park Ave. and 59th St., New York (Borough of Manhattan), until 4 p.m., Jan. 3, for heating and ventilating apparatus in Public School No. 91, Folsom and Fosdick Ave.

N. Y., Seneca Falls—Plans being prepared by M. G. Barnes, Engr., 36 State St., Albany, for one-story, 50x100-ft. hydro-electric plant for Seneca Power Co., Inc. Estimated cost, $250,000. E. H. Gould, Seneca Falls, interested.

N. J., Magnolia—Borough Council contemplates installing electric-lighting system.

Penn., Erie—An addition will be constructed to plant of Erie Lighting Co. Estimated cost, $10,000.

Penn., Lebanon—Plans prepared for power house for Hauer & Mowere:

Penn., Wyomissing—Borough Council passed loan ordinance of $30,000 for purchasing equipment for electric-light plant and has arranged for another loan of $10,000.

Va., Boyce—Northern Virginia Power Co., Winchester, plans to construct transmission line from Boyce to Riverton, via White Post.

W. Va., Buckhannon—Plans being considered for purchasing mill property of D. T. Farnsworth to convert same into power house for furnishing electricity to city and to establish high-pressure water system.

Fla., Ft. Meade—See item under "Water-Works."

Ala., Moulton—Plans being considered by C. C. Prince and H. C. Dunn for electric-light plant in Moulton.

Miss., Sumner—Southern Electric Service Co. contemplates an expenditure of $14,000 for improvements to its plant. A. C. Carl, Winona, Mgr.

Tenn., Sharon—Citizens voted $10,000 bonds for electric-light plant.

Ohio, Belle Center—City will issue $8,000 bonds for rebuilding municipal electric-light plant.

Ohio, Piqua—Dayton Power and Light Co. has taken over plant of Miami Light, Heat and Power Co. and will improve same.

Mich., Allegan—Consumers Power Co. plans to extend its transmission line from Allegan to South Haven via Fennville, Pullman and Lee. Company also contemplates dam across Kalamazoo River.

Mich., Muskegon—Muskegon Heights Gas Co., recently incorporated, will construct gas plant.

Mich., Whitehall—Frugale Power Co. contemplates enlarging its hydro-electric plant. F. H. Speese, Vice-Pres. and Mgr.

Ill., Byron—Byron Electric Light and Power Co., recently incorporated with $15,000 capital stock, plans to build electric-light plant in Byron.

Wis., Manitowac—Plans being prepared for power and boiler house for municipal electric-light and water-works systems.

Wis., Racine—Wisconsin Gas and Electric Co., subsidiary of Milwaukee Electric Railway and Light Co., Milwaukee, will build 80x165-ft. addition to retort house. Estimated cost, $25,000.

Iowa, Guttenberg—Citizens voted to construct municipal electric-light plant.

Iowa, Rhodes—Press reports state that Iowa Railway and Light Co. has been granted franchise for transmission line and distribution system for furnishing electric-light and power.

Minn., Mazeppa—City contemplates expenditure of $10,000 for improvements to municipal electric-light plant.

Kan., Circleville—Citizens voted to issue bonds for municipal electric-light plant.

Kan., Riley—R. B. Fegan, Junction City, granted franchise for electric-light plant in Riley. Noted Dec. 16.

Neb., Pleasant Dale—Martz Engineering Co., First National Bank Bldg., Lincoln, preparing plans for municipal electric-light plant. Estimated cost, $5,000.

Ark., Van Buren—Bids will be received about Jan. 10 by Crawford Gas and Oil Co., recently incorporated with $250,000 capital, for 10 miles of 6-, 8- and 10-in. piping. C. H. Reece, Engr.

Tex., Portland—Bids will be received until Jan. 1 by M. S. Spitler for constructing electric-light plant. J. B. Moore, Engr. Noted Dec. 16.

Okla., Lawton—Franchise granted to Albert T. Woods and associates for gas plant in Lawton.

N. M., Albuquerque—A. G. Hillberg, 13 Park Row, New York, N. Y., preparing plans for 30,000 hp. hydro-electric plant at mouth of White River Cañon on Rio Grande River. Estimated cost, $2,000,000. C. G. Wilfong, Philadelphia, Penn., Pres.

N. M., Clovis—See item under "Water-Works."

Idaho, Pocatello—(Official)—We have been informed that bids for extending street lighting system will be received next spring. Estimated cost, $35,000. J. H. Giles, City Engr. Noted Dec. 9.

Ariz., Casa Grande—See item under "Water-Works."

Ariz., Miami—See item under "Water-Works."

Ariz., Phœnix—Young Men's Business Association is interested in project to install electric-light plant in Phœnix.

Ariz., Prescott—Surveys being made for constructing water storage dam and hydro-electric plant on Burro Creek, near Prescott. E. P. Thayer, Indianapolis, Ind., interested.

Wash., Blueslide—Surveys being made by engineers of Hugh L. Copper Co. for power dam about one mile north of Blueslide. The hydrochemical and power project will involve an expenditure of $10,000,000.

Wash., Okanogan—Okanogan Valley Power Co. will extend its transmission lines along Okanogan River between Okanogan and Malotte.

Ore., Conway—J. Frank Jones, Mayor, considering draft for franchise proposed by G. C. Hardin, Ft. Smith, for supplying natural gas to Conway from Kibler Fields in Crawford County.

Ore., Stayton—Stayton Electric Light Co. will enlarge its power plant.

Calif., San Francisco—Great Western Power Co. plans an expenditure of $4,000,000 for improvements. M. Fleishacker, Pres.

Que., Sherbrooke—Bids will soon be received for enlarging and improving power plant. M. A. Sammett, 301 McGill Bldg., Montreal, Consult. Engr.

Que., Warwick—Plans being considered for electric-light and power systems. Estimated cost, $10,000.

Ont., Aylmer—City plans to build several large additions to its electric-light plant.

Ont., Sarnia—Election will be held Jan. 3 to vote on by-law providing $120,000 for purchasing electric generating plant and electric distribution system of Sarnia Gas and Electric Co. and for remodeling same.

Ont., Springfield—City will install electric-light plant. Estimated cost, $5,000. J. B. Lucas, Clk.

Ont., West Lorne—City plans to build electric-light and power plant. Estimated cost, $80,000. J. S. Robertson, St. Thomas, Clk.

Bids In and Contracts Awarded

Penn., Philadelphia—Contract for boiler house for Pennsylvania Sugar Co. awarded to O'MERA CONSTRUCTION CO., 235 South Turner St., Philadelphia. Estimated cost, $40,000.

Va., Fredericksburg—Contract for electric-light plant and system for Southern Gravel Co., about 4 miles from Fredericksburg, awarded to RAPPAHANNOCK ELECTRIC LIGHT AND POWER CO., Fredericksburg.

Mich., Charlevoix—GENERAL ELECTRIC CO. OF MICHIGAN, Detroit, awarded contract for furnishing all electric-light meters for year ending Nov. 24, 1916.

Ill., Chicago—Contract for one-story boiler house at 4345-53 South Western Ave. for Union Petroleum Co. awarded to H. B. Barnard. Estimated cost, $15,000.

BRIDGES

Proposed Work

N. J., Perth Amboy—Bids will be received until 8:30 p.m., Jan. 5, by Board of Water Commissioners, for trestle over South Amboy-Bordentown Turnpike at Runyon. S. J. Mason, City Engr.

Va., Lunenburg—(Official)—Bids will be received at Office of Clerk, Lunenburg Court House, until noon, Jan. 3, for reinforced-concrete bridge across Middle Meherrin River. G. P. Coleman, Richmond, State Highway Comr.

W. Va., Berkeley Springs—(Official)—Bids will be received until Jan. 14 by County Court of Morgan County for two reinforced-concrete arch bridges of 60- and 80-ft. spans respectively. Plans prepared by West Virginia State Road Bureau, Morgantown, W. Va. R. P. Davis, Bridge Engr., West Virginia State Road Bureau.

Tenn., Manchester—City and Nashville, Chattanooga & St. Louis Ry. will build viaduct over railway tracks.

Tenn., Nashville—City Commission, Nashville, Chattanooga & St. Louis Ry. and Nashville Traction and Light Co. will lengthen and repave Church St. viaduct. Estimated cost, $90,000. W. W. Southgate, City Engr.

Ohio, Lima—City Council plans to construct viaduct over Ottawa River between North and South Lima. Estimated cost, $50,000. Carl Bryson, City Engr.

Ill., Ottawa—Citizens of La Salle Township will issue $85,000 bonds for Shippensport Bridge. Noted Oct. 7.

Iowa, Waverly—Bids will be received by County Auditor until Jan. 6 for substructure of bridge across Cedar River. Estimated cost, $4,500. C. A. Cool, County Engr.

Mo., St. Joseph—St. Joseph & Grand Island R.R. contemplates an expenditure of about $50,000 for repairing pivot pier of Missouri River bridge.

Mo., St. Louis—City Plan Commission has recommended construction of Kingshighway Blvd. viaduct over Broadway. Estimated cost, $60,000.

Mo., Warrensburg—Bids will be received by David Mohler, County Engr., until Jan. 4, for 20 steel bridges. Noted Sept. 23.

Tex., Ft. Worth—Bids will be received until Jan. 3 by Commissioners of Tarrant County for reconstructing Park St. Bridge. Estimated cost, $7,500. H. P. Haynes, County Engr. Noted Dec. 23.

Tex., Riverside—Commissioners of Trinity County, Groveton, and Walker County, Huntsville, will build bridge across Trinity River at Riverside. Estimated cost, $60,000, to be divided equally between the two counties.

Okla., Oklahoma—Bids will be received until Jan. 10 for 12 reinforced-concrete bridges in Oklahoma County. Estimated cost, $35,000. M. Cornelius, County Clk.

Okla., Sulphur—All bids recently received for bridge across Washite River rejected. New bids will be received until Jan. 20 by B. B. Horsman, Clk. of Murray County.

Ariz., Tucson—Bids will be received by L. O. Cowan, City Clk., until 5 p.m., Jan. 15, for reinforced-concrete bridge across Santa Cruz River. Estimated cost, $50,000. Noted Sept. 16.

Ore., Portland—Plans prepared for 400-ft. bridge over Balch Creek Cañon to connect Cornell Rd. with Lincoln Blvd. Estimated cost, $135,000. Philip H. Dater, City Engr.

Calif., Los Angeles—Bids will be received by H. J. Lelande, County Clk., until 2 p.m., Jan. 3, for bridge on Palm Ave.

Calif., Los Angeles—Bids will be received by H. J. Lelande, County Clk., until 2 p.m., Jan. 3, for bridge on Mountain Ave.

Calif., Sacramento—State Highway Commission will build bridge across Eel River near Scotia in Humboldt County. Estimated cost, $90,000, and Humboldt County will pay $40,000 of cost.

Bids In and Contracts Awarded

Penn., Philadelphia—Contract for Diamond St. Bridge over connecting railway awarded to CANTRELL CONSTRUCTION CO., Philadelphia, at $60,758. Noted Dec. 9 and 23.

Penn., Phœnixville — (Official) — Contract for reinforced-concrete bridge across Schuylkill River between Phœnixville and Mont Clare awarded to AMBLER-DAVIS CO., Hanson Bldg., Philadelphia, at $80,894. Noted Dec. 9.

Va., Norfolk—Contract for bridge over Tanner's Creek on Jamestown Blvd. awarded to ALSOP & PIERCE, at $28,780.

Fla., Clearwater—(Official)—We have been informed that bridge from Clearwater to Clearwater Key will be built by E. W. Parker and associates under supervision of E. W. Parker and not by Pinnellas County as stated in our issue of Dec. 9. Work will be done by their own forces and no bids received.

Ohio, Marysville—Contract for steel bridge over Buck Run awarded to JOHN L. PORTER, Marysville, at $4,631.

Ind., Indianapolis—Dunn-McCarthy Co., Chicago, Ill., at $53,659, submitted only complete bid for bridges, abutments and undergrade to crossings connected with crossing improvements at Drover St. and White River levee under Cleveland, Cincinnati, Chicago & St. Louis Ry. and Vandalia R. R.

Ind., Linton—Contract for Joshua Neal Bridge in Stockton Township, near Linton, and Lukenbill Bridge in Stafford Township, near Marco, awarded to VINCENNES BRIDGE CO., Vincennes.

Ill., Bellflower—(Official)—Contract for steel bridge in Lexington Township awarded to PORTER-McCULLY CONSTRUCTION CO., Mackinaw, at $12,990. Noted Dec. 2.

Ill., Watseka — (Official) — Contract for reconstructing bridge No. 137 awarded to CONTINENTAL BRIDGE CO., Peotone, at $6,100. Noted Dec. 2.

Neb., Tekamah—(Official)—Contract for concrete culverts awarded to H. J. CATHROE, Omaha, at $21,330. Towl Engineering Co., Omaha, Engr.

Tex., El Paso—Contract for four bridges across Rio Grande River awarded to EL PASO BRIDGE AND IRON CO., El Paso, at $24,000.

WATER-WORKS

Proposed Work

Maine, Lewiston—Maine Public Utilities Commission gave authority to Wilton Water Co. to issue $8,000 bonds for installing new intake stream chamber and new pipes.

Maine, Madison—Citizens contemplate 14-in. water main from Hancock Pond. Estimated cost, $130,000.

N. Y., Liverpool—Citizens considering installation of water system. Estimated cost, $25,000.

N. J., Peapack—Borough sold $55,000 bonds for municipal water plant.

Penn., Danville—Bids will be received Jan. 19 by Water Commissioners for reinforced-concrete rapid sand filter of 300,000 gal. capacity. Chester & Fleming, Union Bank Bldg., Pittsburgh, Penn., Engr.

Penn., Leighton—(Official)—Plans being prepared for water works system. W. N. Bowyer, City Engr. Noted Dec. 16.

Va., Norfolk—(Official)—Bids will be received by Board of Control until Jan. 8 for repairing three dams and spillways. Estimated cost, $56,000. T. B. Bornin, Engr.-in-charge. Noted Nov. 4. (See adv.)

W. Va., Buckhannon—See item under "Light, Heat and Power."

W. Va., Fairmont—City contemplates installing water meters. Estimated cost, $30,000. Ira Smith, Commr. Water and Sewers.

Ga., Savannah—City plans expenditure of $15,000 to extend water mains. E. R. Conant, Ch. Engr. Water Dept.

Fla., Ft. Meade—City sold $33,000 bonds for extension of sewer system, water-works and construction of new electric-light plant.

S. C., Charleston—Citizens defeated $1,500,000 bonds for water-works. Noted Dec. 2.

Miss., Oxford—J. H. Lawshee, City Clk., will issue $6,500 bonds for water-works and electric-light improvements.

Miss., Pass Christian—Bids will be received until Jan. 4 for laying 4-in. water main in Davis Ave. near Third St. to North Railroad St. W. A. Terrell, City Clk. Noted Sept. 23.

Tenn., Sharon—Citizens voted $25,000 bonds for water-works system and electric-light plant.

Ky., Glasgow—W. M. Dickinson and others have purchased property of Glasgow Water Co. and plan considerable improvements.

Ky., Hazard—Hazard Water Co. contemplates extending pipe through all main streets and installing filtration plant at power house.

Ohio, Akron—State will order installation of water meters capable of measuring flow through 20-in. pipe at plants of large consumers of canal water in Akron and Cincinnati manufacturing districts. Frank R. Fauver, State Supt. of Pub. Wks.

Ohio, South Charleston—Bids received Dec. 14 for water system rejected. Work will be readvertised. W. L. Wentz, City Clk. Noted Dec. 9.

Ind., Ligonier—City Council voted to extend water mains in North Main, North and Chatham St.

Ind., Miller—(Official)—Citizens voted $12,500 bonds for water works system. Carl Olander, City Clk.

Mich., Albion—(Official)—Citizens voted $10,000 bonds for completing municipal water system. J. W. Smith, City Clk. Noted Nov. 11.

Mich., Menominee—Menominee Water Co. will sell $200,000 bonds for municipal water-works system. Noted Nov. 11.

Mich., Monroe—James W. Follin, Engr., submitted reports for water-supply system, also recommends installation of filtration plant.

Mich., Mt. Morris—(Official)—Bids will not be received until spring for installation of water system. H. W. Graham, Pres. Noted Dec. 2.

Ill., Bluffs—Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., retained to prepare preliminary plans for water works system.

Ill., Glasford—Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., preparing plans for water works system.

Ill., Lebanon—Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., preparing preliminary plans for water works system.

Ill., Virden—Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., preparing preliminary plans for water works system.

Iowa, Ft. Madison—Citizens recently voted for sewer system.

Iowa, Iowa City—City Council plans to improve water works. Estimated cost, $50,000.

Iowa, Winterset—Citizens will soon vote on $15,000 bonds for water works.

Minn., St. Paul—Bids will be received until Jan. 17 by August Hohenstein, City Pur. Agt., for 30,000,000-gal. and 7,000,000-gal. covered reservoir, 15,000,000-gal. pumping engine, motor driven, revolving screening equipment. Estimated cost, $10,000. Noted Sept. 30.

Minn., St. Paul—William M. Jones preparing plans for water system. Estimated cost, $500,000.

Kan., Humbolt—Plans for municipal water-works system approved by Public Utilities Commission. Estimated cost, $12,000. Noted Dec. 16.

Mont., Three Forks—City contemplates improvement of water system. Estimated cost, $12,000. Noted Nov. 4.

Ark., Beebe—Contract for water system will be let in February. Estimated cost, $15,000. Lund & Hill, Little Rock, Ark., Consult. Engr. Noted Dec. 2.

Ark., Dardanelle—City retained J. F. Halliday, McAlester, Okla., as engineer for improvements to water works. Estimated cost, $15,000. Noted Dec. 23.

Tex., Carthage—See item under "Sewers."

Tex., Cooper—See item under "Sewers."

Tex., Ft. Worth—Citizens will vote Jan. 6 on $500,000 bonds for water-works system.

Tex., Mart—City sold $18,000 bonds for improvements to water works. J. L. Vaughn, Mayor. Noted Dec. 2.

Tex., Texarkana—Citizens voted to improve water-works system.

Tex., Trinity—Plans prepared for water system. H. S. Wilder, Houston, Consult. Engr. Noted Dec. 2.

Okla., Stillwater—Citizens defeated $116,000 bonds for water works system.

N. M., Clovis—City Council will hold election to vote on $25,000 bonds for extension and improvement to sewer, water and light systems.

Idaho, Downey—W. D. Cotton, Engr., Idaho Falls, retained by City Council to prepare plans for water system.

Idaho, Pocatello—City sold $400,000 bonds for municipal water system. Noted Oct. 14.

Utah, Providence—Town Board plans new water-works system.

Ariz., Casa Grande—Citizens will vote on bonds for municipal water works and electric-light plant. E. R. Stoner, City Clk.

Ariz., Miami—Citizens voted $80,000 bonds for municipal water system; also $40,000 bonds for municipal electric-light plant. Noted Dec. 2.

Wash., Colville—City Council retained Sawyer Bros., Engr., Spokane, for construction of new water supply system. Estimated cost, $15,000. Noted Oct. 7.

Wash., Ridgefield—Bids will be received by J. W. Blackburn, Town Clk., until Jan. 4 for water system. Estimated cost between $10,000 and $15,000. Noted Nov. 11.

Wash., Seattle—Board of Public Works considering plans for water mains in Michigan St. Estimated cost, $10,000. J. H. Dimock, City Engr.

Wash., Seattle—Board of Public Works considering plans for water mains in Orcas and Doris St. Estimated cost, $10,000. A. H. Dimock, City Engr.

Ore., Grants Pass—Citizens defeated proposition to purchase and improve water system. Estimated cost, $120,000.

Ore., Turner—R. O. Thomas, Mayor-elect, contemplates the installation of a water system.

Que., Sherbrooke—City Council will install water main in Wellington St. Estimated cost, $4,720. F. McKean, Supt., Water-Works Dept.

Ont., Dryden—Plans prepared for water system. Estimated cost, $25,000. B. S. McKenzie, 1002 Union Trust Bldg., Winnipeg, Consult. Engr. Noted Dec. 2.

Ont., Dundas—Plans being prepared for water mains in several streets. R. W. Karch, Chn. Pub. Utilities Comn.

Ont., Midland—Citizens plan expenditure of $13,000 for addition to its water-works plant. Frank R. Weston, City Clk.

Ont., Unionville—Plans being prepared by J. E. James, City Engr., 57 Adelaide St. E., Toronto, for water-works system. Estimated cost, $14,000.

Bids In and Contracts Awarded

R. I., Cranston—(Providence post office)—Low bids received for making wash and core borings were as follows: Sprague & Henwood, Inc., Scranton, Penn., at $10,460; William Gates Stearns, Jamaica, N. Y., at $12,380; Alliance Well Co., Providence, R. I., at $12,830. Walter B. Chafee, City Clk. Noted Dec. 9.

N. Y., New York—(Official)—Lowest bid submitted for furnishing apparatus and appurtenances for applying liquid chlorine to Croton water-supply at Dunwoodie, Yonkers, was that of Wallace & Tiernan Co., Inc., 136 Liberty St., New York, at $6,645. Noted Dec. 16.

N. J., Secaucus—Contract for water pipe line connections at County Road and County Farm, awarded to CULLIGAN & MACH, 122 West 26th St., Bayonne.

N. J., Ventnor—(Official)—Contract for supply of pumps and air compressors awarded to JOSEPH T. SURIGARD & CO., Philadelphia, Penn. Estimated cost, $30,674. Noted Nov. 11.

Penn., Philadelphia—Lowest bids received for equipment for city pumping stations were as follows: Coal storage and handling equipment, Specialty Engineering Co., Trenton and Allegheny Ave., Philadelphia, $17,950; stokers and superheaters, Combustion Engineering Corporation, $17,950; blowers, S. F. Sturtevant Co., $1,900; c.-i. pipes and special fittings, Standard Cast-Iron Pipe and Foundry Co., Bristol, Tenn., $6,427; mechanical stoker equipment, Combustion Engineering Corporation, $15,864.

Ga., Fitzgerald—Contract for reinforced-concrete clear-water basin awarded to CASE & COTHRAN, Candler Bldg., Atlanta, Ga. Estimated cost, $6,500.

Ohio, Cleveland—Contract for water mains in South Woodland Rd., awarded to LANSEE CO., Cleveland Heights. Estimated cost, $20,000. F. A. Pease Engineering Co., Marshall Bldg., Cleveland, Engr. Noted Dec. 9.

Ohio, Wilberforce—Contract for improvements to water supply system awarded to SHARTLE MACHINE CO., Columbus. Noted Dec. 2.

Mich., Albion—(Official)—Low bidders for pumping station and boiler house for water system were F. W. Schmacher, Albion, at $7,688; Weston Bros., Albion, at $11,072. J. C. Smith, City Clk. Noted Dec. 9.

Mich., Detroit—Contract for water-works system awarded by Board of Water Commissioners to GAMON METER CO., Newark, N. J.

Ill., Frankfort—Contract for new water mains awarded to CHICAGO HEIGHTS COAL CO., Chicago. Estimated cost, $10,919.

Ill., Galesburg—(Official)—Bids for tubular deep well rejected. F. L. M. Connolly, City Engr. Noted Dec. 16.

Wis., West Allis—Contract for laying water main in 50th Ave. awarded by City Council to H. HOHENSE.

N. D., Velva—City Council rejected all bids for improvements to water works.

Tex., Dallas—(Official)—Contract for new water pipes in Oakcliff St. awarded to AMERICAN CAST IRON PIPE CO. Estimated cost, $215,000. J. M. Preston, City Engr. Noted Dec. 16.

Ore., Gaston—Contract for water works system awarded to V. R. DENNIS, Lewis Bldg., Portland. Estimated cost, $7,500.

Ore., Milwaukee—Low bidders for water works system were: Giebisch & Joplin, Portland, $22,542; Oskar Huber, Portland, $24,666; J. F. Shea, Portland, $24,982. J. W. Morris, City Engr. Noted Nov. 25.

Que., Princeville—Contract for water system, pumping station, also 4-in. and 6-in. c.-i. pipes, valves, pumps, hydrants, etc., awarded to B. FEENEY. Estimated cost, $25,000. Noted Dec. 9.

Ont., Brockville—Contract for filtration plant awarded to ROBERTS FILTRATION CO., Derby, Penn. Estimated cost, $86,000. Noted Oct. 22.

B.C., Port Moody—Contract for supply pipe for new water-works system awarded to CANADIAN PIPE CO.

SEWERS

Proposed Work

Mass., New Bedford—Bids will be received until Jan. 12 for installing intercepting sewers. Estimated cost, $65,000. William F. Williams, City Engr. Noted Oct. 21.

N. Y., Buffalo—City plans expenditure of $4,000,000 for sewage-disposal plant.

N. Y., New Rochelle—Board of Estimates passed $50,000 bond issue for sewage-disposal plant.

N. Y., North Tonawanda—Citizens plan expenditure of between $150,000 and $160,000 for sewage-disposal plant.

N. Y., Oneonta—(Official)—Bids will be received next spring for sewage-disposal plant. Estimated cost, $45,000. F. M. Gurney, City Engr. Noted Dec. 16.

N. Y., Utica—Harry R. Hays, Commissioner of Public Works, recommends that plans be prepared for improvements to sewer system.

N. J., Jersey City—Board of Commissioners approved installation of new sewer in Horseshoe Section.

Md., Baltimore—Citizens defeated $40,000 bonds for three sanitary sewers.

Va., Norfolk—City will construct concrete drain and culvert in south end of Dinwiddie St. W. T. Brooke, City Engr.

N. C., Greensboro—Citizens voted $75,000 bonds for improving and extending sewers and water mains. Noted Nov. 11.

N. C., Kings Mountain—City contemplates sewer system.

Fla., Ft. Meade—See item under "Water-Works."

Fla., Gainesville—See item under "Streets and Roads."

Fla., Gainesville—(Official)—Bids will be received in February for extension of sewer system. Estimated cost, $12,000. G. H. Cairns, City Engr. Noted Dec. 16.

Fla., Key West—John J. Quinn and John R. Pearson applied for franchise to construct sewer system.

Tenn., Nashville—City Commissioners plan to build new sewers. Estimated cost, $300,000. W. W. Southgate, City Engr.

Ky., Paducah—See item under "Buildings."

Ohio, Greenville—Plans been prepared for trunk sewer in Greenville. Estimated cost, $50,000.

Ohio, Lancaster—City plans storm sewer in South Broad St. from Hocking River to Main St. Estimated cost, $8,200.

Ohio, Middletown—Bids will be received by City Commission, City Hall, until noon, Jan. 4, for storm and sanitary sewer in various streets.

Ohio, Portsmouth—City Council sold $32,500 bonds for sewer construction.

Ohio, Youngstown—Bids will soon be received for sewer in Mill Creek Sewer District. Frank Little, City Engr. Noted Oct. 21.

Ind., Fairmount—(Official)—W. J. Sherman Co., Toledo, Ohio, has been retained to prepare plans for complete sanitary sewer system.

Ill., Alton—J. E. Schwaab, City Engr., is preparing plans for East Side trunk sewer. Noted Sept. 16.

Iowa, Clinton—Bids will be received until Jan. 11 for storm sewer in First St. Estimated cost, $5,323.

Iowa, Hampton—Bids will be received until Jan. 7 for sanitary sewer system. P. A. Van Pelt, City Clk. Noted Dec. 23.

Iowa, Rock Valley—Press reports state citizens contemplate sewer system.

Iowa, Waterloo—Citizens comtemplate sewer system and sewage-disposal plant. Estimated cost, $5,000. Burns & McDonnell, 821 Scarritt Bldg., Kansas City, Mo., Engr.

Kan., Kansas City—City plans to construct sewer system. J. L. Beggs, Street Comr.

Neb., Pierce—Bids will be received about Mar. 1 by L. P. Connor, City Clk., for sewer system. Estimated cost, $20,000. Noted Dec. 23.

Mo., St. Louis—Bids will be received by city until noon, Jan. 7, for constructing North Baden public sewer, First Section, also for sewers in Glaise Creek Sewer District No. 12.

Tex., Carthage—City Council contemplates sewer and water works systems.

Tex., Cooper—City contemplates sewer and water works system.

Tex., Dallas—Bids will be received about Jan. 15 for purchase of $350,000 bonds for sewage-disposal plant.

Tex., Dallas—City Commissioners will soon receive bids for sanitary sewer main between Zang's Blvd. and Winnetka Ave. in Oakcliff. Estimated cost, $21,500. Noted Nov. 11.

Tex., Graham—Citizens will vote on bonds for sewer system. Noted Dec. 16.

Tex., Venus—City will hold election Jan. 11 to vote on $10,000 bonds for sewer system.

Okla., Enid—Plans being prepared for sewer system in three new sewer districts and for extensions in two districts. W. C. Rogers, City Clk. Noted Dec. 2.

N. M., Clovis—See item under "Water-Works."

Ore., La Grande—Contract for sewer system will be let in January. Estimated cost, $16,000. L. D. Howland, City Engr. Noted Dec. 9.

Calif., Pomona—Board of Trustees approved plans for sewer system. Estimated cost, $55,000.

Bids In and Contracts Awarded

Mass., Needham—(Official)—Contract for sewer work in Section No. 104 awarded to BAY STATE DREDGING CONTRACTING CO., 247 Atlantic Ave., Boston. Estimated cost, $59,055. Noted Dec. 23.

Mass., Needham—Contract for sewer work in Section No. 103 awarded to BRUNI & POTITTI, 18 Tremont St., Boston. Estimated cost, $34,011.

N. Y., Buffalo—Contract for sewer in Swan and Seneca St., awarded to JOSEPH F. STABELL CONSTRUCTION CO., Niagara St., Buffalo. Estimated cost, $110,693. George H. Norton, City Engr.

N. Y., Mt. Vernon—Contract for sewers awarded to FRED W. BURNHAM, 30 East 42nd St., New York, N. Y.

N. J., Jersey City—Contract for pipe sewer in Wade St. to connect with sewer in Ocean Ave., awarded to CHARLES O'NEILL. Noted Nov. 18.

Md., Baltimore—Low bids received for lateral sewers in District No. 34C, Sanitary Contract No. 170 were from Glass & McAleer, 2030 Hartford Ave., Baltimore; in District No. 39C, Sanitary Contract No. 171, W. H. & C. F. Thompson, 530 East 70th St., Baltimore. Noted Nov. 25.

Ala., Citronelle—Contract for sewer system awarded by city to J. W. GURLEY & CO., Mobile. Estimated cost, $28,088. Edgar B. Kay, Tuscaloosa, Engr. Noted Oct. 14.

Ohio, Springfield—Low bids for constructing a number of sewers in various streets were received from Huonker & Krumholtz, at $4,579 and R. J. Cavanaugh, at $4,857. Noted Nov. 15.

Ind., Mishawaka—Contract for sewers in Wenger Ave. from Lincoln Highway to Homewood Ave. awarded to M. SMITH, Elkhart.

Ind., Wabash—Contract for sanitary sewers in Thorne and Market St., awarded to GEORGE E. HIPSKIND. W. L. Agan, City Engr.

Mich., Grand Rapids—Board of Public Works awarded contract for sewer in Sheridan Ave. to DEBRUINE & NEUWSEN.

Minn., Belle Plaine—Contract for sanitary sewers in Market, Forest and Meridan St. awarded to ILLSTRUP & OLSEN, Minneapolis. Estimated cost, $6,804. Noted Dec. 2.

Minn., St. Paul—(Official)—All bids rejected for sewer in Eaton St. O. Claussen, City Engr. Noted Dec. 16.

Minn., St. Paul—Contract for installing 4,300 ft. 15-in. to 36-in. sewer awarded to TANNER BROS., Detroit, Mich. Estimated cost, $24,490.

Kan., Cherryvale—(Official)—Contract for sewers in District No. 2 awarded to AXTEL & OLDHAM, Kansas City, Mo. Estimated cost, $14,401. Noted Nov. 25.

Kan., Hutchinson—(Official)—Contract for sanitary sewer for Hyde Park addition awarded to J. H. SHEARS & SONS, Hutchinson. E. Metz, City Clk. Noted Oct. 21.

Neb., Lincoln—(Official)—Contract for storm sewer in J St. awarded to CATHROE CO., Omaha, Neb. Estimated cost, $5,391. T. H. Berg, City Clk. Noted Dec. 16.

Tex., Houston—Contract for sewer improvements awarded as follows: HORTON & HORTON, Burnett St. sewer, at $70,500; Paschal St., North Main to Cochran St., at $17,600; DAVIS BROS., White Oak and Florence St. sewer, at $2,000. E. E. Sands, City Engr. Noted Dec. 9.

Ore. Portland—Contract for sewers in various streets awarded to W. S. WEAVER, Portland. A. L. Barbour, City Clk. Noted Sept. 30.

Calif., San Francisco—(Official)—Low bidder for sewer system in South Bay View District was Tibbetts-Pacific Co., 16 California St., San Francisco, at $37,788. M. M. O'Shaughnessy, City Engr. Noted Dec. 2.

Ont., Hull—Citizens will install sewers in Scott and Chateauguay St. by day labor. J. P. A. Laforest, City Engr.

Ont., Ottawa—City will construct sewer by day labor. Estimated cost, $425,000. F. C. Ashwith, City Engr. R. S. & W. S. Lea, 10 Cathcart St., Montreal, Que., Consult. Engr. Noted Nov. 4.

Ont., Sarnia—Contract for sewers in Stewart St., N., Stewart St., S., and William St. awarded to PATRICK CORRIGAN. Estimated cost, $4,626.

Ont., Toronto—Contract for sewers in various streets awarded to W. E. TAYLOR, 43 Clinton St., Toronto. Estimated cost, $22,000. Noted Dec. 16.

GARBAGE

Proposed Work

N. Y., Binghamton—John A. Giles, City Engr., recommended to City Council construction of garbage incinerating plant on Noyes Island. Estimated cost, $110,000.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received by J. T. Fetherston, Comr. of Street Cleaning, Municipal Bldg., until noon, Jan. 18, for final disposition of garbage from boroughs of Manhattan, Bronx, Brooklyn and of City of New York on city land, Form No. 2.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids will be received until noon, Jan. 18, at Room 1247, Municipal Bldg., Borough of Manhattan, for disposal of garbage for period of five years in Boroughs of Manhattan, Bronx and Brooklyn. (See adv.) Plans and specifications on file at office of "Engineering News," 36th St. at Tenth Ave., New York.

Ohio, Cleveland—Bids will be received until noon, Jan. 4, by Adam H. Graham, Dir. of Pub. Ser., for disposal of garbage for period of two years, from Apr. 1, 1916, to Apr. 1, 1918.

Ohio, Columbus—Bids will be received until noon, Jan. 4, by George A. Borden, Dir. of Pub. Ser., for purchase of garbage grease and tankage produced at Municipal Reduction Plant.

Wis., West Allis—Bids will be received until 7:30 p.m., Jan. 3, by E. J. Oberst, City Engr., for municipal garbage incinerator. Estimated cost, $5,000. Noted Dec. 2.

Bids In and Contracts Awarded

N. Y., Utica—Contract for collection and removal of garbage for five years, from Jan. 1, 1916, to Dec. 31, 1920, awarded to DANIEL T. BECKER and JOHN J. O'NEILL, Utica, at $125,940.

N. Y., Utica—Contract for cleaning paved streets of city for five years from Jan. 1, 1916, to Dec. 31, 1920, awarded to HARRY W. ROBERTS CO., Utica, at $332,400.

Penn., Philadelphia—Contract awarded by Department of Public Works for collection and disposal of garbage for 1916 to PENN REDUCTION CO., at $373,588. Noted Nov. 111.

Del., Wilmington—Board of Health awarded contract for disposal of garbage for period of nine years to WILMINGTON SANITARY CO., at $81,500. Noted Oct. 21.

STREETS AND ROADS

Proposed Work

Mass., Cambridge—City Council has appropriated $50,000 for paving Massachusetts Ave. from City Hall to Quincy Sq., and $7,000 for paving Munroe St.

N. Y., Dryden—Stone road will be constructed from Dryden and Groton town line at McLean through DeBoudre's Farm on Dryden-Courtland macadam road.

N. Y., New York—(Borough of Brooklyn)—Official)—Bids will be received by L. H. Pounds, Borough Pres., until 11 a.m., Jan. 6, for furnishing and delivering asphalt, granite and wood paving blocks, 5,000 bbl. portland cement and 2,000 cu.yd. paving sand.

N. Y., Syracuse—Council considering proposition to extend Massena St. through to intersection of Tully and Ontario St. Estimated cost, $100,000.

N. J., Jersey City—Bids will be received by J. C. Sweeney, Clk., Blvd. Comrs., until 11 a.m., Jan. 5, for 40,000 gal. asphaltic road oil, 100,000 gal. asphaltic road binder, about 4,000 yd. crushed stone, 12,000 ft. wire No. 6 and 8 and 750 gal. engine oil.

W. Va., Clarksburg—Press reports state that citizens of Portland District, Preston County, contemplate $250,000 bond issue for road from Albright on Morgantown & Kingwood R.R. to Maryland state line.

W. Va., Morgantown—Bonds for $300,000 sold for road improvements in Morgan District.

W. Va., Welch—Citizens voted $293,000 bonds for road construction in Sandy River District, McDowell County. Noted Nov. 18.

N. C., Greenville—Bonds for $50,000 voted by citizens of Pitt County, Chicod Township, for road work. S. A. Congleton, Chn. of County Comrs.

Ga., Atlanta—Commissioners of Fulton County contemplate 2-mile boulevard around lake at Lakewood.

Ga., Atlanta—Ivy St. will be paved with asphalt from Peachtree St. to Edgewood Ave. Estimated cost, $13,600.

Ga., Savannah—Appropriation of $65,000 made by city for street improvements.

Ga., Tifton—City will issue $10,000 bonds for paving.

Fla., Gainesville—(Official)—Bids will be asked in two or three months for paving portion of University Ave. and extending sewer system. Citizens recently voted $21,000 bonds for this purpose. Noted Dec. 16.

Fla., Palatka—County plans to build sand asphalt road to Orange Springs, 18½ miles. Estimated cost, $77,850.

Fla., St. Augustine—Bids will be received until Jan. 4 by I. I. Moody, Chn., Comrs. of St. Johns County, for paving King St. from San Sebastian Bridge to Horn Rd. with brick.

Miss., Gulfport—Board of Supervisors of Harrison County contemplates $200,000 bond issue for boulevard along sea front.

Miss., Jackson—Bids will be received by W. W. Downing, Chancery Clk., until Jan. 4 for surfacing about 5 miles of road.

Tenn., Columbia—City Council will improve West Seventh, Garden and Railroad St. with asphaltic concrete.

Tenn., Columbia—Maury County Highway Commissioners will build road from Hampshire to County line, about 3 miles.

Tenn., Jonesboro—Citizens voted $425,000 bonds for road construction. Noted Nov. 18.

Tenn., Murfreesboro—Citizens defeated $175,000 bonds to purchase and maintain turnpikes. Noted Sept. 30 and Nov. 4.

Tenn., Nashville—City Commissioners appropriated $146,130 for paving in 1916. W. W. Southgate, City Engr.

Ky., Somerset—Citizens of Pulaski County defeated $300,000 bonds for roads. Noted Sept. 16.

Ohio, Akron—Plans will be prepared for repaving Exchange St. from East Market St. to Portage Path.

Ohio, Akron—Commissioners of Summit County contemplate an expenditure of $372,000 for road work next year.

Ohio, Cleveland—Commissioners of Cuyahoga County will pave West Lake Rd. next spring. Estimated cost, $200,000.

Ohio, Independence—(Official)—Bids will be received by Arthur J. Goudy, Village Clk., until noon, Jan. 8, for sidewalks on Brecksville Rd. between Station No. 178 and 230.

Ind., Columbia City—Bids will be received until 2:30 p.m., Feb. 9, by T. A. McLaughlin, Audr., Comrs. of Whitley County, for road on line between Whitley and Noble Counties.

Ind., Columbia City—Bids will be received by T. A. McLaughlin, Audr., Comrs. of Whitley County, until 1 p.m., Feb. 9, for three gravel roads in Smith Township.

Ind., Ft. Wayne—(Official)—Bids will be received by Board of Park Commissioners of City of Ft. Wayne until 4 p.m., Jan. 17, for improving Rudisill Blvd. from west property line of Piqua Ave. to east property line of Broadway.

Ill., Dixon—According to press reports plans are being considered for $750,000 bond issue for road improvements.

Ill., Galena—City plans to pave a number of streets next spring.

Ill., Galena—Election will be held in Kane County next spring to vote on $1,500,000 bonds for State-aid highways.

Ill., Ottawa—Board of Supervisors of La Salle County contemplate $500,000 bond issue for road work.

Ill., Peoria—Board of Local Improvements plans to pave Elm St. between Adams St. and Reed Ave. with brick. Estimated cost, $6,051.

Wis., Washburn—Plans being prepared for street improvements during 1916.

Iowa, Clinton—Bids will be received by city until Jan. 11 for paving seven blocks in downtown district with brick. Estimated cost, $53,678.

Minn., Carlton—Bids will be received by A. R. Norman, County Audr., until 10 a.m., Jan. 7, for State Rural Highway No. 11. Estimated cost, $32,885. C. D. Conkey, Engr.

Minn., St. Paul—(Official)—Bids will be received by A. Hohenstein, Pur. Agt., until 10:30 a.m., Jan. 3, for grading and improving Osceola Ave. from Lexington Ave. to Dunlap St.

Neb., Omaha—Plans approved by City Commissioners for boulevard from Fontelle to Miller Parks.

Mo., Kansas City—According to press reports movement is on foot to rocksurface the Osage Valley Highway between Kansas City and Springfield.

Mo., Mountain Grove—Bonds for $45,000 voted by citizens for road work.

Mo., Platte City—Board of Supervisors of Platte County plans bond issue for 139 miles of rock roads.

Mo., St. Louis—Bids will be received by E. R. Kinsey, Pres., Bd. of Pub. Ser., until noon, Jan. 7, for grading Taylor Ave. from Broadway to Florisant Ave.

Ark., Waldron—Surveys will be made by State Highway Department, Little Rock, for road from Waldron to Coaldale, 22 miles.

Tex., Dallas—O. H. Lang, City Comr., will submit plan to citizens for paving all streets of city. Estimated cost, $7,500,000.

Tex., Denison—Bids will be received by Commissioners of Grayson County until Jan. 12 for improving highway system. Estimated cost, $1,150,000, of which $900,000 is now available. J. C. Field & Co., 105 Field Bldg., Consult. Engr.

Tex., El Paso—Commissioners of El Paso County contemplate an expenditure of between $100,000 and $125,000 for improving Upper Valley Rd.

Tex., Graham—Citizens of Graham District defeated $35,000 bonds for road improvements.

Tex., Grand Saline—Election will be held Jan. 10 to vote on $16,000 bonds for street improvements.

Tex., La Grange—Election will be held in Fayette County, Commissioners Precinct to vote on bonds for 70 miles of road, Schulenberg portion of National Highway. J. C. Baumgarten, Pres.

Tex., Lockhart—Election will be held Jan. 22 to vote on $50,000 bonds for highway construction. Noted Dec. 9.

Tex., Lufkin—Election will be held Feb. 26 in Angelina County, Lufkin Precinct, to vote on $200,000 bonds for road construction.

Tex., Sulphur Springs—Citizens voted $100,000 bonds for road improvements in Precinct No. 1. Noted Nov. 18.

Wash., Seattle—Bids will be received until Jan. 11 by Commissioners of King County for road from Hazelwood to Newport, part of Permanent Highway No. 13. Estimated cost, $25,000.

Wash., Seattle—Bids will be received until Jan. 16 by Commissioners of King County for Permanent Highway No. 12.

Wash., Walla Walla—City contemplates expenditure of between $75,000 and $100,000 for paving various streets next year.

Ore., Astoria—Bids will be received about Jan. 1 for paving Commercial St.

Ore., Portland—City Council plans to improve East 29th St. from Belmont to East Stark St. and East Washington St. from East 29th to East 31st St.

Bids In and Contracts Awarded

Mass., Boston—(Braintree)—Contract for road in Barnstable Township, Braintree, awarded to THOMAS & MURPHY, Middleboro, at $9,839.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids were received Dec. 20 for repairing asphalt pavement on marginal streets and piers, North, East and Harlem Rivers, about 13,000 sq.yd., as follows: Uvalde Asphalt Paving Co., $1.34 per sq.yd.; Barber Asphalt Paving Co., $1.375 per sq.yd.; Sicilian Asphalt Paving Co., $1.38 per sq.yd. Noted Dec. 16.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids were received Dec. 21 for wood-block pavement in team gangway and wagon way spaces of municipal ferryboat

"Mayor Gaynor," from Franklin Contracting Co., 52 Vanderbilt Ave., New York, at $2,800, and Richard Lamb, at $3,520. Noted Dec. 16.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids were received Dec. 21 for wood-block pavement in team gangway and wagon way spaces of municipal ferryboats "Bayridge," "Gowanus" and "Nassau," from Franklin Contracting Co., 52 Vanderbilt Ave., New York, at $12,700, and Richard Lamb, at $16,737. Noted Dec. 16.

N. Y., New York—(Borough of Manhattan)—(Official)—Bids were received Dec. 21 for wood-block pavement in team gangway and wagon way spaces of municipal ferryboats "Manhattan," "Brooklyn," "Queens," "Bronx" and "Richmond," from Franklin Contracting Co., 52 Vanderbilt Ave., New York, at $15,400, and Richard Lamb, at $18,799. Noted Dec. 16.

N. J., Jersey City—Contract for improving Newark Turnpike awarded to WILLIAM BAKER, INC., at $480,000.

Md., Baltimore—Contract for paving Pratt St. from Linwood Ave. to east city limits awarded to BALTIMORE ASPHALT BLOCK AND TILE CO., Monroe and Lorman St., Baltimore. Noted Dec. 16.

N. C., Lincolnton—Contract for paving Main St. and constructing 20 blocks of sidewalks awarded to NOLL CONSTRUCTION CO., Chattanooga, Tenn.

Fla., Jacksonville—Contract for paving awarded to H. H. ENBODY, Aurora, Ill. Estimated cost, $40,000.

Fla., Tarpon Springs—Contract for constructing sidewalks awarded to SOUTHERN CONCRETE AND CONSTRUCTION CO., Tarpon Springs and St. Petersburg.

Ohio, Cleveland Heights—(Warrensville post office)—Contract for grading and flagging South Woodland Rd. awarded to J. W. CHAPMAN, 1653 Ridgefield Rd., Cleveland. Estimated cost, $25,176.

Ind., Anderson—Commissioners of Madison County awarded contract for four gravel roads to RAYMOND STEPHENS, at $2,120, $2,150, $6,300 and $3,575, respectively; two gravel roads to MADISON CONSTRUCTION CO., at $2,000 and $1,349, respectively. Noted Nov. 25.

Ill., Rock Island—Contract for paving Eighth Ave., and 24th and 29th St. awarded to McCARTHY IMPROVEMENT CO. Estimated cost, $15,052. Noted Dec. 16.

Tex., Clarksville—Contract for system of highways including bridges, culverts, etc., for Road District No. 1, Red River County, awarded to TEXAS NATIONAL CONSTRUCTION CO., Clarksville. Estimated cost, $300,000. J. R. Johnson, Engr. Noted Dec. 2.

Tex., Dallas—Contract for paving Bishop Ave. from Jefferson to Davis St. awarded to STANDARD ENGINEERING AND CONSTRUCTION CO., at $18,023.

Tex., Liberty—N. A. DAWSON, San Antonio, at $25,000, awarded contract for gravel highway on road from Liberty to Livingston.

Tex., San Saba—San Saba County Commissioners awarded contract for constructing and improving sand-clay roads to HORACE H. SHELTON, San Antonio. Estimated cost, $50,000.

Okla., Muskogee—Contract for road improvements in Muskogee County awarded to H. B. WILSON, at $8,000. J. B. Clonts, County Engr. Noted Nov. 11 and Dec. 16.

Wash., Olympia—Contract awarded to S. G. KINDER, Bridgeport, at $7,568 for surfacing with gravel 12 miles of Sunset Highway, Wenatchee northerly.

Wash., Olympia—Contracts for highway work awarded as follows: G. L. STICKLER, Davenport, $23,887, for 8¾ miles, Inland Empire Highway Pullman South; H. L. WILSON CO., Walla Walla, $16,945, for 11½ miles, Inland Empire Highway Kennewick West, Kiona to Richland; G. L. STICKLER, Davenport, $22,639, for 9½ miles, Inland Empire Highway Walla Walla West, Touchet to Wallula; GENERAL CONSTRUCTION CO., Spokane, $21,646, for 9 miles, Insland Empire Highway Rosalia to Oakesdale. Noted Dec. 2.

Wash., Seattle—Vahlbusch-Holmes Co., 2332 First Ave., Seattle, at $13,980, submitted lowest bid for grading Rainier Ave. A. H. Dimock, City Engr.

Ore., Portland—Oregon Hassam Paving Co., at $7,512, low bidder for paving Summit Drive District with hassam, and Manning & Co., at $7,672, for concrete.

INDUSTRIAL WORKS

Proposed Work

Mass., Malden—Commonwealth Acid Phosphate Co. has purchased a site in Wellington District, Malden, on which it plans to construct a plant. Henry C. Sawyer, 53 State St., Boston, Agent.

Mass., Wellington—(Boston post office)—Commonwealth Acid Phosphate Co., recently organized, will build plant. Estimated cost, $250,000. Willard Welsh, 15 Exchange St., Boston, interested.

Conn., New Milford—Press reports state that bleachery to be known as Robertson Bleachery will be constructed at New Milford. Estimated cost, $800,000.

N. Y., Amsterdam—A. V. Morris & Son, Ft. Johnson, plans to rebuild plant at Amsterdam which was recently destroyed by fire with a loss of $100,000.

N. Y., Elmira—Plans being prepared for additions to plant of Fold-Easyhouse Manufacturing Corporation, recently incorporated with $250,000 capital stock. M. C. P. Parker, Pres.

N. Y., New York—(Borough of Brooklyn)—Plans being prepared by John C. Wandell for two-story, 40x100-ft. garage on 40th St. for W. R. Thomas. Estimated cost, $15,000.

N. Y., New York—(Borough of Queens)—(Official)—We have been informed that S. Sugar, 600 West 181st St., New York (Borough of Manhattan), is Arch. for proposed two-story factory for H. W. Beyer & Co., 507 West 50th St., New York, and not National Fireproofing Co., 949 Broadway, New York, as stated in our issue of Dec. 9.

N. Y., New York—(Borough of Queens)—Bids will soon be received by William Higginson, Arch., 13 Park Row (Borough of Manhattan), for 100x364-ft. factory and garage near Nott Ave., Long Island City, for Degnon Realty and Terminal Improvement Co., to be occupied by Rome Manufacturing Co., 149 Broadway, New York.

N. Y., Niagara Falls—Hooker Electrochemical Co. will build addition to plant. Estimated cost, $1,000,000.

N. Y., Niagara Falls—International Acheson Graphite Co. will build addition to plant. Estimated cost, $100,000. W. Acheson Smith, Gen. Mgr.

N. Y., Schenectady—General Electric Co. will construct addition to its plant. Estimated cost, $25,000.

N. J., Jersey City—Joseph Dixon Crucible Co. will erect four-story, 100x150-ft. addition to plant on Monmouth St. Estimated cost, $50,000.

N. J., Jersey City—Plans being prepared by William G. Massarebe, 15 East 40th St., New York, N. Y., for rebuilding six-story, 40x60-ft. factory on Sherman Ave. for Gylmann Realty Co., to be occupied by Alaska Chemical Co. Estimated cost, $30,000.

N. J., Trenton—Robert C. Maxwell Co. purchased site on East State St. and will build plant.

N. J., West Hoboken—Nairn Linoleum Co., Kearney, will build factory at West Hoboken. Estimated cost, $30,000.

Penn., Philadelphia—Plans prepared by Ballinger & Perrott, Arch., Philadelphia, for four-story factory, oxidizing building and two-story pump house for George W. Blabob Co., Philadelphia.

Penn., Philadelphia—Cover & Co. will build five-story ware house at 244 North Third St.

Penn., Philadelphia—Olney Ice Manufacturing and Cold Storage Co. will build plant at Duncannon and Mascher St. Peuckert & Wunder, 310 Chestnut St., Philadelphia, Arch.

Penn., Philadelphia—Plans prepared for four-story, 40x150-ft. warehouse at Front and Federal St. for Pennsylvania R.R. Co. A. C. Shand, Philadelphia, Ch. Engr.

Penn., Philadelphia—Pennsylvania Taximeter Cab Co. plans to build 10-story concrete garage on South Broad St. Estimated cost, $300,000.

Penn., Uniontown—Pennsylvania R.R. Co. will build freight house, warehouse and new yards. Estimated cost, $240,000.

Md., Baltimore—Board of Estimate contemplates building asphalt plant. Estimated cost, $20,000.

W. Va., Clarksburg—Sunnyside Orchard Co., recently incorporated with $80,000 capital stock, plans to build large canning plant on Reynolds Farm on Fairmont-Clarksburg Interurban Traction line.

W. Va., Wheeling—J. E. Moss Iron Works Co. will build addition. Estimated cost, $10,000.

N. C., Winston-Salem—P. H. Hanes Knitting Co. will build four or five-story addition to mill.

Ga., Columbus—Eagle & Phoenix Mills contemplates expenditure of $75,000 for enlarging its mills.

Fla., Jacksonville—Commodores Point Terminal Co. plans to build large wharf warehouse. A. G. Cummer and J. P. Taliaferro, interested.

Tenn., Chattanooga—Tennessee Stove Works contemplates addition. Estimated cost, $50,000.

Tenn., Knoxville—Southern Ry. will build and equip 73x480-ft. steel car-repair shed, 51x100-ft. workshop, 48,000 gal. tank for water supply, 37x92-ft. reclaiming shed, 52x400-ft. scrap dock, 32x100-ft. lumber shed at Coster Shops. Estimated cost, $200,000. W. H. Wells, Washington, D. C., Ch. Engr. Constr.

Tenn., Nashville—Tennessee Extract Co. will construct plant. Estimated cost, $250,000.

Tenn., Nonconnah—(Memphis post office)—Reported that Illinois Central R.R. contemplates building steel car plant. Estimated cost, $1,000,000.

Ky., Ashland—Ashland Steel, Iron and Mining Co. will build plant. Estimated cost, $1,000,000.

Ky., Ashland—United Gas and Fuel Co. will construct plant for purification of oils, manufacture of gasoline and production of petroleum byproducts. Estimated cost, $100,000.

Ohio, Akron—Crandall-Morgan Hardware Co. plans to construct warehouse at Cuyahoga Falls Ave. and Bewin St. Estimated cost, $10,000.

Ohio, Cincinnati—American Tool Works will build plant on Eggleston Ave. Estimated cost, $250,000.

Ohio, Cincinnati—John Steptoe Shaper Co. will build two-story, 65x85-ft. addition to plant on Colerain Ave. Anthony Kunz, Arch.

Ohio, Cleveland—Allyne-Ryan Foundry Co. will construct two additions to its plant at Aetna Rd. and East 91st St. Estimated cost, $15,000.

Ohio, Cleveland—Plans being prepared by E. F. Gibbons, Arch., 1900 Euclid Ave., Cleveland, for two-story addition to plant of Independent Towel and Supply Co., 1820 Central Ave. Estimated cost, $20,000.

Ohio, Cleveland—Richardson & Yost, Arch., 354 Rockefeller Bldg., preparing plans for factory at East 49th St. and Superior Ave. for National Telephone Supply Co. Estimated cost, $50,000.

Ohio, Cleveland—Plans prepared by George S. Rider & Co., Engr., 512 Century Bldg., Cleveland, for two four-story, 160x350-ft. and 143x512-ft. factories for Properties Co. O. M. Stafford, Pres. Noted Dec. 9.

Ohio, Cleveland—Rickerson Manufacturing Co., 912 Schofield Bldg., will build factory at Ottawa and Jones Rd. Estimated cost, $10,000.

Ohio, Hamilton—Chicago & Illinois Western R.R. contemplates roundhouse. W. B. Clark, Chicago, Ill., Pres. and Gen. Mgr.

Ohio, Norwood—United States Playing Card Co. will build four-story, 32x60-ft. addition to plant. Samuel Hannaford & Son, Cincinnati, Arch.

Ohio, Springfield—Plans prepared by W. H. Russ, Arch., Indianapolis, Ind., for four-story, 300x300-ft. addition to plant of Robbins & Myers Co. Estimated cost, $150,000. Noted Dec. 16.

Ind., Indianapolis—Centennial Building Co. will build garage at 10th and Meridian St. Estimated cost, $21,000.

Ind., Indianapolis—Link-Belt Co. will build addition to plant at Addison St. and Vandalia R.R. Estimated cost, $12,000.

Mich., Alpena—Michigan Alkali-Huron Portland Cement Co. will build 125x287-ft. addition to plant.

Mich., Detroit—Stroh Brewing Co. will build two-story reinforced-concrete ice plant on Columbia Ave. Estimated cost, $20,000.

Mich., Highland Park—Ford Motor Co., Detroit, will build addition to plant at Highland Park. Estimated cost, $1,000,000. Frank L. Klingensmith, Detroit, Vice-Pres.

Ill., Chicago—American Cocoa Nut Butter Co. will build three-story addition to plant at 2528 West 18th St. Estimated cost, $18,000. R. G. Pierce, Arch.

Ill., Chicago—H. H. Hanks Co., 4708 West 12th St., will build three-story grain elevator. Estimated cost, $12,000. D. S. Penticost, 127 North Dearborn St., Chicago, Arch.

Ill., Chicago—H. M. Hoyt, 22 Grove St. will build four-story printing plant. Estimated cost, $200,000. S. H. Corwen, 4511 Vinsens Ave., Chicago, Arch.

Ill., Chicago—Western Plumbing Supply Co., 3214-24 Fillmore St., will construct one-story warehouse. Estimated cost, $10,000.

Ill., Chicago—C. Wright, Muskegon, Mich., will build garage at 4868 North Clark St., Chicago. Estimated cost, $26,000. I. C. Saxe, 127 North Dearborn St., Chicago, Arch.

Wis., Fond du Lac—Bids will soon be received by J. E. Hannen, Arch., 74 South Main St., Fond du Lac, for two-story, 73x74x132-ft. garage and machine shop for J. W. Watson. Estimated cost, $15,000.

Wis., Kenosha—Thomas B. Jeffrey Co., manufacturer of automobiles, plans to construct two additions to its plant.

Wis., Manitowoc—Bids will soon be received by Juul & Sixta, Arch., Imig Bldg., Sheboygan, Wis., for two-story, 50x115-ft. garage and machine shop for H. W. Hagen & Co.

Wis., Milwaukee—Plans being prepared by Raulf Construction Co., Patton Bldg., Milwaukee, for 80x500-ft. foundry for Electric Steel Casting Co.

Minn., Minneapolis—Bardwell-Robinson Co. will build four-story, 50x150-ft. addition to plant at Second and 24th St. Estimated cost, $50,000. L. J. Bardwell, Secy.

Minn., Minneapolis—Plans being prepared by Kees & Colburn, Arch., for 12-story factory and warehouse at Fourth and First St. for Wyman, Partridge & Co. Estimated cost, $300,000.

Neb., Omaha—Omaha Ice and Cold Storage Co. plans to construct plant at 23d and Boyd St. Estimated cost, $85,000.

Mont., Billings—Yellowstone Packing Co., recently incorporated with capital of $300,000, will build packing plant. J. B. Henderson, Chinook, J. E. Jurtz and J. G. Hers, Billings, interested.

Mo., Kansas City—Kansas City Tire and Rubber Corporation will construct factory in Kansas City. P. E. Werner, Akron, Ohio, Vice-Pres. and Gen. Mgr.

Mo., St. Joseph—Standard Oil Co. contemplates factory and warehouse at Eighth and Monterer St. Estimated cost, $125,000.

Mo., St. Louis—Bids will be received about Jan. 1 by Barnette, Haynes & Barnette, Arch., Century Bldg., St. Louis, for eight-story building for Pulitzer Publishing Co., 212 North Broadway. Estimated cost, $200,000. Noted Dec. 16.

Tex., Dallas—Reported that Nelson Morris & Co., Chicago, Ill., contemplates packing plant at Dallas. Estimated cost, $75,000.

Tex., El Paso—Krakauer, Zork & Moye's Successors, Inc., will build 90x120-ft., three-story addition to plant. Estimated cost, $50,000. Trost & Trost, El Paso, Arch.

Tex., Marshall—Plans prepared for shops for Texas & Pacific Ry. C. H. Chamberlin, Dallas, Ch. Engr. Noted Oct. 28.

Okla., Blackwell—Planet Oil Co. will establish oil refinery. J. J. Brown, Jr., Box 813, Blackwell, Engr.

Colo., Denver—Ford Motor Co. will build four-story, 128x130-ft. addition to assembling plant. Estimated cost, $150,000. Charles Hendy, Jr., Local Mgr.

Idaho, Twin Falls—Amalgamated Sugar Co. plans to construct sugar factory at Twin Falls. L. R. Eccles, Mgr.

Wash., Northport—Northport Smelting and Refining Co. plans to build addition to smelting plant. Estimated cost, $200,000.

Wash., Seattle—Contract will soon be awarded for four-story, Class A warehouse at Juneau and Atlantic St. for Oregon-Washington R.R. and Navigation Co. to be occupied by American Paper Co. Estimated cost, $100,000. Noted Dec. 16.

Ore., Oregon City—Plans being prepared for reinforced-concrete addition to plant of Hawley Pulp and Paper Co. Estimated cost, $500,000. W. P. Hawley, Sr., Pres. Noted Dec. 23.

Ore., Portland—Studebaker Corporation of America plans to build eight-story reinforced-concrete building. A. L. Sumption, Portland, Mgr.

Calif., Los Angeles—Van Vorst & Berman Co., 1332 East Sixth St., will build three- or four-story, 80x200-ft. factory.

Que., Cap Magdeleine—Union Bag and Paper Co., New York, N. Y., will construct print and sulphide mill at Cap Magdeleine.

Que., Montreal—Steel Co. of Canada, 1272 Notre Dame St., W., will build addition to plant. Estimated cost, $25,000.

Ont., Arnprior—McLachlin Bros. will build addition to plant. Estimated cost, $500,000. G. H. Johnson, Engr.

Ont., Listowel—Plans being prepared for factory for F. W. Hay Shoe Co. Estimated cost, $15,000.

Ont., London—Plans being prepared for addition to plant of Spramotor Co. Estimated cost, $40,000. W. H. Heard, Mgr.

Ont., Mafeking—Mutchenbacker Bros. will rebuild lumber mill. Estimated cost, $20,000.

Ont., Orillia—National Hardware Co., 95 Barrie Rd. W., will construct addition to its factory. Estimated cost, $20,000.

Ont., St. Thomas—Wabash R.R., St. Louis, Mo., plans to enlarge its roundhouse and extend its trackage at St. Thomas. T. J. Frier, St. Louis, Mo., Pur. Agt.

Man., Winnipeg—McLaughlin Carriage Co. will build three-story, 84x225-ft. addition to plant.

Bids in and Contracts Awarded

Mass., South Framingham—I. Levinstein & Co., Inc., 74 India St., Boston, awarded contract to C. A. DODGE CO. for four-story, 74x206-ft. oil plant. Estimated cost, $60,000.

Conn., Chester—C. J. Bates & Son awarded contract for two-story, 40x80-ft. factory to WILLIAM J. SEXTON CO., 84 Boulevard, Hartford.

Conn., Hartford—S. K. F. Ball Bearing Co., New York, N. Y., awarded contract to STONE & WEBSTER CORPORATION, Boston, Mass., for one-story, 75x300-ft. and two-story, 75x150-ft. plant.

Conn., Waterbury—American Brass Co. awarded contract for one-story factory to H. WALES LINES CO., Meriden. Estimated cost, $17,000.

N. Y., New York—(Borough of Brooklyn)—Contract for one-story, 69x100-ft. garage on Thomas St. for Adolf Goebel awarded to M. ARMENDINGER & SON, 1153 Myrtle Ave. Estimated cost, $15,000.

N. Y., New York—(Borough of Manhattan)—Contract awarded to D. C. WEEKS & SONS, 1123 Broadway, for reinforced-concrete factory at 581 Water St. for David Dows, 120 Broadway. Estimated cost, $120,000.

N. Y., Rochester—Rochester Lift Co. will construct factory at 348-350 Whitney St. by day labor. Estimated cost, $50,000.

N. Y., Rochester—Vacuum Oil Co., 904 Exchange St., will construct filter and tank building, kiln and addition to boiler house by day labor. Estimated cost, $60,000.

N. J., Newark—Contract awarded to FREDERICK KILGUS, 13 South Sixth St., Newark, for addition to factory at Dickerson and Hecker St. for Superior Ivory Button Co. Estimated cost, $40,000.

Penn., Coatesville—Midvale Steel Co. awarded contract for additions to plant to IRWIN & LEIGHTON. Noted Dec. 23.

Penn., Milton—American Car and Foundry Co. awarded contract for 100x200-ft. brick plant to WALSH CONSTRUCTION CO., Albany, N. Y.

Penn., Monongahela—Stauffer Chemical Co. awarded contract for 70x100-ft. warehouse to GEORGE HOOG CO., Keystone Bldg., Pittsburgh.

Penn., Philadelphia—Contract awarded to TURNER CONCRETE STEEL CO., 1713 Sansom St., Philadelphia, for concrete work in connection with construction of factory at 23d and Market St. for Kahn & Greenberg. Estimated cost of factory, $75,000.

Penn., Philadelphia—Contract for three-story, 45x71-ft. reinforced-concrete factory at Edgemont and Clementine St. for E. Sutro & Sons Co. awarded to WILLIAM STEEL & SONS CO., 1600 Arch St., Philadelphia. Estimated cost, $18,000.

W. Va., Huntington—Contract for structural steel for one and two-story, 90x100-ft. bakery and office building for Stroehmann's Vienna Bakery awarded to J. E. MOSS IRON WORKS, Wheeling. Noted Nov. 18.

Ohio, Akron—Contract for factory at 1025 Sweitzer Ave. for Star Rubber Co. awarded to CARMICHAEL CONSTRUCTION CO., Akron. Estimated cost, $30,000.

Ohio, Cincinnati—Contract awarded to D. MEINKEN for six-story, 100x250-ft. factory on Spring Grove Ave. for Huenefeld Co. Estimated cost, $200,000. Noted Sept. 30.

Ohio, Cleveland—Chisholm-Moore Co., 5046 Hamilton Ave., awarded contract for three-story, 30x70-ft. addition to plant to GEORGE B. McMILLAN CONSTRUCTION CO., 1794 East 57th St., Cleveland.

Ohio, Cleveland—Frantz Premier Co., Cleveland, awarded contract for factory on Ivanhoe Rd. to SAMUEL AUSTIN & SON CONSTRUCTION CO., 14230 Euclid Ave., Cleveland. Estimated cost, $10,000.

Ohio, Cleveland—Stenagward Realty Co. awarded contract to HENRY G. SLATMEYER CONSTRUCTION CO., 203 Lakeside Ave., Cleveland, for factory at 2108 Superior Viaduct. Estimated cost, $10,000.

Ind., Elkhart—Crow Motor Car Co. awarded contract to GRANT BUSHNELL for 60x240-ft. addition to plant. Estimated cost, $10,000.

Ind., Terre Haute—Indiana Coke and Gas Co. awarded contract for plant to GAS MACHINERY CO., Cleveland, Ohio Estimated cost, $700,000.

Ill., Chicago—(Official)—Contract for hog hair house for Armour & Co. awarded to WOERMAN CONSTRUCTION CO., Suite 543, Century Bldg., St. Louis, Mo.

Ill., Chicago—Joseph Downey awarded contract for three-story warehouse at 2251 South Michigan Ave. to STRESENREUTER BROS. Estimated cost, $45,000.

Ill., Chicago—Evening American Publishing Co. awarded contract for two-story warehouse to WIEBOLT CONSTRUCTION CO. Estimated cost, $75,000.

Ill., Chicago—McAvoy Brewing Co. awarded contract for three-story warehouse at 2339 South Park Ave. to LEYDEN ORTSEIFER CO. Estimated cost, $20,000.

Ill., Chicago—Contract awarded to O. W. ROSENTHAL CO. for two-story addition to plant of Regensteiner Colortype Co., 310 South Racine Ave. Estimated cost, $25,000.

Wis., Eau Claire—Contract for substructure of one-story, 60x250-ft. plant for Gillette Safety Tire Co. awarded to CAST STONE CONSTRUCTION CO., Eau Claire.

Wis., Manitowoc—Aluminum Goods Manufacturing Co. awarded general contract for five-story, 55x300-ft. factory to WALTER W. OEFLEIN, North Milwaukee, Wis. Estimated cost, $100,000. Noted Nov. 25.

Wis., Milwaukee—Contract awarded to WILLIAM WINTER, 1025 Second St., Milwaukee, for two-story, 25x40-ft. addition to bakery of Atlas Bread Co.

Wis., Milwaukee—Contract awarded to MEREDITH BROS. CO., 1042 Kinnikinnic Ave., Milwaukee, for factory and power plant for Newport Mining Co., 1112 First National Bank Bldg. Estimated cost, $100,000. E. G. Wilmer, Secy.

Minn., Minneapolis—Contract for plant for Western States Coke Co. awarded to KOPPERS BROS., Pittsburgh. Estimated cost, $2,000,000. Noted Nov. 11.

Wash., Seattle—Contract awarded to KIEL & WHIPPLE, Central Bldg., Seattle, at $32,867 for four-story addition to warehouse on Whatcom Ave. for Commission of Port of Seattle. Noted Dec. 23.

Ore., Portland—Contract for two-story garage and service plant on Davis St. to be occupied by Pacific Kissel Car Co., awarded to BEERS CONSTRUCTION CO., Portland. Estimated cost, $25,000. Sutton & Whitney, Arch.

Calif., Norwalk—(Official)—Bids received Dec. 13 for laundry for Norwalk State Hospital from L. G. Bergren & Son, $14,672; G. A. Daniels, $15,750; J. Harnish Co., $16,947.

Ont., Kingston—Angrove Bros. awarded contract for garage to KINGSTON CONSTRUCTION CO., Kingston. Estimated cost, $10,000.

FEDERAL GOVERNMENT WORK

Proposed Work

N. Y., Buffalo—Buildings—Plans and specifications for lock houses and other buildings to be constructed on U. S. Ship Canal Lock at Black Rock Harbor have been forwarded to Washington for approval by Maj. Frazier, U. S. Engr.

N. J., Trenton—Completing Delaware River Channel—Appropriation of $65,000 recommended by Government Engineers for completing Delaware River channel from Lalor St. to Pennsylvania R.R. bridge.

N. C., New Berne—Building—Bids will be received at Office of Depot Quartermaster, U. S. Army, Washington, D. C., until 11 a.m., Jan. 24, for reconstructing lodge at U. S. National Cemetery, New Berne.

Fla., Miami — Canal — Government Engineers preparing plans for enlargement of East Coast Canal.

La., New Orleans—Levee—Mississippi River Commission contemplates repairing levees on Mississippi River below New Orleans. Estimated cost, $750,000.

Iowa, Washington—Post Office—Bids will be received by James A. Wetmore, Act. Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 28, for U. S. post office at Washington.

Mont., Ft. Keogh—Electric Lighting System—Bids will be received at Office of Depot Quartermaster, Ft. Keogh, until 10 a.m., Jan. 15, for furnishing and installing electric-lighting system.

Bids In and Contracts Awarded

Mass., Attleboro—Post Office—Bids were received Dec. 21 for U. S. post office at Attleboro, (a) limestone, (b) sandstone, as follows: Charles McCaul Co., Philadelphia, Penn., (a) $86,875, (b) $91,875; King Lumber Co., Charlottesville, Va., (a) $81,475, (b) $90,000; W. H. Fissel & Co., New York, N. Y., (a) $85,800, (b) $90,000. Noted Nov. 18.

D. C., Washington—Dredging—Bids were received Dec. 18 at U. S. Engineer Office for dredging in Anacostia River, (a) Section 1, (b) Section 2, as follows: Bowers Southern Hydraulic Dredging Co., Galveston, Tex., (a) 8c., (b) 5c.; Maryland Dredging and Contracting Co., Baltimore, Md., (a) 5.5c., (b) 5.5c.; Sanford & Brooks, Baltimore, Md., (a) 6.45c., (b) 4.95c. Noted Dec. 9.

Tenn., Humboldt—Post Office—Bids were received Dec. 20 for U. S. post office at Humboldt as follows: Algernon Blair, Montgomery, Ala., $39,656; F. F. Beggs, Scottsburg, Ind., $41,136; George Becking, Chattanooga, Tenn. $41,323. Noted Nov. 11.

Ohio, Cleveland—Dredging—Contract for dredging in Cleveland Harbor awarded to GREAT LAKES DREDGE AND DOCK CO., Williamson Bldg., Cleveland, at $60,000. Noted Nov. 4 and Dec. 2.

Ohio, Middletown—Post Office—Bids were received Dec. 18 for U. S. post office at Middletown, (a) limestone, (b) sandstone, as follows: George W. Stiles Construction Co., Chicago, Ill., (a) $69,132, (b) $76,132; Charles McCaul Co., Philadelphia, Penn., (a) $69,340, (b) $76,340; Roche-Brunner Building Co., Cincinnati, (a) $71,700, (b) $78,600. Noted Nov. 11.

Neb., Aurora—Post Office—Bids were received Dec. 22 for U. S. post office at Aurora as follows: A. W. Lane, 19 South La Salle St., Chicago, Ill., $43,512; G. W. Stiles Construction Co., Chicago, Ill., $45,325; W. D. Lovell, 1415 Eighth St., S. E., Minneapolis, Minn., $45,247. Noted Nov. 18.

Tex., Ft. Bliss—Annex to Hospital—Bids received Nov. 27 for rear annex to hospital at Ft. Bliss from Mayfield & Shaw, El Paso, $14,157; Jennings & Woods, El Paso, $15,689; Buchanan & Gilder, El Paso, $16,254. Noted Nov. 4.

CANALS—DITCHES—IRRIGATION

Proposed Work

Ind., Scottsburg—Ditch—Petition filed in Scott Circuit Court for ditch, 25 miles long, which will pass through Scott, Jackson and Washington Counties.

Ill., Urbana—Drainage—Bids will be received until 11 a.m., Jan. 10, by Joseph P. Gulick, Attorney of Two Mile Slough Drainage District for drainage work in Branch No. 23, of Two Mile Slough Drainage District.

Minn., Duluth—Ditch—Bids will be received until Jan. 7 by County Auditor for Ditch No. 5 Estimated cost, $150,000. Noted Nov. 11.

Minn., Fairmont—Ditches—Martin County will build three drainage ditches Estimated cost, $200,000. H. C. Nolte, County Audr.

Minn., Jackson—Ditch—Contract will soon be awarded for Judicial Ditch No. 35. Estimated cost, $76,647. P. D. McKeller, County Audr.

Minn., Jackson—Ditches—Surveys being made for Judicial Ditches Nos. 38, 41 to 48 inclusive, 50 to 54 inclusive, and 61. P. D. McKeller, County Audr.

Minn., Mankato—Ditches—Surveys completed for Judicial Ditches Nos. 6, 7, 8, 9 and 10. Estimated cost, $80,000, $15,000, $35,000, $35,000 and $15,000 respectively. Roy H. Allison, County Engr., Blue Earth County, Mankato.

Minn., Mankato—Ditch—Surveys being made for Judicial Ditch No. 11, in Blue Earth County. Estimated cost, $125,000. Roy H. Allison, County Engr., Mankato.

Minn., Mankato—Ditch—Surveys made for County Ditch No. 42. Estimated cost, $20,000. Roy H. Allison, County Engr., Mankato.

Minn., Marshall—Ditches—Surveys being made for County Ditches Nos. 11, 12, 20, 21, 22 and 23. Estimated cost between $300,000 and $400,000. E. Sheppard, County Audr.

Minn., New Ulm—Ditches—New surveys being made for County Ditches Nos. 5, 8 and 11, about 72 miles. Surveys being made for Ditches Nos. 28, 29, 30, 31 and 33. Estimated cost, $300,000. F. D. Minium, County Surv.

Minn., Worthington—Ditch—Surveys completed for Judicial Ditch No. 1. Estimated cost, $39,850. Gustave Swanberg, Worthington, County Audr.

Minn., Worthington—Ditch—Surveys being made for Judicial Ditch No. 2. Estimated cost, $25,000. G. Swanberg, Worthington, County Audr.

Kan., Salina—Drainage—Contract will soon be awarded for drainage work in District No. 1. Estimated cost, $12,000. H. B. Walker, Manhattan, State Drainage Engr. Noted Dec. 9.

Mo., Memphis—Drainage—Bids will be received until 2 p.m., Jan. 15, by Earl McDaniel, Secy., Wyacanda River Drainage District No. 1, for 17.3 miles of drainage ditch. C. J. Wiegner, Memphis, Engr.

Tex., Mission—Irrigation—Mission Canal Co. recently sold to Bankers' Trust Co., reorganized under name of United Irrigation Co., with capital of $500,000, and will extend canal system to irrigate larger tract of land.

Colo., Pueblo—Ditches—Directors of Neposta Ditch and Reservoir Association appropriated between $60,000 and $75,000 for improving ditches and reservoirs during 1916.

N. M., Santa Fé—Irrigation—Charles Hutchins, Kansas City, Mo., granted application by James A. French, State Engr., for irrigation pumping plant on Pecos River.

N. M., Springer—Irrigation Dam—Rayado Colonization Co. will raise dam 30 ft. in order to irrigate land.

Idaho, Caldwell—Drainage—U. S. Reclamation Service and Nampa-Caldwell Irrigation District will build drainage system.

Ariz., Palomas—Irrigation—S. H. Woodruff and associates, Los Angeles, Calif., plan to utilize underflow of Gila River by irrigating about 14,000 acres of land.

Wash., Tacoma—Dredging—Plans being prepared by Commissioners of Waterway District No. 1, for dredging and filling Hylebos Creek tide flats. Bids will be received in January. Estimated cost between $350,000 and $400,000. D. B. Roben, 3019 South 11th St., Tacoma, Project Engr.

Ore., Oregon City—Drainage—Linn County Drainage Congress contemplates forming several drainage districts, first being Oak Creek District, 30,000 acres being included in watershed which it plans to drain.

Ore., Prineville—Irrigation—Plans being considered for irrigation of 46,000 acres near Haystack, 9,000 acres near Prineville, North Land Unit, Deschutes Project, by storage of water of Crooked River.

Calif., Los Angeles—Irrigation—Contract will soon be awarded for irrigating 77,000 acres in San Fernando Valley by Board of Supervisors. Noted Nov. 18.

Calif., Oakdale—Irrigation—Bids will be received until Jan. 17 by Oakdale Irrigation District for irrigation work. Estimated cost, $20,000.

Calif., Sacramento—Canal—Surveys will be made for tidewater canal from Sacramento to San Francisco Bay. Estimated cost, $1,000,000. W. F. McClure, State Engr.

Calif., Sacramento—Irrigation—T. G. Patten, E. R. Walker and associates applied to Federal Government for right-of-way across lands in Eldorado and Amador Counties to divert water from Mokelumne River to irrigate 40,000 acres in Sacramento County.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Manhattan)—Dredging—Contract awarded to P. SANFORD ROSS, INC., 277 Washington St., Jersey City, N. J., at $0.30 per cu.yd., for dredging North River from 103d to 109th St., 33,000 cu.yd. Noted Dec. 23.

N. Y. New York—(Borough of Manhattan)—(Official)—Dredging—Bids received Dec. 20 by R. A. C. Smith, Comr. of Docks, for dredging, Contract No. 1497, (a) North River, 150,000 cu.yd., (b) East and Harlem Rivers, 45,000 cu.yd., Boroughs of Manhattan, Bronx, Queens, Brooklyn and Richmond, as follows: Henry Du Bois Sons Co., 17 State St., (a) $0.1295 per cu.yd.; Coastwise Dredging Co., 17 Battery Pl., (a) $0.147, (b) $0.237; P. Sanford Ross, Inc., (a) $0.176, (b) $0.358. Noted Dec. 16.

Penn., Philadelphia—Dredging—Only bid received Dec. 20 by Department of Docks, Wharves and Ferries, for dredging Frankford Creek was from American Dredging Co., at $0.293 per cu.yd.

Ind., Portland—Ditch—E. A. Erwin, Greenville, Ohio, at $22,348 submitted lowest bid for John F. Warren et al Ditch in Jay and Randolph Counties.

Minn., Mankato—(Official)—Ditch—Contract for County Ditch No. 41 awarded to MINNESOTA PIPE AND TILE CO., Mankato, at $8,592. Noted Dec. 16.

Minn., Warroad—Ditch—Contract for Ditch No. 62 awarded to E. G. BRANDENBURG CONSTRUCTION CO., 730 Temple Court, Minneapolis.

Ark., Marion—Ditches—Fred C. Morgan, Indianapolis, Ind., at 7.415c. per cu.yd. submitted lowest bid for approximately 50 miles of ditches for Drainage District No. 7, Crittenden County. Morgan Engineering Co., Memphis, Tenn., Engr. Noted Nov. 25.

Tex., Corpus Christi—Drainage—Robstown Drainage District awarded contract to J. B. ARPIN CONSTRUCTION CO., Houston, at $141,375 for drainage of 80,000 acres. Noted Nov. 25.

Calif., Eureka—Ditch—Contract awarded to CHAPMAN & CO., Klamath Falls, Ore., for ditch 10 miles long for Butte Valley Land Co., Macdoel.

MISCELLANEOUS

Proposed Work

Maine, Bath—Elimination of Grade Crossing—Abolition of grade crossing of Maine Central R.R. approved by Public Utilities Commission, Augusta. Estimated cost, $18,000. B. T. Wheeler, Portland, Ch. Engr.

N. Y., New York—(Borough of Manhattan)—(Official)—Cement, etc.—Bids will be received by Marcus M. Marks, Borough Pres., until 2 p.m., Jan. 3, for furnishing and delivering 500 tons of portland cement, 3,000 tons limestone dust, 7,000 cu.yd. binder stone, 15,000 cu.yd. asphalt wearing surface sand and 2,000 tons refined asphalt.

N. Y., New York—(Borough of Manhattan)—(Official)—Fence—Bids will be received by Cabot Ward, Pres. of Park Bd., Municipal Bldg., until 3 p.m., Jan. 6, for w.-i. fence and setting of artificial granite gate posts around Morningside Park. Noted Aug. 12 and 26.

N. Y., Syracuse—Elimination of Grade Crossings—Syracuse Grade Crossing Commission having plans prepared for elimination of grade crossings in city.

N. J., East Orange—Elimination of Grade Crossings—George F. Swain, Consult. Engr., Boston, Mass., retained by city to prepare plans for elimination of grade crossings along line of Lackawanna R.R.

N. J., Englewood—Ferry House and Slip—Plans being prepared for two-story ferry house and slip at foot of Palisade Ave. for Dyckman St. and Englewood Ferry Corporation, care of Brooklyn and Manhattan Ferry Corporation. Estimated cost, $50,000.

N. J., Jersey City—Park—Hudson County Board of Freeholders appropriated $500,000 to purchase Suckley Estate and improve same for park.

N. J., Morris Plains—Fire House—Bids will soon be received for addition to fire house for New Jersey State Hospital for Insane. Estimated cost, $10,000.

N. J., Wildwood—Pier—Casino Pier Co. will build pier. Heber Crane, Pres.

Penn., Philadelphia—Fire Station—Plans being prepared by City Arch. for fire station at Montgomery and Girard St. Estimated cost, $20,000. George S. Webster, City Engr.

Va., Newport News—Marine Railway—O. A. Bloxom, Battery Park, contemplates building marine railway and oyster-shucking plant.

Miss., Gulfport—Park—City will issue $125,000 bonds for purchasing and improving land for park. George M. Foote, Mayor.

Tenn., Knoxville—Parks—Election will be held Jan. 29 to vote on $50,000 bonds for parks.

Tenn., Waverly—City Commissioners of Nashville plan to build fire house in Waverly. G. J. Tompkins, Comr. of Fire Dept.

Ill., Chicago—Fire Engine House—City will build fire engine house at 4426 North Kedzie Ave. Estimated cost, $19,000. C. W. Kallal, Arch.

Wis., Superior—Dock—Reported that plans will be prepared for replacing ore dock No. 3 at Allouez Bay for Great Northern Ry. during winter of 1916 and 1917. Estimated cost, $1,000,000. A. H. Hogeland, St. Paul, Minn., Ch. Engr.

Wis., West Allis—Grandstand—Plans prepared by Alfred C. Clas, Arch., 520 Colby-Abbot Bldg., Milwaukee, for two sections of concrete grandstand in State Fair Park for State Department of Agriculture. Estimated cost, $50,000. C. P. Norgord, Madison, Comr.

Wis., West Allis—Park Buildings—Plans prepared by Alfred C. Clas, Arch., 520 Colby-Abbot Bldg., Milwaukee, for 100x150-ft. swine and sheep barn in State Fair Park for State Department of Agriculture. C. P. Norgord, Madison, Comr. Estimated cost, $44,000.

Minn., St. Paul—Marble Balustrade and Steps—Bids will be received until 10:30 a.m., Jan. 10, by A. Hohenstein, Pur. Agt., for marble balustrade and steps about the St. Paul Library.

Mo., St. Louis—(Official)—River Terminals—Bids will be received in spring for seven-story, 100x250-ft. river terminal and warehouse for St. Louis River Front and Dock Association. Estimated cost, $250,000. J. L. Wees, 419 Commercial Bldg., St. Louis, Arch. Noted Dec. 16.

Ark., Bridge Junction—(Hopewell post office)—Levee Work—St. Francis Levee Board petitioned River and Harbor Committee of Congress to seek government aid for levee work from Pecan Point to Bledsoe, 76 miles. H. D. Tomlinson, Pres.

Wash., Tacoma—Improving White and Puyallup Rivers—William S. Mitchell and M. Gardner, United States Government Engrs., retained by Inter-County River Improvement Board to review and pass on work done on improvements along White and Puyallup Rivers and to make suggestions.

Calif., Los Angeles—Elimination of Grade Crossings—City Board of Public Utilities approved plans of Pacific Electric Ry. Co. for elevating tracks from station at Sixth and Main St. to San Pedro St. and for terminal improvements. Estimated cost, $300,000. Noted Nov. 11.

Calif., Los Angeles—Subway—Plans being prepared for rearranging tracks at Hill St. Station preliminary to building subway under Olive St., west of station, about 6 miles. Estimated cost rearranging tracks, $40,000; subway, $12,000,000. Noted Nov. 18.

Calif., Manhattan—Pier—Board of Trustees contemplates constructing pleasure pier at Center St. and pavilion at Martin Ave. Estimated cost, $70,000 and $20,000 respectively.

Calif., San Francisco—Automatic Sprinklers—Board of Public Works considering installation automatic sprinklers in city car barns. Estimated cost, $54,000. Frederick J. Churchill, Secy., Bd. of Pub. Wks.

Calif., Santa Monica—Wharf—Santa Monica Land Co. contemplates building wharf, 560-ft. long and 24-ft. wide, at Santa Monica Cañon.

Que., Montreal—Comfort Stations—Plans prepared for three comfort stations at Chaboilez, d'Armes and Dominion Sq. for city. Estimated cost, $5,000, $8,000 and $10,000 respectively. A. Chausse, Arch., City Hall.

Que., Sherbrooke—Subway—City Council contemplates constructing subway in Richelieu St. Estimated cost, $10,411. E. C. Gatien, Clk.

Ont., Port Stanley—Comfort Stations—London & Port Stanley Ry. contemplates construction of four comfort stations. William Spittal, Secy.

MISCELLANEOUS

Bids In and Contracts Awarded

N. Y., Cold Spring Harbor—(Official)—Retaining Walls—Contract for reinforced-concrete foundations and retaining walls for residence of Otto H. Kahn awarded to STEWART ENGINEERING CORPORATION, 17 Battery Pl., New York, at $150,000.

N. Y., New York—(Borough of Brooklyn)—(Official)—Steel Tank—Contract for steel tank and fittings for storage of liquid asphalt at municipal asphalt plant, Seventh St. and Gowanus Canal awarded to P. P. FARLEY, 103 Park Ave., New York, at $5,335. Noted Dec. 16.

N. Y., New York—(Borough of Manhattan)—(Official)—Market—Bids received Dec. 20 by Marcus M. Marks, Borough Pres., for market under Queensborough Bridge, 59th and 60th St., First Ave. and Ave A, from A. W. King, 1511 Bryant Ave., $13,955; W. F. Plass & Bros., 145 West 18th St., $14,850; Thomas J. Waters Co., 271 West 125th St., $14,900. Noted Dec. 16.

N. J., Stoneharbor—Jetties—Contract for bulkhead and jetties for ocean front protection awarded to HILL DREDGING CO., Atlantic City, at $192,414. Noted Sept. 9.

Penn., Philadelphia—Coal Pockets—Contract awarded to C. P. BOWER, Roberts and Wayne Ave., Philadelphia, at $76,130, for coal pockets on Emerald St. for Philadelphia & Reading Ry. Co. Noted Nov. 25.

Penn., Philadelphia—Elevated Railway Work—Bids received Dec. 14 by A. M. Taylor, Dir. Dept. of City Transit, for steel superstructure and appurtenant work for two-track elevated railway in Frankford Ave. from Unity to Dyre St., under Contract No. 519, from American Bridge Co., $249,000; McClintic-Marshall Co., $263,000; Phoenix Bridge Co., $269,800. Noted Nov. 18.

Penn., Philadelphia—Pier—Contract for superstructure of Pier No. 78 at foot of McKean St. awarded to SNARE & TRIEST, Woolworth Bldg., New York, N. Y., at $488,600. Noted Nov. 25 and Dec. 9.

Del., Claymont—Pier—General Chemical Co., Marcus Hook, Penn., awarded contract for pier to JOHN MONKS & SONS, 82 Beaver St., New York, N. Y. Estimated cost, $200,000.

Fla., Daytona—Pavilion—Contract for 150x150-ft. pavilion with about 40-ft. extending over river for C. G. Burgoyne, awarded to JACOB ESPEDAHL, Daytona. Estimated cost, $10,000. Noted Dec. 23.

Ohio, Cleveland—Grading Subway—Contract for grading subway at Hamilton Ave. and Pennsylvania R.R. awarded to J. UDELSON, 2410 East 49th St., Cleveland. Noted Nov. 25.

Ind., Indianapolis—Track Elevation—Bids received Dec. 15 by Board of Public Works for removal of bridge and construction of traffic ways under Vandalia R.R. in connection with track elevation from O'Hogan & Lake Co., Chicago, Ill., Sections H, J, K and M, $43,890; Marsh, Cleary & White Co., Chicago, Ill., Sections H, J, K and M, $47,499; Walsh Construction Co., Cleveland, Ohio, Sections H, J, K and M, $46,000; Dunn-McCarthy Co., Chicago, Ill., Sections H, I, J, K, L and M, $53,659.

Kan., Leavenworth—Riprapping River Bank—Chicago, Burlington & Quincy R.R. awarded contract for willows to be used in riprapping river bank to WARREN HOUSER, Weston. Estimated cost, $75,000.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works;" "Federal Government Work" and "Miscellaneous."

Proposed Work

Mass., Beverly—School Committee will submit proposition to City Council for building high school on City Home site near Cedar St. Estimated cost, $300,000.

Mass., Brookline—Plans prepared for three-story addition to high school. Estimated cost, $125,000. Andrews, Jacques & Rantoul, 50 Congress St., Boston, Arch. Noted Oct. 28 and Aug. 12.

Mass., Westfield—Plans being prepared by C. A. Tinker, Arch., 318 Main St., Springfield, for two-story theater for Goldstein Bros. Estimated cost, $60,000.

Mass., Westfield—Plans being prepared by M. B. Harding, Arch., Westfield, for one-story, 116x178-ft. school. Estimated cost, $50,000. J. M. Dutton, Chn. School Bd. Noted Oct. 21.

R. I., Pawtucket—Pawtucket and Central Falls Aerie of Eagles plan to build home.

N. Y., Binghamton—Plans being prepared for five-story bank and office building for People's Trust Co. Estimated cost, $50,000. E. W. Dickerman, Perry Bldg., Arch.

N. Y., Medina—Board of Education contemplates building schools. Estimated cost, $135,000.

N. Y., Rochester—Plans being prepared by Hutchinson & Cutler, Cutler Bldg., Rochester, for eight-story, 33x110-ft. medical building on Chestnut St. for F. L. Greene & Co., 33 Exchange St. Estimated cost, $75,000.

N. Y., Rochester—Plans being prepared by Foster & Gade, Arch., Sibley Bldg., for three-story building for Home for Friendless. Estimated cost, $200,000. A. M. Lindsey, 250 Main St., E., Pres., Bd. of Dir.

N. J., Newark—City will erect memorial building at Camp and Broad St. Estimated cost, $1,500,000. Thomas L. Raymond, Mayor.

Penn., Allentown—(Official)—We have been informed that Louis E. Jallade, 37 Liberty St., New York, N. Y., is Arch. for six-story addition to Y. M. C. A. building and Ruhe & Lange, Allentown, Assoc. Arch. Estimated cost, $100,000. Noted Dec. 16.

Penn., Braddock—Plans will be prepared by W. W. Williams, Arch., Magee Bldg., Pittsburgh, for church and rectory for S. S. Mary and Paul Church. Estimated cost, $75,000.

Penn., Loretto—St. Francis College plans to build seminary and faculty building. Estimated cost, $50,000. G. Puderbaugh, Hutchinson Bldg., Altoona, Arch.

Penn., Ogontz—Plans being prepared by H. Trumbauer, Arch., Land Title Bldg., Philadelphia, for private school for A. A. Sutherland. Estimated cost, $100,000.

Md., Baltimore—Plans being prepared by Otto G. Simonson, Arch., Maryland Casualty Tower, Baltimore, for 10-story hotel at Light and German St. for Southern Hotel Co.

Md., Baltimore—Revised plans being prepared by J. Evans Sperry, Arch., 409 Calvert Bldg., Baltimore, for six-story building at Park Ave. and Franklin St. for Y. W. C. A. Estimated cost, $200,000. Isabel Harmon, Secy.

D. C., Washington—Plans being prepared by Thomas W. Lamb, Arch., 644 Eighth Ave., New York, N. Y., for two-story, 132x153-ft. theater at 12th and F St. for Marcus Loew, 1493 Broadway, New York, N. Y.

D. C., Washington—Plans being prepared for 10 buildings at Wisconsin Ave. and Davis St. for National School of Domestic Art and Science. M. A. Zurhorst, 1753 Rhode Island Ave., Washington, Principal.

Va., Atlee—Bids will be received until noon Jan. 15, by Board of School Trustees, Henry District, Hanover County, for school. Charles M. Robinson, Inc., 508 Times-Dispatch Bldg., Richmond, Arch.

W. Va., Charleston—W. P. Ginther, Arch., 416 Everett Bldg., Akron, Ohio, preparing plans for three-story addition to St. Francis Hospital. Estimated cost, $40,000.

W. Va., Huntington—Boone County Land Co. will construct store and hotel building. Estimated cost, $40,000.

W. Va., Huntington—Marshall College will erect physical education building. C. I. Woodley, Pres.

W. Va., Morgantown—West Virginia University will build additions to institution. Estimated cost, $75,000.

W. Va., Moundsville—St. Xavier's Congregation plans one-story, 60x90-ft. church and rectory. Estimated cost, $40,000.

W. Va., Point Pleasant—Plans being prepared by H. R. Warner, Capitol St., Charleston, for remodeling hotel into bank, hotel, lodge and store building for Spencer Hotel Co. J. S. Spencer, interested.

W. Va., Wheeling—Plans prepared for 10-story, 50x115-ft. bank, store and office building for Security Trust Co. Estimated cost, $250,000. E. B. Franzheim and F. F. Faris, Schmulbach Bldg., Wheeling, Associate Arch.

W. Va., Wheeling—Plans being prepared by F. F. Faris, Arch., 420 Schmulbach Bldg., Wheeling, for two-story church for Trinity Lutheran Congregation. Estimated cost, $40,000.

N. C., Durham—Citizens voted $75,000 bonds for two schools on Moorehead School site. G. W. Watts, Chn. School Trustees. Noted Oct. 21 and Nov. 18.

N. C., Kinston—Reported that Atlantic Coast Line R.R. and Southern R.R. contemplate building union station. J. E. Willoughby, Wilmington, Ch. Engr., Atlantic Coast Line R.R.

N. C., Rocky Mount—J. C. Mount, Rocky Mount, prepared plans for bank building at 144 South Main St. for Rocky Mount Savings and Trust Co.

S. C., Greenville—A permanent Exposition Building will be constructed by Southern Textile Association. Estimated cost, $50,000.

S. C., Rock Hill—Congregation of First Baptist Church plans to construct three-story edifice. Estimated cost, $40,000.

Ga., Macon—Curran R. Ellis, Arch., Macon, retained by Board of Education to prepare plans for Vineville School. Estimated cost, $40,000.

Ala., Hamilton—Sixth School District plans to build school. Estimated cost, $465,000.

Ala., Seminole—J. B. Wiggins, H. C. Maley and E. E. Bucham, Chicago, Ill., will build club house at Seminole. J. C. Pollock, Gen. Mgr.

Miss., Biloxi—Plans being considered by Biloxi Lodge, Loyal Order of Moose, for new building. F. J. Weiss, Chn. of Bldg. Com.

Miss., Clarksdale—Board of Supervisors contemplates remodeling court house. J. W. Cutler and Charles W. Clark, interested.

Miss., Gulfport—Plans being prepared by Nolan & Torre, Arch., New Orleans, La., for two-story hospital for Kings Daughters. Estimated cost, $40,000.

Miss., Marion—Election will be held Jan. 4 to vote on $100,000 bonds for agricultural high school. Noted Oct. 28.

Tenn., Chattanooga—Volunteer State Life Insurance Co. will build 10-story office building. Estimated cost, $415,000. Barnwell & Barnwell, Arch.

Tenn., Memphis—Plans being considered by city and county for tuberculosis hospital.

Tenn., Memphis—Baptist Memorial Hospital will construct addition. Estimated cost, $125,000.

Tenn., Morristown—Contract will soon be awarded for building for First National Bank. Estimated cost, $50,000. James R. Forgey, Pres.

Ky., Paducah—City contemplates $600,000 bond issue for schools and sewers.

Ohio, Akron—Press reports state that State will construct armory and auditorium. Estimated cost, $100,000. B. L. Barger, Secy. of State Armory Bd.

Ohio, Akron—M. O'Neil, West Market St., plans to build clubhouse to be occupied by Akron City Club Co. Estimated cost, $50,000. S. F. Ziloxi, 69 Edgerton Rd., Pres.

Ohio, Akron—Bids will be received by J. F. Barnhart, Clk., Bd. of Education, Central High School, until noon, Jan. 5, for additions to Miller and Portage Path Schools.

Ohio, Akron—Board of Education plans to construct two-story school to be known as Robinson School. Estimated cost, $50,000. J. F. Barnhart, Central High School, Clk.

Ohio, Bellaire—Baltimore & Ohio Railroad Co. will build freight station at Bellaire.

Ohio, Canton—W. E. Koltz, Vice-Pres. Canton Drop Forge Co., is interested in a project to build motion-picture theater at Market Ave. and Second St. Estimated cost, $65,000.

Ohio, Lebanon—Election will soon be held to vote on $65,000 bonds for courthouse for Warren County.

Ohio, Mt. Vernon—William A. Ashbrook, Congressman, introduced bill which calls for appropriation of $100,000 for public building.

Ohio, Newburg—(Cleveland post office)—Revised plans prepared by W. J. Carter, Arch., Illuminating Bldg., Cleveland, for four-story temple for Newburg Masonic Temple Co. Estimated cost, $60,000. Noted under Cleveland, Ohio, Dec. 23.

Ohio, Salem—Independent Hose Co. will build club house at Salem.

Ohio, Wilmington—Bids will soon be received for three-story courthouse and jail for Clinton County. Estimated cost, $300,000. Weber, Werner & Adkins, 1206 Mercantile Library Bldg., Cincinnati, Arch. Noted Dec. 2.

Ohio, Youngstown—Plans will be prepared by H. Lyman Ford, Arch., 206 Hippodrome Arcade, Youngstown, for two-story store and apartment building on Wick Ave. Estimated cost, $70,000.

Ohio, Zanesville—Municipal Committee of Chamber of Commerce contemplates city hall and market. Estimated cost, $100,000. H. C. Van Voorhis, Chn. of Com.

Ind., Elkhart—B. Haynes, Lunger Bldg., plans four-story, 70x85-ft. office building at Marion and Second St. Estimated cost, $40,000. Ellwood & Ellwood, South Main St., Elkhart, Arch.

Ind., Hammond—All Saints Congregation contemplates church. Estimated cost, $150,000.

Ind., Indianapolis—Contract will soon be awarded for four-story bank and office building for Meyer & Kiser Bank. D. A. Bohlen & Son, 1012 Majestic Bldg., Arch. Noted Dec. 9.

Ind., Michigan City—Bids will be received about Jan. 17 by Worthman & Steinbach and C. L. Pointek, Archs., 1859 West Chicago Ave., Chicago, Ill., for edifice for St. Stanislaus Church. Estimated cost, $100,000.

Ind., South Bend—Plans being prepared by E. L. Tilton, Arch., 32 Broadway, New York, N. Y. (Borough of Manhattan), for library for Notre Dame University. Estimated cost, $150,000.

Mich., Ann Arbor—Trustees of University of Michigan plan to build library. Estimated cost, $350,000.

Mich., Detroit—Y. W. C. A. will construct building at East Adams Ave. and Witherell St. Estimated cost, $250,000.

Mich., Flint—Preliminary plans prepared by Starrett & Van Vleck, Arch., 8 West 40th St., New York, N. Y., for six-story bank and office building for First National Bank.

Mich., Flint—Malcomson & Higgenbotham, Arch., Detroit, will prepare plans for two schools for Board of Education.

Mich., Pontiac—Press reports state that a moving picture and vaudeville theater will be constructed on site of Hotel Wenonah on South Saginaw St. Estimated cost, $70,000.

Ill., Chicago—Plans being prepared by Holsman & Hunt, 332 South Michigan Ave., for five-story hotel for A. B. Mulvey. Estimated cost, $150,000.

Wis., Milwaukee—Milwaukee Athletic Club will build home at Mason St. and Broadway. Estimated cost, $300,000.

Wis., Portage—Board of Education considering plans to construct central school or two individual schools, one on east side and one on west side.

Wis., Waukesha—Citizens defeated $120,000 bonds for schools. G. B. Harris, Pres.

Wis., West Allis—Board of Education plans to build high school next year. G. Mahoney, Secy.

Iowa, Audubon—Election will soon be held to vote on bonds for school.

Iowa, Belmond—Preliminary plans prepared by G. L. Lockhart, Arch., Endicott Bldg., St. Paul, Minn., for high and grade school. Estimated cost, $70,000. A. Fitts, Belmond, Secy., Bd. of Education.

Iowa, Waterloo—Citizens voted $250,000 bonds for high school. W. H. Brunn, Secy., Bd. of Education. Noted Nov. 25.

Iowa, Waukon—Plans will be prepared by Charles A. Dieman Co., Arch., 405 Granby Bldg., Cedar Rapids, for school. Estimated cost, $60,000.

Kan., Caldwell—Bids will soon be received for two-story school. Estimated cost, $50,000. S. S. Voigt, 411 Barnes Bldg., Wichita, Arch., and J. E. Damon, Caldwell, Secy., Bd. of Education.

Kan., Emporia—College of Emporia contemplates new building. Estimated cost, $100,000. W. A. White, Chn.

Neb., North Platte—Bids will be received about Feb. 15 for high school. Estimated cost, $50,000. Bert M. Reynolds, North Platte, Arch. Noted Dec. 23.

Mont., Billings—Billings Labor Unions will construct three-story, 50x140-ft. building. Estimated cost, $70,000. H. Anderson, Chn. Bldg. Com. Dedrick & Piper, Billings, Arch.

Mo., St. Louis—E. C. Simmons will construct building to be occupied by Franklin Bank. Estimated cost, $125,000. Guy C. Mariner, St. Louis, Arch.

Tex., Brownsville—Citizens voted $100,000 bonds for purchasing site and building high and ward schools for Brownsville Industrial School District. Noted Nov. 25.

Tex., El Paso—Plans prepared by Trost & Trost, Arch., for two-story building for H. R. O. Realty Co., St. Louis. Estimated cost, $45,000.

Tex., Marshall—Election will be held Jan. 18 to vote on $60,000 bonds for schools.

Okla., Alva—Citizens voted $90,000 bonds for high school. Noted Nov. 18.

Okla., Chickasha—Citizens voted $70,000 bonds for school for Board of Education.

Ariz., Prescott—Yavapai County will build two-story courthouse. Estimated cost, $200,000. R. T. Belcher, Clk., Bd. of Superv.

Ariz., Safford—Plans being prepared by Lescher & Kibbey, Arch., Phoenix, for two-story, 60x82-ft. courthouse for Graham County. Estimated cost, $45,000.

Calif., Bakersfield—(Official)—Citizens voted $75,000 bonds for two schools. James Egan, Secy., School Com. Noted Dec. 9.

Bids in and Contracts Awarded

Mass., Belmont—Contract for high school awarded to LEIGHTON-MITCHELL CO., 95 Milk St., Boston, at $84,000.

Mass., Marlboro—School Committee awarded contract for school on Washington St. to THOMAS P. HURLEY, Marlboro, at $40,487. Noted Sept. 23.

Mass., Salem—George T. O'Brien, 10 Palmer St., Cambridge, at $61,659, submitted lowest bid for addition to Bowditch School. Noted Dec. 9 and 16.

Mass., Springfield—Contract awarded to ERNEST F. CARLSON CO., Springfield, for theater, garage, bowling alleys and billiard room for Russell C. Parsons.

N. Y., New York—(Borough of Manhattan)—Contract awarded to LEVIN BROS., 320 Fifth Ave., for one-story, 53x93-ft. synagogue for Wel Israel Anshe Poland Congregation. Estimated cost, $75,000.

N. Y., New York—(Borough of Manhattan)—Contract for nine-story nurses home and 70x72-ft. superintendent's house on Lexington Ave. for German Hospital and Dispensary awarded to A. A. SMITH, 69 East 91st St.

N. J., Jersey City—Contract for a theater for the National Theater Co., 1326 St. Nicholas Ave., New York, N. Y., awarded to WELLS CONSTRUCTION CO., 235 Fifth Ave., New York, N. Y. Estimated cost, $65,000.

Penn., Philadelphia—(Official)—Contract awarded to MELODY & KEATING, 1218 Chestnut St., Philadelphia, at $227,918, for 31-room school at B and Allegheny Ave. and nine-room addition to school at 70th and Woodland Ave. Noted Dec. 9.

Ohio, Akron—Contract for Jennings School awarded to DAWSON CONSTRUCTION CO., Columbus. Estimated cost, $70,000. Noted Dec. 2.

Ohio, Athens—Contract for church and Sunday school for First Christian Church awarded to B. DAVIDSON, 152 North Congress St., Athens. Estimated cost, $40,000. Noted Nov. 18.

Ohio, Cincinnati—(Official)—Contract for Industrial Arts Building, tunnel K, power house, stadium, gymnasium and tunnel J, of Eastside High School awarded to ROUCHE-BRUNNER CO., Cincinnati, at $390,700. Noted Dec. 2.

Ohio, Cleveland—County Commissioners awarded contract for detention home on Franklin Ave. to WILLIAM MOORE & CO., at $59,990. Noted Nov. 4.

Ind., Culver—Contract for armory awarded to JAMES I. BARNES, Logansport.

Mich., St. Joseph—Contract for high school awarded to F. H. BEAUMAN CO., at $75,977. Noted Dec. 23.

Wis., Madison—T. C. McCARTHY, 848 Jeunifer St., Madison, at $49,249, awarded contract for Agricultural Soils Bldg., for University of Wisconsin. M. E. McCaffery, Secy.

Wis., Madison—Contract for physics building for University of Wisconsin awarded to WISCONSIN CONSTRUCTION CO., Chippewa Falls. Estimated cost, $200,000. M. E. McCaffery, Secy.

Iowa, Alton—(Official)—Contract for school for Board of Education awarded to H. M. BOSMA, Sheldon. Noted Dec. 16.

MONT CLARE BRIDGE, PHOENIXVILLE, PENN.

Bids were received Dec. 21 by the Commissioners of Montgomery and Chester Counties for the construction of a reinforced-concrete bridge across the Schuylkill River between Phoenixville and Mont Clare from (A) T. L. Eyre, Philadelphia; (B) F. M. Talbot Co., New York, N. Y.; (C) Thomas Sheahan, Hagerstown, Md.; (D) E. W. Foley, New York, N. Y.; (E) Foster Construction Co., Newark, N. J.; (F) Ferro Concrete Co., Harrisburg; (G) Whittaker & Diehl, Harrisburg; (H) J. E. Bunting & Co., Flushing, N. Y.; (I) Day & Zimmerman, Philadelphia; (J) Ambler Davis Co., Philadelphia; (K) Mason, Hilton & Co., New York, N. Y.; (L) National Foundation and Engineering Co., Cleveland, Ohio; (M) Dravo Contracting Co., Pittsburgh; (N) William C. Evans, Ambler, Penn. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Lump sum bid	$113,400	$85,376.61	$92,335	$98,776	$127,437	$99,439	$89,739	$108,000	$94,091	$80,894	$88,200	$108,000	$86,625	$84,027
1,200 cu.yd. foundation excavation, earth	4.20	3.90	3.00	7.00	.75	4.50	3.00	8.00	2.80	2.00	10.00	1.00	3.50	2 40
30 cu.yd. foundation excavation, rock	4.60	3.90	4.00	10.00	2.50	5 00	4 00	10 00	2 80	5 00	10 00	5 00	4 50	6 00
100 cu.yd. river dredging	.48	.50	2.00	1.00	1.00	3 00	3.00	1 00	25	2 00	2 50	1 00	60	2 00
100 cu.yd. roadway grading	.48	.40	.75	1.00	1.00	1 00	.75	.60	30	75	1 00	40	50	.90
1,400 lin.ft. hardwood piles	.36	.40	.70	.50	.75	1.00	.25	60	25	1 00	50	.38	40	1 00
900 cu.yd. concrete piles	94	2.20	2 20	1.50	1.75	3 00	.50	1.00	1 00	3 00	2 00	1 40	1 50	2.10
10 cu.yd. class "A" concrete	14.40	11.00	12.50	10.00	12.50	15.00	15 00	8.50	8 00	30 00	12 00	10 00	11 00	20.00
100 cu.yd. class "B" concrete	8.40	7.00	7.50	9.00	10.00	12.00	9.00	8.00	6.80	25.00	10.00	7.00	8.25	15.00
963 cu.yd. class "C" concrete	7.20	8.25	7.00	8.00	10.00	12.00	8 00	7 50	5 75	7 00	10 00	7 00	7 25	8 00
10 cu.yd. concrete in balustrade	24.00	25.00	27.00	20.00	24.00	25.00	30 00	20.00	15 00	45 00	20 00	32 00	23.00	40.00
250 lin.ft. bush hammered surface	.12	.07	.10	.06	.03	.70	.20	.20	.10	.50	.10	.06	.05	.40
2,000 lin.ft. carbor. rubbed surface	.06	.05	.05	.05	.03	.15	.10	.10	.02½	50	05	05	02	65
108 sq.ft. wood block pavement	3.60	2.20	2.00	3.00	2.50	2.00	1.75	2.60	2 65	2 25	2 00	2 50	2 80	3 70
292 sq.ft. metropolitan block pavement	3.00	1.90	2.50	3.00	2.15	4.00	1.50	3.35	1 90	2 10	2.00	2 50	2.30	2.30
108 sq.ft. standard amiesite pavement	3.72	1.50	2.50	3.00	1.65	2 00	1 50	3.25	1 60	1 50	2 00	4 50	2 30	1 40
292 sq.ft. Belgian or granite block	3.36	3.20	3.50	3.00	3.35	2.00	1.75	3.25	2.45	3 25	2 75	3 00	2 75	3 00
500 cu.yd. waterproofing	.10	.08	.15	.10	.20	.20	.15	.25	.12	.40	.25	.10	.16	.50
3,500 lb. reinforcing steel	.05	.03	.03½	.04	.03	.04	.05	.03½	.03½	.05	.05	.03½	.03	.06
240 lin.ft. curb protection bar	.24	.15	.20	.30	.15	.15	.20	.15	.10	15	.15	.25	.15	12
240 lin.ft. 6-duct t.c. conduit	.36	.50	.35	.50	.35	.50	.25	.50	27	1.50	.35	1.25	.30	1.00
240 lin.ft. 2-duct t.c. conduit	.24	.30	.12	.20	.14	.20	.10	.20	.09	1.00	.15	.40	.10	.40
40 lin.ft. metal conduit	.24	.27	.20	.30	.20	.15	.15	.20	.15	75	.25	.25	.15	.60
1,500 lin.ft. sidewalk and curb finish	.07	.05¾	.05	.10	.10	.20	.07	.15	05	25	05	15	03	22
10 lin.ft. 4-in. terra cotta sewer pipe	.24	.20	.50	.50	1.00	.07	.10	.30	.08	35	.20	.50	10	30
100 lin.ft. 8-in. terra cotta sewer pipe	.48	.40	.70	.75	.60	.15	.12½	.40	.16	80	.25	35	15	80
300 lin.ft. 12-in. terra cotta sewer pipe	.96	.70	1.00	1.50	1 00	30	25	.50	25	1 50	.30	60	27	1.50
2 catch basins	36 00	13.00	10.00	25 00	16.50	20 00	15 00	30 00	35.00	50 00	15.00	20 00	25 00	30.00
2 bronze light fixtures	144.00	90.00	125 00	10.00	145.00	150 00	100 00	80 00	150.00	50.00	75 00	100 00	100 00	40.00
2 draw boxes	48.00	7.50	15.00	1.00	16.50	15.00	10 00	10 00	12 50	25 00	5 00	5 00	7 00	20 00
60 cu.yd. broken stone fill	3.36	1.80	2.00	3.00	2.25	1 50	2 00	2 00	2 00	2 50	2 00	2.30	2 90	2.50
Extended totals	$132,521	$104,866	$110,765	$122,369	$145,832	$126,620	$106,188	$132,174	$107,520	$103,252	$117,212	$123,527	$104,103	$106,011

RAPID TRANSIT SYSTEM, NEW YORK, N. Y.

Section 3, Route No. 8

Bids were received by the Public Service Commission Dec. 7 for constructing Section 3, Route No. 8, a part of Eastern District Subway, under East River from Manhattan at 14th St. to North Seventh St., Brooklyn, from (A) Booth & Flinn, Ltd., 17 Battery Pl., New York; (B) Holbrook, Cabot & Rollins Corporation; (C) Degnon Contracting Co.; (D) Arthur McMullen & Olaf Hoff. The item bids were as follows:

	A	B	C	D
1,400 cu.yd. earth excavation above mean high water	$20.00	$16.00	$7.00	$14.00
2,100 cu.yd. earth excavation below mean high water	20.00	6.40	10.00	14.00
100 cu.yd. earth excavation for sewers	10.00	5.00	6.00	7.00
14,400 cu.yd. earth excavation below mean high water for shafts	25.00	15.60	25.00	60.00
100 cu.yd. rock excavation for shafts	16.85	20.00	12.00	10.00
700 cu.yd. tunnel excavation (earth) above mean high water	20.00	11.48	20.50	15.00
103,500 cu.yd. tunnel excavation (earth) below mean high water	19.40	11.48	20.50	28.00
46,200 cu.yd. tunnel excavation (rock)	19.40	14.50	25.00	34.00
8,400 cu.yd. tunnel excavation (earth and rock)	19.40	33.75	30.00	34.00
42,300 cu.yd. concrete	9.00	14.00	12.00	10.00
1,000 cu.yd. concrete placed in compressed air	15.00	16.75	18.00	20.00
10 cu.yd. rubble stone masonry	3.50	4.00	8.00	4.00
10 cu.yd. dry rubble masonry	2.50	2.50	7.00	4.00
2,400 cu.yd. dry stone packing	2.50	5.00	4.00	3.00
15 cu.yd. brick masonry	12.00	15.00	16.00	15.00
50 cu.yd. hollow terra cotta brick or tile masonry	12.00	15.00	16.00	15.00
12,000 bbl. Portland cement grout	3.50	5.00	2.50	3.50
56,000 bbl. natural cement grout	3.00	4.50	2.00	3.25
3,000 lin.ft. timber piles	.50	.50	.50	.40
100 cu.yd. broken stone or gravel	2.00	1.50	2.00	2.00
2,000 sq.yd. waterproofing 1-ply	.50	.35	.40	.50
100 sq.yd. waterproofing 2-ply	.80	.50	.50	.75
100 sq.yd. waterproofing 3-ply	1.10	.75	.75	1.00
100 sq.yd. waterproofing 4-ply	1.40	1.00	1.10	1.25
100 sq.yd. waterproofing 5-ply	1.70	1.25	1.50	1.50
100 sq.yd. waterproofing 6-ply	2.00	1.50	2.00	1.75
100 sq.yd. waterproofing dry ply	.30	.25	.40	.25
600 sq.yd. waterproofing laid in compressed air	4.00	6.50	3.00	5.00
370 cu.yd. brick laid in asphalt mastic	30.00	25.00	35.00	25.00
100 lin.ft. vitrified pipe, 12 in	.80	.70	.80	1.00
100 lin.ft. vitrified pipe, 10 in	.60	.65	.55	.80
100 lin.ft. vitrified pipe, 8 in	.50	.55	.40	.65
100 lin.ft. vitrified pipe, 6 in	.40	.50	.25	.50
100 lin.ft. vitrified pipe, 4 in	.30	.45	.20	.40
50 lin.ft. c.i. pipe, 6 in	.60	.70	1.00	1.10
100 lin.ft. c.i. pipe, 4 in	.45	.65	.75	.90
50 lin.ft. c.i. pipe, 3 in. extra heavy	.65	1.00	1.00	1.00
50 lin.ft. c.i. pipe, 4 in. extra heavy	.85	1.25	1.00	1.50
7,300 lin.ft. c.i. pipe, 6 in. extra heavy	2.00	1.50	1.20	2.00
500 lin.ft. c.i. pipe, 8 in. extra heavy	2.00	2.00	1.40	2.50
312,000 duct ft. tunnel ducts	.15	.15	.12	.12
70 ton riveted steel	100.00	80.00	90.00	80.00
1,820 ton steel for caissons	160.00	217.00	125.00	130.00
15 ton steel beams and shapes	100.00	140.00	90.00	70.00
15 ton steel rods and bars	50.00	140.00	60.00	80.00
43,500 ton c.i. tunnel lining	45.00	61.50	49.00	59.00
1,600 ton steel bolts and washers in lining	80.00	229.60	90.00	125.00
15 ton miscellaneous iron castings	55.00	60.00	80.00	70.00
1 ton miscellaneous iron furnishings for manholes and basin	75.00	50.00	80.00	70.00
1,000 lb. special wire forms	.15	.10	.10	.25
32,000 lin.ft. one and three-fourths in. hand-rail	.20	.25	.50	.25
660 sq.ft. steel gratings	1.40	1.00	1.25	1.50
50 sq.ft. vault lights	1.25	.80	1.50	2.00
275 sq.yd. restoration of sidewalks	2.00	2.00	2.00	1.50
190 sq.yd. restoration of granite block pavements	3.00	2.00	3.00	1.50
270 sq.yd. restoration of Belgian block pavements	3.25	2.50	2.00	1.50
200 lin.ft. new granite curb	1.00	1.50	2.00	1.00
100 sq.yd. new cement sidewalk	1.25	1.50	2.00	1.50
50 lin.ft. conduits, $\frac{3}{4}$ in	.20	.10	.20	.20
50 lin.ft. conduits, 1 in	.25	.15	.30	.25
20 c.i. outlet boxes	.60	.70	1.00	1.00
100 lin.ft. 12-in. vitrified pipe sewer	1.50	2.50	2.50	1.00
100 lin.ft. 15-in. vitrified pipe sewer	2.00	3.00	3.00	1.25
1 ton c.li. pipe sewr—straight	60.00	45.00	60.00	50.00
1 ton c.i. pipe sewer—special	120.00	80.00	80.00	75.00
50 lin.ft. 3 ft., 6 in. x 2 ft., 4 in. egg sewer	5.00	4.50	8.00	6.00
100 lin.ft. 4 ft., 0 in. circular sewer	6.00	5.00	10.00	8.00
42 lin.ft. 6ft., 0 in., x 7 ft., 0 in., twin masonry sewer	40.00	24.00	30.00	50.00
Maintaining steam railroad (lump sum)	1,000.00	5,000.00	500.00	1,500.00
100 lin.ft. changin 6-in. c.i. water pipe in place	.50	.75	1.50	.50
100 lin.ft. changing 12-in. c.i. water pipe in place	1.00	2.25	2.50	.75
125 lin.ft. changing 6-in. c.i. gas pipe in place	1.00	1.15	1.25	.50
4 ton new c.i. straight pipe	50.00	40.00	50.00	50.00
300 lin.ft. new 6" w.i. gas pipe	2.00	1.50	1.50	1.50
2 ton new c.i. special pipe	110.00	50.00	80.00	60.00
600 lb. new malleable-iron fittings for new w.i. gas pipe	.15	.10	.05	.08
100 lin.ft. changing 3" wrought iron pipe	.30	1.00	1.00	.50
Engineering offices (lump sum)	30,000.00	10,000.00	10,000.00	6,000.00
Extended totals	$6,639,023	$6,907,762	$7,231,391	$9,466,560

Year's Crops—The final crop returns for the year, issued by the Department of Agriculture on Dec. 15, are not greatly different from those already forecast, the changes being decreases in the quantities of corn, buckwheat and flaxseed, and gains in spring wheat, oats, rye, sweet potatoes, tobacco, rice, hay, sugar beets and cotton from the estimates previously noted. Record yields are indicated of wheat as a whole, oats, barley, rye, sweet potatoes, rice, hay and sugar beets, second best crops of corn, tobacco and apples, an average crop of potatoes, and rather short yields of cotton and flaxseed:

[Three figures omitted]

	Production		Record Crop	Year
	1915	1914		
Winter wheat	655,045	684,990	684,990	1914
Spring wheat	356,460	206,027	330,348	1912
All wheat	1,011,505	891,017	891,017	1914
Corn	3,054,535	2,672,804	3,124,746	1912
Oats	1,540,362	1,141,060	1,418,337	1912
Barley	237,000	194,953	223,824	1912
Rye	49,190	42,779	42,779	1914
Buckwheat	15,769	16,881	22,792	1866
Total, six cereals	5,908,361	4,959,494	5,723,495	....
White potatoes	359,108	409,921	420,647	1912
Sweet potatoes	74,295	56,574	59,938	1910
Tobacco, pounds	1,060,587	1,034,679	1,103,415	1910
Flaxseed	13,845	13,749	29,285	1902
Rice	28,947	23,649	25,744	1913
Hay, tons	85,225	70,071	72,691	1912
Sugar beets, tons	6,462	5,585	5,585	1914
Cotton, bales	11,161	16,135	16,135	1914
Apples, barrels	76,670	84,400	84,400	1914

Perhaps the most notable illustration of the year's tendency toward large yields is the showing above made of the aggregate yields of six leading cereals—wheat, corn, oats, barley, rye and buckwheat—exceeding the aggregate of the high record levels of the best of past years by 185,000,000, or 3.2 per cent.

The values of the leading crops this year and last compare as follows:

	1915	1914
Corn	$1,755,859,000	$1,722,070,000
Spring wheat	308,290,000	203,057,000
Winter wheat	622,012,000	675,623,000
All wheat	920,302,000	878,680,000
Oats	555,569,000	499,431,000
Barley	122,499,000	105,903,000
Rye	41,295,000	37,018,000
Buckwheat	12,408,000	12,892,000
Total	$3,417,932,000	$3,255,994,000
Flaxseed	$24,080,000	$17,318,000
Rice	26,212,000	21,849,000
White potatoes	221,104,000	199,469,000
Sweet potatoes	46,081,000	41,294,000
Hay	912,320,000	779,068,000
Tobacco	96,041,000	101,411,000
Cotton	602,393,000	525,324,000
Sugar beets	35,800,000	30,438,000
Apples	156,407,000	156,140,000
Total	$2,120,438,000	$1,872,302,000
Grand total, 15 crops	$5,538,370,000	$5,128,296,000

Only three crops, winter wheat, buckwheat and tobacco, show smaller values than a year ago. The six grain crops show a gain of 5 per cent. over 1914; the nine other crops show a gain of 13.2 per cent., and the fifteen crops together gained 8 per cent. over last year. A notable increase in value is shown by cotton, which, despite a 44 per cent. decrease in yield, shows a 14 per cent. gain in value.

Railway Communication Between India and Ceylon is proposed by closing the present 20-mi. water gap with a solid causeway. The railways at both ends have been extended by embankments and viaducts crossing the main part of the strait at the head of the Gulf of Mannar. This includes the navigation channel, at which there is a double-leaf Scherzer rolling-lift bascule bridge of 289-ft. span, as described in "Engineering News," May 7, 1914. It is now proposed to build a causeway for the remaining 20 mi., service across which is maintained by ferry steamers. Of this distance 13 mi. will be in shallow waterways between several islands along the line of what is known as Adam's Reef, the remaining 7 mi. being on dry land across these islands. The latter portions will be sand fills, protected by riprap of coral rock. For the causeway across the water two rows of reinforced-concrete piles will be driven, 14 ft. apart, with the piles in each row spaced 10 ft. c. to 3. They will be braced longitudinally by arches and transversely by ties and struts, all of concrete. Behind the piles will be placed vertical slabs, or panels, of reinforced concrete, the lower slabs being sunk well below the surface of the sand. When the slabs are in place, the inclosed space will be filled with sand. The rail level and the top of the concrete walls will be 6 ft. above high-water level. It is expected that this solid bank will cause sand to accumulate on each side of it until it forms the nucleus of a single island stretching across this part of the strait.

Immigration and Emigration—Arrivals and departures of certain races of aliens during the first 15 months of the European war, August, 1914, to October, 1915, inclusive, are given hereunder:

	Arrived	Departed	Change	
German	26,414	8,508	I.	17,906
French	22,464	13,026	I.	9,438
Russian	5,298	15,601	D.	10,303
English	73,394	63,335	I.	10,059
Irish	38,626	10,877	I.	27,749
Scotch	25,840	13,058	I.	12,782
Italians (south)	54,525	175,556	D.	121,031
Italians (north)	13,453	14,116	D.	663
Polish	6,718	5,617	I.	1,101
Hebrew	21,390	2,377	I.	19,013
Greek	22,676	14,879	I.	7,797

Engineering News

Volume 74, No. 27
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Hill Publishing Company

NEW YORK, DECEMBER 30, 1915

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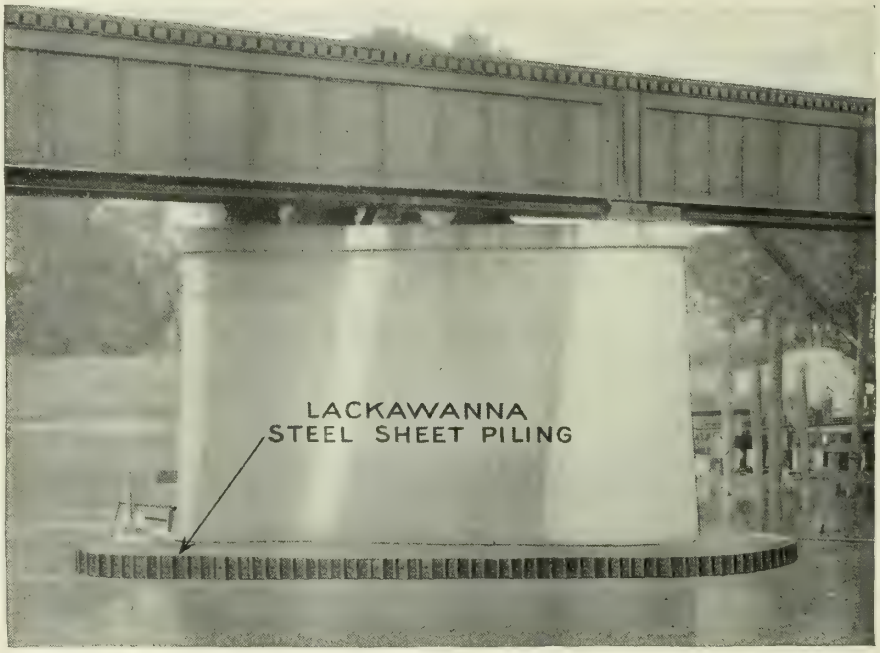


Lackawanna Steel Sheet Piling used in Reconstructing Bridges, C. C. C. & St. L. Ry.

Typical of the bridges reconstructed since the Ohio floods in 1913 is the one south of Dayton on the Miami River, as shown in the pictures.

Nine piers and two abutments here were constructed within cofferdams of Lackawanna $12\frac{3}{4}$ by $\frac{3}{8}$ in. Straight-Web Sections in 20 to 30-foot lengths.

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Engineering News

CHARLES WHITING BAKER, *Editor*

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NUMBER OF COPIES PRINTED THIS ISSUE, 21,000

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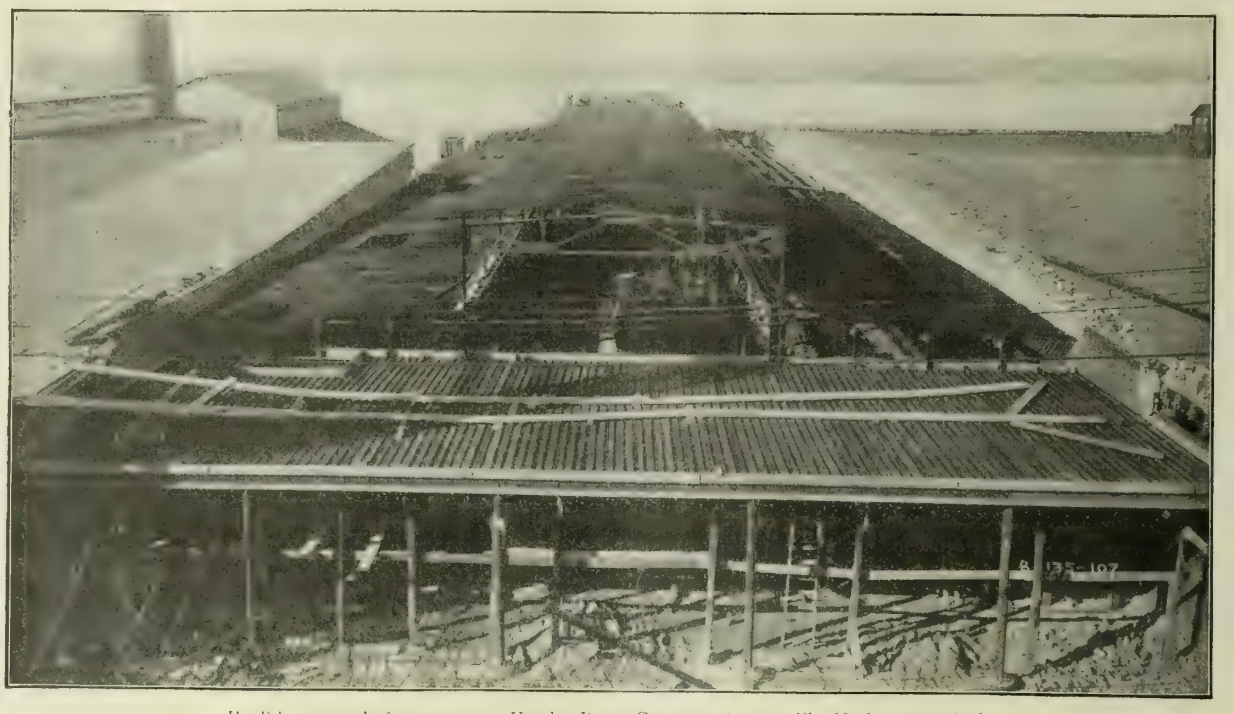
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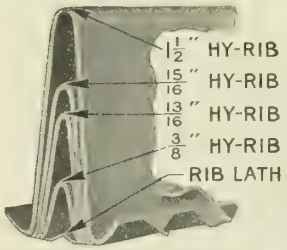
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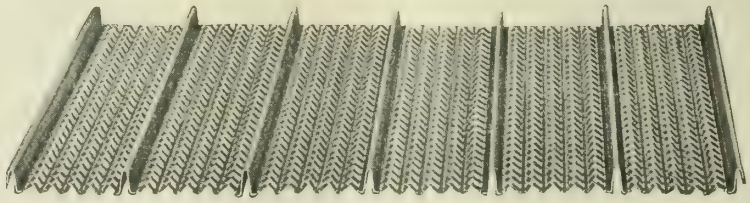


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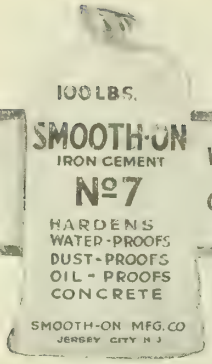
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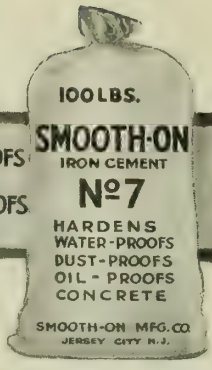
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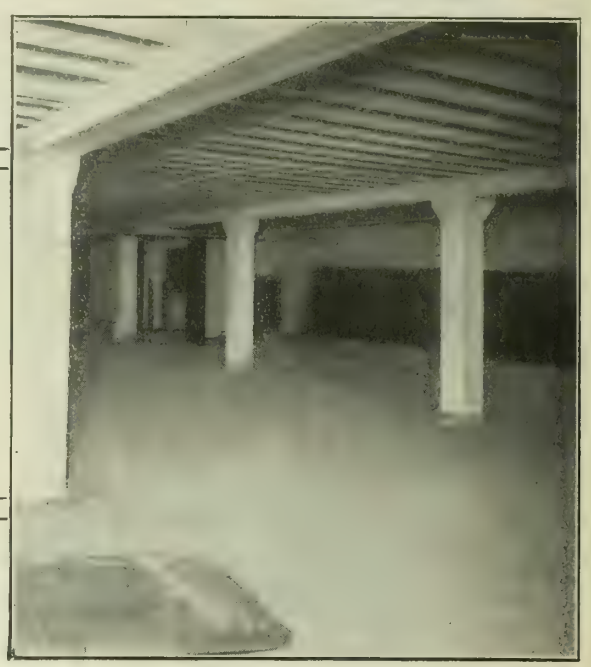
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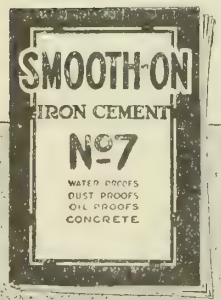
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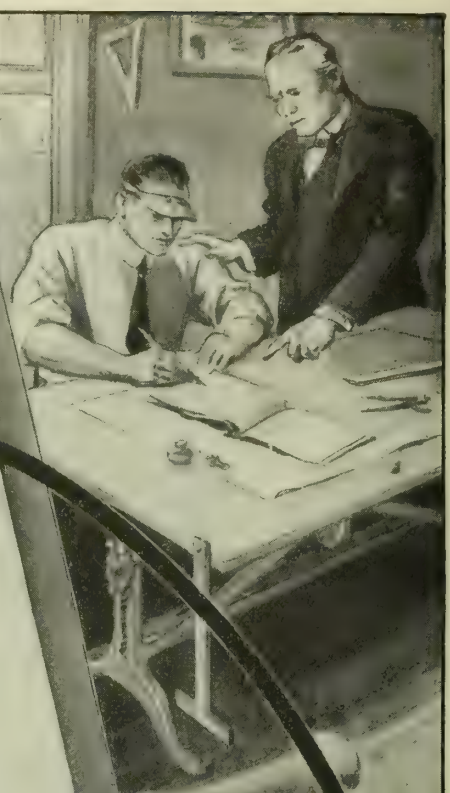
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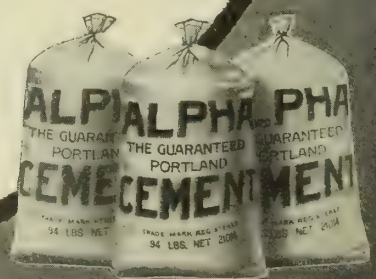
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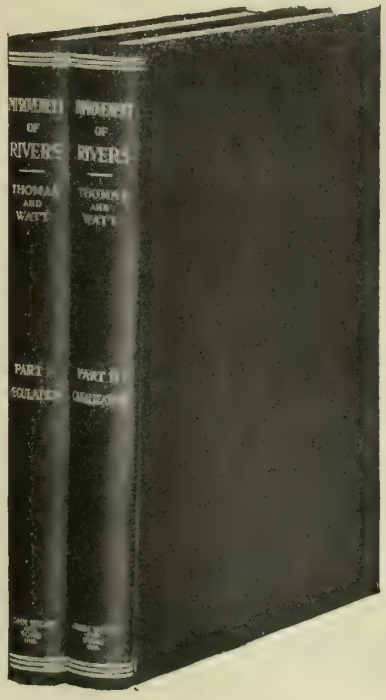
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Weight without Runways or Platform, 2,275 lbs.
Weight with Platform and Runways, 2,700 lbs. Height of discharge, 26″.
Thickness of Drum Shell, No. 10 gauge.
Thickness of Mixing Blades, No. 10 gauge.
Self Oiling Rollers.
Wheels, 20″ x 3″.
Price means complete machine with platform and runways.

Ransome Concrete Machinery Co.
Dunellen - - - New Jersey

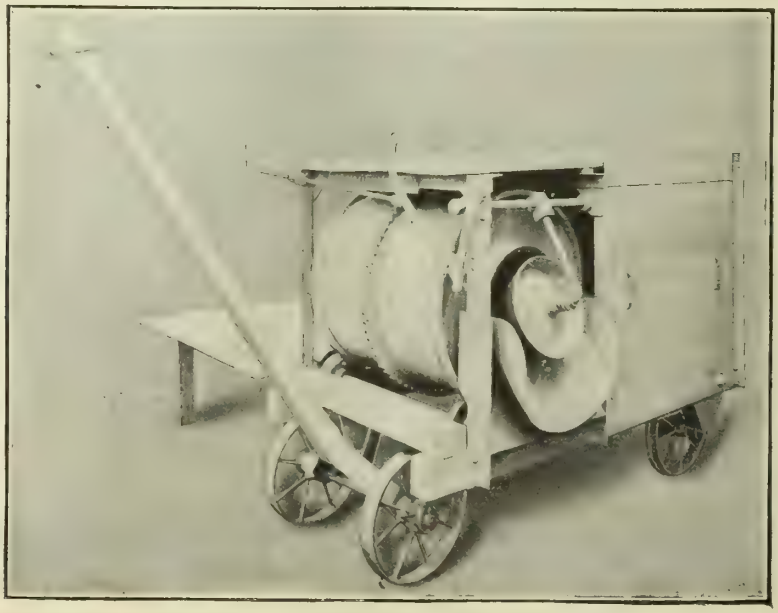
Chicago Office: Fisher Building

W. E. AUSTIN MACHINERY CO., Southern Sales Mgrs., Atlanta, Ga., New Orleans, Houston, Dallas, Memphis, Richmond. **F. H. Hopkins & Co., General Agents for Canada,** Montreal, Winnipeg, Vancouver.

Boston: 6 Beacon Street; Buffalo: 4 Builders Exchange; Cincinnati: Merchants Building; Cleveland: 505 Bangor Building; Columbus: Ransome Concrete Machinery Co.; Denver: Mine & Smelter Supply Co.; Detroit: W. H. Anderson Tool & Supply Co.; El Paso: Mine & Smelter Supply Co.; Kansas City, Kan.: Contracting Machinery Co.; Los Angeles: N. B. Livermore & Co.; Mexico City, Mex.: Mine & Smelter Supply Co.; Minneapolis, Charles Houston, Plymouth Building; New York: 103 Park Avenue; Philadelphia: Commonwealth Building; Pittsburgh: Baird Machinery Co., 123 Water St.; Portland, Ore.: Northwestern Equipment Co.; Salt Lake City: Mine & Smelter Supply Co.; San Francisco: N. B. Livermore & Co.; Seattle: Northwestern Equipment Co.; St. Louis: The Granville Supply Co.; Syndicate Trust Building.

FOREIGN AGENTS: Buenos Aires: Venge y Cia, Casilla, Correo 1273; Copenhagen: Isidor Heimann & Co.; Milan: E. Parodi Delfino.

$275

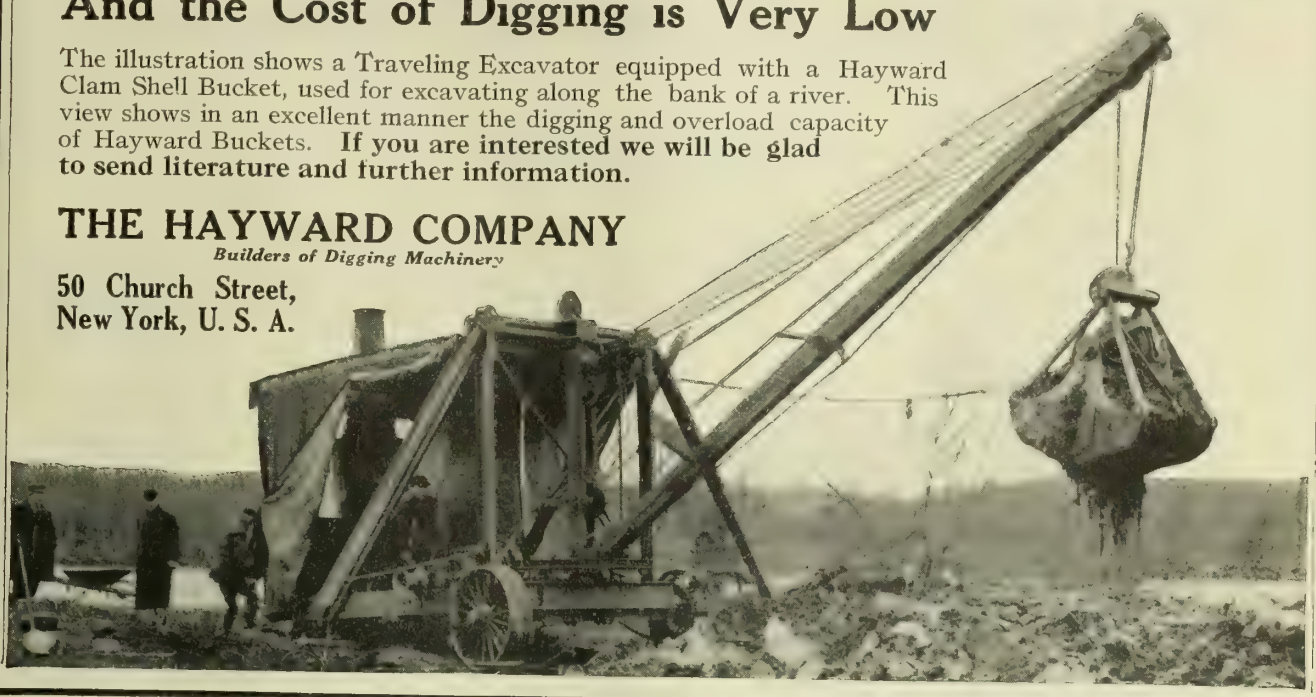


F.O.B. Dunellen

You Can Dig Almost Any Material With HAYWARD CLAM SHELL BUCKETS

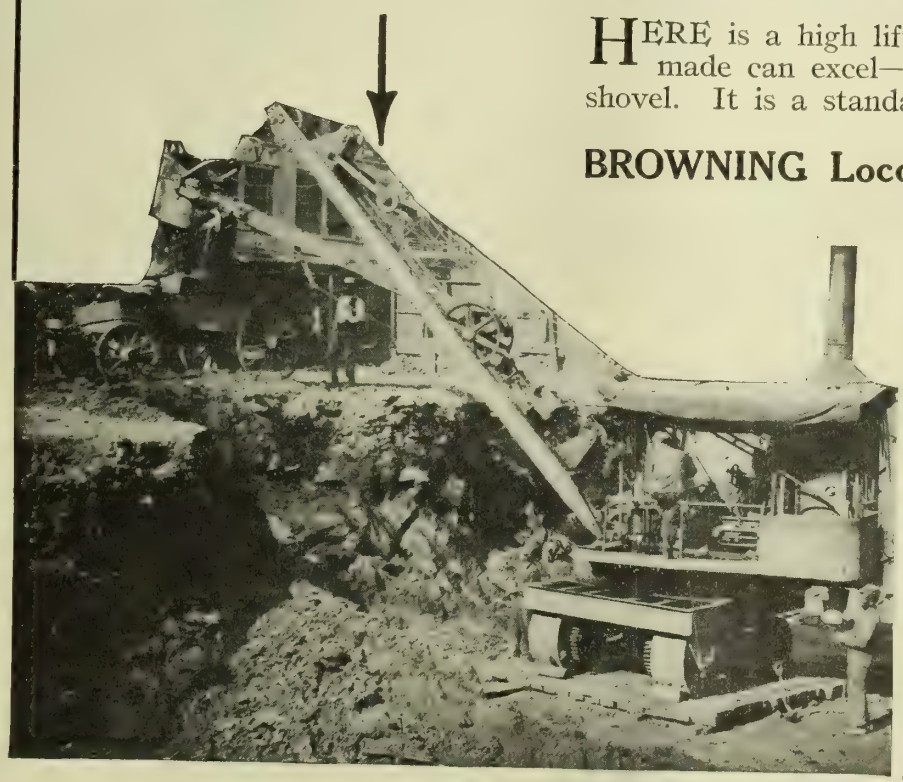
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THE HAYWARD COMPANY
Builders of Digging Machinery
50 Church Street,
New York, U. S. A.

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HERE is a high lift that no steam shovel made can excel—but this is not a steam shovel. It is a standard

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Your Browning is a LIVE piece of machinery. It isn't confined to crane work, nor to shoveling, nor to pile-driving, nor to dredging—*it does all.* Regarding quality—we do not believe it is possible to build a better piece of heavy machinery.

Are you digging for foundations? This Browning handles a good 800 cubic yards each 9-hour day.

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New York, Philadelphia, Chicago
San Francisco

SOUTHWARK

Piercing and Drawing Presses

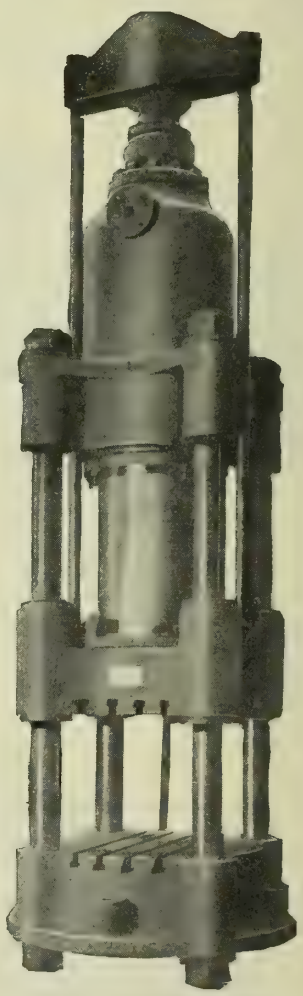
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This type press is the result of extensive experience in building hydraulic equipment.

The speed and pressure are absolutely correct and although built with the idea of obtaining the greatest strength, the press is easily operated and readily controlled.

There are other Southwark designs for nosing and band-shrinking operations.

If in need of hydraulic equipment for any purpose consult us.



350-Ton Shell Piercing Press

The services of our corps of expert engineers are at the disposal of manufacturers desiring press equipment for the production of steel shells. Write for a copy of our Bulletin.

SOUTHWARK FOUNDRY & MACHINE CO.

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By **John P. Davies,** M.E., Assoc. Member Am. Soc. C. E. 544 *pages,* 6x9, 243 *illustrations,* $5.00 (21*s*) *net, postpaid.*

A practical book devoted to the systems and methods of the modern engineering office. It is filled with "reminders" on every detail likely to arise in daily office routine.

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Smith—Construction of Masonry Dams

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A practical book written from the point of view of the construction engineer.

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A practical treatise on tunneling for the engineer and the contractor. The only book that covers all classes of tunnel work.

The underlying principles necessary to the solution of tunnel problems are fully set forth and illustrated by practical examples.

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A sound discussion of fundamental economic principles, prepared in the belief that to the engineer, a working knowledge of first principles is as essential in the Economics as in the Mechanics of Structures.

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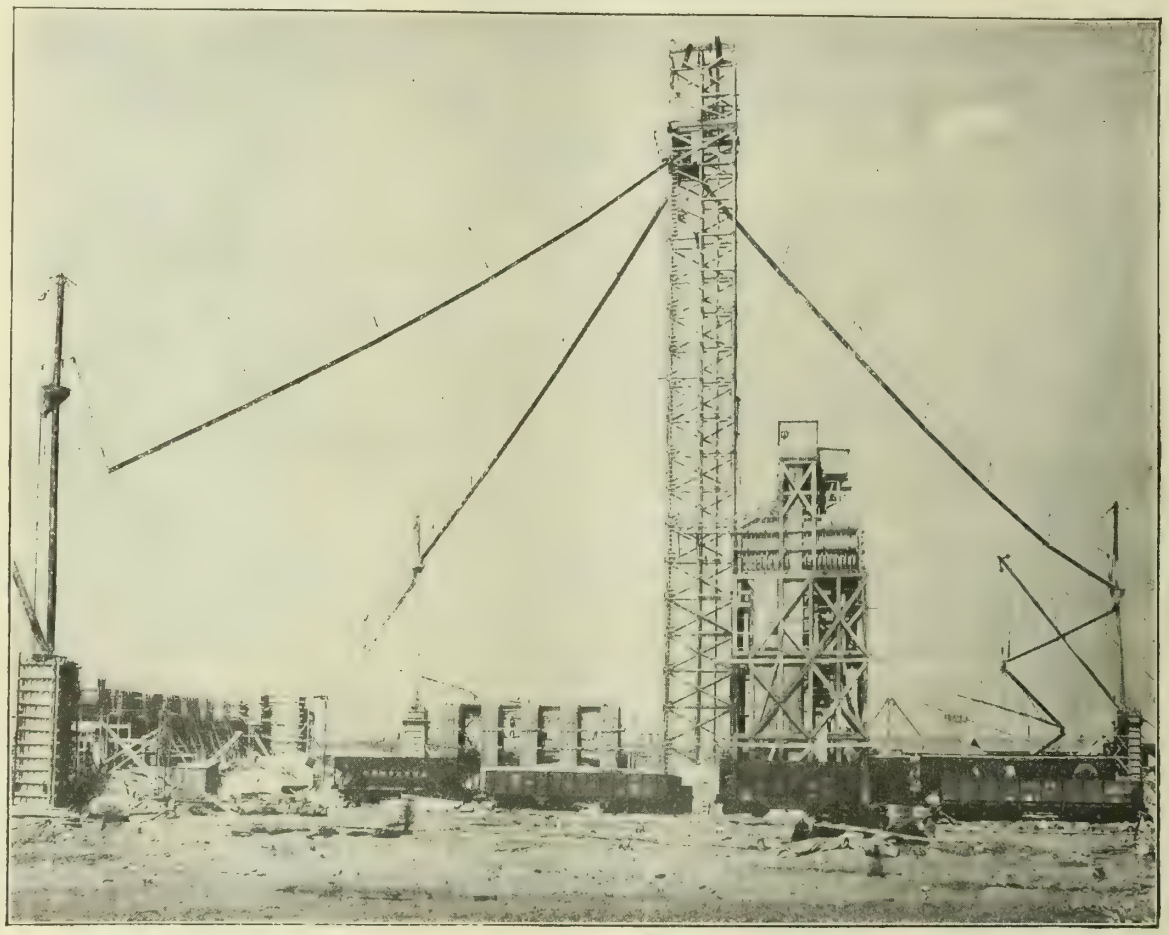
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"The Flexibility of a Hose"

The Insley Gravity Plant on the Field Museum, Chicago

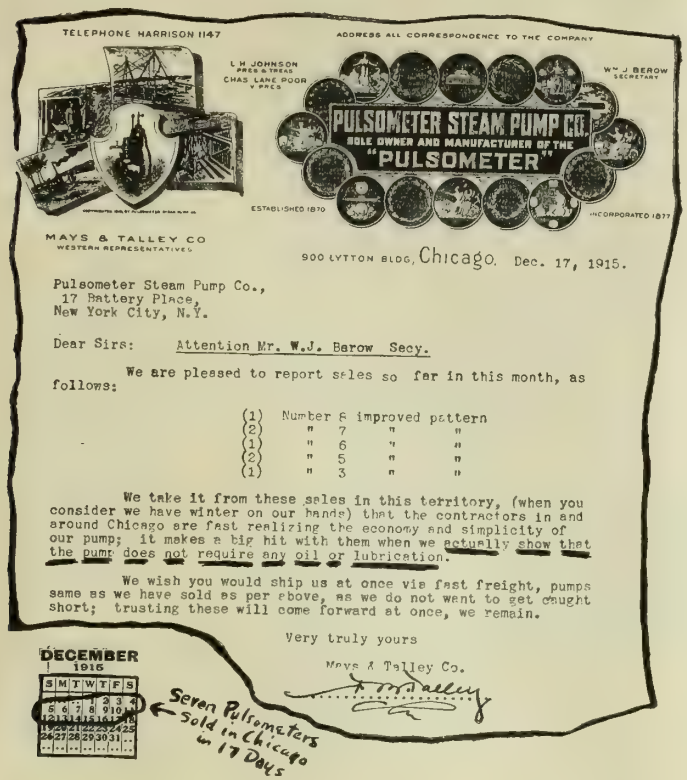


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THE Plant consists of a central tower with four-way hopper, four lines of fixed chutes 150 feet long radiating to four derricks occupying the quarter sections. Each derrick covers 140 feet radius by means of a system of counterweighted chutes. An additional section of chute reaches the far corners. The whole area is covered by these four derricks "with the flexibility of a hose."

The **INSLEY GRAVITY PLANT** for Concrete Distribution is pre-eminently the **EFFICIENCY PLANT.** Let us work with **you** and **your** concrete distribution problem. Our Engineering Department is at your service.

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PULSOMETER STEAM PUMP CO.
SOLE OWNER AND MANUFACTURER OF THE "PULSOMETER"

WM. J. BEROW SECRETARY

ESTABLISHED 1870 INCORPORATED 1877

MAYS & TALLEY CO
WESTERN REPRESENTATIVES

900 LYTTON BLDG, Chicago, Dec. 17, 1915.

Pulsometer Steam Pump Co.,
17 Battery Place,
New York City, N.Y.

Dear Sirs: Attention Mr. W.J. Barow Secy.

We are pleased to report sales so far in this month, as follows:

(1) Number 8 improved pattern
(2) " 7 " "
(1) " 6 " "
(2) " 5 " "
(1) " 3 " "

We take it from these sales in this territory, (when you consider we have winter on our hands) that the contractors in and around Chicago are fast realizing the economy and simplicity of our pump; it makes a big hit with them when we actually show that the pump does not require any oil or lubrication.

We wish you would ship us at once via fast freight, pumps same as we have sold as per above, as we do not want to get caught short; trusting these will come forward at once, we remain.

Very truly yours
Mays & Talley Co.

DECEMBER 1915

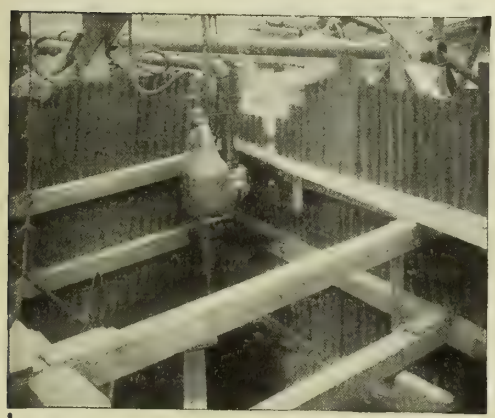
Seven Pulsometers Sold in Chicago in 17 Days

Yes, Indeed! Chicago Contractors are getting wise

This letter has just been received from our Chicago office. Read it! It explains *why* the sales of

PULSOMETER

are good even in Winter—and it shows that our constant hammering on the NO LUBRICATION feature of this pump is *right!* This *is* the point that "gets" a contractor. It "gets" him where he's tender, in the pocketbook.



Think of a pump that will handle practically anything that will flow; water thick with mud, sand, grit, pebbles and containing large quantities of air—lift it 15 or 20 feet by suction, NEVER requires any oil or grease—no special boiler —no foundation—no skilled labor. A pump that's good anywhere on any kind of excavation or pumping-out job. Why not get wise yourself? Write at once for new catalog.

Why *You* Should Buy Pulsometers

1. Will pump practically anything.
2. Are economical of steam.
3. No foundation or special boiler.
4. No skilled labor.
5. NO LUBRICATION.
6. Will pump under water or lift 15 or 20 feet by suction.
7. EXCEED THEIR RATINGS.

Pulsometer Steam Pump Company

18 Battery Place, New York

930 Lytton Bldg., Chicago

Pulsometers Carried in stock by the following Agents:

Harold L. Bond Co., 391 Atlantic Ave., Boston, Mass.
Haubtman & Loeb Co., 717 Magazine St., New Orleans, La.
Harron, Rickard & McCone, 139 Townsend St., San Francisco, Cal.
Harron, Rickard & McCone, 164 N. Los Angeles St., Los Angeles, Cal.
Miller Supply Co., Huntington, West Virginia.
Queen City Supply Co., S. W. Cor Elm and Pearl Sts., Cincinnati, Ohio.
Somers, Fitler & Todd Co., 323 Water St., Pittsburgh, Pa.
The Wheland Company, Chattanooga, Tenn.
V. H. Kreigshaber & Son, Atlanta, Ga.
Pocatello Eng. & Mach. Co., 129 So. Main St., Pocatello, Idaho.
H. A. Paine, Houston, Texas.
A. R. Williams Machinery Co., Toronto, Ont., Canada.
F. H. Hopkins & Co., Montreal, Quebec, Canada.
Henry H. Meyer Co., 110 So. Howard St., Baltimore, Md.
Standard Supply & Equipment Co., 1810 Market St., Philadelphia, Pa.
W. H. Zeigler, 320 Temple Court, Minneapolis, Minn.
Thos. L. Barrett, 27 No. 3rd St., Louisville, Ky.

Lupton Service

revolutionized the Foundry and Forge Shop type of building when—





POND TRUSS

(PATENTED)

was designed

The greatest tribute that can be paid an Industrial product has been given the POND TRUSS — that of adoption by the thinking men of that particular industry for which it was designed.

POND TRUSS was originally designed by the Lupton Service to solve the Daylighting and Ventilating problem for the General Electric Company's Erie Works.

So well did this finished product succeed is evinced in the widespread interest and many important installations in Foundries, Forge Shops, Glass Factories, Machine Shops, Power Houses and Steel Mills in this country and in other lands.

POND TRUSS not only provides for an even and perfect distribution of light, but is designed to eliminate the unnecessary cross-section of building, making the roof areas of such size, slope, and in such location as it may be necessary to deflect gases toward sash, preventing down draughts and all reverse currents when sashes are open. Owners are so well satisfied that in a number of instances old buildings have been remodeled and Pond Truss applied to reduce the tonnage cost by making it practical to operate the buildings under all weather conditions and secure maximum production from each workman, and that any additional cost of Lupton Products over the less meritorious in design and quality of workmanship is compensated for by service, cost of up-keep and all-round satisfaction.

LUPTON STEEL SASH

are used in side walls and monitor of roof of proper type and construction to freely ventilate and light entire floor areas under all weather conditions.

Lupton service is maintained to give authoritative information about any lighting and ventilating problem, without charge and without obligation.

The Lupton Catalogue No. 8 illustrates many examples of the finest buildings as erected in various parts of the world and gives comprehensive and valuable data relative to the subject of Daylight and Ventilation—a copy awaits your request.

The following installations are but a few of the many notable Buildings that are built around POND TRUSS, including various other Lupton Daylighting and Ventilating Products.

General Electric Company, Erie, Pa.
Toledo Glass Company, Toledo, Ohio.
Owens Bottle Machine Co., Toledo, Ohio.
Cleveland Electric Illuminating Co., Cleveland, Ohio.
National Supply Co., Toledo, Ohio.
West Steel Castings Co., Cleveland, Ohio.
Erie Malleable Co., Erie, Pa.
International Harvester Co., West Pullman, Ill.

David Lupton's Sons Company, Tulip and Westmoreland Streets, Philadelpia, Pa.

Contracts to Be Let

Bids received until Jan. 18, 1916.

Garbage Disposal

New York City, N. Y.

Bids or estimates for the disposal of garbage will be received until 12 o'clock noon, on Tuesday, January 18, 1916, at Room No. 1247, Municipal Building, Borough of Manhattan, The City of New York.

Form No. 1, for the disposal of garbage from the Boroughs of Manhattan, The Bronx and Brooklyn, for a period of five years, beginning January 2, 1917. The bidder to provide the site for the plant and to pay the City for the privilege of garbage disposal.

Form No. 2, for the disposal of garbage from the Boroughs of Manhattan, The Bronx and Brooklyn, on a site provided by the City of New York, for a period of five years, beginning January 2, 1917. The City will acquire the plant upon the termination of the contract at a stipulated price.

For further information concerning these contracts, see current issues of The City Record, published at 96 Reade St., N. Y. City, or apply to the Commissioner of Street Cleaning, Municipal Building, New York City.

Bids received until Jan. 5, 1916.

Furnishing Piling, Lumber, etc.

New Orleans, La., Dec. 3, 1915.

Sealed proposals will be received by the Board of Commissioners of the Port of New Orleans until January 5, 1916, at 8:00 p.m., for furnishing creosoted and untreated piling, creosoted lumber, creosoted sheet piling and creosoted wood block, or creosoted piling only, untreated piling only, creosoted lumber only, creosoted sheet piling only and creosoted wood block only, as may be required in the construction of the Dumaine Street Wharf.

Deposit—$3,000.00 cash or certified check.

Payment—monthly in full for material received, 50% allowed for material treated on requisition and not then ordered.

Bond—50% of the amount of the contract.

On and after Dec. 6, 1915, specifications will be on file at the office of the Engineer, J. Devereux O'Reilly, by whom full sets will will be furnished to prospective bidders on deposit of $10.00, which will be refunded to depositors who submit proposals and return sets in good condition.

To depositors not submitting proposals, $5.00 will be refunded on return of set in good condition. The right is reserved to reject any and all bids, and to waive any informality in the bids received.

ERNEST M. LOEB, President.

Bids received until Jan. 13, 1916.

Purchase and Wrecking of School

THE BOARD OF EDUCATION
Office of the Secretary
Paterson, N. J., Dec. 21st, 1915.

Sealed proposals are hereby solicited for the purchase of and the wrecking of the present school building No. 10, situated on the corner of Warren and Mercer Streets, Paterson, N. J.

The above work is to be done in accordance with the specifications of Fred W. Wentworth, Architect, copies of which may be had at the office of the Architect, Room 502 Citizens Trust Building, this city. Proposals must be enclosed in sealed envelopes addressed "Proposals for purchase and wrecking of old School No. 10," addressed to the undersigned and delivered at Room No. 24, City Hall, Paterson, N. J., on or before Thursday, Jan. 13th, 1916, at five o'clock in the afternoon.

The Board of Education reserves the right to reject any or all bids and to waive any defects or informality in any bid, should it be deemed to the best interest of the city so to do.

By order of the Board of Education.

LEONARD STOLK, President.
JAMES F. DUNPHEY, Secretary.

Bids received until Jan. 4, 1916.

Barge Canal Work

STATE OF NEW YORK,
OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.
Albany, December 6th, 1915.

Sealed proposals will be received by the undersigned at his office in the Capitol, at Albany, N. Y., until twelve o'clock noon of Tuesday, January 4th, 1916, at which place and hour they will be publicly opened and read, for improving the New York State canals pursuant to the provisions of Chapter 147, Laws of 1903, and of the amendments thereto, as follows:

CONTRACT NO. 73-A (Revised).
Champlain Canal—Section 1.

For completing the construction of the canal from Northumberland to Stillwater.

Length about 15.0 miles. Sheets 1 to 16 inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the City of Albany or New York, issued by a national or State bank in good credit within the State and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds, coinsurance only will be accepted.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the State will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.

Bids received until Jan. 17, 1915.

Brick Pavement

BOARD OF LOCAL IMPROVEMENTS

City of Evanston, Ill.

Notice is hereby given that bids will be received for paving with brick on concrete portions of Simpson Street, Bridge Street, Leon Place, Asbury Avenue, Grant Street, Noyes Street, Leonard Place, Washington Place, Wesley Avenue, Jackson Avenue, Ashland Avenue and Payne Street, amounting to approximately 29,900 square yards, as a whole, in accordance with the ordinance therefor. Said bids will be opened on the 17th day of January, 1916, at the hour of 8 p.m., in the Mayor's office in the City Hall of the City of Evanston.

The specifications for such improvement and blank proposals will be furnished at the office of the Commissioner of Public Works of the City of Evanston.

The Contractor will be paid in bonds, which bonds shall draw interest at the rate of five (5) per centum per annum, except payment (if any) to contractor by warrant against the first installment, shall bear no interest.

All proposals or bids must be accompanied by a certified check payable to the order of the President of the Board of Local Improvements of the City of Evanston for a sum not less than ten (10) per centum of the aggregate of the proposal. Said proposals or bids must be delivered to the President of the Board of Local Improvements in open session of said Board at the time and place fixed herein for opening the same. No proposal or bid will be considered unless accompanied by a check as herein provided.

The Board of Local Improvements reserve the right to reject any or all bids should they deem it best for the public good.

The successful bidder will be required to furnish a Performance bond equal to the contract and a Maintenance bond equal to twenty-five (25) per centum of the contract price, of some approved surety company guaranteeing said improvement against defects arising from poor material or poor workmanship, for a period of five (5) years from the date of the completion and acceptance thereof.

H. P. PEARSONS,

President of the Board of Local Improvements of the City of Evanston.

Dated, Evanston, Illinois, Dec. 20, 1915.

Bids received until Jan. 5, 1916.

Wharf and Causeway

New Orleans, La., Dec. 3, 1915.

Sealed proposals will be received by the Board of Commissioners of the Port of New Orleans until January 5, 1916, at 8:00 p.m. for the construction of the Dumaine Street Creosoted Wharf and re-inforced concrete causeway with creosoted wood block roadway.

Alternate proposals are requested for bids, to wit:

Board of Commissioners of the Port of New Orleans furnishing all creosoted lumber and piling, or bidders furnishing all material and labor. Bidders will be allowed to submit proposals either way or both ways.

Deposit—$15,000.00 cash or certified check.

Payment—monthly to the extent of 80% of the Engineer's estimate of work accomplished, including allowance for a reasonable stock of material.

Bond—50% of the value of the contract.

On and after Dec. 6, 1915, plans and specifications will be on file at the office of the Engineer, J. Devereux O'Reilly, by whom full sets will be furnished to prospective bidders on deposit of $20.00, which will be refunded to depositors who submit proposals and return sets in good condition.

To depositors not submitting proposals, $10.00 will be refunded on return of set in good condition.

The right is reserved to reject any and all bids, and to waive any informality in the bids received.

ERNEST M. LOEB, President.

Bids received until Jan. 22, 1916.

Street Paving

La Porte, Indiana.

Bids will be received by the Board of Public Works until 11 A.M., January 22, 1916, for paving Indiana Ave. and Michigan Ave. 38,000 square yards. Estimated cost, $110,000.

L. DREW GODDARD, City Engineer.

Bids received until Jan. 17, 1916.

Street Paving

BOARD OF LOCAL IMPROVEMENTS

City of Evanston, Ill.

Notice is hereby given that bids will be received for paving with brick on concrete portions of Bridge Street, Payne Street, Country Road, Noyes Street, Dodge Avenue, Grant Street, Brown Avenue, Grey Avenue, Hartray Avenue and Pioneer Road, amounting to approximately 41,400 square yards, as a whole, in accordance with the ordinance therefor. Said bids will be opened on the 17th day of January, 1916, at the hour of 8 p.m., in the Mayor's office in the City Hall of the City of Evanston.

The specifications for such improvement and blank proposals will be furnished at the office of the Commissioner of Public Works of the City of Evanston.

The Contractor will be paid in bonds, which bonds shall draw interest at the rate of five (5) per centum per annum, except payment (if any) to contractor by warrant against the first installment, shall bear no interest.

All proposals or bids must be accompanied by a certified check payable to the order of the President of the Board of Local Improvements of the City of Evanston for a sum not less than ten (10) per centum of the aggregate of the proposal. Said proposals or bids must be delivered to the President of the Board of Local Improvements in open session of said Board at the time and place fixed herein for opening the same. No proposal or bid will be considered unless accompanied by a check as herein provided.

The Board of Local Improvements reserve the right to reject any or all bids should they deem it best for the public good.

The successful bidder will be required to furnish a Performance bond equal to the contract and a Maintenance bond equal to twenty-five (25) per centum of the contract price, of some approved surety company guaranteeing said improvement against defects arising from poor material or poor workmanship, for a period of five (5) years from the date of the completion and acceptance thereof.

H. P. PEARSONS,

President of the Board of Local Improvements of the City of Evanston.

Dated, Evanston, Illinois, Dec. 20, 1915.

Bids received until Jan. 12, 1916.

Turbo-Centrifugal Pump

Kansas City, Mo.

SEALED PROPOSALS will be received by the Purchasing Agent of Kansas City, Missouri, at the office of the Purchasing Agent, Second Floor City Hall, until two o'clock p.m. of January 12, 1916, for the designing, construction, delivery and erection of a steam turbine, reduction gear, centrifugal pumping unit of a capacity to pump continuously twenty (20) million U. S. gallons of water per twenty-four (24) hours, against a total combined head of three hundred and sixty (360) feet and a steam pressure of one hundred and sixty-five (165) pounds per square inch at throttle; together with all machinery, tools and appurtenances necessary; all in accordance with the plans and general specifications on file in the office of the Chief Engineer of the Water Department.

Each bidder shall deposit with the City Comptroller a certified check in the amount of Seven Hundred and Fifty Dollars ($750.00), payable to the City Comptroller of Kansas City, Missouri, and accompany his bid with the Comptroller's receipt therefor.

The certified check referred to in the Advertisement shall be submitted by each bidder as a guaranty that the bidder will, within ten (10) days after receiving the award of a contract, file with the City a satisfactory bond to the amount of Twenty-five Thousand Dollars ($25,000.00) and will execute the contract.

The Board of Fire and Water Commissioners does not bind itself to accept the lowest or any bid offered, and reserves the right to reject any and all bids and to waive any irregularity or informality in the bids.

(Signed) J. P. LANGAN, Purchasing Agent.

BURTON LOWTHER, Chief Engineer.

PROPOSALS FOR MOTOR SURVEY CRUISER—U. S. Engineer Office, Chicago, Ill.—Sealed proposals for constructing and delivering a motor survey cruiser will be received at this office until 10 A.M., Jan. 12, 1916, and then opened. Information on application.

Bids received until Jan. 8, 1916.

Rebuilding Dams

Norfolk, Va., Dec. 23rd, 1915.

SEALED PROPOSALS will be received by the undersigned, until 1:00 P.M. Saturday, January 8th, 1916, for furnishing materials and labor for rebuilding three (3) Dams and Spillways.

Plans, Specifications, and Information can be obtained from the Engineer in Charge, Department of Water.

The Board of Control reserves the right to reject any or all bids.

T. B. DORNIN, Engineer in Charge. THE BOARD OF CONTROL.

POWER-HOUSES—U. S. Engineer Office, Wheeling District, Wheeling, W. Va.—Sealed proposals will be received here until 11 a.m. (Eastern time), January 22, 1916, and then opened, for building fireproof power-houses at Dams Nos. 16 and 17, Ohio River. Information on application.

LOCK GATES—U. S. Engineer Office, Wheeling District, Wheeling, W. Va.—Sealed proposals will be received here until 11 a.m. (Eastern time), January 14, 1916, and then opened, for furnishing and erecting steel lock gates for Dam No. 14, Ohio River. Information on application.

POWER-HOUSE—U. S. Engineer Office, Wheeling District, Wheeling, W. Va.—Sealed proposals will be received here until 11 a.m. (Eastern time), January 6, 1916, and then opened, for building a fireproof power-house at Dam No. 14, Ohio River. Information on application.

PROPOSALS FOR BOILERS—Office Quartermaster, West Point, N. Y.—Sealed proposals will be received here until 12 M. January 24, 1916, and then opened, for two Water Tube Boilers and Stokers. Further information on application.

U. S. ENGINEER OFFICE, Dallas, Tex.—Sealed proposals for constructing and delivering one steel barge designated "A" will be received here until 12 noon, Jan. 27, 1916, and then publicly opened. Information on application.

Bids received until Jan. 12, 1916.

Purchase of Air Dried Sludge

DEPARTMENT OF PUBLIC IMPROVEMENTS,
SUBDEPARTMENT OF HIGHWAYS ENGINEER,
Baltimore, Md., Dec. 23, 1915.

Sealed proposals, executed in duplicate, for the purchase of Air Dried Sludge, produced at the Sewage Disposal Plant at Back River, Baltimore, are hereby solicited and will be received, addressed to the Board of Awards, care of Richard Gwinn, City Register, at the office of the City Register, City Hall, Baltimore, until 11 A.M., January 12th, 1916. A certified check of the bidder on a clearing-house bank, drawn to the order of the Mayor and City Council of Baltimore, to the amount of $500.00, must accompany each bid. Specifications and blank proposal sheets can be had at the office of the Highways Engineer, City Hall, on application. The right is hereby reserved to reject any and all bids.

R. M. COOKSEY, Highways Engineer.

PROPOSALS FOR THE PURCHASE OF Locomotives offered for sale by The Panama Canal and which are no longer needed.—Sealed proposals will be received at the office of the General Purchasing Officer, The Panama Canal, Washington, D. C., until 10.30 a. m., February 11, 1916, at which time they will be opened in public, for purchasing the above-mentioned articles. Blanks and general information relating to this Circular (No. 1001) may be obtained from this office or the offices of the Assistant Purchasing Agents, 24 State Street, New York City; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.; also from the U. S. Engineer Offices in the following cities: Seattle, Wash.; Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburgh, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky.; Mobile, Ala., and Galveston, Tex.; Commercial Club, Kansas City, Mo.; Chamber of Commerce, Quincy, Ill., and Commercial Club, Tacoma, Wash.—F. C. Boggs, Major, Corps of Engineers, U. S. A., General Purchasing Officer.

Classified Advertising

Positions Open
Civil Service Work
Employment Agencies
Labor Bureaus

Positions Wanted
Wanted
Agents and Salesmen
Contract Work

Miscellaneous
Educational
Books
For Sale

Business Opportunities **Proposals**

RATES: Positions Wanted, 3 cents a word, minimum charge 50 cents an insertion, payable in advance. Other advertisements, 5 cents a word, minimum charge $1.00. Count 4 words for blind address care of our New York or Chicago offices. Advertisements for bids $3.60 an inch.

ANSWERS addressed to us at 10th Ave. and 36th St., New York or 1144 Monadnock Block, Chicago will be forwarded without charge (excepting circulars or similar literature.)

IMPORTANT: Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies. Advertisers' names will not be furnished under any circumstances. Copy received until 10 A.M. Wednesday for next day's issue.

N

POSITIONS WANTED

Mechanical and Electrical Engineers

MECHANICAL AND CIVIL ENGINEER, experienced in design of metallurgical and chemical plants, power plants, conveying and storage equipment, general industrial plant work; good structural designer; available Jan. 1; references. PW186—Eng. News.

MECHANICAL ENGINEER, 35, technical school and 12 years' broad experience; New York interview. PW97—Eng. News.

Civil Engineers

CIVIL ENGINEERING STUDENT, experienced in surveying desires position; have own field and drafting instruments; location immaterial. PW92—Eng. News, Chicago.

GRADUATE CIVIL ENGINEER, 1915, 27, wants a job in railroad, hydraulic, bridge, etc., engineering; will go anywhere or do anything; experienced in city engineering work; references. PW153—Eng. News.

CIVIL ENGINEER, superintendent of a large water company, desires change; 15 years' experience in design, construction and management of hydraulic works. PW149—Eng. News.

CIVIL ENGINEER, 26, university graduate, three years' building experience including designing and estimating reinforced concrete desires to locate elsewhere. PW156—Eng. News.

CIVIL ENGINEER, 10 years' experience as draftsman, designer, inspector, estimator and chief of party on steel and reinforced-concrete structures, desires position with opportunity, outside work preferred; location immaterial. PW158—Eng. News.

GRADUATE CIVIL ENGINEER; 15 years' experience railroad surveys, location, construction, terminals, yards, designs, investigation reports and contract negotiations; Assoc. Mem. Am. Soc. C. E.—PW160—Eng. News.

CIVIL ENGINEER, Assoc. Member American Society, railroad valuation or maintenance work, graduate, 11 years maintenance and construction, two years Federal valuation, employed, desires change. PW21—Eng. News, Chicago.

CIVIL ENGINEER—New York concern about to effect changes wishes to locate suitable position for one of its engineers; young man, in charge of drafting and secretarial departments; location immaterial. PW171—Eng. News.

HIGHWAY ENGINEER, at present employed, open for change; large experience in municipal highway work, including old and modern types of pavements and road construction; good executive, expert on construction and repair costs and cost records; best references. PW172—Eng. News.

GRADUATE CIVIL ENGINEER, single, three years' field and office experience desires position; location immaterial. PW188—Eng. News.

CIVIL ENGINEER, graduate 1912, desires position in any branch of the profession; field, office and tropical experience; possess transit; can report immediately in any locality; salary moderate. PW187—Eng. News.

CONCRETE DESIGNER, 10 years' experience designing, detailing and supervising for various concrete systems, five years in charge of designing factory buildings. PW189—Eng. News.

CIVIL ENGINEER; technical education; eight years' experience field, office and design; railroads, maintenance and construction; Panama Canal construction, marine terminals, structures, concrete, reinforced concrete, steel, timber, reclamation, irrigation. PW183—Eng. News.

GRADUATE CIVIL ENGINEER, six years' field and office experience, desires position with opportunity; designer, building work, reinforced concrete and factory equipment. PW128—Eng. News.

CIVIL ENGINEER, 31, university graduate; 10 years' experience on railroad and industrial plant design and construction; now assistant superintendent with large contractors in Middle West; available after Dec. 15. PW127—Eng. News.

GRADUATE CIVIL ENGINEER, 1915, wishes employment in any branch of engineering where one can learn. PW181—Eng. News.

Bridge and Structural

STRUCTURAL ENGINEER, technical graduate, 14 years' experience in all classes steel structures, including bridges and subways, detailing, checking, estimating, designing, is open for engagement. PW157—Eng. News.

STRUCTURAL ENGINEER, 38, married, desires executive position with a responsible company; familiar with all classes of structural design, particularly power plant and buildings. PW180—Eng. News.

Draftsmen

ARCHITECTURAL DRAFTSMAN, 25 years old, university graduate, 3½ years' experience, desires position. PW192—Eng. News.

Surveyors

EXPERIENCED INSTRUMENT MAN, draftsman or computer desires position, going anywhere. PW169—Eng. News.

Superintendents

SUPERINTENDENT, engineer, 37, will fit any important post in contractor's office or field organization. PW701—Eng. News.

SUPERINTENDENT with 20 years' experience on pile driving, dredging, trestle and dock building, tunnel driving and lining, deep excavations, bridge foundations, locks, dams, hydro-electric developments, open for position. PW142—Eng. News, Chicago.

MUNICIPAL ENGINEER, university graduate; large and varied experience in municipal engineering and construction and an expert in plot development; city engineer of a large Eastern city for a number of years and in charge of all improvements. PW154—Eng. News.

CLERICAL MAN, 29, eight years' general construction experience, particularly large payrolls, cost accounting, correspondence; has initiative and executive ability. PW179—Eng. News.

EXPERIENCED QUARRY SUPERINTENDENT desires position after Feb. 1. Address "R. M.," 716 North Sixth St., Harrisburg, Penn.

MUNIPICAL ENGINEER, 20 years on surveys, planning, constructing and supervising highway improvements, pavements, etc.; good draftsman. PW178—Eng. News.

CONSTRUCTION SUPERINTENDENT and contractor's engineer with 15 years' successful experience in reinforced concrete and fireproof construction; thoroughly practical; progressive and efficient; field forces and plant organized; difficult and time propositions invited. PW185—Eng. News.

AMBITIOUS, ENEREGTIC STRUCTURAL DESIGNER, detailer and estimator with extensive experience on structural steel, reinforced concrete and timber construction, desires position; trusses, girders, bins, hoppers, trestles, highway bridges, furnaces, etc. PW168—Eng. News.

CONTRACTOR'S ENGINEER SUPERINTENDENT wants position Jan. 1; experience, foundations, caissons, buildings, bridges, sewers, dredging, railroad work. PW170—Eng. News.

SUPERINTENDENT OR FOREMAN desires position; wide experience, water sewers, state roads, etc.; strictly temperate; best references. PW184—Eng. News.

GRADUATE SHEFFIELD SCIENTIFIC, 1913, 35, drafting experience on railroad, structural, inspecting sewer construction, desires position with structural engineer, inside or outside; do anything to commence for later opportunity in structural designing; wages secondary to opportunity and permanency; references. PW161—Eng. News.

YOUNG MAN, graduate Cooper Union, 1915, desires position; salary secondary consideration. PW175—Eng. News.

POSITIONS OPEN

DRAFTSMEN—Good detailers wanted for condenser and heater work; location, Eastern New York State; give age, experience and salary expected. P173—Eng. News.

PHILADELPHIA BRANCH OFFICE of large Middle West manufacturing company has good opening for salesmen, designing engineers and draftsmen experienced in reinforced-concrete and other fireproofing materials; give full information P174—Eng. News.

DRAFTSMAN wanted, capable of using transit; desire a young man with experience. P126—Eng. News, Chicago.

DRAFTSMEN wanted, men of experience on heavy structural details of bridges, ore unloaders, and car dumpers; we can use both detailers and checkers. Apply by letter, giving full particulars, the Wellman-Seaver-Morgan Co., 7000 Central Ave., Cleveland, Ohio.

DRAFTSMAN (Marine) wanted for the Panama Canal; must be thoroughly experienced; salary, $125 month, with free steamship transportation from New York or New Orleans; no civil-service examination required for this vacancy; must be American citizen (final papers), under 45 years!, physically sound. Write Panama Canal Office, Washington, D. C.

Civil-Service Opportunities

Examinations for these positions will be held on or up to the dates given.

UNITED STATES CIVIL SERVICE COMMISSION, WASHINGTON, D. C.:

SANITARY ENGINEER (male); $1,600; examination Jan. 19; for vacancy in Bureau of Science, Manila, P. I. Write for Circular No. 35, Application Form B. I. A. 2.

STRUCTURAL ENGINEER AND DRAFTSMAN (male); $1,000-$1,800; examination Jan. 19-20; for vacancy in office of Supervising Architect, Treasury Department, Washington, D. C. Circular No. 53, Application Form 1312.

NAUTICAL EXPERT (male); $1,000-$1,800; examination Jan. 19; for vacancy in Hydrographic Office, Bureau of Navigation, Navy Department. Circular No. 23, Application Form 1312.

ARCHITECTURAL DRAFTSMAN (male); $1,201-$1,500; examination Jan. 22. Write to Civil Service Commission, Albany, N. Y.

Employment Agencies

The Agencies advertising here agree to refund any registration fee on demand any time within the first six months when no position is secured.

H. H. HARRISON & CO., Association Bldg., Chicago, registers high-grade technical, semi-technical and commercial men from all parts of America

STRUCTURAL AND AUTOMOBILE DRAFTSMEN wanted. The Toledo Engineering Agency, Ohio Building, Toledo, Ohio.

CORRESPONDENT

THE UNDERSIGNED plans and conducts correspondence for positions in technical, manufacturing and professional lines for $2500 to $15,000 men exclusively. Complete privacy assured. No commission charged—only service fee and postage. Send name and address only, in confidence, for prefatory details. R. W. Bixby (Established 1910), T1 Niagara Square, Buffalo, N. Y.

BUSINESS OPPORTUNITIES

CIVIL ENGINEER seeking capital to commercialize basic patent. This is a big proposition for a big man or party. BO190—Eng. News.

FOR SALE OR LEASE—Riveted steel pipe and plate works located in Pittsburgh district on the Ohio River; produces all kinds of plate work; dipping plant for steel pipe; six acres of ground; 40,000 ft. floor space; good switching facilities; immediate possession. BO137—Eng. News.

MISCELLANEOUS

CONSULTING ENGINEERS will sub-let private office with use of outer office equipped with drafting tables, etc.; stenographer, phone, all conveniences. Room 416, 38 Park Row, New York.

PATENT ATTORNEYS

IMPROVEMENTS wanted; send for free bulletins listing manufacturers' wants and book "Inventions—Patenting and Promoting." Lancaster and Allwine, 272 Ouray Building, Washington, D. C.

REINFORCED CONCRETE ENGINEERS *and* **STRUCTURAL STEEL DESIGNERS**

who are competent to do the work in these branches of engineering are always **WANTED.** A correspondence course of instruction, prepared and operated by a well-known Consulting Engineer (after many years' experience in these special branches of engineering) will fit you to find employment in the kind of engineering work that knows no "dull times." These courses provide "*actual experience.*"

Address W. 374, Engineering News.

Our Needs More Than Supplied

"In regard to our ad in your help wanted column, which we instructed you to run for four insertions, we will ask you to kindly discontinue it at once and bill us for two insertions. We have received such a volume of replies that our needs have been more than supplied and therefore it will not be necessary for this ad to appear again at this time."

"Positions Open" advertisements in Engineering News give employers quickly a choice among competent and experienced applicants.

For Sale
Second Hand Equipment

Rates: Less than 4 insertions 55 cents per line—4 to 11 insertions 50 cents per line—12 or more insertions 45 cents per line.

Equipment Wanted items appear at the end of this list.

N

ADVERTISERS' NAMES are abbreviated in most of these items. Complete names and addresses are as follows:

ARCHITECTS & Engineers Supply Co., Kansas City, Mo.
BRADEN, James S., 26 Cortlandt St., N. Y. City.
CONTRACTORS' Service Co., 50 Church St., N. Y. City.
DALLETT & CO., Harrison Bldg., Phila., Pa.
GIVIN Co., Herbert, 30 Church St., N. Y. City.
HOISTING Engine Sales Co., Grand Central Term., N. Y. C.
INTERNATIONAL Steel Erection Co., Waukesha, Wis.
JOBST, J. J., Peoria, Ill.—Equipment advertised is in good condition. Very cheap.
LINES FLYNN Co., Inc., 30 Church St., N. Y. City.
MARINE Metal & Supply Co., 167 South St., N. Y. City.
NEW RIVER Co., The, Macdonald, W. Va.
PIPE & Contractors Supply Co., 3 Dover St., N. Y. City.
SAMPSON Co., Geo. H., 13 Pearl St., Boston, Mass., and 32 B'way, N. Y. C.; or Winston & Co., Brown Station, N. Y.
SEYFERT'S SONS, Inc., L. F., 437 N. 3rd St., Phila., Pa.
SOUTHERN Iron & Equipment Co., Atlanta, Ga.
STALLEY, G. T., Box 390, Cleveland, Ohio.
TITAN Equipment Co., 30 Church St., N. Y. (Cort. 1111.)

AIR COMPRESSORS

2—Ingersoll-Rand, Cross Compound steam and air cylinders with Corliss valve gear 2500 cu. ft. capacity.—SAMPSON.

2—Ingersoll-Rand, Cross Compound Steam and Air Cylinders with Corliss valve gear 3300 cu.ft. capacity. Boilers and Condensers with this plant. All in good condition. Bargain.—SAMPSON.

Imperial XB-2 belt driven; 888 cu.ft. cap.; good as new.—SAMPSON.

Imperial XB-2 belt driven; 1190 cu.ft. cap. Nearly new.—SAMPSON.

Several second-hand air compressors, steam and belt driven, straight line and two stage of various sizes from 70 to 1300 cu. ft. capacities. Good condition.—SAMPSON.

1—Rand Class "C" 527 Cu. Ft. and 2—Rand Class "C" 98 cu. ft. straight Line steam Driven.—SAMPSON.

2 Laidlaw-Dunn-Gordon duplex 2-stage and 3 Norwalk tandem 2 stage, capacities 900 to 2100 cu.ft.—NEW RIVER.

American 10x10x10 straight line, steam driven, cap. 236 cu.ft.; Ingersoll-Rand 8x8x8 straight line, steam driven, cap. 100 cu.ft.; Clayton 8x8x7 duplex, cap. 150 cu.ft.—MARINE.

Ingersoll-Rand AA2, 18¼x20¼x13¼x18, 1110'.—GIVIN.

1—6x6 Ingersoll-Rand type NE-1 with regulating device; practically new, having been used less than two months. Address F. W. HAAS, Gary Public Schools, Gary, Ind.

Chicago (Franklin) portable gasoline 7x10, No. 3996, perfect condition, now in use.—INTERNATIONAL.

1 portable, gasoline driven, 80⁴ capacity.—GIVIN.

BOILERS

35, 50, 60 and 80 H.P. locomotive boilers.—PIPE.

4—125 H.P. and 2—150 H.P. Horizontal return tubulars, butt strapped, triple riveted.—MARINE.

4—225-hp. Geary water tube, at bargain prices for immediate disposal.—Apply Room 2405, Park Row Bldg., N. Y. C.

BRIDGES

Highway drawbridge for sale, for delivery in spring of 1916. Through span, 176' swing bridge, center support, 20' clear roadway, with one 4' sidewalk; steel trusses and floor beams with wooden stringers and floor plank; designed to carry one 40-ton car on one span; electric operation; built in spring of 1915. For further information apply to Holbrook, Cabot & Rollins Corp., 6 Beacon St., Boston, Mass.

BUCKETS

1—1 yd. Theo. Smith Orange Peel.—PIPE.

5—¾ cu. yd. standard clam shells.—STALLEY.

Hayward 1⅝ yd., Mead & Morrison 1½ yd., Smith 1 yd. and Union Iron Works ¾ yd. clam shells; 10—Steubner 1¼ yd. "Excelsior" bottom dump concrete.—MARINE.

¾ yd. Hayward Class "E" clamshell.—JOBST.

DERRICKS

Steel stiff leg, 125' boom, bull wheel, 35 ton.—TITAN.

1 Clyde stiff leg, 8 ton cap., 50' mast, 85' boom.—JOBST.

4 steel stiff leg—one 35' mast and sills, 88' boom, good for 6 tons with boom flat; one 25' mast and sills, 90' boom, good for 4 tons with boom flat; two 25' mast and sills, 85' boom, good for 15 tons with boom flat.—INTERNATIONAL.

DREDGES

12" hydraulic, fully equipped, with agitator, pontoons, pontoon pipes, shore pipe, electric light plant, galley and sleeping quarters for 10 men. Derrick scow with hand power. Must be seen to be appreciated. Apply to A. R. Powley Dredging and Construction Co., Kingston, N. Y.

DRILLS

1 Ingersoll-Rand E44, steam and air heads.—GIVIN.

ENGINES, GAS AND OIL

1 8 H.P. Vertical Type Fairbanks with sub-base.—SAMPSON.

ENGINES, STEAM

125 H.P. Brown Corliss.—METROPOLITAN CHAIR CO., New Haven, Conn.

EXCAVATORS

For sewers, cellars, grading, gravel plants.—TITAN.

GENERATORS

Western Electric 100 K.W. dir, con. to 14x14 engine, 240 volts; 2 Western Electric 60 K.W. belt, 125 volts.—MARINE.

HOISTING ENGINES

2—3 drum Nationals, one 10x12 and one 8¼x10, with boilers; Lambert 8½x10 D.D.D.C. Skeleton; 7½x10 D.D.D.C. Skeleton, 15 other makes and sizes.—MARINE.

12 Lidgerwoods and other makes, hoisting engines and cableways, skeleton and with boilers.—PIPE.

1—6¼"x8" D.C. D.D. with boiler and swinger "O. & S."—SEYFERT'S.

1 American hoist 8¼x10, with boiler, D.C. D.D. with swinging engine; 1 Clyde hoisting drum; 1 Lidgerwood hoist 8¼x10 with boiler, D.C. D.D. with swinging engine; 1 American hoist 7x10, with boiler, D.C. D.D.—JOBST.

1 American (steam) 24—5½x8, with 2 drums, 2 winch heads and boiler 28"x7'; 2 Lidgerwood (electric) double drum, 25 hp.—INTERNATIONAL.

15 hp., 220-volt, D.C. double drum hoist.—HOISTING.

INSTRUMENTS, SURVEYING

Second-Hand Transits, Levels, etc. Bought, sold or exchanged. Send for list of Second-Hand Instruments. Get our prices before ordering. WILLIAMS, BROWN & EARLE, Inc., Engineering Supplies, Dept. E, 918 Chestnut St., Phila.

$250 Stackpole V. arc Tr. No. 4, fine condn., $117. Guaranteed; 99 others. We repair, exchange, rent.—ARCHITECTS.

LOCOMOTIVES

[Standard Gauge]

50 locomotives, Switch, Mogul, Consolidation, Ten Wheel and Saddle Tank types.—SOUTHERN.

2—40 ton switchers, overhauled.—CONTRACTORS S. CO.

40-ton Climax geared, rebuilt; like new.—DALLETT.

2 switching locomotives; 40-ton Vulcan and 60-ton Baldwin.—PUBLIC BELT RAILROAD, New Orleans, La.

One Porter locomotive, 100,000 lb. capacity, cylinders 16x24; first-class condition. Reiter, Curtis & Hill, Commercial Trust Bldg., Philadelphia, Pa.

[40" and 44"]

Electric—11 Baldwin, Westinghouse and Goodman; weights 4 to 8 tons.—NEW RIVER.

[36" Gauge]

10 10x16" Porter, Davenport and Vulcans.—SOUTHERN

5 9x14" Porters.—SOUTHERN.

5—10x16 Vulcans, 1911-12.—CONTRACTORS S. CO.

[24" Gauge]

1 General Electric Co.'s electric locomotive with 2 sets of 44-cell Gould batteries; weight 3 tons; G. E. motor, 85 volts. Rated draw bar pull 500 lb. on level track; speeed, 4 miles per hr.; including 1 battery charging rectifier panel, 220 volts A.C. Outfit used six months. Fruin Colnon Contracting Co., 502 Merchants Laclede Bldg., St. Louis, Mo.

LOCOMOTIVE CRANES

4 and 8-wheel, 10, 15 and 20 tons capacity.—HOISTING MACHINERY Co., 48 Church St., New York City.

4 and 8 wheel 10 and 15 ton.—CONTRACTORS S. CO.

15 ton excellent condition, cheap.—STALLEY.

4 and 8 wheel, 10, 15, 20 and 25 tons capacity.—GIVIN.

4 or 8 wheel 5 to 40 ton capacities.—TITAN.

15-ton four-wheel Industrial and 1½ yd. clamshell, $3,600.—Thos. J. Lane, 240 Bushnell Bldg., Springfield, Ohio.

MIXERS (Asphalt and Concrete)

Hadsel 2 yd. Batch with engine; Ransome ¾ yd. with engine and hopper; Foote Continuous No. 2½, 7½ H.P. motor, D.C. on wheels.—MARINE.

Portable plant, complete capacity 300-600 yds. per day, rare bargain.—LINES FLYNN.

1 Eureka continuous, 3 HP. D.C. motor; 1—2½ Smith and one ¾-yd. Ransome with engine on skids.—PIPE.

MOTORS

200 H.P. General Electric, 600 r.p.m., 3-phase, 60-cycle, 2200 volts. Run very little.—SAMPSON.

150 H.P. General Electric, 720 r.p.m., 3-phase, 60-cycle, 220 volts. Run very little.—SAMPSON.

PILING, SHEET STEEL

73 pcs. Lackawanna 14″ arch web, 35 lb. section, 22′ lengths, used once, excellent condition.—37 Dun Bldg., Buffalo, N. Y.

PIPE

Wrought pipe guaranteed, sizes ¾″ to 20″.—PIPE.

300,000 rethreaded wrought, sizes ¾″ to 24″.—MARINE.

Pipe fittings screwed and flanged 7″ to 18″.—NEW RIVER.

All sizes. Second-hand pipe or new mill seconds. Big stock. Prompt shipment.—Eagle Pipe Supply Co., 30 Church St., N. Y.

PUMPS

1 Cameron 3½x2x4 Steam pump.—SAMPSON.

Number of good pumps, various sizes.—NEW RIVER.

Cameron 10x10½x20 and other makes and sizes.—PIPE.

ROAD ROLLERS

1—10-ton gas macadam roller, latest type; little used; first-class condition.—FS176—Eng. News.

SEWER MACHINE

Side track Potter screw machine for sale cheap.—JAMES A. PRINGLE, Topeka, Kan.

SEWER PLANTS

Contractors plant comprising air compressors, mixers, cableways, pumps, cars, hoists, buckets.—LINES FLYNN.

STEAM SHOVELS

Marion, model 60, steam shovel.—SOUTHERN

1 ¾-yd. revolving traction, rebuilt.—LINES FLYNN.

1 70-ton Bucyrus, 2½ yd. dipper; Thew "O."—BRADEN.

50 steam shovels, all makes and sizes; some used only two months; rent or sale. Rare bargains. Everything sold is guaranteed.—CONTRACTORS S. CO.

18-B Bucyrus traction, used few weeks; Type "O" Thew traction, Mass. boiler, prime condition.—DALLETT.

Thew Revolv. No. 0's, 1, A1, some factory rebuilt.—TITAN.

1 Bucyrus ⅝ yd. revolving traction.—GIVIN.

TRACTION ENGINES

1 Advance, 12 HP.—PIPE.

Wanted

22 Theodolites—Two 30-second and twenty one-minute. Good condition; reasonable price.—N. Escalante Co., 64 Wall St., N. Y. City.

Asphalt paving roller—Wanted at once. Price must be right. Send description and price to W177—Eng. News.

Rock buckets—Two 1-yd. or 1¼-yd. for Marion steam shovels, Models 20 and 31.—Shongo Construction Co., Inc., Powers Bldg., Rochester, N. Y.

Bucket—Peerless crane and clamshell.—Cantrell Construction Co., 21st and Sedgley Ave., Phila., Pa.

Dragline machine—About 60′ boom, 1½ or 2 yd. dipper. Give full description, location and lowest price. Address P. O. Box 93, Rochester, N. Y.

Contractors' plants and equipment bought for cash.—Pipe and Contractors Supply Co., 3 Dover St., New York.

FOR SALE—Second Hand Equipment

One 9 x 7½ x 8 Ingersoll-Rand Oil Burning Compressor complete with air receiver, fuel tank and circulating pump.
Two Little David and two Little Giant Wood Boring Machines.
One Cubic Yard Wylie Elevator Bucket, Receiving Hopper and 120 ft. trussed chutes.
One 1-yd. Williams Clam-shell Bucket.
One 7 x 10 single cylinder, single drum Lidgerwood Hoist.
One ½-yd. Concrete Mixer with steam boiler.

None of the above used over six weeks. Attractive prices to cash buyers.

F. S. 191, Engineering News.

Hydraulic Dredging Machinery FOR SALE

New York Ship Building Engine—Triple Expansion Marine Type 20″ Manganese Steel Pump—90 in. Impeller.

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This machinery has been in use but two seasons. Will sell all or any part of this outfit. For prices and further particulars address,

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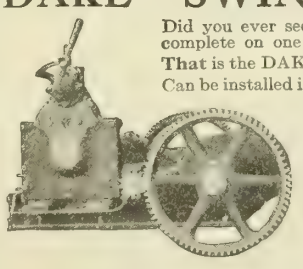
Air Compressors	Electric Locomotives	Pipe
Blowers and Fans	Elevators	Pumps
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Cars	Feed Water Heaters	Steel Pontoon
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Harold Carpenter, Resident Engineer, Astoria Light, Heat & Power Co., East 132nd St. and Locust Ave., New York City.

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NO DEAD CENTERS

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Did you ever see a 7-H.P. engine and swinging gear complete on one compact 42-in. x 46-in. base?

That is the DAKE.

Can be installed in any convenient place near main hoist or can be bolted to the skids in front of your double-drum hoist. The swinging drum is low, giving lots of clearance for the hoisting lines.

The compact DAKE square-piston motor for air or steam, has only two moving parts, and can't stick on a dead center. QUICK-ACTING—trouble-proof. **Write for the Dake catalog just out.**

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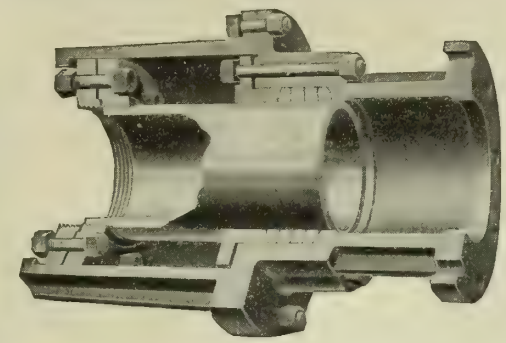
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ENGINEERING NEWS

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SOMETHING OLD—BUT NEW

THE ROSS EXPANSION JOINT consists of the well-known slip joint, with the improvement of a removable guide. This guide eliminates the strain that might be placed on the joint due to sagging of the pipe line, and thereby removes the only reasonable objection there has been to the slip joint type of expansion joint.

THE ROSS EXPANSION JOINT may be repacked, or packing adjusted, without removing it from the pipe line. No special tools are required. On account of the long traverse of the ROSS EXPANSION JOINT, the minimum number are required.

Built in sizes up to 24 in., and for working pressures up to 225 pounds.

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BUFFALO, N. Y. Manufacturers of Alberger Multi-Head Heaters CHICAGO, ILL.

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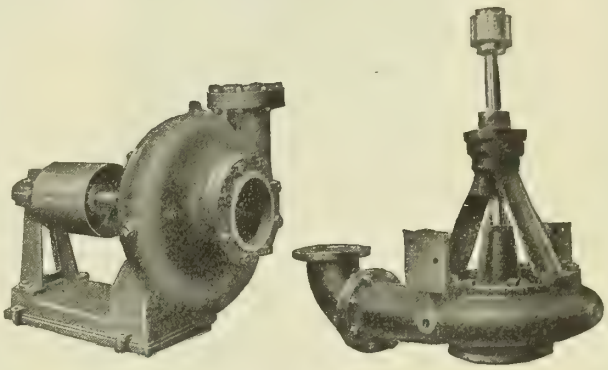
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There are Blawforms for every type of concrete construction from sewers to subways, from sidewalks to skyscrapers.

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General Offices: Pittsburgh
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Blawforms

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Class "C" Volute Pump

Horizontal or Vertical
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LOW IN PRICE
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Embodies Scientific Design that makes it more Efficient than other low-priced pumps. Used principally for small Irrigation Plants, also by Contractors for unwatering Ditches and Cofferdams. Write for Bulletin W 601-19.

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Branch Offices in All Principal Cities

W264.2

A. D. Cook, Lawrenceburg, Ind.

Manufacturer of

Steam and Power Deep Well Pumps, Single and Double Acting, Cook's Patent Brass Tube Well Strainers, Deep Well Cylinders, Sucker Rods and Well Tools. Deep Well Pumping Systems installed complete.

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M^cG **PUMPING MACHINERY** M^cG

IN ALL TYPES FOR ALL USES

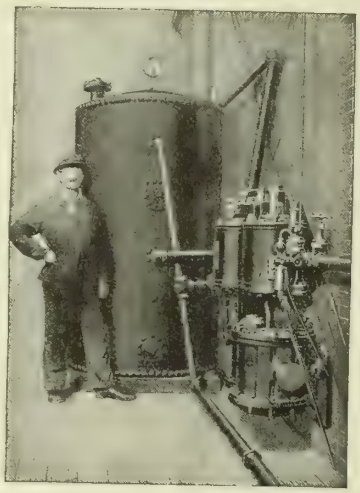
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FOR EVERY SERVICE

THE GOULDS MANUFACTURING CO. SENECA FALLS, N.Y.

A Handy Compressor
Simple Compressor
Strong Compressor



10½-inch Westinghouse Cross-Compound Compressor as used in building construction.

Westinghouse
Steam Driven Compressor

Handy, because being compact it can be readily moved about and set up almost anywhere, no prepared foundation is required. It can be attached to a wall, a post, the trunk of a tree, the boiler of a hoisting engine, or a movable stand is provided.

Simple, because of its few parts and the ease with which it is operated. No expert attendance is required.

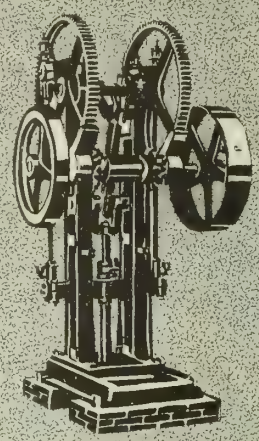
Strong, because of its self-contained mechanical construction. It will withstand very rough handling without injury

Westinghouse Steam Driven Air Compressors are made in both simple and cross-compound types.

SEND for our Compressor Book 9012.

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DEEP WELL PUMPS

Are designed to lift large quantities of water from *deep* wells. They are built for unusually heavy service. *"Downie" Double Stroke Geared Pump Heads* with two *Downie Conical Plunger Valves* and two balanced lines of sucker rods have an efficiency of 85%. *Double Stroke Steam Head* efficiency, 65%. Single Stroke Pumps at 40 to 50% efficiency.

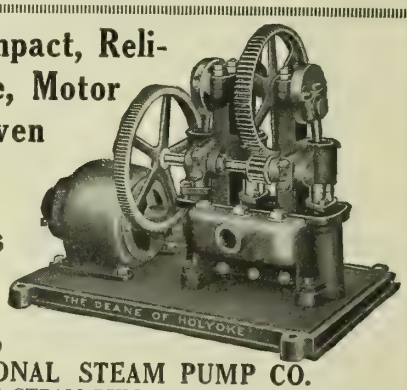
Catalog No. 6 gives details of our complete line. If you are interested in *well drilling* or *pumping* there is a *free* copy waiting for you.

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Beaver Falls, Pa.

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DEANE OF HOLYOKE

Compact, Reliable, Motor Driven
Triplex Pumps



For General Service
Deane of Holyoke Quality
Send for Bulletin D204-19

INTERNATIONAL STEAM PUMP CO.
DEANE STEAM PUMP PLANT
Power Pump Manufacturers
Works: Holyoke, Mass. **New York Office: 115 Broadway**
Branch Offices in All Principal Cities D287.1

Edson Diaphragm Pumps
Operated by Man or Gasoline Power

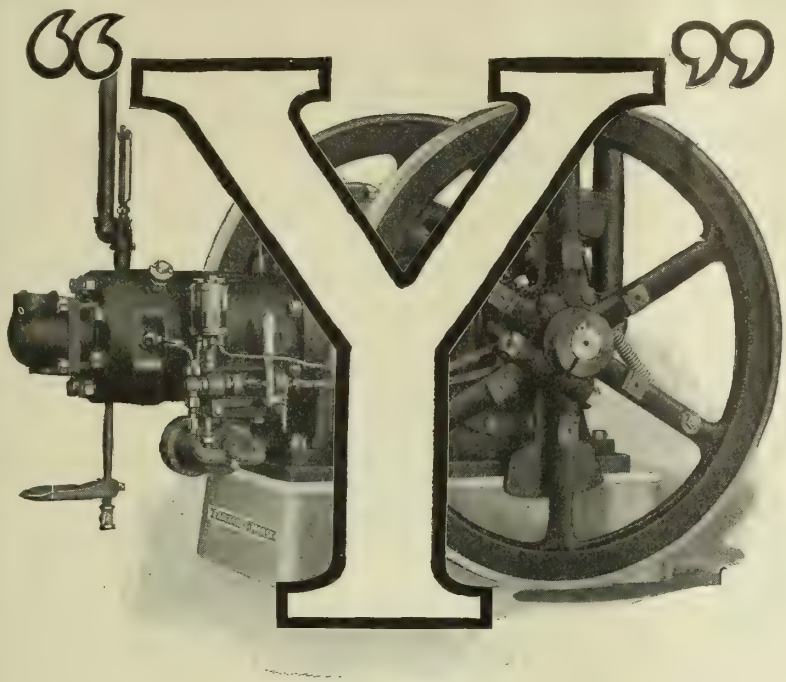
will handle Sand, Mud, Gravel, Sanitary Deposits and anything limpid enough to flow, without clogging or injury. *Send for Descriptive Catalogue.*

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Diaphragm Pumping Engines

Send for Illustrated Catalog giving many styles with prices.

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OIL ENGINE

10-horsepower— 10 hours for 30 cents

Fairbanks, Morse & Co.

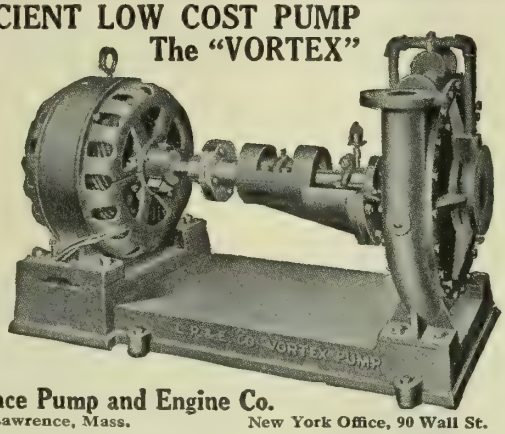
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The "VORTEX"

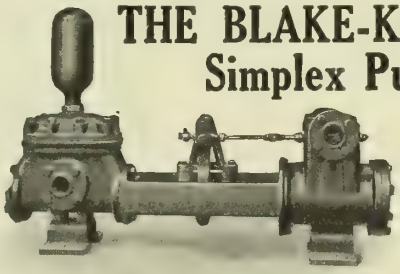
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THE BLAKE-KNOWLES Simplex Pumps



are best for your use, whatever the service may be.

Full lines for Pressure, Tank, Vacuum and air.

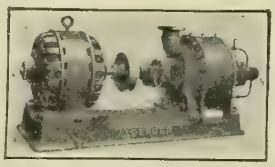
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115 Broadway, New York Works: East Cambridge, Mass.
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FOR ALL PURPOSES.

THE HEINE CHIMNEY CO.
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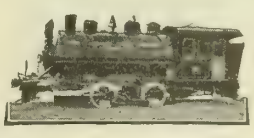
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This is probably more important even in plantation, industrial and contracting work than in railroading, since these industries have frequently to pay higher prices for fuel, and have not, as a rule, the most capacious storage facilities.

Our locomotive engineering department will gladly show you how efficiently Vulcans may be made to burn cheap, low grade fuels.



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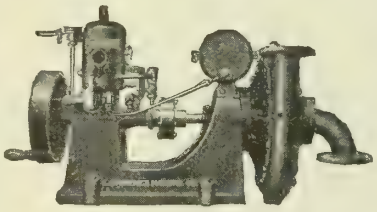
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AMERICAN BLOWER COMPANY, DETROIT

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SHOP HEATING VENTILATING AND COOLING SYSTEMS

For the Modern Contractor



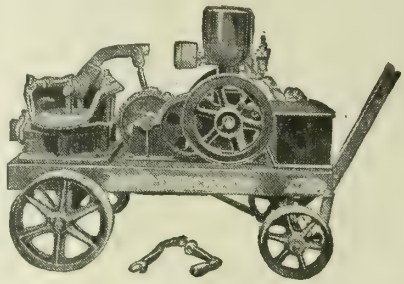
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Positive reliability and extreme ruggedness are noteworthy features. Our engineers will gladly assist you in selecting the best outfit for your needs. **Write.**

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Does the Work of Four Laborers

The Junior Trench Pump will lift water containing sand, gravel or sewerage. Can be operated for 7 hours on 1 gallon of gasoline with a capacity of 3500 gallons per hour. Built for hard service. Any diaphragm pump can be fitted to the outfit.



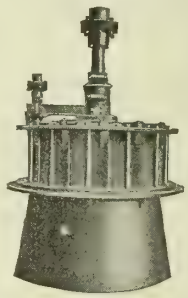
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Samson turbines use the water economically; the speed is quick and steady; they develop great power. Write us today.



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CHEAPER
It's All in the Pump
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Complete Plants for Large or Small Cities.
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Increase capacity of boilers, give more power with less fuel, and prevent all loss and trouble due to wet steam.
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THE DARLING PUMP & MFG. COMPANY, Lim.
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HUNDREDS IN USE

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Design, Manufacture and Erection
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Perfectly adapted for either high or low pressure.

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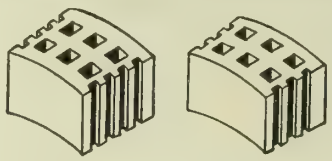
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Send us your orders. Our large stock, always on hand, guarantees prompt shipment. Write.

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Also Manufacture
Welded Wrought Iron Pipe, Lined and Covered with Pure Cement and Having Lead Caulked Bell and Spigot Joints
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STANDARD CAST IRON PIPE & FOUNDRY CO.
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Engineers and Contractors Manufacturers of

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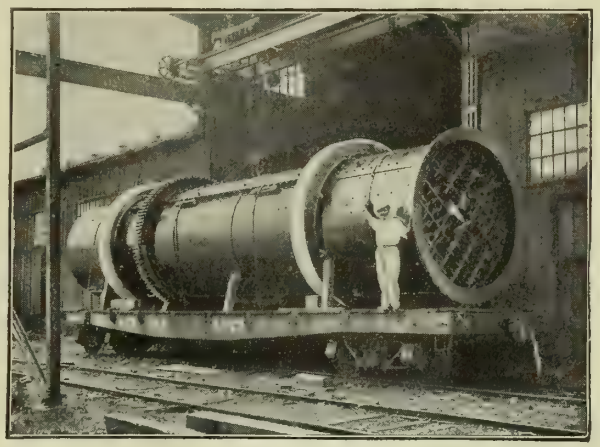
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Self-supporting Stacks and Heavy Plate Work
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of every description for every purpose.



Stacks, Standpipes, Tanks, Penstocks, etc.

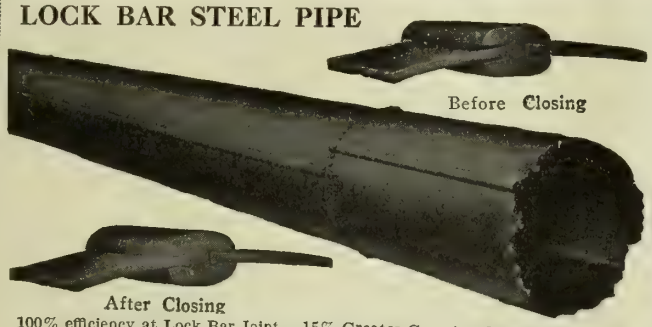
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100% efficiency at Lock Bar Joint. 15% Greater Carrying Capacity than Riveted Pipe. *Long Lengths* mean minimum joints.

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Mathews' Single and Double Valve Gate Valves

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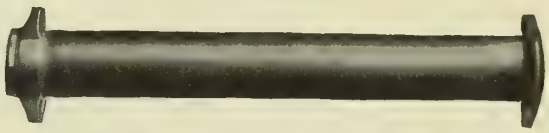
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DOWN underneath the tracks is where your leak is apt to be if you didn't lay that line with

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Breaks and fractures of pipe lines from the vibration of heavy traffic are prevented by the moderately flexible joints of

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U-15



Erected at Porcupine, Ontario, Canada
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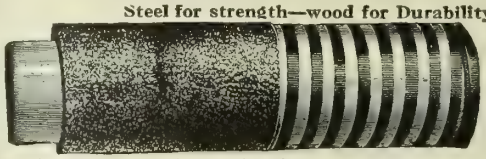
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Steel for strength—wood for Durability.



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Combination Steel and Wood Water Pipe

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SHOES FOR ANY SIZE WOOD PIPE TO WITHSTAND ANY PRESSURE

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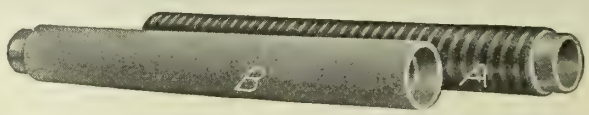
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both continuous stave and machine banded, of Redwood and Douglas Fir. Also tanks. Write.

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Read it now.

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Made of the finest old growth Oregon or Douglas Fir, Portland Wood Pipe is cheaper than iron or steel pipe yet of greater efficiency.

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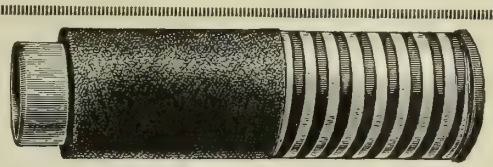
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WATER FILTERS for Municipal and Industrial Plants. Gravity and Pressure Types.

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"Let those now love, who've never loved before and those who always loved, now love the more."

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Long Life. **All parts interchangeable.**

Lasting Accuracy. **Maintenance cost nominal.**

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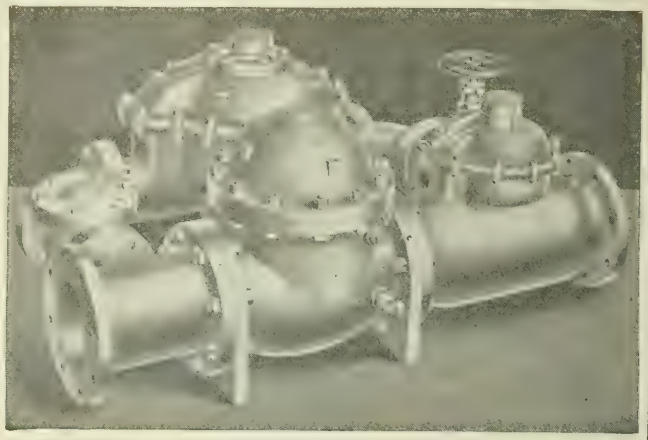
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Stop Wholesale Losses
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Saves you 10 *cts. per yard* in loading broken stone, sand, gravel, coal, coke, etc. A tidy sum you'll admit. Over 100 of these machines are doing it, and reducing labor troubles to a minimum, too. Electric or Gasoline Driven.

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Licensed For "Down Draft or Negative Head."

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Hydraulically and Electrically Operated Valves and Sluice Gates Valves Designed for all Kinds of Service.

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(Angle or Straight Way), up to 24".

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For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyances and Freezing of Float Fixtures inside or outside of Tanks.

"Three Ways of Closing These Valves."

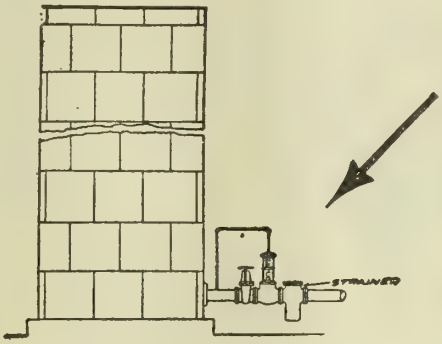
1st—Automatically by Water.
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"No Metal to Metal Seats"



Up to 24"

Up to 24"



Golden-Anderson Patent Automatic Cushioned Water-Regulating Valves.

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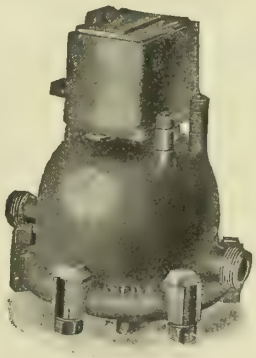
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UNRIVALLED FOR ACCURACY, DURABILITY, EFFICIENCY, LOW MAINTENANCE COST

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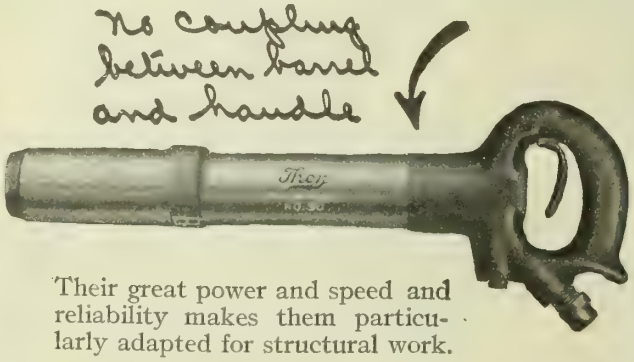
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Drove 1,500,000 Rivets on the

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Their great power and speed and reliability makes them particularly adapted for structural work.

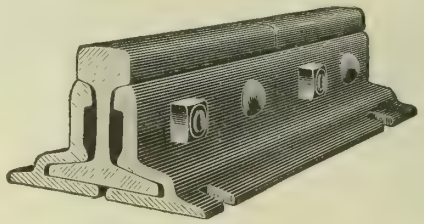
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Continuous Rail Joint.

Makers also of Weber, Wolhaupter and 100% Rail Joints for Standard, Girder, and Special rail sections. Also joints for frogs and switches. Insulated Rail Joints, and Step or Compromise Rail Joints.

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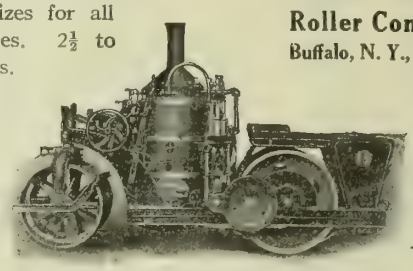
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REVOLVING SHOVELS

MARION Revolving Shovels, even small ones are Shovels of great capacity; they stick right to a job like a bullpup till the whole contract is out of the way—*that's what they are there for.*

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There's a Marion Shovel that will fit right in with *your* work. It's described and illustrated in "Marion Reliability and Your Profits" which we will be glad to send on request for Catalog 939.

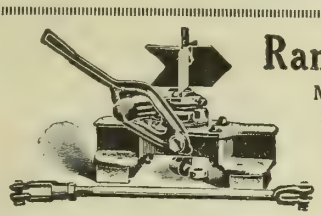
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Manufacturers of Excavating Machinery of Every Description



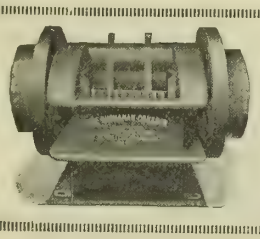


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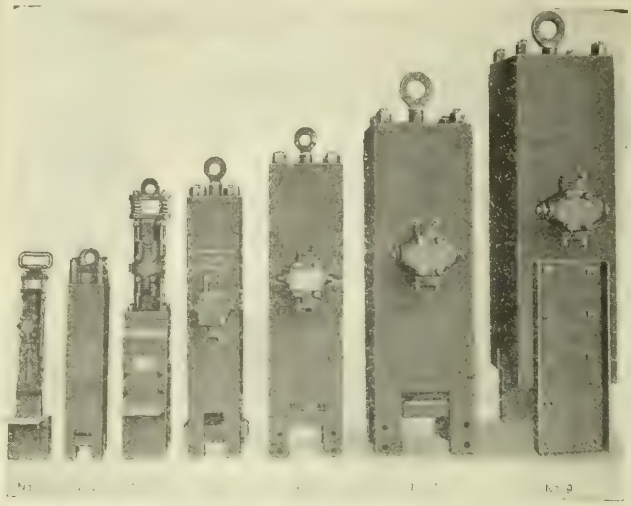
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CRUSHING ROLLS—MAGNETIC SEPARATORS

Crushing Plants complete in all details from 100 to 5,000 tons daily capacity.

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The high standard of excellence established by McKIERNAN-TERRY PILE HAMMERS is known to users the world over. Their reputation for consistent and economical work is the reason.

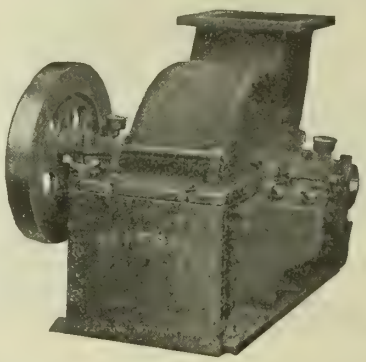
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234 Broadway, New York, N. Y.

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JEFFREY SWING HAMMER PULVERIZER



For Mill or Field Use—

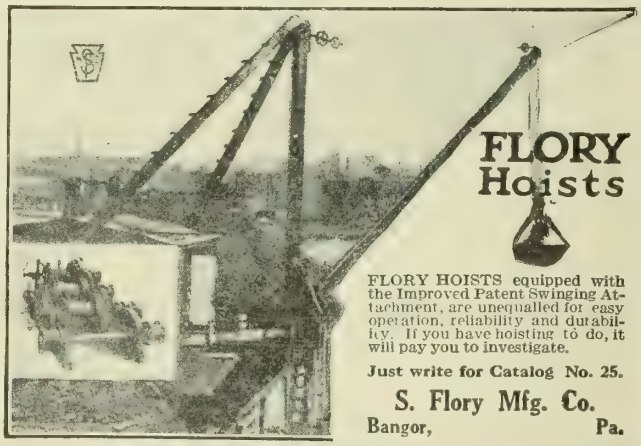
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The Adjustable Breaker Plate positively assures a uniform product.

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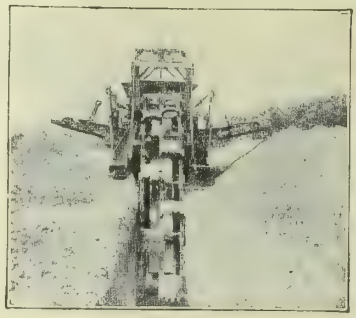


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FLORY HOISTS equipped with the Improved Patent Swinging Attachment, are unequalled for easy operation, reliability and durability. If you have hoisting to do, it will pay you to investigate.

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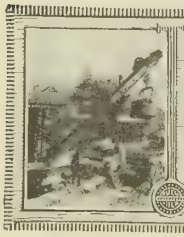
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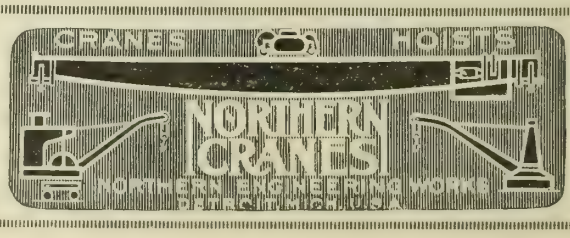
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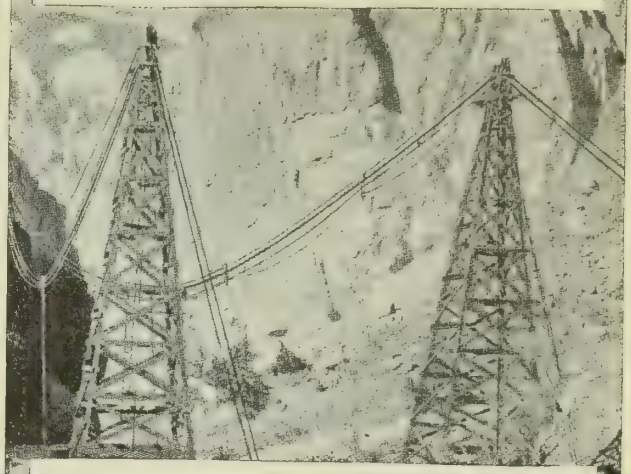
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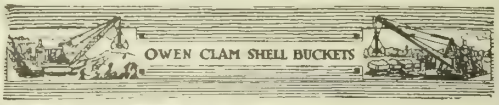
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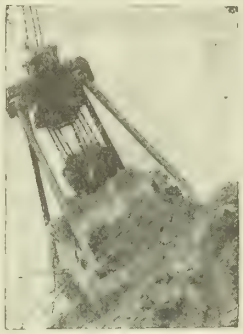
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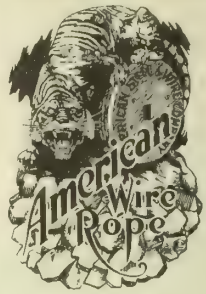
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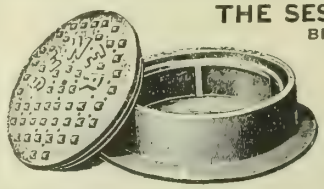
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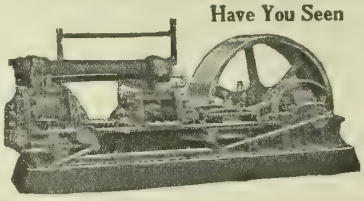


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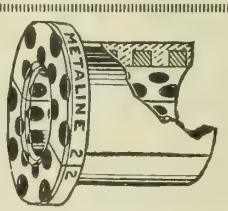
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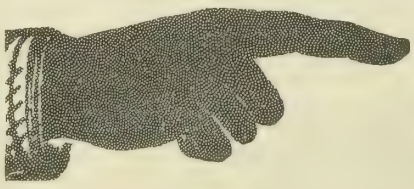
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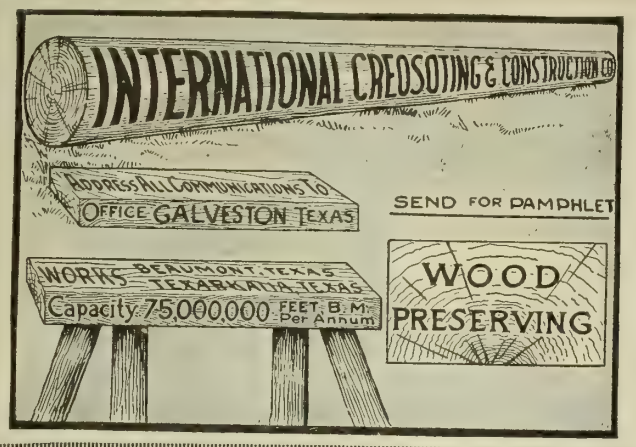


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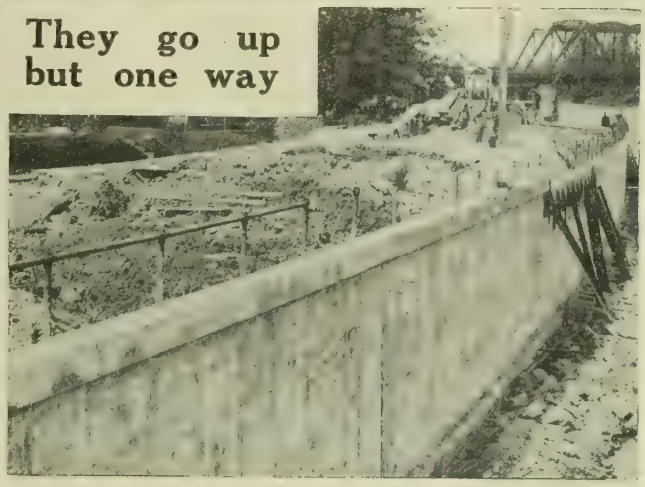
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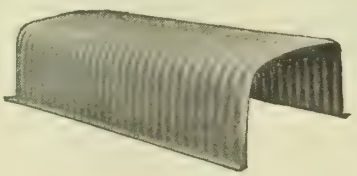
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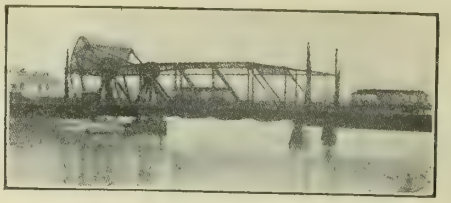


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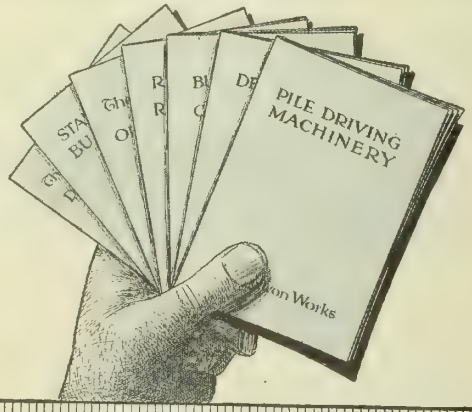
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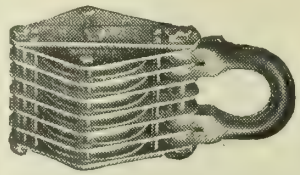
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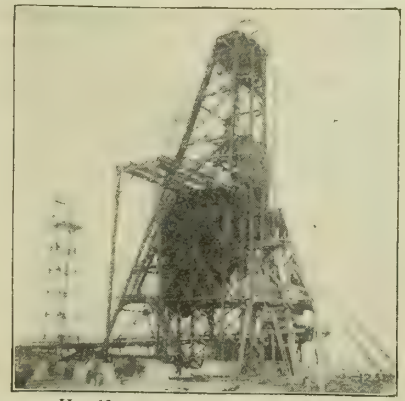
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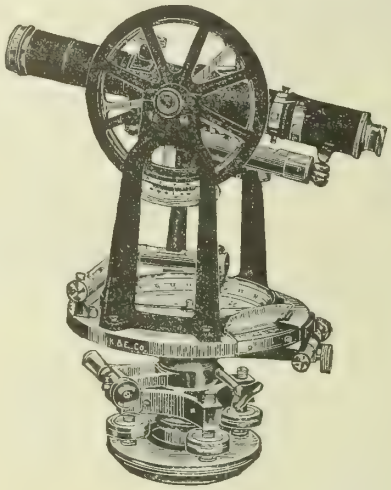
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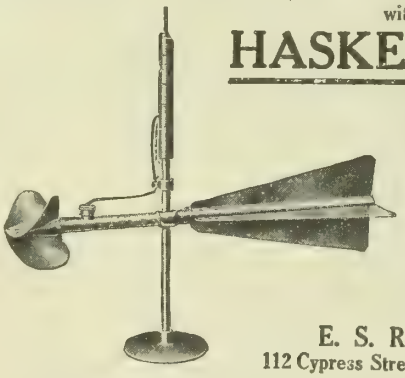
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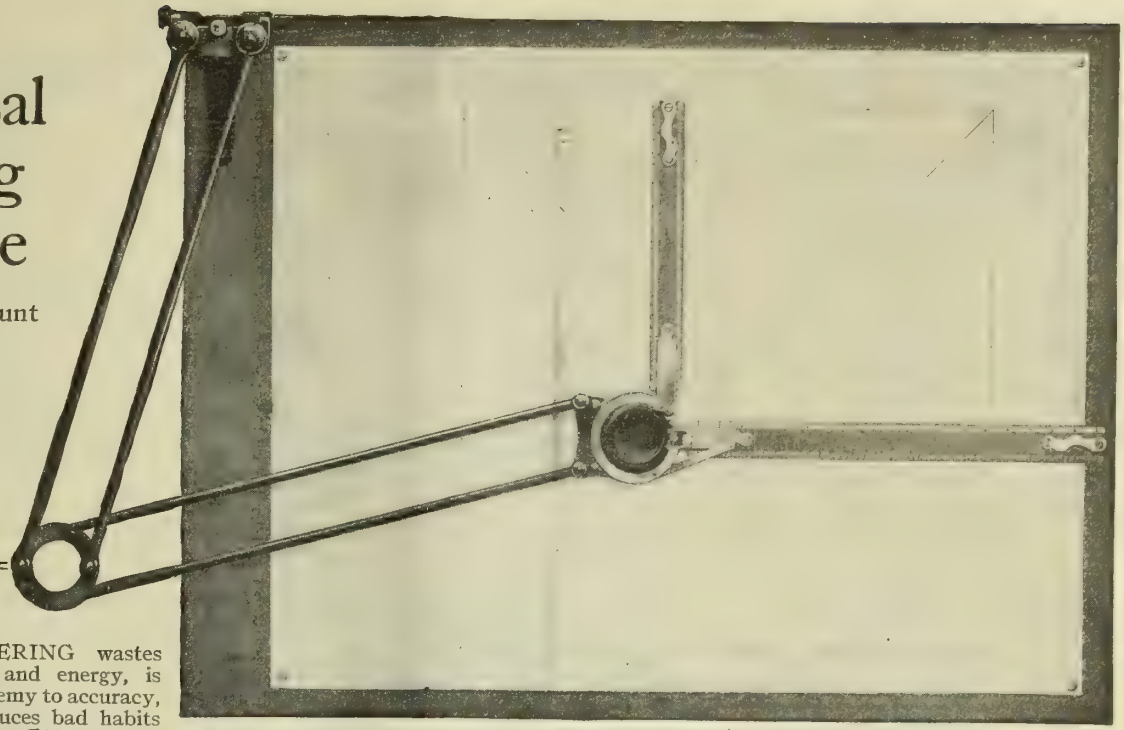
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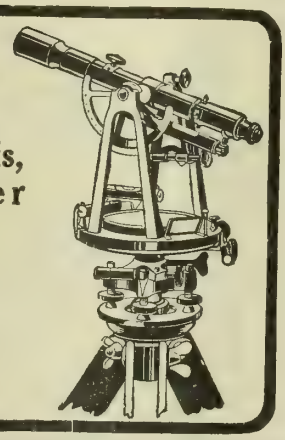
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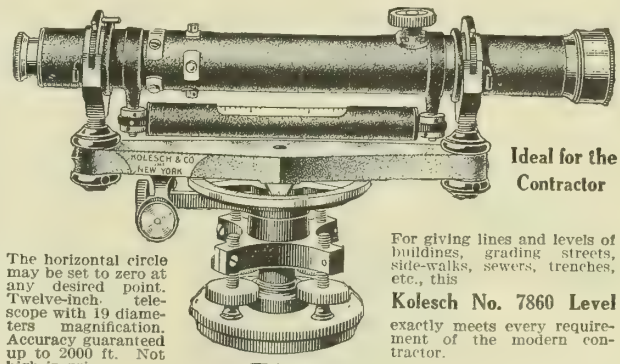


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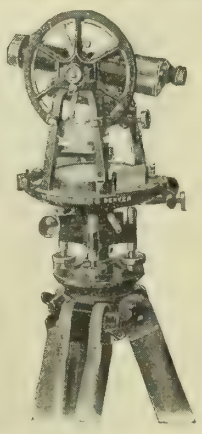
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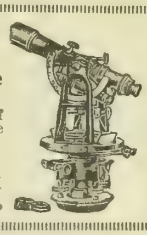
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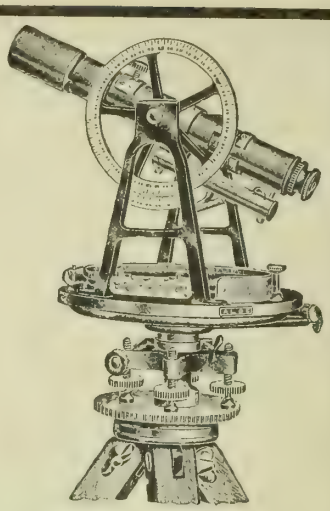
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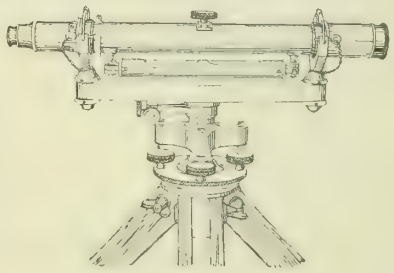
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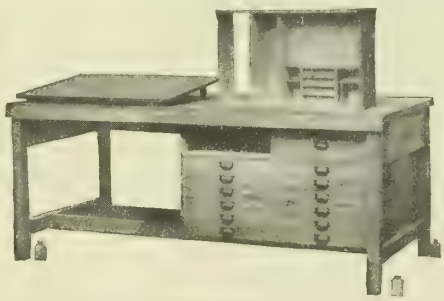
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Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. C.
Link-Belt Co., Philadelphia, Chicago, New York.
"Peck" overlapping bucket conveyor.
Orton & Steinbrenner Co., Chicago, Ill.

Kreolite Wood-Block Floors

"They outlast the factory"



Photograph shows view of Kreolite Wood Block Floor in the plant of the Vulcan Iron Works, Wilkes-Barre, Pa.

A Plank Floor Was Taken Up and a Kreolite Floor Put in Its Place

THE Vulcan Iron Works, Wilkes-Barre, Pa., made a thorough investigation of the experiences of other factories and plants before they changed from the old style plank floor to the modern Kreolite Wood Block Floor.

THE old floor was continually being repaired, hard to truck over and tiresome to the workmen through its unevenness.

THE Kreolite Wood Block Floor shown above will not only outwear a plank, concrete or brick floor, but also stimulates production by giving a smooth surface to truck over and one that is very comfortable for the workmen.

KREOLITE Wood Block Floors have been installed by hundreds of concerns because they make possible a reduction in repair and labor costs and an increase in shop efficiency.

We have a copy of "Factory Floors" for you. Shall we send it?

The Jennison-Wright Company

320 Huron Street **Toledo, Ohio**

Pioneers in Perfect Floors

Webster Mfg. Co., The, Tiffin, Ohio.
Whiting Foundry Equipment Co., Harvey, Ill.

Coal Storage Systems
American Bridge Co., 30 Church St., N. Y. City.
Fairbanks, Morse & Co., Chicago, Ill.

Column Clamps
New England Column Clamp Co., Boston, Mass.

Compounds, Waterproofing
Barrett Mfg. Co., New York, N. Y.
Smooth-On Mfg. Co., Jersey City, N. J.

Compressors, Air
American Well Works, Aurora, Ill.
Chicago Pneumatic Tool Co., Chicago, Ill.
Fuel oil, gas, steam power driven.
Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand Co., 11 Bway., New York, N. Y.
Branches: Boston, Phila., Pittsburgh, Cleveland, Chicago, El Paso, Seattle, San Francisco, Birmingham, St. Louis, Los Angeles, Butte, Denver, Duluth, Knoxville, New Orleans, Salt Lake City.
"Imperial" and "Ingersoll-Rogler."
Stationary and portable, power driven and steam driven.
International Steam Pump Co., 115 Bway., N. Y. C.
McKiernan-Terry Drill Co., 234 Bway., N. Y. C.
Norwalk Iron Works, South Norwalk, Conn.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.
Westinghouse Air Brake Co., Pittsburgh, Penn.

Compressors, Gas and Ammonia
International Steam Pump Co., 115 Bway., N. Y. C.
Norwalk Iron Works, South Norwalk, Conn.

Concrete Construction
Raymond Concrete Pile Co., 140 Cedar St., New York, N. Y. Branches: Chicago, Pittsburgh, Boston, Baltimore, Philadelphia, Atlanta, Detroit, Cleveland, St. Louis, Portland, Oregon; San Francisco, Los Angeles, Omaha, Cincinnati, St. Paul, Kansas City and Montreal.
Cast-in-place and pre-cast concrete piles, concrete interlocking sheet piles, docks, wharves, bulkheads, roads, bins, monolithic foundations, retaining walls, jetties, etc.
See ad. always on page 3.
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
"Kahn" reinforcement and specialties for concrete.
Representatives in principal cities.
Weber Chimney Co., McCormick Bldg., Chicago, Ill.
Reinforced concrete chimneys and towers.

Concrete Reinforcement
American Steel & Wire Co., Chicago, Ill.
Berger Mfg. Co., The, Canton, Ohio.
Special plates for reinforcements.
See advertisement.
Franklin Steel Works, Franklin, Penn.
¼ to 1¼" bars. Mill cap. 75,000 tons per year.
Round, square or square-twisted steel bars.
Lackawanna Steel Co., Lackawanna, N. Y.
Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Laclede Steel Co., St. Louis, Mo. Chicago Office: 332 S. Michigan Ave. Works: Madison, Ill.
Page Woven Wire Fence Co., Monessen, Penn.
Eighteen to 54" wide in multiples of 1½ and 3". Rolls up to 600 ft.
A wire fabric.
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Representatives in principal cities.

Condensers
Alberger Pump & Condenser Co., New York City.
Blake & Knowles Steam Pump Works, The, East Cambridge, Mass.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
International Steam Pump Co., 115 Bway., N. Y. C.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Worthington, Henry R., 115 Broadway, N. Y. City.

Conduit
Johns-Manville Co., H. W., New York City, N. Y.
Fibre, etc., for steam and electrical purposes.
National Tank & Pipe Co., Portland, Oregon.
Wyckoff Pipe & Creosoting Co., New York City.

Contractors, General
Gillespie Co., T. A., 50 Church St., N. Y. City.

Conveyors
International Steam Pump Co., 115 Bway., N. Y. C.
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Ohio Loco. Crane Co., Mansfield St., Bucyrus, O.
Robins Conveying Belt Co., 14 Park Row, N. Y. C.
Webster Mfg Co., The, Tiffin, Ohio.

Cooling Towers
International Steam Pump Co., 115 Bway., N. Y. C.
Worthington, Henry R., 115 Bway., N. Y. City.

Corner Bead Metal
Berger Mfg. Co., The, Canton, Ohio.
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.

Couplers, Car
McConway & Torley Co., Pittsburgh, Penn.

Couplings, Reinforcing Bar
Marion Malleable Iron Works, Marion, Ind.

Cranes
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Cranes, Locomotive
Browning Co., The, Cleveland, Ohio.
Four to 8 wheel—any gauge. Cap. 10 to 100 tons.
Full circle revolving cranes, self-propelling.
Operated by steam or electricity.
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Five to 160 tons cap. Steam, electric, gasoline.
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All standard sizes and capacities.
Ohio Loco. Crane Co., Mansfield St., Bucyrus, O.
Five to 50 tons.
Steam, electric, compressed air, oil or gasoline engine power equipment.
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Case Crane & Engineering Co., Columbus, Ohio.
Northern Engineering Works, Detroit, Mich.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Terry & Tench Co., Inc., 70 E. 45th St., N. Y. C.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Wrecking
Browning Co., The, Cleveland, Ohio.
Ohio Loco. Crane Co., Mansfield St., Bucyrus, O.

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International Creosoting & Construction Co., Galveston, Tex.
Jennison-Wright Co., 320 Huron St., Toledo, Ohio.
Norfolk Creosoting Co., Norfolk, Va.
Northeastern Co., The, Boston, Mass.
Pittsburgh Wood Preserving Co., Pittsburgh, Pa.
Wyckoff Pipe & Creosoting Co., New York City.

Crushers and Pulverizers
Austin Mfg. Co., Chicago, Ill.
Bacon, Earle C., Havemeyer Bldg., N. Y. City.
Buchanan Co., C. G., 90 West St., New York City.
International Steam Pump Co., 115 Bway., N. Y. C.
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Orton & Steinbrenner Co., Chicago, Ill.
Raymond Bros. Impact Pulverizer Co., Chicago, Ill.
Vulcan Iron Wks., 1736 Main St., Wilkes-Barre, Penn.

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American Sheet & Tin Plate Co., Pittsburgh, Pa.
Wood & Co., R. D., Philadelphia, Penn.

Curb and Gutter forms
Blaw Steel Construction Co., Pittsburgh, Penn.

Curb, Steel Protected Concrete
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
"Kahn" curb bars.
Representatives in principal cities.

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American Bridge Co., 30 Church St., N. Y. City.
Hayward Co., The, 50 Church St., New York City.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Nat'l Hoisting Eng. Co., Bergen St., Harrison, N. J.
Terry & Tench Co., Inc., 70 E. 45th St., N. Y. C.

Derrick Irons
Hayward Co., The, 50 Church St., New York City.
Union Iron Wks., West Shore Sta., Hoboken, N. J.

Ditching Machinery
Austin Drainage Excavator Co., F. C., Railway Exchange, Chicago, Ill.
Marion Steam Shovel Co., Station M, Marion, O.
Smith Co., The T. L., 1170 32nd St., Milwaukee.
"Albrecht" excavator and loader.

Diving Apparatus
Morse & Son, Inc., A. J., 221 High St., Boston.

Doors, Steel and Wood (Rolling)
Kinnear Mfg. Co., Columbus, Ohio.

Drafting Machines
Universal Drafting Machine Co., Cleveland, Ohio.

Drag Line Cableway Excavators
Cable Excavator Co., Com'l Trust Bldg., Phila.
Insley Mfg. Co., Indianapolis, Ind.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.

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Aloe Co., A. S., 617 Olive St., St. Louis, Mo.
Hardtmuth, L. & C., 34 E. 23rd St., N. Y. City.
"Kohinoor" brand.
Keuffel & Esser Co., New York. Hoboken, N. J.
Kolesch & Co., New York City.

Drawing Tables
Economy Drawing Table Co., Toledo, Ohio.
Kolesch & Co., New York City.

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Flory Mfg. Co., S., Bangor, Penn.
Hayward Co., The, 50 Church St., New York City.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Marion Steam Shovel Co., Station M, Marion, O.
Morris Machine Works, Baldwinsville, N. Y.

Drills, Air
Chicago Pneumatic Tool Co., Chicago, Ill.

Drills, Core
Ingersoll-Rand Co., 11 Broadway, New York City.
Keystone Driller Co., Beaver Falls, Penn.
McKiernan-Terry Drill Co., 234 Bway., N. Y. C.
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

Drills, Electric
Independent Pneumatic Tool Co., Chicago, Ill.

Drills, Hammer
Ingersoll-Rand Co., 11 Broadway, New York City.
"Jackhamer," "Butterfly," "Leyner Ingersoll," "Jackstoper."
McKiernan-Terry Drill Co., 234 Bway., N. Y. C.
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

Drills, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
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Ingersoll-Rand Co., 11 Broadway, New York City.
"Butterfly," "Sergeant." Also quarry and submarine types.
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McKiernan-Terry Drill Co., 234 Bway., N. Y. C.
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

Dryers
American Blower Co., Detroit, Mich.

Dynamite
Aetna Explosives Co., Inc., 2 Rector St., N. Y. C.

Elevators, Bucket
Jeffrey Mfg. Co., The, Columbus, Ohio.
Ohio Loco. Crane Co., Mansfield St., Bucyrus, O.
Webster Mfg. Co., The, Tiffin, Ohio.

Elevators, Concrete
Ohio Loco. Crane Co., Mansfield St., Bucyrus, O.
Ransome Concrete Machinery Co., Dunellen, N. J.
Cable: Racomaw. Branches: Chicago, Philadelphia, Boston, New York, Columbus, Ohio.
Automatic dump.

Engines, Gas and Gasoline
Alberger Gas Engine Co., 281 Chicago St., Buffalo, N. Y.
Fairbanks-Morse Co., Chicago, Ill.
International Steam Pump Co., 115 Bway., N. Y.C.
National Meter Co., New York City.

Engines, Oil
Fairbanks, Morse & Co., Chicago, Ill.

Engines, Pumping
Blake & Knowles Steam Pump Works, The, East Cambridge, Mass.
Fairbanks, Morse & Co., Chicago, Ill.
International Steam Pump Co., 115 Bway., N. Y. C.
Morris Machine Works, Baldwinsville, N. Y.
Worthington, Henry R., 115 Broadway, N. Y. City.

Engines, Steam
American Blower Co., Detroit, Mich.
Up to 160 hp.
Vertical. Single, double and compound cylinders.
Ball Engine Co., Erie, Penn.
Erie Steam Shovel Co., Erie, Penn.
Lawrence Machine Co., Lawrence, Mass.

Excavating Attachment Derrick
Union Iron Wks., West Shore Sta., Hoboken, N. J.

LEHIGH PORTLAND CEMENT CO.
LEHIGH
ALLENTOWN, PA. - CHICAGO, ILL.

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It is equivalent to a signature of quality and its fair name is jealously protected by the manufacturer.

The value of any advertising or sales propaganda is made—or broken by the reputation of the trade mark or trade name.

Logically, those firms which feature most their trade mark are most careful in maintaining the quality of their product.

Consider the Trade Mark

LEHIGH CEMENT

Concrete for Permanence

See the Cement Manufacturers' Exhibit at the Cement Show, Chicago, February 12-19.



Anderson Avenue, Bergen County, New Jersey. Standard Mixing Asphalt.

Standard Mixing Asphalt For Road Making By the Mixing Process

Assuming the stone to be correctly graded, a successful bituminous concrete roadway depends on the quality of the asphalt. We have developed especially for this purpose

STANDARD MIXING ASPHALT

Standard Mixing Asphalt, like all other Standard Asphalts, has great cementing strength at both high and low temperatures, and high ductility. It is not necessary to cut this asphalt back with a flux, for it is prepared to the correct consistency to bind the stones thoroughly together.

Standard Mixing Asphalt is 99.8% pure, running from 5 to 33% purer than the so-called natural asphalts.

Further information willingly supplied. Ask for facts regarding our Standard Paving Asphalts and Standard Asphalt Binders.

STANDARD OIL COMPANY
(New Jersey)
Newark Baltimore
Geo. W. Lamson, Agent, Ry. Exch. Bldg., Chicago, Ill.

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Ball Engine Co., Erie, Penn.
Browning Co., The, Cleveland, Ohio.
Cable Excavator Co., Com'l Trust Bldg., Phila.
Carson Trench Machine Co., Boston, Mass.
Erie Steam Shovel Co., Erie, Penn.
Insley Mfg. Co., Indianapolis, Ind.
Marion Steam Shovel Co., Station M, Marion, O.
Smith Co., The T. L., 1170 32nd St., Milwaukee.
"Albrecht" excavator and loader.

Excavators, Drag Line
Hayward Co., The, 50 Church St., New York City.
Insley Mfg. Co., Indianapolis, Ind.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Parsons Co., Newton, Ia. Br., 50 Church, N. Y. C.

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Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
"Kahn" building specialties.
Representatives in principal cities.

Expansion Joints
Alberger Heater Co., 281 Chicago St., Buffalo, N. Y.

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Aetna Explosives Co., 2 Rector St., N. Y. City.

Facings, Foundry
American Blower Co., Detroit, Mich.

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Economy Drawing Table Co., Toledo, Ohio.

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American Water Softener Co., Philadelphia, Pa.
N. Y. Cont'l Jewell Filtration Co., New York.
Norwood Engr. Co., Florence, Mass.
Pittsburgh Filter Mfg. Co., Pittsburgh, Penn.
Roberts Filter Mfg. Co., Darby, Penn.

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Berlin Mills Co., Portland, Maine.
Jennison-Wright Co., 320 Huron St., Toledo, Ohio.
Johns-Manville Co., H. W., New York City.
Leopold & Co., Jas., 233 Broadway, New York.
Youngstown Iron & Steel Co., Youngstown, Ohio.

Flumes, Metal
Hinman Hydr. Mfg. Co., 1400 W. Colfax, Denver.

Form Clamps
Insley Mfg. Co., Indianapolis, Ind.
New England Column Clamp Co., Boston, Mass.

Forms, Metal, for Concrete
American Bridge Co., 30 Church St., N. Y. City.
Blaw Steel Construction Co., Pittsburgh, Penn.
165 Broadway, N. Y. City. Peoples Gas Bldg., Chicago.
Standard forms for general work or special forms to order. Sectional or collapsible.
See advertisement.
Hydraulic Pressed Steel Co., 3152 E. 61st St., Cleveland, Ohio.
These forms consists of a framing of upright and horizontal bars, fitted with clamps to secure panels, which constitute the face of the form. The main vertical pieces are U-shaped, flared at the wall and having slotted keyways in the back. The form boards, or panels, are 36x36 in., of wood, faced and edged with pressed steel. Clamps of U-shape, held to the vertical pieces by bolts or keys fitting into the keyholes, straddle the vertical piece and are driven home by wedges until they are tight against the backs of the form boards. When these boards are to be removed, the wedges are slacked and the clamps are turned parallel to the upright piece. Two men with hammers can erect the forms or remove them.

Foundations
MacArthur Concrete Pile & Foundation Co., 11 Pine St., New York City.
Simplex Concrete Piling Co., Tacony, Phila., Pa.
Underpinning & Foundation Co., 290 Broadway, New York City.

Foundation Test Boring
Phillips & Worthington, 90 West St., N. Y. City.

Frogs and Switches
Ramapo Iron Works, Main Office, Hillburn, N. Y.

Furnaces, Annealing and Tempering
American Gas Furnace Co., 24 John St., N. Y. C.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Gas
American Gas Furnace Co., 24 John St., N. Y. C.

Gages
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Gages (Loss of Head)
Simplex Valve & Meter Co., Philadelphia, Penn.

Gages (Rate of Flow)
Simplex Valve & Meter Co., Philadelphia, Penn.

Garbage Disposal Apparatus
Bartlett & Snow Co., The C. O., Cleveland, Ohio.

Gas Holders
Wood & Co. ,R. D., Philadelphia, Penn.

Gas Producer Plants
Improved Equipment Co., 60 Wall St., N. Y. City.

Gas Producers
International Steam Pump Co., 115 Bway., N. Y. C.
Wood & Co. ,R. D., Philadelphia, Penn.

Gate Hoists
Whiting Foundry & Equipment Co., Harvey, Ill.

Generators
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Generators, Electric
Fairbanks, Morse & Co., Chicago, Ill.

Graders
Austin Mfg. Co., Chicago, Ill.

Granite
Master Builders Co., The, Cleveland, Ohio.

Gratings, Subway
Irving Iron Works, Long Island City, N. Y.

Grinders, Pneumatic
Independent Pneumatic Tool Co., Chicago, Ill.

Hammers, Pneumatic
Independent Pneumatic Tool Co., Chicago, Ill.

Hammers, Steam
McKiernan-Terry Drill Co., 234 Bway., N. Y. C.
Union Iron Wks., West Shore Sta., Hoboken, N. J.

Heaters, Feed Water
Alberger Heater Co., 281 Chicago St., Buffalo, N. Y.
Alberger Pump & Condenser Co., New York City.
Blake & Knowles Steam Pump Works, The, East Cambridge, Mass.
International Steam Pump Co., 115 Bway., N. Y. C.

Heaters, Service
Alberger Heater Co., 281 Chicago St., Buffalo, N. Y.

Hoists
Dake Engine Co., Grand Haven, Mich.
Fairbanks, Morse & Co., Chicago, Ill.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Nat'l Hoisting Eng. Co., Bergen St., Harrison, N. J.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Vulcan Iron Wks., 1736 Main St., Wilkes-Barre, Penn.

Hoists, Electric
Fairbanks, Morse & Co., Chicago, Ill.
Flory Mfg. Co., S., Bangor, Penn.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Nat'l Hoisting Eng. Co., Bergen St., Harrison, N. J.
Northern Engineering Works, Detroit, Mich.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.

Hoists, Portable Pneumatic
Ingersoll-Rand Co., 11 Broadway, New York City.

Hoisting Drums
Hayward Co., The, 50 Church St., New York City.

Hoisting Engines
Fairbanks, Morse & Co., Chicago, Ill.
Flory Mfg. Co., S., Bangor, Penn.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Nat'l Hoisting Eng. Co., Bergen St., Harrison, N. J.

Hose, Metallic
American Metal Hose Co., Waterbury, Conn.
Pennsylvania Flexible Metallic Tubing Co., Broad and Race Sts., Philadelphia, Penn.

Hose, Steam
American Metal Hose Co., Waterbury, Conn.
Pennsylvania Flexible Metallic Tubing Co., Broad and Race Sts., Philadelphia, Penn.

Hose, Suction
American Metal Hose Co., Waterbury, Conn.
Pennsylvania Flexible Metallic Tubing Co., Broad and Race Sts., Philadelphia, Penn.

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American Blower Co., Detroit, Mich.
From 3000 cu.ft. upward.

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Eddy Valve Co., Waterford, N. Y.
McKim Foundry & Machine Co., Lockport, N. Y.
Norwood Engr. Co., Florence, Mass.
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Wood & Co., R. D., Philadelphia, Penn.

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Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Hydraulic Machinery
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Hydraulic Presses
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Wood & Co., R. D., Philadelphia, Penn.

Indicator Posts
Wood & Co., R. D., Philadelphia, Penn.

Inks and Adhesives
Higgins & Co., C. M., 271 9th St., Brooklyn, N. Y.

Inserts for Concrete
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
"Trus-Con Slotted," "Kahn Adjustable" and "Trus-Con National Socket" inserts.
Representatives in principal cities.

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Aloe Co., A. S., 617 Olive St., St. Louis, Mo.
Dietzgen Co., Eugene, Chicago, Ill.
Keuffel & Esser Co., New York. Hoboken, N. J.
Lufkin Rule Co., Saginaw, Mich. N. Y. City.

Instruments, Mathematical
Aloe Co., A. S., 617 Olive St., St. Louis, Mo.
Keuffel & Esser Co., New York. Hoboken, N. J.

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Aloe Co., A. S., 617 Olive St., St. Louis, Mo.
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Southwark Fdry. & Mach. Co., Philadelphia, Pa.

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(See Paving Joints, Expansion)

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Coldwell-Wilcox Co., Newburgh, N. Y.

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Union Iron Wks., West Shore Sta., Hoboken, N. J.

Lime Kilns
Improved Equipment Co., 60 Wall St., N. Y. City.

Loaders, Wagon
Jeffrey Mfg. Co., The, Columbus, Ohio.

Locomotives, Electric
Robins Conveying Belt Co., 14 Park Row, N. Y. C.

Locomotives, Industrial
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Robins Conveying Belt Co., 14 Park Row, N. Y. C.
Vulcan Iron Works, 1736 Main St., Wilkes-Barre.

Lumber
Berlin Mills Co., Portland, Maine.
Bowers Co., S. P., 112 N. Broad St., Phila., Pa.

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Simplex Valve & Meter Co., Philadelphia, Penn.

Meters, Boiler Feed Water
Builders Iron Foundry, Providence, R. I.
International Steam Pump Co., 115 Bway., N. Y. C.
Pittsburgh Meter Co., East Pitsburgh, Penn
Worthington, Henry R., 115 Broadway, N. Y. City.

Meters, Current
Gurley, W. & L. E., Troy, N. Y., and Seattle.
"Price"—acoustic, electric recording or telephone indicating.
Ritchie & Sons, E. S., 112 Cypress St., Brookline, Mass.

Meters, Oil and Gas
Builders Iron Foundry, Providence, R. I.
Hersey Mfg. Co., South Boston, Mass. Cable: Boston, Quohersey. Branches: Boston, N. Y., Phila., Buffalo, Chicago, Columbus, O.; Atlanta, San Francisco, Los Angeles, Portland, Ore.
International Steam Pump Co., 115 Bway., N. Y. C.
National Meter Co., 84 Chambers St., N. Y. City.
Pittsburgh Meter Co., East Pittsburgh, Penn.
Worthington, Henry R., 115 Broadway, N. Y. City.

Meters, Steam
Builders Iron Foundry, Providence, R. I.

History in 4 Chapters—Read 'em!

Chapter No. 1. A big metal mine operator said "Don't show me how hard your shovel is or show me any photographs or read any letters of praise. Send me two shovels. I will put them to work and I'll know very shortly whether or not they are worth anything." We sent two.

Chapter No. 2. Letter from operator: "Those two shovels did wonderful work—too wonderful to last; send me 3 dozen and I will test further."
We did.

Chapter No. 3. Letter from operator: "Although those three dozen shovels behaved as well as the two—I still cannot believe that shovels even of chrome nickel steel could always be as good. Enclosed find order for 40 dozen and I will this time give you a good swing." We filled his order.

Chapter No. 4. We are getting all the business of that operator.

WYOMING-MAYARI RED EDGE SHOVELS

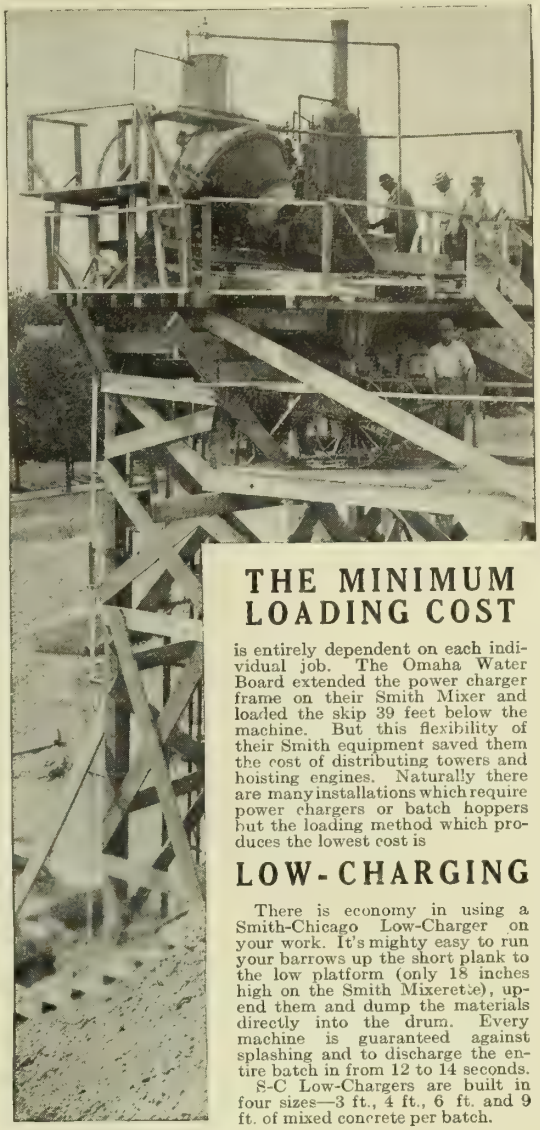


The only trouble with this operator was that he was using his old standards of shovel life and performance and had not fully realized that Wyoming, Mayari Shovels with Chrome Nickel Steel Blades, with Extra Selected Handles, must necessarily give at least twice the service of the best crucible steel shovels that can possibly be made.

When once this is realized and it is understood that Wyoming-Mayari Shovels are as radical and as real an improvement in their field as steel freight cars are in theirs and steam turbines are in theirs, then you can understand why these shovels do the wonderful things they do, so easily,

Ask us **now** for "Scientific Shoveling" and a catalog. We'll send you a dozen shovels on trial if you say so.

WYOMING SHOVEL WORKS
Wyoming, Penn.



THE MINIMUM LOADING COST

is entirely dependent on each individual job. The Omaha Water Board extended the power charger frame on their Smith Mixer and loaded the skip 39 feet below the machine. But this flexibility of their Smith equipment saved them the cost of distributing towers and hoisting engines. Naturally there are many installations which require power chargers or batch hoppers but the loading method which produces the lowest cost is

LOW-CHARGING

There is economy in using a Smith-Chicago Low-Charger on your work. It's mighty easy to run your barrows up the short plank to the low platform (only 18 inches high on the Smith Mixerette), upend them and dump the materials directly into the drum. Every machine is guaranteed against splashing and to discharge the entire batch in from 12 to 14 seconds.

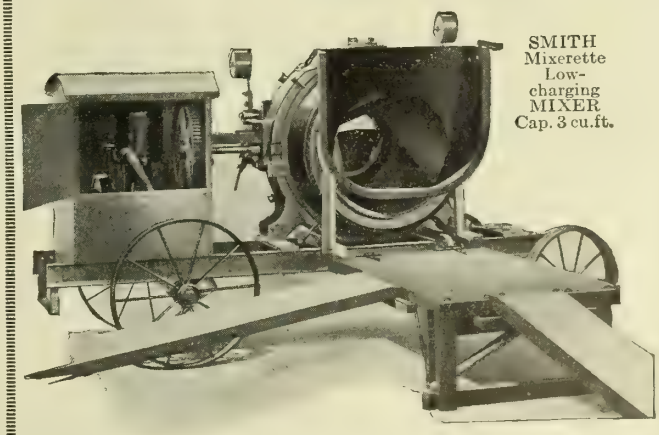
S-C Low-Chargers are built in four sizes—3 ft., 4 ft., 6 ft. and 9 ft. of mixed concrete per batch.

Which Catalog do you want?

Smith Mixer Cat. No. 51-B. Smith-Chicago Cat. No. 10-B.
S-C Low-Charger Cat. No. LC-1-B.

The T. L. SMITH CO.

1126-B Thirty-Second St., MILWAUKEE, WIS.
1404-B Old Colony Building, CHICAGO, ILL.



SMITH Mixerette Low-charging MIXER Cap. 3 cu.ft.

Meters, Water
Builders Iron Foundry, Providence, R. I. Branches: 30 Church St., N. Y. City; 2437 Oliver Bldg., Pittsburgh; 549 The Rookery, Chicago.
Venturi type. Standard sizes 2 to 60"; larger sizes to order. Capacity—standard tubes from 3 gal. per m. minimum to 36,100 gal. per m. maximum. Weights from 50 to 58,300 lb.
Contracted tube causing difference between pressures at contraction and inlet. Differences in pressure transmitted by small piping to indicating-recording and register indicator-recording instruments, where difference in pressure is translated into rate of flow units.
Agents: N. B. Livermore & Co., San Francisco; Northwest. Equip. Co., Portland, Ore., Seattle.
Hersey Mfg. Co., South Boston, Mass. Cable: Boston, Quohersey. Branches: Boston, N. Y., Phila., Buffalo, Chicago, Columbus, O.; Atlanta, San Francisco, Los Angeles, Portland, Ore.
International Steam Pump Co., 115 Bway., N. Y. C.
National Meter Co., 84 Chambers St., N. Y. City.
Pittsburgh Meter Co., East Pittsburgh, Pa. Cable: "Meter," Pittsburgh. Branches: New York, Chicago, Kansas City, Columbia, S. C., Seattle.
Ritchie & Sons, E. S., 112 Cypress St., Brookline, Mass.
Simplex Valve & Meter Co., Philadelphia, Penn. "Venturi," "Pitot Tube," "V Notch Wier," "Rectangular Wier," "Orifice."
Thomson Meter Co., 110 Bridge St., Bklyn., N. Y. One model, eight sizes—⅝ to 6".
Made in bronze only.
Worthington, Henry R., 115 Broadway, N. Y. City.

Mixers, Asphalt
Smith Co., The T. L., 1170 32nd St., Milwaukee.

Mixers (Heated), Asphalt and Concrete
Smith Co., The T. L., 1170 32nd St., Milwaukee. See "Mixers, Asphalt."

Mixers, Concrete
Foote Mfg. Co., Nunda, N. Y.
Nine sizes, 1/9 to 1 cu.yd. capacity.
Agents: Foote Concrete Mchy. Co., Chicago; Wilcox Bros., Inc., and E. J. McHarg & Co., Binghamton, N. Y.; W. C. McAnlis, Detroit; C. W. Klapproth, New York; Edward R. Bacon Co., San Francisco; Hallidie Machinery Co., Seattle; Hodson-Feenaughty Co., Portland, Ore.
International Steam Pump Co., 115 Bway., N. Y. C.
Ransome Concrete Machry. Co., Dunellen, N. J. Cable: Racomaw. Branches: Chicago, Philadelphia, Boston, New York, Columbus, Ohio.
Sizes, 4 to 80 cu.ft. Cap. 4 to 80 cu.yd. per hr. Rotary, non-tilting batch type equipped with gasoline, steam or motor drive. All types of feed.
Smith Co., The T. L., 1170 32nd St., Milwaukee.
Tilting type, 9 sizes, 4 cu.ft. to 62 cu.ft. mixed concrete. Non-tilting type, 10 sizes, 3 cu.ft. to 80 cu.ft. mixed concrete.

Mixers, Hand
Smith Co., The T. L., 1170 32nd St., Milwaukee.
Smith hand mixer, 2½ cu.ft. 1,000 lb., $120.

Mixers, Special
Smith Co., The T. L., 1170 32nd St., Milwaukee.
Glass mixers, fertilizer mixers, core-sand mixers, mortar mixers.

Molds, Pipe and Culvert
Blaw Steel Construction Co., Pittsburgh, Penn.

Motors, Electric
Fairbanks, Morse & Co., Chicago, Ill.

Packing Leather
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Paints
Barrett Mfg. Co., New York, N. Y.
Carey Co., Philip, 18 Wayne Ave., Lockland, Ohio.
Cheesman & Elliot, 100 William St., N. Y. City.
Patterson-Sargent Co., Cleveland, Ohio.

Paints, Graphite
Detroit Graphite Co., 120 Broadway, N. Y. City.
Patterson-Sargent Co., Cleveland, Ohio.

Paints, Marine
Patterson-Sargent Co., Cleveland, Ohio.

Paints, Metal Protective
Detroit Graphite Co., 120 Broadway, N. Y. City.
National Lead Co., 111 Broadway, New York, N. Y. Cable: Leadco. Branches: New York, Boston, Buffalo, Chicago, Cincinnati, Cleveland, St. Louis, San Francisco.
Steel packages of 12½, 25, 50 and 100 lb. net weight. Price: 100 lb. at 8¼c. per lb.; 25 and 50 lb. at 8½ c. per lb.; 12½ lb. at 8¾c. per lb. On lots of 500 lb. or more prices are ½c. per lb. less. F.o.b. shipping point.
"Dutch Boy" red lead in oil. A protective paint for iron and steel. Red, brown, green and black.
Patterson-Sargent Co., Cleveland, Ohio.

Paper, Blueprint
Keuffel & Esser Co., New York. Hoboken, N. J.

Pavements
Jennison-Wright Co., 320 Huron St., Toledo, Ohio

Paving Blocks, Creosoted Wood
Barber Asphalt Paving Co., Maurer, N. J.
Jennison-Wright Co., 320 Huron st., Toledo, Ohio.
All sizes from 3 to 4" in depth.
"Kreolite" lug wood blocks are manufactured with 2 "V"-shaped compressible lugs on one side and one lug on one end, providing a space between each separate row of blocks, giving foothold for horses. When the blocks expand the lugs compress, preventing buckling and bleeding of the floor or pavement.
Eastern Representative. L. P. Drinker, 911 Crozier Bldg., 1420 Chestnut St., Philadelphia, Pa. Western Representative: F. E. Jennison, F. M. Enright, 138 N. La Salle St., Chicago, Ill. Canadian Representative: Frank B. Goodman, 270 Yonge St., Toronto, Ontario.
Wyckoff Pipe & Creosoting Co., New York City.

Paving Blocks, Kyanized Wood
Berlin Mills Co., Portland, Maine.

Paving Brick (Vitrified)
Bessemer Lime Stone Co., Youngstown, Ohio.
Bessemer block, wire-cut-lug and repressed.
National Paving Brick Mfgrs. Asso., Cleveland, O.
An association organized for a dissemination of technical knowledge relating to the use of vitrified brick as a paving material and to influence to the greatest possible extent the proper construction of brick streets and roads.

Paving Joint Filler
Barrett Mfg. Co., New York, N. Y.

Paving Joints, Expansion
Carey Co., Philip, 18 Wayne Ave., Lockland, O.
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
"Kahn Armor Plate" and "Kahn Elastic Filler."
Representatives in principal cities.

No use to file this list for future reference, a new one will be out next week, right up to the minute

Pencils
Hardtmuth, L. & C., 34 E. 23rd St., N. Y. City.
'Kohinoor' brand for the office and drafting room.

Piles, Concrete
MacArthur Concrete Pile & Foundation Co., 11 Pine St., New York City. Branch offices in principal cities.
The "Pedestal" pile, made-in-place with 16-inch diameter cylindrical shaft and 3-foot diameter base. Made by driving core and casing into ground; ramming out concrete to form base; filling casing with concrete and removing casing; leaving completed pile in place.
Raymond Concrete Pile Co., 140 Cedar St., New York, N. Y. Branches: Chicago, Pittsburgh, Boston, Baltimore, Philadelphia, Atlanta, Detroit, Cleveland, St. Louis, Portland, Oregon; San Francisco, Los Angeles, Omaha, Cincinnati, St. Paul, Kansas City and Montreal.
The "Raymond Standard" concrete pile is of the cast-in-place type and is made by driving an expanded steel core, covered with a reinforced sheet steel shell, into the ground to proper resistance. The core is collapsed and withdrawn and the shell left in the ground, inspected and filled with concrete. The concrete and its protecting shell form the completed pile.
See ad. always on page 3.
Simplex Concrete Piling Co., Tacony, Phila., Pa.
Underpinning & Foundation Co., 290 Broadway, New York City.

Pile Drivers
Browning Co., The, Cleveland, Ohio.
McKiernan-Terry Drill Co., 234 Bway., N. Y. C.
Union Iron Wks., West Shore Sta., Hoboken, N. J.

Pile Hammers
National Hoisting Engine Co., Harrison, N. J.

Piling, Sheet Steel
Lackawanna Steel Co., Lackawanna, N. Y. Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Arched-web, straight-web, center-flange, plate steel and protected types. Lengths and strengths suitable to cofferdam, retaining wall, core wall, curtain wall, shore revetment work, etc.
See advertisement.

Piling, Steel
Underpinning & Foundation Co., 290 Broadway, New York City.

Piling, Wood
Berlin Mills Co., Portland, Maine.
Bowers Co., S. P., 112 N. Broad St., Phila., Pa.
Jennison-Wright Co., 320 Huron St., Toledo, Ohio.

Pipe Covering
Carey Co., Philip, 18 Wayne Ave., Lockland, Ohio.
Johns-Manville Co., H. W., New York, N. Y.
"Asbestocel" low-pressure steam and heating.
"Asbesto-Sponge Felted"—high-pressure and superheated steam—and others.
Wyckoff & Son, A., Elmira, N. Y.

Pipe Fittings
American Pipe & Construction Co., 112 N. Broad St., Philadelphia, Penn.
Builders Iron Foundry, Providence, R. I.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Pipe, Iron
American Cast Iron Pipe Co., Birmingham, Ala.
American Pipe & Construction Co., 112 N. Broad St., Philadelphia, Penn.
Central Foundry Co., 90 West St., N. Y. City.
Clow & Sons, Jas. B., Chicago, Ill.
Donaldson Iron Co., Emaus, Lehigh County, Pa.
Fox & Co., John, 253 Broadway, New York City.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Lynchburg Foundry Co., Lynchburg, Va.
Massillon Iron & Steel Co., Masillon, Ohio.
National Tube Co., Pittsburgh, Penn.
Standard Cast Iron Pipe & Fdry. Co., Bristol, Pa.
United States Cast Iron Pipe & Foundry Co., Philadelphia, Penn.
Warren Fdry. & Machine Co., 11 Bway., N. Y. C.
Wood & Co., R. D., 400 Chestnut St., Phila., Pa.

Pipe Joint Compounds (Pressure)
Leadite Co., Inc., The, Land Title Bldg., Philadelphia, Penn.

Pipe, Reinforced Concrete
Lock Joint Pipe Co., 165 Broadway, N. Y. City.

Pipe, Riveted Steel
East Jersey Pipe Co., Fulton and Church St., New York City.
Gillespie Co., The T. A., 50 Church St., N. Y. C.
Kittoe Boiler & Tank Co., Canton, Ohio.
McNeil & Bro., James, Pittsburgh, Penn.
Riter-Conley Mfg. Co., Pittsburgh, Penn.
Struthers-Wells Co., Warren, Penn. N. Y. City.
Tippett & Wood, Phillipsburg, N. J.
Weigele Riveted Steel Pipe Works, Denver, Colo.

Pipe Specials
Builders Iron Foundry, Providence, R. I.
Wood & Co., R. D., 400 Chestnut St., Phila., Pa.

Pipe, Steel
National Tube Co., Pittsburgh, Penn.

Pipe, Wood
Michigan Pipe Co., Bay City, Mich.
National Tank & Pipe Co., Portland, Oregon.
Two inches to 14 feet diameter, up to 300' head.
Pacific Tank & Pipe Co., 5th and Bryant St., San Francisco.
Portland Wood Pipe Co., Portland, Oregon.
Redwood Manufacturers Co., 1605 Hobart Bldg., San Francisco, Calif.
Standard Wood Pipe Co., Williamsport, Penn.
Washington Pipe & Foundry Co., 1512-1620 Center St. and 3001-3019 Asotin St., Tacoma, Wash. Cable: Wash Pipe.
Sizes from 2 inches up. Machine banded, continuous stave and special pipe.
Wyckoff & Son Co., A., Elmira, N. Y.
Wyckoff Pipe & Creosoting Co., New York City.

Pitometers
Pitometer Co., The, 25 Elm St., New York City.
"Cole" recording pitometers.

Poles, Cross-Arms, Etc. (Treated Wood)
Berlin Mills Co., Portland, Maine.
National Tank & Pipe Co., Portland, Oregon.

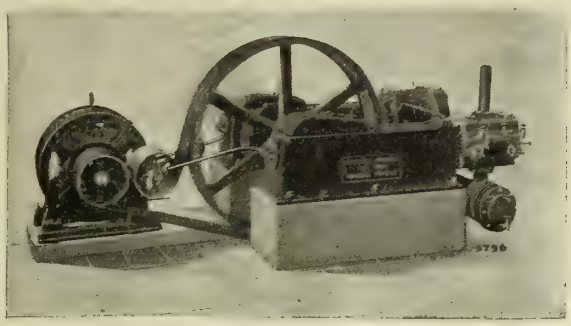
Poles, Tubular Steel
American Bridge Co., 30 Church St., N. Y. City.
Franklin Steel Works, Franklin, Penn.
Mill capacity, 100 poles per day.
Various types for all electric service.
National Tube Co., Pittsburgh, Penn.

Portable Pneumatic Hoists
Ingersoll-Rand Co., 11 Broadway, New York City.

Powder
Aetna Explosives Co., Inc., 2 Rector St., N. Y. C

Power Transmission Machinery
Bacon, Earle C., Havemeyer Bldg., New York.
Leffel & Co., James, Springfield, Ohio.
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O
Webster Mfg. Co., The, Tiffin, Ohio.

AIR COMPRESSORS



Imperial Type Ten Steam or Belt Driven Air Compressors. Capacities 176—3508 cu.ft.

Bulletins 3311-3312

Ingersoll-Rand Air Compressors are built in a complete range of types and sizes—each of which is designed and built to furnish a dependable supply of air at the lowest cost for operation and attendance.

Ingersoll-Rand Compressors are wholly enclosed and automatically lubricated. Air cylinders are completely water jacketed on barrels and heads and ample intercoolers are provided between stages of compound machines. Air valves have proven in continued service to be most efficient and thoroughly reliable.

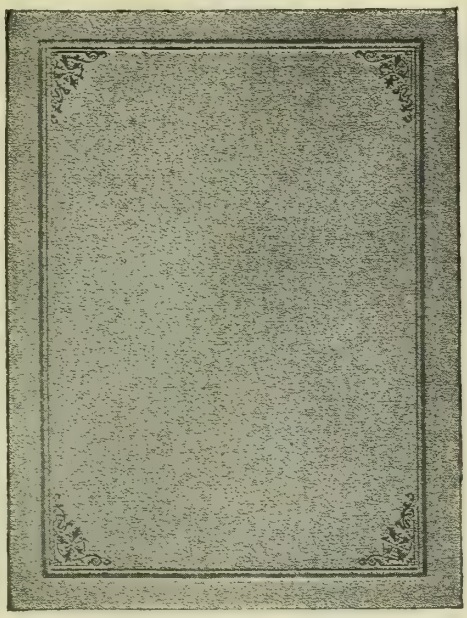
Power is applied in the most economical way, power consumption, whether a belt, electric, oil or steam engine driven unit, is reduced to a minimum.

INGERSOLL-RAND COMPANY

New York **Offices the World Over** **London**

147-C

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ENGINEERING NEWS, 10th AVE. at 36th ST., NEW YORK

Pumps, Air
Blake & Knowles Steam Pump Works, The, East Cambridge, Mass.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Deane Steam Pump Plant, Holyoke, Mass.
International Steam Pump Co., 115 Bway., N. Y. C.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Pumps, Air Lift
Harris Air Pump Co., Indianapolis, Ind.
13 sizes—1 to 8". Cap. 5 to 2000 gal. per m.
Ingersoll-Rand Co., 11 Broadway, New York City.
International Steam Pump Co., 115 Bway., N. Y. C.
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

Pumps, Centrifugal
Alberger Pump & Condenser Co., New York City.
American Well Works, The, Aurora, Ill.
Cameron Steam Pump Wks., A. S., 11 Broadway, New York City.
Darling Pump & Mfg. Co., Williamsport, Penn.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y. Branches: Boston, N. Y., Chicago, Atlanta, Pittsburgh.
International Steam Pump Co., 115 Bway., N. Y. C.
Lawrence Machine Co., Lawrence, Mass.
Lawrence Pump & Engine Co., Lawrence, Mass.
Morris Machine Works, Baldwinsville, N. Y.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Worthington, Henry R., 115 Broadway, N. Y. City.

Pumps, Contractors'
Blake & Knowles Steam Pump Works, The, East Cambridge, Mass.
Bond Co., Harold L., Boston, Mass.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Deane Steam Pump Plant, Holyoke, Mass.
Fairbanks, Morse & Co., Chicago, Ill.
International Steam Pump Co., 115 Bway., N. Y. C.
Parker, A. A., Waterford, N. Y.
Pulsometer Steam Pump Co., 18 Battery Pl., N. Y. The Pulsometer is a self-contained unit which operates by the condensation of steam fed directly to it from a boiler by steam pipe or flexible metallic hose. It contains no pistons, glands, stuffing boxes or eccentrics. Has no mechanical action, therefore requires no lubrication. Requires no auxiliary device to condense its steam, no engine or motor to operate it, and no special foundation or setting, and no special boiler. Usually hung by rope or chains into the excavation where it works. The Pulsometer is designed to handle water containing large percentage of sand, mud, air, pebbles, etc.
Van Nouhuys Mach. Works, Albany, N. Y.
Worthington, Henry R., 115 Broadway, N. Y. City.

Pumps, Deep Well
American Well Works, The, Aurora, Ill.
Blake & Knowles Steam Pump Works, The, East Cambridge, Mass.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Cook, A. D., Lawrenceburg, Ind.
For 2 to 12′ wells. Cap. 500 gal. per m.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y. Branches: Boston, N. Y., Chicago, Atlanta, Pittsburgh.
International Steam Pump Co., 115 Bway., N. Y. C.
Keystone Driller Co., Beaver Falls, Penn.

Pumps, Diaphragm
Bond Co., Harold L., Boston, Mass.
Boston & Lockport Block Co., Boston, Mass.
Edson Mfg. Co., 278 Atlantic Ave., Boston, Mass.
3 sizes, 2½, 3 and 4" suc. 1800-6000 gal. per hr.
Goulds Mfg. Co., Seneca Falls, N. Y. Branches: Boston, N. Y., Chicago, Atlanta, Pittsburgh.
Parker, A. A., Waterford, N. Y.

Pumps, Dredging
Fairbanks, Morse & Co., Chicago, Ill.
International Steam Pump Co., 115 Bway., N. Y. C.
Lawrence Machine Co., Lawrence, Mass.
Lawrence Pump & Engine Co., Lawrence, Mass.
Morris Machine Works, Baldwinsville, N. Y.
Parker, A. A., Waterford, N. Y.
Worthington, Henry R., 115 Broadway, N. Y. City.

Pumps, Gasoline Portable
Deane Steam Pump Plant, Holyoke, Mass.
Parker, A. A., Waterford, N. Y.

Pumps, Hydraulic
Blake & Knowles Steam Pump Works, The, East Cambridge, Mass.

Pumps, Power
Cook, A. D., Lawrenceburg, Ind.
Deane Steam Pump Plant, Holyoke, Mass.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y. Branches: Boston, N. Y., Chicago, Atlanta, Pittsburgh.
McGowan Co., John H., Cincinnati, Ohio.

Pumps, Sinking
Blake & Knowles Steam Pump Works, The, East Cambridge, Mass.

Pumps, Steam
Blake & Knowles Steam Pump Works, The, East Cambridge, Mass.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Deane Steam Pump Plant, Holyoke, Mass.
Fairbanks, Morse & Co., Chicago, Ill.
Keystone Driller Co., Beaver Falls, Penn.
McGowan Co., John H., Cincinnati, Ohio.
Morris Machine Works, Baldwinsville, N. Y.
Pulsometer Steam Pump Co., 18 Battery Pl., N. Y.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Worthington, Henry R., 115 Broadway, N. Y. City.

Pumps, Turbine
Alberger Pump & Condenser Co., New York City.
American Well Works, The, Aurora, Ill.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Lawrence Machine Co., Lawrence, Mass.
Lawrence Pump & Engine Co., Lawrence, Mass.
Morris Machine Works, Baldwinsville, N. Y.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Worthington, Henry R., 115 Broadway, N. Y. City.

Purifiers, Feed Water
N. Y. Cont'l Jewell Filtration Co., New York.
Norwood Engr. Co., Florence, Mass.

Rails and Fastenings
Lackawanna Steel Co., Lackawanna, N. Y. Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Standard heavy and light sections, contact rails, angle and splice bars, joint plates, tin plates, track spikes and bolts.

Rail Joints
Rail Joint Co., 185 Madison Ave., New York City.
Base supported rail joints. Types: "Continuous Tee," "Weber Tee," "Walhaupter Tee," "Continuous Step," "Continuous Insulating," "Weber Insulating," "Continuous Girder," "Weber Girder," "Continuous Frog and Switch," "100% Tee Rail Straight Angle Bar" or "Bent Angle Bar." Hot-worked high carbon steel used, oil quenched when desired.

Riveters
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Rivets
Pennsylvania Steel Co., Steelton, Penn.

Road Oils and Preservatives
Barber Asphalt Paving Co., Maurer, N. J.
Barrett Mfg. Co., New York City.
Standard Oil Co., Newark, N. J.

Road Rollers
Austin Mfg. Co., Chicago, Ill.
Buffalo Steam Roller Co., Buffalo, N. Y.
"Buffalo Pitts." Two and a half to 20 tons.

Rolls, Crushing
Buchanan Co., C. G., 90 West St., N. Y. City.

Roofing
Barrett Mfg. Co., New York, N. Y.
Carey Co., Philip, 18 Wayne Ave., Lockland, Ohio.
Johns-Manville Co., H. W., New York, N. Y.
Asbestos fire and acid resisting. Built-up; Roll—all weights and types; Corrugated; Shingles.

Roofing, Metal
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Berger Mfg. Co., The, Canton, Ohio.
Youngstown Iron & Steel Co., Youngstown, Ohio.

Rope, Manila
Waterbury Co., The, 63 Park Row, N. Y. City.

Rope, Transmission
Waterbury Co., The, 63 Park Row, N. Y. City.
Webster Mfg. Co., The, Tiffin, Ohio.

Rope, Wire
American Steel & Wire Co., Chicago, Ill.
Waterbury Co., The, 63 Park Row, N. Y. City.

Sash, Steel (See Window Sash, Steel)

Screens, Rotary
Jeffrey Mfg. Co., The, Columbus, Ohio.
Webster Mfg. Co., The, Tiffin, Ohio.

Screens, Well
American Well Works, The, Aurora, Ill.

Second-Hand Equipment
(See Alphabetical Index for For Sale Ads.)
Astoria Light, Heat & Power Co., The, East 132d St. and Locust Ave., New York City.

Sharpening Machines (Drill Bit)
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

Sheaves
Haiss Mfg. Co., 142d St. and Rider Ave., N. Y. C.

Shoes, Wood Pipe
Marion Malleable Iron Works, Marion, Ind.

Shovels, Hand
Wyoming Shovel Works, Wyoming, Penn.

Shovels, Power
Ball Engine Co., Erie, Penn.
"Erie Steam and Electric Revolving Shovels."
Marion Steam Shovel Co., Station M, Marion, O.
Cable: Barnhart. Branches: Atlanta, Chicago, New York, San Francisco, Seattle.
All standard sizes and capacities.
Electric, steam or gasoline power equipment.
Thew Automatic Shovel Co., Lorain, Ohio.

Shutters, Steel and Wood Rolling
Kinnear Mfg. Co., Columbus, Ohio.

Sidewalk Forms
Berger Mfg. Co., The, Canton, Ohio.
Blaw Steel Construction Co., Pittsburgh, Penn.

Skips
Insley Mfg. Co., Indianapolis, Ind.

Sluice Gates
Coldwell-Wilcox Co., Newburgh, N. Y.
Hinman Hydr. Mfg. Co., 1400 W. Colfax, Denver.

Softeners, Water
American Water Softener Co., Philadelphia, Pa.
N. Y. Cont'l Jewell Filtration Co., New York.
Roberts Filter Mfg. Co., Darby, Penn.

Stacks, Steel
Wiederholdt Construction Co., St. Louis, Mo.

Standpipes
Kittoe Boiler & Tank Co., Canton, Ohio.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Struthers-Wells Co., Warren, Penn. N. Y. City.
Tippett & Wood, Phillipsburg, N. J.
Walsh's Holyoke Steam Boiler Works, Holyoke, Mass.

Steam Hammers
Nat'l Hoist. Eng. Co., Bergen St., Harrison, N. J.

Steam Traps
American Blower Co., Detroit, Mich.
Tilting, return, separating, vacuum, condensing.

Steel (Plates and Bars)
Lackawanna Steel Co., Lackawanna, N. Y. Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Sheared and universal plates, sheet bars, merchant bars in rounds, squares, flats, ovals, half ovals and hexagons.

Steel Plate Construction
American Bridge Co., 30 Church St., N. Y. City.
Blaw Steel Construction Co., Pittsburgh, Penn.
Chicago Bridge & Iron Works, Chicago, Ill.
Coatesville Boiler Works, 30 Church St., N. Y. C.
East Jersey Pipe Co., Fulton and Church St., New York City.
Franklin Steel Works, Franklin, Penn.
Hydraulic Pressed Steel Co., 3152 E. 61st St., Cleveland, Ohio.
Kittoe Boiler & Tank Co., Canton, Ohio.
McNeil & Bro., James, Pittsburgh, Penn.
Pennsylvania Steel Co., Steelton, Penn.
Riter-Conley Mfg. Co., Pittsburgh, Penn.
Struthers-Wells Co., Warren, Penn.
Tippett & Wood, Phillipsburg, N. J.
Walsh's Holyoke Steam Boiler Works, Holyoke, Mass.

Steel, Structural
American Bridge Co., 30 Church St., New York.
Belmont Iron Wks., Phila. 32 Broadway, N. Y. C.
Mill capacity, 4,000 tons monthly.
Berlin Construction Co., Berlin, Conn.
Blaw Steel Construction Co., Pittsburgh, Penn.
165 Broadway, New York City. Peoples Gas Bldg., Chicago.
Case Crane & Engineering Co., Columbus, Ohio.
Chicago Bridge & Iron Works, Chicago, Ill.
Eastern Bridge & Structural Co., Worcester, Mass.
Fort Pitt Bridge Works, Pittsburgh, Penn.
Franklin Steel Works, Franklin, Penn.
Hydraulic Pressed Steel Co., 3152 E. 61st St., Cleveland, Ohio.
Kenwood Bridge Co., Chicago, Ill.
Lackawanna Bridge Co., New York.
Lackawanna Steel Co., Lackawanna, N. Y. Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Standard structural beams, angles and channels.
MacKinnon-Holmes & Co., Sherbrooke, Que., Can.
McClintic-Marshall Co., Pittsburgh, Penn.
Milwaukee Bridge Co., Milwaukee, Wis.
Minneapolis Steel & Machry. Co., Minneapolis.
Morava Construction Co., Chicago, Ill.
Mount Vernon Bridge Co., Mt. Vernon, Ohio.
Penn Bridge Co., Beaver Falls, Penn.
Phoenix Bridge Co., Phoenixville, Penn.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Mfg. Co., Pittsburgh, Penn.
Riverside Bridge Co., Martins Ferry, Ohio.
Shoemaker & Co., Lewis F., Pottstown, Penn.
Snare & Triest Co., Woolworth Bldg., N. Y. C.
Strauss Bascule Bridge Co., Chicago, Ill.
Variety Iron & Steel Works, Cleveland, Ohio.
Wisconsin Bridge & Iron Co., Chicago, Ill.

Stokers
Babcock & Wilcox Co., The, 85 Liberty St., New York City. Works: Barberton, Ohio. Branch offices in principal cities.

Strainers, Well
Cook, A. D., Lawrenceburg, Ind.

Superheaters, Steam and Air
Power Specialty Co., 111 Broadway, N. Y. City. Boston, Philadelphia, Pittsburgh, Chicago.

Swinging Gear
Dake Engine Co., Grand Haven, Mich.

An Erie Buyer wrote this Advertisement—

Advertisements have been written by the boss, by the hired man and the professional writer, but when you come right down to search for the ad that carries conviction in every line this is it:

Written by N. H. Battjes, President of the Standard Builders' Supply Company of Grand Rapids, Mich., to a prospective Erie buyer, dated October 21.

"We received our ERIE Shovel during the month of May, have operated it continuously ever since, first for the purpose of grading and excavating for railroad tracks and later on for loading gravel.

"We are highly pleased with the shovel and believe it to be the best shovel that we have ever operated. It has a much longer and higher reach than the——— shovel. Whereas, we formerly owned two——shovels, which were satisfactory, we believe the ERIE Shovel far superior to the———and if we had to purchase a shovel today we would purchase none other. If you have use for a shovel you cannot make a mistake in purchasing the ERIE."

We do not purpose to gild the lily by adding anything to this advertisement beyond suggesting that now—**now**—is exactly the right time to investigate the Erie Revolving Shovel. Ask for our new Bulletin S-14 containing FACTS—FIGURES—PHOTOS, (mostly photos) you'll find it interesting.

ERIE REVOLVING SHOVEL



There are definite reasons for the superiority of the Erie Shovel. Here are a few of them:

Automatic Crowding Device—Controls Crowding Engines so you cannot cut below grade—unless you want to. Level floor bottom readily maintained. Shallow cuts efficiently handled.

Three Lever Cantrol—Just three levers and a foot brake to handle. Greatly simplifies operation of shovel. Enables operator to handle greater yardage.

Large Working Range—Cuts 35 feet wide on floor bottom. 50 feet wide at height of eight feet. Wagons can be loaded on top of an 8-ft. bank.

Sturdy, Accessible Construction—Erie Shovels are built for service. The operating mechanism is all accessible. Nothing "buried" or "hidden."

BALL ENGINE COMPANY, ERIE, PA.

Tanks, Automatic Sprinkler
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

Tables and Boards, Drawing
Dietzgen Co., Eugene, Chicago, Ill.
Keuffel & Esser Co., New York. Hoboken, N. J.

Tanks and Towers
American Bridge Co., 30 Church St., N. Y. City.
Baltimore Cooperage Co., The, Baltimore, Md. Cable Address: Tanktowers, W. U. Code. Wooden and metal tanks, steel towers. All sizes for water, acids, chemicals, etc.
Blaw Steel Construction Co., Pittsburgh, Penn.
Chicago Bridge & Iron Works, Chicago, Ill.
Coatesville Boiler Works, 30 Church St., N. Y. C.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Struthers-Wells Co., Warren, Penn.
Tippett & Wood, Phillipsburg, N. J.
Walsh's Holyoke Steam Boiler Works, Holyoke, Mass.

Tanks, Wood
National Tank & Pipe Co., Portland, Oregon.
Pacific Tank & Pipe Co., 5th and Bryant St., San Francisco.
Portland Wood Pipe Co., Portland, Oregon.
Redwood Manufacturers Co., 1605 Hobart Bldg., San Francisco, Calif.
Washington Pipe & Foundry Co., 1512-1620 Center St. and 3001-3019 Asotin St., Tacoma, Wash. Cable: Wash Pipe.

Tapes, Steel and Metallic
Aloe Co., A. S., 617 Olive St., St. Louis, Mo.
Dietzgen Co., Eugene, Chicago, Ill.
Keuffel & Esser Co., New York. Hoboken, N. J.
Lufkin Rule Co., Saginaw, Mich. N. Y. City;

Test Boring
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

Ties, Steel
American Bridge Co., 30 Church St., N. Y. City.

Ties, Treated Wood
Berlin Mills Co., Portland, Maine.

Timber (Treated)
Berlin Mills Co., Portland, Maine.
Eppinger & Russell Co., 165 Broadway, New York.

Tools, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

Tracing Cloth
Hardtmuth, L. & C., 34 E. 23rd St., N. Y. City. "Kohinoor" brand.

Tramways
American Steel & Wire Co., Chicago, Ill.
Waterbury Co., The, 63 Park Row, New York.

Transmission Towers, Galvanized
American Bridge Co., 30 Church St., New York.
Blaw Steel Construction Co., Pittsburgh, Penn.

Trenching Machinery
Austin Drainage Excavator Co., F. C., Railway Exchange Bldg., Chicago, Ill.
Ball Engine Co., Erie, Penn.
Carson Trench Mach. Co., Boston, Mass.
Erie Steam Shovel Co., Erie, Penn.
Marion Steam Shovel Co., Station M, Marion, O.
Parsons Co., Newton, Ia. 50 Church St., N. Y. C.

Turbines, Steam
Alberger Pump & Condenser Co., New York City.

Turbines, Water
Leffel & Co., James, Springfield, Ohio.

Card lists of Equipment are hard to keep, they won't correct themselves. this list will

Turnbuckles
American Bridge Co., 30 Church St., New York.

Turntables
American Bridge Co., 30 Church St., New York.
Pennsylvania Steel Co., Steelton, Penn.
Whiting Foundry Equipment Co., Harvey, Ill.

Turpentine
Berlin Mills Co., Portland, Maine.

Underpinning
Underpinning & Foundation Co., 290 Bway., N. Y.

Valves, Altitude
Simplex Valve & Meter Co., Philadelphia, Penn.

Valves, Automatic Air
Simplex Valve & Meter Co., Philadelphia, Penn.

Valves, Water, Steam, Gas
Coldwell-Wilcox Co., Newburgh, N. Y.
Darling Pump & Mfg. Co., Williamsport, Penn.
Eddy Valve Co., Waterford, N. Y.
Golden-Anderson Valve Specialty Co., 1202 Fulton Bldg., Pittsburgh, Penn.
"Controlling Altitude"—automatically maintain uniform water level in tanks, etc. "Water Regulating"—control a reduced pressure regardless of initial volume. "Triple Acting Non-Return"—for automatically protecting boilers and steam lines. "Float Valves" for maintaining water.
Norwood Engrg. Co., Florence, Mass.
Rensselaer Valve Co., Troy, N. Y.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Ventilating Apparatus
American Blower Co., Detroit, Mich.
Lupton's Sons Co., David, Westmoreland and Tulip Sts., Philadelphia, Penn.

Wagon Loaders
Haiss Mfg. Co., 142nd St. and Rider Ave., N. Y. C.

Wagons, Dump
Austin Mfg. Co., Chicago, Ill.
Western Wheeled Scraper Co., Aurora, Ill.

Water, Stage Recorders
Leupold & Voelpel, Portland, Oregon.

Waterproofing
Barrett Mfg. Co., New York City.
Carey Co., Philip, 18 Wayne Ave., Lockland, Ohio.
Johns-Manville Co., H. W., New York City, N. Y.

Well Drillers
Phillips & Worthington, 90 West St., N. Y. City.

Well Drilling Machines
American Well Works, The, Aurora, Ill.
Keystone Driller Co., Beaver Falls, Penn.

Winches
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.

Window Sash, Steel
Lupton's Sons Co., David, Westmoreland and Tulip Sts., Philadelphia, Penn.
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
Representatives in principal cities.
"United" steel sash; horizontally and vertically pivoted sash. Counterbalanced and counterweighted sliding sash. Center pivoted and top hung continuous sash. Steel and glass partitions, sliding and swing doors. Casement sash.

Wire Clips
Marion Malleable Iron Works, Marion, Ind.

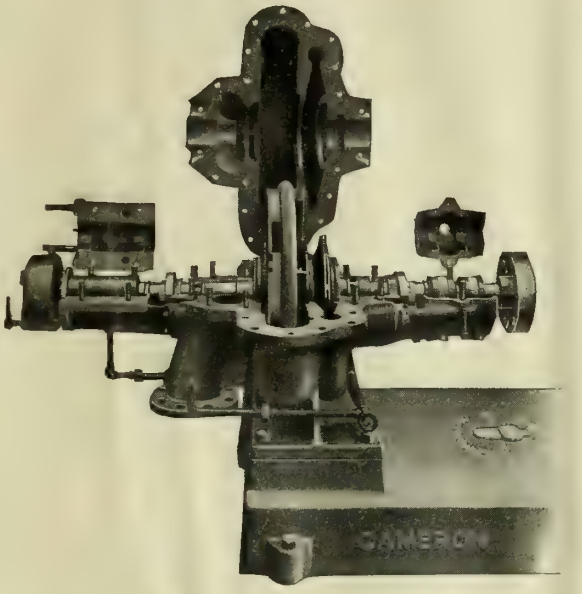
Wood Preserving
Barber Asphalt Paving Co., Maurer, N. J.
Barrett Mfg. Co., New York City, N. Y.
Carbolineum Wood Preserving Co., 181 Franklin St., New York City, N. Y.
International Creosoting & Construction Co., Galveston, Tex.
Northeastern Co., The, Boston, Mass.
Pittsburgh Wood Preserving Co., Pittsburgh, Pa.

IF YOU are in the market for any class of machinery or equipment which you cannot find in the Buying Section, Engineering News will have your wants published free of cost and thus put you in touch with the right manufacturer or dealer.

Business Department

The Slogan of the Cameron—"Character: the Grandest Thing"

In Long, Steady, Unbroken Pumping



There is where pump efficiency tells and there is where

CAMERON

MULTI-STAGE TURBINE CENTRIFUGALS

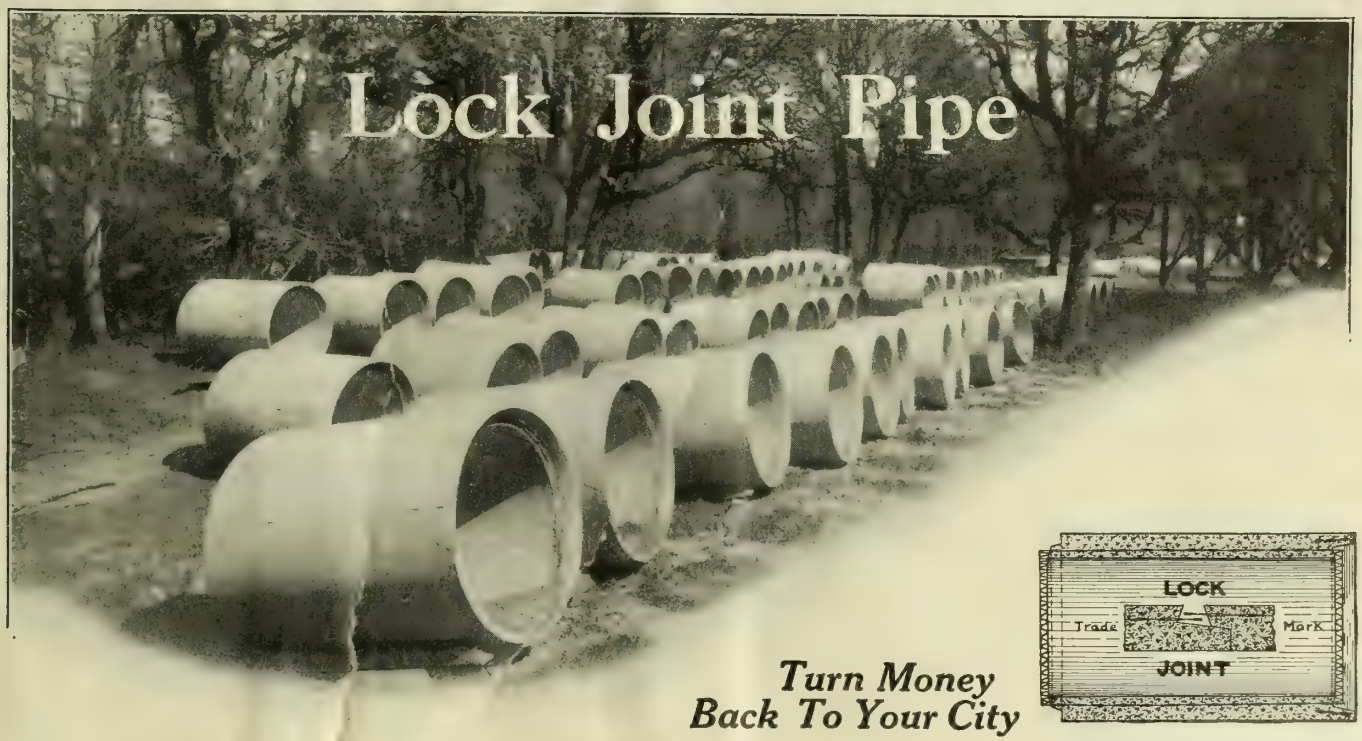
have proved their superiority. In Municipal Pumping Stations and Irrigation Systems, these long pulls are the rule—and engineers have found Cameron Centrifugals best adapted to this work.

These pumps are extremely simple, compact, easily installed, and are driven by electric motor, or other motive power.

Note the accessibility. Casings are split horizontally, so that every working part may be reached without disturbing pipe connections or pump alignment. Built of the finest material. Highest efficiency.

Write now for Bulletin No. 151.

A. S. Cameron Steam Pump Works
11 Broadway, New York
Offices the World Over



Turn Money Back To Your City

LOCK Trade Mark JOINT

Build your next sewer or water line of the Meriwether System Lock Joint Pipe. You can use your own citizens for labor—you can buy your materials locally, **and get the best. Write for the 100-page book of photographs showing many Lock Joint Pipe jobs.**

Lock Joint Pipe Company, **165 Broadway, New York City**
The Canadian Lock Joint Pipe Co., Limited, Regina, Sask., Can. **Pacific Lock Joint Pipe Co., Tacoma, Seattle, Wash.**

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